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Standard Test Methods for Askarels[1]

This standard is issued under the fixed designation D 901; 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.

1. Scope

1.1 These test methods cover procedures for testing askarels that are used in transformers and certain other electrical apparatus as an insulating and cooling medium. These methods are generally suitable for specification acceptance, factory control, reference testing, and research. The procedures appear in the following sections:

Test Method	ASTM Designation of Test Method
Chemical Tests:	
Neutralization Number	D 664, D974
Water Content	D 1533
Scavenger Content	D 1701
Chlorine Compounds, Hydrolyzable	D 1820, D2441
Chlorides, Inorganic	D 1821
Thermal Stability	D 1936
Electrical Tests:	
Dielectric Breakdown Voltage	D 877
Dissipation Factor and Relative Permittivity	D 924
Specific Resistance	D 1169
Physical Tests:	
Viscosity	D 88, D455
Fire Point	D 92
Pour Point	D 97
Sampling	D 923
Refractive Index	D 1218
Visual Examination	D 1702
Specific Gravity	D 1810
Coefficient of Thermal Expansion	D 1903
Color	D 2129
Polychlorinated Biphenyls in Environmental Materials	D 3304
Polychlorinated Biphenyls in Mineral Insulating Oils by Gas Chromatography	D 4059

For askarels having a Saybolt Universal viscosity of over 110 s at 100°F, modifications of certain test procedures are necessary.

1.2 As a precaution, insulating systems incorporating askarels and cellulose or other organic materials should be purged to remove any traces of flammable gases by bubbling dry nitrogen through the askarel and flushing the gas space with dry nitrogen before any work is performed on the apparatus.

1.3 Current governmental regulations prohibit the manufacture and sale of polychlorinated biphenyls (PCBs). This method serves as a reference for all askarels, PCB and non-PCB.

NOTE 1—Various materials have been used successfully in taking, storing, and testing samples of askarels. Until experience has developed a strong preference, materials referred to in these methods will be understood to be approved but not specified.

NOTE 2—Methods for handling and disposal of askarels and askarel-impregnated materials are given in a recent ANSI Committee C-107 Guide, *Guidelines for Handling and Disposal of Capacitor and Transformer-Grade Askarels Containing Polychlorinated Biphenyls*.[2]

NOTE 3—For specifications for askarels, see Specifications D 2233 and D 2283.

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.* Specific precautionary statements are given in 1.2.

2. Referenced Documents

2.1 *ASTM Standards:*

D 88 Test Method for Saybolt Viscosity[3]

D 92 Test Method for Flash and Fire Points by Cleveland Open Cup[4]

D 97 Test Method for Pour Point of Petroleum Products[4]

D 445 Test Method for Kinematic Viscosity of Transparent and Opaque Liquids (and the Calculation of Dynamic Viscosity)[4]

D 664 Test Method for Acid Number of Petroleum Products by Potentiometric Titration[4]

D 877 Test Method for Dielectric Breakdown Voltage of Insulating Liquids Using Disk Electrodes[5]

D 923 Test Methods for Sampling Electrical Insulating Liquids[5]

D 924 Test Method for Dissipation Factor (or Power Factor) and Relative Permittivity (Dielectric Constant) of Electrical Insulating Liquids[5]

[1] These methods are under the jurisdiction of ASTM Committee D-27 on Electrical Insulating Liquids and Gasesand are the direct responsibility of Subcommittee D27.02on Synthetics.

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[2] Available from the American National Standards Institute, 11 West 42nd Street, 13th Floor, New York, NY 10036.

[3] *Annual Book of ASTM Standards*, Vol 04.04.

[4] *Annual Book of ASTM Standards*, Vol 05.01.

[5] *Annual Book of ASTM Standards*, Vol 10.03.

D 974 Test Method for Acid and Base Number by Color-Indicator Titration[4]
D 1169 Test Method for Specific Resistance (Resistivity) of Electrical Insulating Liquids[5]
D 1218 Test Method for Refractive Index and Refractive Dispersion of Hydrocarbon Liquids[4]
D 1533 Test Method for Water in Insulating Liquids (Karl Fischer Reaction Method)[5]
D 1701 Test Methods for Scavenger Content of Askarels[5]
D 1702 Method for Visual Examination of Used Chlorinated Aromatic Hydrocarbons (Askarels) in the Field[6]
D 1810 Test Method for Specific Gravity of Askarels[5]
D 1820 Test Method for Hydrolyzable Chlorine Compounds in Chlorinated Aromatic Hydrocarbons (Askarels)[5]
D 1821 Test Method for Inorganic Chlorides in Askarels[5]
D 1903 Test Method for Coefficient of Thermal Expansion of Electrical Insulating Liquids of Petroleum Origin, and Askarels[5]
D 1936 Test Method for Thermal Stability of Chlorinated Aromatic Hydrocarbons (Askarels)[6]
D 2129 Test Method for Color of Water White Electrical Insulating Liquids[5]
D 2233 Specification for Chlorinated Aromatic Hydrocarbons (Askarels) for Capacitors[5]
D 2283 Specification for Chlorinated Aromatic Hydrocarbons (Askarels) for Transformers[5]
D 2441 Test Method for Hydrolyzable Chlorine Compounds in Chlorinated Aromatic Hydrocarbons (Askarels) by Refluxing[5]
D 2864 Terminology Relating to Electrical Insulating Liquids and Gases[5]
D 3304 Method for Analysis of Environmental Materials for Polychlorinated Biphenyls[5]
D 4059 Test Method for Analysis of Polychlorinated Biphenyls in Insulating Liquids by Gas Chromatography[5]

3. Terminology Definitions

3.1 For definitions of terms not defined in these methods, see Terminology D 2864.

CHEMICAL TEST METHODS

Neutralization Number

4. Definitions

4.1 *total acid number*—the number of milligrams of potassium hydroxide (KOH) required to react with 1 g of askarel when tested as prescribed.

4.2 *strong base number*—the number of milligrams of KOH equivalent to the acid required to react with 1 g of askarel when tested as prescribed.

5. Significance and Use

5.1 In the inspection of unused askarels, the neutralization value is of importance as a quality index of purity.

5.2 Since askarel is not subject to deterioration by oxidation, small changes in the neutralization value of used askarels may indicate the solution of basic or acidic materials from the various solid materials in contact with the askarel or the deterioration of such soluble materials to form basic or acidic materials. A large change in acidity may indicate decomposition of the askarel by an electric arc.

6. Procedure

6.1 Determine the neutralization number in accordance with Test Method D 974. Neutralization number may also be determined in accordance with Test Method D 664 if it is desired to use an electrometric titration method.

Water Content

7. Definition

7.1 *water content of an askarel*—that amount of water, expressed in parts per million, by weight which is present in the liquid.

8. Significance and Use

8.1 The test is significant in that it will show the presence of water which may not be evident from electrical tests.

8.2 Changes in water content of an askarel in service may be indicative of undesirable operating conditions requiring correction.

9. Procedure

9.1 Determine the water content of askarel in accordance with Test Methods D 1533.

Scavenger Content

10. Description of Term Specific to This Standard

10.1 *scavenger*—askarels are decomposed by an electric arc with the evolution of HCl gas. A scavenger is or may be added to the askarel which reacts chemically with HCl gas to form a nonvolatile reaction product, serving a useful function in improved preservation of the arced apparatus.

11. Significance and Use

11.1 Measurement of scavenger content indicates the amount of protection available against arc-formed gases and permits estimation of the amount of make-up additive required.

12. Procedure

12.1 Determine the scavenger content of askarels in accordance with Test Methods D 1701.

Chlorine Compounds, Hydrolyzable

13. Scope

13.1 This method provides a quantitative measure of the stability of the askarel to hydrolysis under prescribed test methods.

14. Significance and Use

14.1 Unstable compounds, if present in amounts beyond the acceptable limit, may be deleterious to askarel-filled apparatus.

[6] Discontinued, see *1990 Annual Book of ASTM Standards*, Vol 10.03.

15. Procedure

15.1 Determine the hydrolyzable chlorine compounds as parts per million of chloride ion in accordance with Test Method D 1820. Where service conditions require the detection of certain chlorine addition compounds that do not respond fully to the temperature used in Test Method D 1820, Test Method D 2441 may be used.

Chlorides, Inorganic

16. Significance and Use

16.1 In the presence of water, chlorides can ionize. Their corrosive action can then be detrimental to the life of the apparatus in which the askarel is used.

17. Procedure

17.1 Determine the inorganic chlorides in accordance with Test Method D 1821.

Thermal Stability

18. Description of Term Specific to This Standard

18.1 *thermal stability of chlorinate aromatic hydrocarbon materials*—their resistance to thermal decomposition which results in the liberation of chloride ions.

19. Significance and Use

19.1 Adequate thermal stability is required for satisfactory use of these materials as dielectric fluids.

20. Procedure

20.1 Determine the thermal stability of the askarel as parts per million of reactive chlorine in accordance with Test Method D 1936.

ELECTRICAL TEST METHODS

Dielectric Breakdown Voltage

21. Definitions

21.1 Refer to Definitions D 2864.

22. Significance and Use

22.1 The dielectric breakdown voltage of an askarel is of importance as a measure of its ability to withstand electrical stress without failure. It may also indicate the presence of contaminating materials, such as water, conducting solid particles, dissolved contaminants, or the decomposition products resulting from an electric arc. A high dielectric breakdown voltage, however, is not a certain indication of the absence of all contaminants.

23. Procedure

23.1 Except as stated in Section 24, determine the dielectric breakdown voltage of askarels in accordance with Test Method D 877.

24. Referee Tests

24.1 For referee tests, make breakdowns in an atmosphere having a relative humidity not exceeding 55 %. At higher humidities, the dielectric breakdown voltage of the test samples may be materially lowered by the absorption of atmosphere moisture.

Dissipation Factor and Permittivity

25. Definition

25.1 For definitions of dissipation and relative permittivity refer to Definitions D 2864.

26. Significance and Use

26.1 The dissipation factor of an askarel is essentially proportional to the energy dissipated as heat in the askarel, other factors remaining constant. In many types of electrical equipment, it is necessary or highly desirable to keep the heat loss in the dielectric to a minimum. Since askarel is not subject to oxidation, an increased dissipation factor value may be attributed to the presence of dissolved polar contaminants in the askarel.

26.2 The relative permittivity of an askarel is a measure of its relative ability to store electrostatic energy. It is of considerable importance in the design of certain electrical apparatus and may also be useful as an indication of the composition and purity of the askarel.

27. Procedure

27.1 Determine the dissipation factor and relative permittivity of askarels in accordance with Test Method D 924, observing the precaution that in cells used for testing askarels, phenolic insulation should not be used at any point where it comes in contact with the liquid.

Specific Resistance

28. Definition

28.1 *specific resistance (resistivity)*—the ratio of the d-c potential gradient in volts per centimetre paralleling the current flow within the specimen, to the current density in amperes per square centimetre at a given instant of time and under prescribed conditions. This is numerically equal to the resistance between opposite faces of a centimetre cube of the liquid. The units are ohm-centimetres.

29. Significance and Use

29.1 The resistivity of a liquid is a measure of its electrical insulating properties under conditions comparable to those of the test. High resistivity reflects low content of free ions and ion-forming particles, and normally indicates a low concentration of conductive contaminants.

30. Procedure

30.1 Determine the specific resistance (resistivity) of electrical insulating liquids in accordance with Test Method D 1169.