

TAMIL NADU ELECTRICITY REGULATORY COMMISSION
(Constituted under Section 82 (1) of the Electricity Act 2003)
(Central Act 36 of 2003)

PRESENT:-

Thiru.K.Venugopal

.... Member

and

Thiru.S.Nagalsamy

.... Member

M.P.No.18 of 2012

Tamil Nadu Generation and Distribution
Corporation Limited, (TANGEDCO) Represented
by its Chief Engineer / Commercial
144, Annal Salai, Chennai – 600 002

.... Petitioner

Vs.

1. Tamil Nadu Spinning Mills Association,
No.2, Karur Road, Near Beschi College,
Modern Nagar,
Dindigul-624001.
2. M/s.Simpson & Co., Ltd., HTSC.No.2009,
No.851/862, Anna Salai,
Chennai-600002.
3. M/s.Arun Vyapar Udyog (P) Ltd., HT
SC.No.1586,
C.804, Shivalaya Building,
Ethiraj Salai,
Chennai-600 008.
4. M/s.Arun Smelters (P) Ltd., HT SC.No.1616,
C.804, Shivalaya Building,
Ethiraj Salai,
Chennai-600008.

5. M/s.Arun Vyapar Udyog (P) Ltd.,
HTSC.No.1519,
C.804, Shivalaya Building,
Ethiraj Salai,
Chennai-600008.
6. M/s.Thangam Steel Ltd., HT.No.1577,
C36 2nd Avenue, 3rd Floor,
Anna Nagar,
Chennai-600040.
7. M/s.Vaibhav Mercantile Ltd., HT No.1648,
No.C.36 II Avenue, Anna Nagar,
Chennai-600040.
8. M/s.Shardow India Ltd., HT.No.1084,
Huzur Gardens, Sembium,
Chennai-600011.
9. M/s.Simpson & Ltd., HT No.1074,
No.861/862 Anna Salai,
Chennai-600002.
10. M/s.T.I.D.C. India, HT SC.No.1110,
a unit of Tube Investments of India Ltd.,
Post Box No.11, Ambattur, CTH Road,
Chennai-600053.
11. M/s.Kamakshi Lamipack Pvt.Ltd., HT SC.No.1675,
No.68(40) 2nd Main Road,
Ambattur Industrial Estate,
Chennai – 600058.
12. M/s.Chennai Heat Treaters Pvt.Ltd., HT SC
No.1738,
No.SP 158, III Main Road,
Ambattur Industrial Estate,
Chennai – 600058.
13. M/s.Rane Brake Linings Ltd., HT SC No.1157,
Maithri No.132, Cathedral Road,
Chennai-600086.
14. M/s.Breaks India Ltd., HT SC No.1113,
MTH Road,
Padi,
Chennai-600050.

15. M/s.Sundaram Fasteners Ltd., HT SC No.1150,
98A, Dr.Radhakrishnan Salai,
Mylapore, Chennai-600004.
16. M/s.Wabco India Ltd., HT SC No.1717,
Plot No.3 (SP) 3rd Main Road,
Ambattur Industrial Estate,
Chennai-600058.
17. M/s.Sundaram Clayton Ltd., HT SC No.1109,
Jayalakshmi Estates, No.29, Haddows Road,
Chennai-600006.
18. M/s.Sundaram Clayton Ltd., HT SC No.1514,
Jayalakshmi Estates, No.29, Haddows Road,
Chennai-600006.
19. M/s.Tube Products of India, HT SC No.1050,
A Unit of Tube Investment of India Ltd.,
Post Bag No.4, Avadi,
Chennai-600054.
20. M/s.Best Cast I.T.Ltd., HT SC No.1603,
No.16, Poonamallee High Road,
Velappanchavadi,
Chennai-600077.
21. M/s.Sundaram Fasteners Ltd., HT SC No.1739,
98A, Dr.Radhakrishnan Salai,
Mylapore, Chennai-600004.
22. M/s.Sundaram Fasteners Ltd., HT SC No.1496,
98A, Dr.Radhakrishnan Salai,
Mylapore, Chennai-600004.
23. M/s.Lucas TVS Ltd., HT SC No.1102,
MTH Road,
Padi, Chennai-600050.
24. M/s.Sundaram Clayton Ltd., HT SC No.903,
B, 14 Sipcot Industrial Estate, Oragadam.

25. M/s.IP Rings Ltd., HT SC No.158,
D11/12, Industrial Estate,
Maraimalai Nagar - 603 209.
26. M/s.India Pistons Ltd., HT SC No.305,
Plot No.1 to 4 & 13 to 16, Sengundram Indl.Area,
Melrosapuram, Singaperumal Koil Post,
Kancheepuram District-603204.
27. M/s.Sundaram Auto Components Ltd.,
HT SC No.668,
Plot No.B-11, Sipcot Indl.Park, Oragadam,
Sriperumbudur Taluk.
28. M/s.IP Pins Liners Ltd., HT SC No.121,
A-1-C, Indl.Estate, Maraimalai Nagar,
Kancheepuram District – 603 209.
29. M/s.Mahle IPL Ltd., HT SC No.107,
A-4, Indl. Estate,
Maraimalai Nagar- 603 209.
30. M/s.Sundaram Fasteners Ltd., HT SC No.548,
Plot No.AA1, Central Avenue, Auto Ancillary SEZ,
Mahindra World City,
Kancheepuram District – 603 002.
31. M/s.TI Metal Forming, HT SC No. 79,
Thiruvallur High Road,
Thiruninravur-602 024.
32. M/s.Orchid Chemicals and Pharmaceuticals Ltd.,
HTSC No.562,
138-149, Sipcot Indl.Estate, Old Mahabalipuram
Road,
Alathur, Thiruporur.
33. M/s.Tractor and Farm Equipemnts Ltd.,
HTSC No.278,
Gears Division, RS-51/1, Vandalur,
Kelambakkam Rd,
Pudupakkam Village,
Kancheepuram Dist. 603103.

34. M/s.Tractor and Farm Equipments Ltd.,
HTSC No.566,
Power Source Division, B3/3 MMDA,
Indl.Estate,
Maraimalai Nagar – 603 209.
35. M/s.Tractor and Farm Equipments Ltd.,
HT SC No.288,
No.48/4, Vandalur, Kelambakkam Road,
Pudupakkam – 603 103.
36. M/s.Brakes India Ltd., HT SC No.222,
Vandalur Road, Polambakkam Village,
Cheyyur Taluk,
Kancheepuram District-603 309.
37. M/s.Sundaram Brake Linings Ltd., HT SC No.522,
Plot No.AA-6, 6th Avenue, Auto Ancillary SEZ,
Mahindra World City, Kancheepuram Dist.603 002.
38. M/s.Turbo Energy Ltd., HT SC No.558,
Old Mahabalipuram Road, Paiyanur-603104,
Kancheepuram District.
39. M/s.BBL Daido Pvt.Ltd., HT SC No.393,
RS No.19, Vandalur, Kelambakkam Road,
Pudupakkam Village, Kelambakkam-603103.
40. M/s.India Japan Lighting Pvt.Ltd., HT SC No.275,
No.1, Puduchatram, Thirumazhisai,
Thiruvellore High Road – 600 124.
41. M/s.BYD Electronics India (P)Ltd., HT SC No.753,
Plot No.OZ-7, Sipcot SEZ, Oragadam,
Sriperumbudur-602 105.
42. M/s.Technical Stampings Automotive Ltd.,
HTSC No.318, Plot No.G16-18, Sipcot Indl.Park,
Irrungattukottai, Sriperumbudur Taluk,
Kancheepuram District.
43. M/s.Global Stampings & Welding Automotive Ltd.,
HTSC No.630, 488/2, Mannur Village,
Valarpuram (Post), Sriperumbudur-602 105.

44. M/s.Asahi India Glass Ltd., HT SC No.424,
Sipcot Indl.Park, F76-81, Sipcot Indl.Park
Irungattukottai, Sriperumbudur-602105.
45. M/s.Delphi-TVS Diesel Systems Ltd.,
HTSC No.153,
Mannur, Thodukadu Post, Sriperumbudur Taluk,
Kancheepuram District 602 105.
46. M/s.SL Lumax Ltd., HT SC No.354,
G-15, Sipcot Industrial Park,
Irrungattukottai, Sriperumbudur-602105.
47. M/s.Flsmidth Pvt.Ltd., HT SC No.544,
34, Egatoor Kelambakkam, (Rajiv Gandhi Salai),
Chennai-603 103.
48. M/s.Ucal Fuel Systems Ltd., HT SC No.76,
E9-E12, Industrial Complex,
Maraimalai Nagar – 603 209.
49. M/s.Ucal Fuel Systems Ltd., HT SC No.598,
A3/A3, A4, CMDA Indl. Complex,
Maraimalai Nagar – 603 209.
50. M/s.Sri Aarvee hotels, HT SC No.35,
Bharathiar Road, Coimbatore-641 044.
51. M/s.Needle Industries India (P) Ltd., HT SC No.31,
7/62, Ketty, The Nilgiris.
52. M/s.Needle Industries India (P) Ltd., HT SC No.39,
7/62, Ketty, The Nilgiris.
53. M/s.Bimetal Bearings Ltd., HTSC No.37,
371, Marudhamalai Road,
P.N.Pudur, Coimbatore – 641 041.
54. M/s.Ranga Alloys, HTSC No.531,
SF No.337, 338 Chinnakallipatti Village,
Sirumugai Post, Coimbatore- 641 302.
55. M/s.Patspin India Ltd., HT SC No.306,
Unit II SF No.2/85B, Udumalai-Tirupur Road,
Kottamangalam Post, Udumalpet.

56. M/s.Karur K.C.Packagings Ltd., HTSC No.156,
SF No.636A & 661, Marchinaickenpalayam,
Ambarampalayam (Post)
Pollachi Taluk.
57. M/s.Lakshmi Saraswathy Cotton Mills (P) Ltd.,
HTSC No.74, Kuthchipalayam,
Thokkavadi, Tiruchengode-637 209.
58. M/s.Tractor and Farm Equipments Ltd.,
HT SC No.198,
10/205, Kalladapatti Nilakottai T.K.
Dindigul – 624 215.
59. M/s.Thai Plastics (P) Ltd., HT SC No.229,
Shed No.D-50, Sidco Indl Estate, Kappalur,
Madurai-8.
60. M/s.Platinum Textiles Ltd., HT SC No.004,
C.K.Mangalam, Thiruvadani-623 407.
61. M/s.Karur K.C.P.Packaging (P) Ltd.,
HTSC No.25 & 52, 330/1, Chinnandankoil Road,
Karur-639 001.
62. M/s.SJLT Textiles(P) Ltd., HT SCNo.203,
Unit-II, Karugudi Village & Post, Thathiyangar
Pettai(Via), Musiri TK, Trichy District-621210.
63. M/s.Rane TRW Steering Systems Ltd.,
HT SC No.65,
Viralimalai, Trichy.
64. M/s.Aranthangi Chemicals Products Ltd.,
HTSC No.39,
256/3A1, Pudukkottai Road, Aliyanilai,
Aranthangi 614 616.
65. M/s.Tmt.Muthammal Textiles Pvt.Ltd.,
HTSC No.80,
52, Alexandria Road, Cantonment,
Trichy-620001.
66. M/s.Rane Engine Valves, HTSC No.124,
SF No.109, 110,111 Seniapatti, Kasavanur,
Viralimalai, Pudukkottai Dist.

67. M/s.High Energy Batteries (I)Ltd., HTSC No.13, Pakkudy Road, Mathur, Pudukkottai Dist.
68. M/s.KGS Nelsun Paper Mills Ltd., HTSC No.57 Solagampatti, Thohur (Via) Thanjavur.
69. M/s.Sundaram Clayton Ltd., HTSC No.244, Belagondapally, Hosur-Thally road, Hosur.
70. M/s.Sundaram Blestol Ltd., HT SC No.309, Kodagondapalli, Haritha, Hosur-635 109.
71. M/s.Sundaram Fasteners Ltd., HT SC No.23, Haritha Complex, Sipcot Indl. Complex, Hosur.
72. M/s.Sundaram Auto Components Ltd., HT SC No.117, (Rubber Division) Belagondapally, Hosur-Thally Road, Hosur- 635 114.
73. M/s.Sundaram Auto Components Ltd., HT SC No.122, (Plastic Division) Haritha Complex, Hosur.
74. M/s.Upasana Engineering Ltd., HTSC No.330, Kothakondapally, Hosur.
75. M/s.India Nippon Electricals Ltd., HTSC No.93, Hosur Thally Road, Uliveeranapalli, Dennkanikottai(TK), Hosur.
76. M/s.Bimetal Bearing Ltd., HTSC No.56, 105, Hosur-Krishnagiri Road, Perandapalli, Hosur-635125.
77. M/s.Prime Gold International (P)Ltd., HTSC No.311, SF No.289 & 290, Uliveeranapally, Belakondapalli, Hosur.
78. M/s.Rane (Madras) Ltd., HT SC No.215, Amabkkam, Varanavasi Village (Via) Thenneri.
79. M/s.T.I.Metal Forming, HT SC No.209, Plot No. G.80-81, Sidco Indl.Estate, Kakkalur, Tiruvallur 602 003.

80. M/s.Light Alloy Products Ltd., HTSC No.1159, Regd.Office at 67, Chamiers Road, Chennai-28.
81. M/s.Turbo Energy Ltd., HT SC No.1125, Regd.Office at 67, Chamiers Road, Chennai-28.
82. M/s.ABI-Showatech India Ltd., HTSC No.1139, Regd Office at 67, Chamiers Road, Chennai-289.
83. M/s.Carborundum Universal Ltd.,(CUMI), HT SC No. 1117, Regd. office at Parry House, 43, Moore Street, Chennai-1.
84. M/s.Murugappa Morgan Thermal Ceramics Ltd.,(MMTCL) HTSC No.1084, Reg.Office. DARE House Complex, New No.2, NSC Bose Road, Chennai-1.
85. M/s.Brakes India Ltd., HT SC No.1144, Foundry Division, Arakkonam Road, Sholinghur-631 102.
86. M/s.Brakes India Ltd., HT SC No.1235, Foundry Division Unit-II, Kaveripakkam Road, Pulivalam – 632505.
87. M/s.Brakes India Ltd., HTSC No.1067, Brake Division, Arakkonam Road, Sholinghur-631102.
88. M/s.Brakes India Ltd., HT SC No.1168, Arakkonam Road, Sholinghur 631 102.
89. M/s.Carborundum Universal Ltd., HT SC No.1262, (CUMI) Regd.Office at “Parry House” 43, Moore Street, Chennai-1.
90. M/s.Ultra Tech Cement Ltd., HT SC No.1203, Chetteri, Arakkonam, Vellore-3.
91. M/s.Pioneer Jellice India(P)Ltd., HTSC No.77, 65,66 and 67 Semmankuppam Village, Poondiyankuppam, Cuddalore.
92. M/s.National Sewing Thread Co.Ltd., HT SC No.1, 11 Venugopal Pillai Road, Chidambaram 608001.

93. M/s.SSD Oil Mills Co.Ltd.,
No.6A, 11th Avenue, Ashok Nagar,
Chennai-83.
94. M/s.Rohini Textile Industry (P)Ltd., HT SC No.78,
No.2, Rogini Garden, Kangayam Road, Tiruppur.
95. M/s.Saravana Textiles Pvt.Ltd., HT SC No.26,
114/A-1, Srivilliputtur Road, Melapattam
Karisalkulam
Rajapalayam-626 110.
96. M/s.Senthur Textiles Pvt.Ltd., HT SC No.202,
28/130-A, Gandhi Kalaimandram Road,
Rajapalayam,
Virudhunagar District.
97. M/s.Sakthi Steel Industries Ltd., HT SC No.253,
Amaravathi Pattinam Village,
Uthiramerur.

.... Respondents

**Dates of hearing: 21-06-2012, 28-09-2012, 27-11-2012
and 31-01-2013**

Date of Order : 11-07-2013

1. M.P. No. 18 of 2012 was filed by M/s.TANGEDCO.
2. TANGEDCO issued instructions to the officers in the Distribution Circle vide Memo No. CE/Comml/EE/R&C/AEE/F.R&C/D.No.70-1/12 dated 12-3-2012 and an amendment to the same vide memo No. CE/Comml/EE/R&C/AEE/D.No.70-2/12 dated 27-3-2012. The petitioner further stated that these memos were issued consequent to the amendment to the Supply Code and the Distribution Code respectively as extracted below:-

- “3 (A) In case of Open Access consumer, ABT compliant meter with facilities to record export and import of energy shall be provided both at the generator and consumer ends in accordance with the Central Electricity Authority (Installation and Operation of Meters) Regulations, 2006. This amendment in the Supply Code has also been made in the Distribution Code sub-regulation I (A) of regulation 32.
3. Various writ petitions were filed challenging the aforesaid memoranda in WP No. 7900, 12383 of 2012, etc (Batch cases)
 4. The Hon’ble High Court of Madras disposed off the writ petitions with certain observations and directions. TANGEDCO was directed to approach the State Commission for appropriate Orders with regard to installation of ABT meters and proceed thereon as per the directions issued by the Commission. Till such time the Commission passes the final Order, respondent TANGEDCO in the Writ Petitions did not insist on the installation of ABT meters as a precondition for availing open access facility. TANGEDCO shall not also insist that HT consumers / petitioners should give an undertaking for the purpose of issuing NOC for availing the open access facility.
 5. The petitioner herein Viz., M/s. TANGEDCO is relying on regulations 4, 5, 6 and 7 of the Central Electricity Authority (installation and operation of meters) Regulations, 2006, as amended in 2010. [Regulation 4 - type of meters, Regulation 5 – Standards, Regulation 6 – Ownership of meters and Regulation 7 – Location of meters]. As regards the meters for consumers directly connected to the Inter-State Transmission system or

Intra-State Transmission system under availability based tariff and have been permitted open access or for consumers connected to Distribution system and permitted open access, location of the meter was suggested as “As decided by appropriate Commission” in the Regulations issued by the Central Electricity Authority. This petitioner has also submitted that the writ petitioners before the Hon’ble High Court of Madras have admitted that they are not disputing or objecting to the installation of ABT meters as per the Order of the Tamil Nadu Electricity Regulatory Commission and specified by the Central Electricity Authority as per notification dated 17-3-2006 as observed by the High Court in paragraph 8 of the said order. The main issue which arises, according to the petitioner, is that in the event of non-reduction / stopping drawal of power by the HT consumer and open access customer when the SLDC has resorted to curtail or cancel the capacity reserved for open access as per Regulations of the TNERC Open access Regulations, 2005, a provision to impose some penalty is necessary. TANGEDCO, has pleaded that this Commission may consider to Order that failure on the part of the HT consumer and open access customer to reduce / stop the drawal on the directions of the SLDC will invite suspension of NOC / clearance / concurrence for three days for each day of default. The prayer of the petitioner also include the following:-

- (1) Approve the memo dated 12-3-2012 along with the undertaking annexed thereto and the amendment made to the same on 27-3-2012.

- (2) To consider to specify the location of the meter.
 - (3) To consider to approve the specifications filed by the petitioner for the purpose of installation of ABT compliant meter with its associated CT / PT by the HT consumers and open access customer.
 - (4) To consider to order that failure on the part of the HT consumer and open access customer to reduce / stop the drawal on the direction of the SLDC will invite suspension of NOC / clearance / concurrence for 3 days for each day's default or any other similar provision as may be deemed fit and proper by the Commission.
6. The petition was admitted on 21-6-2012. Since the petition did not mention any respondents and the order of the Hon'ble High Court of Madras mandated hearing of the concerned parties, the Commission directed TANGEDCO to implead and serve notices on all the parties who filed writ petitions before the Hon'ble High Court. TANGEDCO filed affidavit dated 31st May 2012 and 18th July 2012 impleading 8 Nos of respondents and 96 Nos of respondents respectively. Counters were filed by-
- (1) M/s. Kamakshi Lamipack Pvt. Ltd., Chennai on 9th October 2012.
 - (2) M/s. Chennai Heatreaters pvt. Ltd., Chennai on 9th October 2012;
and
 - (3) The Tamil Nadu Spinning Mills Association got themselves impleaded in this petition by filing an affidavit on 8th August 2012 and also filed a counter on 4th October 2012.

7. **Counter by Respondents:-** M/s.Kamakshi Lamipack Pvt. Ltd., and M/s.Chennai Heatreaters Pvt. Ltd., in their counter have stated that the existing TOD meters have adequate facilities and therefore no separate ABT compliant meter is necessary. The third counter filed by TASMA refers to the CEA Regulations. Argument of this respondent is that the ownership of interface meters is with the State Transmission utility and in the present case it is the respondent TANGEDCO who should own the meter and not the consumers. They have also raised the issue of the location of meter, which according to Regulations of the CEA, has to be decided by the Tamil Nadu Electricity Regulatory Commission. Further, a reference to the TNERC Supply Code and the Distribution Code has also been made as follows:-

Regulation 7 (3) of the Tamil Nadu Electricity Supply Code

“Unless the consumer elects to purchase his own meter, the licensee shall provide meter of high quality, high precision and accuracy and may require the consumer to give adequate security for the price of the meter and pay the hire charges therefor. Where the consumer elects to purchase his own meter, the licensee shall ensure that such meter is of high quality, high precision and accuracy and shall arrange to recalibrate the same at consumer cost.”

Regulation 32(1) of the Tamil Nadu Electricity Distribution Code

“Licensee’s supply mains and equipments. – (1) The Licensee may provide in Low Tension service connections its own meter, board, cut-out and other equipments and for High Tension Service connections, its own circuit breakers, High Tension fuses and other equipments and these will remain the property of the licensee and must on no account be operated, handled or removal by anyone, who is not an employee of the Licensee, unless authorized by the Licensee. If the consumer elects to purchase a meter, it shall be tested, installed, operated, maintained and sealed by the licensee. The consumer shall claim the meter purchased by him as his asset only after it is permanently removed from the system of the licensee”

Referring to the above, respondent TASMA has expressed a view that the meters are the property of the licensee and therefore only they are authorized to handle these equipments.

8. TASMA have also raised the issue of TANGEDCO not having approved any list of suppliers based on the samples and testing made on the quality and working of the meters and therefore consumers cannot, on their own, buy any ABT compliant meter. The issue regarding testing of these meters by approved laboratories and notification of such laboratories has also been raised in the counter filed by TASMA.

9. **Finding of the Commission:-**

9.1. The matter was heard by the Commission on 21-6-2012 wherein the petition was admitted and direction was given to TANGEDCO for impleading of the persons who have approached the High Court as respondents. TANGEDCO was also directed to host the petition on its website and serve individual notices to all the respondents.

9.2. I.A. No. 1 of 2012 filed by Tamil Nadu Spinning Mills Association was heard on 28-9-2012 and the same was allowed impleading them in the matter. The matter was finally heard on 31-1-2013 wherein the Chief Engineer, Commercial, TANGEDCO presented the case and the learned Counsels Thiru N.L.Raja and Thiru Parthasarathy appeared before the Commission.

9.3. The following regulations of the Central Electricity Authority (Installation and Operation) meters Regulations, 2006 are required to be kept in view for considering the issue in question:-

“6. Ownership of meters. -

(1) Interface meters

(a) All interface meters installed at the points of interconnection with Inter-State Transmission System (ISTS) for the purpose of electricity accounting and billing shall be owned by CTU.

(b) All interface meters installed at the points of interconnection with Intra-State Transmission System excluding the system covered under sub-clause (a) above for the purpose of electricity accounting and billing shall be owned by STU.

(c) All interface meters installed at the points of interconnection between the two licensees excluding those covered under sub-clauses (a) and (b) above for the purpose of electricity accounting and billing shall be owned by respective licensee of each end.

(d) All interface meters installed at the points of interconnection for the purpose of electricity accounting and billing not covered under sub-clauses (a), (b) and (c) above shall be owned by supplier of electricity.”

9. Installation of meters. -

(1) Generating company or licensee, as the case may be, shall examine, test and regulate all meters before installation and only correct meters shall be installed.

10. Operation, Testing and Maintenance of meters. -

The operation, testing and maintenance of all types of meters shall be carried out by the generating company or the licensee, as the case may be.

14. Meter reading and recording. -

(1) Interface meters

It shall be the responsibility of the Appropriate Transmission Utility or the licensee to take down the meter reading and record the metered data, maintain database of all the information associated with the interface meters and verify the correctness of metered data and furnish the same to various agencies as per the procedure laid down by the Appropriate Commission.

17. Quality assurance of meters. -

(1) The distribution licensee shall put in place a system of quality assurance and testing of meters with the approval of Appropriate Commission.

(2) The licensee shall set up appropriate number of accredited testing laboratories or utilize the services of other accredited testing laboratories. The licensee shall take immediate action to get the accreditations of their existing meter testing laboratories from NABL, if not already done.

(3) The generating company or licensee shall ensure that all type, routine and acceptance tests are carried out by the manufacturer complying with the requirement of the relevant IS or BS or IEC as the case may be.

18. Calibration and periodical testing of meters. –

(1) Interface meter

(a) At the time of commissioning, each interface meter shall be tested by the owner at site for accuracy using standard reference meter of better accuracy class than the meter under test.

(b) All interface meters shall be tested at least once in five years. These meters shall also be tested whenever the energy and other quantities recorded by the meter are abnormal or inconsistent with electrically adjacent meters. Whenever there is unreasonable difference between the quantity recorded by interface meter and the corresponding value monitored at the billing center via communication network, the communication system and terminal equipment shall be tested and rectified. The meters may be tested using NABL accredited mobile laboratory or at any accredited laboratory and recalibrated if required at manufacturer's works.

(c) Testing and calibration of interface meters may be carried out in the presence of the representatives of the supplier and buyer. The owner of the meter shall send advance notice to the other party regarding the date of testing.”

9.4. This Commission has notified “TNERC Intra State Open Access Regulations 2005” Regulation 15 of this Regulation is relevant and extracted below:-

“15. Metering

(1) The open access customer shall provide metering arrangements in accordance with the Central Electricity Authority's “Regulations on Installation and Operation of meters” and based on period of supply and tariff category.

(2) The Generating company or a Licensee contracting to effect supply to an open access customer shall provide Main Meters at interconnecting points based on the customers to whom it will effect supply under open access or in case of interstate transmission, it shall arrange communication of energy accounts of respective Regional Load Dispatch Centers, effected through displacement/adjustment in the format as may be specified by State Load Dispatch Centre on real time basis as well as periodically;

(3) The Distribution Licensee may provide Check Meters of the same specification as Main Meters”.

9.5. As regards ownership of meters, in Regulation 6 referred in para 9.3 above, the CEA has defined the ownership of meters by CTU for Inter-State Transmission system, STU for Intra-State Transmission system. As regards

interface meters installed at the points of inter connection between the two licensees excluding the ownerships of CTU and STU as discussed above, such meters for electricity accounting and billing shall be owned by respective licensee of each end. sub-regulation (d) of the said regulation 6 envisages that all interface meters installed at the points of inter connection for the purpose of accounting and billing not covered under the above three categories shall be owned by the supplier of electricity. This clearly indicates that in respect of OA customers the interface meters shall be owned by the supplier of electricity Viz., the generator. In case the generator and customer are one and the same, the OA customer shall provide the necessary meter. A similar provision exists in the open access Regulations issued by this Commission as well. Hence in case of open access customers, the meter shall be owned by the generators or if the wheeling is done captively the OA customers shall own the meters. The Commission does not agree with the argument of some of the respondents that the existing meters are adequate and therefore ABT compliant meters are not necessary as with the existing meters it will not be possible for arriving at the deviations from the schedule at 15 minutes interval.

9.6. Having decided the issue of ownership of the meter, the next issue is how to procure these meters. Open access is available to all HT consumers only. Therefore, the metering arrangement would involve use of CTs, PTs, etc. With a view to standardize the entire arrangement it will be appropriate that these meters are procured by the licensee Viz., TANGEDCO. The cost of these meters shall however be borne by the open access customers or

generators as the case may be. In case the OA customers opt to procure meters of their own, they are at liberty to do so. In such a case, the OA customers shall procure the meters in accordance with the specifications filed by TANGEDCO in their petition. To that extent, the specifications submitted by the TANGEDCO stands approved. A copy of the specifications, as submitted by TANGEDCO, is appended to this Order.

9.7. The ABT Meter shall be with AMR facilities and suitable for interfacing with the licensees data communication system. All new open access customers shall be provided with ABT meters in line with this Order. All existing OA customers shall be provided with ABT meters in line with this Order within 3 months from the date of issue of this Order.

9.8. The location of meter at consumer / user end shall be inline with the Commission's Distribution / Supply Code. Meter location at the supplier / generator end shall be in line with CEA's metering regulations as amended from time to time.

9.9. In line with regulation 17 of the CEA's Regulations, the licensee shall set up appropriate number of meter testing laboratories and shall take immediate action to get the accreditation from NABL. As regards third party meter testing, the Commission has already notified Electronic Testing and Design Lab, Chennai (ETDC) and Chief Electrical Inspector, Government of Tamil Nadu as the agencies for third party meter testing.

10. Consequent to this Order, the memos dated 12-3-2012 and 27-3-2012 issued by TANGEDCO in connection with installation of ABT meters are hereby set

aside. In the light of this order TANGEDCO shall proceed further in the matter with regard to installation of ABT compliant meters.

11. Appeal:

An appeal against this order shall lie before the Appellate Tribunal for Electricity under section 111 of the Electricity Act, 2003 within a period of 45 days from the date of receipt of a copy of this order by the aggrieved person.

Ordered accordingly.

(Sd.....)
(S.Nagalsamy)
Member

(Sd.....)
(K.Venugopal)
Member

/ True Copy /

Secretary
Tamil Nadu Electricity
Regulatory Commission

APPENDIX
THE DETAILS OF ABT METER SPECIFICATION AND OTHER PARTICULARS.

ITEM-1.

GENERAL TECHNICAL AND COMMUNICATION RELATED SPECIFICATION OF 3-PHASE 4-WIRE CT/PT OPERATED 5/1 Amps OF CLASS 0.2S ACCURACY FULLY STATIC AMR COMPATIBLE FOUR QUADRANT WITH AVAILABILITY BASED TARIFF (ABT) METER FOR HT-OPEN ACCESS CONSUMERS INSTALLATIONS(not meant for generators) TO BE READ WITH M81/2010-11 SPECIFICATION

| | | |
|-----|--|---|
| 1.0 | Standards to which meters shall comply | <p>While drafting this specification, reference has been made to TANGEDCO's Specification M.81/2010-11 and International Standard Specification with latest amendments. In case, if certain details are not covered in this specification the specification M.81/ International standard shall be applicable.</p> <p>IEC 62053-22 A.C. Static meters for active energy class 0.2s IEC 62053-23 A.C Static meters for reactive energy/CBIP-304 with latest amendments. IEC 14697-1999 A.C. static transformer operated watt-hour and VAR-hour-meters for class 0.2s IEC 60297 Dimensions of mechanical structures – Panels and racks.</p> |
| 2.0 | General Technical Requirements | |
| 2.1 | Type | AMR compatible static 3-phase 4 wire ABT Meter. |
| 2.2 | Frequency Range | 50Hz \pm 5% |
| 2.3 | Accuracy Class | 0.2s |
| 2.4 | Real Time internal Clock | <p>a) RTC shall be pre-programmed for 30 years day / date without any necessity for correction. Maximum drift shall not exceed \pm 3 minutes per year</p> <p>b) Time & Date setting shall only be possible through one of the following:</p> <p>i) Common meter reading instrument (CMRI) and this shall need proper security with password without any pre-programming through computer.</p> |

| | | |
|------|--|--|
| | | ii) From remote server through suitable communication network. |
| 2.5 | Clock Day / Date Synchronisation | <p>i) Synchronisation of energy meter 'RTC' time / date shall be possible through password key code enabled command from remote server or suitable station PC.</p> <p>ii) Master clock reference shall be obtained from main server or local PC.</p> <p>iii) Error log to be recorded by the system software if the RTC time is out of range.</p> |
| 2.6 | Display | The meter shall have 8 (7+1 decimal) digits (with \pm indication) with permanent backlit LCD. |
| 2.7 | Quantities to be measured, recorded, displayed and communicated. | <p>i) The reading of the meter shall be without any multiplication factor. Meters with multiplication factor will not be accepted.</p> <p>ii) TOD Timings – As per Specification M.81</p> |
| 2.8 | Maximum Demand integration period | <p>i) DIP shall be set at 15 minutes duration by default and 30 minutes programmable.</p> <p>ii) DIP shall commence at the fixed time intervals of real time.</p> <p>iii) Maximum demand computation shall be based on sliding window concepts with integration period of 15 minutes and there shall be 3 updates of 5 minutes in a block.</p> |
| 2.9 | Maximum Demand Reset | <p>i) Meters shall continuously monitor and calculate the average maximum demand for each demand integration period of 15 minutes and the maximum of these shall be stored along with date and time, when it is occurred.</p> <p>ii) Reset of maximum demand shall be made possible</p> <ol style="list-style-type: none"> a) Manually through a separate push button with sealing arrangements. b) Through RS-232 port using CMRI / laptop at site and remotely from central server with meter configuration software. c) Provision for Automatic reset of MD at pre-defined period. |
| 2.10 | Communication Facilities and Standards | <p>a) It shall also be possible to retrieve meter data through communication port by CMRI / LAPTOP BCS / Modems</p> <p>b) Meter shall be provided with minimum of</p> |

| | | |
|------|---------------------------------------|---|
| | | <p>2 ports including optical port.</p> <p>i) RS-232 port</p> <p>ii) Network port</p> <p>RS-232 port provided shall be compatible with RJ-11 connector and one additional wire with RJ-11 connector with USB converter at the other end shall be supplied as an accessory with each meter.</p> <p>Meter shall be able to communicate through any of this port with standard transparent modem for AMR Compatibility.</p> <p>c) Both the port shall be able to communicate simultaneously.</p> |
| 2.11 | Tamper & Fraud Monitoring & Recording | As per Specification M81/2010-11 |
| 3.0 | Fixing arrangement | The energy meter shall be panel / rack / metal box mounted. |
| 3.1 | Sealing | Proper sealing arrangement shall be provided in metering system with uni-directional screws as per M-81 |
| 3.2 | Data Storage | Minimum of 60 days with 15 minutes integration period for the parameters shown in cl.3.7 |
| 3.3 | ABT Features | <p>a) The active energy measurement shall be carried out on 3 phase 4-wire principle with an accuracy as per class 0.2s of IEC 62053 – 22.</p> <p>b) The meter shall compute the average frequency during each successive 15 minute block and store in its memory.</p> <p>c) The meter shall compute the reactive power on 3-phase 4-wire principle with an accuracy class of 0.2s and integrate the reactive energy algebraically into two separate reactive energy registers, one for the period for which the average rms voltage is greater than 103% (reactive high-export lead var only) and the other for the period for which the average rms voltage is below 97% (reactive low-import lag var only).</p> <p>d) Meter shall compute active & apparent energy as per Specification M81/2010-11.</p> <p>e) Meter shall have capability and facility to</p> |

| | | |
|-----|--------------------------------|--|
| | | <p>compensate for errors of external measurement transformers i.e CT and VT.</p> <p>i) Linear compensation for measurement PT errors (ratio and phase) there shall be linear adjustment which shall be applied across the complete measurement range of the transformer.</p> <p>ii) Non-linear compensation for measurement CT errors (ratio and phase) compensation; this shall allow multiple ratio and phase adjustments to be applied for different load points per phase input of the meter.</p> <p>iii) It shall be possible to program the errors of CT and VT in meter through front optical communication port through high level software. Metering system design should support this feature and further it shall be possible to configure and incorporate this feature in meter whenever required. The above provision can be made through BCS software also. Clause-e is a preferred feature.</p> <p>f) The meter manufacturer shall supply meter with MIOS protocol with complete details of API and shall have provision of incorporating DLMS companion standard as and when required such that it can be interfaced with standard computer station / master computer station while implementing AMR. Necessary protocol is to be furnished along with the supply.</p> <p>g) Software requirement as per clause 9.0 Of M-81 is to be complied while supplying the meter.</p> |
| 3.4 | Meter Power Supply Arrangement | <p>The meter must be capable to operate with power drawn from PT secondary circuit without requirement of external supply. The total burden imposed on CTs and PTs by the meter for measurement and operation shall be as per the relevant standards. While operating with supply from PT the meter shall not require any separate auxiliary supply for their normal operation.</p> |

| | | |
|-----|------------------------|---|
| | | Further the meter shall be capable to display and data downloading of the stored quantities through an internal inbuilt power pack battery. The batteries provided for display / optical port downloading etc., shall have life of not less than 10 years. |
| 3.5 | Monitoring of Voltages | <p>The meter shall continuously compute the instantaneous average of the rms values of the three line-to-neutral VT secondary voltages as a percentage of 63.51 volt and display while scrolling. The accuracy of the voltage measurement / computation shall be atleast 0.2% accuracy.</p> <p>The three line-to-neutral voltages shall be continuously monitored and in case of any or all of these falls below about 70%, the condition shall be suitably indicated and recorded in the logs. The indication details shall be given on the front of the meter. The time blocks in which such a voltage failure occurs / persists shall also be marked for eg. With star (*), while storing in the meter memory. The indication shall automatically become normal when VT secondary voltages are healthy again. The two specified Varh registers shall remain stay-put while VT supply is unhealthy.</p> |
| 3.6 | Harmonic Measurement | <ol style="list-style-type: none"> 1. Continuous measurement of Voltage and current harmonics up to a minimum of 29th order. 2. Display of voltage & current THD phase wise in % in auto scroll mode. 3. Display & record the value of THD in current harmonics when it exceeds 8 % with both date and time. 4. Display & record the value of THD in Voltage harmonics, when it exceeds 5 % with both date and time. Meters shall continuously monitor harmonics and display and record the % THD in current or voltage above the threshold (maximum) value for every continuous period of 15 minutes(ie., updating if required when there is |

| | | |
|-----|------------------------------|---|
| | | <p>further increase in values) and the maximum of these for a billing period shall be stored along with date and time, when it is occurred.</p> <p>5. Highest value of THD in Voltage and current harmonics in % above the threshold value mentioned(V-5%,C-8%) should be available at BCS end with date and time as a billing parameter.</p> <p>6. It shall be viewed through BCS software along with reset and billing data. It is also preferred to have highest % recorded in each order of voltage harmonics in the BCS.</p> <p>7. The recorded harmonic value should get reset while resetting the demand in the meter.</p> |
| 3.7 | Load Survey | <p>The meter shall be capable of storing the following parameters with 15 minutes integration period for a minimum period of 60 days at each midnight in its memory. Preferable for more than 60 days.</p> <p>i) daily Kwhr with 96 integrated values along with cumulative Kwhr at 00.00Hrs on daily basis.</p> <p>ii) daily KVAhr with 96 integrated values with cumulative Kvahr at 00.00Hrs on daily basis along with maximum demand recorded for the day.</p> <p>iii) daily average VI profile with PF for every 15 minutes with high / low of the day</p> <p>iv) no. of hours no-load available in all 3-phases on daily basis.</p> <p>v) no. of hours supply available in all 3-phases on daily basis.</p> <p>vi) average frequency with 96 integrated values on daily basis with high / low of the day</p> <p>vii) reactive high energy with 96 integrated values on daily basis</p> <p>viii) reactive low energy with 96 integrated values on daily basis.</p> |
| 3.8 | Recommended Guarantee Period | 5 Years from the date of delivery / commissioning whichever is later and shall |

| | | |
|------|------------------------------------|--|
| | | be replaced within 2 weeks from the date of failure intimation. |
| 3.9 | Software | As per Specification M81/2010-11 |
| 3.10 | Programmable Features | As per Specification M81/2010-11 |
| 3.11 | Self Diagonistic Feature | As per Specification M81/2010-11 |
| 3.12 | Calibration for class of accuracy. | The meters shall be calibrated at manufactures lab if the same has got NABL accreditation for the class of accuracy. Meter manufacturer has to issue the calibration certificate for the meter by conducting test on all points as stipulated in the standards. If the manufacturing faculty does not have accredited lab then meter has to be calibrated in any of NABL approved lab. Meters without calibration certificate will not be accepted. |

CHIEF ENGINEER
MATERIALS MANAGEMENT

Display – I (Auto Scroll)

| | |
|---|-----------------|
| 1 | Display Check |
| 2 | RTC |
| 3 | Phase Sequence |
| 4 | R Phase Voltage |
| 5 | Y Phase Voltage |
| 6 | B Phase Voltage |
| 7 | R Phase Current |
| 8 | Y Phase Current |
| 9 | B Phase Current |

| | |
|----|---|
| 10 | Instantaneous Active Power |
| 11 | Instantaneous Reactive Power |
| 12 | Instantaneous Apparent Power |
| 13 | Instantaneous PF |
| 14 | Rising MD 1 in KVA |
| 15 | Last Block Ave.frequency |
| 16 | Last Block Net.KWh |
| 17 | Last Block Net KVA |
| 18 | Cumulative Forward KWh, Tariff 1 |
| 19 | Cumulative Forward KWh, Tariff 2 |
| 20 | Cumulative Forward KWh, Tariff 3 |
| 21 | Cumulative Forward KWh, Tariff 4 |
| 22 | Cumulative Forward KWh, Tariff 5 |
| 23 | Cumulative Forward KWh |
| 24 | Cumulative Forward KVArh, lag |
| 25 | Cumulative Forward KVArh, lead |
| 26 | Cumulative Forward KVAh |
| 27 | Reset Period Average PF (independent of tariffs) |
| 28 | Billing Power Factor (b pf) |
| 28 | Cum MD1 KVA |
| 30 | Reset Period MD1 for Tariff 1 |
| 31 | Reset Period MD1 for Tariff 2 |
| 32 | Reset Period MD1 for Tariff 3 |
| 33 | Reset Period MD1 for Tariff 4 |
| 34 | Reset Period MD1 for Tariff 5 |
| 35 | Reset Period MD1 |
| 36 | Total Power Off hours |
| 37 | Reset Count |
| 38 | % THD of Voltage Harmonics Phase wise (R, Y, B) |
| 39 | % THD of Current Harmonics Phase wise (R, Y, B) |
| 40 | % THD above the threshold value with date & time. |
| 41 | Anomaly String |
| 42 | Version |

Provision shall be made for addition of parameters in future.

Display – II (PUSH BUTTON)

| | |
|---|------------------------------------|
| 1 | Cumulative Forward KVArh Lag High |
| 2 | Cumulative Forward KVArh Lead High |

| | |
|----|--|
| 3 | Cumulative Forward KVARh Lag Low |
| 4 | Cumulative Forward KVARh Lead Low |
| 5 | Cumulative Reverse KVARh Lag High |
| 6 | Cumulative Reverse KVARh Lead High |
| 7 | Cumulative Reverse KVARh Lag Low |
| 8 | Cumulative Reverse KVARh Lead Low |
| 9 | Average frequency for 15 min present integration period |
| 10 | Cumulative Fundamental Forward Kwh |
| 11 | Angle between R phase voltage and current |
| 12 | Angle between Y phase voltage and current |
| 13 | Angle between B phase voltage and current |
| 14 | Quadrant of operation for R Y B powers |
| 15 | Wrong password entry count |
| 16 | Cumulative forward KWh at latest rest.tariff 1 |
| 17 | Cumulative forward KWh at latest rest.tariff 2 |
| 18 | Cumulative forward KWh at latest rest.tariff 3 |
| 19 | Cumulative forward KWh at latest rest.tariff 4 |
| 20 | Cumulative forward KWh at latest rest.tariff 5 |
| 21 | Cumulative forward KWh at latest reset (independent tariffs) |
| 22 | Cumulative forward KVARh lag at latest reset Tariff 0 |
| 23 | Cumulative forward KVARh lead at latest reset Tariff 0 |
| 24 | Cumulative forward KVARh at latest reset (independent tariffs) |
| 25 | Previous Reset Average pf (independent tariffs) |
| 26 | Previous MD1 for Tariff 1 |
| 27 | Previous MD1 for Tariff 2 |
| 28 | Previous MD1 for Tariff 3 |
| 29 | Previous MD1 for Tariff 4 |
| 30 | Previous MD1 for Tariff 5 |
| 31 | Maximum of Previous MD 1 |
| 32 | Voltage failure count |
| 33 | Current Failure count |
| 34 | Voltage unbalance count |
| 35 | Current unbalance count |
| 36 | Current Reversal count |
| 37 | Frequency |
| | |

DISPLAY III (HIGH RESOLUTION MODE)

Cumulative Forward, Active, Reactive, Apparent Energy
 Cumulative Reverse, Active, Reactive, Apparent Energy

| SETTINGS | |
|-----------------|---|
| 1 | MD - IMPORT KVA, 15 MIN EXPORT KVA, 15 MIN LOAD SURVEY PARAMETERS 1. IMPORT KVAH 2. IMPORT KWH 3. IMPORT KVARH LAG 4. IMPORT KVARH LEAD 5. EXPORT KVAH 6. EXPORT KWH 7. EXPORT KVARH LAG 8. EXPORT KVARH LEAD 9. AVG VOLTAGE 10. AVG CURRENT 11. AVG FREQUENCY 12. IMPORT KVA 13. IMPORT KW 14. EXPORT KVA 15. EXPORT KW 16. AVERAGE PF |
| 2 | INTEGRATION = 15 MIN |
| 3 | Rest type = Manual |
| 4 | KVAH = Lead as Lead, Bi – Directional |
| 5 | TOD configuration 5 sold |
| | 0000 to 0500 5 |
| | 0500 to 0600 4 |
| | 0600 to 0900 1 |
| | 0900 to 1800 4 |
| | 1800 to 2100 2 |
| | 2100 to 2200 3 |
| | 2200 to 2400 5 |

TECHNICAL SPECIFICATION FOR 11/22/33 KV METERING SETS OF CLASS ACCURACY 0.2s

1.0 SCOPE:

This specification covers the design, manufacture, assembly, testing and supply of 11/22/33 KV oil filled, copper wound metering equipment (combined CT-PT unit) for metering purpose comprising of one number three phase oil cooled Potential Transformer and three numbers single phase oil immersed Current Transformer to suit the requirement of 11/22/33 KV three phase four wire system of metering.

2.0. STANDARD :

Except where modified by this specification the CTs. and PTs. of the Metering sets shall comply with the requirements of following standards of latest issue.

| | | |
|---------------|---|--|
| IS: 2705-1992 | - | Specification for Current Transformers |
| IS: 3156-1992 | - | Specification for Potential Transformers |
| IS: 3347-1986 | - | Specification for Insulator/ Bushing |
| IS: 2099-1986 | - | Specification for Insulator/ Bushing |
| IS: 5621-1980 | - | Specification for hollow bushings. |
| IS: 335-1986 | - | Specification for new insulating oil |
| IS : 2633 | - | Galvanization |
| IS: 10601 | - | Primary Terminals |
| IS: 5561 | - | Specification for Terminal Connector |

3.0 SERVICE CONDITIONS

The metering equipments to be supplied shall be suitable for satisfactory continuous operation under the following tropical conditions:

3.1 Environmental Conditions

Maximum ambient temperature (degree C) : 55
Maximum ambient temperature in shade (degree C) : 45
Maximum temperature of air in shade (degree C) : 35
Maximum daily average temperature (degree C) : 40
Maximum yearly weighted average temperature (degree C) : 32
Relative Humidity (%) : 10 to 95
Maximum Annual rainfall (mm) : 1450

Maximum wind pressure (Kg/sqm) : 150
 Maximum altitude above mean sea level (meters) : 1200
 Isoceraunic level (days / year) : 50
 Seismic level (Horizontal acceleration) : 0.3g
 Climate:- Moderately hot and humid tropical climate
 Conducive to rust and fungus growth

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3.2 PRINCIPAL PARAMETERS:

11/22/33 KV combined CT/PT Metering Equipments units shall be suitable for 50 Hz frequency & for service under the system conditions having frequency fluctuations of +/- 5% and voltage fluctuation of + 10% / -30%. The 11/22/33 KV oil immersed combined CT/PT (metering equipment) units shall be hermetically sealed and suitable for service under the system conditions as per following specific parameters:

| Sl.No. | Particulars | Parameters |
|--------|--|------------------|
| 1. | Type of installation | Outdoor |
| 2. | System frequency | 50 Hz \pm 5% |
| 3. | Normal System Voltage | 11/22/33 KV |
| 4. | Highest System Voltage for substantially long period | 12/24/36KV |
| 5. | System voltage fluctuations | + 10% & -30%. |
| 6. | System earthing | Solidly grounded |

4.0 ESSENTIAL COMPONENTS :

Each metering set shall comprise of the following.

4.1. STEEL TANK :

a) The oil filled container incorporating the voltage transformers and current transformers should be fitted with incoming and outgoing primary terminals and secondary terminal box. The secondary terminal box shall be arranged on sides. The metering set should have 3 bushing on the incoming side and 3 bushings on the outgoing side. The over all tank should be rectangular cubicle.

b) The tank shall be built with a plate of 5 mm thick top and 3.15 mm sides and bottom and hot dip/Spray gun galvanised (Both for interior and exterior). Process and method of the same shall be furnished at the time of inspection. All fittings shall be capable of withstanding without leakage or distortion at the standard test pressure. All joints of the tank and fittings shall be hot oil tight and

no leakage should occur during service. Both side of the joint should have continuous welding.

c) It shall be provided with an oil gauge (prismatic). The prismatic oil gauge glass shall be fixed to the side wall of the tank. The tank shall be provided with necessary lifting lugs. Tank including top cover shall be hot dip/Spray gun galvanised.

d) The secondary terminal box cover, tank cover and other vertical joints where gaskets are used shall be suitably bent **atleast 25 mm bent**. This is to safeguard against seepage of water into tank in case of damaged gasket.

: 3 :

The secondary terminal box cover is provided with necessary sealing arrangement **with sealing bolts and nuts at all corners. Bolts should be atleast of 10 mm diameter GI bolts spaced maximum 70 mm apart. A thin hylum sheet is to be provided inside the secondary terminal box, such that it covers all the secondary terminals.**

e) The **6 mm** gaskets shall be dovetailed joints to prevent moisture entry. The number of joints (dovetailed joint) shall not be more than two.

f) It should be fitted with two nos. base channel 75 x 40 x 5 mm size across the width of the tank for mounting on double pole structure.

g) Suitable arrangement shall be provided with the metering equipment to facilitate expansion and contraction of oil due to changes in temperature. The extra oil space is to be provided by giving proper shape of the top cover with central portion projected outside and side sloping. The top cover is bolted with the tank with minimum 6 mm thick oil and heat cork sheet bonded with resistant nitrile / neoprene gasket of best quality.

h) The tank body shall be welded with 2 No Lifting lugs of adequate strength at side walls of main tank with suitable diagonal locations for balanced lifting of the tank. Similarly 2 No lifting lugs / hooks be welded on the top cover for lifting top cover with bushings as and when required. In all the four corners 6 mm holes one each at the corner of tank flange and on top cover flange are to be provided so as to match each other. The same shall be sealed by bolts with sealing holes, sealing wire and tablet after testing the equipment by TANGEDCO representatives. All the welded joints in the tank should be leak proof and pressure tested without oil at 1 Kg./cm² for 30 minutes. All the top cover corner bolts are to be provided with sealing bolt with nut.

i) An explosion vent diaphragm shall be provided opposite side of the Metering Equipment secondary terminal box which should operate at a pressure of 0.5 to 0.6 Kg./Sq.Cm.

j) The connection between the CT and PT inside the metering equipment shall have adequate clearance and reinforced insulation to avoid flashover between the two, inside the unit.

k) Adequate electrostatic & electromagnetic shielding should be provided to eliminate the effect of electro magnetic induction / electrostatic charge between the C.T and the P.T. secondary leads. The minimum electrical clearance between phases and phase to earth as specified in the ISS shall be maintained.

l) The windings of instrument Transformers shall be oil-cooled type. The paper used for insulation shall be of high insulation grade. The Insulating materials for winding between HV and LV & between interlayer of the winding and for end turn shall be as per relevant I.S. However, end turns have to be

: 4 :

provided with reinforced insulation and lead connecting the bushing shell be provided with extra insulation.

m) The tank top cover shall have a slope of sufficient angle to avoid stagnation of rain water.

n) The following details of equipment shall be engraved on base channel with at least 10 mm letters.

1. Make, 2. Serial No. & 3. Year of manufacturing.

o) The top cover of the metering set is to be linked through copper strip loop at side with main tank (this is for earthing purpose of top cover). 3 numbers bushing on incoming & outgoing terminals with MA, MB & MC (for incoming) and LA, LB & LC (for outgoing) marking is to be provided. The secondary terminal are to be marked with 1S1-1S3, 2S1-2S3 & 3S1-3S3 for CT terminals and a, b, c & n for PT terminals.

p) **EARTHING:** Two earthing terminals shall be provided with adequate size protected against corrosion, metallicly clean and identifiable by means of the sign marked in a legible and indelible manner on or adjacent to the terminals.

q) All bolts should be provided with 2 flat washers and a spring washer with a nut.

r) All welded joints should be leak proof and pressure tested at 1 kg/sq.cm for 30 minutes. This should be conducted in all units.

4.2 CURRENT TRANSFORMER:

Three nos. single Phase copper wound C.T. of specified ratio are to be properly fitted with in the tank of the metering equipment on 'R' phase, 'Y' phase and 'B' phase. The C.T. secondary winding will have suitable insulation cover. The primary winding shall be of adequate cross-section to carry continuously the rated current plus 20% overload. The CTs shall have dual metering core of same class of accuracy and ratio.

- 4.2.1 The conductor in the secondary winding of the CT shall not be less than 3.24 sq.mm.
- 4.2.2 Normal current density shall not be more than 1.5 Amps/ sq.mm. in primary winding of the CT.
- 4.2.3 The primary winding shall be of adequate cross-section to carry continuously the rated current plus 20% overload.

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4.2.4 The 11/22/33 KV Current Transformers shall have the following technical characteristics/parameters: -

| | |
|--|---|
| 1. Nominal system voltage (KV rms) | 11/22/33 |
| 2. Highest system voltage (KV rms) | 12/24/36 |
| 3. Frequency | 50 Hz. |
| 4. Transformation ratio (C.T. Ratio) | Single ratio as per requirement. |
| 5. Rated output (V.A burden) | 5 VA @ 0.8 PF Lag |
| 6. System neutral Earthing : | Effectively Earthed |
| 7. Class of accuracy | 0.2 S |
| 8. Rated continuous thermal current | 1.2 times of rated primary current. |
| 9. Short time thermal current rating | i) Lower Ratio (less than 100A) - 100 times for one sec ii) Higher Ratio (100A and above) - 25KA for one sec |
| 9.a. Rated dynamic withstand current (kAp) | 46 |

| | |
|--|--|
| 10. Rated dynamic current rating | 2.5 times of short time thermal current rating |
| 11. Instrument Security factor | < 5. |
| 12. All other characteristics and test parameter | As per IS: 2705/1972 (latest version) |
| 13. Max temperature rise over ambient temp of 50° at rated continuous thermal current at rated frequency rated bush. | 55°C |
| 14. Rated Insulation level : | |
| a) 1.2/50 microsecond impulse withstand voltage (KVpeak) | 75/125/170 |
| b) One minute power frequency withstand voltage (KVrms) on primary winding | 28/50/70 |
| 15. Power frequency over voltage withstand requirements for secondary winding for one minute (KVrms) | 3 |
| 16. Over voltage interturn test | As per clause 7.5 of IS : 2705 Part-I |
| 17. Creepage Distance Total mm | 300 |
| 18. Type of Insulation | Class A (in oil) |
| 19. Installation | Outdoor |

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4.3 POTENTIAL TRANSFORMER:

The metering equipment shall contain one No. three phase copper wound potential transformer connected in star with the HV neutral floating. The primary winding has to be designed for unearthed neutral i.e. for the highest voltage of 12/24/36 KV. The P.T winding shall have uniform insulation. PT winding should have uniform insulation throughout from live terminal to neutral end, and not the graded insulation. The 11/22/33 KV metering unit should be suitably designed for with-standing the unbalanced voltages developed due to single phasing operation during load regulatory measures in 11/22/33 KV distribution system. It should be capable of withstanding the disturbance of back e.m.f., magnetic characteristic and consequential mechanical inter-play of forces, if any, under such single phasing. Secondary winding of PT should be three

phase star connected with neutral brought out. On secondary side of PT four terminals shall be marked as a, b, c and n. No PT fuses are to be provided either on primary side or on secondary side.

The 11/22/33 KV potential transformers shall have the following technical characteristics/ parameters:

1. Nominal system voltage (rms) 11/22/33 KV
2. Highest system voltage (rms) 12/24/36 KV
3. Transformation ratio of P.T. 11000/110V:22000/110V:
33000/110V
4. Frequency 50 Hz.
5. Rated output (VA burden) 15 VA @ 0.8 PF Lag.
6. Winding connections Star/Star with floating neutral.
7. No. of Phases Three
8. Class of accuracy 0.2
9. All other characteristics and test parameters As per IS: 3156 (Part-II) (latest version)
10. Max temperature rise over ambient temp of 50° at rated continuous thermal current at rated frequency rated bush. 55°
11. Installation Outdoor
12. Rated Insulation level :
 - a) 1.2/50 microsecond impulse withstand voltage (KV peak) 75 / 150 / 170
 - b) One minute power frequency withstand voltage (KV rms) on primary winding 28 / 50 / 70
13. Power frequency voltage withstand requirements for secondary winding for one minute (KV rms) 3
14. Voltage factor 1.2 continuous and 1.5 for 30 secs.

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The 11/22/33 KV metering equipment shall also have the following common technical characteristics/ parameters:

| | | |
|-----------|--|--------------------------|
| A. | Impulse withstand voltage on assembled metering equipment. | 75 / 170 / 125 KV (peak) |
|-----------|--|--------------------------|

| | | |
|------------|--|--------------------------|
| B. | One-minute power frequency dry withstand voltage test on assembled metering equipment. | |
| i) | Primary (rms) | 28 /50/70KV |
| ii) | Secondary (rms) | 3 KV |
| C. | One-minute power frequency (wet) withstand voltage test on assembled metering equipment. | 28 /50/70KV |
| D | P.D measuring voltage/ Permissible voltage (For bushings only) | 7.6/50 : 15.2/50 : 25/50 |

4.4. CORE MATERIAL :

The core material of C.T. & P.T. set shall be of high grade non aging electrical silicon steel (CRGO) of first quality having low hysteresis loss and high permeability to ensure accuracy at both normal and over current / voltage.

TECHNICAL SPECIFICATIONS

| MATERIAL GRADE | MAX. GUARANTEED CORE LOSS |
|--------------------|---|
| M5 or better Grade | In Watt / KG should be indicated in the Technical bid |

Having silicon content of 3%(approx).
Density of laminations – 7.65 g/cc (approx)
Standard – BS 601(part-2) 1973

4.5. BUSHINGS:

The metering equipment shall be supplied with 6 No 12KV oil communicating porcelain weatherproof bushings with brass studs as per rating of the metering units. The bushing should conform to latest version of IS: 3347-1986(part III)/IS: 5621-1980 and IS: 2099-1986. The creepage distance must correspond to heavily polluted atmosphere.

The bushings only from the following reputed manufacturers who are having complete testing facilities will be accepted:-

M/s. Jayashree Insulators,
M/s. WS Industries,
M/s. BHEL,
M/s. Allied Ceramics,
M/s. India Potteries,
M/s. IEC and
M/s. CJI, Khurja, U.P.

Or equivalent

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The Type Test Certificates for the bushings should be furnished at the time of inspection.

The bushing stems shall be provided with suitable bimetallic connectors so as to connect the jumper without disturbing the bushing stem. The bush rod stem length should be at least 40 mm and 3 nuts with 2 flat washers of brass material should be provided with each bush rod.

Type & Make - Out door/ Reputed indigenous make as mentioned above

Dry flash over voltage –as per IS

Wet flash over voltage – as per IS

Dry 60 Sec withstand voltage – as per IS

Under oil flash over on puncture withstand test voltage (Power frequency)- as per IS

Full wave impulse withstand test voltage –as per IS

Creepage distance in polluted air – max

4.6. TERMINAL BOX

The secondary terminal box is fabricated built in with the tank with same 3.15 mm thick M.S. sheet. The dimensions of the terminal box should be such that adequate space is available for tightening the secondary cable connections on the secondary terminals provided in the box. The secondary terminals in the terminal box shall have proper marking with polarity indications. The box is provided with two nos. brass gland of heavy duty flange type (No.2) on the bottom plate suitable to accommodate 6 core 4 sq mm & 4 core 2.5 sq mm armoured copper cables. The terminal box is provided with approximately 25 mm wide collars/flange for holding its cover plate made of 16 SWG (1.6mm) M.S. Sheet. The 15 mm wide portion of the three sides (except bottom side) of the terminal box cover sheet is to be bent inside by 180° to make 'U' shape groove enabling this sheet slide down over the flange/collars of the terminal box and completely cover all the collars of the terminal box. This will protect the entry of rain water inside the terminal box and will not need nut & bolts for its clamping. However 2 No. 6 mm diameter holes one each in middle of the top and bottom collar/ flange are to be drilled. Similar holes are drilled in the cover plate and its top bend also so that the corresponding holes match and align when cover plate is slide down on the terminal box collars. These holes shall serve the purpose of providing bolts with sealing provisions for the terminal box by the commissioning staff after making all secondary connections.

4.6.1. The CT's and PT's secondary terminals shall be distinctly shown with markings. The CT's secondary terminals shall be separated from the PT's secondary terminals by means of barrier. The width of the barrier is to be 50% of the total width of the terminal box

4.6.2 Terminals shall be provided separately for earthing terminal of P.T. (in addition to two terminal as indicated already) and secondary neutral terminal of P.T. inside the secondary terminal box without any internal link and such that they can be connected externally when required.

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The terminal box should be placed in the centre of the primary incoming side of the metering set.

Each metering set should be complete with interconnection and internal secondary wirings.

4.7. INSULATING OIL

The metering sets shall be supplied with adequate quantity of new insulating oil whose level shall not be below the minimum oil level marking on the oil level gauge. The insulating oil shall conform to IS.335-1983 of the latest issue with amendments upto date.

The test certificate of oil being used shall be provided at the time of inspection. The oil in the Metering Equipment shall be filled under vacuum. Oil drain valve or sampling cock or non return type oil filling valve provided to facilitate factory processing shall be sealed before dispatch of Metering Equipments.

The Metering Equipment shall be hermetically sealed. The volume above the oil level in the tank shall be filled with Nitrogen gas conforming to commercial grade as per IS:1747:72.

INSPECTION AND TESTING OF INSULATING OIL :

To ascertain the quality of insulating oil the manufacturer's test report should be submitted at the time of inspection. Arrangements should also be made for testing the oil, after taking out the samples from the manufactured CTPT sets and tested in the presence of TANGEDCO representative for all metering sets.

The insulating oil shall have the following technical characteristics/ parameters: -

| | |
|--|---|
| Appearance of oil | - Clean, transparent & free from suspended matter |
| Density at 27 deg.C (max.) | - 0.812 |
| Kinematics viscosity at 27 deg.C (max) | - 11.68 |
| interfacial tension at 27 deg.C (max) | - 0.047 |
| Flash point, pensky marten closed (min)- | 152.000 |
| Pour point (max) | -27.000 |
| Neutralization value | |
| a. Total acidity (max) | - NIL |

- b. inorganic acidity / alkalinity – NIL
- Corrosive sulphur - Non corrosive
- Electric strength (break down voltage) (min)
 - a. New unfiltered oil - 30 kv
 - b. after filtration - 70 kv
- Dielectric dissipation factor - 0.000
- Specific resistance (resistivity)
 - a. at 90 deg. C (MIN) - 432×10^{12}
 - b. at 27 deg. C (MIN) - 7421×10^{12}

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Oxidation stability

- a. Neutralization value after oxidation - 0.031
 - b. Total sludge, after oxidation (max) - 0.025
- Ageing characteristics after accelerating ageing open breaker method with copper catalyst for 96 hrs.
- a Specific resistance (resistivity)
 - i. at 27 deg. C (MIN) 145×10^{12}
 - ii. at 90 deg. C (MIN) 10×10^{12}
 - b Dielectric dissipation factor. Tan delta at 90 deg. C 0.003
 - Total acidity (max) 0.025
 - Total sludge value (max) 0.009
 - Presence of oxidation inhibitors - Absent
 - Water content (max) - 12

5.0. CLEARANCE :

The minimum clearance between different phase terminals and earthed parts shall not be less than the values specified below in accordance with BS: 162-1961 or the relevant ISS with amendments upto date.

| Rated voltage | Minimum clearance to earth | Minimum clearance between different phase terminals |
|---------------|----------------------------|---|
| 11 KV | 190 mm | 255 mm |
| 22 KV | 279mm | 330mm |
| 33 KV | 350mm | 430mm |

6.0 FITTINGS AND ACCESSORIES:

The metering equipment shall have the following:-

- (a) Riveted 'Rating and connection Diagram plate' shall be fitted besides the terminal box on the same face of the metering equipment. This shall indicate Name of manufacturer, voltage, C.T. Ratio, class of accuracy, burden etc and shall be embossed / engraved on the rating plate.
- (b) 2 No. base mounting channels dully welded to the bottom of the tank.
- (c) 1 Nos. oil drain valve with plug located 25 mm above the bottom of the tank on one of the sidewalls of the tank.
- (d) 2 No. earthing terminals (stud and bolts should be properly galvanized and confirm to latest version of IS: 1363 and IS: 1367).
- (e) 1 no. non return oil filling plug.
- (f) 2 nos. lifting lugs to lift the metering equipment.
- (g) 2 nos. lifting lugs / hooks to lift the top cover.
- (h) 1 no. oil filling hole with cap on the top cover.

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- (i) 6 nos. bimetallic clamps fitted on the bushing stud suitable for holding ACSR Dog conductor.
- (j) Serial no. of metering equipment, year of manufacture and CT ratio are to be punched clearly on the side wall of the equipment at location below the terminal box. The same shall be clearly visible from ground after erecting the metering set in the structure.
- (k) Prismatic oil level gauge / indicator with minimum oil level marking.

The metering equipment shall be complete in all respect. Any fitting, accessories or apparatus which may not have been specifically mentioned in the specification for 11/22/33 KV metering set covered under the scope of the supply, but which are usual or necessary in the equipment of similar type shall be deemed to be supplied by the supplier without extra charges.

7.0. MARKING :

Every metering set shall be provided with a name plate as per relevant IS (IS.2705-1992 and IS.3156-1992).

Besides the above, the following particulars shall be incorporated in the name plate. **The name plate shall be non-detachable type & fixed with rivets, not with bolts & nuts.**

1. Consumer Service Connection No.
2. Quantity of oil in liters.

3. Total weight of the unit in kilograms.
4. Date of inspection.
5. Date of calibration.

8.0. DRAWINGS :

The drawings showing the general arrangements of the metering sets indicating the fittings and other details and also the connection diagrams may be furnished along with the metering set supplied.

9.0. TEST CERTIFICATES :

TYPE TESTS: The equipment offered shall be fully type tested from a **Govt. recognised Lab** by the manufacturer as per the IS-2705/1992 and IS-3156/1992 (with latest amendment). The manufacturer shall furnish a copy of type test certificates with certified drawing along with the metering set supplied. (11/22/33 KV Metering Equipment). Type test certificate for (lower ratios i.e below 100/5A) ratio of 20/5A and for (higher ratios i.e above 100/5A) ratio of 100/5A for each class of voltage should be furnished.

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Accuracy class of CT & PT shall be tested and confirmed with all instruments (including standard reference CTs and PTs calibrated only at NABL accredited Lab).

9.1. TYPE TESTS FOR CTs :

- a) Verification of terminal marking and polarity
- b) Short time current Test.
- c) Temperature rise test.
- d) Lightning Impulse Test.
- e) High Voltage Power frequency wet withstand voltage test.
- f) Determination of errors or other characteristics according to the requirements of the appropriate designation or accuracy class.

9.2. TYPE TESTS FOR PTs :

- a) Verification of terminal marking and polarity.
- b) High voltage Power frequency wet withstand voltage test.
- c) Power frequency dry withstand tests on Primary winding.
Power frequency dry withstand test on Secondary winding.
- d) Determination of errors according to the requirements of the appropriate accuracy class.
- e) Temperature rise test.

- f) Impulse Voltage test.
- g) Lightning Impulse test

9.3. TYPE TESTS FOR METERING SET BUSHINGS :

- a) Dry flash over voltage.
- b) Wet flash over voltage.
- c) Dry 1 Minute withstand voltage.
- d) Impulse withstand voltage (1.2/50 Micro Seconds –ve wave)

9.4. Type test certificate for rated combined CT-PT unit (Metering sets) from a Govt. recognized Lab within 3 years from the date of supply, should be enclosed along with the equipment for short time current test, temperature rise test, lightning impulse test, accuracy test, high voltage power frequency voltage withstand test as per IS-2705/1992 and IS-3156/1992 (with latest amendment).

9.5. ROUTINE TEST

Each of completely assembled metering unit shall be subjected to the following routine tests at the manufacturer's works in accordance with the details specified in IS:2705 and IS:3156:-

- a. Verification of terminal marking and polarity test of CT and PT of metering unit
- b. Power frequency dry withstand test on primary winding of CT and PT of metering unit.

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- c. Power frequency dry withstand test on secondary winding of CT and PT of metering unit.
- d. Over Voltage inter turn test on CT of metering unit.
- e. Determination of errors or other characteristics according to requirements and class of accuracy of CT and PT of combined Metering Equipment.
- f. Induced voltage test on PT of metering unit.
- g. Break down voltage test of transformer oil.
- h. Pressure test on tank of metering unit with oil at 0.8 kg./sq.cm.
- i. Ratio & phase angle error test of CTs of metering unit.
- j. Insulation Resistance test with 1 KV megger.
- k. **Air pressure test on empty tank of transformer at 1kg/sq.cm for 30 minutes opened for physical verification test (One unit in every lot offered for pre-despatch inspection)**
- l. Phase out test : In case voltage failure in any one of the phase on primary side, there should be a corresponding voltage failure indication on secondary side. Necessary test will be conducted at site to ensure the above voltage failure indication.

9.6 Acceptance:

These tests are to be carried out by the representative of TANGEDCO at the works of the supplier on each offered metering set in accordance to the relevant I.S. of C.T. and PTs and technical requirements of this specification mentioned earlier. In addition to the routine tests, the acceptance tests also cover the physical check of the dimensions & parameters as per the Technical specification, the Guaranteed Technical Particulars and the approved drawing of the metering equipment dispatches will be allowed only after these tests have been found to be in order at the premises of manufacturers.

The manufacturers shall have requisite testing facility for routine and acceptance tests.

9.7 Recommended Guarantee Period:

Four years from the date of delivery or commissioning whichever is later. Manufacturer shall repair / replace the failed unit within 2 weeks from the date of failure intimation.

* * * * *

GUARANTEED TECHNICAL PARTICULARS

| Sl. No. | Technical Particular | Details |
|----------------|--|----------------|
| 1. | Name of Manufacturer | |
| 2. | Type of Equipment (Outdoor Oil Immersed) | |
| 3. | Overall Dimensions of the equipment | |
| 4. | Dimensions of the tank (Please furnish drawing with the offer) | |
| | (a)Length (mm) | |
| | (b)Breadth (mm) | |
| | (c)Height (mm) | |
| 5. | Material of the tank | |
| | a.Thickness of Bottom & Top Cover (mm) | |
| | b.Thickness of Sides (mm) | |
| 6. | Make of Insulating oil to be used | |
| 7. | Volume of insulating oil in the Tank (Lt.) | |
| 8. | Total Weight of the complete equipment with oil and fittings (Kg.) | |
| 9. | Core Details | |
| | a.Weight of Core of CT (3 nos. in Kg.) | |
| | b.Weight of Core of P. T. (Kg.) | |
| | c.Material of the Core | |
| 10. | Weight of Copper | |
| | a.CT Primary (3 nos.) | |
| | b.CT Secondary (3 nos.) | |
| | c.PT Primary | |
| | d.PT Secondary | |
| 11. | Winding Details | |
| | a.Class of insulation | |
| | b.Material of Insulation of winding | |
| | c.Cross-sectional Area of CT primary (mm ²) | |
| | d.Winding of CT Secondary | |
| | (i)No. of Turns | |
| | (ii)Cross-sectional Area (mm ²) | |
| | e.Winding of P. T. Primary | |
| | (i)No. of Turns | |
| | (ii)Cross-sectional Area (mm ²) | |

| | | |
|-----|---|--|
| | f. Winding of P. T. Secondary | |
| | (i) Connection mode | |
| | (ii) No. of Turns | |
| | (iii) Cross sectional Area (mm ²) | |
| 12. | Bushing Details | |
| | (i) Make | |
| | (ii) Total creepage distance | |
| | (iii) IS to which bushing confirms | |
| | (iv) Electrical clearance between fitted bushings phase to phase | |
| 13. | Current Transformer | |
| | a. Nominal System voltage (KV rms) | |
| | b. Highest system voltage (KV rms) | |
| | c. Frequency | |
| | d. Impulse withstand (KV Peak) (On metering unit) | |
| | e. One minute power frequency dry withstand voltage test (on metering unit) | |
| | (i) Primary (KV rms) | |
| | (ii) Secondary (KV rms) | |
| | f. One minute power frequency wet withstand voltage test (KV peak) (On metering unit) | |
| | g. Transformation ratio (C. T. Ratio) | |
| | h. Rated output (VA burden) | |
| | i. Class of accuracy | |
| | j. Rated continuous thermal current | |
| | k. Short time thermal current rating | |
| | l. Rated dynamic current. | |
| | m. Instrument Security factor | |
| | n. Maximum ratio error | |
| | o. Maximum Temp. Rise over ambient Temp, of 50 ° C at rated continuous thermal current at rated frequency and burden. | |
| 14 | Potential Transformer | |
| | a. Nominal system voltage (KV rms) | |
| | b. Highest system voltage (KV rms) | |
| | c. Frequency | |
| | d. Transformation ratio | |
| | e. Rated output (VA burden) per phase | |
| | f. Class of accuracy | |
| | g. No. of phase | |

| | | |
|-----|--|----------------------------|
| | h.Maximum ratio error | |
| | i.Max. phase angle error | |
| | j.Rated voltage factor and time | |
| | k.Max. Temp. Rise over ambient temp. | |
| | l.Winding connections | |
| | (i)Primary | |
| | (ii)Secondary | |
| | m.Whether neutrals are brought out | |
| 15 | Whether the metering equipment Is suitable for satisfactorily working under abnormal conditions viz single phasing supply by arrangements by Looping supply phase with other line phase. | |
| 16. | Minimum electrical clearance between phase to earth with bushing mounted on equipment | |
| 17. | Whether air pressure release device is provided | |
| 18. | Whether arrangement provided to take care of expansion & contraction in oil. | |
| 19. | Whether oil drain plug is provided | |
| 20. | Whether 2 Nos. earthing terminals are provided. | |
| 21. | Whether dimensional drawing of the collets equipment is enclosed. | |
| 22. | Whether Oil gauge is provided on the tank. | |
| 23. | Whether secondary terminals in the terminal box are properly marked. | |
| 24. | Whether base channels are mounted as per specification. | |
| 25. | Whether terminal connectors are provided as per specification. | |
| 26. | Resistance of H. V. and L.V. winding at 75 ° C per phase. | |
| 27. | Value of max. current density of primary of C.T. | |
| 28. | Identification/ Marking | |
| | A) Primary Terminals | |
| | Incoming | MA, MB, & MC |
| | Outgoing | LA, LB, & LC |
| | B) Secondary Terminals | |
| | CTs | 1S1-1S3, 2S1-2S3 & 3S1-3S3 |
| | PTs | a, b, c & n |

