

APPROVED



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امور تدوین استانداردها

IGS

Iranian Gas Standards

مشخصات فنی خرید

روغن ترانسفورمرهای برق

Insulating Oils for use in Power Transformers Part 1



ابلاغ مصوبه هیأت مدیره

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باسلام،

به استحضار می رساند در جلسه ۱۳۴۰ مورخ ۱۳۸۷/۸/۱۲ هیأت مدیره، نامه شماره گ. ۹۵۷۱۶/۰۰۰/۹ مورخ ۸۷/۷/۳۰ آن مدیریت در مورد تصویب نهایی استانداردها تحت عناوین "روغن ترانسفورمرهای برق" به شماره IGS-M-CH-044-1(0)، "بررسی دوره ای کیفیت روغن ترانسفورمرهای برق" به شماره IGS-C-CH-044-2(0) و "روش تست کارایی برای شیرهای سماوری اندازه ۲ تا ۲۴ اینچ" به شماره IGS-M-PL-002(1), Part 1, APPENDIX ارجاعی از سرپرست شرکت مطرح و تصویب شد.

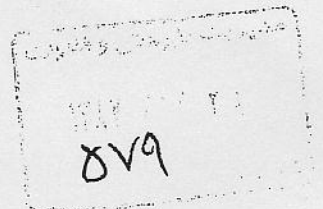
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FOREWORD

This standard is intended to be mainly used by NIGC and contractors and has been prepared on interpretation recognized standards , technical documents , knowledge , backgrounds and experiences in gas industries at national and international levels .

Iranian gas standards (IGS) are prepared , reviewed and amended by technical standard committees within NIGC Standardization division and submitted to the NIGC's "STANDARDS COUNCIL" for approval .

IGS Standards are subject to revision , amendment or withdrawal , if required , thus the latest edition of IGS shall be checked/inquired by NIGC users .

This standard must not be modified or altered by the end users within NIGC and her contractors . Any deviation from normative references and / or well known manufacturers specifications must be reported to Standardization division .

Any comments from concerned parties on NIGC distributed IGS are welcome to technical standards committees and will receive serious attention and consideration should a revision to standards is recommended .

GENERAL DEFINITIONS :

Throughout this standard the following definitions , where applicable , should be followed :

1- "STANDARDIZATION DIV." has been organized to deal with all aspects of industrial standards in NIGC . Therefore , all queries for clarification or amendments are requested to be directed to mentioned div.

2- "COMPANY" : refers to national Iranian gas company .

3- "SUPPLIER" : refers to a firm who will supply the service , equipment or material to igs specification whether as the prime producer or manufacturer or a trading firm .

4- "SHALL " : is used where a provision is mandatory .

5- "SHOULD" : is used where a provision is advised only .

6- "MAY" : is used where a provision is completely discretionary .

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1. SCOPE

This standard specification covers the minimum requirements for unused mineral insulating oils for use as insulant and for heat transfer in transformers . These oils are obtained by distillation and refining of crude petroleum . Oils with or without additives are both within the scope of this standard specification .

Note : The choice of oil and its classification according to clause 4.2 should comply with the transformer manufacturer's recommendations .

2. REFERENCES

Throughout this standard specification the following standards are referred to . The editions of these standards that are in effect at the time of issues of this standard specification (2008) shall, to the extent specified herein , form part of this standard specification . The applicability of changes in standards that occur after the date of this standard specification shall be mutually agreed upon by the purchaser and the supplier.

ASTM D 92A (2002) "Test method for flash and fire points by cleveland open cup tester"

ASTM D 97 (2002) "Test method for pour point of petroleum products"

ASTM D 445 (2001) "Test method for kinematic viscosity of transparent and opaque liquids (the calculation of dynamic viscosity)"

ASTM D 877 (2002) "Test method for dielectric breakdown voltage of insulating liquids using disk electrodes"

ASTM D 923 (1997) "Practice for sampling electrical insulating liquids"

ASTM D 971 (1999) "Test method for interfacial tension of oil against water by the ring method"

ASTM D 974 (2002) "Test method for acid and base number by color – indicator titration"

ASTM D 1275 (1996) "Test method for corrosive sulfur in electrical insulating oils"

ASTM D 1298 (1999) "Test method for density , relative density (specific gravity) , or API gravity of crude petroleum and liquid petroleum products by hydrometer method"

ASTM D 1524(1999) "Test method for visual examination of used electrical insulating oils of petroleum origin in the field"

ASTM D 1533 (2000) "Test method for water in insulating liquids by coulometric Karl Fischer titration"

ASTM D 2440 (1999) "Test method for oxidation stability of mineral insulating oil"

ASTM D 2668 (2002) "Test method for 2,6 – di – tert – buthyl – p – cresol and 2,6 – di – tert – buthyl phenol in electrical insulating oil by infrared absorption"

ASTM D 4052 (2002) "Test method for density and relative density of liquids by digital density meter"

ASTM D 4059 (2000) "Test method for analysis of polychlorinated biphenyls in insulating liquids by gas chromatography"

ASTM D 4768 (1996) "Test method for analysis of 2,6 ditertiary – buthyl para – cresol and 2,6 – ditertiary – buthyl phenol in insulating liquids by gas chromatography"

BS 2000 : Part 1 (1995) "Methods of test petroleum and its products – Part 1 – Determination of acidity , neutralization value – colour indicator titration method"

BS 2000 , Part 15 (1995) "Methods of test for petroleum and its products Part 15 : Petroleum products – Determination of pour point"

BS EN ISO 3104 (1996) "Method of test for petroleum and its products Part 71 : section 1 : Petroleum products – Transparent and opaque liquids – Determination of kinematic viscosity"

BS EN ISO 3675 (1996) "Crude petroleum and liquid petroleum products – Laboratory determination of density or relative density – Hydrometer method"

BS 5263 (1980) "Method for sampling liquid dielectrics"

BS 5680 (1979) "Method for detection of corrosive sulphur in petroleum – based electrical insulating oils"

BS 5737 (1979) "Method for the measurement of relative permittivity , dielectric dissipation factor and d.c. resistivity of insulating liquids"

BS 5797 (1986) "Methods for measurement of gassing of insulating liquids under electrical stress and ionization"

BS EN 22719 (1994) "Methods of test for petroleum and its products part 404 : Petroleum products and lubricants – determination of flash point – Pensky – Martens closed cup method"

BS EN 60156 (1996) "Insulating liquids – Determination of the breakdown voltage at power frequency"

BS EN 61125 (1993) "Unused hydrocarbon – Based insulating liquids – Test methods for evaluating the oxidation stability"

EN 61619 (1997) "Insulating liquids – Contamination by polychlorinated biphenyls (PCBs) – Method of determination by capillary column gas chromatography"

IEC 156 (1995) "Insulating liquids – Determination of the breakdown voltage at power frequency"

IEC 814 (1997) "Insulating liquids – Oil impregnated paper and pressboard – Determination of water by automatic coulometric Karl Fischer titration"

IEC 60247 (1978) "Measurement of relative permittivity , dielectric dissipation factor and d.c. resistivity of insulating liquids"

IEC 60666 (1979) "Detection and determination of specified anti – oxidant additives in insulating oils"

3. DEFINITIONS

Additive

Suitable chemical substance which is deliberately added to a mineral insulating oil in order to improve certain characteristics .

Antioxidant additive

Additive incorporated in an insulating oil to improve oxidation stability .

Uninhibited oil

Mineral insulating oil , containing no antioxidant additives , but which may contain other additives .

Trace inhibited oil

Mineral insulating oil containing up to 0.08% antioxidant additive together with other additives .

Inhibited oil

Mineral insulating oil containing a minimum of 0.08% and a maximum of 0.40% antioxidant additive together with other additives .

4. REQUIREMENTS**4.1 Characteristics**

Insulating oil shall be in accordance with the minimum requirements given in Table 1 when tested in accordance with the specified methods .

4.2 Classification**4.2.1 Antioxidant additive content**

Transformer oils are classified into three groups , according to their content of antioxidant additive :

- _ Uninhibited transformer oils : marked with **U** .
- _ Trace inhibited transformer oils : marked with **T** .
- _ Inhibited transformer oils : marked with **I** .

4.2.2 Lowest cold start energizing temperature (LCSET)

Standard LCSET in this standard specification is -30°C , optionally other LCSET can be selected depending on the climatic condition according to :

Transformer oil I : -40°C , Transformer oil T : -30°C , Transformer oil U : 0°C .

4.3 Sampling

Sampling shall be carried out in accordance with test methods ASTM D 923 or BS 5263 .

4.4 Appearance

The appearance of the oil shall be clear bright , and free from suspended matter and sediment when a representative sample of insulating oil is examined in an un – coloured , clean glass bottle and with transmitted light under an oil depth of approximately 100 mm and at ambient temperature .

4.5 Interchangeability

Interchangeability of type of used oil with another type of oil shall be approved with the transformer manufacturer .

4.6. Compatibility

Compatibility tests may be needed to determine the feasibility of mixing unused oils of different type and origin, with oil in service. The main characteristics of the mixture should not be less favourable than those of the worst individual oil. Reference to the oil supplier is recommended if any doubts concerning compatibility arise.

After mixing, oils should be tested in accordance with BS EN 61125, method C.

5. INSPECTION

5.1 The manufacturer shall set up and maintain such quality and inspection system to ensure the products comply with all aspects of the requirements of this standard specification.

5.2 The manufacturer shall be responsible for carrying out all the tests and quality assurances required by this standard specification and shall maintain complete records of all such tests and qualifications. Such records shall be available for review by the purchaser or its nominated inspector. These documents and test results shall be traceable with regard to the batch number of each lot.

5.3 The supplier shall furnish to the purchaser a certificate of quality stating that each lot has been sampled, tested, and qualified in accordance with this standard specification and has been found to meet the specified requirements.

5.4 The purchaser or its nominated inspector reserves the right to inspect a part or whole of the products during manufacturing and prior to packing and could witness any inspections and tests in accordance with this standard specification.

5.5 Purchaser's inspector reserves the right to have access to the products at any time during manufacturing.

5.6 The manufacturer shall provide all facilities necessary for carrying out all inspections and tests as required by this standard specification.

5.7 Random sampling proportional to the quantity of each lot and frequency of inspections and tests as required by this standard specification shall be at the discretion of the inspector.

5.8 If a sample rejected in any inspection or test, re-sample shall be carried out, in case of any rejection in new samples, all products represented by such sampling shall be rejected.

5.9 Inspection or tests that carried out by the purchaser's inspector, in no way relieves the manufacturer/supplier of his responsibilities and liabilities under the conditions, terms and inspection of this standard specification.

6. DOCUMENTATION

The manufacturer/supplier shall provide original technical catalogues, Material Safety Data Sheet (MSDS) and application procedure recommendation and guidelines.

7. PACKING

7.1 The insulating oil shall be suitably packed in approved containers in accordance with the requirements of the purchase order .

7.2 The containers shall be protected against all damage or defects which may occur during handling .

8. MARKING

8.1 Marking of Containers

Each container shall be legibly marked at least with the following information :

Name and trade mark of the manufacturer

Product designation (type and trade name)

IGS No.

Net weight

Handling

Storage

Date of manufacture

Date of expiry

Order No.

Batch No.

Manufacturer's address

HMIS (including Health , Fire , Reactivity , Personal Protection , Specified Hazard , etc.)

8.2 Instruction

Supplier and/or manufacturer shall provide complete sets of instruction for use and replacement of oil in service and refilling with an unused oil .

9. STORAGE LIFE

The insulating oil shall meet the requirement of clause 4 after storage for 24 months of delivery date , in a tightly covered container at temperature between -10 to +35 °C .

Table 1 – Physical , Electrical and Chemical Characteristics

Items	Properties	Units	Requirements	Test Methods
1	Physical : Kinematic viscosity , max 40 °C -30 °C	cSt	12 1800	ASTM D 445 or BS EN ISO 3104
2	Flash point , min	°C	140	ASTM D 92A or BS EN 22719
3	Pour point , max	°C	-30	ASTM D 97 or BS 2000 – P15
4	Density at 20 °C , max	kg/dm ³	0.895	BS EN ISO 3675 or ASTM D 1298 or ASTM D 4052
5	Appearance	---	Clear , free from sediment and suspended matter	ASTM D 1524 or Clause 4.4
**6	Interfacial tension at 25 °C , min	Dynes/cm	40	ASTM D 971
7	Electrical : Dielectric breakdown voltage as delivered , min	kV	30	ASTM D 877 or BS 60156 or IEC 156
**8	Gassing tendency at 50 Hz after 120 min , method A , max	mm ³ /min	5	BS 5797
9	Dielectric dissipation factor , at 90 °C and 40 Hz to 62 Hz , max	---	0.005	BS 5737 or IEC 60247
10	Chemical : Oxidation stability , 164 h : -Total acid number , max -Sludge , max	mg KOH/g % by mass	0.6 0.3	ASTM D 2440 or BS EN 61125
**11	Corrosive sulfur	---	Non–corrosive	ASTM D 1275 or BS 5680
12	Water , max	ppm	30	ASTM D 1533 or IEC 814
13	Neutralization value , max	mg KOH/g	0.03	ASTM D 974 or BS 2000 , Part 1
14	PCB content	ppm	Not detectable*	ASTM D 4059 or EN 61619
15	Antioxidant additives	---	(U) uninhibited oil : not detectable (T) trace inhibited oil : max. 0.08 % (I) inhibited oil : max. 0.08-0.40 %	IEC 60666 or ASTM D 2668 or ASTM D 4768

* No PCB (polychlorinated biphenyl) shall be included in oil .

** It is not a general requirement . It is used when transformer manufacturer recommend .