PESHAWAR ELECTRIC SUPPLY COMPANY (PESCO)

Electricity Distribution Efficiency Improvement Project (EDEIP)

(P170230)

BIDDING DOCUMENT FOR PROCUREMENT
OF

Package - II

4,011 No's Standard Asset Performance Management System (APMS) with Magnetic Contactor and Non – Motorized MCCB along with Allied Material and Related Services for Installation in PESCO Operation Circles (Mardan & Swabi)

Single Stage – Two Envelop (SSTE) Bidding Procedure

CHIEF ENGINEER (DEVELOPMENT)
PROJECT MANAGEMENT UNIT
PESHAWAR ELECTRIC SUPPLY COMPANY

OCtober 2026 (Rev.01)

BASIC INFORMATION SHEET FOR PROSPECTIVE BIDDERS

Project: Electricity Distribution Efficiency Improvement Project (EDEIP)

RFB Reference No.: PK-PESCO-556534-GO-RFB-ICB-12

1. Name of Firm: _____
2. Country: _____
3. Name of Contact Person: _____
4. Designation: _____
5. Email Address: _____
6. Telephone/Mobile No.: _____
7. Complete Address: _____

Date: _____ Signature/Stamp: _____

Standard Procurement Document

Table of Contents

PART 1 – Bidding Procedures 3

Section I - Instructions to Bidders 5
Section II - Bid Data Sheet (BDS) 39
Section III - Evaluation and Qualification Criteria 45
Section IV - Bidding Forms 51
Section V - Eligible Countries 75
Section VI - Fraud and Corruption 77

PART 2 – Supply Requirements 79

Section VII - Schedule of Requirements 81

PART 3 – Contract 92

Section VIII - General Conditions of Contract 93
Section IX - Special Conditions of Contract 125
Section X - Contract Forms 129

PART 1 – Bidding Procedures

Section I - Instructions to Bidders

Contents

A. General 7

1. Scope of Bid 7
2. Source of Funds 7
3. Fraud and Corruption 8
4. Eligible Bidders 8
5. Eligible Goods and Related Services 11

B. Contents of Request for Bids Document 11

6. Sections of Bidding Document 11
7. Clarification of the Bidding Document 12
8. Amendment of Bidding Document 12

C. Preparation of Bids 13

9. Cost of Bidding 13
10. Language of Bid 13
11. Documents comprising Bid 13
12. Letters of Bid 14
13. Alternative Bids 14
14. Bid prices and Discounts 14
15. Currencies of Bid and Payment 17
16. Documents Establishing the Eligibility and Conformity of the Goods and Related Services 17
17. Documents Establishing the Eligibility and Qualifications of the Bidder 18
18. Period of Validity of Bids 19
19. Bid Security 19
20. Format and Signing of Bid 21

D. Submission of Bids 22

21. Sealing and Marking of Bids 22
22. Deadline for Submission of Bids 23
23. Late Bids 23
24. Withdrawal, Substitution, and Modification of Bids 23

E. Public Opening of Technical Parts of Bids 24

25. Public Opening of Technical Parts of Bids 24

F. Evaluation of Bids - General Provisions 25

26. Confidentiality 25
27. Clarification of Bids 26
28. Deviations, Reservations, and Omissions 26
29. Nonconformities, Errors and Omissions 26

G. Evaluation of Technical Parts of Bids 27

30. Evaluation of Technical Parts 27
31. Determination of Responsiveness 27
32. Qualification of the Bidders and Detailed Evaluation of the Technical Part 27

H. Notification of Evaluation of Technical Parts and Public Opening of Financial Parts of Bids 28

33. Notification of Evaluation of Technical Parts and Public Opening of Financial Parts 28

I. Evaluation of Financial Parts of Bids 30

34. Evaluation of Financial Parts 30
35. Correction of Arithmetic Errors 32
36. Conversion to Single Currency 32
37. Margin of Preference 32
38. Comparison of Financial Parts 32
39. Abnormally Low Bids 33

J. Evaluation of Combined Technical and Financial Parts, Most Advantageous Bid and Notification of Intention to Award 33

40. Evaluation of combined Technical and Financial Parts 33
41. Purchaser's Right to Accept Any Bid, and to Reject Any or All Bids 33
42. Standstill Period 33
43. Notification of Intention to Award 34

K. Award of Contract 34

44. Award Criteria 34
45. Purchaser's Right to Vary Quantities at Time of Award 34
46. Notification of Award 34
47. Debriefing by the Purchaser 35
48. Signing of Contract 36
49. Performance Security 37
50. Procurement Related Complaint 37

Section I - Instructions to Bidders

A. General

1. Scope of Bid

1.1 In connection with the Specific Procurement Notice, Request for Bids (RFB), specified in the **Bid Data Sheet (BDS),** the Purchaser, as specified in the **BDS,** issues this bidding document for the supply of Goods and, if applicable, any Related Services incidental thereto, as specified in Section VII, Schedule of Requirements. The name, identification and number of lots (contracts) of this RFB are specified in the **BDS.**

1.2 Throughout this bidding document:

(a) the term "in writing" means communicated in written form (e.g. by mail, e-mail, fax, including, if specified in the **BDS**, distributed or received through the electronic-procurement system used by the Purchaser), with proof of receipt;

(b) if the context so requires, "singular" means "plural" and vice versa; and

(c) "Day" means calendar day, unless otherwise specified as "Business Day". A Business Day is any day that is an official working day of the Borrower. It excludes the Borrower's official public holidays.

2. Source of Funds

2.1 The Borrower or Recipient (hereinafter called "Borrower") specified in the **BDS** has applied for or received financing (hereinafter called "funds") from the International Bank for Reconstruction and Development or the International Development Association (hereinafter called "the Bank") in an amount specified in the **BDS,** toward the project named in the **BDS.** The Borrower intends to apply a portion of the funds to eligible payments under the contract for which this bidding document is issued.

2.2 Payment by the Bank will be made only at the request of the Borrower and upon approval by the Bank in accordance with the terms and conditions of the Loan (or other financing) Agreement. The Loan (or other financing) Agreement prohibits a withdrawal from the loan account for the purpose of any payment to persons or entities, or for any import of goods, if such payment or import is prohibited by a decision of the United Nations Security Council taken under Chapter VII of the Charter of the

United Nations. No party other than the Borrower shall derive any rights from the Loan (or other financing) Agreement or have any claim to the proceeds of the Loan (or other financing).

3. Fraud and Corruption

3.1 The Bank requires compliance with the Bank's Anti-Corruption Guidelines and its prevailing sanctions policies and procedures as set forth in the WBG's Sanctions Framework, as set forth in Section VI, Fraud and Corruption.

3.2 In further pursuance of this policy, bidders shall permit and shall cause their agents (where declared or not), subcontractors, subconsultants, service providers, suppliers, and personnel, to permit the Bank to inspect all accounts, records and other documents relating to any initial selection process, prequalification process, bid submission, proposal submission, and contract performance (in the case of award), and to have them audited by auditors appointed by the Bank.

4. Eligible Bidders

4.1 A Bidder may be a firm that is a private entity, a state-owned enterprise or institution (subject to ITB 4.6), or any combination of such entities in the form of a joint venture (JV) under an existing agreement or with the intent to enter into such an agreement supported by a letter of intent. In the case of a joint venture, all members shall be jointly and severally liable for the execution of the entire Contract in accordance with the Contract terms. The JV shall nominate a Representative who shall have the authority to conduct all business for and on behalf of any and all the members of the JV during the Bidding process and, in the event the JV is awarded the Contract, during contract execution. Unless specified in the **BDS**, there is no limit on the number of members in a JV.

4.2 A Bidder shall not have a conflict of interest. Any Bidder found to have a conflict of interest shall be disqualified. A Bidder may be considered to have a conflict of interest for the purpose of this Bidding process, if the Bidder:

(a) directly or indirectly controls, is controlled by or is under common control with another Bidder; or

(b) receives or has received any direct or indirect subsidy from another Bidder; or

(c) has the same legal representative as another Bidder; or

(d) has a relationship with another Bidder, directly or through common third parties, that puts it in a position to influence the Bid

of another Bidder, or influence the decisions of the Purchaser regarding this Bidding process; or

(e) or any of its affiliates participated as a consultant in the preparation of the design or technical specifications of the works that are the subject of the Bid; or

(f) or any of its affiliates has been hired (or is proposed to be hired) by the Purchaser or Borrower for the Contract implementation; or

(g) would be providing goods, works, or non-consulting services resulting from or directly related to consulting services for the preparation or implementation of the project specified in the BDS reference ITB 2.1 (the name of the project), that it provided or were provided by any affiliate that directly or indirectly controls, is controlled by, or is under common control with that firm; or

(h) has a close business or family relationship with a professional staff of the Borrower (or of the project implementing agency, or of a recipient of a part of the loan) who: (i) are directly or indirectly involved in the preparation of the bidding document or specifications of the Contract, and/or the Bid evaluation process of such Contract; or (ii) would be involved in the implementation or supervision of such Contract unless the conflict stemming from such relationship has been resolved in a manner acceptable to the Bank throughout the Bidding process and execution of the Contract.

4.3 A firm that is a Bidder (either individually or as a JV member) shall not participate in more than one Bid, except for permitted alternative Bids. This includes participation as a subcontractor. Such participation shall result in the disqualification of all Bids in which the firm is involved. A firm that is not a Bidder or a JV member, may participate as a subcontractor in more than one Bid.

4.4 A Bidder may have the nationality of any country, subject to the restrictions pursuant to ITB 4.8. A Bidder shall be deemed to have the nationality of a country if the Bidder is constituted, incorporated or registered in and operates in conformity with the provisions of the laws of that country, as evidenced by its articles of incorporation (or equivalent documents of constitution or association) and its registration documents, as the case may be. This

criterion also shall apply to the determination of the nationality of proposed subcontractors or subconsultants for any part of the Contract including related Services.

4.5 A Bidder that has been sanctioned by the Bank, pursuant to the Bank's Anti-Corruption Guidelines, and in accordance with its prevailing sanctions policies and procedures as set forth in the WBG's Sanctions Framework as described in Section VI paragraph 2.2 d. shall be ineligible to be prequalified for, initially selected for, bid for, propose for, or be awarded a Bank-financed contract or benefit from a Bank-financed contract, financially or otherwise, during such period of time as the Bank shall have determined. The list of debarred firms and individuals is available at the electronic address specified in the BDS.

4.6 Bidders that are state-owned enterprises or institutions in the Purchaser's Country may be eligible to compete and be awarded a Contract(s) only if they can establish, in a manner acceptable to the Bank, that they (i) are legally and financially autonomous (ii) operate under commercial law, and (iii) are not under supervision of the Purchaser.

4.7 A Bidder shall not be under suspension from Bidding by the Purchaser as the result of the operation of a Bid–Securing Declaration or Proposal-Securing Declaration.

4.8 Firms and individuals may be ineligible if so indicated in Section V, Eligible Countries, and:

(a) as a matter of law or official regulations, the Borrower's country prohibits commercial relations with that country, provided that the Bank is satisfied that such exclusion does not preclude effective competition for the supply of goods or the contracting of works or services required; or

(b) by an act of compliance with a decision of the United Nations Security Council taken under Chapter VII of the Charter of the United Nations, the Borrower's country prohibits any import of goods or contracting of works or services from that country, or any payments to any country, person, or entity in that country.

4.9 A Bidder shall provide such documentary evidence of eligibility satisfactory to the Purchaser, as the Purchaser shall reasonably request.

4.10 A firm that is under a sanction of debarment by the Borrower from being awarded a contract is eligible to participate in this procurement, unless the Bank,

at the Borrower's request, is satisfied that the debarment;

(a) relates to fraud or corruption; and

(b) followed a judicial or administrative proceeding that afforded the firm adequate due process.

5. Eligible Goods and Related Services

5.1 All the Goods and Related Services to be supplied under the Contract and financed by the Bank may have their origin in any country in accordance with Section V, Eligible Countries.

5.2 For purposes of this ITB, the term "goods" includes commodities, raw material, machinery, equipment, and industrial plants; and "related services" includes services such as insurance, installation, training, and initial maintenance.

5.3 The term "origin" means the country where the goods have been mined, grown, cultivated, produced, manufactured or processed; or, through manufacture, processing, or assembly, another commercially recognized article results that differs substantially in its basic characteristics from its components.

B. Contents of Request for Bids Document

6. Sections of Bidding Document

6.1 The bidding document consist of Parts 1, 2, and 3, which include all the sections indicated below, and should be read in conjunction with any addenda issued in accordance with ITB 8.

PART 1 Bidding Procedures

- Section I - Instructions to Bidders (ITB)
- Section II - Bidding Data Sheet (BDS)
- Section III - Evaluation and Qualification Criteria
- Section IV - Bidding Forms
- Section V - Eligible Countries
- Section VI - Fraud and Corruption

PART 2 Supply Requirements

- Section VII - Schedule of Requirements

PART 3 Contract

- Section VIII - General Conditions of Contract
- Section IX - Special Conditions of Contract
- Section X - Contract Forms

6.2 The Specific Procurement Notice - Request for Bids (RFB) issued by the Purchaser is not part of this bidding document.

6.3 Unless obtained directly from the Purchaser, the Purchaser is not responsible for the completeness of the document, responses to requests for clarification, the Minutes of the pre-Bid meeting (if any), or addenda to the bidding document in accordance with ITB 8. In case of any contradiction, documents obtained directly from the Purchaser shall prevail.

6.4 The Bidder is expected to examine all instructions, forms, terms, and specifications in the bidding document and to furnish with its Bid all information or documentation as is required by the bidding document.

7. Clarification of the Bidding Document

7.1 A Bidder requiring any clarification of the bidding document shall contact the Purchaser in writing at the Purchaser's address specified in the **BDS**. The Purchaser will respond in writing to any request for clarification, provided that such request is received prior to the deadline for submission of Bids within a period specified in the **BDS.** The Purchaser shall forward copies of its response to all Bidders who have acquired the bidding document in accordance with ITB 6.3, including a description of the inquiry but without identifying its source. If so, specified in the **BDS**, the Purchaser shall also promptly publish its response at the web page identified in the **BDS**. Should the clarification result in changes to the essential elements of the bidding document, the Purchaser shall amend the bidding document following the procedure under ITB 8 and ITB 22.2.

8. Amendment of Bidding Document

8.1 At any time prior to the deadline for submission of Bids, the Purchaser may amend the bidding document by issuing addenda.

8.2 Any addendum issued shall be part of the bidding document and shall be communicated in writing to all who have obtained the bidding document from the Purchaser in accordance with ITB 6.3. The Purchaser shall also promptly publish the addendum on the Purchaser's web page in accordance with ITB 7.1.

8.3 To give prospective Bidders reasonable time in which to take an addendum into account in preparing their Bids, the Purchaser may, at its discretion, extend the deadline for the submission of Bids, pursuant to ITB 22.2.

C. Preparation of Bids

9. Cost of Bidding

9.1 The Bidder shall bear all costs associated with the preparation and submission of its Bid, and the Purchaser shall not be responsible or liable for those costs, regardless of the conduct or outcome of the Bidding process.

10. Language of Bid

10.1 The Bid, as well as all correspondence and documents relating to the Bid exchanged by the Bidder and the Purchaser, shall be written in the language specified in the **BDS.** Supporting documents and printed literature that are part of the Bid may be in another language provided they are accompanied by an accurate translation of the relevant passages into the language specified in the **BDS,** in which case, for purposes of interpretation of the Bid, such translation shall govern.

11. Documents comprising Bid

11.1 The Bid shall comprise two Parts, namely the Technical Part and the Financial Part. These two Parts shall be submitted simultaneously in two separate sealed envelopes (two-envelope Bidding process). One envelope shall contain only information relating to the Technical Part and the other, only information relating to the Financial Part. These two envelopes shall be enclosed in a separate sealed outer envelope marked "ORIGINAL BID".

11.2 The **Technical Part** shall contain the following:

(a) **Letter of Bid - Technical Part:** prepared in accordance with ITB 12;

(b) **Bid Security** or **Bid-Securing Declaration**: in accordance with ITB 19.1;

(c) **Alternative Bid - Technical Part**: if permissible in accordance with ITB 13, the Technical Part of any Alternative Bid;

(d) **Authorization**: written confirmation authorizing the signatory of the Bid to commit the Bidder, in accordance with ITB 20.3;

(e) **Bidder's Eligibility**: documentary evidence in accordance with ITB 17 establishing the Bidder's eligibility to Bid;

(f) **Qualifications**: documentary evidence in accordance with ITB 17 establishing the Bidder's qualifications to perform the Contract if its Bid is accepted;

(g) **Eligibility of Goods and Related Services**: documentary evidence in

accordance with ITB 16, establishing the eligibility of the Goods and Related Services to be supplied by the Bidder;

(h) **Conformity**: documentary evidence in accordance with ITB 16, that the Goods and Related Services conform to the bidding document;

(i) any other document **required in the BDS.**

11.3 The **Financial Part** envelope shall contain the following:

(a) **Letter of Bid – Financial Part:** prepared in accordance with ITB 12 and ITB 14;

(b) **Price Schedules**: completed prepared in accordance with ITB 12 and ITB 14;

(c) **Alternative Bid - Financial Part;** if permissible in accordance with ITB 13, the Financial Part of any Alternative Bid;

(d) any other document **required in the BDS.**

11.4 The Technical Part shall not include any financial information related to the Bid price. Where material financial information related to the Bid price is contained in the Technical Part the Bid shall be declared non-responsive.

11.5 In addition to the requirements under ITB 11.2, Bids submitted by a JV shall include a copy of the Joint Venture Agreement entered into by all members. Alternatively, a letter of intent to execute a Joint Venture Agreement in the event of a successful Bid shall be signed by all members and submitted with the Bid, together with a copy of the proposed Agreement.

11.6 The Bidder shall furnish in the Letter of Bid information on commissions and gratuities, if any, paid or to be paid to agents or any other party relating to this Bid.

12. Letters of Bid

12.1. The Bidder shall prepare the Letter of Bid – Technical Part, and Letter of Bid – Financial Part using the relevant forms furnished in Section IV, Bidding Forms. The forms must be completed without any alterations to the text, and no substitutes shall be accepted except as provided under ITB 20.3. All blank spaces shall be filled in with the information requested.

13. Alternative Bids

13.1. Unless otherwise specified in the **BDS,** Alternative Bids shall not be considered.

14. Bid prices and Discounts

14.1 The prices and discounts quoted by the Bidder in the Letter of Bid - Financial Part and in the Price

Schedules shall conform to the requirements specified below.

14.2 All lots (contracts) and items must be listed and priced separately in the Price Schedules.

14.3 The price to be quoted in the Letter of Bid - Financial Part, in accordance with ITB 12.1 shall be the total price of the Bid, excluding any discounts offered.

14.4 The Bidder shall quote any discounts and indicate the methodology for their application in the Letter of Bid - Financial Part, in accordance with ITB 12.1.

14.5 Prices quoted by the Bidder shall be fixed during the Bidder's performance of the Contract and not subject to variation on any account, unless otherwise specified in the **BDS.** A Bid submitted with an adjustable price quotation shall be treated as nonresponsive and shall be rejected, pursuant to ITB 31. However, if in accordance with the BDS, prices quoted by the Bidder shall be subject to adjustment during the performance of the Contract, a Bid submitted with a fixed price quotation shall not be rejected, but the price adjustment shall be treated as zero.

14.6 If so specified in ITB 1.1, Bids are being invited for individual lots (contracts) or for any combination of lots (packages). Unless otherwise specified in the **BDS,** prices quoted shall correspond to 100% of the items specified for each lot and to 100% of the quantities specified for each item of a lot. Bidders wishing to offer discounts for the award of more than one Contract shall specify in their Bid the price reductions applicable to each package, or alternatively, to individual Contracts within the package. **However, discounts that are conditional on the award of more that one lot will not be considered for bid evaluation purpose**.

14.7 The terms EXW, CIP, and other similar terms shall be governed by the rules prescribed in the current edition of Incoterms, published by the International Chamber of Commerce, as specified in the **BDS.**

14.8 Prices shall be quoted as specified in each Price Schedule included in Section IV, Bidding Forms. The disaggregation of price components is required solely for the purpose of facilitating the comparison of Bids by the Purchaser. This shall not in any way limit the Purchaser's right to contract on any of the terms offered. In quoting

prices, the Bidder shall be free to use transportation through carriers registered in any eligible country, in accordance with Section V, Eligible Countries. Similarly, the Bidder may obtain insurance services from any eligible country in accordance with Section V, Eligible Countries. Prices shall be entered in the following manner:

(a) For Goods manufactured in the Purchaser's Country:

(i) the price of the Goods quoted EXW (ex-works, ex-factory, ex warehouse, ex showroom, or off-the-shelf, as applicable), including all customs duties and sales and other taxes already paid or payable on the components and raw material used in the manufacture or assembly of the Goods;

(ii) any Purchaser's Country sales tax and other taxes which will be payable on the Goods if the Contract is awarded to the Bidder; and

(iii) the price for inland transportation, insurance, and other local services required to convey the Goods to their final destination (Project Site) specified in the **BDS.**

(b) For Goods manufactured outside the Purchaser's Country, to be imported:

(i) the price of the Goods, quoted CIP named place of destination, in the Purchaser's Country, as specified in the **BDS;**

(ii) the price for inland transportation, insurance, and other local services required to convey the Goods from the named place of destination to their final destination (Project Site) specified in the **BDS;**

(c) For Goods manufactured outside the Purchaser's Country, already imported:

(i) the price of the Goods, including the original import value of the Goods; plus any mark-up (or rebate); plus any other related local cost, and custom duties and other import taxes already paid or to be paid on the Goods already imported.

(ii) the custom duties and other import taxes already paid (need to be supported with documentary evidence) or to be paid on the Goods already imported;

(iii) the price of the Goods, obtained as the difference between (i) and (ii) above;

(iv) any Purchaser's Country sales and other taxes which will be payable on the Goods if the Contract is awarded to the Bidder; and

(v) the price for inland transportation, insurance, and other local services required to convey the Goods to their final destination (Project Site) specified in the **BDS.**

(d) for Related Services, other than inland transportation and other services required to convey the Goods to their final destination, whenever such Related Services are specified in the Schedule of Requirements:

(i) the price of each item comprising the Related Services (inclusive of any applicable taxes).

15. Currencies of Bid and Payment

15.1 The currency(ies) of the Bid and the currency(ies) of payments shall be the same. The Bidder shall quote in the currency of the Purchaser's Country the portion of the Bid price that corresponds to expenditures incurred in the currency of the Purchaser's country, unless otherwise specified in the **BDS.**

15.2 The Bidder may express the Bid price in any currency. If the Bidder wishes to be paid in a combination of amounts in different currencies, it may quote its price accordingly but shall use no more than three foreign currencies in addition to the currency of the Purchaser's Country.

16. Documents Establishing the Eligibility and Conformity of the Goods and Related Services

16.1 To establish the eligibility of the Goods and Related Services in accordance with ITB 5, Bidders shall complete the country of origin declarations in the Price Schedule Forms, included in Section IV, Bidding Forms.

16.2 To establish the conformity of the Goods and Related Services to the bidding document, the Bidder shall furnish as part of its Bid the documentary evidence that the Goods conform to the technical specifications and standards

specified in Section VII, Schedule of Requirements.

16.3 The documentary evidence may be in the form of literature, drawings or data, and shall consist of a detailed item by item description of the essential technical and performance characteristics of the Goods and Related Services, demonstrating substantial responsiveness of the Goods and Related Services to the technical specification, and if applicable, a statement of deviations and exceptions to the provisions of the Section VII, Schedule of Requirements.

16.4 The Bidder shall also furnish a list giving full particulars, including available sources and current prices of spare parts, special tools, etc., necessary for the proper and continuing functioning of the Goods during the period specified in the **BDS** following commencement of the use of the goods by the Purchaser.

16.5 Standards for workmanship, process, material, and equipment, as well as references to brand names or catalogue numbers specified by the Purchaser in the Schedule of Requirements, are intended to be descriptive only and not restrictive. The Bidder may offer other standards of quality, brand names, and/or catalogue numbers, provided that it demonstrates, to the Purchaser's satisfaction, that the substitutions ensure substantial equivalence or are superior to those specified in the Section VII, Schedule of Requirements.

17. Documents Establishing the Eligibility and Qualifications of the Bidder

17.1 To establish Bidder's eligibility in accordance with ITB 4, Bidders shall complete the Letter of Bid – Technical Part, included in Section IV, Bidding Forms.

17.2 The documentary evidence of the Bidder's qualifications to perform the Contract, if its Bid is accepted, shall establish to the Purchaser's satisfaction:

(a) that, if required in the **BDS**, a Bidder that does not manufacture or produce the Goods it offers to supply shall submit the Manufacturer's Authorization using the form included in Section IV, Bidding Forms to demonstrate that it has been duly authorized by the manufacturer or producer of the Goods to supply these Goods in the Purchaser's Country;

(b) that, if required in the **BDS**, in case of a Bidder not doing business within the

Purchaser's Country, the Bidder is or will be (if awarded the Contract) represented by an Agent in the country equipped and able to carry out the Supplier's maintenance, repair and spare parts-stocking obligations prescribed in the Conditions of Contract and/or Technical Specifications; and

(c) that the Bidder meets each of the qualification criterion specified in Section III, Evaluation and Qualification Criteria.

18. Period of Validity of Bids

18.1. Bids shall remain valid until the date specified in the **BDS** or any extended date if amended by the Purchaser in accordance with ITB 8. A Bid that is not valid until the date specified in the **BDS**, or any extended date if amended by the Purchaser in accordance with ITB 8, shall be rejected by the Purchaser as nonresponsive.

18.2. In exceptional circumstances, prior to the expiry of the Bid validity, the Purchaser may request Bidders to extend the period of validity of their Bids. The request and the responses shall be made in writing. If a Bid Security is requested (in accordance with ITB 19), it shall also be extended for a corresponding period. A Bidder may refuse the request without forfeiting its Bid Security. A Bidder granting the request shall not be required or permitted to modify its Bid, except as provided in ITB 18.3.

18.3. If the award is delayed by a period exceeding fifty-six (56) days beyond the expiry of the initial Bid validity, the Contract price shall be determined as follows:

(a) In the case of fixed price contracts, the Contract price shall be the Bid price adjusted by the factor specified in the **BDS**.

(b) In the case of adjustable price contracts, no adjustment shall be made.

(c) In any case, Bid evaluation shall be based on the Bid price without taking into consideration the applicable correction from those indicated above.

19. Bid Security

19.1. The Bidder shall furnish, as part of the Technical Part of its Bid, either a Bid-Securing Declaration or a Bid Security, as specified in the **BDS,** in original form and, in the case of a Bid security**,** in the amount and currency specified in the **BDS.**

19.2. A Bid Securing Declaration shall use the form included in Section IV, Bidding Forms.

19.3. If a Bid Security is specified pursuant to ITB 19.1, the Bid security shall be a demand guarantee in any of the following forms at the Bidder's option:

(a) an unconditional guarantee issued by a bank or non-bank financial institution (such as an insurance, bonding or surety company);

(b) an irrevocable letter of credit;

(c) a cashier's or certified check; or

(d) another security specified in the **BDS**,

from a reputable source from an eligible country. If an unconditional guarantee is issued by a non-bank financial institution located outside the Purchaser's Country the issuing non-bank financial institution shall have a correspondent financial institution located in the Purchaser's Country to make it enforceable unless the Purchaser has agreed in writing, prior to Bid submission, that a correspondent financial institution is not required. In the case of a bank guarantee, the Bid security shall be submitted either using the Bid Security Form included in Section IV, Bidding Forms, or in another substantially similar format approved by the Purchaser prior to Bid submission. The Bid security shall be valid for twenty-eight (28) days beyond the original date of expiry of the Bid validity, or beyond any extended date if requested under ITB 18.2.

19.4. If a Bid Security is specified pursuant to ITB 19.1, any Bid not accompanied by a substantially responsive Bid Security shall be rejected by the Purchaser as non-responsive.

19.5. If a Bid Security is specified pursuant to ITB 19.1, the Bid Security of unsuccessful Bidders shall be returned as promptly as possible upon the successful Bidder's signing the contract and furnishing the Performance Security pursuant to ITB 49.

19.6. The Bid Security of the successful Bidder shall be returned as promptly as possible once the successful Bidder has signed the Contract and furnished the required performance security.

19.7. The Bid Security may be forfeited:

(a) if a Bidder withdraws its Bid prior to the expiry date of Bid validity specified by the Bidder on the Letter of Bid or any extended date provided by the Bidder; or

(b) if the successful Bidder fails to:

(i) sign the Contract in accordance with ITB 48; or

(ii) furnish a performance security in accordance with ITB 49.

19.8. The Bid Security or Bid-Securing Declaration of a JV must be in the name of the JV that submits the Bid. If the JV has not been legally constituted into a legally enforceable JV at the time of Bidding, the Bid security or Bid-Securing Declaration shall be in the names of all future members as named in the letter of intent referred to in ITB 4.1 and ITB 11.5.

19.9. If a Bid security is **not required** in the **BDS**, pursuant to ITB 19.1, and

(a) if a Bidder withdraws its Bid during the period of Bid validity specified by the Bidder on the Letter of Bid, or any extended date provided by the Bidder, or

(b) if the successful Bidder fails to: sign the Contract in accordance with ITB 48; or furnish a performance security in accordance with ITB 49;

the Borrower may, **if provided for** in the **BDS**, declare the Bidder ineligible to be awarded a contract by the Purchaser for a period of time **as stated** in the **BDS**.

20. Format and Signing of Bid

20.1 The Bidder shall prepare the Bid, in accordance with ITB 11 and ITB 21.

20.2 Bidders shall mark as "CONFIDENTIAL" information in their Bids which is confidential to their business. This may include proprietary information, trade secrets, or commercial or financially sensitive information.

20.3 The original and all copies of the Bid shall be typed or written in indelible ink and shall be signed by a person duly authorized to sign on behalf of the Bidder. This authorization shall consist of a written confirmation **as** specified **in the BDS** and shall be attached to the Bid. The name and position held by each person signing the authorization must be typed or printed below the signature. All pages of the Bid where entries or amendments have been made shall be signed or initialed by the person signing the Bid.

20.4 In case the Bidder is a JV, the Bid shall be signed by an authorized representative of the JV on behalf of the JV, and so as to be legally binding on all the members as evidenced by a power of attorney signed by their legally authorized representatives.

20.5 Any inter-lineation, erasures, or overwriting shall be valid only if they are signed or initialed by the person signing the Bid.

D. Submission of Bids

21. Sealing and Marking of Bids

21.1 The Bidder shall deliver the Bid in two separate, sealed **envelopes** (the Technical Part and the Financial Part). These two envelopes shall be enclosed in a sealed outer envelope marked "ORIGINAL BID".

21.2 In addition, the Bidder shall submit copies of the Bid in the number specified **in the BDS**. Copies of the Technical Part shall be placed in a separate sealed envelope marked "COPIES: TECHNICAL PART". Copies of the Financial Part shall be placed in a separate sealed envelope marked "COPIES: FINANCIAL PART". The Bidder shall place both of these envelopes in a separate, sealed outer envelope marked "BID COPIES". In the event of any discrepancy between the original and the copies, the original shall prevail. If alternative Bids are permitted in accordance with ITB 13, the alternative Bids shall be submitted as follows: the original of the alternative Bid Technical Part shall be placed in a sealed envelope marked "ALTERNATIVE BID – TECHNICAL PART" and the Financial Part shall be placed in a sealed envelope marked "ALTERNATIVE BID – FINANCIAL PART" and these two separate sealed envelopes then enclosed within a sealed outer envelope marked "ALTERNATIVE BID – ORIGINAL", the copies of the alternative Bid will be placed in separate sealed envelopes marked "ALTERNATIVE BID – COPIES OF TECHNICAL PART", and "ALTERNATIVE BID – COPIES OF FINANCIAL PART" and enclosed in a separate sealed outer envelope marked "ALTERNATIVE BID - COPIES".

21.3 The envelopes marked "ORIGINAL BID" and "BID COPIES" (and, if appropriate, a third envelope marked "ALTERNATIVE BID") shall be enclosed in a separate sealed outer envelope for submission to the Purchaser.

21.4 All inner and outer envelopes, shall:

(a) bear the name and address of the Bidder;

(b) be addressed to the Purchaser in accordance with ITB 22.1;

(c) bear the specific identification of this Bidding process indicated in ITB 1.1; and

(d) bear a warning not to open before the time and date for Bid opening.

21.5 If all envelopes are not sealed and marked as required, the Purchaser will assume no responsibility for the misplacement or premature opening of the Bid.

22. Deadline for Submission of Bids

22.1. Bids must be received by the Purchaser at the address and no later than the date and time specified in the **BDS.** When so specified in the **BDS**, Bidders shall have the option of submitting their Bids electronically. Bidders submitting Bids electronically shall follow the electronic Bid submission procedures specified in the **BDS**.

22.2. The Purchaser may, at its discretion, extend the deadline for the submission of Bids by amending the bidding document in accordance with ITB 8, in which case all rights and obligations of the Purchaser and Bidders previously subject to the deadline shall thereafter be subject to the deadline as extended.

23. Late Bids

23.1. The Purchaser shall not consider any Bid that arrives after the deadline for submission of Bids, in accordance with ITB 22. Any Bid received by the Purchaser after the deadline for submission of Bids shall be declared late, rejected, and returned unopened to the Bidder.

24. Withdrawal, Substitution, and Modification of Bids

24.1. A Bidder may withdraw, substitute, or modify its Bid after it has been submitted by sending a written notice, duly signed by an authorized representative, and shall include a copy of the authorization (the power of attorney) in accordance with ITB 20.3, (except that withdrawal notices do not require copies). The corresponding substitution or modification of the Bid must accompany the respective written notice. All notices must be:

(a) prepared and submitted in accordance with ITB 20 and ITB 21 (except that withdrawal notices do not require copies), and in addition, the respective envelopes shall be clearly marked "WITHDRAWAL," "SUBSTITUTION," or "MODIFICATION;" and

(b) received by the Purchaser prior to the deadline prescribed for submission of Bids, in accordance with ITB 22.

24.2. Bids requested to be withdrawn in accordance with ITB 24.1 shall be returned unopened to the Bidders.

24.3. No Bid may be withdrawn, substituted, or modified in the interval between the deadline for submission of Bids and the expiration of the

period of Bid validity specified by the Bidder on the Letter of Bid -Technical Part and repeated in the Letter of Bid - Financial Part, or any extension thereof.

E. Public Opening of Technical Parts of Bids

25. Public Opening of Technical Parts of Bids

25.1. Except as in the cases specified in ITB 23 and ITB 24.2, the Purchaser shall, at this Bid opening, publicly open and read out, in accordance with this ITB, all bids received by the deadline at the date, time and place specified **in** the BDS in the presence of Bidders' designated representatives and anyone who chooses to attend. Any specific electronic Bid opening procedures required if electronic Bidding is permitted in accordance with ITB 22.1, shall be as specified in the **BDS.**

25.2. First, the written notice of withdrawal in the envelopes marked "WITHDRAWAL" shall be opened and read out and the envelope with the corresponding Bid shall not be opened, but returned to the Bidder. If the withdrawal envelope does not contain a copy of the "power of attorney" confirming the signature as a person duly authorized to sign on behalf of the Bidder, the corresponding Bid will be opened. No Bid withdrawal shall be permitted unless the corresponding withdrawal notice contains a valid authorization to request the withdrawal and is read out at Bid opening.

25.3. Next, envelopes marked "SUBSTITUTION" shall be opened and read out and exchanged with the corresponding Bid being substituted, and the substituted Bid shall not be opened, but returned to the Bidder. No Bid substitution shall be permitted unless the corresponding substitution notice contains a valid authorization to request the substitution and is read out at Bid opening.

25.4. Next, envelopes marked "MODIFICATION" shall be opened and read out with the corresponding Bid. No Bid modification shall be permitted unless the corresponding modification notice contains a valid authorization to request the modification and is read out at Bid opening. Only Bids that are opened and read out at Bid opening shall be considered further.

25.5. Next, all other envelopes marked "TECHNICAL PART" shall be opened one at a time. All envelopes marked "FINANCIAL PART" shall remain sealed, and kept by the Purchaser in safe custody until they are opened, at a later public opening, following the evaluation of the

Technical Part of the Bids. On opening the envelopes marked "TECHNICAL PART" the Purchaser shall read out: the name of the Bidder and whether there is a modification; and Alternative Bid the presence or absence of a Bid Security, if required and any other details as the Purchaser may consider appropriate.

25.6. Only Technical Parts of Bids and Alternative Bid - Technical Parts that are read out at Bid opening shall be considered further in the evaluation. The Letter of Bid – Technical Part and the separate sealed envelope marked "FINANCIAL PART" are to be initialed by representatives of the Purchaser attending Bid opening in the manner specified in the **BDS.**

25.7. At the Bid opening the Purchaser shall neither discuss the merits of any Bid nor reject any Bid (except for late Bids, in accordance with ITB 23.1).

25.8. Following the opening of the Technical Parts of the Bid the Purchaser shall prepare a record that shall include, as a minimum:

(a) the name of the Bidder and whether there is a withdrawal, substitution, or modification;

(b) the presence or absence of a duly sealed envelope marked "FINANCIAL PART";

(c) the presence or absence of a Bid Security or Bid-Securing Declaration; and

(d) if applicable, any Alternative Bid - Technical Part;

25.9. The Bidders' representatives who are present shall be requested to sign the record. The omission of a Bidder's signature on the record shall not invalidate the contents and effect of the record. A copy of the record shall be distributed to all Bidders.

F. Evaluation of Bids - General Provisions

26. Confidentiality

26.1 Information relating to the evaluation of the Technical Part shall not be disclosed to Bidders or any other persons not officially concerned with the Bidding process until the notification of evaluation of the Technical Part in accordance with ITB 33. Information relating to the evaluation of Financial Part, the evaluation of combined Technical Part and Financial Part, and recommendation of contract award shall not be disclosed to Bidders or any other persons not officially concerned with the RFB process until the Notification of Intention to

Award the Contract is transmitted to Bidders in accordance with ITB 43.

26.2 Any effort by a Bidder to influence the Purchaser in the evaluation or contract award decisions may result in the rejection of its Bid.

26.3 Notwithstanding ITB 26.2, from the time of Bid opening to the time of Contract Award, if any Bidder wishes to contact the Purchaser on any matter related to the Bidding process, it should do so in writing.

27. Clarification of Bids

27.1 To assist in the examination, evaluation, comparison of the Bids, and qualification of the Bidders, the Purchaser may, at its discretion, ask any Bidder for a clarification of its Bid. Any clarification submitted by a Bidder in respect to its Bid and that is not in response to a request by the Purchaser shall not be considered. The Purchaser's request for clarification and the response shall be in writing. No change, including any voluntary increase or decrease, in the prices or substance of the Bid shall be sought, offered, or permitted, except to confirm the correction of arithmetic errors discovered by the Purchaser in the Evaluation of the Bids, in accordance with ITB 35.

27.2 If a Bidder does not provide clarifications of its Bid by the date and time set in the Purchaser's request for clarification, its Bid may be rejected.

28. Deviations, Reservations, and Omissions

28.1 During the evaluation of Bids, the following definitions apply:

(a) "Deviation" is a departure from the requirements specified in the bidding document;

(b) "Reservation" is the setting of limiting conditions or withholding from complete acceptance of the requirements specified in the bidding document; and

28.2 "Omission" is the failure to submit part or all of the information or documentation required in the bidding document.

29. Nonconformities, Errors and Omissions

29.1 Provided that a Bid is substantially responsive, the Purchaser may waive any nonconformities in the Bid.

29.2 Provided that a Bid is substantially responsive, the Purchaser may request that the Bidder submit the necessary information or documentation, within a reasonable period of time, to rectify nonmaterial nonconformities or

omissions in the Bid related to documentation requirements. Such omission shall not be related to any aspect of the price of the Bid. Failure of the Bidder to comply with the request may result in the rejection of its Bid.

G. Evaluation of Technical Parts of Bids

30. Evaluation of Technical Parts

30.1 In evaluating the Technical Parts of each Bid, the Purchaser shall use the criteria and methodologies listed in ITB 31, ITB 32, the BDS, if applicable, and Section III, Evaluation and Qualification Criteria. No other evaluation criteria or methodologies shall be permitted.

31. Determination of Responsiveness

31.1 The Purchaser's determination of a Bid's responsiveness is to be based on the contents of the Bid itself, as defined in ITB 11. A substantially responsive Bid is one that meets the requirements of the bidding document without material deviation, reservation, or omission. A material deviation, reservation, or omission is one that:

(a) if accepted, would:

(i) affect in any substantial way the scope, quality, or performance of the Goods and Related Services specified in the Contract; or

(ii) limit in any substantial way, inconsistent with the bidding document, the Purchaser's rights or the Bidder's obligations under the Contract; or

(b) if rectified, would unfairly affect the competitive position of other Bidders presenting substantially responsive Bids.

31.2 The Purchaser shall examine the technical aspects of the Bid submitted in accordance with ITB 16 and ITB 17, in particular, to confirm that all requirements of Section VII, Schedule of Requirements have been met without any material deviation or reservation, or omission.

31.3 If a Bid is not substantially responsive to the requirements of bidding document, it shall be rejected by the Purchaser and may not subsequently be made responsive by correction of the material deviation, reservation, or omission.

32. Qualification of the Bidders and Detailed Evaluation of the Technical Part

32.1 The Purchaser shall determine, to its satisfaction, whether all eligible Bidders, whose Bids have been determined to be substantially responsive to the bidding document, meet the

Qualification Criteria specified in Section III, Evaluation and Qualification Criteria.

32.2 The determination shall be based upon an examination of the documentary evidence of the Bidder's qualifications submitted by the Bidder, pursuant to ITB 17. The determination shall not take into consideration the qualifications of other firms such as the Bidder's subsidiaries, parent entities, affiliates, subcontractors (other than specialized subcontractors if permitted in the bidding document), or any other firm different from the Bidder.

32.3 Prior to Contract award, the Purchaser will verify that the successful Bidder (including each member of a JV) is not disqualified by the Bank due to noncompliance with contractual SEA/SH prevention and response obligations. The Purchaser will conduct the same verification for each subcontractor proposed by the successful Bidder. If any proposed subcontractor does not meet the requirement, the Purchaser will require the Bidder to propose a replacement subcontractor.

32.4 Only substantially responsive bids submitted by eligible and qualified bidders shall proceed to the detailed technical evaluation to assess adequacy of the Technical Part followed by evaluation applying technical factors/subfactors and corresponding scores as specified in the BDS.

H. Notification of Evaluation of Technical Parts and Public Opening of Financial Parts of Bids

33. Notification of Evaluation of Technical Parts and Public Opening of Financial Parts

33.1 Following the completion of the evaluation of the Technical Parts of the Bids, and the Bank has issued its no objection (if applicable), the Purchaser shall notify in writing those Bidders who have failed to meet the Qualification Criteria and/or whose Bids were considered non-responsive to the requirements in the bidding document, advising them of the following information:

(a) the grounds on which their Technical Part of Bid failed to meet the requirements of the bidding document;

(b) their envelope marked "FINANCIAL PART" will be returned to them unopened after the completion of the bid evaluation process and the signing of the Contract;

(c) notify them of the date, time and location of the public opening of the envelopes marked 'FINANCIAL PART".

33.2 The Purchaser shall, simultaneously, notify in writing those Bidders whose Technical Parts have been evaluated as substantially responsive to the bidding document and met the Qualification Criteria, advising them of the following information:

(a) their Bid has been evaluated as substantially responsive to the bidding document and met the Qualification Criteria; and

(b) their envelope marked "FINANCIAL PART" will be opened at the public opening of Financial Parts;

(c) notify them of the date, time and location of the public opening of the envelopes marked "FINANCIAL PART".

33.3 The opening date shall be not less than ten (10) Business Days from the date of notification of the results of the technical evaluation, specified in ITB 33.1 and 33.2. However, if the Purchaser receives a complaint on the results of the technical evaluation within the ten (10) Business Days, the opening date shall be subject to ITB 50.1. The Financial Part of the Bid shall be opened publicly in the presence of Bidders' designated representatives and anyone who chooses to attend.

33.4 At this public opening the Financial Parts will be opened by the Purchaser in the presence of Bidders, or their designated representatives and anyone else who chooses to attend. Bidders who met the Qualification Criteria and whose Bids were evaluated as substantially responsive will have their envelopes marked "FINANCIAL PART" opened at the second public opening. Each of these envelopes marked "FINANCIAL PART" shall be inspected to confirm that they have remained sealed and unopened. These envelopes shall then be opened by the Purchaser. The Purchaser shall read out the names of each Bidder, the technical score and the total Bid prices, per lot (contract) if applicable, including any discounts and Alternative Bid - Financial Part, and any other details as the Purchaser may consider appropriate.

33.5 Only envelopes of Financial Part of Bids, Financial Parts of Alternative Bids and discounts that are

opened and read out at Bid opening shall be considered further for evaluation. The Letter of Bid - Financial Part and the Price Schedules are to be initialed by a representative of the Purchaser attending the Bid opening in the manner specified in the **BDS**.

33.6 The Purchaser shall neither discuss the merits of any Bid nor reject any envelopes marked "FINANCIAL PART".

33.7 The Purchaser shall prepare a record of the Financial Part of the Bid opening that shall include, as a minimum:

(a) the name of the Bidder whose Financial Part was opened;

(b) the Bid price, per lot (contract) if applicable, including any discounts,

(c) if applicable, any Alternative Bid - Financial Part.

33.8 The Bidders whose envelopes marked 'FINANCIAL PART" have been opened or their representatives who are present shall be requested to sign the record. The omission of a Bidder's signature on the record shall not invalidate the contents and effect of the record. A copy of the record shall be distributed to all Bidders.

I. Evaluation of Financial Parts of Bids

34. Evaluation of Financial Parts

34.1 Provided that a Bid is substantially responsive, the Purchaser shall rectify quantifiable nonmaterial nonconformities related to the Bid Price. To this effect, the Bid Price shall be adjusted, for comparison purposes only, to reflect the price of a missing or non-conforming item or component, by adding the average price of the item or component quoted by substantially responsive Bidders. If the price of the item or component cannot be derived from the price of other substantially responsive Bids, the Purchaser shall use its best estimate.

34.2 To evaluate the Financial Part of each Bid, the Purchaser shall consider the following:

(a) evaluation will be done for Items or Lots (contracts), as specified in the **BDS;** and the Bid Price as quoted in accordance with ITB 14;

(b) price adjustment for correction of arithmetic errors in accordance with ITB 35.1;

(c) price adjustment due to discounts offered in accordance with ITB 14.4;

(d) converting the amount resulting from applying (a) to (c) above, if relevant, to a single currency in accordance with ITB 36;

(e) price adjustment due to quantifiable nonmaterial nonconformities in accordance with ITB 34.1; and

(f) the additional evaluation factors specified in Section III, Evaluation and Qualification Criteria.

34.3 The estimated effect of the price adjustment provisions of the Conditions of Contract, applied over the period of execution of the Contract, shall not be taken into account in Bid evaluation.

34.4 If this bidding document allows Bidders to quote separate prices for different lots (contracts), each lot will be evaluated separately to determine the Most Advantageous Bid using the methodology specified in Section III, Evaluation and Qualification Criteria. **Discounts that are conditional on the award of more than one lot or slice shall not be considered for Bid evaluation**.

34.5 The Purchaser's evaluation of a Bid will exclude and not take into account:

(a) in the case of Goods manufactured in the Purchaser's Country, sales and other similar taxes, which will be payable on the goods if a contract is awarded to the Bidder;

(b) in the case of Goods manufactured outside the Purchaser's Country, already imported or to be imported, customs duties and other import taxes levied on the imported Good, sales and other similar taxes, which will be payable on the Goods if the contract is awarded to the Bidder;

(c) any allowance for price adjustment during the period of execution of the contract, if provided in the Bid.

34.6 The Purchaser's evaluation of a Bid may require the consideration of other factors, in addition to the Bid price quoted in accordance with ITB 14. These factors may be related to the characteristics, performance, and terms and conditions of purchase of the Goods and Related Services. The effect of the factors selected, if any, shall be expressed in monetary terms to facilitate comparison of Bids, unless otherwise specified in the **BDS** from amongst those set out in Section III, Evaluation and Qualification

Criteria. The criteria and methodologies to be used shall be as specified in ITB 34.2 (f).

35. Correction of Arithmetic Errors

35.1 In evaluating the Financial Part of each Bid, the Purchaser shall correct arithmetic errors on the following basis:

(a) if there is a discrepancy between the unit price and the line item total that is obtained by multiplying the unit price by the quantity, the unit price shall prevail and the line item total shall be corrected, unless in the opinion of the Purchaser there is an obvious misplacement of the decimal point in the unit price, in which case the line item total as quoted shall govern and the unit price shall be corrected;

(b) if there is an error in a total corresponding to the addition or subtraction of subtotals, the subtotals shall prevail and the total shall be corrected; and

(c) if there is a discrepancy between words and figures, the amount in words shall prevail, unless the amount expressed in words is related to an arithmetic error, in which case the amount in figures shall prevail subject to (a) and (b) above.

35.2 Bidders shall be requested to accept correction of arithmetic errors. Failure to accept the correction in accordance with ITB 35.1, shall result in the rejection of the Bid.

36. Conversion to Single Currency

36.1 For evaluation and comparison purposes, the currency(ies) of the Bids shall be converted in a single currency as specified in the **BDS.**

37. Margin of Preference

37.1 Unless otherwise specified in the **BDS,** a margin of preference shall not apply.

38. Comparison of Financial Parts

38.1 The Purchaser shall compare the evaluated costs of the Bids to determine the Bid that has the lowest evaluated cost. The comparison shall be on the basis of CIP (place of final destination) prices for imported goods and EXW prices, plus cost of inland transportation and insurance to place of destination, for goods manufactured within the Borrower's country, together with prices for any required installation, training, commissioning and other services. The evaluation of prices shall not take into account custom duties and other taxes levied on imported goods quoted CIP and sales and similar taxes

levied in connection with the sale or delivery of goods.

39. Abnormally Low Bids

39.1 An Abnormally Low Bid is one where the Bid price, in combination with other elements of the Bid, appears so low that it raises material concerns with the Purchaser as to the capability of the Bidder to perform the Contract for the offered Bid Price.

39.2 In the event of identification of a potentially Abnormally Low Bid, the Purchaser shall seek written clarification from the Bidder, including a detailed price analyses of its Bid price in relation to the subject matter of the contract, scope, delivery schedule, allocation of risks and responsibilities and any other requirements of the bidding document.

39.3 After evaluation of the price analyses, in the event that the Purchaser determines that the Bidder has failed to demonstrate its capability to perform the contract for the offered Bid price, the Purchaser shall reject the Bid.

J. Evaluation of Combined Technical and Financial Parts, Most Advantageous Bid and Notification of Intention to Award

40. Evaluation of combined Technical and Financial Parts

40.1 The Purchaser's evaluation of responsive Bids will take into account technical factors, in addition to cost factors in accordance with Section III Evaluation and Qualification Criteria. The weight to be assigned for the Technical factors and cost is specified in the **BDS**. The Purchaser will rank the Bids based on the evaluated Bid score (B).

40.2 The Purchaser will determine the Most Advantageous Bid. The Most Advantageous Bid is the Bid of the Bidder that meets the Qualification Criteria and whose Bid has been determined to be substantially responsive to the Bidding document and is the Bid with the highest combined technical and financial score.

41. Purchaser's Right to Accept Any Bid, and to Reject Any or All Bids

41.1 The Purchaser reserves the right to accept or reject any Bid, and to annul the Bidding process and reject all Bids at any time prior to Contract Award, without thereby incurring any liability to Bidders. In case of annulment, all Bids submitted and specifically, Bid securities, shall be promptly returned to the Bidders.

42. Standstill Period

42.1 The Contract shall not be awarded earlier than the expiry of the Standstill Period. The Standstill Period shall be ten (10) Business Days unless extended in accordance with ITB 47. The Standstill Period

commences the day after the date the Purchaser has transmitted to each Bidder the Notification of Intention to Award the Contract. Where only one Bid is submitted, or if this contract is in response to an emergency situation recognized by the Bank, the Standstill Period shall not apply.

43. Notification of Intention to Award

43.1 The Purchaser shall send to each Bidder (that has not already been notified that it has been unsuccessful) the Notification of Intention to Award the Contract to the successful Bidder. The Notification of Intention to Award shall contain, at a minimum, the following information:

(a) the name and address of the Bidder submitting the successful Bid;

(b) the Contract price of the successful Bid;

(c) the total combined score of the successful Bidder;

(d) the names of all Bidders who submitted Bids, and their Bid prices as readout, and as evaluated and technical scores;

(e) a statement of the reason(s) the Bid (of the unsuccessful Bidder to whom the notification is addressed) was unsuccessful;

(f) the expiry date of the Standstill Period;

(g) instructions on how to request a debriefing and/or submit a complaint during the standstill period.

K. Award of Contract

44. Award Criteria

44.1 Subject to ITB 41, the Purchaser shall award the Contract to the successful Bidder. This is the Bidder whose Bid has been determined to be the Most Advantageous Bid as specified in ITB 40.

45. Purchaser's Right to Vary Quantities at Time of Award

45.1 At the time the Contract is awarded, the Purchaser reserves the right to increase or decrease the quantity of Goods and Related Services originally specified in Section VII, Schedule of Requirements, provided this does not exceed the percentages **specified in the BDS,** and without any change in the unit prices or other terms and conditions of the Bid and the bidding document.

46. Notification of Award

46.1 Prior to the date of expiry of the Bid validity and upon expiry of the Standstill Period, specified in ITB 42.1 or any extension thereof, and upon satisfactorily addressing any complaint that has been filed within the Standstill Period, the

Purchaser shall notify the successful Bidder, in writing, that its Bid has been accepted. The notification of award (hereinafter and in the Contract Forms called the "Letter of Acceptance") shall specify the sum that the Purchaser will pay the Supplier in consideration of the execution of the Contract (hereinafter and in the Conditions of Contract and Contract Forms called "the Contract Price").

46.2 Within ten (10) Business Days after the date of transmission of the Letter of Acceptance, the Purchaser shall publish the Contract Award Notice which shall contain, at a minimum, the following information:

(a) name and address of the Purchaser;

(b) name and reference number of the contract being awarded, and the selection method used;

(c) names of all Bidders that submitted Bids, and their Bid prices as read out at Bid opening, and as evaluated;

(d) names of all Bidders whose Bids were rejected either as nonresponsive or as not meeting qualification criteria, or were not evaluated, with the reasons therefor;

(e) the name of the successful Bidder, the final total contract price, the contract duration and a summary of its scope; and

(f) successful Bidder's Beneficial Ownership Disclosure Form.

46.3 The Contract Award Notice shall be published on the Purchaser's website with free access if available, or in at least one newspaper of national circulation in the Purchaser's Country, or in the official gazette. The Purchaser shall also publish the contract award notice in UNDB online.

46.4 Until a formal Contract is prepared and executed, the Letter of Acceptance shall constitute a binding Contract.

47. Debriefing by the Purchaser

47.1 On receipt of the Purchaser's Notification of Intention to Award referred to in ITB 43.1, an unsuccessful Bidder has three (3) Business Days to make a written request to the Purchaser for a debriefing. The Purchaser shall provide a debriefing to all unsuccessful Bidders whose request is received within this deadline.

47.2 Where a request for debriefing is received within the deadline, the Purchaser shall provide a

debriefing within five (5) Business Days, unless the Purchaser decides, for justifiable reasons, to provide the debriefing outside this timeframe. In that case, the standstill period shall automatically be extended until five (5) Business Days after such debriefing is provided. If more than one debriefing is so delayed, the standstill period shall not end earlier than five (5) Business Days after the last debriefing takes place. The Purchaser shall promptly inform, by the quickest means available, all Bidders of the extended standstill period

47.3 Where a request for debriefing is received by the Purchaser later than the three (3) Business Day deadline, the Purchaser should provide the debriefing as soon as practicable, and normally no later than fifteen (15) Business Days from the date of publication of Public Notice of Award of contract. Requests for debriefing received outside the three (3) day deadline shall not lead to extension of the standstill period.

47.4 Debriefings of unsuccessful Bidders may be done in writing or verbally. The Bidders shall bear their own costs of attending such a debriefing meeting.

48. Signing of Contract

48.1 The Purchaser shall send to the successful Bidder the Letter of Acceptance including the Contract Agreement, and a request to submit the Beneficial Ownership Disclosure Form providing additional information on its beneficial ownership. The Beneficial Ownership Disclosure Form shall be submitted within eight (8) Business Days of receiving this request.

48.2 The successful Bidder shall sign, date and return to the Purchaser, the Contract Agreement within twenty-eight (28) days of its receipt.

48.3 Notwithstanding ITB 48.2 above, in case signing of the Contract Agreement is prevented by any export restrictions attributable to the Purchaser, to the country of the Purchaser, or to the use of the products/goods, systems or services to be supplied, where such export restrictions arise from trade regulations from a country supplying those products/goods, systems or services, the Bidder shall not be bound by its Bid, always provided however, that the Bidder can demonstrate to the satisfaction of the Purchaser and of the Bank that signing of the Contact Agreement has not been prevented by any lack of diligence on the part of the Bidder in completing any formalities, including applying for permits, authorizations and licenses necessary for the export of the products/goods,

systems or services under the terms of the Contract.

49. Performance Security

49.1 Within twenty-eight (28) days of the receipt of the Letter of Acceptance from the Purchaser, the successful Bidder, if required, shall furnish the Performance Security in accordance with the GCC 18 using for that purpose the Performance Security Form included in Section X, Contract Forms, or another Form acceptable to the Purchaser. If the Performance Security furnished by the successful Bidder is in the form of a bond, it shall be issued by a bonding or insurance company that has been determined by the successful Bidder to be acceptable to the Purchaser. A foreign institution providing a bond shall have a correspondent financial institution located in the Purchaser's Country, unless the Purchaser has agreed in writing that a correspondent financial institution is not required.

49.2 Failure of the successful Bidder to submit the above-mentioned Performance Security or sign the Contract shall constitute sufficient grounds for the annulment of the award and forfeiture of the Bid Security. In that event the Purchaser may award the Contract to the Bidder offering the Most Advantageous Bid.

50. Procurement Related Complaint

50.1 The procedures for making a Procurement-related Complaint are as specified in the BDS.

Section II - Bid Data Sheet (BDS)

The following specific data for the Goods to be procured shall complement, supplement, and/or amend the provisions in the Instructions to Bidders (ITB). Whenever there is a conflict, the provisions herein shall prevail over those in ITB.

ITB Reference	A. General
ITB 1.1	The reference number of the Request for Bids (RFB) is: **PK-PESCO-556534-GO-RFB-ICB-12** The Purchaser is: **Chief Engineer (Dev.) PMU, Peshawar Electric Supply Company (PESCO)** The name of the RFB is: **Procurement of 4,011 Nos. Standard Asset Performance Management System (APMS) with Magnetic Contactor and Non – Motorized MCCB (Ordering Code: APMS-MC-S100 & APMS-MC-S200) along with Allied Material and Related Services for Installation on Distribution Transformers of 100KVA & 200KVA Ratings in PESCO Operation Circles (Mardan & Swabi)** The number and identification of lots (contracts) comprising this RFB is: **One (01) Lot.**
ITB 1.2(a)	Electronic-Procurement is**: Not Allowed.**
ITB 2.1	The Borrower is: **Islamic Republic of Pakistan** Loan or Financing Agreement amount: a) **Agreement No IBRD – 93180** b) **Loan Amount - $195 Millions** c) **Loan Amount with PESCO as per Financing Agreement- $69.78 Millions** The name of the Project is: **Electricity Distribution Efficiency Improvement Project (EDEIP)**
ITB 4.1	Maximum number of members in the Joint Venture (JV) shall be: **Three (03) Only.**
ITB 4.5	A list of debarred firms and individuals is available on the Bank's external website: http://www.worldbank.org/debarr.
	B. Contents of Bidding Document
ITB 7.1	For **Clarification of Bid purposes** only, the Purchaser's address is: Attention: **Chief Engineer (Development) PMU PESCO** Address: **Chief Engineer (Dev :) PMU PESCO Head Quarter,** **Sakhi Chashma Shami Road, Peshawar, (Khyber Pakhtunkhwa) Pakistan**

	City: **Peshawar** ZIP Code: **25170** Country: **Pakistan** Requests for clarification should be received by the Purchaser no later than: **Fourteen (14) days prior to the deadline for submission of bids.** Web page: https://www.pesco.com.pk/world-bank/wb-reports E mail address: ce.pmupesco@gmail.com , pmupesco@gmail.com
C. Preparation of Bids	
ITB 10.1	The language of the Bid is: **English**. All correspondence exchange shall be in **English** language. Language for translation of supporting documents and printed literature is **English**.
ITB 11.2 (i) & 11.3 (d)	The Bidder shall submit the following additional documents in its Bid: **Affidavit/undertaking confirming that, if awarded the contract, they will (i) obtain from PITC a Certificate of UDIL Compliance and;(ii) Valid Proto-type reports of equipment as per PPMC Specification: PPMC-DS-01 :2026 (for APMS), DDS 50:2007 (for TOD/TOU multi rate and Bi-Directional LT/HT energy meters), DDS 98:2011 (for AMI), DDS 110:2012 (for MDC), DDS:80-2007 (for LT CTs), DDS:8-2007 (for S/C cable) (Latest approved versions), if not submitted with bid within thirty (30) days from the date of issuance of Notification of Intention to Award (NOIA). Any delay would lead to revocation of NOIA or termination of contract whichever occurs earlier.**
ITB 13.1	Alternative bids **shall not be** considered.
ITB 14.5	The prices quoted by the Bidder **shall not** be subject to adjustment during the performance of the Contract.
ITB 14.7	The Incoterms edition is: **2020**
ITB 14.8 (a)(iii), (b)(ii) and (c)(v)	Final Destination (Project Site): **PESCO GSC Ware House 132KV Grid Station Industrial State, Jamrud Road, Hayat Abad, Peshawar, KPK, Pakistan.**
ITB 14.8 (b)(i)	Place of Destination: CIP, **Karachi Port Trust (Port of Karachi).**
ITB 15.1	The Bidder **is** required to quote in the currency of the Purchaser's Country the portion of the Bid price that corresponds to expenditures incurred in that currency.
ITB 16.4	Period of time the Goods are expected to be functioning (for the purpose of spare parts): 60 months from the date of delivery of final consignment.
ITB 17.2 (a)	Manufacturer's authorization is **required.**
ITB 17.2 (b)	After sales service is: **required**

	In case of a Bidder not doing business within the Purchaser's Country, the Bidder is or will be (if awarded the Contract) represented by an Agent in the country equipped and able to carry out the Supplier's maintenance, repair and spare parts- stocking obligations prescribed in the Conditions of Contract and/or Technical Specifications;
ITB 18.1	The Bid shall be valid until: One Hundred and Twenty (**120) Days** after bid opening date.
ITB 18.3 (a)	The Bid price shall be adjusted by the following factor(s): **Not Applicable**
ITB 19.1	All Bids must be accompanied by a Bid Security of **US$ 100,000.00/-** (One hundred thousand US Dollars only) **or** equivalent Pakistani Rupee (PKR) at the exchange rate 28 days prior to bid submission date.
ITB 19.3 (a)	The text of ITB 19.3 (a) is replaced with the following text: "The Bid security shall be an unconditional guarantee issued by a Scheduled bank. Bid security shall be submitted either using the Bid Security Form included in Section IV, Bidding Forms, or in another substantially similar format approved by the Purchaser prior to Bid submission. Bid security can also be in form of cashier's check (pay order). The Bid security shall be valid for twenty eight (28) days beyond the original date of expiry of the Bid validity, or beyond any extended date if requested under ITB 18.2".
ITB 19.3 (d)	Other types of acceptable securities: **Not applicable.**
ITB 20.3	The written confirmation of authorization to sign on behalf of the Bidder shall consist of**:** **Power of Attorney or Authority letter on bidder's Company letter Head**. Bid submitted by an existing or intended JV shall include an undertaking signed by all parties stating that: "All parties shall be jointly and severally liable and nominating an authorized representative who shall have the authority to conduct all business for and on behalf of any and all the parties of JV during the bidding process and in the event the JV is awarded the contract during contract execution"
D. Submission of Bids	
ITB 21.2	In addition to the original of the Bid, the number of copies is: **One (01)** In addition to above, One (01) softcopy (USB) of technical bid is required to be included in the technical envelope, and a separate softcopy (USB) of financial bid is required to be included in the financial envelope. The envelope and softcopy of technical bid shall not include any information about the financial bid. In case of any discrepancy, the hard copy shall prevail.
ITB 22.1	For **Bid submission purposes** only, the Purchaser's address is: Attention: **Chief Engineer (Development) PMU PESCO** Address: **Chief Engineer (Dev :) PMU PESCO Head Quarter,**

	Sakhi Chashma Shami Road Peshawar, Khyber Pakhtunkhwa, Pakistan **Email Address:** ce.pmupesco@gmail.com City: **Peshawar** Postal Code: **25170** Country: **Pakistan** **The deadline for Bid submission is:** Date: **01-12-2026** Time: **11:00 AM** Bidders **shall not** have the option of submitting their Bids electronically.
E. Public Opening of Technical Parts of Bids	
ITB 25.1	The Bid opening shall take place at: **Chief Engineer (Dev :) PMU PESCO Head Quarter,** **Sakhi Chashma Shami Road, Peshawar** **Khyber Pakhtunkhwa – Pakistan** **Email Address:** ce.pmupesco@gmail.com City: **Peshawar** Country: **Pakistan** Date: **01-12-2026** Time: **11:00 AM** (Just after the deadline for Bid submission)
ITB 25.6	The Letter of Bid - Technical Part and the sealed envelope marked "Second Envelope - Financial Part" shall be initialed by all representatives of the Purchaser (Bid opening Committee constituted by CE (Dev) PMU, PESCO) conducting Bid opening **and shall be numbered.**
G. Evaluation of Technical Parts of Bids	
ITB 32.4	The Technical Factors and sub factors as applicable and the corresponding scores out of 100% are:

S.No.	Rated Criteria	Weightage
1	APMS Functional Performance	**40%**
2	Interoperability / Universal Data Integration Layer (UDIL)	**20%**
3	Deployment & Commissioning Methodology	**15%**
4	Reliability / Diagnostics / Lifecycle Support	**15%**
5	Quality Assurance and Health, Safety & Environment (HSE)	**10%**

The weighting to be given for Technical Factor (including technical and non-price factors) is: 30%.

H. Notification of Evaluation of Technical Parts and Public Opening of Financial Parts of Bids

ITB 33.5	The Letter of Bid – Financial Part and the Price Schedules shall be initialed by all representatives of the Purchaser conducting Bid opening.
I. Evaluation of Financial Part of Bids	
ITB 34.2(a)	Evaluation will be done for the **complete Lot.** If a Price Schedule shows items listed but not priced, their prices shall be assumed to be included in the prices of other items. An item not listed in the Price Schedule shall be assumed to be not included in the Bid, and provided that the Bid is substantially responsive, the average price of the item quoted by substantially responsive Bidders will be added to the Bid price and the equivalent total cost of the Bid so determined will be used for price comparison
ITB 34.6	The adjustments shall be determined using the following criteria, from amongst those set out in Section III, Evaluation and Qualification Criteria: **(a)** Deviation in Delivery schedule: **YES** **(b)** Deviation in payment schedule: **YES** **(c)** the cost of major replacement component, mandatory spare parts, and service: **No.** **(d)** the availability in the Purchaser's Country of spare parts and after-sales services for the equipment offered in the Bid: **No.** **(e)** Life cycle costs: the costs during the life of the goods or Equipment: **No.** **(f)** the performance and productivity of the equipment offered; **No.**
ITB 36.1	The currency that shall be used for Bid evaluation and comparison purposes to convert at the selling exchange rate all Bid prices expressed in various currencies into a single currency is: **Pakistani Rupees (PKR*)*** The source of exchange rate shall be: **State Bank of Pakistan** The date for the exchange rate shall be*:* **28 days prior to the bid submission date.**
ITB 37.1	A margin of domestic preference **shall not** apply.
J. Evaluation of Combined Technical and Financial Parts and Most Advantageous Bid	
ITB 40.1	The weight to be given for cost is: 7**0%*.***
	J. Award of Contract
ITB 45.1	The maximum percentage by which quantities may be increased / decreased is: **±15%**
ITB 50.1	The procedures for making a Procurement-related Complaint are detailed in the "Procurement Regulations for IPF Borrowers (Annex III)." If a Bidder wishes to make a Procurement-related Complaint, the Bidder should submit its complaint following these procedures, in writing (by the quickest means available, that is either by email or fax), to:

	For the attention: Convener GRC Committee Purchaser: **PESCO** **Email address:** planning.pesco@gmail.com, ce.pmupesco@gmail.com A copy of the complaint can be sent for the Bank's information and monitoring to: pprocurementcomplaints@worldbank.org In summary, a Procurement-related Complaint may challenge any of the following: **1.** the terms of the Bidding Documents; **2.** the Purchaser's decision to exclude a Bidder from the procurement process prior to the award of contract; and **3.** the Purchaser's decision to award the contract.

Section III - Evaluation and Qualification Criteria

This section contains the criteria that the purchaser shall use to evaluate bids and qualify the bidders. No other factors, methods or criteria shall be used other than specified in this bidding document

TECHNICAL PART

1. Qualification

Qualification Criteria (ITB 32.1)

The Purchaser shall assess each Bid against the following Qualification Criteria. Requirements not included in the text below shall not be used in the evaluation of the Bidder's qualifications.

(a) **Financial Capability**: The Bidder shall submit audited financial statements or, if not required by the law of the Bidder's country, other financial statements acceptable to the Purchaser, for the last **Three (03) years** prior to bid submission deadline, demonstrating the current soundness of the Bidder's financial position. For a joint venture, this requirement shall be met by each member;

(b) **Specific Experience**: The Bidder shall demonstrate that it has successfully completed contracts as per following requirements:

(i) **Value:** Successfully completed at least three (3) Supply and Installation contracts of APMS on general distribution transformers along with Related Services within the last ten (10) years of an aggregate value of at least US$ 08 million in which at least one (1) contract of value not less than US$ 04 million need to be demonstrated. . For a joint venture, this requirement may be met by all members combined by number of contracts and value. However, the lead partner must have that one (1) contract of value not less than US$ 04 million.

(ii) **Quantity:** "Executed minimum three (3) contracts within the last ten (10) years with at least 1.5 times of quantities of APMS on general distribution transformers, stated in the bidding document. For a joint venture, this requirement may be met by all members by quantity.

Note: The exchange rate for USD (if the contract currency for Specific Experience references attached as (b) above is not in US Dollars) for calculating the contract value in USD Exchange Rate shall be based on the State Bank of Pakistan's (SBP's) rate on the signing date of that contract. In the event that the SBP exchange rate for the signing date of that contract submission date is unavailable, the exchange rate from the last available working day shall apply.

(c) **Documentary Evidence:** The Bidder shall furnish documentary evidence to demonstrate that the Goods it offers meet the following usage requirement as mentioned in clause 13 'Functional requirements' of specification PPMC-DS-01:2026 "Latest approved version at 28 days prior to the bid submission deadline".

Such as:

i) It shall accept disconnect & re-connect commands as programmed, on demand data request and other parameters/updates from head end system/MDM system.

ii) It shall have internal disconnection due to preset load limiting (overload) or exceeding thermal threshold and must communicate the instantaneous and critical data with the latest status of the breaker contacts to the head end system etc.

(d) **Manufacturing experience and Technical Capacity**: For the items under the Contract that the bidder is a manufacturer, the Bidder shall furnish documentary evidence to demonstrate that:

(i) It has been manufacturing APMS on general distribution transformers of similar nature and complexity for at least Five (05) years, prior to the bid submission deadline.

(ii) Its annual production capacity of APMS on general distribution transformers in any of the two (2) years out of five (5) prior to the bid submission deadline, is at least **Two (02) times** of the quantities specified under the contract.

(e) **Manufacturer's authorization**: A Bidder who does not manufacture an item/s where a manufacturer authorization is required in accordance with BDS ITB 17.2 (a), the Bidder shall provide evidence of being duly authorized by a manufacturer (Manufacturer's Authorization Form, Section IV, Bidding Forms), meeting the criteria in (d) (i) and (ii) above, to supply the Goods;

(f) [A bidder who does not manufacture an item/s where a manufacturer authorization is not required in accordance with BDS ITB 17.2 (a), the bidder shall submit documentation on, its status as a supplier, to the satisfaction of the Purchaser *(e.g. authorized dealer/ distributor of the items)]*- **Not Applicable.**

2. Technical Evaluation (ITB 32.4)

Assessment of adequacy of Technical Part with the requirements

(a) **Technical Responsiveness**

Bidders have to meet the minimum technical proposals requirements provided in the bidding documents on a pass/fail criterion prior to being considered for technical evaluation by applying the scored technical factors/sub factors in accordance with BDS ITB 32.4. This will include an assessment of Bidder's technical compliance, work plan, functional guarantees and technical capacity. The minimum Qualifying Technically Score shall be **70 % of the total assigned Score**.

(b) **Rated Criteria**

The Rated Criteria (including technical and non-price factors, and sub factors) to be evaluated and the scores to be given to each factor and sub factor are specified in the BDS ITB 32.4.

Technical Part Scoring Methodology

The technical Factors and sub factors as applicable and the corresponding scores out of 100% are:

SR.No.	Rated Criteria	Weightage
1	APMS Functional Performance	**40%**
2	Interoperability / Universal Data Integration Layer (UDIL)	**20%**
3	Deployment & Commissioning Methodology	**15%**
4	Reliability / Diagnostics / Lifecycle Support	**15%**
5	**Quality Assurance and** Health, Safety & Environment **(HSE)**	**10%**

The weighting to be given for Rated Criteria (including technical and non-price factors) is: 30%.

During the evaluation process, the evaluation committee will assign each desirable/preferred feature a whole number score from 0 to 4, where 0 means that the feature is absent, and 1 to 4 either represent predefined values for desirable features amenable to an objective way of rating. The scoring will be 1 for the feature being present but showing deficiencies; 2 for meeting the requirements; 3 for marginally exceeding the requirements; and 4 for significantly exceeding the requirements.

The score for each sub- factor (i) within a factor (j) will be combined with the scores of sub-factors in *the* same factor as a weighted sum to form the Factor Technical Score using the following formula:

$$S_j \equiv \sum_{i=1}^{k} t_{ji} * w_{ji}$$

where:

t_{ji} = the technical score for sub- factor "i" in factor "j",

w_{ji} = the weight of sub- factor "i" in factor "j",

k = the number of scored sub-factors in factor "j", and

$$\sum_{i=1}^{k} w_{ji} = 1$$

The Factor Technical Scores will be combined in a weighted sum to form the total Technical Bid Score using the following formula:

$$T \equiv \sum_{j=1}^{n} S_j * W_j$$

where:

S_j = the Factor Technical Score of factor "j",

W_j = the weight of factor "j" as specified **in the BDS,**

n = the number of Factors, and

$$\sum_{j=1}^{n} W_j = 1$$

FINANCIAL PART

1. Margin of Preference (ITB 37): Not Applicable

2. Evaluation Criteria (ITB 34.6)

The Purchaser shall use the criteria and methodologies listed in this Section to evaluate the Financial Part.

The Purchaser's evaluation of the Financial Part may take into account, in addition to the Bid Price, one or more of the following factors as **specified in BDS ITB 34.6,** using the following criteria and methodologies.

(a) **Delivery schedule. (As per Incoterms specified in the BDS):** The Goods specified in the List of Goods are required to be delivered within the acceptable time range (after the earliest and before the final date, both dates inclusive) specified in Section VII, Schedule of Requirements. No credit will be given to deliveries before the earliest date, and Bids offering delivery after the final date shall be treated as nonresponsive. Within this acceptable period, an adjustment of **USD 10,000.00 per day** will be added, for evaluation purposes only, to the Bid price of Bids offering deliveries later than the "Earliest Delivery Date" specified in Section VII, Schedule of Requirements.

(b) **Deviation in payment schedule:** Bidders shall state their Bid price for the payment schedule outlined in the SCC. Bids shall be evaluated on the basis of this base price. Bidders are, however, permitted to state an alternative payment schedule and indicate the reduction in Bid price they wish to offer for such alternative payment schedule. The Purchaser may consider the alternative payment schedule and the reduced Bid price offered by the Bidder selected on the basis of the base price for the payment schedule outlined in the SCC.

(c) Cost of major replacement components, mandatory spare parts, and service: **No**

(d) Availability in the Purchaser's Country of spare parts and after sales services for equipment offered in the Bid*:* **No**

(e) Life Cycle Cost: **No**

(f) Performance and productivity of the equipment: **No.**

(g) Specific additional criteria: **No**

Combined Evaluation

The Purchaser will evaluate and compare the Bids that have been determined to be substantially responsive.

The Purchaser's evaluation of responsive Bids will take into account technical factors, in addition to cost factors.

An Evaluated Bid Score (B) will be calculated for each responsive Bid using the following formula (for comparison in percentages), which permits a comprehensive assessment of the Bid price and the technical merits of each Bid:

$$B \equiv \frac{Clow}{C} * X * 100 + \frac{T}{Thigh} * (1 - X) * 100$$

where

C = Evaluated Bid Price

C_{low} = the lowest of all Evaluated Bid Prices among responsive Bids

T = the total Technical Score awarded to the Bid

T_{high} = the Technical Score achieved by the Bid that was scored best among all responsive Bids

X = weight for the Cost as specified in the BDS

The Bid with the best evaluated Bid Score (B) among responsive Bids shall be the Most Advantageous Bid provided the Bidder is qualified to perform the Contract.

Multiple Contracts (ITB 34.4): Not Applicable

Alternative Bids (ITB 13.1): Not Applicable

Section IV - Bidding Forms

Table of Forms

Letter of Bid – Technical Part 52

Technical Part 54

Technical Bid Checklist 55

Functional Guarantees 57

Manufacturer's Authorization 59

Bidder Information Form 61

Bidder's JV Members Information Form 62

Sexual Exploitation and Abuse (SEA) and/or Sexual Harassment Performance Declaration 63

Form of Bid Security 64

Form of Bid Security (Bid Bond) (NOT APPLICABLE) 66

Letter of Bid - Financial Part 68

Price Schedule Forms 70

Price Schedule: Goods Manufactured Outside the Purchaser's Country, to be Imported 71

Price Schedule: Goods Manufactured Outside the Purchaser's Country, already imported* 72

Price Schedule: Goods Manufactured in the Purchaser's Country 73

Price and Completion Schedule – Allied Material / Services 74

Letter of Bid – Technical Part

INSTRUCTIONS TO BIDDERS: DELETE THIS BOX ONCE YOU HAVE COMPLETED THE DOCUMENT

Place this Letter of Bid in the first envelope "TECHNICAL PART".

The Bidder must prepare the Letter of Bid on stationery with its letterhead clearly showing the Bidder's complete name and business address.

Note: All italicized text in black font is to help Bidders in preparing this form and Bidders shall delete it from the final document.

Date of this Bid submission: [*insert date (as day, month and year) of Bid submission*]
RFB No.: [*insert number of Bidding process*]
Request for Bid No.: [*insert identification*]
Alternative No.: [*insert identification No if this is a Bid for an alternative*]

To: **The Chief Engineer (Development) PMU PESCO, Peshawar**

We, the undersigned Bidder, hereby submit our Bid, in two parts, namely:

(a) the Technical Part, and

(b) the Financial Part.

In submitting our Bid we make the following declarations:

(a) **No reservations:** We have examined and have no reservations to the bidding document, including addenda issued in accordance with Instructions to Bidders (ITB 8);

(b) **Eligibility**: We meet the eligibility requirements and have no conflict of interest in accordance with ITB 4;

(c) **Bid/Proposal-Securing Declaration**: We have not been suspended nor declared ineligible by the Purchaser based on execution of a Bid Securing Declaration or Proposal Securing Declaration in the Purchaser's country in accordance with ITB 4.7;

(d) **Sexual Exploitation and Abuse (SEA) and/or Sexual Harassment (SH):** [*select the appropriate option from (i) to (iii) below and delete the others. In case of JV members and/or subcontractors, indicate the status of disqualification by the Bank of each JV member and/or subcontractor]*.

We, including any of our subcontractors:

(i) [have not been subject to disqualification by the Bank for non-compliance with SEA/ SH obligations]

(ii) [are subject to disqualification by the Bank for non-compliance with SEA / SH obligations]

(iii) [had been subject to disqualification by the Bank for non-compliance with SEA / SH obligations, and were removed from the disqualification list. An arbitral award on the disqualification case has been made in our favor]

(e) **Conformity:** We offer to supply in conformity with the bidding document and in accordance with the Delivery Schedules specified in the Schedule of Requirements the following Goods: [*insert a brief description of the Goods and Related Services*];

(f) **Bid Validity**: Our Bid shall be valid until *[insert day, month and year in accordance with ITB 18.1],* and it shall remain binding upon us and may be accepted at any time before the expiration of that period;

(g) **Performance Security**: If our Bid is accepted, we commit to obtain a performance security in accordance with the bidding document;

(h) **One Bid per Bidder**: We are not submitting any other Bid(s) as an individual Bidder, and we are not participating in any other bid(s) as a Joint Venture member or as a subcontractor, and meet the requirements of ITB 4.3, other than Alternative Bids submitted in accordance with ITB 13;

(i) **Suspension and Debarment**: We, along with any of our subcontractors, suppliers, consultants, manufacturers, or service providers for any part of the contract, are not subject to, and not controlled by any entity or individual that is subject to, a temporary suspension or a debarment imposed by the World Bank Group or a debarment imposed by the World Bank Group in accordance with the Agreement for Mutual Enforcement of Debarment Decisions between the World Bank and other development banks. Further, we are not ineligible under the Purchaser's country laws or official regulations or pursuant to a decision of the United Nations Security Council;

(j) **State-owned enterprise or institution**: [*select the appropriate option and delete the other*] [*We are not a state-owned enterprise or institution*] / [*We are a state-owned enterprise or institution but meet the requirements of ITB 4.6*];

(k) **Binding Contract**: We understand that this Bid, together with your written acceptance thereof included in your Letter of Acceptance, shall constitute a binding contract between us, until a formal contract is prepared and executed;

(l) **Not Bound to Accept**: We understand that you are not bound to accept the lowest evaluated cost Bid, the Most Advantageous Bid or any other Bid that you may receive; and

(m) **Fraud and Corruption**: We hereby certify that we have taken steps to ensure that no person acting for us, or on our behalf, engages in any type of Fraud and Corruption.

Name of the Bidder: *[*insert complete name of Bidder*]

Name of the person duly authorized to sign the Bid on behalf of the Bidder: ** [*insert complete name of person duly authorized to sign the Bid*]

Title of the person signing the Bid: [*insert complete title of the person signing the Bid*]

Signature of the person named above: [*insert signature of person whose name and capacity are shown above*]

Date signed [*insert date of signing*] **day of** [*insert month*], [*insert year*]

*: In the case of the Bid submitted by a Joint Venture specify the name of the Joint Venture as Bidder.
**: Person signing the Bid shall have the power of attorney given by the Bidder. The power of attorney shall be attached with the Bid Schedules.

Technical Part

The technical bid shall include all relevant information required to evaluate the technical Part in accordance with the requirements.

To establish the conformity of the Goods and Related Services to the RFB document, the Bidder shall furnish the documentary evidence that the Goods conform to the technical specifications and standards, including any essential technical and performance characteristics specified in Section VII, Schedule of Requirements. Any required functional guarantees shall also be provided. The attached forms/format may support the Bidder to organize information required to present its technical bid.

The documentary evidence may be in the form of literature, drawings or data, and shall consist of a detailed item by item description of the essential technical and performance characteristics of the Goods and Related Services, demonstrating substantial responsiveness of the Goods and Related Services to the technical specification, and if applicable, a statement of deviations and exceptions to the provisions of the Section VII, Schedule of Requirements.

In the interest of timely bid evaluation and contract award, Bidders are encouraged not to overload the supporting materials with documents that do not directly address the Purchaser's requirements.

The Bidder shall also furnish a list giving full particulars, including available sources and current prices of spare parts, special tools, etc., necessary for the proper and continuing functioning of the Goods during the period specified in the BDS following commencement of the use of the goods by the Purchaser.

Standards for workmanship, process, material, and equipment, as well as references to brand names or catalogue numbers specified by the Purchaser in the Schedule of Requirements, are intended to be descriptive only and not restrictive. The Bidder may offer other standards of quality, brand names, and/or catalogue numbers, provided that it demonstrates, to the Purchaser's satisfaction, that the substitutions ensure substantial equivalence or are superior to those specified in the Section VII, Schedule of Requirements.

If there are assessed supply chain risks, the technical bid must include proposed supply chain risk management plan.

The Manufacture's Authorizations shall be included in accordance with ITB BDS 17.2 (a) and the attached Manufacturer's Authorization form.

Technical Bid Checklist

The bidder shall provide the corresponding values for each functions of the proposed goods in the right column of below table in accordance with the Technical Specifications of APMS Rating (100KVA & 200 KVA) for Pole Mounting Distribution Transformers.

1. APMS

Sr. No.	Description	Offered Value	Compliance	Remarks
1	Manufacturer Name			
2	Type / Model / Designation			
3	Applicable Standards (DDS / IEC)			
4	Rated Voltage (V)			
5	Rated Frequency (Hz)			
6	APMS Rating (25/50/100/200/400/630 kVA)			
7	Degree of Protection (Enclosure IP)			
8	Ambient Temperature Range			
9	Maximum Altitude			
10	Functional Compliance (as per Clause 13)			
11	Alarm & Tripping Logic Details			
12	Field Performance Evidence			
13	Compliance with PPMC-DS-01:2026			
14	Weight			

2. MCCB NON-MOTORIZED

Sr. No.	Description	Offered Value	Compliance	Remarks
1	Manufacturer Name			
2	Model / Frame Size			
3	Standard (IEC 60947-2) compliance			
4	Rated Voltage (V)			
5	Rated Current (In)			
6	Number of Poles (3P)			
7	Breaking Capacity (Icu, kA)			
8	Service Breaking Capacity (Ics, % of Icu)			
9	Making Capacity (Icm)			
10	Thermal Setting Range (Ir)			
11	Magnetic Setting Range (Im)			
14	Type of Trip Unit (Thermal-Magnetic / Electronic)			
18	Mechanical Endurance			
19	Electrical Endurance			
20	Type Test Reports (ILAC Lab)			
21	Compliance with PPMC-DS-01:2026			
22	Weight			

3. MAGNETIC CONTACTOR

Sr. No.	Description	Offered Value	Compliance	Remarks
1	Manufacturer Name			
2	Model / Type			
3	Standard (IEC 60947-4-1)			
4	Rated Operational Voltage (V)			
5	Rated Frequency (Hz)			
6	Rated Current (AC 6a duty)			
7	Utilization Category (AC 6a)			
8	Coil Voltage (V)			
9	Mechanical Endurance (operations)			
10	Electrical Endurance (AC 6a duty)			
11	Making Capacity			
12	Breaking Capacity			
13	Surge Protection (RC / MOV)			
14	Electrical Interlocking with MCCB			
15	Coordination Type (Type 2)			
16	Type Test Reports (ILAC Lab)			
17	Compliance with PPMC-DS-01:2026			
18	Weight			

4. SMCD

Sr. No.	Description	Offered Value	Compliance	Remarks
1	Manufacturer Name			
2	Model / Type			
3	Standards (DDS-50, 98, 110 / IEC 62052/53) compliant			
4	Accuracy Class (kWh / kVARh)			
5	Communication Technology			
6	DLMS/COSEM Compliance (Yes/No)			
7	Optical Port Availability			
8	Auxiliary Ports (MCCB Interface)			
9	Battery Type & Capacity			
10	Battery Backup Duration			
11	RTC Backup (Supercapacitor)			
12	Event Logging Capacity			
13	Alarm & Trip Configurability			
14	Remote Operation Capability			
15	Firmware Upgrade Capability			

Functional Requirements

1. Asset Performance Management System (APMS) shall communicate all metering data and events as per latest specifications and must be stored inside meter which will be communicated to Head-End System (HES)/MDM (Meter Data Management) upon connection as per requirement for the purpose of ensuring Interoperability. The APMS shall be fully compliant with Device Language message Specifications (DLMS) / COSEM (Companion Specifications for Energy Metering) (As per IEC 62056). Furthermore, for deployment where metering data is managed through the Meter Data Management (MDM) system of Power Information Technology Company (PITC), the APMS associated Meter Data Collector (MDC) and communication interfaces shall mandatorily comply with the requirement of Universal Data Integration Layer (UDIL) latest version and shall be duly certified by Power Information Technology Company (PITC) ensuring seamless integration, standardized data exchange and avoidance of vendor- specific dependencies.
2. APMS shall be able to record, report and perform following switching operations of Magnetic Contactor as per ordering code-3: APMS-MC-S-100 & APMS-MC-S-200 i.e. disconnections / reconnections in accordance with Clause -13 of Technical Specifications:
   a. Operation Remotely through Head-End/ MDM.
   b. Operation through SMCD (Independent of Head-End System / MDM)
   c. Operation through local electrical means (Push Buttons)
   d. Operation through local mechanical means (Toggle / Operating Handle) only for MCCB.
3. APMS shall record, report and perform specified functions against abnormal conditions through Head – End/ MDM for testing purposes, as per range of testing values are specified against each conditions in clause 13.5 of the Technical Specifications.
   Over Voltage, Under Voltage, Phase Over Current, Over Load Condition, Voltage Unbalance, Current Unbalance, High Apparent Power.
4. Alarm and tripping against abnormal conditions specified in Para 3 above shall be available.
5. Threshold values of these Alarms and Tripping functions and their corresponding time settings shall be user programmable from Head – End System / MDM. Alarm & Tripping shall occur based on these threshold values. Default values against different parameters mentioned in Para-3, in case of abnormal conditions.
6. APMS shall perform Load shedding according to preset time schedule.
7. SMCD in APMS shall be programmed bi-directional by default.
8. The Metering Accuracy Class shall be 0.5S for KWh and 1.0 for kVARh (IEC62053-21).
9. The offered material should be type tested/prototype approved as per relevant specifications. However, If the bidder does not possess the prototype approval for

the offered material, the bidder shall have to obtain the prototype approval from the office of Chief (Technical Services) before the start of mass production.

10. PITC will be responsible to provide the hardware for MDC installation whereas, the software installation shall be the responsibility of the Supplier. Also, the configuration of the Head-end system/MDC shall be the responsibility of the Supplier. Existing hardware can be used after getting resource utilization assessment/stress testing by PITC.
11. The Supplier will submit the UDIL certification request to PITC within 07 days from the date of issuance of NOA complete in all respect. As per the prevailing practice PITC issues the UDIL certificate within 30 days from the date of submission of the request. Any delay from the issuance of certificate from the PITC will not be attributed on bidders/suppliers' part provided the bidder request for UDIL certification is complete in all respect.
12. All the data filed are required as per the latest UDIL version. The latest UDIL version can be obtained from the PITC website i.e. https://pitc.com.pk/index.php/projects/open-architecturebased-ami .
13. The Smart AMI energy meters data must be compliant with Universal Data Integration Layer (UDIL) latest version, developed by PITC for multi-Supplier compliance and the supplier will have to submit requirements for a certificate of operation ability from PITC after the issuance of LOA within 07 days and PITC shall issue UDIL certificate within 30 days from submission date. In case of UDIL fail the firm will re-submit the same within 07-days.
14. Non-submission of requirement by the beneficiary for UDIL Certificate within the above specified period may be tantamount to cancellation of LOA and confiscation of bid money in favor of Purchaser. Purchaser will sign the contract agreement after receiving the UDIL Certificate from PITC.
15. Certificate of compliance of Suppliers' driver software with UDIL's latest version and its further integration with PESCO billing system i.e. CIS/IBS, is compulsory to be obtained from PITC.
16. The supplied Smart AMI Energy Meters will expose data and services as per specifications laid down in UDIL's latest version only. The meter will be created in the respective Suppliers' driver software to expose data and services in compliance with UDIL's latest version document.

Functional Guarantees

(Not Required)

Manufacturer's Authorization

[The Bidder shall require the Manufacturer to fill in this Form in accordance with the instructions indicated. This letter of authorization should be on the letterhead of the Manufacturer and should be signed by a person with the proper authority to sign documents that are binding on the Manufacturer. The Bidder shall include it in its Bid, if so indicated in the ***BDS****.]*

Date: *[insert date (as day, month and year) of Bid submission]*

RFB No.: *[insert number of RFB process]*
Alternative No.: *[insert identification No if this is a Bid for an alternative]*

To: *[insert complete name of Purchaser]*

WHEREAS

We *[insert complete name of Manufacturer],* who are official manufacturers of *[insert type of goods manufactured],* having factories at [insert full address of Manufacturer's factories], do hereby authorize *[insert complete name of Bidder]* to submit a Bid the purpose of which is to provide the following Goods, manufactured by us *[insert name and or brief description of the Goods],* and to subsequently negotiate and sign the Contract.

We hereby extend our full guarantee and warranty in accordance with Clause 28 of the General Conditions of Contract, with respect to the Goods offered by the above firm.

We confirm that we do not engage or employ forced labor or persons subject to trafficking or child labor, in accordance with Clause 14 of the General Conditions of Contract.

Signed: *[insert signature(s) of authorized representative(s) of the Manufacturer]*

Name: *[insert complete name(s) of authorized representative(s) of the Manufacturer]*

Title: *[insert title]*

Dated on _____ day of _____, _____ *[insert date of signing]*

Bidder Information Form

[The Bidder shall fill in this Form in accordance with the instructions indicated below. No alterations to its format shall be permitted and no substitutions shall be accepted.]

Date: *[insert date (as day, month and year) of Bid submission*]
RFB No.: *[insert number of Bidding process]*
Alternative No.: *[insert identification No if this is a Bid for an alternative]*

Page _____ of_ _____ pages

1. Bidder's Name *[insert Bidder's legal name]*
2. In case of JV, legal name of each member: *[insert legal name of each member in JV]*
3. Bidder's actual or intended country of registration: *[insert actual or intended country of registration]*
4. Bidder's year of registration: *[insert Bidder's year of registration]*
5. Bidder's Address in country of registration: *[insert Bidder's legal address in country of registration]*
6. Bidder's Authorized Representative Information Name: *[insert Authorized Representative's name]* Address: *[insert Authorized Representative's Address]* Telephone/Fax numbers: *[insert Authorized Representative's telephone/fax numbers]* Email Address: *[insert Authorized Representative's email address]*
7. Attached are copies of original documents of *[check the box(es) of the attached original documents]* ☐ Articles of Incorporation (or equivalent documents of constitution or association), and/or documents of registration of the legal entity named above, in accordance with ITB 4.4. ☐ In case of JV, letter of intent to form JV or JV agreement, in accordance with ITB 4.1. ☐ In case of state-owned enterprise or institution, in accordance with ITB 4.6 documents establishing: • Legal and financial autonomy • Operation under commercial law • Establishing that the Bidder is not under the supervision of the Purchaser 8. Included are the organizational chart, a list of Board of Directors, and the beneficial ownership. The successful Bidder shall provide additional information on beneficial ownership, using the Beneficial Ownership Disclosure Form.

Bidder's JV Members Information Form

[The Bidder shall fill in this Form in accordance with the instructions indicated below. The following table shall be filled in for the Bidder and for each member of a Joint Venture]].

Date: *[insert date (as day, month and year) of Bid submission*]

RFB No.: *[insert number of RFB process]*

Alternative No.: *[insert identification No if this is a Bid for an alternative]*

Page _____ of_ _____ pages

1. Bidder's Name: *[insert Bidder's legal name]*
2. Bidder's JV Member's name: *[insert JV's Member legal name]*
3. Bidder's JV Member's country of registration: *[insert JV's Member country of registration]*
4. Bidder's JV Member's year of registration: *[insert JV's Member year of registration]*
5. Bidder's JV Member's legal address in country of registration: *[insert JV's Member legal address in country of registration]*
6. Bidder's JV Member's authorized representative information Name: *[insert name of JV's Member authorized representative]* Address: *[insert address of JV's Member authorized representative]* Telephone/Fax numbers: *[insert telephone/fax numbers of JV's Member authorized representative]* Email Address: *[insert email address of JV's Member authorized representative]*
7. Attached are copies of original documents of *[check the box(es) of the attached original documents]* ☐ Articles of Incorporation (or equivalent documents of constitution or association), and/or registration documents of the legal entity named above, in accordance with ITB 4.4. ☐ In case of a state-owned enterprise or institution, documents establishing legal and financial autonomy, operation in accordance with commercial law, and that they are not under the supervision of the Purchaser, in accordance with ITB 4.6. 8. Included are the organizational chart, a list of Board of Directors, and the beneficial ownership. The successful Bidder shall provide additional information on beneficial ownership for each JV member using the Beneficial Ownership Disclosure Form.

Sexual Exploitation and Abuse (SEA) and/or Sexual Harassment Performance Declaration

[The following table shall be filled in by the Bidder, each member of a Joint Venture and each subcontractor proposed by the Bidder]

Bidder's Name: *[insert full name]*
Date: *[insert day, month, year]*
Joint Venture Member's or Subcontractor's Name: *[insert full name]*
RFB No. and title: *[insert RFB number and title]*
Page *[insert page number]* of *[insert total number]* pages

SEA and/or SH Declaration **in accordance with Section III, Qualification Criteria, and Requirements**
We: ☐ (a) have not been subject to disqualification by the Bank for non-compliance with SEA/ SH obligations ☐ (b) are subject to disqualification by the Bank for non-compliance with SEA/ SH obligations ☐ (c) had been subject to disqualification by the Bank for non-compliance with SEA/ SH obligations, and were removed from the disqualification list. An arbitral award on the disqualification case has been made in our favor.
[*If (c) above is applicable, attach evidence of an arbitral award reversing the findings on the issues underlying the disqualification]*

Form of Bid Security

(Bank Guarantee)

[The bank shall fill in this Bank Guarantee Form in accordance with the instructions indicated.]

[Guarantor letterhead or SWIFT identifier code]

Beneficiary: *[Purchaser to insert its name and address]*

RFB No.: *[Purchaser to insert reference number for the Request for Bids]*

Alternative No.: *[Insert identification No if this is a Bid for an alternative]*

Date: *[Insert date of issue]*

BID GUARANTEE No.: *[Insert guarantee reference number]*

Guarantor: *[Insert name and address of place of issue, unless indicated in the letterhead]*

We have been informed that _____ *[insert name of the Bidder, which in the case of a joint venture shall be the name of the joint venture (whether legally constituted or prospective) or the names of all members thereof]* (hereinafter called "the Applicant") has submitted or will submit to the Beneficiary its Bid (hereinafter called "the Bid") for the execution of _____ under Request for Bids No. _____ _ ("the RFB").

Furthermore, we understand that, according to the Beneficiary's conditions, Bids must be supported by a Bid guarantee.

At the request of the Applicant, we, as Guarantor, hereby irrevocably undertake to pay the Beneficiary any sum or sums not exceeding in total an amount of _____ (_____) upon receipt by us of the Beneficiary's complying demand, supported by the Beneficiary's statement, whether in the demand itself or a separate signed document accompanying or identifying the demand, stating that either the Applicant:

(a) has withdrawn its Bid prior to the Bid validity expiry date set forth in the Applicant's Letter of Bid, or any extended date provided by the Applicant; or

(b) having been notified of the acceptance of its Bid by the Beneficiary prior to the expiry date of the Bid validity or any extension thereof provided by the Applicant has failed to: (i) sign the contract agreement, or (ii) furnish the performance security, in accordance with the Instructions to Bidders ("ITB") of the Beneficiary's bidding document.

This guarantee will expire: (a) if the Applicant is the successful Bidder, upon our receipt of copies of the Contract agreement signed by the Applicant and the performance security issued to the Beneficiary in relation to such Contract agreement; or (b) if the Applicant is not the successful Bidder, upon the earlier of (i) our receipt of a copy of the Beneficiary's notification to the Applicant of the results of the Bidding process; or (ii) twenty-eight days after the expiry date of the Bid validity.

Consequently, any demand for payment under this guarantee must be received by us at the office indicated above on or before that date.

This guarantee is subject to the Uniform Rules for Demand Guarantees (URDG) 2010 Revision, ICC Publication No. 758.

_____

[Signature(s)]

Note: All italicized text is for use in preparing this form and shall be deleted from the final product.

Form of Bid Security (Bid Bond) - Not Applicable

[The Surety shall fill in this Bid Bond Form in accordance with the instructions indicated.]

BOND NO. _____

BY THIS BOND *[name of Bidder]* as Principal (hereinafter called "the Principal"), and *[name, legal title, and address of surety],* **authorized to transact business in** *[name of country of Purchaser],* as Surety (hereinafter called "the Surety"), are held and firmly bound unto *[name of Purchaser]* as Obligee (hereinafter called "the Purchaser") in the sum of *[amount of Bond]*[1] *[amount in words]*, for the payment of which sum, well and truly to be made, we, the said Principal and Surety, bind ourselves, our successors and assigns, jointly and severally, firmly by these presents.

WHEREAS the Principal has submitted or will submit a written Bid to the Purchaser dated the ___ day of _____, 20__, for the supply of *[name of Contract]* (hereinafter called the "Bid").

NOW, THEREFORE, THE CONDITION OF THIS OBLIGATION is such that if the Principal:

(a) withdraws its Bid prior to the Bid validity expiry date set forth in the Principal's Letter of Bid, or any extended date provided by the Principal; or

(b) having been notified of the acceptance of its Bid by the Purchaser prior to the expiry date of the Bid validity or any extension thereto provided by the Applicant has failed to: (i) execute the Contract agreement; or (ii) furnish the Performance Security, in accordance with the Instructions to Bidders ("ITB") of the Purchaser's bidding document.

then the Surety undertakes to immediately pay to the Purchaser up to the above amount upon receipt of the Purchaser's first written demand, without the Purchaser having to substantiate its demand, provided that in its demand the Purchaser shall state that the demand arises from the occurrence of any of the above events, specifying which event(s) has occurred.

The Surety hereby agrees that its obligation will remain in full force and effect up to and including the date 28 days after the date of expiry of the Bid validity set forth in the Principal's Letter of Bid or any extension thereto provided by the Principal.

IN TESTIMONY WHEREOF, the Principal and the Surety have caused these presents to be executed in their respective names this ____ day of _____ 20__.

---

[1] The amount of the Bond shall be denominated in the currency of the Purchaser's country or the equivalent amount in a freely convertible currency.

Principal: _____ Surety: _____

Apply Corporate Seal (where appropriate)

_____	_____
(Signature)	*(Signature)*
(Printed name and title)	*(Printed name and title)*

Letter of Bid - Financial Part

INSTRUCTIONS TO BIDDERS: DELETE THIS BOX ONCE YOU HAVE COMPLETED THE DOCUMENT

Place this Letter of Bid - Financial Part in the second envelope marked "FINANCIAL PART".

The Bidder must prepare the Letter of Bid - Financial Part on stationery with its letterhead clearly showing the Bidder's complete name and business address.

Note: All italicized text is to help Bidders in preparing this form.

Date of this Bid submission: [*insert date (as day, month and year) of Bid submission*]
RFB No.: [*insert number of bidding process*]
Request for Bid No.: [*insert identification*]
Alternative No.: [*insert identification No if this is a Bid for an alternative*]

To: [*insert complete name of Purchaser*]

We, the undersigned Bidder, hereby submit the second part of our Bid, the Financial Part

In submitting our Financial Part we make the following additional declarations:

(a) **Bid Validity**: Our Bid shall be valid until *[insert day, month and year in accordance with ITB 18.1],* and it shall remain binding upon us and may be accepted at any time before the expiration of that period;

(b) **Total Price:** The total price of our Bid, excluding any discounts offered in item (c) below is:

In case of only one lot, the total price of the Bid is [*insert the total price of the bid in words and figures, indicating the various amounts and the respective currencies*];

In case of multiple lots, the total price of each lot is [*insert the total price of each lot in words and figures, indicating the various amounts and the respective currencies*];

In case of multiple lots, total price of all lots (sum of all lots) [*insert the total price of all lots in words and figures, indicating the various amounts and the respective currencies*];

(c) **Discounts:** The discounts offered and the methodology for their application are:

(i) The discounts offered are: [*Specify in detail each discount offered*]

(ii) The exact method of calculations to determine the net price after application of discounts is shown below: [*Specify in detail the method that shall be used to apply the discounts*];

(d) **Commissions, gratuities and fees:** We have paid, or will pay the following commissions, gratuities, or fees with respect to the bidding process or execution of the Contract: [*insert complete name of each Recipient, its full address, the reason for which each commission or gratuity was paid and the amount and currency of each such commission or gratuity*].

Name of Recipient	Address	Reason	Amount

(If none has been paid or is to be paid, indicate "none.")

(e) **Binding Contract:** We understand that this Bid, together with your written acceptance thereof included in your Letter of Acceptance, shall constitute a binding contract between us, until a formal contract is prepared and executed.

Name of the Bidder: *[*insert complete name of the Bidder*]

Name of the person duly authorized to sign the Bid on behalf of the Bidder: ** [*insert complete name of person duly authorized to sign the Bid*]

Title of the person signing the Bid: [*insert complete title of the person signing the Bid*]

Signature of the person named above: [*insert signature of person whose name and capacity are shown above*]

Date signed [*insert date of signing*] **day of** [*insert month*], [*insert year*]

*: In the case of the Bid submitted by a Joint Venture specify the name of the Joint Venture as Bidder.

**: Person signing the Bid shall have the power of attorney given by the Bidder. The power of attorney shall be attached with the Bid Schedules.

Price Schedule Forms

*[The Bidder shall fill in these Price Schedule Forms in accordance with the instructions indicated. The list of line items in column 1 of the **Price Schedules** shall coincide with the List of Goods and Related Services specified by the Purchaser in the Schedule of Requirements.]*

Price Schedule: Goods Manufactured Outside the Purchaser's Country, to be Imported

(Group C Bids, goods to be imported)

Currencies in accordance with ITB 15

Date: _____
RFB No: _____

Alternative No: _____
Page No _____ of _____

1	2	3	4	5	6	7	8	9	10
Line Item N°	Description of Goods	Country of Origin	Delivery Date as defined by Incoterms	Quantity and physical unit	Unit price CIP [Karachi Port of Shipment] in accordance with ITB 14.8(b)(i)	CIP Price per line item (Col. 5x6)	Price per line item for inland transportation and other services required in the Purchaser's Country to convey the Goods to their final destination Jamrud Warehouse as per ITB 14.8 (a)(iii), (b)(ii) and (c)(v) specified in BDS	Total Price per Line item upto PESCO GSC Ware House 132kV Grid Station Industrial State, Jamrud Road, Hayat Abad, Peshawar, KPK, Pakistan (Col. 7+8)	Estimated Provisional Sum (Non-competitive) (All types of Applicable Duties & taxes (if any) in Purchaser Country)
[insert number of the item]	*[insert name of good]*	*[insert country of origin of the Good]*	*[insert quoted Delivery Date]*	*[insert number of units to be supplied and name of the physical unit]*	*[insert unit price CIP per unit]*	*[insert total CIP price per line item]*	*[insert the corresponding price per line item]*	*[insert total price of the line item]*	
							Total Price		

Name of Bidder *[insert complete name of Bidder]* Signature of Bidder *[signature of person signing the Bid]* Date *[Insert Date]*

Price Schedule: Goods Manufactured Outside the Purchaser's Country, already imported*

(Group C Bids, Goods already imported)

Currencies in accordance with ITB 15

Date:_____
RFB No: _____
Alternative No: _____
Page N° _____ of _____

1	2	3	4	5	6	7	8	9	10	11	12
Line Item N°	Description of Goods	Country of Origin	Delivery Date as defined by Incoterms	Quantity and physical unit	Unit price including Custom Duties and Import Taxes paid, in accordance with ITB 14.8(c)(i)	Custom Duties and Import Taxes paid per unit in accordance with ITB 14.8(c)(ii) , [to be supported by documents]	Unit Price net of custom duties and import taxes, in accordance with ITB 14.8 (c) (iii) (Col. 6 minus Col.7)	Price per line-item net of Custom Duties and Import Taxes paid, in accordance with ITB 14.8(c)(i) (Col. 5×8)	Price per line item for inland transportation and other services required in the Purchaser's Country to convey the goods to their final destination, as specified in BDS in accordance with ITB 14.8 (c)(v)	Sales and other taxes paid or payable per item if Contract is awarded (in accordance with ITB 14.8(c)(iv)	Total Price per line item (Col. 9+10)
[insert number of the item]	*[insert name of Goods]*	*[insert country of origin of the Good]*	*[insert quoted Delivery Date]*	*[insert number of units to be supplied and name of the physical unit]*	*[insert unit price per unit]*	*[insert custom duties and taxes paid per unit]*	*[insert unit price net of custom duties and import taxes]*	*[insert price per line-item net of custom duties and import taxes]*	*[insert price per line item for inland transportation and other services required in the Purchaser's Country]*	*[insert sales and other taxes payable per item if Contract is awarded]*	*[insert total price per line item]*
										Total Bid Price	

Name of Bidder *[insert complete name of Bidder]* Signature of Bidder *[signature of person signing the Bid]* Date *[insert date]*

Price Schedule: Goods Manufactured in the Purchaser's Country

Purchaser's Country

_____

(Group A and B Bids)

Currencies in accordance with ITB 15

Date: _____
RFB No: _____
Alternative No: _____
Page N° _____ of _____

1	2	3	4	5	6	7	8	9	10
Line Item N°	Description of Goods	Delivery Date as defined by Incoterms	Quantity and physical unit	Unit price EXW	Total EXW price per line item (Col. 4×5)	Price per line item for inland transportation and other services required in the Purchaser's Country to convey the Goods to their final destination	Cost of local labor, raw materials and components from with origin in the Purchaser's Country % of Col. 5	Sales and other taxes payable per line item if Contract is awarded (in accordance with ITB 14.8(a)(ii)	Total Price per line item (Col. 6+7)
[insert number of the item]	*[insert name of Good]*	*[insert quoted Delivery Date]*	*[insert number of units to be supplied and name of the physical unit]*	*[insert EXW unit price]*	*[insert total EXW price per line item]*	*[insert the corresponding price per line item]*	*[Insert cost of local labor, raw material and components from within the Purchase's country as a % of the EXW price per line item]*	*[insert sales and other taxes payable per line item if Contract is awarded]*	*[insert total price per item]*
								Total Price	

Name of Bidder *[insert complete name of Bidder]* Signature of Bidder *[signature of person signing the Bid]* Date *[insert date]*

Price and Completion Schedule – Allied Material / Services

Currencies in accordance with ITB 15						Date: _____ RFB No: _____ Alternative No: _____ Page N° _____ of _____
1	2	3	4	5	6	7
Service N°	Description of Services (excludes inland transportation and other services required in the Purchaser's Country to convey the goods to their final destination)	Country of Origin	Delivery Date at place of Final destination	Quantity and physical unit	Unit price	Total Price per Service (Col. 5*6 or estimate)
[insert number of the Service]	*[insert name of Services]*	*[insert country of origin of the Services]*	*[insert delivery date at place of final destination per Service]*	*[insert number of units to be supplied and name of the physical unit]*	*[insert unit price per item]*	*[insert total price per item]*
				Total Bid Price		

Name of Bidder *[insert complete name of Bidder]* Signature of Bidder *[signature of person signing the Bid]* Date *[insert date]*

Section V - Eligible Countries

Eligibility for the Provision of Goods, Works and Non Consulting Services in Bank-Financed Procurement

In reference to ITB 4.8 and ITB 5.1, for the information of the Bidders, at the present time firms, goods and services from the following countries are excluded from this Bidding process:

Under ITB 4.8 (a) and ITB 5.1: **None.**

Under ITB 4.8(b) and ITB 5.1: **None.**

Section VI - Fraud and Corruption

(Section VI shall not be modified)

1. Purpose

1.1 The Bank's Anti-Corruption Guidelines and this annex apply with respect to procurement under Bank Investment Project Financing operations.

2. Requirements

2.1 The Bank requires that Borrowers (including beneficiaries of Bank financing); bidders (applicants/proposers), consultants, contractors and suppliers; any sub-contractors, sub-consultants, service providers or suppliers; any agents (whether declared or not); and any of their personnel, observe the highest standard of ethics during the procurement process, selection and contract execution of Bank-financed contracts, and refrain from Fraud and Corruption.

2.2 To this end, the Bank:

a. Defines, for the purposes of this provision, the terms set forth below as follows:

i. "corrupt practice" is the offering, giving, receiving, or soliciting, directly or indirectly, of anything of value to influence improperly the actions of another party;

ii. "fraudulent practice" is any act or omission, including misrepresentation, that knowingly or recklessly misleads, or attempts to mislead, a party to obtain financial or other benefit or to avoid an obligation;

iii. "collusive practice" is an arrangement between two or more parties designed to achieve an improper purpose, including to influence improperly the actions of another party;

iv. "coercive practice" is impairing or harming, or threatening to impair or harm, directly or indirectly, any party or the property of the party to influence improperly the actions of a party;

v. "obstructive practice" is:

(a) deliberately destroying, falsifying, altering, or concealing of evidence material to the investigation or making false statements to investigators in order to materially impede a Bank investigation into allegations of a corrupt, fraudulent, coercive, or collusive practice; and/or threatening, harassing, or intimidating any party to prevent it from disclosing its knowledge of matters relevant to the investigation or from pursuing the investigation; or

(b) acts intended to materially impede the exercise of the Bank's inspection and audit rights provided for under paragraph 2.2 e. below.

b. Rejects a proposal for award if the Bank determines that the firm or individual recommended for award, any of its personnel, or its agents, or its sub-consultants, sub-contractors, service providers, suppliers and/ or their

employees, has, directly or indirectly, engaged in corrupt, fraudulent, collusive, coercive, or obstructive practices in competing for the contract in question;

c. In addition to the legal remedies set out in the relevant Legal Agreement, may take other appropriate actions, including declaring misprocurement, if the Bank determines at any time that representatives of the Borrower or of a recipient of any part of the proceeds of the loan engaged in corrupt, fraudulent, collusive, coercive, or obstructive practices during the procurement process, selection and/or execution of the contract in question, without the Borrower having taken timely and appropriate action satisfactory to the Bank to address such practices when they occur, including by failing to inform the Bank in a timely manner at the time they knew of the practices.

d. Pursuant to the Bank's Anti-Corruption Guidelines, and in accordance with the Bank's prevailing sanctions policies and procedures, may sanction a firm or individual, either indefinitely or for a stated period of time, including by publicly declaring such firm or individual ineligible (i) to be awarded or otherwise benefit from a Bank-financed contract, financially or in any other manner;1 (ii) to be a nominated2 sub-contractor, consultant, manufacturer or supplier, or service provider of an otherwise eligible firm being awarded a Bank-financed contract; and (iii) to receive the proceeds of any loan made by the Bank or otherwise to participate further in the preparation or implementation of any Bank-financed project;

e. Requires that a clause be included in bidding/request for proposals documents and in contracts financed by a Bank loan, requiring (i) bidders (applicants/proposers), consultants, contractors, and suppliers, and their sub-contractors, sub-consultants, service providers, suppliers, agents, personnel, permit the Bank to inspect[3] all accounts, records and other documents relating to the procurement process, selection and/or contract execution, and to have them audited by auditors appointed by the Bank.

.

.

PART 2 – Supply Requirements

Section VII - Schedule of Requirements

Contents

1. List of Goods and Delivery Schedule **82**

2. **List of Related Services and Completion Schedule :** **84**

3. Technical Specifications **85**

5. Inspections and Tests .....Error! Bookmark not defined.

1. List of Goods and Delivery Schedule

Line Item No.	Description of Goods	Quantity	Physical unit	Final (Project Site) Destination as specified in BDS	Delivery (as per Incoterms) Date		
					Earliest Delivery Date from signing of the Contract	Latest Delivery Date from signing of the Contract	Bidder's offered Delivery date [*to be provided by the Bidder*]
01	Standard Asset Performance Management System (APMS) with Magnetic Contactor and Non – Motorized MCCB (Ordering Code: APMS-MC-S200) for 200KVA Ratings along with allied material required for installation and PITC-UDIL compliant MDC driver software	1,034	No	PESCO GSC Ware House 132kV Grid Station Industrial State, Jamrud Road, Hayat Abad, Peshawar, KPK, Pakistan.	120 days	150 days	
02	Standard Asset Performance Management System with Magnetic Contactor and Non – Motorized MCCB (Ordering Code: APMS-MC-S100) for 100KVA Ratings along with allied material required for installation and PITC-UDIL compliant MDC driver software	2,977	No				

03	Insulated S/C AA Cable 185 mm2 for APMS of 200KVA Transformers	52	Km				
04	Insulated S/C AA Cable 120 mm2 for APMS of 100KVA Transformers	149	Km				
05	Earth Rod, wire and allied material complete including Boring to achieve earth resistance < 2 Ω	4,011	Set		120 days	150 days	
06	PG Connector (T-150)	11,908	No's				
07	PG Connector (T- 220)	4,136	No's				
08	Bimetallic Lugs for 200KVA T/F for 185mm^2 S/C Cable	8,272	No's				
09	Bimetallic Lugs for 100KVA T/F for 120mm^2 S/C Cable	23,816	No's				

2. List of Related Services and Completion Schedule :

Sr. No.	Description of Service	Quantity / Physical Unit No's		Place where Services shall be performed	Final Completion Date(s) of Services
		100KVA Transformers	200KVA Transformers	PESCO Operation Circles	240 days Commencing from the date of signing of the Contract
01	Installation, Testing & Commissioning of APMS on Distribution Transformers in Mardan Circle along with allied material required for installation and PITC-UDIL compliant MDC driver software	2,016	630	Mardan	
02	Installation, Testing & Commissioning of APMS on Distribution Transformers in Swabi Circle along with allied material required for installation and PITC-UDIL compliant MDC driver software	961	404	Swabi	

NOTE:

i. The Contractor shall be responsible to Collect APMS and allied material from the PESCO GSC Ware House 1Station Industrial State, Jamrud Road, H on their account, for installation at site through Handing /Taking Protocol dully signed by the designated representatives of the both Parties,

ii. The Contractor shall be responsible for preparation of Form – C (Material Re-conciliation Report) and Form A-90 (Assets capitalization Report) dully Signed by the designated representatives of PESCO & PIMSC.

iii. The final list of APMS (Division Wise) will be shared at the time of the commencement of the Work.

3. Technical Specifications

1. GENERAL

1.1 All design, equipment, material and workmanship shall comply with and be testedin accordance with requirements of the Specifications as attached in Volume-II of this Standard Procurement Document. Equipment or parts which are not covered by the Specifications, shall comply with rules, codes and regulations of the International Electro Technical Commission/International Safety Standards or National Transmission and Dispatch Company (NTDC) Pakistan / Power Planning Monitoring Company (PPMC) Technical Specifications.

1.2 All dimensions and units given by the Bidder in the Bid with its associated drawings and the Approval Drawings as submitted by the Supplier shall be in metric system and all reference to weights, measurements and quantities shall be metric units.

1.3 The contract shall be executed in strict conformity with the specifications and/or drawings given or mentioned in this section and the supplier shall do no `Work` without proper specifications, instructions and/or drawings.

1.4 All the goods, the quantities of which are defined in Schedule of Prices for main equipment, shall be of the material in accordance with the Technical Specifications appended hereto.

1.5 Wherever reference is made in the Technical Specifications to specific standards and codes to be met by the goods and materials to be furnished or tested, the provisions of the latest current edition or revision of the relevant standards or codes in effect shall apply, unless otherwise expressly stated in the Contract. Where such standards and codes are national or relates to a particular country or region, other authoritative standards that ensure substantial equivalence to the standards and codes specified will be acceptable.

1.6 Goods and material specified in the Technical Specification must comply with standards cited or other recognized standards, which ensure an equal or higher quality than the standards mentioned subject to the prototype approval by Chief (Technical Services) PPMC.

2. MATERIAL AND WORKMANSHIP

2.1. MATERIAL

All design, equipment and material shall be of highest grade, free from defects/imperfection and shall comply with and be tested in accordance with requirements of the specifications. Equipment or parts, which are not covered by the specifications, shall comply with rules, codes and regulations of the international Electro-Technical Commission/International Safety Standards or National Transmission and Dispatch Company Pakistan Specifications. All necessary tests shall be performed to ensure that technical requirements arefulfilled.

2.2. The general intent of these Specifications is to require the supply of equipment and materials equal or superior to those actually described herein. Unless otherwise stated, reference to the brand or manufacturer, if made, is only for the sake of comparison as to type, design, character or quality of the equipment and materials desired and shall not be interpreted as eliminating other equipment and materials of equal performance, quality and durability subject to prototype approval by Chief

(Technical Services) PPMC.

2.3. All dimensions and units given by the bidder in the bid and with its associated drawings and the drawings submitted by the Supplier for approval shall be in metric system and all reference to weights, measurements and quantities shall be in metric units.

3. WORKMANSHIP

i. Workmanship and general finish shall be of the highest standard free from defects/Imperfection, in accordance with the requirements specified herein, and the best modern standard practice.

ii. All components of the same design and designation shall be the best modern practices identical and like components shall be interchangeable. All necessary tests shall be performed to ensure that technical requirements are fulfilled.

4. SPECIFICATIONS AND DRAWINGS

4.1 The Contract shall be executed in strict conformity with the technical provisions' specification and Drawings mentioned in Specification issued by Chief (Technical Services) PPMC, PPMC-DS-01:2026 (APMS) (Latest Amended 28 days prior to Bid Submission date) and the supplier shall do no 'Work' without proper specification, Instructions and/or Drawings.

Specifications and/or drawings are intended to complement each other so that if anything is shown on the drawings as required but not mentioned in the Specifications or vice versa, it shall be of like effect as if shown or mentioned in both. If any errors, omissions or discrepancies are found in the figures, specifications and/or drawings or, if any feature shall appear to the Supplier tobe indefinite or unclear, the same shall be referred to the Chief Engineer (Dev) PMU PESCO Peshawar whose written explanation and/or clarification shall be obtained before proceeding with the work.

4.2 Approval of the Chief Engineer (Dev) PMU PESCO Peshawar does not relieve the Contractor of his responsibility to do the work in accordance with the Contract.

4.3 The Supplier shall be responsible for any discrepancies, errors or omissions in any drawings or other particulars supplied by him whether such drawings or particulars have been approved by the Chief Engineer (Dev) PMU PESCO Peshawar or not.

4.4 All drawings and documents furnished by the Supplier in accordance with the Contract shall become the property of PESCO (Client of Project).

4.5 All the goods and equipment, the quantities of which are defined in Price Schedules, shall be of the material in accordance with the Technical Provisions & Technical Specifications appended hereto.

4.6 Goods & material specified in the Technical Provisions & Technical Specification must comply with standards cited or other recognized standards, which ensure an equal or higher quality than the standards mentioned subject to the prototype approval by the Chief (Technical Services) PPM.

4.7. The Goods (APMS with allied Material) and Related Services shall comply with following Technical Specifications and Standards:

Name of Goods	Technical Specifications and Standards
Standard Asset Performance Management System (APMS) with Magnetic Contactor and Non – Motorized MCCB (Ordering Code: APMS-MC-S) for 200KVA and 100KVA Rating Distribution Transformers along with allied material required for installation.	Chief (Technical Services) PPMC, PPMC Specification No. PPMC-DS-01-2026, DDS - 50:2007, DDS - 98:2011, DDS - 110:2012, DDS - 80:2007 and UDIL (Latest Amended 28 days prior to Bid Submission.) as per Attached Volume-II) of the Bid.
Insulated S/C, AA, 185 mm2 Cable for APMS of 200KVA Transformers.	Technical specification DDS: 8-2007 (Latest approved versions 28 days prior to the deadline for bid submission) as per Attached Volume-II) of the Bid
Insulated S/C, AA, 120 mm2 Cable for APMS of 100KVA Transformers.	
Earth Rod, wire & allied material complete set including Boring to achieve earth resistance < 2 Ω.	Spec: P-111:76 (Latest approved versions 28 days prior to the deadline for bid submission) as per Attached Volume-II) of the Bid.
PG -150 & 220	Spec. P25-76 CE (D&S) WAPDA
IT conditions provided by PESCO's IT department.	As per Attached Volume-II) of the Bid.

5. DRAWINGS:

Technical data/ Drawings as per PPMC Specification No. PPMC-DS-01:2026 for APMS and DDS-8-2007 for cables (Latest approved versions 28 days prior to the deadline for bid submission) and the successful bidder will provide three (03) Sets of data / drawings for approval from PESCO. In case if data / drawing is already approved by PPMC / PESCO, the same will be applicable for subjected tender.

6. INSPECTIONS AND TESTS

The inspections and tests shall be carried out as per PPMC specifications PPMC-DS-01:2026 (Amended up to 28 days prior to the deadline for submission of bid), for APMS and DDS:08-2017 (amended up to 28 days prior to the deadline for submission of bid), for Cables.

The purchaser reserves the right for carrying out any other tests of a reasonable nature at the works of the supplier/laboratory or at any other recognized laboratory/research institute in addition to the type, acceptance and routine tests as mentioned in the specifications attached here to, the costs of participation in such

test(s) and inspections by the Purchaser's nominated inspector(s) shall be borne by the Purchaser to satisfy that the material complies with the intent of this specification

A brief details of the Tests to be carried out but not limited to the following:

APMS	Tests to be carried out
Standard Asset Performance Managemen System (APMS) with Magnetic Contactor and Non – Motorized MCCB (Ordering Code: APMS-MC-S100 & APMS S200) for 200KVA and 100KVA Rating Distribution Transformers	The manufacture shall perform the Functional requirements of APMS as per clause 13 and drawings under PPMC Technical Specifications PPMC-DS-01:2026.
	Prototype Test : Manufacturer / Bidder shall submit one (01) Complete APMS Unit, Technical Data and 3 Sets of Drawings for Prototype approval in the o/o the Chief (Technical Services)PPMC. Details of the Tests will be as per Clause 14 of Technical Specifications PPMC-DS-01:2026. **Routine Tests:** The Supplier/ Manufacturer of APMS shall perform following Routine Tests on each APMS at their Premises and shall maintain its proper record to submit on demand:- 1. Visual examination & verification of dimensions (as per approved drawings) 2. Verification of components (as per drawings) 3. Power Frequency Test. 4. Complete Functionality Tests of APMS as per Clause 13 **Sample Tests:** Following sample tests of APMS during mass productions shall be carried out by Material inspection, PPMC, PIMSC and PESCO nominated representatives as per clause 15.2 of Technical Specifications PPMC-DS-01:2026:- a. Visual Examination & Verification of dimensions, components (as per approved drawings) and calibration certificates (equipment, sensor assemblies) b. Power Frequency Test(2.5kV) c. Conductivity Test of bus bars. d. Wiring Inspection. e. Fail safe test. f. Communication verification on MDC. g. Paint thickness test (0.100mm minimum at any point on surface) h. Galvanizing test. i. Tin Plating test. (=>20Micros) j. Bakelite dielectric test. (8kV). k. Alarm generation test.

Allied material for installation of APMS	1. The Inspection and sample Tests of Insulated S/C, AA, 120 mm2 and 185 mm2 Cables will be performed at Manufacturer's premises as per Clause -13 of Technical Specifications DDS - 8:2007(Latest approved versions 28 days prior to the deadline for bid submission .Inspection and Testing of Earth Rod, wire & allied material complete will be as per Technical Specifications No.P-111, 76 (Latest Amended 28 days prior to Bid Submission.)

1. Successful bidder will provide UDIL compliance certificate from PITC Lahore within Thirty **(30)** days from the issuance of Letter of Acceptance(LOA) without affecting the completion schedule
2. After installation of APMS on LT Side of transformer, the below mentioned communication tests will be carried out at site and concerned Superintending Engineer (Operation circle) and Director IT, PESCO will issue acceptance certificate i.e. the incorporation of the below mentioned components of AMI network i.e. Meter Data Collection (MDC) and Meter Data Management (MDM) in accordance with their relevant specifications,
    - Real time monitoring and operation
    - Preventive actions against damage
    - Load disconnection during fault / abnormal conditions
    - Energy auditing
    - Schedule of Load Shedding
    - Human / Equipment safety
3. Purchaser Country: Pre-shipment Inspection at manufacturer's work will be carried out by PESCO and PIMSC nominated representatives.
4. Foreign Country: Pre-shipment Inspection at manufacturer's work will be carried out by PESCO and PIMSC nominated representatives.

SPECIAL PROVISIONS

SP-1 SCOPE OF SUPPLY AND ORDERING CODE

SCOPE OF SUPPLY:

The scope includes Supply, Installation, Testing and Commissioning of Asset Performance Management System (APMS) for 100KVA & 200KVA Transformers along with Allied Material and Related Services in PESCO Mardan Circle and Swabi Circle of Khyber Pakhtunkhwa - Pakistan.

As per Clause 6 of PPMC Technical Specifications PPMC-01:2026, Asset Performance Management System (APMS) shall be comprised of the following major components, specified in details under Clauses 7, 8,9,10 & 11 respectively.

a. Smart Metering and Controlling Device(SMCD)
b. Current Transformers(CTs)
c. Non – Motorized Molded Case Circuit Breaker (MCCB)
d. Magnetic Contactor
e. APMS Enclosure

ORDERING CODE:

Following Ordering Codes are applicable for procurement of APMS.

ORDERING CODE	DESCRIPTION
APMS- MC -S 100	Standard APMS with Magnetic Contactor and Non – Motorized MCCB.
APMS-MC-S 200	Standard APMS with Magnetic Contactor and Non – Motorized MCCB.

SP-2 SHOP INSPECTION AND ORDERS FOR GOODS

2.1 Inspection

Unless otherwise authorized by the Chief Engineer (Dev) PMU PESCO Peshawar no Goods shall be shipped from its point of original manufacture or final shop assembly before it has been inspected and approved by the Chief Engineer (Dev) PMU PESCO Peshawar.

2.2 Goods Orders

The Supplier shall, if requested, provide the Chief Engineer (Dev) PMU PESCO Peshawar with unpriced/priced copies of the Supplier's purchase orders for Goodsor approved sub-Contracted supply at the time any such orders are placed. The Supplier shall also provide the Chief Engineer (Dev) PMU PESCO Peshawar with any other relevant information requested to ensure proper expediting and scheduling of the deliveries.

2.3 Acceptance of Materials

The approval by the Chief Engineer (Dev) PMU PESCO Peshawar of any Goods prior to shipment shall in no way relieve the Supplier of any of his

responsibilities for meeting all of the requirements of the Specifications and shall not prevent subsequent rejection if such Goods are later found to be defective or not conformingto the Specifications.

SP- 3 SCHEDULE AND MEETINGS

(1) The Supplier shall manufacture & supply the Goods in accordance with the dates/periods specified in Delivery & Completion Schedule given herein above. The Supplier shall regularly review the Schedule and notify the Chief Engineer (Dev) PMU PESCO Peshawar promptly of any revisions which in his view may be required from time to time.

(2) Each group of Goods shall be completely delivered. The Supplier shall keep the Chief Engineer (Dev) PMU PESCO Peshawar informed of the progress of the Contract and notify the Chief Engineer (Dev) PMU PESCO approximately eight (08) weeks in advance, in writing, as to when the Goods will be ready for inspection and for shipping and shall supply lists covering each consignment in sufficient detail to enable the Chief Engineer (Dev) PMU PESCO Peshawar to check the contents of the packages.

(3) In preparing the Delivery and Completion Schedule, the Supplier shall fully take into account the requirements (and possibilities) for ocean (or air) freight. Progress of all shipments shall be continuously monitored and the Supplier shall provide staff or agents to expedite all shipments to ensure compliance with the approved Delivery Schedule.

SP-4 LANGUAGE:

All correspondence, literature, drawings, name plates, diagrams, applicable data, equipment details, instructions and maintenance books and manuals, spare parts, books and descriptive data shall be in the English language

SP-5 The Contractor shall be responsible for collecting supplied APMS & Allied material from the PESCO Store Designated by the Office of the Chief Engineer (Dev.) PMU PESCO for installation, Testing & commissioning at Site, at no additional cost.

PART 3 – Contract

Section VIII - General Conditions of Contract

Table of Clauses

1. Definitions 96
2. Contract Documents 97
3. Fraud and Corruption 97
4. Interpretation 97
5. Language 98
6. Joint Venture, Consortium or Association 98
7. Eligibility 98
8. Notices 98
9. Governing Law 99
10. Settlement of Disputes 99
11. Inspections and Audit by the Bank 99
12. Scope of Supply 100
13. Delivery and Documents 100
14. Supplier's Responsibilities 100
15. Contract Price 101
16. Terms of Payment 101
17. Taxes and Duties 102
18. Performance Security 102
19. Copyright 102
20. Confidential Information 103
21. Subcontracting 103
22. Specifications and Standards 104
23. Packing and Documents 104
24. Insurance 104

25. Transportation and Incidental Services 105

26. Inspections and Tests 105

27. Liquidated Damages 106

28. Warranty 106

29. Patent Indemnity 107

30. Limitation of Liability 108

31. Change in Laws and Regulations 108

32. Force Majeure 109

33. Change Orders and Contract Amendments 109

34. Extensions of Time 110

35. Termination 110

36. Assignment 112

37. Export Restriction 112

Section VIII. General Conditions of Contract

1. Definitions

1.1 The following words and expressions shall have the meanings hereby assigned to them:

(a) "Bank" means the World Bank and refers to the International Bank for Reconstruction and Development (IBRD) or the International Development Association (IDA).

(b) "Contract" means the Contract Agreement entered into between the Purchaser and the Supplier, together with the Contract Documents referred to therein, including all attachments, appendices, and all documents incorporated by reference therein.

(c) "Contract Documents" means the documents listed in the Contract Agreement, including any amendments thereto.

(d) "Contract Price" means the price payable to the Supplier as specified in the Contract Agreement, subject to such additions and adjustments thereto or deductions therefrom, as may be made pursuant to the Contract.

(e) "Day" means calendar day.

(f) "Completion" means the fulfillment of the Related Services by the Supplier in accordance with the terms and conditions set forth in the Contract.

(g) "GCC" means the General Conditions of Contract.

(h) "Goods" means all of the commodities, raw material, machinery and equipment, and/or other materials that the Supplier is required to supply to the Purchaser under the Contract.

(i) "Purchaser's Country" is the country specified **in the Special Conditions of Contract** (SCC).

(j) "Purchaser" means the entity purchasing the Goods and Related Services, as **specified in the SCC.**

(k) "Related Services" means the services incidental to the supply of the goods, such as insurance, installation, training and initial maintenance and other such obligations of the Supplier under the Contract.

(l) "SCC" means the Special Conditions of Contract.

(m) "Subcontractor" means any person, private or government entity, or a combination of the above, to whom any part of the Goods to be supplied or execution of any part of the Related Services is subcontracted by the Supplier.

(n) "Supplier" means the person, private or government entity, or a combination of the above, whose Bid to perform the Contract has been accepted by the Purchaser and is named as such in the Contract Agreement.

(o) "The Project Site," where applicable, means the place **named in the SCC.**

2. Contract Documents

2.1 Subject to the order of precedence set forth in the Contract Agreement, all documents forming the Contract (and all parts thereof) are intended to be correlative, complementary, and mutually explanatory. The Contract Agreement shall be read as a whole.

3. Fraud and Corruption

3.1 The Bank requires compliance with the Bank's Anti-Corruption Guidelines and its prevailing sanctions policies and procedures as set forth in the WBG's Sanctions Framework, as set forth in Appendix 1 to the GCC.

3.2 The Purchaser requires the Supplier to disclose any commissions or fees that may have been paid or are to be paid to agents or any other party with respect to the Bidding process or execution of the Contract. The information disclosed must include at least the name and address of the agent or other party, the amount and currency, and the purpose of the commission, gratuity or fee.

4. Interpretation

4.1 If the context so requires it, singular means plural and vice versa.

4.2 Incoterms

(a) Unless inconsistent with any provision of the Contract**,** the meaning of any trade term and the rights and obligations of parties thereunder shall be as prescribed by Incoterms **specified in the SCC**.

(b) The terms EXW, CIP, FCA, CFR and other similar terms, when used, shall be governed by the rules prescribed in the current edition of Incoterms **specified in the SCC** and published by the International Chamber of Commerce in Paris, France.

4.3 Entire Agreement

The Contract constitutes the entire agreement between the Purchaser and the Supplier and supersedes all communications, negotiations and agreements (whether written or oral) of the parties with respect thereto made prior to the date of Contract.

4.4 Amendment

No amendment or other variation of the Contract shall be valid unless it is in writing, is dated, expressly refers to the Contract, and is signed by a duly authorized representative of each party thereto.

4.5 Nonwaiver

(a) Subject to GCC Sub-Clause 4.5(b) below, no relaxation, forbearance, delay, or indulgence by either party in enforcing any of the terms and conditions of the Contract or the granting of time by either party to the other shall prejudice, affect, or restrict the rights of that party under

the Contract, neither shall any waiver by either party of any breach of Contract operate as waiver of any subsequent or continuing breach of Contract.

(b) Any waiver of a party's rights, powers, or remedies under the Contract must be in writing, dated, and signed by an authorized representative of the party granting such waiver, and must specify the right and the extent to which it is being waived.

4.6 Severability

If any provision or condition of the Contract is prohibited or rendered invalid or unenforceable, such prohibition, invalidity or unenforceability shall not affect the validity or enforceability of any other provisions and conditions of the Contract.

5. Language

5.1 The Contract as well as all correspondence and documents relating to the Contract exchanged by the Supplier and the Purchaser, shall be written in the language specified in the **SCC.** Supporting documents and printed literature that are part of the Contract may be in another language provided they are accompanied by an accurate translation of the relevant passages in the language specified**,** in which case, for purposes of interpretation of the Contract, this translation shall govern.

5.2 The Supplier shall bear all costs of translation to the governing language and all risks of the accuracy of such translation, for documents provided by the Supplier.

6. Joint Venture, Consortium or Association

6.1 If the Supplier is a joint venture, consortium, or association, all of the parties shall be jointly and severally liable to the Purchaser for the fulfillment of the provisions of the Contract and shall designate one party to act as a leader with authority to bind the joint venture, consortium, or association. The composition or the constitution of the joint venture, consortium, or association shall not be altered without the prior consent of the Purchaser.

7. Eligibility

7.1 The Supplier and its Subcontractors shall have the nationality of an eligible country. A Supplier or Subcontractor shall be deemed to have the nationality of a country if it is a citizen or constituted, incorporated, or registered, and operates in conformity with the provisions of the laws of that country.

7.2 All Goods and Related Services to be supplied under the Contract and financed by the Bank shall have their origin in Eligible Countries. For the purpose of this Clause, origin means the country where the goods have been grown, mined, cultivated, produced, manufactured, or processed; or through manufacture, processing, or assembly, another commercially recognized article results that differs substantially in its basic characteristics from its components.

8. Notices

8.1 Any notice given by one party to the other pursuant to the Contract shall be in writing to the address **specified in the SCC.**

The term "in writing" means communicated in written form with proof of receipt.

8.2 A notice shall be effective when delivered or on the notice's effective date, whichever is later.

9. Governing Law

9.1 The Contract shall be governed by and interpreted in accordance with the laws of the Purchaser's Country, unless otherwise **specified in the SCC.**

9.2 Throughout the execution of the Contract, the Supplier shall comply with the import of goods and services prohibitions in the Purchaser's Country when:

(a) as a matter of law or official regulations, the Borrower's country prohibits commercial relations with that country; or

(b) by an act of compliance with a decision of the United Nations Security Council taken under Chapter VII of the Charter of the United Nations, the Borrower's Country prohibits any import of goods from that country or any payments to any country, person, or entity in that country.

10. Settlement of Disputes

10.1 The Purchaser and the Supplier shall make every effort to resolve amicably by direct informal negotiation any disagreement or dispute arising between them under or in connection with the Contract.

10.2 If, after twenty-eight (28) days, the parties have failed to resolve their dispute or difference by such mutual consultation, then either the Purchaser or the Supplier may give notice to the other party of its intention to commence arbitration, as hereinafter provided, as to the matter in dispute, and no arbitration in respect of this matter may be commenced unless such notice is given. Any dispute or difference in respect of which a notice of intention to commence arbitration has been given in accordance with this Clause shall be finally settled by arbitration. Arbitration may be commenced prior to or after delivery of the Goods under the Contract. Arbitration proceedings shall be conducted in accordance with the rules of procedure **specified in the SCC.**

10.3 Notwithstanding any reference to arbitration herein,

(a) the parties shall continue to perform their respective obligations under the Contract unless they otherwise agree; and

(b) the Purchaser shall pay the Supplier any monies due the Supplier.

11. Inspections and Audit by the Bank

11.1 The Supplier shall keep, and shall make all reasonable efforts to cause its Subcontractors and subconsultants to keep, accurate and systematic accounts and records in respect of the Goods in such form and details as will clearly identify relevant time changes and costs.

11.2 Pursuant to paragraph 2.2 e. of Appendix 1 to the General Conditions the Supplier shall permit and shall cause its agents (where declared or not), subcontractors, subconsultants, service providers, suppliers, and personnel, to permit, the Bank and/or persons appointed by the Bank to inspect the site and/or the accounts, records and other documents relating to the procurement process, selection and/or contract execution, and to have such accounts, records and other documents audited by auditors appointed by the Bank. The Supplier's and its Subcontractors' and sub-consultants' attention is drawn to Sub-Clause 3.1 (Fraud and Corruption) which provides, inter alia, that acts intended to materially impede the exercise of the Bank's inspection and audit rights constitute a prohibited practice subject to contract termination (as well as to a determination of ineligibility pursuant to the Bank's prevailing sanctions procedures).

12. Scope of Supply

12.1 The Goods and Related Services to be supplied shall be as specified in the Schedule of Requirements.

13. Delivery and Documents

13.1 Subject to GCC Sub-Clause 33.1, the Delivery of the Goods and Completion of the Related Services shall be in accordance with the Delivery and Completion Schedule specified in the Schedule of Requirements. The details of shipping and other documents to be furnished by the Supplier are **specified in the SCC.**

14. Supplier's Responsibilities

14.1 The Supplier shall supply all the Goods and Related Services included in the Scope of Supply in accordance with GCC Clause 12, and the Delivery and Completion Schedule, as per GCC Clause 13.

14.2 The Supplier, including its Subcontractors, shall not employ or engage forced labor or persons subject to trafficking, as described in GCC Sub-Clauses 14.3 and 14.4.

14.3 Forced labor consists of any work or service, not voluntarily performed, that is exacted from an individual under threat of force or penalty, and includes any kind of involuntary or compulsory labor, such as indentured labor, bonded labor or similar labor-contracting arrangements.

14.4 Trafficking in persons is defined as the recruitment, transportation, transfer, harbouring or receipt of persons by means of the threat or use of force or other forms of coercion, abduction, fraud, deception, abuse of power, or of a position of vulnerability, or of the giving or receiving of payments or benefits to achieve the consent of a person having control over another person, for the purposes of exploitation.

14.5 The Supplier, including its Subcontractors, shall not employ or engage a child under the age of 14 unless the national law specifies a higher age (the minimum age).

14.6 The Supplier, including its Subcontractors, shall not employ or engage a child between the minimum age and the age of 18 in a manner that is likely to be hazardous, or to interfere with, the child's education, or to be harmful to the child's health or physical, mental, spiritual, moral, or social development.

14.7 Work considered hazardous for children is work that, by its nature or the circumstances in which it is carried out, is likely to jeopardize the health, safety, or morals of children. Such work activities prohibited for children include work:

(a) with exposure to physical, psychological or sexual abuse;

(b) underground, underwater, working at heights or in confined spaces;

(c) with dangerous machinery, equipment or tools, or involving handling or transport of heavy loads;

(d) in unhealthy environments exposing children to hazardous substances, agents, or processes, or to temperatures, noise or vibration damaging to health; or

(e) under difficult conditions such as work for long hours, during the night or in confinement on the premises of the employer.

14.8 The Supplier shall comply, and shall require its Subcontractors if any to comply, with all applicable health and safety regulations, laws, guidelines, and any other requirement stated in the Technical Specifications.

14.9 **Pursuant to the SCC**, the Supplier, including its Subcontractors/ suppliers/ manufacturers shall take all technical and organizational measures necessary to protect the information technology systems and data used in connection with the Contract. Without limiting the foregoing, the Supplier, including its Subcontractors/ suppliers/ manufacturers, shall use all reasonable efforts to establish, maintain, implement and comply with, reasonable information technology, information security, cyber security and data protection controls, policies and procedures, including oversight, access controls, encryption, technological and physical safeguards and business continuity/disaster recovery and security plans that are designed to protect against and prevent breach, destruction, loss, unauthorized distribution, use, access, disablement, misappropriation or modification, or other compromise or misuse of or relating to any information technology system or data used in connection with the Contract.

14.10 The Supplier shall comply with additional obligations as **specified in the SCC.**

15. Contract Price

15.1 Prices charged by the Supplier for the Goods supplied and the Related Services performed under the Contract shall not vary from the prices quoted by the Supplier in its Bid, with the exception of any price adjustments **authorized in the SCC.**

16. Terms of Payment

16.1 The Contract Price, including any Advance Payments, if applicable, shall be paid as **specified in the SCC.**

16.2 The Supplier's request for payment shall be made to the Purchaser in writing, accompanied by invoices describing, as appropriate, the Goods delivered and Related Services performed, and by the documents submitted pursuant to GCC

Clause 13 and upon fulfillment of all other obligations stipulated in the Contract.

16.3 Payments shall be made promptly by the Purchaser, but in no case later than sixty (60) days after submission of an invoice or request for payment by the Supplier, and after the Purchaser has accepted it.

16.4 The currencies in which payments shall be made to the Supplier under this Contract shall be those in which the Bid price is expressed.

16.5 In the event that the Purchaser fails to pay the Supplier any payment by its due date or within the period **set forth in the SCC,** the Purchaser shall pay to the Supplier interest on the amount of such delayed payment at the rate **shown in the SCC,** for the period of delay until payment has been made in full, whether before or after judgment or arbitrage award.

17. Taxes and Duties

17.1 For goods manufactured outside the Purchaser's Country, the Supplier shall be entirely responsible for all taxes, stamp duties, license fees, and other such levies imposed outside the Purchaser's Country.

17.2 For goods Manufactured within the Purchaser's Country, the Supplier shall be entirely responsible for all taxes, duties, license fees, etc., incurred until delivery of the contracted Goods to the Purchaser.

17.3 If any tax exemptions, reductions, allowances or privileges may be available to the Supplier in the Purchaser's Country, the Purchaser shall use its best efforts to enable the Supplier to benefit from any such tax savings to the maximum allowable extent.

18. Performance Security

18.1 If required as specified in the SCC, the Supplier shall, within twenty-eight (28) days of the notification of contract award, provide a performance security for the performance of the Contract in the amount **specified in the SCC.**

18.2 The proceeds of the Performance Security shall be payable to the Purchaser as compensation for any loss resulting from the Supplier's failure to complete its obligations under the Contract.

18.3 As specified in the SCC, the Performance Security, if required, shall be denominated in the currency (ies) of the Contract, or in a freely convertible currency acceptable to the Purchaser; and shall be in one of the format stipulated by the **Purchaser in the SCC,** or in another format acceptable to the Purchaser.

18.4 The Performance Security shall be discharged by the Purchaser and returned to the Supplier not later than twenty-eight (28) days following the date of Completion of the Supplier's performance obligations under the Contract, including any warranty obligations, unless **specified otherwise in the SCC.**

19. Copyright

19.1 The copyright in all drawings, documents, and other materials containing data and information furnished to the Purchaser by the Supplier herein shall remain vested in the Supplier, or, if

they are furnished to the Purchaser directly or through the Supplier by any third party, including suppliers of materials, the copyright in such materials shall remain vested in such third party.

20. Confidential Information

20.1 The Purchaser and the Supplier shall keep confidential and shall not, without the written consent of the other party hereto, divulge to any third party any documents, data, or other information furnished directly or indirectly by the other party hereto in connection with the Contract, whether such information has been furnished prior to, during or following completion or termination of the Contract. Notwithstanding the above, the Supplier may furnish to its Subcontractor such documents, data, and other information it receives from the Purchaser to the extent required for the Subcontractor to perform its work under the Contract, in which event the Supplier shall obtain from such Subcontractor an undertaking of confidentiality similar to that imposed on the Supplier under GCC Clause 20.

20.2 The Purchaser shall not use such documents, data, and other information received from the Supplier for any purposes unrelated to the contract. Similarly, the Supplier shall not use such documents, data, and other information received from the Purchaser for any purpose other than the performance of the Contract.

20.3 The obligation of a party under GCC Sub-Clauses 20.1 and 20.2 above, however, shall not apply to information that:

(a) the Purchaser or Supplier need to share with the Bank or other institutions participating in the financing of the Contract;

(b) now or hereafter enters the public domain through no fault of that party;

(c) can be proven to have been possessed by that party at the time of disclosure and which was not previously obtained, directly or indirectly, from the other party; or

(d) otherwise lawfully becomes available to that party from a third party that has no obligation of confidentiality.

20.4 The above provisions of GCC Clause 20 shall not in any way modify any undertaking of confidentiality given by either of the parties hereto prior to the date of the Contract in respect of the Supply or any part thereof.

20.5 The provisions of GCC Clause 20 shall survive completion or termination, for whatever reason, of the Contract.

21. Subcontracting

21.1 The Supplier shall notify the Purchaser in writing of all subcontracts awarded under the Contract if not already specified in the Bid. Notification by the Supplier, for addition of any Subcontractor not named in the Contract, shall also include the Subcontractor's declaration in accordance with Appendix 2 to the GCC- Sexual exploitation and Abuse (SEA) and/or Sexual

Harassment (SH) Performance Declaration. Such notification, in the original Bid or later shall not relieve the Supplier from any of its obligations, duties, responsibilities, or liability under the Contract.

21.2 Subcontracts shall comply with the provisions of GCC Clauses 3 and 7.

22. Specifications and Standards

22.1 Technical Specifications and Drawings

(a) The Goods and Related Services supplied under this Contract shall conform to the technical specifications and standards mentioned in Section VI, Schedule of Requirements and, when no applicable standard is mentioned, the standard shall be equivalent or superior to the official standards whose application is appropriate to the Goods' country of origin.

(b) The Supplier shall be entitled to disclaim responsibility for any design, data, drawing, specification or other document, or any modification thereof provided or designed by or on behalf of the Purchaser, by giving a notice of such disclaimer to the Purchaser.

(c) Wherever references are made in the Contract to codes and standards in accordance with which it shall be executed, the edition or the revised version of such codes and standards shall be those specified in the Schedule of Requirements. During Contract execution, any changes in any such codes and standards shall be applied only after approval by the Purchaser and shall be treated in accordance with GCC Clause 33.

23. Packing and Documents

23.1 The Supplier shall provide such packing of the Goods as is required to prevent their damage or deterioration during transit to their final destination, as indicated in the Contract. During transit, the packing shall be sufficient to withstand, without limitation, rough handling and exposure to extreme temperatures, salt and precipitation, and open storage. Packing case size and weights shall take into consideration, where appropriate, the remoteness of the goods' final destination and the absence of heavy handling facilities at all points in transit.

23.2 The packing, marking, and documentation within and outside the packages shall comply strictly with such special requirements as shall be expressly provided for in the Contract, including additional requirements, if any, **specified in the SCC,** and in any other instructions ordered by the Purchaser.

24. Insurance

24.1 Unless otherwise **specified in the SCC,** the Goods supplied under the Contract shall be fully insured—in a freely convertible currency from an eligible country—against loss or damage incidental to manufacture or acquisition, transportation, storage, and delivery, in accordance with the applicable Incoterms or in the manner specified in the **SCC.**

25. Transportation and Incidental Services

25.1 Unless otherwise **specified in the SCC,** responsibility for arranging transportation of the Goods shall be in accordance with the specified Incoterms.

25.2 The Supplier may be required to provide any or all of the following services, including additional services, if any, **specified in SCC:**

(a) performance or supervision of on-site assembly and/or start-up of the supplied Goods;

(b) furnishing of tools required for assembly and/or maintenance of the supplied Goods;

(c) furnishing of a detailed operations and maintenance manual for each appropriate unit of the supplied Goods;

(d) performance or supervision or maintenance and/or repair of the supplied Goods, for a period of time agreed by the parties, provided that this service shall not relieve the Supplier of any warranty obligations under this Contract; and

(e) training of the Purchaser's personnel, at the Supplier's plant and/or on-site, in assembly, start-up, operation, maintenance, and/or repair of the supplied Goods.

25.3 Prices charged by the Supplier for incidental services, if not included in the Contract Price for the Goods, shall be agreed upon in advance by the parties and shall not exceed the prevailing rates charged to other parties by the Supplier for similar services

26. Inspections and Tests

26.1 The Supplier shall at its own expense and at no cost to the Purchaser carry out all such tests and/or inspections of the Goods and Related Services as are **specified in the SCC.**

26.2 The inspections and tests may be conducted on the premises of the Supplier or its Subcontractor, at point of delivery, and/or at the Goods' final destination, or in another place in the Purchaser's Country as **specified in the SCC.** Subject to GCC Sub-Clause 26.3, if conducted on the premises of the Supplier or its Subcontractor, all reasonable facilities and assistance, including access to drawings and production data, shall be furnished to the inspectors at no charge to the Purchaser.

26.3 The Purchaser or its designated representative shall be entitled to attend the tests and/or inspections referred to in GCC Sub-Clause 26.2, provided that the Purchaser bear all of its own costs and expenses incurred in connection with such attendance including, but not limited to, all traveling and board and lodging expenses.

26.4 Whenever the Supplier is ready to carry out any such test and inspection, it shall give a reasonable advance notice, including the place and time, to the Purchaser. The Supplier shall obtain from any relevant third party or manufacturer any necessary permission or consent to enable the Purchaser or its designated representative to attend the test and/or inspection.

26.5 The Purchaser may require the Supplier to carry out any test and/or inspection not required by the Contract but deemed necessary to verify that the characteristics and performance of the Goods comply with the technical specifications codes and standards under the Contract, provided that the Supplier's reasonable costs and expenses incurred in the carrying out of such test and/or inspection shall be added to the Contract Price. Further, if such test and/or inspection impedes the progress of manufacturing and/or the Supplier's performance of its other obligations under the Contract, due allowance will be made in respect of the Delivery Dates and Completion Dates and the other obligations so affected.

26.6 The Supplier shall provide the Purchaser with a report of the results of any such test and/or inspection.

26.7 The Purchaser may reject any Goods or any part thereof that fail to pass any test and/or inspection or do not conform to the specifications. The Supplier shall either rectify or replace such rejected Goods or parts thereof or make alterations necessary to meet the specifications at no cost to the Purchaser, and shall repeat the test and/or inspection, at no cost to the Purchaser, upon giving a notice pursuant to GCC Sub-Clause 26.4.

26.8 The Supplier agrees that neither the execution of a test and/or inspection of the Goods or any part thereof, nor the attendance by the Purchaser or its representative, nor the issue of any report pursuant to GCC Sub-Clause 26.6, shall release the Supplier from any warranties or other obligations under the Contract.

27. Liquidated Damages

27.1 Except as provided under GCC Clause 32, if the Supplier fails to deliver any or all of the Goods by the Date(s) of delivery or perform the Related Services within the period specified in the Contract, the Purchaser may without prejudice to all its other remedies under the Contract, deduct from the Contract Price, as liquidated damages, a sum equivalent to the percentage **specified in the SCC** of the delivered price of the delayed Goods or unperformed Services for each week or part thereof of delay until actual delivery or performance, up to a maximum deduction of the percentage **specified in those SCC.** Once the maximum is reached, the Purchaser may terminate the Contract pursuant to GCC Clause 35.

28. Warranty

28.1 The Supplier warrants that all the Goods are new, unused, and of the most recent or current models, and that they incorporate all recent improvements in design and materials, unless provided otherwise in the Contract.

28.2 Subject to GCC Sub-Clause 22.1(b), the Supplier further warrants that the Goods shall be free from defects arising from any act or omission of the Supplier or arising from design, materials, and workmanship, under normal use in the conditions prevailing in the country of final destination.

28.3 Unless otherwise **specified in the SCC,** the warranty shall remain valid for twelve (12) months after the Goods, or any

portion thereof as the case may be, have been delivered to and accepted at the final destination **indicated in the SCC,** or for eighteen (18) months after the date of shipment from the port or place of loading in the country of origin, whichever period concludes earlier.

28.4 The Purchaser shall give notice to the Supplier stating the nature of any such defects together with all available evidence thereof, promptly following the discovery thereof. The Purchaser shall afford all reasonable opportunity for the Supplier to inspect such defects.

28.5 Upon receipt of such notice, the Supplier shall, within the period **specified in the SCC,** expeditiously repair or replace the defective Goods or parts thereof, at no cost to the Purchaser.

28.6 If having been notified, the Supplier fails to remedy the defect within the period **specified in the SCC,** the Purchaser may proceed to take within a reasonable period such remedial action as may be necessary, at the Supplier's risk and expense and without prejudice to any other rights which the Purchaser may have against the Supplier under the Contract.

29. Patent Indemnity

29.1 The Supplier shall, subject to the Purchaser's compliance with GCC Sub-Clause 29.2, indemnify and hold harmless the Purchaser and its employees and officers from and against any and all suits, actions or administrative proceedings, claims, demands, losses, damages, costs, and expenses of any nature, including attorney's fees and expenses, which the Purchaser may suffer as a result of any infringement or alleged infringement of any patent, utility model, registered design, trademark, copyright, or other intellectual property right registered or otherwise existing at the date of the Contract by reason of:

(a) the installation of the Goods by the Supplier or the use of the Goods in the country where the Site is located; and

(b) the sale in any country of the products produced by the Goods.

Such indemnity shall not cover any use of the Goods or any part thereof other than for the purpose indicated by or to be reasonably inferred from the Contract, neither any infringement resulting from the use of the Goods or any part thereof, or any products produced thereby in association or combination with any other equipment, plant, or materials not supplied by the Supplier, pursuant to the Contract.

29.2 If any proceedings are brought or any claim is made against the Purchaser arising out of the matters referred to in GCC Sub-Clause 29.1, the Purchaser shall promptly give the Supplier a notice thereof, and the Supplier may at its own expense and in the Purchaser's name conduct such proceedings or claim and any negotiations for the settlement of any such proceedings or claim.

29.3 If the Supplier fails to notify the Purchaser within twenty-eight (28) days after receipt of such notice that it intends to conduct any such proceedings or claim, then the Purchaser shall be free to conduct the same on its own behalf.

29.4 The Purchaser shall, at the Supplier's request, afford all available assistance to the Supplier in conducting such proceedings or claim, and shall be reimbursed by the Supplier for all reasonable expenses incurred in so doing.

29.5 The Purchaser shall indemnify and hold harmless the Supplier and its employees, officers, and Subcontractors from and against any and all suits, actions or administrative proceedings, claims, demands, losses, damages, costs, and expenses of any nature, including attorney's fees and expenses, which the Supplier may suffer as a result of any infringement or alleged infringement of any patent, utility model, registered design, trademark, copyright, or other intellectual property right registered or otherwise existing at the date of the Contract arising out of or in connection with any design, data, drawing, specification, or other documents or materials provided or designed by or on behalf of the Purchaser.

30. Limitation of Liability

30.1 Except in cases of criminal negligence or willful misconduct,

(a) the Supplier shall not be liable to the Purchaser, whether in contract, tort, or otherwise, for any indirect or consequential loss or damage, loss of use, loss of production, or loss of profits or interest costs, provided that this exclusion shall not apply to any obligation of the Supplier to pay liquidated damages to the Purchaser and

(b) the aggregate liability of the Supplier to the Purchaser, whether under the Contract, in tort or otherwise, shall not exceed the total Contract Price, provided that this limitation shall not apply to the cost of repairing or replacing defective equipment, or to any obligation of the supplier to indemnify the Purchaser with respect to patent infringement

31. Change in Laws and Regulations

31.1 Unless otherwise specified in the Contract, if after the date of 28 days prior to date of Bid submission, any law, regulation, ordinance, order or bylaw having the force of law is enacted, promulgated, abrogated, or changed in the place of the Purchaser's Country where the Site is located (which shall be deemed to include any change in interpretation or application by the competent authorities) that subsequently affects the Delivery Date and/or the Contract Price, then such Delivery Date and/or Contract Price shall be correspondingly increased or decreased, to the extent that the Supplier has thereby been affected in the performance of any of its obligations under the Contract. Notwithstanding the foregoing, such additional or reduced cost shall not be separately paid or credited if the same has already been accounted for in the price adjustment provisions where applicable, in accordance with GCC Clause 15.

32. Force Majeure

32.1 The Supplier shall not be liable for forfeiture of its Performance Security, liquidated damages, or termination for default if and to the extent that it's delay in performance or other failure to perform its obligations under the Contract is the result of an event of Force Majeure.

32.2 For purposes of this Clause, "Force Majeure" means an event or situation beyond the control of the Supplier that is not foreseeable, is unavoidable, and its origin is not due to negligence or lack of care on the part of the Supplier. Such events may include, but not be limited to, acts of the Purchaser in its sovereign capacity, wars or revolutions, fires, floods, epidemics, quarantine restrictions, and freight embargoes.

32.3 If a Force Majeure situation arises, the Supplier shall promptly notify the Purchaser in writing of such condition and the cause thereof. Unless otherwise directed by the Purchaser in writing, the Supplier shall continue to perform its obligations under the Contract as far as is reasonably practical, and shall seek all reasonable alternative means for performance not prevented by the Force Majeure event.

33. Change Orders and Contract Amendments

33.1 The Purchaser may at any time order the Supplier through notice in accordance GCC Clause 8, to make changes within the general scope of the Contract in any one or more of the following:

(a) drawings, designs, or specifications, where Goods to be furnished under the Contract are to be specifically manufactured for the Purchaser;

(b) the method of shipment or packing;

(c) the place of delivery; and

(d) the Related Services to be provided by the Supplier.

33.2 If any such change causes an increase or decrease in the cost of, or the time required for, the Supplier's performance of any provisions under the Contract, an equitable adjustment shall be made in the Contract Price or in the Delivery/Completion Schedule, or both, and the Contract shall accordingly be amended. Any claims by the Supplier for adjustment under this Clause must be asserted within twenty-eight (28) days from the date of the Supplier's receipt of the Purchaser's change order.

33.3 Prices to be charged by the Supplier for any Related Services that might be needed but which were not included in the Contract shall be agreed upon in advance by the parties and shall not exceed the prevailing rates charged to other parties by the Supplier for similar services.

33.4 **Value Engineering:** The Supplier may prepare, at its own cost, a value engineering proposal at any time during the performance of the contract. The value engineering proposal shall, at a minimum, include the following;

(a) the proposed change(s), and a description of the difference to the existing contract requirements;

(b) a full cost/benefit analysis of the proposed change(s) including a description and estimate of costs (including life cycle costs) the Purchaser may incur in implementing the value engineering proposal; and

(c) a description of any effect(s) of the change on performance/functionality.

The Purchaser may accept the value engineering proposal if the proposal demonstrates benefits that:

(a) accelerates the delivery period; or

(b) reduces the Contract Price or the life cycle costs to the Purchaser; or

(c) improves the quality, efficiency or sustainability of the Goods; or

(d) yields any other benefits to the Purchaser,

without compromising the necessary functions of the Facilities.

If the value engineering proposal is approved by the Purchaser and results in:

(a) a reduction of the Contract Price; the amount to be paid to the Supplier shall be the percentage specified **in the PCC** of the reduction in the Contract Price; or

(b) an increase in the Contract Price; but results in a reduction in life cycle costs due to any benefit described in (a) to (d) above, the amount to be paid to the Supplier shall be the full increase in the Contract Price.

33.5 Subject to the above, no variation in or modification of the terms of the Contract shall be made except by written amendment signed by the parties.

34. Extensions of Time

34.1 If at any time during performance of the Contract, the Supplier or its subcontractors should encounter conditions impeding timely delivery of the Goods or completion of Related Services pursuant to GCC Clause 13, the Supplier shall promptly notify the Purchaser in writing of the delay, its likely duration, and its cause. As soon as practicable after receipt of the Supplier's notice, the Purchaser shall evaluate the situation and may at its discretion extend the Supplier's time for performance, in which case the extension shall be ratified by the parties by amendment of the Contract.

34.2 Except in case of Force Majeure, as provided under GCC Clause 32, a delay by the Supplier in the performance of its Delivery and Completion obligations shall render the Supplier liable to the imposition of liquidated damages pursuant to GCC Clause 26, unless an extension of time is agreed upon, pursuant to GCC Sub-Clause 34.1.

35. Termination

35.1 Termination for Default

(a) The Purchaser, without prejudice to any other remedy for breach of Contract, by written notice of default sent to the Supplier, may terminate the Contract in whole or in part:

(i) if the Supplier fails to deliver any or all of the Goods within the period specified in the Contract, or within any extension thereof granted by the Purchaser pursuant to GCC Clause 34;

(ii) if the Supplier fails to perform any other obligation under the Contract; or

(iii) if the Supplier, in the judgment of the Purchaser has engaged in Fraud and Corruption, as defined in paragraph 2.2 a of the Appendix 1 to the GCC, in competing for or in executing the Contract.

(b) In the event the Purchaser terminates the Contract in whole or in part, pursuant to GCC Clause 35.1(a), the Purchaser may procure, upon such terms and in such manner as it deems appropriate, Goods or Related Services similar to those undelivered or not performed, and the Supplier shall be liable to the Purchaser for any additional costs for such similar Goods or Related Services. However, the Supplier shall continue performance of the Contract to the extent not terminated.

35.2 Termination for Insolvency.

(a) The Purchaser may at any time terminate the Contract by giving notice to the Supplier if the Supplier becomes bankrupt or otherwise insolvent. In such event, termination will be without compensation to the Supplier, provided that such termination will not prejudice or affect any right of action or remedy that has accrued or will accrue thereafter to the Purchaser

35.3 Termination for Convenience.

(a) The Purchaser, by notice sent to the Supplier, may terminate the Contract, in whole or in part, at any time for its convenience. The notice of termination shall specify that termination is for the Purchaser's convenience, the extent to which performance of the Supplier under the Contract is terminated, and the date upon which such termination becomes effective.

(b) The Goods that are complete and ready for shipment within twenty-eight (28) days after the Supplier's receipt of notice of termination shall be accepted by the Purchaser at the Contract terms and prices. For the remaining Goods, the Purchaser may elect:

(i) to have any portion completed and delivered at the Contract terms and prices; and/or

(ii) to cancel the remainder and pay to the Supplier an agreed amount for partially completed Goods and

Related Services and for materials and parts previously procured by the Supplier.

36. Assignment

36.1 Neither the Purchaser nor the Supplier shall assign, in whole or in part, their obligations under this Contract, except with prior written consent of the other party.

37. Export Restriction

37.1 Notwithstanding any obligation under the Contract to complete all export formalities, any export restrictions attributable to the Purchaser, to the country of the Purchaser, or to the use of the products/goods, systems or services to be supplied, which arise from trade regulations from a country supplying those products/goods, systems or services, and which substantially impede the Supplier from meeting its obligations under the Contract, shall release the Supplier from the obligation to provide deliveries or services, always provided, however, that the Supplier can demonstrate to the satisfaction of the Purchaser and of the Bank that it has completed all formalities in a timely manner, including applying for permits, authorizations and licenses necessary for the export of the products/goods, systems or services under the terms of the Contract. Termination of the Contract on this basis shall be for the Purchaser's convenience pursuant to Sub-Clause 35.3.

APPENDIX 1

(Text in this Appendix shall not be modified)

Fraud and Corruption

1. Purpose

1.1 The Bank's Anti-Corruption Guidelines and this annex apply with respect to procurement under Bank Investment Project Financing operations.

2. Requirements

2.1 The Bank requires that Borrowers (including beneficiaries of Bank financing); bidders (applicants/proposers), consultants, contractors and suppliers; any sub-contractors, sub-consultants, service providers or suppliers; any agents (whether declared or not); and any of their personnel, observe the highest standard of ethics during the procurement process, selection and contract execution of Bank-financed contracts, and refrain from Fraud and Corruption.

2.2 To this end, the Bank:

a. Defines, for the purposes of this provision, the terms set forth below as follows:

i. "corrupt practice" is the offering, giving, receiving, or soliciting, directly or indirectly, of anything of value to influence improperly the actions of another party;

ii. "fraudulent practice" is any act or omission, including misrepresentation, that knowingly or recklessly misleads, or attempts to mislead, a party to obtain financial or other benefit or to avoid an obligation;

iii. "collusive practice" is an arrangement between two or more parties designed to achieve an improper purpose, including to influence improperly the actions of another party;

iv. "coercive practice" is impairing or harming, or threatening to impair or harm, directly or indirectly, any party or the property of the party to influence improperly the actions of a party;

v. "obstructive practice" is:

(a) deliberately destroying, falsifying, altering, or concealing of evidence material to the investigation or making false statements to investigators in order to materially impede a Bank investigation into allegations of a corrupt, fraudulent, coercive, or collusive practice; and/or threatening, harassing, or intimidating any party to prevent it from disclosing its knowledge of matters relevant to the investigation or from pursuing the investigation; or

(b) acts intended to materially impede the exercise of the Bank's inspection and audit rights provided for under paragraph 2.2 e. below.

b. Rejects a proposal for award if the Bank determines that the firm or individual recommended for award, any of its personnel, or its agents, or its sub-

consultants, sub-contractors, service providers, suppliers and/ or their employees, has, directly or indirectly, engaged in corrupt, fraudulent, collusive, coercive, or obstructive practices in competing for the contract in question;

c. In addition to the legal remedies set out in the relevant Legal Agreement, may take other appropriate actions, including declaring misprocurement, if the Bank determines at any time that representatives of the Borrower or of a recipient of any part of the proceeds of the loan engaged in corrupt, fraudulent, collusive, coercive, or obstructive practices during the procurement process, selection and/or execution of the contract in question, without the Borrower having taken timely and appropriate action satisfactory to the Bank to address such practices when they occur, including by failing to inform the Bank in a timely manner at the time they knew of the practices;

d. Pursuant to the Bank's Anti-Corruption Guidelines, and in accordance with the Bank's prevailing sanctions policies and procedures, may sanction a firm or individual, either indefinitely or for a stated period of time, including by publicly declaring such firm or individual ineligible (i) to be awarded or otherwise benefit from a Bank-financed contract, financially or in any other manner;1 (ii) to be a nominated2 sub-contractor, consultant, manufacturer or supplier, or service provider of an otherwise eligible firm being awarded a Bank-financed contract; and (iii) to receive the proceeds of any loan made by the Bank or otherwise to participate further in the preparation or implementation of any Bank-financed project;

e. Requires that a clause be included in bidding/request for proposals documents and in contracts financed by a Bank loan, requiring (i) bidders (applicants/proposers), consultants, contractors, and suppliers, and their sub-contractors, sub-consultants, service providers, suppliers, agents, personnel, permit the Bank to inspect[3] all accounts, records and other documents relating to the procurement process, selection and/or contract execution, and to have them audited by auditors appointed by the Bank.

[1] For the avoidance of doubt, a sanctioned party's ineligibility to be awarded a contract shall include, without limitation, (i) applying for pre-qualification, expressing interest in a consultancy, and bidding, either directly or as a nominated sub-contractor, nominated consultant, nominated manufacturer or supplier, or nominated service provider, in respect of such contract, and (ii) entering into an addendum or amendment introducing a material modification to any existing contract.

[2] A nominated sub-contractor, nominated consultant, nominated manufacturer or supplier, or nominated service provider (different names are used depending on the particular bidding document) is one which has been: (i) included by the bidder in its pre-qualification application or bid because it brings specific and critical experience and know-how that allow the bidder to meet the qualification requirements for the particular bid; or (ii) appointed by the Borrower.

[3] Inspections in this context usually are investigative (i.e., forensic) in nature. They involve fact-finding activities undertaken by the Bank or persons appointed by the Bank to address specific matters related to investigations/audits, such as evaluating the veracity of an allegation of possible Fraud and Corruption, through the appropriate mechanisms. Such activity includes but is not limited to: accessing and examining a firm's or individual's financial records and information, and making copies thereof as relevant; accessing and examining any other documents, data and information (whether in hard copy or electronic format) deemed relevant for the investigation/audit, and making copies thereof as relevant; interviewing staff and other relevant individuals; performing physical inspections and site visits; and obtaining third party verification of information.

APPENDIX 2

Sexual Exploitation and Abuse (SEA) and/or Sexual Harassment (SH) Performance Declaration for Subcontractors*

[The following table shall be filled in by each subcontractor proposed by the Supplier, that was not named in the Contract]

Subcontractor's Name: *[insert full name]*

Date: *[insert day, month, year]*
Contract reference *[insert contract reference]*
Page *[insert page number]* of *[insert total number]* pages

SEA and/or SH Declaration
We: ☐ (a) have not been subject to disqualification by the Bank for non-compliance with SEA/ SH obligations. ☐ (b) are subject to disqualification by the Bank for non-compliance with SEA/ SH obligations. ☐ (c) had been subject to disqualification by the Bank for non-compliance with SEA/ SH obligations, and were removed from the disqualification list. An arbitral award on the disqualification case has been made in our favor.
[*If (c) above is applicable, attach evidence of an arbitral award reversing the findings on the issues underlying the disqualification.]*
Period of disqualification: From: _____ To: _____

Name of the Subcontractor_____

Name of the person duly authorized to sign on behalf of the Subcontractor_____

Title of the person signing on behalf of the Subcontractor_____

Signature of the person named above_____

Date signed _____ day of _____, _____

Countersignature of authorized representative of the Supplier:
Signature: _____

Date signed _____ day of _____, _____

Section IX - Special Conditions of Contract

The following Special Conditions of Contract (SCC) shall supplement and / or amend the General Conditions of Contract (GCC). Whenever there is a conflict, the provisions herein shall prevail over those in the GCC

GCC 1.1(i)	The Purchaser's Country is: **Islamic Republic of Pakistan.**
GCC 1.1(j)	The Purchaser is: **Peshawar Electric Supply Company (PESCO)**
GCC 1.1 (o)	The Project Site(s)/Final Destination(s) is/are: **PESCO GSC Ware House 132kV Grid Station Industrial State, Jamrud Road, Hayat Abad, Peshawar, Kpk, Pakistan.**
GCC 1.1 (p)	The term **SEA/SH** where used in the Contract has the following meaning: • "**Sexual Exploitation and Abuse" "(SEA)"** means the following: **Sexual Exploitation** is defined as any actual or attempted abuse of position of vulnerability, differential power or trust, for sexual purposes, including, but not limited to, profiting monetarily, socially or politically from the sexual exploitation of another. **Sexual Abuse** is defined as the actual or threatened physical intrusion of a sexual nature, whether by force or under unequal or coercive conditions. • **"Sexual Harassment" "(SH)"** is defined as unwelcome sexual advances, requests for sexual favors, and other verbal or physical conduct of a sexual nature by supplier's personnel with other supplier's, or purchaser's personnel.
GCC 4.2 (a)	The meaning of the trade terms shall be as prescribed by Incoterms.
GCC 4.2 (b)	The version edition of Incoterms shall be: **2020**
GCC 5.1	The language shall be: English
GCC 8.1	For **notices**, the Purchaser's address shall be: Attention: **Chief Engineer (Development) PMU PESCO** Address: **Chief Engineer (Dev:) PMU PESCO Peshawar, PESCO, Sakhi Cheshma Shami Road, Peshawar, (Khyber Pakhtun Khwa) Pakistan** City: **Peshawar** ZIP Code: **25170** Country: **Pakistan.** Telephone: **+92-91-9211757** Facsimile number: **+92-91-9213018** E mail address: ce.pmupesco@gmail.com
GCC 9.1	The governing law shall be the law of: **Islamic Republic of Pakistan**.
GCC 10.2	The rules of procedure for arbitration proceedings pursuant to GCC Clause 10.2 shall be as follows: **(a) Contract with foreign Supplier:**

	GCC 10.2 (a) — All disputes arising in connection with the present Contract shall be finally settled under the Rules of Conciliation and Arbitration of the International Chamber of Commerce (ICC) by one or more arbitrators appointed in accordance with said Rules. **(b) Contracts with Supplier national of the Purchaser's Country:** In the case of a dispute between the Purchaser and a Supplier who is a national of the Purchaser's Country, the dispute shall be referred to adjudication or arbitration in accordance with the Arbitration Act 1940 of the Purchaser's Country.
GCC 13.1	Details of Shipping and other Documents to be furnished by the Supplier are: 1. Bill of lading. 2. A non-negotiable sea way bill, an airway bill, a railwayconsignment notes, a road consignment note. 3. Insurance certificate. 4. Certificate " Country of Origin" 5. Manufacturer's or Supplier's warranty certificate. 6. Inspection certificate issued by nominated inspection agency. 7. Supplier's factory shipping details. 8. A written request for payment. The above documents shall be received by the Purchaser before arrival of the Goods and, if not received, the Supplier will be responsible for any consequent delay and expenses.
GCC 14.9	Cyber Security **does not apply.**
GCC 14.10	GCC 14.10.1 The Supplier shall have a code of conduct, and provide appropriate sensitization, for the Supplier's personnel carrying out installation that include, but not limited to, maintaining a safe working environment and not engaging in the following practices: (i) any form of sexual harassment including unwelcome sexual advances, requests for sexual favors, and other verbal or physical conduct of a sexual nature with other Supplier's or Purchaser's personnel; (ii) any form of sexual exploitation, which means any actual or attempted abuse of position of vulnerability, differential power or trust, for sexual purposes, including, but not limited to, profiting monetarily, socially or politically from the sexual exploitation of another; (iii) any form of sexual abuse, which means the actual or threatened physical intrusion of a sexual nature, whether by force or under unequal or coercive conditions; and (iv) any form of sexual activity with individuals under the age of 18, except in case of pre-existing marriage. GCC 14.10.2 The Purchaser may require the Supplier to remove (or cause to be removed), from the site or other places where the

	installation is being executed, a Supplier's personnel that undertakes behaviors that are inconsistent with the code of conduct stated in GCC 14.9.1. Notwithstanding any requirement from the Purchaser to replace any such person, the Supplier shall immediately remove (or cause to be removed) any such person, from the site or other places where the installation is being executed. In either case, the Supplier shall promptly appoint, as appropriate, a suitable replacement with equivalent skills and experience.
	GCC 14.10.3 The Firm/Supplier/Manufacturer shall be responsible for fulfilling the following E&S obligations/requirements: a. The Firm/Supplier/Manufacturer shall ensure that the Equipment and all its constituent parts do not cause any harm to the environment during transportation, operations and at the end of its useful life. b. During the handling and transportation utmost care is being taken by the suppliers to keep the equipment in safe and secure mode. c. Moreover, suppliers will ensure that more diligent care to be taken for handling and packing of the equipment and to adopt standardized procedures in true letter and spirit. d. During the storage of equipment at warehouse, utmost care would be taken to place equipment on wooden planks or concrete floor to avoid soil contamination due to such hazards. e. The equipment shall be transported via national road networks. f. Proper Traffic Management Plan shall be implemented to ensure road safety, public safety and to prevent public nuisance. g. For Transportation of equipment/Material Vehicular Emission Tested (VETs) certified vehicles shall be used to avoid Air pollution. Well maintained haulage trucks are used for transportation of material and such transport shall be conducted periodically and not continuously. h. A Safety Data Sheet (complete with all 16 sections as per GHS (Globally Harmonized System)) for the Equipment must be provided by Firm/Supplier/Manufacturer and made available in the equipment transportation vehicle as well as attached/fixed to the equipment. Safety symbols must be clearly displayed/attached to equipment. The 16 sections of SDS are listed below: 1. Identification 2. Hazard(s) identification (NB new order) 3. Composition/information on ingredients 4. First-aid measures

	5. Fire-fighting measures 6. Accidental release measures 7. Handling and storage 8. Exposure control/personal protection 9. Physical and chemical properties 10. Stability and reactivity 11. Toxicological information 12. Ecological information 13. Disposal considerations 14. Transport information 15. Regulatory information 16. Other information i. The Firm/Supplier/Manufacturer shall develop and provide standard operating procedures for the safe handling and transportation of equipment in accordance with best international practices and NEPRA HSE requirements. j. There is enough clearance to ensure safety of the project area and community.
GCC 15.1	The prices charged for the Goods supplied and the related Services performed **shall not be adjustable.**
GCC 16.1	GCC 16.1—The method and conditions of payment to be made to the Supplier under this Contract shall be as follows : **A. Payment for Goods supplied from abroad:** Payment of foreign currency portion shall be made in currency of the Contract Price to foreign bidders and Pakistani currency to local bidders in the following manner: (i) **Advance Payment:** Ten (10) percent of the Contract Price shall be paid within Sixty (60) days of signing of the Contract, and upon submission of claim and a bank guarantee for equivalent amount valid until the Goods are delivered and, in the form, provided in the bidding document or another form acceptable to the Purchaser. (ii). **On Shipment:** Seventy (70) percent of the Contract Price of the Goods shipped shall be paid through irrevocable confirmed **Letter of Credit** opened in favor of the Supplier in a bank in its country, upon submission of documents specified in GCC Clause 13. (iii). **On Acceptance:** Twenty (20) percent of the Contract Price of Goods received shall be paid within Sixty (60) days of receipt of the Goods upon submission of claim supported by the acceptance certificate issued by the Purchaser. **A. Payment for Goods and Services supplied from within the Purchaser's Country:** Payment for Goods and Services supplied from within the Purchaser's Country shall be made in **Pakistani Rupees**, as follows:

	(i) **Advance Payment:** Ten (10) percent of the Contract Price shall be paid within Sixty (60) days of signing of the Contract against a simple receipt and a bank guarantee for the equivalent amount and in the form provided in the bidding document or another form acceptable to the Purchaser. (ii). **On Delivery:** Eighty (80**)** percent of the Contract Price shall be paid on receipt of the Goods and upon submission of the documents specified in GCC Clause 13. (iii). **On Acceptance:** The remaining Ten (10) percent of the Contract Price shall be paid to the Supplier within Sixty (60)) days after the date of the acceptance certificate for the respective delivery issued by the Purchaser. **NOTE:** In case the bidder/supplier does not avail advance payment facility, then the bidder shall be allowed to claim 90% of the contract price on delivery. **B. Payment for Related Services:** **i. Advance Payment for Related Services:** Ten (10) percent of the Contract Price for related services shall be paid within Sixty (60) days after issuance of Goods Receipt Note (GRN) at the final destination by the Purchaser, and upon submission of claim and a bank guarantee for equivalent amount valid until the Completion of all the related Services and in the form provided in the bidding document. ii. **On Completion of Related Services**: Ninety (90) percent of the Contract Price for related services shall be paid within Sixty (60) days after issuance of the "Satisfactory Completion Certificate" for each Circle by the respective SE Operation and upon submission of the Claim as per Contract Provisions. **NOTE:** In case the bidder/supplier does not avail advance payment facility, then the bidder shall be allowed to claim 100% of the contract price on completion of the related services under the Contract Provisions.
GCC 16.5	The payment-delay period after which the Purchaser shall pay interest to the supplier shall be Ninety (90) days. The interest rate that shall be applied is KIBOR+1% for PKR and SOFR +1% for foreign currency.
GCC 18.1	The successful bidder shall furnish to the purchaser a Performance Security (Unconditional Bank Guarantee) equal to **Ten (10) percent** of the total value of contract. As per Clause 14 of the Technical specification PPMC-DS-01:2026, the supplier / Manufacturer shall submit one sample of each complete APMS Unit (i.e. 01 No. for 100KVA Transformer, and 01 No for 200KVA Transformer), Technical Data and 03 Sets of drawings for Proto Type approval in the O/o Chief (Technical Services) at the time of Contract Agreement.

GCC 18.3	The Performance Security shall be in the form of "**a Demand Guarantee".** From a scheduled Bank of Pakistan in favor of Chief Engineer (Development) PMU PESCO commencing from the receipt of last consignment at the final destination and valid up to extent of required warrantee period. The Performance security shall be denominated in **"a freely convertible currency acceptable to the Purchaser"**, in accordance with their portions of the Contract Price" In case the unconditional guarantee is issued by a bank outside of the Purchaser's country, the issuing bank preferably shall have a correspondent bank located in the Purchaser's country to make it enforceable.
GCC 18.4	**Discharge of the Performance Security shall take place:** Not later than twenty-eight (28) days following the date of completion of the Supplier's performance obligations under the Contract, including warranty obligations.

GCC 23.2	The packing, marking and documentation within and outside the packagesshall be: **Packing** (a) Packing of the Goods shall be as is required to prevent their damageor deterioration during transit to their final destination, as indicated in the Contract. The packing shall be sufficient to withstand, without limitation, rough handling during transit and exposure to extreme temperatures, salt and precipitation during transit, and open storage. Packing case size and weights shall take into consideration, where appropriate, the remoteness of the Goods' final destination and the absence of heavy handling facilities atall points in transit. (b) In case the equipment is shipped in container(s), each unit shall be so packed that it can be safely transported by road/ rail to ultimate destination in the country without disturbing the packing of other items. (c) The final packing shall be such that the weight and dimensions of packages are within reasonable limits in order to facilitate "handling, storage and transportation". (d) The packing, marking, and documentation within and outside the packages shall comply strictly with such special requirements as shall be expressly provided for in the Contract, including additional requirement, ifany, and in any subsequent instructions ordered by the Purchaser. **Identification and Marking** 1. All members, parts, units or components of the Equipment shall be plainly die-indented with a number to identify the member, part, unit or component itself and with a letter to indicate the type of Goods in accordance with approved drawings. The identification marking shall be plainly legible and durable and shall be so located that other member, part,unit or component when in its assembled position does not obscure the number or letter. All the marking on ferrous part or unit shall be made before galvanizing. 2. Each crate, case, box "package" or bundle shall have labels and or tags made from strong waterproof material and marked in indelible and non- fade-able ink securely attached hereto. These labels or tags shall indicate atleast the name of the Project, the Consignee and the manufacturer, the typeof Goods or component and the quantity it contains so that it can be easilychecked upon delivery. A packing list shall be included in each crate or box. Each package delivered under the Contract shall be consecutively numbered and shall also be marked with code number or other identification to be approved by PESCO so that various components of theGoods, which are shipped, disassembled and which may not be interchangeable can be identified, collected and stored at the Site together. Additional information and or color coding that may reasonably be required by PESCO to facilitate identification, shipment to stores or site handling and storage will also be provided.

	4. All boxes weighing in excess of 500 kilograms shall be adequately marked for straining and lifting. Whenever necessary the boxes shall be provided with lifting hooks attached by means of vertical rods secured to strong bottom supports. **Container Marking** In addition to labels and marking indicated above all packages, bundles, containers cases or boxes shall be clearly and boldly marked on two opposite sides and on the top and all reels on both sides as follows: Ultimate Consignee: **Deputy. Manager** PESCO GSC Warehouse 132KV Grid StationIndustrial State, Jamrud Road, Hayat Abad, Peshawar, KPK, Pakistan. Destination _____ Contract No. _____ Name of Project _____ Weight And Dimension _____ Serial Number _____ Inscription "PESCO" **Note: The Goods/Material Packaging should comply with Attached Technical Specification.**
GCC 24.1	The insurance coverage shall be as specified in the Incoterms.
GCC 25.1	The Supplier is required under the Contract to transport the Goods to the Project Site at Final Destination **"GSC Ware House 132KV Grid Station Industrial State, Jamrud Road, Hayat Abad, Peshawar, KPK, Pakistan"** including insurance shall be arranged by the Supplier, and related costs shall be included in the Contract Price
GCC 25.2	**Incidental services to be provided are: Not Applicable**

GCC 26.1	i. The firm having no past experience of regular Purchase order of APMS will be considered as non-responsive. ii If the bidder does not possess the prototype approval for the offered material within the last Five(05) years, the bidder shall have to obtain from PITC a Certificate of UDIL Compliance and; Valid Proto-type reports of equipment as per PPMC Specification: PPMC-DS-01 :2026 (for APMS), DDS 50:2007 (for TOD/TOU multi rate and Bi-Directional LT/HT energy meters), DDS 98:2011 (for AMI), DDS 110:2012 (for MDC), DDS:80-2007 (for LT CTs), DDS:8-2007 (for S/C cable) (Latest approved versions), if not submitted with bid within thirty (30) days from the date of issuance of Notification of Intention to Award (NOIA). Any delay would lead to revocation of NOIA or termination of contract whichever occurs earlier. All expenses of testing charges will have to be borne by the manufacturer/supplier. Any change suggested during prototype testing for compliance of specification shall have to be incorporated without any extra price or claim to the purchaser. If the prototype sample fails, the material shall be improved and re-offered for prototype testing to Chief (Technical Services) PPMC, Lahore. The time taken for improvement in samples and resubmission of drawings will not entitle the manufacturer to claim extension in delivery period on this account. If Prototype fails for the second time, firm will be considered non-Responsive and performance guarantee will be fortified in favor of PESCO.
GCC 26.2	The inspections and tests will be conducted at the manufacturer's premises. These inspections and tests will be witnessed by one each representative (inspector) of Material Inspection (MI) PPMC, PESCO nominated Inspector(s) for the Factory Acceptance Test (FAT), and by PESCO and/or PIMSC and PPMC inspectors for the Type Test, as detailed in Section VII. The associated costs of these tests will be borne by the bidder and Purchaser detailed as below: **For Factory Acceptance Test (FAT):** All associated costs including visa expenses/fees, boarding, lodging, daily allowance and travel expenses of PESCO, PPMC(MI) and/or PIMSC Nominated Inspectors for FAT Shall be **borne by the Purchaser**. **For Type Test(s):** All the associated costs and expenses will be the responsibility of the bidder.
GCC 27.1	The liquidated damage shall be: 0.5% per week of Contract Price.
GCC 27.1	The maximum amount of liquidated damages shall be: **10 %** of Contract amount.
GCC 28.3	**The period of validity of the warranty shall be:** As per Warranty Sub - Clause-19.1 of PPMC Specifications PPMC-DS- 01:2026, the Warranty Period shall be as follows: "The Complete APMS, including all associated components such as MCCB,SMCD, OTL sensor assembly and enclosure(as applicable per the ordering code),shall be warranted for a period of five **(05)** years from the date of supply or completion of the specified duty cycles (for MCCB and Magnetic Contractor, whichever comes earlier. In the absence of

	recorded duty cycle data, the Warranty Period shall be considered five (05) years from the date of supply at the final destination: PESCO GSC Ware House 132KV Grid Station Industrial State, Jamrud Road, Hayat Abad, Peshawar, KPK-Pakistan and issuance of "Satisfactory certificate" by the purchaser.
GCC 28.5 & 28.6	The period for repair or replacement shall be: Sixty (60) days for foreign originated material and 30 days for local originated material from the date of notification by the purchaser of the concurrence of such defects.
GCC 33.4	Not Applicable.

Attachment: Price Adjustment Formula (Not Applicable)

If in accordance with GCC 15.1, prices shall be adjustable, the following method shall be used to calculate the price adjustment:

15.1 Prices payable to the Supplier, as stated in the Contract, shall be subject to adjustment during performance of the Contract to reflect changes in the cost of labor and material components in accordance with the formula:

$$P_1 = P_0 \left[a + \frac{bL_1}{L_0} + \frac{cM_1}{M_0}\right] - P_0$$

$$a+b+c = 1$$

in which:

P_1	=	adjustment amount payable to the Supplier.
P_0	=	Contract Price (base price).
a	=	fixed element representing profits and overheads included in the Contract Price and generally in the range of five (5) to fifteen (15) percent.
b	=	estimated percentage of labor component in the Contract Price.
c	=	estimated percentage of material component in the Contract Price.
L_0, L_1	=	*labor indices applicable to the appropriate industry in the country of origin on the base date and date for adjustment, respectively.
M_0, M_1	=	*material indices for the major raw material on the base date and date for adjustment, respectively, in the country of origin.

The Bidder shall indicate the source of the indices and the base date indices in its Bid. The coefficients a, b, and c as specified by the Purchaser are as follows:

a = *[insert value of coefficient]*
b= *[insert value of coefficient]*
c= *[insert value of coefficient]*

Base date = thirty (30) days prior to the deadline for submission of the Bids.

Date of adjustment = *[insert number of weeks]* weeks prior to date of shipment (representing the mid-point of the period of manufacture).

The above price adjustment formula shall be invoked by either party subject to the following further conditions:

(a) No price adjustment shall be allowed beyond the original delivery dates. As a rule, no price adjustment shall be allowed for periods of delay for which the Supplier is entirely responsible. The Purchaser will, however, be entitled to any decrease in the prices of the Goods and Services subject to adjustment.

(b) If the currency in which the Contract Price P_0 is expressed is different from the currency of origin of the labor and material indices, a correction factor will be applied to avoid incorrect adjustments of the Contract Price. The correction factor shall be: Z_0 / Z_1, where,

Z_0 = the number of units of currency of the origin of the indices which equal to one unit of the currency of the Contract Price P_0 on the Base date, and

Z_1 = the number of units of currency of the origin of the indices which equal to one unit of the currency of the Contract Price P_0 on the Date of Adjustment.

(c) No price adjustment shall be payable on the portion of the Contract Price paid to the Supplier as advance payment.

Section X - Contract Forms

Table of Forms

Notification of Intention to Award **130**

Letter of Acceptance **136**

Contract Agreement **137**

Performance Security **139**

Advance Payment Security **143**

Notification of Intention to Award

[*This Notification of Intention to Award shall be sent to each Bidder that submitted a Bid, unless the Bidder has previously received notice of exclusion from the process at an interim stage of the procurement process.*]

[*Send this Notification to the Bidder's Authorized Representative named in the Bidder Information Form*]

For the attention of Bidder's Authorized Representative

Name: *[insert Authorized Representative's name]*

Address: *[insert Authorized Representative's Address]*

Telephone/Fax numbers: *[insert Authorized Representative's telephone/fax numbers]*

Email Address: *[insert Authorized Representative's email address]*

[IMPORTANT: insert the date that this Notification is transmitted to Bidders. The Notification must be sent to all Bidders simultaneously. This means on the same date and as close to the same time as possible.]

DATE OF TRANSMISSION: This Notification is sent by: [*email/fax*] on [*date*] (local time)

Notification of Intention to Award

Purchaser: *[insert the name of the Purchaser]*
Project: *[insert name of project]*
Contract title: *[insert the name of the contract]*
Country: *[insert country where RFB is issued]*
Loan No. /Credit No. / Grant No.: *[insert reference number for loan/credit/grant]*
RFB No: *[insert RFB reference number from Procurement Plan]*

This Notification of Intention to Award (Notification) notifies you of our decision to award the above contract. The transmission of this Notification begins the Standstill Period. During the Standstill Period you may:

a) request a debriefing in relation to the evaluation of your Bid, and/or

b) submit a Procurement-related Complaint in relation to the decision to award the contract.

1. The successful Bidder

Name:	[*insert name of successful Bidder*]
Address:	[*insert address of the successful Bidder*]
Contract price:	[*insert contract price of the successful Bid*]
Total combined score:	*[insert the total combined score of the successful Bidder]*

2. Other Bidders *[INSTRUCTIONS: insert names of all Bidders that submitted a Bid, Bid prices as read out and evaluated, technical scores and combined scores.]*

Name of Bidder	Technical Score	Bid Price	Evaluated Bid Cost	Combined Score
[*insert name*]	*[insert Technical score]*	[*insert Bid price*]	*[insert evaluated cost]*	*[insert combined score]*
[*insert name*]	*[insert Technical score]*	[*insert Bid price*]	*[insert evaluated cost]*	*[insert combined score]*
[*insert name*]	*[insert Technical score]*	[*insert Bid price*]	*[insert evaluated cost]*	*[insert combined score]*
[*insert name*]	*[insert Technical score]*	[*insert Bid price*]	*[insert evaluated cost]*	*[insert combined score]*
[*insert name*]	*[insert Technical score]*	[*insert Bid price*]	*[insert evaluated cost]*	*[insert combined score]*

3. Reason/s why your Bid was unsuccessful *[Delete if the combined score already reveals the reason]*

[INSTRUCTIONS: State the reason/s why <u>this</u> Bidder's Bid was unsuccessful. Do NOT include: (a) a point by point comparison with another Bidder's Bid or (b) information that is marked confidential by the Bidder in its Bid.]

4. How to request a debriefing

DEADLINE: The deadline to request a debriefing expires at midnight on [*insert date*] (local time).

You may request a debriefing in relation to the results of the evaluation of your Bid. If you decide to request a debriefing your written request must be made within three (3) Business Days of receipt of this Notification of Intention to Award.

Provide the contract name, reference number, name of the Bidder, contact details; and address the request for debriefing as follows:

Attention: [*insert full name of person, if applicable*]

Title/position: [*insert title/position*]

Agency: [*insert name of Purchaser*]

Email address: [*insert email address*]

Fax number: [*insert fax number*] ***delete if not used***

If your request for a debriefing is received within the 3 Business Days deadline, we will provide the debriefing within five (5) Business Days of receipt of your request. If we are unable to provide the debriefing within this period, the Standstill Period shall be extended by five (5) Business Days after the date that the debriefing is provided. If this happens, we will notify you and confirm the date that the extended Standstill Period will end.

The debriefing may be in writing, by phone, video conference call or in person. We shall promptly advise you in writing how the debriefing will take place and confirm the date and time.

If the deadline to request a debriefing has expired, you may still request a debriefing. In this case, we will provide the debriefing as soon as practicable, and normally no later than fifteen (15) Business Days from the date of publication of the Contract Award Notice.

5. How to make a complaint

Period: Procurement-related Complaint challenging the decision to award shall be submitted by midnight, [*insert date*] (local time).

Provide the contract name, reference number, name of the Bidder, contact details; and address the Procurement-related Complaint as follows:

Attention: [*insert full name of person, if applicable*]

Title/position: [*insert title/position*]

Agency: [*insert name of Purchaser*]

Email address: [*insert email address*]

Fax number: [*insert fax number*] ***delete if not used***

At this point in the procurement process, you may submit a Procurement-related Complaint challenging the decision to award the contract. You do not need to have requested, or received, a debriefing before making this complaint. Your complaint must be submitted within the Standstill Period and received by us before the Standstill Period ends.

Further information:

For more information see the Procurement Regulations for IPF Borrowers (Procurement Regulations) (Annex III). You should read these provisions before preparing and submitting your complaint. In addition, the World Bank's Guidance "How to make a Procurement-related Complaint" provides a useful explanation of the process, as well as a sample letter of complaint.

In summary, there are four essential requirements:

1. You must be an 'interested party'. In this case, that means a Bidder who submitted a Bid in this bidding process, and is the recipient of a Notification of Intention to Award.
2. The complaint can only challenge the decision to award the contract.
3. You must submit the complaint within the period stated above.
4. You must include, in your complaint, all of the information required by the Procurement Regulations (as described in Annex III).

6. Standstill Period

DEADLINE: The Standstill Period is due to end at midnight on [*insert date*] (local time).

The Standstill Period lasts ten (10) Business Days after the date of transmission of this Notification of Intention to Award.

The Standstill Period may be extended as stated in Section 4 above.

If you have any questions regarding this Notification please do not hesitate to contact us.

On behalf of the Purchaser:

Signature: _____

Name: _____

Title/position: _____

Telephone: _____

Email: _____

Beneficial Ownership Disclosure Form

INSTRUCTIONS TO BIDDERS: DELETE THIS BOX ONCE YOU HAVE COMPLETED THE FORM

This Beneficial Ownership Disclosure Form ("Form") is to be completed by the successful Bidder[1]. In case of joint venture, the Bidder must submit a separate Form for each member. The beneficial ownership information to be submitted in this Form shall be current as of the date of its submission.

For the purposes of this Form, a Beneficial Owner of a Bidder is any natural person who ultimately owns or controls the Bidder by meeting one or more of the following conditions:

- *directly or indirectly holding 25% or more of the shares*
- *directly or indirectly holding 25% or more of the voting rights*
- *directly or indirectly having the right to appoint a majority of the board of directors or equivalent governing body of the Bidder*

RFB No.: [*insert number of RFB process*]
Request for Bid No.: [*insert identification*]

To: **[*insert complete name of Purchaser*]**

In response to your request in the Letter of Acceptance *dated [insert date of letter of Acceptance]* to furnish additional information on beneficial ownership: *[select one option as applicable and delete the options that are not applicable]*

(i) we hereby provide the following beneficial ownership information.

Details of beneficial ownership

Identity of Beneficial Owner	Directly or indirectly holding 25% or more of the shares (Yes / No)	Directly or indirectly holding 25 % or more of the Voting Rights (Yes / No)	Directly or indirectly having the right to appoint a majority of the board of the directors or an equivalent governing body of the Bidder (Yes / No)
[include full name (last, middle, first), nationality, country of residence]			

OR

(ii) *We declare that there is no Beneficial Owner meeting one or more of the following conditions:*

- directly or indirectly holding 25% or more of the shares
- directly or indirectly holding 25% or more of the voting rights
- directly or indirectly having the right to appoint a majority of the board of directors or equivalent governing body of the Bidder

OR

(iii) We declare that we are unable to identify any Beneficial Owner meeting one or more of the following conditions. [If this option is selected, the Bidder shall provide explanation on why it is unable to identify any Beneficial Owner]

- directly or indirectly holding 25% or more of the shares
- directly or indirectly holding 25% or more of the voting rights
- directly or indirectly having the right to appoint a majority of the board of directors or equivalent governing body of the Bidder]"

Name of the Bidder: *[*insert complete name of the Bidder*]_____

Name of the person duly authorized to sign the Bid on behalf of the Bidder: **[*insert complete name of person duly authorized to sign the Bid*]_____

Title of the person signing the Bid: [*insert complete title of the person signing the Bid*]_____

Signature of the person named above: [*insert signature of person whose name and capacity are shown above*]_____

Date signed [*insert date of signing*] **day of** [*insert month*], [*insert year*]_____

* In the case of the Bid submitted by a Joint Venture specify the name of the Joint Venture as Bidder. In the event that the Bidder is a joint venture, each reference to "Bidder" in the Beneficial Ownership Disclosure Form (including this Introduction thereto) shall be read to refer to the joint venture member.
** Person signing the Bid shall have the power of attorney given by the Bidder. The power of attorney shall be attached with the Bid Schedules.

Letter of Acceptance

[letterhead paper of the Purchaser]

[date]

To: *[name and address of the Supplier]*

Subject: ***Notification of award Contract No.*** . . . . . .

This is to notify you that your Bid dated . . . . ***[insert date] . .*** . . for execution of the . . . . . ***. [insert name of the contract and identification number, as given in the SCC]*** . . . . . for the Accepted Contract Amount of . . . . . ***. [insert amount in numbers and words and name of currency]***, as corrected and modified in accordance with the Instructions to Bidders is hereby accepted by our Agency.

You are requested to furnish (i) the Performance Security within 28 days in accordance with the Conditions of Contract, using for that purpose one of the Performance Security Form*s* and (ii) the additional information on beneficial ownership in accordance with ITB 48.1 within eight (8) Business days using the Beneficial Ownership Disclosure Form, included in Section X, - Contract Forms, of the Bidding Document.

Authorized Signature: _____

Name and Title of Signatory: _____

Name of Agency: _____

Attachment: Contract Agreement

Contract Agreement

[The successful Bidder shall fill in this form in accordance with the instructions indicated]

THIS AGREEMENT made the *[insert: **number**]* day of *[insert: **month**]*, *[insert: **year**]*.

BETWEEN

(1) *[insert complete name of Purchaser]*, a *[insert description of type of legal entity, for example, an agency of the Ministry of .... of the Government of {insert name of Country of Purchaser}, or corporation incorporated under the laws of {insert name of Country of Purchaser}]* and having its principal place of business at *[insert address of Purchaser**]*** (hereinafter called "the Purchaser"), of the one part, and

(2) *[insert name of Supplier**]***, a corporation incorporated under the laws of *[insert: country of Supplier**]*** and having its principal place of business at *[insert: address of Supplier]* (hereinafter called "the Supplier"), of the other part:

WHEREAS the Purchaser invited Bids for certain Goods and ancillary services, viz., *[insert brief description of Goods and Services]* and has accepted a Bid by the Supplier for the supply of those Goods and Services

The Purchaser and the Supplier agree as follows:

1. In this Agreement words and expressions shall have the same meanings as are respectively assigned to them in the Contract documents referred to.

2. The following documents shall be deemed to form and be read and construed as part of this Agreement. This Agreement shall prevail over all other contract documents.

   (a) the Letter of Acceptance

   (b) Letter of Bid - Technical Part

   (c) Letter of Bid - Financial Part

   (d) the Addenda Nos._____ (if any)

   (e) Special Conditions of Contract

   (f) General Conditions of Contract

   (g) the Specification (including Schedule of Requirements and Technical Specifications)

   (h) the completed Schedules (including Price Schedules)

   (i) any other document listed in GCC as forming part of the Contract

3. In consideration of the payments to be made by the Purchaser to the Supplier as specified in this Agreement, the Supplier hereby covenants with the Purchaser to provide the Goods and Services and to remedy defects therein in conformity in all respects with the provisions of the Contract.

4. The Purchaser hereby covenants to pay the Supplier in consideration of the provision of the Goods and Services and the remedying of defects therein, the Contract Price or such other sum as may become payable under the provisions of the Contract at the times and in the manner prescribed by the Contract.

IN WITNESS whereof the parties hereto have caused this Agreement to be executed in accordance with the laws of *[insert the name of the Contract governing law country]* on the day, month and year indicated above.

For and on behalf of the Purchaser:

Signed: *[insert signature]*

in the capacity of *[insert title or other appropriate designation]*

in the presence of *[insert identification of official witness]*

For and on behalf of the Supplier:

Signed: *[insert signature of authorized representative(s) of the Supplier]*

in the capacity of *[insert title or other appropriate designation]*

in the presence of *[insert identification of official witness]*

Performance Security

Option 1: (Bank Guarantee)

[The bank, as requested by the successful Bidder, shall fill in this form in accordance with the instructions indicated]

[Guarantor letterhead or SWIFT identifier code]

Beneficiary: *[insert name and Address of Purchaser]*

Date: *[Insert date of issue]*

PERFORMANCE GUARANTEE No.: *[Insert guarantee reference number]*

Guarantor: *[Insert name and address of place of issue, unless indicated in the letterhead]*

We have been informed that _ *[insert name of Supplier, which in the case of a joint venture shall be the name of the joint venture]* (hereinafter called "the Applicant") has entered into Contract No. *[insert reference number of the contract]* dated *[insert date]* with the Beneficiary, for the supply of _ *[insert name of contract and brief description of Goods and related Services]* (hereinafter called "the Contract").

Furthermore, we understand that, according to the conditions of the Contract, a performance guarantee is required.

At the request of the Applicant, we as Guarantor, hereby irrevocably undertake to pay the Beneficiary any sum or sums not exceeding in total an amount of *[insert amount in figures]* (_____) *[insert amount in words]*,[1] such sum being payable in the types and proportions of currencies in which the Contract Price is payable, upon receipt by us of the Beneficiary's complying demand supported by the Beneficiary's statement, whether in the demand itself or in a separate signed document accompanying or identifying the demand, stating that the Applicant is in breach of its obligation(s) under the Contract, without the Beneficiary needing to prove or to show grounds for your demand or the sum specified therein.

This guarantee shall expire, no later than the …. Day of ……, 2…[2], and any demand for payment under it must be received by us at this office indicated above on or before that date.

---

[1] *The Guarantor shall insert an amount representing the percentage of the Accepted Contract Amount specified in the Letter of Acceptance, and denominated either in the currency (ies) of the Contract or a freely convertible currency acceptable to the Beneficiary.*

[2] *Insert the date twenty-eight days after the expected completion date as described in GC Clause 18.4. The Purchaser should note that in the event of an extension of this date for completion of the Contract, the Purchaser would need to request an extension of this guarantee from the Guarantor. Such request must be in writing and must be made prior to the expiration date established in the guarantee. In preparing this guarantee, the Purchaser might consider adding the following text to the form, at the end of the penultimate paragraph: "The Guarantor agrees to a one-time extension of this guarantee for a period not to exceed [six months] [one year], in response to the Beneficiary's written request for such extension, such request to be presented to the Guarantor before the expiry of the guarantee."*

This guarantee is subject to the Uniform Rules for Demand Guarantees (URDG) 2010 Revision, ICC Publication No. 758, except that the supporting statement under Article 15(a) is hereby excluded.

_____
[signature(s)]

Note: All italicized text (including footnotes) is for use in preparing this form and shall be deleted from the final product.

Option 2: Performance Bond - (Not Applicable)

By this Bond *[insert name of Principal]* as Principal (hereinafter called "the Supplier") and *[insert name of Surety]* as Surety (hereinafter called "the Surety"), are held and firmly bound unto *[insert name of Purchaser]* as Obligee (hereinafter called "the Supplier") in the amount of *[insert amount in words and figures]*, for the payment of which sum well and truly to be made in the types and proportions of currencies in which the Contract Price is payable, the Supplier and the Surety bind themselves, their heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS the Supplier has entered into a written Agreement with the Purchaser dated the _____ day of _____, 20 __, for *[name of contract and brief description of Goods and related Services]* in accordance with the documents, plans, specifications, and amendments thereto, which to the extent herein provided for, are by reference made part hereof and are hereinafter referred to as the Contract.

NOW, THEREFORE, the Condition of this Obligation is such that, if the Supplier shall promptly and faithfully perform the said Contract (including any amendments thereto), then this obligation shall be null and void; otherwise, it shall remain in full force and effect. Whenever the Supplier shall be, and declared by the Purchaser to be, in default under the Contract, the Purchaser having performed the Purchaser's obligations thereunder, the Surety may promptly remedy the default, or shall promptly:

(1) complete the Contract in accordance with its terms and conditions; or

(2) obtain a Bid or Bids from qualified Bidders for submission to the Purchaser for completing the Contract in accordance with its terms and conditions, and upon determination by the Purchaser and the Surety of the lowest responsive Bidder, arrange for a Contract between such Bidder and Purchaser and make available as work progresses (even though there should be a default or a succession of defaults under the Contract or Contracts of completion arranged under this paragraph) sufficient funds to pay the cost of completion less the Balance of the Contract Price; but not exceeding, including other costs and damages for which the Surety may be liable hereunder, the amount set forth in the first paragraph hereof. The term "Balance of the Contract Price," as used in this paragraph, shall mean the total amount payable by Purchaser to Supplier under the Contract, less the amount properly paid by Purchaser to the Supplier; or

(3) pay the Purchaser the amount required by Purchaser to complete the Contract in accordance with its terms and conditions up to a total not exceeding the amount of this Bond.

The Surety shall not be liable for a greater sum than the specified penalty of this Bond.

Any suit under this Bond must be instituted not later than twenty-eight (28) days following the date of completion of the Supplier's performance of its obligations under the Contract, including any warranty obligations.

No right of action shall accrue on this Bond to or for the use of any person or corporation other than the Purchaser named herein or the heirs, executors, administrators, successors, and assigns of the Purchaser.

In testimony whereof, the Supplier has hereunto set his hand and affixed his seal, and the Surety has caused these presents to be sealed with his corporate seal duly attested by the signature of his legal representative, this _____ day of _____ 20 _____.

SIGNED ON _____ on behalf of _____

By _____ in the capacity of _____

In the presence of _____

SIGNED ON _____ on behalf of _____

By _____ in the capacity of _____

In the presence of _____

Advance Payment Security

Demand Guarantee

[Guarantor letterhead or SWIFT identifier code]

Beneficiary: *[Insert name and Address of Purchaser]*

Date: *[Insert date of issue]*

ADVANCE PAYMENT GUARANTEE No.: *[Insert guarantee reference number]*

Guarantor: *[Insert name and address of place of issue, unless indicated in the letterhead]*

We have been informed that *[insert name of Supplier, which in the case of a joint venture shall be the name of the joint venture]* (hereinafter called "the Applicant") has entered into Contract No. *[insert reference number of the contract]* dated *[insert date]* with the Beneficiary, for the execution of *[insert name of contract and brief description of Goods and related Services]* (hereinafter called "the Contract").

Furthermore, we understand that, according to the conditions of the Contract, an advance payment in the sum *[insert amount in figures]* () *[insert amount in words]* is to be made against an advance payment guarantee.

At the request of the Applicant, we as Guarantor, hereby irrevocably undertake to pay the Beneficiary any sum or sums not exceeding in total an amount of *[insert amount in figures]* (_____) *[insert amount in words]*[1] upon receipt by us of the Beneficiary's complying demand supported by the Beneficiary's statement, whether in the demand itself or in a separate signed document accompanying or identifying the demand, stating either that the Applicant:

(a) has used the advance payment for purposes other than toward delivery of Goods; or

(b) has failed to repay the advance payment in accordance with the Contract conditions, specifying the amount which the Applicant has failed to repay.

A demand under this guarantee may be presented as from the presentation to the Guarantor of a certificate from the Beneficiary's bank stating that the advance payment referred to above has been credited to the Applicant on its account number *[insert number]* at *[insert name and address of Applicant's bank]*.

The maximum amount of this guarantee shall be progressively reduced by the amount of the advance payment repaid by the Applicant as specified in copies of interim statements or payment certificates which shall be presented to us. This guarantee shall expire, at the latest, upon our receipt of a copy of the interim payment certificate indicating that ninety (90) percent of the Accepted Contract Amount, has been certified for payment, or on the *[insert day]* day of

[1] *The Guarantor shall insert an amount representing the amount of the advance payment and denominated either in the currency(ies) of the advance payment as specified in the Contract, or in a freely convertible currency acceptable to the Purchaser.*

[insert month], 2 *[insert year]*, whichever is earlier. Consequently, any demand for payment under this guarantee must be received by us at this office on or before that date.

This guarantee is subject to the Uniform Rules for Demand Guarantees (URDG) 2010 Revision, ICC Publication No.758, except that the supporting statement under Article 15(a) is hereby excluded.

_____

[signature(s)]

VOLUME – II

APMS

POWER PLANNING AND MONITORING COMPANY

SPECIFICATION (PPMC-DS-01:2026)

Asset Performance Management System (APMS) for Pole Mounted Distribution Transformers

Document Change Record

NGC document change record

Version	Document No.	Dated	Effective date of Application	Remarks
1.0	DDS-76:2007	2007	2007	1st Release
1.1	Amendment-1	2010	2010	Amendment
2.0	DDS-76:2023	2023	2023	2nd Release
2.1	Amendment-1	2024	2024	Amendment

PPMC document change record

Version	Document No.	Dated	Effective Date of Application	Remarks
1.0	PPMC-DS-01	2026	23-04-2026	1st Release

This specification has been prepared with due deliberations with technical working groups of DISCOs and Manufacturers.

PREPARED BY:		DRAWINGS BY:
Engr. Zaryab Hassan Specialist (D&S)	Engr. Yasir Arshad Asst. Specialist (D&S)	Engr. Amir Hamza Asst. Specialist (D&S)

REVIEWED AND CHECKED BY:
Engr. Sakhawat Ali Team-lead (D&S)

APPROVED BY:			
Engr. Talha Khalid Chief Policy and Strategic Planning	Mr. Mubashir Jalal Chief Monitoring and Reporting	Mr. Naveed Qaiser Chief Financial Officer, Planning Support & RA	Engr. Tufail Ahmed Shaikh Chief Technical Services **(Convener)**

Members of Technical Working Group (TWG) from Power Sector

Signed to the extent of UDIL Compliance as National Interoperability Standard, only.

Muhammad Hanif
DG (EA), PITC

Mr. Majid Jatoi
Director General MIRAD HESCO

Mr. Zubair Akhtar
General Manager (TSW) IESCO

Mr. Muhammad Boota Goraya
Chief Engineer (T&G) GEPCO

Mr. Sardar Sajid Nawaz
Operation Director HAZECO

Mr. Nisar Sarwar
Chief (TS) LESCO

Mr. Jamshed Ali
Addl. CE GSC/MM TESCO

Mr. Asad Iqbal
Addl. CE PS&C PESCO

Mr. Syed M Tayyab
Senior Lead (NE) KE

Mr. M Asghar Khan Ghallu
Chief Strategic Planner MEPCO

Mr. Abid Rasheed
Director General MIRAD FESCO

Mr. Muhammad Zulqarnain
Manager P&F MIRAD QESCO

Mr. Mushtaq Ahmed Abbasi
Customer Service Director SEPCO

Table of Contents

FOREWORD 6

1. SCOPE 8
2. APPLICABLE SPECIFICATIONS AND STANDARDS 9
3. ORDERING CODE 10
4. DEFINITIONS 10
5. SERVICE CONDITIONS 12
6. MAJOR COMPONENTS OF APMS 12
7. SMART METERING AND CONTROLLING DEVICE (SMCD) 12
8. CURRENT TRANSFORMER (CT) 14
9. MOLDED CASE CIRCUIT BREAKER (MCCB) 15
10. MAGNETIC CONTACTOR 18
11. APMS ENCLOSURE 20
12. APMS-OTL 23
13. FUNCTIONAL REQUIREMENTS OF APMS 25
14. PROTOTYPE APPROVAL 26
15. MASS PRODUCTION TESTS 28
16. SAMPLING, ACCEPTANCE AND REJECTION 29
17. INTEROPERABILITY 31
18. PACKING 31
19. WARRANTY 31

FOREWORD

The Federal Cabinet, Government of Pakistan vide its decision dated 27.10.2021 ratified the decision of Cabinet Committee on Energy (CCoE) meeting held on 08.10.2021, as per which the development of uniform Design & Standards for distribution sector of Pakistan is one of the core functions of PPMC.

Subsequently, in pursuance of Federal Cabinet decision, the Ministry of Energy (Power Division) vide notification dated 06.02.2026 has transferred the functions relating to the design, standards and specifications of 11 kV and below from NGC to PPMC.

In pursuance of the Ministry of Energy (Power Division) Notification dated 06.02.2026, whereby the functions related to development of uniform design, standards and specifications for distribution sector of Pakistan have been entrusted to Power Planning and Monitoring Company (PPMC) as it was performing before 2011 under then PEPCO (now PPMC).

Subsequent to this transition, Lahore Electric Supply Company (LESCO) vide its letter No. 1729-36 dated 11.02.2026, carried out a proof of concept (PoC) of the Asset Performance Management System (APMS) with additional features of oil temperature and oil level monitoring on distribution transformers. The PoC was undertaken through educational purchase orders to evaluate field performance, operational effectiveness and integration aspects of the enhanced system. Furthermore, LESCO through DG (MIRAD) letter No. 2508-14 dated 14.04.2026, proposed amendments and highlighted key technical and operational considerations based on field experience, including system integration challenges, monitoring limitations and the need for improved control and protection coordination.

Accordingly, the agenda for revision of the APMS specification was placed before the 1st Specification Review Committee (SRC) meeting vide No. TS/PPMC/DS/02-001 dated 18.02.2026. During the meeting held on 19.02.2026, and in line with the approved Minutes of Meeting, the initiation of the revision of the Asset Performance Management System (APMS) specification was duly considered and formally approved by the competent forum, taking into account LESCO's requirements and the need to strengthen existing standards. Thereafter, the draft specification was extensively deliberated with Technical Working Groups (TWGs) comprising representatives from all Distribution Companies (DISCOs), PITC, and K-Electric, ensuring incorporation of collective field experience, operational requirements, and practical considerations across utilities. Also, in alignment with the Ministry of Energy (Power Division) letter No. 12(23)/2018-DISCO-I dated 24.06.2025 regarding adoption of e-SIM technology in smart energy meters, provision for both embedded SIM (eSIM) and conventional physical SIM-based communication modules have been incorporated. However, mechanism of adoption e-SIM needs to be developed and implemented.

Following detailed consultations and incorporation of stakeholder inputs, the specification was subsequently approved in the 3rd SRC meeting held on 22.04.2026 held vide No DS-SRC-02 dated 22-04-2026.

This specification, titled *"Asset Performance Management System (APMS) for Pole Mounted Distribution Transformers,"* has then been developed in continuation of the earlier specification DDS-76:2023 (amended to date), incorporating necessary improvements in light of field feedback and evolving sectoral needs.

The present revision introduces enhanced functionalities, including optional oil temperature and oil level monitoring through dedicated sensor assemblies, improved control philosophy through coordinated operation of MCCB and magnetic contactor, and clearly defined requirements for installation, operation, and safety. A significant addition is the introduction of a structured ordering code framework, enabling DISCOs and K-Electric to select configurations in line with their specific operational requirements. This modular approach provides flexibility in procurement while maintaining standardization and interoperability across the power distribution network.

The revised specification has been formulated in response to the evolving needs of Pakistan's power distribution sector, with particular emphasis on improved monitoring, protection, control, and reduction of technical and commercial losses. In this context, APMS is envisioned as a critical tool for transformer-level energy audit, enabling enhanced visibility of system performance and facilitating a gradual transition from feeder-level to transformer-level load management. This targeted approach supports more efficient network operation, minimizes indiscriminate interventions, and helps safeguard compliant consumers.

While earlier specifications established a foundational framework, certain limitations were identified in terms of flexibility, feature integration, clarity of requirements, and alignment with current international practices. The present revision addresses these gaps through the introduction of structured ordering codes, enhanced monitoring capabilities and alignment with relevant IEC and international standards, while also accounting for local environmental and operational conditions.

The specification emphasizes standardization, safety, reliability, and lifecycle performance, while ensuring adaptability to future technological advancements and avoiding vendor-specific dependencies. However, the effective realization of APMS benefits is contingent upon proper and continuous monitoring by utilities. Timely analysis of system data and appropriate operational response are essential for achieving improvements in loss reduction, asset protection, and service delivery. It is imperative that all protection features integrated within the APMS remain enabled and fully functional at all times.

This document has been developed through extensive consultations with DISCOs, K-Electric, and industry stakeholders. Recognizing that field conditions and technologies continue to evolve, the specification is intended to remain a dynamic document. All utilities are strongly encouraged to provide feedback based on field performance, particularly regarding operational effectiveness, reliability, load management outcomes, and impact on losses.

PPMC adopts an inclusive approach towards standard development and welcomes input from all stakeholders, including utility personnel, manufacturers, and field engineers. Feedback and suggestions may be shared with the office of Design and Standards, PPMC, through the designated email address (feedback.pds@ppmc.gov.pk), with reference to relevant clauses and supporting data where available. This collaborative approach will ensure that the specification continues to evolve as a robust, practical, and forward-looking document aligned with international best practices.

1. SCOPE

1.1 This specification covers Asset Performance Management System (APMS) for Pole Mounted Distribution Transformers

1.2 APMS shall provide following salient features and services for Distribution Transformers on their LT side after incorporating other components of Advance Metering Infrastructure (AMI) network:

a. Real time monitoring and Operation/Controlling
b. Preventive actions against damage of distribution transformers
c. Load disconnection during Fault/ Abnormal Conditions
d. Energy auditing
e. Scheduling of Load Management
f. Human/Equipment Safety

1.3 This specification covers APMS to be used on the LT side of following distribution transformers:

a. 25 kVA Pole Mounted Distribution Transformer
b. 50 kVA Pole Mounted Distribution Transformer
c. 100 kVA Pole Mounted Distribution Transformer
d. 200 kVA Pole Mounted Distribution Transformer
e. 250 kVA Pole Mounted Distribution Transformer
f. 400 kVA Pole Mounted Distribution Transformer
g. 500 kVA Pole Mounted Distribution Transformer
h. 630 kVA Pole Mounted Distribution Transformer

1.4 This specification introduces an optional Oil Temperature and Oil Level Monitoring feature for the Asset Performance Management System (APMS) installed on pole mounted distribution transformers; The feature shall be realized through integration of a dedicated Oil Temperature and Oil Level Sensor Assembly connected to the SMCD directly or through a suitable controller

1.5 This specification introduces:

a. Ordering code provisions,
b. Sensor installation requirements,
c. Controller technical requirements (if used)

1.6 This specification also introduces use of Magnetic Contactor with MCCB for switching operations only.

2. APPLICABLE SPECIFICATIONS AND STANDARDS

2.1 The APMS shall be designed, manufactured, tested and supplied in accordance with (PPMC-PPMC-DS-01:2026 and latest IEC/International/National standards listed in **clause 2.3.**

2.2 In case the requirements laid down herein differ from those given in International/IEC Standards or other local specifications, the requirements listed herein shall prevail.

2.3 Following specifications and latest IEC/ International standards shall be applied:

DDS-50:2007 (amended to date)	3-Phase Multi-rate (TOD/TOU) Solid-State LT/HT Static Energy Meter
DDS-98:2011 (amended to date)	Specification for Advance Metering Infrastructure
DDS-110:2012 (amended to date)	Meter Data Collection (MDC) Server to be used in AMI
UDIL (latest version)	Universal Data Integration Layer-Multivendor compliant AMI in Pakistan
DDS-80:2007 (amended to date)	LT Current Transformer for metering
IEC 62052-11	Electricity Metering Equipment- General requirements
IEC 62053-21	Electricity Metering Equipment- Static Meters for AC Active Energy (classes 0.5, 1 and 2)
IEC 60947-2	Low voltage switchgear and control-gear – Part 2
IEC 61869-2	Instrument Transformers – Part 2: Additional requirements for current transformers
IEC 60076-22-1	Power transformer and reactor fittings – Protective devices
IEC 60529	Degrees of protection provided by enclosures (IP Code)
IEC 60068-2-2	Environmental testing – Dry heat test
IEC 61439-1	Low-voltage switchgear and control gear assemblies- General Rules
DDS-84:2020	Distribution transformers
IEC-60947-4-1	Low voltage switchgear: contactors and motor starters- electromechanical contactors and motor starters
ISO 2859-1	Sampling procedures for inspection by attributes
IEC 60751	Industrial platinum resistance thermometers and platinum temperature sensors
ISO/IEC 17025	International standard for testing and calibration laboratories

3. ORDERING CODE

3.1 Following ordering codes are applicable for procurement of APMS.

Ordering Code	Description
APMS-CB-S-***	Standard APMS with motorized MCCB
APMS-CB-OTL-***	APMS with motorized MCCB and with oil Temperature and level monitoring
APMS-MC-S-***	Standard APMS with Magnetic Contactor and non-motorized MCCB
APMS-MC-OTL-***	APMS with Magnetic Contactor, non-motorized MCCB and with oil Temperature and level monitoring

*** 025, 050, 100, 200, 250, 400, 500 & 630 (025 depicts 25 kVA, 050 depicts 50 kVA, 100 depicts 100 kVA, 200 depicts 200 kVA, 250 depicts 250 kVA, 400 depicts 400 kVA, 500 depicts 500 kVA and 630 depicts 630 kVA)

4. DEFINITIONS

4.1 **Molded case circuit-breaker (MCCB):**

A mechanical switching device capable of making, carrying and breaking currents under normal circuit conditions and under pre-defined conditions, making, carrying for a given time, and breaking currents under abnormal conditions such as those of short circuits

4.2 **Rated voltage for MCCB:**

The rated voltage of a circuit breaker is the value of voltage which designates it and to which the operating conditions during making or breaking of current.

4.3 **Rated nominal current for MCCB:**

The rated nominal current of a circuit breaker is the value of current which the circuit breaker can carry under test conditions.

4.4 **Rated frequency for MCCB:**

The rated frequency of a circuit breaker is the service frequency for which the circuit breaker is designed.

4.5 **Ambient temperature:**

The average temperature of the air surrounding the complete APMS Unit.

4.6 **Rated short time current of MCCB:**

The rated short time current of a circuit breaker is the value of prospective short circuit current which the circuit breaker shall be required to carry in the closed position for a specified time and under the test conditions specified.

4.7 **Breaking capacity of MCCB:**

A value of prospective breaking current that a switching device can break at a stated voltage under prescribed condition of use and behavior.

4.8 **Making capacity of MCCB:**

A value of prospective making current that a switching device can make at a stated voltage under prescribed condition of use and behavior.

4.9 **Short time withstand current:**

Current that a circuit or a switching device in the closed position can carry during a specified short time under prescribed conditions of use and behavior.

4.10 **Rated short-circuit breaking capacity for MCCB:**

The rated short-circuit breaking capacity (I_{cs}) for an MCCB, is the maximum prospective symmetrical fault current that the MCCB can safely interrupt under specified test conditions without sustaining damage.

4.11 **Rated short-circuit making capacity MCCB:**

The rated short-circuit making capacity (I_{cm}) for an MCCB, is the maximum prospective symmetrical fault current that the MCCB can withstand for a brief period without sustaining damage during the circuit closing operation.

4.12 **Short time delay:**

Any intentional delay in operation within the limits of the rated short time withstand current.

4.13 **Magnetic contactor:**

A Magnetic Contactor is an electrically controlled switch that uses an electromagnet to open and close a circuit.

4.14 **Static meter:**

A type of electronic energy meter that measures energy consumption using solid-state electronic components, without any moving parts.

4.15 **APMS-CB-OTL:**

Configuration of APMS with MCCB incorporating an Oil Temperature and Oil Level Monitoring System consisting of a sensor assembly and controller (if used).

4.16 **APMS-MC-OTL:**

Configuration of APMS with Magnetic Contactor and MCCB incorporating an Oil Temperature and Oil Level Monitoring System consisting of a sensor assembly and controller (if used)

5. SERVICE CONDITIONS

5.1 System Conditions:

System Nominal Voltage	415 V
System Highest Voltage	10% of Nominal Voltage
Nominal Frequency	50 Hz

5.2 Climate Conditions:

Ambient Temperature	Maximum	55°C
	Maximum mean over any 24 Hours	40°C
	Mean in any year	30°C
	Minimum	-25°C
Relative Humidity	Up to 100%	
Altitude (above sea level)	Up to 3000 meters	

6. MAJOR COMPONENTS OF APMS

6.1 Asset Performance Management System (APMS) shall be comprised of following components

a. Smart Metering and Controlling Device (SMCD)
b. Current Transformers (CTs)
c. Molded Case Circuit Breaker (MCCB)
d. Magnetic Contactor (optional as per ordering code)
e. APMS Enclosure

7. SMART METERING AND CONTROLLING DEVICE (SMCD)

7.1 Smart Metering and Controlling Device (SMCD) shall be in accordance with Specifications DDS-50:2007, DDS-98:2011, DDS-110:2012 (all amended to-date).

7.2 It shall measure, record and display MDI, kWh, kVARh, Power Factor and other specified quantities in compliance with the specifications given in Clause 7.1.

7.3 Metering Accuracy Class shall be 0.5S for kWh and 1.0 for kVARh.

7.4 In addition to above, it shall fulfill following specified requirements:

a. It shall have Communication Module with minimum 4G/GSM/GPRS technology incorporating a SIM card/e-SIM.

b. It shall be able to communicate metering and other data stored in its memory and receive commands/write operations from Head-End System / MDM in accordance with the specifications mentioned in Clause 2 and the requirements stated herein.

c. Auxiliary components/ports essentially required for its Communication with both Head-End System / MDM and MCCB or Magnetic Contactor (whichever is applicable) shall also be provided.

d. It shall have optical communication port which shall perform functions of data reading/writing and parameterization of data. It should be disabled by default however, it can be enabled remotely through HES/MDM as per requirement of concerned utility.

7.5 It should be equipped with a battery. The battery type shall be lithium thionyl chloride (LiSOCl2) having minimum capacity of 2000 mAh.

a. Battery manufacturing origins shall be:
   i. Japan (Toshiba, Maxell, Mitsubishi and Panasonic)
   ii. USA (Tadiran, Ultralife and Sonnenchein)
   iii. Germany (Geyer and Varta)
   iv. France (Saft)
   v. South Korea (Xeno)

b. Operational Life of battery shall be minimum five (05) years.

c. Without any Power, the backup battery shall maintain the time, calendar and multi-rate program for a continuous period of at least 5 years.

d. Low Battery indication shall be displayed when minimum 25% battery life is left.

e. Storage/Shelf life of battery shall be more than 15 years.

f. The manufacturing year of Battery should not be more than eighteen (18) Months at the time of offering APMS.

7.6 Super capacitor will be provided for Real-Time Clock (RTC) to maintain date and time for at least 07 days in absence of power.

7.7 In the absence of power, LCD display shall be 'On demand' through scroll buttons.

7.8 It shall have provision for following abnormal conditions:

a. Over Voltage
b. Under Voltage
c. Phase Over Current
d. Overload Condition
e. Voltage Unbalance
f. Current Unbalance
g. High Apparent Power
h. High Oil Temperature
i. Low Oil Level
j. Sensor Fault

7.9 Write provision for two (02) setting levels i.e., Alarm and Tripping shall be available for conditions specified in Clause 7.8, Sr. No. (**a** to **d** and **h**). Write provision for one (01) setting level i.e., Alarm shall be available for Sr. No. (**e** to **g** and **i to j**).

7.10 Threshold values of Alarm and Tripping functions and corresponding time settings shall be user programmable locally through optical port or remotely through head-End system/MDM. Once programmed, these function values shall be stored in its memory.

7.11 It shall perform normal operations and tripping operations of MCCB on the basis of programmed threshold values. Events, i.e., Alarm and Tripping shall be communicated to Head-End System/MDM.

7.12 At least 20 events, Alarm and Tripping, for each abnormal condition given in clause 7.8 and normal switching of MCCB/ Magnetic Contactor with date and time stamp shall be provided before rollover.

7.13 It shall be DLMS/COSEM compliant.

7.14 PCB must have conformal coating.

7.15 SMCD manufacturers shall possess valid prototype approval after fulfilling the requirements of this specification and qualifying prototype testing from Design & Standards department, PPMC.

8. CURRENT TRANSFORMER (CT)

8.1 Current Transformers used in APMS shall have following technical parameters as per IEC 61869-2:

Transformer Ratings	CT Ratio	Accuracy Class	VA Burden
25 kVA	50/5A	0.5	2.5 VA (min)
50 kVA	100/5A	0.5	2.5 VA (min)
100 kVA	200/5A	0.5	2.5 VA (min)
200 kVA	400/5A	0.5	2.5 VA (min)
250 kVA	400/5A	0.5	2.5 VA (min)
400 kVA	600/5A	0.5	2.5 VA (min)
500 kVA	800/5A	0.5	2.5 VA (min)
630 kVA	1000/5A	0.5	2.5 VA (min)

8.2 CT error limits shall be as under:

Ratio Error (± %) at Current (% of Rated)				Phase Displacement (± Minutes) at Current (% of Rated)			
5	20	100	120	5	20	100	120
1.5	0.75	0.5	0.5	90	45	30	30

8.3 The temperature rise test shall be performed at 120% of rated current as per IEC 61869-2 (latest available)

8.4 Dimensional requirements for the base plate are given in the drawings. Other CT dimensions should be so that they can be adequately fixed on bus bars.

8.5 Other than the requirements stated above, the technical parameters and testing criteria shall be in accordance with DDS-80:2007 (amended to date).

8.6 CT manufacturers shall possess valid prototype approval after fulfilling the requirements of this specification and qualifying for prototype testing from the office of Design & Standards (D&S) PPMC.

9. MOLDED CASE CIRCUIT BREAKER (MCCB)

FOR MOTORIZED MCCB WITH RESIDUAL CURRENT (ORDERING CODES APMS-CB)

9.1 MCCB shall provide protection for the following protection functions:

a. Adjustable Overload Protection with long inverse time delay trip and trip characteristic with inverse time curves.

b. Adjustable Short Circuit Protection with definite trip time delay.

c. Adjustable Short Circuit with instantaneous trip

d. Adjustable Residual Current Protection.

9.2 MCCB shall be 3P+N type in compliance of latest IEC-60947-2 standard and the requirements given in this specification.

9.3 It can have thermal-magnetic mechanism or electronic/Microprocessor based mechanism.

9.4 It should be equipped with a motor-operated mechanism for switching purpose.

9.5 The motor-operated mechanism shall have quick make, quick break action. The charging time will not be counted in making time.

9.6 Two position indications ON-OFF shall be available on MCCB or its Motor Operator.

9.7 An "Auto/Manual" switch shall be provided on MCCB or its Motor Operator. When set to "manual" position it shall lock out the remote control.

9.8 Necessary auxiliary contacts/communication ports/control circuits etc. shall be used between MCCB and SMCD for communication between them.

9.9 The communication cables shall be carried through PVC spiral/flexible conduits. These shall have proper tagging and ferruling for easy traceability through cable ducts.

9.10 It shall have adjustable long time pick up current (overload/thermal) settings from at-least 0.7 to 1.0 times of MCCB current rating and also adjustable long-time delay settings.

9.11 It shall have adjustable short time pick up current (short circuit/ magnetic) settings of the current rating and definite time trip delay/setting. The magnetic pickup range is 5-10 x I_n.

9.12 It shall have adjustable Instantaneous pick-up current settings and MCCB shall trip instantaneously within 50msec.

9.13 The minimum pick up settings value of adjustable residual current shall be ≤30mA. Its operating characteristics shall be as per IEC 60947-2 (clause B.4.2.4.1).

9.14 MCCB technical parameters are given below: -

Rated Voltage:	415/430 V
Rated Frequency:	50 Hz
Rated Nominal Current:	
25 kVA APMS:	50-60 A
50 kVA APMS:	100 A
100 kVA APMS:	200 A
200/250 kVA APMS:	400 A
400/500 kVA APMS	800 A

630 kVA APMS	1200 A
Rated Symmetrical Breaking Capacity:	25 kA (minimum)
Rated Making Capacity:	2x Rated Symmetrical Breaking Current (min)

Note: If higher rating is to be used considering the unavailability of said ratings, approval from Design and Standards (D&S) is to be sought.

9.15 Type test reports from independent ILAC accredited international labs or STL approved labs shall be provided. The type test report will be as per latest IEC standard IEC-60947-2 (latest) with additional characteristics given herein.

NON-MOTORIZED MCCB (ORDERING CODES APMS-MC)

9.16 MCCB shall provide protection for the following protection functions:

a. Overload Protection with long inverse time delay trip and trip characteristic with inverse time curves.
b. Short Circuit protection with instantaneous trip.

9.17 MCCB shall be 3P type in compliance with the latest IEC-60947-2 standard and the requirements given in this specification.

9.18 The MCCB shall be manually operated by quick make and quick break mechanism.

9.19 The MCCB shall be mechanically trip-free. ON-OFF breaker position shall be provided with breaker handle/ knob.

9.20 To minimize the effect of arcing, the breaker shall be fitted with arc quenching chamber.

9.21 MCCB technical parameters are given below: -

Rated Voltage:	415/430 V
Category	A
Rated Frequency:	50 Hz
Rated Nominal Current:	
25 kVA APMS:	50-60 A
50 kVA APMS:	100 A
100 kVA APMS:	200 A
200/250 kVA APMS:	400 A
400/500 kVA APMS	800 A
630 kVA APMS	1200 A
Rated Symmetrical Breaking Capacity:	25 kA (minimum)
Rated Making Capacity:	2x Rated Symmetrical Breaking Current (min)

Note: If higher rating is to be used considering the unavailability of said ratings, approval from Design and Standards (D&S) is to be sought.

9.22 The breaker shall be equipped with adjustable magnetic/instantaneous /electronic (microprocess based) trip units/Fixed at $10I_n$ as mentioned in table below. The magnetic/instantaneous (I_i) or electronic settings shall be in steps or continuously be adjustable in range specified below

Rated Current (Amps)	Magnetic Trip Setting Range (Amps)
40	Fixed- 400A
60	Fixed- 600A
80	Fixed- 800A
160	Min 800-1600A
200	Min 1000-2000A
250	Min 1250-2500A
400	Min 2000-4000A
800	Min 4000-8000A
1200	Min 6000-12000A

9.23 The adjustable and instantaneous time lag release settings shall be completely independent of each other.

9.24 MCCB shall trip instantaneously within 50msec.

9.25 Type test reports from independent ILAC accredited international labs or STL approved labs shall be provided. The type test report will be as per latest IEC standard IEC-60947-2 (latest) with additional characteristics given herein.

10. MAGNETIC CONTACTOR

10.1 The Magnetic Contactor shall be used only with ordering codes APMS-MC along with non-motorized MCCB.

10.2 Magnetic Contactor shall be of industrial grade suitable for 415-430 V, 50 Hz system, 3P configuration and coil Voltage of 220-240V AC.

10.3 The Magnetic Contactor shall be rated, Type-2 co-ordination and the AC-6a rating shall be demonstrated either by direct transformer switching test or by derivation from AC-3 rating in accordance with IEC 60947-4-1

10.4 Minimum durability should be mentioned in following quantities in type test reports,

a. Mechanical: minimum 1,000,000 operations.
b. Electrical durability at AC 6a duty: according to IEC standard.

10.5 The contactor shall comply with making and breaking performance requirements as per IEC 60947-4-1 for AC-6a duty.

a. The device shall be capable of safely making and breaking currents under:
   i. Normal operating conditions
   ii. Inductive load switching

b. The making and breaking capacities shall be verified through type tests in accordance with IEC provisions.

10.6 Other technical parameters shall match or exceed Transformer rating and be electrically interlocked with control logic to prevent chattering. Interlocking is required between control logic and switching devices to prevent unintended repeated operations (chattering). This applies to SMCD–contactor–MCCB interaction.

10.7 Contactor should not be used as a protective device. Short-circuit and Overload shall be provided by MCCB and operational based control and voltage based control shall be provided by contactor in ordering codes APMS-MC. It is recommended that LT line should be well protected where ordering codes APMS-MC are used and avoided where frequent faults occur on LT lines.

10.8 Contactor coil shall be protected by surge suppressor / RC snubber and contactor coil shall be controlled through an intermediate control interface (relay/driver circuit). Direct energization is avoided to protect SMCD output contacts.

10.9 Type test reports from independent ILAC accredited international labs or STL approved labs shall be provided. The type test report will be as per latest IEC standard IEC-60947-4-1 (latest) with additional characteristics given herein.

10.10 Drawings shall be approved with consultation with DISCOs and OEMs while considering for induction into the system against respective ordering codes (APMS-MC)

11. APMS ENCLOSURE

11.1 Enclosure body and door shall be made from high grade steel sheet of 1.6 mm and 2.3 mm thickness respectively.

11.2 Copper Busbars shall have 98% IACS conductivity and tin plated with minimum thickness of 20 microns.

11.3 Busbars shall have rectangular cross-section with

a. 050mm² (min) area for 25 kVA
b. 100mm² (min) area for 50 kVA
c. 150mm² (min) area for 100 kVA
d. 300mm² (min) area for 200/250 kVA
e. 600mm² (min) area for 400/500 kVA (2x riveted busbars per phase may be used)
f. 800mm² (min) area for 630kVA (2x riveted busbars per phase may be used)

11.4 Busbars shall be covered with heat shrink LV grade insulation sleeves except the connection points.

11.5 Busbars shall be mounted on Bakelite/ polymer insulators.

11.6 Following clearances shall be maintained in air within the enclosure:

a. Phase to phase 50 mm
b. Phase to earth 25 mm

(where such clearances cannot be maintained like MCCB/Contactor terminals, insulated separators/sleeves shall be used)

11.7 Gland sizes are,

a. For 025 kVA APMS PG-16 (8 Nos)
b. For 050 kVA APMS PG-21 (8 Nos)
c. For 100 kVA APMS PG-30 (8 Nos)
d. For 200/250 kVA APMS PG-42 (8 Nos)
e. For 400/500 kVA APMS PG-42 (16 Nos)
f. For 630 kVA APMS PG-42 (16 Nos)

11.8 Type tested Bimetallic Lugs (Not provided with APMS) shall be used for incoming and outgoing cable connections corresponding to the size/cross sectional area of the cables used by DISCOs,

11.9 Mounting of SMCD shall be made on two mounting brackets as per dimensions given in the attached drawings

11.10 Mounting of components i.e., MCCB, contactor (if used) and busbars shall be made on the back plate. No equipment shall be directly mounted on enclosure walls.

11.11 A window of 150x100mm shall be provided and placed on the front door for SMCD display reading. Transparent polycarbonate sheet of 5 mm thickness overlapped on the window by 15mm on all sides shall be fixed on the inner side. It shall be made dust/waterproof using Neoprene Rubber packing.

11.12 Interior and exterior of enclosure surface shall be painted with powder coating paint. Finished color shall be light grey (RAL 7032) and paint thickness shall be 0.100mm minimum at any point on surface. The paint shall be applied as,

a. The surfaces of the MS plate shall be thoroughly cleaned and sand blasted to prepare the metal surface for painting.
b. All the interior and exterior surfaces of the enclosure shall be thoroughly cleaned through the process of degreasing and phosphating to prepare the metal surface for painting. Good quality pretreatment is a mandatory requirement.
c. Oven baked powder coating paint having durable weather resistant properties suitable to be used in coastal area shall be applied.

11.13 Steel sheets and all structural joints shall be welded/bolted together so that entire enclosure is rigid and self-supporting.

11.14 Two MS bolted connectors shall be provided on the outside of enclosure for earthing purposes.

11.15 A flexible tinned copper strap of 6mmSq shall be used for electrical connectivity between door and body for earthing purposes.

11.16 Enclosure door shall have strong hinges, gutter arrangement and Neoprene rubber gasket. Louvers shall be provided on both sides of the APMS enclosure for cross ventilation as per attached drawings. Vermin proofing shall also be ensured.

11.17 Locking and sealing arrangement of enclosure shall be provided on the outside of door. The earthing terminal of hot dip galvanized MS material with zinc coating of minimum 30 microns.

11.18 Color coding for phase/neutral wiring, CT output wiring, Busbar sleeves shall be red, yellow, blue and black.

11.19 Control and Power circuit diagrams shall be engraved and printed with black color on stainless steel/powder coated Al plate fixed inside the APMS door. All the components shall be shown through symbols in the diagram.

11.20 Following information shall be painted on the APMS enclosure:

a. "APMS for 25 kVA/ 50 kVA/ 100 kVA/ 200kVA/ 250 kVA/ 400 kVA/ 500 kVA/ 630 kVA Transformer" with black color paint on the front door

b. "Danger Symbol" with red color paint on both side walls.

11.21 Following information shall be engraved and printed with black color on a stainless-steel/powder coated Al nameplate and fixed on the front of APMS enclosure:

a. APMS Designed for 25 kVA/ 50 kVA/ 100 kVA/ 200kVA/ 250 kVA/ 400 kVA/ 500 kVA/ 630 kVA Distribution Transformer.
b. Serial No.
c. Rated Voltage (V)
d. Rated Current (A)
e. MCCB Rating (A)
f. Magnetic Contactor Rating (A) (if applicable)
g. CT Ratio
h. Year of Manufacturing
i. P.O No. & Date
j. Warranty Expiry Date
k. Name of Supplier/ Manufacturer
l. Name of DISCO
m. Manufacturer of OTL (for OTL ordering codes only)
n. Low Oil level and Normal Recovery Point (for OTL ordering codes only)
o. Ordering Code

11.22 **Enclosure Tests**

Following tests shall be carried out on the enclosure.

11.22.1 **Visual Inspection**

APMS enclosure shall be visually inspected for any defects mentioned below:

Examination	Defects
Material	Enclosure components not made from specified material.
Finish	Nuts, bolts and washers not galvanized. Busbars not tin-plated. There shall be no dents/rust on the enclosure.
Construction & Dimensions	Enclosure design not in accordance with the drawings. Component missing, improper fittings or not fulfilling Dimensional requirements.
Markings	Markings/ name plate is incomplete or missing.

11.22.2 **Galvanizing Test of Nuts & Bolts and Earthing Terminal**

Nuts, bolts, DA bolts and washers shall be tested in accordance with WAPDA Specification P-82:81 (amended to-date)

11.22.3 **Bus bar Test**

Copper Bus bars shall have electrical conductivity of 98% IACS and Tin coating of 20microns.

11.22.4 **Bakelite/polymer Insulation Tests**

Bakelite/polymer insulator shall withstand 8kV (min) for one minute.

11.22.5 **Temperature rise test**

The temperature rise test shall be carried out on completely assembled APMS enclosure according to IEC 61439-1

11.22.6 **IP class test**

The verification of IP class (IPx5) shall be tested according to IEC 60529.

11.22.7 **Paint Thickness test**

Paint thickness shall be tested using paint thickness gauge and it shall not be less than 0.100mm minimum at any point on surface.

11.23 4x double arming bolts DA-14 (As per PD 56b) along with 2X powder coated channels (As per drawing) for mounting arrangement shall be provided along with the enclosure by APMS manufacturer.

12. APMS-OTL

12.1 In case of APMS-***-OTL, followings conditions are to be met by sensor and controller:

Parameter	Requirement
Operating Temperature Range of sensor	-20 °C to + 125 °C
Temperature Accuracy of sensor	Minimum ±2 °C (or class C or better)
Pressure Withstand of sensor	Minimum 6 PSI continuous (Part inside transformer). 15 PSI (30 minutes)
Sensor IP class	IP65
Controller enclosure IP Class (if used)	IP54

Oil Compatibility	Parts inside transformer must be compatible with transformer mineral oil
Max power consumption of sensor & controller (if used)	≤ 5 W
Protection requirements (for controller)	Reverse polarity protection Overvoltage protection (120% of Un)
Protection breaker (for controller if used)	≤ 1 A
PCB requirement (controller)	Conformal coating
Environmental compliance	IEC 60068-2-2 (Dry Heat test)

12.2 The sensor assembly shall be installed through the transformer oil filling plug and shall fit the oil plug arrangement specified in DDS-84:2020 without modification to the transformer tank.

12.3 Sensor installation shall ensure oil sealing using oil resistant gasket compatible with transformer mineral oil

12.4 Manufacturer shall define:

a. Low Oil Level Alarm Point
b. Normal Oil Level Recovery Point

12.5 In case of sensor failure, wiring disconnection or controller malfunction, APMS shall generate a sensor fault event.

12.6 Temperature sensor accuracy shall be ±2 °C or as per class C or better.

12.7 Installation of the sensor shall not reduce BIL of transformers. Transformers shall remain compliant with IEC 60076-3.

12.8 The external sensor wiring (pilot wires) connecting the Oil Temperature and Oil Level Sensor Assembly to the APMS/SMCD shall be provided in the form of a robust flexible capillary-type conduit/tubing (5 meters). The capillary conduit shall be metallic, flexible and mechanically protected. It should come inside APMS enclosure from below through a suitable gland.

12.9 The sensor assembly/body should be grounded with transformer body (1.5-meter flexible copper wire of 6mmsq shall also be provided).

13. FUNCTIONAL REQUIREMENTS OF APMS

13.1 This specification covers minimum level of functional requirements for design, materials, manufacturing, testing and performance of APMS for 25 kVA, 50 kVA, 100 kVA, 200 kVA, 250 kVA, 400 kVA, 500 kVA and 630 kVA rated Distribution transformers.

13.2 APMS shall have functional characteristics as mentioned in clause 13.3 to 13.11.

13.3 It shall communicate all metering data and events as per latest specifications and must be stored inside meter which will be communicated to HES/MDM upon connection as per requirement (As per clause 17.1).

13.4 It shall be able to record, report and perform following switching operations of MCCB or Magnetic Contactor (as per respective ordering code requirements) i.e., disconnection/reconnection:

a. Operation Remotely through Head-End / MDM
b. Operation through SMCD (Independent of Head-End System / MDM)
c. Operation through local electrical means (Push buttons)
d. Operation through local mechanical means (Toggle/Operating Handle) only for MCCB.

13.5 It shall record, report and perform specified functions against following abnormal conditions through Head-End / MDM for testing purposes, range of testing values are specified with each condition:

a. Over Voltage (up to 20%, higher than Transformer rated voltage)
b. Under Voltage (up to 20%, lower than Transformer rated voltage)
c. Phase Over Current (up to 20%, higher than per phase rated current)
d. Overload Condition (up to 20%, higher than Transformer rated load)
e. Voltage Unbalance (up to 20%, of Transformer rated voltage between phases)
f. Current Unbalance (up to 20%, of per phase rated current between phases)
g. High Apparent Power (up to 20%, higher than Transformer rated kVA rating)
h. High Temperature (100°C)
i. Low Oil Level (binary values)
j. Sensor fault (binary values)

13.6 Write provision for two (02) setting levels i.e., Alarm and Tripping against conditions specified in Clause 13.5, Sr. No. (**a** to **d** & **h**) shall be available. For conditions specified in Clause 13.5, Sr. No. (**e** to **g** & **i to j**) write provision for one (01) setting level i.e., Alarm shall be available.

13.7 Threshold values of these Alarm and Tripping functions and their corresponding time settings shall be user programmable from Head-End system/MDM. Alarm and Tripping shall occur based on these threshold values. Default Values against different parameters mentioned in clause 7.8 shall be provided by the respective utility/DISCO at the time of placing purchase order.

13.8 Performing Load shedding according to preset time schedule shall be provided.

13.9 SMCD shall be programmed bi-directional by default (in white color).

13.10 Tripping events shall be recorded and reported for short circuit and Residual protection (for ordering codes APMS-CB).

13.11 The APMS with OTL feature shall:

a. Measure transformer oil temperature
b. Monitor transformer oil level
c. Generate alarms for sensor fault condition
d. Transmit parameters to backend system
e. Integrate with HES and MDM systems
f. All sensors shall have temperature accuracy certificate from ISO/IEC17025 Lab and functional test reports on oil level monitoring (OEM/APMS provider).

14. PROTOTYPE APPROVAL

14.1 Supplier/manufacturer shall submit one (01) complete APMS unit, technical data and three (03) sets of drawings for prototype approval in the office of Design and Standards, PPMC.

14.2 All the testing arrangements including boarding, lodging and daily allowance shall be borne by manufacturer.

14.3 All the type testing shall be carried out at an independent accredited laboratory under witnessing of D&S PPMC engineer(s).

14.4 Testing Lab instruments should be calibrated from ILAC/PNAC/STL accreditation bodies.

14.5 Manufacturers shall submit satisfactory field performance of APMS from end user for renewal of prototype (if product is provided to DISCOs). If no product is provided to DISCOs, prototype test compliance can be submitted.

14.6 Following tests shall be performed during prototype testing on complete enclosure: -

a. Visual Examination & Verification of dimensions (as per specified drawings)

b. Verification of Components (as per specified drawings)

c. Power Frequency Test of 2.5 kV shall be applied between all four busbars and between ground for one (01) minute.

d. Enclosure Tests as per Clause 11.22.

e. Complete Functionality Tests of APMS as per Clause 13 (10 Nos. operations against each pre-defined operating condition, Normal and abnormal).

14.7 The firm shall possess testing setup for functionality tests of APMS including three phase Current Injection set with adjustable features. The routine tests can be performed In-House.

14.8 For APMS-OTL, manufacturer shall demonstrate compatibility with DDS-84:2020 (amended to date) oil plug arrangement, successful communication with MDC and compliance with all certification requirements.

14.9 Following prototype tests shall be carried out on APMS-OTL sensor and controller assembly only with condition given in clause 14.3.

Sr. No.	Test Name	Standard / Reference	Test Description	Acceptance Criteria
1	Temperature Measurement Accuracy Test	Comparison with calibrated standard	Sensor tested across full operating temperature range	Accuracy within ±2 °C
2	Oil Level Functional Test	Visual method	Verification of oil level alarm and recovery levels using a small sealed tank	Correct Low Oil Alarm and Normal Recovery Point as per datasheet
3	Pressure Withstand Test	Calibrated pressure Gauge	Sensor exposed to internal pressure conditions using a small sealed tank (simulation of transformer pressure conditions)	Withstand 15 PSI for 30 minutes then 6 PSI for 24hours without leakage
4	IP Class verification Test (Sensor)	IEC 60529	Verification of ingress protection of sensor	Minimum IP65
5	IP Class verification Test (Controller)	IEC 60529	Verification of controller enclosure's IP class	Minimum IP54
7	Environmental Temperature Test	IEC 60068 series	Operation under extreme temperature conditions (temperature range is for part inside transformer.	Reliable operation between −20 °C to +125 °C

			Test to be conducted using a small sealed tank.	
8	Dry Heat Test	IEC 60068-2-2	Controller subjected to elevated temperature	No degradation in performance
9	Power Consumption Test	Power analyser	Measurement of OTL assembly power consumption	≤ 5 Watts

14.10 Compatibility certificate is required for sensor assembly with different transformer manufacturers stating that this does not reduce BIL.

14.11 Only PPMC approved sensor assemblies shall be used. (protocols attached in Annex-A).

14.12 Prototyped APMS-CB-OTL doesn't require re-prototyping for APMS-CB-S. However, APMS-CB-S cannot be used as APMS-CB-OTL unless prototyped so. Likewise, APMS-MC-OTL doesn't require re-prototyping for APMS-MC-S. However, APMS-MC-S cannot be used as APMS-MC-OTL unless prototyped so

14.13 For APMS-MC ordering codes, if manufacturer(s) offers their product, the drawings shall be approved as per components and dimensions shall be decided accordingly.

14.14 The validity of Prototype approval will be five (5) years unless there is any change in design or as per PPMC Prototype/Type test Policy.

14.15 The manufacturer must be ISO-9001 and ISO 14001 certified.

15. MASS PRODUCTION TESTS

Following routine and sample tests shall be performed on APMS

15.1 **Routine Tests**

The supplier/manufacturer of APMS shall perform following routine tests on each APMS at their premises and shall maintain its proper record to submit on demand: -

a. Visual Examination & Verification of dimensions (as per approved drawings)
b. Verification of Components (as per approved drawings)
c. Power Frequency Test
d. Complete Functionality Tests of APMS as per Clause 13.
e. For APMS-OTL, following tests are added,

Sr. No.	Test Name	Test Description	Acceptance Criteria
1	Visual Inspection	Inspection of sensor, controller and enclosure	No physical defects
2	Wiring Inspection	Inspection of internal wiring arrangement	Proper dressing and routing in wiring ducts
3	Functional Test	Verification of sensor output and controller response	Correct readings and signal transmission
4	Alarm Generation Test	Verification of alarm signals	Correct alarm for low oil level and temperature
5	Fail-Safe Test	Simulation of sensor disconnection or failure	Distinct Sensor Fault Alarm generated
6	Communication Test	Verification of data transmission	Successful communication with APMS controller

15.2 Sample Tests

Following sample tests of APMS during mass production shall be carried out by Material Inspection, PPMC:-

a. Visual Examination & Verification of dimensions, components (as per approved drawings) and calibration certificates (equipment, sensor assemblies)
b. Power Frequency Test (2.5KV)
c. Conductivity test of busbars.
d. Wiring inspection.
e. Fail safe test.
f. Communication verification on MDC.
g. Paint thickness test (0.100mm minimum at any point on surface)
h. Galvanizing test
i. Tin plating test. (=>20 Microns)
j. Bakelite dielectric test. (8kV)
k. Alarm generation test

16. SAMPLING, ACCEPTANCE AND REJECTION

16.1 General:

16.1.1 All inspections shall be carried out under the supervision of the Purchaser/Inspection Authority (MI, PPMC) unless otherwise specified.

16.1.2 Sample Quantities.

Offered Quantity	No of Samples
Up-to 25	3
Up-to 50	5
Up-to 90	8
Up-to 150	13
Up-to 280	20
Up-to 500	32
Up-to 1200	50
Up-to 3200	80
Up-to 10000	125
Up-to 35000	200

16.2 **Inspection & Acceptance Table:**

Sr. No.	Test Description	Remarks	Acceptance/rejection
1	Visual Examination & Verification of Dimensions	As per approved drawings	i. If more than one sample fails, then the lot shall be rejected. ii. If only one sample out of the selected samples fails, then re-sampling of double size shall be made. The failure shall be documented and with reasons and acknowledgement from all parties. iii. In case, if any other sample from re-sampling fails, whole LOT shall be rejected and it would be documented and acknowledged by all parties.
2	Power Frequency Test (2.5 kV)	No breakdown or flashover	
3	Complete Functionality Test of APMS along with alarm generation	Full operational verification	
4	Wiring Inspection	Ferruling, termination, routing	
5	Fail Safe Test	Mandatory zero failure	
6	Communication Verification on MDC	Data transmission & integration	
7	Paint Thickness Test	Corrosion protection	
8	Galvanizing Test (1 item from each sample)	Zinc coating compliance	
9	Tin Plating Test (≥20 µm) (1 item from each APMS)	Conductivity & corrosion	
10	Bakelite Dielectric Test (1 item from each APMS)	No breakdown / puncture	

Note: The rejected sample during first sampling shall be rectified before acceptance of LOT.

17. INTEROPERABILITY

17.1 For the purpose of ensuring interoperability, the APMS shall be fully compliant with DLMS/COSEM. Furthermore, for deployments where metering data is managed through the Meter Data Management (MDM) system of Power Information Technology Company, the APMS, associated MDC and communication interfaces shall mandatorily comply with the requirements of the Universal Data Integration Layer (UDIL) latest version and shall be duly certified by PITC ensuring seamless integration, standardized data exchange and avoidance of vendor-specific dependencies.

18. PACKING

Each APMS Unit shall be supplied duly packed to withstand rigors of rail/road transportation. The Glands shall not be damaged. DA bolts, Chanels for mounting arrangements shall also be provided. Moreover, it shall be protected against entry of moisture, rainwater and dust by covering with suitable bubble wrap sheet.

19. WARRANTY

19.1 The complete APMS, including all associated components such as MCCB, SMCD, Magnetic Contactor, ~~CTI sensor assembly~~, and enclosure (as applicable per the ordering code), shall be warranted for a period of five (05) years from the date of supply or completion of the specified duty cycles (for MCCB and Magnetic Contactor), whichever comes earlier. In the absence of recorded duty cycle data, the warranty period shall be considered five (05) years from the date of supply.

19.2 During the warranty period, the manufacturer/supplier shall be responsible for rectification or replacement of any defective components arising due to design, material or workmanship issues at no additional cost to the purchaser. The fault evaluation report shall jointly be made with representative of DISCO, MI and D&S to ascertain the root cause.

19.3 The warranty shall cover all electrical, mechanical and communication components including battery performance as per specified operational life.

Annex – A

PPMC APPROVAL PROTOCOL FOR SENSOR ASSEMBLY

A- Type Approval (Mandatory Before OTL Prototype for OTL OEM)

Documents Required:

1. Design drawings
2. Mounting arrangement (DDS-84 compatibility)
3. Material specifications
4. Calibration procedure

Type Tests (Mandatory)

Test	Standard	Purpose
Accuracy test (±2°C) (Sensor & controller)	ISO/IEC 17025	Standard governing calibration of equipment against a traceable reference standard.
Pressure test (6 PSI / 15 PSI)	DDS-84:2020 (to date)	Tank conditions
Temperature endurance (-20 to 125°C)	IEC 60068-2-1 / 2-2	Environmental suitability (correct readings)
IP test (IP65)	IEC 60529	Dust + water protection
Vibration test	IEC 60068	Field robustness

Impulse test (with sensor installed) on at-least 2x Transformers (25kVA) of different manufacturers or as per D&S PPMC requirements	IEC 60076-3
Functional test (low level / high temp alarms)	Operational
Fitment verification	OEM certification

PPMC APPROVAL PROTOCOL FOR CONTROLLER (if used)

Test	Standard	Purpose
Power consumption	IEC 60076-22-1 <5Watts	Efficiency
Dry heat test	IEC 60068-2-2	Thermal endurance
IP test (IP54)	IEC 60529	Enclosure protection
EMC test	IEC 61000 series	Interference immunity

Note: All tests shall be performed at an independent Lab

Annex-B

SCHEDULE OF TECHNICAL DATA

1. APMS:

Sr. No.	Description	Offered Value	Compliance	Remarks
1	Manufacturer Name			
2	Type / Model / Designation			
3	Applicable Standards (DDS / IEC)			
4	Rated Voltage (V)			
5	Rated Frequency (Hz)			
6	APMS Rating (25/50/100/200/400/630 kVA)			
7	Degree of Protection (Enclosure IP)			
8	Ambient Temperature Range			
9	Maximum Altitude			
10	Functional Compliance (as per Clause 13)			
11	Alarm & Tripping Logic Details			
12	Field Performance Evidence			
13	Compliance with PPMC-DS-01:2026			
14	Weight			

2. MCCB MOTORIZED WITH EARTH LEAKAGE PROTECTION.

Sr. No.	Description	Offered Value	Compliance	Remarks
1	Manufacturer Name			
2	Model / Frame Size			
3	Standard (IEC 60947-2) compliance			
4	Rated Voltage (V)			
5	Rated Current (In)			
6	Number of Poles (3P / 3P+N)			
7	Breaking Capacity (Icu, kA)			
8	Service Breaking Capacity (Ics, % of Icu)			
9	Making Capacity (Icm)			
10	Thermal Setting Range (Ir)			
11	Magnetic Setting Range (Im)			
12	Short Time Delay (if applicable)			
13	Residual Protection (Yes/No, value)			

14	Type of Trip Unit (Thermal-Magnetic / Electronic)			
15	Motorized Operation (Yes/No)			
16	Auto/Manual Mode Availability			
17	Auxiliary Contacts / Communication Interface			
18	Mechanical Endurance			
19	Electrical Endurance			
20	Type Test Reports (ILAC Lab)			
21	Compliance with PPMC-DS-01:2026			
22	Weight			

3. MCCB NON-MOTORIZED.

Sr. No.	Description	Offered Value	Compliance	Remarks
1	Manufacturer Name			
2	Model / Frame Size			
3	Standard (IEC 60947-2) compliance			
4	Rated Voltage (V)			
5	Rated Current (In)			
6	Number of Poles (3P)			
7	Breaking Capacity (Icu, kA)			
8	Service Breaking Capacity (Ics, % of Icu)			
9	Making Capacity (Icm)			
10	Thermal Setting Range (Ir)			
11	Magnetic Setting Range (Im)			
14	Type of Trip Unit (Thermal-Magnetic / Electronic)			
18	Mechanical Endurance			
19	Electrical Endurance			
20	Type Test Reports (ILAC Lab)			
21	Compliance with PPMC-DS-01:2026			
22	Weight			

4. MAGNETIC CONTACTOR

Sr. No.	Description	Offered Value	Compliance	Remarks
1	Manufacturer Name			
2	Model / Type			
3	Standard (IEC 60947-4-1)			
4	Rated Operational Voltage (V)			
5	Rated Frequency (Hz)			
6	Rated Current (AC 6a duty)			
7	Utilization Category (AC 6a)			
8	Coil Voltage (V)			
9	Mechanical Endurance (operations)			
10	Electrical Endurance (AC 6a duty)			
11	Making Capacity			
12	Breaking Capacity			
13	Surge Protection (RC / MOV)			
14	Electrical Interlocking with MCCB			
15	Coordination Type (Type 2)			
16	Type Test Reports (ILAC Lab)			
17	Compliance with PPMC-DS-01:2026			
18	Weight			

5. SMCD

Sr. No.	Description	Offered Value	Compliance	Remarks
1	Manufacturer Name			
2	Model / Type			
3	Standards (DDS-50, 98, 110 / IEC 62052/53) compliant			
4	Accuracy Class (kWh / kVARh)			
5	Communication Technology			
6	DLMS/COSEM Compliance (Yes/No)			
7	Optical Port Availability			
8	Auxiliary Ports (MCCB Interface)			
9	Battery Type & Capacity			
10	Battery Backup Duration			
11	RTC Backup (Supercapacitor)			
12	Event Logging Capacity			
13	Alarm & Trip Configurability			
14	Remote Operation Capability			
15	Firmware Upgrade Capability			

16	PTA Compliance (for communication)			
17	Type Approval (PPMC)			
18	DLMS Certification Attached			
19	Weight			

6. OTL (OIL TEMPERATURE & LEVEL ASSEMBLY)

Sr. No.	Description	Offered Value	Compliance	Remarks
1	Manufacturer Name			
2	Model / Type			
3	Applicable Standards (IEC 60751, IEC 60068, IEC 60529)			
4	Temperature Measurement Range (°C)			
5	Temperature Accuracy (± °C)			
6	Drift over Time			
7	Oil Level Detection Method			
8	Pressure Withstand (PSI)			
9	Sensor IP Rating			
10	Controller IP Rating			
11	Operating Temperature Range			
12	Power Consumption			
13	Mounting Arrangement (DDS-84 compatible)			
14	Fail-Safe Feature (Yes/No)			
15	Calibration Certificate (ISO/IEC 17025 lab)			
16	Type Test Reports			
17	Transformer Compatibility Certificate			
18	PPMC Approval Status			
19	Weight			

LIST OF DRAWINGS

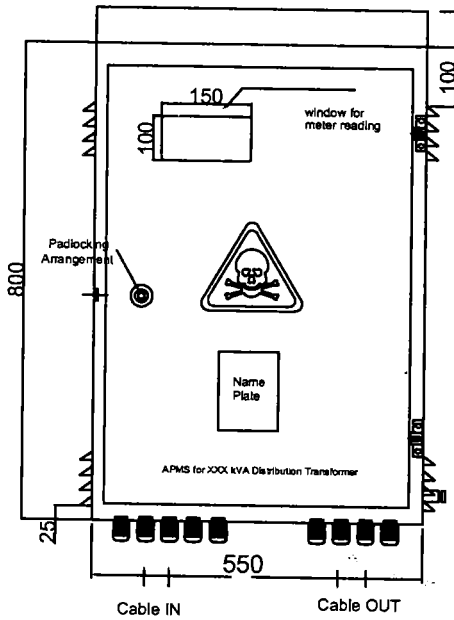
Sr No.	Drawing No.	Drawing Title
01	APMS/PPMC/D&S/01	Enclosure Unit for 25/50/100 kVA
02	APMS/PPMC/D&S/02	Enclosure Unit for 200/250 kVA
03	APMS/PPMC/D&S/03	Enclosure Unit for 400/500,630 kVA
04	APMS/PPMC/D&S/04	Internal Components Arrangement
05	APMS/PPMC/D&S/05	Base Plate for 25/50/100 kVA
06	APMS/PPMC/D&S/06	Base Plate for 200/250 kVA
07	APMS/PPMC/D&S/07	Base Plate for 400/500,630 kVA
08	APMS/PPMC/D&S/08	Air Vent for 25/50/100 kVA
09	APMS/PPMC/D&S/09	Air Vent for 200/250,400/500,630 kVA
10	APMS/PPMC/D&S/10	Meter Support Channel
11	APMS/PPMC/D&S/11	Rating Plate
12	APMS/PPMC/D&S/12	Earthing Terminal
13	APMS/PPMC/D&S/13	Current Transformer
14	APMS/PPMC/D&S/14	Insulator
15	APMS/PPMC/D&S/15	Circuit Diagram with magnetic Contactor
16	APMS/PPMC/D&S/16	Circuit Diagram with magnetic Contactor
17	APMS/PPMC/D&S/17	Magnetic Contactor Arrangement
18	APMS/PPMC/D&S/18	Tolerance Sheet

Power Planning and Monitoring Company (PPMC)
DESIGN AND STANDARDS (D&S)

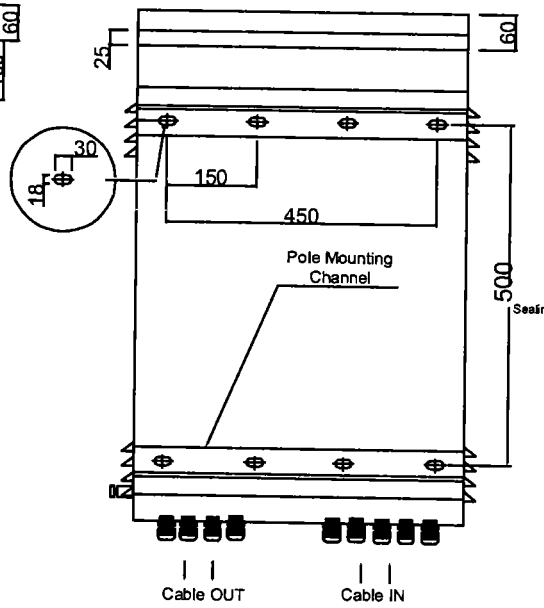
Drawn By:	Checked By:	Verified By:	Scale:	NTS
ENGR.AAMIR HAMZA ASST.SPECIALIST (D&S)	ZARYAB HASSAN SPECIALIST (D&S)	SAKHAWAT ALI TEAM LEAD (D&S)	Revision Nos:	0/0
			Date :	17/04/2026

PPMC

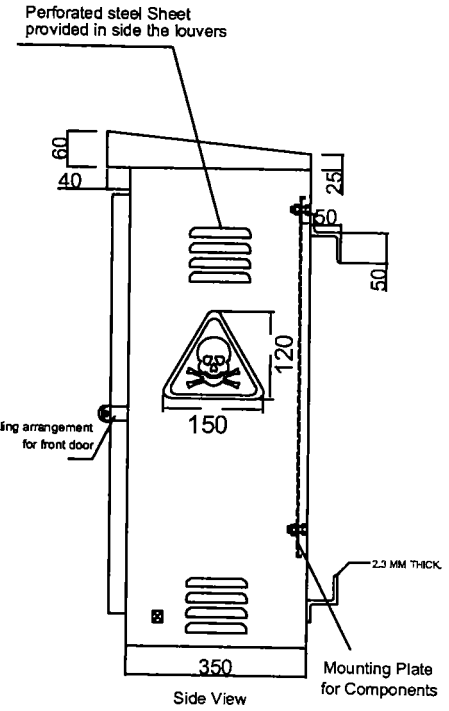
Product :	Asset Performance Management System For 25kVA,50kVA,100kVA,200/250kVA,400/500kVA and 630kVA Transformer
Drawing Title:	LIST OF DRAWINGS
Reference :	PPMC-DS-01
Drawing No.	APMS/PPMC/D&S/ 00 OF 18



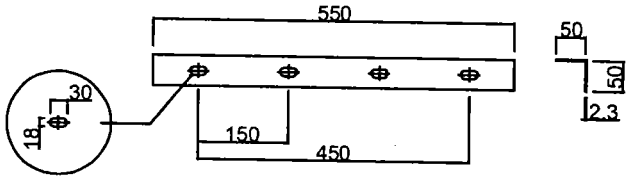
Front View



Back View



Side View



Pole Mounting Channel (2 NOS)

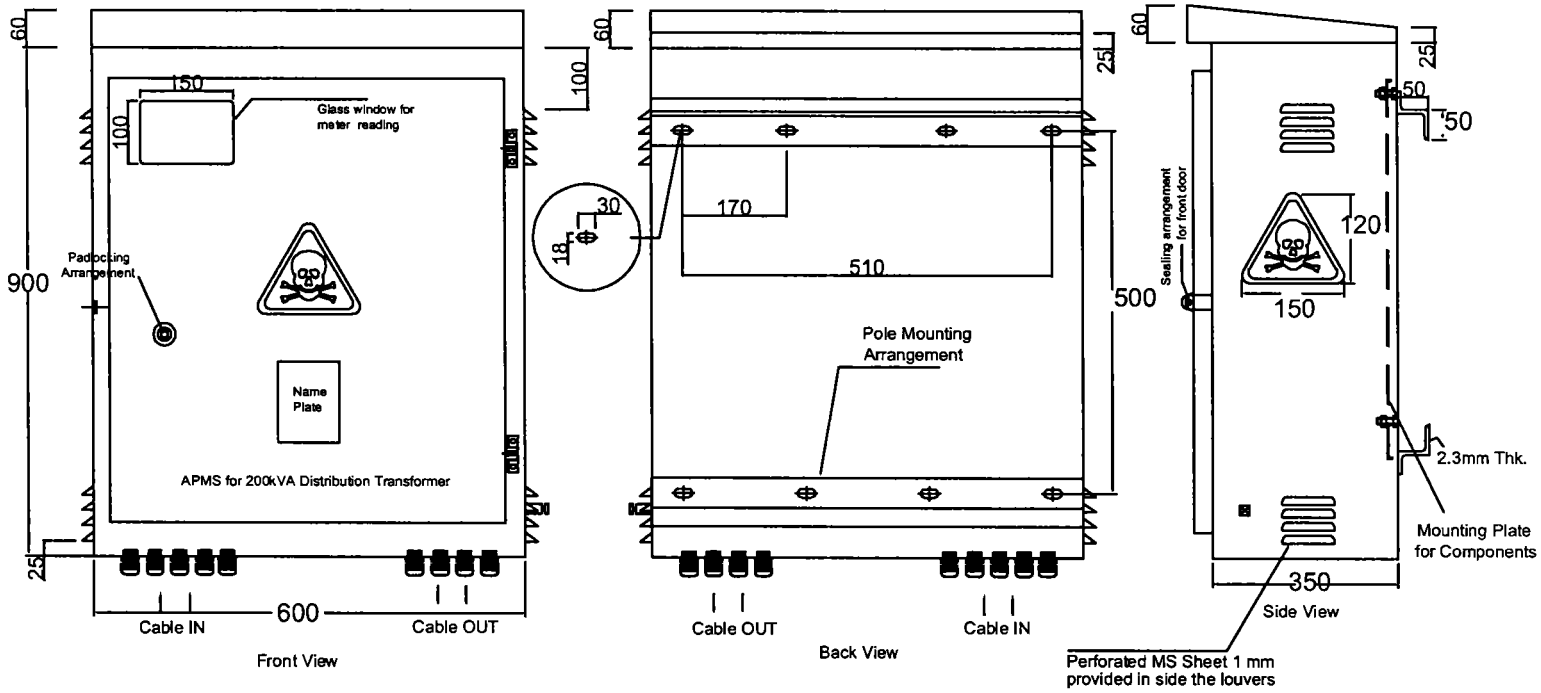
Note:
1.Tolerance: as per Dwg.No APMS/PPMC/D&S/18
2.All Dimension are in Millimeters.
3.Enclosure Sheet Thickness=1.6mm (Min)
4.Door Sheet Thickness =2.3mm (Min)
5.Color: RAL-7032 (Powder Coating)
6.Louvers May be Increased By Manufactures To Fullfill Temprature Rise Test Requriments.

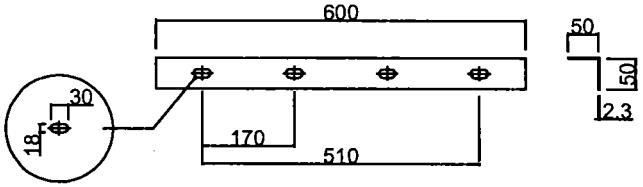
Power Planning and Monitoring Company (PPMC)
DESIGN AND STANDARDS (D&S)

Drawn By:	Checked By:	Verified By:	Scale:	NTS
ENGR.AAMIR HAMZA ASST.SPECIALIST (D&S)	ZARYAB HASSAN SPECIALIST (D&S)	SAKHAWAT ALI TEAM LEAD (D&S)	Revision No:	0/0
			Date :	17/04/2026

PPMC

Product :	Asset Performance Management System For 25kVA,50kVA,100kVA Transformer
Drawing Title:	Enclosure Unit
Reference :	PPMC-DS-01
Drawing No.	APMS/PPMC/D&S/01 OF 18





Pole Mounting Channel (2 NOS)

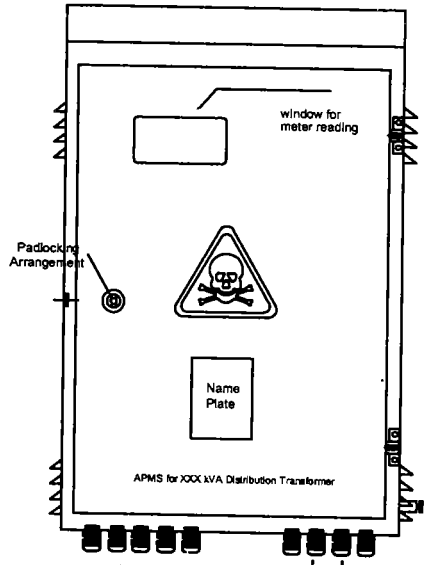
Note:
1.Tolerance: as per Dwg.No APMS/PPMC/D&S/18
2.All Dimension are in Millimeters.
3.Enclosure Sheet Thickness=1.6mm (Min)
4.Door Sheet Thickness =2.3mm (Min)
5.Color: RAL-7032 (Powder Coating)
6.Louvers May be Increased By Manufactures To Fullfill Temprature Rise Test Requriments.

Power Planning and Monitoring Company (PPMC)
DESIGN AND STANDARDS (D&S)

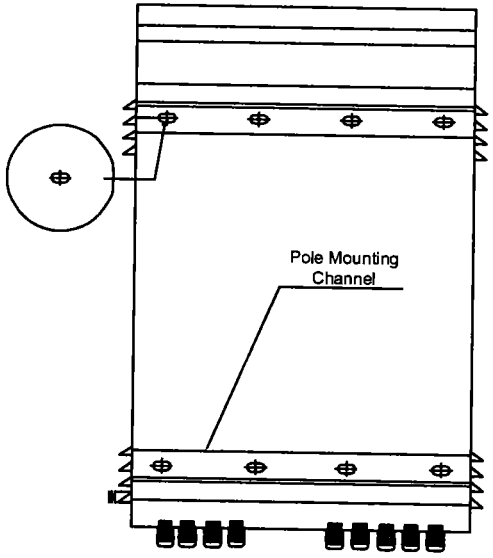
Drawn By:	Checked By:	Verified By:	Scale:	NTS
ENGR.AAMIR HAMZA ASST.SPECIALIST (D&S)	ZARYAB HASSAN SPECIALIST (D&S)	SAKHAWAT ALI TEAM LEAD (D&S)	Revision Nos:	0/0
			Date :	17/04/2026

PPMC

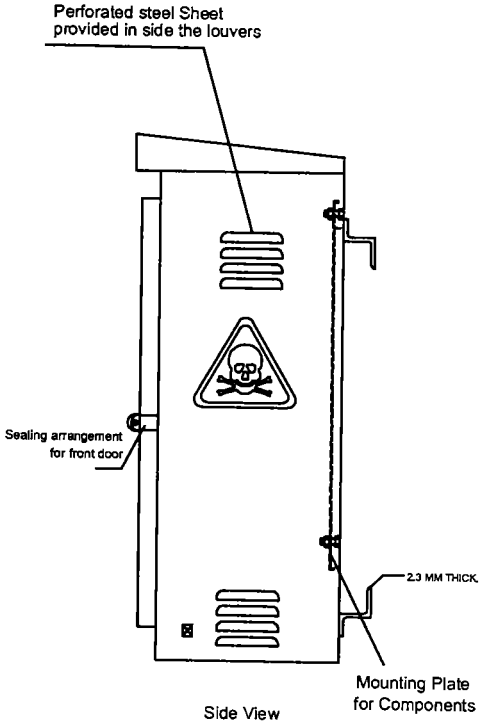
Product :	Asset Performance Management System For 200/250 kVA Transformer
Drawing Title:	Enclosure Unit
Reference :	PPMC-DS-01
Drawing No.	APMS/PPMC/D&S/ 02 OF 18



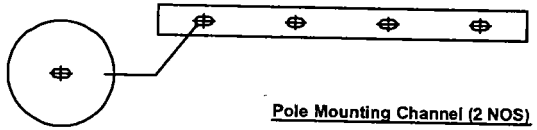
Front View



Back View



Side View



Pole Mounting Channel (2 NOS)

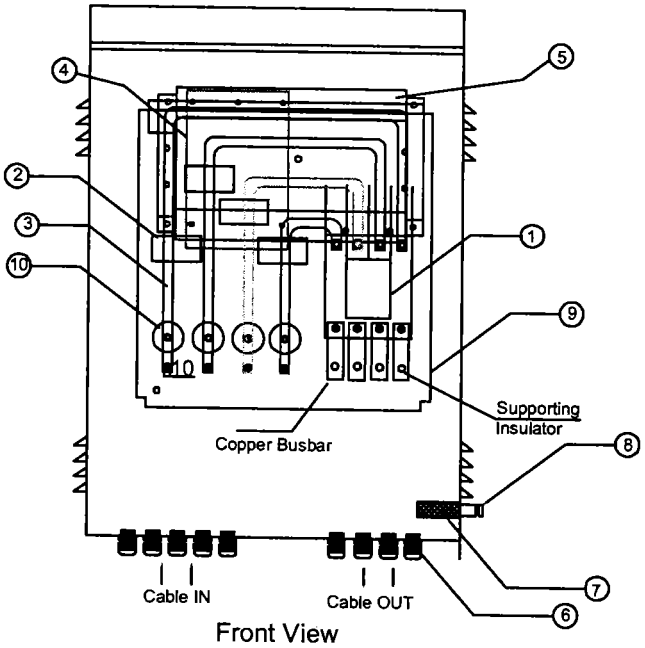
Note:
1.Tolerance: as per Dwg.No APMS/PPMC/D&S/18
2. This Indicative drawing is for reference only. Detailed dimensional arrangement shall be made as per the prototype.

Power Planning and Monitoring Company (PPMC)
DESIGN AND STANDARDS (D&S)

Drawn By:	Checked By:	Verified By:		
ENGR.AAMIR HAMZA ASST.SPECIALIST (D&S)	ZARYAB HASSAN SPECIALIST (D&S)	SAKHAWAT ALI TEAM LEAD (D&S)	Scale:	NTS
			Revision No:	0/0
			Date :	17/04/2026

PPMC

Product :	Asset Performance Management System For 400/500kVA, 630kVA Transformer
Drawing Title:	Enclosure Unit
Reference :	PPMC-DS-01
Drawing No.	APMS/PPMC/D&S/ 03 OF 18



Front View

LEGEND

1- MCCB
2- LT CTs
3- Copper Bus Bars
4- Smart Metering and Control Device
5- Channel for Meter Support
6- Cable Glands
7- Copper braided wire for door earthing
8- Earthing Terminal
9- Mounting Plate for Components
10- Busbar Support Insulators

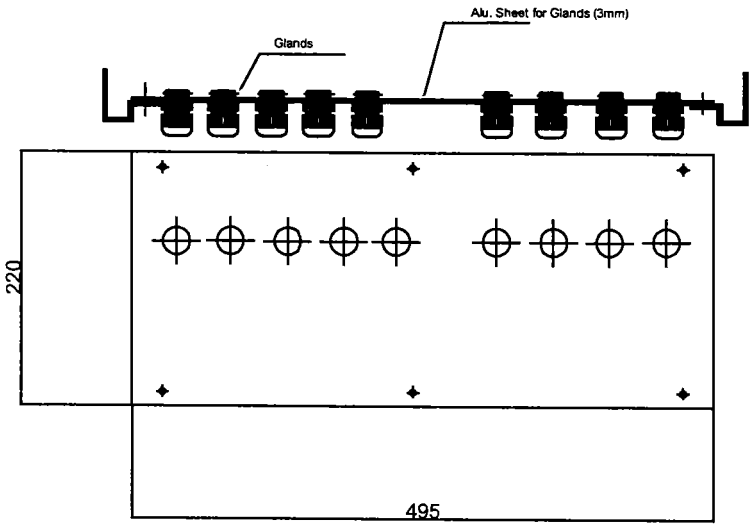
Note:
1.Tolerance: as per Dwg.No APMS/PPMC/D&S/18
2. Detailed dimension and Holes Position shall be as per approved Prototype

Power Planning and Monitoring Company (PPMC)
DESIGN AND STANDARDS (D&S)

Drawn By:	Checked By:	Verified By:	Scale:	NTS
ENGR.AAMIR HAMZA ASST.SPECIALIST (D&S)	ZARYAB HASSAN SPECIALIST (D&S)	SAKHAWAT ALI TEAM LEAD (D&S)	Revision No:	0/0
			Date :	17/04/2026

PPMC

Product :	Asset Performance Management System For 25kVA,50kVA,100kVA,200/250kVA,400/500kVA and 630kVA Transformer
Drawing Title:	Internal Components Arrangement
Reference :	PPMC-DS-01
Drawing No.	APMS/PPMC/D&S/ 04 OF 18



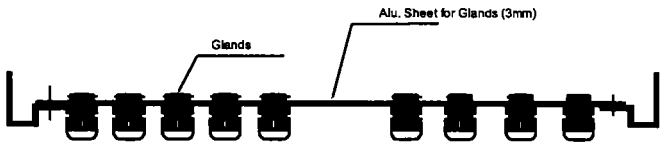
Note:
1. Tolerance: as per Dwg.No APMS/PPMC/D&S/18
2. All Dimension are in Millimeters.
3. Gland Material = PVC
4. Holes Positions Can Be Changed But Will Be Fixed Once Prototype is Approved.

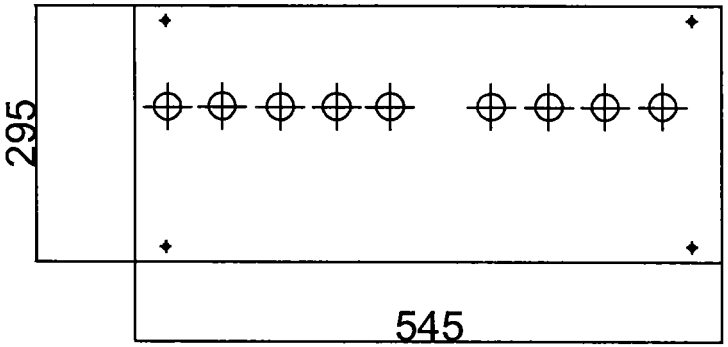
Power Planning and Monitoring Company (PPMC)
DESIGN AND STANDARDS (D&S)

Drawn By:	Checked By:	Verified By:	Scale:	NTS
ENGR.AAMIR HAMZA ASST.SPECIALIST (D&S)	ZARYAB HASSAN SPECIALIST (D&S)	SAKHAWAT ALI TEAM LEAD (D&S)	Revision No:	0/0
			Date :	17/04/2026

PPMC

Product :	Asset Performance Management System For 25kVA,50kVA,100kVA Transformer
Drawing Title:	Base Plate
Reference :	PPMC-DS-01
Drawing No.	APMS/PPMC/D&S/ 05 OF 18





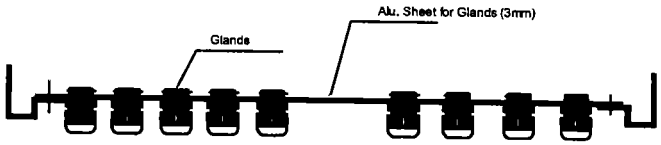
Note:
1.Tolerance: as per Dwg.No APMS/PPMC/D&S/18
2.All Dimension are in Millimeters.
3.Gland Material = PVC
4. Holes Position Can Be Changed But Will Be Fixed Once Prototype is Approved.

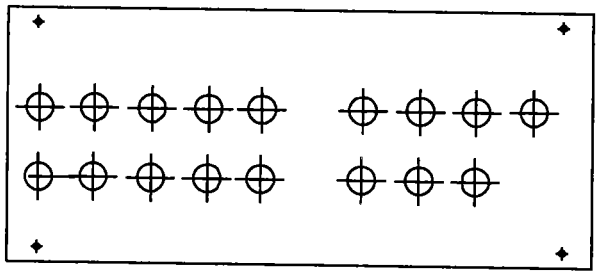
Power Planning and Monitoring Company (PPMC)
DESIGN AND STANDARDS (D&S)

Drawn By:	Checked By:	Verified By:	Scale:	NTS
ENGR.AAMIR HAMZA ASST.SPECIALIST (D&S)	ZARYAB HASSAN SPECIALIST (D&S)	SAKHAWAT ALI TEAM LEAD (D&S)	Revision No:	0/0
			Date :	17/04/2026

PPMC

Product :	Asset Performance Management System For 200/250kVA Transformer
Drawing Title:	Base Plate
Reference :	PPMC-DS-01
Drawing No.	APMS/PPMC/D&S/06 OF 18





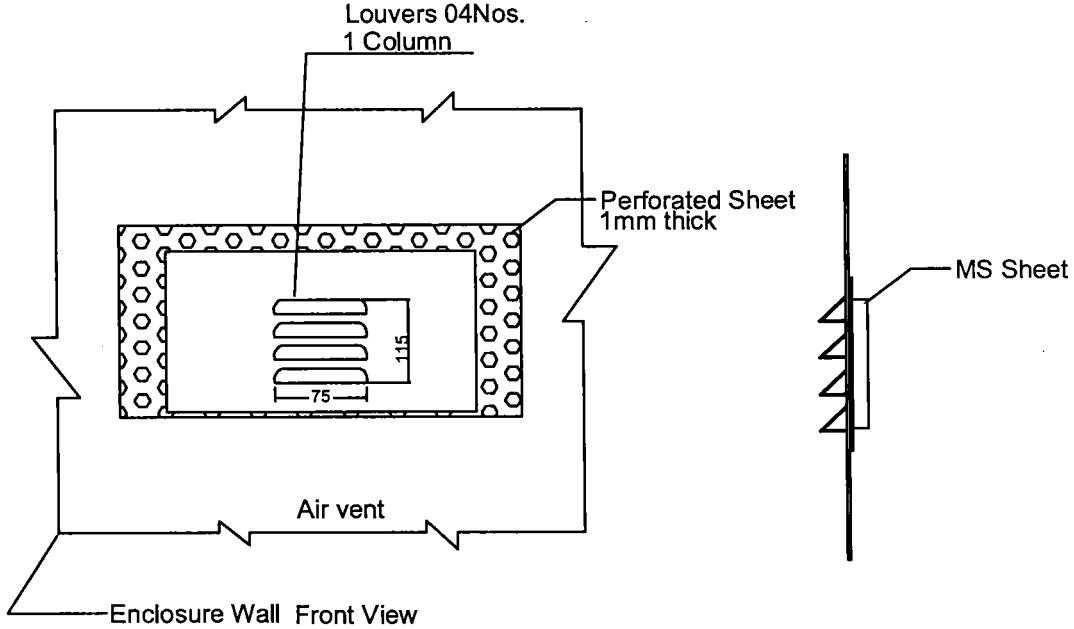
Note:
1.Tolerance: as per Dwg.No APMS/PPMC/D&S/18
2.All Dimension are in Millimeters.
3.Gland Material = PVC
4. Detailed dimension and Holes Position shall be as per approved Prototype

Power Planning and Monitoring Company (PPMC)
DESIGN AND STANDARDS (D&S)

Drawn By:	Checked By:	Verified By:	Scale:	NTS
ENGR.AAMIR HAMZA ASST.SPECIALIST (D&S)	ZARYAB HASSAN SPECIALIST (D&S)	SAKHAWAT ALI TEAM LEAD (D&S)	Revision Nos:	0/0
			Date :	17/04/2026

PPMC

Product :	Asset Performance Management System For 400/500kVA,630kVA Transformer
Drawing Title:	Base Plate
Reference :	PPMC-DS-01
Drawing No.	APMS/PPMC/D&S/ 07OF 18



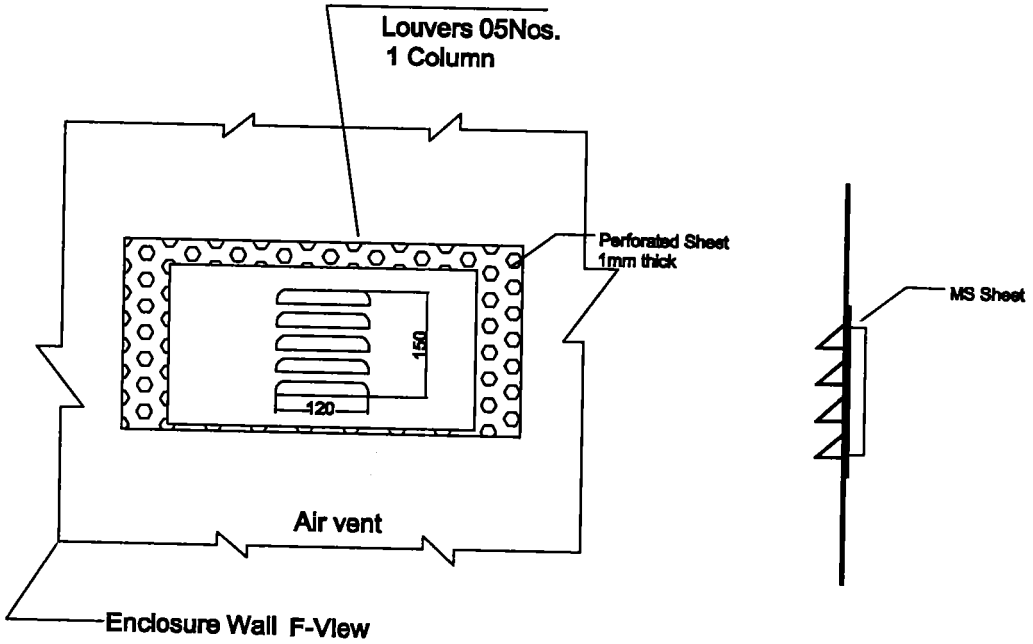
Note:
1.Tolerance: as per Dwg.No APMS/PPMC/D&S/18
2.All Dimension are in Millimeters.
3.Number of Louvers may be increased to comply with temperature rise test. However, it shall be fixed during prototype approval

Power Planning and Monitoring Company (PPMC)
DESIGN AND STANDARDS (D&S)

Drawn By:	Checked By:	Verified By:	Scale:	NTS
ENGR.AAMIR HAMZA ASST.SPECIALIST (D&S)	ZARYAB HASSAN SPECIALIST (D&S)	SAKHAWAT ALI TEAM LEAD (D&S)	Revision Nos:	0/0
			Date :	17/04/2026

PPMC

Product :	Asset Performance Management System For 25kVA,50kVA,100kVA Transformer
Drawing Title:	Air Vent
Reference :	PPMC-DS-01
Drawing No.	APMS/PPMC/D&S/ 08 OF 18



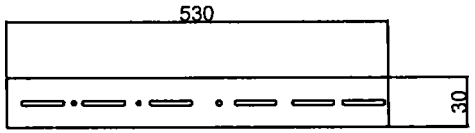
Note:
1.Tolerance: as per Dwg.No APMS/PPMC/D&S/18
2.All Dimension are in Millimeters.
3.Number of Louvers may be increased to comply with temperature rise test. However, it shall be fixed during prototype approval

Power Planning and Monitoring Company (PPMC)
DESIGN AND STANDARDS (D&S)

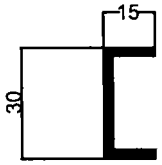
Drawn By:	Checked By:	Verified By:	Scale:	NTS
ENGR.AAMIR HAMZA ASST.SPECIALIST (D&S)	ZARYAB HASSAN SPECIALIST (D&S)	SAKHAWAT ALI TEAM LEAD (D&S)	Revision No:	0/0
			Date :	17/04/2026

PPMC

Product :	Asset Performance Management System For 200/250kVA,400/500kVA,630kVA Transformer
Drawing Title:	Air Vent
Reference :	PPMC-DS-01
Drawing No.	APMS/PPMC/D&S/ 09 OF 18



Channel for Meter Support.



Sectional View

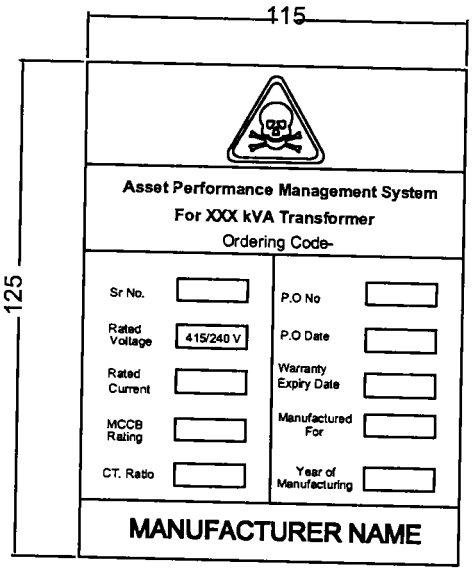
Note:
1.Tolerance: as per Dwg.No APMS/PPMC/D&S/18
2.All Dimension are in Millimeters.
3. Holes shall be made as per Requirement

Power Planning and Monitoring Company (PPMC)
DESIGN AND STANDARDS (D&S)

Drawn By:	Checked By:	Verified By:	Scale:	NTS
ENGR.AAMIR HAMZA ASST.SPECIALIST (D&S)	ZARYAB HASSAN SPECIALIST (D&S)	SAKHAWAT ALI TEAM LEAD (D&S)	Revision No:	0/0
			Date :	17/04/2026

PPMC

Product :	Asset Performance Management System For 25kVA,50kVA,100kVA,200/250kVA,400/500kVA and 630kVA Transformer
Drawing Title:	Meter Support Channel
Reference :	PPMC-DS-01
Drawing No.	APMS/PPMC/D&S/ 10 OF 18



Note:

Following Information Will Be In-Corporated In The Name Plate if There is Any Additional Requirement By The Customer (height maybe increased to 135 mm if needed :

1. Magnetic contactor Rating (A)
2. Manufacturer of OTL (for OTL ordering codes only)
3. Low Oil level and Normal Recovery Point (for OTL ordering codes only)

Note:

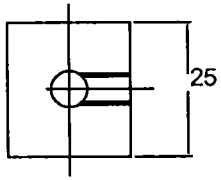
1. Tolerance: as per Dwg.No APMS/PPMC/D&S/18
2. All Dimension are in Millimeters.
3. Material: Non Magnetic SS-316 Sheet/ Aluminium Powder Coated Plate
4. Thickness 0.5mm

Power Planning and Monitoring Company (PPMC)
DESIGN AND STANDARDS (D&S)

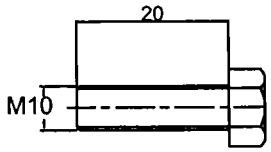
Drawn By:	Checked By:	Verified By:	Scale:	NTS
ENGR.AAMIR HAMZA ASST.SPECIALIST (D&S)	ZARYAB HASSAN SPECIALIST (D&S)	SAKHAWAT ALI TEAM LEAD (D&S)	Revision No:	0/0
			Date :	17/04/2026

PPMC

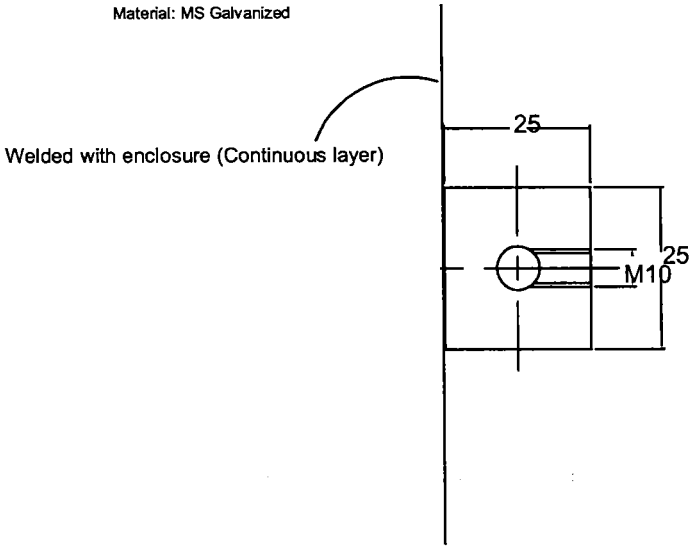
Product :	Asset Performance Management System For 25kVA,50kVA,100kVA,200/250kVA,400/500kVA and 630kVA Transformer
Drawing Title:	Rating Plate
Reference :	PPMC-DS-01
Drawing No.	APMS/PPMC/D&S/ 11 OF 18



Material: MS Galvanized



Material: MS
Finish: Galvanized



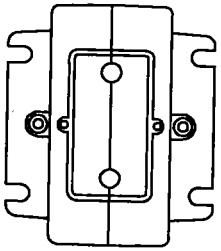
Note:
1.Tolerance: as per Dwg.No APMS/PPMC/D&S/18
2.All Dimension are in Millimeters.

Power Planning and Monitoring Company (PPMC)
DESIGN AND STANDARDS (D&S)

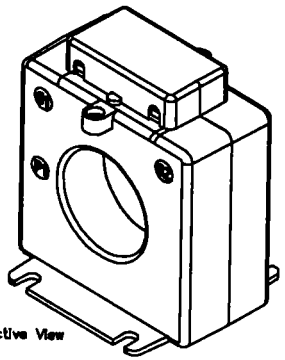
Drawn By:	Checked By:	Verified By:	Scale:	NTS
ENGR.AAMIR HAMZA ASST.SPECIALIST (D&S)	ZARYAB HASSAN SPECIALIST (D&S)	SAKHAWAT ALI TEAM LEAD (D&S)	Revision No:	0/0
			Date :	17/04/2026

PPMC

Product :	Asset Performance Management System For 25kVA,50kVA,100kVA,200/250kVA,400/500kVA and 630kVA Transformer
Drawing Title:	Earthing Terminal
Reference :	PPMC-DS-01
Drawing No.	APMS/PPMC/D&S/ 12 OF 18

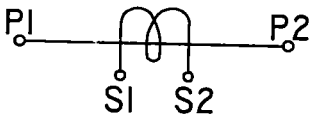


Top View



Perspective View

Terminal Markings



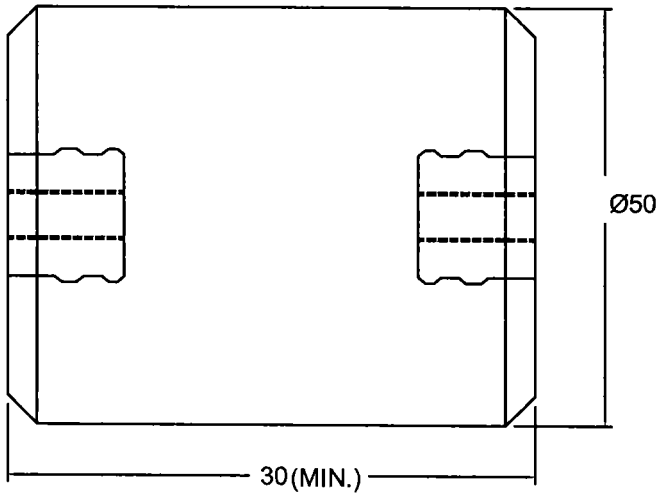
NOTE:

1. TERMINAL MARKINGS
   a. Primary P1,P2
   b. Secondary S1,S2
2. Dimensions shall be fixed according to the approved Prototype

Power Planning and Monitoring Company (PPMC) DESIGN AND STANDARDS (D&S)				
Drawn By:	Checked By:	Verified By:	Scale:	NTS
ENGR.AAMIR HAMZA ASST.SPECIALIST (D&S)	ZARYAB HASSAN SPECIALIST (D&S)	SAKHAWAT ALI TEAM LEAD (D&S)	Revision Nos:	0/0
			Date :	17/04/2026

PPMC

Product :	Asset Performance Management System For 25kVA,50kVA,100kVA,200/250kVA,400/500kVA and 630kVA Transformer
Drawing Title:	Current Transormer
Reference :	PPMC-DS-01
Drawing No.	APMS/PPMC/D&S/ 13 OF 18



Material: Bakelite/Polymer

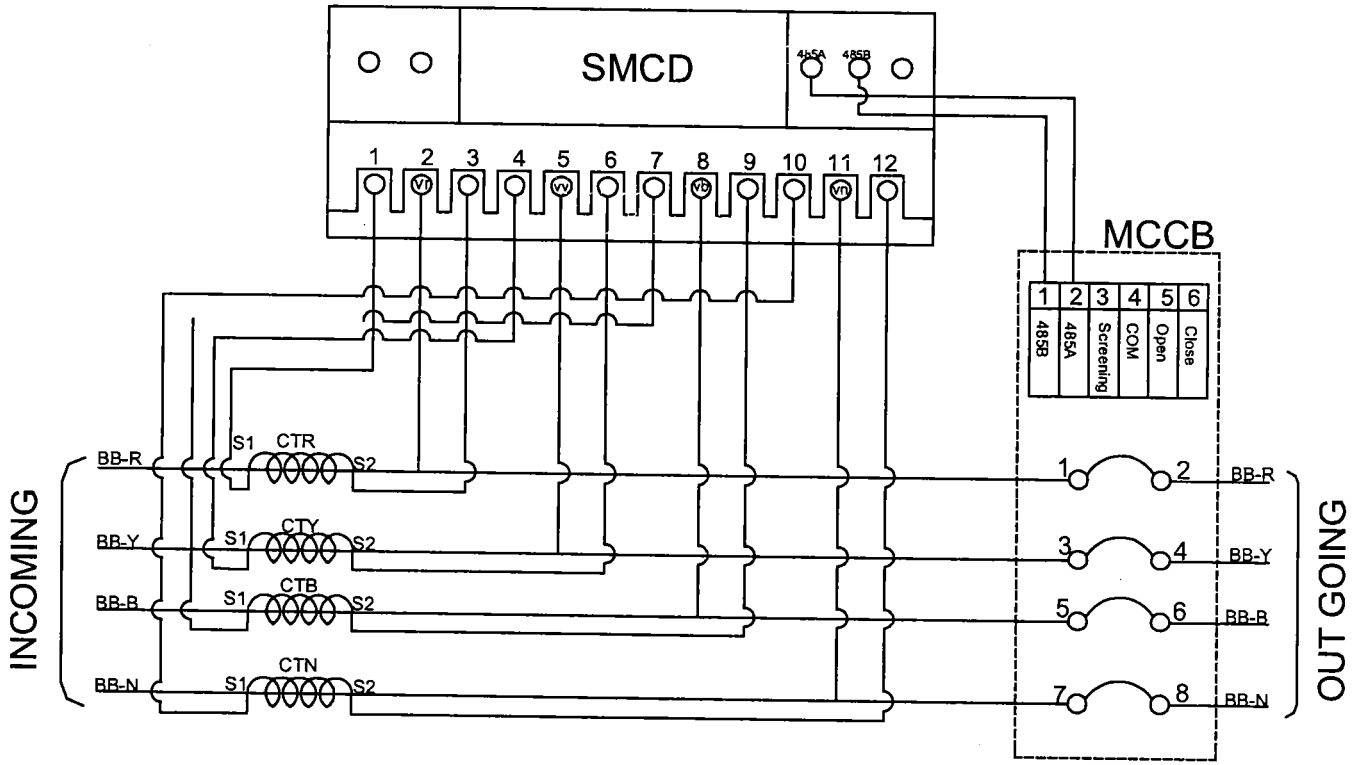
Note:
1.Tolerance: as per Dwg.No APMS/PPMC/D&S/18
2.All Dimension are in Millimeters.
3.Spacers maybe used by manufacture for Adjustment Purpose

Power Planning and Monitoring Company (PPMC)
DESIGN AND STANDARDS (D&S)

Drawn By:	Checked By:	Verified By:	Scale:	NTS
ENGR.AAMIR HAMZA ASST.SPECIALIST (D&S)	ZARYAB HASSAN SPECIALIST (D&S)	SAKHAWAT ALI TEAM LEAD (D&S)	Revision No:	0/0
			Date :	17/04/2026

PPMC

Product :	Asset Performance Management System For 25kVA,50kVA,100kVA,200/250kVA,400/500kVA and 630kVA Transformer
Drawing Title:	Insulator
Reference :	PPMC-DS-01
Drawing No.	APMS/PPMC/D&S/ 14 OF 18



Note:

Terminals are shown for Visualization purpose Only

Legends

01	BB-R	Busbar For Red Phase
02	BB-Y	Busbar For Yellow Phase
03	BB-B	Busbar For Blue Phase
04	BB-N	Busbar For Neutral(Black)
05	MCCB	Molded Case Circuit Breaker

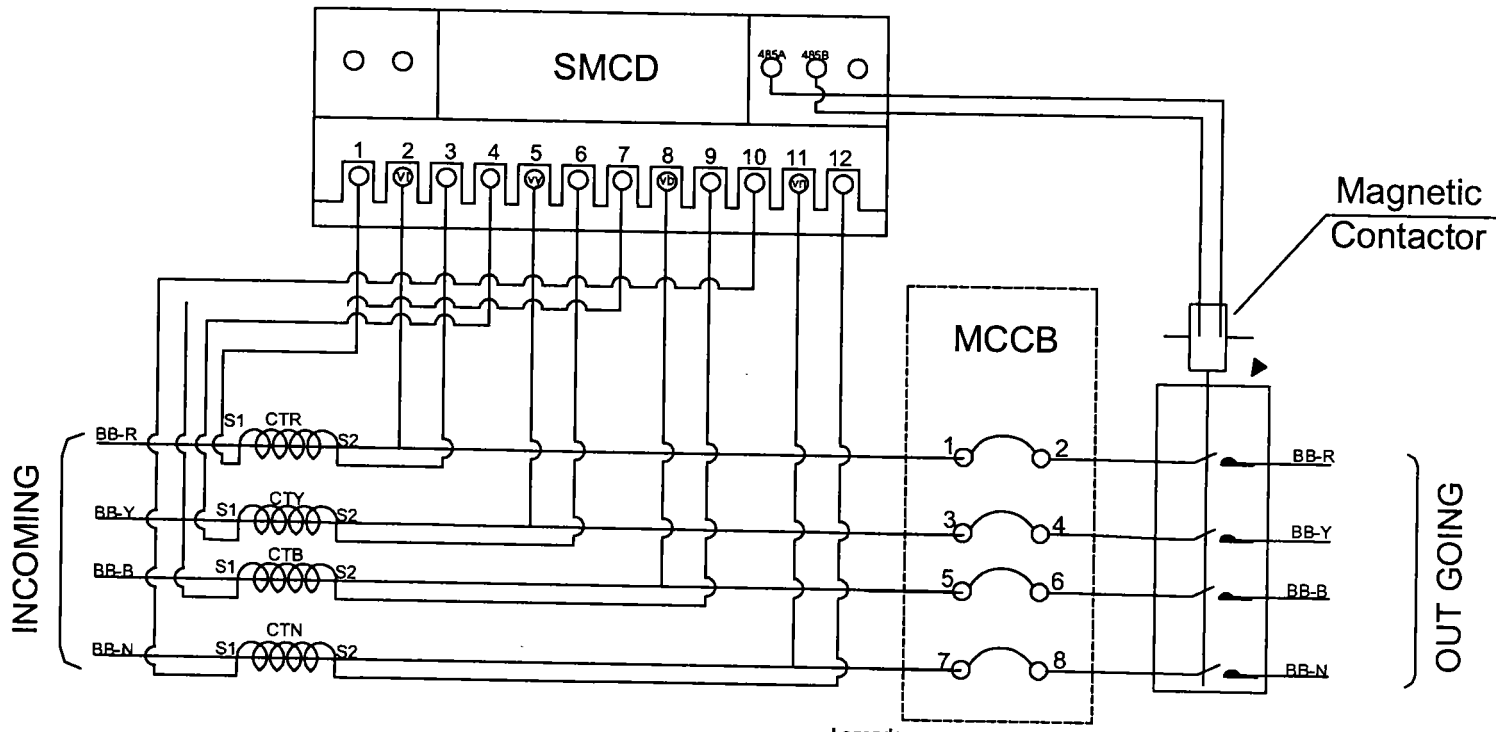
01	CTR	CT For Red Phase
02	CTY	CT For Yellow Phase
03	CTB	CT For Blue Phase
04	CTN	CT For Neutral(Black)
05	SMCD	Smart Metering and Controlling Device

Power Planning and Monitoring Company (PPMC)
DESIGN AND STANDARDS (D&S)

Drawn By:	Checked By:	Verified By:	Scale:	NTS
ENGR.AAMIR HAMZA ASST.SPECIALIST (D&S)	ZARYAB HASSAN SPECIALIST (D&S)	SAKHAWAT ALI TEAM LEAD (D&S)	Revision Nos:	0/0
			Date :	17/04/2026

PPMC

Product :	Asset Performance Management System For 25kVA,50kVA,100kVA,200/250kVA,400/500kVA and 630kVA Transformer
Drawing Title:	Circuit Diagram with Magnetic Contactor
Reference :	PPMC-DS-01
Drawing No.	APMS/PPMC/D&S/ 15 OF 18



Note:

Terminals are shown for Visualization purpose Only

Legends

01	BB-R	Busbar For Red Phase
02	BB-Y	Busbar For Yellow Phase
03	BB-B	Busbar For Blue Phase
04	BB-N	Busbar For Neutral(Black)
05	MCCB	Molded Case Circuit Breaker

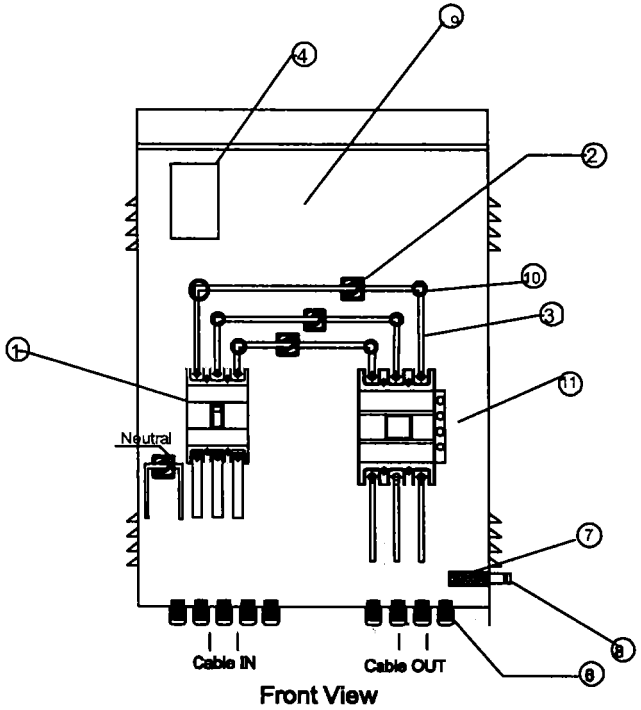
01	CTR	CT For Red Phase
02	CTY	CT For Yellow Phase
03	CTB	CT For Blue Phase
04	CTN	CT For Neutral(Black)
05	SMCD	Smart Metering and Controlling Device

Power Planning and Monitoring Company (PPMC)
DESIGN AND STANDARDS (D&S)

Drawn By:	Checked By:	Verified By:	Scale:	NTS
ENGR.AAMIR HAMZA ASST.SPECIALIST (D&S)	ZARYAB HASSAN SPECIALIST (D&S)	SAKHAWAT ALI TEAM LEAD (D&S)	Revision Nos:	0/0
			Date:	17/04/2026

PPMC

Product:	Asset Performance Management System For 25kVA, 50kVA, 100kVA, 200/250kVA, 400/500kVA and 630kVA Transformer
Drawing Title:	Circuit Diagram with Magnetic Contactor
Reference:	PPMC-DS-01
Drawing No.	APMS/PPMC/D&S/ 16 OF 18



LEGEND

1- MCCB
2- LT CTs
3- Copper Bus Bars
4- Smart Metering and Control Device
5- Channel for Meter Support
6- Cable Glands
7- Copper braided wire for door earthing
8- Earthing Terminal
9- Mounting Plate for Components
10- Busbar Support Insulators
11-Magenetic Contractor

Note:
1.Tolerance: as per Dwg.No APMS/PPMC/D&S/18

4. Detailed dimension and Holes Position shall be as per approved Prototype

Power Planning and Monitoring Company (PPMC)
DESIGN AND STANDARDS (D&S)

Drawn By:	Checked By:	Verified By:	Scale:	NTS
ENGR.AAMIR HAMZA ASST.SPECIALIST (D&S)	ZARYAB HASSAN SPECIALIST (D&S)	SAKHAWAT ALI TEAM LEAD (D&S)	Revision Nos:	0/0
			Date :	17/04/2026

PPMC

Product :	Asset Performance Management System For 25kVA,50kVA,100kVA,200/250kVA,400/500kVA 630kVATransformer
Drawing Title:	MAGNETIC CONTRACTOR ARRANGEMENT
Reference :	PPMC-DS-01
Drawing No.	APMS/PPMC/D&S/ 17 OF 18

Tolerance Sheet

Tolerance in Dimensions

DIMENSION RANGE	TOLERANCE
1.0mm To 10mm	±10.0%
11mm To 55mm	±5.0%
56mm To 75mm	±3.0%
76mm & Above	±2.0%

Power Planning and Monitoring Company (PPMC)
DESIGN AND STANDARDS (D&S)

Drawn By:	Checked By:	Verified By:	Scale:	NTS
ENGR.AAMIR HAMZA ASST.SPECIALIST (D&S)	ZARYAB HASSAN SPECIALIST (D&S)	SAKHAWAT ALI TEAM LEAD (D&S)	Revision Nos:	0/0
			Date:	17/04/2026

PPMC

Product:	Asset Performance Management System For 25kVA,50kVA,100kVA,200/250kVA,400/500kVA and 630kVA Transformer
Drawing Title:	Tolerance Sheet
Reference:	PPMC-DS-01
Drawing No.	APMS/PPMC/D&S/ 18 OF 18

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.

PRINTING HISTORY

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

TABLES

Table		Page
Table I	Percentage error limits with balanced loads (Active)	12
Table II	Percentage error limits for meter carrying a Single phase load (Active)	12
Table III	Percentage error limits with balanced loads (Reactive)	12
Table IV	Percentage error limits for meter carrying a Single phase load (Reactive)	13
Table V	Influence Quantities for Active Energy	13
Table VI	Influence Quantities for Reactive Energy	15

****

CONTENTS

	Section	Page
0.	Foreword	4
1.	Scope	4
2.	Reference Standards	4
3.	Definitions	5
4.	Performance Standards	8
5.	Mechanical Requirements	9
6.	Electrical Requirement	10
7.	Influence of Other Quantities	13
8.	Meter Characteristics	17
9.	Tests	19
10.	Name & Rating Plate	21
11.	Packing	21
12.	Sample	21
13.	Inspection	21
14.	Warranty	24
15.	Training	24
16.	Bid Data, Test Certificates, Drawings, Literature, Reference List & Manufacturing Experience.	24
17.	Annex – I (Reference Standards)	25
18.	Schedule of Technical Data	28
19.	Annex – II (Format of Software)	32

****

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 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:

- ASHFAQ AHMED
  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

Sr. No.	Description	Page No.
1-	Normal Mode	1
2.	Alternate Mode	2
3.	Programming Report	3
4.	Billing Report	4-5
5.	Security Report	6
6.	Event Log Report	7

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 Comulative 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	P.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	Intergration 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 (Current Reading)

Energy

1	Current Total kWh	0.00
2	Current kWh Rate-TI	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-TI	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	

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 day (Provision of 3120 Readings for two channel)

Date	Time (Hrs)	Data	
8/8/2006	12.30	kWh Reading	0.00
		Max Demand (kW)	0.00
-do-	1.00	kWh Reading	0.00
		Max Demand (kW)	0.00
-do-	1.30	kWh Reading	0.00
		Max Demand (kW)	0.00
-do-	2.00	kWh Reading	0.00
		Max Demand (kW)	0.00

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 Outages

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 Occurance		Event Recovery	
Date	**Time**	**Date**	**Time**

Event Log Report

Name of Event
Power Outages

Event Occurance		Event Recovery	
Date	Time	Date	Time

Event Log Report

Name of Event
Disconnection of Phases

Event Occurance		Event Recovery	
Date	Time	Date	Time

Event Log Report

Name of Event
Reverse Energy

Phase	Event Occurance Date	Event Occurance Time	Event Recovery Date	Event Recovery Time

Event Log Report

	Event Occurance		Event Recovery	
	Date	Time	Date	Time
Under Voltage				
Over Voltage				
Demand Overload				

Event Log Report

Name of Event
Reverse Polarity

Event Occurance		Event Recovery	
Date	Time	Date	Time

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

SPECIFICATION DDS-50:2007

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

AMENDMENT NO.2

DATED 14TH MAY, 2012

1. **Add new point in clause 7.2.1 as under:-**

   - Opening of meter after breaking the seals shall be detected and an indication (OPENED) shall be permanently displayed on the meter's LCD.

2. **Add new point in clause 7.2.2 as under:-**

   - An event with date and time stamp shall be stored in the memory at the occurrence of opening of meter.

3. **Add new point in clause 7.2.3 as under:-**

   - Opening of meter warning permanently on the LCD.

4. **Amend point 1 in clause 7.4 as under:-**

   - Min. Two Channel recording having sufficient capacity to record at least 90 days of Data of 30 minutes interval.

5. **Amend point 4 in clause 7.5 as under:-**

   - Without any Power the Back- Up battery shall maintain the time and calendar for a continuous period of at-least 24 months.

6. **Add new point in clause 7.5 as under:-**

   - Frequency tolerance of the timing source shall be equal to or less than ± 20 ppm at reference temperature.

(ASHFAQ AHMAD) DY. MANAGER (DE)	(DR. RANA ABDUL JABBAR KHAN) MANAGER (DE)	(ZUBAIR MALIK) CHIEF ENGINEER (D&S)

NATIONAL TRANSMISSION & DESPATCH COMPANY

CHIEF ENGINEER (STANDARDS & SPECIFICATIONS)

No. CE/S&S/NTDC/MTR/CRT-15/206-07 Date: 24/01/2025

M/s. Creative Electronics (Pvt.) Ltd.,
160/S, Quaid-e-Azam Industrial Estate,
Kot Lakhpat, Lahore.

Subject: **PROTOTYPE APPROVAL OF HT/ LT (CT&PT/ CT OPERATED) GSM/ GPRS/ 3G ENABLED STATIC ENERGY METER, KWH (CLASS 0.5S) & KVARH (CLASS 2.0), MODEL: P2000-T/C, TYPE: HLG3-R1 AS PER WAPDA/ PEPCO SPECIFICATIONS DDS-50:2007 AND DDS-98:2011 (AMENDED-TO-DATE).**

Ref:

i. Your Letter No. 786/CE/2024/358 Dated 29.08.2024.
ii. This Office Previous Approval Letter No. CE/S&S/NTDC/MTR/CRT/15/444-445 Dated 11.02.2022.
iii. This Office Letter No. CE/S&S/NTDC/MTR/CRT-15/26-27 Dated 03.01.2025.
iv. PCSIR Lab Lahore Letter No. EMTL/4481 Dated 14.01.2025.
v. SUPARCO EMC Test Report No. SRDC-L/BD-Div/2025/11 Dated 22.01.2025.

You have offered five (05) Nos. samples of **HT/ LT (CT&PT/ CT Operated) GSM/ GPRS/ 3G Enabled Static Energy Meter, KWH (Class 0.5S) & KVARH (Class 2.0), Model: P2000-T/C, Type: HLG3-R1** bearing Sr. No. 3299786713, 3299786714, 3299786715, 3299786716 & 3299786717 for prototype approval vide letter at ref. [i]. The offered prototype samples of subject energy meter have qualified all the specified tests performed at your works premises, SUPARCO Lab., Lahore and PCSIR Lab., Lahore as per WAPDA/ PEPCO Specifications DDS-50:2007, DDS-98:2011 (amended to date) and relevant IEC standards. Therefore, prototype approval is hereby accorded with the following conditions: -

- **THIS APPROVAL IS VALID FOR THREE (03) YEARS FROM THE DATE OF ISSUANCE OF THIS LETTER.**
- The previous prototype approval issued vide this office letter at ref. [ii] will be superseded by this approval.
- During mass production;
  - *i. Energy Meter's Sr. No. on its Security Box (at front and backside) shall be printed in bold, moreover Barcode printing space at its Name Plate/ Meter Base or as and when required by the purchaser shall be provided.*
  - *ii. You shall ensure the procurement of locally manufactured/ assembled Components/ Parts only from your approved vendor(s). The quality control of these Components/ Parts must be ensured in accordance with the approved design and standard procedures.*
  - *iii. You shall ensure the procurement of Imported Components/ Parts only from the same Origin, Type, Make and Manufacturer as per approved component list.*
- UDIL verification will be performed by PITC as per requirement of purchaser and in accordance with the relevant specifications
- In case of any defect or malfunctioning observed during field performance at any stage during mass production, this office shall review the prototype approval even during the currency of purchase order.
- In case of any change in Component or Design, Revision/ Amendment in the Specification or cancellation of pre-qualification & registration of the firm, fresh prototype approval will be required.
- This approval does not relieve you from the responsibility towards the quality and field performance of the product during mass production. The mass production shall conform to the quality of prototype approved samples. However, the purchaser has the right to confirm the quality through various tests as and when deemed necessary.

(ENGR. KHALID MEHMOOD)
Chief Engineer (S&S) NTDC

Enclosed:

a)- One Set of approved drawings.
b)- One sample energy meter bearing Sr. No. 3299786713.
c)- List of components with make & origin and Photographs (along with components in loose form).

CC to:

- Chief Engineer (Material Inspection) PPMC, WAPDA House, Lahore along with a Set of approved drawings, sample of energy meter bearing Sr. No. 3299786714 and list of components with make & origin and Photographs (along with components in loose form).
- Master file with sample energy meter bearing Sr. No. 3299786715 (along with components in loose form) will retain with this office.

SPECIFICATION DDS-50:2007 (AMENDED-TO-DATE)

3-PHASE MULTIRATE (TOD/TOU) SOLID-STATE ENERGY METERS

AMENDMENT NO.: 3 DATED: 22nd September, 2020.

REGARDING BI-DIRECTIONAL ENERGY METER GSM/GPRS (AMI BASED)

A normal 3-Phase, Multi-Rate (TOD/ TOU) Solid State energy meter, HT/ LT Type is capable of registering flow of electricity in both directions i.e. forward and reverse, may be used as bi-directional energy meter GSM/GPRS (AMI based) for net metering by adding separate registers for import and export of energy which is a preferable solution to overcome theft of energy.

i. *This amendment is applicable to Bi-Directional Smart Energy Meters for Net-Metering in co-ordination with specification DDS-98:2011 (Amended to Date) for Advanced Metering Infrastructure (AMI) and DDS-110:2012 (Amended to Date) for Meter Data Collection (MDC) server to be used in Advanced Metering Infrastructure (AMI) to monitor energy import / export with the real time.*

ii. *MDC server should be used for reading and displaying the import and export registers and also reverse energy alarms occurred during night time only.*

1- **ADD CLAUSE-7.8:**

Bi-Directional Energy Meters:

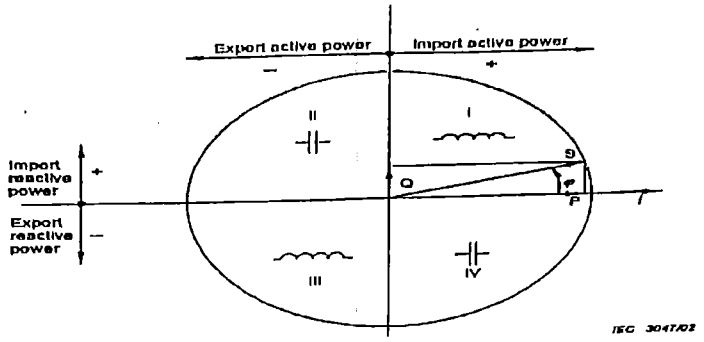
Energy Meter shall be capable of recording following energies.

- Min. Four TOD periods Energy Import (kWh+)
- Min. Four TOD periods Energy Export (kWh-)
- Min. Four TOD periods Energy Import (kVArh+)
- Min. Four TOD periods Energy Export (kVArh-)

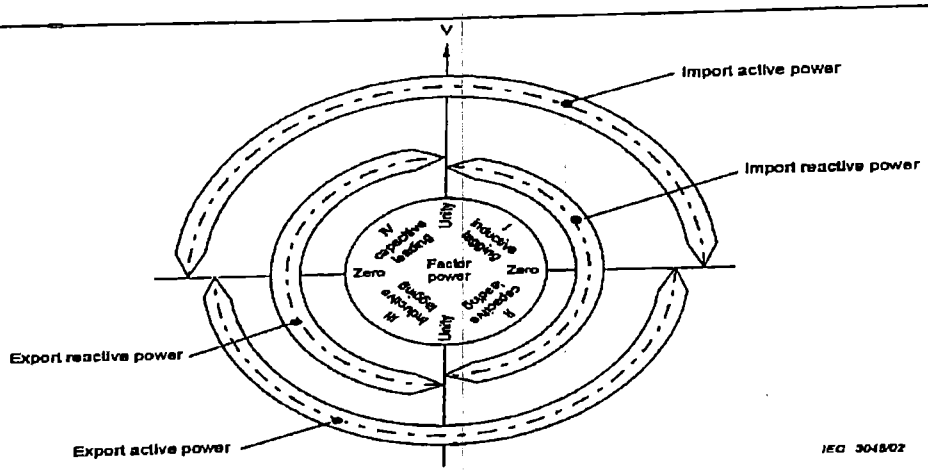
The four quadrants indicators shall display the Import (Forward Direction) and Export (Reverse Direction) of Energies.

2- **The Geometric representation of Active and Reactive Energies (Import and Export) shall be as per Annexure-C of IEC 62053-23.**

Geometric representation of active and reactive power



NOTE 1 Diagram in accordance with clauses 12 and 14 of IEC 60375.
NOTE 2 Reference of this diagram is the current vector (fixed on right-hand line).
NOTE 3 The voltage vector *V* varies its direction according to the phase angle φ.
NOTE 4 The phase angle φ between voltage *V* and current *I* is taken to be positive in the mathematical sense (counter clockwise).



NOTE 1 If the upright line is taken as the voltage vector and a line is drawn to represent the current vector of a single-phase or a balanced three-phase system, this current vector will indicate the condition of the other quantities.
NOTE 2 Reference of this diagram is the voltage vector *V* (fixed on upright line).
NOTE 3 The current vector *I* varies its direction according to the phase angle φ.
NOTE 4 The phase angle φ between current *I* and voltage *V* is taken to be positive in the clockwise direction.

3- **ADD CLAUSE-9.2:**

Colour of the Name Plate and printing of important information regarding Bi-Directional Energy Meter:

i)- The colour of Name Plate shall be as per RAL-6037 (Pure Green).

ii)- The text "BI-DIRECTIONAL/ GREEN METERING", "IMPORT AND EXPORT" with Rightward (→) and Leftward (←) arrows respectively, shall be printed on name plate.

4- **ADDITION OF ACCURACY CLASSES AS PER IEC 62053-22 AND IEC 62053-23:**

The accuracy classes mentioned in clause-1.2 (a) and (b) of Wapda Specification DDS-50: 2007 (amended to-date) are amended as 0.5S for kwh and 1.0 for kvarh and applicable to BI-DIRECTIONAL Energy Meters only.

The tests mentioned in clauses 6.4 and 6.5 of Wapda Specification DDS-50: 2007 (amended to-date) shall be carried out according to IEC 62053-22 and IEC 62053-23 for newly added accuracy class.

5- **SHIFTING OF DISPLAY QUANTITIES FROM "ALTERNATE MODE" TO "NORMAL MODE" FOR NORMAL STATIC LT/ HT (TOD/ TOU) ENERGY METERS:**

The display quantities i.e. Average Power Factor of current month for rate A and Rate B for Import and Export, Voltage and Current of all phases has been deleted from ALTERNATE MODE and added in NORMAL MODE as per DISCOs recommendation. The remaining Sequence/ Sr. Nos. of the display quantities in ALTERNATE MODE shall be changed/ revised accordingly.

NORMAL MODE DISPLAY ITEMS (BI-DIRECTIONAL)						
Description (Not Displayed on LCD)		Description (Displayed on LCD)				
Items	OBIS Code	Window Number	Nos. of Digits after Decimal	Scalar	Unit	Symbol
All segment on	-	1	-	-	-	-
Date	1-0:0.9.2*255	2	-	-	-	-
Time	1-0:0.9.1*255	3	-	-	-	-
kWh Import (Total)	1-0:1.8.0*255	4	2	k	Wh	→
kWh Export (Total)	1-0:2.8.0*255	5	2	k	Wh	←
kWh Import (Rate A)	1-0:1.8.1*255	6	2	k	Wh	→
kWh Export (Rate A)	1-0:2.8.1*255	7	2	k	Wh	←
kWh Import (Rate B)	1-0:1.8.2*255	8	2	k	Wh	→
kWh Export (Rate B)	1-0:2.8.2*255	9	2	k	Wh	←
kVArh Import (Total)	1-0:3.8.0*255	10	2	k	VArh	→
kVArh Export (Total)	1-0:4.8.0*255	11	2	k	VArh	←
kVArh Import (Rate A)	1-0:3.8.1*255	12	2	k	VArh	→
kVArh Export (Rate A)	1-0:4.8.1*255	13	2	k	VArh	←
kVArh Import (Rate B)	1-0:3.8.2*255	14	2	k	VArh	→
kVArh Export (Rate B)	1-0:4.8.2*255	15	2	k	VArh	←
Max. kW Import	1-0:1.6.0*255	16	3	k	W	→
Max. kW Export	1-0:2.6.0*255	17	3	k	W	←
Max. kW Import (Rate A)	1-0:1.6.1*255	18	3	k	W	→
Max. kW Export (Rate A)	1-0:2.6.1*255	19	3	k	W	←
Max. kW Import (Rate B)	1-0:1.6.2*255	20	3	k	W	→
Max. kW Export (Rate B)	1-0:2.6.2*255	21	3	k	W	←
kW CUM Import	1-0:1.2.0*255	22	3	k	W	→
kW CUM Export	1-0:2.2.0*255	23	3	k	W	←
kW CUM Import (Rate A)	1-0:1.2.1*255	24	3	k	W	→
kW CUM Export (Rate A)	1-0:2.2.1*255	25	3	k	W	←
kW CUM Import (Rate B)	1-0:1.2.2*255	26	3	k	W	→
kW CUM Export (Rate B)	1-0:2.2.2*255	27	3	k	W	←
No. of Resets	1-0:0.1.0*255	28	0	-	-	-
Instantaneous Power Import	1-0:1.7.0*255	29	2	k	W	→
Instantaneous Power Export	1-0:2.7.0*255	30	2	k	W	←
Average Power Factor	1-0:13.0.0*255	31	2	-	-	→

Current Month Import						
Average Power Factor Current Month Export	1-0:84.0.0*255	32	2	-	-	←
Average Power Factor Current Month Import (Rate A)	1-0:13.0.1*255	33	2	-	-	→
Average Power Factor Current Month Export (Rate A)	1-0:84.0.1*255	34	2	-	-	←
Average Power Factor Current Month Import (Rate B)	1-0:13.0.2*255	35	2	-	-	→
Average Power Factor Current Month Export (Rate B)	1-0:84.0.2*255	36	2	-	-	←
Voltage Phase A	1-0:32.7.0*255	37	2	-	V	-
Voltage Phase B	1-0:52.7.0*255	38	2	-	V	-
Voltage Phase C	1-0:72.7.0*255	39	2	-	V	-
Current Phase A	1-0:31.7.0*255	40	2	-	A	→ ←
Current Phase B	1-0:51.7.0*255	41	2	-	A	→ ←
Current Phase C	1-0:71.7.0*255	42	2	-	A	→ ←

ALTERNATE MODE DISPLAY ITEMS (BI-DIRECTIONAL)

Description (Not Displayed on LCD)		Description (Displayed on LCD)				
Items	OBIS Code	Window Number	Nos. of Digits after Decimal	Scalar	Unit	Symbol
Meter ID	0-0:96.1.0*255	1	-			-
Previous Interval Demand Import	1-0:1.4.0*255	2	3	k	W	→
Previous Interval Demand Export	1-0:2.4.0*255	3	3	k	W	←
Time Left Interval	1-0:129.0.2*255	4	-	-	-	-
Last Month kWh Import (Total)	1-0:1.8.0*101	5	2	k	Wh	→
Last Month kWh Export (Total)	1-0:2.8.0*101	6	2	k	Wh	←
Last Month kWh Import Rate A	1-0:1.8.1*101	7	2	k	Wh	→
Last Month kWh Export Rate A	1-0:2.8.1*101	8	2	k	Wh	←
Last Month kWh Import Rate B	1-0:1.8.2*101	9	2	k	Wh	→
Last Month kWh Export Rate B	1-0:2.8.2*101	10	2	k	Wh	←
Last Month kVArh Import (Total)	1-0:3.8.0*101	11	2	k	VArh	→
Last Month kVArh Export (Total)	1-0:4.8.0*101	12	2	k	VArh	←
Last Month kVArh Import Rate A	1-0:3.8.1*101	13	2	k	VArh	→
Last Month kVArh Export Rate A	1-0:4.8.1*101	14	2	k	VArh	←
Last Month kVArh Import Rate B	1-0:3.8.2*101	15	2	k	VArh	→
Last Month kVArh Export Rate B	1-0:4.8.2*101	16	2	k	VArh	←
Last Month KW Import	1-0:1.6.0*101	17	3	k	W	→
Last Month KW Export	1-0:2.6.0*101	18	3	k	W	←
Last Month KW Import Rate A	1-0:1.6.1*101	19	3	k	W	→
Last Month KW Export Rate A	1-0:2.6.1*101	20	3	k	W	←
Last Month KW Import Rate B	1-0:1.6.2*101	21	3	k	W	→
Last Month KW Export Rate B	1-0:2.6.2*101	22	3	k	W	←
Cumulative KW Import (Total)	1-0:1.2.0*255	23	3	k	W	→
Cumulative KW Export (Total)	1-0:2.2.0*255	24	3	k	W	←
Cumulative KW Import Rate A	1-0:1.2.1*255	25	3	k	W	→
Cumulative KW Export Rate A	1-0:2.2.1*255	26	3	k	W	←
Cumulative KW Import Rate B	1-0:1.2.2*255	27	3	k	W	→
Cumulative KW Export Rate B	1-0:2.2.2*255	28	3	k	W	←
Last Reset Date	1-0:0.1.2*101	29	-	-	-	-
Last Reset Time	1-0:0.1.2*101	30	-	-	-	-

NOTE:

i. *DISCO's metering committee will secure these bi-directional Energy Meters by sealing properly after making necessary connections.*

ii. *DISCO will ensure installation of these Energy Meters for recording import and export of energy.*

Prepared By:

Engr. Tanveer Ahmad **Assistant Manager (D.E)**	Engr. Imran Majeed **Deputy Manager (D.P)**	Engr. Shoaib Khan **Deputy Manager (D&S)**

Checked By:

Engr. Amjad Ali **Addl. Chief Engineer(D&S)**	Engr. M. Afzal Moghal **Addl. Chief Engineer (D.E)**	Engr. Lubna Kausar **Addl. Chief Engineer (D.P)**

Approved By:

Engr. M. Bakhsh Mahaar **Chief Engineer (S&S)** **NTDC** **Secretary SRC**	Engr. Taqi ud Din **Chief Engineer (P&C)** **NTDC** **Member SRC**	Engr. Farooq Rashid **Chief Engineer (C&M)** **NTDC** **Member SRC**
Engr. Javaid Mahmood **General Manager** **(Asset Management) North, NTDC** **Member SRC**	Engr. Tahir Mehmood **General Manager** **(Design & Engineering) NTDC** **Convener SRC**	

PAKISTAN ELECTRIC POWER COMPANY
(PEPCO)

SPECIFICATION DDS-98:2011

SPECIFICATION FOR ADVANCED METERING INFRASTRUCTURE (AMI)

SERVICES DIVISION (NTDC) DESIGN & STANDARDS DEPARTMENT

CamScanner

Sr. No.	Description	Page
	Title page	
	Index of page	
0	Foreward	1
1	Scope	1
2	Definitions	1
3	Network Architecture	2
4	RTU Specification	2
5	GSM/GPRS Modem/Module Specification	2-3
6	Relay/Contactor Specification	3
7	AMR Server/Host Software	3
8	DCU Specification	4
9	Testing SOP	4
10	Sample	4
11	Prototype	4
12	Testing and Inspection	4
13	Annex-I Network Diagram	5
14	Annex-II DCU Specification	6-7
15	Annex-III Testing SOP	8-13

CamS

SPECIFICATION FOR ADVANCED METERING INFRASTRUCTURE (AMI)

0.0 FOREWARD:

0.1 This standard specification has been prepared by the Engineering Directorate of Chief Engineer (D&S).

0.2 This specification is intended for procurement of material and not for contract.

0.3 This specification is subject to revision as and when required.

1.0 SCOPE:

1.1 This specification has been prepared for the introduction of GSM/GPRS enabled energy meters and GSM/GPRS Modem/Module as integral part of meters of specifications DDS-50, DDS-60 and DDS-65 that should be used in DISCOs for AMI system.

1.2 This specification covers the aspects of GSM/GPRS communication between AMR enabled meters and AMR server using SMS and GPRS technology.

2.0 DEFINITIONS:

2.1 **Manufacturer Identifier:** The unique numeric identification of each meter manufacturer.

2.2 **Meter Type:** Each separate meter product of the meter manufacturer is identified using Meter Type.

2.3 **Payload:** Metering data GSM communication is composed within the structure called Payload.

2.4 **SMS:** Short Message Service is a communication service standardized in the GSM mobile communication system.

2.5 **GPRS:** General Packet Radio Service is a packet oriented mobile data service available to users of the cellular communication systems Global System for Mobile Communication (GSM).

2.6 **RTU:** Remote Terminal Unit is a device, which interfaces telemetering data of objects in the physical world to central server.

2.7 **DCU:** Data Concentrator Unit is a device used to Communicate between RTU and AMI server.

CamScanner

3.0 NETWORK ARCHITECTURE:

Proposed Network Diagram is given in Annexure –I

4.0 RTU (Remote Terminal Unit):

4.1 Meters:

4.1.1 Meters to be supplied by the vendors should comply with the respectiveWAPDA standards viz. DDS-50:2007, DDS-60:2007 and DDS-65:2003 (amended to date).

4.1.2 Meters should have built-in communication device i.e. GSM/GPRS Modem/Module for direct communication to server over SMS and GPRS.

4.1.3 Meters should be capable of generating the query response originated by the host system/sever.

4.1.4 Meters should be capable of sending data to the host system at a preprogrammed interval and two (2) IP addresses should be programmed in the GSM/GPRS module and three (3) number of SIMS (GSM subscriber) should be programmed for communication with the meter and metercan only be communicated to through these SIMS for downloading data.

4.1.5 Meter should send data to the host system with time and date stamp when alerts/events generated inside the meter including the CT fail or CT bypass.

4.1.6 Meter time should be synchronized to Host Server from time to time automatically.

4.1.7 The meter should be multivendor compliant and the protocols to be used for communication following international standards DLMS/COSEM.

4.1.8 Load profile and Event Data should be in the format as defined in the meter reporting software of relevant specifications.

4.1.9 Load limit device (Relay/Contactor) may be provided as per demand in the meters to operate from server automatically if load exceeds than the predefined load limit.

5.0 GSM/GPRS MODEM/MODULE:

5.1 The GSM/GPRS Modem and antenna shall be integral part of the meter.

5.2 Quad-Band GSM/GPRS 850/900/1800/1900MHz.

5.3 Compliant to GSM phase 2/2+

Class 4 (2W @ 850/900MHz)

Class 1(1W @ 1800/1900MHz)

5.4 The Modem shall have the capability for SMS and GPRS communication.

5.5 The modem shall have single LED in the front, which should be visible from the distance.

5.6 The LED shall indicate the operational status of the modem like:

i) Fast blinking LED indicates absence of SIM card or no network service or insufficient signal strength.

ii) OFF LED indicates modem is not working.

iii) Slow blinking LED indicates healthiness of the modem and is registered to the GSM network.

iv) Data communication indication should be provided on LCD.

5.7 SIM card shall be field replaceable.

6.0 RELAY/CONTACTOR SPECIFICATION:

6.1 Relay/Contactor must have the capability to connect and disconnect the consumer output for each phase in case of over loading and non payment.

6.2 Relay/Contactor should be able to reconnect after preprogrammed time interval and keep connected within preprogrammed threshold otherwise disconnected.

6.3 Consumer load threshold for disconnection and number of retries should be programmable.

6.4 Relay/Contactor should be operated remotely form server.

7.0 AMR SERVER/ HOST SOFTWARE:

7.1 AMR Server/Host Software must be DLMS/COSEM compliant and the host software should be capable to provide all metering data mentioned in meter reporting software in relevant WAPDA/PEPCO specifications.

7.2 The host software shall provide GUI (Graphical User Interface) for users to initiate data queries and receive responses.

7.3 The host software must have capabilities to store and report all metering data in a database management system as required in the relevant meter specifications reporting software like billing data, event data, load profiles etc.

7.4 The database shall have redundant hard drives and there should be at least one mirroring server.

7.5 The database server should have backup interface for CD/DVD.

7.6 The billing interface will generate billing data to be used in DISCO's customer information and billing system in the form ofcsv format.

8.0 DCU Specification:

DCU Specification is given in Annexure-II

9.0 TESTING SOP:

Testing Method of GSM/GPRS enabled meters is given in Annexure-III.

10.0 SAMPLE:

The sample requirement is as per relevant meter specifications.

11.0PROTOTYPE:

The prototype requirement is as per relevant meter specifications.

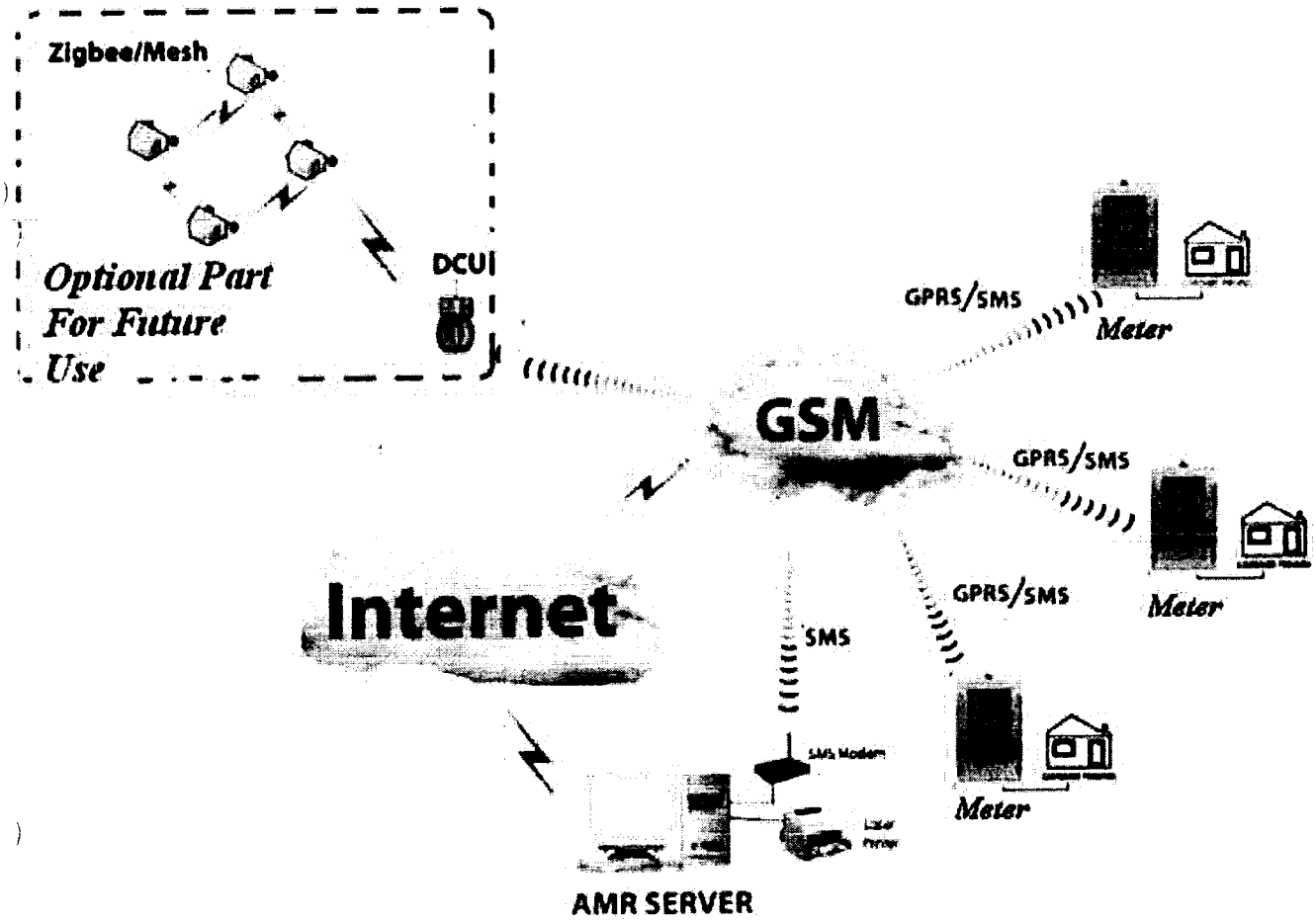
12.0TESTING AND INSPECTION:

Inspection requirement is as per relevant meter specifications in addition to verification of GSM/GPRS features.

(ASHFAQ AHMAD) **DY: MANAGER (DISTT. ENGG.)**	**(DR. RANA ABULD JABBAR KHAN)** **MANAGER (DISTT. ENGG.)**	**(INAYAT HUSSAIN)** **CHIEF ENGINEER (D&S)**

Annex-I

Network Architecture



Annex-II
DCU Specifciations

Data Gateway for LAN/WAN Enabled Meters

Data Gateway shall act as a gateway/bridge between the WAN connected host software and LAN connected meters.

Data Gateway shall communicate with WAN connected host software using GSM/GPRS.

Data Gateway shall communicate with LAN connected meters using either RF433MHz or ZigBee protocol.

SIM Card for GSM/GPRS shall be field replaceable.

Date Gateway shall have minimum capacity to handle 100 nodes.

Data Gateway shall have the required capability of storing relevant LAN and WAN addresses.

Data Gateway shall have following I/O ports:

RS 485/RS 232/USB port for configuration of Data Gateway

Communication Interfaces:

GSM/GPRS Module for WAN

RF 433MHz for LAN

Operating Frequency: 433 MHz

Data Rate: 4.8Kbps

Modulation Technique: FSK

RSSI: Better than or equal to -100dBm

ZigBee for LAN:

Operating Frequency: ISM 2.4 GHz

Network Technology: Mesh

Technical characteristics of DCU shall be as under:

Power Supply:

3 Phase 4 wire 3x230/400VAC at 50Hz should also be operational on 2 wire.

IP Code (Environmental Protection):

Protection against penetration of dust & water: IP54

Operating Temperature:

-25°C to + 60°C

Status Indicators:

Power: Indicates the availability of power to the DCU.

WAN: Indicates communication status with the host software.

LAN: Indicates communication status with the meter.

Annex-III

SOP

FOR

TESTING OF GPRS/GSM ENABLED ENERGY METERS

Additional Tests & Limits of Testing for GPRS/GSM Enabled Meters

GPRS Enabled Meters are generally consideredas Electronic Meters with the additional functionality for remote communication in GSM/GPRS mode. There exist certain conditions in which the normal test procedure or limits already specified for metering need to bereviewed keeping in view the requirements of GSM/GPRS system.

This document addresses only the additional requirements for ensuring successful meter operation with GSM/GPRS module during communications.

1. Power Requirement.(IEC 62053-61 Clause 4.3)

The specification of general electronic Meter addresses the Power Requirements of non-multi-functional and non-multi-energy Electronic Meters. But the GPRS/GSM modules attached in a GPRS/GSM enabled meters do have certain Power Requirements.

These requirements are properly addressed in IEC 62053-61. The user and manufacturer should consider that first of all, the meter is multi-energy as well as multi-functional. Alsoit has a Communication Device installed within the meter deriving energy from the Main's Power Supply.

The Power Loss of GPRS/GSM Enabled Meter may increase due to additional Load of' GPRS/GSM Module in normal operating conditions and the VA burden may increase also. During Transmission/Reception of GPRS/GSM Data the power requirements increase. The total power loss should not exceed the values given in IEC 62053-61.

2. Low Voltage Application.

The Specification of general electronic meters also addresses the Voltage Limit Range of Operation as well as Specified Range of Operation. In case of GPRS/GSM Enabled Meters, this limit is also applicable.

3. Test including Testing at Different Frequencies other than Line Frequency(CISPR 22 Clause 3.1)

The normal electronic meters are tested for its Immunity to EMC and for EMC Emission (both radiated and conducted). This testing cannot hold true for GPRS/GSM enabled meters because the GPRS/GSM enabled meters itself are Radiating Devices.

CISPR 22 which is the standard for Testing of Emissions clearly states that the ITEs (Information Technology Equipment) that have their own radiating devices built in are out of scope of this standard and therefore, National Radio Regulations have to be applied. Electricity Meters are not covered under the Pakistan Telecommunication Authority (PTA) regulations. Therefore, an FCC, USA/EuropeanDirectives approval, certification, and test reports for the GSM/GPRS modules should be provided.

4. Extended Temperature Range

The meter shall fulfill the requirements set forth in the WAPDA specifications except for the test, for successful communication which shall be conducted within temperature range of -25 °C to +70 °C.

5. EMC Requirements (IEC 62052-11)

All the EMC requirements and conditions specified and applicable on the normal Electronic Meter should also be applicable to the GPRS/GSM Enabled Meters accordingly.

6. All other Electrical Requirements (IEC 62053-21)

All other electrical requirements and conditions specified and applicable on the normal Electronic Meter shall also apply to the GPRS/GSM enabled meters accordingly.

Testing of GPRS/GSM Enabled Meters.

The Type-Tests performed on the meter generally fall in three categories.

1. The tests during which the meter is not energized:
2. The tests during which the meter is energized but accuracy is not taken.
3. The tests during which the meter is energized and accuracy is taken. Methods for testing the GPRS/GSM Capability of the Meter in each category is defined as under: -

Category 1

Tests during which meter is not energized.

Testing Methodology

The Type Tests in which meter is not energized, the meter should be checked for communication before and after application of tests. This isto ensure that the communication System of the meter is not effected by the application of test.

Application Methodology

To execute this scheme, meter should be energized before application of the test and its communication is checked. Then the meter is de-energized and the required test is performed. After application of test and its success, the meter is again energized and its communication is verified.

Interpretation of Results

When the communication is confirmed, the meter is considered to be accepted.

List ofTests Under Category 1

Sr. No.	Test Name	Specification
	Tests Insulation Properties	**As per Relevant Specifications**
1	Impulse Voltage test for circuits and between circuits.	
2	AC Voltage Test (4kV)	
3	Insulation Resistance Test	
	Tests of the effect of the climatic	
4	Dry Heat Test	
5	Dry Test	
6	Solar Radiation Test	
	Mechanical Tests	
7	Spring Hammer Test	
8	Shock test	
9	Vibration Test	
10	Test of Penetration of Dust Particles	
11	Test of Penetration of Water	

Category 2

Tests during which Meter is Energized but Accuracy is not Taken.

Testing Methodology

This category addresses the Type Tests in which meter is energized with the voltage applied at the meter terminals and with or without current flowing through the meter but accuracy is not observed.

The meter undergoing the tests under this category should be checked for successful communication during application of the specified test. It should also comply with the test conditions and should not affect the result. This is to ensure that the communication of the meter is not affecting the meter in particular test conditions.

In cases where Temporary Loss of Function of meter is allowed, the same is applicable to the communication enabled meter. Example of such test is the Electrostatic Discharge Test.

Application Methodology

To execute this scheme, meter should be energized according to the test specification. The communication with the meter is performed during the application of Test conditions.

The meter communication shall be checked before and after application of the test conditions.

Interpretation of Results

If the meter communicates properly and the test results remain within the permissible limits during this communication then the meter is considered to comply with the test standard.

List of Tests Under Category 2

Sr.#	Test Name	Specification
	Test of Accuracy requirement	**As per Relevant Specifications**
1	Test of no-load condition	
2	Test of Starting. Current	
	Tests of Electrical requirements	
3	Test of Power Consumption of Voltage Circuit	
4	Test of Power Consumption of Current Circuit	
5	Test of Effect of Voltage Dips & short interruption)	
6	Test of Influence of Short Time Over Current	
7	Test of Temperature Rise of Terminals	
8	Immunity to Earth Fault	
	Tests of Electromagnetic Compatibility (EMC)	
9	Test of Immunity to Electrostatic Discharges	
	Tests of the effect of the climatic environments	
10	Damp Heat Cycle Test	
	Miscellaneous Requirements	
11	Voltage Limit Range of Operation	
12	Test of meter Operation / Recording	

Category 3

Tests during which meter is energized & accuracy is also taken.

Testing Methodology

This category addresses the Type Tests in which meter is energized with the voltage applied at the meter terminals as well as current flowing through the Meter to test the operation and accuracy of the meter under application of test conditions.

The meter undergoing the tests under this category should be checked for successful communication during application of the specified test. It should also comply with the test conditions and should not affect the accuracy results except within the permissible tolerance.

Application Methodology

To execute this scheme, meter should be energized according to the test specification. The communication with the meter is performed during the application of Test condition. Whenever possible, the meter shall be checked for communication during the test condition; otherwise it shall be checked before and after the test condition is applied.

Interpretation of Results

If the meter communicates properly and the accuracy results remain with in the permissible limits during, before, and after (as applicable) then the meter is considered to comply with the test standard.

List of Tests Under Category 3

Sr.#	Test Name	Specification
	Test of Accuracy requirement	**As per Relevant Specifications**
1	Test of Accuracy	
2	Test of Meter Constant	
	Tests of Influence quantities	
3	Voltage Variation	
4	Frequency Variation	
5	Reverse Phase Sequence	
6	Voltage Unbalance	
7	Harmonic Content in current & voltage circuit	
8	Odd Harmonics in the current circuit	
9	Sub Harmonics in the AC Current	
10	Continuous magnetic induction of external origin	
11	Magnetic induction of external origin 0.5mT	
12	Influence of Radar Magnet (0.5 Tesla)	
13	Test of Ambient Temperature influence	
14	Test of Temp at Extreme Condition (-25^0C to $+70^0$C)	
	Tests of Electromagnetic Compatibility (EMC)	
15	Fast Transient Burst Test	
16	Surge Immunity Test	
17	Test of Immunity to Electromagnetic RF Fields (Conducted Disturbance)	
18	Damp Oscillatory Waves Immunity Test	

SPECIFICATION NO. DDS-98:2011

SPECIFICATION FOR

ADVANCE METERING INFRASTRUCTURE (AMI)

AMENDMENT NO. 1

DATED 9TH JULY, 2012

1. Amend clause 6.1 as under:-

   Relay/Contractor must have the capability of connect and disconnect the consumer output phase lines simultaneously in case of over loading and non payment.

2. Amend class 7.1 as under:

   Refer to DDS-110:2012 MDC specification.

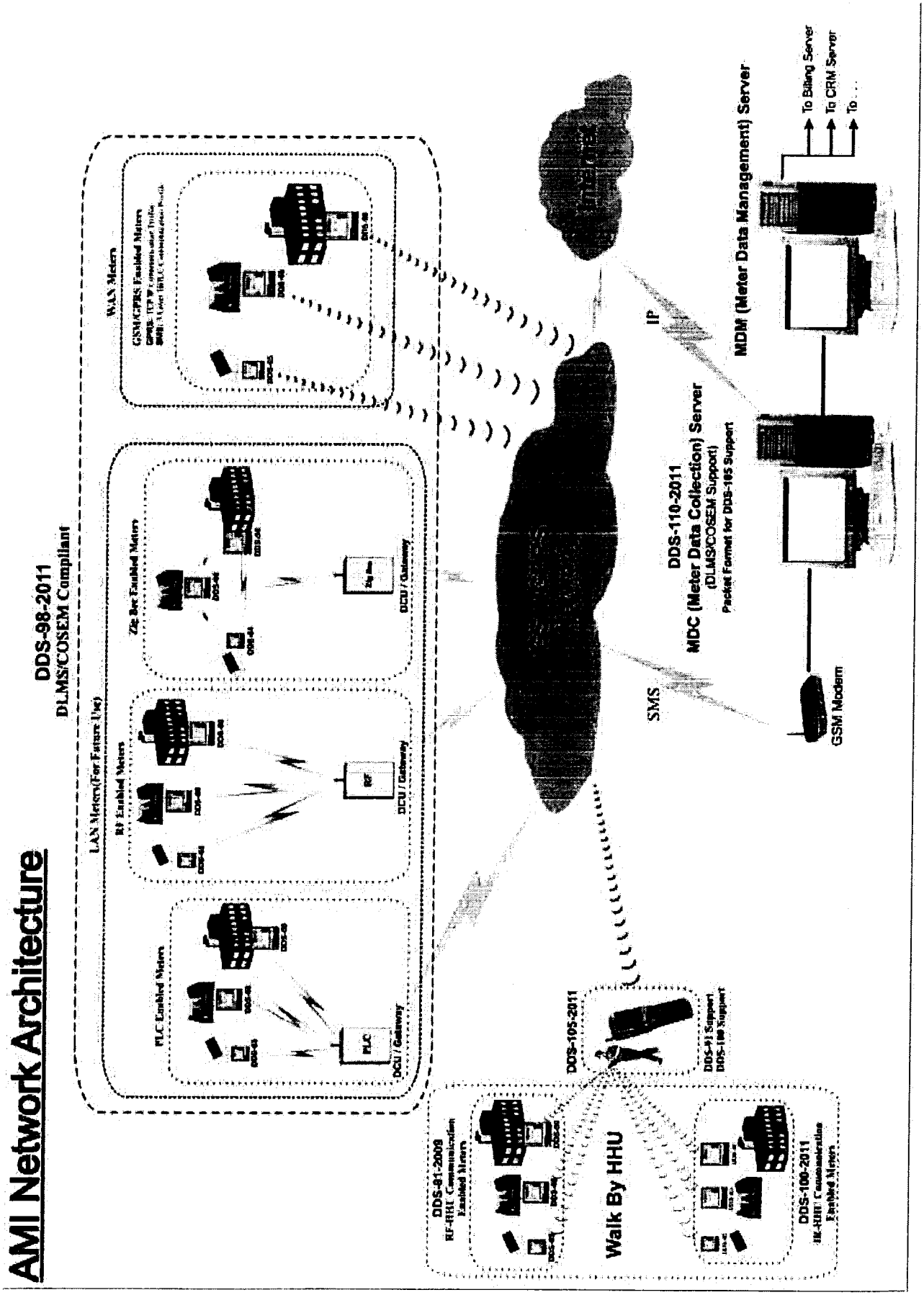
3. Amend clause 7.4 as under:

   Refer to DDS-110:2012 MDC specification

   Replace Annexure-I with AMI Network Architecture (Attached).

SD	SD	SD
(ASHFAQ AHMAD D.M (D.E)	(DR. RANA ABDUL JABBAR KHAN MANAGER (D.E)	(ZUBAIR MALIK) C.E(D&S)

0.0 AMI NETWORK ARCHITECTURE



NATIONAL TRANSMISSION & DESPATCH COMPANY
Office of Chief Engineer (Design & Standards) NTDC
48- L, Model Town Extension, Lahore.
Ph No.042/99230024, Fax No.99230025
Email: cedengg@yahoo.com.

No. 1562-20/CEDS/X-262- Dated: 16-03-2011

All Chief Executive Officers,
DISCOs.

Subject: **SPECIFICATION OF ADVANCED METERING INFRASTRUCTURE (AMI)**

Please find enclosed specification No. DDS-98:2011 for Advanced Metering Infrastructure (AMI), which has been prepared after incorporating the feedback from all DISCOs and meter manufacturers.

DA/Specification.

(Dr. Rana Abdul Jabbar Khan)
Manager (D.E), NTDC,
Lahore.

CC to: -

1. General Manager (Services Division) WAPDA House, Lahore.
2. Director General (Energy Conservation), WAPDA House, Lahore.
3. Chief Engineer (Material Inspection) NTDC, Sunny View, Lahore.
4. Chief Engineer (PMU) PEPCO, PIA Building, Lahore.
5. Chief Engineer (P&D), WAPDA House, Lahore.
6. All Meter manufacturers. M/S. Microtech
7. US AID, House No. 23, Street No. 19, F-6/2, Islamabad.
8. PA to Chief Engineer (D&S)
9. Master file.

CamSca

NATIONAL TRANSMISSION AND DESPATCH COMPANY (NTDC)

SPECIFICATION-DDS-110:2012

METER DATA COLLECTION (MDC) SERVER TO BE USED IN ADVANCED METERING INFRASTRUCTURE (AMI)

(D&S) Department

Contents

1. Foreword: 3
2. Scope: 3
3. Definitions: 3
4. Network Architecture: 6
5. AMI Interoperability 7
6. Software Architecture: 8
7. User Interface Application: 8
8. Database Management System (DBMS): 9
9. Hardware: 9
10. GSM Modem: 10
11. Communicator: 10
12. Web Services in MDC for MDM 27
13. Data Export Formats: 46
14. User Acceptance Criteria: 48
15. Annex-I: Schedule of Technical Data: 52
16. Annex-II Parameters list for communication verification: 55

SPECIFICATION FOR METER DATA COLLECTION (MDC) SERVER TO BE USED IN ADVANCED METERING INFRASTRUCTURE (AMI)

1. Foreword:

1.1. This standard specification has been prepared by the Engineering Directorate of Chief Engineer (D&S).

1.2. This specification is intended for procurement of material and not for contract.

1.3. This specification is subject to revision as and when required.

2. Scope:

2.1. This specification is being prepared for the introduction of a Meter Data Collection (MDC) server to be used with Advanced Metering Infrastructure (AMI).

2.2. This specification is intended for the introduction of MDC based Meter Reading System to be used with Meters as per relevant specification DDS-50:2007, DDS-60:2007 and DDS-65:03 having communication as per specification DDS-98:2011.

2.3. This specification covers the aspects of Meter Data Collection (MDC) server specification, MDC Software Specification, MDC integration with AMI and multi-vendor protocol.

2.4. This specification shall cover the multi-vendor compliance of the existing manufacturers as well as the prospective vendors.

2.5. This specification shall cover the interoperability between meters of different vendors with MDCs of different vendors.

2.6. This specification shall cover the interoperability between MDCs of different vendors with MDM of different vendors.

3. Definitions:

3.1. **AMI:**

Advanced Metering Infrastructure (AMI) are systems that measure, collect and analyze energy usage, and communicate with metering devices such as electricity

meters, either on request or on a schedule. These systems include hardware, software, communications and Meter Data Management (MDM) software etc.

3.2. **Meter Serial Number:**

Meter serial number is printed on meter label and stored in meter memory.

3.3. **Manufacturer Identifier**:

The unique numeric identification of each meter manufacturer.

3.4. **Meter Type:**

Meter Type shall correspond to design specification i.e. DDS-50:2007, DDS-60:2007 & DDS-65:03.

3.5. **MDC:**

Meter Data Collection Server is a system in Advanced Metering Infrastructure (AMI) used to obtain data from the meters and store it into the database.

3.6. **Wakeup:**

Wakeup is a request sent by Meter Data Collection (MDC) Server to the meter for making a connection.

3.7. **Pull:**

Pull is a mechanism in which MDC demands for specific information or data from meter and meter sends data in response.

3.8. **GPRS:**

General Packet Radio Service is a packet oriented communication technology. This technology is specifically used for communication between mobile phone and internet.

3.9. **SMS:**

Short Message Service is a communication service standardized in the GSM mobile communication system.

3.10. **Voice Call:**

Voice Call is a GSM service used to interchange speech data between two communication entities.

3.11. **TCP:**

Transmission Control Protocol is transport layer protocol for Internet Protocol (IP).

3.12. **IP:**

Internet Protocol is a networking layer protocol and forms the core of Internet all around the world.

3.13. **DVD:**

DVD is an optical disc storage media format, offering higher storage capacity than Compact Discs while having the same dimensions.

3.14. **RAID:**

RAID (an acronym for redundant array of independent disks; originally redundant array of inexpensive disks) is a storage technology that combines multiple disk drive components into a logical unit to increase the data storage reliability.

3.15. **OBIS:**

The OBIS OBject Identification System defines identification codes for all data in DLMS/COSEM compliant metering equipment.

3.16. **Mockup:**

In manufacturing and design, a mockup is a scaled model of a design or device, used for teaching, demonstration, design evaluation, promotion, and other purposes. A mockup is a prototype if it provides at least part of the functionality of a system and enables testing of a design.

3.17. **CIM:**

The Common Information Model (CIM) is an abstract information model that provides data understanding through the identification of the relationships and associations of the data within a utility enterprise.

meters, either on request or on a schedule. These systems include hardware, software, communications and Meter Data Management (MDM) software etc.

3.2. **Meter Serial Number:**

Meter serial number is printed on meter label and stored in meter memory.

3.3. **Manufacturer Identifier**:

The unique numeric identification of each meter manufacturer.

3.4. **Meter Type:**

Meter Type shall correspond to design specification i.e. DDS-50:2007, DDS-60:2007 & DDS-65:03.

3.5. **MDC:**

Meter Data Collection Server is a system in Advanced Metering Infrastructure (AMI) used to obtain data from the meters and store it into the database.

3.6. **Wakeup:**

Wakeup is a request sent by Meter Data Collection (MDC) Server to the meter for making a connection.

3.7. **Pull:**

Pull is a mechanism in which MDC demands for specific information or data from meter and meter sends data in response.

3.8. **GPRS:**

General Packet Radio Service is a packet oriented communication technology. This technology is specifically used for communication between mobile phone and internet.

3.9. **SMS:**

Short Message Service is a communication service standardized in the GSM mobile communication system.

3.10. **Voice Call:**

Voice Call is a GSM service used to interchange speech data between two communication entities.

3.11. **TCP:**

Transmission Control Protocol is transport layer protocol for Internet Protocol (IP).

3.12. **IP:**

Internet Protocol is a networking layer protocol and forms the core of Internet all around the world.

3.13. **DVD:**

DVD is an optical disc storage media format, offering higher storage capacity than Compact Discs while having the same dimensions.

3.14. **RAID:**

RAID (an acronym for redundant array of independent disks; originally redundant array of inexpensive disks) is a storage technology that combines multiple disk drive components into a logical unit to increase the data storage reliability.

3.15. **OBIS:**

The OBIS OBject Identification System defines identification codes for all data in DLMS/COSEM compliant metering equipment.

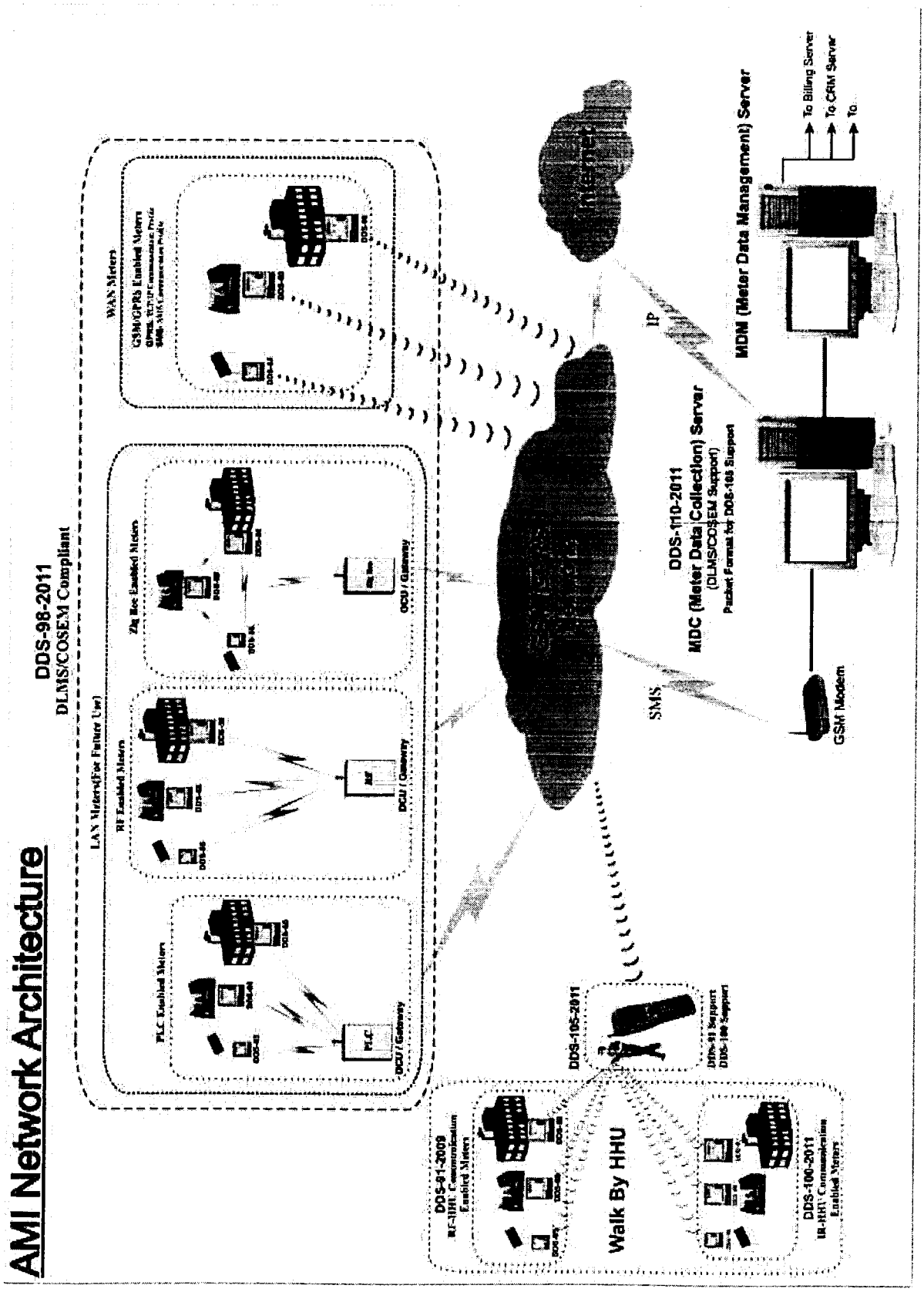
3.16. **Mockup:**

In manufacturing and design, a mockup is a scaled model of a design or device, used for teaching, demonstration, design evaluation, promotion, and other purposes. A mockup is a prototype if it provides at least part of the functionality of a system and enables testing of a design.

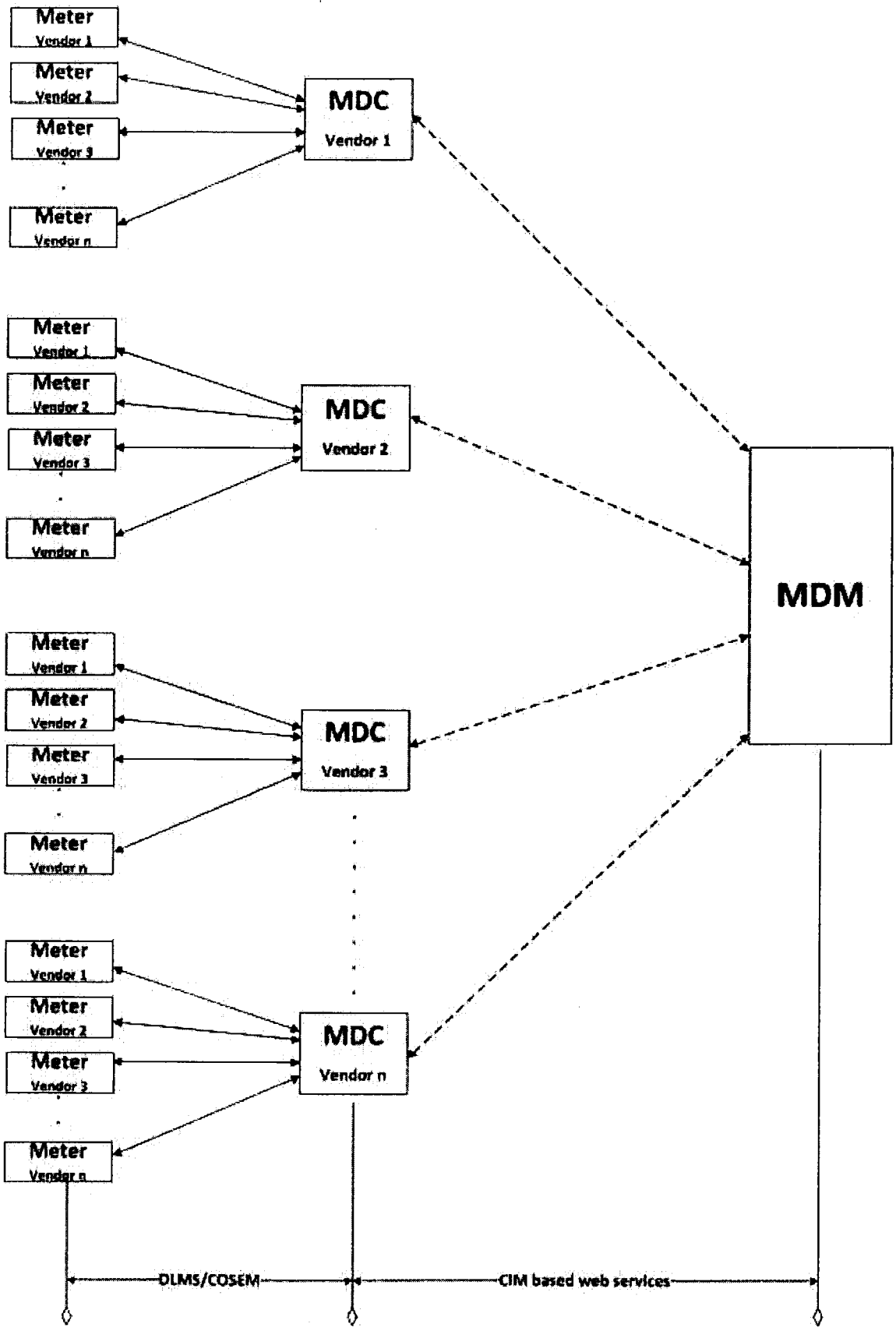
3.17. **CIM:**

The Common Information Model (CIM) is an abstract information model that provides data understanding through the identification of the relationships and associations of the data within a utility enterprise.

4. Network Architecture:



5. AMI Interoperability



Communication between meter and MDC over TCP/IP shall follow clause 11.1 "Communication protocol" and clause 11.2 "Communication modes" of this document. Web services for MDM shall follow clause 12 of this specification.

6. Software Architecture:

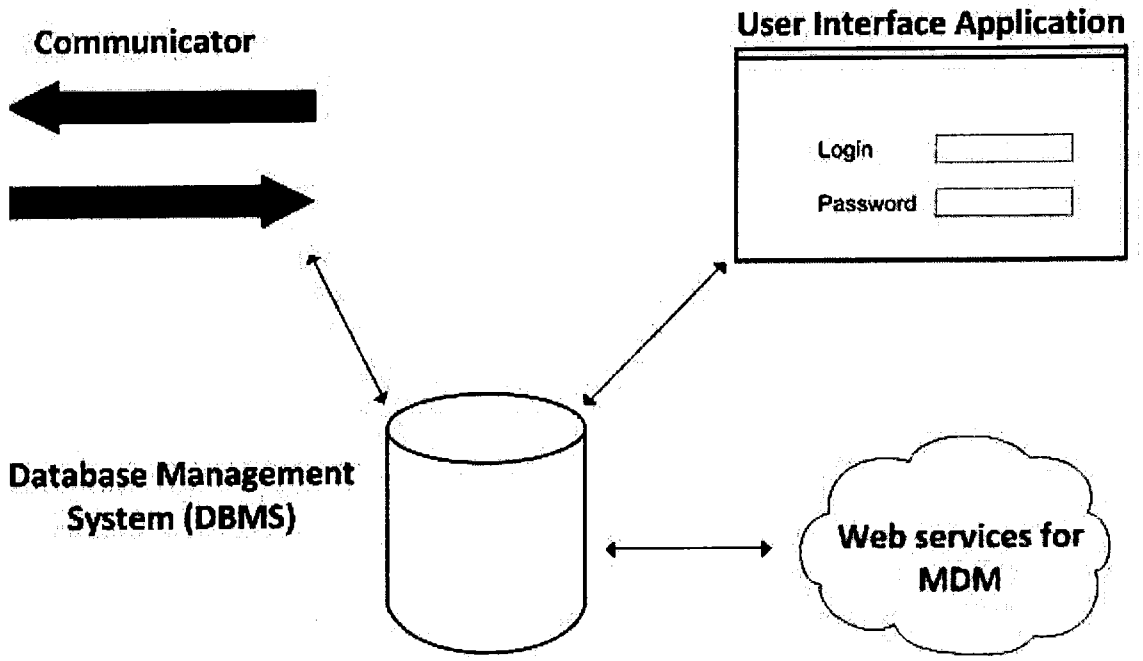
Meter Data Collection (MDC) Server shall have following:

6.1. User Interface Application

6.2. Database Management System (DBMS)

6.3. Communicator

6.4. Web Services for MDM



7. User Interface Application:

7.1. It is responsible for providing a graphical interface to the user to view the data received from the communicator; send meter configuration and other relevant data to the meters.

7.2. MDC software shall be capable of displaying all metering data as per relevant meter's specifications (DDS-50:2007, DDS-60:2007 and DDS-65:03).

7.3. The interface application shall provide customer hierarchy for at least 3 levels. It shall also provide user management and user rights. User rights shall limit a user to a certain level of customer hierarchy.

7.4. The user interface application shall provide a mechanism for meter management functions. For example, adding or deleting a meter, meter configuration etc.

7.5. The user interface application shall provide a Graphical User Interface (GUI).

8. Database Management System (DBMS):

8.1. The Database Management System (DBMS) is a central repository for all metering data collected through communicator.

8.2. The host software shall have capabilities to store and report all metering data in a database management system as required in the relevant meter specifications like billing data, event data, load profiles etc.

8.3. It shall provide mechanism for periodic as well as on-demand backup; and also, it shall be able to restore data on request.

8.4. The Database server shall have backup interface for DVD.

8.5. The database shall be capable to hold the metering data as specified in "Schedule of Technical Data" for a period specified therein (Annex-I)

9. Hardware:

9.1. The Database Management Server shall have RAID hard drives.

9.2. There shall be at least one backup server (optional).

9.3. Server Class machines shall be used.

9.4. Online UPS shall be used.

9.5. Reliable Internet Connection with at least one static public IP address shall be used.

9.6. There shall be arrangement for at least two generators.

9.7. Data center room shall be properly air-conditioned.

9.8. There shall be at least one GSM Modem for Wakeup SMS/voice call to send one SMS/ make Voice call all at a time.

9.9. It shall be possible to use more than one server for load sharing when data load is high. The vender will propose system on the basis of requirements given by the customer in Annex-1.

10. GSM Modem:

GSM modem of following specifications shall be used with MDC

10.1. Quad-Band GSM/GPRS 850/900/1800/1900MHz

10.2. Compliant to GSM phase 2/2+

10.2.1. Class 4 (2W @ 850/900MHz)

10.2.2. Class 1(1W @ 1800/1900MHz)

10.3. The Modem shall have the capability for SMS and voice call communication

10.4. The modem shall have LED indicator visible from the distance.

10.5. The LED shall indicate the operational status of the modem like:

10.5.1. Fast blinking LED indicates absence of SIM card or no network service or insufficient signal strength.

10.5.2. OFF LED indicates modem is not working.

10.5.3. Slow blinking LED indicates healthiness of the modem and is registered to the GSM network

10.6. The SIM card shall be field replaceable

10.7. It shall have RS232 or USB interface for computer

11. Communicator:

It is responsible for handling all communications between meters and MDC and sending data into database for the user interface application.

11.1 Communication Protocols:

10.1.1. MDC shall support DLMS/COSEM communication protocol.

10.1.2. MDC shall also accept output data files as specified in DDS-105:2011 (if applicable).

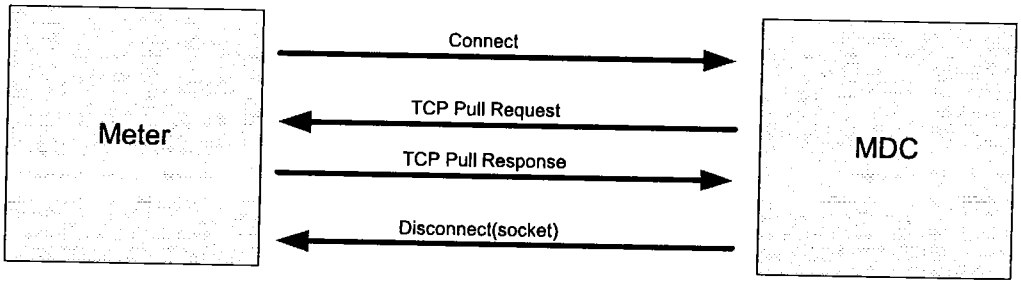
11.2. Communication Modes:

Meters shall be configurable to one of following Mode-I or Mode-II at a time

11.2.1. Mode I (GPRS as Primary Medium and SMS/Voice Call for Wakeup):

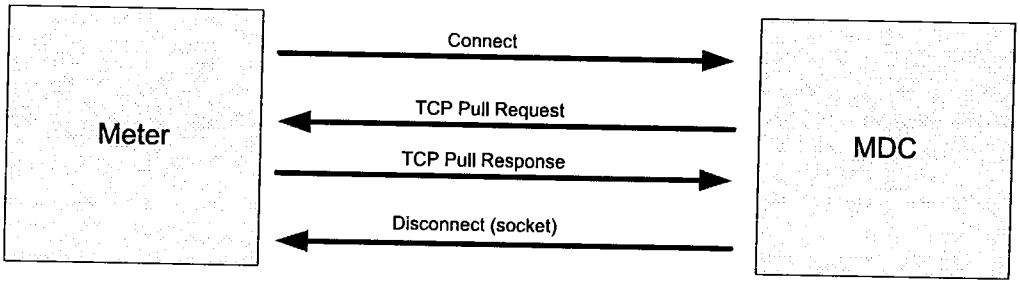
11.2.1.1. Pull at Preprogrammed Interval:

Meter shall establish a TCP connection with the MDC server at a predefined interval via GPRS. Number of retries and retry interval shall be programmable. The MDC shall pull data from the meter as shown in the figure below:



11.2.1.2. Pull at Events & Alarms:

The meter has a number of events/alarms; any of these events/alarms can be configured as a major alarm. If a major alarm/event occurs, meter shall establish a TCP/IP connection with the MDC via GPRS. Number of retries and retry interval shall be programmable. The MDC shall pull data from the meter as shown in the figure below:



9.9. It shall be possible to use more than one server for load sharing when data load is high. The vender will propose system on the basis of requirements given by the customer in Annex-1.

10. GSM Modem:

GSM modem of following specifications shall be used with MDC

10.1. Quad-Band GSM/GPRS 850/900/1800/1900MHz

10.2. Compliant to GSM phase 2/2+

10.2.1. Class 4 (2W @ 850/900MHz)

10.2.2. Class 1(1W @ 1800/1900MHz)

10.3. The Modem shall have the capability for SMS and voice call communication

10.4. The modem shall have LED indicator visible from the distance.

10.5. The LED shall indicate the operational status of the modem like:

10.5.1. Fast blinking LED indicates absence of SIM card or no network service or insufficient signal strength.

10.5.2. OFF LED indicates modem is not working.

10.5.3. Slow blinking LED indicates healthiness of the modem and is registered to the GSM network

10.6. The SIM card shall be field replaceable

10.7. It shall have RS232 or USB interface for computer

11. Communicator:

It is responsible for handling all communications between meters and MDC and sending data into database for the user interface application.

11.1 Communication Protocols:

10.1.1. MDC shall support DLMS/COSEM communication protocol.

10.1.2. MDC shall also accept output data files as specified in DDS-105:2011 (if applicable).

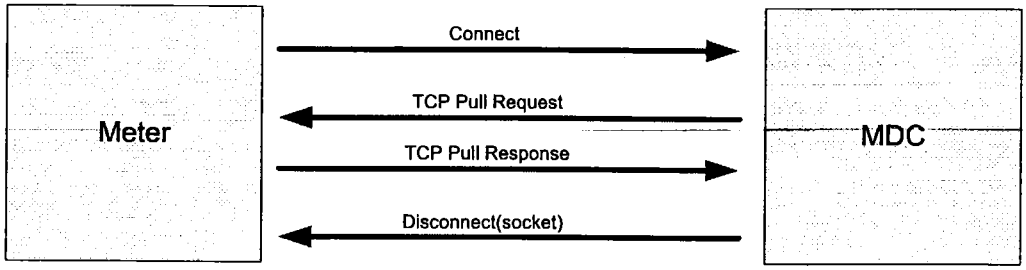
11.2. Communication Modes:

Meters shall be configurable to one of following Mode-I or Mode-II at a time

11.2.1. Mode I (GPRS as Primary Medium and SMS/Voice Call for Wakeup):

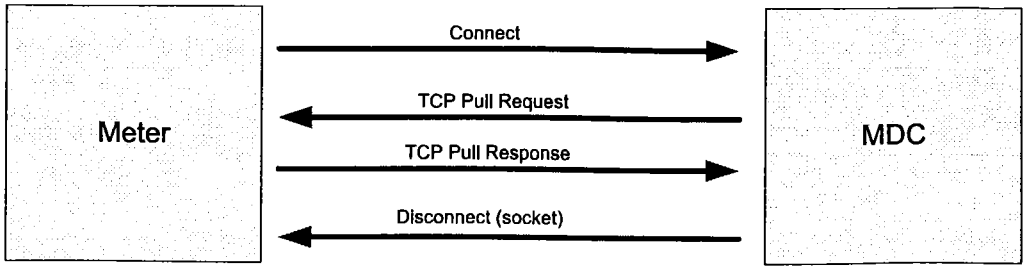
11.2.1.1. Pull at Preprogrammed Interval:

Meter shall establish a TCP connection with the MDC server at a predefined interval via GPRS. Number of retries and retry interval shall be programmable. The MDC shall pull data from the meter as shown in the figure below:



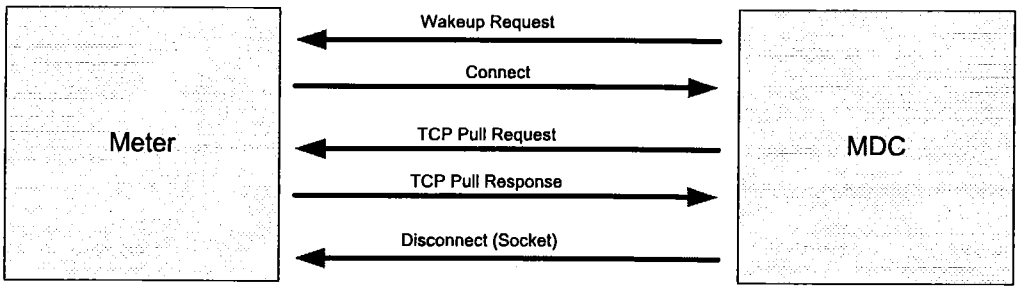
11.2.1.2. Pull at Events & Alarms:

The meter has a number of events/alarms; any of these events/alarms can be configured as a major alarm. If a major alarm/event occurs, meter shall establish a TCP/IP connection with the MDC via GPRS. Number of retries and retry interval shall be programmable. The MDC shall pull data from the meter as shown in the figure below:



11.2.1.3. Pull on-Demand:

For on-demand data the MDC shall send wakeup SMS or initiate a wakeup voice call for the meter. In response the meter shall establish a TCP/IP connection with the MDC server via GPRS. Number of retries and retry interval shall be programmable. The MDC shall pull data from the meter as shown in the figure below:



11.2.1.4. DLMS/COSEM application layer for mode I:

For IP based communication DLMS/COSEM specification suggest TCP communication profile. Meter shall support at least three associations as described below:

Association 0: (Public Association)

1. Client SAP: 0x10
2. Server SAP: 0x0001
3. Application context: Logical Name (LN) referencing
4. Authentication mechanism: Lowest Level Security (No security).
5. xDLMS context: At least meter shall support following services in association 0
    - get,
    - block-transfer-with-get-or-read,
6. Security suite: No security
7. Security context: No security

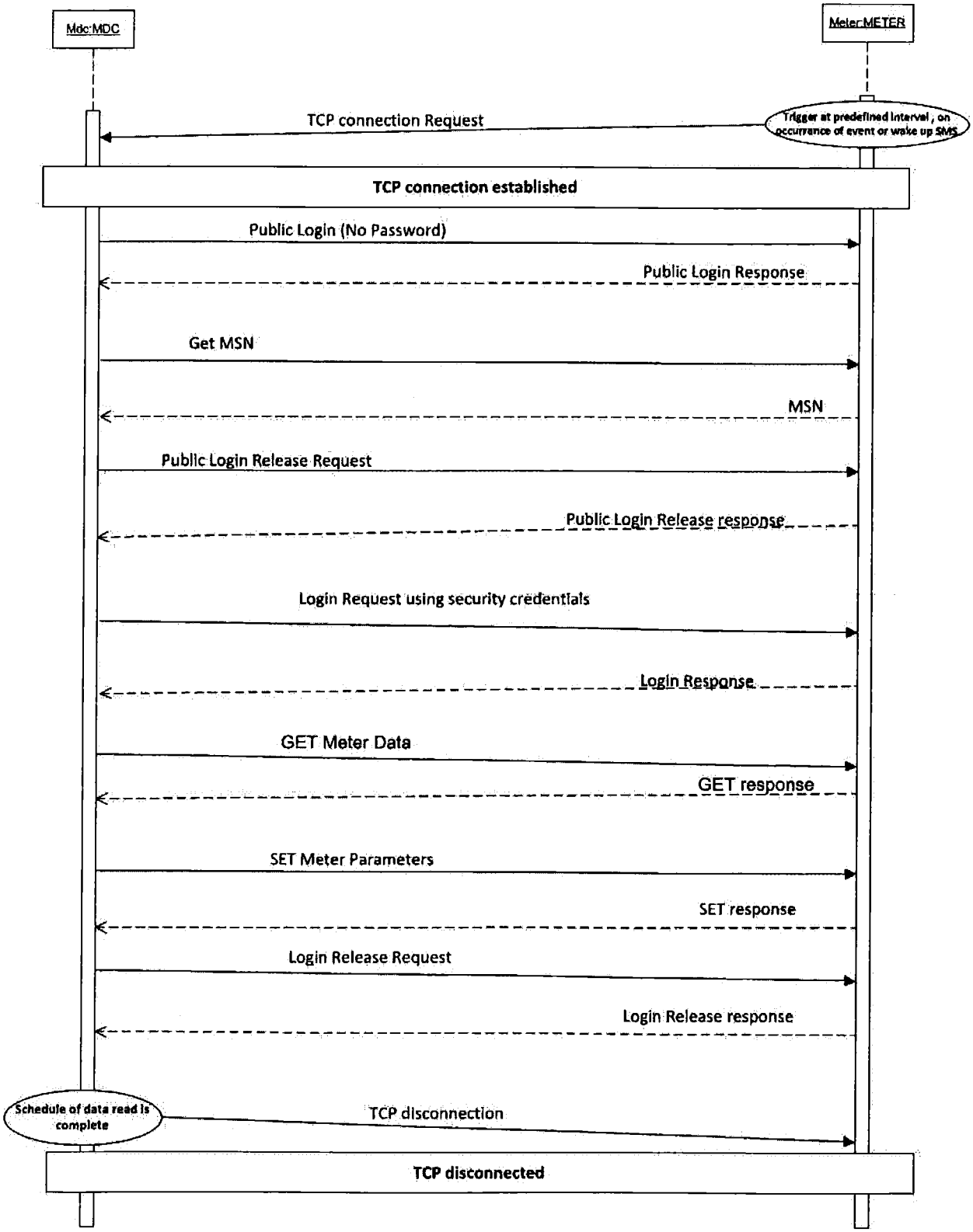
Association 1: (Association for Management user)

1. Client SAP: 0x01
2. Server SAP: 0x0001
3. Application context: Logical Name (LN) referencing with ciphering
4. Authentication mechanism: HLS using GMAC with mechanism id 5.
5. xDLMS context: At minimum meter must support following services in association 1
    - get,
    - set,
    - action,
    - block-transfer-with-get-or-read,
    - block-transfer-with-set-or-write,
    - block-transfer-with-action
6. Security suite: Security suite(0)
7. Security context: Authentication and encryption as per security suite 0.

Association 2: (Association for reader)

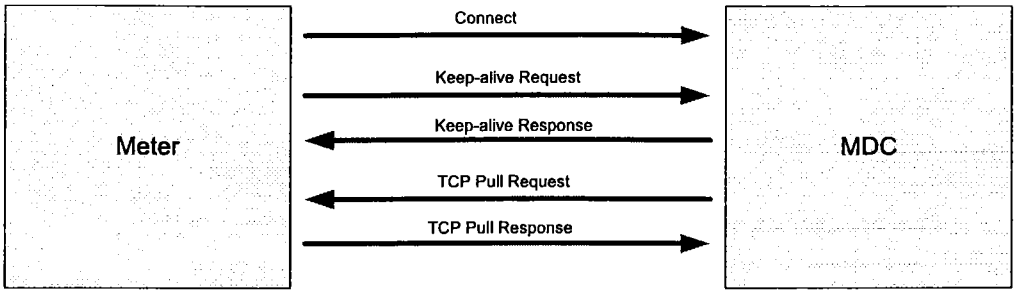
1. Client SAP: 0x12
2. Server SAP: 0x0001
3. Application context: Logical Name (LN) referencing with ciphering
4. Authentication mechanism: HLS using GMAC with mechanism id 5.
5. xDLMS context: At minimum meter shall support following services in association 2
    - get,
    - action,
    - block-transfer-with-get-or-read,
    - block-transfer-with-action
6. Security suite: Security suite(0)
7. Security context: Authentication and encryption as per security suite 0.

11.2.1.5. Sequence diagram for data read in Mode I:



11.2.2. Mode-II (GPRS always alive):

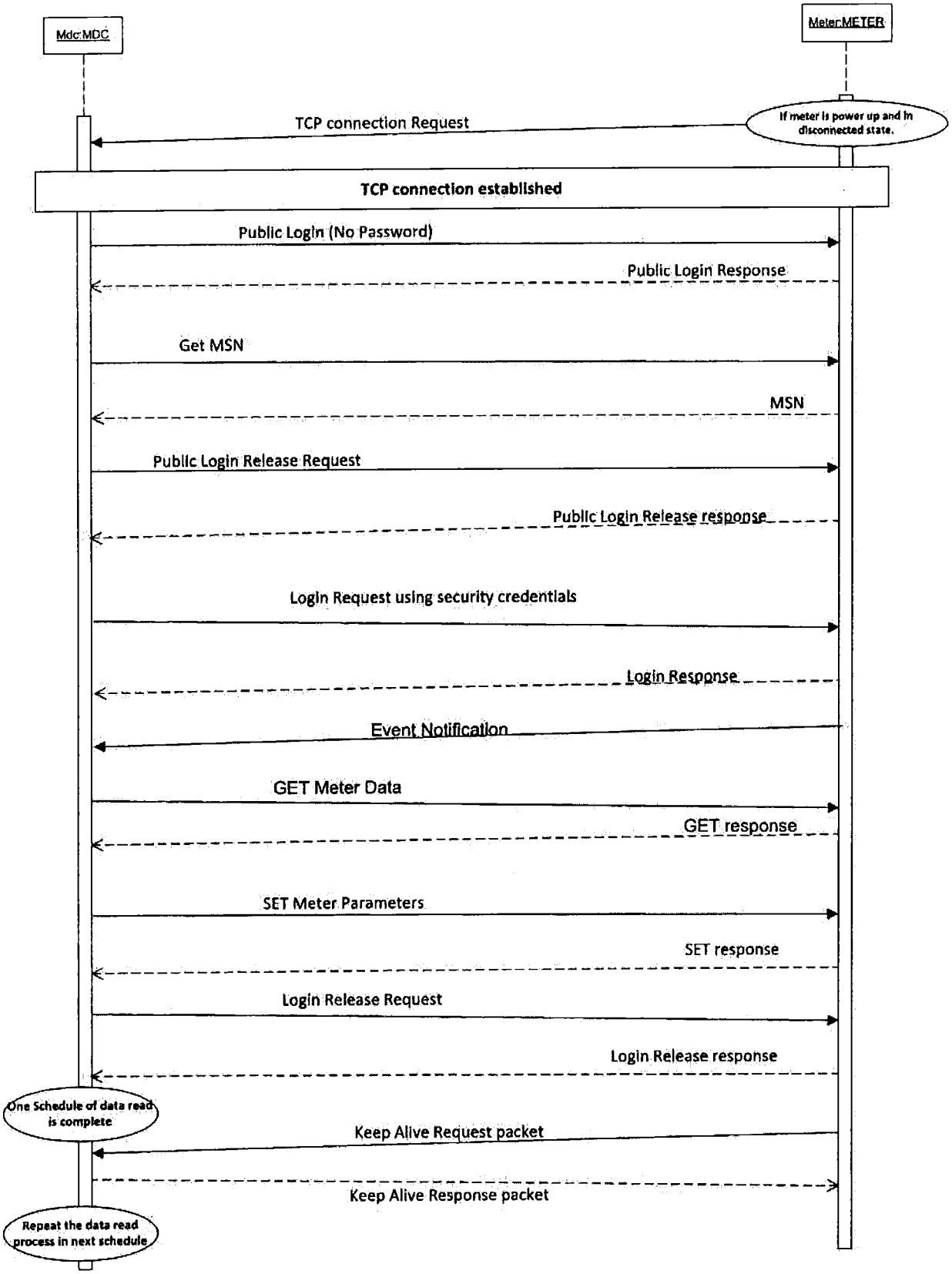
Meter shall always maintain a TCP/IP connection with the MDC server via GPRS. In this process the meter shall send periodic heart beat/keep-alive packets to the MDC server. The MDC shall pull data from the meter as and when required as shown in the figure below:



11.2.2.1. DLMS/COSEM application layer for mode II:

Application layer in mode II shall follow all points mentioned in section 10.2.1.4.for application layer for mode I

11.2.2.2. Detailed Sequence Diagram for data read in Mode II:



11.3. Communication Channels:

Meter shall have two programmable IP addresses. For communication via GPRS one of two programmed IP address shall be used as primary address and the other IP address shall be used as secondary address. The meter shall try to establish a TCP/IP connection with the primary IP address if it fails to do so then the meter shall try to establish TCP/IP connection with secondary IP address.

Meter shall have at least three programmable GSM Numbers. In case of Wakeup command via SMS or voice call the meter shall only respond to the wakeup commands originated from the GSM number programmed in it.

For configuring and reading of communication mode, two IP addresses and three programmable GSM numbers, following OBIS codes shall be used.

Quantity	OBIS code	Interface Class	Attribute
Two IP addresses	0.0.2.2.0.255	**Auto connect (class_id = 29, version = 2)**	6
Three GSM numbers	0.0.2.1.0.255	**Auto answer (class_id = 28, version = 2)**	7
Communication mode (Mode I and Mode II)	0.0.2.2.0.255	**Auto connect (class_id = 29, version = 2)**	2

These OBIS code shall have read & write access in association 1 and read only access in association 2.

11.4. Communication OBIS codes:

10.4.1. Energy and Demand:

Energy and Demand quantities OBIS codes shall only be accessible in Association 1 and Association 2. For representing decimal values in interface classes Register (class Id=3, version 0) and Extended Register (class Id=4, version 0), Attribute 2 (value) and Attribute 3(Scalar_unit) shall be used together i.e. Value x 10^{scalar}.

Standard OBIS codes for quantities used for billing purposes are shown below:

Cumulative Active energy absolute (Abs KWH)		**Interface Class**	**Choice of Data type for Attribute 2**
Total	1.0.15.8.0.255	**Register (class_id = 3, version = 0)**	Double-long-unsigned
Tariff 1	1.0.15.8.1.255	**Register (class_id = 3, version = 0)**	Double-long-unsigned
Tariff 2	1.0.15.8.2.255	**Register (class_id = 3, version = 0)**	Double-long-unsigned
Tariff 3	1.0.15.8.3.255	**Register (class_id = 3, version = 0)**	Double-long-unsigned
Tariff 4	1.0.15.8.4.255	**Register (class_id = 3, version = 0)**	Double-long-unsigned

Cumulative Reactive Energy KVarh Q1 + Q3 in single packet (Pakistan Specific)		**Interface Class** (These are country specific OBIS codes, any suitable class id can be used)	**Choice of Data type for Attribute 2**
Total	1.0.94.92.0.255	**Register (class_id = 3, version = 0)**	Double-long-unsigned

Tariff 1	1.0.94.92.1.255	**Register (class_id = 3, version = 0)**	Double-long-unsigned
Tariff 2	1.0.94.92.2.255	**Register (class_id = 3, version = 0)**	Double-long-unsigned
Tariff 3	1.0.94.92.3.255	**Register (class_id = 3, version = 0)**	Double-long-unsigned
Tariff 4	1.0.94.92.4.255	**Register (class_id = 3, version = 0)**	Double-long-unsigned

Maximum Demand Active absolute (MDI-KW abs)		**Interface Class**	**Choice of Data type for Attribute 2**
Total	1.0.15.6.0.255	**Extended Register (class_id = 4, version = 0)**	Double-long-unsigned
Tariff 1	1.0.15.6.1.255	**Extended Register (class_id = 4, version = 0)**	Double-long-unsigned
Tariff 2	1.0.15.6.2.255	**Extended Register (class_id = 4, version = 0)**	Double-long-unsigned
Tariff 3	1.0.15.6.3.255	**Extended Register (class_id = 4, version = 0)**	Double-long-unsigned
Tariff 4	1.0.15.6.4.255	**Extended Register (class_id = 4, version = 0)**	Double-long-unsigned

Cumulative Maximum Demand Active absolute (Cum-MDI-KW abs)		**Interface Class**	**Choice of Data type for Attribute 2**
Total	1.0.15.2.0.255	**Register (class_id = 3, version = 0)**	Double-long-unsigned
Tariff 1	1.0.15.2.1.255	**Register**	Double-long-unsigned

		(class_id = 3, version = 0)	
Tariff 2	1.0.15.2.2.255	**Register (class_id = 3, version = 0)**	Double-long-unsigned
Tariff 3	1.0.15.2.3.255	**Register (class_id = 3, version = 0)**	Double-long-unsigned
Tariff 4	1.0.15.2.4.255	**Register (class_id = 3, version = 0)**	Double-long-unsigned

Associated data		**Interface Class**	**Choice of Data type for Attribute 2**
MDI Reset Date and Time	1.0.0.1.2.255	**Data (class_id = 1, version = 0)**	Octet String(12)
MDI Reset Count	1.0.0.1.0.255	**Data (class_id = 1, version = 0)**	Long-unsigned

11.4.2. Instantaneous:

These instantaneous quantities OBIS codes shall only be accessible in Association 1 and Association 2. For representing decimal values in interface classes Register (class Id=3, version 0) and Extended Register (class Id=4, version 0), Attribute 2 (value) and Attribute 3(Scalar_unit) shall be used together i.e. Value x 10^{scalar}.

Standard OBIS codes instantaneous data elements are shown below;

Quantity	**OBIS code**	**Interface Class**	**Choice of Data type for Attribute 2**
Aggregate Active power Import (KW+)	1.0.1.7.0.255	**Register (class_id = 3,**	Double-long-unsigned

		version = 0)	
Aggregate Active Power Export (KW-)	1.0.2.7.0.255	**Register (class_id = 3, version = 0)**	Double-long-unsigned
Aggregate Reactive power Import	1.0.3.7.0.255	**Register (class_id = 3, version = 0)**	Double-long-unsigned
Aggregate Reactive power export	1.0.4.7.0.255	**Register (class_id = 3, version = 0)**	Double-long-unsigned
Voltage Phase A	1.0.32.7.0.255	**Register (class_id = 3, version = 0)**	Double-long-unsigned
Voltage Phase B	1.0.52.7.0.255	**Register (class_id = 3, version = 0)**	Double-long-unsigned
Voltage Phase C	1.0.72.7.0.255	**Register (class_id = 3, version = 0)**	Double-long-unsigned
Current Phase A	1.0.31.7.0.255	**Register (class_id = 3, version = 0)**	Double-long-unsigned
Current Phase B	1.0.51.7.0.255	**Register (class_id = 3, version = 0)**	Double-long-unsigned
Current Phase C	1.0.71.7.0.255	**Register (class_id = 3, version = 0)**	Double-long-unsigned
Average Power Factor	1.0.13.7.0.255	**Register (class_id = 3, version = 0)**	Double-long-unsigned
Frequency	1.0.14.7.0.255	**Register (class_id = 3, version = 0)**	Double-long-unsigned
Time	1.0.0.9.1.255	**Data (class_id = 1, version = 0)**	Octet String(4)
Date	1.0.0.9.2.255	**Data (class_id = 1, version = 0)**	Octet String(5)
Current Tariff	0.0.96.14.0.255	**Data (class_id = 1, version = 0)**	Double-long-unsigned
CT ratio Numerator	1.0.0.4.2.255	**Data (class_id = 1, version = 0)**	Double-long-unsigned
CT ratio Denominator	1.0.0.4.5.255	**Data (class_id = 1, version = 0)**	Double-long-unsigned
PT ratio Numerator	1.0.0.4.3.255	**Data (class_id = 1, version = 0)**	Double-long-unsigned
PT ratio Denominator	1.0.0.4.6.255	**Data (class_id = 1, version = 0)**	Double-long-unsigned
Customer Code	0.0.96.1.10.255	**Data (class_id = 1, version = 0)**	Octet String

11.4.3. Events Codes and Event notification Packet:

For Event notification standard packet of DLMS/COSEM with Tag 0xC2 should be used. Referred to IEC-62056-53 OBIS code to be used in this Packet is 0.0.96.11.0.255.. This OBIS code shall be implemented with Interface Class **Data (class_id = 1, version = 0)** and choice of data type for attribute 2 should be long-unsigned. Only attribute 2 of event code object shall be sent in event notification packet. Alternatively, MDC can PULL events data using GET command with 0xC0. This OBIS code contains the event code of most recent event occurred. Event code list is implementation specific. List of Event codes for all necessary quantities is given below.

List of event Codes					
Quantity	**Event Code**	**DDS-50**	**DDS-60**	**DDS-65 Multi Tariff**	**DDS-65 Single Tariff**
MDI reset	101	Y	Y	Y	N
Parameterization	102	Y	Y	Y	N
Power fail start (will be reported when power is restored)	111	Y	Y	Y	N
Power fail end	112	Y	Y	Y	N
Phase failure	113	Y	Y	N	N
Over Volt	114	Y	N	N	N
Under Volt	115	Y	N	N	N
Demand Over Load	116	Y	N	N	N
Reverse Energy (Active energy)	117	Y	Y	N	N
Reverse Polarity	118	Y	Y	N	N
CT Bypass	121	Y	N	N	N

11.4.4. Keep-alive Packet Format:

The Transport Layer payload of Keep-alive request is defined in the table as follows:

Tag	Length of Meter Number	Meter Number
1 byte **(0xDD)**	1 byte	As Specified in Section 10.5

The Transport Layer payload of Keep-alive response is defined in the table as follows:

Tag
1 byte **(0xDA)**

The above request and response packets of Keep-alive commands are payload of Transport Layer. The reasons behind choosing it as Transport Layer payload are given below:

- To keep GPRS data traffic low.
- The purpose served by this packet is beyond the DLMS protocol specification.
- Tags used for Keep-alive request and response packets are utilized by DLMS specification for some other purpose.

Communication network layers stack, showing the generation of Keep-alive request and response, is shown below.

<table>
<tr><td></td><td></td><td>Keep-alive Request/Response</td></tr>
<tr><td></td><td>Transport Layer Header</td><td>Transport Layer payload</td></tr>
<tr><td>IP Header</td><td colspan="2">IP payload</td></tr>
</table>

11.5. Meter Identifier:

The MDC shall communicate with meter using a unique 4-Byte Meter Identifier. The office of the Chief Engineer Design and Standards shall allocate prefix to each manufacturer a 4 byte meter identifier as mentioned below:

Meter Serial Number Format		
00-40	00-99	000001-999999
Manufacturer	Meter Type	Meter Serial Number
40 SBL	99 DDS-50	Start =000001 , End = 999999
39 PEL	98 DDS-60	
38 Escorts	97 DDS-65	
37 KBK	Etc.	
36 MicroTech		
35 CTI		
33 Ace Indigo		
32 Creative Electronics		
Etc.		

Meter identifier shall be readable from meter with OBIS code given below;

Quantity		**Interface Class**	**Choice of Data type for Attribute 2**
Meter Identifier	0.0.96.1.0.255	**Data (class_id = 1, version = 0)**	Double-long-unsigned

Meter identifier OBIS code shall be accessible in association 0, association 1 and association 2.

11.6 Load Profile

OBIS code to be used for load profile is:

Quantity	OBIS code	Attribute	Interface Class	Selective access
Load Profile data	1.0.99.1.0.255	2	Profile generic (class_id = 7, version = 1)	Range Descriptor and date&time as restricting object

Restricting_object in range descriptor shall be date&time with OBIS code given below.

Restricting object	OBIS code	Interface Class	Attribute
Date&time	0.0.1.0.0.255	Clock (class_id = 8, version = 0)	2

Load Profile data shall only be accessible in Association 1 and Association 2.

Load profile channels can be accessed using attribute 3 of same OBIS code.

Quantity	OBIS code	Attribute	Interface Class
Load Profile channels	1.0.99.1.0.255	3	Profile generic (class_id = 7, version = 1)

Load Profile channels shall have read and write access in Association 1 and read only access in Association 2

11.7 Billing data

OBIS code to be used for billing data is:

Quantity	OBIS code	Attribute	Interface Class	Selective access
Billing data	1.0.98.1.0.255	2	Profile generic (class_id = 7, version = 1)	Entry descriptor

Billing data shall only be accessible in Association 1 and Association 2.

Billing data quantities list shall be read only. It can be read using attribute 3 of same OBIS code.

Quantity	OBIS code	Attribute	Interface Class
Billing data quantities list	1.0.98.1.0.255	3	Profile generic (class_id = 7, version = 1)

Billing data quantities list shall have read only access in Association 1 and Association 2.

Along with the energy and demand quantities billing data quantities list shall contain MDI reset counter to support selective access using entry descriptor.

Restricting object	OBIS code	Interface Class	Attribute
MDI Reset Count	1.0.0.1.0.255	**Data (class_id = 1, version = 0)**	2

11.8 Events data

Meter shall store relevant event code as mentioned in section 10.4.3 along with occurrence date&time.

OBIS code for event code is also mentioned in section 10.4.3.

OBIS code to be used for events data is:

Quantity	OBIS code	Attribute	Interface Class	Selective access
Events data	0.0.99.98.0.255	2	Profile generic (class_id = 7, version = 1)	Entry descriptor

Events data shall only be accessible in Association 1 and Association 2.

OBIS codes captured in each entry of events log shall be:

Associated data	OBIS code	Interface Class	Attribute
Date &Time	0.0.1.0.0.255	**Clock (class_id = 8, version = 0)**	2
Events counter	0.0.96.15.0255	**Data (class_id = 1, version = 0)**	2
Events code	0.0.96.11.0.255	**Data (class_id = 1, version = 0)**	2

Data type for attribute 2 of Events counter OBIS code shall be Double-long-unsigned.

11.9 Contactor control

For remote ON and OFF of the contactor following OBIS code and method shall be used.

Restricting object	OBIS code	Interface Class	method
Remote OFF	0.0.96.3.10.255	Disconnect control (class_id = 70, version = 0)	1::remote_disconnect(0)
Remote ON	0.0.96.3.10.255	Disconnect control (class_id = 70, version = 0)	2::remote_connect(0)

These methods shall only be accessible in Association 1.

12. Web Services in MDC for MDM

MDC shall expose web services which are based on CIM IEC 61968-9 and IEC 61968-100.

- These web services shall be "SOAP" based and shall be using "*HTTPS*" as transport protocol.
- Messages exchanged between MDC and MDM shall follow Common Message Envelope given in IEC 61968-100.
- WS-Security is security extension to SOAP for web services. Event SOAP Header shall contain Username and Password for authentication purpose.
- MDC and MDM shall exchange SOAP messages over secure VPN (if not co-located) using HTTPS.
- Strongly typed web services shall be used for data exchange. The strongly-typed web service integration pattern is intended for use to implement semantic based interfaces in support of a SOA integration strategy. The strongly-typed pattern has the following characteristics:

    1) Uses SOAP-based web services, where fine-grained WSDLs are used to define a contract.

    2) Enables stronger payload validation by defining operation messages using strongly typed payloads

- WSDLs of web services shall follow the templates provided in Annex C of IEC 61968-100.
- XML schemas (XSDs) used in web services shall follow the Annex H of IEC 61968-9.
- WSDLs and their corresponding XML schemas (XSD) of web services shall be made accessible for MDM using VPN (if not co-located).
- XML serializer used in both MDC and MDM should be compliant to World Wide Web Consortium recommendation XSD 1.1.

12.1 Common message envelope

XML file formed on the basis of Common message envelope of IEC 61968-100 shall come under Body of SOAP envelope. XML schema for common message envelope is given in Annex A of IEC 61968-100. Major elements of the message are:-

- Header
- Request
- Reply
- Payload

Request is only present in request message. Reply element is only present in response messages. Data in Payload depends on Header element which is compulsory. There are two fields in *Header* element that must be populated: Verb and Noun. These two fields are explained below:-

Verb: This field is used to identify a specific action to be taken. There are an enumerated set of valid verbs, where commonly used values include 'get', 'create', 'change', 'cancel', 'close', 'execute' and 'reply'. Within event notification messages 'past tense' verbs are used, which can include 'created', 'changed', 'canceled', 'closed' and 'executed'.

Noun: to identify the subject of the action and/or the type of the payload, such as MeterReadings, Notification, etc.

Optional field of Header element are Revision, Context, Replaydetection, Timestamp, Source, AsyncReplyFlag, ReplyAddress, AckRequired, User, MessageID, CorrelationID, Comment, Property. Their use is explained in IEC 61968-100.

Payload element of a message depends on the combination of verb and noun used in header element.

- WSDLs of web services shall follow the templates provided in Annex C of IEC 61968-100.
- XML schemas (XSDs) used in web services shall follow the Annex H of IEC 61968-9.
- WSDLs and their corresponding XML schemas (XSD) of web services shall be made accessible for MDM using VPN (if not co-located).
- XML serializer used in both MDC and MDM should be compliant to World Wide Web Consortium recommendation XSD 1.1.

12.1 Common message envelope

XML file formed on the basis of Common message envelope of IEC 61968-100 shall come under Body of SOAP envelope. XML schema for common message envelope is given in Annex A of IEC 61968-100. Major elements of the message are:-

- Header
- Request
- Reply
- Payload

Request is only present in request message. Reply element is only present in response messages. Data in Payload depends on Header element which is compulsory. There are two fields in *Header* element that must be populated: Verb and Noun. These two fields are explained below:-

Verb: This field is used to identify a specific action to be taken. There are an enumerated set of valid verbs, where commonly used values include 'get', 'create', 'change', 'cancel', 'close', 'execute' and 'reply'. Within event notification messages 'past tense' verbs are used, which can include 'created', 'changed', 'canceled', 'closed' and 'executed'.

Noun: to identify the subject of the action and/or the type of the payload, such as MeterReadings, Notification, etc.

Optional field of Header element are Revision, Context, Replaydetection, Timestamp, Source, AsyncReplyFlag, ReplyAddress, AckRequired, User, MessageID, CorrelationID, Comment, Property. Their use is explained in IEC 61968-100.

Payload element of a message depends on the combination of verb and noun used in header element.

In this specification only Verb, Noun and their corresponding payloads are explained in detail and those guidelines shall be followed in design of web services for communication between MDC and MDM.

12.2 WS-Security

As explained above WS-Security is security extension to SOAP services. Web Services used for communication between MDC and MDM shall follow username password authentication based type of WS-Security. For this purpose SOAP Header of every message shall contain "*Username*" and "*Password*" for authentication purpose. Password shall be exchanged in form of message digest (Hashed) form. Kindly note SOAP Header is different from Header of Common message envelope explained in section 12.1 of this specification.

12.3 Web Services

There are four main categories of web services that are used for data exchange between MDC and MDM. These categories are explained below.

12.3.1 Services to request Meter Readings from MDC

Only two web services: will be used for exchanging/exporting data to MDM from MDC.

1) RequestMeterReadings

2) ExecuteMeterReadings

Entity	***Web service***	***Operations***	***Messages use in operation***	***Type of message (Schema)***
MDM	RequestMeterReadings	getMeterReadings	**Output:**GetMeterReadingsRequestMessage **input:**GetMeterReadingsResponseMessage **Fault:** Fault message (solicit-response pattern of WSDL message exchange)	• GetMeterReadings.xsd[1] • MeterReadings.xsd[2] • Common_message_envelope.xsd[3]
MDC	ExecuteMeterReadings	getMeterReadings	**input:**GetMeterReadingsRequestMessage **Output:**GetMeterReadingsResponseMessage	• GetMeterReadings.xsd[1] • MeterReadings.xsd[2] • Common_mess

			Fault: Fault message (request- response pattern of message exchange in WSDL)	age_envelope.xsd[3] Response and fault messages do not contain payloads.

1. GetMeterReadings.xsd is given in Annex H.15 of IEC 61968-9
2. MeterReadings.xsd is given in Annex H.23 of IEC 61968-9
3. Common_message_envelope.xsd is given in Annex A of IEC 61968-100

MDC should provide Meter Readings present in its database as per parameters in GetMeterReadingsRequestMessage.

12.3.1.1 GetMeterReadingsRequestMessage

HeaderType

Verb	get
Noun	MeterReadings
Revision	2.0
Timestamp	Validate as per request—Not to be older than 24 hours
Correlation Id	Response must contain same id as in request

RequestType

other	As per GetMeterReadings.xsd of Annex H.15 of IEC 61968-9

GetMeterReadings important fields in RequestType

Element	Usage
EndDevice	List of MSNs
EndDeviceGroup	List of subdivisions
Reading	Timestamp and ReadingReasonKind: billing, inquiry, loadManagement, service connect and service disconnect etc
Reading Type	Only mRID to be used and it must contain type of data "Monthly Billing data", "Daily reads" , "Instantaneous data" and "Interval Data"
UsagePoint	List of Reference numbers
UsagePointGroup	Batch numbers
TimeSchedule	Reading Date&time interval parameter

PayloadType
Not used for GetMeterReadingsRequestMessage

.

12.3.1.2 GetMeterReadingsResponseMessage

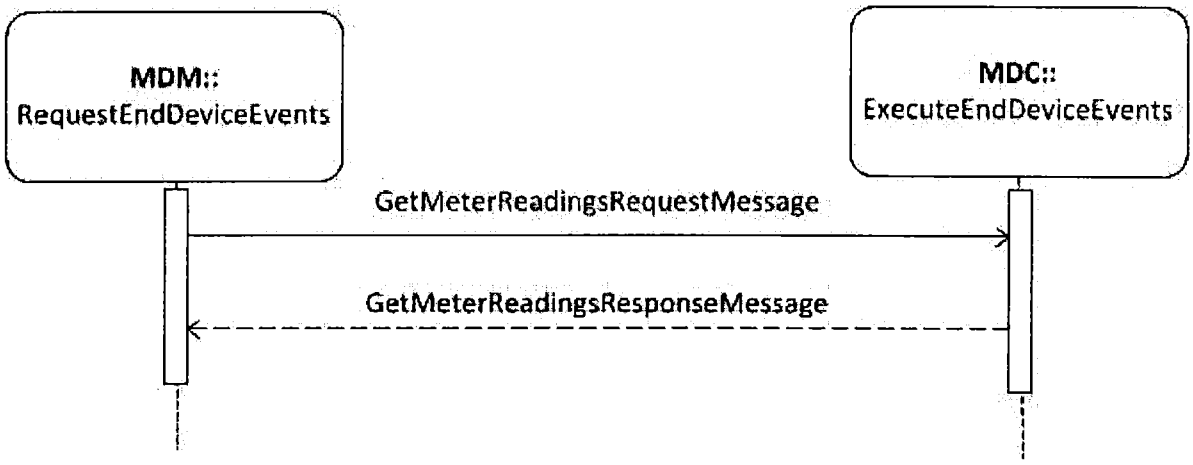
HeaderType

Verb	reply
Noun	MeterReadings
Revision	2.0
Timestamp	Timestamp of system for message generation
Correlation Id	Same as in Request message

RequestType
Not used for GetMeterReadingsResponseMessage.

			tMessage **input:**GetEndDeviceEventsResponseMessage **Fault:** Fault message (solicit-response pattern of WSDL message exchange)	s.xsd[5] • Common_message_envelope.xsd
MDC	ExecuteMeterReadings	getEndDeviceEvents	**input:**GetMeterReadingsRequestMessage **Output:**GetMeterReadingsResponseMessage **Fault:** Fault message (request-response pattern of message exchange in WSDL)	• GetEndDeviceEvents.xsd[4] • EndDeviceEvents.xsd[5] • Common_message_envelope.xsd Response and fault messages do not contain payloads.

4. GetEndDeviceEvents.xsd is given in Annex H.13 of IEC 61968-9
5. EndDeviceEvents.xsd is given in Annex H.7 of IEC 61968-9



MDC should provide Meter events present in its database as per parameters in GetEndDeviceEventsRequestMessage.

12.3.2.1 GetEndDeviceEventsRequestMessage

HeaderType

Verb	get
Noun	EndDeviceEvents
Revision	2.0
Timestamp	Validate as per request—Not to be older than 24 hours
Correlation Id	Response must contain same id as in request

RequestType

other	As per GetEndDeviceEvents.xsd of Annex H.13 of IEC 61968-9

GetEndDeviceEvents important fields in RequestType

Element	**Usage**
EndDevice	List of MSNs
EndDeviceGroup	List of subdivisions
EndDeviceEventType	Only mRID to be used and it must contain name of event "Power fail End", "Over load" as per table given in section 11.4.3 of this specification.
UsagePoint	List of Reference numbers
UsagePointGroup	Batch numbers
TimeSchedule	Reading Date&time interval parameter

PayloadType
Not used for GetEndDeviceEventsRequestMessage.

12.3.2.2 GetEndDeviceEventsResponseMessage

HeaderType

Verb	reply
Noun	EndDeviceEvents

Revision	2.0
Timestamp	Timestamp of system for message generation
Correlation Id	Same as in Request message

PayloadType	
other	As per EndDeviceEvents.xsd given in Annex H.7 of IEC 61968-9.

Required Fields used in EndDeviceEvents schema.

Field	Type
EndDeviceEvent	EndDeviceEvent
EndDeviceEventType	EndDeviceEvent type for above event As per Annex E of IEC 61968-9.

Required elements and their definition for EndDeviceEvent

Field	Type
mRID	Name of event as per table 11.4.2
createdDateTime	DateTime of event created in meter
issuerID	MSN of meter

EndDeviceEventType for different data are to be used as per Annex E of IEC 61968-9.

12.3.3 Services for On demand relay control and MDI reset

To perform meter control on request using CIM based web services, two web services shall be made in MDC namely:-

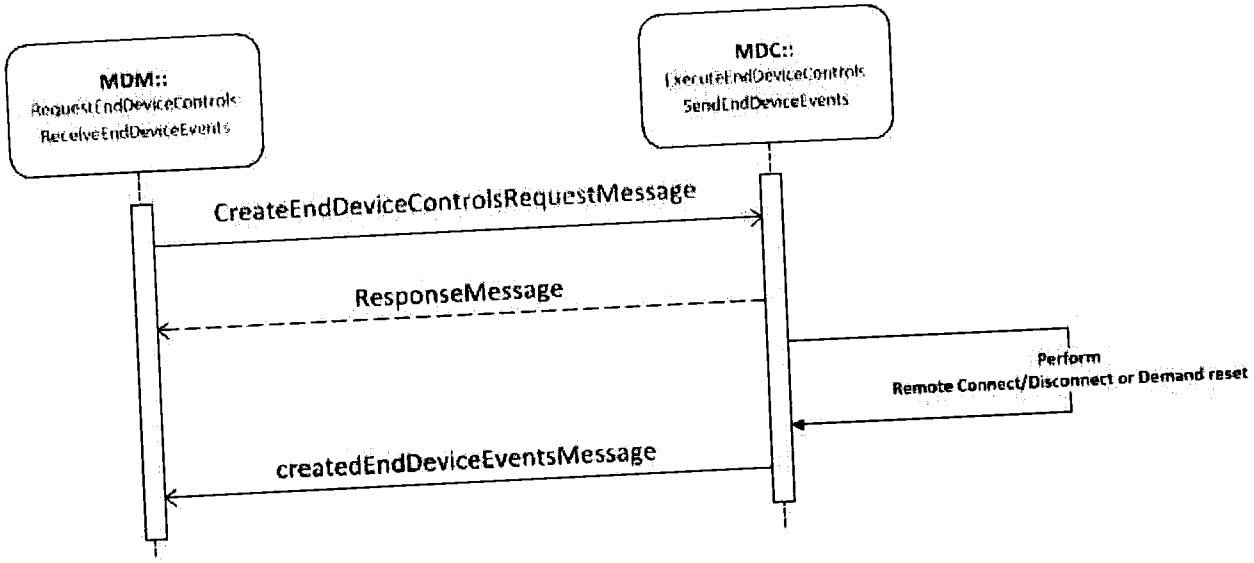
1) ExecuteEndDeviceControls
2) SendEndDeviceEvents.

Corresponding services in MDM shall be:-

1) RequestEndDeviceControls
2) ReceiveEndDeviceEvents

Entity	*Web service*	*Operations*	*Messages use in operation*	*Type of message (Schema)*
MDM	RequestEndDeviceControls	**createEndDeviceControls**	**Output:**CreateEndDeviceControlsRequestMessage **input:**ResponseMessage **Fault:** Fault message (solicit-response pattern of WSDL message exchange)	• EndDeviceControls.xsd[6] • Common_message_envelope.xsd Response and fault messages do not contain payload.
MDC	ExecuteEndDeviceControls	**createEndDeviceControls**	**Input:**CreateEndDeviceControlsRequestMessage **Output:**ResponseMessage **Fault:** Fault message (request- response pattern of message exchange in WSDL)	• EndDeviceControl.xsd[6] • Common_message_envelope.xsd Response and fault messages do not contain payloads.
MDC	SendEndDeviceEvents	**createdEndDeviceEvents**	**Output:**createdEndDeviceEventsmessage (Notification pattern of message exchange in WSDL)	• EndDeviceEvents.xsd • Common_message_envelope.xsd
MDM	ReceiveEndDeviceEvents	**createdEndDeviceEvents**	**Input:**createdEndDeviceEventsmessage (one way pattern exchange in WSDL)	• EndDeviceEvents.xsd • Common_message_envelope.xsd

6. EndDeviceControls.xsd is given in Annex H.6 of IEC 61968-9



12.3.3.1 CreateEndDeviceControlsRequestMessage

HeaderType

Verb	create
Noun	EndDeviceControls
Revision	2.0
Timestamp	Validate as per request—Not to be older than 24 hours
Correlation Id	Response must contain same id as in request

RequestType
Not used for GetEndDeviceControlsRequestMessage.

PayloadType

other	As per EndDeviceControls.xsd given in Annex H.6 of IEC 61968-9.

Required Fields used in EndDeviceControls schema.

Field	Type
EndDeviceControl	EndDeviceControl
EndDeviceControlType	EndDeviceControl type for above event As per Annex F of IEC 61968-9.

EndDeviceControlType for different data are to be used as per Annex F of IEC 61968-9.

Required elements and their definition for EndDeviceControl

Field	Type
mRID	Name of event as per table 11.4.2
reason	On demand

12.3.3.2 ResponseMessage

HeaderType

Verb	reply
Noun	EndDeviceControls
Revision	2.0
Timestamp	Timestamp of system for message generation
Correlation Id	Same as in Request message

ReplyType

Result	An enumeration of results:- OK, PARTIAL and FAILED

PayloadType
Not used for ResponseMessage.

Required Fields used in EndDeviceControls schema.

Field	Type
EndDeviceControl	EndDeviceControl
EndDeviceControlType	EndDeviceControl type for above event As per Annex F of IEC 61968-9.

EndDeviceControlType for different data are to be used as per Annex F of IEC 61968-9.

Required elements and their definition for EndDeviceControl

Field	Type
mRID	Name of event as per table 11.4.2
reason	On demand

12.3.3.2 ResponseMessage

HeaderType

Verb	reply
Noun	EndDeviceControls
Revision	2.0
Timestamp	Timestamp of system for message generation
Correlation Id	Same as in Request message

ReplyType

Result	An enumeration of results:- OK, PARTIAL and FAILED

PayloadType
Not used for ResponseMessage.

12.3.3.3 createdEndDeviceEventsMessage

HeaderType

Verb	created
Noun	EndDeviceEvents
Revision	2.0
Timestamp	Timestamp of system for message generation
Correlation Id	Same as in Request message

RequestType
Not used for createdEndDeviceEventsMessage

PayloadType

other	As per EndDeviceEvents.xsd given in Annex H.7 of IEC 61968-9.

Required Fields used in EndDeviceEvents schema.

Field	**Type**
EndDeviceEvent	EndDeviceEvent
EndDeviceEventType	EndDeviceEvent type for above event As per Annex E of IEC 61968-9.

EndDeviceEventType for different data are to be used as per Annex E of IEC 61968-9

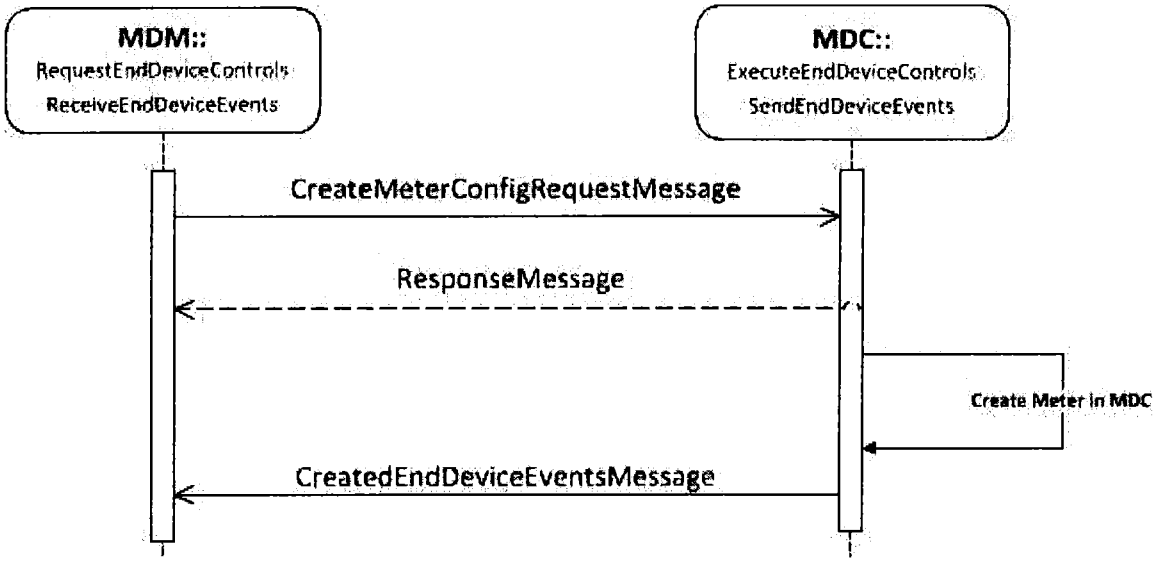
Required elements and their definition for EndDeviceEvent

Field	**Type**
mRID	Name of event as per table 11.4.2
createdDateTime	DateTime of event created in meter
issuerID	MSN of meter

EndDeviceControlType values for on demand Load control and Demand reset and their corresponding EndDeviceEventType are extracted from Annex E and F of IEC 61968-9 and given below.

			of message exchange in WSDL)	.xsd
MDM	ReceiveEndDeviceEvents	**createdEndDeviceEvents**	**Input:**createdEndDeviceEventsmessage (one way pattern exchange in WSDL)	• EndDeviceEvents.xsd[11] • Common_message_envelope.xsd[12]

7. MeterConfig.xsd is given in Annex H.22 of IEC 61968-9



12.3.4.1.1 CreateMeterConfigRequestMessage

HeaderType

Verb	create
Noun	MeterConfig
Revision	2.0
Timestamp	Validate as per request—Not to be older than 24 hours
Correlation Id	Response must contain same id as in request

RequestType

Not used for CreateMeterConfigRequestMessage.

PayloadType

other	As per MeterConfig.xsd given in Annex H.22 of IEC 61968-9.

Required Fields in MeterConfig schema.

Field	Type
Meter.mRID	Contains MSN of meter.
Meter.formnumber	Contains order number from Disco.
Meter.ConfigurationEvents	ConfigurationEvent is field in structure of Meter element Provides following information • the date and time at which the configuration or configuration change became effective or is to become effective, • the entity performing the configuration operation, and • Free-form remarks providing additional business information related to the configuration event.
Meter.EndDeviceInfo	Contains ratings of meter

12.3.4.1.2 ResponseMessage

HeaderType

Verb	reply
Noun	MeterConfig
Revision	2.0
Timestamp	Timestamp of system for message generation
Correlation Id	Same as in Request message

ReplyType

Result	An enumeration of results:- OK, PARTIAL and FAILED

PayloadType
Not used for ResponseMessage.

12.3.4.1.3 createdEndDeviceEventsMessage

HeaderType

Verb	created
Noun	EndDeviceEvents
Revision	2.0
Timestamp	Timestamp of system for message generation
Correlation Id	Same as in Request message

RequestType
Not used for createdEndDeviceEventsMessage

PayloadType

other	As per EndDeviceEvents.xsd given in Annex H.7 of IEC 61968-9.

Required Fields used in EndDeviceEvents schema.

Field	**Type**
EndDeviceEvent	EndDeviceEvent
EndDeviceEventType	EndDeviceEvent type for above event As per Annex E of IEC 61968-9.

EndDeviceEventType for different data are to be used as per Annex E of IEC 61968-9

Required elements and their definition for EndDeviceEvent

Field	**Type**
mRID	Name of event as per table 11.4.2
createdDateTime	DateTime of event created in meter
issuerID	MSN of meter

Event or Control Description	**Expected Events**
New meter created	Success :3.7.0.83 Failure: 3.7.0.297

12.3.4.2 Services to create new UsagePoint/Reference number in MDC

Entity	*Web service*	*Operations*	*Messages use in operation*	*Type of message (Schema)*
MDM	RequestUsagePointConfig	• **createUsagePoint Config**	**Output:**CreateUsagepointConfigRequestMessage **input:**ResponseMessage **Fault:** Fault message (solicit-response pattern of WSDL message exchange)	• UsagePointConfig.xsd[8] • Common_message_envelope.xsd Response and fault messages do not contain payload.
MDC	ExecuteUsagePointConfig	•**createUsagePointConfig**	**Input:**CreateUsagepointConfigRequestMessage **Output:**ResponseMessage **Fault:** Fault message (request- response pattern of message exchange in WSDL)	• UsagePointConfig.xsd[8] • Common_message_envelope.xsd Response and fault messages do not contain payloads.
MDC	SendEndDeviceEvents	**createdEndDeviceEvents**	**Output:**createdEndDeviceEventsmessage (Notification pattern of message exchange in WSDL)	• EndDeviceEvents.xsd • Common_message_envelope.xsd
MDM	ReceiveEndDeviceEvents	**createdEndDeviceEvents**	**Input:**createdEndDeviceEventsmessage (one way pattern exchange in WSDL)	• EndDeviceEvents.xsd • Common_message_envelope.xsd

8. UsagePointConfig.xsd is given in Annex H.27 of IEC 61968-9

Rest of the detail is same as for service for creating meter only difference is of schema UsagePointConfig.xsd instead of MeterConfig.xsd.

12.3.4.3 Services to create new Customer in MDC

Entity	*Web service*	*Operations*	*Messages use in operation*	*Type of message (Schema)*
MDM	RequestCustomerConfig	• **createCustomerConfig**	**Output:** CreateCustomerConfigRequestMessage	• CustomerConfig.xsd[9] • Common_mes

			input: ResponseMessage **Fault:** Fault message (solicit-response pattern of WSDL message exchange)	sage_envelope .xsd Response and fault messages do not contain payload.
MDC	ExecuteCustomerConfig	• **createCustomerConfig** •	**Input:**CreateCustomerConfigRequestMessage **Output:**ResponseMessage **Fault:** Fault message (request- response pattern of message exchange in WSDL)	• CustomerConfig.xsd[9] • Common_message_envelope .xsd Response and fault messages do not contain payloads.
MDC	SendEndDeviceEvents	**createdEndDeviceEvents**	**Output:**createdEndDeviceEventsmessage (Notification pattern of message exchange in WSDL)	• EndDeviceEvents.xsd • Common_message_envelope .xsd
MDM	ReceiveEndDeviceEvents	**createdEndDeviceEvents**	**Input:**createdEndDeviceEventsmessage (one way pattern exchange in WSDL)	• EndDeviceEvents.xsd • Common_message_envelope .xsd

9. CustomerConfig.xsd is given in Annex H.4 of IEC 61968-9

Rest of the detail is same as for service for creating meter only difference is of schema CustomerConfig.xsd instead of MeterConfig.xsd.

12.3.4.4 Services to associate a usage point and customer in MDC

Entity	*Web service*	*Operations*	*Messages use in operation*	*Type of message (Schema)*
MDM	RequestMasterDataLinkageConfig	• **createMasterDataLinkageConfig**	**Output:** CreateMasterDataLinkageConfigRequestMessage **input:**ResponseMessage	• MasterDataLinkageConfig.xsd[10] • Common_message_envelope .xsd

			Fault: Fault message (solicit-response pattern of WSDL message exchange)	Response and fault messages do not contain payload.
MDC	ExecuteMasterDataLinkage Config	• **createMasterData LinkageConfig** • **deleteMasterData LinkageConfig**	**Input:**CreateCustom erConfigRequestMe ssage **Output:**ResponseM essage **Fault:** Fault message (request- response pattern of message exchange in WSDL)	• MasterDataLin kageConfig.xsd [10] • Common_mes sage_envelope .xsd Response and fault messages do not contain payloads.
MDC	SendEndDeviceEvents	**createdEndDeviceEve nts**	**Output:**createdEnd DeviceEventsmessa ge (Notification pattern of message exchange in WSDL)	• EndDeviceEve nts.xsd • Common_mes sage_envelope .xsd
MDM	ReceiveEndDeviceEvents	**createdEndDeviceEve nts**	**Input:**createdEndDe viceEventsmessage (one way pattern exchange in WSDL)	• EndDeviceEve nts.xsd • Common_mes sage_envelope .xsd

10. MasterDataLinkageConfig.xsd is given in Annex H.21 of IEC 61968-9

Rest of the detail is same as for service for creating meter only difference is of schema MasterDataLinkageConfig.xsd instead of MeterConfig.xsd.

13. Data Export Formats:

13.1 Billing_Data.csv

Sr #	Item Name	Type (ASCII Text)	Description
1	Reading Date	YY/MM/DD	
2	Reading Time	HH:MM:SS	
3	Reference Number	XXXXXXXXXXXXXX	
4	Meter Serial Number	NNNNNNNNNN	
5	T1 Active kWh	XXXXXX.XX	kWh
6	T2 Active kWh	XXXXXX.XX	kWh
7	T3 Active kWh	XXXXXX.XX	kWh

			Fault: Fault message (solicit-response pattern of WSDL message exchange)	Response and fault messages do not contain payload.
MDC	ExecuteMasterDataLinkage Config	• **createMasterData LinkageConfig** • **deleteMasterData LinkageConfig**	**Input:**CreateCustom erConfigRequestMe ssage **Output:**ResponseM essage **Fault:** Fault message (request- response pattern of message exchange in WSDL)	• MasterDataLin kageConfig.xsd [10] • Common_mes sage_envelope .xsd Response and fault messages do not contain payloads.
MDC	SendEndDeviceEvents	**createdEndDeviceEve nts**	**Output:**createdEnd DeviceEventsmessa ge (Notification pattern of message exchange in WSDL)	• EndDeviceEve nts.xsd • Common_mes sage_envelope .xsd
MDM	ReceiveEndDeviceEvents	**createdEndDeviceEve nts**	**Input:**createdEndDe viceEventsmessage (one way pattern exchange in WSDL)	• EndDeviceEve nts.xsd • Common_mes sage_envelope .xsd

10. MasterDataLinkageConfig.xsd is given in Annex H.21 of IEC 61968-9

Rest of the detail is same as for service for creating meter only difference is of schema MasterDataLinkageConfig.xsd instead of MeterConfig.xsd.

13. Data Export Formats:

13.1 Billing_Data.csv

Sr #	Item Name	Type (ASCII Text)	Description
1	Reading Date	YY/MM/DD	
2	Reading Time	HH:MM:SS	
3	Reference Number	XXXXXXXXXXXXXX	
4	Meter Serial Number	NNNNNNNNNN	
5	T1 Active kWh	XXXXXX.XX	kWh
6	T2 Active kWh	XXXXXX.XX	kWh
7	T3 Active kWh	XXXXXX.XX	kWh

8	T4 Active kWh	XXXXXX.XX	kWh
9	TL Active kWh	XXXXXX.XX	kWh
10	T1 Reactive kVArh	XXXXXX.XX	kVArh
11	T2 Reactive kVArh	XXXXXX.XX	kVArh
12	T3 Reactive kVArh	XXXXXX.XX	kVArh
13	T4 Reactive kVArh	XXXXXX.XX	kVArh
14	TL Reactive kVArh	XXXXXX.XX	kVArh
15	T1 Active MDI	XXX.XXX	kW
16	T2 Active MDI	XXX.XXX	kW
17	T3 Active MDI	XXX.XXX	kW
18	T4 Active MDI	XXX.XXX	kW
19	TL Active MDI	XXX.XXX	kW
20	T1 Cumulative Active MDI	XXXXXX.XX	kW
21	T2 Cumulative Active MDI	XXXXXX.XX	kW
22	T3 Cumulative Active MDI	XXXXXX.XX	kW
23	T4 Cumulative Active MDI	XXXXXX.XX	kW
24	TL Cumulative Active MDI	XXXXXX.XX	kW
25	MDI Reset Date	YY/MM/DD	
26	MDI Reset Time	HH:MM:SS	
27	MDI Reset Count Number	XXXX	

Note: Unavailable quantities shall be appended by blank spaces

13.2 Instantaneous_Data.csv

Sr #	Item Name	Type (ASCII Text)	Description
1	Reading Date	YY/MM/DD	
2	Reading Time	HH:MM:SS	
3	Reference Number	XXXXXXXXXXXXXX	
4	Meter Serial Number	NNNNNNNNNN	
5	Aggregate Active power Import (KW+)	XXXXXX.XXX	kW

Provision of Communicator Application		

14.2 User Interface Application

Criteria	Pass	Fail
Capable of displaying all metering data as per relevant WAPDA/PEPCO meter's specifications i.e. DDS-50,DDS-60 and DDS-65		
Provides customer hierarchy for at least 3 levels		
Provides user management and user rights		
User rights limit a user to a certain level of customer hierarchy		
Provides a GUI		

14.3 Database Management System

Criteria	Pass	Fail
Stores and reports all metering data in DBMS		
Provides mechanism for periodic as well as on-demand backup; and also restores data on request		
Database server has a backup interface for DVD		
Capable to hold the metering data as specified in "Schedule of Technical Data"		

14.4 Hardware:

Criteria	Pass	Fail
RAID Hard Drives(if applicable)		
At least one backup server(if applicable)		
Server Class machines(if applicable)		
Online UPS(if applicable)		
Arrangement for at least two generators(if applicable)		
At least one GSM Modem.		
More than one server for load sharing(if applicable)		

14.5 Server side GSM Modem:

Criteria	Pass	Fail
Quad Band (verification through datasheet)		
SMS Capability(if applicable)		
Voice Call Capability(if applicable)		
LED Indicator		
Field Replaceable SIM		
RS232 or USB Interface		

14.6 Communicator

Criteria	Pass	Fail
Supports DLMS/COSEM communication protocol		
Supports output data files as specified in DDS-105:2011(if applicable)		

14.7 Communication Modes

Criteria	Pass	Fail
Mode I (Pull at preprogrammed Interval)		
Mode I (Pull at Events & Alarms)		
Mode I (Pull on Demand)		
Mode II(GPRS always alive)		

14.8 Communication Channels

Criteria	Pass	Fail
Provision of two Programmable IP addresses		
Provision of primary and secondary IP addresses		
Provision of three Programmable GSM Numbers		

14.9 Meter Identifier

Criteria	Pass	Fail
Supports Meter Identifier		

14.10 Meter to MDC interoperability verification

Criteria	Pass	Fail
Through CTT test report (Version of CTT shall 3.0 or higher)		

14.10 MDC to MDM interoperability verification

Criteria	Pass	Fail
Verifying the WSDL and XSD of web services on LAN		

14.12 Data Export Format

Criteria	Pass	Fail
Billing Data Export Format as per relevant specifications		
Instantaneous Data Export Format as per relevant specifications		

Engr. Atif Shahzad DY. MANAGER (D&S)	Engr. Shabir Ahmed Shaikh Addl. Chief Engineer (D&S)	Engr. Tahir Mahmood CHIEF ENGINEER (S&S)

15. Annex-I: Schedule of Technical Data:

Following data is to be filled by the customer as per their requirement

13.1. Billing Data to be transferred from meter to MDC to be filled for each meter/customer type.

S.No.	Item	Type	Required (mark Yes/No)
1	TL kWh	Billing	
2	T1 kWh	Billing	
3	T2 kWh	Billing	
4	T3 kWh	Billing	
5	T4 kWh	Billing	
6	TL kVArh	Billing	
7	T1 kVArh	Billing	
8	T2 kVArh	Billing	
9	T3 kVArh	Billing	
10	T4 kVArh	Billing	
11	TL MDI kW	Billing	
12	T1 MDI kW	Billing	
13	T2 MDI kW	Billing	
14	T3 MDI kW	Billing	
15	T4 MDI kW	Billing	
16	TL CUM MDI kW	Billing	
17	T1 CUM MDI kW	Billing	
18	T2 CUM MDI kW	Billing	
19	T3 CUM MDI kW	Billing	
20	T4 CUM MDI kW	Billing	

13.2. Instantaneous Data to be transferred from meter to MDC to be filled for each meter/customer type

S.No.	Item	Type	Required (mark Yes/No)
1	Aggregate Active power Import (KW+)	Instantaneous	
2	Aggregate Active Power Export (KW-)	Instantaneous	
3	Aggregate Reactive power Import	Instantaneous	
4	Aggregate Reactive power export	Instantaneous	
5	Voltage Phase A	Instantaneous	
6	Voltage Phase B	Instantaneous	
7	Voltage Phase C	Instantaneous	
8	Current Phase A	Instantaneous	
9	Current Phase B	Instantaneous	
10	Current Phase C	Instantaneous	
11	Average Power Factor	Instantaneous	
12	Frequency	Instantaneous	
13	Time	Instantaneous	
14	Date	Instantaneous	
15	Current Tariff	Instantaneous	
16	CT ratio Numerator	Instantaneous	
17	CT ratio Denominator	Instantaneous	
18	PT ratio Numerator	Instantaneous	
19	PT ratio Denominator	Instantaneous	
20	Customer Code	Instantaneous	

13.3. Frequency and Duration of Data to be filled for each meter/customer type used.

S.No.	Item	Count/Frequency/Duration
1	Billing Data interval	
2	Instantaneous Data interval	
3	Number of meters/customers in this category	
4	Data to be stored inside server for how many number of months	

13.4. IT Infrastructure requirement.

S.No.	IT Infrastructure	Required from bidder (Yes/No)
1	Servers	
2	Switched Router	
3	Online UPS	
4	Reliable Internet Connection	
5	Generators	
6	Data Center Room	
7	GSM Modems	
8	Tower	
9	Others(to be specified)	

13.5. Optional Features:

S.No.	Feature Names	Required from bidder (Yes/No)
1	Wake up on SMS	
2	Wake on voice call	
3	Backup server	
4	DDS-105:2011 integration required	

13.6. Service Level Agreement (SLA):

S.No.	Feature Names	
1	Meters to be integrated (specify make and model)	
2	After sales support duration	
3	Quantity to be integrated for each type and make of meters	
4		

16. Annex-II Parameters list for communication verification:

S.No.	Quantity Name
1	Meter Serial Number
2	Total kWh
3	Total kvarh

PAKISTAN WATER AND POWER DEVELOPMENT AUTHORITY

WAPDA SPECIFICATION

DDS-8:2007

SHEATHED INSULATED DISTRIBUTION CABLES

600 VOLTS (SID CABLES)

OFFICE OF CHIEF ENGINEER (DESIGN & STANDARDS)
WAPDA, FAISAL TOWN, LAHORE

5

PAKISTAN WATER AND POWER DEVELOPMENT AUTHORITY
Office of the Chief Engineer (Design & Standards) WAPDA
17/C-I, Ist. Floor, IEEEP Building, Faisal Town, Lahore
Ph.# 042/9231641 – Fax # 042/9231646
Email: cedengg@yahoo.com

No. 4078-96/CEDS/Z-8 Dated: 17-10-2007

The Chief Executive Officer
All DISCOs

Subject: WAPDA SPECIFICATION NO.DDS-8:2007 – SHEATHED INSULATED DISTRIUTION CABLES

Enclosed please find herewith copy of revised WAPDA Specification NO.DDS-8:2007 – Sheathed Insulated Distribution Cables for your guidance and record.

17/x/07
(AZIZ UR REHMAN)
DIRECTOR (D&S)

Cc to:-

- General Manager (C&M) Power WAPDA WAPDA House, Lahore.
- Chief Engineer (Material Inspection) WAPDA, Sunny View, Lahore.
- Chief Engineer (P&D) WAPDA, Lahore
- All manufacturers.

CONTENTS

SR.#	DESCRIPTION	PAGE #
0.	FOREWORD	
1.	SCOPE	
2.	SERVICE CONDITIONS	
3.	TYPES AND SIZES OF CABLES	
4.	CABLE CONSTRUCTION	
5.	CORE IDENTIFICATION	
6.	DIMENSIONS	
7.	CONDUCTOR	
8.	POLYVINYL CHLORIDE FOR INSULATION AND SHEATH	
9.	INSULATION	
10.	SHEATH	
11.	ARMOURING	
12.	TESTS	
13.	TEST SAMPLES, ACCEPTANCE AND REJECTION	
14.	TEST METHODS	
15.	MARKING AND PACKING	
16	Amendment No 1 dated 26.01.2010	
17	[illegible] No 2 dated 7.06.2010	

SPECIFICATION NO. DDS-8: 2007

SHEATHED INSULATED DISTRIBUTION CABLES

600 VOLTS (SID CABLES)

0. FOREWORD

0.1 This Specification has been prepared by the Standards Directorate of Design Distribution Department.

0.2 This Specification is intended only for the procurement of material and does not include all the necessary provisions of contract.

0.3 This Specification is subject to revision as and when required.

0.4 This Specification super cedes product description PD-25,26a,27a; 28b & 29 and DDS-8:84.

1. SCOPE

1.1 This Specification covers single core, single core underground, two core, four core armoured and four core unarmoured cables for use in 415/240 Volts distribution system. It covers the sizes which have been standardized for use in WAPDA. This Specification covers the. cables, which will be commonly known as "SID Cables".

2. SERVICE CONDITIONS

2.1 The cable shall be suitable for operation in a 415/240 volts, 50Hz. three phase multiple neutral earthed distribution system.

2.2 The single core underground and four core armored cable shall be suitable for direct burial, rest of the cables shall be suitable for installation in air or running in the ducts. The duct and soil conditions vary from dry to wet. Highly corrosive salts are encountered in the soil.

2.3 Ambient Temperature:

Maximum.	50 °C
Max: mean over 24 hours.	45 °C
Mean in the year.	39 °C
Minimum.	-10 °C

2.4 Relative humidity may range upto 100%.

2.5 The cables shall be suitable for conductor operating temperature as follows :-

Continuous operation.	70 °C
Short circuit(5 sec. maximum duration)	160 °C.

3. TYPES AND SIZES OF CABLES

3.1 The types and sizes of cables which have been standardized are given in Table-I:-

TABLE - I

Sr.No.	Type of Cable	Size of cable (mm ^{2})
1.	Single core cable.	25, 70, 120, 185, 300
2.	Single core underground cable.	25,70,120, 185, 300
* 3.	Two core cable.	10, ,25
**4.	Four core unarmoured cable	10, 25,70,120,185, 300
5.	Four core armoured cable	10,25, 70,120,185, 300

* 2 core 25mm^2 cable has also been standardized under twisted Unsheathed Distribution Cables.

** Four core 25, 70 & 95mm^2 cables have also been standardized under twisted Unsheathed Distribution Cables to be used in the narrow and zig zag streets of Cities and Villages as main and sub main distribution lines. Specified in DDS-1-85

4. CABLE CONSTRUCTION

4.1 Single Core Cable (unarmoured)

4.1.1 The conductor shall consist of circular stranded aluminium of electrical grade purity as specified in IEC 228:78.

4.1.2 The insulation shall be extruded polyvinyl chloride compound over the conductor. The polyvinyl chloride compound shall have properties as given in clause 8 of this Specification and shall be suitable for continuous conductor temperature of 70 °C.

4.2 Single Core Underground Cable (Armoured)

4.2.1 The conductor shall be as given in clause 4.1.1.

4.2.2 The insulation shall be extruded polyvinyl chloride compound over the conductor. An extruded polyvinyl chloride compound sheath shall be applied over the insulation. General purpose PVC shall be used both for insulation as well as sheath and shall be suitable for continuous conductor temperature of 70 °C.

4.3 Two Core Cable

4.3.1 The construction of individual cores of the two core cable shall be the same as single core cable.

TABLE-II

Sr. No	ITEM	Nominal Cross-Sectional Area of Conductor					
		10mm²	25mm²	70mm²	120mm²	185mm²	300mm²
1	Conductor						
	(i)Stranding						
	(Minumim No of strands/ nominal dia of each strand,mm)						
	a)Circular conductor (non compacted)	7/1.35	7/2.14	19/2.14	37/2.03	37/2.52	61/2.52
	b)Shaped conductor (No. of strands)	-	7	19	37	37	61
	(ii) Weight of Conductor Kg / Km	27.7	69.5	189	331	509	839
2	Max Conductor D.C. resistant at 20deg C (ohm/km) for single core and multi core cables	3.08	1.2	0.443	0.253	0.164	0.1
3	Nimonal insulation thickness for:						
	a) Single core cable (mm)	-	1.5	1.98	2.3	2.3	2.75
	b) Multi core cable (mm)	1.2	1.42	1.64	1.86	2.3	2.74
4	Nimonal thickness outer sheath						
	a) Single core underground	-	1.4	1.6	2.05	1.97	2.34
	b) Two core	1.8	1.8	-	-	-	
	c) Four core un armouorred cable	2.1	2.1	2.6	3.2	2.96	3.4
	d) Four core armouorred cable	2.08	2.1	2.52	3.08	3.147	3.51
5	Nominal thickness (mm) of bedding for four core armoured cable	1.64	1.8	2.36	2.61	2.7	2.87
6	Dia of armoured wire (mm) for four core armoured Cable only	1.6	1.6	2.1	2.64	2.5	3.175

Note:
The above values genrally conform to the values given in IEC standards , but some of values have been modiefied due to extream weather condations of Pakistan

4.3.2. The core shall be laid flat and sheathed with a black PVC compound.

4.4 Four core Unarmoured Cable

4.4.1 The individual core of cable below 25mm sq. shall be of circular stranded cross-section while those 25mm sq. and above may either be of circular cross section or shaped cross section. The shaped cross section cable shall conform to IEC-228:78.

4.4.2 Circular Stranded Cross-Section Cables

4.4.2.1 The four individual cores shall be laid up together with a right hand lay. A right hand lay is defined as clock-wise twist away from the observer.

4.4.2.2 The laid up cores shall have PVC/Polypropylene fillers both at the centre and the outer sides to give the cable a round shape. Thickness of the sheath over the cores shall be according to Table-II of this Specification.

4.4.2.3 Polypropylene binding tap having a thickness of 35 micron and above shall be wrapped over the laid up cores and fillers with a fifty percent overlap.

4.4.2.4 The polypropylene fillers twin are of suitable tex having a softening point not less than 150°C.

4.4.3 Shaped Stranded Cross-Section Cables

4.4.3.1 The laid up shall have PVC/Polypropylene fillers both at the centre and the outer sides to give the cable a round shape.

4.4.3.2 Polypropylene binding tap having a thickness of 35 micron and above shall be wrapped over the laid up cores and fillers with a fifty percent overlap.

4.4.3.3 Polyproperlyne binding tap shall have the property of splitting longitudinally but no lattitudinally.

4.4.3.4 The PVC shall be applied over the cores having the thickness as per Table-II.

4.5 Four Core Armoured Cable

4.5.1 The construction of the four core armoured cable shall be the same as of four core unarmoured cable with the exception that a single layer of galvanized steel wire shall, be. applied over the extruded PVC bedding. The direction of armour wire shall be left handed. A PVC sheath shall be applied over the armour wire, thickness of PVC sheath shall be as per Table-II.

5. **CORE IDENTIFICATION**

5.1 The cores of all cables shall be identified by colours in accordance with following sequence:-

Sr. No.	Type	Colour
1.	Single Core cable	Black
2.	Two Core cable	Red, Black
3.	Four Core cable	Red, Black, Light Blue and either Yellow or Green

6. **DIMEN SIONS**

6.1 The dimension of conductors shall be in accordance with Table-I. The cross-sectional. area of conductor shall be the sum of the areas of its component wires. The stranding of conductor shall be as given in Table-II.

6.2 For 2-Core,10mm sq,Cables

6.2.1 The tolerance /Nominal values mentioned in this specification be so adjusted that the overall size of 2-core,10 mm sq cable should remain within the following limits:-

(a) Width Wise 15.0 mm (Minimum)
16.5 mm (Maximum)

(b) Depth/Height wise 9.2 mm (Minimum)
10.1mm (Maximum)

6.2.2 There should be no gap between insulation and sheath.

7. **CONDUCTOR**

7.1 The conductor shall be 3/4th hard drawn stranded aluminum conforming to IEC 228:1978.

7.2 For circular conductor, the successive layers shall have opposite direction of lay, the outer most layer being right handed. The wires in each layer shall be evenly and closely stranded.

7.3 For sector shaped conductor only nominal areas and maximum D.C. resistance are to be checked.

7.4 Tolerance

7.4.1 ±1% tolerance is allowed on diameters of individual strands of circular conductors only. This tolerance is not applicable for sector shaped conductors.

8. POLYVINYL CHLORIDE FOR INSULATION AND SHEATH

8.1 The insulation and sheath shall be made from polyvinyl chloride compound type 'A' conforming to IEC 502:78 and shall be suitable for service conditions described in clause. 2 of this specification. The polyvinyl compound shall meet the following properties

8.2 Original Physical Properties

a) Minimum tensile strength	12.5 N/mm^2 OR 1.27kg/mm^2
b) Minimum elongation at break	150 percent.

8,3 Properties After Ageing in Air Oven

Ageing Conditions

Temperature.	80±20 °C
Duration of treatment.	168 hours.
a) Tensile strength after ageing, percentage of unaged value.	Max 120 Min. 80
b) Elongation at break after ageing, percentage of unaged value.	Max: 120 Min. 80

8.4 Heat Shock Test

Test conditions :

Temperature.	150± 2 °C
Duration of treatment.	1 hour
Result obtained.	No cracks

8.5.. Heat Distortion

Temperature	80±2 °C
Time under load.	First case 4 hours (for cables up to conductor size of 35mm sq.) Second case 6 hours (for cables having conductor size more than 35mm sq.)
Maximum percentage distortion	50%.

8.6 Cold Bend Test

Test conditions::

Temperature .	- 15±2 °C
Result to be obtained	No cracks

8.7 Resistance to Burning

Self extinguishing.

8.8 Colour Fastness

The colour of insulation and sheath shall fast to both. water and to sun light.

9. **INSULATION**

9.1 The insulation shall be made of polyvinyl chloride compound described in clause 8. The nominal insulation thickness shall be according to Table-II.

9.2 Tolerance

9.2.1 The insulation thickness given in Table-II are based on rated voltages.

9.2.2 The average thickness of the insulation shall not be less than the specified nominal value.

9.2.3 Thickness at any place may however be less than the specified nominal value provided the difference does not exceed 0.1mm + 10% of the specified nominal value.

10 **SHEATH**

10.1 The sheath shall be made of polyvinyl chloride compound described in clause 8 of this specification. The nominal sheath thickness shall be in accordance with Table-II.

10.2 Tolerances

10.2.1 The average thickness of the sheath shall not be less than the specified nominal values.

10.2.2 The thickness at any place may however be less than the specified nominal value provided the difference does not exceed 0.lmm + 10% of the specified nominal value.

11. **ARMOURING**

11.1 Bedding (Inner covering & Filler)

11.1.1 The bedding for four core armoured cable shall consist of an extruded Layer of PVC, general purpose PVC Shall be used. Nominal thickness of bedding shall be as given in Table-II. The PVC for the bedding shall meet the requirements laid down in clause 8 of this specification.

11.1.2 The average thickness of bedding shall not be less than the specified nominal values.

11.1.3 The thickness at any place may however be less than the specified nominal value provided the difference does not exceed 0.lmm + 10% of specified nominal value.

11.2 Wire Armour

11.2.1 Wire armour shall consist of a single layer of galvanized steel wires and the nominal diameters of round armour wire shall be as given in Table-II. The direction of lay of armour shall be left hand. The armour wire shall have following properties :-

a) The wire shall be of good uniform quality of circular cross-section free from splinters, irregularities and brittle places, and capable of being welded.
b) The tensile strength shall not be less than 37.8 kg/ mm ^{2} and not more than 50. kg/mm^2.
c) The elongation at break shall not be less than 12 percent.
d) The dimensions of armour wires shall not fall below the nominal values by more than 5%.

12. TESTS

12.1 Electrical Sample Tests for PVC Insulation & Sheath

12.1.1 The PVC insulation and sheath shall be subjected to following tests:

i. Insulation resistance measurement at room temperature.
ii. Insulation resistance measurement at maximum rated temperature.
iii. High voltage alternating current test.

12.2 Non Electrical Sample Tests for PVC Insulation & Sheath

i. Measurement of thickness of insulation and sheath.
ii. Tests for determining the mechanical properties of insulation before and after ageing.
iii. Weight loss test.
iv. Heat distortion test.
v. Heat shock test.
vi. Test for the behaviour of PVC at low temperature. (cold bend test)
vii) Colour fastness test.
viii) Accelerated water absorption test.
ix) Resistance to burning.

12.3 Routine Test

12.3.1 Out of all finished lengths, 10% lengths of cables randomly selected shall be subject to the following tests:-

i) Conductor resistance test
ii) A.C. Voltage

12.3.2 The manufacturer shall maintain record of Routine Tests carried out during the manufacturing process, which may be seen by the Inspector while undertaking testing as described in clause 12.3.1 above.

13. TEST SAMPLES, ACCEPTANCE AND REJECTION

13.1 The manufacturer shall afford to the inspector all necessary test facilities and assistance for carrying out the tests. The facilities shall be provided free of charge.

13.2 The manufacturer shall divide each consignment into lots for inspection. These lots shall be so selected that material in a lot is of reasonably uniform quality and as far as possible is manufactured at the same time and under the same conditions. The manufacturer shall keep sufficient production records to ensure that this can be done regularly. The lot size shall consist of any number of lengths up to a maximum of as follows :-

i. Single core/Two core cables 500 lengths.
ii. Four core cables 100 lengths.

13.3 From each lot, regardless of its size, samples of cables shall be taken at random from the following lengths of cables: -

i. Single core/Two core cables 2 lengths.
However, if the samples so taken from the offered lots are less than 10 lengths then 10 lengths shall be subjected to the tests.

ii. Four core cables 2 lengths
However, if the samples so taken from the offered lots are less than 5 lengths then 5 lengths shall be subjected to the tests.

One sample sufficient to provide the required No. of specimens for each test, shall be taken from each cable, single core or multi-core, in each of the selected lengths.

13.4 The samples taken shall be subjected to each of the tests prescribed in clause 12.1 and 12.2. The lot shall be accepted, if for each test, the sample complies with the requirements of clause 13.5.

13.5 If in any test one sample fails, the whole of, the respective lot shall be rejected.

14. TEST METHODS

14.1 Electrical Sample Test for PVC Insulation & Sheaths

The cable shall be subjected to the following tests, applied successively on the same sample of cable, 10 m to 15 m in length. The test shall be limited to not more than 3 cores.

14.1.1 Insulation Resistance Measurement at Room Temperature

a) This test shall be made on the sample length before any other electrical test. All outer covering shall be removed and the core shall be immersed in water at room temperature at least 1 hour before the test. The measurement shall be made between conductor and water. The measurement may be confirmed at 20+1°C. The D.C test voltage shall be 300 V to 500 V, and shall be applied for a sufficient time to reach steady measurement, but for not less than 1 min.

b) Calculations The volume resistivity and/or the insulation resistance constant shall be calculated from the insulation resistance by the formula given below-

$$f = \frac{2X \ \pi \ LR}{\log e \ D/d}$$

Where :

f = Volume resistivity in ohm centimeters.
R= Measured insulation resistance in ohms.
L= Length of the cable in centimeters.
D= Outer diameter of the insulation in millimeters.
d = Inner diameter of the insulation in millimeters.

Also the "insulation resistance constant Ki" may be calculated, using the formula

$$Ki = \frac{LR \times 10^{-11}}{\log_{10} D/d} = 10 \times 0.367 \ f \ M\Omega \ Km$$

c) Requirements: The values calculated from the measurement shall not be less than those specified in Table-III given below:

TABLE - III

Electrical, Type Test Requirements

Designation of the insulating compounds	PVC
- Maximum rated conductor temperature (C°)	70
- Volume resistivity (Ω cm)	
- at 20°C	10^{13}
- at max: rated temperature (70 °C)	10^{10}
- Insulation resistance constant Ki.	(M Ω Km)
- at 20°C	36.7
- at max: rated temperature (70°C)	0.037

14.1.2 Insulation Resistance Measurement at Maximum Rated Temperature

a) The core of the cable sample with all outer covering removed shall be immersed in water which shall be heated at the specified temperature for at least 1 hour before test. The D.C test voltage shall be 300 V to 500 V and shall be applied for a sufficient time to reach steady measurement, but not less than 1 min.

b) Calculations: The volume resistivity and/or the insulation resistance constant shall be calculated from the insulation resistance by the formula given in sub clause 14.1.1.b.

c) Requirements: The values calculated from the measurements shall not be less. than specified in Table-III given above in sub clause 14.1.1.c.

14.1.3 High Voltage Alternating Current Test

a) Procedure: The cores of the cable sample with all outer coverings removed shall be immersed in water at room temperature for at least 1 hour.

A power frequency voltage equal, to three times the rated voltage shall be gradually applied and maintained continuously for 4 hours between the conductor and the water.

b) Requirements: No break down shall occur.

14.2 Non-Electrical sample Tests for Insulation & Sheaths

14.2.1 Measurement of Thickness of Insulation

a) Sampling : One sample of each cable core shall be taken from each of three places separated from each other by at least 1 m. For cables having more than three cores of equal nominal cross-section, the number of cores on which the measurement is made shall be limited to three cores or 10% of the cores, which ever is large

b) Procedure : The measurement shall be made as described in clause 4 of IEC Publication 540.

c) Requirements: The average, which shall be rounded off to the nearest 0.1 mm of all the measured values on each core shall not be less than the specified nominal thickness and the smallest measured value shall not fall below 90% of the specified nominal thickness by more than 0.1 mm.

14.2.2 Measurement of Thickness of Sheaths

a) Sampling: One sample of cable shall be taken from each of three places separated from each other by at least 1 m.

b) Procedure: The measurements shall be made described in clause 4 of. IEC Publication 540.

c) Requirements: Each piece of sheath shall comply with the following

The average, which shall be rounded off to the nearest 0.1 mm of the measured values shall not be less than the specified nominal thickness. The smallest value shall not fall below 90% of the specified nominal thickness by more than 0.1 mm.

14.2.3 Test for Determining the Mechanical Properties of Insulation Before and After Ageing

a) Sampling: Sampling and the preparation of the test pieces shall be carried out as described in clause 5 of IEC Publication 540.

b) Ageing Treatment: The ageing treatments shall be carried out as described in clause 6 of IEC Publication 540 under the condition specified in clause 8.3 of this specification.

c) Conditioning & Mechanical Tests: Conditioning and the measurement of mechanical properties shall be carried out as described in clause 5 of IEC Publication 540.

d) Requirements: The test results for unaged and aged test pieces shall comply with the requirements given in clauses 8.2 and 8.3 of this specification.

14.2.4 Tests for Determining the Mechanical Properties of Sheaths Before and After Ageing

a) Sampling: Sampling and the preparation of the test pieces shall be carried out as described in clause 5 of IEC Publication 540.

b) Ageing Treatments: The ageing treatments shall be carried out as described in clause 6 of IEC Publication 540, under the conditions specified in clause 8.3 of this specification.

c) Conditioning and Mechanical Tests: Conditioning and measurements of mechanical properties shall be carried out as described in clause 5 of IEC Publication 540.

d) Requirements: The test results for unaged and aged test pieces shall comply with the requirements given in clauses 8.2 & 8.3 of this specification.

14.2.5 Additional Ageing Test on Pieces of Completed Cables

a) General: This test is intended to check that the insulation and sheath are not liable to deteriorate in operation due to contact with other components in the cable.
The test is applicable to the cables of all types.

b) Sampling; Samples shall be taken from the completed cable as described in clause 6 of IEC Publication 540.

c) Ageing Treatment: The ageing treatment of the pieces of cable shall be carried out in an air oven, as described in clause 6 of IEC Publication 540, under the following conditions:

Temperature:	10±2°C above the rated operating conductor temperature of the cable or, if the operating temperature of the cable is not known, 10±2°C above the rated operating conductor temperature for the insulating material.
Duration	168 hours.

d) Mechanical Tests: Test pieces of insulation and sheath from the aged pieces of cable shall be prepared and subjected to mechanical tests as described in clause 6 of IEC Publication 540.

e) Requirements: The variation between the medium values of tensile strength and elongation at break after ageing and the corresponding values obtained without ageing (See sub-clauses 14.2.3 and 14.2.4) shall not exceed the values applying to the test after ageing in an air oven specified in clause 8.3 of this specification.

14.2.6 Weight Loss Test on PVC Insulation and Sheaths

a) Procedure: The sampling and complete test procedure shall be in accordance with clause 7 of IEC Publication 540.

b) Requirements: The test results shall comply with the following requirements:

Treatment:	80±2 °C
Max: possible loss of mass.	2 mg/cm^2

14.2.7 Test for the Behaviour of PVC Insulation and Sheaths at High Temperatures (Heat Distortion Test)

a) Procedure: The sampling and test procedure shall be in accordance with clause 8 of IEC Publication 540 employing the test conditions given in clause 8.5 of this specification.

b) Requirements: The test results shall comply with the requirements given in clause 8.5 of this specification.

14.2.8 Test for Behaviour of PVC Insulation and Sheath at Low Temperatures (Cold Bend Test)

a) Procedure: The sampling and test procedure shall be in accordance with clause 9 of IEC Publication 540, employing the test temperature specified in clause 8.6 of this specification.

b) Requirements: The results of the tests shall comply with the requirements given in clause 8.6 of this specification.

14.2.9 Test for Resistance of PVC Insulation and Sheaths to Cracking (Heat Shock Test)

a) Procedures The sampling and test procedure shall be in accordance with clause 10 of IEC Publication 540, the test temperature and period of heating being in accordance with clause 8.4 of this specification.

b) Requirements: The results of tests shall comply with the requirements given in clause 8.4 of this specification.

14.2.10 Colour Fastness Test for Sheaths & Insulation

14.2.10.1 Colour Fastness to Water

A piece of core about 100 mm, long, from which the conductor has been removed (or a piece of sheath about 100 mm long, from which the cores have been removed) -shall be cut into small pieces and then immersed in, about 10 times its own volume, of distilled water for 48 hours at a temperature of 70°C. At the end of this period the water shall be examined. Requirement as per clause 8.8 of this specification.

14.2.10.2 Colour Fastness to Day Light

14.2.10.2.1 The test will be considered as a sort of type test but will be carried out one in a purchase order.

14.2.10.2.2 This test shall be made in accordance with method 507 A, in BS 2782 : Part 5. Requirement as per clause 8.8 of this specification.

14.2.11 Accelerated Water Absorption Test

14.2.11.1 Gravimetric Method

14.2.11.1.1 Test Specimen

A 275 mm test specimen of the insulated conductor shall be taken if the weight of the specimen is less than 100 grams. For heavier specimens, a segment of the insulation 100mm long and 25mm wide shall be out from the insulated conductor and smoothed to remove all corrugations.

14.2.11.1.2 Preparation of Test Specimen

The surface of the test specimen shall be cleaned by scrubbing with a lintless cloth moistened with water. The specimen shall be dried for 48 hours at 70°C and then weight to the nearest milligram, weight, A. The area, S, shall be the number of square centimeter in a 254 mm length of the insulated wire or the total area in square centimeter of the segment. The insulated wire specimen shall be bent in the shape of a U around a mandrel having a diameter not less than three times in tightly fitting holes in the cover of a 1-point glass jar so that 254mm of the specimen will be immersed when the jar is completely filled with water and cover applied.

14.2.11.1.3 Immersion of Specimen

The test specimen shall be immersed in freshly boiled distilled water at 70°C for 168 hours. The level of the water shall be maintained flush with the under surface of the cover during the soaking period. The segment-shaped specimen shall be completely immersed. After the specimen has been immersed for 168 hours, the water shall be cooled to room temperature. The specimen shall he removed and the adhering water shaken off. The specimen shall be bolted lightly with lintless cloth and weighed within 3minutes to the nearest milligram, weight B. The specimen shall be dried in a vacuum of 5 millimeters of mercury or less over calcium chloride at 70°C for 48 hours and then weighed to the nearest milligram, weight C.

14.2.11.1.4 Calculation

The water absorption shall be calculated in terms of milligrams per square centimeter of surface as follows :

(if C is less than A) = B-C

Water absorption
(if C is greater than A)

$$= \frac{B-A}{S}$$

Where:
A= Weight of the specimen in milligrams before immersion.
B= Weight of the specimen in milligrams after immersion.
C= Weight of the specimen in milligrams after drying in vacuum.
S= Total area in square centimeter of the test specimen.

14.2.11.1.5 Requirements:

Max: water absorption = 1.5 mg/cm^2

14.2.12 Resistance to Burning.

a) Procedure: Compliance is checked by the following test which is made on three samples of the completed flexible cable each 30 cm long. The test is made in still air with a Bunsen burner, having a nozzle, with an internal diameter of 9mm burning town gas. With the burner „in the vertical position, the flame is adjusted so that the over-all height of the flame is 10cm with an inner blue cone of 5 cm. The burner is then supported so that its axis is at an angle of 45 degree to the vertical. The sample is held vertically, in such a position that the tip of the inner cone of the flame touches the surface of the sample at a distance of approximately 10cm from its lower end. The sample is held in the flame for 1 minute. If the insulation or sheath burns, it shall do so slowly and the burning shall not spread-appreciably; any flame shall have died out in less than 30 seconds after removal of the burner.

b) Requirement: The insulation and sheath shall be self-extinguishing.

14.3 Routine Tests

The routine tests shall normally be carried out on all finished cable lengths. The routine tests required by this standard are:-

14.3.1 Measurement of Electrical Resistance of Conductor

a) Sampling: For multi core cables the measurement shall be made on all the conductors of each insulated conductor selected for the routine tests.

b) Procedure: The complete cable length, or a sample there from, shall be in the test room, which shall be maintained at reasonably constant temperature, for at least 12 hours before the test. If it is doubtful whether the conductor temperature is the same as the room temperature,. the resistance shall be measured after the cable has been in the test room for 24 hours. Alternatively, the

15.4 For 5% of the 2 core cable length on order, 100 meters length i.e. one coil may be supplied in two workable random lengths neither of which shall be shorter than 40 meters. Such coil shall be clearly marked with the length of two pieces on wrapper, and the payment would be made for length actually supplied.

15.5 The single core and four core cables shall be whirled around the wooden drums. The length of the cable shall be as given in Table - IV

TABLE – IV

Sr. No.	CABLE	Length of cable on Drum
Single core cable		
i)	25,70 & 120mm ^{2}	1000 meters.
ii)	185 & 300 mm ^{2}	500 meters.
Four core unarmoured cable		
i)	10 mm ^{2}	250 meters.
ii)	25, 70 & 120 mm ^{2}	200 meters.
iii)	185 & 300 mm ^{2}	150 meters.
Four core armoured		
i)	10 mm ^{2}	250 meters.
ii)	25 & 70 mm ^{2}	200 meters
ii)	185 & 300 mm ^{2}	100 meters.

15.6 The dimension of the wooden drum will be as per drawing No. CEDE/DDST/18. The reels shall be made from high quality KIKER WOOD and shall be of sound construction, able to withstand the usual rigors of transportation and field construction. The complete periphery of the reels apart from being protected by heavy wooden lagging nailed at each end of the reel flanges as per Fig. CEDE/DDST/18 shall also be bound by two steel straps. The wooden reel shall be given two brush coats of 100% creosote before winding of cable.

15.7 The manufacturer shall provide the following markings on the reels/pickings in legible and indelible letters:

i) Manufacturer's name and designation.
ii) Cable designation.
iii) Address of the consignee and purchase order No.
iv) Sr. No. of the reel/packing

15.8 The manufacturer's shall stamp the following information on metalic plates which shall be securely nailed to the reel. In case of packing the following information shall be printed on card stapled securely to the packing:

i) Size and designation of the cable.
ii) Net weight, tare weight and gross weight in Kg.
iii) Total length of the cable on the reel/packing in meters.
iv) Sr. No. of the reel/packing.

resistance shall be measured on a sample of conductor contained for at least 1'hour in a temperature controlled oil bath. The measured value of resistance shall be corrected to a temperature of 20°C and 1 KM length in accordance with the formula and factors given in clause 6 of IEC-228:1978.

c) Requirements: The D.C resistance of each conductor at 20°C shall not exceed the appropriate maximum value specified in Table-II of this specification.

14.3.2 Alternating Current Voltage Test

The test shall be made at room temperature with an alternating voltage approximately of sine wave form having a frequency in the range 40 Hz. to 62 Hz. The value of voltage shall be 3000 volts.

a) For armoured cable the voltage shall be applied between each insulated conductor and all the other conductors and armour wires, which shall be earthed.

b) For unarmoured cable the voltage shall be applied between conductors.

c) For single core cable, it shall be immersed in water at room temperature for one hour and test voltage then be applied between the conductor and water. The test voltage shall be increased gradually and maintained at full value (3000 volts) for 5 minutes.

15. MARKING AND PACKING

3KV

15.1 The word "WAPDA" shall be super scribed on every meter length of all the cables in the form of protruding mould.

15.2 The two core cable shall be supplied in coils of 100 meters length wrapped in Hessian/Cotton cloth/Polyethylene. of the following characteristics :-

Hessian:

Thickness	0.8mm
Shearing Strength	1.00 to 1.04 kg/mm ^{2}

Cotton Cloth :

Thickness	0.40mm
Shearing Strength	2.2 to 2.6 kg/mm ^{2}

Polyethylene

Thickness	0.15mm
Shearing Strength	0.35 to 0.55 kg/mm ^{2}

The wrapping should be overlapped.

15.3 For two core cable a tolerance of ±5% in standard length of L.T. PVC cables is allowed for only 10% coils of the entire order.

15.9. Both sides of the reel shall have an arrow mark indicating the direction of rolling.

15.10 All markings shall appear on both sides of the reel in the positions indicated in Fig.CEDD/DDST/18.

15.11 In case of packing the following information shall be printed on sticker paper pasted on steel sheet of size 9 x 6 cm tagged with the packing."

i) Manufacturer's name and designation.
ii) Cable designation.
iii) Address of consignee with P.O. No.
iv) Total length of Cable.
v) Serial Number of the Coil.

16. **ENCLOSURES**

(NASIR OSMAN) Deputy Director (D&S)	20/7/07 (AZIZ UR REHMAN) Director (D&S)	(YAQOOB BAIG MIRZA) 8/9/2007 Chief Engineer (Design & Standards)

NATIONAL TRANSMISSION & DESPATCH COMPANY
Office of Chief Engineer (Design & Standards) NTDC
48-L Model Town Extension, Lahore.
Ph No.042/99230024, Fax No.042/99230025
Email: cedengg@yahoo.com.

No. 2100-2118/CEDS/Z-8 Dated: 07-06-2010

The Chief Executive Officers

All DISCOs.

Subject: **AMENDMENT NO.2 DATED 07.06.2010 – DDS-8:2007**

Enclosed please find herewith a copy of amendment no.2 of WAPDA specification DDS-8:2007 for your reference and record.

DA/As above.

MANAGER (D&S) 7/6/10
o/o Chief Engineer (D&S) NTDC

CC: -

- General Manager (Services Division) NTDC, PEPCO, Wapda House , Lahore.
- Chief Engineer (Material Inspection) NTDC PEPCO, Sunny View, Lahore.
- Director HV&SC Testing Lab. NTDC Faisalabad
- All cable manufacturers.

SPECIFICATION NO. DDS-8:2007

SHEATHED INSULATED DISTRIBUTION CABLES

600 VOLTS (SID CABLES)

AMENDMENT NO. 2

DATED 7TH JUNE, 2010.

Change the values in Sub Clause 4.3.1 Table-II, 1 (b)

"Shaped Conductor" (Minimum No. of strands) be read follow:

$10mm^2$	$25mm^2$	$70mm^2$	$120mm^2$	$185mm^2$	$300mm^2$
-	6	12	15	30	30

7/6/2010 (NASIR OSMAN) Dy. Manager (D&S)	7/6/10 (MANSOOR NASIR) Manager (D&S)	(MUHAMMAD SHAFQAT) Chief Engineer (Design & Standards)

NATIONAL TRANSMISSION & DESPATCH COMPANY
Office of Chief Engineer (Design & Standards) NTDC
48-L Model Town Extension, Lahore.
Ph No.042/99230024, Fax No.99230025
Email: cedengg@yahoo.com.

No. 408-24 **/CEDS/**2.8 **Dated:** 29-01-2010

The Chief Executive Officers
All DISCOs

Subject: SHEATED INSULATED DISTRIBUTION CABLES 600 VOLTS (SID CABLES) - AMENDMENT NO.1

Enclosed please find herewith copy of Amendment No.1 of Specification No.8:2007 (Sheated Insulated Distribution Cables) for your guidance and record.

D A/Attached

29/1/2010
(AZIZ-UR-RHEMAN)
MANAGER (D&S)
O/O Chief Engineer (D & S) NTDC

c.c.to

- General Manager (~~C&M~~ S.D) Power, WAPDA House, Lahore.
- Chief Engineer (MI) NTDC Sunny View, Lahore.
- All manufacturers of Sheated Insulated Distribution Cables

SPECIFICATION NO. DDS-8:2007

SHEATED INSULATED DISTRIBUTION CABLES

600 VOLTS (SID CABLES)

AMENDMENT NO.1

DATED 26th January 2010

Clause 12.3.3 is added as under:

12.3.3. Wrapping Test:

Out of all finished length, 1 % lengths of cables randomly selected shall be subjected to the wrapping test.

12.3.3.1 Procedure:
The aluminium wire shall be wrapped round a mandrel of diameter equal to the wire diameter to form a close helix of eight turns. Six turns shall then be unwrapped and again closely wrapped.
The wire shall not break or show any cracks.

26/1/10 (JAVAID NASEEB MALIK) DY. MANAGER (D&S)	26/1/2010 (AZIZ UR REHMAN) MANAGER (D&S)	26/1/2010 (MUHAMMAD SHAFQAT) CHIEF ENGINEER (D & S) NTDC

10/A

172
7

SPECIFICATION P-111-76
(UDC 621.416.99 / 614.825)

EARTH ROD

46

[illegible]

[illegible]

PAKISTAN
WATER AND POWER DEVELOPMENT AUTHORITY
DESIGN DEPARTMENT (TDC)

SPECIFICATION P-111: 76

172/10

HARDWARE FOR EARTHING OF DISTRIBUTION LINES

0 FOREWORD

0.1 This specification has been prepared by the Standards and Research Directorate of the Design Department (Power) Wapda, Lahore.

0.2 This specification is intended only for the purpose of procurement of material and does not include the provisions of contract.

1 SCOPE

1.1 This specification covers hardware used in earthing of distribution lines.

2 HARDWARE

2.1 *Clamps*

The clamps having designation as below shall be supplied in accordance with drawings noted against each type in table-1.

Table - 1

Designation	Drawing No	Remarks
1. Ground conductor clamp type-S	PDW/DF-236	Used for L & H type lattice steel structure
2. Ground conductor clamp type PL	PDW/DF-235	Used forL-type tubular poles
3. Ground conductor clamp type-PH	PDW/DF-235	Used for H-type tubular poles
4. Earth rod clamp type-R	PDW/DF-234	

2.2 Earth Rod

The earth rod shall be supplied in accordance with drawing No. PDW/DF-237

3 MATERIAL

3.1 The steel used in the manufacture of all items except those in sub-clause 3.2 shall have the following characteristics:

Tensile strength	41-56 kg/mm^2
Min: Yield point	25 kg/mm^2
Min: elongation	20% in 200mm gauge length

3.2 Grey cast iron used in the manufacture of spacer of earth rod clamp shall have the following characteristics:

4 CONSTRUCTION REQUIREMENTS

4.1 The ground conductor clamps and base of earth rod clamp shall be manufactured from mild steel flat.

4.2 The earth rod & U-bolt of earth rod clamp shall be manufactured from rolled bar mild steel.

4.3 The spacer of earth rod clamp shall be die-casted from grey cast iron.

4.4 The nuts and bolts shall conform to Wapda Specification P-19.

4.5 The earth rod shall have a cone point and chamfered head for maximum ease in driving.

4.6 The clamps and earth rod shall be reasonably smooth and free from sharp projections. The nuts shall run freely over the entire length of threads.

4.7 The clamps shall be so manufactured that they provide substantial and reliable mechanical connection of ground conductor with earth rod or structure/pole to have adequate electrical conductivity.

4.8 The corners and edges of every item shall be rounded off and there shall be no cracks or burrs.

4.9 The holes shall be made prior to galvanising.

4.10 The nuts and bolts shall be electro galvanised in accordance with WAPDA Specification P-82.

4.11 All items except those in sub-clause 4.10 shall be hot dip galvanised in accordance with Wapda Specification P-82 "Zinc Coating". The average and minimum weight of coating shall be 915 and 840 gm/sq meter respectively. This corresponds to a thickness of 0.13 and 0.12 mm respectively.

5 TESTS

5.1 The following tests shall be carried out on all hardware items.

1) Visual examination
2) Verification of dimensions
3) Galvanising test
4) Tensile test

6 TEST METHODS

6.1 Visual Examination

Individual items shall be visually examined for the defects given below:

Table

Sr No	Examination	Defects
1.	Construction	Not of shape shown in drawings. Any part missing or not of correct material. Grooves and holes not properly formed. Any cracks on items.
2.	Finish	Galvanising not proper, presence of burrs, black or bare spots and projections which will interfere with the proper use of the article. Corners, edges not rounded off.
3.	Marking	Missing, not legible, incomplete or not permanent.

Verification of Dimensions

The dimensions shall conform to the drawings attached.

Galvanising Test

The galvanising shall be tested as per Wapda Specification P-02.

Tensile Test

The mild steel items shall be tested for tensile strength as per ISO/R-82-1974.

The grey cast iron items shall be tested for tensile strength as per ISO/R-185-1961.

SAMPLING, ACCEPTANCE AND REJECTION

Each type of items shall be divided into lots containing upto 500 units each. A sample of 50 items shall be drawn at random from each lot.

The selected samples shall be subjected to visual examination and verification of dimensions. If the number of defective units is four the lot shall be accepted, if the number of defective units is more than five the lot shall be rejected. If the number of defective units is five, another sample of 50 units shall be selected at random and subjected to tests. If the number of defective units is again five or more, the lot shall be rejected. If the number of defective units is four or less the lot shall be accepted.

Three random samples of all items selected from a lot of 500 units shall be subjected to galvanising test and tensile test.

7.4 If one unit from any group of three units selected as per clause 7.3 fails to meet the requirements another group of three units shall be selected at random. If any units in the second group fails the tests the lot shall be rejected.

8 MARKING

8.1 Individual items shall be punched with 'WAPDA-ED' and manufacturer's name or trade mark. The size of lettering shall be at least 5 mm and the marking shall be such that it can be read distinctly after galvanising.

8.2 The marking of ground rod shall be located within 300 mm of the top of the rod.

9 PACKING

9.1 The clamps shall be packed in wooden boxes containing not more than 50 units in each box.

9.2 The earth rods shall be bundled and banded in groups of five. The bandling shall be at three locations with galvanised steel wire or steel binding straps. The bundles shall then be in wooden crates, capable of withstanding the rigours of transporation and handling.

9.3 The nuts and bolts shall be packed as per WAPDA Specification P-19.

Encls: Drawing No. PDW/DF-234
PDW/DF-235
PDW/DF-236
PDW/DF-237

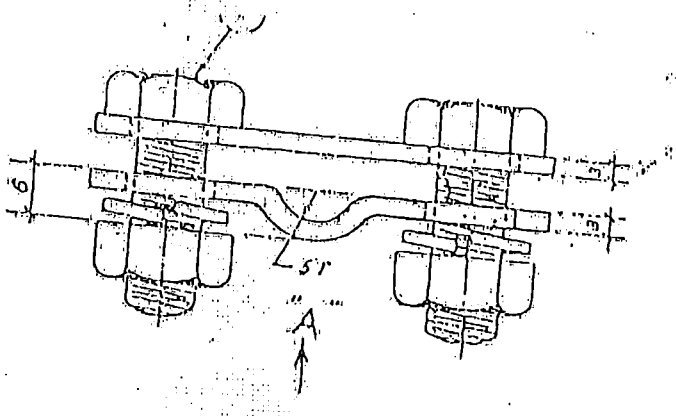
175

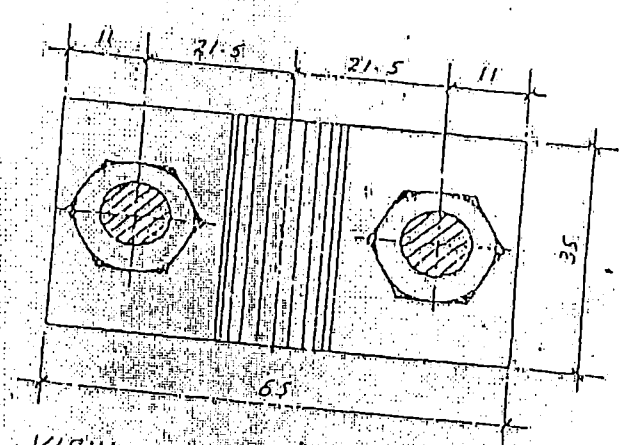
76

MATERIAL:- MILD STEEL, GALVANISED.

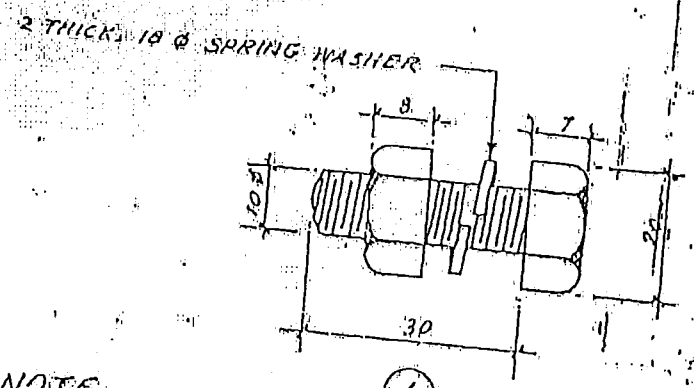
PAKISTAN WATER AND POWER DEVELOPMENT AUTHORITY	DESIGN. DEPARTMENT
EARTH ROD	
DWN. A. HASSAN.	SCALE:- 1:1
TCD.	DATE:-

(261)





VIEW IN DIRECTION OF "A"



(1)

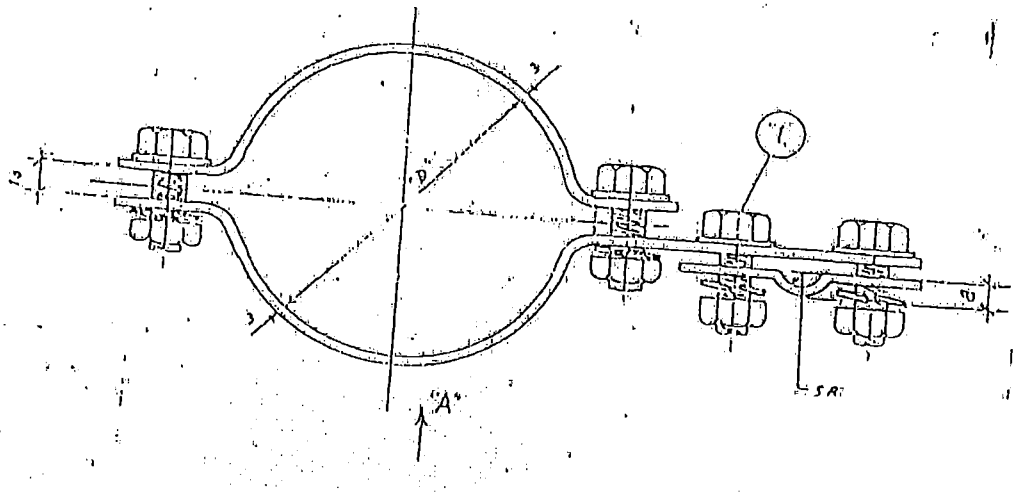
NOTE:-

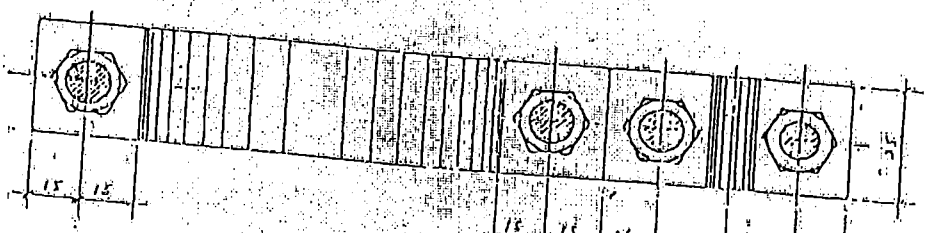
1. ALL HOLES ARE 12 Ø.
2. MATERIAL :- MILD STEEL, GALVANISED.
3. MATRIAL FOR SPRING WASHERS CARBON SPRING STEEL, GALVANISED.

PAKISTAN WATER AND POWER DEVELOPMENT AUTHORITY			DESIGNS DEPTT. POWER
GROUND CONDUCTOR CLAMP S-TYPE FOR LATTICE STEEL STRUCTURE			
DWN MAJEED		SCALE 1:1	DATE 16.11.76
TCD MAJEED			
CKD		DWG. NO. PDW/DF-236	

MATERIAL OF SPRING WASHER CHANGED.		
REVISIONS		BY

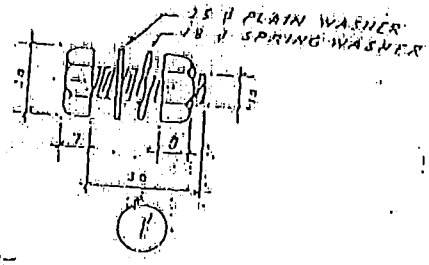
260





VIEW IN DIRECTION OF "A"

CLAMP DESIGNATION	DIMENSION "D" mm
PL - TYPE	165
PH - TYPE	219



NOTE:-

1. ALL HOLES ARE 12 ø.
2. MATERIAL:- MILD STEEL, GALVANISED.
3. MATERIAL FOR SPRING WASHERS CARBON SPRING STEEL, GALVANISED.

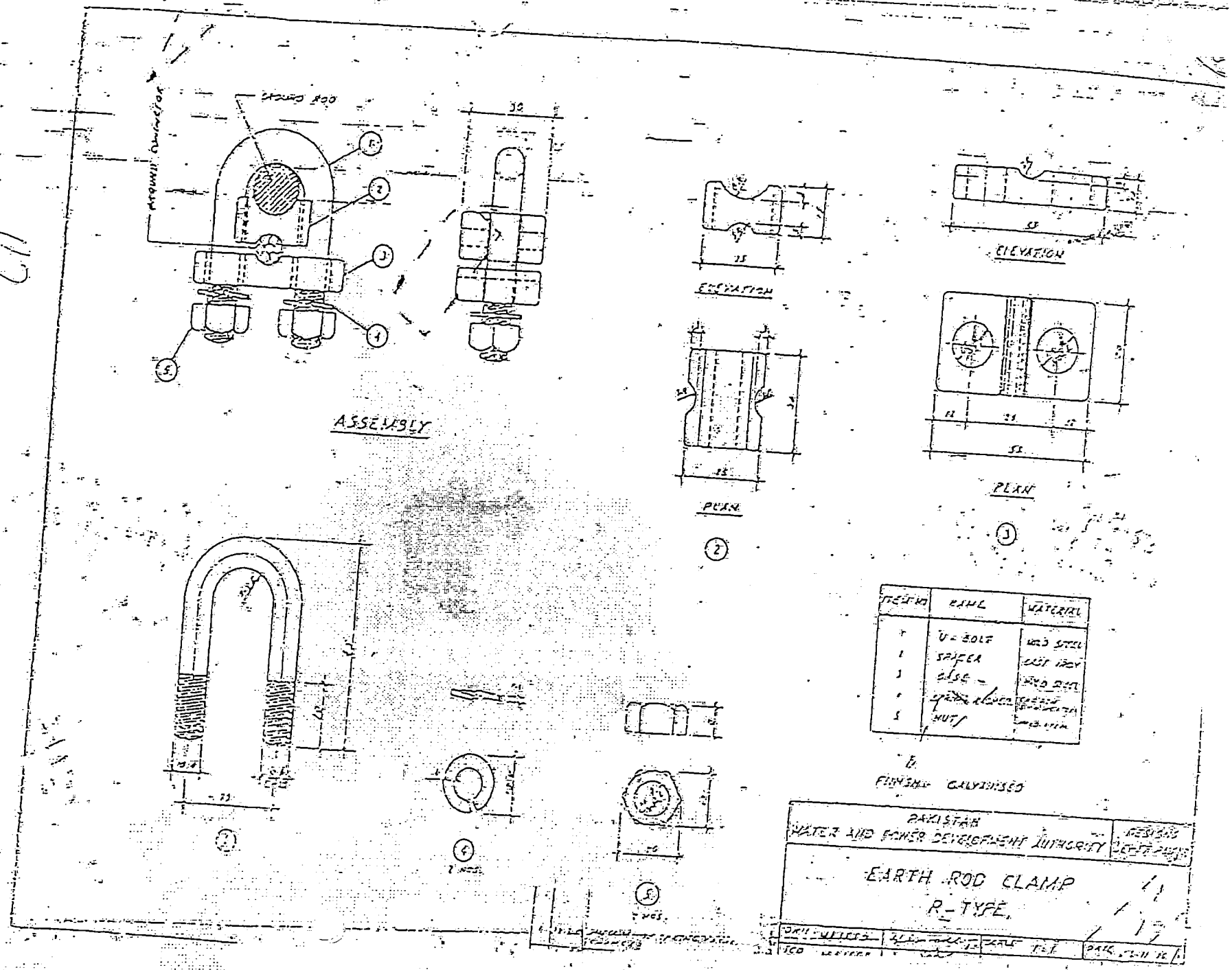
PAKISTAN

WATER AND POWER DEVELOPMENT AUTHORITY

DESIGN DEPARTMENT

GROUND CONDUCTOR CLAMP PL & PH TYPE FOR TUBULAR POLES

MATERIAL OF SPRING WASHER CHANGED		DWN. MAJEED		SCALE:	DATE 14.10.76
		TCD. MAJEED			
REVISIONS	BY	CKD.		DWG. NO. PDW/DF-235	


ASSEMBLY
ELEVATION
PLAN
ELEVATION
PLAN
FINISH GALVANISED
PAKISTAN
WATER AND POWER DEVELOPMENT AUTHORITY
EARTH ROD CLAMP
R-TYPE

2581

SPECIFICATION P-111: 76

HARDWARE FOR EARTHING OF DISTRIBUTION LINES

AMENDMENT NO. 1

DATED 26th FEBRUARY, 1981

1. Clause 3.1: In second line, add after 3.2 "and 3.3".

2. Clause 3.2: Add clause 3.3 after clause 3.2 as under:

"Clause 3.3 The steel used in the manufacture of spring washers shall be carbon spring steel as per Wapda Specification P-28".

3. Clause 4.10: In first line, add after "nuts" the word "washers".

4. Clause 4.11: Replace with the following:

"All items except those in sub-clause 4.10 shall be hot dip galvanized in accordance with Wapda Specification P-82 'Zinc Coating'. The weight and thickness of coating shall be as under:

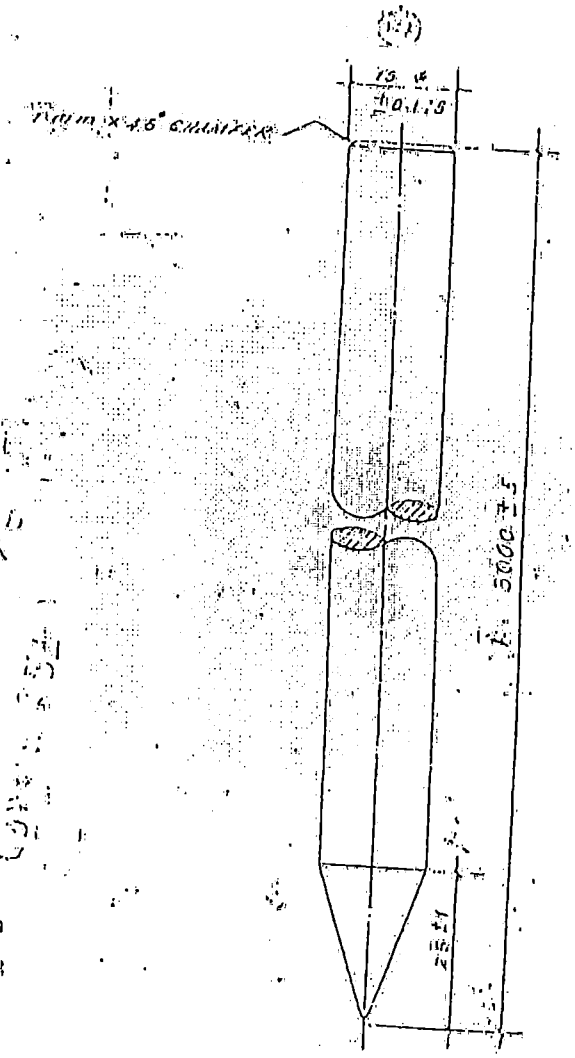
Items	Weight of Coating (gm/Sq meter)		Thickness of Coating (mm)	
	Average	Minimum	Average	Minimum
Clamps	610	550	0.086 mm	0.077 mm
Earth Rod	915	840	0.130 mm	0.120 mm

5. Clause 6.1.1: Replace with the following:

"The mild steel items excluding earth rod shall be tested for tensile strength as per ISO/R-82-1971".

6. Replace drawing Nos. PDW/DR-234, 235 & 236 with amended drawings dated 28.2.1981.

176



MATERIAL:- MILD STEEL, GALVANISED.

PAKISTAN WATER AND POWER DEVELOPMENT AUTHORITY			DESIGN DEPARTMENT
EARTH ROD			
DWN. A. HASSAN	[illegible] A.E.	SCALE 1:1	DATE 14.10.76
TCD. A. HASSAN	[illegible] C.D.	DWG. NO. PDW/DA-237	
CKD	[illegible] DIR		