उत्पाद मैनुअल
ऊष्मारोधी द्रव - विद्युतीय प्रयोजनार्थ अनुप्रयुक्त सिंथेटिक कार्बनिक एस्टर की विशिष्टियाँ
IS 16081: 2013/ IEC 61099: 2010 के अनुसार

PRODUCT MANUAL
Insulating Liquids - Specifications for Unused Synthetic Organic Esters for Electrical Purposes
according to IS 16081: 2013/ IEC 61099: 2010

यह उत्पाद नियमावली सभी क्षेत्रीय/शाखा कार्यालयों और लाइसेंसधारियों द्वारा विभिन्न उत्पादों के लिए भारतीय मानक ब्यूरो (अनुरूपता मूल्यांकन) विनियम, 2018 की योजना-I के अंतर्गत प्रमाणन के संचालन में एकरूपता और पारदर्शिता सुनिश्चित करने के लिए संदर्भ सामग्री के रूप में उपयोग की जाएगी। बीआईएस प्रमाणन प्राप्त करने के इच्छुक भावी आवेदक भी इस दस्तावेज़ का उपयोग कर सकते हैं।

This Product Manual shall be used as reference material by all Regional/Branch Offices & licensees to ensure uniformity of practice and transparency in operation of certification under Scheme-I of Bureau of Indian Standards (Conformity Assessment) Regulations,2018 for various products. The document may also be used by prospective applicants desirous of obtaining BIS certification.

1.	**मानक संख्या / IS No.**	:	IS 16081 : 2013/ IEC 61099 : 2010
	शीर्षक / Title	:	Insulating Liquids Specifications for Unused Synthetic Organic Esters for Electrical Purposes
	संशोधनों की संख्या **No. of amendments**	:	Nil
2.	**नमूनाकरण दिशानिर्देश / Sampling Guidelines**		
a)	**कच्चा माल** **Raw material**	:	Nil *Note: This section indicates the requirements for raw material (if specified in the IS) for which compliance is to be established during Grant of Licence/Change in Scope of Licence/Factory Surveillance.*
b)	**समूहीकरण दिशानिर्देश** **Grouping Guidelines**	:	Nil
c)	**नमूने का परिमाण / Sample Quantity**	:	5 Liters Additional 2 Liters required for Biodegradation Test as per Cl 5.2.
d)	**परीक्षण अनुरोध में घोषित किए जाने वाले पैरामीटर** **Parameters to be Declared in Test Request**		Parameters as given in scope of licence *Note: Apart from the above, any other requirements/ parameters may also be declared as per the standard, as applicable.*
3.	**परीक्षण उपकरण की सूची** **List of Test Equipment**	:	Please refer **ANNEX – A**

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4.	**निरीक्षण एवं परीक्षण योजना** **Scheme of Inspection and Testing**	:	Please refer **ANNEX – B**
5.	**एक दिन में संभावित परीक्षण** **Possible tests in a day**	:	1. Colour (Cl 7.1.1) 2. Appearance (Cl 7.1.2) 3. Density (Cl 7.1.3) 4. Kinematic viscosity at 40 °C (Cl 7.1.4) 5. Flash point and fire point (Cl 7.1.5) 6. Pour point (Cl 7.1.6) 7. Water content (Cl 7.1.8) 8. Acidity (Cl 7.1.9) 9. Breakdown voltage (Cl 8.1) 10. Dielectric dissipation factor, permittivity and d.c. resistivity (Cl 8.2) *Note: This section is for the guidance of BIS Certification Officers/ Technical Auditors of BIS Authorized Outside Surveillance Agencies(OSAs) during factory inspection to provide ready reference regarding the tests which can be witnessed during the inspection in the factory by the officer/ auditor.*
6.	**लाइसेंस का दायरा / Scope of the Licence:**		

"Licence is granted to use Standard Mark as per **IS 16081 : 2013/ IEC 61099 : 2010** with the following scope:

Name of the product	Unused Synthetic Organic Esters For Electrical Purposes
Classification	*Less flammable synthetic organic ester liquids*
Biodegradability	*As per IS 13503/ IEC 61039*

ANNEX -A
List of Test Equipments
(Indicative List, For Guidance Only)

Sl. No.	Test Parameter & Clause Ref.	Test Method Standard	Test Apparatus & Required Reagents
1	Colour (Cl 7.1.1, Specification sheet 1)	ISO 2211	-Spectrophotometer (Optional) -Two Colorimetric Tubes (50 ml or 100ml Nessler Cylinders) -Cobalt(II) chloride hexahydrate ($CoCl_2 \cdot 6H_2O$) -Hydrochloric acid (HCl) -Chloroplatinic acid or Potassium chloroplatinate
2	Appearance (Cl 7.1.2, Specification sheet 1)	IS 16081/ IEC 61099	-Light Source -Clean clear glass sample container (approx. 10 cm light path) under transmitted light station
3	Density at 20 °C (Cl 7.1.3, Specification sheet 1)	ISO 3675 / IS 1448 (Part16)	-Hydrometer cylinder of clear glass, plastics material, or metal - Hydrometers, of glass, graduated in units of density -Constant temperature bath -Thermometer -Glass or plastics stirring rod (Optional)
4	Kinematic viscosity (Cl 7.1.4, Specification sheet)	ISO 3104 IS 1448 (Part 25/Sec 1)	- Glass capillary type viscometer -Viscometer holder -Temperature-controlled bath for 40°C -Temperature-measuring device -Timing device, capable of taking readings with a discrimination of 0.1 s or better -Refrigerated Thermostatic Bath for –20 °C
5	Flash & Fire Points (Cl 7.1.5, Specification sheet 1)	Flash Point - ISO 2719 / IS 1448 (Part:21) Fire Point- ISO 2592/IS 1448(Part 69)	-Pensky-Martens closed cup flash point test apparatus -Temperature measuring devices -Barometer, absolute pressure reading, accuracy of ±0.5 kPa -Heating bath or oven -Cleaning solvent - Cleveland Open Cup apparatus - Shield, to cover at least three sides of the test cup -Temperature measuring device -Barometer -Cleaning solvent, Verification liquids, Steel wool
6	Pour Point (Cl 7.1.6, Specification sheet 1)	ISO 3016 / IS 1448 (Part 10/ Sec2)	- Test jar as per Cl 5.1 of IS 1448 (Part 10/ Sec 2), -Temperature measuring device (Digital contact thermometer/Liquid-in-glass thermometers) -Cork, Jacket, Disc, Gasket, Cooling Baths -Timing device, capable of measuring up to 30 s with an accuracy of 0.2 s.
7	Crystallization (Cl 7.1.7)	Annex A of IS 16081/ IEC 61099	- Crystallizing dish of adequate capacity (150 ml to 250 ml), - a refrigerator able to maintain a temperature of –25 °C ± 1 °C
8	Water Content (Cl 7.1.8)	IEC 60814 / IS 13567	- Automatic Coulometric Karl Fischer Titrator with titration vessel, platinum electrodes, detection circuit, Current regulator circuit, DC power supply, end-point indicator, Current integrator, Electro-magnetic stirrer. -KF Reagents -Neutralizing solution -Desiccant -Lubricant grease - Glass syringes: 10 cm^3 and 5 cm^3 syringes

9	Acidity (Cl 7.1.9)	IEC 62021-1/ IEC 62021-2	**-**Automatic potentiometric titrator with motorized burette (0.001 mL to 0.01 mL dispensing resolution) -Combined glass pH electrode for non-aqueous titrations (with LiCl in ethanol reference electrolyte) -Glass titration vessel (50 mL to 100 mL capacity) with multi-port cover and magnetic stirrer -Nitrogen gas purging assembly with regulator and delivery tube -Analytical balance sensitive to 0.0001 g -$0.01 mol/L$ (or $0.05 mol/L$) Potassium Hydroxide (KOH) in ethanol or propan-2-ol **-** toluene, propan-2-ol (isopropanol), and water **-**$1M\ LiCl$ solution in ethanol or propan-2-ol **-** Standard aqueous pH buffer solutions ($pH4.00$, $pH7.00$, and $pH10.00$)
10	Oxidation Stability (Cl 7.1.10) Total sludge and Total acidity	IS 12422/ IEC 61125/ Method C / Annex A	-Thermostatic Heating/oxidation bath (120 °C ± 0.5 °C), -Glass oxidation tubes, gas intel tubes, - Flowmeter, Oxygen Supply (0.15 L/h per tube), -Filtering crucibles, Porcelain vessels -Laboratory Glassware, -Copper wire catalyst coils, -Kinematic viscometer, -Membrane filtration apparatus - Analytical balance (0.1 mg accuracy), -Drying oven -Acetone, normal heptane -Automatic potentiometric titrator - 0.05 mol/l alcoholic potassium hydroxide, -phenolphthalein indicator
11	Breakdown Voltage (BDV) (Cl 8.1, Specification sheet 1)	IS 6792/ IEC 60156	-AC High Voltage Test Set (Integrated with voltage regulator, step-up transformer, switching system, current-limiting resistors, measuring device) -Test cell with volume 350ml to 600ml -Electrodes made either of brass, bronze or austenitic stainless steel, -Stirring device
12	Dielectric dissipation factor, permittivity and d.c. resistivity (Cl 8.2, Specification sheet 1)	IS 16086/ IEC 61620 IS 16840/ IEC 60247	-Test Cell -Heating Device (forced draught air oven/ oil-filled thermostatically controlled bath) -Square wave generator -Measurement chain for conductance and capacitance measurement or -Three terminal test cell -AC Dielectric Loss Test Bridge with AC power supply (Schering Bridge / Automatic Capacitance & Tan Delta Test Set) - Standard Capacitor -Inductive or Heating Oven with Temperature Sensor -Time-Measuring Device
13	Gassing tendency (Cl 8.3) (Optional)	Method A of IEC 60628:1985	- Precision Borosilicate Gassing Cell -Gas Burette Assembly -Inner High-Voltage Electrode, Outer Ground Electrode -High-Voltage AC Power Supply -Constant Temperature Transparent Oil Bath -Transparent Acrylic Safety Shield -Hydrogen Gas (H_2), -n-Heptane or petroleum ether -Burette Leveling Liquid like dibutyl phthalate
14	Biodegradation (Cl 5.2, Table 1)	OECD 301 B, C, F / US EPA OPPTS 835.311	-Closed respirometer, CO2 evolution apparatus, Incubation bath, -TOC analyzer / dissolved oxygen meter

The above list is indicative only and may not be treated as exhaustive.

ANNEX B
Scheme of Inspection and Testing

For the purpose of this scheme, there shall be two types of units

a) Manufacturing units: Manufacturing units are those units which produce Unused Synthetic Organic Esters.

b) Repacking units: Repacking units are those units which procure ISI Marked Unused Synthetic Organic Esters as per IS 16081: 2013 from a manufacturing unit holding a valid BIS licence for this product, repack it and dispatch it to the customer(s).

1. QUALITY ASSURANCE PLAN

1.1 It is expected that during operation of BIS licence manufacturers will implement a Quality Assurance Plan (QAP) i.e. a plan of regular testing and in-process controls, designed to ensure that the product bearing the Standard Mark conforms to all requirements of the Indian Standard.

1.2 The manufacturers shall define a Quality Assurance Plan (QAP) defining the control unit (i.e. lot/batch etc.), the levels of control (i.e. the frequency and number of samples for conducting the different tests as per the Indian Standard) and declare the arrangement for testing i.e. whether in-house or sub-contracting/ sharing for each applicable test and submit the same to BIS Branch Office for information. The manufacturer shall comply with the QAP and maintain test records in accordance with para 2.1.

1.3 Recommended Levels of Control/ Control Unit:

1.3.1 For the guidance of manufacturers, the recommended definition of control unit is: *Unused Synthetic Organic Esters produced in a continuous manufacturing run in one day* shall constitute a control unit.

1.3.2 For the guidance of manufacturers in preparing the Quality Assurance Plan, recommended levels of control are given in Table 1. Manufacturer has the discretion of declaring their own levels of control or accept the levels of control given in this document.

1.3.3 The manufacturer shall ensure inspection and testing as per the Quality Assurance Plan submitted by them on the whole production of the factory which is covered by this plan.

1.4 However, all manufacturers shall ensure compliance of their products to all the requirements of the Indian Standard.

2. ENSURING COMPLIANCE THROUGH TESTING

The manufacturers shall ensure compliance of their products to all the requirements of the Indian Standard for which they may have in-house test facilities. However, there is no obligation to maintain in-house laboratory. Licensee may use alternative arrangements for tests of the production as per the declared QAP. Various alternatives are available for operation of BIS certification as given below and the relevant guidelines for availing such relaxations by the manufacturers, as amended from time to time, are to be referred:

i) Shared testing resources like common facility,

ii) Cluster based testing facility,

iii) Sub-contracting to outside laboratories which may either be:

a) BIS recognised/ empanelled laboratories, or

b) Any accredited laboratory as per ISO/IEC 17025

2.1 Test Records- The manufacturers shall maintain test records for the tests carried out (either in-house or at a sub-contracted or at shared test facility) to establish conformity of the product to the Standard for operation of licence. For the tests being subcontracted or conducted at a shared test facility, test results issued by the laboratories or test facilities, shall be made available for inspection by BIS.

3. PACKING AND MARKING

The Standard Mark as given in the Schedule of the licence shall be incorporated legibly and indelibly on each container of the product provided always that the product so marked conforms to each requirement of the specification.

3.1 Packing and Marking shall be done as per the provisions of the standard.

3.2 If material is supplied in bulk, rail tank cars, tank containers, or packed in drums or intermediate bulk containers etc. the Standard Mark as given in Schedule of the licence and Licence Number (i.e. CM/L) shall be incorporated on a test certificate to be provided along with each bulk, rail tank cars, tank containers or drums as per the format at Appendix-1 enclosed, provided always that the product thus marked conforms to all the requirement of the specification. Packing shall be done as per provisions of Indian Standard and the marking details as per Cl 6.2 of IS 16081:2013 shall also be indicated on the test certificate.

3.3 Repacking units shall mark the following on each container/package in place of “Manufacturer’s name” as per 5.2. (b) of the Marking requirements given in the Indian Standard

i. Manufactured by: Name, trade mark (if any) and BIS Licence Number of the manufacturing unit

ii. Packaged by: Name, trade mark (if any) and BIS Licence number of the packaging unit.

3.4 The re-packer shall also maintain records of the repacked material, as per the format given in Table 3.

3.5 **Additional Marking requirements**: The material shall also be marked with the following additional requirement on each container/package:

a) “For BIS certification details please visit www.bis.gov.in”

4. REJECTION

The production which conforms to the Indian Standard and covered under the scope of this licence shall be marked with the Standard Mark. Disposal of non-conforming product shall be done in such a way so as to ensure that there is no violation of provisions of BIS Act, 2016.

TABLE-1

(Recommended Levels of Control by BIS- for Guidance Only)

(1)				(2)		
Test Details				**Levels of Control**		
Cl.	**Requirement**	**Test Methods**		**No. of Sample**	**Frequency**	**Remarks**
		Clause	**Reference**			
Cl 7.1.1	Colour	Cl 7.1.1	ISO 2211	One	Each Control Unit	If the Unused Synthetic Organic Esters fail in any requirement, two more samples shall be drawn from the same control unit and tested for those particular requirements and the control unit shall be rejected if there is any further failure. The control unit so rejected may be suitably re -processed and the defects rectified. Such re -processed control unit may be marked when tested again in accordance with the Scheme and found conforming to the requirements of the Specification.
Cl 7.1.2	Appearance	Cl 7.1.2	IS 16081/ IEC 61099	One		
Cl 7.1.3	Density at 20°C(kg/dm³)	Cl 7.1.3	IS 1448 (Part 16)/ ISO 3675	One		
Cl 7.1.4	Kinematic viscosity at 40°C and -20°C	Cl 7.1.4	IS 1448 (Part 25/Sec 1)/ ISO 3104	One		
Cl 7.1.5	Flash point (°C)	Cl 7.1.5	IS 1448 (Part 21)/ ISO 2719	One		
Cl 7.1.5	Fire point (°C)	Cl 7.1.5	IS 1448(Part 69)/ ISO 2592	One		
Cl 7.1.6	Pour Point (°C)	Cl 7.1.6	IS 1448 (Part 10/ Sec 2)/ ISO 3016	One		
Cl 7.1.8	Water content	Cl 7.1.8	IS 13567/ IEC 60814	One		
Cl 7.1.9	Acidity	Cl 7.1.9	IS 16863 (Part 1)/ (Part 2) IEC 62021-1/ IEC 62021-2	One		
Cl 7.1.10	Oxidation stability (164 h)	Cl 7.1.10	IS 12422/ IEC 61125 Method C	One	Once in 6 Months or whenever there is a change in the composition or source of the raw material	
Cl 7.1.10	1)Total acidity (mg KOH/g)	Cl 7.1.10		One		
Cl 7.1.10	2)Total sludge (% mass)	Cl 7.1.10		One		
Cl 8.1	Breakdown Voltage(kV)	Cl 8.1	IS 6792/ IEC 60156	One	Each Control Unit	
Cl 8.2	Dielectric dissipation factor, tan δ at 90°C & 50Hz	Cl 8.2	IS 16086/ IEC 61620 IS 16840/ IEC 60247	One	Once in 3 months or whenever there is a change in the composition or source of the raw material	
Cl 8.2	DC resistivity at 90°C	Cl 8.2	IS 16840/ IEC 60247	One		
Cl.8.3	Gassing Tendency	Cl.8.3	Method A of IEC 60628: 1985	One		
Cl 5.2	Biodegradation (Optional)	Cl 5.2	OECD 301 B, C or F / OPPTS 835.311 (US EPA)	One	Once in 3 Years or whenever there is a change in the composition or source of the raw material	
Cl 5.3	Toxicity (Optional)	Cl 5.3	Modified Ames test or OECD 201-203; US EPA 600 /4.82.068:1983	One		
Cl 7.1.7	Crystallization	Cl 7.1.7	Annex A IS 16081/ IEC 61099	One		

TABLE-2

(For Re-packing Units)

(Recommended Levels of Control by BIS- for Guidance Only)

(1)				(2)		
Test Details				**Levels of Control**		
Cl.	**Requirement**	**Test Method**		**No. of Sample**	**Frequency**	**Remarks**
		Clause	**Reference**			
Cl 7.1.1	Colour	Cl 7.1.1	ISO 2211	One	Unused Synthetic Organic Esters produced in a day by each manufacturer, in each consignment received	If the Unused Synthetic Organic Esters fails in any requirement, two more samples shall be drawn from the same consignment and tested for those particular requirements and the consignment shall be rejected if there is any further failure. The consignment so rejected may be returned to the supplier for re processing.
Cl 7.1.2	Appearance	Cl 7.1.2	IS 16081/ IEC 61099	One		
Cl 7.1.3	Density at 20°C(kg/dm³)	Cl 7.1.3	IS 1448 (Part 16)/ ISO 3675	One		
Cl 7.1.4	Kinematic viscosity at 40°C and -20°C	Cl 7.1.4	IS 1448 (Part 25/ Sec 1)/ ISO 3104	One	Once in 6 months for synthetic esters received from each manufacturer	
Cl 7.1.5	Flash point (°C)	Cl 7.1.5	IS 1448 (Part 21)/ ISO 2719	One		
Cl 7.1.5	Fire point (°C)	Cl 7.1.5	IS 1448(Part 69)/ ISO 2592	One		
Cl 7.1.6	Pour Point (°C)	Cl 7.1.6	IS 1448 (Part 10/ Sec 2)/ ISO 3016	One		
Cl 7.1.8	Water content	Cl 7.1.8	IS 13567/ IEC 60814	One	Unused Synthetic Organic Esters produced in a day by each manufacturer, in each consignment received	
Cl 7.1.9	Acidity	Cl 7.1.9	IS 16863 (Part 1)/ (Part 2) IEC 62021-1/ IEC 62021-2	One		
Cl 8.1	Breakdown Voltage(kV)	Cl 8.1	IS 6792/ IEC 60156	One		
Cl 7.1.10	Oxidation stability (164 h)	Cl 7.1.10	IS 12422/ IEC 61125 Method C	One	Once in a year for synthetic esters received from each manufacturer	
Cl 7.1.10	1)Total acidity (mg KOH/g)	Cl 7.1.10		One		
Cl 7.1.10	2)Total sludge (% mass)	Cl 7.1.10		One		
Cl 8.2	Dielectric dissipation factor, tanδ at 90°C & 50Hz	Cl 8.2	IS 16086/ IEC 60247	One	Once in a year for synthetic esters received from each manufacturer	
Cl 8.2	DC resistivity at 90°C	Cl 8.2	IS 16840/ IEC 60247	One		
Cl.8.3	Gassing Tendency	Cl.8.3	Method A of IEC 60628: 1985	One		
Cl 5.2	Biodegradation (Optional)	Cl 5.2	OECD 301 B, C or F / OPPTS 835.311 (US EPA)	One	Once in 3 years for synthetic esters received from each manufacturer	
Cl 5.3	Toxicity (Optional)	Cl 5.3	Modified Ames test or OECD 201-203; US EPA 600 /4.82.068:1983	One		
Cl 7.1.7	Crystallization (Optional)	Cl 7.1.7	Annex A IS 16081/ IEC 61099	One		

APPENDIX-1

XYZ COMPANY
(Registered Office Address and Works Address)

TEST CERTIFICATE NO._____DATED

SUPPLIED TO M/s_____ (Name and Address of Consignee)

It is certified that the material described below fully conforms to IS 16081: 2013/ IEC 61099: 2010.
The properties of the product, as tested in accordance with the Scheme of Inspection and Testing contained in the BIS Certification Marks Licence No. CM/L_____are as indicated below:

TEST RESULT

Order No. and date	**Name of the material**	**Test**	**Requirement**	**Observed value**	**Control Unit/ Batch Number**	**Month and Year of manufacture**	**Quantity**	**Remarks**
	Less flammable synthetic organic ester liquids	Colour						
		Appearance						
		Density at 20°C(kg/dm³)						
		Kinematic viscosity at 40°C						
		Kinematic viscosity at -20°C						
		Flash point (°C)						
		Fire point (°C)						
		Pour Point (°C)						
		Water content (mg/kg)						
		Acidity (mg KOH/g)						
		Oxidation stability (164 Hrs)						
		1)Total acidity (mg KOH/g)						
		2)Total sludge (% mass)						
		Breakdown Voltage(kV)						
		Dielectric dissipation factor ,tanδ at 90°C & 50Hz						
		DC resistivity at 90°C						

Remarks: **The material supplied conforms to requirements of IS 16081: 2013/ IEC 61099: 2010**
Tank Car/Tank Truck/Container Ship No._____

Signature (XYZ Company)

TABLE-3

Record of Repacking of Unused Synthetic Organic Esters

Sl. No.	Name of the Manufacturer	Particulars of test reports received with C.U/Batch no.	Date of manufacture	Quantity received	Date of receipt	Date of re-packing	Batch No.	Details of repacking		Total quantity repacked	Details of dispatch
								Size of Packing	No.		
1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*