PAKISTAN
WATER AND POWER DEVELOPMENT AUTHORITY

SPECIFICATION NO. DDS-50 :2007

3 – PHASE MULTIRATE (TOD / TOU)
SOLID – STATE ENERGY METERS
kWh (CLASS – 1)
kvarh (CLASS – 2)

WAPDA

DISTRIBUTION & STANDARD DEPARTMENT
IEEEP BUILDING FAISAL TOWN, LAHORE.

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PRINTING HISTORY

- First Edition 1995
- Second Edition 1999
- Third Edition 2001
- Fourth Edition 2007

TABLES

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SPECIFICATION

DDS-50:2007

SOLID–STATE, MULTIRATE 3-PHASE, 3 ELEMENT, 4-WIRE ENERGY METERS

(Time of Day "TOD"/Time of Use "TOU" Meters)

0 FOREWORD

0.1 This Specification has been prepared by the Design & Standard 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.

0.4 This specification will supercede the previous specification DDS-50:1995, DDS-50:1999 and DDS-50:2001 with all relevant amendments.

1. SCOPE

1.1 The Specification covers Multi Rate (Time of day) total static (solid state) Poly- phase energy meters capable of measuring MDI–KW, kWh, & kvarh along with other quantities and built-in programmable features mentioned in this specification. The meter shall record and display all these quantities in four programmable TOD periods along with other features mentioned in the specification hereunder.

1.2 This Specification covers:

a) HT type CT & PT operated, 3 phase, 4 wire, 3 element, 3x63.5/110V, 5/10 Amp, 50 Hz, Accuracy Class 1.0 (kWh) and Accuracy Class 2.0 (kvarh) – Energy Meters.

b) LT type CT operated 3 Phase, 4 wire, 3 element, 3x230/400 V, 5/10 Amp, 50 Hz Accuracy Class 1.0 (kWh) and Accuracy Class 2.0 (kvarh) – Energy Meters.

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) element to produce an output proportional to watt-hour.

3.2 MULTI-RATE METER.

Energy meter provided with a number of registers, each becoming operative at specified time intervals corresponding to different tariffs.

3.3 MEASURING ELEMENT

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

3.4 TEST OUTPUT

Device which can be used for testing the meter.

3.5 OPERATIONAL INDICATOR

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

3.6 MEMORY

Element which stores digital information

3.7 NON-VOLATILE MEMORY

Storage device which can retain information in the absence of power

3.8 DISPLAY

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

3.9 REGISTER

Electronic device comprising both memory and display which stores and displays information.

3.10 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.

3.11 VOLTAGE CIRCUIT

Internal connections 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.

3.12 AUXILIARY CIRCUIT

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

3.13 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).

3.14 INDOOR METER

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

3.15 OUTDOOR METER

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

3.16 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.

3.17 COVER

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

3.18 CASE

Comprises the base and the cover.

3.19 PROTECTIVE EARTH TERMINALS

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

3.20 TERMINAL BLOCK

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

3.21 TERMINAL COVER

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

3.22 CLEARANCE

Shortest distance measured in air between two conductive parts.

3.23 CREEPAGE DISTANCE

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

3.24 BASIC INSULATION

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

3.25 BASIC CURRENT (I_n)

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

3.26 MAXIMUM CURRENT (I_{max})

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

3.27 REFERENCE VOLTAGE

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

3.28 REFERENCE FREQUENCY

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

3.29 PERCENTAGE ERROR

Percentage error is given by the following formulas:-

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

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.

3.30 REFERENCE CONDITIONS

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

3.31 ELECTROMAGNETIC DISTURBANCE

Conducted or radiated electromagnetic interference which may effect functionality or metrological operation of the meter.

3.32 RATED OPERATING CONDITIONS

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

3.33 SPECIFIED MEASURING RANGE

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

3.34 SPECIFIED OPERATING RANGE

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

3.35 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.

3.36 STORAGE AND TRANSPORT CONDITIONS

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

3.37 NORMAL WORKING POSITION

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

3.38 THERMAL STABILITY

Thermal stability is considered to be reached when the change in error as a consequence of thermal effects is, during 20 min., 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 Voltage	3x63.5/110 V & 3x230/400 V

4.2 SERVICE CONDITIONS

4.2.1 Temperature Range

Specified Operating Range	-25 Degree C to 60 Degree C
Limit range of Operation (extreme condition)	-25 Degree C to 80 Degree C
Limit range for storage and transport	-25 Degree C to 80 Degree C

4.2.2 Relative humidity may range upto 95% non- condensing.

4.2.3 Altitude: Up to 1000 meter above sea level.

5. MECHANICAL REQUIREMENTS

5.1 GENERAL MECHANICAL REQUIREMENTS

Meters shall be designed and constructed 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, such as thin wire. X-ray film.
- Dust and water proof.
- 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.

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 requirements of IEC-60529 amended to date.

5.3.2 Meter Cover

The cover of meter shall be made of strong metallic/insulating materials with polycarbonate transparent window. Arrangement for MDI resetting knob and optical communication interface shall be provided in the cover/reading window. The joints at window and resetting device shall not allow ingress of thin wire/film or similar objects.

5.3.3 Meter Base

The base of the meter shall either be made of die cast Aluminum Alloy or strong insulating materials.

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 either be tube or pressure plate type to accommodate 5mm dia copper conductor.

5.5 EARTHING CONNECTION ARRANGEMENT

a) If 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.

b) If the base is of metallic/conducting material, the common point of the PCB shall also be electrically connected to the external earth terminal, (which shall be clearly identified by the earthing symbol), as well as to the neutral point of the terminal block.

5.6 TERMINAL BLOCK COVER

A sealable terminal block cover of insulating material shall be provided. 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 and 6 of IEC 60529. For protection against penetration of dust & water the meter shall be IP51 compliant.

6. ELECTRICAL REQUIREMENTS

6.1 STANDARD RATINGS

	HT Type Meter	LT Type Meter
Rated/Max. Current	5/10 Amp	5/10 Amp
Reference Voltage	3x63.5/110V	3x230/400V
Reference Frequency	50 Hz	50 Hz
Accuracy Class	1.0	1.0
Meter Type	3 Phase, 3 Element, 4 Wire, for recording true energy in a 4 wire system with neutral solidly grounded.	

6.2 OTHER ELECTRICAL REQUIREMENTS

Power Losses of voltage Circuits at reference voltage	1.5 W & 8 VA	1.5 W & 8 VA
Current circuit at rated current	2.5 VA	2.5 VA

i) The overall maximum error of the measurement of the power consumption shall not exceed 5%.

ii) The figure of power consumption loss are mean values. Switching power supplies with peak power values in excess of these specified values are permitted, but it should be ensured that the rating of associated voltage transformers is adequate.

Starting current	0.002 In at unity power factor for kWh
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 5 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	6 KV for HT and 8 KV for LT: 1.2/50 micro sec.
Short time Over current	20 times Imax for 0.5 sec.
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 times of reference voltage
Limit range of operation	From 0.7 to 1.3 of reference 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 8.1 of IEC 62053-21, 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**
0.02 In ≤ I ≤ 0.05 In	1	± 1.5
0.05 In ≤ I ≤ I max	1	± 1.0
0.05 In ≤ I ≤ 0.1 In	0.5 Lagging 0.8 leading	± 1.5 ±1.5
0.1 In ≤ I ≤ I max	0.5 Lagging 0.8 leading	±1.0 ± 1.0
0.1 In ≤ I ≤ In	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**
0.05 In ≤ I ≤ I max	1	± 2.0
0.1 In ≤ I ≤ 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 rated current and unity power factor, shall not exceed 1.5%.

6.4.2 Limits of error due to variation of the currents

When the meter is under reference conditions given in clause 8.5 of IEC 62053-23 the percentage errors shall not exceed the limits given in Table III & IV.

TABLE-III

Percentage error limits with balanced loads

Value of Current	Sin Φ (Inductive or capacitive)	Percentage error limits
0.02 In ≤ I <0.05 In	1	± 2.5
0.05 In ≤ I ≤ I max 0.05 In ≤ I <0.1 In	1 0.5	± 2.0 ± 2.5
0.1 In ≤ I ≤ I max	0.5	± 2.0
0.1 In ≤ I ≤ I max	0.25	± 2.5

TABLE-IV

Percentage error limits
(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
0.05 In ≤ I ≤ I max	1	± 3.0
0.1 In ≤ 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 In and sin Φ = 1 shall not exceed 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 8.2 of IEC 62053-21, shall not exceed the limits given in Table-V.

TABLE-V
Influence Quantities

Influence quantity		Value of current (balanced unless otherwise stated)	Power Factor	Mean temperature coefficient % K for Meters of class 1
Ambient Temperature variation	6)	0.05 In ≤ I ≤ Imax 0.1 In ≤ I ≤ Imax	1 0.5 lagging	0.05 0.07
				Limits of variation in Percentage error for Meters of class 1
Voltage variation ± 10%	1)	0.02 In ≤ I ≤ Imax 0.05 In ≤ I ≤ Imax	1 0.5 lagging	0.7 1.0
Frequency variation ± 5%	-	0.02 In ≤ I ≤ Imax 0.05 In ≤ I ≤ Imax	1 0.5 lagging	0.5 0.7
Reverse Phase Sequence	-	0.1 In	1	1.5
Voltage Unbalance	-	In	1	2.0
Harmonics contents in current and voltage circuits	3)	0.5 Imax	1	0.8
Odd Harmonic in the AC Current circuit	2) 3)	0.5 In	1	3.0
Sub-harmonic in the A.C current circuit	2) 3)	0.5 In	1	3.0
Continuous Magnetic induction of External origin	3)	In	1	2.0
Magnetic induction of Internal origin 0.5 mT	4)	In	1	2.0
Electromagnetic RF Fields	-	In	1	2.0
Operation of accessories	5)	0.05 In	1	0.5
Conducted disturbances induced by radio frequency fields		In	1	4.0
Fast transient burst		In	1	3.0
Damped oscillatory waves immunity		In	1	2.0

1) For the voltage ranges from -20% to -10% and +10% to +15% the limits of variation in %age errors are three times the values given in this table.
Below 0.8Un, 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 conditions see Clause No. 8.2.2 of IEC 62053-21.

3) The test conditions are specified under clause 8.2.1 to 8.2.4 of IEC-62053-21.

4) 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 value shown in this table. The magnetic induction shall be obtained by placing the meter in the center of the circular coil, 1 m in mean diameter of square section and of small radial thickness relative to the diameter and having 400 At.

5) Such an accessory, when enclosed in the meter case, is energized intermittently, for example the electro-magnet 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 are irreversible connections the variation of error shall not exceed those indicated in this table if the meter is tested with the connections giving the most unfavorable conditions.

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

6.5.2 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 8.5 of IEC 62053-23 shall not exceed the limits given in Table-VI

TABLE-VI
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 5)	0.05 In ≤ I ≤ I max 0.1 In ≤ I ≤ I max	1 0.5	0.10 0.15
			Limits of variation in Percentage error for Meters of class 2
Voltage variation ±10% 1)	0.02 In ≤ I ≤ I max 0.05 In ≤ I ≤ I max	1 0.5	1.0 1.5
Frequency variation ±2%	0.02 In ≤ I ≤ I max 0.05 In ≤ I ≤ I max	1 0.5	2.5 2.5

Continuous magnetic induction of external origin 2)	In	1	3.0
Magnetic induction of external origin 0.5 mT 3)	In	1	3.0
Electromagnetic RF Fields	In	1	3.0
Operation of accessories 4)	0.05 In	1	1.0
Conducted disturbances, induced by radio-frequency	In	1	3.0
Fast Transient burst	In	1	4.0
Damp oscillatory waves immunity	In	1	4.0

1) For the voltage ranges from –20% to –10% to +15%, the limits of variation in percentage errors are three times the values given in this Table.

2) The test conditions are specified in 8.2.2 of IEC 62053-23.

3) 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 center 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.

4) 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.

5) 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 atleast 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 of appended below divided in seven parts:

7.1 BASIC DATA RECORDING AND STORAGE

- Min. Four TOD periods Energies (kWh).
- Min. Four TOD periods Energies (kvarh).
- Min. Four TOD periods Max. Demand (kW).
- Min. Four TOD periods Cumulative Max. Demand (kW).
- No. of Resets alongwith Date and Time Stamp for Last Reset.
- Present interval Demand.
- Time left in Interval.
- Average Power Factor, continuous and by rate.
- Last six months Billing Data kWh, kvarh, kW continuous & by rate shall be available at all times.

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 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 any voltage exists with or without neutral connected.
- If data entry keys/button are provided in the meter for manual entry of data these shall be inside the meter cover except the reset device and display scroll push button. No data shall be changeable modified by the simultaneous operation of these switches or in any way without opening the meter cover.
- The meter shall be protected against any loss of data and functional performance due to any external interference such as influence of CD drive, Mobile phones and shall comply to all relevant IEC/ANSI standards.
- A strong magnet having strength of 0.5 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

7.2.2 Security Logging with Date and Time Stamp

- Total No. of Power Outages.
- Phase failure and Disconnection of wires excluding neutral wire.
- Reverse energy flow.
- Reverse Polarity.
- 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;

- Demand Overload Warning .
- Over and under Voltage (with Date & Time Stamp). The over and under voltage should be programmable.
- By-passing the incoming energy, current and voltage quantities (with Date & Time Stamp).
- 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 6 digits for Energy consumption.
- Display scrolling time shall be programmable.
- Min. three programmable Display modes shall be available.
- One Display mode shall be the Normal or Automatic display mode. Other display mode shall be for Security / Diagnostics etc. and 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
- Phase Indicators.
- Power Quadrant Indicator.
- All Segment Check.
- Active TOD period indicator.
- Display Mode Indicator.
- Display Quantity Labels.
- Pulse Output for field testing of Meter shall be available on the Display/Optical interface.

7.4 LOAD PROFILING / RECORDING

- Min. Two Channel recording having sufficient capacity to record at-least 65 days of Data of 30 minutes interval.
- Load Profile Data shall also be downloadable in the meter reporting software for future processing.
- All Load Profile Data shall be stored in a Non-Volatile Memory.

7.5 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 and TOD program for a continuous period of at-least 12 months.
- The battery shall be connected using standard connectors, it shall not be welded, brazed, soldered or riveted, so that it may be easily/conveniently replaceable.

7.6 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:

- Meter Reading Multiplier.
- Demand Time interval (10,15,30,60 minutes).
- Annual Calendar Programmable for Four seasons, Four Tariffs/Rates daily, min. 100 programmable dates/days to account for holidays and weekends.
- The meter shall have upgradeability option both in Hardware and Software to configure for other ancillary devices.
- Demand resets can be configured for automatic resets on a preset date to override the manual reset.
- The meter shall be Multi Vendor compliant.
- Meter programming shall be DOS/Windows based.
- Optical Communication Port of the meter shall either be IEC 62056-21 or ANSI C12.18 Type II compliant.
- 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.
- The meter should have the capability for reprogramming as a new meter or amending the existing program without loss of previous data.

7.7 REPORTING SOFTWARE & SECURITY

- The Software shall be password protected.
- The Reporting software shall be Windows/DOS based.
- It shall be possible to graphically represent Load Profile Data reports.

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 & kvarh 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 & kvarh 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 cyclic 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 & kvarh parts as per IEC 62053-23) where applicable

- Test of Accuracy
- Test of influence quantities
- Test of ambient temperature influence
- 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 informations:

- Name of the manufacturer and country of origin
- Type of meter
- Meter rating and other information
- Important display sequence with codes.
- WAPDA P.O. No.
- Word Serial No. and year of manufacture
- Multiplying factors for different CT/PT ratios.

10. PACKING

10.1 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.

10.2 For overseas shipment, a suitable number of individually thermo pore 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. INSPECTION

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

12.1 SAMPLE TESTS (ELECTRICAL)

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.

12.1.2 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:

i) Impulse test
ii) Power loss test.

12.1.3 The lot shall be accepted if all the meters qualify in the tests described in clause 12.1.1 & 12.1.2 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 12.1.1 & 12.1.2 above. If any one meter fails in any of the above tests the whole lot shall be rejected.

12.2 SAMPLE TESTS (MECHANICAL)

12.2.1 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:

Sr. No	Description	Nos. of Meters
1-	Test of protection against penetration of dust and water.	One meter
2-	Dimensional Check.	One meter
3-	Tests for Electromagnetic Interference (EMI)	One meter.

The lot shall be accepted if meters qualify the above tests in clause 12.2.1. 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 test in the second group, the entire lot shall be rejected.

12.3 VERIFICATION TEST FOR SOFTWARE FUNCTIONALITY

12.3.1 Verification test for software functionality and display features on offered meters shall be performed 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.

12.4 TYPE TESTS

12.4.1 The remaining type tests not performed on the above samples shall be carried out (as per recommended sequence of IEC-1036 Annexure-E) 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 meter in any of the tests the lot shall be rejected.

12.5 PROCEDURE FOR INSPECTION FOR LOCAL MANUFACTURERS IS GIVEN BELOW:-

12.5.1 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 & IEC 62053-23

- Accuracy test
- Starting current test

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

12.5.2 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

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

- Accuracy test
- Starting current test
- Running with no load test (Creep 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 Tests (Mechanical)

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

- Spring Hammer test
- Tin coating test

(b) Following tests be performed on three meters selected randomly from offered :

- Strong/Radar Magnet Test (One No.)
- Shock and vibration test (One No.)
- Rain fall test (One No.)

12.5.3 ACCEPTANCE CRITERIA

a) Electrical Test

- The lot shall be accepted if one meter fails in any one of the tests described in clause 12.5.2 (i).
- Re-sampling of the same size should 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) & (b).
- 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.

12.5.4 VERIFICATION FUNCTIONALITY TEST OF SOFTWARE

12.5.4.1 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.

13. WARRANTY

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

14. TRAINING

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

15. 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).
62053-23:2003	Static meters for reactive energy (Classes 2 and 3).
62052-11:2003	Metering equipment.
60514 Ed. 1.0	Acceptance inspections of Class 2 alternating current watthour meter.
62056-21	Direct local data exchange

b. ANSI

C12.1 - 1995	Electric Meters Code for Electricity Metering
C12.10 - 1997	Physical aspects of watthour meters-Safety Standards
C12.18 - 2002	Protocol specification for ANSI type 2 Optical ports
C12.19 - 1997	Utility industry end device data tables

2. ELECTRICAL TESTING STANDARDS

a. IEC

60038: 1983 IEC standard voltages
Amendment 1 : 1994
Amendment 2 : 1997

60060-1: 1989	High voltage test techniques-Part 1 General definitions and test requirements
60085:1984	Thermal evaluation and classification of electrical insulation
61000-4-2:1995	Electromagnetic compatibility (EMC) – Part 4 Testing and measurement techniques – Section 2 Electrostatic discharge immunity test Basic EMC publication
61000-4-3:2002	Electromagnetic compatibility (EMC) – Part 4-3 Testing and measurement techniques – Radiated, radio-frequency, electromagnetic field immunity test

61000-4-4:1995 Electromagnetic compatibility (EMC) – Part 4: Testing and measurement techniques – Section 4: Electrical fast transient/burst immunity test. Basic EMC publication

61000-4-5:1995 Electromagnetic compatibility (EMC) – Part 4: Testing and measurement techniques – Section 5: Surge immunity test

61000-4-6:1996 Electromagnetic compatibility (EMC) – Part 4: Testing and measurement techniques – Section 6: Immunity to conducted disturbances, induced by radio-frequency fields

61000-4-12:1995 Electromagnetic compatibility (EMC) – Part 4: Testing and measurement techniques – Section 12: Oscillatory waves immunity test. Basic EMC publication

CISPR 22:1997 Information technology equipment – Radio disturbance characteristics limits and methods of measurement
Amendment 1:2000

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)
Amendment 1:1999

60695-2-11:2000 Fire hazard testing – Part 2-11: Glowing/hot-wire based test methods – Glow-wire flammability test method for end-products

60068-2-75:1997 Test Eh: Hammer tests

b. ISO Standard

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

4. ENVIRONMENTAL STANDARDS

a. IEC

60068-2-1:1990 Test A: Cold
Amendment 1:1993,
Amendment 2:1994

60068-2-2:1947	Tests B: Dry heat Amendment 1:1993, Amendment 2:1994
60068-2-5:1975	Test Sa: Simulated solar radiation at ground level
60068-2-6:1995	Test Fc: Vibration (sinusoidal)
60068-2-30:1980	Test Db and guidance: Damp heat, cyclic (12 + 12-hour cycle)
60068-2-27: 1987	Test Ea and guidance: Shock.
60721-1-3-3: 1994	Classification of environmental conditions- Part 3: Environmental parameters and their severities-Section 3 Stationary use at weather protected locations

PREPARED BY:

- FAISAL MEHMOOD
  Asst. Director
  Design & Standard _____

- MANSOOR NASIR
  Deputy Director
  Design & Standard _____

- MAHBOOB ALAM
  Director
  Design & Standard _____

- RANA ANWAR UL HASSAN KHAN
  Chief Engineer
  Distribution Engineering _____

****

SCHEDULE OF TECHNICAL DATA
FOR SOLID STATE TOD ENERGY METERS
DDS-50:2007

A. GENERAL

a) Bidder's name & Address _____

b) Manufacturer's name & Address _____

c) Manufacturing Experience _____

B. ENERGY METERS

1. Model No. /Type _____

2. Rated 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 Losses in

   i) Potential circuit _____
   ii) Current circuit _____

10. Max. current that meter can withstand during short circuit for 0.5 second. _____

11. Dielectric strength

   i) Impulse Voltage _____
   ii) A.C. test voltage _____

12. Insulation resistance of meter _____

13. Material of:

a. Base _____
b. Cover _____
c. Terminal block _____
d. Terminal _____

(All the above shall be indicated on drawings to be supplied with the bid)

14. Temperature rise of meter _____

15. Type of terminals _____

16. Centre to centre clearance between different phases. _____

17. Whether the meter is complaint to the Reference Standards for testing Mentioned in annex-I of the specs. _____

18. 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. Load profiling/Recording; (as per clause 7.4 of the spec) give details. _____

e. Back-up Battery; (as per clause 7.5 of the spec), give details. _____

f. Meter Programming, Software and security;(as per clause 7.6 of the spec), give details. _____

g. Reporting Software & security; (as per clause 7.7 of the spec), give details. _____

19. Operating ambient temp. range. _____

20. Size & No. of digit of LCD Display _____

21. Whether meter have the upgrad-ability option. _____

22. What is sampling rate _____

23. Impulse test voltage with energy _____

24. I.P class of meter _____

25 No. of digit of following features:

i. kWh _____
ii. kvarh _____
iii. Demand kW _____
iv. Cumulative kW _____
v. No. of Reset digits _____

26. What values/ readings are controlled through resetting device? _____

27. Detail of resetting device with sealing arrangement (give drawings) _____

28. Min. No. of tariff/rates for which the Tariff register can be programmable for: _____

- kWh _____
- kvarh _____
- kW _____

29. Effect of external magnetic field/pulses on meter _____

30. Effect of Radio frequency signals _____

31. Type of Memory _____

32. Storage capacity of Memory _____

33. Time to retain the memory _____

34. Detail of push button/other mechanism for reading different values of register _____

35. In case of error in register which types of checks are provided which automatically identifies the error. _____

36. 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%. _____

f) The timing element is programmable through: _____

g) Detail of programming device. In case of handheld programming device group of meter of which one programming device is supplied. _____

h) No. of programmable dates to account for holidays and week ends. _____

37. Name/rating plate , detail of information given on name plate. _____

38. Attachments

Whether the following material has been attached:

a) Accuracy Curves _____

b) Drawing of Meter showing dimensions, mounting details etc. _____

39. Bidders/manufacturer have to supply all relevant drawings & technical literature duly marked. _____

40. Details of deviations of the offered meter from specification (use separate sheet if required). _____

Signature & Seal of
Bidder/ Manufacturer

Annex. – II

FORMAT OF SOFTWARE

LIST OF DISPLAY ITEMS IN TOU METER

NORMAL MODE

1 All Segment On
2 Date
3 Standard Time
4 kWh (Total)
5 kWh Rate A
6 kWh Rate B
7 kvarh (Total)
8 kvarh Rate A
9 kvarh Rate B
10 Max kW
11 Max kW Rate A
12 Max kW Rate B
13 kW CUM
14 Kw CUM Rate A
15 Kw CUM Rate B
16 No. of Resets
17 Instantaneous Power
Cautions (Code)
Diagnostic (Code)
UN programmed meter (Freezing)

Self check diagnostics for RAM/ROM, Processor, non-volatile
Memory failure and other essential hardware circuitry (Freezing)

LIST OF DISPLAYABLE ITEMS IN TOU METER

ALT MODE

1 Meter ID
2 Previous Interval Demand
3 Time Left Interval
4 Average P.F. current Month
5 Average P.F. Rate A current Month
6 Average P.F. Rate B current Month
7 Last Month kWh (Total)
8 Last Month kWh Rate A
9 Last Month kWh Rate B
10 Last Month kvarh (Total)
11 Last Month kvarh Rate A
12 Last Month kvarh Rate B
13 Last Month kW
14 Last Month kW Rate A
15 Last Month kW Rate B
16 Cumulative kW (Total)
17 Cumulative kW Rate A
18 Cumulative kW Rate B
19 Last Reset Date
20 Last Reset Time
21 Average P.F. (Month) Last
22 – do - Rate A Last
23 – do - Rate B last
24 Last Interval kW
25 Voltage Phase A
26 Voltage Phase B
27 Voltage Phase C
28 Current Phase A
29 Current Phase B
30 Current Phase C

Programming Report

Meter Information

1 Consumer Identification
2 Consumer Name
3 Consumer Address
4 Meter Serial No.
5 Meter Type
6 Current Date
7 Current Time

Meter Parameters

1	R.T. Ratio	Programmable
2	C.T. Ratio	Programmable
3	Over Voltage	Programmable
4	Under Voltage	Programmable
5	Power Limit, kW	Programmable
6	Date of Reset	Programmable
7	Display Scrolling time	Programmable in second
8	Reset Method	Automatic
9	Integration Period (Demand Interval	30 Minutes

Tariffs Parameters

1	Number of Seasons	04
2	Tariff Number	04

Season Setting

No.			
01	01 / 03	Day 1	18-22, 22-6, 6-18
		Day 2	19-23, 23-7, 7-19
		Day-3	20-22, 24-6, 8-18
		Day-4	17-21, 21-5, 5-17
02	01 / 06	Day 1	18-22, 22-6, 6-18
		Day 2	19-23, 23-7, 7-19
		Day 3	20-22, 24-6, 8-18
		Day 4	17-21, 21-5, 5-17
03	01 / 09	Day 1	18-22, 22-6, 6-18
		Day 2	19-23, 23-7, 7-19
		Day 3	20-22, 24-6, 8-18
		Day 4	17-21, 21-5, 5-17
04	01 / 12	Day 1	18-22, 22-6, 6-18
		Day 2	19-23, 23-7, 7-19
		Day 3	20-22, 24-6, 8-18
		Day 4	17-21, 21-5, 5-17

BILLING REPORT

Meter Information

1 Consumer Identification
2 Meter Serial No.
3 Meter Type
4 Programmer Identification
5 Current Date
6 Current Time
7 Current Season

Revenue Data (for Sixty Five days)

The following data for 30 minutes interval should be available in the meter for last 65 days (Provision of 3120 Readings for two channel)

Date	Time (Hrs)	**Data**	
		h Reading	0.00
	12:30		
		Max Demand (kW)	0.00
		kWh Reading	0.00
- do -	1:00		
		Max Demand (kW)	0.00
		kWh Reading	0.00
- do -	1:30		
		Max Demand (kW)	0.00
		kWh Reading	0.00
- do -	2:00		
		Max Demand (kW)	0.00

BILLING REPORT

Meter Information

1	Consumer Identification
2	Meter Serial No.
3	Meter Type
4	Programmer Identification
5	Current Date
6	Current Time
7	Current Season

Revenue Data (Current Reading)

Energy

1	Current Total kWh	0.00
2	Current kWh Rate T1	0.00
3	Current kWh Rate-T2	0.00
4	Current kWh Rate-T3	0.00
5	Current kWh Rate-T4	0.00
6	Current Total kvarh	0.00
7	Current kvarh Rate-T1	0.00
8	Current kvarh Rate-T2	0.00
9	Current kvarh Rate-T3	0.00
10	Current kvarh Rate-T4	0.00

Maximum Demand

1	Current Max kW Date and Time
2	Current Max kW Rate T1 Date and Time
3	Current Max kW Rate T2 Date and Time
4	Current Max kW Rate T3 Date and Time
5	Current Max kW Rate T4 Date and Time

Cumulative Demand

1	Current Cum kW	0.0000
2	Current Cum kW Rate T1	0.0000
3	Current Cum kW Rate T2	0.0000
4	Current Cum kW Date Rate T3	0.0000
5	Current Cum kW Date Rate T4	0.0000
6	Nos. of Reset	
7	Date of last Reset	

Security Report

Meter Information

1. Consumer Identification
2. Meter Serial No.
3. Meter Type
4. Programmer Identification
5. Current Date
6. Current Time
7. Current Season

Security Data

1	Last OPTOCOM Communications Date and Time
2	No. OPTOCOM Communications
3	Last Demand Reset Date and Time
4	No. Demand Reset
5	Last Programming Date and Time
6	I.D. of Last Programmer
7	No. of Programming
8	Last Power Outage Date and Time
9	No. of Power Outage

Event Log Report

Meter Information

1 Consumer Identification
2 Meter Serial No.
3 Meter Type
4 Programmer Identification
5 Current Date
6 Current Time
7 Current Season

Name of Event
C.T. By Pass

Event Occurrence		Event Recovery	
Date	**Time**	**Date**	**Time**

Event Log Report

Name of Event
Power Outages

Event Occurrence		Event Recovery	
Date	**Time**	**Date**	**Time**

Event Log Report

Name of Event
Reverse Energy

	Event Occurrence		Event Recovery	
Phase	**Date**	**Time**	**Date**	**Time**

Event Log Report

	Event Occurrence		Event Recovery	
	Date	**Time**	**Date**	**Time**
Under Voltage				
Over Voltage				
Demand Overload				

Event Log Report

Name of Event
Reverse Polarity

Event Occurrence		Event Recovery	
Date	**Time**	**Date**	**Time**

Event Log Report

Name of Event
Disconnection of Phases

Event Occurrence		Event Recovery	
Date	**Time**	**Date**	**Time**

NATIONAL TRANSMISSION & DESPATCH COMPANY
Office of Chief Engineer (Design & Standards) NTDC
178, Block N, Model Town Extension, Lahore.
Ph No.042/5161916, Fax No.5161917
Email: cedengg@yahoo.com.

No. 5134-50/CEDS/ 7184. Dated: 03-9-2008

The Chief Executive Officers
All DISCOs.

Subject: **AMENDMENT NO.1 – WAPDA SPECIFICATION NO. DDS-50:2007 FOR 3 PHASE MULTI RATE (LT/HT) SOLID STATE ENERGY METERS**

Enclosed please find herewith a copy of amendment No.1 dated 02.09.2008 in WAPDA specification No. DDS-50:2007 for your reference and record please.

3/9/08

(AZIZ UR REHMAN)
MANAGER (D&S)

Cc to:-

1. General Manager (Services Division) NTDC, PEPCO, Wapda House , Lahore
2. Chief Engineer (Material Inspection) NTDC PEPCO, Sunny View, Lahore.
3. Chief Engineer (P&D) NTDC, WAPDA House ; Lahore.
4. All meter manufacturers.

M/S. SBEEC

COPY: MR. Kamran A. Rana 8/9/08

WAPDA SPECIFICATION DDS-50:2007

THREE PHASE MULTI RATE (LT/HT) SOLID STATE ENERGY METER

AMENDMENT NO.1

DATED 2ND. SEPTEMBER, 2008

Replace under clause 7.5 "BACK UP BATTERY" :-

Existing sub clause:

- The battery shall be connected using standard connectors, it shall not be welded, brazed, soldered or riveted, so that it may be easily/conveniently replaceable.

New sub clause:

- The battery shall be solidly welded, brazed or soldered and placed within the meter body, so that it may not be easily approached.

(MANSOOR NASIR) DY. MANAGER (D&S)	2/9/08 (AZIZ UR REHMAN) MANAGER (D&S)	02.09.08 (RANA MUHAMMAD AJMAL KHAN) CHIEF ENGINEER (D & S) NTDC