



Designation: D 5000 – 89 (Reapproved 2005)

An American National Standard

Standard Practice for Evaluating Activity of Clay Elements Using a Side-Stream Sensor¹

This standard is issued under the fixed designation D 5000; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

INTRODUCTION

Calcined clay is a widely used adsorptive medium for removing polar contaminants and additives from petroleum fluids. In refineries, clay is installed in large bed-type vessels to refine products such as lubricants or aviation turbine fuel. In the field, clay is usually used in canister or bag type elements installed as a bank of elements in a vessel to remove traces of contaminants, particularly from non-additive jet fuel immediately before delivery to an airport.

1. Scope

1.1 This practice describes a field procedure to determine whether the useful life of the clay has been exceeded in canister or bag-type clay elements that are installed in ground filtration units of aviation fuel handling systems.

1.2 The field procedure utilizes the apparatus of Test Method D 3948 to periodically test a small clay capsule installed in a sidestream around a clay treatment vessel that receives a fixed ratio of the same fuel that flows through the clay elements in the vessel.

1.3 The values stated in SI units are to be regarded as the standard. The values given in parentheses are for information only.

1.4 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*²

D 2550 Method of Test for Water Separation Characteristics of Aviation Turbine Fuels³

D 3602 Test Method for Water Separation Characteristics of Aviation Turbine Fuels³

¹ This practice is under the jurisdiction of ASTM Committee D02 on Petroleum Products and Lubricants and is the direct responsibility of Subcommittee D02.J0 on Aviation Fuels.

Current edition approved June 1, 2005. Published August 2005. Originally approved in 1989. Last previous edition approved in 2000 as D 5000–89(2000).

² For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

³ Withdrawn.

D 3948 Test Method for Determining Water Separation Characteristics of Aviation Turbine Fuels by Portable Separometer

3. Terminology

3.1 *Definitions:*

3.1.1 *surfactants*—surface active molecular species that exhibit both water soluble and oil soluble properties, and affect the physical behavior at the interface between water and oil phases by forming emulsions or changing the wetting characteristics of solid surfaces exposed to water and oil.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *active limit*—the Micro-Separometer (MSEP) rating by Test Method D 3948 of the effluent from a clay monitor that represents low surfactant content and therefore continued activity of the clay for absorption.

3.2.2 *clay*—a naturally occurring mineral, largely hydrous aluminum silicate, calcined at high temperature to remove water and volatile matter, used in granular form as an adsorptive media for removing polar compounds that are present in many hydrocarbon fluids.

3.2.3 *clay treatment*—a process for exposing fuels and blending components at ambient temperatures to granulated calcined clay in order to remove polar impurities such as surfactants.

3.2.4 *deactivation of clay media*—results when adsorptive surfaces are no longer capable of adsorbing polar species and improving the quality of the feed stream.

3.2.5 *deactive limit*—the MSEP rating by Test Method D 3948 of the effluent from a clay monitor that represents high surfactant content and therefore the deactivation of the clay for adsorption.

3.2.6 *sidestream*—flow system that parallels the main flow stream into and out of a unit, such as a vessel, holding filter elements but usually operating at a lower flow rate.

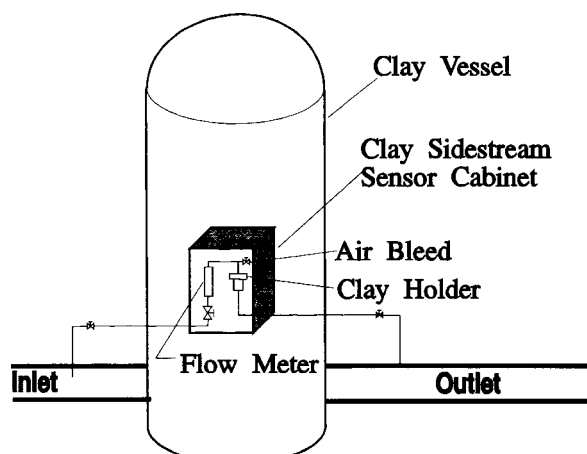


FIG. 1 Schematic of Clay Sidestream Sensor Installation

4. Summary of Practice

4.1 A sample of the clay from the element installed in a ground clay treatment vessel is placed into a clay holder that is then mounted in a sidestream cabinet that receives main fuel flow through an inlet probe at a rate proportional to main line flow. After preconditioning to ensure that flow is not bypassing the holder, it is placed on-stream to monitor the clay elements in the main vessel.

4.2 At intervals of two to eight weeks depending on surfactant levels experienced in the system, the clay holder is removed and tested twice in the Mark V deluxe or two-speed⁴ Micro-separometer with reference fuel containing a specified surfactant additive. The rating of the reference fuel from the clay holder by Test Method D 3948 determines whether the clay is deactivated or still capable of adsorbing surfactants. In the latter case, the clay holder is returned to the sidestream cabinet and monitoring continues.

4.3 If the rating suggests that clay is spent, the elements are changed and a fresh clay holder is installed. A plot or record of successive periodic tests is desirable to anticipate changes of clay elements or to increase testing frequency. (Fig. 1 is a schematic of a sidestream sensor installation around a clay treating vessel).

5. Significance and Use

5.1 Clay elements are widely used in aviation fuel handling systems to adsorb polar contaminants that are picked up in shipments by tanker, barge, or pipeline from refineries to terminals, airports, or both. Some of these contaminants such as surfactants interfere with efficient operation of filter-separator units that remove water from fuel.

5.2 In order to determine whether the clay elements are spent, it is necessary to test fuel both into and out of clay treatment vessels frequently. Clay elements must be changed when no improvement in quality is noted. Unless carried out frequently, such testing may not disclose a deactivated clay treatment vessel in time to prevent failure of downstream filter/separators.

⁴ The Mark V deluxe or two-speed Micro-Separometer, is available from EMCEE Electronics, Inc., 520 Cypress Ave., Venice, FL 34292.

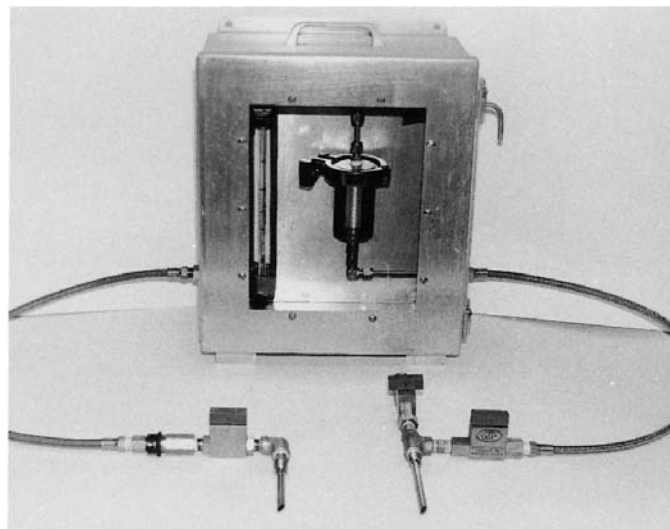


FIG. 2 Clay Side-Stream Sensor

5.3 To avoid such failures, a small sample of clay in a clay holder contained in a sidestream installation that receives flow proportional to the main stream flow is evaluated periodically using a reference fuel containing a known surfactant. When the rating of the reference fuel by Test Method D 3948 indicates that the capsule clay is becoming spent, the elements in the main filter vessel are ready for change.

6. Apparatus

6.1 *Sidestream Sensor*, consisting of the following components as illustrated in Fig. 2:

6.1.1 *Inlet Probe*, metal line and valve to the cabinet,⁵

6.1.2 *Metal Line and Valve*, from the cabinet,⁵

6.1.3 *Cabinet, Flow Meter*, accurate to $\pm 5\%$,⁵

6.1.4 *Clay Holder and Air Bleed*, contained in the sensor cabinet,⁵ and

6.1.5 *Clay Cone Insert*, (test capsule).⁵

6.2 *Micro-Separometer*, Mark V⁴ deluxe or two-speed.

6.3 *Clay Holder Bracket*, and tubing assembly.

NOTE 1—The sensor cabinet and probes are installed across the inlet and effluent of the clay treating vessel being monitored. The inlet probe may consist of a short 6.4 mm ($\frac{1}{4}$ in.) diameter tube that protrudes into the moving stream of fluid.⁵

7. Reagents and Materials

7.1 *Reference Fluid Base*, is fuel from the fuel supply system under evaluation. In the event the fuel contains additives or has a WSIM less than 96 the fuel should be clay treated as described in Test Method D 3948.

7.2 *Dispersing Agent*, is a toluene solution containing 1 mg of solid (100 % dry) bis 2 ethyl hexyl sodium sulfosuccinate per mL of toluene.

⁵ The sole source of supply of the apparatus known to the committee at this time is Gammon Technical Products, 235 Parker Avenue, Manasquan, NJ 08736. If you are aware of alternative suppliers, please provide this information to ASTM International Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee,¹ which you may attend.