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SOP

METERING EQUIPMENT/METER

METER TESTING DN

2020

ME TESTING PROCEDURE

DEFINITION:

Metering Equipment in short is known as ME and used for measuring the Electrical quantity i.e. current and voltage by the use of current transformer and potential (voltage) transformer. It is also known as combined CT: PT unit and used only for metering purpose.

ME is using to measure bulk amount of energy and power flow in substation and HT consumer where HT (High Tension, Voltage level 11KV, 33KV) side metering is required. Meter is connected in secondary side of ME having ratings of 110 Volt (Ph to ph) and 5 Amp base current.

In substation all the installation and commissioning is done by STM Division and for HT consumer it is done by Meter Testing Division.

Before installation there is some procedure adopted by Meter Testing Division for standard & quality work.

Following offices are involved for execution of work:

A. O&M/ City -Circles & Divisions

B. Area Store

C. Meter testing -Circle & Divisions

All the above offices are involved for execution of work related to ME testing and commissioning at field or at consumer premises from the beginning. Further various procedure adopted for execution or divided as per related office to office

Work Flow:**1. Requirement**

- For New Service Commissioning:
- For Failed ME replacement
- For Defective ME replacement
- For ME replacement Against standardization
- For ME replacement against Load Enhancement

ME requirement is given by O&M / City office depend on the condition of execution of work i.e. NSC / load enhancement or failed /defective standardization to SE (MT-I) on URJAS portal.

2. Release of ME

The ME of appropriate ratings are released by SE(MT-I) as per requirement /availability at Area store or in field with 2.5Sqmm. 12 Core copper cable.

3. Drawls from Area Store

After getting the release order ME is drawn from Area Store by authorized O&M person.

4. ME Testing at MT Lab

Authorized O&M person brings the ME to related MT lab along with 2.5Sqmm12 core copper cable, 3kg M-Seal, Postal Order Signed by EE (O&M/City Dn) and Pre Commissioning format

STANDARD OPERATING PROCEDURE OF ME TESTING

ME is brought to MT lab by O&M Team from store/Field after release by SE (MT-I) office against NSC/Failed/Defective/Standardization with 2.5SQMM 12 core cable and approx 3kg M-seal and with Postal order signed by EE (O&M/City Dn). Following steps are adopted for testing of ME at Lab

STEP-1

Checking of Pre Commissioning performa :- The Checking of Performa for verification which is containing details of consumer name Address, Contract Demand and ME ratings, consumer's s/s details and Testing against requirement (NSC/Failed/Defective/Standardization).

STEP-2

Physical verification of ME:- The physical verification is done by MT officer /testing team at lab i.e. Oil Leakage, damage of ME tank, Insulator damage, Oil level & physical condition (i.e. deterioration, Insulation damage, corrosion in armored) of cable. If any abnormality found & noted down the details of ME and physical condition without testing and return back to Area Store/O&M office. If physical condition found ok then STEP 3 is adopted.

STEP-3**Following tests are carried out in the lab:-****1. Insulation resistance test****2. Continuity check****3. Break Down voltage test**

Details of the testing procedure:

1. **Insulation resistance test:** - Insulation Resistance value (IR value) is checked with the help of 1 KV megger. This is done for primary of PT to earth, secondary of PT to earth and secondary CT to Earth.
 - a) **Between Primary PT to Earth:-** Line wire of megger is connected to PT Primary terminal and earth wire to ME body and value checked with the help of megger for all PT primary terminals. The IR value must be greater than 1000Mohm.
 - b) **Between Secondary (PT) to Earth:-** Line wire of megger is connected to PT secondary terminal and earth wire to ME Body and the value checked with the help of megger for all PT secondary terminals. The IR value must be greater than 500M ohm for all three phases.
 - c) **Between Primary and Secondary of PT:** - Line wire is connected with primary side of PT and earth to ME secondary PT terminal, the IR value must be greater than 1000Mohm for all three phase.
 - d) **Between Secondary CT to Earth:** - Line wire is connected with Secondary CT terminal and earth wire to ME body of Megger, IR value must be greater than 500Mohm.

2(i).Continuity check of PT by megger :-

Between 3 phases of Primary of PT:- All the 3 primary PT terminal continuity is checked with the help of continuity tester by live wire and Earth wire, if the value is shown as zero then primary PT continuity is ok.

Between 3 phases of Secondary PT:-All the 3 secondary PT terminal continuity is checked with the help of continuity tester by live wire and Earth wire, if the value is shown as zero value then secondary PT continuity is ok.

2.(ii) Continuity checked of CT by multimeter:-

Between primary CT terminals:- Two leads of multi meter are connected to CT primary main & load terminals for continuity check and beep sound observed which means continuity is ok.

Between secondary CT terminals:- Two leads of multi meter are connected to CT primary main & load terminals for continuity check and beep sound observed which means continuity is ok.

3) Break Down voltage test: - oil sample is drawn from ME oil drain valve, and placed in BDV kit jar with 2.5mm gap, and Break down voltage is increased up to 60KV .This sample should withstand for 1 minute. If break down occurs before 30KV, it means oil contains some moisture and ME needs replacement.

ME can be accepted after test results of IR value, continuity and BDV is between 30 KV to 60 KV are found ok.

STEP-4

After test results of IR value, Continuity and BDV are found OK, 12 core 2.5 sq mm armored control cable is connected with ME secondary terminal with proper feruling/markings of CT & PT terminal in both ends of cable. After connection of cable the following test is performed at lab.

1. CT polarity test**2. PT polarity test****3. Current Ratio test****4. Voltage Ratio test****Detail of Testing Procedure:**

1). CT polarity test:- This test is conducted to ascertain that Primary CT terminal polarity is the same as that of secondary CT Terminal. It requires a galvanometer with null deflection facility in ideal Condition and deflection in right side (Clockwise) when DC voltage (i.e. 1.5 volt dry cell) is applied with positive polarity and in left side (Anti Clock wise) with negative polarity. When battery positive terminal is connected with CT main side HT terminal & Negative terminal is connected with load side HT terminal, Galvanometer is connected in secondary side of same phase CT, with Positive terminal connected with main terminal of secondary CT and Negative terminal of galvanometer to load terminal of secondary CT, the Galvanometer deflects in forward/right side which means Polarity of Primary CT is same as secondary CT. This test is conducted for all phase CTs.

2). PT polarity test:- It requires a galvanometer with null deflection in ideal Condition and deflect in forward or right side when applying the DC voltage (i.e. 1.5 volt dry cell) with positive polarity and backward or left deflection with negative polarity. All PT terminal connects with wire and galvanometer connects in Secondary PT terminal between RY, YB and BR phases. When voltage is applied in primary PT, RY, YB and BR terminal with positive polarity and same deflection forward/right side deflection occurred in Galvanometer connected between RY, YB & BR.

3). Current Ratio test:- This requires Primary Injection Kit. As per the current ratio of ME, current is injected in the primary side with the help of PI kit; secondary side current is measured by clamp on meter and checked with current according the CT ratio of ME.

4). Voltage ratio Test:- Normal three phase LT voltage available in lab is, applied to ME in primary side and applied Voltage measured by multi meter and same time measured in Secondary side of ME between RYB phase and neutral. Magnetic Induction balance condition checked by removing the input or primary.

All the results are noted down in available ME testing format and details of ME i.e. Make Serial No, CTR and PTR are written on Postal Order in Both part.

STEP-5

After Ok test result at lab, all the connected secondary terminal and wire at secondary box are covered with M-Seal and stick Postal order without counterfoil. After sealing of secondary studs with M-seal, Continuity is checked and ME top cover and ME secondary box are sealed with available sealing arrangement i.e with lead seals.

1. All 4 corner of top cover of ME tank
2. All 4 corner of ME secondary box cover.

All the records maintained at lab and a test result copy with counter foil of postal order is placed at consumer file.

After completion of all the procedure ME is handed over to O&M team.

STEP-6

Installation of ME at site: ME should be installed at site in presence of MT Team and O&M team. The following precaution should be made during the installation:

1. O&M team should be fully equipped and in all safety measure.
2. During the installation , ME should be mounted ME mounting channel with proper fittings.
3. Proper earthing of ME at two locations should be ensured.
4. ME secondary cable must be in line with pole and no any physical /insulation damage will occurred.
5. After installation MT team will connect the ME secondary in TTB.
6. After pre commissioning test, ME jumper with appropriate clamp should be connected with line (11KV/33KV).
7. After normal ME charge, Meter parameter should be check and meter reading should be taken.

Tests of ME for NSC/Failed at site

1. **Tests at the time of NSC:** - At the time of commissioning once again polarity test of CT and PT are carried out in the field. CT Ratio tests are conducted with the help of PI kit. *ME secondary Box and ME tank Top cover seals And ME serial No and Make are also verified at site.*
 - (a) Insulation resistance test is required at site.
 - (b) CT & PT polarity test galvanometer is required and 1.5 battery and connecting wires.
 - (c) CT ratio test requires PI Kit and UPS /single phase supply for power on the PI kit and wires.
 - (d) If required, Voltage ratio test should be also performed at site in the following conditions :-
 1. If ferules are missing at site during installation
 2. For identification of ryb secondary PT phase terminals.
 3. If PT polarity is found reverse.
 4. And if Continuity is missing of any phase
2. **ME Testing against Failed at site:** - The following testing procedure is adopted at site when ME is declared faulty.

Continuity is Checked between Primary CT & secondary CT & that of PT, and then IR value testing is done for the ME. If IR value is ok then CT ratio test is carried out with the help of PI kit. If this test is found ok then, PT ratio testing is performed. If PT ratio test is ok then ME is not defective/failed.

In the first case if the IR value is not up to the mark (i.e. primary to Earth-1000M Ω & Secondary to Earth -500M Ω) then CT ratio test is carried out to find the proper ratio which indicates the condition of the CT. If this ratio is ok then ME is declared as failed on PT failure. If this CT ratio is not ok then ME is declared failed on both CT and PT failure.

3. **ME Testing against Failed at Lab:-** Failed ME is tested at Lab on pre intimation to consumer and O&M officer. In presence of consumer /consumer representative following procedure is adopted at lab.
 - (a) Physical Verification:-**ME is physically verified for any damage, Burn, Leakage & any insulation damage in the 12 core cable.
 - (b) Continuity test:-** Continuity is checked between primary CT, Primary PT, Secondary CT and secondary PT.
 - (i) if continuity between primary CT is not found and secondary CT ok, then ME is declared failed on primary CT is open.
 - (ii) if continuity between primary CT is ok but same phase secondary CT is found open then ME is declared failed on secondary CT open.
 - (iii)** if continuity between Primary PT is ok but continuity of secondary PT is not found then ME is declared failed on PT secondary open
 - (iv)** If continuity between primary PT is not ok but secondary PT is Ok then ME declared failed on primary PT open.

(v) If continuity of both CT & PT is not found then, then ME is declared failed on both CT & PT open.

(c) Insulation Resistance test:-

Insulation Resistance value of ME is checked with the help of megger, between primary terminal to Earth, Secondary terminal to Earth and between Primary to secondary & the values are noted down at lab.

(d)Current ratio Test:-

Current is injected in primary side with the help of PI kit and secondary current is measured at the corresponding phase at secondary of ME.

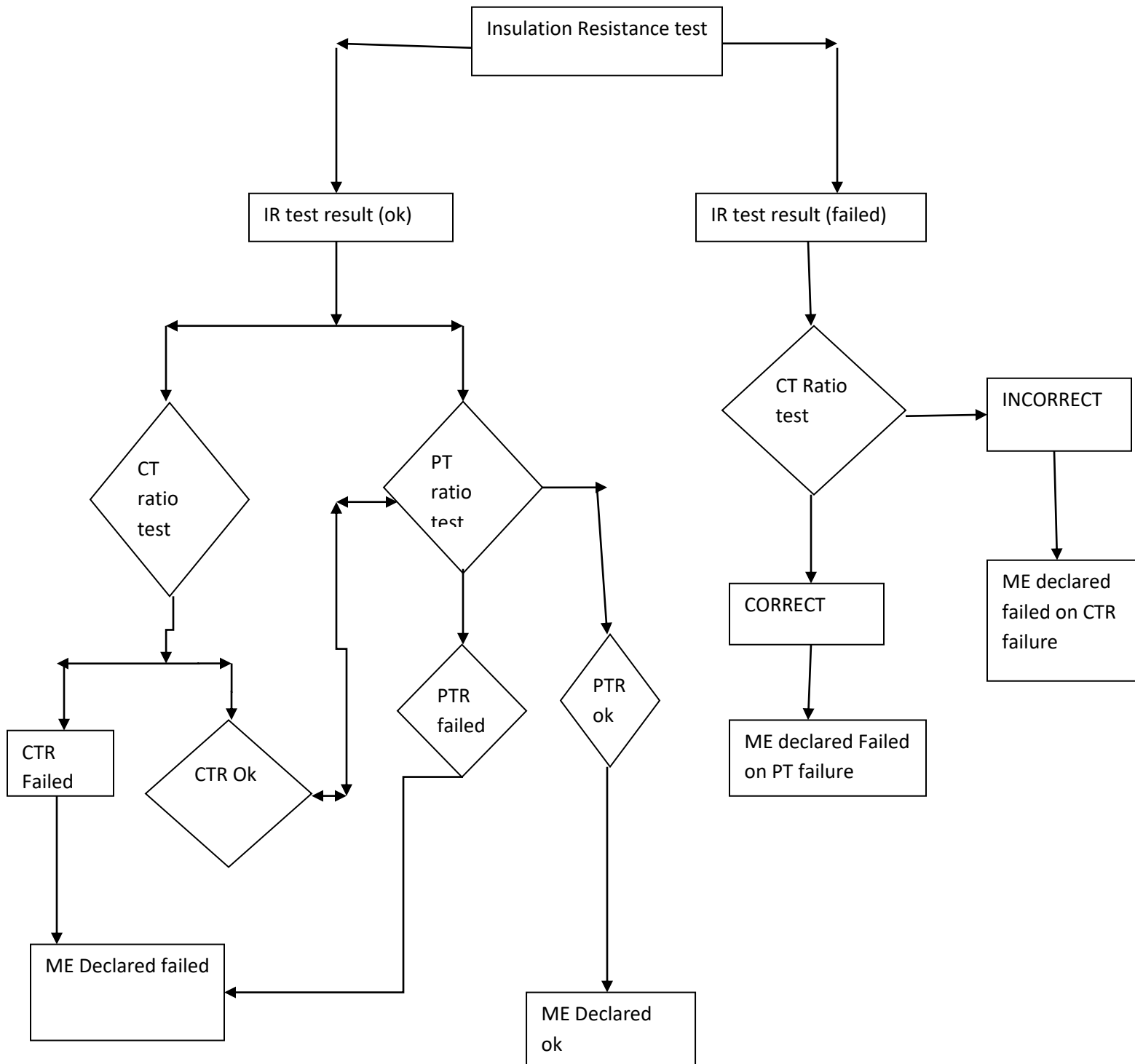
- (i) If primary winding of CT is open then current can not be injected and ME is declared failed due to primary CT failure.
- (ii) If primary winding of CT is OK but secondary CT found open, then current is not drawn from primary terminal after injection of current. ME is declared failed on CT secondary open .
- (iii) If both primary and secondary windings are OK, then if current is found at secondary side according to the CT ratio then CT is ok but if current is not found according the ratio then ME is declared defective/failed.

(e)Voltage ratio test:-

Voltage ratio test is performed at lab as per available supply voltage (i.e. 440 volt 3phase or 230 volt single phase),

- (i) . If voltage ratio is not found in order then ME is declared failed.
- (ii) . If voltage ratio is found ok the ME PT is OK,

Remarks:- If ME is declared failed on CT failure the cost of ME will be recovered from the consumer and If declared failed on PT failure then no cost will be recovered. The cost will be recovered in PT failure if any faults were occurred in consumer installation as per report of field , this can be decided by inspection report prepared by O&M/MT team at the time of fault / replacement.




Standard Testing Procedure for HT Meter Testing

- Categories of HT Meters**
1. HT Trivector Meter 0.2s, 0.5s accuracy class
 2. HT ABT Meters 0.2s accuracy class
 3. HT Solar Net Meters 0.2s and 0.5s accuracy class

(A) Laboratory Testing :-

Before installation at HT consumer's premises, each and every meter is to be tested in the MT Lab.

Equipments used - Phantom Loading Kit,
Reference standard meter (RSS) or Electronic Reference Standard Meter (ERSM)

Before testing of HT meter with ERSM, the meter should be powered on with the help of Phantom Loading Kit. Visually check for any abnormal indication on meter display like cover open – CO/ and Magnet tamper – Mag/  etc.

Meter with cover open or magnet tamper prior to installation should not be used at consumer's installation.

Test is to be performed:-

1. Test of Starting Current**2. Test of No load condition****3. Accuracy measurement****4. Dial test****Details of Tests**

- Test of Starting Current-** In this test 0.1% of I_b i.e. 0.005 amp current at unity power factor and V_{ref} (63.5 V) is applied to the meter with the help of presetting in the phantom loading kit and time taken in appearance of the first pulse of meter should be noted from

the timer of the ERSM. This is indicated in the blue bar in the ERSM equipment connected in series. The time is noted down when the first pulse appears. The meter should start recording energy at 0.1% of I_b i.e. 0.005A.

- ii. **Test of No load condition** (Creep test) this test is conducted in no load condition of the meter and a voltage of 115 percent of the reference voltage i.e. 115% of 110V = 125.5V shall be applied to the voltage circuit with the help of presetting in the phantom loading kit. The voltage is applied for a period which is 20 times of the time taken in appearance of first pulse in starting current test. In this test meter shall produce not more than one output pulse which may be due to residual energy in the meter. This can be verified on the ERSM connected in the series. Appearance of first pulse if any can be verified by ERSM. This is to ascertain that the meter does not creep on no load condition.
- iii. **Accuracy measurement:-**Accuracy of energy measured by the meter is compared with that of reference meter connected in series of the meter at various loads and power factor conditions normally for 10-20 pulses. To carry out this test phantom loading kit and meter are connected in series with the ERSM. Phantom loading kit acts as the power source and supplies various loading conditions on different power factors which can be preset in the phantom loading kit. ERSM is used to compare the accuracy as this equipment also computes power consumption in series of meter under testing. Meter constant is added on ERSM for comparison which is calculated by Meter rating.
Meter constant = (METER CTR x METER PTR/1000) x Meter Pulses.
This test is generally conducted at following loading and power factor conditions:-

(iii) (a) at Unity Power Factor

- 100% Load
- 50% Load
- 5% Load

(iii) (b) at PF 0.5 lag

- 100% Load
- 50% Load
- 10 % Load

(iii) (c) at PF 0.86 Lead

- 100% Load
- 50% Load
- 10% Load

- iv. **Dial Test:-** Verification of accuracy of meter and MD is basic purpose of carrying out Dial test. This test is conducted for 15 minutes (as MD can only be recorded after testing of meter for at least 15 minutes), @ 90% of I_b i.e. 4.5A and 0.866 lagging power factor. Before start of the test MD of the meter under testing is reset. Initial KWh, KVAh and KVArh in high resolution mode of the meter is recorded manually before dial test. High resolution mode gives 3 to 4 digits after the decimal and so it is called high resolution mode. To bring the meter in high resolution mode ,for Genus make meters both the buttons for up and down

scroll are required to be pressed simultaneously and for other makes of meter ,the feature is available in the meter display. After the test again KWh ,KVAh and KVArh are recorded and subtracted from the initial values .CMRI in calibration mode can also be used for dial test for recording the energy consumed in the meter. The CMRI and reference meter should be simultaneously started and stopped through respective switches after 15 minutes. When CMRI is connected with the meter through optical port , there will be no need to record energy consumed in the meter .Formula for error calculation for **KWh**

$$\text{Percentage Error} = \frac{\text{Energy registered by Meter} - \text{Energy registered by Ref.Meter}}{\text{Energy Registered by Reference meter}} \times 100$$

MD recorded by the meter under testing is to be compared with the calculated MD as worked out by following formula:-

1.732xVxI (calculated) = 4*KVAh recorded in 15 min of dial test =Recorded MD in the meter

For verifying of MD auto reset date:-The meter is connected with modem and Base Computer Software(BCS) through the modem connected with PC/laptop by dialing in GSM mode. Then the MD auto resetting date is verified in the BCS. If the MD reset date is required to be changed, same is done with the help of BCS.

(B).On Site Testing of HT Meters

Frequency of testing of HT Meter - As per MPERC Guidelines all HT meters are to be tested once in a year

1. Before starting the testing, verification as per check list be done

Step-1

➤ **Physical inspection** : During the visit of consumer premises , following point should be checked :-

- (a) **ME installation:** - It should be check the ME mountings in poles and ME HT terminal jumper with cable or overhead line and connection with tapping poles. Any oil leakage, damage of tank & any damage of ME secondary cable.
- (b) **Meter Box Installation:** - Meter box should be checked with ME secondary cable, meter box condition either any damage or rusting. Meter box outer cover lead and paper seal.
- (c) **Consumer Installation:** AB switch, LA and DO fuses jumper, Do fuses and consumer transformer.

IF any abnormality found, inspection report prepared in front of consumer /consumer representative and intimation given to higher authority for further necessary action.

Step-2

➤ **Verification of Consumer Details :-**

- (a) **Consumer Details:-**Verify consumer name and HT meter number & make of the meter as per record from file.
- (b) **Meter box Outer Cover Seal:-**Verify the details of meter box outer cover lead seal and paper seals and matched with record file. If lead seal found tampered and sps torned then intimate to the consumer/consumer representative, O&M officer and higher authority of MT. In front of consumer/consumer representative & O&M officer inspection report/panchnama prepared about the findings.
- (c) **Meter Box Inner Cover Seals:-**If outer seal & Paper seal are found ok, then open the meter box outer cover in front of consumer representative. Seals of Meter box inner cover is verified and checked for any tampered. If seals are found tampered then, intimate the consumer respective/Consumer , SE (O&M/City) & SE (MT-I) and Panchnama prepared in front of consumer/consumer representative .Before opening the inner cover meter parameter checked either inner cover seals & paper seals are ok or tampered.

Step-3

➤ **Verification of Meter parameters:**

Meter display parameter should be checked & recorded with the help of MRI or Meter display parameter before opening the inner cover of meter box..



Meter parameters are:

- (a). Instantaneous voltage
- (b) Instantaneous current
- (c) Instantaneous Power Factor
- (d) Instantaneous loads (KW, KVAR, KVA)
- (e) Phase angle (120 degree apart from each other by MRI

If such feature is available in meter or in MRI

- (f) Any tamper recorded by meter.

CONDITION-1

- If voltage, current, pf and loads are found normal but meter display shows abnormal indication like cover open-CO/  and magnet tamper –MAG/  etc then in such case intimation to consumer representative is given & O&M /City Dn team and higher authority of MT are informed Panchnama is prepared based upon the observations and as per instruction given by higher authority, inner cover is opened . All seals are verified as per records and noted down. Meter should be seized and sealed/packed with signature of the consumer and MT /O&M officers and staff on each of the documents prepared for detail testing at lab. All the procedure is adopted as given in supply code.

CONDITION-2

- Meter display having no abnormality but voltage/current parameters if found abnormal as per rating of Meter & ME.

Example.1. (For voltage parameter):-

If meter PTR is 11KV/110V or 33KV/110V or -/110V, then meter should recorded /display phase to neutral voltage as below:-

ME Secondary Voltage	Meter Terminal Voltage	Meter Display Voltage
For (11KV/110V)-		
Ph to Ph - 110V	110V	$11KV/\sqrt{3} = 6.35 \text{ KV}$
Ph to Neu- 63.5V	63.5V	
For (33KV/110V)-		
Ph to Ph- 110 V	110V	$33KV/\sqrt{3} = 19.05 \text{ KV}$
Ph to Neu- 63.5V	63.5V	
For (-/110V)		
Ph to Ph - 110V	110V	$110V/\sqrt{3} = 63.5V$
Ph to Neu- 63.5V	63.5V	

Example.2 (For Current parameter)

If meter CTR is 5/5A, 10/5A, 25/5A, 50/5A& -/5Amp etc. then meter should display Current according the ratio :-

Meter CTR	ME secondary current	Meter display current
5/5A or -/5A	1A, 2A, 3A, 4A or 5A	1A,2A,3A,4A or 5A
10/5A	1A,2A,3A,4A,or5A	2A,4A,6A,8A or 10A
25/5A	1A,2A,3A,4A,or5A	5A,10A,15A,20Aor 25A
50/5A	1A, 2A,3A,4A,or5A	10A,20A,30A,40A or50A

Meter should display according the ratio as mentioned above.

If any phase voltage /current is found abnormal high or low from others, it should be noted down and intimated to consumer/ consumer representative. Voltage & Current is measured at Consumer's transformer LT side and values of current and voltage are matched with noted meter parameters.

Condition-3

- If meter parameter is found normal then meter box inner cover should open in front of consumer/consumer representative after verification of papers seals and lead seals in inner cover of meter box.
- The details of seals are noted down for record and follow the step4. For further procedure..

Srep-4

All seals, meter wiring & connection are to be checked after opening the inner cover.
Following seals must be present

- 1 No. lead seal on MD push button.
- 2 No. lead seals and 1 paper seal on meter terminal block cover.
- 2 No. lead seals and 2 No. paper seals on test terminal cover.
- 1 No. upper and 1 No. lower Meter body seal.
- L&R (Left and Right) side polycarbonate seals.
- Left and Right side stickers provided by the meter mfg. Co. with number.

Verify the Contract Demand of the HT consumer from the file.

Note down readings in push button mode and check for any ongoing tamper. Temper may be available in push button mode and will be displayed

Verify MF of meter:-

$$\text{Over all MF} = \frac{\text{External CTR} \times \text{PTR} \times \text{Dial Factor}}{\text{Meter CTR} \times \text{PTR}}$$

For example if CTR of ME is 5/5 and PTR is 33KV/110V and dial factor indicated on meter is 1 for KWh meter, Meter CTR is 5/5 and meter PTR is 11KV/110 V then overall MF will be

$$(33000/110 \times 5/5 \times 1) / (5/5 \times 11000/110) = 3.$$

In some cases meter PTR is displayed as -/110V. Considering all above parameters as same then overall MF will be

$$(33000/110 \times 5/5 \times 1) / (110/110 \times 5/5) = 300.$$

In some cases meter PTR is displayed as -/110V & CTR as -/5Amp. Considering all above parameters as same then overall MF will be

$$(11000/110 \times 5/5 \times 1) / (110/110 \times 5/5) = 100.$$

Step-5

As per Condition 3 is mentioned above, if all the parameters and seals are found ok, meter testing work with the help of electronic standard meter should be performed at site on consumer load. The following procedure is adopted for testing of meter at site.

- **Wiring connection:**

1. **CT wiring connection:-** For testing identical phase of meter CT wiring/terminal is connected in series with ERSM CT wiring/terminal. It is done with the help of TTB screw and spare terminals.
2. **PT wiring connection:-** PT wiring are parallel connected with meter PT terminals with the help of TTB PT link terminal.
3. **ERSM Auxiliary Supply:-** This is used for power on the ERSM for execution of work. This can be done by use of external single phase supply or supply available at PT terminal of TTB.

The reference meter is connected in series with the HT meter by using spare terminal of Test Terminal Block (TTB). The reference meter is powered up from the PT terminal of the TTB. Details of TTB diagram are shown separately (Annexure I & II).

Important: Practice should be followed that the “ONE SCREW of CT in TTB which is to be kept OPEN is removed completely and dropped in the Box”. In such case if screw is not left open and kept in TTB then there is a possibility of partial or full shorting of CT by screw.

- **Testing Procedure:-**

1. **Power on the ERSM:-** After checking of all connections in ERSM, it is powered up and function of ERSM display are checked which is now ready to use.
2. **Measurement of Voltage:-** Voltage measured at TTB by use of multimeter and verified at ERSM display where voltage parameters are shown. This is ME secondary Phase to Phase and Phase to neutral voltage. It is noted down in the prescribed format.
RY----Volt,YB-----Volt,BR-----Volt,rn-----volt,yn-----volt,bn-----volt

3. **Measurement of Current:-** ERSM is connected in series by loosening of CT shorting screw for all RYB phases. ERSM Current is matched with meter display current. It should be same as per the ratings of CT. ERSM shows the ME secondary current. Values are noted down in given prescribed format as “**Meter current/ERSM current Before test**”

4. **Consumption Measurement :-** Consumption of energy(KWH,KVARH,KVAH) is measured by DIAL Test for 15 minutes/30 minutes on consumer load and power factor. This can be done by either by taking initial and final reading in high resolution mode for KWH,KVARH,KVAH or with the help of CMRI as explain above.

Total energy recorded by the meter in 15 minutes dial test =
(Final reading – Initial Reading) x Overall MF.

Similarly energy recorded by the Reference Meter = Reading x External (CTR x PTR).

For example, in case of 33KV 5/5 amp ME, this ratio will be $\text{Reading} \times 33000 \times 5 / 110 \times 5 = 300$

(Remark:- Both MF must be for same unit i.e. wh,kwh,mwh depending on recorded consumption/displayed units)

5. **Error calculation:** - This can be calculated as per the given formula.

Percentage error = $\frac{(\text{Energy Recorded by Meter} - \text{Energy Recorded by Ref. Meter}) \times 100}{\text{Energy Recorded by Reference Meter}}$

Energy Recorded by Reference Meter

6. **Load test:** During the dial test of 15 minutes at least 5-6 measurement of current in CT circuit is taken with the help of clamp on meter so as to compare HT and LT side currents.

Simultaneously 5-6 readings of LT side current of consumer transformer for load test are taken

1A on 33 KV side \approx 75A on LT side(33/0.44)

1A on 11 KV \approx 25A on LT side(11/0.44)

This is rough estimate and a very good tool to ascertain the health in ERSM of the CT PT unit. Load test formula = $\sqrt{3} \times V \times I \times 15/60 = \text{KVAH}$ (Since dial test is performed for 15 minutes)

Step-6

After the testing is complete and it is found the percentage error is within permissible limits as per the accuracy class of the meter, the CT shorting screw needs to be tightened and current zero value in the ERSM should be observed before sealing of TTB cover. Care should be taken to avoid shorting of PT and CT wires while removing from TTB. The sealing of the TTB, Inner & Outer Meter Box is to be done. Use Rice paper seal and numbered lead seals for sealing. The lead seal to be pressed with sealing pliers without fail.

Important: Practice should be followed that the “ONE SCREW of CT in TTB which is to be kept OPEN is removed completely and dropped in the Box”. In such case if screw is not left open and kept in TTB then there is a possibility of partial or full shorting of CT by screw.

Consequent upon sealing, all the details of the seals are entered in the formats of meter testing .Also ensure to get the meter testing formats and reading formats signed by the consumer and concerned AE/EE (O&M) present during testing at site.

(C).On Site Meter Testing of LT Whole Current Meters

Frequency of testing -LT 3ØMeters – Once in three yrs.

-LT 1-Ø Meters – One in five yrs.

Testing with External Load :This procedure is to be used for direct connected whole current meters of accuracy class 2.0/1.0/**0.5s**

Equipments Used : Reference Meter, External Load.

Procedure

1. Disconnect the connected load by removing the load connection from output end of the Main Switch/MCB/Fuses.
2. Connect reference standard, external load on load side of meter under testing (MUT).
3. External Load: The current drawn due to external load should be minimum 10% of I_b but should be less than I_{max} . Typically it should be 1-2 KW heating load per phase.
4. It is recommended to “select direct connection method” of testing in reference standard (ERSM) and capture MUT pulse with scanning head. Clamp on CT meter can also be used to measure current in the circuit.
5. Note down the instantaneous values of Voltage, Current, Power factor as displayed by the reference standard. Ensure the current value is greater than 10% of I_b .
6. It is recommended to start testing 2 minutes after load is ON. Check the stability of the error of the MUT by checking the initial errors at 20 pulses.
7. The typical test duration should be 2 minutes but should not more than 5 minutes.
8. Start the test and note down the results in percentage error.

In case consumer “Actual Load” is used as external load, then ensure actual Load is

- Greater than 10% of I_b and the load is stable.

MUT should be always tested for Active Energy mode (KWh), unless agreed for other energy parameters.

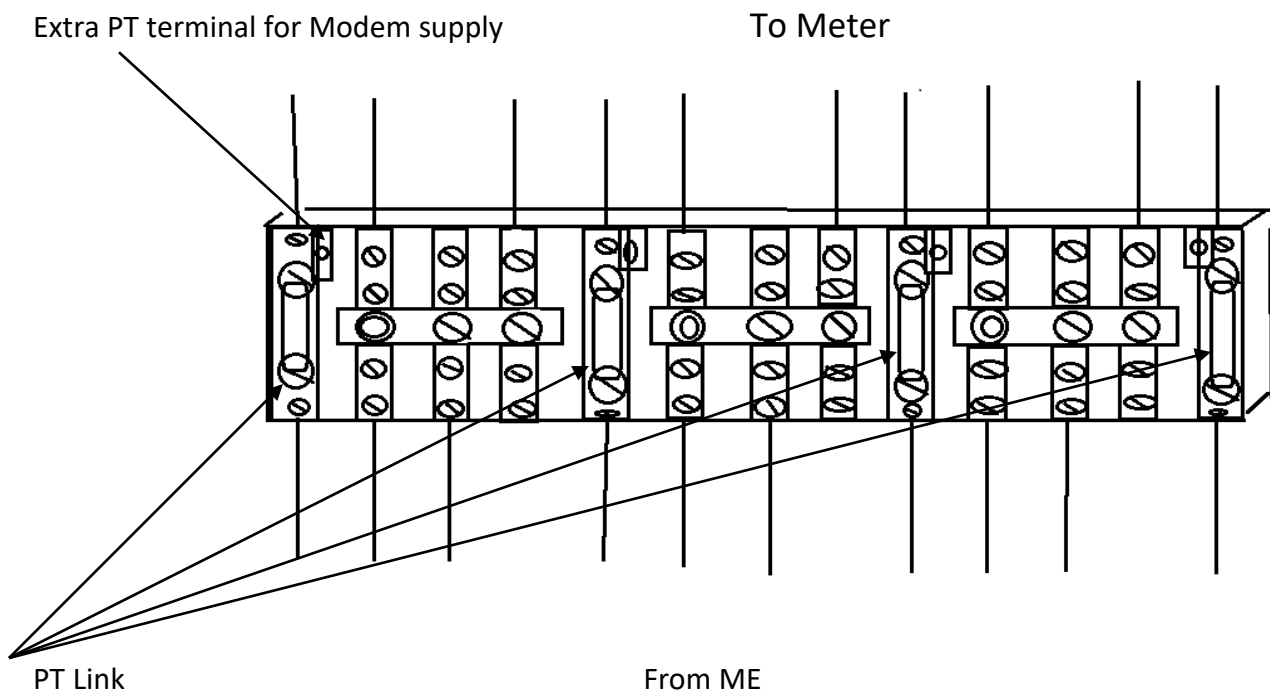
Annexture -I

Use of TTB in HT connection:

1. For interconnection of CT & PT between meter & ME secondary cable.
2. For connection of modem without opening the meter terminal cover.
3. For connection with ERSM in series of CT circuit and Parallel connection of PT circuit for meter testing.
4. For meter replacement work by shorting the CT circuit and by down the PT link without interrupting the power supply of consumer.

Constructional details

1. There is 4 pt link for connection of PT wiring with the arrangement of link removal facility either slide up or slide down.
2. Facility of two PT terminal points in upper side of TTB for connection of meter as well as modem.
3. There is 18 CT terminal, 9 upper and 9 lower for connection of CT wiring of Meter and ME.



Annexure-II

