
Transformer Insulating Mineral Oil



1. Scope

This standard details the manufacturer requirements for new transformer insulating mineral oil. Seattle City Light purchases naphthenic, ASTM Type II mineral oil with Diteritary Butyl Paracresol (DBPC) added to inhibit oxidation within the transformer.

This standard applies to SCL Stock No. 753100.

2. Application

This oil is used to replace or supplement mineral oil in repaired or maintained distribution transformers. As of this writing, only new Network transformers are purchased with mineral oil. All other transformers are purchased with natural ester insulating fluids like FR3.

3. Industry Standards

Transformer insulating oil shall meet the applicable requirements of the following industry standards:

ASTM D3487-09 - "Standard Specification for Mineral Insulating Oil Used in Electrical Apparatus;" ASTM

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4. Requirements

Oil shall be refined to exhibit the following attributes:

Electrical Property	ASTM Standard	Value
Dielectric breakdown- 0.10 inch gap	D877	30kV, minimum
Dielectric breakdown- 1mm gap	D1816	20kV, minimum
Dielectric breakdown- 2mm gap	D1816	35kV, minimum
Liquid power factor- 25 degrees C	D924	0.05%, maximum
Liquid power factor- 100 degrees C	D924	0.3%, maximum
Gassing tendency	D2300	negative
Chemical Properties		
Aniline point	D611	84 degrees C maximum
Corrosive sulfur	D1275	passes
Acid number	D974	0.015 mg KOH/g maximum
Moisture	D1533	25ppm maximum
PCBs	D4059	less than 1ppm maximum
Furanic compounds	D5837	20 ppb maximum
Oxidation inhibitor	D2668 D4768	0.2-0.3% by weight
Physical Properties		
Color	D1500	0.5 maximum
Flash point	D92	145 degrees C minimum
IFT	D971	40 dynes/cm minimum
Pour point	D97	-40 degrees C maximum
Viscosity	D445	11 cSt maximum at 40 degrees C
Appearance	D1524	clear and bright
Sludge free life	Doble	80 hours, +/-8 hours
Power factor valued oxidation	Doble	passes
Sludge % at 72 hours	D2440	0.1% maximum
Acid number at 72 hours	D2440	0.3 maximum
Sludge % at 164 hours	D2440	0.2% maximum
Acid number at 164 hours	D2440	0.4 maximum
Rotating vessel	D2112	220 minutes minimum

5. Conflict

Where conflict exists, the following order of precedence shall apply:

1. Seattle City Light Purchase Order (PO)
2. Seattle City Light General Terms and Conditions
3. Seattle City Light detailed material standard
4. This material standard
5. IEC publications
6. ASTM publications
7. Other industry standards.

6. Purchase Order Information

Purchase Order will state the following minimum information:

- Oil description
- Seattle City Light material standard number including revision date
- Seattle City Light stock number
- Total order quantity
- Price
- Delivery date
- Quantity per tanker.

7. Design Changes

Manufacturer shall inform Seattle City Light in writing of all design changes that could affect the product's understood or published attributes.

8. Packaging

Oil tankers shall be filled to prevent contamination during shipping and handling.

Individual tankers shall be legibly marked with:

- Manufacturer's name
- Manufacturer's catalog number
- Product description
- Seattle City Light's Stock Number
- Seattle City Light's Purchase Order Number.

9. Documentation

9.1 General

Documentation shall be in English and use customary inch-pound units.

Documentation shall utilize common industry terminology and well-understood abbreviations.

9.2 Bidder's Data

Bidder shall identify all exceptions to Seattle City Light requirements with reference to the requirement to which exception is taken; indicate if no exceptions taken.

9.3 Certified (Production) Test Reports

For each shipment a certified production test report (CTR) shall be emailed to:
standards.scl@seattle.gov.

Certified production test report shall include:

- A unique certified test report number
- Seattle City Light Purchase Order number
- Manufacturer's name
- Manufacturing plant location
- Basic oil description
- Manufacturer's order number
- Shipping information or serial numbers and shipment volume
- Test values for each shipment that demonstrate compliance with ASTM D3487 and this standard including Section 6 Attributes

Supplier shall provide a certified production test report and follow the product evaluation process per Section 10 of this material standard.

9.4 Plant QA Processes

Upon request, supplier shall provide information describing their plant's quality assurance processes.

10. Product Evaluation

Seattle City Light Quality Assurance and Standards will evaluate the certified production test report for compliance.

Following the internal evaluation, Seattle City Light Material Control will inform the supplier if oil shipment is in compliance, or not.

Upon receipt at Seattle City Light, the oil will be tested for dielectric strength in accordance with the requirements of ASTM D1816.

- Sampling for purposes of inspection and test shall be in accordance with ASTM D 117, latest revision. A composite sample of not less than 5 gallons of oil shall be taken from each lot.
- For purposes of sampling, a lot shall consist of a manufacturer's batch. If the material cannot be identified by batch, a lot shall consist of not more than 10,000 gallons of oil of the same grade offered for delivery at one time.
- Inspection and Tests, as listed in Section 6, shall be conducted in accordance with the applicable ASTM test method.
- The supplier shall ensure that all inspection and tests required by this standard are performed on each batch of insulating oil furnished.
- All inspection and tests shall be the responsibility of the supplier and shall be performed at its expense in a recognized laboratory. These test reports shall be certified by an authorized representative of the laboratory conducting the tests.
- The certified test report shall accompany the packing list.

11. Approved Manufacturers

Any supplier meeting the technical requirements of this document.

12. References

SCL 7531.0 Insulating Oil – Electrical Napthenic (canceled)
Half Century Transformer Maintenance, SD Myers 2010
Hanson, Brett; SCL Standards Engineer, originator, and subject matter expert for 4487.00

11. Sources

SCL Material Standard 4487.00 (canceled and renumbered to 7525.15); “Transformer Insulating Mineral Oil”