



## **Standard Specification for Phosphate Ester Based Fluids for Turbine Lubrication<sup>1</sup>**

This standard is issued under the fixed designation D 4293; 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 ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

### **1. Scope**

1.1 This specification covers the requirements for phosphate ester based fire resistant fluids for use in turbine lubrication.

1.2 The specification defines only unused fluid before it is installed in the turbine. It is not intended for fluids used in electrohydraulic control (EHC) systems.

1.3 The use of this type of fluid is restricted to turbine systems that have been designed or modified to accommodate phosphate ester lubricants.

1.4 The following precautionary caveat pertains only to Sections 5 and 5.3. *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:*

D 92 Test Method for Flash and Fire Points by Cleveland Open Cup<sup>2</sup>

D 97 Test Method for Pour Point of Petroleum Oils<sup>2</sup>

D 445 Test Method for Kinematic Viscosity of Transparent and Opaque Liquids (and the Calculation of Dynamic Viscosity)<sup>2</sup>

D 665 Test Method for Rust-Preventing Characteristics of Inhibited Mineral Oil in the Presence of Water<sup>2</sup>

D 892 Test Method for Foaming Characteristics of Lubricating Oils<sup>2</sup>

D 974 Test Method for Acid and Base Number by Color-Indicator Titration<sup>2</sup>

D 1744 Test Method for Water in Liquid Petroleum Products by Karl Fischer Reagent<sup>2</sup>

D 2619 Test Method for Hydrolytic Stability of Hydraulic Fluids (Beverage Bottle Method)<sup>2</sup>

D 4057 Practice for Manual Sampling of Petroleum and Petroleum Products<sup>3</sup>

#### *2.2 Federal Test Method Standard:*

791B, Method 5308 Corrosiveness and Oxidation Stability

of Light Oils (Metal Strip)<sup>4</sup>

#### *2.3 SAE Specification:*

SAE Aeronautical Material Specification (AMS) 3150C Hot Manifold and High Temperature Ignition Flammability Tests<sup>5</sup>

### **3. Functional Property Requirements**

3.1 Requirements for ISO viscosity grades 32 and 46 phosphate ester based fire resistant fluids are shown in Table 1.

3.2 The choice of viscosity grade for use in a particular turbine should comply with the turbine manufacturer's recommendation.

3.3 The autoignition temperature property for phosphate esters, although important to turbine manufacturers and to fluid users, is not listed because there is no published procedure in the ASTM manual.

### **4. Significance and Use**

4.1 This is a specification to define the requirements of fire resistant fluids for use in turbine lubrication. This specification defines phosphate ester fluids which will give satisfactory lubrication performance in a turbine engine. However, it is possible that phosphate esters that do not meet this specification may give adequate performance in the field.

4.2 Fire resistant fluids are more difficult to ignite and show little tendency to propagate a flame. The term "fire resistant fluid" does not mean that the fluid will not burn.

4.3 The normal fluid operating temperature will be in the range of 54 to 65°C and will experience a maximum temperature of about 93°C during flow across the turbine bearings whose housing temperature may be as high as 343°C.

### **5. Safety Precautions**

5.1 The fire tests are used to measure and describe the properties of the phosphate esters in response to heat and flame under controlled laboratory conditions and should not be considered or used for the description or appraisal of the fire hazard of the fluids under actual fire conditions.

5.1.1 Fires that have occurred in operating turbines have usually been caused by fluid or vapors contacting hot surfaces.

<sup>1</sup> This specification is under the jurisdiction of ASTM Committee D-2 on Petroleum Products and Lubricants and is the direct responsibility of Subcommittee D02.N0.06 on Turbine Oils.

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<sup>2</sup> *Annual Book of ASTM Standards*, Vol 05.01.

<sup>3</sup> *Annual Book of ASTM Standards*, Vol 05.02.

<sup>4</sup> Available from Standardization Documents Order Desk, Bldg. 4, Section D, 700 Robbins Ave., Philadelphia, PA 19111-5094 Attn:NPODS.

<sup>5</sup> Available from Society of Automotive Engineers, 400 Commonwealth Dr., Warrendale, PA 15096.