

SPECIFICATION NO. DDS-65:03

STATIC SINGLE PHASE 2 WIRE
ENERGY METERS WITH MULTIRATE TARIFF
OPTIONAL (CLASS-I)

AMENDMENT NO. 1

DATED 20th MARCH, 2004

Add following under clause 7 :-

- i. Existing clauses 7.1 to 7.4 will be applicable for multi rate meters.
- ii. Add new clause 7.5 below which will be applicable for single tariff meters.

7.5 BASIC DATA RECORDING

7.5.1 Static Watt Hour Meter

- Energy (Kwh)

7.5.2 Security Features

- Every meter shall have a unique Sr. No. in its memory which can be displayed.
- Meter shall be capable of recording energy accurately in the case of change of phase with the neutral wire.
- LED indication shall be provided for Kwh.
- Reverse energy flow indication shall be provided in the meter through LCD/LED.
- Meter shall record energy consumption in the absence of neutral wire as long as phase wire is connected to the phase terminal or the neutral terminal of meters. In this case energy recording shall start when minimum of 10% of basic current flows through the phase wire in such case the energy recording shall be based on current flowing through the meter with assumed voltage and power factor.

Meter shall be protected against external interference

mobile phones and shall comply to all relevant IEC/ ANSI standards for functional performance and loss of data.

7.5.3 DISPLAY

- The display shall be LCD type with at least 5 whole digit for energy consumption.
- Display mod indicator
- Display quantity labels.
- Pulse output for field testing of meter.

 Deputy Director (D&S)	 Director (D&S)	 Chief Engineer (Distt. Engg.)
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SPECIFICATION NO. DDS-65:2003

STATIC SINGLE PHASE, 2-WIRE ENERGY METERS WITH MULTIRATE TARIFF OPTIONAL (CLASS-1)

AMENDMENT NO. 3

DATED 17th March, 2007

Add following clauses under INSPECTION

13.5 Inspection procedure for local manufacturers

13.5.1 ROUTINE TEST

Following routine tests shall be carried out by manufacturer on each meter and witnessed by the Inspector as per respective clauses of IEC 62053-21

Starting Current Test

Accuracy Test

If failure exceeds than 5%, the group offered for routine inspection be rejected -

13.5.2 SAMPLE TEST

The meters offered for acceptance shall be grouped into lots containing upto 500 meters. A sample comprising ten meters shall be selected at random from each lot and eight meters be subjected to electrical test and two meters for mechanical test.

(i) Sample Test (Electrical)

(a) Following tests be performed on each of two selected sample meters -

- Impulse Test
- Power Loss Test
- Influence Of Harmonics Test.
- DC and Even Harmonics Test
- A.C. Voltage Test

(b) Following tests be performed on each of four selected sample meters -

- Starting Current Test
- Running With No Load Test (Creep Test)
- Accuracy Test

(c) Following EMC tests be performed on each of two selected sample meters -

- Fast Transient Burst Test
- Surge Immunity Test
- Electrostatic Discharge Test

(ii) Sample Test (Mechanical)

(a) Following tests be performed on each of two meters already selected -

- Impact Test
- Tin coating Test

- (b) Following tests be performed on three meters selected randomly from offered lot. 1 Dimensional check be performed on one meter and remaining two tests be performed on both the meters. -

Dimensional Check

Shock And Vibration Test

- Rain Fall Test

13.5.1 ACCEPTANCE CRITERIA

- a) Electrical Test -

- The lot shall be accepted if one meter fails in any one of the tests described in clause 13.5.2 (i)
- Re-sampling of the same size shall be carried out if -

One meter fails in any of the two tests

OR

Two meters fail in any one test

- The lot shall be rejected if:

Three or more meters fail in any of the test

OR

One meter fails in any three or more tests

OR

One meter fails in any two tests and one meter in one test

- b) Mechanical Test

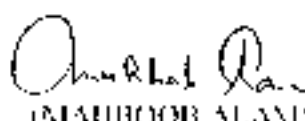
- The lot shall be accepted if meters qualify the above tests in clause 13.5.2 (ii) (a)
- In case any meter fails in the relevant test, another sample of double the size shall be selected and test be repeated
- If any meter fails in any test during re-sampling, the entire lot shall be rejected

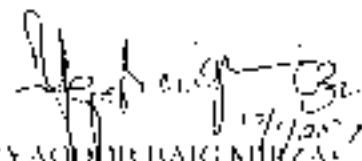
NOTE: Rejected lot can be re-offered for routine tests

13.6 VERIFICATION FUNCTIONALITY TEST OF SOFTWARE (Applicable In Case Of Multirate Meter)

- 13.6.1 Verification test of the functionality of software and display features on offered meters shall be performed by loading/down loading of and auditing of the reports. Copy of the report be retained for official record. The number of meters shall be two. If any meter fails to comply with the functionality requirements, the entire offered lot shall be rejected.


(MAHABUB MASRI)
DY. DIRECTOR (D&S)


(MAHABUB ALAM)
DIRECTOR (D&S)


(YASHRAJ BAIG MURZA)
CHIEF ENGINEER (D&S)

SPECIFICATION NO. DDS-65:03

STATIC SINGLE PHASE 2 WIRE
ENERGY METERS WITH MULTIRATE TARIFF
OPTIONAL (CLASS-I)

AMENDMENT NO. 4

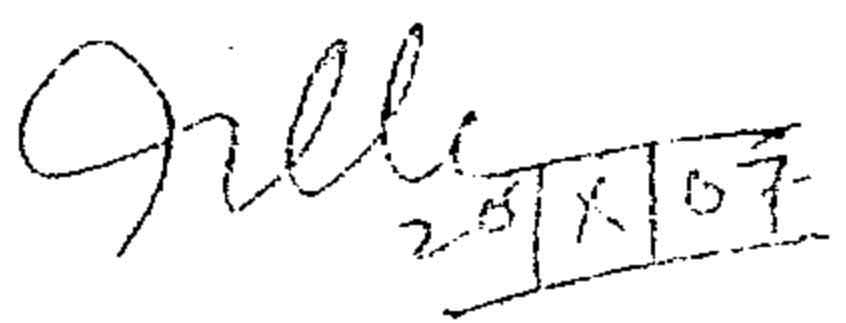
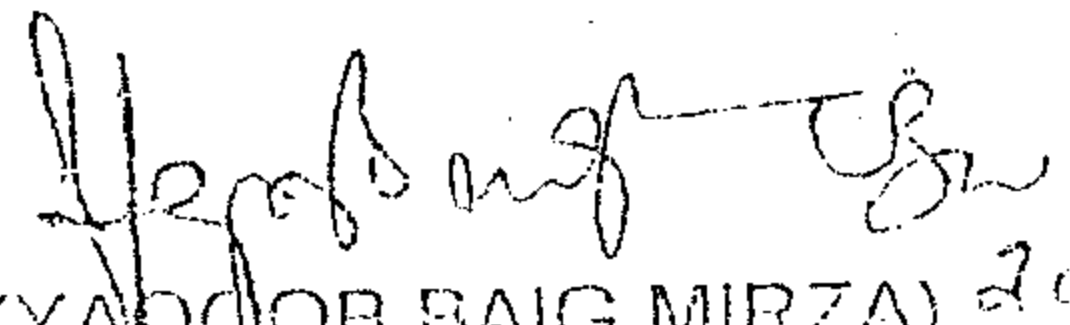
DATED 20th October 2007

• Add following under clause 7.2.1: -

- The meter shall be properly shielded against the affects of strong magnetic field of 0.7 tesla.
- The meter shall be capable to provide safeguard against the theft of energy through dimmer.

• Add following under clause 7.3: -

- The meter shall be equipped with fixed long life battery to display reading during power supply failure.

 (MANSOOR NASIR) Deputy Director (D&S)	 (AZIZ UR REHMAN) Director (D&S)	 (YAQOOB BAIG MIRZA) 20/10/2007 Chief Engineer (Design & Standards)
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SPECIFICATION NO. DDS-65:03

STATIC SINGLE PHASE 2 WIRE
ENERGY METERS WITH MULTIRATE TARIFF
OPTIONAL (CLASS-I)

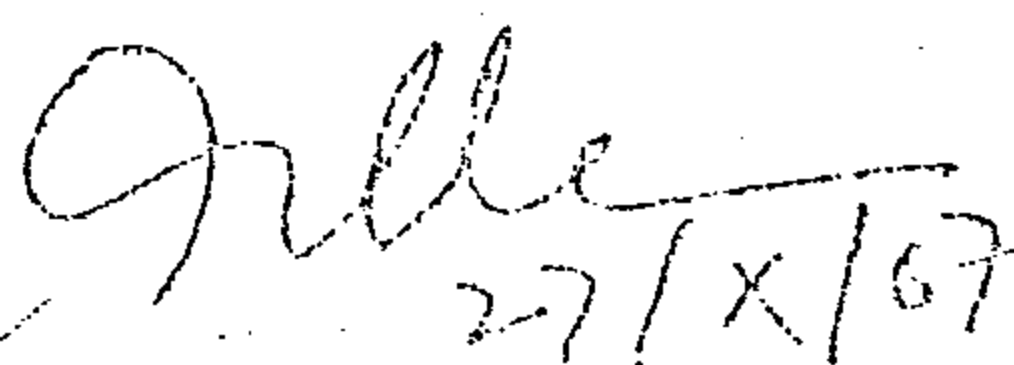
AMENDMENT NO. 5

DATED 27TH OCTOBER, 2007

• Add following under clause 7.5: -

- The meter shall be properly shielded against the affects of strong magnetic field of 0.7 tesla.
- The meter shall be capable to provide safeguard against the theft of energy through dimmer.
- The meter shall be equipped with fixed long life battery to display reading during power supply failure.


(MANSOOR NASIR)
Deputy Director (D&S)


27/X/07
(AZIZ UR REHMAN)
Director (D&S)


(YASHWANTRAO BAIG MIRZA) 27/10/2007
Chief Engineer (Design & Standards)

SPECIFICATION NO. DDS-65:2003

STATIC SINGLE PHASE, STATIC ENERGY METER

AMENDMENT NO. 6

DATED 05TH DECEMBER 2009

1. **The existing Sub Clause 13.4.2 shall be replaced as under:**

13.4.2 **JOINT TYPE TESTING**

Over and above normal inspection, the representative of Chief Engineer (Design & Standards) and Chief Engineer (MI) PEPCO will carry out all possible locally available type tests jointly, once during the calendar year and it shall be applicable during this period to all PEPCO/DISCOs purchase orders. The type testing will be carried out keeping in view that every time different DISCOs purchase order will be selected for the test. Chief Engineer (MI) PEPCO will communicate the schedule for joint type testing due well before time for a lot of reasonable size (not less 2000 meters).

2. **Add following new Sub Clauses**

13.4.3 **TESTING CRITERIA**

For joint type testing five (05) meters shall be selected jointly from the offered lot and all tests mentioned in the specification shall be performed.

- 13.4.4 Out of above five (05) samples, three (03) meters shall be subjected to following tests in sequence as mentioned in IEC 62052-11 Annexure-F:
- a) Tests of Insulation Properties;
 - b) Test of Accuracy Requirements;
 - c) Tests of Electrical Requirements;
 - d) Tests of Electro Magnetic Compatibility (EMC), in house;
 - e) Tests of the effect of the Climatic Environments.

Note: The manufacturer should enable the meter with three decimals while performing tests of EMC and voltage dips & short interruption.

- 13.4.5 One (01) meter out of three (03) meters be subjected to EMC test of RF Field to be performed at AWC Wah Cantt (or elsewhere approved by Chief Engineer (D&S):

- 13.4.6 Remaining two (02) meters out of five (05) shall be subjected to following tests: -

- f) Mechanical tests = One meter
- g) Miscellaneous requirement including verification of components and dimensions, = One meter

13.4.6 (a) If any one (01) meter fails in any test then double the quantity of samples shall be collected and all tests shall be repeated in sequence mentioned above. If any meter fails again in any test, whole lot shall be rejected.

(b) In case one (01) meter fails in two tests or two (02) meters fails in one test then whole lot shall be rejected.

13.4.7 In case of rejected lot, the manufacturer shall identify the cause of failure and re-offer the meters for joint inspection after rectifying the defect. Warranty of the meters already supplied during preceding months of the last joint type testing or prototype approval (whichever is earlier) shall be doubled.

3- The existing Clause 13.5.2 (Sample Test) shall be replaced as under: -

13.5.2 SAMPLE TEST

The meters offered for acceptance shall be grouped into lots containing up to 1000 meters. A sample comprising Ten (10) meters shall be selected at random from each lot and subjected to following tests: -

(i) Electrical

- | | | |
|----|--|----------------------------|
| 1- | Impulse Voltage Power loss & Influence of DC & even harmonics test and AC voltage test | = 02 Nos. |
| 2- | a) Test of accuracy requirement: | = 05 Nos. already selected |
| | b) Test of starting condition | |
| | c) Test of no load condition | |
| 3- | EMC tests | = 02 Nos. |
| | a) Fast transient burst test | |
| | b) Test of immunity to electro static discharges | |
| | c) Surge immunity test | |

(ii) Mechanical

- | | | |
|----|---|---|
| 1- | Shock & Vibration test | = 2 Nos. (Twice in P.O) |
| 2- | Test of protection against penetration of water and dust. | = Any 2 meters already selected |
| 3- | Dimensional check and verification of components | = Any 01 meter (against each inspection call) |
| 4- | Impact test and Tin coating test | = Any 01 meter already selected |
| 5- | Test of resistance to heat & fire. | = Any 01 meter already selected |

(iii) Verification for limit range of operation.

Following tests to be performed on one number meter already selected to verify the limit range and specified range of operation as per clause 4.2.1.

The selected meter will be subjected to uniform rate of increase of temperature, meter error shall be measured at unity power factor at interval short enough to allow a correct drawing to be made of the curve of error variation as a function of time. The same test shall be repeated for 0.5 lagging power factor.

(iv) Extreme Temperature Condition

Following test to be performed on one (01 No.) meter already selected:

- i. Test of Extreme Temperature condition:
- ii. Temperature = 80 °C
Duration = 04 hours

Meter shall be energized with reference voltage and I_{max} current continuously for four hours then the Accuracy of meter will be checked that will determine its qualification in test.

(v) Security Features Verification:

Following tests be performed on the meters already selected:

- i) Influence of magnet (0.7 Tesla) 2 Nos.
- ii) Dimmer Test 2 Nos.
(Once in Inspection call)
- iii) Single wire operation 2 Nos.

4- Acceptance Criteria.

- a) The existing Sub Clause 13.5.3 (a) shall remain the same

5- The existing clause 13.5.3 (b) shall be read as under:

- b) Mechanical Test, Limit Range of Operation, Extreme Temperature Condition and Security Features Verification:

- The lot shall be accepted if meters qualify the above tests in clause 13.5.2. In case any meter fails in the relevant test, another sample from the same lot of double the size shall be selected and test be repeated.
- If any meter fails in any test during re-sampling, the entire lot shall be rejected.

6- Add following new Sub Clause 13.5.4: -

13.5.4 Visual Inspection

The meter shall be inspected visually for, but not limited to, the defects mentioned below:

Examination	Defects
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Material:

1. The material used are not of good quality finish, contain surface defects or other imperfections injurious to the working of the meter.
2. The parts of terminal block e.g. terminals, pressure plates and terminals screws are not of specified material / quality.
3. Sealing screws are not made of steel.

Design and Construction:

1. The design or construction differs in any respect from that of the approved prototype.
2. Any part or components is missing, loose or damaged, effecting use or performance of the meter in any respect.
3. Clearance between various live parts and that between live and earthed metal parts is not sufficient.
4. The connections of leads to the potential coil are not soldered securely and show tendency to opening.
5. Sealing screws are not captive. If washers are used to keep them captive, they are not of proper design.
6. Sealing hook for the terminals is not of proper design, size or is found broken.
7. Gaskets are not of neoprene, not properly embedded, shows cracks, uneven thickness of surfaces.

Workmanship/Finishing/Marking

1. Meters are not uniform in quality, show scale, chips, dented or bent edges or other disfiguring / blemishes.
2. The terminal block is chipped at some places, shows signs of breakage, presence of weak points or other moulding defects.
3. Ultrasonic welding are not strong and smooth.
4. Joints are not in proper alignment, causing assembly defects of nature that interferes with normal working.
5. Nameplate markings are missing, incomplete, incorrect, illegible, not permanent, or not in accordance with relevant clause.
6. The connection diagrams and terminal marking are missing, incomplete, or applied in a temporary manners.
7. Polycarbonate cover is not clear transparent, not properly finished, deformed, shows burrs, extra material, cracks, cold shots, voids and air bubbles etc.

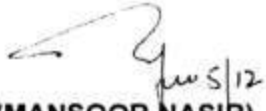
7- Add the following at the end of Clauses 8.2.5 and 13.5.2.

NOTE: *The manufacturer should provide UV Stabilized LCD Certificate from their principal at the time of prototype approval and during mass production.*

8- Add new clause 17 as under:

Clause 17. VERIFICATION OF LOCAL VENDORS

The verification of local vendors for the manufacturing of locally manufactured components of their meter shall be done twice in the calendar year which shall be applicable to all purchase orders for all DISCOs

 (MANSOOR NASIR) Dy. Manager (D&S)	 (AZIZ UR REHMAN) Manager (D&S)	 (MUHAMMAD SHAFQAT) Chief Engineer (Design & Standards)
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SPECIFICATION
DD-S-65:2003

STATIC SINGLE PHASE 2 WIRE ENERGY METERS with
MULTI-RATE TARIFF OPTIONAL

0 FOREWORD

- 0.1 This Specification has been prepared by the Standard, Directorate of Distribution Engg. Department of WAPDA.
- 0.2 This Specification is intended for the purpose of technical specification only for the procurement of material and does not include provisions of contract, unless otherwise provided in the contract.
- 0.3 This Specification is subject to-revision as and when required.

1.0 SCOPE

- 1.1 The Specification covers total Static Single Phase 2 Wire energy meters Class I capable of measuring kWh alongwith other quantities and built-in programmable features mentioned in this specification. The meter shall record and display all these quantities mentioned in the specification hereunder:
- 1.2 This Specification covers:
 - 1) Static Single Phase 2 Wire, 240V, 10(40) Amp 50 Hz, Accuracy Class 1.0 Energy Meters.
 - 2) As above with additional Multi-Rate Tariff function.

2. REFERENCE STANDARDS

The Reference Standards are listed and provided in Annex - I.

3.0 DEFINITIONS

3.1 STATIC WATT-HOUR METER

Meter in which current and voltage act on solid state (electronic) elements to produce an output proportional to watt-hour.

3.2 MEASURING ELEMENT

Part of the meter which produces an output proportional to the energy.

3.3 TEST OUTPUT

Device which can be used for testing the meter.

3.4 OPERATION INDICATOR

Device which gives a visible signal of the operation of the meter.

3.5 MEMORY

Element which stores digital information.

3.6 NON-VOLATILE MEMORY

Memory which can retain information in the absence of power.

3.7 DISPLAY

Device which displays the content(s) of (a) memory (ies)

3.8 REGISTER

Electronic Device operating both memory and display which stores and displays information.

3.9 CURRENT CIRCUIT

Internal connection of the meter and part of the measuring element through which flows the current of the circuit which the meter is connected.

3.10 VOLTAGE CIRCUIT

Internal connection of the meter part of the measuring element and power supply for the meter supplied with the voltage of the circuit to which the meter is connected.

3.11 AUXILIARY CIRCUIT

Elements (lamps, contacts, etc.) and connections of an auxiliary device within the meter case intended to be connected to an external device, for example clock, relay, impulse counter.

3.12 CONSTANT

Value expressing the relation between the energy registered by the meter and the corresponding value of the test output. If this value is a number of pulses, the constant should be either pulses per kilowatt-hour (imp.kWh) or watt hours per pulse (Wh/imp).

3.13 INDOOR METER

Meter which can only be used with additional protection against environmental influences (mounted in a house, in a cabinet)

3.14 OUTDOOR METER

Meter which can be used without additional protection in an exposed environment.

3.15 BASE

Back of the meter by which it is generally fixed and to which are attached the measuring element, the terminals or the terminal block, and the cover.

3.16 COVER

Enclosure on the front of the meter, made either wholly of transparent material or opaque material provided with window(s) through which the operation indicator (if fitted) and the display can be read.

3.17 CASE

Comprises the base and the cover.

3.18 PROTECTIVE EARTH TERMINALS

Terminal connected to accessible conductive parts of the meter for safety purposes.

3.19 TERMINAL BLOCK

Support made of insulating material on which all or some of the terminals of the meter are grouped together.

3.20 TERMINAL COVER

Cover which covers the meter terminals and generally, the ends of the external wires or cables connected to the terminals.

3.21 CLEARANCE

Shortest distance measured in air between two conductive parts.

3.22 CREEP DISTANCE

Shortest distance measured over the surface of insulation between two conductive parts.

3.23 BASIC INSULATION

Insulation applied to live parts to provide basic protection against electric shock.

3.24 BASIC CURRENT (I_b)

Value of current in accordance with which the relevant performance of the meter is fixed.

3.25 MAXIMUM CURRENT (I_{max})

Highest value of current at which the meter purports to meet the accuracy requirements of this standard.

3.26 REFERENCE VOLTAGE (U_n)

Value of the voltage in accordance with which the relevant performance of the meter is fixed.

3.27 REFERENCE FREQUENCY

Value of the frequency in accordance with the relevant performance of the meter is fixed.

3.28 PERCENTAGE ERROR

Percentage error is given by the following formula :

$$\text{Percentage error} = \frac{\text{Energy registered by the meter} - \text{True Energy}}{\text{True Energy}} \times 100$$

Since the true value cannot be determined, it is approximated by a value with a stated uncertainty that can be traced to standards agreed upon between manufacturer and user or to national standards.

3.29 REFERENCE CONDITIONS

Appropriate set of influence quantities and performance characteristics, with reference values, their tolerances and reference ranges, with respect to which the intrinsic error is specified.

3.30 ELECTROMAGNETIC DISTURBANCE

Conducted or radiated electromagnetic interference which may effect functionally or meteorologically the operation of the meter.

3.31 RATED OPERATING CONDITIONS

Set of specified measuring ranges for performance characteristics and specified operating ranges for influence quantities, within which the variations of operating errors of a meter are specified and determined.

3.32 SPECIFIED OPERATING RANGE

Range of values of a Single influence quantity which forms a part of the rated operating conditions.

3.33 LIMIT RANGE OF OPERATION

Extreme conditions which an operating meter can withstand without damage and without degradation of its metrological characteristics when it is subsequently operated under its rated operating conditions.

3.34 STORAGE AND TRANSPORT CONDITIONS

Extreme conditions which a non-operating meter can withstand without damage and without degradation of its meteoric

3.35 NORMAL WORKING POSITION

Position of the meter defined by the manufacturer for normal service.

3.36 THERMAL STABILITY

Thermal stability is considered to be reached when the change in error as a consequence of thermal effects during 20 min. is less than 0.1 times the maximum permissible error for the measurement under consideration.

4. PERFORMANCE STANDARDS

4.1	i.	Reference Temperature	23 Degree C
	ii.	Reference Frequency	50 Hz
	iii.	Reference voltages	240 V

4.2 SERVICE CONDITIONS**4.2.1 Temperature Range**

Specified Operating Range	-25 Degree C to 60 Degree C
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Limit Range of Operation (extreme condition)	-25 Degree C to 80 Degree C
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Limit Range for Storage and Transport	-25 Degree C to 80 Degree C
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4.2.4 Relative humidity may range upto 95% non-condensing.

4.2.5 Altitude: Upto 1000 meter above level.

5. MECHANICAL REQUIREMENTS**5.1 GENERAL MECHANICAL REQUIREMENTS**

Meters shall be designed and constructed for Outdoor use in such a way as to avoid introducing any danger in normal use and under normal conditions, so as to ensure especially:-

- personal safety against electric shock.
- personal safety against effects of excessive temperature.
- protection against spread of fire.
- protection against penetration of solid objects.
- protection against Dust and Water.

All parts which are subject to corrosion under normal working conditions shall be protected effectively. Any protective coating shall not be liable to damage by ordinary handling nor damage due to exposure to air, under normal working conditions. Meters shall withstand solar radiation test.

- 5.2 The electrical connections in the meter shall be resistant to tampering. These shall be made so as to prevent their opening from outside the meter base/cover accidentally or deliberately without breaking the seals.

5.3 CASE

- 5.3.1 The meter shall have a reasonably dust proof and moisture proof case which can be sealed in such a way that the internal parts of the meter are accessible only after breaking the seals. The meter shall comply with the dust proof and water proof requirements of IEC-60529 amended to date.

5.3.2 Meter Cover

The cover of meter shall either be made of clear or opaque shatter proof ultra violet stabilized polycarbonate material. In case of Clear polycarbonate material the electronics of the meter shall be protected with a shield inside the Meter Cover made of a suitable opaque material to protect the electronics from extreme environmental/especially solar radiation conditions.

5.3.3 Meter Base

The base of the meter shall be made of strong insulating material.

5.3.4 Meter Security Box

The meter is to be supplied in a transparent Polycarbonate Meter Security box. Meter Security Box shall be designed incorporating the following requirements:

- i) Thickness of Polycarbonate shall be 2 mm minimum
- ii) Continuous Ultrasonic welding shall be provided at the points of contact between Upper and Lower parts and the Meter Cover. The Meter Cover maybe integrated with the Upper part of the Meter Security Box.
- iii) The Terminal Strip once inserted cannot be pulled back.
- iv) The Terminal Strip once fully inserted should be flush with side wall.
- v) Terminal Strip in fully inserted position should cover the Terminal hole opening completely and it shall not be possible to pull it back for all practical purposes.
- vi) Provision should be made to avoid accidental insertion of Terminal Strip before installation.
- vii) The Meter Box shall be supplied with Rag Bolts alongwith nut and washer.

5.4 TERMINALS – TERMINAL BLOCK

- 5.4.1 The terminals shall be grouped in a terminal block having adequate insulating properties and mechanical strength. The material (Bakelite or similar material) of

which the terminal block is made shall be capable of passing the tests given in ISO Standard 75 for a temperature of 135 Deg. C and glow wire test of 960 Degree C.

5.4.2 Arrangements may be provided to prevent the exit of terminal block by force from outside without opening the meter cover.

5.4.3 The terminal shall be pressure plate type to permit the connection of both solid and stranded aluminum conductor of diameter 7 mm to a depth of atleast 20 mm without being directly bitten by the screws used for fixing the conductors. The terminals in which screws bite directly into the conductor shall not be acceptable.

5.4.4 The moving parts of the terminals including screws shall be made of brass having minimum electrical conductivity of 65% of copper. The fixed part of terminal i.e. pressure plate shall be made of copper having a thickness of 2.4 mm and minimum electrical conductivity of 99.99 % of stranded copper.

5.4.5 The terminals shall be Tin or Nickel plated. In case of Tin plating the thickness shall be 20 microns on all parts except threaded portions on which it shall be min 10 microns. In case of Nickel plating the coating thickness shall be 10 microns on all parts except the threaded portion on which it shall be min 7 microns.

5.5 EARTHING CONNECTION ARRANGEMENT

As the base is of insulating material, the common ground of the main PCB shall be internally connected to the neutral point of the terminal block.

5.6 TERMINAL BLOCK COVER

A terminal block cover of transparent polycarbonate insulating material shall be provided. The terminal Block cover shall be fixed with two screws fastened to the terminal block. No access to the terminals shall be possible without breaking the seals.

5.7 PROTECTION AGAINST HEAT, FIRE, PENETRATION OF DUST & WATER, SOLAR RADIATION.

The complete meter i.e. case terminal block shall meet the requirements of clauses 5.7 & 5.8 of IEC 62052-11. For protection against penetration of dust & Water the meter shall be IP54 compliant.

6. ELECTRICAL REQUIREMENTS

6.1 STANDARD RATINGS

Basic/max. Current 10/40 Amp

Reference Voltage 240 V

Reference Frequency	50 Hz
Accuracy Class	1.0
Meter Type	Static Single Phase 2 Wire, 240V, 10(40) Amp 50 Hz, Accuracy Class 1.0 – Energy Meters.

6.2 OTHER ELECTRICAL REQUIREMENTS

Power Losses of voltage circuit at reference voltage	2.0 W & 10 VA
Power Losses of Current circuit at basic current	4 VA
Starting current	0.4% of I_b at unity power factor
Running with no load	From 0.8 to 1.15 of reference voltage but with no current. Meter shall not produce more than one pulse.
Initial Start Up	Within 3 sec., after application of rated voltage meter display shall start functioning.
Temperature rise of external surface	25 Degree C with ambient temp. of 40 Degree C.
Temperature rise of terminal	30 Degree C with ambient temp. of 40 Degree C.

6.2.1 Dielectric strength

Power frequency withstand	4 KV for one minute
Impulse voltage withstand	8 KV : 1.2/50 micro sec & minimum 9 joules
Short time Over current	30 times I_{max} with a relative tolerance of 0% to -10% for $\frac{1}{2}$ cycle at rated frequency
Insulation resistance	More than 5 Mega Ohms.

Creepage Distance 20mm Min

6.3 VOLTAGE RANGE

Specified operating Range	From 0.9 to 1.1 of reference voltage
Limit range of operation	From 0.0 to 1.15 of ref. Voltage

6.4 ACCURACY REQUIREMENT

6.4.1 Limits of error due to variation of the current.

When the meter is Under reference conditions given in clause 8.5 of IEC 62053-21, the percentage errors shall not exceed the limits given in Table I.

TABLE - I
Percentage Error Limits

Value of Current	Power Factor	Percentage error Limits for meters
$0.05 I_b \leq I < 0.1 I_b$	1	± 1.5
$0.1 I_b \leq I \leq I_{max}$	1	± 1.0
$0.1 I_b \leq I < 0.2 I_b$	0.5 Lagging 0.8 leading	± 1.5 ± 1.5
$0.2 I_b \leq I \leq I_{max}$	0.5 Lagging 0.8 leading	± 1.0 ± 1.0
$0.2 I_b \leq I \leq I_b$	0.25 lagging 0.5 leading	± 3.5 ± 2.5

6.5 INFLUENCE OF OTHER QUANTITIES

6.5.1 Limits of error due to influence quantities:

The additional percentage error due to the change of influence quantities with respect to reference conditions, as given in clause 8.5 of IEC 62053-21 shall not exceed the limits given in Table-II.

TABLE - II

Influence Quantities

Influence quantity		Value of current (balanced unless) otherwise	Power Factor	Limits of Variation in % age error for meters
Ambient temperature variation	9)	$0.1 I_b \leq I \leq I_{max}$ $0.2 I_b \leq I \leq I_{max}$	1 0.5 lagging	0.05 %/K 0.07 %/K
Voltage variation $\pm 10\%$	1) 8)	$0.05 I_b \leq I \leq I_{max}$ $0.1 I_b \leq I \leq I_{max}$	1 0.5 lagging	0.7 1.0
Frequency variation $\pm 2\%$	8)	$0.05 I_b \leq I \leq I_{max}$ $0.1 I_b \leq I \leq I_{max}$	1 0.5 lagging	0.5 0.7
Harmonic components in the current and voltage circuits	5)	$0.5 I_{max}$	1	0.8
DC and even harmonics in the a.c. current circuit	4)	$0.5 I_{max}$	1	3.0
Odd harmonics in the a.c. current circuit	5)	$0.5 I_b$ 2)	1	3.0
Sub-harmonics in the a.c. current circuit	5)	$0.5 I_b$ 2)	1	3.0
Continuous magnetic induction of external origin	5)	I_b	1	2.0
Magnetic induction of external origin 0.5 mT	6)	I_b	1	2.0
Electromagnetic fields RF	-	I_b	1	2.0
Operation of accessories	7)	$0.05 I_b$	1	0.5
Conducted disturbances, induced by radio-frequency fields	-	I_b	1	2.0
Fast transient burst	-	I_b	1	4.0

- 1) For the voltage ranges from -20% to -10% and $+10\%$ to $+15\%$ the limits of variation in percentage errors are three times the values given in this table.

Below $0.8 U_n$ the error of the meter may vary between $+10\%$ and -100% .

- 2) The distortion factor of the voltage shall be less than 1% . For test condition see 8.2.2 and 8.2.3.

- 3) Polyphase meters with three measuring elements shall measure and register, within the limits of variation in percentage error shown in this table. If the following phases are interrupted:

- In a three-phase, four wire network one or two phases:
- In a three-phase, three wire network (if the meter is designed for this service) one of the three phases.

This only covers phase interruptions and does not cover events such as transformer fuse failures.

- 4) This test does not apply to transformer-operated meters. The test conditions are specified in Clause A.1.

- 5) The test conditions are specified in 8.2.1 to 8.2.4.

- 6) A magnetic induction of external origin of 0.5 mT produced by a current of the same frequency as that of the voltage applied to the meter and under the most unfavourable conditions or phase and direction shall not cause a variation in the percentage error of the meter exceeding the values shown in this table.

The magnetic induction shall be obtained by placing the meter in the centre of a circular coil, 1 m in mean diameter of square section and of small radial thickness relative to the diameter and having 400 At .

- 7) Such an accessory, when enclosed in the meter case, is energized intermittently, for example the electromagnet of a multi-rate register.

It is preferable that the connection to the auxiliary device(s) is marked to indicate the correct method of connection. If these connections are made by means of plugs and sockets, they should be irreversible.

However, in the absence of those markings or irreversible connections, the variations of errors shall not exceed those indicated in this table if the meter is tested with the connections giving the most unfavourable condition.

- 8) The recommended test point for voltage variation and frequency variation is $/b$ for direct connected meters and $/n$ for transformer-operated meters.

- 9) The mean temperature coefficient shall be determined for the whole operating range. The operating temperature range shall be divided into 20 K wide ranges. The mean temperature coefficient shall then be determined for these ranges by taking measurements 10 K above and 10 K below the middle of the range. During the test, the temperature shall be in no case outside the specified operating temperature range.
- 10) The test only applies to transformer-operated meters.

6.6 METER CONSTANT

The relation between the test output and the indication in the display shall comply with the marking on the name plate.

Output devices generally do not produce homogeneous pulse sequences. Therefore, the manufacturer shall state the necessary number of pulses to ensure a measuring accuracy of at least 1/10 of the class of the meter at the different test points.

7. METER CHARACTERISTICS

The meter shall generally comprise of the following characteristics as a minimum. A list of characteristics is appended below :

7.1 BASIC DATA RECORDING AND STORAGE

7.1.1 STATIC WATTHOUR METER

- Energy (Kwh).
- At-least three months Billing Data kWh, shall be available at all times.

7.1.2 MULTI-RATE METER (when applicable)

- Min. Four Multi Rate periods Energies (KWh).
- Min Two Seasons per year should be programmable
- Min 100 days per year holidays should be programmable
- At-least three months Billing Data kWh, shall be available at all times.

7.1.3 BACK-UP BATTERY (APPLICABLE IN CASE OF MULTI-RATE METERS)

- The Back-up Battery shall be of Lithium-Ion type.
- Low Battery indication shall be displayed when min. 25% battery life is left.
- Storage life of Battery shall be more than 15 years.
- Without any Power the Back-Up battery shall maintain the time, calendar and Multi-Rate program for a continuous period of at-least 12 months.
- The battery shall be connected using standard connectors, it shall not be welded, brazed or soldered and it shall be replaceable in the field.

7.2 SECURITY FEATURES, EVENT RECORDING, AND DIAGNOSTICS:

7.2.1 Security Features

- Every Meter shall have a unique serial No. in its memory which can be displayed/reported.
- The No. of times programmed and the identification of the last programmer shall be reported/displayed.
- A programmable meter ID code shall be provided.
- At-least two levels of access/security codes shall be provided one for meter reading (only) by the authorized personnel and a second one for programming and reading.
- The meter shall be capable of recording energy accurately in case of change of phase with neutral wire.
- LED indication shall be provided for KWh.
- Reverse energy flow indication shall be provided on the meter through LCD/LED.
- Meter shall keep on recording/operating with or without neutral. Without Neutral it shall record atleast 10% of Basic load.
- The meter shall be protected against any external interference such as influence of Strong Electromagnet/Radar Magnet, CD drive, Mobile phones and shall comply to all relevant IEC/ANSI standards for functional performance and loss of data.
- Total No. of Power Outage.
- At-least 20 total events shall be recorded in the meter at any one time before Roll Over they may comprise of the above or any additional features.

7.2.2 Diagnostics

The meter shall display cautions and diagnostics for the following conditions;

- Un-programmed Meter.
- Self check diagnostics for RAM/ROM, Processor, non-volatile memory failure and other essential hardware circuitry.

7.3 DISPLAY

- The Display shall be LCD type with at-least 5 whole digits for Energy consumption.
- Display scrolling time shall be programmable.
- Min. three programmable Display modes shall be available.
- First Display mode shall be the Normal or Automatic display mode. Second display mode shall be for Security / Diagnostics etc. The third Display mode shall be for Test Purposes. Activation of Display Mode shall either be with a secure Push Button or an equally secure alternate method.
- All Segment Check.
- Display Mode Indicator.
- Display Quantity Labels.
- Pulse Output for field testing of Meter shall be available optically.

7.4 METER PROGRAMMING, SOFTWARE, AND SECURITY

The following features shall be programmable in the meter as a minimum along-with other features that may be provided:

- The meter shall have non-volatile EEPROM memory.
- Once programmed the meter shall be re-programmable as a new meter or as existing meter without loss of previous data, through the required security passwords.
- Meter programming shall be DOS/Windows based.
- An Optical Communication Port shall be provided on the meter cover and shall either be IEC 62056-21 or ANSI C12.18 Type II compliant

8. TESTS

Following routine, type and sample tests shall be carried out as per requirements of IEC standards.

8.1 ROUTINE TESTS

Following routine tests shall be carried out on KWH, KW meters as per respective IECs:

Accuracy Test
Running with no load test
Starting current test
Insulation resistance test

8.2 TYPE TEST

Following type tests shall be carried out on KWH, KW meters as per respective IECs.

8.2.1 Tests of mechanical requirements

- Spring hammer test
- Shock test
- Vibration test
- Test of resistance to heat and fire
- Test of protection against penetration of dust and water

8.2.2 Test of climate influence

- Dry heat test
- Cold test
- Damp heat cycle test
- Solar Radiation test

8.2.3 Tests of electrical requirements

- Test of power consumption of voltage circuit
- Test of power consumption of current circuit
- Test of effect of voltage dips and short interruptions
- Test of influence of short time over current
- Test of influence of self heating
- Test of influence of heating
- Impulse voltage test
- A.C. voltage test.

8.2.4 Tests for electromagnetic compatibility (EMC)

- Test of immunity to electrostatic discharges
- Test of immunity to electromagnetic HF fields
- Fast transient burst test
- Radio interference measurement

8.2.5 Tests of Accuracy requirements (for KWH meter parts as per IEC 62053-21 where applicable)

- Test of Accuracy
- Test of influence quantities
- Test of no load condition
- Test of starting condition

9. NAME AND RATING PLATE

9.1 A suitable name/rating plate shall be provided inside at the front of the meter, indicating the following information:

- Name of the manufacturer and country of origin
- Type of meter
- Meter rating and other information
- WAPDA P.O. No.
- Serial No. and year of manufacture

10. PACKING

- 10.1 Each meter shall be individually packed in thermopore packing or thermopore lined packing, covered with adhesive tape at joints or plastic strips etc.
- 10.2 For overseas shipment, a suitable number of individually thermopore packed meters shall then further be packed in sea worthy packing.
- 10.3 The packing shall be strong enough to withstand rigors of ocean, rail, road etc.

11. SAMPLE

At least one number sample of multirate meter shall be submitted with the bid.

12. PROTOTYPE APPROVAL

The successful bidder shall submit 3 nos samples for Prototype Approval in case valid Prototype Approval as per WAPDA purchase procedure does not exist for the offered model/type. All tests shall be carried on the submitted prototype meters to ensure compliance to WAPDA and IEC specs. Meters shall be subjected to all tests including type, routine and sample tests. Once approved such prototype approval shall be valid as per WAPDA purchase procedure.

13. INSPECTION

The successful bidder shall offer the meters for testing/inspection, Procedure for pre-shipment inspection is given below:

13.1 SAMPLE TESTS (ELECTRICAL)

- 13.1.1 The meters offered for acceptance shall be grouped into lots containing upto 1000 meters. A sample comprising of five (05) meters shall be selected at random from each lot and subjected to tests as below:

Starting Current Test

Creep Test
Accuracy Test
A.C. Voltage Test

13.1.2 The meters offered for acceptance shall be grouped into lots containing upto 1000 meters. A sample comprising of two (02) meters shall be selected at random from each lot and subjected to following tests:

Impulse Test
Power Loss Test

13.1.3 The lot shall be accepted if all the meters qualify in the tests described in clause 13.1.1 & 13.1.2 above. The lot shall be rejected if two or more meters fail in any of the tests. If any one meter fails in any of the above tests re-sampling shall be carried out after collecting same No. of meters and subjected to the tests described in clause 13.1.1 & 13.1.2 above. If any one meter fails in any of the above tests the whole lot shall be rejected.

13.2 SAMPLE TESTS (MECHANICAL)

13.2.1 The meter offered for acceptance shall be grouped into lots containing upto 1000 meters. Sample comprising of three (03) meters shall be selected at random from each lot and subjected to tests as below:

<u>Sr. No.</u>	<u>Description</u>	<u>Nos. of Meters</u>
1.	Test of protection against penetration of dust and water	One meter
2.	Dimensional Check	One meter
3.	Tests of Electromagnetic Compatibility/Interference (EMI)	One meter

The lot shall be accepted if meters qualify the above tests in clause 13.2.1. In case any meter fails in the relevant test, another sample of double the size shall be selected and test/tests repeated. If any meter fails in the relevant in the second group, the entire lot shall be rejected.

13.3 VERIFICATION TEST OF FUNCTIONALITY OF SOFTWARE

13.3.1 Verification test of the functionality of software and display features on offered meters shall be promoted by loading/unloading of programme and auditing the diagnostic reports. The number of meters shall be three if any meter fails to comply with the functionality requirements the entire offered lot shall be rejected.

13.4 TYPE TESTS

- 13.4.1 The remaining type tests not performed on the above samples shall be carried out (as per recommended sequence of IEC 62052-11 Annexure (F) on three (03) Nos. meters out of the total offered meters. If two meters fail in any of the above tests, the lot shall be rejected. If one of the meters fails to qualify any of the above tests, re-sampling shall be carried out. In case of failure of any of the tests the lot shall be rejected.

14. **WARRANTY**

The supplier shall provide two years warranty for the successful operation of the meter including its maintenance where ever required.

15. **TRAINING**

The successful bidder shall arrange a comprehensive practical training regarding programming, billing, loading of software etc. in Pakistan.

16. **BID DATA, TEST CERTIFICATES, DRAWINGS, LITERATURE, REFERENCE LIST & MANUFACTURING EXPERIENCE**

All the bidders shall submit complete technical data, detailed drawings test certificates, literature in English language, supply reference list and manufacturing experience alongwith the bid.

Annex – I

REFERENCE STANDARDS

When following standards referred to in this document have been superseded, the latest revisions shall apply.

1. METERING STANDARDS**a. IEC**

- 62053-21 : 2003, Static Meters for Active Energy (Classes 1 and 2).
- 61358 (1996-05) Acceptance inspection for direct connected alternating current static watt-hour meters for active energy (Classes 1 and 2).
- 62052-11 : 2003 Electricity Metering Equipment (AC) – General Requirements, Tests and Test conditions
- 61162, 61107 Optical interface

b. ANSI

- C12.18 Protocol specification for ANSI type II Optical ports
- C12.19 Utility industry end device data tables

2. ELECTRICAL TESTING STANDARDS**a. IEC**

- 60038: 1983, IEC standard voltages.
50(301, 302, 303): 1983, International Electrotechnical Vocabulary (IEV) Chapter 301: General terms on measurements in electricity. Chapter 302: Electrical measuring instruments. Chapter 303: Electronic measuring instruments.
- 60060-1: 1989 High voltage test techniques.
- 60085: 1984, Thermal evaluation and classification of electrical insulation.
- 61000-4-2: 1995, Electromagnetic compatibility (EMC)-Part 4: Testing & measurement techniques-section 2: Electrostatic discharge immunity test.
- 61000-4-3: 2002, Electromagnetic compatibility (EMC)-Part 4-3: Testing & measurement techniques-section 2: Radiated radio frequency electromagnetic field immunity test.

61000-4-4: 1995, Electromagnetic compatibility (EMC)-Part 4: Testing & measurement techniques-section 4: Electrical fast transient/burst immunity test.

CISPR22: 1997, Information technology equipment-Radio disturbance characteristics-Limits & methods of measurement.

b. ANSI

C37.90.1 – 1989, IEEE standard surge withstand capability

C62.41 – 1991, IEEE recommended practice on surge voltages in Low-voltage AC power circuits.

3. MECHANICAL TESTING STANDARDS

a. IEC

60529: 1989, Degrees of protection provided by enclosures (IP code).

60695-2-11: 2000, Fire hazard testing. Part2-11: Glowing/hot wire based test methods.

60817: 1984, Spring operated impact test apparatus and its calibration.

b. ISO Standard

75-2: 1993, Plastics – Determination of temperature of deflection under load-Part 2: Plastic & ebonite.

4. ENVIRONMENTAL STANDARDS

a. IEC

60068-2-1: 1990, Environmental testing, part 2: Tests. Tests A: Cold.

60068-2-2: 1974, Basic environmental testing procedures, part 2: Tests. Tests B: Dry Heat.

60068-2-5: 1975, Basic environmental testing procedures, part 2: Tests. Test Sa: Simulated solar radiation at ground level.

60068-2-6: 1995, Environmental testing, part 2: Tests. Test Fc: Vibration (sinusoidal).

- 60068-2-1.1: 1981, Basic environmental testing procedures, part 2: Tests. Test Ka: Salt mist.
- 60068-2-27: 1987, Basic environmental testing procedures, part 2: Tests. Test Ea and guidance: Shock.
- 60068-2-30: 1980, Basic environmental testing procedures, part 2: Tests. Test Db and guidance: Damp heat, cyclic (12 + 12-hour cycle).
- 60721-1: Ed. 2.0 b Classification of environmental conditions. Part 1: Environmental parameters and their severities.
- 60721-2-1 (1982-01) Classification of environmental conditions. Part 2: Environmental conditions appearing in nature. Temperature and humidity.
- 60721-2-4 (1987-12) Classification of environmental conditions. Part 2: Environmental conditions appearing in nature. Solar Radiation and temperature.