TYPE TEST REQUIREMENTS FOR SMART METERS

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Outline of Presentation

- Introduction
- Applicable IS Standards for Smart Meters
- Type tests for Smart Meters
- Test conditions
- Conclusion

Introduction

- Smart meter shall be subject to metrology tests, Load Switch capability test, Data exchange protocol and Smart meter communicability test (Optional test)
- Tests for metrology include
  - Type tests
  - Routine tests
  - Acceptance tests

Type Test : Series of tests carried out on meters of the same type having identical characteristics, selected by manufacturer to prove conformity with all the requirements of Standard for the relevant class of meter. These are intended to prove the general qualities & design of a given type of meter.

Routine Test : Tests carried out on each meter to check conformity with the requirements of standard in aspects which are likely to vary during production.

Acceptance test : Test carried out on Samples taken from a lot for the purpose of acceptance of the lot.

Number of Samples and Criteria for Conformity

- **Type tests shall be applied to 3 test specimens. In the event of 1 specimen failing to comply in any respect, further 3 specimen shall be taken all of which shall comply with the requirement of the standard.**
- **For Test of Load Switch, 1 Sample in case of Load Switch Utilization Category UC1 and 4 samples in case of Load Switch Utilization Category UC2/UC3**
- **For Data Exchange protocol and Smart meter communicability test, 1 Sample**

Applicable Indian Standards for Smart Meters

- IS 16444 was adopted by the BIS in 2015 and consists of Two parts.

- IS 16444 (Part 1): 2015 & Amendment No. 1, 2017 covers the general requirements and tests for

  a.c. Static Direct connected Watthour Smart Meter, Class 1 & 2.

- IS 16444 (Part 2): 2017 covers the general requirements and tests for

  a.c. Static Transformer operated Watthour & Var-Hour Smart Meters, Class 0.2S, 0.5S & 1.0S.

- IS 16444 (Part 1): 2015 applies to :

- Static Watt-hour direct connected meters consisting of measuring element(s), time of use register (s), display, load switch and built in / plug in type bidirectional communication module all integral with the meter housing.

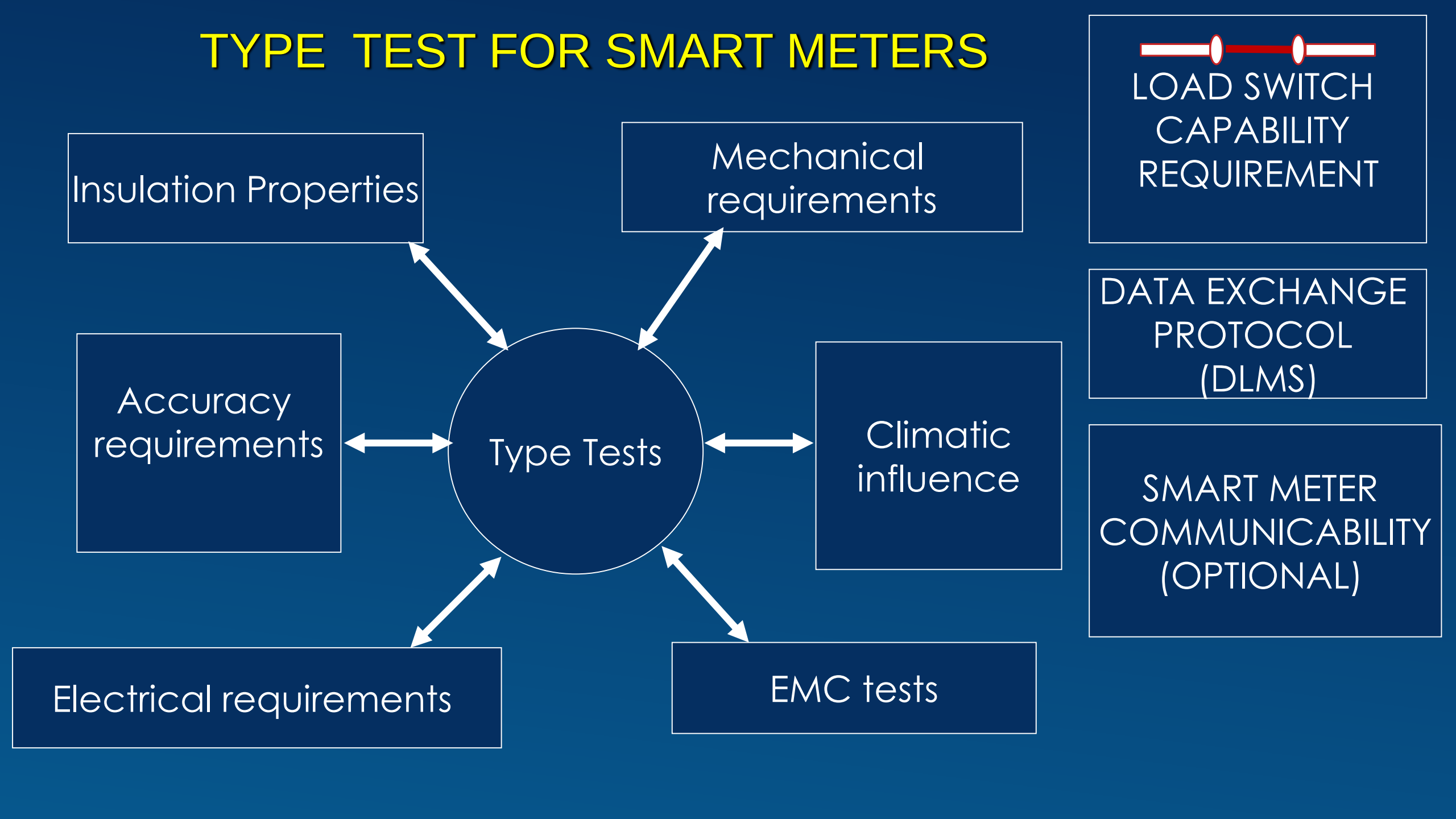
- Smart meter for indoor use & capable of forward (import) or both forward (import) and reverse (export) energy measurement.

- IS 16444 (Part 2): 2017 applies to :

- Transformer operated static watt-hour meters & Var-Hour meters consisting of measuring element(s), time of use register(s), display and built in / plug in type bidirectional communication module all integral with the meter housing.

- Smart meter for indoor use & capable of forward (import) or import and export energy measurement.

TYPE TEST FOR SMART METERS



Schedule of Type Tests for Smart Meter

Sl. No.	Test	IS:16444 (Part 1):2015, Amendment 1, Jan'2017	IS:16444 (Part 2):2017
1)	**Test of Insulation Properties**		
	Impulse voltage test	√	√
	ac High Voltage Test		
	Insulation resistance test		
2)	**Test of Accuracy Requirements**		
	Test on limits of error	√	√
	Interpretation of test results		
	Test of meter constant		
	Test of starting condition		
	Test of no-load condition		
	Test of ambient temperature influence		
	Test of repeatability of error		
	Test of influence quantities		

Sl. No.	Test	IS:16444 (Part 1):2015, Amendment 1, Jan'2017	IS:16444 (Part 2):2017
3)	**Test of Electrical Requirement**		
	Test of Power consumption	√	√
	Test of Influence of supply voltage		
	Test of influence short-time of over currents		
	Test of Influence of self-heating		
	Test of influence of heating		
	Test of influence of immunity to earth fault		

Sl. No.	Test	IS:16444 (Part 1):2015, Amendment 1, Jan'2017	IS:16444 (Part 2):2017
4)	**Test of Electromagnetic Compatibility**		
	Radio interference measurement	√	√
	Fast transient burst test		
	Test of immunity to electrostatic discharges		
	Test of immunity to electromagnetic HF field		
	Surge Immunity Test Applicable as per IS 16444 (Part1)		
5)	**Test for climatic Influences**		
	Dry Heat Test	√	√
	Cold test		
	Damp heat cyclic test		

Sl. No.	Test	IS:16444 (Part 1):2015, Amendment 1, Jan'2017	IS:16444 (Part 2):2017
6)	**Test of Mechanical requirements**		
	Vibration test	√	√
	Shock test		
	Spring hammer test		
	Protection against penetration of dust and water		
	Test of resistance to heat and fire		
Note 1	**Test before resistance to heat and fire**		
	Accuracy of the meter at pre-defined points.	√	√
	Data read test by reading cumulative kWh energy register through the communication module.		
	Remote : disconnect/connect		

Sl. No.	Test	IS:16444 (Part 1):2015, Amendment 1, Jan'2017
7)	**Test for load Switch**	
	Performance requirements for Load Switching utilization category **UC1**	Clause 4.6.6.2.1 of IS 15884 On one additional Sample
	Performance requirements for Load Switching utilization category **UC2 & UC3**	Clause 4.6.6.2.2 & Annex G of IS 15884 On four additional Sample G-1 : LOAD SWITCHING CAPABILITIES G-2 : NORMAL OPERATION G-3 : ELECTRICAL ENDURANCE G-4 : LINE TO LOAD VOLTAGE SURGE WITHSTAND G-5 : FAULT CURRENT MAKING CAPACITY G-6 : SHORT-CIRCUIT CURRENT CARRYING CAPACITY G-7 : MINIMUM SWITCHED CURRENT G-8 : DIELECTRIC STRENGTH **G-9 : SEQUENCE OF TEST** **As Per Table 22** **(Test Sequence and Sample Plan)** **Sample A : G-2, G-4, G-5, G-7, 4.4.1, G-8** **Sample B : G-6, G-7, 4.4.1, G-8 (Test 1)** **Sample C : G-6, G-7, 4.4.1, G-8 (Test 2 if required)** **Sample D : G-3, G-7, 4.4.1, G-8**

Sl. No.	Test	IS:16444 (Part 1):2015, Amendment. 1, Jan'2017	IS:16444 (Part 2):2017
8)	Test for Data Exchange protocol	**IS 15959 (Part 2)**	**IS 15959 (Part 3)**
9)	Test for Smart meter communicability (Optional)		

TEST CONDITIONS

TEST OF INSULATION PROPERTIES

The meter shall be such that they retain adequate dielectric qualities, taking into account of the atmospheric influences & different voltages to which they are subjected under normal conditions of use. The meter shall withstand the impulse voltage test and ac high voltage test.

Impulse voltage test:

Test condition:
Impulse Voltage : 6kV
10 Positive & 10 Negative impulses are applied on each circuit

- Test voltage for circuits and between circuits
- Test voltage for electric circuits relative to earth

Observation : Smart Meter shall withstand Impulse Voltage & No flash over shall be observed

ac High Voltage test:

Test Condition **:**
Test voltage applied for **one minute**
For Insulation Class 1 : 2.0 kVrms
For Insulation Class 2 : 4.0 kVrms
➢Test frequency between 45 Hz to 55 Hz

Observation : Smart meter shall withstand High Voltage & No flashover shall be observed.

Insulation Resistance (IR) test:
Test voltage applied for **one minute**
Test voltage : 500 ±50 V DC

Observation : Insulation resistance shall be > 5MΩ / 50MΩ
After Insulation properties test, the Accuracy of the meter shall be within the permissible limits.

TEST OF ACCURACY REQUIREMENTS

Test on limits of error :

a) Limits of error due to variation of current (Balanced Condition)

b) Limits of error due to variation of current (Unbalanced Condition)

Observation : % Error shall be within the permissible limits as per standard

Test of meter constant :

Meter Constant expressing the relation between the energy registered by the meter and the corresponding pulse count of the test output (imp/kWh or Wh/imp, imp/kVARh) is verified.

Observation : Meter constant shall comply with the marking of name plate.

Test of Starting condition :

The meter shall start and continue to register at the 0.4% of Ib for Class 1 & 0.5% for class 2 for Direct connected meters and for transformer operated meters 0.2% of Ib for Class 1 & 0.3 for Class 2. For Transformer operated Watthour & Var-Hour meters 0.1% for 0.2S,0.5S & 0.2 for 1S Class

Observation : Meter shall start & continue to register energy.

Test of No-load condition :

V=115% of Vref with current circuit open

Observation : Test output shall not produce more than one output pulse.

Test of Ambient Temperature Influence :

To check for degradation of change of characteristics of components which leads to failure

Influence of variation in ambient temperature is determined by obtaining mean temperature coefficient over range of ± 15 ºC of ref. Temp.
Observation : Mean Temperature coefficient shall be within permissible limits

Test of Repeatability of error :

Repeatability of error is the degree of closeness of agreement between results of successive error for tests carried out under identical conditions, arising out of factors other than measurement uncertainties. Vref , 0.05Ib & Ib at pf=1 , 20 error readings at an interval of 30 min
Observation : Variation in % Error (Emax-Emin) limits shall be within the permissible limits as per standard.

Test of Influence Quantities :

Influence quantity is any quantity, generally external to the meter, which may affect its working performance.

The variation of error due to an influence quantity is the difference between the % error of the meter, when only one influence quantity assumes successively two specified values, one of them being the reference value.

Voltage variation :

Ibasic , pf=1 & 0.5lag V=±10% , + 20%, -30%, -40%

For Transformer operated meters V =±10%, ±20%, -30%, -40%

Observation : Variation in % Error shall be within the permissible limits of Standard.

Frequency variation :

50 Hz ±5%

Observation : Variation in % Error shall be within the permissible limits of Standard.

Waveform:10% of 3rd harmonic in the current circuit:

- Current harmonics in phase & anti phase

Observation : Variation in % Error shall be within the permissible limits of Standard.

Reverse phase sequence :

RYB / RBY , Current =0.1Ib at pf=1

(same is applicable for Transformer operated meter in Active & Reactive mode)

Observation : Variation in % Error shall be within the permissible limits of Standard.

Voltage Unbalance :

To check meter records correctly even in the absence of one or two phases.
one phase / two phase interruptions at Vref & Ib
Observation : Variation in % Error shall be within the permissible limits of Standard.

DC & Even harmonics in ac current circuit :

(Applicable for Direct connected meter)
Variation in % Error with & without dc component in ac current circuit is verified at 0.5 Ib, 0.5 Imax/2 and 0.5 Imax
Observation : Variation in % Error shall be within the permissible limits of Standard.

DC & AC magnetic Influence :

ALTERNATING AC MAGNETIC INDUCTION OF EXTERNAL ORIGIN:

- ✓ **400AT : 0.5 mT.**
- ✓ **2800AT : 10mT (Abnormal)**

To be verified in Phase & Antiphase conditions
Observation : Variation in % Error shall be within the permissible limits of Standard.

CONTINOUES MAGNETIC INDUCTION OF EXTERNAL ORIGIN:

- ✓ **1000AT : 67mT**
- ✓ **10000AT : 0.2T (Abnormal)**

Observation : Variation in % Error shall be within the permissible limits of Standard.

TEST OF ELECTRICAL REQUIREMENT

Test of Power consumption test :

The purpose of power consumption is to verify energy efficiency of the Smart meter.

The active and apparent power consumption in each voltage circuit and current circuit (apparent power) shall not exceed the values defined in the standard.

I) **Voltage Circuit** :The active and apparent power consumptions of a direct-connected composite Smart Meter for each circuit at reference voltage, reference temperature and reference frequency shall not exceed 5.0W and 15VA during the Idle Mode of Communication Module. This applies to either one NAN or one WAN module present in the Smart Meter.

If a separate module for servicing to IHD is present, the above figures shall not exceed 6W and 18VA during the Idle mode of communication Module.

The additional power requirement during DATA transmission shall not exceed 7W per communication module.

II) **Current Circuit** : The apparent power taken by each current Circuit of direct connected meter at maximum current, Reference frequency and reference temperature shall not exceed a value in VA equivalent to 0.08 % of Vref in Volts multiplied by 100% of Imax in amperes

(for Transformer operated 1VA).

Test of Influence of Supply Voltage :

Ibasic , pf=1 & 0.5lag V=±10% (Specified operating range), + 20% (Limit range of operation) , -30% (Extended operating range)
1.9Vref with 0.5Ib (withstand range - Abnormal voltage conditions)
For Transformer operated meters V =±10%, ±20%, -30%, -40%
Observation : Variation in % Error shall be within the permissible limits of Standard.

Voltage Dips and Short Interuptions :

Voltage circuit energized with Vref without any circuit in the current circuits

a) Voltage Interruptions of Vref = 100% Interruption time : 1Sec, No of Interruptions : 3, Restoring time between interruption : 50ms

b) Voltage Interruptions of Vref = 100% Interruption time : 20 mSec, No of Interruptions : 1

c) Voltage dips of Vref = 50% Dip time : 1 Min, No of dip : 1

Observation : Variation in % Error shall be within the permissible limits of standard
Change in register reading should be within the permissible limit (x= 10^{-6} .m. Vref. Imax)

Test of Influence of Short-time overcurrents :

Meters should withstand the short-time over current in the event of load connected to it is shorted, the short-time current will flow through the meter till the opening of protection device.

Testing shall be carried out with the meter energized

Short circuit test current:

- ✓ 20 times Imax for 0.5 Sec (CT operated meter)
- ✓ 30 times Imax for 10m Sec (Direct current meter)
- ✓ The period of time for which the generator voltage is maintained at the terminals after the overcurrent has occurred shall be one minute
- ✓ Meter is energised at Vref for 1 hour after test
- ✓ Accuracy before and after the test is verified.

Observation : No abnormality & Variation in % Error shall be within the permissible limits of Standard.

Influence of Self Heating :

The variation in % error due to self-heating shall not exceed the values

- Meter is Energized at Reference voltage for 2.0 hours and then loaded with Imax.
- Test Duration : Min 1.0 hour UPF & Min 1.0 Hour 0.5 Lag
- Readings are taken every 5 min.
- Variation in error during twenty min. shall not be more than 0.2 %.
- Test is continued beyond 1.0 hour until the variation in 20 min is within 0.2%.

Causes of failure :

- Size of cables used for testing
- Size of Terminal block , Screws used for cables
- Inside arrangement of the CT
- Rivets/ screws used in the meter for connecting primary of CT
- Heating of terminals

Observation : Variation between Min & Max error shall be within the limit as per standard

Test of Influence of heating :

Under normal condition of the use, electrical circuits and insulation shall not reach a temperature which might adversely affect the operation of the meter. The temperature rise at any point of the external surface of the meter shall not exceed by more than 20ºC

To ensure there is no abnormal heating in the meter which raises the temp. of the body to a limit which can create a safety risk for personnel or insulation of the meter itself.

- Temperature rise of the terminal block and the meter shall not rise more than 20ºC
- Dielectric properties of the meter shall not be degraded due the excessive Heating of the terminal block and therefore verification of insulation properties is carried out.
- Meter is energized with 115% of reference voltage and Imax for Two hours.
- After Heating test, IR & Functional accuracy test is carried out.

Observation : Temperature rise , error & Insulation resistance value shall be within the permissible limits of Standard.

Test of Immunity to Earth Fault :

This test is applicable for 3 phase 4 wire meters

Test condition:

- Earth fault condition is simulated in one of the 3 lines – all voltages increased to 1.1 times Vref during 4 hrs.
- Neutral of MUT is disconnected from Ground of Meter Test Equip.(MTE) & connected to line of MTE at which Earth fault has to be simulated.
- In this way 2 voltage terminals of MUT which are not affected by Earth fault are connected to 1.9 times Vref. Current= 0.5Ib & UPF.

Observation : After the test , MUT shall show no damage & shall operate correctly.

Variation in % Error shall be within the permissible limits of Standard.

TEST FOR ELECTROMAGNETIC COMPATIBILITY

Radio Interference Measurement:

The meter shall not generate conducted or radiated noise, which could interfere with other equipment

- **Conducted Emission** :
- IEC 62052-11, CISPR 22 for Is 16444 (Part 1) & IS 6842 for IS 16444 (Part 2)
- ✓ 150kHz to 30MHz
- ✓ Observation : The measured emission values shall be within the permissible limits of standard.

Radiated Emission :

- IEC 62052-11, CISPR 22

Observation : The measured emission values shall be within the permissible limits of standard.

Immunity to Electromagnetic HF field:

To determine immunity of the specimen to various levels of RF signals.

Ex: TV Radio ,cellular, navigation transmission

80MHz to 2000MHz for IS 16444 (Part 1) & 80MHz to 1000MHz IS 16444 (Part 2)

Test field strength: 10V/m

Observation : Change in register reading shall be within the permissible limits.

Variation in % Error shall be within the permissible limits of standard.

Fast Transient Burst Test:

Burst of very high noise pulses upto several kV Could be due to

- ✓ Opening of a switch / breakers
- ✓ AC compressors
- ✓ Relay contact bouncing

Series of pulses of 15ms burst duration

Total burst duration = 300ms, Rise time = 5ns, Fall time = 50 ns.

2kV : 1 min with each polarity

4kV : 1 min with each polarity

Observation : Change in register reading shall be within the permissible limits.

Variation in % Error shall be within the permissible limits of standard.

Test of Electrostatic discharge test:

- ✓ Abrupt discharge of static charge accumulated by a person or an object
- ✓ Human body is the main source & carrier
- ✓ Electrostatically charged upto a few kV

Direct discharge:

Contact discharge: 8kV, Air discharge : 15kV, Indirect discharge : VCP, HCP

Only Voltage Circuit energised , No current in current circuit

No. of discharges: 10+ve & 10-ve

On all accessible parts

Observation : ESD shall not produce a change in register of more than x kWh (x= 10^{-6} .m. Vref. Imax)

Surge Immunity Test :

Surges caused by overvoltages from switching and lightning transients.

The major mechanisms by which lightning produced surge voltages are the following:
A direct lightning stroke to an external circuit (outdoor) injecting high currents producing voltages by either flowing through earth resistance of flowing through the impedance of the external circuit.

An indirect lightning stroke (i.e. a stroke between or within clouds or to nearby objects which produces electromagnetic fields) that induces voltages/currents on the conductors outside and/or inside a building.

Test Condition :
Surge Voltage 4kV, Tested in differential Mode (Line to Line), 5 +ve & 5 –ve surges,
Repetition rate : max. 1/min
Phase angle : 60 Deg & 240 Deg

Observation : Meter shall withstand & no flashover shall be observed.
Surge shall not produce a change register of more than xkWh
After the test, accuracy of the meter shall be within the permissible limits as per standard.

TEST OF CLIMATIC INFLUENCES

The metering installations are generally not protected from climatic changes & hence a meter shall not only withstand but also work properly in these climatic conditions.

After each of the climatic tests, the meter shall show no damage or change of the information. These tests should not affect the functioning of the meter.

Dry heat test: To simulate storage & transit conditions during which meter may be subjected to extreme temperature. Meter in non-operating condition

Temp: +70ºC ± 2ºC , Duration: 72 hrs.

Observation : Limits of % Error shall be within the permissible limits of Standard.

No change in register reading.

Cold test *:* To simulate extreme temp.

Meter in non-operating condition

Temp: -25ºC ± 3ºC , Duration: 72 hrs.

Observation : Limits of % Error shall be within the permissible limits of Standard.

No change in register reading.

Damp heat cyclic test:

To determine the suitability of the components / equipment for use or storage under condition of high humidity when combined with cyclic temp. changes and, in general , producing condensation on the surface of the specimen.

Serves as a corrosion test . Result is judged visually.

Test Conditions -

Upper temp 40ºC ± 2ºC
RH 93 to 97 %
6 cycles, each Cycle of 24 hours
Meter in operating condition : Energized with Ref voltage
24 hrs after the end of test , the meter shall be subjected to insulation resistance test

Observation : After the test , an Insulation Resistance test & Functional accuracy test is carried out.
Limits of % Error shall be in within limits of Standard.
No change in register reading.

TEST FOR MECHANICAL REQUIREMENTS

Vibration test: Meter may be subjected to Mech. Vibration during transportation & handling . Also there may be vibrations at installation site due to operation of heavy machineries

Test Parameters :

Type of Vibration	:	Sine Sweep
Axis	:	X, Y & Z – axes
Frequency	:	10-150-10 Hz
Transition frequency	:	60 Hz
Displacement	:	0.15 mm peak (between 10 Hz and 60 Hz)
Acceleration	:	19.6 m/s^2 peak (between 60 Hz and 150 Hz)
Sweep rate	:	One octave per minute
Number of sweep cycles per axis	:	Ten
Condition of sample during test	:	Meter in non-operating condition, without packing

Observation : No visual external damage ,Variation in % Error before and after vibration test shall be within the limits of standard.

Shock test:
To test immunity of meter against Mech. Shocks which a meter may encounter during transportation or handling

Test Parameters :

Pulse shape	: Half-sine
Axis	: X, Y & Z – axes
Peak acceleration	: 400 m/s^2
Duration of the pulse	: 18 ms
Number of shocks	: Two each in both +ve and –ve directions of X, Y & Z –axes
Condition of sample during test	: Meter in non-operating condition, without packing

Observation : Variation in % Error before and after vibration test shall be within the limits of standard.

Protection against penetration of Dust & water*:*

To verify IP 5X & IP X1 as per standard.

IP testing is the process of verifying ingress of Dust and liquid as per IS/IEC 60529

Ingress of dust is not totally prevented, but dust shall not penetrate in a sufficient quantity to interfere with satisfactory operation and safety of the product (5X)

Water Ingress testing is a type of ingress protection (IP test).

This type of testing can be in the form of water dripping.

Observation : Functionality of meter to be observed

Before Test of Resistance to Heat & fire following tests shall be carried out :

a) Accuracy tests at predefined points

b) Data read Test

c) Remote disconnect / connect test (applicable as per IS 16444 (Part1))

Resistance to heat & fire:

To ensure reasonable safety against spread of fire. The terminal block, terminal cover & meter case should not be ignited by thermal overload of live parts in contact with them.

Terminal block: 960ºC ± 15ºC

Terminal cover & meter case: 650ºC ± 10ºC

Duration of application: 30s ± 1s

Observation : There shall not be ignition, flame extinguished within the duration as per standard & height of flame shall be within the limit as per standard.

TEST FOR LOAD SWITCH

LOAD SWITCHING CAPABILITY PERFORMANCE REQUIREMENTS FOR LOAD SWITCHING FOR UC1

- Capable of make and break at *V*ref, Imax with a linear resistive load and at *V*ref, Ib, and 0.4 inductive power factor for 3000 operations.
- In the case of a polyphase Smart meter, the tests and test values apply to each phase.
- After the test, it shall pass the Heating test

PERFORMANCE REQUIREMENTS FOR LOAD SWITCHING FOR UC2 & UC3

LOAD SWITCHING CAPABILITIES

a) Capable of making and breaking negligible currents

b) Capable of making, breaking and carrying rated currents

c) Capable of making into fault currents

d) Capable of carrying short-circuit currents

Test to be carried out for UC2 & UC3

- Normal Operation (G2)
- Electrical endurance (G3)
- Line to Load voltage Surge withstand (G4)
- Fault current making capacity (G5)
- Short circuit carrying capacity (G6)
- Minimum Switched current (G7)
- Power consumption
- Dielectric Strength (G8)

G-9 SEQUENCE OF TESTS

The test sequence and sample plan given in Table 22 is recommended.

Table 22 Test Sequence and Sample Plan

Sl No.	Test Number	Test Clause	Sample A	Sample B	Sample C	Sample D
(1)	(2)	(3)	(4)	(5)	(6)	(7)
i)	1	G-2	*	—	—	—
ii)	2	G-3	—	—	—	*
iii)	3	G-4	*	—	—	—
iv)	4	G-5	*	—	—	—
v)	5	G-6	—	*	—	—
vi)	6	G-6	—	—	*	—
vii)	7	G-7	*	*	*	*
viii)	8	4.14 and 4.14.1.3	*	*	*	*
ix)	9	G-8	*	*	*	*

NOTES

1 The '*' in the table indicates that the particular test should be performed on the particular sample, but the sequence of the tests shall always follow the same order as the test number sequence. For example: Sample A shall be subjected to the test numbers 1, 3, 4, 7, 8 and 9, in that specific order.

2 Tests 1 and 3 may alternatively be performed on any one of the Samples B, C or D, prior to performing the tests indicated in the table.

3 Sample C might not be required, depending on the result of Test 5 on Sample B (*see* Note 3 of G-6)

Test for Data Exchange Protocol (DLMS)

- The Data Exchange Protocol (DLMS) chosen for Smart meter shall be as per IS 15959 (Part 2) for direct connected smart meters & IS 15959 (Part 3) for Transformer operated Smart meters.
- Test is carried out on optical port.

Test for Smart meter Communicability (Optional test)

- Standard provides for use of suitable communication technologies in the design of Smart Meters.
- To access the communication capability a few tests including a test for end to end communication capability are identified and included in IS 15959 (Part 2) & IS 15959 (Part 3)
- Communication module(s) may be of PLC or RF for NAN and cellular technologies or OFC technology for WAN
- Modules for WAN/NAN/IHD shall be approved by designed agency authorized by DOT and shall have Equipment Type Approval (ETA).

CONCLUSION

- **Testing will ensure:**
  - **Accuracy**
  - **Reliability**
  - **Energy efficiency**
  - **Safety**
  - **EMC Compliance**
  - **Environment hardness**
  - **Mechanical hardness**

- **Independent testing ensures that the Smart meters are subject to the same standard and requirement which alleviates consumer & utility concern.**
- **Both labs at CPRI Bangalore & Bhopal are equipped with state-of-the-art test equipment's for complete type testing and DLMS protocol testing under one roof and is NABL accredited as per ISO/IEC 17025 and BIS recognized.**


THANK
YOU