



Maharashtra State Electricity Distribution Company Limited

SPEC. NO. STORES: MSC-II /New Insulating Oil/2011

TECHNICAL SPECIFICATION

FOR

NEW INSULATING OIL

FOR

TRANSFORMERS & SWITCHGEARS

IN

MSEDCL

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TECHNICAL SPECIFICATION NEW INSULATING OIL

SPEC. NO. STORES: MSC-II /New Insulating Oil/2011

1.0 Scope :

- 1.1 The specification covers manufacturing, sampling, testing, packing, marking and delivery of premium grade unhibited Mineral New Insulating Oil for Transformers and Switchgears.
- 1.2 This specification prescribes the requirements of new insulating oil of petroleum origin suitable for use as an insulating, heat transfer medium and arc quenching medium.
- 1.3 The composition of oil shall be pure hydrocarbon mineral oil, without any additive, clean and sufficiently free from moisture or other foreign matter likely to impair its properties.

2.0 Service Conditions:

The oil to be supplied against this specification shall be suitable for satisfactory continuous operation of power and distribution electrical equipments such as transformers, switchgears, capacitors and allied equipments under the following tropical conditions.

- 2.1 Maximum ambient temperature (Degree C) 50
- 2.2 Maximum temperature in shade (Degree C) 45
- 2.3 Minimum temperature of air in shade (Degree C) 3.5
- 2.4 Relative Humidity (%) 10 to 100
- 2.5 Maximum Annual Rainfall (mm) 1450
- 2.6 Maximum Wind Pressure (Kg/Sq.) 150
- 2.7 Maximum altitude above mean sea level (meter) 1000
- 2.8 Isoceraunic level (days/year) 50
- 2.9 Seismic level (Horizontal acceleration) 0.39
- 2.10 Moderately hot and humid tropical climate
Conductive to rust and fungus growth.
- 2.11 Reference Ambient Temperature for temperature rise : 50 Deg C

3.0 Reference Standards:

- 3.1 Unless otherwise specified, the new insulating oil to be supplied shall be conformed to Indian Standards amended up to date as follows:

Sr. No.	IS No.	Title
1	335/1993	New Insulating Oils - Specification (fourth revision)
2	1070 : 1992	Reagent grade water – specification (third revision)
3	1448:[P:2]: 1967	Methods of test for petroleum and its products : Part 2 Acidity (First revision)

4	1448:[P:10]: 1970	Methods of test for petroleum and its products : Part 10 cloud point and pour point (First revision)
5	1448:[P:16]: 1990 & 1448:[P:21]: 1992	Methods of test for petroleum and its products: Part 21 Flash Point (closed) by Pensky Martens apparatus (Third revision)
6	1448:[P:25]: 1976	Methods of test for petroleum and its products: part 25 Determination of kinematics and dynamic viscosity (First revision)
7	1783:[Part1]: 1983	Drums, large, fixed ends: Part 1 Grade A Drums (second revision)
8	1783:[Part 2]: 1988	Drums, large, fixed ends: Part 1 Grade A Drums (third revision)
9	4759:1984	Hot-dip zinc coatings on structural steel and other allied products (second revision)
10	6103:1971	Methods of test for specific resistance (resistivity) of electrical insulating liquids
11	6104:1971	Methods of test for interfacial tension of oil against water by the ring method.
12	6262:1971	Method of test for power factor and dielectric constant of electrical insulating liquids.
13	6272:1971	Metal polishes (special)
14	6792:1992	Method for determination of electric strength of insulating oils
15	6855:1973	Method of sampling for liquid dielectric
16	12177:1987	Methods of test for oxidative ageing of electrical insulation of petroleum oils by the open beaker method
17	12463:1988	Inhibited mineral insulating oils
18	13567:1992	Determination of water in insulating liquids and in oil-impregnated paper and press board by automatic coulometric Karl Fischer titration – Method of test
19	13631:1992	Method of test for detection and determination of antioxidant additives in insulating oils.

3.2 In case of conflict arising out due to variations between the applicable standard and the standards specified herein the provisions of this specification should prevail.

4.0 General Technical Requirements:

The characteristics of the oil when it is sampled a manufacturer's work ad /or at the point of delivery and tested in accordance with the methods referred to in TABLE 1 of IS: 335: 1993 amended upto date.

- 4.1. The appearance of the insulating oil shall be transparent clear, bright, odourless liquid free from suspended matter or sediments (impurities).
- 4.2. The Density of oil shall be **maximum 0.89 g / cm³ at 29.5 ° C** as per IS 1448 [P:16]:1990.
- 4.3. The Kinematic Viscosity of insulating oil shall be **maximum 27 cSt** at 27 ° C as per IS 1448 [P:25]:1976.
- 4.4 Interfacial tension of the insulating oil shall be **minimum 0.04 N/m** at 27 ° C as per IS 6104 :1971.
- 4.5. Flash point (closed) of the insulating oil measured by Pensky Marten apparatus shall be **minimum 140 ° C** as per IS: 1448 [P:21]:1992
- 4.6. Pour Point of the insulating oil shall be maximum (- 6 ° C) as per IS: 1448 [P:10]:1970.
- 4.7. Neutralization Value of insulating oil as per IS: 1448 [P:2]:1967 shall be as indicated below. The Alcoholic potassium hydroxide solution of **0.02 N** should be used in place of **0.1 N** indicated in the test method.
 - a) Total Acidity shall be maximum **0.03 mg/KOH/gm**.
 - b) Inorganic Acidity/ Alkalinity shall be nil.
- 4.8. As per Annexure –B of IS : 335: 1993 the Corrosive Sulphur of insulating oil shall be **Non-Corrosive**.
- 4.9 As per IS 6792:1992 the Electric Strength (Breakdown voltage) of insulating oil shall be as follows.
 - a) The Breakdown voltage of new unfiltered oil should be minimum **30 KV (rms) at 2.5 mm gap**. If the above value is not attained the oil shall be filtered.
 - b) The Breakdown voltage of filtered oil should be minimum **60 KV (rms) at 2.5 mm gap**.
- 4.10 As per IS: 6262:1971 the Dielectric dissipation factor of insulating oil shall be maximum **0.002** (tan δ) at 90 ° C .
- 4.11. The Water content in the oil shall be maximum **40 ppm** as per IS: 13567:1992.
- 4.12 Specific Resistance (Resistivity) of oil shall be as follows:
 - a) at 90 ° C - **35 x 10¹² Ohm-cm (Minimum)**

- b) at 27 ° C - 1500 x 10¹² Ohm-cm (minimum)
- 4.13 As per Annexure –B of IS : 335: 1993 the oxidation stability of the oil shall be as follows :
- a) Neutralization value after oxidation shall be maximum 0.4 Mg/KOH/g
 - b) Total sludge after oxidation shall be maximum 0.10 percent by weight.
- 4.14 As per IS: 12177:1987 Method A: Aging characteristics of insulating oil after accelerated ageing (Open beaker method with Copper catalyst) shall be as follows:
- a) Specific resistance (Resistivity) as per IS: 6103 : 1971 shall be
 - 1) 2.5 x 10¹²Ohm/cm (minimum) at 27 ° C
 - 2) 0.2 x 10¹²Ohm-cm (minimum) at 90 ° C
 - b) Dielectric dissipation factor (tan δ) shall be 0.20 maximum at 90 ° C as per IS: 12177:1987
 - c) Total acidity shall be 0.05 Mg/KOH/gm (maximum) as per IS: 1448:[P:2]:1967
 - d) Total sludge shall be 0.05 (Maximum) Percent by weight as per Annex A of IS:12177-1987.
- 4.15. As per IS: 13631:1992 the oil shall not contain Percent by weight of antioxidant additives value of 0.5 (Maximum) shall be treated as absence of DBPC- phenolic type inhibitor.
- 4.16 ISI Certification mark for New Insulating Oil :
The New Insulating Oil is to be supplied confirming to IS-335-1993 as amended upto date should bear ISI certification mark, without ISI mark insulating oil will be rejected.

5.0 Packing :

- 5.1 The oil shall be delivered in perfectly clean steel drums of 210 liters nominal capacity conforming to Grade “A” type 2 conforming IS: 1783 (Part 1) : 1993 amended upto date. The drum shall be coated from inside with epoxy lacquer or phosphate coating or better. The inside coating of the drum shall be resistant to insulating oil. The outside surface of the drum may be coated with anticorrosive primer and finish paint, for protection against atmospheric corrosion. The colour of the finishing paint shall be Navy Blue (Shade No. 106) conforming to IS:5:1994 (Colours of ready mixed paints). The drum shall be effectively sealed immediately after filling the oil to avoid ingress of moisture.

5.2 Steel Barrel:

The New Insulating Oil of above specification shall be supplied in standard packing of 200 liters nominal capacity, non-returnable Brand New Steel Barrels (Drums) `A` grade type-2 conforming to IS-1783 (Part-I) 1993 as amended upto date.

The Type-2 drums shall be as per Fig-2 with triple / Spiral seam (Drawings No. MSEDCL/MM-II/OIL/01 and MSEDCL/MM-II/OIL/02) with ISI marking.

6.0 Sampling :

Sampling of oil shall be done in accordance with IS 6885: 1973.

7.0 Tests :

The tenderer shall submit Test reports of the offered New insulating Oil with the offer in electronic format (i.e. Compact Disc) and in physical format. The tests shall be carried out at laboratories accredited by National Accreditation Board for testing and Calibration Laboratories (NABL) such as CPRI/ERDA to prove the requirements specified in this specification & as per relevant standards IS:335 amended up-to-date. The tests should be carried out within 5 years prior to the date of opening of this tender. The offer without test reports from NABL laboratories is considered as non- responsive and likely to be rejected.

The successful tenderer shall get approved the test reports of new insulating oil and drum from **Chief Engineer (Stores)**, MSEDCL, Prakashgad, Bandra, Mumbai prior commencement of the supply. The Drum drawings shall be submitted to the **Chief Engineer (Stores)** and get approved before commencement of the supply.

8.0 Pre dispatch Inspection :

The tenderers should arrange for sample testing of New Insulating Oil twice during the contractual period, at their cost. Tenderers should note that no separate testing charges will be payable by the MSEDCL. Sample testing will have to be arranged as and when directed by the MSEDCL at CPRI, Bangalore/ERDA, Vadodara Laboratories.

9.0 Testing Facility :

- 9.1 The tenderer should have adequate testing facility for all routine and acceptance tests on insulating oil and should provide the testing arrangements and testing equipments to testing Engineer of MSEDCL. The tenderer should submit the list of testing equipments available with them with the offer.
- 9.2 The bidder should also supply along with his offer the pamphlets/literatures in respect of insulating oil available with them.
- 9.3 The bidder should not change GTP parameters of insulating oil once it offered in A/T, and Type Test Reports.

10.0 Rejection :-

Apart from rejection due to failure in testing of insulating oil to meet the specified test requirements the oil shall be liable for rejection on any one of the following reasons.

- i. If tests are not carried out as per clause no. 7.0 of this specification.
- ii. If Drawings are not submitted with offer as per clause no. 5.2 of this specification.
- iii. If GTP parameters are not submitted as per clause no. 4.0 of this specification.

- iv. The bidder should fill up all the details in GTP parameter list, the statement such as “as per drawings enclosed”, “as per MSEDCL’s requirement” “as per IS” etc. shall be considered as details are not furnished and such offers shall liable for rejection.

11.0 Quality Assurance

- 11.1 Names of the supplier for the raw material, list of standards accordingly to which the raw materials are tested, list of test normally carried out on raw materials in presence of bidder’s representatives, copies of test certificates.
- 11.2 Information and copies of test certificate as in (i) above respect of bought out accessories.
- 11.3 List of manufacturing facilities available.
- 11.4 Level of automation achieved and list of areas where manual processing still exists.
- 11.5 List of areas in manufacturing process where stage inspection are normally carried out for quality control and details of such tests and inspections.
- 11.6 List of testing equipment available with the bidder for final testing of insulating oil and test plant limitation, if any, vis-à-vis the special acceptance and routine tests specified in the relevant standards and the present specification.
- 11.7 The successful bidder shall submit the Routine Test Certificate along with documentary evidence having paid for the excise duty for the following raw materials viz Crude Oil, at the time of Testing.

12.0 Qualifying Requirement: As per Tender

SPECIFICATION FOR DRUMS, LARGE, FIXED ENDS

Grade “A” DRUMS

1.0 Scope :

This specification covers design, manufacturing, testing, supply Non- Returnable, New Steel Barrels (Drums) of Grade-A , Type 1 & Type 2, conforming as per IS: 1783-(Part-1) 1993 of 200 liters nominal capacity with fixed ends with the following types of construction.

- a) Type-1 – Drums of steel sheets of nominal thickness 1.25 mm for body and ends, with end seam resistance welded and double seam construction.
- b) Type – 2 – Drums of sheets of nominal thickness 1.25 mm for body and ends, with end seam of spiral/triple seam construction.

2.0 References :-

The following Indian standards are necessary adjuncts to this standard.

IS No.	Title
513 : 1994	Cold rolled low carbon steel sheets and sheets (Fourth revision).
1394 : 1984	Glossary of terms relating to metal Containers (Third revision).
1784 : 1984	Screwed closures for drums (Second revision).
3258 : 1966	Methods of sampling of metal Containers.

3.0 Terminology:

For the purpose of this standard, the definitions given in IS:1394:1984 shall apply.

4.0 Capacity :

The minimum gross capacity of the drums measured with water at ambient temperature shall be 210 litres.

5.0 Dimensions :

The drums of type 1 & type 2 construction shall have dimensions as given in Fig. 1 & Fig.2. The drum drawings are attached with the specification. Drawings No. MSEDCL/MM-II/OIL/01 & MSEDCL/MM-II/OIL/02.

6.0 Material :

6.1 The material for type 1 & Type 2 drums shall be as follows –

- a) Type 1- Body and ends of the drums shall be Cold Rolled Carbon Steel sheets conforming to Grade “O” or “D” or “DD” of IS: 513:1994.
- b) Type 2 – Body and ends of the drums shall be Cold Rolled Carbon Steel sheets conforming to Grade “O” or “D” of IS: 513:1994.

6.2 The nominal thickness of steel sheets for body and ends of both types of drums shall be 1.25 mm.

6.3 The sheets and blanks shall be phosphatized by any of the recognized processes.

7.0 Construction:

7.1 The sheets shall be blanked and formed to shape. The blanks shall be free from cracks, dents, pitting, rust other defects.

7.2 The body shall be continuously resistance welded so as to provide air-tight joint.

7.3 Triple/Spiral seam construction for type 2 drums.

The top and bottom ends shall be seamed to the body as shown in Fig.2. The seam shall have rolled 5 layers of sheet with the sealing compound forming a core at the joint of body and end sheets. The sealing compound forming the core shall be flexible and chemically resistant to the product to be packed.

7.4 The Drums shall be provided with two rolling bends or he as expanded or rolled in the drum body, located as shown in Fig 1 & Fig. 2.

7.5 Closures :-

The drums shall be fitted with two screwed closures one of 50 mm and the other of 20 mm as desired by the purchaser. The position of the screwed closure shall be as shown in Fig 1 & Fig.2. Screwed closures shall be conforming to IS:1784:1984.

8.0 Finish :-

8.1 The drums shall be in clean condition, the inside being free from all traces of rust and foreign matter.

8.2 The inside and outside surfaces of each drums shall be treated as per Specification Cl.No.5.1 of insulating Oil.

9.0 Tests :-

9.1 Leakage Test :-

Each drum shall be tested for leakage by either of the methods:

At air pressure of 50 Kpa (0.5 Kgf/ cm²) with the seams under water or covered with soap solution. The drums shall not show any sign of leakage or drop in the test pressure when observed for at least 10 seconds.

OR

Using special equipment fill the drum with helium, thereafter putting the drum in an air-tight chamber, creating a high vacuum in the annular space between the inner wall of the chamber and outer surface of the drum and thereafter testing for leakage in the drum by checking for presence of helium in annular space using Mass Spectrometer.

OR

Using special equipment put drum in air –tight chamber creating a high vacuum in the annular space between the inner walls of the chamber and outer surface of drum and thereafter testing for leakage in the drum by observing for any drop in the differential pressure between inside of the drum and outside of the drum.

9.2 Drop Test :-

- 9.2.1 Fill the drum to 98 percent of its gross capacity with water at ambient temperature and close it properly, suspend the drum with the diagonal in the vertical position and raise it to a height so that the lowest point on the drum is 1.80 mm clear off the horizontal striking test surface. The striking surface shall be horizontally plain concrete floor or a steel plate at least 40 mm thick. The drum shall be dropped in such a way that it strikes the floor at the bottom rim at its junction with the side seam. The same drum shall again be dropped so that it strikes the floor at the top rim at its junction with the side seam.
- 9.2.2 The drum shall be examined for any leakage of water after the test. Any leakage of water shall indicate failure of the drum in the test.
- 9.2.3 The drum after the test shall be subjected to air leakage test as per 8.1. The drum shall not show any sign of leakage.

9.3 Hydraulic Pressure Test :-

The drum shall be subjected to a gradually applied hydraulic pressure of 200 Kpa (2.0 kgf/cm.sq.). This pressure shall be maintained for at least 5 minutes and any leakage of water or drop in the pressure shall indicate failure of the drum in the test.

10.0 Sampling :-

- 10.1 Representative samples of the drums for tests regarding dimensions, capacity, construction, finish, air leakage shall be drawn as prescribed in IS:3259-1988.
- 10.2 One sample from each lot of 2000 drums shall be subjected to drop test as detailed in Cl.No. 9.2.1 to 9.2.3 of this specification.
- 10.3 One fresh sample from each lot of 2000 drums shall be selected and subjected to hydraulic pressure test as detailed in Cl. No. 9.3 of this specification.

- 10.4 If the sample tested above fails two more drums from the same lot shall be subjected to the same test and if any of the two samples fails again, the lot shall be deemed to have failed in the test.

11.0 Marking :-

Each drum shall be marked with the following particulars by embossing on the head with raised markings.

- a) Name of the manufacturer with trademark.
- b) Grade and type of the drum
- c) New mineral insulating oils
- d) Identification code
- e) the date of manufacture
- f) Quantity in litres.
- g) MSEDCL
- h) Work order No.

12.0 Schedules

- 12.1 The bidder shall fill in the following schedules which form part of the tender specification and offer. If the schedules are not submitted duly filled in with the offer, the offer shall be rejected.

Schedule `A' -Guaranteed Technical Particulars

Schedule `B' -Schedule of Tenderer's Experience.

- 12.2 The discrepancies between the specification and the catalogs, Literatures and indicative drawings which are subject to change, submitted as part of the offer, shall not be considered and representation in this regard will not be entertained.
- 12.3 The Bidder shall submit the list of orders for similar type of equipments, executed of under execution during the last three years, with full details in the schedule of Tenderer's experience (Schedule `B') to enable the purchaser to evaluate the tender.

Schedule “A”

GUARANTEED TECHNICAL PARTICULARS

Guaranteed Technical Parameters of New Insulating Oil in Drums for Transformers and Switchgears as per technical specification.		
Sr. No.	GTP Parameters	
1	Applicable Standards for Insulating Oil	Text
2	Specify the maximum Density of oil in g/cm ³ at 29.5 degree celsius as per IS 1448 [P: 16] : 1990	Text
3	Maximum Kinetic viscosity of insulating oil in cSt at 27 deg. centigrade as per IS 1448 [P:25] : 1976	Text
4	Specify minimum Interfacial tension of insulating oil in N/m at 27 degree celsius as per IS 6104:1971	Text
5	Specify the minimum Flash Point (closed)of insulating oil in deg. centigrade by Pensky Marten apparatus as per IS: 1448 (P:21) : 1992	Text
6	Specify the maximum Pour Point of insulating oil in deg. centigrade as per IS: 1448 [P: 10] : 1970	Text
7	Specify the Neutralisation Value of insulating oil as per IS: 1448[P:2]:1967 a) Maximum acidity in (mg/KOH/gm) b) Inorganic acidity / Alkalinity.	Text
8	Condition of Corrosive sulphur of insulating oil	Text
9	Specify the minimum Breakdown value of un - filtered oil in KV (rms) as per specification	Text
10	Specify the minimum Breakdown value of filtered oil in KV (rms) as per specification	Text
11	Specify maximum Dielectric dissipation factor (tan delta) of insulating oil at 90 deg. C as per IS : 6262:1971	Text
12	Specify maximum Water content in oil in ppm as per specification	Text
13	Minimum Specific Resistance (Resistivity) of oil in ohm-cm at 90 deg. C.	Text
14	Minimum Specific Resistance (Resistivity) of oil in ohm-cm at 27 deg. C	Text
15	Specify the Oxidation stability of the oil as per Annexure- B of IS : 335:1993 a) Maximum Neutralization value in (Mg/KOH/g)	Text
	b) Maximum Total sludge after oxidation in percent by weight	Text
16	Aging characteristics of insulating oil after accelerated aging (Open beaker method with copper catalyst) Specify minimum Specific resistance (Resistivity) in ohm-cm 1. at 27 deg.celsius. 2. at 90 deg. Celsius	Text
17	Specify percent by weight of antioxidant additives	Text
18	Nominal capacity of oil drum in liters	Text
19	Sampling shall be done as per IS 6885: 1973(Yes/No)	Text
20	Test Reports of Insulating oil submitted on soft copy with the offer(Yes/No)	Text
21	New steel barrels confirms to IS-1783 as amended upto date (Yes/No)	Text

22	Insulating oil bears ISI certification mark(Yes/No)	Text
23	Tenderer have adequate testing facility to carry out tests specified in the specification (Yes/No)	Text
24	List of equipments for testing submitted with the offer(Yes/No)	Text
25	List of supplier for raw material ,list of standards applied , routine tests for raw material,List of tests carried out are enclosed with offer(Yes/No) material , list of test certificates submitted on soft copy (Yes/No)	Text
26	Dimensions of oil barrel as per drawings enclosed	Text
27	Material for oil drum	Text
28	Give construction details of drum	Text
29	Leakage Tests shall be carried out on each oil drums at pressure of 50 K Pa as per specification. (Yes/No)	Text
30	Duration of Leakage Tests in minutes	Text
31	Method used for carrying out Leakage Tests shall on each oil drums as per specification.	Text
32	Drop Tests shall be carried out on oil drum as per specification (Yes/No)	Text
33	Hydraulic pressure test shall be carried out on oil drum as per specification (Yes/No)	Text
34	Hydraulic pressure (in Kpa) used in the test for oil drum	Text
35	Marking shall be carried out on each oil drum as per of specification.(Yes/No)	Text
36	The appearance of the new insulating oil	Text
37	Aging characteristics of insulating oil after accelerated aging (Open beaker method with copper catalyst) Specify maximum Dielectric dissipation factor (tan delta) at 90 deg.celsius.	Text
38	Aging characteristics of insulating oil after accelerated aging (Open beaker method with copper catalyst) Specify maximum acidity in Mg/KOH/gm	Text
39	Aging characteristics of insulating oil after accelerated aging (Open beaker method with copper catalyst) Specify maximum Total sludge percent by weight as per annex A of IS :12177.	Text

SCHEDULE – ‘B’

SCHEDULE OF TENDERER’S EXPERIENCE

Tenderer shall furnish here a list of similar orders executed/under execution by them to whom a reference may be made by company in case it is necessary.

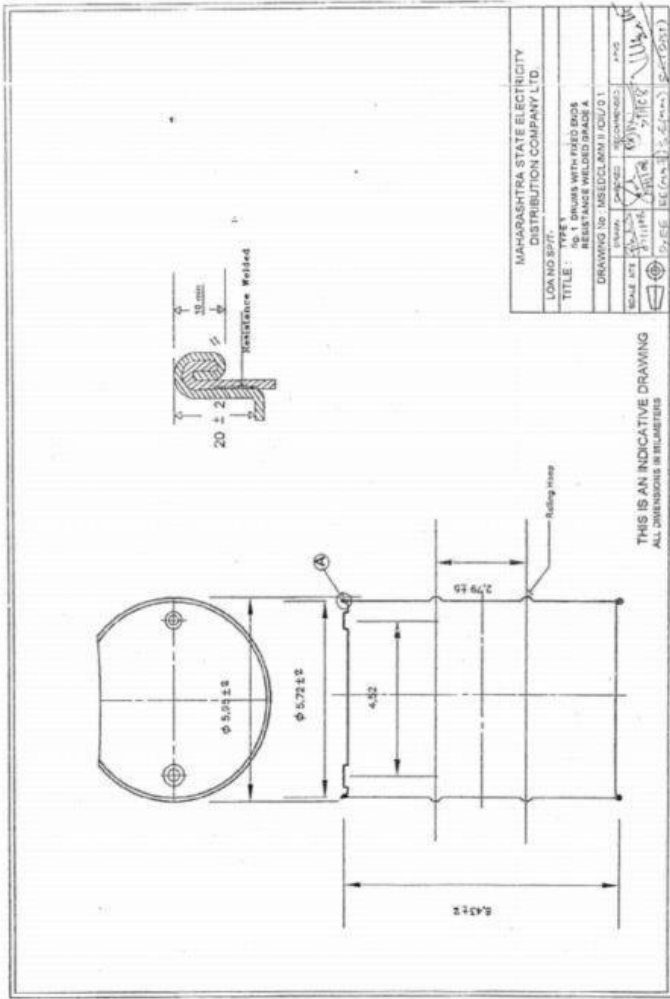
Sr. No.	Name of client & Description Order	Value of order	Period of supply and Commissioning Alongwith Size and qty.	Name and address to whom reference may be made
1	2	3	4	5

Name of Firm

Name & Signature of Tenderer

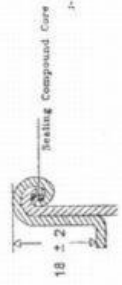
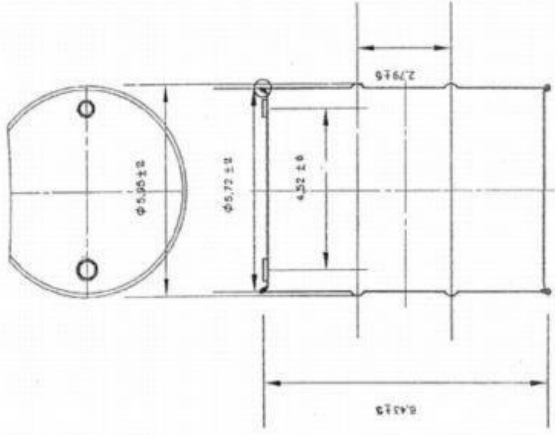
Designation

Date

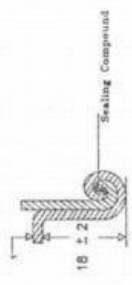


THIS IS AN INDICATIVE DRAWING
ALL DIMENSIONS IN MILLIMETERS

MAHARASHTRA STATE ELECTRICITY DISTRIBUTION COMPANY LTD.	
LOA NO SP/IT	TYPE
TITLE: BOXES WITH FUSED BOX RESISTANCE WELDED BRACK A	
DRAWING NO: MSE/CLM/11/01/01	DATE
SCALE: 1:1	DESIGNER
DATE: 21/11/14	CHECKER
DATE: 21/11/14	APPROVER
DATE: 21/11/14	DATE: 21/11/14
DATE: 21/11/14	DATE: 21/11/14



(Spiral Seam)



(Triple Seam)

Details at A

MAHARASHTRA STATE ELECTRICITY DISTRIBUTION COMPANY LTD.	
LOA NO. 8571	
TITLE: TYPE: 1000V CABLE JOINT WITH TRIPLE / SPIRAL SEALED JOINT	
DRAWING NO. MSEDCL/MS/1001/02	DATE: 11/12/16
SCALE: 1:1	DESIGNED BY: S. K. Kulkarni
DRW. NO. 1001/02	CHECKED BY: S. K. Kulkarni
DATE: 11/12/16	APPROVED BY: S. K. Kulkarni

THIS IS AN INDICATIVE DRAWING
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