

FUEL PERMEATION BY RECIRCULATION**Application**

This test method determines the permeation of liquids, exhibiting high vapor pressures, through tubing walls, while controlling temperature and pressure independently of each other. This is achieved in a recirculating system in which liquids permeated through the tubing walls are collected by a controlled flow of nitrogen (dry) and absorbed on activated carbon.

Materials and Apparatus Required

Permeation Test Station (Design EMS)

11 Graduated Cylinder (2 - 4)

41 Flask for fuel mixing and use as a reservoir

Balance (0.01 g readability)

Silicon tubing (1 - 3 meters)

Adjustable wrench (2)

Vacuum pump

Compression fittings for 3/8 and 5/16 inch O.D. tubes

Fumehood

Gloves

Glasses

Fuel mixtures (as specified)

Nitrogen (cylinder or supply line)

Activated carbon beads 6 - 14 mesh

Date	Action	Revisions
2001 09 24	Revised	Editorial – no technical change A. Cockman
1994 09 13		

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Conditioning and Test Conditions

All test values indicated herein are based on material conditioned in a controlled atmosphere of 23 +/- 2 °C and 50 +/- 5 % relative humidity for not less than 24 h prior to testing and tested under the same conditions unless otherwise specified.

Procedure

- A. To connect the tubing to be tested into the glass test chamber refer to Figure 1.
 - 1. Remove the cover from the glass test chamber.
 - 2. If necessary, cut tubing to identical lengths.
 - 3. Insert the tubing through the openings of the cover.
 - 4. Using compression fittings, connect the tubing to the quick connects.
 - 5. Using compression fittings, connect the tubing to the U joint.
 - 6. Insert the connected tubing into the test chamber.
 - 7. Clamp down the cover making sure that a complete and uniform seal is obtained.
- B. Label the collection bottles (containing the carbon beads) for identification purposes.
- C. Weigh and record the exact weight and time weighed for each collection bottle (Chart 1). **Do not** remove the bottle heads for weighing.
- D. Turn on water bath heater and adjust to required temperature.
- E. Fill the steel holding vessel with the fuel mixture.
 - 1. Ensure all valves are closed (Figure 2).
 - 2. Connect the fuel reservoir with silicon tubing to valve #1.
 - 3. Open valves #1, #2, and #3.
 - 4. Turn on the vacuum pump. The fuel mixture will be drawn into the steel holding vessel.

5. When the vessel is full, close valves #1 and #3.
 6. Turn off the vacuum pump.
 7. Remove fuel flask and silicon tubing.
- F. Pressurizing the Fuel Lines
1. Open valve #4.
 2. Turn on the nitrogen flow and **carefully** pressurize the system to the required pressure (i.e., 2 bar, 4 bar), making sure of the absence of leaks. (Do not pressurize over 10 bar.)
 3. Close valve #4 and shut off nitrogen flow.
 4. Open valve #2 and start the gasoline pump.
 5. Using the gasoline pump, adjust the gasoline flow to required flow rate.
- G. Fill the Collection System with the Nitrogen Carrier Gas
1. Open the 3-way valve so that only the balloon reservoir receives the nitrogen.
 2. Turn the nitrogen on to a low flow and fill the balloon.
 3. Turn the nitrogen flow off.
 4. Open the 3-way valve to introduce the nitrogen to the entire collection system.
 5. Turn on the nitrogen gas pump and adjust to the required flow rate.
- H. Weigh the collection bottles daily, (weekends and holidays excluded) recording exact weights and times for the specified period of time (i.e., 200 h).
- J. Shut Down the Permeability Test Station
1. Turn off nitrogen pump.
 2. Empty system of fuel (Figure 2).
 - (a) **Carefully** open valve #3 to release pressure.
 - (b) Turn off fuel pump.