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Kenya Power

DATA CONCENTRATOR UNIT (DCU) - SPECIFICATION

A Document of the Kenya Power & Lighting Co. Ltd

December 2025



TITLE:
**DATA CONCENTRATOR UNIT
(DCU) – SPECIFICATION**

(For Energy Meters and
Distribution Transformer Metering
Applications)

Doc. No. **KP1/13D/4/1/TSP/14/064**

Issue No. **1**

**Revision
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0.1 Circulation List

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	Manager, Standards
Electronic copy (pdf) on KPLC Server (currently: Network→stima-fprnt-001→techstd&specs)	

REVISION OF KPLC STANDARDS

To keep abreast of progress in the industry, KPLC standards shall be regularly reviewed. Suggestions for improvements to approved standards, addressed to the Manager, Standards Department are welcome.

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0.2 Amendment Record

Rev No.	Date (YYYY-MM-DD)	Description of Change	Prepared by (Name & Signature)	Approved by (Name & Signature)
Issue 1 Rev 0	2025-12-08	New issue	Eng. Benson Dianga	Eng. Faith Gichugu

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FOREWORD

This Specification has been prepared by the Standards Department in collaboration with, Commercial Services & Sales, Network Management and Information Communication Technology (ICT) all of Kenya Power & Lighting Co. Plc. (KPLC).

Kenya Power (KPLC) is undertaking a strategic transition from legacy one-way metering to a fully interoperable, bidirectional smart metering infrastructure that will also include metering loads served by distribution transformers. This strategy will enable real-time data acquisition, remote monitoring and control for improved operational efficiency, enhanced customer service, and strengthened energy accountability across the distribution network. Central to this initiative is the deployment of Data Concentrator Units (DCUs) at distribution transformer (DT) sites. The DCUs will function as interoperable gateways between downstream meters and KPLC's Head-End Systems (HES).

This specification defines the technical requirements for Data Concentrator Units (DCUs) as both distribution transformer metering devices and communication gateways that collect data from downstream energy meters and transmit it to the KPLC Head-End System (HES).

This specification defines the minimum acceptable technical requirements for DCUs for use by KPLC. The supplier and manufacturer shall be responsible for ensuring compliant design, adherence to this specification and all applicable standards and regulations, and the application of sound engineering practice and good workmanship in the manufacture of the units.

Users of the specification shall be responsible for its correct interpretation and application.

The following are committee members that prepared this specification:

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1. SCOPE

- 1.1. This specification covers the design, manufacture, testing at the Manufacturer's premises and delivery of Data Concentrator Unit (DCU).
- 1.2. The specification also covers test requirements for the Data Concentrator Unit (DCU) as well as a schedule of Guaranteed Technical Particulars (GTP) to be fully filled with offered values, parameters and descriptions, signed by the manufacturer and submitted for tender evaluation.
- 1.3. It shall be the responsibility of the supplier to ensure the adequacy of the design, good engineering practice, adherence to the specification and applicable standards and regulations as well as ensuring good workmanship in the manufacture of the DCU for The Kenya Power & Lighting Company Plc.
- 1.4. The specification does not purport to include all the necessary provisions of a contract.

2. NORMATIVE REFERENCES

The following standards contain provisions which, through reference in this text, constitute provisions of this specification. For dated editions, the cited edition shall apply; for undated editions, the latest edition of the referenced document (including any amendments) shall apply.

BS EN 10088-2:2014:	Stainless steels —Part 2: conditions for sheet/plate corrosion resisting steels for general purposes
IEC 61140:	Protection against electric shock - Common aspects for installation and Equipment
EN 10088-2 / ASTM A240	Stainless steel material requirements
ETSI EN 300 220 / FCC Part 15	RF mesh radio operation
IEC 60068 / 62262	Environmental and mechanical robustness
IEC 60529 / 62208	IP rating and enclosure integrity
IEC 61000	EMC immunity and emissions
IEC 61140	Electrical safety, insulation class
IEC 62052/53 Series	Meter accuracy, performance, electrical testing
IEC 62056	DLMS/COSEM communication, optical port, data model
IEC 62056-21: 2002:	Electricity metering - Data exchange for meter reading,
IEC 62056-6-1:2023:	Electricity metering data exchange - The DLMS®/COSEM suite
IEC 62058:	Electricity metering equipment (AC) - Acceptance inspection
IEC 62208:	Empty enclosures for low-voltage switchgear
IEEE 1901 / 1901.2	Narrowband PLC over LV networks

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IEEE 1901-2013:	IEEE Standard for Low-Frequency (less than 500 kHz) Narrowband Power
IEEE 802.15.4(g)	RF Mesh communication for smart metering
ISO 9001:2015:	Quality Management Systems
ISO/IEC 17025:	General Requirements for the Competence of Calibration and Testing Laboratories
ITU-T G.9903 / G.9904	G3-PLC and PRIME PLC physical & MAC layers

3. TERMS AND DEFINITIONS

For the purpose of this specification, the definitions given in the reference standards shall apply in addition to the ones given below:

COSEM: Companion Specification for Energy Metering

CT: Current Transformer

DCU: Data Concentrator Unit

DLMS: Device Language Message Specification

GSM: Global System for Mobile Communications

HES: Head-End System

LV: Low Voltage

MDMS: Meter Data Management System

OBIS: Object Identification System

OFDM: Orthogonal Frequency Division Multiplexing

PLC: Power Line Communication

RF: Radio Frequency

VT: Voltage Transformer

WAN: Wide Area Network

4. REQUIREMENTS

4.1. Service Conditions

The DCU shall be suitable for use outdoors in tropical areas with harsh conditions including areas exposed to:

- Altitudes of up to 2200m above sea level
- Average ambient temperature of +30°C with a minimum of -1°C and a maximum of +50°C, in direct sunlight

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- iii. Humidity: up to 95%
- iv. Pollution: Design pollution level to be taken as “Very Heavy” (Pollution level IV) in accordance with IEC TS 60815.
- v. Isokeraunic levels of up to 180 thunderstorm days per year.

4.2. General Design Requirements

- 4.2.1. The DCU shall be manufactured to IEC 62052-11, IEC 62053-21, IEC 62053-22, IEC 62053-23, IEC 62056, IEEE 1901, ITU-T G.9903, ITU-T G.9904, and the requirements of this specification.
- 4.2.2. The DCU shall be a single, integrated device capable of collecting, aggregating, storing, and securely transmitting data from downstream energy meters to the KPLC Head-End System (HES), while simultaneously operating as a Distribution Transformer (DT) energy meter to monitor and report transformer-level electrical parameters.
- 4.2.3. The DCU shall be connected to the low-voltage side of secondary distribution transformers with star-connected secondary windings, rated at a nominal three-phase voltage of 420VAC, 50 Hz.
- 4.2.4. The DCU shall support the DLMS/COSEM communication protocol and be fully interoperable with the existing KPLC Head-End Systems (HES).
- 4.2.5. The DCU shall be powered from voltage phase monitoring inputs connected to the main LV circuits from the transformer LV bushings and not from fuse-carrier-controlled circuits. The terminals for these main circuit inputs shall be clearly marked and preferentially positioned within the termination array.
- 4.2.6. The DCU shall be equipped with a display unit for presenting the required operating and measurement parameters. Refer to clause 4.7 for detailed specifications
- 4.2.7. The DCU shall be equipped with LED indicators for alarms, communication/connection status, and energy consumption.
- 4.2.8. The DCU shall be provided with a USB 2.0 port and an Ethernet port for network connectivity.
- 4.2.9. The DCU shall be equipped with a data port compliant with SCSSCAA9 (MC171) standards for programming and interrogation.
- 4.2.10. The DCU shall support programming and data download via an infrared optical port. The infrared optical port shall be compliant with IEC 62056-21 for programming and data retrieval.
- 4.2.11. The DCU shall be rugged and suitable for harsh outdoor conditions, and shall provide a minimum degree of protection of IP54 in accordance with IEC 60529.
- 4.2.12. The DCU shall be supplied in a sealable enclosure suitable for mounting on concrete or wooden poles. The enclosure shall comply with the requirements specified in Clause 4.8. The DCU and its enclosure

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shall include provisions for twist-tight seals to prevent unauthorized access, allowing entry only by authorized maintenance personnel.

4.2.13. The DCU shall be securely and safely mounted inside the enclosure and shall not be mounted on the enclosure door.

4.2.14. The DCU shall be installed in a vertical orientation with all mounting points secured using bolts. All fixing accessories shall be corrosion-resistant.

4.2.15. The DCU shall have a protection class of Class II (double insulated) in accordance with IEC 61140.

4.2.16. The DCU shall be supplied with an internal Li-ion backup battery of suitable ratings to support DCU basic heartbeat operations, clock, and calendar, during AC power failure for a minimum of 8 hours.

4.2.17. The DCU shall be equipped with open-tamper detection protection for the terminal cover, body cover, and communication module cover. Upon opening, the DCU shall generate an alarm to the HES and log the event internally.

4.2.18. The DCU shall include non-volatile memory capable of storing data with a long-term retention period of at least 10 years or for the service life of the DCU as guaranteed by the manufacturer, whichever is longer, without requiring electrical supply.

4.3. Functional Requirements

4.3.1 Requirements for Transformer Metering

4.3.1.1 The DCU shall acquire distribution transformer energy and power quality data through low-voltage current transformers (CTs) and direct voltage tapings from transformer LV circuits.

4.3.1.2 The DCU shall measure and display transformer-level active, reactive, and apparent energy, as well as power factor, in both import and export modes.

4.3.1.3 The DCU shall support multi-channel profiling of energy served (kVA, kW, kVAh), voltage, current, power factor, and harmonics for a minimum duration of six (6) months, at programmable data intervals ranging from 1 to 60 minutes, for each distribution transformer.

4.3.1.4 The DCU shall record all power data to support the generation of reports, analytics, alerts, and insights for loss reduction, power quality analysis, and outage management.

4.3.1.5 The primary units for measured values shall be: kilowatt-hour (kWh) for active energy, kilovolt-ampere reactive hour (kVAh) for reactive energy, and kilovolt-ampere hour (kVAh) for apparent energy.

4.3.1.6 The metering accuracy of the DCU shall be class 0.2 for active energy and reactive energy measurements as per accuracy requirements in compliance with IEC 62053-22 clause 8.1-8.6.

4.3.1.7 The DCU shall continue to measure, record and meter energy consumption under unbalanced load conditions or in the cases of phase failures.

4.3.1.8 The DCU shall accurately measure energy even under incorrect phase sequence conditions and the phase sequence status shall be indicated on the display unit.

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4.3.1.9 The DCU shall feature screw-type terminals capable of carrying the continuously rated LV CT secondary current. Terminal holes and screws shall be made of brass.

4.3.1.10

The current and voltage input terminals shall have the following rated specifications:

a) Voltage Inputs:

- i. Number of Inputs: **16**
- ii. Nominal Voltage per Input: **230 V AC (phase-to-neutral)**
- iii. Voltage Measurement Range: **0–300 V AC**
- iv. Measurement Accuracy: **±0.5% for active energy; ±1% for reactive energy**
- v. Overvoltage Protection: **Not less than 1.2 × rated voltage**

b) Current Inputs

- i. Number of Inputs: **8**
- ii. Current Rating: **Configurable based on CT ratings (e.g., 5 A base, scaled by CT ratio)**
- iii. Measurement Range: **0–In × CT ratio**
- iv. Measurement Accuracy: **±0.5% for active energy; ±1% for reactive energy**
- v. Overcurrent Protection: **Not less than 1.2 × rated current**

4.3.2 Requirements for Energy Meters Data Concentration Management

4.3.2.1 The DCU shall facilitate bidirectional communication between downstream energy meters and the KPLC Head-End System (HES).

4.3.2.2 The primary downlink communication between the DCU and energy meters shall be through G3-PLC and PRIME-PLC and RF Mesh communication standards.

4.3.2.3 The DCU shall be interoperable with all energy meters certified to DLMS/COSEM standards, regardless of manufacturer, model, brand, or vendor.

4.3.2.4 The DCU shall be capable of collecting and transmitting data from over 1,000 downstream energy meters.

4.3.2.5 The DCU shall be able to communicate with energy meters within a distance of up to 1000 Meters.

4.3.2.6 The DCU shall display the number of connected energy meters at any time on the display unit.

4.3.2.7 The DCU shall support bidirectional communication with the Head-End System (HES), enabling it to automatically transmit metering data, outage and grid events, alarms, firmware updated while also responding to HES-initiated on-demand data requests, control commands and configuration updates.

4.3.2.8 The DCU shall continuously verify the status of communication links with all connected meters and maintain an up-to-date register of meters that are online and offline.

4.3.2.9 The DCU shall ensure that all uplink data, including energy readings, alarms and events are accurately time-stamped and transmitted with high reliability.

4.3.2.10 The DCU shall have sufficient memory and storage capacity to support local logging of energy measurement data. It shall be capable of storing up to 18 months of energy data for more than 1,000 meters. The DCU shall maintain registers according to the OBIS code specification to support energy

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monitoring, analysis, and reporting.

4.3.2.11 The DCU shall support the configuration and closure of energy measurement periods on any selected date of the month, as determined through software or remotely via the Head-End System (HES), to facilitate energy management, reporting, and analysis.

4.4 Requirements for Communications:

- 4.4.1 The primary uplink communication between the Data Concentrator Unit (DCU) and the Head-End System (HES) shall be GPRS, 3G, and 4G. The DCU shall also provide for 1000BASE-TX (100 Mbps) Ethernet connection will be provided as an alternative WAN or backup communication interface.
- 4.4.2 The Data Concentrator Unit (DCU) shall incorporate also an integrated Wide Area Network (WAN) communication interface based on licensed cellular LTE Cat-M (Category M1) technology, compliant with 3GPP TS 36.300, TS 36.306 and release 13 or later. The interface shall provide native IP connectivity (IPv4 and/or IPv6) and support IEC 62056 (DLMS/COSEM) over IP for reliable transmission of aggregated meter data, events, alarms, control commands, and firmware files.
- 4.4.3 The LTE Cat-M interface shall support Power Saving Mode (PSM) and extended discontinuous reception (eDRX), automatic network re-attachment, store-and-forward buffering, configurable retry mechanisms and secure firmware-over-the-air (FOTA) updates to ensure energy-efficient, reliable and resilient operation.
- 4.4.4 The DCU shall incorporate GPS functionality to provide precise time synchronization for interval readings, event logging and network coordination. GPS shall also enable geolocation of the DCU for asset management and network mapping purposes.
- 4.4.5 The primary downlink communication between the DCU and the energy meters shall support G3-PLC and RF-Mesh, with automatic selection or configuration of the available communication medium as specified by the utility. The DCU shall also support two channels of RS485 communication interface.
- 4.4.6 The G3-PLC communication system shall comply with ITU-T G.9903 and IEEE 1901.2 standards, operating primarily in the CENELEC-A Frequency Band (35–91 kHz) and FCC Frequency Band (154–487 kHz) and using the appropriate dynamic and adaptive sub-carrier modulations completer with all their differential modes. The devices shall support Extended Band operation, IPv6 networking, and maintain backward compatibility with legacy G3-PLC devices. The band switching shall enable automatic selection of the most suitable PLC band based on network conditions.
- 4.4.7 The RF Mesh system shall operate within CA designated free frequency band and shall comply with ETSI EN 300 220, FCC Part 15, and ITU-R radio regulations. The physical and MAC layers shall comply with IEEE 802.15.4g (Smart Utility Networks) and IEEE 802.15.4, with supporting for IPv6 over 6LoWPAN and routing based on IETF RPL. Application-layer data exchange shall comply with DLMS/COSEM as per IEC 62056 series to ensure interoperability.
- 4.4.8 The communication technologies GPRS, Ethernet, G3-PLC and RF Mesh shall be supported through interchangeable plug-in modules, allowing seamless integration and field replacement without affecting overall device functionality. G3-PLC and RF Mesh shall be integrated on a single module and shall operate concurrently under a unified, interoperable firmware management framework.
- 4.4.9 The plug-in communication modules shall be of standardized mechanical dimensions, form factor,

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electrical interface, and pin alignment to ensure full interchangeability across DCUs of the same model and series. The modules shall support hot-swapping or safe replacement without the need for rewiring or modification of the DCU. The mechanical keying and electrical pin configuration shall prevent incorrect insertion.

- 4.4.10 The interface shall provide secured mechanical latching and vibration resistance suitable for outdoor installations. All modules shall comply with IEC 60512 (connector testing and performance), IEC 60603 (connector dimensions and pin configuration), IEC 61984 (connector safety), IEC 60068 (environmental testing), IEC 60529 (ingress protection), IEC 61000 (EMC) and IEC 62368-1 (ICT equipment safety) as applicable and shall be clearly labeled with model, protocol type, electrical rating, and serial number for asset management and maintenance.
- 4.4.11 The DCU shall support on-site data reading via the optical communication port even during mains power failure. The optical port shall include provisions for sealing to prevent unauthorized access.
- 4.4.12 The DCU shall be equipped with an internal antenna and shall also provide a connector for an external antenna for communication. The internal antenna shall support external antenna extension where required to enhance signal performance.

4.5 ICT and Integration Requirements

- 4.5.1 The DCUs shall integrate seamlessly with existing KPLC Head-End Systems(HES)
- 4.5.2 All communication between the DCU and Head End Systems shall be secure and encrypted using AES-256 with downward compatibility to AES-128.
- 4.5.3 The DCU shall support event-triggered synchronization to the HES, including first-time boot, first breath and last gasp communication and management of request from the HES.
- 4.5.4 The DCU shall support Over-the-Air (OTA) firmware updates, remote configuration, STS token loading and other evolving requirements through KPLC's HES.
- 4.5.5 The DCU shall provide secure logging and controlled access to locally stored meter data for remote management, diagnostics, troubleshooting and analysis
- 4.5.6 The DCU management interfaces shall allow end-users to view device status, logs, configuration settings, and update history. The programming tool shall support authentication of individual users and not groups.
- 4.5.7 The authentication suite shall support 3 access levels to end users as follows:
- “Low level security” (Read-Only) - Allow users to read specified data fields with appropriate access rights.
 - “Middle level security” (Technical personnel) - Allow users with the appropriate access rights to reconfigure, interrogate data, clear alarms, push firmware updates and carry out diagnostics in the DCU.
 - “High level security” (Administrators) - Allow users with the appropriate access rights to define access control, perform system configurations (APN/DNS Settings etc.), perform maintenance and diagnostics using the DCU programming tool.

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- 4.5.8 The DCU shall support DLMS/COSEM-compliant OBIS code structures to interpret and transmit meter data accurately to KPLC's HES.
- 4.5.9 The supplier shall ensure that all OBIS data is correctly formatted and transmitted to KPLC systems without loss or data corruption.
- 4.5.10 The DCU shall function as a communication gateway, capable of converting protocols between the WAN (GPRS/3G/4G/Ethernet) and the NAN (G3-PLC, PRIME, or RF Mesh), in both directions.
- 4.5.11 The DCU shall have an internal clock synchronized with the Head-End-System GPS-based central timestamp to ensure accurate timekeeping for data logs.
- 4.5.12 The DCU firmware shall support both remote and local upgrades and configuration. Firmware upgrade and configurations, including periodic security patches shall not affect the DCU's metrology functions and shall be provided by the manufacturer at no additional cost for the operational lifetime of the DCU.
- 4.5.13 The DCU shall support integration with a licensed Wireless Application Service Provider (WASP) for cellular communication services and shall operate with WASP-managed SIM cards and data services to enable secure, reliable data transmission between meters and HES.
- 4.5.14 The DCUs shall be supplied together with a laptop loaded with software for interrogating the DCU data. The laptop specifications shall be as in **Table 1**.

Table 1: Laptop Technical Specifications

Description	Mandatory Minimum Requirements
Processor	Intel Core i7-14 th Generation or higher
RAM	16GB DDR5
Operating System	Windows 11 pro 64 bit or higher
Hard Disk	1TB SSD
Display Panel	15.6" FHD LED Glossy (2560x1600) with integrated Webcam 720p camera
Graphics	Integrated Intel Graphics
Internal Audio	Integrated HD audio internal speaker (standard) or Stereo with Dolby Audio TM, 1xMic Headphones Combo
Communications	GPRS/ HSDPA Modem, Integrated Intel Gigabit Network Connection (10/100/1000 NIC)
Wireless	Intel 802.12 AC WLAN and Bluetooth(R)
Interfaces	VGA, MDP, 4-in-1 Card Reader, Smart Card Reader. RJ-45, Headphone and Microphone Jack, Mechanical Docking, USB 3.0, 2x USB C, W/WAN SIM, Express Card Slot, 1 HDMI port, Bluetooth, Wi-Fi enabled
Pointing Devices	Touchpad with scroll zone
Keyboard	Keyboard with Number Pad – English (Standard)
Mouse	External USB Mouse
Warranty	1 Year
Power	8-cell 90WHr Lithium-Polymer Battery; External AC adapter
Power Supply	230V AC, 50 Hz, British plugs
Carrying Case	Genuine Leather Carrying Case

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Manufacturer's Authorization

Manufacturers Authorization Certificate/ Letter and for the models quoted, the principal (Manufacturer) MUST have an established regional office in Kenya.

4.6 Electrical Requirements

- 4.6.1 The DCU shall be powered directly from the transformer low-voltage (LV) circuit . The input supply shall be rated at 3×230/420VAC, 50Hz, with a current rating of 3 × 1(5) A and shall operate reliably within a voltage range of 120VAC to 265VAC.
- 4.6.2 Each DCU shall be designed to terminate voltage signals tapings from sixteen (16No.) piercing connectors with a clamping slot conductor sizes ranging from 50mm² to 100mm² The Piercing Connectors shall conform to the specifications for *Distribution Transformer Metering LVCTs & Accessories* KP1-13D-4-1-TSP-14-065
- 4.6.3 Each DCU shall be designed to terminate current signals from eight (8No.) Low voltage Current Transformers for Distribution Transformer metering. The current transformers (CTs) shall be those that conform to the specifications for *Distribution Transformer Metering LVCTs & Accessories* KP1-13D-4-1-TSP-14-065
- 4.6.4 The voltage and CT leads shall be adequately rated for insulation and current for both DCU power supply and signal transmission. The leads shall be rugged and suitable for outdoor use.
- 4.6.5 The lead shall have a minimum length of 3.0 m and shall have ferrule terminations of maximum 2.5 mm² on one end for DCU terminations and a forked spade lüging termination for pan headed screw terminations on CT secondary terminals .
- 4.6.6 The lead terminals for both CTs and voltage tapping piecing connectors shall have 2.5 mm² Ferrule Terminations at the DCU end. The opposite end shall be fitted with Forked Spade Lugs to match the CT and Piecing connector screw terminals, which shall be screws of up to M5 suitable for conductors of 1.5–4 mm².
- 4.6.7 The lead cable terminations shall be designed for secure mechanical and electrical contact, complying to torque specifications, and be suitable for outdoor installation.
- 4.6.8 The electrical parameters shall be as per Table 2. The rating design parameters shall all form part of Type Test Report.

Table 2: Electrical Parameters of DCU

Item	Parameter
General requirements, tests and test conditions	IEC 62052-11
Particular requirements for static meters for active energy	IEC 62053-22
Power consumption and voltage requirements	IEC 62053-22

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Item	Parameter
Shock test	IEC 62052-11
Plastic-determination of temperature	IEC 62052-11
Degree of protection	IP54
Measurement Base	Active / Reactive energy, 3 element, 4 quadrant
Network type	3 phase 4-wire
Connection type	CT connected
Accuracy	kWh Class 0.2s (IEC 62053-22); kVARh class 2 (IEC 62053-23)
Temperature range (operating)	-1 to+50° C
Voltage measurement (Un)	3x 230 V/420V 50Hz, 3 phase 4 wire
Voltage range	0.4 Un to 1.3 Un
Voltage circuit burden	2 W and 10 VA as per IEC 62053- 21 and ANSI C12.20
Immunity to Fast Transient Bursts	4 kV
Lightning Impulse Withstand voltage	6 kVp, 1.2/50 μs
Current measurement	In =1 A; I _{max} = 10 A
Short circuit current	20 I _{max} for 0.5 s
Starting current	0.001 In
Current circuit burden	≤1 VA@5A as per IEC 62053- 21
Power Frequency withstand voltage	4 kVrms, 50 Hz, 1 min.
Insulation classification	Protective Class II
Electrostatic discharge	15 kV air discharge
Immunity to HF fields	80 MHz to 2 GHz @ 10V/m with load; 80 MHz to 2 GHz @ 30V/m no load- Accuracy not affected by magnetic fields from all sides-front, sides, top and bottom of the meter.
Radio interference	4 kV

4.7 Display Unit Requirements

- 4.7.1 The DCU shall be equipped with a display unit capable of presenting operational parameters and measured values, including continuous indication of the presence or absence of each individual phase voltage.
- 4.7.2 The display unit shall provide a minimum of ten (10) numeric characters with selectable integer values and two decimal places for energy measurement. Each digit shall have a minimum size of 4.0 mm (W) × 8.0 mm (H) and shall have a backlit to ensure clear visibility during reading.
- 4.7.3 The data on the display unit shall remain clearly legible within a viewing angle of ±15° in both the horizontal and vertical directions.

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4.7.4 The display unit shall be capable of displaying various tampering conditions of the DCU.

4.7.5 The display unit shall be capable of displaying alarms and tampering conditions, including:

- i. Power up and power down events
- ii. Individual phase failure
- iii. Over- and under-voltage based on preset thresholds
- iv. Low battery
- v. DCU internal errors
- vi. Terminal and DCU cover removal, including during power failure
- vii. Main DCU cover removal, including during power failure
- viii. Communication status
- ix. Uplink and downlink communication failures
- x. Magnetic tamper detection (minimum 0.5 mT)
- xi. Presence of current in the absence of one or more phases
- xii. Current imbalance exceeding 30% on one or more phases
- xiii. Significant Reverse Power flow
- xiv. Total Harmonic Distortion (THD) for both voltage and current

4.7.6 The display parameters derived from OBIS codes shall be configurable via software.

4.8 DCU Enclosure Requirements

4.8.1 Each DCU shall be supplied with an enclosure: The DCU enclosure, including all doors, shall be fabricated from stainless steel and shall be capable of withstanding mechanical and thermal stresses, as well as humidity, in accordance with IEC 62262.

4.8.2 The DCU enclosure shall be fabricated from stainless steel Grade 1.4404 (ASTM A240 Type 316L) in accordance with EN 10088-2 or approved equivalent, with a minimum thickness of 1.0 mm and shall have sufficient mechanical strength to withstand rough handling under normal operating conditions.

4.8.3 The DCU enclosure shall provide a minimum degree of protection of IP54 in accordance with IEC 60529 and IEC 62208. The enclosure shall be designed with a sloped roof to facilitate effective rainwater runoff and shall allow adequate heat dissipation to ensure reliable operation.

4.8.4 The DCU enclosure door shall be vandal-proof, with hinges mounted internally to prevent removal from the outside. The door shall allow an opening of at least 120° and operate smoothly on its hinges. A suitable lever or mechanism shall be provided to hold the door securely in the open position.

4.8.5 The DCU enclosure shall be supplied with two (2) fixing brackets along with bolts and nuts suitable for pole mounting. All brackets, bolts, and nuts shall be made of corrosion-resistant materials.

4.8.6 The DCU enclosure shall be equipped with an integrated locking mechanism and provisions for sealing. The enclosure shall be capable of generating an alert to the Head-End System (HES) if opened or tampered with. The doors shall have provision for padlocking with a utility standard padlock

4.9 Auxiliary components

4.9.1 The DCU shall be supplied together with the following components at no extra charge to KPLC:

- i. External antennae.

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- ii. USB cable for computer connection configurations,
 - iii. Corrosion resistant mounting brackets, bolts and nuts enclosure on the pole.
- 4.9.2 Accessories specified in *Accessories for Distribution Transformer metering DCU* KP1-13D-4-1-TSP-14-065. (Quantities and types to be outlined in tender document Schedule of Requirements)
- i. Lead cables for CTs signal
 - ii. Piercing connectors for each phase with a range of 50 to 100mm² conductor sizes
 - iii. CTs of suitable ratings as specified on tender document

5 TESTS AND INSPECTION

- 5.1 The DCU shall be inspected and tested in accordance with the requirements of IEC 62052-11, IEC 62053-21, IEC 62053-22, IEC 62053-23, IEC 62056, IEEE 1901, ITU-T G.9903, ITU-T G.9904, other applicable Standards and the requirements of this specification. It shall be the responsibility of the supplier to perform or to have performed the tests specified and whatever other tests normally required for any manufactured devices.
- 5.2 Copies of type test reports for the DCU offered shall be submitted with the tender (by bidder) for evaluation. The type test reports shall cover, but shall not be limited to, the tests outlined in clause 5.5 of this specification and shall have been issued by a third Party testing Laboratory, accredited to ISO/IEC 17025. The accreditation certificate to ISO/IEC 17025 for the same third-party testing laboratory shall also be submitted with the tender for evaluation (all in English language).
- 5.3 Copies of type test reports for the current transformers offered shall be submitted with the tender (by bidder) for evaluation. The type test reports shall be as stipulated in the *Accessories for Distribution Transformer metering DCU* KP1-13D-4-1-TSP-14-065. The accreditation certificate to ISO/IEC 17025 for the third-party testing laboratory shall also be submitted with the tender for evaluation (all in English language).
- 5.4 Routine and sample test reports for the DCU and current transformers to be supplied shall be submitted to KPLC for approval before shipment/delivery. KPLC Engineers (5) will witness tests at the factory for assessment of compliance to requirements before shipment. All tests shall be carried out as per the relevant standards.
- 5.5 The following tests shall be conducted on the DCU as per IEC 62052-11, IEC 62053-21, IEC 62053-22, IEC 62053-23, IEC 62056, IEEE 1901, ITU-T G.9903, ITU-T G.9904 and other relevant standards:

5.5.1 Tests of Insulation Properties

- 5.5.1.1 Impulse Voltage Test
- 5.5.1.2 AC High Voltage Test
- 5.5.1.3 Insulation Test

5.5.2 Test of Accuracy Requirements

- 5.5.2.1 Tests on Limits of Error
- 5.5.2.2 Interpretation of Test Results

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- 5.5.2.3 Test of Starting Conditions
- 5.5.2.4 Test of No-load Condition
- 5.5.2.5 Test of Ambient Temperature Influence
- 5.5.2.6 Test of Repeatability Error
- 5.5.2.7 Test of Influence Quantities

5.5.3 Test of Electrical Requirements

- 5.5.3.1 Test of Power Consumption
- 5.5.3.2 Test of Influence of Supply Voltage
- 5.5.3.3 Test of influence of Short-term Over-currents
- 5.5.3.4 Test of Influence of Self-heating
- 5.5.3.5 Test of Influence of Heating
- 5.5.3.6 Test of Influence of Immunity to Earth Faults

5.5.4 Test for Electromagnetic Compatibility

- 5.5.4.1 Radio Interference Measurement
- 5.5.4.2 Fast Transient Burst Test
- 5.5.4.3 Test of Immunity to Electrostatic Discharges
- 5.5.4.4 Test of Immunity to electromagnetic HF Fields

5.5.5 Test for Climatic Influences

- 5.5.5.1 Dry Heat Test
- 5.5.5.2 Cold Test
- 5.5.5.3 Damp Heat Cyclic Test
- 5.5.5.4 Accelerated ageing test

5.5.6 Test for Mechanical Requirements

- 5.5.6.1 Vibration Test
- 5.5.6.2 Shock Test
- 5.5.6.3 Spring Hammer Test
- 5.5.6.4 Protection Against Penetration of Dust and Water (Ingress protection)
- 5.5.6.5 Test of Resistance to Heat and Fire

5.5.7 Functional Tests

- 5.5.7.1 Open Cover tamper detection.
- 5.5.7.2 Open terminal cover tamper detection.

5.5.8 Interoperability Tests

- a) Communication tests
- b) Validation of OBIS mappings to ensure compatibility with KPLC Head-End Systems.

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5.5.9 Additional Tests

- 5.5.9.1 Glow wire testing for polycarbonate material
- 5.5.9.2 Accuracy tests in the presence of harmonics
- 5.5.9.3 Influence of D.C and even harmonics
- 5.5.9.4 Measurement of Total energy – Effect of Harmonics
- 5.5.9.5 Magnetic induction of external origin (AC & DC)

5.6 The routine and sample test certificates shall be submitted for approval, before dispatch of the DCU (and current transformers.)

APPENDICES

A: Quality Management System

- A1. The supplier shall submit a Quality Assurance Plan (QAP) that will be used to ensure that the design, material, workmanship, tests, service capability, maintenance and documentation of the DCU will fulfil the requirements stated in the contract documents, standards, specifications and regulations. The QAP shall be based on and include relevant parts to fulfil the requirements of ISO 9001:2015.
- A2. The Manufacturer's Declaration of Conformity to applicable standards and copies of quality management certifications including a copy of a valid and relevant ISO 9001: 2015 certificate shall be submitted with the tender for evaluation.
- A3. The bidder shall indicate the delivery time/schedule of the DCU, manufacturer's monthly production capacity and experience in the production of the DCU being offered
- A4. The Bidder shall clearly indicate what testing facilities are available in the works of the manufacturer and whether the facilities are adequate to carry out all Routine, and Acceptance Tests. These facilities should be available to KPLC Engineers to access and assess. Should any of the tests not be able to be carried out at the manufacturer's premises, the bidder shall have to arrange for such testing at any of the ISO/IEC 17025 accredited laboratories at their own cost.

B: Test and Inspection

- B.1. Copies of previous Type test reports issued by a third-party testing laboratory that is accredited to ISO/IEC 17025 shall be submitted with the tender for technical evaluation. The accreditation certificate to ISO/IEC 17025 for the same third-party testing laboratory used shall also be submitted with the tender document (all in the English Language)
- B.2: The test certificates shall be submitted together with other technical documents during tender submission. Acceptance tests shall also be carried out at the Manufacturer's works in line with clause 5 of this specification.
- B3 The supplier of the DCU shall carry out interoperability tests with existing KPLC HES. The supplier shall facilitate interoperability testing to validate OBIS mappings and ensure compatibility with KPLC's Head-End Systems.
- B.4: On receipt of the DCU units, KPLC will inspect them for acceptance at stores and will perform tests

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(routine and interoperability) on them to verify compliance with this specification. Any equipment which upon examination, test or use, fails to meet any or all of the requirements in this specification shall be replaced by the supplier without charge to KPLC,

C: Warranty and Training

- C.1. The manufacturer shall guarantee through a warranty document that all goods supplied under this contract shall have no defect arising from design, materials or workmanship.
- C.2. A warranty of 24 months from the date of delivery of the DCU to Kenya Power store shall be offered by the manufacturer.
- C.3 At no extra cost to KPLC, the supplier shall carry out technical training on the operation and maintenance of the DCUs after delivery to at least twenty (20) KPLC staff and Confirm their competency on use of the DCU. The training shall cover but not be limited to:
- Design and construction, functional and communication features
 - Interoperability and integration
 - Monitoring, troubleshooting, diagnostics and incident resolution
 - Configuration and commissioning.
 - Firmware features and updates
 - Mounting and installation

D: Markings and Packing

D.1: Marking

The following information shall be legibly and indelibly marked on each DCU:

- Serial Number of DCU
- Model No.
- Month and Year of Manufacture.
- Manufacturer's name;
- Country of Manufacture;
- Technical parameters
- Words "**PROPERTY OF KPLC**".

D.2: Packing

- D.2.1 : Packing shall be suitable for handling during transit by rail/road and secured to avoid any loss or damage during transit.
- D.2.2 : The cases shall be furnished with an illustrated operating and maintenance instructions for the items.
- D.2.3 : Instructions for safe handling of the DCUs shall be provided together with necessary safety precautions to be taken in the management of the unit.

E. Documentation

- E.1 The bidder shall submit its tender complete with technical documents required by Appendices F (Guaranteed Technical Particulars) for tender evaluation. The technical documents to be submitted

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(all in the English language) for tender evaluation shall include the following:

- i. Guaranteed Technical Particulars signed by the manufacturer;
- ii. Copies of the Manufacturer's catalogues, brochures, and technical data sheets for the DCU and layout drawings.
- iii. Product Data: Electrical characteristics of the DCU
- iv. Details of manufacturing capacity and the manufacturer's experience;
- v. Copies of required type test reports by a third-party testing laboratory accredited to ISO/IEC 17025;
- vi. Copy of accreditation certificate to ISO/IEC 17025 for the third-party testing laboratory;
- vii. Manufacturer letter of authorization, ISO 9001:2015 certificate and other technical documents required in the tender.
- viii. Certification by DLMS/COSEM

E.2 The successful bidder (supplier) shall submit the following documents/details to The Kenya Power & Lighting Company for approval before manufacture:

- i. Guaranteed Technical Particulars signed by the manufacturer;
- ii. Quality assurance plan (QAP) that will be used to ensure that the design, material; workmanship, tests, service capability, maintenance and documentation will fulfil the requirements stated in the contract documents, standards, specifications and regulations.
- iii. Three sets of operational manuals and drawings detailing dimensions, panel layout, wiring and schematic.
- iv. Detailed Test Program to be used during factory testing;
- v. Copies of the Manufacturer's catalogues, brochures, and technical data sheets for the DCU and layout drawings.
- vi. Marking details and method to be used in marking the equipment;
- vii. Packaging details (including packaging materials and marking and identification of component packages).

E.3 The supplier shall submit together with the product during delivery of the DCUs to KPLC stores, recommendations for use, care, safety precaution, storage and routine inspection/testing procedures, all in the English Language. The documents shall also state the safe environmentally accepted disposal mechanism recommended.

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F. GUARANTEED TECHNICAL PARTICULARS

To be filled and signed by the Manufacturer and submitted together with relevant copies of the Manufacturer's catalogues, brochures, drawings, technical data, all in English Language)

Tender No.

Clause Number	KPLC Requirements	Bidder's Offer (indicate full details)
	Name and Address of Manufacturer	State
	Country of Manufacturer	State
	Name & Address of Bidder	State
	Type/ Model No.	State
1.	Scope	State
2	Normative References	State
3	Terms and Definitions	State
4	REQUIREMENTS	
4.1	Service Conditions	State
4.2	General Design Requirements	
4.2.1	Standard of manufacturing	
4.2.2	DCU Resource Capability	State
4.2.3	DCU Connection type	State
4.2.4	Communication Protocol and interoperability	describe
4.2.5	DCUs own power supply	describe
4.2.6	Display capability	List
4.2.7	LEDs for indicating alarms, connection status and consumption	Provide
	Inbuilt antenna with provision for external antennae for communication	Provide
4.2.8	USB and Ethernet ports	Provide
4.2.9	SCSSCAA9 (MC171) compliant data port for programming and interrogating the DCU	Provide
4.2.10	Infrared optical port compliant with IEC 62056-21 for DCU programming and data downloading	State
4.2.11	Degree of Protection design	State
4.2.12	Enclosure type and mounting installations	Specify
4.2.13	Position of mounting	specify
4.2.14	Orientation and accessories for mounting	specify
4.2.15	Protection Class as per IEC 61140	Provide
4.2.16	Battery pack and battery capacity	Specify
4.2.17	Anti-tamper and alarm provisions	Specify
4.2.18	Data integrity and storage duration	State
4.3	Functional Requirements	
4.3.1	Transformer Metering	
4.3.1.1	Transformer metering Connection set up	State

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Clause Number	KPLC Requirements	Bidder's Offer (indicate full details)
4.3.1.2	Transformer metering measurement parameters	describe
4.3.1.3	Transformer Metering multi channels measurement	
4.3.1.4	Transformer Metering and Data analytics	State
4.3.1.5	Transformer Metering primary measured energy values	State
4.3.1.6	Accuracy class for measurement.	State
4.3.1.7	Metering transformer unbalanced loads	State
4.3.1.8	Metering transformer under incorrect sequence	State
4.3.1.9	Data signal termination design	State
4.3.1.10	Number of Input terminals	
	Voltage Current	State State
4.3.2	Energy Meters Data Concentration Management	
4.3.2.1	Bidirectional communication	State
4.3.2.2	Primary down link communication	Specify
4.3.2.3	Scope of DCU interoperability, Standards	State
4.3.2.4	The signal range of communication	State
4.3.2.5	Management capacity	State
4.3.2.6	Displaying the number of connected non smart energy meters on LCD	State
4.3.2.7	Remote and local firmware upgrades	State
4.3.2.8	Data registry maintenance on online/offline meters	State
4.3.2.9	Ability to diagnose health and status of uplink	State
4.3.2.10	Metering data storage capacity and duration of storage	State
4.3.2.11	Profiling Capability channels, period and data intervals	State
4.4	Requirements for communications	State
4.4.1	Primary Uplink communication	State
4.4.2	Incorporation of licensed WAN cellular LTE Cat-M	
4.4.3	Provisions of WAN cellular LTE Cat-M	
4.4.4	GPS functionality and geolocation of installed DCU	State
4.4.5	Primary downlink communication	State
4.4.6	The G3-PLC version provisions	State
4.4.7	The RF Mesh version provisions	State
4.4.8	The communication module packages design.	State
4.4.9	Module design for replacement and maintenance	State
4.4.10	Compliance in communication Module design	State
4.4.11	Optical port provisions and security	State
4.4.12	Provision of antenna and its design.	State
4.5	ICT and Integration Requirements	
4.5.1	Integration with KPLC Head-End Systems	State
4.5.2	Communication, security and Encryption	State
4.5.3	Event-triggered synchronization & First breath and last gasp communication to the HES	State

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4.5.4	Over-the-Air (OTA) firmware updates and remote configuration	State
4.5.5	Event-triggered synchronization	State
4.5.6	DCU management interfaces capability for KPLC	
4.5.7	Supported Access levels	State
4.5.8	Compliance with DLMS/COSEM standards regardless of the manufacturer,.	State
4.5.9	Compliance with OBIS ID for DCU metering data parameters	State
4.5.10	Over-the-Air (OTA) firmware updates and remote configuration	State
4.5.11	DCU protocol conversion provision	State
4.5.12	Provision of an internal clock synchronized with the Head-End-System GPS-based central timestamp for data logs.	State
4.5.13	Local & Remote upgrade of firmware and security patches	State
4.5.14	Support integration with a licensed Wireless Application Service	
4.5.14	Laptop Technical Specifications	Provide a table
4.6	Electrical Requirements	
4.6.1	Mains power with reference values	State
4.6.2	No. of Piecing Connectors	State
4.6.3	No. of LV Current transformers	State
4.6.4	CT Designs for transformer	State
4.6.5	Length of the lead cables	State
4.6.6	Lead cable mechanical termination offer/description	State
4.6.7	Lead cable functional termination offer/description	State
4.6.8	Electrical Parameters of DCU	
	General requirements, tests and test conditions	State
	Particular requirements for static meters for active energy	State
	Power consumption and voltage requirements	State
	Shock test	State
	Plastic-determination of temperature deflection under load	State
	Degree of protection	State
	Measurement Base	State
	Network type	State
	Connection type	State
	Accuracy	State
	Temperature range (operating)	State
	Voltage measurement (Un)	State
	Voltage range	State
	Voltage circuit burden	State
	Immunity to Fast Transient Bursts	State
	Lightning Impulse Withstand voltage	State
	Current measurement	State

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Clause Number	KPLC Requirements	Bidder's Offer (indicate full details)
	Short circuit current	State
	Starting current	State
	Current circuit burden	State
	Power Frequency withstand voltage	State
	Insulation classification	State
	Electrostatic discharge	State
	Immunity to HF fields	State
	Radio interference	State
4.7	Display Unit Requirements	
4.7.1	Capable of presenting operational parameters and measured values, including continuous indication of the presence or absence of each individual phase voltage.	State
4.7.2	No. and size of Numerical characters	Provide
4.7.3	Data on Display visibility	State
4.7.4	Capable of displaying various tampering conditions	State
4.7.8	Alarms displayed	List
4.7.6	Display parameters and their configuration	State
4.8	DCU Enclosure Requirements	
4.8.1	Material of enclosure	State
4.8.2	Standard of manufacture of DCU enclosure	State
4.8.3	Degree of protection for DCU enclosure	State
4.8.4	Management design for door aperture for enclosure	State
4.8.5	Accessories and brackets for Enclosure mounting	State
4.8.6	Access security design for enclosure.	State
4.9	Accessories	
4.9	Accessories supplied	List
5	Tests and Inspection	
5.1	Test standards	State
	Responsibility to perform tests	State
5.2	Copies of Test reports submitted for DCU	Submit
5.3	Copies of Test reports submitted for Current Transformers	Submit
5.4	Routing & Sample Test Reports submitted before shipment/Delivery	State
5.5	Tests Conducted on DCU	State
5.5.1-5.5.9	Test Certificates for approval before dispatch	State/ State
5.6	Submission of routine and sample test certificates to be submitted for approval, before dispatch of the DCU	State
APPENDICES		
A	Quality Management System	
A.1	QAP based on ISO 9001: 2015	Submit

Issued by: Head of Section, Standards Development

Authorized by: Manager, Standards

Signed:

Signed:

Date: 2025-12-24

Date: 2025-12-24



Kenya Power

TITLE:
DATA CONCENTRATOR UNIT (DCU) – SPECIFICATION

(For Energy Meters and Distribution Transformer Metering Applications)

Doc. No. KP1/13D/4/1/TSP/14/064

Issue No. 1

Revision No. 0

Date of Issue 2025-12-24

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Clause Number	KPLC Requirements	Bidder's Offer (indicate full details)
A.2	Manufacturer's Declaration of Conformity & Copy of ISO 9001: 2015 Certificate	Submit
A.3	Delivery time/schedule of the DCU, manufacturer's monthly production capacity and experience in the production	Indicate
A.4	Details of Testing Facilities	Submit
B	Test and Inspection	
B.1	Copies of Type test reports, Copy of accreditation certificate to ISO/IEC 17025	Submit
B.2	Test Certificates & technical documents	Submit
B.3	Acceptance Tests As per clause 5	State
B.4	Inspection at KPLC Stores and replacement of DCUs that do not meet requirements	State
C	Warranty and Training	
C.1	Warranty that goods have no defect arising from design, materials or workmanship	Provide/Submit
C.2	Warranty period	State
C.3	Installation, Test, Commissioning and Training at no extra cost	State
D	Marking and Packing	
D.1	Marking details	State
D.2	Packing details	State
E	Documentation	
E.1	Documents submitted with tender for evaluation	Submit
E.2	Documents submitted for approval before manufacture	Submit
E.3	Recommendations for use, care, safety precaution, storage and routine inspection/testing procedures	Submit
Statement of compliance to specification (indicate deviations if any & supporting documents)		State

NOTE:

- 1) Bidders shall give full details of the items on offer as per the specification and applicable standards. The details provided shall conform to the test reports and their certificates, as well as labelled drawings complete with dimensions, catalogues and/or brochures for the purpose of tender evaluation.
- 2) Bidders should note that there is conflict between the GTPs and the clauses in the specification, the clauses in the specification take precedence. Failure to complete the schedules shall lead to rejection of the bid.
- 3) Guaranteed values shall be specified. * Words like 'agreed', 'confirmed', 'As per KPLC specifications', etc. shall not be accepted and shall be considered non-responsive.

.....
Manufacturer's Name, Signature, Stamp and Date

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Signed:

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