



The K- Electric Limited

TPRE (Planning & Engineering – Distribution)

SAP Document Code:	1000000168	Specs. #.	K/R&D/STP/21 (Rev-02)
Specification	Three Phase Direct Online TOU Static Energy Meters 5 KW & Above (Accuracy Class-1)		

Specification for Three Phase Direct Online TOU Static Energy Meters 5 KW & Above (Accuracy Class-1)

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0.0 Foreword

0.1 This specification has been prepared by Technical Process Re-Engineering (TPRE) Department.

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 static poly-phase energy meters capable of measuring MDI-kW, kWh & kvarh, along with other quantities and built-in programmable features mentioned in this specification.

1.2 This specification covers:

3-phase, 4 wire, 3 element, 3x230/400 V, 10/100 Amp, 50Hz whole current energy meter kWh of Accuracy Class 1 & kvarh of Accuracy Class 2 with multi-rate rate function.

2.0 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 on 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.

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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 connections of the meter and part of the measuring element through which flows the current of the circuit to 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 are 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.

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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 Creepage 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.

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3.26 Reference Voltage (Un)

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 Measuring Range

Set of values of a measured quantity for which the error of a meter is intended to lie within specified limits.

3.33 Specified Operating Range

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

3.34 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.

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3.35 Extended Operating Range

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.

3.36 Storage & Transport Conditions

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

3.37 Normal Working Position

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

3.38 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.

4.0 Performance Standards

- 4.1 i. Reference Temperature 23°C
- ii. Reference Frequency 50 Hz
- iii. Reference voltages 3x230/400V

4.2 Climatic Condition

- a). Peak ambient temperature - 50°C
- b). Mean max. temperature during 24 hours - 45°C
- c). Minimum temperature - 0°C
- d). Maximum relative humidity - 95 °C (dry bulb 43 °C).
- e). Average annual rain fall - 150 mm
- f). Altitude - Mean sea level
- g). Location - Sea coast with semi desert interior and marshy soil near the coastal area.

5.0 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.

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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 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 IP-54 requirements of IEC-60529 (latest edition).

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 3 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.
- viii. Printing of KE meter number at the following three locations:
 - a. At inside of front of Polycarbonate Security Box.
 - b. On the sliding strip.
 - c. At inside of the back of Polycarbonate Security Box.

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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 glow wire test of 960°C, while terminal cover and meter case shall be capable of passing 650°C temperature test as per IEC-62052-11 (latest edition).

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 / copper conductor of cross sectional area 25 mm² to a depth of at least 20mm 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. Protection Against Heat, Fire, Penetration of Dust & Water, Solar Radiation.

The complete meter i.e. case terminal block shall meet the requirements of clauses of IEC 62052-11(latest edition). For protection against penetration of dust & water the meter shall be IP 54 complaint.

6.0 Electrical Requirements

6.1 Standard Ratings

Basic /max. Current	10/100 Amp
Reference Voltage	3x230/400 V
Reference Frequency	50 Hz
Accuracy Class for kwh	1.0
Accuracy Class for kvarh	2.0
Meter Type	3-Phase, 3-Element, 4-Wire, Whole Current Meter suitable for recording the energy in a 4 wire system, neutral solidly grounded.

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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 Ib 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.
Temperature rise of external surface	25°C with ambient temp. of 45°C.
Temperature rise of terminal	30°C with ambient temp. of 45°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 ½ cycle at rated frequency.
Insulation resistance	More than 5 Mega Ohms.
Creepage distance	20 mm min.

6.3 Voltage Range

Specified operating Range	From 0.9 to 1.1 of reference voltage.
Extended operating range	From 0.50 to 1.15.
Limit range of operation	From 0.002 to 1.9 of ref. voltage.

6.4 Accuracy Requirement

6.4.1 Limits of Error Due to Variation of the Current (kwh)

When the meter is under reference conditions given in IEC 62053-21 (latest edition), the percentage errors shall not exceed the limits given in Table-I & II.

Table - I
Percentage Error Limits With Balanced Loads

Value of Current	Power Factor	Percentage error Limits for meters of Class-1
0.05 Ib ≤ I < 0.1 Ib	1	± 1.5

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$0.1 I_b \leq I \leq I_{max}$	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

Table – II
Percentage error limits

(Meter carrying a single phase load but with balanced poly-phase voltages applied to the voltage circuits)

Value of Current	Power Factor of the relevant element	Percentage error Limits for meters of Class-1
$0.1 I_b \leq I < I_{max}$	1	± 2.0
$0.2 I_b \leq I \leq I_{max}$	0.5 lagging	± 2.0

The difference between the percentage error when the meter is carrying a single phase load and a balanced poly-phase load at basic current and unity power factor shall not exceed 1.5%.

6.5 Influence of Other Quantities(kwh)

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

Table – III
Influence Quantities

Influence quantity		Value of current (balanced unless) otherwise	Power Factor	Limits of Variation in % age error for meters of Class-1
Voltage variation $\pm 10\%$	1)	$0.05 I_b \leq I \leq I_{max}$ $0.1 I_b \leq I \leq I_{max}$	1 0.5 lagging	0.7 1.0
Frequency variation $\pm 2\%$	-	$0.05 I_b \leq I \leq I_{max}$ $0.1 I_b \leq I \leq I_{max}$	1 0.5 lagging	0.5 0.7
Reversed phase sequence	-	$0.1 I_b$	1	1.5
Voltage unbalance	3)	I_b	1	2.0
Harmonic components in the current and voltage circuits	4)	$0.5 I_{max}$	1	0.8
Odd harmonics in the AC current circuit	4)	$0.5 I_b$ 2)	1	3.0

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Sub-harmonics in the AC current circuit	4)	0.5 Ib 2)	1	3.0
Continuous magnetic induction of external origin	4)	Ib	1	2.0
Magnetic induction of external origin 0.5 mT	5)	Ib	1	2.0
Electromagnetic RF fields	-	Ib	1	2.0
Operation of accessories	6)	0.05 Ib	1	0.5
Conducted disturbances, induced by radio-frequency fields	-	Ib	1	2.0
Fast transient burst	-	Ib	1	2.0

- i) 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 Table-III.
Below 0.8 Un the error of the meter may vary between + 10% and -100%.
- ii) The distortion factor of the voltage shall be less than 1%.
- iii) Poly-phase meters shall measure and register within the limits of variation in percentage error shown in Table-III if one or two phases of the 3-phase network are interrupted.
- iv) The test conditions are specified in 8.2.1 to 8.2.4 of IEC 62053-21.
- v) 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 unfavorable conditions or phase and direction shall not cause a variation in the percentage error of the meter exceeding the values shown in the Table-III.

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.
- vi) 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 unfavorable condition.

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6.5.2 Limits of Error Due to Ambient Temperature Variation

The mean temperature coefficient shall not exceed the limits given in Table-IV.

Table - IV
Temperature Coefficient

Value of Current	Power Factor	Mean Temp. Coefficient %K for meters of Class-1
From 0.1 Ib to I _{max}	1	0.05
From 0.2 Ib to I _{max}	0.5 lagging	0.07

6.5.3 Limits of Error Due to Variation of the Currents (kvarh)

When the meter is under reference conditions given in IEC 62053-23 (latest edition). The percentage errors shall not exceed the limits given in Table V & VI.

Table – V
Percentage error limits with balanced loads

Value of Current	Sin ϕ (Inductive or Capacitive)	Percentage error limits for meter of Class-2
0.05 Ib < I < 0.1 Ib	1	+2.5
0.1 Ib < I < I _{max}	1	+2.0
0.1 Ib < I < 0.2 Ib	0.5	+2.5
0.2 Ib < I < I _{max}	0.5	+2.0
0.2 Ib < I < I _{max}	0.25	+2.5

Table – VI

Percentage error limits (poly-phase meter carrying a single phase load but with balanced poly-phase voltages applied to the voltage circuits).

Value of Current	Sin ϕ (Inductive or capacitive)	Percentage error limits for meter of Class-2
0.1 Ib < I < I _{max}	1	+ 3.0
0.2 Ib < I < I _{max}	0.5	+ 3.0

The difference between the percentage error when the meter is carrying a single phase load and a balanced poly phase load at basic current Ib and sin $\phi = 1$ shall not exceed 2.5%.

The energy for inductive load be recorded and should register the absolute some of quadrant 1 & 3.

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6.5.4 Limits of Error Due to Influence Quantities (kvarh):

The additional percentage error due to the change of influence quantities with respect to reference conditions, as given in IEC 62053-23 (latest edition) shall not exceed the limits given in Table-VII.

Table-VII
Influence Quantities

Influence quantity	Value of Current (balanced unless otherwise stated)	Sin ϕ (Inductive or capacitive)	Mean temperature coefficient % K for Meters of class 2
Ambient temperature Variation	0.1 I _b < I < I max 0.2 I _b < I < I max	1 0.5	0.10 0.15
			Limits of variation in Percentage error for Meters of class 2
Voltage variation +10%	0.05 I _b < I < I max 0.1 I _b < I < I max	1 0.5	1.0 1.5
Frequency variation +2%	0.05 I _b < I < I max 0.1 I _b < I < I max	1 0.5	2.5 2.5
DC component in the current circuit	$\frac{I_{max}}{\sqrt{2}}$	1	6.0
Continuous magnetic induction of external origin	I _b	1	3.0
Magnetic induction of external origin 0.5 mT	I _b	1	3.0
Electromagnetic RF Fields	I _b	1	3.0
Operation of accessories	0.05 I _b	1	1.0
Conducted disturbances, induced by radio-frequency fields	I _b	1	3.0
Fast Transient burst	I _b	1	4.0

- i) 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-VII.
Below 0.8 Un the error of the meter may vary between +10% and -100%.
- ii) The recommended point for voltage variation and frequency variation is I_b for direct connected meters.

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- iii) The purpose of this test is to check for current sensor saturation only.
- iv) The test conditions are specified in IEC 62053-23 (latest edition).
- v) 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 unfavorable conditions of 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.
- vi) 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 not be interchangeable.

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.

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.

7.0 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 KWH & KVARH Multi-Rate Meter

- Energy (KWh).
- Reactive energy (kvarh).
- Max. Demand (KW), shall be block type.
- Demand Interval shall be 30 minutes, however it shall be programmable for other values also.
- Cumulative Max. Demand (KW).

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- There should be a separate LED for testing and calibration of Reactive energy.
- At-least twelve months Billing Data kWh, kvarh, KW and number of resets shall be available at all times.
- Min. Four Multi rate periods Energies (KWh).
- Min. Four Multi rate periods Max. Demand (KW).
- Min. Four Multi rate periods Cumulative Max. Demand (KW).
- Min. Four Multi rate periods Reactive Energies (kvarh).
- Min Two Seasons per year should be programmable.
- Min 100 days per year holidays should be programmable.

7.1.2 Load Profiling/Recording:

- Min. Two Channel recording having sufficient capacity to record at-least 65 days of Data of 30 minutes interval. Minimum two quantities to be recorded are kWh & kW.
- After downloading Load Profile Data in computer through reporting software, it should be available in tubular form.
- There should be date and time stamp for every entry of Load Profile data.
- All Load Profile Data shall be stored in a Non-Volatile Memory.

7.1.3 Back-up Battery

- 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, Multi-Rate program & function of LCD display during power outage for a continuous period of at-least 24 months.
- The battery shall be connected using standard connectors, it shall not be welded, brazed or soldered.

7.2 Security Features, Event Recording and Diagnostics:

7.2.1 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 along with Date & Time stamp 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.
- Meter shall keep on recording/ operating as long as voltage exists on any two terminal of the meter with or without neutral.
- The meter shall be protected against any external interference such as influence of Strong Electromagnet, CD drive and Mobile phones and shall comply to all relevant IEC/ANSI standards for functional performance and loss of data.
- A strong magnet having strength of 0.7 Tesla, when measured in an air gap of 3mm, rectangular in shape with minimum dimension of 65 x 35 x 35mm shall not effect the accuracy of meter by more than 4% at Basic Current and Unity Power Factor when applied on the meter from any direction. After the test meter shall perform within prescribed limit of Accuracy.

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7.2.2 Security Features

- Total No. of power outages.
- Phase failure/Disconnection of wires.
- Reverse energy flow of active and reactive energy.
- Reverse polarity.
- Programming event.
- At-least 100 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.
- Optical port communication with date and time stamp.

7.2.3 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 (06) digits without decimal for Energy consumption.
- Maximum demand shall have two whole digits and two decimal digits.
- 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 be with a Push Button.
- Phase Indicators shall be permanently displayed in all Display modes.
- All Segment Check.
- Power quadrant indicator.
- Active TOD period indicator.
- An indication of consumption on each phase to show on the display by flashing indicator. The absence of consumption to be indicated by a static indicator.
- The absence of voltage on any phase to be shown by the indicator being switched off.
- Display Mode Indicator.
- Display Quantity Labels.
- Pulse Output for field testing of Meter shall be available optically.
- The battery shall be able to display all the quantities selected for normal mode display during power supply failure through use of push button.
- The meter shall have forward and reverse scroll capability.

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:

- Demand Time interval (10, 15, 30, 60 minutes).

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- Demand resets shall be configured for automatic resets on a preset date to override the manual reset.
- The meter shall have non-volatile EEPROM memory.
- Once programmed the meter shall be re-programmable as a new meter with all reading/registers reset to zero (0).
- Meter programming shall be Windows based.
- An Optical Communication Port shall be provided on the meter cover and shall either be IEC 62056-21 (latest edition) or ANSI C12.18 Type II compliant.

8.0 Peripheral Devices

8.1 Hand Held Unit HHU (Optional)

- Meter shall be equipped with RF-Module.
- The communication range for RF-Module shall not be less than 30 meters (line of sight).
- HHU should have a radio frequency unit must be built-in, that shall collect meter reading from the meter to the HHU.
- The operating frequency for RF-Module should be 433 MHz.
- Complete data present in the meter shall be transferable to HHU using RF interface.
- The HHU software must convert the data to a format that could be transferred to SAP ISU.
- The HHU should be multi vender compliant.

8.2 HHU Software

The HHU software shall be Windows based and would be supplied free of cost. It would have following (but not limited to) features.

- Monitoring / reading of all registers
- Diagnostic / troubleshooting / time setting / configuration
- RF interface for wireless meter communication
- SAP-ISU interface for uploading meter data & down loading MROs.

The software shall be a user friendly, menu driven. The software shall have provisions to create user and configure different access levels for the user.

8.3 Optical Probe

The optical probe shall be used to transfer data to and from the meter. The probe shall have an optical head on one end to interface with the meter and a USB connector on the other end to connect directly with the PC. The communication through optical probe shall conform to protocol IEC-62056-21 (latest edition) Data Exchange for Meter Reading, Rate and Load Control.

8.4 Support System Requirements for Meter Software

The meter software shall be Windows NT/2000/XP based and would be supplied free of cost. It would have following (but not limited to) features.

- Monitoring / reading of all registers.
- Diagnostic / troubleshooting / setting / configuration.
- Configuring the meter shall be controlled locally via access code/password.

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➤ HHU interface.

The software shall be a user friendly, menu driven. The software shall have provisions to create user and configure different access levels for the user.

9.0 Type Test

9.1 The type tests are intended to verify compliance of the characteristics of the meter with the relevant requirements of this specification. In case of any change of internal component in the currency of contract the type test shall be carried out a fresh. The tests shall be carried out at an independent Laboratory in the presence of KE engineers from R&D & Meter Departments. All expenditure regarding air ticket, boarding, lodging etc. shall be borne by the bidder. Criteria of selection of samples and acceptance / rejection shall be as per relevant IEC.

Following type tests shall be carried out on kwh, kvarh & kw meters as per IEC-62052-11 and other relevant IECs (latest edition).

9.1.1 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.

9.1.2 Test of climate influence:

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

9.1.3 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.

9.1.4 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.

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9.1.5 Tests of Accuracy requirements for kwh & kvarh meter parts as per IEC 62053-21 (latest edition) and IEC 62053-23 (latest edition) where applicable:

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

10.0 Name and Rating Plate

10.1 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.
- Number of phases and number of wires.
- Nominal and maximum current, nominal voltage and frequency.
- Accuracy class.
- Meter constant.
- KE P.O. No.
- KE Meter No. and year of manufacturer.
- KE property, not for sale.
- Display sequence should be printed on nameplate.
- SAP item code no.

11.0 Packing

Each meter shall be individually packed in thermo pore packing or thermo pore lined packing, covered with adhesive tape at joints or plastic strips etc.

The packing shall be strong enough to withstand rigors of ocean, rail, road etc.

12.0 Sample

At least three number samples of meter shall be submitted with the bid.

13.0 Pre-Shipment Inspection

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

13.1 Routine Tests

Following routine tests shall be carried out on kwh, kvarh & kw meters as per respective IECs by the manufacturer:

- Accuracy Test.
- Running with no load test.
- Starting current test.

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- Insulation resistance test.

13.2 Sample Tests (Electrical)

13.2.1 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

13.2.2 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.
- Fast transient burst test.
- Influence of harmonics test.
- DC and even harmonics test.
- Dry Heat Test at 80°C.

13.2.3 The lot shall be accepted if all the meters qualify in the tests described in clause 13.2.1 & 13.2.2 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 13.2.1 & 13.2.2 above. If any one meter fails in any of the above tests the whole lot shall be rejected.

13.3 Sample Tests (Mechanical)

13.3.1 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:

Sr. No.	Description	Nos. of Meters
1.	Test of protection against penetration of dust and water.	Two meter
2.	Dimensional Check.	One meter.

The lot shall be accepted if meters qualify the above tests in clause 13.3.1. 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.

13.4 Verification Test of Functionality of Software

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13.4.1 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.

13.5 The remaining type tests not performed on the above samples shall be carried out (as per recommended sequence of IEC 62052-11 (latest edition) 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.

14.0 Inspection Procedure for Local Manufacturers

14.1 Routine Tests

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

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

14.2 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:-

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

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

- o Starting Current Test
- o Running with No Load Test (Creep Test)
- o Accuracy Test

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

- o Fast Transient Burst Test
- o Surge Immunity Test

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o Electrostatic Discharge Test

(ii) Sample Test (Mechanical)

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

o Impact Test

o Tin Coating Test

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

o Dimensional Check

o Shock and Vibration Test

o Rain Fall Test

14.3 Acceptance Criteria

a) Electrical Test

- The lot shall be accepted if one meter fails in any one of the tests described in clause 14.2 (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

If any meter fails in any test during re-sampling, the entire lot shall be rejected.

- 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 14.2 (ii)
- 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.

14.4 Verification Functionality Test of Software

14.4.1 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.

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15.0 Warranty

The supplier shall provide two years warranty for the successful operation and replacement free of cost.

16.0 Training

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

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Specification

Three Phase Direct Online TOU Static Energy Meters 5 KW & Above (Accuracy Class-1)

17. 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.

18. LIST OF DISPLAY ITEMS IN TOU METER NORMAL MODE

18.1 Normal Mode (Same items shall be displayed during power outage)

All Segment Check

1. Meter ID.
2. Date.
3. Time.
4. Present tariff A kWh.
5. Present tariff B kWh.
6. Present tariff A Max. kW.
7. Present tariff B Max. kW.
8. Previous tariff A Max. kW.
9. Previous tariff B Max. kW.
10. Error Code.

Alternate Mode:

All Segment Check

1. Meter ID.
2. Date.
3. Time.
4. Present total kWh.
5. Present tariff A kWh.
6. Present tariff B kWh.
7. Present total kvarh.
8. Present tariff A kvarh.
9. Present tariff B kvarh.
10. Present tariff A Max. kW.
11. Present tariff B Max kW.
12. Previous tariff A Max. kW.
13. Previous tariff B Max. kW.
14. Instantaneous kW.
15. Phase A Voltage.
16. Phase B Voltage.
17. Phase C Voltage.
18. Phase A Current.
19. Phase B Current.
20. Phase C Current.
21. Power Factor.
22. Frequency.
23. Error Code.

NOTE:

Display items in Normal & alternate mode are programmable. Normal mode shall be print on nameplate of meter. Number of rate will be applicable as defined by KESC.

Shahid Zaheer
GM (Meters)

Muhammad Akram Siddiqui
GM (AMR)

Syed Munawar Uddin
GM (R&D)

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**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

62052-11: Electricity metering equipment (AC).
(latest edition) General requirements, tests and test conditions Part-11: Metering equipments.

62053-21 Electricity metering equipment (AC).
(latest edition) Particular requirements Part-21: Static meters for active energy (clauses 1 & 2).

62053-23 Electricity metering equipment (AC).
(latest edition) Particular requirements Part-23: Static meters for reactive energy (clauses 2 & 3).

2. Electrical Testing Standards

a. IEC

60038: IEC standard voltages.
(Latest edition) 50(301, 302, 303) : 1983, International Electro technical Vocabulary (IEV) Chapter 301: General terms on measurements in electricity. Chapter 302: Electrical measuring instruments. Chapter 303:Electronic measuring instruments.

60060-1: High voltage test techniques.
(Latest edition)

60085: Thermal evaluation and classification of electrical insulation.
(Latest edition)

61000-4-2: Electromagnetic compatibility (EMC)-Part 4: Testing &
(Latest edition) measurement techniques-section 2: Electrostatic discharge immunity test.

61000-4-3: Electromagnetic compatibility (EMC) – Part 4-3: Testing &
(Latest edition) measurement techniques-section 2: Radiated radio frequency electromagnetic field immunity test.

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

CISPR22: Information technology equipment-Radio disturbance
(Latest edition) characteristics-limits & methods of measurement.

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3. Mechanical Testing Standards

a. IEC

60529: Degrees of protection provided by enclosures (IP code).
(Latest edition)

60695-2-11: Fire hazard testing, Part 2-11: Glowing/hot wire based test methods.
(Latest edition)

60817: Spring operated impact test apparatus and its calibration.
(Latest edition)

4. Environmental Standards

a. IEC

60068-2-1: Environmental testing, Part 2: Tests. Tests A: Cold.
(Latest edition)

60068-2-2: Basic environmental testing procedures, part 2: Tests. Tests B: Dry Heat.
(Latest edition)

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

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

60068-2-11: Basic environmental testing procedures, part 2: Tests. Test Ka: Salt mist.
(Latest edition)

60068-2-27: Basic environmental testing procedures, part 2 : Tests. Test Ea and guidance: Shock.
(Latest edition)

60068-2-30: Basic environmental testing procedures, part 2: Tests. Test Db and guidance: Damp heat, cyclic (12 + 12-hour cycle).
(Latest edition)

60721-1: Classification of environmental conditions. Part 1: Environmental parameters and their severities.
(Latest edition)

60721-2-1: Classification of environmental conditions. Part 2: Environmental conditions appearing in nature. Temperature and humidity.
(Latest edition)

60721-2-4: Classification of environmental conditions. Part 2: Environmental conditions appearing in nature. Solar Radiation and temperature.
(Latest edition)

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Schedule of Technical Data

For Three Phase Direct Online Static Energy Meters 5KW & Above
(Accuracy Class-1)

A. General

- a) Bidder's name & Address
- b) Manufacturer's name & Address.
- c) Manufacturing Experience

B. Energy Meters

- 1. Model No. / Type
- 2. Basic current
- 3. Maximum current
- 4. Minimum starting current at ref. Voltage & ref. Frequency
- 5. Operating voltage
- 6. Overload capacity
- 7. Accuracy class
 - i. kWh Meter
 - ii. MDI
 - iii. kvarh
- 8. No. of elements
- 9. Detail of:
 - i. kWh part
 - ii. MDI part
- 10. Losses in
 - i) Potential Ckt
 - ii) Current Ckt
- 11. Encapsulation Details
 - i) Current Sensor
 - ii) Class of Insulation
- 12. Max. current that meter can withstand during short circuit for 0.5 second.
- 13. Dielectric strength
 - i) Impulse Voltage
 - ii) C test Voltage
- 14. Insulation resistance of meter.
- 15. Material of:
 - a. Base
 - b. Cover
 - c. Security Box
 - d. Terminal Block
 - e. Terminals

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- f. Printed Ckt Board
(All the above shall be indicated on drawings to be supplied with the bid.)
16. Temperature rise of meter
17. Type of terminals
18. Centre to centre clearance between different phases
- a. Creepage Distance
- b. Clearance
19. Whether the meter is compliant to the reference standards for testing mentioned in Annex -I of the specs.
20. Whether the meter have the following characteristics:
- a. Basic data recording and storage; (as per clause 7.1 of the spec.), give details.
- b. Security Features, Events recording and Diagnostics; (as per clause 7.2 of the spec.), give details.
- c. Display (as per clause 7.3 of the spec.), give details.
- d. Back-up Battery; (as per clause 7.1.3 of the spec.), give details.
- e. Meter Programming, Software and Security; (as per clause 7.4 of the spec.) give details.
21. Operating ambient temp. range.
- a. Specified Operating Range
- b. Limit Range of Operation (Extreme Condition)
- c. Limit range for storage and Transport
22. Size & No. of digit of LCD Display.
23. Whether meter have the upgrade ability option for AMR.
24. What is the sampling rate.
25. IP class of meter
26. No. of digits for following features;
- i) kWh
- ii) kvarh
- iii) Demand kW
- iv) Cumulative kW
- v) No. of Reset digits
27. What values / readings are controlled through resetting device?
28. Detail of resetting device with sealing arrangement (give drawing).
29. Min. No. of rate/rates for

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which the rate register can be programmed for:

- kWh
- kvarh
- kW

30. Effect of external magnetic field as per IEC 62053-21.
31. Effect of Radio frequency signals.
32. Effect of Influence of DC and Even Harmonics as per IEC 62053-21.
33. Effect of other Influence Qty. as per IEC
34. Type of Meter Memory
35. Storage capacity of memory
36. Time to retain the memory
37. In case of error in register
Which types of checks are Provided which automatically Identifies the error.
38. Meter Clock:
 - a) Source of operation of Built in clock.
 - b) Effect of variation of Frequency of source
 - c) Source of operation of Clock in case of power outage.
 - d) If battery is used what Is the life of battery.
 - e) Period / life for which the battery can supply power continuously to check and register prior to its discharge below 25%.
 - g) No. of programmable dates to account for holidays and week ends.
39. The Meter Programming/Reading Software is Windows
40. Name / Rating Plate;
Detail of information given on Name Plate
41. Attachments
Whether the following material has been attached;
 - a. Accuracy Curves
 - b. Drawings of meter showing dimensions, mounting details etc.
42. Bidders / manufacturers have to supply all relevant drawings & technical literature duly marked.

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43. Details of the deviations of the offered equipment from specification (use separate sheet if required).

Signature & Seal of

Bidder / Manufacturer

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Amendment No. 01

(January 30, 2015)

Following clauses have been revised , other text of the clauses shall remain same.

6.0 Electrical Requirements

6.3 Voltage Range

Limit range of operation From 0.000 to 1.9 of ref. voltage

7.1.3 Back-up Battery

➤ The battery shall be welded, brazed or Soldered

(Revised Text)

7.2.1 Security Features

Every meter shall have a unique Sr. No. in its memory which can be displayed , the meter Sr. No shall be three Alpha and Four Numeric e.g. (ABC12345)

(Revised Text)

8.0 Peripheral Devices

8.1 Stands Deleted

8.2 Stands Deleted

8.4 Support System Requirements for Meter Software

➤ HHU interface (Stands Deleted)

(Revised Text)

8.4 Support System Requirements for Meter Software

A PC with meter software which shall be Windows NT/2000/XP based and would be supplied free of cost. It would have following (but not limited to) features.

➤ HHU interface (Stands Deleted)

(Revised Text)

10.0 Name & Rating Plate

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

- Month and year of Warranty Expiry

(Revised Text)

11.0 Packing

Catalogue having following feature are to be provide with each meter

- i) Meter Technical Data
- ii) Normal Mode Display
- iii) Alternate Mode Display
- iv) Error & Caution Code with explanation
- v) Installation instruction

Any additional information as deemed necessary by the manufacturer may also be provided

(Revised Text)

18. LIST OF DISPLAY ITEMS IN TOU METER NORMAL & ALTERNATE MODE

18.1 Normal Mode (Same items shall be displayed during power outage)

All Segment Check

All segment check

- 01 Meter ID
- 02 Date
- 03 Time
- 04 Present Total KWh
- 05 Present Tariff T1 KWh
- 06 Present Tariff T2 KWh
- 07 Present Tariff T1 Max. KW
- 08 Present Tariff T2 Max. KW
- 09 Previous Tariff T1 Max KW
- 10 Previous Tariff T2 Max KW
- 11 Instantaneous Power Factor
- 12 Error & Caution Codes.

T1 & T2 Timings are “ T1= 2230 to 1830 Hrs & T2=1830 to 2230 Hrs”

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Alternate Mode:

All Segment Check

1. Meter ID.
2. Date.
3. Time.
4. Present Total (T) KWh.
5. Present Tariff T1 KWh.
6. Present Tariff T2 KWh.
7. Present Total (T) Kvarh.
8. Present Tariff T1 Kvarh.
9. Present Tariff T2 Kvarh.
10. Present Tariff T1 Max. KW.
11. Present Tariff T2 Max. KW.
12. Previous Tariff T1 Max. KW.
13. Previous Tariff T2 Max. KW.
14. Instantaneous KW.
15. Phase A Voltage.
16. Phase B Voltage.
17. Phase C Voltage.
18. Phase A Current.
19. Phase B Current.
20. Phase C Current.
21. Power Factor.
22. Frequency.
23. Error Code.

Voltage & Current values are to be displayed with phase identifications.

NOTE: Display items in Normal & alternate mode are programmable. Normal mode shall be print on nameplate of meter. Number of tariff rates will be applicable as defined by KE

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Schedule of Technical Data

For Three Phase Direct Online Static Energy Meters 5KW & Above
(Accuracy Class-1)

(Revised Text)

13. Dielectric strength
- ii) One minute power frequency

(Revised Text)

26. No. of digits for following features;
- iv) stands Deleted.
v) stands Deleted

27. Stands Deleted

28. Stands Deleted

Following new Clauses/Sub-Clauses have been added in the specification.

5.3.5 Meter Security Box

- i) Printing of Meter Serial No. on the inside of front cover and back plate of meter security box shall be in the same font, size and Style

7.2.1 Features

- Fourth CT is to be provided on neutral for Shunt detection.
- Meter should record energy consumption in absolute sum i.e. Energy should always be recorded in forward direction.

7.2.2 Security Features

- Shunt in meter is also to be recorded as an event.

7.3 Display

- Displayed meter Sr. No shall be three Alpha and Five Numeric e.g. (TAZ12345)

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7.3.1 OPENED indication is to be displayed permanently when ever meter cover is opened however all billing data is to be displayed through forward/reverse push buttons in this condition.

7.3.2 Following indications are to be provided in meter display.

- i) “Norm” for Normal Mode
- ii) “Alt” for Alternate Mode
- iii) “Test” for Test Mode

7.3.4 Codes for the following Errors are to be provided in meter display to diagnose the healthiness of meter

- i) Low Battery
- ii) Meter is un-programmed
- iii) RAM Error
- iv) ROM Error
- v) EEPROM Error
- vi) A/D Chip Error
- vii) Meter parameterization Error

Any additional Error codes as deemed necessary by the manufacturer may be provided

7.3.5 Codes for following cautions are to be provide in meter display, caution codes shall be automatically removed from meter display when normal condition has been restored.

- i) Reverse Active Energy
- ii) Reverse Reactive Energy
- iii) By pass (shunt in meter)
- iv) Reverse Phase Sequence
- v) Demand Overload
- vi) Phase Failure
- vii) Time not set
- viii) Under voltage
- ix) Over voltage
- x) Over current

Any additional Caution codes as deemed necessary by the manufacturer may be provided

7.3.6 Test Mode is to be used for testing of meters with the help of following data in Test Mode:

- Timer (05 Minutes : Starting from 5 and moving in reverse , should stop at zero)
- KWh (up to two decimal places) recorded during 05 minute interval
- Kvarh (up to two decimal places) recorded during 05 minute interval
- KWh (up to two decimal places) recorded during 05 minute interval

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All above quantities should start recording with the start of timer and should stop with the stop of the timer. The KW/KWh/Kvarh recorded during testing period must also be recorded in the absolute billing data.

7.4.1 Software Demonstration

The bidder shall demonstrate the software features, event logs ,Error/Caution Codes, Test mode operation of their offered meters in Meter Department lab during the process of technical evaluation.

9.0 Type Test

9.1.6 Selection of samples and type testing criteria shall be as per KE SOP K/D/R&D/500/2011 Rev (01) dated October 15, 2011

9.1.7. All samples meters selected for type testing shall have three (03) decimal places in KW & KWh for verification of reading required for certain type tests.

9.1.8. Following details as mentioned below are to be provided before proceeding for type testing. Duly signed and stamped by the manufacturer.

a) Component list:

- i) Component Name
- ii) Part Number
- iii) Top Marking
- iv) Manufacturer Name
- v) Country of Origin
- vi) Grade (Commercial, Industrial etc)

b) Drawings

- i) Meter Security Box
- ii) Meter housing
- iii) Meter ID plate Printed
- iv) Meter Sealing Strip
- v) Terminal Block
- vi) Current Terminal Blade
- vii) Current Terminal
- viii) Rag bolt nut & washer
- ix) Cardboard packing box
- x) Screw for current terminal fixing
- xi) Screw for PCB assembly to current blade fixing

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c) Photographs

- i) All components as per attached list
- ii) Meter front view
- iii) Meter Base Assembly
- iv) PCB front view
- v) PCB rear view
- vi) Meter ID plate
- vii) Meter Packing Box

9.1.9 After successful completion of type test, at the time of conducting remaining type tests as described in Clause 7.2 & sub-clause 7.2.1 at manufacturer’s works, components and drawings verification test as per list of components and drawings provided by manufacturer would also be carried out.

If the list of components list and drawings has any deviation with that of the type tested meter, than the type tests would be considered null and void.

14.0 Inspection Procedure For Local Manufacturers

14.2 Sample Test

(iii) Verification of components

Out of the 8 meters selected for electrical tests, one meter would be subjected to verification of components as per detail provided in clause 8.1.8 duly verified by TPRE & MTD

13.3 Acceptance Criteria

c) Verification of components

If one meter subjected to verification of components test as per clause 13.2 fails, all meters offered against that particular inspection call would be considered as Failed & stand out rightly rejected.

7.4.2 Meter main cover open indication “OPENED” to be displayed along with all billing data.

19.0 List of Components used in manufacturing of meters having following information to be provided

- a) Part Name
- b) Manufacturer’s Name
- c) Country of Origin
- d) Model No / Type
- e) Rating

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Amendment No. 02

(July 01, 2016)

Following clauses have been revised/added, other text of the clauses shall remain same.

(Original Text)

7.2 Security Features, Event Recording and Diagnostics:

7.2.1 Features

- The No. of times programmed and the identification of the last programmer along with Date & Time stamp 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.
- Meter shall keep on recording/ operating as long as voltage exists on any two terminal of the meter with or without neutral.
- Fourth CT is to be provided on neutral for Shunt detection.

(Revised Text)

7.2 Security Features, Event Recording and Diagnostics:

7.2.1 Features

- The No. of times of data retrieved and the identification of the last data retriever along with Date & Time stamp shall be reported/ displayed.
- Deleted.
- At-least a level of access/security codes/password shall be provided to retrieve meter data.
- Meter shall keep on recording/ operating as long as voltage exists on any two terminals out of the available four voltage terminals (i-e Red, Yellow, Blue and Neutral) of the meter.
- CTs or Shunt assembly units shall be provided on phases and neutral for Shunt detection to achieve required features.

(Original Text)

7.3.6 Test Mode is to be used for testing of meters with the help of following data in Test Mode:

- Timer (05 Minutes : Starting from 5 and moving in reverse , should stop at zero)
- KWh (up to two decimal places) recorded during 05 minute interval
- Kvarh (up to two decimal places) recorded during 05 minute interval

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- KWh (up to two decimal places) recorded during 05 minute interval

All above quantities should start recording with the start of timer and should stop with the stop of the timer. The KW/KWh/Kvarh recorded during testing period must also be recorded in the absolute billing data.

(Revised Text)

7.3.6 Test Mode is to be used for testing of meters with the help of following data in Test Mode:

- Timer (05 Minutes : Starting from 5 and moving in reverse , should stop at zero)
- KW (up to two decimal places) recorded during 05 minute interval
- KWh (up to two decimal places) recorded during 05 minute interval
- Kvarh (up to two decimal places) recorded during 05 minute interval

All above quantities should start recording with the start of timer and should stop with the stop of the timer. The KW/KWh/Kvarh recorded during testing period must also be recorded in the absolute billing data.

(Original Text)

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:

- Demand Time interval (10, 15, 30, 60 minutes).
- Demand resets shall be configured for automatic resets on a preset date to override the manual reset.
- The meter shall have non-volatile EEPROM memory.
- Once programmed the meter shall be re-programmable as a new meter with all reading/registers reset to zero (0).
- Meter programming shall be Windows based.
- An Optical Communication Port shall be provided on the meter cover and shall either be IEC 62056-21 (latest edition) or ANSI C12.18 Type II compliant.

(Revised Text)

7.4 Meter Programming, Software and Security

The following features shall be programmed in the meter as a minimum along-with other features that may be provided. There should be no option/provision of change/write in program/configuration in the meter via optical port:

- Demand Time interval (30 minutes).
- Demand resets shall be configured for automatic resets on a preset date to override the manual reset.
- The meter shall have non-volatile EEPROM memory.

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- Deleted
- Meter programming shall be Windows based.
- An Optical Communication Port shall be provided on the meter cover and shall either be IEC 62056-21 (latest edition) or ANSI C12.18 Type II compliant.

(Original Text)

8.3 Optical Probe

The optical probe shall be used to transfer data to and from the meter. The probe shall have an optical head on one end to interface with the meter and a USB connector on the other end to connect directly with the PC. The communication through optical probe shall conform to protocol IEC-62056-21 (latest edition) Data Exchange for Meter Reading, Rate and Load Control.

(Revised Text)

8.3 Optical Probe

The optical probe shall be used to transfer data from the meter. The probe shall have an optical head on one end to interface with the meter and a USB connector on the other end to connect directly with the PC. The communication through optical probe shall conform to protocol IEC-62056-21 (latest edition) Data Exchange for Meter Reading, Rate and Load Control.

(Original Text)

14.2 Sample Test

- (ii) Sample Test (Mechanical)
 - (a) Following tests be performed on each of two meters already selected:
 - o Impact Test
 - o Tin Coating Test
 - (b) Following tests be performed on three meters selected randomly from offered lot. Dimensional check be performed on one meter remaining two tests be performed on both the meters:
 - o Dimensional Check
 - o Shock and Vibration Test
 - o Rain Fall Test

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(Revised Text)

14.2 Sample Test

- (ii) Sample Test (Mechanical)
 - (a) Following tests shall be performed on each of two meters already selected from offered lot as below:
 - Dimensional Check
 - Shock and Vibration Test
 - Terminal strip operation test (to verify the requirements as per clause 5.3.4)
 - Rain Fall Test
 - Opened indication verification test (test shall be performed by opening/removing polycarbonate cover of meter)
 - Impact Test (on polycarbonate meter cover)
 - Tin Coating & copper purity test for copper plates (as per clause 5.4)
 - (b) (Stand deleted)

(Original Text)

7.3 Display

7.3.1 OPENED indication is to be displayed permanently when ever meter cover is opened however all billing data is to be displayed through forward/reverse push buttons in this condition.

(Revised & Additional Text)

7.3 Display

- The first three Alpha digits of LCD display shall be of 14 segments.
- 7.3.1 “OPENED” indication is to be displayed permanently when ever meter polycarbonate cover is opened however all billing data is to be displayed through forward/reverse push buttons in this condition.

(Original Text)

15.0 Warranty

The supplier shall provide two years warranty for the successful operation and replacement free of cost

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(Revised and additional Text)

15.0 Warranty

- 15.1 The supplier shall provide two years warranty for the successful operation and new replacement free of cost.
- 15.2 All under warranty replaced meters will be subjected to routine sample test as per procedure.
- 15.3 The warranty period shall restart from the month / year, when the replaced meter is offered for sample/routine testing or supplied.
- 15.4 Vendor will be responsible to collect the Faulty Meter and deliver the replaced meter free of cost.
- 15.5 Replacement of meters shall be provided within 45 days after intimation.
- 15.6 The meter serial number and PO number shall be same for replaced meter (as of faulty meter) and all billing data shall be “Zero”

(Original Text)

7.1.3 Back-up Battery

- Storage life of Battery shall be more than 15 years.

(Revised and additional Text)

7.1.3 Back-up Battery

- The life of battery shall be more than 15 years, if it is not providing power to LCD/RTC.
- The manufacturing date of battery shall not be more than one year from the date of inspection call/delivery.
- The manufacturer/bidder shall provide the test reports/ technical details/documents/data sheets confirming quality of offered battery as per requirements of this specification.

Following new Clauses/Sub-Clauses have been added in the specification.

10.0 Name & Rating Plate

- The notice “**Breaking Seals or Tempering of Meter is an Offence**” shall be embossed or printed on front of meter polycarbonate cover/rating plate (with sticker on inside surface).

20.0 Life of energy Meter:

- 20.1 The energy meter shall be designed for satisfactory performance in conditions as defined in clause 4.0 & 5.0 of this specification for upto 10 Years (minimum).

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21.0 LCD Display & Real Time Clock (RTC):

- 21.1 The manufacturer shall ensure that the RTC/LCD display (without utility power of 6 hrs daily) shall be maintained for entire life of energy meter.
- 21.2 In case of failing to meet above said parameters/requirements, the manufacturer shall replace the faulty energy meter with new one free of cost during entire life of energy meter.

22.0 Type Test Validity & Requirements:

- 22.1 The validity of type test shall be 03 years from the date of issuance of type test report.
- 22.2 The manufacturer has to declare the process of development of prototype meters along with the details of components (mentioning description, make/model origin etc) and manufacturing (foreign or locally) to KE before development prototype meters for type testing.
- 22.3 The prototype meters shall be developed in the presence of designated KE engineers and all processes will be explained and recorded. The same process will be followed for mass production of energy meters and will be verified by KE engineers during sample/routine testing.
- 22.4 In case of change of components or change in design, following type tests shall be performed and categorize as:
 - 22.4.1 Category 1
 - 22.4.1.1 Due to change in manufacturer and design of following components, complete prototype testing will be performed as per requirements of this specification at any independent lab of world repute under the witnessing of KE engineers.
 - i. Micro controller unit (MCU)
 - ii. Digital signal processor (DSP)
 - iii. EEPROM
 - iv. Voltage regulator
 - v. Metal oxide varister (MOV)
 - vi. Printed circuit board (PCB)
 - vii. Clock oscillator
 - viii. Current transformer (CT)
 - ix. Potential transformer (PT)
 - x. Liquid crystal display (LCD)
 - xi. Modem
 - 22.4.2 Category 2
 - 22.4.2.1 Due to change in the assembly location codes of the following components without change of model, design & manufacturer, following tests shall be performed as per requirements of this specification at any independent lab of world repute under the witnessing of KE engineers
 - i. Micro controller unit (MCU)

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- ii. Digital signal processor (DSP)
- iii. EEPROM
- iv. Voltage regulator
- v. Metal oxide varistor (MOV)
- vi. Printed circuit board (PCB)
- vii. Clock oscillator
- viii. Current transformer (CT)
- ix. Potential transformer (PT)
- x. Liquid crystal display (LCD)

22.4.2.1.1 Detail of tests

- i. Impulse voltage test
- ii. AC voltage test
- iii. Accuracy test
- iv. Test of meter constant
- v. Test of starting condition
- vi. Test of non-load condition
- vii. Test of single phase load
- viii. Ambient temperature variation
- ix. Variation of voltage test
- x. Variation of frequency test
- xi. Reverse phase sequence
- xii. Unbalance voltage
- xiii. 5th harmonic contents in the current and voltage circuit
- xiv. Odd harmonics in the AC current circuit
- xv. Sub-harmonics in the AC current circuit
- xvi. Continuous magnetic induction of external origin 0.5 mT
- xvii. Test of power consumption
- xviii. Test of influence of supply voltage
- xix. Test of influence of short time over current
- xx. Test of influence of self heating
- xxi. Test of influence of heating
- xxii. Fast transient burst test
- xxiii. Test of immunity of electrostatic discharge
- xxiv. Surge immunity test

22.4.3 Category 3

22.4.3.1 Due to change in design, model & manufacturer of backup battery, contractor/relay following tests shall be performed as per requirements of this specification at any independent lab of world repute under the witnessing of KE engineers

- i. Short time over current
- ii. Test of temperature influence of extreme condition
- iii. AC voltage test
- iv. Impulse voltage test
- v. Mechanical endurance test
- vi. Electrical endurance test

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- vii. VA drop in current circuit
- viii. Surge immunity test

22.4.4 Category 4

22.4.4.1 Due to change in the approved design and model of following components, following tests shall be performed as per requirements of this specification at any independent lab of world repute under the witnessing of KE engineers

22.4.4.1.1 List of Mechanical Components

1. **Poly carbonate cover**
2. **Base plate**
3. **Sliding security strip**
4. **Current terminate & screws**
5. **Pressure plate**
6. **Terminal block**
7. **Nameplate**
8. **Load seals**
9. **Eye rag bolts**
10. **All types of electrical connection cables**
11. **Packing material**

1. **Poly carbonate**

- i. Dimensional test
- ii. Penetration of water and dust test
- iii. Spring hammer test
- iv. Heat and fire test
- v. Impact test

2. **Base plate**

- i. Dimensional test
- ii. Heat and fire test

3. **Sliding security strip**

- i. Dimensional test
- ii. Heat and fire test

4. **Current terminal and screws**

- i. Dimensional test
- ii. Thickness & coating tests
- iii. Conductivity test

5. **Pressure plate**

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- i. Dimensional test
- ii. Thickness of coating tests
- iii. Conductivity test

6. Terminal block

- i. Dimensional test
- ii. Deflection test (ISO 75)
- iii. Heat & fire test

7. Nameplate

- i. Dimensional test
- ii. Solar radiation test
- iii. Visual inspection

8. Lead seals

- i. Visual inspection
- ii. Material test

9. Eye rag bolts

- i. Dimensional test
- ii. Material test

10. All types of electrical connected cables

- i. Visual / dimensional test
- ii. Conductivity test

11. Packing material

- i. Visual / dimensional test
- ii. Quality assurance as per sample

23.0 Printing of KE number/Meter Number:

23.1 Printing of KE number/Meter number should be of same patter (without hyphen “-“sign and space) as on LCD display ATB, Terminal strip and back side of meter.

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Amendment No. 03

(July 31, 2017)

Following clauses have been revised / added; other text of the clauses shall remain same.

(Original Text)

7.1.3 Back-up Battery

- The life of battery shall be more than 15 years, if it is not providing power to LCD/RTC.

(Revised & Additional Text)

7.1.3 Back-up Battery

- The shelf life of battery shall be more than 15 years.
- The minimum battery capacity shall be 1600 mAh (More than one batteries can be used but their cumulative capacity should not be less than 1600 mAh).
- To check/test the healthiness of batteries installed in energy meters, batteries shall be checked/tested through battery analyzer / battery healthiness test equipment to check the initial voltage level of battery with 10 mA load for four second duration for activated batteries and then after to verify that if the battery retain its voltage level after removal of the load according to data sheet provided by battery manufacturers.
- The KE inspection team shall check/test the batteries as per above and sampling shall be done as per clause 14.2 (ii) (a) above.

(Original Text)

9.0 Type Test

- 9.1 The type tests are intended to verify compliance of the characteristics of the meter with the relevant requirements of this specification. In case of any change of internal component in the currency of contract the type test shall be carried out a fresh. The tests shall be carried out at an independent Laboratory in the presence of KE engineers from R&D & Meter Departments. All expenditure regarding air ticket, boarding, lodging etc. shall be borne by the bidder. Criteria of selection of samples and acceptance / rejection shall be as per relevant IEC.

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(Revised Text)

9.0 Type Test

9.1 The type tests are intended to verify compliance of the characteristics of the meter with the relevant requirements of this specification. In case of any change of internal component in the currency of contract the type test shall be carried out a fresh. The type tests shall be carried out at KEMA, CESI or any equivalent independent Laboratory. Type tests shall be performed under the witnessing of KE TPRE & Meter departments engineers (if required) and same will be decided during technical evaluation process.

(Additional Text)

11.0 Packing

The packed energy meters shall be supplied in form of bundle (wrapped), comprising of 05 Meters in one bundle in sequence number.

(Original Text)

14.2 Sample Test

(ii) Sample Test (Mechanical)

(a) Following tests shall be performed on each of two meters already selected from offered lot as below:

- Dimensional Check
- Shock and Vibration Test
- Terminal strip operation test (to verify the requirements as per clause 5.3.4)
- Rain Fall Test
- Opened indication verification test (test shall be performed by opening/removing polycarbonate cover of meter)
- Impact Test (on polycarbonate meter cover)
- Tin Coating & copper purity test for copper plates (as per clause 5.4)

(Revised Text)

14.2 Sample Test

(ii) Sample Test (Mechanical)

(a) Following tests shall be performed on each of two meters already selected from offered lot as below:

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- Dimensional Check
- Shock and Vibration Test
- Terminal strip operation test (to verify the requirements as per clause 5.3.4)
- Rain Fall Test
- Opened indication verification test (test shall be performed by opening/removing polycarbonate cover of meter)
- Impact Test (on polycarbonate meter cover only)/As per WAPDA practices
- Tin/Nickel Coating/plating
- Battery healthiness test

(Original Text)

15.0 Warranty

- 15.1 The supplier shall provide two years warranty for the successful operation and new replacement free of cost.
- 15.5 Replacement of meters shall be provided within 45 days after intimation.
- 15.6 The meter serial number and PO number shall be same for replaced meter (as of faulty meter) and all billing data shall be “Zero”

(Revised & Additional Text)

15.0 Warranty

- 15.1 The supplier shall provide three years warranty for the successful operation and new replacement free of cost with Zero “00”reading.
- 15.5 Replacement of meters shall be provided within 30 days after intimation.
- 15.6 The new serial number shall be provided for the under warranty claimed energy meters (Different than previous), however, PO number shall be same for replaced meter (against warranty).
- 15.7 The percentage of under warranty meters should not be more than 0.5% of total quantity against any PO of any manufacturer.

(Original Text)

20.0 Life of energy Meter:

- 20.1 The energy meter shall be designed for satisfactory performance in conditions as defined in clause 4.0 & 5.0 of this specification for up to 10 Years (minimum).

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(Revised Text)

20.1 *Stands deleted*

(Original Text)

21.0 LCD Display & Real Time Clock (RTC):

21.1 The manufacturer shall ensure that the RTC/LCD display (without utility power of 6 hrs daily) shall be maintained for entire life of energy meter.

(Revised Text)

21.0 LCD Display & Real Time Clock (RTC):

21.1 *(Stands deleted)*

21.2 To maintain RTC, super capacitor shall be installed having capacity to maintain RTC without utility power for at least 07 days. After discharging of super capacitor, the RTC shall automatically shifted on the battery backup.

21.3 To power up RTC, first priority shall be of KE power supply, second shall be super capacitors whereas, third priority shall be battery as back up source.

(Original Text)

22.4.4.1.1 List of Mechanical Components

8. Lead seals

- i. Visual inspection
- ii. Material test

9. Eye rag bolts

- i. Dimensional test
- ii. Material test

(Revised Text)

22.4.4.1.2 List of Mechanical Components

8. Lead seals

- i. Visual inspection
- ii. *Stands deleted*

9. Eye rag bolts

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- i. Dimensional test
- ii. *Stands deleted*

(Additional Clauses)

14.3 Acceptance Criteria

14.3.1 If 20% lots (500 Units each) rejected in offered inspection call quantity, the whole offered inspection quantity (as of inspection call) shall be rejected. For example, if the inspection call is of 10,000 meters and for inspection, it has grouped in 20 lots of 500 energy meters each, the whole offered quantity against inspection call (10,000 units) shall be rejected if 04 lots out of 20 rejected as per criteria set in this specification

24.0 Peak & Off Peak hours (Time of Use) Tariff Programming:

24.1 Following peak & off peak timing and seasons shall be programmed in the three phase meters as:

Peak Timings:

Off-Peak Timings:

- | | |
|---|--|
| <ul style="list-style-type: none"> a) Season – 1, April to October (inclusive) 6:30 PM to 10:30 PM b) Season – 2, November to March (inclusive) 6:00 PM to 10:00 PM | <ul style="list-style-type: none"> Remaining 20 Hours of the day Remaining 20 Hours of the day |
|---|--|

24.2 Maximum Demand Indicator (MDI).

The meter shall be programmed to measure/record Maximum Demand (MDI) for succession period of 30 minutes duration in a month/as per NEPRA ruling.

25.0 Bar code Provision:

25.1.1 Linear Bar Code (code 128) shall be provided (printed or sticker) on Meter Name/rating plate by encoding Unique meter serial no. as **ABC12345** on each energy meter provided by KE. The Numbers of Alpha & Numeric digits may vary as per need & requirement.

25.1.2 The bar code shall be provided on front side of rating plate of meter and on meter box at front side, which should be easily readable by scanner.

25.1.3 The bar code print should have the following properties:

- i) The print quality must be adequate for reading.
- ii) Ink should be UV resistant and should not fade under sunlight.
- iii) A space (quiet zone) of at least 5 mm should be left around the code.

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