PAKISTAN SPORTS BOARD

TECHNICAL BID

BIDDING DOCUMENTS
VOLUME – I

"DESIGN, SUPPLY, INSTALLATION, TESTING AND COMMISSIONING OF SOUND AMPLIFICATION SYSTEM, ELECTRONIC TIMING DEVICES & DG SETS AT DIFFERENT FACILITIES OF PAKISTAN SPORTS COMPLEX, ISLAMABAD"

Contract No. PSB/Islamabad/04/2026

November, 2026

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INSTRUCTIONS TO BIDDERS

A. GENERAL

IB.1 Scope of Bid and Source of Funds

1.1 Scope of Bid

The Director General, Pakistan Sports Board (PSB) (hereinafter called the "Employer") wishes to receive Bids on for the scope of work which includes, but shall not be limited to:

Design, Supply, Installation, Testing and Commissioning of Sound Amplification System, Electronic Timing Devices and DG Sets at Different Facilities of Pakistan Sports Complex, Islamabad.

The Works to be executed under this Contract comprise of Design, Supply, Installation, Testing and Commissioning of Sound Amplification System, Electronic Timing Devices and DG Sets at Different Facilities of Pakistan Sports Complex, Islamabad. Following the execution and completion of the above-stated works, the Contractor shall be obliged to remedy defects therein in accordance with the provisions of Contract.

A detailed scope of work under these Bidding Documents has been described in Clause 2 of Specifications - Special & Technical Provisions. The successful Bidder will be expected to complete the Works within the stipulated period of 182 days as specified in these Bidding Documents.

Bidders must quote prices for the complete scope of work. Any Bid covering partial scope of work will be rejected as non-responsive, pursuant to Clause IB.24.

1.2 Source of Funds

The Employer has received funds from the Government of Pakistan and it is intended that part of the proceeds of the funds will be applied to eligible payments under the Contract for which these Bidding Documents are issued.

IB.2 Eligible Bidders

2.1 Bidding is open to all firms and persons meeting the following requirements:

a) Duly licensed by the Pakistan Engineering Council (PEC) in the category C1 and above having PEC Specialization code EE04.
b) Affidavit on non-Judicial Stamped Paper for Non-Litigation and No Blacklisting.

IB.3 Eligible Goods and Services

3.1 All Goods & ancillary Services to be supplied under this Contract shall have their origin in eligible countries listed in Appendix 'A' to Instructions to Bidders

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and all expenditures made under the Contract will be limited to such Goods and Services.

3.2 For purpose of this Clause, "origin" means the place where the Goods are mined, grown or produced or from where the ancillary services are supplied. Goods are produced when, through manufacturing, processing or substantial and major assembling of components, a commercially recognized product results that is substantially different in basic characteristics or in purpose or utility from its components.

3.3 The origin of Goods and Services is distinct from the nationality of the Bidder.

IB.4 Cost of Bidding

4.1 The Bidder shall bear all costs associated with the preparation and submission of its Bid and the Employer will in no case be responsible or liable for those costs, regardless of the conduct or outcome of the Bidding process.

B. BIDDING DOCUMENTS

IB.5 Contents of Bidding Documents

5.1 In addition to Invitation for Bids, the Bidding Documents are those stated below, and should be read in conjunction with any Addenda issued in accordance with Clause IB.7.

1. Instructions to Bidders with Appendices

2. Form of Bid & Schedules to Bid

   Schedules to Bid are the following:
   (i) Schedule A: Specific Works Data
   (ii) Schedule B: Works to be Performed by Sub-Contractors
   (iii) Schedule C: Proposed Program of Works
   (iv) Schedule D: Deviations from Technical Provisions
   (v) Schedule E: Deviations from Contractual Conditions
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3. Schedule of Prices (Volume-II)
4. Preamble to Conditions of Contract
5. General Conditions of Contract (GCC)
6. Particular Conditions of Contract (PCC)
7. Standard Forms
   Forms include the following:
   (i) Form of Bid Security
   (ii) Form of Contract Agreement
   (iii) Form of Performance Security

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(iv) Form of Bank Guarantee for Advance Payment

8. Specifications - Special & Technical Provisions

5.2 The Bidders are expected to examine carefully the contents of all the above documents. Failure to comply with the requirements of Bid submission will be at the Bidders own risk. Pursuant to Clause IB.24, Bids which are not substantially responsive to the requirements of the Bidding Documents will be rejected.

IB.6 Clarification of Bidding Documents

6.1 A prospective Bidder requiring any clarification(s) in respect of the Bidding Documents may notify the Employer with a copy to the Engineer in writing or at the address:

The Employer
Director General
Pakistan Sports Board
Abpara, Kashmir Highway,
Islamabad.
Phone No.: 051-9202410, 051-9202412

The Engineer
To be appointed by the Employer

The Employer will examine the request for clarification of the Bidding Documents which it receives not later than ten (10) days prior to the deadline for the submission of Bids and if needed will issue the clarification/amendment of the Bidding Documents (without identifying the source of enquiry) to all prospective Bidders who have purchased the Bidding Documents.

IB.7 Amendment of Bidding Documents

7.1 At any time but not later than seven (7) days prior to the deadline for submission of Bids, the Employer may, for any reason, whether at his own initiative or in response to a clarification requested by a prospective Bidder, modify the Bidding Documents by issuing addendum.

7.2 Any addendum thus issued shall be part of the Bidding Documents pursuant to Sub-Clause 7.1 hereof, and shall be communicated in writing to all purchasers of the Bidding Documents. Prospective Bidders shall acknowledge receipt of each addendum in writing to the Employer. The Bidder shall also confirm in the Form of Bid that the information contained in such addenda have been considered in preparing his Bid.

7.3 To afford prospective Bidders reasonable time in which to take an addendum into account in preparing their Bids, the Employer may at its discretion extend the deadline for submission of Bids in accordance with Clause IB.19.

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C. PREPARATION OF BIDS

IB.8 Language of Bid

8.1 The Bid prepared by the Bidder and all correspondence and documents relating to the Bid, exchanged by the Bidder and the Engineer shall be written in the English language, provided that any printed literature furnished by the Bidder may be written in another language so long as accompanied by an English translation of its pertinent passages in which case, for purposes of interpretation of the Bid, the English translation shall govern.

IB.9 Documents Comprising the Bid

9.1 The Bid prepared by the Bidder shall comprise the following components:

(a) Covering Letter

(b) Form of Bid duly filled, signed and sealed, in accordance with Clause IB.17.

(c) Schedules (A to I) to Bid duly filled and signed, in accordance with the instructions contained therein.

(d) Schedule of Prices completed in accordance with Clauses IB.11 and 12 in separate sealed envelope.

(e) Bid Security furnished in accordance with Clause IB.15.

(f) Power of Attorney in accordance with Clause IB 17.5.

(g) Documentary evidence established in accordance with Clause IB.13 that the Bidder is eligible to Bid and is qualified to perform the contract if its Bid is accepted.

(h) Documentary evidence established in accordance with Clause IB.14 that the Plant and ancillary Services to be supplied by the Bidder are eligible Plant and Services and conform to the Bidding Documents.

(i) Any other documents prescribed in Particular Conditions of Contract or Technical Provisions to be submitted with the Bid.

(j) Joint Venture Agreement (if applicable).

IB.10 Form of Bid and Schedules

10.1 The Bidder shall complete, sign and seal the Form of Bid, Schedules (A to I, or as modified) to Bid and Schedule of Prices furnished in the Bidding Documents and shall also enclose other information as detailed in Clause IB.9.

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IB.11 Bid Prices

11.1 The Bidder shall fill up the Schedule of Prices attached to these documents indicating the unit rates and prices of the Works to be performed under the Contract. Prices on the Schedule of Prices shall be entered keeping in view the instructions contained in the Preamble to the Schedule of Prices.

11.2 The Bidder shall fill in rates and prices for all items of the Works described in the Schedule of Prices. Items against which no rate or price is entered by a Bidder will not be paid for by the Employer when executed and shall be deemed covered by rates and prices for other items in the Schedule of Prices.

11.3 The Bidder's separation of price components in accordance with Sub-Clause 11.1 above will be solely for the purpose of facilitating the comparison of Bids by the Employer/Engineer and will not in any way limit its right to contract on any of the terms offered.

11.4 Unless otherwise stipulated in the Conditions of Contract, prices quoted by the Bidder shall remain fixed during the Bidder's performance of the Contract and not subject to variation on any account. When the Bidders are required to quote only fixed price(s), a Bid submitted with an adjustable price quotation will be treated as non-responsive and rejected, pursuant to Clause IB.24.

11.5 Any discount offered shall be valid for at least the period of validity of the Bid. A discount valid for lesser period shall be considered null and void.

IB.12 Currencies of Bid

12.1 Prices shall be quoted in the following currencies:

(a) For Plant and Services which the Bidder will supply from within Pakistan, the prices shall be quoted in the Pak. Rupees.

(b) For Plant and Services which the Bidder will supply from outside Pakistan, the prices shall be quoted in Pak Rupees.

12.3 The currencies of payment shall be as stated in Particular Conditions of Contract. However, provisions in Sub-Clauses 12.1 & 12.2 above, shall not in any way constitute a contractual or legal binding on the Employer for the payment in any currencies required by the Contractor.

IB.13 Documents Establishing Bidder's Eligibility and Qualifications

13.1 Pursuant to Clause IB.9, the Bidder shall furnish, as part of its Bid, documents establishing the Bidder's eligibility to Bid and its qualifications to perform the Contract if its Bid is accepted.

13.2 The documentary evidence of the Bidder's eligibility to Bid shall establish to the Employer's satisfaction that the Bidder, at the time of submission of its Bid is

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from an eligible source country as defined under Clause IB.2.

13.3 The documentary evidence of the Bidder's qualifications to perform the Contract if its Bid is accepted, shall establish to the Employer's/Engineer's satisfaction:

(a) that, in the case of a Bidder offering to supply Plant under the Contract which the Bidder did not manufacture or otherwise produce, the Bidder has been duly authorized by the Plant manufacturer or producer to supply the Plant to Pakistan;

(b) that the Bidder/Manufacturer has the financial, technical and production capability necessary to perform the Contract; and

(c) that, in the case of a Bidder not doing business within Pakistan the Bidder is or will be (if successful) represented by an agent in Pakistan equipped and able to carry out the Supplier's maintenance, repair and spare parts stocking obligations prescribed by the Conditions of Contract and/or Technical Provisions.

13.4 (a) Bidder/Manufacturer must possess and provide evidence of the following experience:

Category	**Assigned Marks**	**Explanation / Criteria for Marks Obtained**
General Experience - Experience in Execution of Projects	40	General Experience in execution of Projects. Max. Marks = 40 • 20 marks will be awarded for each Project having project cost ≥ Rs. 1,500M up to maximum of 40 marks. • 10 marks will be awarded for each Project having project cost from Rs. 1000M to Rs. 1499.99 M up to maximum of 40 marks. • 8 marks will be awarded for each Project having project cost from Rs. 750 M to 999.99M up to maximum of 40 marks. • No marks will be awarded for project having project cost < Rs. 750M.
	40	

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B. Personnel Capabilities (Maximum Marks 20, Passing Marks 10)		
1	**Project Manager**	5 marks will be awarded for M.Sc. Civil / Electrical Engineer having at least 12 years relevant experience or B.Sc. Civil / Electrical Engineer having at least 15 years' experience. **Max Marks = 5**
2	**Construction Manager**	3 marks will be awarded for B.Sc. Civil / Electrical Engineer having at least 10 years' experience. **Max Marks = 3**
3	**Site Engineer**	2 marks will be awarded for B.Sc. Civil / Electrical / Electronics Engineer at least 05 years' experience. **Max Marks = 2**
4	**Site Engineer**	2 marks will be awarded or B.Sc. Civil / Electrical / Electronics Engineer at least 05 years' experience. **Max Marks = 2**
5	**Associate Engineer (Civil/ Electrical/ Electronics)**	2 marks will be awarded for each Site Inspector having B-Tech / DAE Civil / Electrical / Electronics and at least 05 years' experience. **Max Marks = 2**
6	**Associate Engineer (Electrical)**	2 marks will be awarded for Site Inspector having B-Tech / DAE Electrical and at least 05 years' experience. **Max Marks = 2**
7	**Quantity Surveyor (Civil)**	2 marks will be awarded for Quantity Surveyor having B-Tech / DAE Civil having at least 08 years' experience **Max Marks = 2**
8	**Surveyor**	2 marks will be awarded for each Surveyor having certificate having at least 08 years' experience. **Max Marks = 2**

Bidders shall furnish documentary evidence of qualification in shape of PEC certificates of Engineers.

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C. Financial Capabilities (Maximum Marks 40, Passing Marks 20)			
Category	**Requirement**	**Marks Assigned**	**Explanation for Marks Obtained**
Average Annual Turnover	Last 3 years Audit Reports / Balance Sheets duly audited by a firm of Chartered Accountants.	20	• The minimum annual volume of construction work (Annual Turn-Over) during any of the last three years: **Max Marks = 20** • 10 Marks will be awarded if the Turnover is in range of PKR. 350 million to PKR. 599 million • 20 Marks will be awarded if the Turnover is more than PKR. 600 million.
Working Capital (Current Assets – Current Liabilities)	Audited Financial Statements for last three (03) years.	20	• The amount of Working Capital (Current Assets – Current Liabilities) & credit facilities (in specific name of the Project), net of other construction commitments of the construction, shall be as under: **Max Marks = 20** • 10 Marks will be awarded if the Working Capital is in range of PKR. 700 million to PKR. 1,000 million • 20 Marks will be awarded if the Working Capital is more than PKR. 1,000 million.
Audit Reports	Bidder shall provide last 3 years Audit Reports / Balance Sheets duly audited by a firm of Chartered Accountants. This submission is mandatory to qualify for the bid.		

13.5 Joint Venture

Joint Venture is allowed for upto two (02) firms. Joint Venture shall qualify collectively.

IB.14 Documents Establishing Plant' Eligibility and Conformity to Bidding Documents

14.1 Pursuant to Clause IB.9, the Bidder shall furnish, as part of its Bid, documents establishing the eligibility and conformity to the Bidding Documents of all Plant and Services which Bidder proposes to perform under the Contract.

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14.2 The documentary evidence of the Plant and Services eligibility shall establish to the Employer's satisfaction that they will have their origin in an eligible source country as defined under Clause IB.3. A certificate of origin issued at the time of shipment will satisfy the requirements of the said Clause.

14.3 The documentary evidence of the Plant and Services' conformity to the Bidding Documents may be in the form of literature, drawings and data and shall furnish:

(a) A detailed description of the Plant, essential technical and performance characteristics.

(b) Complete set of technical information, description data, literature and drawings as required in accordance with Schedule A to Bid, Specific Works Data. Drawings and data submitted must be in sufficient detail and clarity to permit the Employer to verify compliance with the provisions of the Tender Documents. This will include but not be limited to the following:

(i) A sufficient number of drawings, diagrams, photographs, catalogues, illustrations and such other information as are necessary to illustrate clearly the significant characteristics such as general construction dimensions and other relevant information about the Goods/Plant to be furnished.

(ii) Details of equipment and machinery with capacity.

(iii) Any other information which is required for evaluation purposes.

(c) A clause-by-clause commentary on Technical Provisions, provided with the Bidding Documents, demonstrating the 'Goods/Plant' and Services' substantial responsiveness to those Specifications or a statement of deviations and exceptions to the provisions of the Technical Provisions as required in Schedule D to Bid.

14.4 For purpose of the commentary to be furnished pursuant to Sub-Clause 14.3(c) above, the Bidder shall note that standards for workmanship, material and equipment, and references to brand names or catalogue numbers, designated by the Engineer in the Technical Provisions are intended to be descriptive only and not restrictive. The Bidder may substitute alternative standards, brand names and/or catalogue numbers in its Bid, provided that it demonstrates to the Engineer's satisfaction that the substitutions are substantially equivalent or superior to those designated in the Technical Provisions. Copies of the standards proposed by the Bidder other than those specified in the Bidding Documents shall be furnished.

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IB.15 Bid Security

15.1 Each Bidder shall furnish, as part of his Bid, a Bid Security of an amount not less than 20,000,000/- in Pak Rupees.

15.2 The Bid Security shall be, at the option of the Bidder, in the form of Deposit at Call or a Bank Guarantee issued by a Scheduled Bank of Pakistan or from a bank located outside Pakistan duly counter-guaranteed by a Scheduled Bank in Pakistan in favor of the Employer, Director General Pakistan Sports Board, valid for a period 28 days beyond the Bid validity date.

15.3 The Bid Security is required to protect the Employer against the risk of Bidder's conduct which would warrant the security's forfeiture, pursuant to Sub-Clause 15.7 hereof.

15.4 Any Bid not accompanied by an acceptable Bid Security shall be rejected by the Employer as non-responsive, pursuant to Clause IB.24.

15.5 The Bid securities of unsuccessful Bidders will be returned upon award of contract to the successful Bidder or on the expiry of validity of Bid Security which ever is earlier.

15.6 The Bid Security of the successful Bidder will be returned when the Bidder has furnished the required Performance Security, pursuant to Clause IB.34 and signed the Contract Agreement, pursuant to Clause IB.35.

15.7 The Bid Security may be forfeited:

(a) if a Bidder withdraws his Bid during the period of Bid validity;

(b) if a Bidder does not accept the correction of his Bid Price, pursuant to Sub-Clause 24.2 hereof; or

(c) in the case of a successful Bidder, if he fails to:

(i) furnish the required Performance Security in accordance with Clause IB.34, or

(ii) sign the Contract Agreement, in accordance with Clause IB.35.

IB.16 Validity of Bids

16.1 Bids shall remain valid for ninety (90) days after the date of Bid opening as prescribed in Clause IB.19.

16.2 In exceptional circumstances prior to expiry of original Bid validity period, the Employer may request the Bidders to extend the period of validity for a specified additional period which shall in no case be more than the original Bid validity period. The request and the responses thereto shall be made in writing. A

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Bidder may refuse the request without forfeiture of his Bid Security. A Bidder agreeing to the request will not be required or permitted to modify his Bid, but will be required to extend the validity of his Bid Security for the period of the extension, and in compliance with Clause IB.15 in all respects.

IB.17 Format and Signing of Bid

17.1 Bidders are particularly directed that the amount entered on the Form of Bid shall be for performing the Contract strictly in accordance with the Bidding Documents.

17.2 All Schedules to Bid (A to I) are to be properly completed.

17.3 No alteration is to be not made in the Form of Bid nor in the Schedules thereto except in filling up the blanks as directed. If any alteration be made or if these instructions be not fully complied with, the Bid may be rejected.

17.4 Bids (Separate Technical and Priced Bids) should be submitted electronically **ONLY** through **EPADS**. Manual submission of bids is NOT allowed. For registration and training on EAPDS or in case of any technical difficulty in using EPADS, prospective bidders may contact PPRA Team, Director MIS Room No.109, 1st Floor, FBC building Sector G-5/2, Islamabad. Contact Number 051-111-137-237.

17.5 The Bid shall be typed or written in indelible ink and shall be signed by a person or persons duly authorized to sign. This shall be indicated by submitting a written Power of Attorney authorizing the signatory of the Bidder to act for and on behalf of the Bidder. All pages of the Bid and Schedules to Bid shall be initialed and stamped by the person or persons signing the Bid.

17.6 The Bid shall contain no alterations, omissions or additions, except to comply with instructions issued by the Employer, or as are necessary to correct errors made by the Bidder, in which case such corrections shall be initialed by the person or persons signing the Bid.

17.7 Bidders shall indicate in the space provided in the Form of Bid their full and proper addresses at which notices may be legally served on them and to which all correspondence in connection with their Bids and the Contract is to be sent.

17.8 Bidders should retain a copy of the Bidding Documents as their file copy.

D. SUBMISSION OF BIDS

IB.18 Sealing and Marking of Bids

18.1 Each Bidder shall submit his Bid as under:

Bids (Separate Technical and Priced Bids) should be submitted electronically **ONLY** through **EPADS**. Manual submission of bids is NOT allowed. For registration and training on EAPDS or in case of any

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technical difficulty in using EPADS, prospective bidders may contact PPRA Team, Director MIS Room No.109, 1st Floor, FBC building Sector G-5/2, Islamabad. Contact Number 051-111-137-237.

IB.19 Deadline for Submission of Bids

19.1 (a) Bids must be received by the Employer on EPADS not later than the time and date stipulated in the Invitation for Bids.

19.2 The Employer may, at his discretion, extend the deadline for submission of Bids by issuing an addendum in accordance with Clause IB.7, in which case all rights and obligations of the Employer and the Bidders previously subject to the original deadline will thereafter be subject to the deadline as extended.

IB.20 Late Bids

20.1 (a) Any Bid received by the Employer after the dead line for submission of Bids prescribed in Clause IB.19 will be returned unopened to such Bidder.

IB.21 Modification, Substitution and Withdrawal of Bids

21.1 Withdrawal of a Bid during the interval between the deadline for submission of Bids and the expiration of the period of Bid validity specified in the Form of Bid may result in forfeiture of the Bid Security pursuant to Clause IB.15.

E. BID OPENING AND EVALUATION

IB.22 Bid Opening

22.1 A committee consisting of nominated members by the Employer and by the Engineer will open the Bids, including withdrawals, substitution and modifications made pursuant to Clause IB.21, in the presence of Bidders' representatives who choose to attend, at the time, date and location stipulated in the Invitation for Bids. Technical Bids will be opened first. At the end of the evaluation of the Technical Bids, the Employer will invite bidders who have submitted substantially responsive Technical Bids and who have been determined as being qualified for award to attend opening of the Price Bids.

The Bidders' representatives who are present shall sign in a register evidencing their attendance.

22.2 Not Used.

22.3 The Bidder's name, Bid Prices, unit rates, any discount offered, the presence or absence of Bid Security, and such other details as the Employer at its discretion may consider appropriate, will be announced by the Employer at the Bid opening. The Employer will record minutes of Bid opening.

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Any Bid Price or discount which is not read out and recorded at Bid opening will not be taken into account in the evaluation of Bid.

22.4 Discounts offered for lesser period than the Bid validity shall not be considered in evaluation.

IB.23 Clarification of Bids

23.1 To assist in the examination, evaluation and comparison of Bids the Engineer may, at its discretion, ask the Bidder for a clarification of its Bid. The request for clarification and the response shall be in writing and no change in the price or substance of the Bid shall be sought, offered or permitted.

IB.24 Preliminary Examination & Determination of Responsiveness of Bids

24.1 Prior to detailed evaluation pursuant to Clause IB.26, the Engineer will determine the responsiveness of the Bids as follows:

(a) the Engineer will examine the Bids to determine whether;
- (i) the Bid is complete and does not deviate from the scope,
- (ii) any computational errors have been made,
- (iii) required sureties have been furnished,
- (iv) the documents have been properly signed,
- (v) the Bid is valid till required period,
- (vi) the Bid prices are firm during currency of contract if it is a fixed price bid,
- (vii) completion period offered is within specified limits,
- (viii) the Bidder/Manufacturer is eligible to Bid and possesses the requisite experience,
- (ix) the Bid does not deviate from basic technical requirements and
- (x) the Bids are generally in order.

(b) A bid is likely not to be considered, if;
- (i) it is unsigned,
- (ii) its validity is less than specified,
- (iii) it is submitted for incomplete scope of work,
- (iv) it indicates completion period later than specified,
- (v) it indicates that Works and materials to be supplied do not meet eligibility requirements,
- (vi) it indicates that Bid prices do not include the amount of income tax.

(c) A bid will not be considered, if;
- (i) it is not accompanied with bid security,
- (ii) it is submitted by a bidder who has participated in more than one bid,
- (iii) it is received after the deadline for submission of Bids,
- (iv) it is submitted through fax, telex, telegram or email,
- (v) it indicates that prices quoted are not firm during currency of the contract whereas the Bidders are required to quote fixed price(s),

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(vi) the bidder refuses to accept arithmetic correction,
(vii) it is materially and substantially different from the Conditions/ Specifications of the Bidding Documents.

24.2 Arithmetical errors will be rectified on the following basis:

If there is a discrepancy between the unit price and total price that is obtained by multiplying the unit price and quantity, the unit price shall prevail and the total price shall be corrected. If there is a discrepancy between the words and figures the amount in words shall prevail. If there is a discrepancy between the total Bid price entered in Form of Price Bid and the total shown in Schedule of Prices Summary, the amount stated in the Form of Price Bid will be corrected by the Employer/Engineer in accordance with the Corrected Schedule of Prices.

If the Bidder does not accept the corrected amount of Bid, his Bid will be rejected and his Bid Security forfeited.

24.3 Prior to the detailed evaluation, pursuant to Clause IB.26 the Employer/Engineer will determine the substantial responsiveness of each Bid to the Bidding Documents. For purpose of these Clauses, a substantially responsive Bid is one which conforms to all the terms and conditions of the Bidding Documents without material deviations.

A material deviation or reservation is one

(i) which affect in any substantial way the scope, quality or performance of the Works.

(ii) which limits in any substantial way, inconsistent with the Bidding Documents, the Employer's rights or the Bidder's obligations under the Contract; or

(iii) whose rectification/adoption would affect unfairly the competitive position of other Bidders presenting substantially responsive Bids.

The Employer's/Engineer's determination of a Bid responsiveness will be based on the contents of the Bid itself without recourse to extrinsic evidence.

24.4 A Bid determined as substantially non-responsive will be rejected and will not subsequently be made responsive by the Bidder by correction of the non-conformity.

24.5 Any minor informality or non-conformity or irregularity in a Bid which does not constitute a material deviation may be waived by Employer, provided such waiver does not prejudice or affect the relative ranking of any Bidder.

IB.25 Conversion to Single Currency

25.1 Not Used.

IB.26 Detailed Evaluation of Bids

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26.1 Only the Bids previously determined to be substantially responsive pursuant to Clause IB.24 will be evaluated and compared in detail by the Employer/Engineer as per the requirements given hereunder:

26.2 Evaluation and Comparison of Bids

(a) Bids will be evaluated for each item and/or complete scope of work.

(b) Basis of Price Comparison
The prices will be compared on the basis of the Evaluated Bid Price pursuant to Para (e) herein below.

(c) Technical Evaluation
It will be examined in detail whether the Plant offered by the Bidder comply with the Technical Provisions of the Bidding Documents. For this purpose, design offered by the Bidder will be reviewed for which the Bidder's data submitted with the Bid under Schedule A to Bid (Specific Works Data) will be compared with the technical features/criteria of the Goods/Plant detailed and prescribed by the Employer in the Technical Provisions. Other technical information submitted with the Bid regarding the Scope of Work will also be reviewed.

(d) Commercial Evaluation
It will be examined in detail whether the Bids comply with the commercial/contractual conditions of the Bidding Documents. It is expected that no major deviation/stipulation shall be taken by the Bidders.

(e) Evaluated Bid Price
In evaluating the Bids, the Employer will determine for each Bid in addition to the Bid Price, the following factors (adjustments) in the manner and to the extent indicated below to determine the Evaluated Bid Price:

(i) making any correction for errors pursuant to Sub-Clause 24.2 hereof.

(ii) excluding Provisional Sums, if any, but including priced Daywork.

(iii) making an appropriate adjustment for any other acceptable variation or deviation.

26.3 Evaluation Methods

Not Used

26.4 If the Bid of the successful Bidder is seriously unbalanced in relation to the Employer's estimate of the cost of work to be performed under the Contract,

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the Employer may require the Bidder to produce detailed price analyses for any or all items of the Schedule of Prices to demonstrate the internal consistency of those prices with the construction methods and schedule proposed. After evaluation of the price analyses, the Employer may require that the amount of the Performance Security set forth in Clause IB.34 be increased at the expense of the successful Bidder to a level sufficient to protect the Employer against financial loss in the event of default of the successful Bidder under the Contract.

IB.27. Domestic Preference

Not Used

IB.28 Process to be Confidential

28. 1 Subject to Clause 23 heretofore, no Bidder shall contact Employer and/or Engineer on any matter relating to its Bid from the time of the Bid opening to the time the Bid evaluation result is announced by the Employer. The evaluation result may be announced at least ten (10) days prior to award of Contract. The announcement to all Bidders will include table(s) comprising read out prices, discounted prices, price adjustments made, final evaluated prices and recommendations against all the Bids evaluated.

28.2 Any effort by a Bidder to influence Employer and/or Engineer in the Bid evaluation, Bid comparison or Contract Award decisions may result in the rejection of his Bid. Whereas any Bidder feeling aggrieved may lodge a written complaint not later than fifteen (15) days after the announcement of the Bid evaluation result; however, mere fact of lodging a complaint shall not warrant suspension of the procurement process.

F. AWARD OF CONTRACT

IB.29. Post-Qualification

29.1 The Employer having credible reasons for, or a prima facie evidence of any defect in bidders' capacities, will determine to its satisfaction that the substantially responsive, lowest evaluated bidder, is qualified to satisfactorily perform the Contract in accordance with Qualification Criteria stipulated in the Bidding Documents.

29.2 The determination will take into account the bidder's financial, technical and production capabilities. It will be based upon an examination of the documentary evidence of the bidder's qualification submitted under Appendix B to Instructions to Bidders "Evidence of Bidder's Capability" by the bidder pursuant to Clause IB.13, as well as such other information as required under the Bidding Documents.

29.3 An affirmative determination will be a pre-requisite for award of the Contract to the lowest evaluated Bidder. A negative determination will result in rejection of

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that Bidder's Bid in which event, Employer will proceed to undertake a similar determination of the next lowest evaluated Bidder's capabilities to perform the Contract satisfactorily.

IB.30 Award Criteria

30.1 Subject to Clause IB.32, the Employer will award the Contract to the Bidder whose Bid has been determined to be substantially responsive to the Bidding Documents and who has offered the lowest evaluated Bid Price, provided that such Bidder has been determined to be qualified to satisfactorily perform the Contract in accordance with the provisions of Clause IB.29.

IB.31 Employer's Right to Vary Quantities

31.1 Employer reserves the right at the time of award of Contract to increase or decrease by up to 25% the quantity of Plant and Services contained in the Schedule of Prices without any change in the unit price or other terms and conditions.

IB.32 Employer's Right to Accept any Bid and to Reject any or all Bids

32.1 Notwithstanding Clause IB.30, the Employer reserves the right to accept or reject any Bid, and to annul the bidding process and reject all Bids, at any time prior to award of Contract, without thereby incurring any liability to the affected Bidders or any obligation to inform the affected Bidders of the grounds for the Employer's action except that the grounds for its rejection shall upon request be communicated, to any Bidder who submitted a Bid, without justification of grounds. Rejection of all Bids shall be notified to all Bidders promptly.

32.2 No negotiation with the Bidder having been evaluated as lowest responsive or any other Bidder shall be permitted. However, the Employer may have clarification meeting(s) to get clarified any item(s) in the Bid evaluation report.

IB.33 Notification of Award

33.1 Prior to expiration of the period of Bid validity prescribed by the Employer, the Employer will notify the successful Bidder in writing ("Letter of Acceptance") that his Bid has been accepted. This letter shall name the sum which the Employer will pay the Contractor in consideration of the execution and completion of the Works by the Contractor as prescribed by the Contract (hereinafter and in the Conditions of Contract called the "Contract Price").

33.2 The Letter of Acceptance and its acceptance by the Bidder will constitute the formation of the Contract, binding the Employer and the Bidder till signing of the formal Contract Agreement.

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33.3 Upon furnishing by the successful Bidder of a Performance Security, the Employer will promptly notify the other Bidders that their Bids have been unsuccessful and return their Bid securities.

IB.34 Performance Security

34.1 The successful Bidder shall furnish to the Employer a Performance Security in the form and the amount stipulated in the Conditions of Contract within a period of 14 days after the receipt of Letter of Acceptance.

34.2 Failure of the successful Bidder to comply with the requirements of Sub-clause IB.34.1, IB.35 or Clause IB.43 shall constitute sufficient grounds for the annulment of the award and forfeiture of the Bid Security.

IB.35 Signing of Contract Agreement

35.1 Within 14 days from the date of furnishing of acceptable Performance Security under the Conditions of Contract, the Employer will send to the successful Bidder the Form of Contract Agreement provided in the Bidding Documents, duly filled in and incorporating all agreements between the parties for signing and return it to the Employer.

35.2 The formal Agreement between the Employer and the successful Bidder shall be executed within 14 days of the receipt of such Form of Contract Agreement by the successful Bidder from the Employer.

G. ADDITIONAL INSTRUCTIONS

IB.36 Instructions not Part of Contract

36.1 Bids shall be prepared and submitted in accordance with the above Instructions to Bidders including Additional Instructions which are provided to assist Bidders in preparing their Bids, and do not constitute part of the Bid or the Contract Documents.

IB.37 Contract Documents

37.1 The Documents which will be included in the Contract are listed in the Form of Contract Agreement set out in these Bidding Documents.

IB.38 Sufficiency of Bid

38.1 Each Bidder shall satisfy himself before bidding as to the correctness and sufficiency of his Bid and of the rates and prices entered in the Schedule of Prices. Except insofar as it is otherwise expressly provided in the Contract, the rates and prices entered in the Schedule of Price shall cover all his obligations under the Contract and all matters and things necessary for the proper completion of the Works.

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IB.39 One Bid per Bidder

39.1 Each Bidder shall submit only one Bid either by himself, or as a partner in a joint venture. A Bidder who submits or participates in more than one Bid will be disqualified and Bids submitted by him shall not be considered for evaluation and award.

IB.40 Bidder to Inform Himself

40.1 The Bidder is advised to obtain for himself at his own cost and responsibility all information that may be necessary for preparing the Bid and entering into a Contract for execution of the Works. This shall include but not be limited to the following:

(a) inquiries on Pakistani Income Tax and Sales Tax.
(b) inquiries on customs duties and other import taxes, to the concerned authorities of Customs and Excise Department.
(c) information regarding port clearance facilities, loading and unloading facilities, storage facilities, transportation facilities and congestion at Pakistan seaports.
(d) investigations regarding transport conditions and the probable conditions which will exist at the time the Plant will be actually transported.

IB.41 Site Visit and Local Conditions

41.1 Bidder must verify and supplement by his own investigations the information about site and local conditions. However, Employer will assist the Bidder wherever practicable and possible.

41.2 All Bidders are required to visit the site at their own expense to review the areas allocated for the Plant and the interfacing facilities, if any. Bidders may also wish to study local conditions, available facilities, communications, craft wages, roads and other transport facilities. Bidders shall also acquaint themselves with the relevant laws, rules, and regulations of Pakistan.

41.3 The Bidders and any of their personnel or agents will be granted permission by the Employer to enter upon his premises and lands for the purpose of such inspection, but only upon the express condition that the Bidders, their personnel and agents, will release and indemnify the Employer, his personnel and agents from and against all liability in respect thereof and will be responsible for death or personal injury, loss of or damage to property and any other loss, damage, costs and expenses incurred as a result of such inspection.

IB.42 Pre-Bid Meeting

42.1 The Employer may, on his own motion or at the request of any prospective

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bidder(s), hold a Pre-Bid meeting to clarify issues and to answer any questions on matters related to the Bidding Documents. The date, time and venue of Pre-Bid meeting, if convened, shall be intimated through letter for invitation.

All prospective Bidders or their authorized representatives shall be invited to attend such a Pre-Bid meeting.

42.2 The Bidders are requested to submit questions, if any, in writing so as to reach the Employer not later than four (4) days before the proposed Pre-Bid meeting.

42.3 Minutes of the Pre-Bid meeting, including the text of the questions raised and the replies given, will be transmitted without delay to all purchasers of the Bidding Documents. Any modification of the Bidding Documents listed in Sub-Clause 5.1 hereof which may become necessary as a result of the Pre-Bid meeting shall be made by the Employer exclusively through the issue of an Addendum pursuant to Clause IB.7 and not through the minutes of the Pre-Bid meeting.

IB.43 Integrity Pact

43.1 The Bidder shall sign and stamp the Integrity Pact provided in Schedule-H to Bid in the Bidding Documents for all Federal Government procurement contracts exceeding Rupees ten million. Failure to provide such Integrity Pact shall make the Bid non-responsive.

IB.44 General Performance of the Bidders

44.1 The Employer reserves the right to obtain information regarding performance of the bidders on their previously awarded contracts/works. The Employer may in case of consistent poor performance of any Bidder as reported by the employers of the previously awarded contracts, inter-alia, reject his bid and/or refer the case to the Pakistan Engineering Council. Upon such reference, PEC in accordance with its rules, procedures and relevant laws of the land take such action as may be deemed appropriate under the circumstances of the case including black listing of such Bidder and debarring him from participation in future bidding for similar works.

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Appendix A to
Instructions to Bidders

NAME OF ELIGIBLE COUNTRIES

All countries of the World as spelled out in Special Provisions with whom Islamic Republic of Pakistan has commercial relations.

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EVIDENCE OF BIDDER'S CAPABILITY

Note: Bidders to provide the following information with the Bid separately and indicate herein its references where this information is available.

Sr.No.	Information to be Supplied	Bid References
1.	Name of Bidder, business address and country of incorporation.	
2.	Type of firm whether individually owned, partnership, corporation or joint venture and the names of its owners or partners.	
3.	The annual reports giving general description of the firm, sort of business carried out, balance sheets, profit and loss statements, turn over and business done by the firm, duly authenticated, for the last three (3) years. Audited Balance Sheets for the preceding 3 years and projected assets and liabilities for the next 2 years shall be provided.	
4.	Location and address of manufacturing facilities.	
5.	Details of the facilities where the offered equipment is proposed to be manufactured. This description should include the facilities and capacities of the particular factories including testing facilities and the processes used in manufacturing and testing. Where parts or components are purchased from outside, the details of equipment purchased and the names and experience record of the suppliers.	

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Sr.No.	Information to be Supplied	Bid References
6.	Detailed description of the quality control testing and research facilities. If the equipment is manufactured under license, the name of the licenser and details of the licensing arrangements, such as the duration of the license, the facilities provided to the Bidder by the licenser and whether future improvements are available or not etc. A copy of the license agreement may be attached.	
7.	Names, qualifications and experience of the key technical personnel.	
8.	The time since the manufacturer has been in this business and the time since he has been doing work of similar nature.	
9.	The time since the particular equipment offered has been manufactured and the time for which it has been in service. The manufacturer shall have the experience stated in Sub-Clause IB 13.4(a).	
10.	Reference lists of similar works done by the Bidder in its country and abroad indicating the name of customer, description and quantity of product, year of supply and the approximate value.	
11.	Details of projects under execution and future contractual commitments. (for each partner, in case of a joint venture).	
12.	Banking reference, names of banks and addresses may be given to whom reference regarding financial capability of the Bidder may be made, with authority to make inquiries from the Bidder's bankers and clients regarding any financial and technical aspects (for each partner, in case of a joint venture).	

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Sr.No.	Information to be Supplied	Bid References
13.	Information on any litigation or arbitration resulting from contracts completed or under execution by the Bidder over the last ten (10) years. The information shall indicate the parties concerned, the matter of dispute, the disputed amounts and the result thereof (for each partner, in case of a joint venture).	

Appendix C to
Instructions to Bidders

Domestic Goods (Value added in Pakistan)

Not Used

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FORM OF BID
(LETTER OF TECHNICAL BID)

Contract No.: PSB/Islamabad/04/2026

BIDDING DOCUMENTS FOR

DESIGN, SUPPLY, INSTALLATION, TESTING AND COMMISSIONING OF SOUND AMPLIFICATION SYSTEM, ELECTRONIC TIMING DEVICES & DG SETS AT DIFFERENT FACILITIES OFPAKISTAN SPORTS COMPLEX, ISLAMABAD

To:

Director General
Pakistan Sports Board
Abpara, Kashmir Highway
Islamabad
Phone No.: 051-9202410, 051-9202412

Gentlemen,

1. Having examined the Bidding Documents including Instructions to Bidders, Conditions of Contract, Specifications, Drawings, Schedules to Bid, Schedule of Prices and Addenda Nos. ..... for the execution of the above-named Works, we, the undersigned, being a company doing business under the name of and address .....
.....
..... and being duly incorporated under the laws of .....
hereby offer to execute and complete such Works and remedy any defects therein in conformity with the said Documents including Addenda thereto.

2. We understand that all the Schedules attached hereto form part of this Bid.

3. We undertake, if our Bid is accepted, to commence the Works and to deliver and complete the whole of the Works comprised in the Contract within the time(s) stated in Preamble to the Conditions of Contract.

4. We agree to abide by this Bid for the period of 90 days from the date fixed for receiving the same and it shall remain binding upon us and may be accepted at any time before the expiration of that period.

5. Unless and until a formal Agreement is prepared and executed, this Bid, together with your written acceptance thereof, shall constitute a binding contract between us.

6. We undertake, if our Bid is accepted to execute the Performance Security referred to in Clause 10 of Conditions of Contract for the due performance of the Contract.

7. We do hereby declare that the Bid is made without any collusion, comparison of figures or arrangement with any other person or persons making a Bid for the Works.

8. We do hereby declare that our firm, including any subcontractors or suppliers for any part of the Contract, have nationalities from eligible countries [insert the nationality of the Bidder, including that of all parties that comprise the Bidder if the Bidder is a consortium or association, and the nationality of each Subcontractor and Supplier].

9. We, including any subcontractors or suppliers for any part of the Contract, do not have any conflict of interest.

10. We are not participating, as a Bidder or as a subcontractor, in more than one bid in this bidding process.

11. We confirm, if our Bid is accepted, that all partners of the joint venture shall be liable jointly and severally for the execution of the Contract and the composition or the constitution of the joint venture shall not be altered without the prior consent of the Employer. (Please delete in case of Bid from a single firm).

Dated this ..... day of 2025

Signature ..... in the capacity of ..... duly authorized to sign the Bid for and on behalf of .....
(Name of Bidder in Block Capitals)

(Seal of Bidder)

Bidder's Address
.....
.....

Witness:

Signature: .....
Name: .....
Address:
.....
.....
Occupation .....

SCHEDULES TO BID INCLUDE THE FOLLOWING:

(i) Schedule A: Specific Works Data
(ii) Schedule B: Works to be Performed by Sub-Contractors
(iii) Schedule C: Proposed Program of Works
(iv) Schedule D: Deviations from Technical Provisions
(v) Schedule E: Deviations from Contractual Conditions
(vi) Schedule F: Methods of Performing Works
(vii) Schedule G: Proposed Organizations
(viii) Schedule H: Integrity Pact
(ix) Schedule I: List of Recommended Manufacturers

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SCHEDULE – A TO BID

SPECIFIC WORKS DATA

The main technical data is prescribed in the relevant sections of the Technical Provisions. However, the Bidder may supplement the main technical data by providing hereunder other salient parameters to enable the Employer/Engineer to assess technical conformance of the offered Plant to the requirements of the Bidding Documents.

Initials of Signatory to Bid:……

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SCHEDULE – B TO BID

WORK TO BE PERFORMED BY SUBCONTRACTORS

The Bidder will do the work with his own forces except the part (s) of the Works listed below which he intends to sub-contract.

Items of Works to be Sub-Contracted	Name and address of Sub-Contractor	Statement of similar works previously Executed (attach evidence)

Note:

1. No change of Sub-Contractor shall be made by the Bidder without prior approval of the Employer.
2. The truthfulness and accuracy of the statement as to the experience of Subcontractors is guaranteed by the Bidder. The Employer's judgment shall be final as to the evaluation of the experience of Subcontractors submitted by the Bidder.
3. Statement of similar works shall include description, location & value of work, year completed and name & address of the clients.

Initials of Signatory to Bid:.....

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SCHEDULE – C TO BID

PROPOSED PROGRAMME OF WORKS

Bidder shall provide a programme in a bar-chart/CPM/PERT form showing the sequence of work items by which he proposes to complete the Work of the entire Contract. The programme should indicate the sequences of work items and the period of time during which he proposes to complete the Works including the activities like designing, schedule of submittal of drawings, ordering/procurement of materials, manufacturing, delivering, design & construction of associated civil works, installation/erection, testing and commissioning of Works to be executed under the Contract. Initials of

Signatory to Bid:.....

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SCHEDULE – D TO BID

DEVIATIONS
FROM TECHNICAL PROVISIONS

It is presumed that the Bidder shall not take any deviation. However, if he intends to take deviations to the specified technical provisions, those must be listed in the space provided below:

Sr. No.	Clause No. / Section No.	Deviations/Clarifications

Note: Attach additional sheets, if necessary

Initials of Signatory to Bid:……

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SCHEDULE – E TO BID

DEVIATIONS
FROM CONTRACTUAL CONDITIONS

It is presumed that the Bidder shall not take any deviation. However, if he intends to take deviations to the specified Contractual/Commercial Conditions, those must be listed in the space provided below:

Sr. No.	Clause No. / Section No.	Deviations/Clarifications

Note: Attach additional sheets, if necessary

Initials of Signatory to Bid:……

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METHOD OF PERFORMING WORKS

The Bidder is required to submit a narrative outlining the method of performing the Works. The narrative should indicate in detail and include but not be limited to:

- The sequence and methods in which he proposes to carry out the Works, including the number of shifts per day and hours per shift, he expects to work.

- A list of all major items of plant, tools and vehicles proposed to be used in carrying out the Works at Site, including number of each kind, make, type, capacity of all equipment, working condition, which shall be deployed by him for Civil Work and Erection, Testing and Commissioning of the Works, in sufficient detail to demonstrate fully that the equipment will meet all the requirements of the Specifications.

- The procedure for installation/erection of equipment and transportation of equipment and materials to the site.

- Details regarding mobilization in Pakistan, the type of facilities including personnel accommodation, office accommodation, provision for maintenance and for storage, communications, security and other services to be used.

- The Contractor shall provide description of his construction camp's facilities and staff housing requirements.

- The Contractor shall be responsible for pumps, electrical power, water and electrical distribution systems, and sewerage system including all fittings, pipes and other items necessary for servicing the Contractor's construction camp and staff housing facilities. The Bidder shall list or explain his plans for providing these facilities for the service of the Contract as follows:

    1. Site Preparation (clearing, land preparation, etc.).
    2. Provision of Services.
        a) Power (expected power load, etc.).
        b) Water (required amount and system proposed).
        c) Sanitation (sewage disposal system, etc.).

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3. Construction of Facilities

   a) Contractor's Office, Workshop and Work Areas (areas required and proposed layout, type of construction of buildings, etc.).

   b) Warehouses and Storage Areas (area required, type of construction and layout).

   c) Housing and Staff Facilities (Plans for housing for proposed staff, layout, type of construction, etc.)

4. Construction Equipment Assembly and Preparation (detailed plans for carrying out this activity).

5. Other Items Proposed (Security services, etc.).

Initials of Signatory to Bid:……

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SCHEDULE – G TO BID

PROPOSED ORGANIZATION FOR THE PROJECT

The Bidder shall provide in this Schedule Organization chart indicating the key personnel he will employ for Head office and for Site office involved in management, supervision and engineering of the Works to be done under the Contract to direct and execute the Works, together with their names, qualifications, experience, positions held and their nationalities.

Designation	Name of	Summary of Qualifications Experience, Present Position and Nationality

- Head Office:

- Site Office:
  Contractor's Representative
  Site Superintendent
  Supervising Engineer
  Plant Erectors
  Construction Supervisors
  Other Key Staff

Initials of Signatory to Bid:……

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SCHEDULE – H TO BID

INTEGRITY PACT
(On Stamp Paper)

DECLARATION OF FEES, COMMISSIONS AND BROKERAGE ETC. PAYABLE BY THE SUPPLIERS OF GOODS, SERVICES & WORKS

_____ [the Bidder/Contractor] hereby declares its intention not to obtain or induce the procurement of any contract, right, interest, privilege or other obligation or benefit from Government of Pakistan or any administrative subdivision or agency thereof or any other entity owned or controlled by it (Government of Pakistan) through any corrupt business practice.

Without limiting the generality of the foregoing, _____ [the Bidder/Contractor] represents and warrants that it has fully declared the brokerage, commission, fees etc. paid or payable to anyone and not given or agreed to give and shall not give or agree to give to anyone within or outside Pakistan either directly or indirectly through any natural or juridical person, including its affiliate, agent, associate, broker, consultants, director, promoter, shareholder, sponsor or subsidiary, any commission, gratification, bribe, finder's fee or kickback, whether described as consultation fee or otherwise, with the object of obtaining or inducing the procurement of a contract, right, interest, privilege or other obligation or benefit in whatsoever form from Government of Pakistan, except that which has been expressly declared pursuant hereto.

_____ [The Bidder/Contractor] certifies that it has made and will make full disclosure of all agreements and arrangements with all persons in respect of or related to the transaction with Government of Pakistan and has not taken any action or will not take any action to circumvent the above declaration, representation or warranty.

_____ [The Bidder/Contractor] accepts full responsibility and strict liability for making any false declaration, not making full disclosure, misrepresenting facts or taking any action likely to defeat the purpose of this declaration, representation and warranty. It agrees that any contract, right, interest, privilege or other obligation or benefit obtained or procured as aforesaid shall, without prejudice to any other rights and remedies available to Government of Pakistan under any law, contract or other instrument, be voidable at the option of Government of Pakistan.

Notwithstanding any rights and remedies exercised by Government of Pakistan in this regard _____ [the Bidder/Contractor] agrees to indemnify Government of Pakistan for any loss or damage

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incurred by it on account of its corrupt business practices and further pay compensation to Government of Pakistan in an amount equivalent to ten times the sum of any commission, gratification, bribe, finder's fee or kickback given by _____ [the Bidder/Contractor] as aforesaid for the purpose of obtaining or inducing the procurement of any contract, right, interest, privilege or other obligation or benefit in whatsoever form from Government of Pakistan.

Name of Bidder/Contractor: .....

Signature: .....

(Seal)

SCHEDULE – I TO BID

LIST OF RECOMMENDED MANUFACTURERS

Equipment and materials specified with brand names have been provided in order to establish a standard of performance and do not necessarily indicate a preference for a particular manufacturer or material.

The names of manufacturers given below are to indicate the level of quality and performance anticipated by the Engineer/ Employer. Other makes may be accepted provided that the quality and performance of such equipment, in the sole opinion of the Engineer, are at least equal to or better than the equipment/ product offered by the recommended manufacturer.

The acceptance of equipment/ materials offered by these manufacturers will be subject to compliance of offered models/materials with the specifications, capacity and/or performance requirements.

Onus lies with the Contractor for establishing the genuineness of any material/product for its make and origin.

S.NO.	ITEM	MANUFACTURER	
1	**Sound System**	i	JBL Professional (USA)
		ii	Meyer Sound (USA)
		iii	Danley Sound Labs (USA)
		iv	Martin Audio (UK)
		v	Electro-Voice
		Vi	Studio-Master (UK)
		vii	RCF (Italy)
2	DATA NETWORKING SYSTEM (PASSIVE COMPONENTS)	i	3M (Corning) (USA)
		ii	Schneider (France)
		iii	R & M (Switzerland)
3	DATA NETWORKING SYSTEM (ACTIVE COMPONENTS)	i	Cisco (USA)
		ii	HP (USA)
		iii	JUNIPER (USA)
4	PVC CONDUITS, PIPES, DUCTS & ACCESSORIES	i	SHAVYL
		ii	DADEX
		iii	ADAMJEE DURABUILT
		iv	BETA
		v	POLO

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5	CABLE TRAY	i	JEI
		ii	ERCON
		iii	SUNTECH
		iv	EZZI ENGINEERING
			OR APPROVED EQUIVALENT
6	**Low Voltage DG SET** (CBU) Foreign Coupled, Coupler should be authorized by the Manufacturer for Engine & Alternator		**Engine**
		i	Caterpillar
		ii	FG Wilson
		iii	Cummins
		iv	Kholer
		v	Siemens
			Alternator
			Lorrey Sumer
			Mecc Alte
			Stamp Ford
			Caterpillar
7	**Timing Devices**	i	Omega/ Swiss Timing (Switzerland)
		ii	Colorado
		iii	Time Tronics

Authorized Signature and official Seal: _____

Name: _____

Date: _____

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PREAMBLE TO CONDITIONS OF CONTRACT

Commencement Date	Sub-Clause 1.1.1.(i) The date for commencement of the Works is the date of issuance of the Engineer's Written Order to Commence which shall be issued within 14 days of signing of Contract Agreement.
Defect Liability Period	Sub-Clause 1.1.11 The Defect Liability Period is 364 days after the date certified in the Taking-Over Certificate but subject to extension as provided under Sub-Clause 30.4.
The Employer	Sub-Clause 1.1.12. The Employer is **The Director General** Pakistan Sports Board Abpara, Kashmir Highway Islamabad
The Engineer	Sub-Clause 1.1.15. To be notified by the Employer at later stage
Time for Completion	Sub-Clause 1.1.35. The Time for Completion for whole of the Works is 90 days reckoned from the Commencement Date.
Warranty Period	Sub-Clause 1.1.40. The Warranty Period is 5 years for (goods/equipment)
Engineer's Duties & Authorities	Sub-Clause 2.1 The duties & authorities of the Engineer are specified in Particular Conditions of Contract.
Confirmation in Writing	Sub-Clause 2.6 (i) If the Contractor shall require the confirmation, it shall be notified to the Engineer within ten (14) days. (ii) Engineer shall confirm the decision/instruction within ten (14) days.
Ruling Language	Sub-Clause 5.1. The version in English language (ruling language) shall prevail.
Day to Day Communications	Sub-Clause 5.2. The language for day to day communication is English

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As Built-Drawings	Sub-Clause 6.10 As-Built drawings shall be provided to the Engineer within twenty eight (28) days from the date of issuance of Taking-Over Certificate.
General Obligations	Sub-Clause 8.1 No Employer's supplied equipment to be provided.
Programme to be Furnished	Sub-Clause 12.1. The Programme must be submitted in the form of Bar-chart with critical path/activities for individual school and overall Project.
Electricity Water, Gas and Other Services	Sub-Clause 14.3. Contractor shall arrange supplies from his own resources
Employer's Equipment	Sub-Clause 14.4. There will be no Employer's Equipment available for use by the Contractor.
Working Hours	Sub-Clause 18.3. The normal working hours on the Site are to conform to the applicable labour laws and the existing customs of Pakistan.
Time for Completion	Sub-Clause 25.1 Period of Completion is as stated under Sub-Clause 1.1.35 hereof.
Earlier Completion	Sub-Clause 26.3 No Bonus for earlier completion shall be paid.
Delay in Completion	Sub-Clause 27.1. Failure of the Contractor to meet the Time for Completion entitles the Employer to deduct from the Contract Price, the liquidated damages @ 0.05 % percent of the Contract Price as stated in Letter of Acceptance, excluding Provisional Sums for each and every day, including holidays, of delay or part thereof; but to a maximum limit of 10 % of the Contract Price as stated in Letter of Acceptance, excluding Provisional Sums.
Prolonged Delay	Sub-Clause 27.2. Maximum amount recoverable from the Contractor by the Employer shall be 10% of Contract Price as stated in the Letter of Acceptance, excluding Provisional Sum.

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Terms of Payment

Sub-Clause 33.1.
In addition to the provisions under Clause 33, the terms of payment shall be as stated in Sub-Clause 33.1 of Particular Conditions of Contract.

Payment

Sub-Clause 33.5.
Time for Payment for Interim Payment Certificate is 14 Days.
Time for Payment for Final Payment Certificate is 28 Days.

Payment in Foreign Currencies

Sub-Clause 35.1.
Not Applicable

Rates of Exchange

Sub-Clause 35.3
Not Applicable

Insurance of Works

Sub-Clause 43.1.
The amount of insurance shall be for full replacement value of the Works. For the deductibles, if any, the Contractor shall submit an undertaking that he shall indemnify and keep indemnified the Employer for the amount of deductibles provided in the insurance policy.
Sub-Clause 43.1.(a)
The additional risks to be insured are as stated in Sub-Clause 43.1(a) of the Particular Conditions of Contract.

Third Party Liability

Sub-Clause 43.3.
The amount of insurance against third party liability taken out by the Contractor shall not be less than Pak Rs. 1,000,000 per occurrence with number of occurrences unlimited.

Payment on Termination for Employer's Default

Sub-Clause 46.3.
The additional amount payable by the Employer on termination shall not exceed the actual cost of work executed.

Labour, Materials and Transport

Sub-Clause 47.1.
The Contract shall not subject to price adjustment.

Notices to Employer and Engineer

Sub-Clause 49.2.
The address of the Employer for notices is the same as given in Sub-Clause 1.1.12 here above.
The address of the Engineer for notices is the same as given in Sub-Clause 1.1.15 here above.

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Disputes & Arbitration	Sub-Clause 50.4 Venue of Arbitration shall be Islamabad, Islamic Republic of Pakistan
Applicable Law	Sub-Clause 51.1. The Contract in all respects be read and construed and shall operate as a Pakistani Contract in conformity with the Laws of Islamic Republic of Pakistan.
Procedural Law for Arbitration	Sub-Clause 51.2. The procedural law for arbitration shall be the Rules of Pakistan Arbitration Act 1940
Language and Place of Arbitration	Sub-Clause 51.3. The language of arbitration is English language. The place of arbitration is Islamabad, Islamic Republic of Pakistan

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[Notes on the Conditions of Contract

The Conditions of Contract comprise two parts:

(a) General Conditions of Contract
(b) Particular Conditions of Contract

Over the years, a number of "model" General Conditions of Contract have evolved. The one used in these Standard Bidding Documents was prepared by the International Federation of Consulting Engineers (Federation Internationale des Ingenieurs-Conseils, or FIDIC), and is commonly known as the FIDIC Conditions of Contract. (The used version is the 1987 edition, reprinted in 1988 with editorial amendments.)

The FIDIC Conditions of Contract have been prepared for an ad measurement (unit price or unit rate) type of contract, and cannot be used without major modifications for other types of contract, such as lump sum, turnkey, or target cost contracts.

The standard text of the General Conditions of Contract chosen must be retained intact to facilitate its reading and interpretation by bidders and its review by the Employer. Any amendments and additions to the General Conditions, specific to the contract in hand, should be introduced in the Particular Conditions of Contract.

The use of standard conditions of contract for all electrical/mechanical Works will ensure comprehensiveness of coverage, better balance of rights or obligations between Employer and Contractor, general acceptability of its provisions, and savings in time and cost for bid preparation and review, leading to more economic prices.

The FIDIC Conditions of Contract are copyrighted and may not be copied, faxed, or reproduced. Without taking any responsibility of its being accurate, Pakistan Engineering Council with prior consent of FIDIC Secretariat, has reproduced herein the FIDIC General Conditions of Contract for reference purpose only which cannot be used by the users for preparing their bidding documents. The bidding document may include a purchased copy, the cost of which can be retrieved as part of the selling price of the bidding document. Alternatively, the FIDIC Conditions of Contract can be referred to in the bidding documents, and the bidders are advised to obtain copies directly from FIDIC.*

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* Add the following text if the bidding documents, as issued, do not include a copy:
"Copies of the FIDIC Conditions of Contract can be obtained from:
FIDIC Secretariat
P.O. Box 86
1000 Lausanne 12
Switzerland
fidic.pub@fidic.org – FIDIC.org/bookshop]

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FEDERATION INTERNATIONALE DES INGENIEURS-CONSEILS

CONDITIONS OF CONTRACT FOR ELECTRICAL AND MECHANICAL WORKS

INCLUDING ERECTION ON SITE

WITH FORMS OF TENDER AND AGREEMENT

NOT TO BE COPIED

THIRD EDITION 1987
Reprinted 1988 with editorial amendments



PART-II: PARTICULAR CONDITIONS OF CONTRACT

This Contract is a Lump Sum Contract for all the purposes. Any mentions or descriptions and intents in this Contract Agreement which are contrary to the spirit of Lump Sum Contract shall be ignored.

These Conditions of Particular Application Part-II are additions, deletions and amendment to General Conditions of Contract Part-I. Clause Nos., if similar as of Part-I are amendments therein otherwise these are additional clauses or sub-clauses thereto.

1.1 Definitions

The text of Sub-Clause 1.1.1 is deleted and substituted by the following:

"Commencement Date" means the date specified in the Preamble to Conditions of Contract.

The text of Sub-Clause 1.1.2 is deleted and substituted by the following:

"Conditions" means the Preamble to Conditions of Contract, General Conditions of Contract (GCC) and Particular Conditions of Contract (PCC).

Sub-Clause 1.1.3

At the end of Sub-Clause, the following is added:

"Any subsequent document mutually agreed and signed by the Employer and the Contractor, shall be the part of the Contract."

The text of Sub-Clause 1.1.5 is deleted and substituted by the following:

"Contract Price" means the sum stated in the Letter of Acceptance as payable to the Contractor for the execution and completion of the Works subject to such additions thereto or deductions there from as may be made under the provisions hereinafter contained and remedying of any defects therein in accordance with the provisions of the Contract".

Sub-Clause 1.1.11

The Defects Liability Period is the period mentioned in the Preamble to Conditions of Contract.

Sub-Clause 1.1.15

The word 'Engineer' wherever appearing in FIDIC Conditions of Contract, Particular Conditions of Contract or in the Document should be read as "Employer's Representative".

The following is added at the end of Sub-Clause:

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"or any other competent person appointed by the Employer as his replacement."

Sub Clause 1.1.16

Replace the word 'Engineer's Representative' with the word "Employer's Representative".

Sub-Clause 1.1.23

The following paragraph is added:

The word 'Goods' is synonymous with the word "Plant".

The text of Sub-Clause 1.1.27 is deleted and substituted by the following:

"Schedule of Prices" means the completed and priced Schedule of Prices, or any part or individual schedule thereof, submitted by the Contractor with his Bid or revised and mutually agreed and forming a part of the Contract Documents.

Add the following at the end of Sub-Clause 1.1.33:

The word 'Tender' is synonymous with the word "Bid" and the word 'Tender Documents' with "Bidding Documents".

The following new Sub-Clauses 1.1.38 to 1.1.50 are added:

"1.1.38 "Month" means calendar month according to Gregorian calendar.

1.1.39 "Operation and Maintenance Manuals" has the meaning described in Sub-Clause 6.6."

Sub-Clause 1.1.40 "Project" means "Design, Supply, Installation, Testing and Commissioning of Sound System Amplification System at Different Facilities of Pakistan Sports Complex, Islamabad".

Sub-Clause 1.1.41

The word 'Part II' wherever appearing in FIDIC Conditions of Contract is synonymous with the words "Particular Conditions of Contract".

Sub-Clause 1.1.42

The words 'Local Goods' is synonymous with the words "Indigenous Goods" and the word 'Installation' with "Erection".

Sub-Clause 1.1.43

"Turnkey Basis" means the single responsibility for design, supply, installation and commissioning of all mechanical and electrical equipment, civil and other works necessary for the completion and commercial operation of the Plant and shall

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include all such items of Plant and equipment or work, whether mentioned in the Specifications, Bid drawings, Schedule of Prices or not, which are required to make the Plant operationally complete in accordance with the guarantees prescribed under the Contract.

Notwithstanding the foregoing, it may be clarified however, that unless expressly prescribed otherwise by the Contract, the payment to the Contractor shall be made by measurement in accordance with the provisions set out under Sub-Clause 33.8 of Particular Conditions of Contract and the Contract shall not be construed as a lump sum contract in this regard.

Sub-Clause 1.1.45

"Constructional Plant" means all appliances or things of whatsoever nature (other than Temporary Works) required for execution and completion of the Works and the remedying of any defects therein but does not include Plant, materials or other things intended to form or forming part of Permanent Works. The word 'Constructional Plant' is synonymous with "Contractor's Equipment".

Sub-Clause 1.1.46

"Contractor's Agent" means the person for the time being or from time to time appointed by the Contractor pursuant to the provisions of Clause 13. The word "Contractor's Agent" is synonymous with "Contractor's Representative".

Sub-Clause 1.1.47

"Performance Tests" means tests intended to demonstrate the attainment of guaranteed contract performance to be conducted in accordance with the requirement of the Specifications.

Sub-Clause 1.1.48

"Reliability Test" means such test or tests as provided for in the Contract, or as may be agreed upon, which shall be successfully completed as a pre-requisite to Taking Over.

Sub-Clause 1.1.49

"Temporary Works" means all temporary works of every kind (other than Contractor's Equipment) required in or about the execution and completion of the Works and the remedying of any defects therein.

Sub-Clause 1.1.50

"Permanent Works" means the permanent works to be executed (including Plant) in accordance with the Contract.

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Sub-Clause 2.1 Engineer's Duties

The text of Sub-Clause 2.1 is deleted and substituted by the following:

"The Engineer shall carry out the duties specified in the Contract.

The Engineer may exercise the authority attributable to the Engineer as specified in or necessarily to be implied from the Contract. The Engineer is required to obtain the specific approval of the Employer before carrying out his duties in accordance with the following Clauses of General Conditions of Contract (GCC):

(a) approval of Subcontractor under Sub-Clause 4.1,
(b) certifying additional sums under Sub-Clause 5.4,
(c) certifying additional costs under Sub-Clauses 11.3 & 12.3,
(d) certifying any cost under Sub-Clause 14.6,
(e) approval of extension of time under Clause 26,
(f) issuing a Taking–Over Certificate under Sub-Clause 29,
(g) issuing a Defects Liability Certificate under Sub-Clause 30.11,
(h) issuing a Variation Order under Clause 31,
(i) fixing rates or prices under Clauses 31 and 34,
(j) certifying additional costs under Sub-Clause 44.5 and
(k) certifying additional costs under Sub-Clause 47.2;

Except for such variations pursuant to Sub-Clause 31.1 of the GCC which may be necessary in an emergency affecting safety of life, the Works or of adjoining property."

Except as expressly stated in the Contract, the Engineer shall have no authority to relieve the Contractor of any of his obligations under the Contract."

Sub-Clause 2.6 Confirmation in Writing

(i) In line 3 after the words "undue delay" the following is added:
"but not after the number of days mentioned in the Preamble to Conditions of Contract from the instruction or decision".

(ii) At the end of Sub-Clause 2.6, the following is added:

"The Engineer shall confirm or otherwise within the period mentioned in the Preamble to Conditions of Contract from the receipt of requirement(s) from the Contractor".

Sub-Clause 2.8 Replacement of Engineer

The text of Sub-Clause 2.8 is deleted in its entirety and substituted by the following:

"If the Employer intends to replace the Engineer, the Employer shall, not less than 14 days before the intended date of replacement, give notice to the Contractor, of the name, address and relevant experience of the intended replacement Engineer. The Employer shall not replace the Engineer with a person against whom the Contractor

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raises reasonable objection by notice to the Employer, with supporting particulars."

The following new Sub-Clause 2.9 is added:

Sub-Clause 2.9 Engineer Not Liable

"Approval, reviews and inspection by the Engineer of any part of the Works does not relieve the Contractor from his sole responsibility and liability for the supply of remaining materials and equipment for the Works and parts thereof and complete the remaining erection works and testing and commissioning in accordance with the Contract and neither the Engineer's authority to act nor any decision made by him in good faith as provided for under this Contract whether to exercise or not to exercise such authority shall give rise to any duty or responsibility of the Engineer to the Contractor, any Subcontractor, any of their representatives or employees or any other person performing any of the Works. However, the Contractor shall be compensated if any loss/damage is occurred due to the decision of the Engineer."

The following new Sub-Clause 4.2 is added:

Sub-Clause 4.2 No Contractual Relation Between Subcontractor and the Employer

"Nothing contained in the Contract Documents shall create any contractual relation between any Subcontractor and the Employer."

Sub-Clause 5.3 Priority of Contract Documents

The text of Sub-Clause 5.3 is deleted and substituted by the following:

"Unless otherwise provided in the Contract, the priority of the Contract Documents shall be as follows:

1. The Contract Agreement (if completed)
2. The Letter of Acceptance
3. The completed Form of Bid
4. Preamble to Conditions of Contract
5. The Particular Conditions of Contract
6. The General Conditions of Contract
7. The priced Schedule of Prices
8. The completed Schedules to Bid (A to I)
9. The Specifications
10. The Drawings
11. Any other document forming part of the Contract.

In case of discrepancies between drawings, those of larger scale shall govern unless they are superseded by drawing(s) of a later date regardless of scale. All drawings and specifications shall be interpreted in conformity with the Contract Agreement and these conditions."

Sub-Clause 5.4 Documents Mutually Explanatory

The text appearing in the last line after the words "the Contract Price" is deleted and the following text is added:

The Technical Specifications are taken to be correct, but complete accuracy is not guaranteed. Any error or ambiguity must be reported to the Employer and the Engineer before starting the work affected. In the event of any dispute arising as to the true intended meaning of Technical Specification, the Engineer shall interpret the same and his interpretation shall be accepted as final and binding upon all parties concerned, except to the extent provided for in the Arbitration provisions hereof.

Sub-Clause 6.2 Consequences of Disapproval of Contractor's Drawings

Full stop is deleted and the following words are added at the end of the Sub-Clause: "for the approval of the Engineer. However, the Contractor shall not be entitled for time extension on this account".

Sub-Clause 6.6. Operation and Maintenance Manuals

Paras 2 & 3 are deleted and the following text is added at the end of Para 1 of Sub-Clause:

"The Operation and Maintenance Manuals shall include full instructions for the operation, servicing and maintenance of the Plant, not only during the period of the Contractor's liability but more particularly during its operating life.

The directions shall be set out simply, clearly and systematically. This may be divided into two volumes if desirable, one for operation and the second for servicing and maintenance (in sub–volumes for major items of Plant).

The operational data shall include a complete physical and functional description of the Plant (in sub–volumes for major items of Plant) and step–by–step procedures for inspection, checking and adjustments for proper operation of the Plant.

The maintenance data shall include complete instructions for routine checks, servicing, maintenance and repair of all parts and for dismantling, handling and re–assembly of all equipment, sub–assemblies and all separate components. The maintenance data shall also include where possible parts catalogues. The lists shall provide all necessary information for identifying the parts and for re–ordering the parts including name of part, part number and catalogue references where applicable, name of manufacturer, size, capacity and other characteristics.

General arrangements, single line diagrams and detailed drawings shall be provided for ready reference in the operation and maintenance instructions.

The manuals shall be printed on ISO paper size A4 (210x297 mm) with offset or equivalent printing strongly bound in a durable stiff cover bearing the title in approved legend. Drawings shall be folded or reduced to 297 mm height. All volumes shall bear on the spine an approved shortened version of the title.

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The Contractor shall submit three (3) draft copies for approval of the Engineer prior to producing finished volumes.

The Contractor shall provide seven (7) copies of the approved Operation and Maintenance Manuals prior to Taking Over by the Employer. Supplementary Operation and Maintenance Manual shall be provided by the Contractor, if required, to incorporate changes resulting from experience during the operation and maintenance period. The work shall not be considered to be completed for the purpose of taking over until such manual and drawings have been supplied to the Employer.

Sub-Clause 6.9 Manufacturing Drawings

The words "Unless otherwise specified in Part-II" are deleted and the following is added at the end of Sub-Clause:
"However, the Contractor is required to disclose to the Engineer or the Employer any confidential information necessary to justify the reliability, the efficiency and the operation and maintenance of the Plant supplied by him."

The following new Sub-Clause 6.10 is added:

Sub-Clause 6.10 "As–Built" Drawings

"The Contractor shall furnish to the Engineer six (6) copies and one (1) reproducible of approved quality of all "As–Built" drawings within the period mentioned in the Preamble to Conditions of Contract. All drawings shall also be provided in an electronic form (CD).

The following new Sub-Clause 6.11 is added:

Sub-Clause 6.11 Shop Drawings

The Contractor shall submit to the Engineer for review 3 copies of all shop and erection drawings applicable to this Contract as per provision of relevant Sub-Clause of the Contract.

Review and approval by the Engineer shall not be construed as a complete check but will indicate only that the general method of construction and detailing is satisfactory and that the Engineer's review or approval shall not relieve the Contractor of any of his responsibilities under the Contract.

Sub-Clause 7.1 Errors in Contractor's Drawings

In second line, the text 'unless they are due to incorrect Employer's Drawings or other written information supplied by the Employer or the Engineer' is deleted.

Sub-Clause 7.2 Errors by Employer or Engineer

Sub-Clause 7.2 is deleted in its entirety.

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Sub-Clause 8.1 General Obligations

The text of Sub-Clause 8.1 is deleted and substituted by the following:

"(a) The Contractor shall commence the work on the date specified in the Preamble to Conditions of Contract and shall proceed with the same with due expedition and without delay.

(b) The Contractor shall, in accordance with the Contract, with due care and diligence, complete the Works and test and commission the Plant and carry out the Works within the Time for Completion. The Contractor shall also provide all necessary Contractor's Equipment, superintendence, labour and except as stated herein below, all necessary facilities therefor.

The Employer will permit use of the Erection and Testing Equipment and Maintenance Tools as given in the Preamble to Conditions of Contract.

The above facilities shall be provided at no cost to the Contractor but he shall procure at his cost all required consumable materials and any other items necessary for the proper execution of the Works. These shall be properly used and maintained by the Contractor and returned to the Employer upon handing over of the Works in good condition, fair wear and tear excepted. In case of any damage, loss or theft, the items shall be replaced by the Contractor at his own cost."

Sub-Clause 8.2 Setting Out

The first three (3) paragraphs are deleted and substituted with the following:

The Contractor shall be responsible for correctness of position, level and dimensions of the work according to the drawings notwithstanding that he may have been assisted by the Employer/Engineer in setting out the same.

The following new Sub-Clause 8.3 is added:

Sub-Clause 10.1 Performance Security

The text of Sub-Clause 10.1 is deleted and substituted by the following:

"The Contractor shall provide a Performance Security in the prescribed Form annexed to these Documents. The said Security shall be furnished by the Contractor within 14 days after the receipt of Letter of Acceptance. The Performance Security shall be of an amount equal to 10 percent of the Contract Price in the currency (ies) of the Contract in the form of Insurance Guarantee from any insurance company acceptable to the Employer operating in Pakistan with financial strength rating of AA approved by Pakistan Credit Rating Agency (PACRA) or JCR.

The cost of complying with the requirements of this Sub-Clause shall be borne by the Contractor".

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Sub-Clause 10.3 Claims under Performance Security

Sub-Clause 10.3 is deleted in its entirety.

The following new Sub Clause 10.4 is added:

Sub-Clause 10.4 Performance Security Binding on Variations and Changes

"The Performance Security shall be binding irrespective of variations and changes in the quantities of the Works or extensions in completion time of the Works, which are granted or agreed upon under the provisions of the Contract."

Sub-Clause 12.1 Programme to be Furnished

(1) The text of Sub-Clause 12.1(a) is deleted and substituted by the following:

"(a) the order in which the Contractor proposes to carry out the Works (including preliminaries, required material ordering, delivery to Site, erection and rectifications work, testing, commissioning of the Plant including design and construction of associated civil works and taking–over by the Employer). The programme shall also include the following:

(i) Employment of local and expatriate labour of various categories.
(ii) Local material procurement
(iii) Material imports, if any".

(2) The text of Sub-Clause 12.1(c) is deleted and substituted by the following:

"(c) the times by which the Contractor requires the Employer:

(i) to provide access to the Site.
(ii) to have obtained consents, way leaves and approvals necessary for the purpose of the Works."

The following new Sub-Clause 12.4 is added:

Sub-Clause 12.4 Monthly Progress Report

"During the period of the Contract, the Contractor shall submit six (6) sets of report to the Engineer not later than the 8th day of each month including:

(i) a construction schedule indicating the progress achieved during the preceding month;

(ii) description of all work carried out since the last report;

(iii) description of the work planned for the next forty-two (42) days sufficiently detailed to enable the Engineer to determine his programme of inspection and testing;

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(iv) summary of daily job record for the preceding month;

(v) colour digital photographs to illustrate progress."

The following new Sub-Clause 12.5 is added:

Sub-Clause 12.5 Daily Job Record

"During the period of the Contract, the Contractor shall keep a daily record of the work progress, which shall be made available to the Engineer as and when requested.

The daily record shall include particulars of weather conditions, number of men working in different categories, deliveries of materials, quantity, location and assignment of equipment."

Sub-Clause 13.1 Contractor's Representative

At the end of the Sub-Clause, the following is added:

"The Contractor's Representative shall be a competent and skilled person approved by the Engineer (which approval may at any time be withdrawn) and who shall be present on the Site during all working hours. He shall be fluent in the English language. He shall not be transferred from the Site without the consent of the Engineer. The Contractor's Representative shall be a professional engineer as defined in the Pakistan Engineering Council Act 1975 (V of 1976)."

The following new Sub-Clause 13.3 is added:

Sub-Clause 13.3 Language Ability of Superintending Staff of Contractor

"A reasonable proportion of the Contractor's superintending staff shall have a working knowledge of the English language."

The following new Sub-Clause 13.4 is added:

Sub-Clause 13.4 Employment of Local Personnel

"The Contractor shall, to the extent practicable and reasonable, employ staff and labour from sources within Pakistan."

Sub-Clause 14.1 Contractor's Equipment

Replace the word "or" at the end of Sub-paragraph (a) by "and" and insert the following at the end of Sub-paragraph (b):

"which shall not be unreasonably withheld."

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Sub-Clause 14.2 Safety Precautions

At the end of the Sub-Clause, the following is added:

"In order to provide for the safety, health and welfare of persons, and for prevention of damage of any kind, all operations for the purposes of or in connection with the Contract shall be carried out in compliance with the safety requirements of the Government of Pakistan with such modifications thereto as the Engineer may authorize or direct and the Contractor shall take or cause to be taken such further measures and comply with such further requirements as the Engineer may determine to be reasonably necessary for such purpose.

The Contractor shall make, maintain, and submit reports to the Engineer concerning safety, health and welfare of persons and damage to property as the Engineer may from time to time prescribe."

Sub-Clause 14.3 Electricity Water and Gas

The text of Sub-Clause 14.3 is deleted and substituted by the following:

"The Contractor shall be responsible for making his own arrangements for the adequate supply of electricity, water and gas required for the effective performance of his obligations under the Contract. Subject to the aforesaid, the Contractor shall be entitled to use for the purposes of the Works such supplies and services as may be available on the Site. The Contractor shall, before the commencement of the work at Site, seek the approval of the Engineer as to his detailed requirements of electricity, water and gas for the entire Contract period. The Contractor shall pay the Employer at the rates/cost incurred by the Employer. The Contractor shall at his own cost provide any apparatus necessary for such use".

Sub-Clause 14.4 Employer's Equipment

The text of Sub-Clause 14.4 is deleted and substituted by the following:

"The Employer shall, if the Contractor so requests for the execution of the works, operate any available equipment of which details are given in the Preamble to Conditions of Contract. The Contractor shall pay the Employer a mutually agreed price for such use.

The Employer shall during such operation retain control of and be responsible for the safe working of the equipment."

Sub-Clause 14.8 Information for Import Permits & Licenses

The text of Sub-Clause 14.8 is deleted and substituted by the following:

"The Contractor shall submit to the Employer in good time such details of all Plant and Contractor's Equipment as is to be imported into Pakistan and identify as to what assistance of the Employer is required for obtaining by the Contractor of all necessary import permits or licenses".

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Sub-Clause 15.2 Compliance with Laws

The text of Sub-Clause 15.2 is deleted and substituted by the following:

"The Contractor shall comply with the Laws of country of manufacture and the Laws of Pakistan where the Plant is to be erected".

The following new Sub-Clause 16.4 is added:

Sub-Clause 16.4 Photographs of Works and Advertisement Prohibited

"Except with the prior written authorization of the Employer the Contractor shall not exhibit or permit to be exhibited any photographs or advertisement on the Works. Any authorized exhibition shall be immediately removed if the Employer so requires."

Sub-Clause 16.5 Training of Employer's Staff

Sub-Clause 16.5 is added:

"The Contractor shall provide such facilities for the training of such numbers of Pakistani engineers, engineering students, apprentices and trade apprentices on such sections of the Works at the Site or on the Contractor's premises or Contractor selected plant manufacturer's premises and factories, or wherever else work is in hand, as specified or directed by the Engineer".

The language of training at the above stated premises shall be English and Urdu."

Sub-Clause 17.3 Civil Works on Site

The text of Sub-Clause 17.3 is deleted and substituted by the following:

"The Contractor shall carry out design and associated civil work required for the completion of the Works under the Contract."

Sub-Clause 17.4 Consents and Way Leaves

The text of Sub-Clause 17.4 is deleted and substituted by the following:

"The Employer shall issue permissions, letters, certificates and provide such other assistance to the Contractor for his obtaining permits-to-work, way leaves and approvals from any other department/authority and right of way from private owners, if required. The Contractor will bear the cost of logistics, fees, etc. for such activities. The Employer, will reimburse the Contractor only the payments made by him in respect of any land compensation for obtaining such way leaves, required for the Works."

Sub-Clause 17.5 – Import Permits and Licenses

The word "Employer" is deleted and substituted by the word "Contractor" and the following is added at the end of Sub-Clause 17.5:

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"the Employer will provide assistance for this purpose."

Sub-Clause 18.1 – Engagement of Labour

At the end of the Clause the following is added:

"in accordance with the regulations, orders and requirements of the Government of Pakistan".

The following new Sub-Clauses 18.5 to 18.16 are added:

"Sub-Clause 18.5 Employment of Persons in the Service of Others

The Contractor shall not recruit or attempt to recruit his staff and labour from amongst the persons in the service of the Employer or the Engineer and vice–versa, unless mutually agreed between the Employer/Engineer and the Contractor.

Sub-Clause 18.6 Alcoholic Liquor or Drugs

The Contractor shall not, otherwise than in accordance with the statutes, Ordinances and Government Regulations or Orders for the time being in force, import, sell, give, barter or otherwise dispose of any alcoholic liquor or drugs, or permit or suffer any such importation, sale gift, barter or disposal by his Subcontractors, agents, employees or labour.

Sub-Clause 18.7 Arms and Ammunition

The Contractor shall not give, barter or otherwise dispose of to any person or persons, any arms or ammunition of any kind or permit or suffer the same as aforesaid.

Sub-Clause 18.8 Festivals and Religious Customs

The Contractor shall in all dealings with his staff and labour have due regard to all recognized festivals, days of rest and religious or other customs.

Sub-Clause 18.9 Disorderly Conduct

The Contractor shall at all times take all reasonable precautions to prevent any unlawful riotous or disorderly conduct by or amongst his staff and labour and for the preservation of peace and protection of persons and property in the neighbourhood of the Works against the same.

Sub-Clause 18.10 Records of Safety and Health

The Contractor shall maintain such records and make such reports concerning safety, health and welfare of persons and damage to property as the Engineer may from time to time prescribe.

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Sub-Clause 18.11 Reporting of Accidents

The Contractor shall report to the Engineer details of any accident as soon as possible after its occurrence. In the case of any fatality or serious accident, the Contractor shall, in addition to appropriate action required under the law, notify the Engineer immediately by the quickest available means.

Sub-Clause 18.12 Rates of Wages and Conditions of Labour

The Contractor shall pay rates of' wages and observe conditions of labour not less favourable than those established for the trade or industry where the work is carried out. In the absence of any rates of wages or conditions of labour so established, the Contractor shall pay rates of wages and observe conditions of labour which are not less favourable than the general level of wages and conditions observed by other employers whose general circumstances in the trade or in industry in which the Contractor is engaged are similar.

Sub-Clause 18.13 Housing for Labour

Save insofar as the Contract otherwise provides, the Contractor shall provide and maintain such housing accommodation and amenities as he may consider necessary for all his supervisory staff and labour, employed for the purposes of or in connection with the Contract including all fencing, electricity supply, sanitation, cookhouses, fire prevention, water supply and other requirements in connection with such housing accommodation or amenities. On completion of the Contract, these facilities shall be handed over to the Employer or if the Employer so desires, the temporary camps or housing provided by the Contractor shall be removed and the Site reinstated to its original condition, all to the approval of the Engineer.

Sub-Clause 18.14 Epidemics

In the event of any outbreak of illness of an epidemic nature, the Contractor shall comply with and carry out such regulations, orders and requirements as may be made by the Government, or the local medical or sanitary authorities, for purpose of dealing with and overcoming the same.

Sub-Clause 18.15 Supply of Water

The Contractor shall, so far as is reasonably practicable, having regard to local conditions, provide on the Site, to the satisfaction of the Engineer or his representative, adequate supply of drinking and other water for the use of his staff and labour.

Sub-Clause 18.16 Compliance by Subcontractors

The Contractor shall be responsible for compliance by his Subcontractors of the foregoing provisions."

Sub-Clause 19.1 Manner of Execution

The following is added at the end of Sub-Clause:

"The Contractor shall submit for approval of the Engineer, his detailed method statement(s) for the execution of such items of work as may be desired by the Engineer. Approval of such method statement(s) shall neither relieve the Contractor of his responsibilities under the Contract nor form any basis for claiming additional costs."

Sub-Clause 19.3 Uncovering Work

The following is added at the end of second paragraph of Sub-Clause 19.3:

"In any other case, all costs shall be borne by the Contractor."

The following new Sub-Clause 19.4 is added:

Sub-Clause 19.4 Use of Pakistani Materials

"The Contractor shall so far as may be consistent with the Contract make the maximum use of materials, supplies and equipment indigenous to or produced in Pakistan and services available in Pakistan or operated in Pakistan provided such materials, supplies, equipment and services shall be of required standard."

The following new Sub-Clause 20.6 is added:

Sub-Clause 20.6 Pre-Shipment Inspection:

Equipment to be supplied under this Contract shall be subject to Pre-Shipment inspection and testing by two (02) Engineers of Employer and two (02) Engineers of Consultant at its respective point of original manufacture of Sound System, Timing Devices and DG Sets or final shop assembly before its packing & dispatch to site. The Contractor shall make necessary arrangements and provide all the facilities required for the representatives of Employer / Engineer for conducting such inspection, at Contractor's cost. The cost of travel including overseas travel, arranging of Visas, boarding and lodging of Employer's and Engineer's representatives shall be the responsibility of the Contractor.

In addition, the Contractor shall provide daily allowance (US$ 200 per day) for out-of-pocket expenses to each of Employer's and Consultant's representative engineers nominated for inspection. The number of days shall be actual days spent in travel calculated from the dates of travel from and to hometown of the concerned representative. The daily allowance in cash (US$) shall be provided before start of travel from hometown.

The Contractor shall submit tests procedures / protocols for approval of Employer/Engineer well in advance to the set date of pre-shipment inspection. All relevant submittals, shop drawings and requisite technical data should be approved by the Engineer prior to start production.

The Contractor shall give at least 3 (three) weeks' notice to the Employer and Consultant for attending such inspections/tests.

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Sub-Clause 24.1 Cost of Suspension

At the end of the second paragraph after the word "Contractor" the following is added:

"or for the proper execution or for the safety of the Works or Plant unless such necessity results from any act or default of the Engineer or the Employer or in consequence of any of the Employer's Risks under Sub-Clause 37.2."

Sub-Clause 24.4 Resumption of Work

First paragraph of Sub-Clause 24.4 is deleted and substituted by the following:

"If the Contractor chooses not to treat prolonged suspension as an omission or termination under Sub-Clause 24.3, the Employer shall, upon the request of the Contractor, take over the responsibility for protection, storage, security and insurance of the suspended Works and of the Plant which has been delivered to the Site and which is affected by suspension and the risk of loss or damage thereto shall thereupon pass to the Employer".

Sub-Clause 25.1 Time for Completion

The text of Sub-Clause 25.1 is deleted and substituted by the following:

"The Works at the place of the project mentioned in the Preamble to Conditions of Contract shall be completed tested and commissioned within the period mentioned in the Preamble to Conditions of Contract."

Sub-Clause 26.1 Extension of Time for Completion

Sub-Clause 26.1(h) is deleted.

The following new Sub-Clause 26.1.1 is added:

Sub-Clause 26.1.1 Financial Compensation Against Extension of Time

"The Contractor shall not be entitled for any financial compensation consequent upon the extension of time (EOT) for completion granted to him under the provisions of Sub-Clause 26.1 of the General Conditions of Contract and he shall not have any further recourse or claim against the Employer, nor shall have any right of a action against Employer for loss or damage suffered by the reasons of delay on which basis EOT is granted to him.

Sub-Clause 26.3 Earlier Completion

Sub-Clause 26.3 is deleted.

The following new Sub-Clause 26.4 is added:

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Sub-Clause 26.4 Rate of Progress

"If for any reason, which does not entitle the Contractor to an extension of time, the rate of progress of the Works or any Section is at any time, in the opinion of the Engineer, too slow to comply with the Time for Completion, the Engineer shall so notify the Contractor who shall thereupon take such steps as are necessary, subject to the consent of the Engineer, to expedite progress so as to comply with the Time for Completion. The Contractor shall not be entitled to any additional payment for taking such steps. If, as a result of any notice given by the Engineer under this Clause, the Contractor considers that it is necessary to do any work at night or on locally recognized days of rest, he shall be entitled to seek the consent of the Engineer so to do. Provided that if any steps, taken by the Contractor in meeting his obligations under this Sub-Clause, involve the Employer in additional supervision costs, such costs shall, after due consultation with the Employer and the Contractor, be determined by the Engineer and shall be recoverable from the Contractor by the Employer, and may be deducted by the Employer from any moneys due or to become due to the Contractor and the Engineer shall notify the Contractor accordingly, with a copy to the Employer."

Sub-Clause 27.1 Delay in Completion

The text of Sub-Clause 27.1 is deleted and substituted by the following:

If the Contractor fails to deliver the Works, or any part thereof, within the time stated in Sub-Clause 25.1, or fails to complete the whole of the Work, or, if applicable, any Section within the relevant time prescribed by Sub-Clause 25.1, then the Contractor shall pay to the Employer the relevant sum stated herein below as liquidated damages for such default (which sum shall be the only moneys due from the Contractor for such default) for every day or part of a day which shall elapse between the relevant time for Delivery or Time for Completion and the actual date of delivery at site or the date stated in a Taking–Over Certificate of the whole of the Works or the relevant Section, as the case may be, subject to the applicable limit stated herein below.

The Employer may deduct the amount of such damages from any monies due or to become due to the Contractor. The payment or deduction of such damages shall not relieve the Contractor from his obligation to complete the Works, or from any other of his obligations and liabilities under the Contract.

The liquidated damages for each day of delay and the maximum amount of liquidated damages shall be the amounts mentioned in the Preamble to Conditions of Contract.

The following new Sub-Clause 27.3 is added:

Sub-Clause 30.4 Extension of Defects Liability Period

At the end of 4th paragraph of Sub-Clause the following is added:
"or a mutually agreed period."

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Sub-Clause 30.5 Failure to Remedy Defects

In first line after the words "reasonable time" the following is added:
"fixed by the Engineer".

Sub-Clause 30.9 Defects in Employer's and Engineer's Designs

Sub-Clause 30.9 is deleted in its entirety.

The following new Sub-Clause 30.13 is added:

Sub-Clause 30.13 Unfulfilled Obligations

"After the Defects Liability Certificate has been issued, the Contractor and the Employer shall remain liable for the fulfillment of any obligation which remains unperformed at that time. For the purposes of determining the nature and extent of any such obligation, the Contract shall be deemed to remain in force."

Sub-Clause 31.1 Engineer's Right to Vary

The following is added at the end of second paragraph:

"No such variation shall in any way vitiate or invalidate the Contract, but the effect, if any, of all such variations shall be valued in accordance with Clause 31. Provided that whether the issue of an instruction to vary the Works is necessitated by some default of or breach of Contract by the Contractor or for which he is responsible, any additional cost attributable to such default shall be borne by the Contractor".

Sub-Clause 31.5 Records of Costs

The word "Engineer" in 4th line of Sub-Clause is deleted and substituted by "Engineer/Employer".

The following new Sub-Clauses 31.6 to 31.8 are added:

Sub-Clause 31.6 Daywork under Variation Order

"A Variation Order may provide that work done pursuant thereto shall be executed as Daywork. In such case the Contractor shall be paid for such work under the conditions and the rates and prices set out in the Day Work Schedule."

Sub-Clause 31.7 Value Engineering

The Contractor may, at any time, submit to the Engineer a written proposal which in the Contractor's opinion will reduce the cost of constructing, maintaining or operating the works, or improve the efficiency or value to the Employer of the completed Works or otherwise be of benefit to the Employer. Any such proposal shall be prepared at the cost of the Contractor. However Employer is not bound to accept such proposal.

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Sub-Clause 31.8 Changes in Estimated Quantities

For the removal of doubt, it is declared that any increase or decrease of the estimated quantities set out in the Schedule of Prices ascertained by measurement in accordance with the provisions of Sub-Clause 33.8 hereof is not a variation within the meaning of this Clause.

Sub-Clause 33.1 Terms of Payment

The text of Sub-Clause 33.1 is deleted and substituted by the following:

"Unless otherwise agreed, the Contractor shall be paid in the following manner, the Contract Price adjusted to give effect to such additions thereto and such deductions there from as are provided in the Contract.

Plant and Equipment Supplied from Abroad (outside the Employer Country)

For imported equipment and materials (to be imported for the permanent works), the payment conditions shall be as under:

(i) 25% (Twenty-Five Percent) of the quoted rates of imported items in schedule of prices (Bill of Quantities) shall be paid as advance against Insurance Guarantee from PCRA/AA rated Insurance Company in Pakistan, after the Contractor has obtained necessary approval of equipment and materials from the Engineer.

(ii) 40% (Forty percent) of the quoted rates of imported items in schedule of prices (Bill of Quantities) shall be paid against Insurance Guarantee from PCRA/AA rated Insurance Company in Pakistan after (a) the approval of Technical Submittals and (b) after the Contractor has established his LC or Banking Contract for equipment and materials & submission of Verified LC or Banking Contract documentation to the Employer / Engineer.

(iii) 15% (Fifteen percent) of the quoted rates of imported items in schedule of prices (Bill of Quantities) shall be paid after the Contractor has obtained necessary approval / verification for Factory Acceptance Test of equipment and materials from the Engineer after confirmation of Equipment Manufacturer and Pre-Shipment Inspection at OEM premises.

(iv) 10% (Ten percent) of the quoted rates of imported items in schedule of prices (Bill of Quantities) shall be paid on submission of negotiated shipping documents and safely arrival of equipment / material at Karachi Port after the witness as specified in Sub-Clause 20.6 of Conditions of Contract.

(v) 05% (Five percent) of the quoted rates of imported items in schedule of prices (Bill of Quantities) shall be paid on delivery of equipment / material at site and issuance of inspection certificates and approval by the Engineer.

(vi) 05% (Five percent) of the quoted rates of imported equipment/material in schedule of prices shall be paid on completion of installation, testing and commissioning of the equipment and system and issuance of taking over

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certificate by the Engineer.

(vii) 2.5% (Two-point-Five percent) of each payment shall be deducted as Retention Money from each payment of the Contractor and this payment shall be payable to the Contractor after the issuance of the Defect Liability Certificate.

Plant and Equipment Supplied from within the Employer's Country

For Local equipment and materials (to be imported for the permanent works), the payment conditions shall be as under:

(i) 25% (Twenty-Fife percent) of the quoted rates of local items in schedule of prices (Bill of Quantities) shall be paid as advance against Insurance Guarantee from PCRA/AA rated Insurance Company in Pakistan, after the Contractor has obtained necessary approval of equipment and materials from the Engineer.

(ii) For remaining 75% (Seventy-Five percent) The Contractor shall submit to the Engineer after the end of each month six copies, each signed by the Contractor's representative approved by the Engineer a statement, in such form as the Engineer may from time to time prescribe, showing the amounts to which the Contractor considers himself to be entitled up to the end of the month in respect of:

a) the value of the Permanent Works executed,
b) any other items in the Bill of Quantities including those for Contractor's Equipment, Temporary Works, dayworks and the like, and
c) any other sum to which the Contractor may be entitled under the Contract or otherwise.

(iii) 2.5% (Two-point-Five percent) of each payment shall be deducted as Retention Money from each payment of the Contractor and this payment shall be payable to the Contractor after the issuance of the Defect Liability Certificate.

Payment Procedure

The procedures to be followed in applying for certification and making payments shall be as follows:

The Contractor will submit its invoices to the Engineer who will certify the payable amount recommending the (undisputed) amount to the Employer within 28 (Twenty Eight) days of receipt of invoices from the Contractor so that the Employer would arrange the payment to the Contractor within next 14 (Fourteen) days for Interim Payment Certificate & within next 28 (Twenty Eight) days for Final Payment Certificate, through Letter of Credit or Cheque as the case may be."

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The following new Sub-Clauses 33.1.1 to 33.1.5 are added:

Sub-Clause 33.1.1 Retention of Payment

"If at any time any payment would fall due for Works or part of Works and, if there shall be any defect in part of such Works in respect of which such payment is proposed, the Employer may retain the whole or any part of such payment. Any sum retained by the Employer pursuant to the provisions of this Clause shall be paid to the Contractor after the said defect is removed."

Sub-Clause 33.1.2 Payment Where Taking-Over Certificate Issued for Section or Part of Works

"If any section or part of the Works shall be taken-over separately under Clause 29 (Taking-Over) hereof, the payments herein provided for on or after Taking-Over shall be made in respect of the section or part taken-over and reference to the price shall mean such part of the price as shall, in the absence of agreement, be apportioned thereto by the Engineer."

Sub-Clause 33.1.3 Extra Payment

No extra payment in respect of overtime, additional materials, or special conditions or hardship shall be claimed by the Contractor unless otherwise provided in the Contract or such payments have been previously authorized in writing by the Engineer or the Employer.

Sub-Clause 33.1.4 Breakdown of Lump Sum Items

For the purposes of statements submitted in accordance with Sub-Clause 33.1 hereof, the Contractor shall submit to the Engineer, within twenty eight (28) days after the receipt of the Letter of Acceptance, a breakdown for each of the lump sum items contained in the Bid. Such breakdowns shall be subject to the approval of the Engineer.

Sub-Clause 33.1.5 Mode of Payment

All payments in shall be directly disbursed to the Contractor upon receipt of application for certification of payment by the Employer and Engineer.

Sub-Clause 33.2 Method of Application

The following paragraph is added:

The Contractor shall submit to the Employer/Engineer six (6) copies of the Application for Certificate of Payment (invoices) each signed by the Contractor and in such form as the Employer/Engineer may from time to time prescribe.

The Employer/Engineer shall examine such invoices within the time stated in Preamble. After such time each invoice will be deemed to have been accepted. After such time each invoice amounts are not accepted by the Engineer/ Employer which

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has to be communicated giving the reasons in writing to the Contractor within the same time. If such exceptions made by the Engineer/ Employer are not acceptable to the Contractor he will justify his claims by attaching all necessary documentation and include such items in the next invoice. However, the portions of such invoices accepted by the Engineer/ Employer shall be due without delay.

Sub-Clause 33.5 Payment

The text of Sub-Clause 33.5 is deleted and substituted by the following:

"The amount due to the Contractor under any Certificate of Payment issued by the Engineer pursuant to this Clause, or to any other term of the Contract shall, subject to Clause 27, be paid by the Employer to the Contractor within a period mentioned in the Preamble to Conditions of Contract after such Certificate of Payment has been delivered to the Employer, or in the case of the Final Certificate of Payment referred to in Sub-Clause 33.10 within a period mentioned in the Preamble to Conditions of Contract after such Final Certificate of Payment has been delivered to the Employer.

Deduction shall be made from the net amounts payable to the Contractor of any sum(s) in accordance with the prevalent Federal and/or Provincial laws, provided that no such deduction shall be made from those payments in respect of which the Contractor has obtained exemption under the Law."

Sub-Clause 33.6 Delayed Payment

The text of Sub-Clause 33.6 is deleted and substituted by the following:
"In the event of the failure of the Employer to make payment within the times stated in Sub-Clause 33.5, the Employer shall pay to the Contractor compensation at the rate of 8% percent for local currency per annum upon all local currency sums unpaid from the date by which the same should have been paid. The provisions of this Sub-Clause are without prejudice to Contractor's entitlement under Sub-Clause 46.1."

Sub-Clause 33.8 Payment by Measurement

The text of Sub-Clause 33.8 is replaced with the following:

The Engineer shall, except as otherwise stated, ascertain and determine by measurement the value in accordance with the Contract of Work done in accordance with the Contract. He shall, when he requires any work to be measured, give notice to the Contractor's Agent who shall forthwith attend or send a qualified agent to assist the Engineer or the Engineer's Representative in making such measurement and shall furnish all particulars required by either of them. Should the Contractor not attend, or neglect or omit to send such agent, then the measurement made by the Engineer or approved by him shall be taken to be the correct measurement of the Work. For the purpose of measuring any work to be measured by records, the Engineer's Representative shall prepare records month by month of such work and the Contractor as and when called upon to do so in writing shall within (14) days attend to examine and agree with such records with the Engineer's Representative and shall sign the same when so agreed and if the Contractor does not attend to examine and agree, any such records shall be taken to be correct. If after

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examination of such records the Contractor does not agree to the same or does not sign the same as agreed, they shall nevertheless be taken to be correct, unless the Contractor shall within fourteen (14) days of such examination lodge with the Engineer's Representative for decision by the Engineer notice in writing of the respects in which such records are claimed by him to be incorrect.

The following Sub-Clauses 33.12 to 33.14 are added:

Sub-Clause 33.12 Withholding of Payment

If the Works or any parts thereof are not being carried out to the Engineer's satisfaction and in order to protect the Employer from loss on account of:

(a) defective work not rectified
(b) guarantees not met
(c) claims filed against the Contractor
(d) failure of the Contractor to make payments due for Plant procured or labour employed by him.
(e) damage to any other contractor employed by the Employer.
(f) Contractor's non–compliance with the Contract
(g) any Government dues recoverable from the Contractor if notified by the Government

The Engineer may notify withholding of such payments or part thereof as may, in his opinion, be related to the aforesaid reasons/grounds. When the reasons/grounds for withholding the payment are removed by the Contractor, the Engineer shall upon being satisfied to that effect issue Certificate of Payment in respect of withheld amounts."

Sub-Clause 33.13 Payment Deductions

All costs, damages, or expenses which the Employer shall have paid for which the Contractor is liable under the terms and conditions of the Contract, may be deducted by the Employer from any monies due or becoming due to the Contractor from the Employer.

Sub-Clause 33.14 Cost Account Statement

Before completion of the Project, the Contractor shall submit a completion Cost Account Statement of all works performed hereunder broken down in such detail and using cost account codes as the Employer may direct.

Sub-Clause 35.1 Payment in Foreign Currencies

The text of Sub-Clause 35.1 is deleted and substituted by the following:

"All the payments under this Contract shall be made in local currency (Pakistan Rupees) Only."

Sub-Clause 35.2 Currency Restrictions

The text of Sub-Clause 35.2 is deleted in its entirety.

Sub-Clause 35.3 Rates of Exchange

The text of Sub-Clause 35.3 is deleted in its entirety

Sub-Clause 36.4 Payment Against Provisional Sums

The text of Sub-Clause 36.4 is deleted and substituted by the following:

"Provisional Sums, if any will be expended on the direction of the Engineer through Variation Orders which would be valued in accordance with the provisions of Clause 31 Conditions of Contract."

Sub-Clause 37.2 Employer's Risks

The text of Sub-Clause 37.2 is deleted and substituted by the following:

The Employer's Risks are:

(a) (Insofar as they relate to Pakistan) war and hostilities (whether war be declared or not), invasion, act of foreign enemies:

(b) (Insofar as they relate to Pakistan) rebellion, revolution, insurrection, military or usurped power or civil war:

(c) ionizing radiation or contamination by radioactivity from any nuclear fuel, radio-active toxic explosives or other hazardous properties of any explosive nuclear assembly or nuclear components thereof:

(d) pressure waves caused by aircraft travelling at sonic or supersonic speed:

(e) (Insofar as they relate to Pakistan) riot, commotion or disorder, unless solely restricted to the employees of the Contractor or of his Subcontractors.

(f) use or occupation of the Work or any part thereof by the Employer:

(g) fault, error, defect or omission in the design of any part of the Works by the Engineer, Employer or those for whom the Employer is responsible for which the Contractor has disclaimed responsibility in writing within a reasonable time after the receipt of such design:

(h) the use or occupation of the Site by the Works or any part thereof, or for the purposes of the Contract: or interference, whether temporary or permanent with any right of way, light, air or water or with any easement, wayleaves or right of a similar nature which is the inevitable result of the construction of the Works in accordance with the Contract:

(i) the right of the Employer to construct the Works or any part thereof on, over,

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under, in or through any land:

(j) damage (other than that resulting from the Contractor's method of construction) which is the inevitable result of the construction of the Works in accordance with the Contract:

(k) the act, neglect or omission or breach of contract or of statutory duty of the Engineer, the Employer or other contractors engaged by the Employer or of their respective employees or agents.

Sub-Clause 39.2 Loss or Damage Before Risk Transfer Date

The words "by arbitration under Clause 50" are deleted and substituted "by the Engineer".

The following new Sub-Clause 39.4 is added:

Sub-Clause 39.4 Duty to Minimize Delay

"Each Party shall at all times use all reasonable endeavors to minimize any delay in the performance of the Contract as a result of Force Majeure risks

The Contractor shall give notice to the Employer and vice versa the Employer shall give notice to the Contractor in case of foreseeable delay by the Force Majeure risks.

Sub-Clause 40.2 Employer's Liability

The text of Sub-Clause 40.2 from the words "death or personal injury" to the end of the Sub-Clause, is deleted and substituted by the following:

"..... (other than the Works) death or personal injury to the extent caused by those of the Employer's Risks listed in paragraphs (f), (g), (h), (i), (j), and (k) of Sub-Clause 37.2 but not otherwise".

Sub-Clause 42.2 Maximum Liability

The words "the sum stated in the Preamble to Conditions of Contract or if no such sum is stated" appearing in 2nd line of Sub-Clause are deleted.

Sub-Clause 42.6 Foreseen Damages

Sub-Clause 42.6 is deleted in its entirety.

Insurance

Sub-Clause 43.1(a) The Works

The risks to be insured are:

(i) Fire, smokes, explosion, falling objects, earthquake, perils of the sea,

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tempest, impact by aircraft or land vehicle, aircraft and other aerial devices or articles dropped therefrom, lightning, strike, riot, civil commotion, escape of water, inundation, rain, snow, land slides, flood, act of God, vandalism or malicious damage, windstorm or hail storm and;

(ii) Collision, upset, overturn, derailment, stranding or sinking of an automobile or any conveyance of a common carrier by land, water or air in which the Plant or any part thereof is being carried including overland transportation in Pakistan from port of entry to the Site, and

(iii) Theft, burglary or attempted theft or burglary, and

(iv) Any loss or damage during pre-erection storage, and

(v) Faults in construction and erection, lack of skill, lack of experience, negligence, malicious act, and

(vi) any other sudden and unforeseen event such as loss or damage due to collapse etc. on site, transport of items to be erected, and

(vii) Actions of the Employer in the operation of plant or part thereof on behalf of the Contractor.

Sub-Clause 43.1.1 Marine Insurance of Plant

(1) The Contractor shall in the joint names of the Contractor and the Employer, obtain Marine Cargo All Risks Insurance to cover loss or damage to the Plant or part thereof during transport.

(2) The insurance for each consignment of Plant or part thereof shall attach from the time the Plant or part thereof leave the warehouse or place of storage and terminate after ninety (90) days on its completion of unloading at the Site or until insurance survey whichever occurs first. Upon arrival of each consignment at the Site, the Contractor shall, immediately arrange insurance survey by the insurance company.

(3) The sum insured for imported Plant or part thereof shall be for its full replacement value at the Site i.e. 100 % CIF value at the Site for each consignment of the Plant or part thereof plus not less than 30 % of CIF value at the Site to cover any additional costs resulting from loss or damage thereof.

(4) The Insurance Policy for imported Plant etc. shall be on "All Risks" basis and shall not be limited to the attachment/endorsement of following clauses:

(a) Institute Cargo Clauses (A)

(b) Institute War Clauses (Cargo)

(c) Institute Strikes Clauses (Cargo)

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(d) Institute Cargo Clauses (Air) excluding sending by Post

(e) Institute War Clauses (Air Cargo) excluding sending by Post.

(f) Institute Strikes Clauses (Air Cargo)

(g) Special Replacement Clauses (Air)

(h) Institute Theft, Pilferage and Non-delivery Clauses

Sub-Clause 43.1.2 Erection/Construction All Risks Insurance

(1) The Contractor shall insure the Works or part thereof in the joint names of the Contractor and the Employer.

(a) from the date following the completion of the first unloading at the Site of the Plant or part thereof and other materials (to be used for construction or erection) and from commencement of Works at Site until the Risk Transfer Date against any loss or damage caused by any of the Contractor's risks and any other risks specified in Sub-Clause 43.1.(a) above and

(b) during the Defects Liability Period against any loss or damage which is caused either:

(i) by the Contractor in completing any outstanding work or complying with his obligations under Clause 30, or
(ii) by any of the Contractor's risks and any other risks specified in Sub-Clause 43.1(a) above, which occurred prior to the Risk Transfer Date.

(2) The sum insured shall be the full replacement value at the Site, which includes:

(a) (i) FOB value of imported Plant to be erected

(ii) Ex-factory value of Indigenous Plant to be erected, if any

(b) freight and insurance including local transport

(c) customs duties and taxes etc.

(d) cost of erection

(e) cost of civil engineering work including escalation

(f) clearance of debris, maximum @ 5 % of minimum amount of Third Party Liability Insurance

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Plus 30% to cover any additional costs resulting from loss or damage thereof.

Sub-Clause 43.1.3 General

Should a loss be sustained, the Contractor shall replace or repair any loss or damage at his own cost and complete the Works in accordance with the Contract as soon as possible after occurrence of such loss or damages, without waiting for the settlement of the insurance claim.

Sub-Clause 43.2 Contractor's Equipment

The text of Sub-Clause 43.2 is deleted and substituted by the following:

"The Contractor shall insure the Contractor's Equipment for its full replacement value while on the Site against all loss or damage caused by any of the Contractor's Risks."

Sub-Clause 43.7 Remedies on the Contractor's Failure to Insure

In 3rd line after the word, "purpose", the expressions- "and reasonable costs including the man-hours costs of Employer's Personnel" are added.

The following New Sub-Clause 43.9 to 43.11 is added:

Sub-Clause 43.9 Contractor to Notify

"It shall be the responsibility of the Contractor to notify the insurance company of any changes in nature and extent of the Works and to ensure the adequacy of the insurance coverage at all times in accordance with the provisions of the Contract."

Sub-Clause 43.10 Procurement of Insurance Policies

The Contractor shall submit to the Engineer for review, the draft of the insurance policies to be procured under this Contract as soon as possible after receipt of Letter of Acceptance so that terms of the policies may be agreed and approved by the Employer.

Sub-Clause 43.11 Insurance Company

The policies of marine insurance and all other insurances with respect to Contractor's operations in Pakistan shall be effected with any of the insurance company acceptable to the Employer operating in Pakistan with financial strength rating of AA approved by Pakistan Credit Rating Agency (PACRA) or JCR including National Insurance Corporation (NIC) of Pakistan.

Sub-Clause 44.6 Damage Caused by Force Majeure

At the end of the Sub-Clause 44.6 the following is added:

"However the Contractor shall put up his claim to the Employer / Engineer with full

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details and justification."

Sub-Clause 44.8 Payment on Termination for Force Majeure

Text in sub-para (c) is deleted and para (d) and (e) are re-numbered as (c) and (d).

Sub-Clause 44.10 Force Majeure Affecting Engineer's Duties

Sub-Clause 44.10 is deleted in its entirety.

Sub-Clause 45.2 Contractor's Default

The following paragraph is added at the end of Sub-Clause 45.2.

"The Employer or such other contractor may use for such completion any Contractor's Equipment which is upon the Site as he or they may think proper, and the Employer shall pay the Contractor a reasonable compensation for such use".

Sub-Clause 45.4 Payment after Termination

The text of Sub-Clause 45.4 is deleted and substituted by the following:

"The Employer shall not be liable to make any further payments to the Contractor until the Works have been completed. When the Works are so complete, the Engineer shall certify the total cost of such completion of Works.

The Employer may recover the extra cost of such completion, as certified by the Engineer, from any sums otherwise due and payable to the Contractor and/or by disposing of the Contractor's Equipment and stores taken over by the Employer under this Clause or as otherwise provided by law. If there is no such extra cost the Employer shall pay any balance due to the Contractor."

The following new Sub-Clause 45.6 is added:

"Sub-Clause 45.6 Integrity Pact

If the Contractor, or any of his Sub-contractors, agents or servants gives or offers to give to any person any bribe, gift, gratuity or commission as an inducement or reward:

(a) for doing or forbearing to do any action in relation to the Contract with the Engineer/Employer, or

(b) for showing or forbearing to show favour or disfavour to any person in relation to the Contract or to any other contract with the Engineer/Employer.

then the Employer may, after having given 14 days' notice to the Contractor, terminate the Contract and expel him from the Site, and the provision of this Clause shall apply as if such termination and expulsion had been made under Sub-Clause 45.2."

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Sub-Clause 46.1 Employer's Default

The comma and the word "or" at the end of paragraph (d) of Sub-Clause 46.1 are deleted and substituted by period (.) Paragraph (e) of Sub-Clause 46.1 is deleted.

Sub-Clause 46.3 Payment on Termination for Employer's Default

The words "including loss of profit" in the second paragraph of Sub-Clause 46.3 are deleted.

Sub-Clause 47.1 Price Adjustment

The Contract is not subject to Price Adjustment.

Sub-Clause 48.1(A) Local Taxation

The rates and prices quoted by the Contractor in the Schedule of Prices shall be deemed to have included (i) business taxes, income tax, super tax and other taxes on income, and (ii) fees charged for services provided under this Contract.

Sub-Clause 48.2 Clearance Through Customs

Following is added at the end:

"All the cost incurred on account of transportation, import duties and taxes and all other costs attributable to customs clearance shall be sole responsibility of the contractor and shall be deemed included in the rate quoted by the Contractor."

Sub-Clause 48.3 Port Charges and Port Congestion

The Contractor shall be deemed to have obtained all information regarding facilities and charges, in respect of port clearance, loading and unloading, storage, transportation, congestion and confirmed the requirements thereof at his own responsibility and all such costs and charges are deemed to be included in the rates and prices of the Schedule of Prices.

Sub-Clause 49.1 Notices to Contractor

The following paragraph is added at the end of Sub-Clause 49.1:

"For the purposes of Sub-Clause 49.1, the Contractor shall, immediately after receipt of Letter of Acceptance, intimate in writing to the Employer and the Engineer by registered post, the address of his principal place of business or any change in such address during the period of the Contract."

Sub-Clause 50 Disputes & Arbitration

Clause 50 is deleted and in its place the following Sub-Clauses 50.1 to 50.5 are inserted:

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"50.1 If a dispute of any kind whatsoever arises between the Employer and the Contractor in connection with, or arising out of, the Contract or the execution of the Works, whether during the execution of the Works or after their completion and whether before or after repudiation or other termination of the Contract, including any dispute as to any opinion, instruction, determination, certificate or valuation of the Engineer, the matter in dispute shall, in the first place, be referred in writing to the Engineer, with a copy to the other party. Such reference shall state that it is made pursuant to this Clause. No later than the fifty sixth (56) day after the day on which he received such reference, the Engineer shall give notice of his decision to the Employer and the Contractor. Such decision shall state that it is made pursuant to this Clause.

Unless the Contract has already been repudiated or terminated, the Contractor shall, in every case, continue to proceed with the Work with all due diligence, and the Contractor and the Employer shall give effect forthwith to every such decision of the Engineer unless and until the same shall be revised, as hereinafter provided in an amicable settlement or in an arbitral award.

In any case where the Conditions of Contract provide that the decision of the Engineer is to be final and conclusive, such decision shall not be referable to arbitration under this Clause nor shall the same be questioned in any other form of proceedings whatsoever.

50.2 If either the Employer or the Contractor be dissatisfied with a decision of the Engineer or if the Engineer fails to give notice of his decision on or before the fifty sixth (56) day after the day on which he received the reference, then either the Employer or the Contractor may, on or before the twenty eighth (28) day after the day on which the said period of fifty six (56) days expired, as the case may be, give notice to the other party to commence arbitration, as hereinafter provided, as to the matter in dispute. Such notice shall establish the entitlement of the party giving the same to commence arbitration, as hereinafter provided, as to such dispute and, subject to Sub-Clause 50.5, no arbitration in respect thereof may be commenced unless such notice is given.

If the Engineer has given notice of his decision as to a matter in dispute to the Employer and the Contractor and no notification of intention to commence arbitration as to such dispute has been given by either the Employer or the Contractor on or before the twenty eighth (28) day after the day on which the parties received notice as to such decision from the Engineer the said decision shall become final and binding upon the Employer and the Contractor.

50.3 Where notice of intention to commence arbitration as to a dispute has been given in accordance with Sub-Clause 50.2, arbitration of such dispute shall not be commenced unless an attempt has first been made by the parties to settle such dispute amicably through mutual negotiation within ninety (90) days from the date of notification of Engineer's decision.

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50.4 Any dispute in respect of which:

(a) the decision, if any, of the Engineer has not become final and binding pursuant to Sub-Clause 50.1 and

(b) amicable settlement has not been started/reached within the period stated in Sub-Clause 50.3

shall be finally settled, unless otherwise specified in the Contract, under the Rules of Pakistan Arbitration Act, 1940 (Act No. X of 1940) and Rules made thereunder as amended, by one or more arbitrators appointed under such Rules.

The said arbitrator(s) shall have full power to open up, review and revise any decision, opinion, instruction, determination, certificate or valuation of the Engineer for the purpose of obtaining said decision pursuant to Sub-Clause 50.1. No such decision shall disqualify the Engineer from being called as a witness and giving evidence before the arbitrator(s) on any matter whatsoever relevant to the dispute.

The venue of arbitration proceedings shall be the place in Pakistan as mentioned in the Preamble to Conditions of Contract.

50.5 Where neither the Employer nor the Contractor has given notice of intention to commence arbitration of a dispute within the period stated in Sub-Clause 50.1 or 50.2 and the related decision has become final and binding, either party may, if the other party fails to comply with such decision, and without prejudice to any other rights it may have, refer the failure to arbitration in accordance with Sub-Clause 50.4. The provisions of Sub-Clauses 50.1 to 50.2 shall not apply to any such reference."

Additional Conditions

52. Liens

Each contractor, for himself and for any persons directly or indirectly responsible to him, and for his or their material, equipment and employees, and for all other persons performing any labor or furnishing any labor or material for any/or all of the Work covered by his Contract, will be required to release or waive, to the full extent permitted by law, all mechanical and other liens, for or on account of the Work done or equipment and material furnished hereunder and the improvements or structures herein same may be incorporated, and the land to which they are appurtenant shall at all times be free and clear of all such liens.

53.1 Payment of Income Tax, Etc.

The Contractor shall be responsible for the payment, if any is required, of all Pakistani Income Tax, Super Tax, and other taxes on income arising out of the Contract, and the rates and prices stated in the priced Schedule of Prices

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shall be deemed to cover all such taxes.

53.2 Personnel, Taxes and Duties

The Contractor or his personnel shall pay all personal income tax or other taxes due in Pakistan, if any, for the personnel employed by the Contractor for implementing the work or any other activity required by the Contract. The Contractor shall obtain, at his own cost, work permits from competent authorities to enable any foreign personnel to work in Pakistan. The Contractor shall be responsible for all formalities in connection with passports, obtaining visas, police permits, and expenses for customs duties, if any, related to personal goods of foreign personnel employed on the Project. However, the Employer will, if requested, assist the Contractor in obtaining visas and work permits.

53.3 Income Taxes Provisions in Subcontracts

Provisions to the like effect as those contained in this Clause shall be incorporated in Subcontracts.

54. Liability of the Contractor

The Contractor or his Subcontractors or assigns shall follow strictly, all relevant labour laws including the Workmen's Compensation Act and the Employer shall be fully indemnified for all claims, damages etc. arising out of any dispute between the Contractor, his Subcontractors or permitted assigns and the labour employed by them.

55. Joint and Several Liability

If the Contractor is a joint venture of two or more persons, all such persons shall be jointly and severally bound to the Employer for the fulfilment of the terms of the Contract and shall designate one of such persons to act as leader with authority to bind the joint venture. The composition or the constitution of the joint venture shall not be altered without the prior consent of the Employer.

56. Details to be Confidential

The Contractor shall treat the details of the Contract as private and confidential, save in so far as may be necessary for the purposes thereof, and shall not publish or disclose the same or any particulars thereof in any trade or technical paper or elsewhere without the prior consent in writing of the Employer or the Engineer. If any dispute arises as to the necessity of any publication or disclosure for the purpose of the Contract, the same shall be referred to the decision of the Engineer whose award shall be final.

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FORM OF BID SECURITY
(Bank Guarantee)

Guarantee No._____
Executed on _____
Expiry date _____

[Letter by the Guarantor to the Employer]

Name of Guarantor (Bank) with address:_____
Name of Principal (Bidder) with address:_____
_____
Penal Sum of Security (express in words and figures):_____
_____
Bid Reference No._____ Date of Bid _____

KNOW ALL MEN BY THESE PRESENTS, that in pursuance of the terms of the Bid and at the request of the said Principal, we the Guarantor above-named are held and firmly bound unto the _____, (hereinafter called The "Employer") in the sum stated above, for the payment of which sum well and truly to be made, we bind ourselves, our heirs, executors, administrators and successors, jointly and severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION IS SUCH, that whereas the Principal has submitted the accompanying Bid numbered and dated as above for _____ (Particulars of Bid) to the said Employer; and

WHEREAS, the Employer has required as a condition for considering the said Bid that the Principal furnishes a Bid Security in the above said sum to the Employer, conditioned as under:

(1) that the Bid Security shall remain valid for a period 28 days beyond the period of validity of the Bid;

(2) that in the event of;

(a) the Principal withdraws his Bid during the period of validity of Bid, or

(b) the Principal does not accept the correction of his Bid Price, pursuant to Sub-Clause 24.2 of Instructions to Bidders, or

(c) failure of the successful bidder to

(i) furnish the required Performance Security, in accordance with Clause 34 of Instructions to Bidders, or

(ii) sign the proposed Contract Agreement, in accordance with Clause 35 of Instructions to Bidders,

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then the entire sum be paid immediately to the said Employer as liquidated damages and not as penalty for the successful bidder's failure to perform.

NOW THEREFORE, if the successful bidder shall, within the period specified therefor, on the prescribed form presented to him for signature enter into a formal Contract with the said Employer in accordance with his Bid as accepted and furnish within twenty eight (28) days of his being requested to do so, a Performance Security with good and sufficient surety , as may be required, upon the form prescribed by the said Employer for the faithful performance and proper fulfilment of the said Contract or in the event of non-withdrawal of the said Bid within the time specified for its validity then this obligation shall be void and of no effect, but otherwise to remain in full force and effect.

PROVIDED THAT the Guarantor shall forthwith pay to the Employer the said sum stated above upon first written demand of the Employer without cavil or argument and without requiring the Employer to prove or to show grounds or reasons for such demand notice of which shall be sent by the Employer by registered post duly addressed to the Guarantor at its address given above.

PROVIDED ALSO THAT the Employer shall be the sole and final judge for deciding whether the Principal has duly performed his obligations to sign the Contract Agreement and to furnish the requisite Performance Security within the time stated above, or has defaulted in fulfilling said requirements and the Guarantor shall pay without objection the sum stated above upon first written demand from the Employer forthwith and without any reference to the Principal or any other person.

IN WITNESS WHEREOF, the above bounden Guarantor has executed the instrument under its seal on the date indicated above, the name and seal of the Guarantor being hereto affixed and these presents duly signed by its undersigned representative pursuant to authority of its governing body.

_____
Guarantor (Bank)

Witness:

Signature _____

1. _____

Name _____

_____
Corporate Secretary (Seal)

Title _____

2. _____

_____

_____
(Name, Title & Address)

_____
Corporate Guarantor (Seal)

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FORM OF CONTRACT AGREEMENT

THIS CONTRACT AGREEMENT (hereinafter called the "Agreement") made on the _____ day of _____(month) 20_____ between _____ _____ (hereafter called the "Employer") of the one part and _____ (hereafter called the "Contractor") of the other part.

WHEREAS the Employer is desirous that certain Works, viz _____ should be executed by the Contractor and has accepted a Bid by the Contractor for the execution and completion of such Works and the remedying of any defects therein.

NOW this Agreement witnesseth as follows:

1. In this Agreement words and expressions shall have the same meanings as are respectively assigned to them in the Conditions of Contract hereinafter referred to.

2. The following documents after incorporating addenda, if any except those parts relating to Instructions to Bidders shall be deemed to form and be read and construed as part of this Agreement, viz:

(a) The Contract Agreement
(b) The Letter of Acceptance
(c) The completed Form of Bid
(d) The Preamble to Conditions of Contract
(e) The Particular Conditions of Contract
(f) The General Conditions of Contract
(g) The priced Schedule of Prices
(h) The completed Schedules to Bid
(i) The Specifications
(j) The Drawings

3. In consideration of the payments to be made by the Employer to the Contractor as hereinafter mentioned, the Contractor hereby covenants with the Employer to execute and complete the Works and remedy defects therein in conformity and in all respects with the provisions of the Contract.

4. The Employer hereby covenants to pay the Contractor, in consideration of the execution and completion of the Works as per provisions of the Contract, 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 Contract Agreement to be executed on the day, month and year first before written in accordance with their respective laws.

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Signature of the Contactor

(Seal)

Signature of the Employer

(Seal)

Signed, Sealed and Delivered in the presence of:

Witness:

(Name, Title and Address)

Witness:

(Name, Title and Address)

FORM OF PERFORMANCE SECURITY
(Bank Guarantee)

Guarantee No._____
Executed on _____
Expiry date _____

[Letter by the Guarantor to the Employer]

Name of Guarantor (Bank) with address:_____
Name of Principal (Contractor) with address:_____

_____

Penal Sum of Security (express in words and figures)_____

_____

Letter of Acceptance No. _____Dated _____

KNOW ALL MEN BY THESE PRESENTS, that in pursuance of the terms of the Bidding Documents and above said Letter of Acceptance (hereinafter called the Documents) and at the request of the said Principal we, the Guarantor above named, are held and firmly bound unto the _____ (hereinafter called the Employer) in the penal sum of the amount stated above for the payment of which sum well and truly to be made to the said Employer, we bind ourselves, our heirs, executors, administrators and successors, jointly and severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION IS SUCH, that whereas the Principal has accepted the Employer's above said Letter of Acceptance for _____ _____ (Name of Contract) for the _____

_____ (Name of Project).

NOW THEREFORE, if the Principal (Contractor) shall well and truly perform and fulfill all the undertakings, covenants, terms and conditions of the said Documents during the original terms of the said Documents and any extensions thereof that may be granted by the Employer, with or without notice to the Guarantor, which notice is, hereby, waived and shall also well and truly perform and fulfill all the undertakings, covenants terms and conditions of the Contract and of any and all modifications of said Documents that may hereafter be made, notice of which modifications to the Guarantor being hereby waived, then, this obligation to be void; otherwise to remain in full force and virtue till all requirements of Clause 30, Defects after Taking Over, of Conditions of Contract are fulfilled.

Our total liability under this Guarantee is limited to the sum stated above and it is a condition of any liability attaching to us under this Guarantee that the claim for payment in writing shall be received by us within the validity period of this Guarantee, failing which we shall be discharged of our liability, if any, under this Guarantee.

We, _____ (the Guarantor), waiving all objections and defences under the Contract, do hereby irrevocably and independently guarantee to pay to the Employer without delay upon the Employer's first written demand without cavil or arguments and without requiring the Employer to prove or to show grounds or reasons for such demand any sum or sums up to the amount stated above, against the Employer's written declaration that the Principal has refused or failed to perform the obligations under the Contract which

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payment will be effected by the Guarantor to Employer's designated Bank & Account Number.

PROVIDED ALSO THAT the Employer shall be the sole and final judge for deciding whether the Principal (Contractor) has duly performed his obligations under the Contract or has defaulted in fulfilling said obligations and the Guarantor shall pay without objection any sum or sums up to the amount stated above upon first written demand from the Employer forthwith and without any reference to the Principal or any other person.

IN WITNESS WHEREOF, the above-bounden Guarantor has executed this Instrument under its seal on the date indicated above, the name and corporate seal of the Guarantor being hereto affixed and these presents duly signed by its undersigned representative, pursuant to authority of its governing body.

_____
Guarantor (Bank)

Witness:

1. _____

_____
Corporate Secretary (Seal)

2. _____

_____
Name, Title & Address

Signature _____

Name _____

Title _____

_____
Corporate Guarantor (Seal)

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FORM OF BANK GUARANTEE/BOND FOR ADVANCE PAYMENT

Guarantee No._____
Executed on_____
Expiry date _____

[Letter by the Guarantor to the Employer]

WHEREAS the _____ (hereinafter called the Employer) has entered into a Contract for _____ _____ _____ (Particulars of Contract), with _____ _____ (hereinafter called the Contractor).

AND WHEREAS the Employer has agreed to advance to the Contractor, at the Contractor's request, an amount of Rupees_____ (Rs._____) which amount shall be advanced to the Contractor as per provisions of the Contract.

AND WHEREAS the Employer has asked the Contractor to furnish Guarantee to secure advance payment for performance of his obligations under the said Contract.

AND WHEREAS _____ (Bank) (hereinafter called the Guarantor) at the request of the Contractor and in consideration of the Employer agreeing to make the above advance to the Contractor, has agreed to furnish the said Guarantee.

NOW THEREFORE the Guarantor hereby guarantees that the Contractor shall use the advance for the purpose of above mentioned Contract and if he fails, and commits default in fulfillment of any of his obligations for which the advance payment is made, the Guarantor shall be liable to the Employer for payment not exceeding the aforementioned amount.

Notice in writing of any default, of which the Employer shall be the sole and final judge, as aforesaid, on the part of the Contractor, shall be given by the Employer to the Guarantor, and on such first written demand payment shall be made by the Guarantor of all sums then due under this Guarantee without any reference to the Contractor and without any objection.

This guarantee shall come into force as soon as the advance payment has been credited to the account of the Contractor.

This guarantee shall expire not later than _____ by which date we must have received any claims by registered letter, telegram, telex or telefax.

It is understood that you will return this Guarantee to us on expiry or after settlement of the

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total amount to be claimed hereunder.

_____
Guarantor (Bank)

Witness:

1. _____

_____
Corporate Secretary (Seal)

2. _____

_____
Name, Title & Address

Signature _____

Name _____

Title _____

_____
Corporate Guarantor (Seal)

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SPECIFICATIONS – SPECIAL PROVISIONS

1. GENERAL

1.1. Specifications – Special Provisions shall form an integral part of Bidding & Contract documents.

1.2. The Contractor shall notify all sub-contractors of the provisions of these Special Provisions.

2. DESCRIPTION OF PROJECT, WORKS INVOLVED AND SITE

The Employer intends to complete Design, supply, installation, testing and commissioning of Sound Amplification System, Electronic Timing Devices and DG Sets at Different Facilities of Pakistan Sports Complex, Islamabad. Bidder is required to visit the site before submission of Bid and Bid proposal should be submitted at the time of Bid Submission.

Contract No: PSB/Islamabad/04/2026
Location: Pakistan

The Employer will give to the Contractor possession of the area designated and defined as the Site and shown on the drawing as may be required to implement as much of the Works, when the Engineer's Notice to Commence the Works is given.

SOUND SYSTEM

IP BASED PUBLIC ADDRESS SYSTEM AND VOICE EVACUATION SYSTEM

SCOPE OF WORK

The scope of work shall include the design, supply, installation, testing and commissioning of IP based Public Address and Voice Evacuation System (PAVES) complete in all respect. Contractor shall supply install, test and commission a Public Address system comprising of Amplifiers, loudspeakers and all necessary cabling and termination. The system shall be generally as indicated on the drawings and as herein specified, to the approval of the Engineer. The Contractor shall be responsible for providing complete PAVES system solution with design including auxiliary equipment for best quality of service and all such equipment shall be deemed to be included in the scope of Contractor.

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The complete system shall be supplied by a specialist Subcontractor having at least five years' experience in the field. All equipment supplied shall be from single reputed manufacturer having an experience of 20 years in similar works and shall be installed by the authorized representative of the manufacturer. All the equipment included in this system shall be covered by manufacturer's warranty for minimum five (05) years. All bidders shall have to visit the site to take physical dimensions and prepare site specific design to verify their horizontal / vertical lengths etc. before submission of proposals. The bidders may raise the queries for any clarification, missing information or ambiguity if any, within one week after issuance of tender documents. Any work to be carried out by the owner / main contractor, should be mentioned clearly along with the bid, otherwise no claim against extra work shall be acceptable. Specification, Drawings and BOQ etc. should be read carefully. Any deviation from specification / BOQ should be mentioned well in time before submission of bid.

For the purpose of Public Address System, the speakers are grouped into different zones as follows;

a) Corridors and Passage
b) Stadiums
c) Indoor and outdoor swimming pools
d) Indoor sports courts
e) Parking

Different level of priorities as per following shall be allotted to different signals for transmission through same speaker.

a) Emergency announcements highest priority
b) Fire tone next
c) Sports announcements
d) Music Least

All control consoles shall be placed in the Control / Management Room. Announcement shall be played from the Control / Management Room. The announcement shall be made in individual mode (i.e. one zone at a time) or to multiple zones at a time.

The SOP can vary subject to the requirement of Chief Operating Officer. This shall be specified at the time of Completion of Commissioning and is included in part of vender software and hardware programming.

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The IP Public Address (PA) and Voice Evacuation System works are to be performed; the requirements given in the Technical Specification shall be fulfilled. The Contractor shall be responsible and provide the following:

- Monitoring and control of IP Public Address (PA) and Voice Evacuation System equipment in different areas.
- All the Major equipment e.g. Network Controller, Power Amplifier, Power Supply Manger, Speakers and Storage backup device shall be provided from the same manufacturer.
- Video Display Unit (VDU)
- Provide the necessary hardware and software for above System.
- All International sport software packages shall be provided in original installation media along with their licenses. The International sport software must be fully integrated with the Score Boards, Timing System Devices and all other stadium facilities.
- The Supplier/manufacturer should provide valid related software license for the period of 10 years.
- Preparing an Engineering Design Report covering at least the following subsystems:

1) Detailed Drawings for the IP Public Address (PA) and Voice Evacuation System showing all Coverage areas of the project.
2) Schematics and interconnection diagrams of complete IP Public Address (PA) and Voice Evacuation System showing PA system components including Network Controller, Power Amplifier, Power Supply Manger, Speakers and other elements to monitor and control the processes outlined above.
3) The exact quantities and types of hardware and software required.
4) Technical details of the hardware and software of the complete systems.
5) Cable and conduit schedules and routing plan.
6) Details of any civil works required.
7) Detailed description of the data acquisition software, user configurable functions and software features to be provided.
8) Complete details, brochures and pictures of the proposed area.
9) Installation, testing and commissioning procedures and methodology.

- Procure, transport and deliver equipment and hardware to site, after approval of the above report(s) by the Engineer.
- Design, Install, test and commission of Network Controller, Power Amplifier, Power Supply Manger, Speakers in accordance with the

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procedures given in the engineering design report. No payment shall be made without approval of equipment.

- Provide training to the Employer's personnel.

Bidder shall submit with his bid the following Documents/Data for all system equipment including Network Controller, Power Amplifier, Power Supply Manger, Speakers UPS, and Batteries:

- Schedule of technical data as per given format of all equipment
- Detailed Drawings for the complete system showing all areas of the project
- Brochures and data sheets with make, model of each equipment
- Authorized local distributor certificate and Warranty certificate from local distributor
- Block diagram of IP Public Address (PA) and Voice Evacuation System including OFC showing interconnectivity of all equipment.
- Detail of Cabinets.
- Field of view showing coverage area of each speaker.
- Test standards and design.
- Backup calculations showing that Hard Disks shall be able to record data on workstation of all system for a period of one Month.
- International Standards Reports/Certificates

TERMS AND CONDITIONS

- The Manufacturer should have at least 20 years of experience in the field of manufacturing and installing of timing system equipment for International Sports Applications.
- The list of these references should be presented along with Name, phone number of clients, country name, place and year of installation.
- The manufacturer/supplier/local agency/contractor should mention the country and port of shipment in their offer along with authorization from Manufacture or from his local representative in order to participate in the Bid process.
- The Manufacturer's country of origin should be:
  Europe, USA and Japan.

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- The OEM should have at least 25 Numbers of installations or similar during last Ten (10) years.
- The OEM should have a local partner in Pakistan.
- Failure to comply the above requirements shall disqualify the manufacturer

STANDARDS

All equipment shall be of imported origin. Equipment design and manufacturing shall be only from Europe, USA and Japan only. Materials/Equipment shall be designed, manufactured, tested and installed according to the BS/IEC/ISO/ITU/EN/CE Recommendations. The latest edition and amendments shall apply in all cases for complete submittal.

1) EN 54 Fire detection and fire alarm systems, Voice alarm control and indicating equipment.
2) EN 55032:2016
3) EN55032:2015 DEVICE CLASS A
4) EN 61000-3-2:2014 Class A
5) EN 61000-3-3:2013
6) EN 55035:2017
7) Low Voltage Directive (LVD) 2014/35/EU
8) Electromagnetic Compatibility (EMC) 2014/30/EU
9) Restriction of Hazardous Substances (RoHS) 2011/65/EU

WARRANTY

The Contractor shall provide warranty for all equipment for a period of five (05) years through authorized local distributor commencing the hand-over and acceptance date to the Employer. No equipment shall be accepted without warranty certificate from the manufacturer. It shall cover all costs for WARRANTY SERVICE, including parts replacement, labor; prompt field service, pick-up, transportation, and delivery. No extra cost shall be admissible for Warranty services.

MATERIALS AND EQUIPMENT

a) Furnish and install at locations shown the specified equipment, to provide a completely operational Digital Public Address System.

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b) Provide and install all equipment, components, cable and mounting hardware as required to meet manufacturer's specifications and documented installation procedures.

c) All materials and equipment shall be standard, regularly manufactured equipment. All systems and components shall be thoroughly tested and proven in actual field use. Where possible, all system components shall be from one manufacturer. Whenever components are included from sources other than the manufacturer of the system, the CONTRACTOR shall demonstrate and verify that the components are compatible, prior to system acceptance, and shall provide to the CUSTOMER that use of such components will not void or impair the system warranty.

Where required, provide 220 VAC, 50 Hz power from nearest electrical panel, through a junction box, to the system equipment.

Test for ground loops that may result from use of different power sources for various components.

All items of public address system shall be listed product of a single manufacturer.

Contactor or vendor must provide all operation and maintenance manual of the offered system.

Normal instruction should be mentioned in black color and emergency instructions or important notes must be in Red color.

Each and every software, firmware, hardware updates will be provided free of cost in the warranty and maintenance contact period.

SYSTEM OVERVIEW

The Digital Public Address System shall be a highly sophisticated, microprocessor controlled and modular unit. Public Address System shall have a lifespan of 20+ years with 100%+ output guaranteed. It shall be built around 19-inch rack mounted Euro card circuit boards where the configurations can be tailored and expanded to meet every need precisely. The supply of the Digital Public Address System shall include, but not limited to the following:

a) Recessed mount (ceiling) speakers, sound projectors c/w line matching transformers and central alarm controller, power amplifiers, call stations, where applicable;

b) Equipment rack complete with forced air ventilation fan(s), mounting brackets blank panels, terminal boards, etc.

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All routing, switching and priority functions shall be easily programmed and changed by non-technical personnel. It shall accept input signals from call stations, microphones, music sources, pre-recorded message source, etc. The primary objective of the system is to provide clear announcements during public addressing and one-way voice communication during an emergency, the secondary function shall be to provide background music where required. The loudspeakers shall be wired up in zones and with supervision; localized volume controls as specified shall be provided so that the desired volume adjustments may be made. The zones shall further be grouped according to function so that it shall be possible to make an announcement by pressing just one switch on the call station. To allow flexibility in the system, it shall be designed to be expandable with easy installation without changes in controller. When the zones are selected for public addressing, a chime shall first be heard, followed by the announcement. The system shall have a range of tones such that it shall be possible to program different tones for call stations. The system shall comply with country Public Address Evacuation Code of practice for the one-way emergency voice communication system in all aspects. The PA system shall be the integrated solution for back ground music (BGM) and emergency voice alarm system (EVAS). The voice alarm system shall be modular & digital, designed for public address and emergency evacuation. All the essential EVAS functionality – such as system supervision, spare amplifier switching, loudspeaker line surveillance, digital message management and a fireman's panel interface – shall be combined.

The Contractor shall provide Speaker Placement Viewer or equivalent professional software along with license to consultant to verify the drawings. License should be valid for at least three years.

DIGITAL SYSTEM SOFTWARE

The software for the networked public address system shall consist of separate sections for configuration, diagnostics and logging, and file transfer. The configuration software shall consist of a web server that allows the configuration settings to be made via a standard web browser. It shall support three access levels: administrator, installer, and user, each with different access rights. The configuration software shall support the assignment of all system units in a system and the individual configuration of each unit. The configuration software shall

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support call macros to allow users to configure various functions and/or actions that can be assigned to inputs such as control inputs and call station keys. A call macro shall define one or more of the following: priority, start and end tones with volume setting, an audio input for live speech insertion with volume setting, a message or sequence of messages with a number of repetitions and volume setting, maximum call duration, its routing scheme (partial, non-partial, stacked) and its timing scheme.

The configuration software shall support zone configuration and zone grouping. In zone configuration, it should be possible to assign zone-related items such as amplifier channel outputs, audio outputs and control outputs to defined zones. The configuration software shall support spare power amplifier configuration and assignment, where a power amplifier can be linked to a spare power amplifier so that if there is a fault in the power amplifier, its load will automatically change over to the spare power amplifier. The number of main power amplifiers that share the same spare power amplifier shall be flexible. The configuration software shall configure all equipment inputs and outputs in the system, including audio processing functions and operation modes.

The configuration software shall have configure keys on call station or control inputs with various functions, such as zone selection, priority selection, message selection, tone selection, call (macro) activation, BGM selection, control output switching, fault status acknowledges and/or reset, emergency status acknowledges and/or reset, recall and cancel. Control inputs can be configured for monitoring lines connected to them for open circuits and short circuits.

It shall be possible to configure various time- volume settings for BGM and calls in a zone. The configuration software shall support the assignment of BGM sources to music channels, which can be assigned to different zones. It shall be possible to use control inputs to report the fault status of third-party equipment, allowing users to view logged events of monitored external devices.

The software shall also provide control of audible and visual fault indicators. It shall be possible to acknowledge and reset faults and alarm states, and to log these actions. The system software shall be certified by an independent test agency for compliancy to the standards EN.

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BASIC CALL STATION

The basic call station shall have desktop paging station, buttons, LED indicators, zone name display and gooseneck microphone.

The basic call station shall have the following parameters:

The basic call station shall have five zone keys with integrated LED status indicator (paging zone selection management) and Gooseneck microphone. The basic call station shall have RJ45 connector, microphone volume control and Lock/Unlock switch for zone. The basic call station shall have input sensitivity of -50 dBu and less than 90 dBu SNR. The basic call station shall have frequency response from 45 Hz to 15 KHz and less than 0.1% of harmonic distortion (THD). Call station must be certified by an independent test agency for compliancy to the international standard IEC for emergency sound systems, EN, CE and FCC.

CEILING MOUNT SPEAKERS WITH BACK BOX COVER (EN STANDARD)

It shall meet the following minimum requirements:

i. Rated power should be as per requirement and as proposed by contractor and approved by the Engineer. The rated voltage should be 70/100 volts.

ii. The speaker shall have effective frequency response from 150 Hz to 20 kHz, dispersion angle of 180° conical and sensitivity of 93 dB. The speaker shall have 6" of woofer/driver and maximum sound pressure level (SPL) of 102 dB. The speaker shall have transformer for power taping. The Material should be ABS Plastic housing with Steel grill. It must be certified by an independent test agency for compliance to the international standard IEC for emergency sound systems, EN Certified System, CE and FCC.

OUTDOOR PUBLIC ADDRESS SYSTEM

DIGITAL MATRIX SYSTEM EN STANDARD

The digital audio matrix shall have 8 x balanced input and 8 x balanced output channels. The input channels shall have the functionality to receive and forward the voice signals for processing. The output channels shall set up individually (MONO zones) or in pairs (STEREO zones). The digital matrix must have ports for connecting pager consoles for setting up audio

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signal priority levels (talk over/pager). Integrate with web server and standard web navigator should be through programming, without the need to install additional software. The digital audio matrix shall have options for background music and notices with message priority and selection of source/independent volume. The digital audio matrix / network controller shall have the following Minimum Parameters.

The digital audio matrix shall have AD/DA Convertor of 24-bit, sampling Rate 48 kHz and Channel Isolation should be 100 dBu. It must have Dynamic Range of 110 dBu

It must contain Volume control; ON-OFF, label and style. It should have Open Interface that allows for control of the system by Web, Android and iOS application.

Input impedance shall be at least or greater than 2kΩ. Matrix should have frequency response of 20 Hz to 20 kHz. The network controller harmonic distortion shall be (THD+IMD) equal to or less than 0.005%. Among physical parameters, case material shall be Steel or better. Audio matrix must comply to the international standards IEC for emergency sound systems, EN, CE and FCC. The network controller cabinet shall be rack mounting without the need for free rack space between units.

SYSTEM POWER AMPLIFIERS EN STANDARD

The Class-D amplifiers shall be EN Standard. The network interface of the amplifiers shall support digital audio and control signals.

The amplifiers shall have Output power at 4Ω impedance high efficiency multichannel amplifier (class D) with Auto stand-by function. It should have Thermal and overload protections, High efficiency, auto standby and Forced air cooling System. It should also comply with BRIDGE Technology. The amplifiers shall have frequency response from 20Hz to 20kHz and less than 0.1% of harmonic distortion (THD). The amplifiers shall have greater than 105 dB of SNR and greater than 80dB of channel crosstalk. The amplifiers shall have input impedance 20kΩ and Input gain of 2dBu.It must be certified by an independent test agency for compliance to the international standard IEC for emergency sound systems, EN Certified System, CE and FCC.

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LINE SPEAKER EN STANDARD

It shall meet the following minimum requirements:

- Excellent sound reproduction suitable for various music and speech applications
- Controlled directivity in acoustic sensitive environments
- Professional loudspeaker shall be designed for high-quality audio
- Rigid construction cabinets

The speaker shall be used for stadium. The speaker shall have rated power as proposed by the supplier and approved by the Engineer with frequency response from 190 Hz - 20 kHz, having woofer, tweeter. The speaker shall have sensitivity of 99 dB 1W/1M dB. The speaker shall have maximum sound pressure level (SPL) of 105 dB. It must be certified by an independent test agency for compliance to the international standard IEC for emergency sound systems, EN Certified System, CE and FCC.

SUB-WOOFER EN STANDARD

It shall meet the following minimum requirements:

i. High power and excellent sound delivery
ii. Rigid construction cabinets

The woofer shall be used for stadium. The sub-woofer shall have rated power of 350 W with frequency response from 33 - 160 Hz. The sub-woofer shall have sensitivity of 96 dB. The sub-woofer shall have maximum sound pressure level (SPL) of 128 dB. It must be certified by an independent test agency for compliance to the international standard IEC for emergency sound systems, EN Certified System, CE and FCC.

HORN SPEAKER EN STANDARD

The speaker shall have rated power of 50 W with frequency response from 400 Hz – 6 kHz. The speaker shall have sensitivity of 105 dB and dispersion angle of 140° (H), 90° (V). The speaker shall have maximum sound pressure level (SPL) of 120 dB. The speaker shall have 100-volt built-in transformer for power taping. The speaker shall have IP66 class of protection. The material should be ABC plastic, U type steel bracket with

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Ingress Protection of IP66. It must be certified by an independent test agency for compliance to the international standard IEC for emergency sound systems, EN Certified System, CE and FCC.

COLUMN SPEAKERS EN STANDARD

It shall meet the following minimum requirements:

The speaker shall have rated power as per project requirement with frequency response from 135 Hz – 20 kHz. The speaker shall have sensitivity of 90 dB and dispersion angle of 180° (H), 50° (V). The speaker shall have woofer/driver and tweeter. The speaker shall have maximum sound pressure level (SPL) of 107 dB. The speaker shall have 100-volt built-in transformer for power taping. The speaker shall have IP66 class of protection. The material should be Aluminum. It must be certified by an independent test agency for compliance to the international standard IEC for emergency sound systems, EN Certified System, CE and FCC.

UHF WIRELESS RECEIVER EN STANDARD

The wireless receiver shall have frequency range of 10.7 MHz with two-way frequency conversion. The wireless receiver shall have BNC antenna and less than 0.7% of THD. The wireless receiver shall have 6 dBμV of sensitivity and 36 dB of image rejection. The wireless receiver shall be operated on 12-15 VDC.

HANDHELD UHF WIRELESS TRANSMITTER EN STANDARD

The handheld transmitter shall have carrier frequency range from 606 MHz to 621 MHz. The handheld transmitter shall have FM modulation with audio frequency response ranges from 45 Hz to 18 kHz. The transmitter shall have greater than 105 dB SNR. The transmitter shall have built-in spiral antenna supporting 32 Channels. The transmitter shall have working range of 90m or greater. The transmitter shall have alkaline battery.

HEADSET CONDENSER MICROPHONE EN STANDARD

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The wireless headset condenser shall have frequency range from 70 Hz to 16 KHz with impedance of 1.5KΩ at 1 KHz. The condenser shall have -68 dB of sensitivity and 1 meter of cable length. The condenser shall be resistant to corrosion and moisture. The condenser shall have adjustable belt to make headset size comfortable ta wear. The condenser shall be protected from sweat.

CD PLAYER

CD player shall have stereo audio source including FM tuner, USB port, SD slot and Bluetooth connection. CD player shall have balanced and unbalanced stereo audio outputs and headphones output (stereo jack) with volume control in frontal panel. CD player shall have IR remote control, FM antenna, stereo RCA cable and rack-mount bracket included.

PAS CABLES

The PAS cables shall be as mentioned in the Bill of Quantities. The cables shall be 2.5/4.0mm^2 2-Core LSZH insulated. The PVC conduits shall be used for the installation of PA system. Sizes of cable shall be provided as per standard length.

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ELECTRONIC TIMING DEVICES

SCOPE OF WORK

The scope of work shall include the design, supply, installation, testing and commissioning of Timing system for swimming pool system & other international Olympics games including but not limited to running and football etc complete with associated electrical and communication wiring works, control equipment mounting brackets and accessories. The Contractor shall be responsible for providing complete turnkey system solution including auxiliary equipment for best quality of service, and all such equipment with accessories shall deemed to be included in the scope of Contractor and no extra payment shall be made to the Contractor for these.

The Contractor shall have to visit the site to take physical dimensions of hoist way, pits overhead and machine room to verify their horizontal / vertical lengths etc. before submission of proposals.

For Timing system for swimming pool system & other international Olympics games including but not limited to running and football etc and the requirements given in the Technical Specification shall be fulfilled. The Contractor shall be responsible and provide the following:

- Monitoring and control of Timing System Equipment
- All the Major equipment e.g. hardware and software and Storage backup device shall be provided from the same manufacturer.
- Provide the necessary hardware and software for above System.

- All International sport software packages shall be provided in original installation media along with their licenses. The International sport software must be fully integrated with the Score Boards, Sound Amplification System and all other stadium facilities.
- The Supplier/manufacturer should provide valid related software license for the period of 10 years.

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- Prepare an Engineering Design Report covering at least the following:

  i. Detailed Drawings for the Timing System Equipment of the project.

  ii. Schematics and interconnection diagrams of complete Timing System Equipment components including cameras, controllers and other elements to monitor and control the processes outlined above.

  iii. The exact quantities and types of hardware and software required.

  iv. Technical details of the hardware and software of the complete system.

  v. Cable and conduit schedules and routing plan.

  vi. Details of any civil works required.

  vii. Detailed description of the data acquisition software, user configurable functions and software features to be provided.

  viii. Installation, testing and commissioning procedures and methodology.

- Procure, transport and deliver equipment and hardware to site, after approval of the above report(s) by the Engineer.
- Design, Installation, testing and commissioning of Timing system Equipment in accordance with the procedures given in the engineering design report. No payment shall be made without approval of equipment.
- Provide training to the Employer's personnel.

Bidder shall submit with his bid the following Documents/Data for all system equipment including Timing system Equipment UPS, Batteries:

- Schedule of technical data as per given format of all equipment.
- Detailed Drawings for the complete system showing all areas of the project.

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- Brochures and data sheets with make, model of each equipment
- Authorized local distributor certificate and Warranty certificate from local distributor.
- Block diagram of Timing system Equipment including OFC showing interconnectivity of all equipment including connection.
- Detail of Data Cabinets.
- Field of view showing coverage area of each camera.
- Backup calculations showing that Hard Disks shall be able to record data of all cameras for a period of one Month.
- International Standards Reports/Certificates

TERMS AND CONDITIONS

- The Manufacturer should have at least 20 years of experience in the field of manufacturing and installing of timing system equipment for International Sports Applications.
- The list of these references should be presented along with Name, phone number of clients, country name, place and year of installation.
- The manufacturer/supplier/local agency/contractor should mention the country and port of shipment in their offer along with authorization from Manufacture or from his local representative in order to participate in the Bid process.
- The Manufacturer's country of origin should be:
  USA, Europe & Japan.
- Manufacturer and his Subsidiaries should have supplying, installed and commissioning of Electronics Timing Systems for Athletics and Swimming events in different major International sports events Football World Cup, Olympic and Asian Games.
- PC-based controller should be fully integrated system including all video processing features, and incorporates all additional video routers and signal path control equipment to fulfill all the specific needs of a projects.

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- The controller system is highly scalable according to the needs in means of video inputs, output signals, LED screens, controllers, and back-up units and so on.
- The system is remotely accessible and controllable over networking from any location. This dedicated control system is capable of operating the display system on a stand-alone basis, but also has the capability to cascade multiple units to communicate with each another via a network, enabling a seamless interoperation between a main and multiple hot-plug backup controller and / or a repeater / other controller.
- All computers and equipment are installed into a standard 19 inch rack cabinet.
- The OEM should have at least 25 Numbers of installations or similar during last Ten (10) years.
- The OEM should have a local partner in Pakistan.
- Failure to comply the above requirements shall disqualify the manufacturer.

STANDARDS

All equipment shall be designed and Manufactured by the Original Equipment Manufacturer (OEM). Equipment design and manufacturing shall be only from USA, Europe & Japan. Materials/Equipment shall be designed, manufactured, tested and installed according to the BS/IEC/ISO/ITU/EN/CE Recommendations.

WARRANTY

The Contractor shall provide warranty for all equipment for a period of five (05) years through authorized local distributor commencing the hand-over and acceptance date to the Employer. No equipment shall be accepted without warranty certificate from the manufacturer. It shall cover all costs for WARRANTY SERVICE, including parts replacement, labor; prompt field service, pick-up, transportation, and delivery. No extra cost shall be admissible for Warranty services.

The Manufacturer/contractor/supplier shall guarantee the spare parts availability for period of 10 years.

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FUNCTIONAL / EQUIPMENT DESCRIPTION

I. GENERAL REQUIREMENTS

a) Stadium Capacity: Design and install a timing and scoring system for a national stadium.

b) Competition Venues: The stadium will host various national and international competitions, including track and field, swimming, and other sports.

c) System Integration: Ensure seamless integration with existing stadium infrastructure, including sound and public address systems, scoreboards, and video displays.

d) Running Track Timing System: A Timing System with High Accuracy (0.02 Seconds) with Wireless Transmission. The System Should Include UHF RFID Tags for Athletes, an LED Display for Showing Results, And Wireless Antennas for Receiving Data.

II. Hardware Requirements

a) Timing System: Design and install a timing system that meets the requirements of international sports federations, such as the IAAF and FINA.

Timing System: Includes but not limited to Main Unit, Antennas, and Software for Accurate Timing and Wireless Transmission.

- Power Supply: 220V, 50HZ
- Operating Temperature: 0°C TO 50°C
- Humidity: Up To 80%
- Detection Method: UHF RFID OR Photo-Finish Technology

b) Start System: Provide a start system that includes a starter's console, start gates, and a false start detection system.

c) WIRELESS ANTENNAS

- Type: Wireless Antennas for Receiving Data from UHF RFID Tags
- Quantity: 8 Units or as required
- Placement: Strategically Placed Around the Track to Ensure Accurate Data Reception.

d) Touchpads and Backup Systems: Sensitive pads that record swimmer times, with options for 6, 8, 10, or 12 lanes. A console that connects to touchpads, backup push buttons, and relay judging platforms, like the System 6 Timing Computer Console Install touchpads for track events and

backup systems, including photo finish cameras and manual timing systems.

III. Software Requirements

a) Timing and Scoring Software: Provide software that meets the requirements of international sports federations and allows for real-time data entry, calculation, display of results, Data Analysis and Reporting.
b) Data Management: Ensure that the software can manage large amounts of data, including athlete information, competition schedules, and results.
c) Integration with International Federation Systems: Ensure that the software can integrate with international federation systems.

IV. Standards and Compliance

a) International Olympic Committee (IOC) Standards: Ensure that the system meets the standards of the IOC for Olympic Games and other international multi-sport events.
b) Local and National Standards: Ensure that the system meets local and national standards for safety, accessibility, and building codes.

MODULE SPECIFICATION

The Modular specifications will be as pronounced in bill of quantities.

INTEGRATED CONTROL SOLUTION

The Controller shall consist of the following;

(i). Control Monitor, Keyboard, Mouse
(ii). Operator Workstation Core i7 latest generation
(iii). Three Number of Sending Box
(iv). Router / Layer 3 Switch POE
(v). Fiber Patch Panel and Converters
(vi). UPS
(vii). High speed RAM in optimum size for all features and operating system running smoothly
(viii). Up-to-date monitor driver card with fastest dedicated

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video RAM

(ix). SSD-Storage

(x). Video inputs for HDMI, HD/SD-SDI, and/or DVI, Composite, Component signals

(xi). GPI for fire alarm system integration to display automated messages for two levels of alarm (warning, evacuation) / it is an optional possibility, if requested & quoted

(xii). Monitor with HD resolution as User Interface

(xiii). Multi-View Monitor for live sources and diagnostics monitoring, preview and program.

(xiv). 42 U Rack

MEDIA CONTROLLER

The Media controller shall be extra-large resolution, HDMI/DVI video input and Ethernet output ports, Brightness from 0.1% to 100%, complete in all respect with the following features.

(i). Operating System (Window)

(ii). Image Channel Simultaneous: 04

(iii). HDMI/DVI input

(iv). HDMI/External audio input

(v). 10bit/8bit HD Video Source

(vi). 1 Light Sensor Interface

(vii). 18-bit Grey Scale Processing and Presentation

(viii). Standard 1U Housing and Independent Power Supply

(ix). Video I/O Card

(x). Audio I/O Card

(xi). Connectivity: Network (Ethernet, RJ-45 LAN, Fiber Optic and USB)

(xii). Temperature (0 to 60 C^0)

STEEL STRUCTURE

The steel structure, if required, for installation of screen modules shall include all necessary arrangement including structural steel sections, nuts, bolts etc. and all other required accessories, complete in all respect. The contractor shall provide

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an optimum level of design and details covering all necessary requirements by the Contractor. The contractor shall submit shop drawings and calculation pertaining to structure stability and adequacy for engineer review and approval.

CONTENT MANAGEMENT FEATURES:

- Editing of layout templates for multi-window arrangement with PIP, display dividing, and overlapping
- Capability to display live inputs and / or unlimited numbers of stored media simultaneously
- Automatically scales and adjusts view inputs for appropriate view screen aspect ratio, with optional manual signal format selection
- Manual adjustment capability for view inputs to correct aspect ratio or cropping out of unnecessary borders
- Capability to control alpha lending value for each window
- Capability to assign an alpha mask for each window
- Capability to create templates with media place-holders, where the operator shall select the desired content runtime, upon selection
- Capability to assign different play lists to individual windows
- Support of the following graphical format in any window in original or custom aspect rate:
  GIF, JPG, PNG, BMP, TIF ICO, EMF, WMF
- Capability to display the following view formats in any window in original or custom aspect rate and / or playback speed:
  AVI, MPEG-1, MPEG-2, MPEG-TS, MP4, WMV, DIVX, XVID, QT, MOV, MKV, SVF, VOB, DVCPRO, M-JPEG, H2, 64/AVC, ASF, MXF
- Capability to display the following network streams in any window in original or custom aspect rate and / or playback speed:
  HTTP (e.g. YouTube), UDP, RTMP, RTSP, MMS, MMSH, WebRTC, NDI
- Support animation, view files rates of up to 100 frames per second and up to 4K resolution
- Capability to control external media payers via RS-485 / RS-232 control port
- Editing of DSK layer text messages and tickers
- Outline shadow, background, color shading and alpha blending features for all texts, tickers and media files

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- Live data connection to unlimited number systems for displaying real-time media contents and scoring information
- Maintaining up-to-date scoring data
- Display of date, time in different formats on a top-most layer
- Seamless switching between media contents and live video sources applying transition effects without any additional external video mixer or media player device
- Seamless switching between board content templates applying transition without any additional external view mixer or media player device
- Transition effects (duration between 0.2 and 3 sec) and timed delay (duration between 0.1 and 1000 sec) between play list elements
- Support for the following transient effect.

SPARES PARTS FOR TIMING SYSTEM SCOREBOARD (3% OF INSTALLED EQUIPMENT)

The Contractors shall submit the list of Spare Parts with his bid. The cost of the spare parts shall be included in the cost of the equipment to be supplied and installed by the Contractor.

Contractors shall also list in the Price Schedules of Additional Spares those additional spare parts which the manufacturers recommend should be held to cater for future operation of all equipment supplied under the Contract. A firm price shall be quoted for all items, which shall include for delivery to the Engineer's stores.

The Engineer, at his discretion, may order all or any of the spare parts. Parts ordered within one year of the expiry of the Warranty Period shall be delivered within one month at the prices quoted in the priced schedule.

Spare parts shall be treated and packed to ensure safe transport and a long shelf life without deterioration.

Each packing case shall be clearly and indelibly labeled. The label shall provide the relevant information given in the contract including serial number of contents, shelf life and its expiry date, and where appropriate, lifting and storage/stacking instructions. The shelf life shall be at least five years. Where, because of case size, it is not practical to provide the above information on the packing case, the

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details shall be given in a sealed waterproof envelope which shall be securely attached to the case.

FUNCTIONAL / EQUIPMENT DESCRIPTION - TECHNICAL SPECIFICATIONS

RUNNING TRACK AND TIMING SYSTEM

- For The Running Track, A Timing System with High Accuracy (0.02 Seconds) with Wireless Transmission.
- The System Should Include UHF RFID Tags for Athletes, an LED Display for Showing Results, And Wireless Antennas for Receiving Data.

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3. CODES, STANDARDS AND CERTIFICATES

A. Standards other than those Specified

Where requirements for materials or equipment are specified by reference to a standard which has its origin in one country, it is not the intention to restrict the requirements solely to that standard and that country. Other standards, including standards of other countries, will be accepted provided the requirements thereof, in the sole opinion of the Engineer, are at least equal to the requirements of the standard specified. The Contractor may propose to the Engineer an equivalent standard other than that specified, in which case he shall submit the proposed standard and all other information required and shall submit written proof that his proposed standard is equivalent in all significant respects to the standard specified. All submissions must be made in the English language.

B. Codes and Standards at Site

The Contractor shall supply and have at his site office: -

a) Copies of all latest editions of codes and standards referred to in these Specifications or equivalent codes and standards as approved by the Engineer.

b) Catalogues and published recommendations from manufacturers supplying products and materials for the project.

c) The Contractor shall provide manufacturer's or supplier's materials which must meet the requirements of a specific code or standard as stated in these Specifications.

4. MANUFACTURER'S RECOMMENDATIONS

Installation of manufactured items shall be in accordance with procedures recommended by the manufacturer or as approved by the Engineer.

5. UNITS OF MEASUREMENTS

Both FPS and MKS System of Units shall be used throughout the Project, as mentioned.

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6. PLANT, EQUIPMENT AND TOOLS

The Contractor shall provide at his cost modern plant, equipment and tools, adequate and befitting to the nature, magnitude and size of this Contract, in strict compliance with the requirements of the General Conditions of Contract, Conditions of Particular Applications and Technical Specifications.

7. STORAGE & HANDLING FACILITIES

The Contractor shall make his own arrangements for providing the necessary space for the storage of plant, equipment and materials and for Contractor's temporary office, in and around the site of works, during the currency of the Contract.

8. FIELD LABORATORY AND TESTING

8.1. General

The Contractor shall provide and maintain a field laboratory equipped with approved equipment to perform all the tests required by the Engineer. The quality control testing shall be performed by the Contractor's competent personnel in accordance with a site testing and quality control programme to be established by the Contractor and approved by the Engineer. The Engineer may however, require certain tests to be performed in any other laboratory designated by him.

The Contractor shall provide technical and laboratory helpers to the Engineer for testing.

The Field Laboratory, including all equipment and staff shall be placed at the disposal and direction of the Engineer during the Contract.

The Contractor shall keep a complete record of all quality tests performed on site.

All quality control tests shall be carried out in accordance with applicable standards and codes.

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8.2. Field Laboratory Equipment Requirements

The Laboratory shall be equipped with new unused and latest Equipment to perform tests as per Technical Specifications and General Conditions of Contract. Additional equipment/materials shall be supplied by the Contractor as and when required by the Engineer to perform any specified test, at no additional cost to the Employer.

8.3. Testing Laboratory Certificates

The Engineer may accept test result and a certificate from a commercial testing laboratory, certifying that the product has been tested within a specified period acceptable to the Engineer and that it conforms to the requirements of these Specifications. Contractor shall seek prior approval of the laboratory from the Engineer before carrying out any test.

8.4. Method of Payment

The cost of providing running and maintenance of the laboratory, equipment, materials and staff, testing charges for materials supplied by the Employer and all other tests to be performed in any other laboratory designated by the Engineer shall be deemed to be included in the price quoted by the Contractor and no separate claim for payment on this account shall be entertained by the Engineer. Further more the cost of any additional laboratory, field and shop tests required through the resubmission of samples because of failure of compliance with Specifications shall be borne by the Contractor.

In case the Contractor does not provide the specified equipment or testing facility from another approved laboratory, cost of testing plus 100 percent overheads shall be recovered from his bills.

9. SURVEYING INSTRUMENTS

9.1. General

The minimum quantity of survey equipment is stated below which shall be available with the Contractor at site of Works along with

qualified Surveyors and Survey Helpers. The equipment shall be maintained throughout the Contract Period and replaced by the Contractor in case of damage or loss. The survey equipment shall be made available to the Engineer when requested. All surveying equipment shall be in good working condition.

9.2. Surveying Equipment Required

The Contractor shall provide and maintain the following surveying equipment at site as per requirements.

a)	Electronic distance measuring device complete with (400 grades) Universal Theodolite with data logger, aiming head and standard equipment supplied by the manufacturer, including tripod, control unit stand, batteries, charging unit, pole reflector, single prism reflector, three, six and nine prism reflectors complete with tripods and Traverse Equipment for Theodolite.	01 + 01 Nos.
b)	Automatic Levels with tripods and staff	01 + 01 Nos.
c)	Steel measuring tapes 50 m long	03 + 01 Nos.
d)	Steel measuring tapes 20 m long	03 + 01Nos.
e)	All other miscellaneous tools, equipment and materials required in surveying.	As directed by the Engineer.

Note: One set of equipment given from Sr. No. a to d is to be provided for exclusive use of Employer/Engineer.

10. APPROVAL OF MATERIALS AND PLANT

10.1. Quality of Materials

All materials, fixtures, fittings, supplies and plant furnished under the Contract shall be new and unused, standard first grade quality and of the best workmanship and design. No inferior or low-grade materials, supplies or articles will be either approved or accepted, and all work of assembly and construction shall be done in a first-class and workman like manner. In asking for prices for materials intended for

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delivery to the Site and incorporation in the Works under any portion of these Specifications, the Contractor shall provide the manufacturer or supplier with complete information as may be necessary to secure compliance to this Clause and, in every case, he shall quote this Clause in full to each such manufacturer or supplier.

10.2. Submission of Samples and Data

10.2.1. The Contractor shall furnish for approval of the Engineer and consent of the Employer with reasonable promptness all samples as directed by the Engineer or specifically called for in the Specifications and in accordance with the time schedule provided in the schedule of submittals. The Engineer shall check and approve such samples with reasonable promptness only for conformance with the design concept of the Works and for compliance with the information given in the Contract Documents. All work shall be in accordance with approved samples.

10.2.2. Samples shall be furnished so as not to delay fabrication, allowing the Engineer reasonable time for consideration of the sample submitted.

10.2.3. Each sample shall be properly labeled with the name and quality of the material, manufacturer's name, name of the project, the Contractor's name and the date of submission, and the Specifications Article number to which the sample refers.

10.2.4. The manufacturer's installation directions shall be provided with each sample. The Contractor shall pay all transportation costs and deliver samples to the Engineer's office, Site or testing laboratory as directed by the Engineer.

10.2.5. Samples shall be of adequate size to permit proper evaluation of the material by the Engineer. Where variations in colour, texture, dimensions or other characteristics are to be expected, the Contractor shall submit samples showing the maximum range of variation. Materials exceeding the range of variation of the approved samples shall not be used on the Work.

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10.2.6. In order to permit coordinated selection of colours and finishes, the Contractor shall deliver samples of all related items to the Engineer at one time. Samples of such materials will not be approved until all related samples have been submitted.

10.2.7. If both Shop Drawings and samples are required for the same item, the Engineer may require both to be submitted before approving either.

10.2.8. The Contractor shall erect Mock-up samples of finished items where specifically called for in the documents or as directed by the Engineer.

The Mock-up samples shall be preserved/protected by the Contractor till the end of the project or as directed by the Engineer.

10.2.9. No acceptance or approval of any Shop Drawings or sample, or any indication or request by the Engineer on any Shop Drawings shall constitute an authorization for any increase in the Contract Sum.

10.3. Inspection

All material and Plant furnished and all work performed under this Contract will be subject to inspection by the Engineer at all times and in all states of completion both off-Site and on-Site. The Contractor shall furnish promptly without additional charge, all facilities, labour and materials reasonably needed for performing such inspection and testing as may be required by the Engineer.

10.4. Approved Sample at Site

The Contractor shall, at all times, keep on the Site approved samples. All such samples shall be made available to the Engineer as and when required.

11. BAR BENDING SCHEDULE

Bar bending (reinforcement bars) schedule of all structural drawings shall be prepared by the Contractor and submitted in triplicate to the Engineer for approval.

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12. DRAWINGS

12.1. Bid Drawings

Bid Drawings issued with the Bidding Documents, called the Bid Drawings, show scope of the work to be performed by the Contractor. The Drawings are generally in sufficient detail so as to be used as a basis for construction, fabrication and for placing orders for materials subject to corrections based on the future issue of supplementary Drawings as provided under Sub-Clause 12.2 hereof.

12.2. Construction Drawings, Supplementary Drawings

After award of Contract, the Bid Drawings will automatically become Construction Drawings.

The Engineer shall have authority to issue to the Contractor, from time to time, such supplementary Drawings and instructions as shall be necessary for the purpose of the proper and adequate execution and completion of the Works and the remedying of any defects therein. The Contractor shall follow these drawings.

When additional information regarding the geological formations or other conditions becomes available, the Engineer may find it desirable to change dimensions or design of one or more of the features of the Works to conform to the newly disclosed conditions. The Engineer reserves the right to make such reasonable changes, and the Contractor's operations shall be conducted so as to accommodate any such reasonable changes in the Works.

12.3. Definition of Term Drawings

The term Drawings as used in the Specifications means the Drawings referred in Clauses 12.1 and 12.2 above.

12.4. Checking of Drawings

The Contractor shall check all Drawings carefully as soon as practicable after receipt thereof, and shall promptly notify the Engineer of any errors discovered.

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12.5. Copies of Drawings

Drawings will be issued to the Contractor as described below:

12.5.1. Bid Drawings (at Construction stage)

Three (3) sets of the Bid Drawings will be issued to the Contractor at the time of Construction free of charge. Additional sets will be provided at cost of reproduction to be borne by the Contractor upon written request of the Contractor.

12.5.2. Supplementary Drawings

Three (3) prints of each supplementary Drawing will be issued to the Contractor free of charge. Additional sets will be provided at cost of reproduction to be borne by the Contractor upon written request of the Contractor.

12.6. Drawings to Be Furnished by the Contractor

The Contractor shall submit to the Engineer for review, such drawings as are required under the Contract, sufficiently in advance of the work intended to be executed.

12.6.1. Reinforcement Drawings

Reinforcement placement drawings and bar bending schedules (to be provided by the Contractor as per clause 11 above) of all RCC work shall be prepared by the Contractor and submitted in triplicate to the Engineer for approval, sufficiently in advance of the works in which they are intended to be used.

12.6.2. Shop Drawings

(a) The Contractor shall submit to the Engineer for review three (3) copies of all drawings to be issued for setting out, fabrication, supply order and construction; based on data, requirements, dimensions, details, codes, standards and design provided in the drawings issued

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by the Engineer. Such drawings shall be submitted at least twenty-eight (28) days before they are required for use. The Engineer may notify the Contractor that a drawing fails to comply with the relevant requirement of the Contract, in which case the drawing shall be rectified and resubmitted for approval at the Contractor's cost. Fabrication or construction shall not commence on any part of the Works until the shop drawings or construction drawings for that part of the Works have been approved by the Engineer.

The Works shall be executed in accordance with the drawings as approved by the Engineer. If the Contractor wishes to modify any approved drawings, he shall immediately notify the Engineer and submit revised drawings for approval. If the Engineer instructs that further drawings are necessary for executing the Works, the Contractor shall prepare such drawings and submit them for approval.

The Contractor at his cost shall rectify errors, omission, ambiguities, inadequacies and other defects.

Approval by the Engineer, in accordance with this paragraph, shall not relieve the Contractor of any of his responsibilities under the Contract.

(b) The shop drawings shall be properly identified indicating the part of the Works, the name of the contractor / supplier etc., the date of preparation and the dates of all revisions. The Shop Drawings shall be complete and shall show the design dimensions, proposed materials to be used, finishes, type of shop paint and all other details in connection thereto.

(c) Where adjoining work requires shop drawings, the Contractor shall prepare and submit composite shop

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drawings, which shall show and define the work under all affected trades. If the Contractor executes work before coordinating with other trades so as to cause interference with work of those trades, he shall make changes necessary to correct the conditions without extra cost to the Employer.

(d) No changes shall be made by the Contractor in the resubmitted shop drawings in excess of the corrections spelled out by the Engineer and in a separate note on the shop drawings.

(e) No work in the shop shall be started and no material or plant ordered until the Engineer has approved the shop drawings. It shall be the responsibility of the Contractor to submit the shop drawings on a schedule that allows reasonable time for checking and approval and subsequent fabrication. Failure to submit shop drawings in ample time for checking, correcting, and rechecking will not justify extension of time for completion of the Works.

(f) The Contractor shall also check and verify all site measurements whenever requested by other Specialist Contractors or by other Sub-Contractors to enable them to prepare their own shop drawings and pass on the information with sufficient promptness, so as not to delay the work in any way. A copy of all such information passed on shall be given to the Engineer.

12.6.3. As-Built Drawings

The Contractor shall, at all times, keep on Site a separate set of prints of all drawings on which all significant changes between the work shown on the Drawings and that which is actually constructed, shall be noted neatly, accurately and promptly as the work progresses. The Subcontractor(s) for

plumbing, mechanical and electrical shall, at all times, keep on Site, a separate set of prints of the drawings (showing their parts of the Works) on which all significant changes between the work shown on the Drawings and that which is actually constructed, shall be noted neatly, accurately and promptly as the work progresses. Such drawings shall show the exact physical location and configuration of the works as actually installed.

The Contractor shall, within fourteen (14) days of issuance of Taking-Over Certificate for whole of the Works, furnish to the Engineer for his approval two (2) copies of such marked up drawings. One (1) copy of each of the marked up drawings approved by the Engineer shall be returned to the Contractor by the Engineer and these shall be used for the preparation of the As - Built Drawings.

The Contractor shall furnish to the Engineer six (6) complete sets and of all As -Built Drawings within twenty-eight (28) days of receipt of drawings stated above, from the Engineer.

13. PROTECTION OF THE WORKS

The Contractor shall whenever necessary cover up and protect the works from weather and damage by his own or other workmen performing subsequent operation. The Contractor shall provide all necessary dustsheets, barriers and guard rails and clear away the same at completion.

14. RESTORATION AND CLEANING

Upon completion of the works the Contractor shall restore all items covered by the Contract to the satisfaction of the Engineer.

The Contractor shall do regular cleaning and clear away all rubbish and excess materials that may accumulate from time to time on completion and before handing over. Upon completion of the works he shall obliterate all signs of temporary construction facilities such as work areas, structures, foundations of temporary structures, stock piles of excess or waste materials,

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or any other vestiges of construction, as directed by the Engineer. All buildings shall be cleaned; floors and paving scrubbed and the works and site shall be left in a clean and satisfactory state for immediate use and occupation. Care shall be taken not to use any cleaning materials, which may cause damage to the surface to be cleaned.

The Contractor shall also take all necessary precautions to keep the works and site free from vermin during construction and he shall leave the works vermin free on completion. Application of pest control agents shall not commence until the specific product, name, method and extent of application have been submitted to and approved by the Engineer.

15. SITE OFFICE AND TEMPORARY FACILITIES TO BE PROVIDED BY THE CONTRACTOR

15.1 Contractor's Office, Facilities Etc.

The Contractor shall establish and maintain a Site office. The Contractor shall provide all facilities in connection with the execution, completion, of the Works, remedying defects therein and maintenance of the utilities services. The facilities shall not be limited to the Contractor's Site Office, labour camps, work yard and storage areas, temporary water supply, waste water disposal, temporary electricity, medical unit, temporary roads, fire protection and fire fighting equipment etc. The Contractor shall be solely responsible for arranging all utilities and the Contractor shall setup, maintain and operate an architectural and engineering facility at site with adequate number of technical and support staff as well as equipment required for particular nature of job covered under the Contract to prepare drawings/shop drawings for approval of the Engineer.

The Contractor shall make arrangements for his own camp, workshops, yards, storage areas, and areas for erection of equipment, offices & offices for the Engineer and the Employer outside the site area and all approvals & permissions in this regard from the concerned authorities for all such facilities shall be the responsibility of the Contractor.

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15.2 Temporary Roads

The Contractor shall prepare and maintain such temporary roads as may be necessary, from the site to the nearest road and also within the plot. Such roads shall be positioned strictly in accordance with the Engineer's instructions and the Contractor shall reduce or control any dust nuisance by regularly spraying water and compaction as directed.

15.3 Temporary Services

15.3.1 Temporary Water Supply

The Contractor shall supply in sufficient quantity all necessary potable and other water for construction purposes for all trades at points within a reasonable distance of any building being constructed. The Contractor shall make arrangements and pay charges for water service installation, maintenance and removal thereof, and pay the costs of water for all trades.

At completion of the work, the temporary water services equipment and piping shall be removed by the Contractor at his own expense.

15.3.2 Temporary Electricity

The Contractor shall make all the necessary arrangements for a temporary electricity service, pay all expense in connection with the installation, operation and removal thereof and pay the costs of electricity consumed by all trades. If the Contractor is un-able to arrange a temporary electrical connection, then he shall arrange and furnish an Electric Power Generating set at site and maintain the generating set in perfect working condition through-out the duration of Contract. The generating power of the set shall be sufficient to operate all plant and equipment as well as the camps and offices of the Contractor and the offices of the Engineer/Employer, during construction at site. Should the set fail to meet the required demand at site or fail to function or operate, the Contractor shall immediately

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replace the same with other generating set/sets to the satisfaction of the Employer as well as the Engineer.

A temporary lighting system shall be furnished, installed and maintained by the Contractor as required to satisfy the minimum requirements for safety and security and to the satisfaction of the Engineer.

At completion of construction work, temporary electricity services shall be removed by the Contractor at his own expense.

15.3.3 **Waste Disposal**

The Contractor shall make such temporary provisions as may be required in order to dispose of any chemicals, fuels, oils, grease, bituminous materials, waste and soil waste and the like without causing pollution to either the site or the environment. Disposal of any materials, wastes, effluent, garbage, oil, grease, chemicals and the like shall be in areas specified by the concerned local authority proposed by the Contractor and subject to the approval of the Engineer. If any waste material is dumped in unauthorized areas the Contractor shall remove the material and restore the area to the condition of the adjacent undisturbed area. If necessary, contaminated ground shall be excavated, disposed off as directed by the Engineer and replaced with suitable fill material compacted and finished with topsoil all at the expense of the Contractor.

15.3.4 **Fire Protection**

The Contractor shall provide and maintain adequate fire protection in the form of barrels of water with buckets, fire bucket tanks, fire extinguisher, or other effective means ready for instant use, distributed around the project and in and about temporary inflammable structures during construction of the works.

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Gasoline and other flammable liquids shall be stored in and dispensed from safety containers approved by the Engineer and storage shall not be within building.

Torch-cutting and welding operations performed by the Contractor shall have the approval of the Engineer before such work is started and a chemical extinguisher is to be available at the location where such work is in progress.

The Contractor shall follow the instructions and specifications of the Civil Defense Department or any other local department concerned with such activities.

15.4 Sign Board

The Contractor shall erect and maintain at the Site in a location to be approved by the Engineer one (01) Sign Board of dimensions approved by the Engineer. The Sign Board shall be made of metal. It shall be mounted on steel posts securely anchored and braced. The Contractor shall paint on the Sign Boards, the name of the Works, and the names of the Employer, Engineer and the Contractor both in English and Urdu Language.

15.5 Site Office for Employer/Engineer and Engineer's Staff

Not Applicable

15.6 Site Facilities to Be Provided by the Contractor

15.6.1 General

Without prejudice to the generality of the various clauses of the Contract, particular attention is drawn to the obligation of the Contractor to make his own arrangement at his own expense for the following.

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15.6.2 **Labour Camps and Staff Residences**

The Contractor shall provide, operate and maintain labour camps and staff residences and are required for the proper and efficient progress of the work to house his own employees. For the purposes of operation and maintenance of the Camps and Residences, the Contractor shall comply with the rules of Pakistan Labour Camp Rules 1960 and all other applicable provisions of the Pakistan Labour Laws.

15.6.3 **Administrative and Field Office**

The Contractor shall provide, operate and maintain administrative and field offices required for his staff and would be responsible for Operation and Maintenance, furniture, equipment, appliances, janitor services and security of the same.

15.6.4 **Work yards and Storage Areas**

The Contractor shall provide, operate and maintain all sheds, fencing, foundations and all above ground structures required to store material or equipment brought on to the site by him. The Contractor shall be responsible for the security of his entire camps, residence, site and field offices work yard and storage area.

15.6.5 **Water Supply, Sewerage System and Electricity**

The Contractor shall make his own arrangement, at his own expense for provision, operation and maintenance of electric supply, reasonable supplies of raw and potable water and sewerage system at the site of works and his labour camps, staff residences and offices. The Contractor shall pay all fees, and charges (including bills) of whatsoever nature to the concerned departments (if any) in order to procure connections of the above facilities and thereafter using these facilities. If the Contractor is un-able to arrange a temporary electrical connection, then he shall arrange and furnish an

Electric Power Generating set (with sufficient generating capacity to meet the required demand of electricity) at site and maintain the generating set in perfect working condition through-out the duration of Contract.

15.6.6 **Medical Care**

The Contractor shall arrange provision of adequate medical facilities for his employees.

Adequately equipped and properly staffed first aid stations or dispensaries shall be provided by the Contractor at camps and other strategic locations, to administer first aid treatment at all times free of charge to all persons on the Site, including personnel of the Engineer and the Employer. The nature, number and location of facilities furnished and the Contractor's staff for administering first-aid treatment shall meet the requirements of the Health Services of the Government of Pakistan and of Section III of the Manual "Safety Requirements for Construction by Contract", published by the Employer, and shall be subject to approval by the Engineer.

15.6.7 **Other Facilities**

The Contractor shall also be responsible for providing at his own cost other facilities for his own staff and labour such as educational, recreational, transport, telephone and catering if required.

15.7 **Other Facilities For Employer's Representative Personnel To Be Provided By The Contractor**

The Contractor shall procure, provide and maintain the following items for the exclusive use of the Consultant's Project Management Unit and Site Team to meet the operational/working needs in connection with the project.

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A) **02 Nos. 1000 cc well maintained rented Vehicles, model 2023 and above,** along-with driver & his salary, 300 liters fuel per month and repair and maintenance if any shall be maintained by the Contractor

B) **02 Nos. Brand New latest HP OMEN Laptop 16-am0073dx / Dell/ Lenovo** or Equivalent as approved by the Consultant, having following specs:

- Intel® Core™ Ultra 7 255H Processor
- 32GB DDR5 RAM, 1TB SSD
- NVIDIA® GeForce RTX™ 5060 8GB
- 16.0″ 2K (1920×1200) IPS LED Display 144hz, 300nits)
- RGB Backlit Keyboard
- Battery 4-cell, 70 Wh Li-ion polymer

C) **HP Victus 15 FA2787NR / Dell/ Lenovo** or Equivalent as approved by the Consultant, having following specs:

- 13th Gen Core i7 13620H Processor Raptor Lake
- 32GB DDR5 RAM, 512-GB SSD
- 8GB NVIDIA GeForce RTX 5060 GDDR7 GC
- 15.6" Full HD 1080p IPS 144Hz MicroEdge AG Display DTS:X® Ultra
- Audio RGB Backlit KB W11, 4 cell 70wh battery.

D) 02 Nos. Brand New latest model **Hp document scanner**s as approved by the Employer representative, having following specs:

- Sheet fed document scanner (duplex) HP
- Upto 40 ppm simplex / 80 ipm duplex (HP)
- Holds upto 50 sheets ADF (HP)
- Upto 600 dpi optical scan (HP)
- Recommended daily duty approx 4000 pages per day (HP)
- One-pass duplex; multi-feed detection, scan to cloud / file formats; wide size upto 122 in length (HP)

E) 01 No. A4 Printer Laser B/W HP 4003DN / Brother or equivalent as approved by the Consultant

F) 01 No. A3 Colored Printer Laser B/W HP 4003DN / Brother or equivalent as approved by the Consultant

These laptops and scanners shall be provided within 10 days from the commencement date. The Contractor will be responsible for all maintenance, repairs, and will provide an equivalent replacement in case of break down within two (02) days.

All laptops and scanners shall become the property of the Employer after completion of Defects Liability Period of the Project. Deduction @ Rs. 200,000/- per month per vehicle, @ Rs. 400,000/- per laptop, @ Rs. 200,000/0 per printer and @ Rs. 150,000/- per scanner shall

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be made from Contractor's receivables in the Contractor fails to provide laptops altogether.

16. CONSTRUCTION PROCEDURES

The Contractor shall submit to the Engineer his proposed construction procedures in accordance with the General Conditions of Contract.

If the Engineer shall see that the work progress is slow in such a way that the work will not be completed in the time specified, then he shall order the Contractor to work overtime or in more shifts and the Contractor shall obey these orders without any additional payments and without any objections or request for compensation.

17. NOTIFICATION TO ENGINEER

The Engineer shall be notified weekly in writing of the nature and location of the Works the Contractor intends to perform during the next week so as to enable necessary inspection and measurement to be carried out. The Engineer may, if necessary, direct that longer notice be given of certain operations.

18. NIGHT WORK

When work is done at night the Contractor shall maintain from sunset to sunrise such lights on or about his work and plant as the Engineer may deem necessary for the proper observations of the work and the efficient execution thereof.

19. WEATHER

No work is to be undertaken when, in the opinion of the Engineer, the weather is so unsuitable that proper protection of the work cannot be ensured.

20. CO-ORDINATION WITH OTHER CONTRACTORS

It shall be the responsibility of the Contractor to keep-up good relations with other Contractors employed on site by the Employer. The Contractor shall cooperate and coordinate his work with that of the other Contractors working at the Site, to whatever extent may be necessary to complete the Project in accordance with the approved programme of the Works and in

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accordance with the Engineer's instructions. Should a disagreement or dispute arise between the Contractor and other contractors, the same shall be referred without delay to the Engineer for his decision. Upon such decision, the Contractor shall proceed with the work in accordance therewith. In case the access to the works of other contractors is through the Site area of the Contractor, the Contractor shall coordinate with and permit all reasonable access to other Contractors.

21. ACCIDENT PREVENTION, SAFETY MEASURES AND PROTECTIVE EQUIPMENT

The Contractor shall comply and enforce compliance by all his sub-contractors with the highest standards of safety and accident prevention in accordance with international standards and in compliance with all applicable laws, ordinances and statutory provisions.

The Contractor shall provide and maintain all requisite barriers, fences, warning signs, lights and other safety precautions as required for the protection of persons and property on or adjacent to the site shall be provided at the Contractor's cost.

The Contractor shall also provide and maintain all false work, scaffolding and handrails which shall be well constructed and secured at all times. Where overhead work is being carried out, warning signs shall be installed at ground level clearly warning of the overhead work.

All warning signs shall be in two languages, English and Urdu, and shall at all times be maintained in a clean and legible condition, to the satisfaction of the Engineer.

As the work at site is expected to be carried out round the clock, the Contractor shall keep and maintain at all times a transport facility to move the patients to the hospital in case of an emergency.

Trash shall be removed at frequent intervals to the satisfaction of the Engineer.

Safety netting shall be provided at all levels where work is in progress, all around the building.

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22. SETTING OUT OF WORK AND SURVEY

22.1 Reference Points, Lines

The Contractor shall establish benchmarks and / or reference line at the Site in accordance with the instructions of the Engineer. The Contractor shall set out its work from these benchmarks and lines. The Contractor shall supply plant, equipment, materials and labour for checking if required of the survey control by the Engineer. Slope stakes will be set by the Contractor before commencement of excavation and will be re-established as required during progress of work using established bench-marks and reference points.

22.2 Verification

The Engineer may make checks as the work progress to verify lines and grades established by the Contractor and to determine the conformance of the work as it progresses with the requirements of the Drawings and Specifications. Such checking by the Engineer shall not relieve the Contractor of his responsibility to perform all work in accordance with the Drawings and Specifications and the lines and grades given therein.

Based upon the basic control, the Contractor shall provide his own primary control points, as needed for the Works, and shall preserve and maintain them until otherwise authorized.

The Contractor shall be responsible for maintaining all survey markers/monuments, and property corners. If any markers/monuments are destroyed by the Contractor, the Contractor shall arrange, at his own cost, to retrace and replace them to the entire satisfaction of the Engineer. If a monument cannot be replaced in its original position, the Contractor shall install a witness corner. The Contractor shall complete and file monument reference cards on all monuments as per instructions of the Engineer.

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The Contractor shall provide experienced construction surveyors with adequate experience in the construction surveys similar in nature as required by this Contract.

Based upon established basic control monuments the Contractor shall establish all lines and grades necessary to control the Works, and shall be responsible for all measurements that may be required for execution of the Works to the tolerance prescribed below.

The Contractor shall perform such surveys and computations as are necessary to determine quantities of work performed or placed during each progress payment period, and shall also perform all surveys necessary for the Engineer to determine final quantities of work in place. The Engineer will determine final quantities based on original ground levels determined by the Contractor and agreed by the Engineer.

The Contractor shall notify the Engineer at least one week before performing a quantity survey and, unless specifically waived, quantity surveys shall be performed in the presence of an authorized representative of the Engineer.

Degree of accuracy for the survey works shall satisfy the following specified tolerances:

(a) Structure points shall be set within 0.01-foot accuracy from point to point, except where tighter tolerances are required.

(b) Cross-section points shall be located within 0.10 foot, horizontally and 0.01 foot vertically.

(c) Permissible closing error for a levelling line meant for establishing Temporary Bench Mark (TBMs) shall not exceed $0.045 \times \sqrt{M}$ foot, where M is in miles. The permissible closing error shall be duly adjusted.

The Contractor shall provide all materials, equipment and labour required for surveying work, including, but not limited to, instruments, stakes, spikes, steel pins, templates, platforms, and tools, and

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except as required to be incorporated in the work or left in place, all such materials and equipment, shall remain the property of the Contractor. Surveying instruments shall be in perfect working condition and shall be subject to rigid inspection for proper operation at least after every two weeks of use. Defective instruments shall be promptly replaced or repaired and adjusted to the satisfaction of the Engineer.

Survey data shall be recorded in accordance with recognized professional surveying standards. Original field notes, computations, and other surveying data shall be recorded in the Contractor furnished field books. Notes or data not in accordance with standard formats will be rejected. Illegible notes or data, or use of erasures on any page of a field book will be considered sufficient cause for rejection of part or the entire field book. Copied notes or data will not be permitted; therefore, rejection of part or all of a field book may necessitate re-surveying. Corrections by ruling or lining out errors will be satisfactory.

The cost of all materials, equipment, surveyors and labour required for surveys for the Works and quantity surveys required by this clause shall be deemed to be included in the rates and prices of the various items in the Bill of Quantities and no separate measurement and payment in their respect shall be made.

22.3 Survey Instruments

The Contractor shall maintain at the Site the requisite surveying instruments in perfect working conditions to enable the Engineer's Representative to check levels and lines of the work at all times.

23. ENVIRONMENTAL PROTECTION

The Contractor shall exercise care to protect the natural landscape and shall conduct his construction operations so as to prevent any unnecessary destruction, scarring or defacing of the natural surroundings in the vicinity of the Works. Except where clearing is required for the Permanent Works, approved construction roads and the Temporary Works, and for excavation

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operations, all trees and native vegetation shall be preserved and shall be protected from damage which may be caused by the Contractor's construction operations and equipment. On completion of the Works, all work areas shall be smoothed and graded in a manner to conform to the natural appearance of the landscape. Where unnecessary destruction, scarring, damage or defacing may occur as a result of the Contractor's operations, it shall be repaired, replanted, or otherwise corrected as directed by the Engineer at no additional cost to the Employer.

24. INSPECTION OF WORKS

Contractor shall get approval of the form of request to be submitted by him for inspection. Daily in the morning Contractor shall submit request on approved format for the work to be performed during the day for inspection of the Engineer. Engineer shall assign his staff and approve/disapprove the works and return signed copy of request to the Contractor.

25. PAYMENT OF WORK

No payment shall be made for the works involved within the scope of this section or Special Provision of specification unless otherwise specifically stated in the Bills of Quantities or herein.

The cost thereof shall be deemed to have been included in the total price quoted by the Contractor.

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PAKISTAN SPORTS BOARD

PRICE BID

BIDDING DOCUMENTS
VOLUME – II

"DESIGN, SUPPLY, INSTALLATION, TESTING AND COMMISSIONING OF SOUND AMPLIFICATION SYSTEM, ELECTRONIC TIMING DEVICES & DG SETS AT DIFFERENT FACILITIES OF PAKISTAN SPORTS COMPLEX, ISLAMABAD"

Contract No. PSB/Islamabad/04/2026

November, 2026

National Engineering Services Pakistan (Pvt) Limited.
NESPAK House Sector G-5/2, Islamabad, Pakistan.
Phone: +92-51-9221910 - 13 Fax: +92-51-9221914.
Email: Islamabad@nespak.com.pk
http://www.nespak.com.pk

Letter of Price Bid

Contract No.: PSB/Islamabad/04/2026

BIDDING DOCUMENTS FOR

DESIGN, SUPPLY, INSTALLATION, TESTING AND COMMISSIONING OF SOUND AMPLIFICATION SYSTEM, ELECTRONIC TIMING DEVICES & DG SETS AT DIFFERENT FACILITIES OF PAKISTAN SPORTS COMPLEX, ISLAMABAD"

To:

Director General
Pakistan Sports Board
Abpara, Kashmir Highway
Islamabad
Phone No.: 051-9202410, 051-9202412

We, the undersigned, declare that:

(a) We have examined and have no reservations to the Bidding Documents, including Addenda issued in accordance with Instructions to Bidders (IB)7;

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

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

Rs……
……

(d) Our Bid shall be valid for a period of 118 days from the date fixed for the bid submission deadline in accordance with the Bidding Documents, and it shall remain binding upon us and may be accepted at any time before the expiration of that period;

(e) If our Bid is accepted, we commit to obtain a performance security in accordance with the Bidding Documents;

(f) We understand that this bid, together with your written acceptance thereof included in your notification of award, shall constitute a binding contract between us, until a formal contract is prepared and executed and we do hereby declare that the Bid is made without any collusion, comparison of figures or arrangement with any other bidder for the Works.

(g) We understand that you are not bound to accept the lowest evaluated bid or any other bid that you may receive.

(h) We agree to permit Employer or its representative to inspect our accounts and records and other documents relating to the bid submission and to have them audited by auditors. This permission is extended for verification of any information provided in our Technical Bid which comprises all documents enclosed herewith in accordance with Conditions of Contract.

(i) If awarded the contract, the person named below shall act as Contractor's Representative.

Name .....

In the capacity of .....

Signed .....

Duly authorized to sign the Bid for and on behalf of .....

Date .....

Address.....

SCHEDULE OF PRICES

Description

1. Preamble to Schedule of Prices (SOP1 to SOP-04)
2. Schedule of Prices

   Summary of Bid Prices for Sound Amplification System, Electronic Timing System Devices and DG Sets – (03 separate Pages)

   Bill No. 1: Sound Amplification System – Jinnah Stadium (5 Pages)

   Bill No. 2: Sound Amplification System – Hamidi Hall (2 Pages)

   Bill No. 3: Sound Amplification System – Liaqat Gymnasium (3 Pages)

   Bill No. 4: Sound Amplification System – Naseer Banda Hockey Stadium (2 Pages)

   Bill No. 5: Sound Amplification System – Roshan Squash Court (2 Pages)

   Bill No. 6: Sound Amplification System – Rodham Hall (2 Pages)

   Bill No. 7: Sound Amplification System – Swimming Pool Indoor (3 Pages)

   Bill No. 8: Sound Amplification System – Swimming Pool Outdoor (2 Pages)

   Bill No. 9: Sound Amplification System – Jinnah Stadium (3 Pages)

   Bill No. 10: Electronic Timing System Devices (5 Pages)

   Bill No. 11: Diesel Generator Sets (3 Pages)

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1. PREAMBLE TO SCHEDULE OF PRICES

1. General

1.1 The Schedule of Prices shall be read in conjunction with the Conditions of Contract together with the Specifications (Technical & Special) and Bid Drawings.

1.2 The Bidder shall quote for all items of the Works executed on turnkey basis and the prices shall be quoted for the complete scope of Work as described or implied from these Bidding Documents.

2. Description & Quantities

2.1 Price given in the Schedule of Prices against each item shall be for the scope covered by that item as detailed in the Specifications (Technical & Special), Bid Drawings or elsewhere in the Bidding Documents. The general directions and descriptions of work and materials are not necessarily repeated nor summarized in the Schedule of Prices and do not generally give a full description of the Plant and equipment to be supplied and the services to be performed under each item. References to the relevant sections of the Bidding Documents shall be made to ascertain the full scope of the requirements included in each item prior to filling in the rates and prices against each item in Schedule of Prices.

The Schedule of Prices only identifies major components of the Plant and it does not restrict the responsibility of the Contractor to furnish all equipment, material and services as deemed necessary by the Employer/Engineer for making the Plant operationally complete and satisfactory as specified and/or implied in the Bidding Documents and subsequent revisions thereto.

2.2 The quantities as shown in the Schedule of Prices are estimated quantities and provisional only being given as an indication of the Scope of Work to enable the Bidder to bid for different items of the Works in accordance with his estimate of costs. The estimated quantities shall be used for comparing the Bids. It is, however, be noted that the basis of payment will be the actual quantities of work executed and measured by the Contractor and verified by the Engineer.

1.3 The sizes & dimensions mentioned and/or specified in the various technical descriptions and specifications including Bid Drawings are tentative and not final as the responsibility for detailed design rests with the Contractor under the Contract. If, in the opinion of the Engineer, at the time of review of Contractor's drawings/designs for approval, certain sizes & dimensions of some items have to be increased for proper completion and/or operation of the Works, then revised sizes & dimensions shall be supplied by the Contractor at no extra cost to the Employer.

3. Units & Abbreviations

3.1 Units of measurement, symbols and abbreviations expressed in the Bidding Documents shall comply both with FPS & MKS System.

The following abbreviations shall be used in the Schedule of Prices:

	Abbreviation
Pakistani Rupees	PKR/Pak Rs.
Ex Works	EXW
Quantity	Qty
Square Feet	Sft.
Running Feet	Rft.
Running Meter	Rm.
Cuibc Meter	Cm.
Meter	m

4. Rates and Prices

4.1 Except as otherwise expressly provided under the Conditions of Contract, the unit rates and lump sum amounts entered in the Schedule of Prices will be the rates at which the Contractor will be paid, and shall be deemed to include for the full scope and all costs incurred by the Contractor in the performance of the Works, the provision of services including his overheads, income tax, super tax, other indirect costs, profits and costs of accepting the general risks, liabilities and obligations set forth or implied in the Contract, except for such costs which are specified as reimbursable under the Contract.

The unit rates shall be extended to show the total amount for each item. The total of the Schedule of Prices is the Total Bid Price and shall be entered in Paragraph 1 of the Form of Bid. Where a discrepancy exists between the unit rate and the extended total amount, the unit rate shall be taken as correct and the total amount adjusted accordingly.

4.2 Unless otherwise stipulated in the Conditions of Contract, the rates and prices entered by the Bidder shall be fixed and firm and shall not be subject to adjustment during the performance of the Contract.

4.3 All duties, taxes and other levies payable by the Contractor under the Contract, or for any other cause, as on the date twenty eight (28) days prior to the deadline for submission of Bids shall be included in the rates and prices and the total Bid Price submitted by a Bidder except as provided under Para 8 hereof.

Additional/reduced duties, taxes and levies due to subsequent additions or changes in legislation shall be reimbursed/deducted as per provisions of the Conditions of Contract.

4.4 The whole cost of complying with the provisions of the Contract shall be included in the items provided in the priced Schedule of Prices, and where no items are provided in the Schedule of Prices for any work required to be executed by the Contractor on turnkey basis under single responsibility for the completion of the Works and to make the Plant operationally complete, the cost of such item (s) shall be deemed to be distributed among the rates and prices entered for the related items of the Works and no separate payment will be made by the Employer for those items executed by the Contractor.

The rates, prices and amounts shall be entered against each item in the Schedule of Prices. Where a Bidder fails to quote a price of any item of the Schedule of Prices, the Employer will consider that the price of that item is included among other items and the Contractor will be obligated to furnish that item at no extra cost to the Employer, if awarded the Contract.

4.5 The Bidder shall be deemed to have obtained all information as to port clearance facilities and charges, loading and unloading facilities and charges, storage facilities and charges, transportation facilities and charges, congestion and/or other conditions to be expected at Karachi Port and or any other seaport of Pakistan and all requirements related thereto.

The Contractor shall be responsible to make complete arrangements for the transportation of the Plant to the Site. The Bidder shall be deemed to have included all clearing, forwarding and other incidental costs in this regard in his Bid. The Contractor will have the option to use either Karachi Port or any other seaport of Pakistan.

4.6 The Contractor shall provide all parts of the Works to be completed in every respect for commercial operation. Notwithstanding that any details, accessories, etc. required for the complete installation and satisfactory operation of the Plant, are not specifically mentioned in the Schedule of Prices, Specifications including Bid Drawings, such details shall be considered as included in the Contract Price. All charges for the supply of goods, materials, accessories or work not specifically mentioned herein but necessary for the completion and operation of the Works shall be deemed to have been included in the quoted prices.

4.7 All costs in connection with Pre-inspection of complete system items in the manufacturer facility as per provisions of Sub-Clause 20.6 of Particular Conditions of Contract shall be borne by the Contractor and shall be deemed to have been included in the quoted prices.

All costs in connection with the holding of meetings shall be borne by the Contractor.

The rates in the Schedule of Prices shall also include Contractor's cost for providing Performance Security and other Bank Guarantees required for performance of the Contract.

5. Bid Prices

5.1 Break-up of Bid Prices

Contractor shall quote rates in Pakistan Rupees against each item of work stated in the schedule of prices. All the costs of Order placing, approval, procurement, local and international transportation, customs clearance, installation, testing and commissioning and all other costs incurred for successful completion of works shall be deemed to be included in the item rates quoted by the Contractor.

5.2 Total Bid Price

The total of Bid prices under in the Schedule of Prices shall be entered in the Summary of Bid Prices.

6. Erection & Testing Equipment and Maintenance Tools

6.1 The Bidder shall be responsible to provide all Erection and Testing Equipment & Maintenance Tools at the Site, at his own expenses.

7. Provisional Sums

7.1 Provisional Sums included and so designated in the Schedule of Prices if any, shall be expended in whole or in part at the direction and discretion of the Employer/ Engineer. The Contractor will only receive payment in respect of Provisional Sums if he has been instructed by the Employer/Engineer to utilize such sums.

Provisional Sums shall be expended for reimbursement of Contractor's invoices for any additional site protection works, relocation of services or any other work / payments as instructed by the Employer/Engineer through change order.

DAYWORK SCHEDULE

Not Used

PAKISTAN SPORTS BOARD

SOUND AMPLIFICATION SYSTEM

Bill of Quantities

Summary

Note :	The system cost must also include cost of 5% free Spare Parts for overall equipment.	
Sr. No.	**Item's Description**	**Total Price (Rs.)**
1	Jinnah Stadium	
2	Hamidi Hall	
3	Liaquat Gymnasium	
4	Naseer Banda Hockey Stadium	
5	Roshan Squash Court	
6	Rodham Hall	
7	Swimming Pool Indoor	
8	Swimming Pool Outdoor	
A	**Total Price (Pak Rs.)**	
B	Buy Back Value of dismantelled/ demolished existing Sound System complete in all respects.(Dismantling the existing sound system/speaker of all venues and buying back is included in this item).	
C	**Net Cost (A-B)**	

PAKISTAN SPORTS BOARD					
SOUND AMPLIFICATION SYSTEM (Jinnah Stadium)					
Bill of Quantities					
Sr. No.	**Description**	**Unit**	**Quantity**	**Unit Price (Rs.)**	**Amount (PKR)**
	Design , Supply, installation, testing and commissioning of Sound System for stadium complete in all respects including all material, labor, tools, accessories etc. as per latest applicable international standards EN 54 , IEC 60268, IP66 , and technical specifications attached herewith. **Note:** **1) The bidder shall submit the OEM designed proposal (System should be single OEM with native integration,) Each sport avenue should be able to operate independently and club with all other avenue Centrally announcements . along with accoustic report and design caculations at the time of bid submission.** **2) The Bidder shall provide all BoQ items as per Technical Specifications of Bidding Documents, brands shown and approved by consultant.** **3) Contractor is advised to check the health of already installed wiring and cables and confirm the cable running lengths as per site conditions before commencement of work.** **4) The shown information are representative/conceptual only. Detailed assessment and engineering is the responsibility of the EPC Contractor.** **5) Any other item required for completion of system not covered in BOQ or specifications / drawings in accordance with the same standards and brands shown and approved by consultant. All such items shall be covered in the rates quoted in the below given item but complete description & quantity required and brands shall be mentioned separately**				
1	**PN- 260 or Equivalent Network Power Amplifier 600W Feature** Reception of Network Audio in conjuction with our integrated Software (MS-N300), it can receive digital network audio in LAN/WAN environment in real time. Remote Control and System Management through Network. After accessing the web page through the network, it can control the volume and master volume of each channel of the equipment or control the system even from a distance. High Efficiency Class-D Amplifier Designed as a Class-D amplifier for high efficiency and low power 1 Analogue Audio Input Terminal Support XLR and RCA analogue audio inputs are provided. 1.3 inch OLED Check the device status through 1.3inch OLED Priority Setting Function for Broadcasting Free setting the priority as user wants. Setting for Output Impedance 70V/100V/Low-Z Setting the output impedance to 70V/100V/Low-Z by operating the impedance setting switch on the rear of the product. Standby Mode Enter the standby mode through the web page and the power consumption is minimized when entering the standby mode.	per watt	16,000		
2	**V2-5000 or Equivalent Professional Power Amplifier 5000W Feature** - 2 Ω-load stable per-channel, 4Ω-load stable in bridged mono -2U rack space -Switch mode power supply available for high efficiency and low weight -Forced air cooled(front panel intake, rear panel exhaust) - Front panel indicators for output signal, clip, protect and power -Rack ears for permanent installation in a standard 19"(rack mount width) enclosure -Selectable high pass filter on each channel-clip limiter circuitry - Gain selectable switch for both channel -Front removable dust filters	per watt	16,000		

PAKISTAN SPORTS BOARD					
SOUND AMPLIFICATION SYSTEM (Jinnah Stadium)					
Bill of Quantities					
Sr. No.	**Description**	**Unit**	**Quantity**	**Unit Price (Rs.)**	**Amount (PKR)**
3	**NC-900 6000 or Equivalent Analog Network Converter** NC-900 is an equipment to send & receive contact signal to from network for integrated network control of 6000 Analog System. Feature • Controls ES-6116, PS-6116, RG-6116, EP-6216 via network • Sends/receives Audio (MP3, PCM, RTSP) via network • Supports DHCP, STATIC IP (Default setting: STATIC IP, 192.168.1.99) Supports network redundancy	Job	1		
4	**NCS-1000 or Equivalent Network Converter Server** NCS-1000 is a server to control all equipment connected with the network as a hardware equipment for integrated network control. Feature • Controls all sound equipment connected to network in integrated method. • Applies a standard network protocol Supports DHCP, STATIC IP (Default setting: STATIC IP, 192.168.1.99) • Supports network redundancy • Provides web-based integrated control software (MS-N300)	Job	1		
5	**NPX-8000 or Equivalent Digital Audio Matrix System** The NPX system is an 8x8 audio matrix system that allows you to select and broadcast a variety of source sources in any location. You can select the source and adjust the volume directly through the local controller and audio input device in each output area. In addition, the NPX-8000 provides high-performance S/N and THD, and various DSP functions for tuning the input and output audio to set up BGM broadcasting in places where natural ambience and image are required. The NPX system can be used in various places such as exhibition centers, hospitals, hotels, shopping malls, restaurants and cafes where high quality BGM are required. And also it can be used educational facilities such as conference centers, seminar rooms, audiovisual rooms and auditoriums that require rich and clear sound.	Job	1		
	Feature • Audio matrix controlling device of the NPX system • High quality Digital Signal Processor (HPF, LPF, EQ, Programmable Delay, Limiter, Mute, Gain) • Interlocked with external device through 8 contact closer input/output terminals (contact closer operation setting possible) • Provide PC program (MP-8000) and mobile application for system integration control and remote monitoring. • Wall-mounted zone controller and audio input device for distributed controlling • Remote microphone for paging broadcasting (NRM-8000A) • Sound source playback with SD card • LED indicator of audio input/output and status of device				
6	**ASP-100 or Equivalent Audio Streaming Player** ASP-100 is a device for receiving stream broadcasting through network. You can play BGM without limitation of capacity or space, because you can play the sound source transmitted in real time without downloading or saving the sound source. In addition, web page GUI allows users to easily control streaming channels and volumes, and the system can be easily set up as well. Feature • Streaming channel select, playback/stop, volume control via webpage • Security control(password/log setting) via webpage System check schedule setting and system restoration via webpage • Broadcast/Network status check via LED (Power/Network/On Air/Operation/DHCP) • Selectable Dynamic IP (DHCP) and Static IP (STATIC) • Keep accurate time by synchronizing time with Internet Continuous streaming playback via redundancy setting and buffering management • RCA audio output terminal • Factory reset button (Restoration)can be easily set up as well.	Job	1		

PAKISTAN SPORTS BOARD					
SOUND AMPLIFICATION SYSTEM (Jinnah Stadium)					
Bill of Quantities					
Sr. No.	**Description**	**Unit**	**Quantity**	**Unit Price (Rs.)**	**Amount (PKR)**
7	**SC-6224 or Equivalent Speaker Line Checker** The SC-6224 is a 24 channel speaker line checker that tests speaker line impedance. It automatically performs tests on speaker line by program timer that indicates a status with LED indicator. **Feature** - Check the status of each speaker line with LED. - Setting the test time interval and automatic test The test time intervals can be set from 5 to 200 minutes by user request. - Use of high frequency test signal It uses the high frequency test signal when checking out the speaker line, so it may be inaudible to listener. - Speaker impedance measuring error range setting Speaker impedance measuring error range can be set as 10% or 20% - Communication: function of serial data transceiver (transmitter/receiver). (RS-232C, RS-422) • EXPANSION OF DEVICE Multicast (1:70) (This function is planned to upgrade) Unicast (1:20) (This function is planned to upgrade)	Job	1		
8	**DASR-288 or Equivalent Dante Audio Signal Router** The DASR-288 is a digital audio transport system utilizing Audinate's DanteTMnetwork audio solution. The DASR-288 connects to your network with a single Ethernet cable. It is a DanteTM Break Out/Encoder interface in a 2RU form factor designed for all types of commercial AV installations. It offers eight channels of line-level analogue in and 8 line-level analogue outputs. Precision 24-bit A- D and D-A converters are used for superb audio performance with a 119 dB dynamic range at sample rates up to 192 kHz. This product is used as the audio matrix, each having eight 8 inputs, where you can send uncompressed audio with low latency using standard TCP/IP Ethernet network. It's remotely controlled via the network and can be placed anywhere in a facility. Unique to the DASR-288 is its Data tunneling. No other manufacturer offers this feature, which allows you to transport with the Digital audio, 8 contact closures in and 8 contact closures out together combined with either RS-232C serial data. Each of the 8 balanced analog inputs and 8 outputs may be assigned to any Dante flow in the system, either by means of the Audinate's Dante Controller Windows or OSX application or own S-Connect Windows Software.	Job	1		
	The S-Connect allows for system configuration as well as easy channel switching. The S-Connect Software is designed to operate by simple touch screen. Dual redundant Gigabit Dante Network connections are available. Both primary and secondary connections support full Gigabyte ports for full redundancy. Signal Monitoring is available for all 8 inputs and 8 outputs with a front panel mounded dual LEDs, indicating signal presence and clipping. Network status LEDs also monitor network connectivity and transition speed. **Feature** - 8channel real-time audio signal transmission 8channel audio input (Line Input 1~8) 8channel audio output (Line output 1-8) - Data transmission via network RS-232C Serial Data transmission Contact (Dry Contact) Data transmission - S-CONNECT: set up for equipment and system operating monitoring program -Check out status of suitable equipment through webpage (CGI)				

PAKISTAN SPORTS BOARD					
SOUND AMPLIFICATION SYSTEM (Jinnah Stadium)					
Bill of Quantities					
Sr. No.	**Description**	**Unit**	**Quantity**	**Unit Price (Rs.)**	**Amount (PKR)**
9	**Inter-m 2way speaker CU-9120 or equivalent outdoor** The CU-9000 series is a high-performance column speaker specialized in demanding environments. It is equipped with a high-performance speaker driver that enables clear voice transmission from a distance, and is designed to be durable with a waterproof and dust-proof design (IP65), an aluminum body and a galvanized steel grille. Therefore, it can be applied to special facilities such as brine, port facilities that need to cope with corrosion, and factories that require dust prevention. Feature • Use unit having excellent sound quality/articulation/durability • Use solid aluminum body and flame retarding steel grill • Integrated aluminum galvanized steel • Suitable for emergency broadcasting, announcement broadcasting as well as BGM playback because of excellent voice transmission performance at a long distance • Easy-to-install design in sophisticated colors • Excellent waterproof, moistureproof, and dustproof (IP65)	per watt	6,000		
	• Prevents corrosion and discoloration deformation even when used for long time • Providing 3 models to choose 30W / 60W / 120W power depending on the application Applying high performance matching transformer to maximize the characteristics of dedicated speaker driver • Easy input power selection via rotary switch • Provide dedicated wall bracket which can be adjustable up to 11 degrees downward and left and right angles to 70 degrees. • Built-in high-end tweeter which can reproduce clean and clear sound at high frequencies				
10	**CU-7120 or Equivalent Line Speaker** Use unit having excellent sound articulation/durability Indoor type, 100V/70V line of high impedance steel model Available to reproduce not only announcement but also high quality music Providing 2 models to choose 120W power depending on the application Applying high performance matching transformer to maximize the characteristics of dedicated speaker driver Screw Terminal for easy installation and connection (attached) Provide dedicated wall bracket which can be adjustable up to 11 degrees downward and left and right angles to 70 degrees. Built-in high- end tweeter which can reproduce clean and clear sound at high frequencies Wood enclosure	per watt	4,800		
11	**Speaker ICA8** The ICA series supports stable delivery of the sound over long distance by arranging driver gaps that minimizes interference between units. Therefore, with the ICA series, despite its small size, it can deliver sound far with high sound pressure. It is designed with a compact size to minimize the exposure of the speaker and suitable for various environments. Also, it has a stand hole that can be used in various spaces, and a wall- mounting bracket that can be used alone on the wall is provided. The ICA series is a great choice for small to medium-sized spaces where large line array systems are difficult to install. Also, it is good for stylish spaces. **Feature** • 4"x8 Passive Column Array Speaker • 4" Full Range Driver with 1" Copper Voice Coil 320W output • Stand hole application for stand connection • Polyurea coating that is resistant to external shocks and water resistant • Applied birch enclosure	per watt	9,600		

PAKISTAN SPORTS BOARD					
SOUND AMPLIFICATION SYSTEM (Jinnah Stadium)					
Bill of Quantities					
Sr. No.	**Description**	**Unit**	**Quantity**	**Unit Price (Rs.)**	**Amount (PKR)**
12	**Speaker ICA12S** The ICA series supports stable delivery of the sound over long distance by arranging driver gaps that minimizes interference between units. Therefore, with the ICA series, despite its small size, it can deliver sound far with high sound pressure. It is designed with a compact size to minimize the exposure of the speaker and suitable for various environments. Also, it has a stand hole that can be used in various spaces, and a wall- mounting bracket that can be used alone on the wall is provided. The ICA series is a great choice for small to medium-sized 12 spaces where large line array systems are difficult to install. Also, it is good for stylish spaces. Feature • 12" Compact Sub-Woofer Speaker • 400W high power, clear bass reproduction • Sound-optimized enclosure design • Stand hole application for stand connection • Polyurea coating that is resistant to external shocks and water resistant • Applied birch enclosure	per watt	12,000		
13	**MX-1646D or Equivalent pre mixers** MIC INPUT Impedance XLR3 type female Electrically Balanced / <2.2KΩ Nominal level -60dBu to 16dBu Hi-Z INPUT Impedance TRS Jack socket Electrically Balanced />50K Nominal level -34dBu to +10dBuSTEREO INPUT Impedance TRS Jack socket Electrically Balanced / >10KΩ Nominal level -20dBu to +10dBuRETURN INPUT Impedance TRS Jack socket Electrically Balanced />10KΩ Nominal level OdBu(+20dBu max)OUTPUT MIX OUTPUT Minimum Load XLR3 type male Electrically Balanced />600Ω Nominal level OdBu (+20dBu max) GROUP OUTPUT Minimum load TRS Jack socket Unbalanced/>2KΩ Nominal 13 level 0dBu (+20dBu max) AUX OUTPUT Minimum load TRS Jack socket Unbalanced />2KΩNominal level 0dBu (+20dBu max) MONITOR OUTPUT Minimum load TRS Jack socket Unbalanced />2KΩ Nominal level 0dBu (+20dBu max) PHONES OUTPUT Minimum load TRS Jack socket Unbalanced/>35Ω Nominal level 100mW/600Ω PHANTOM POWER Voltag XLR 3 type female/+48V TYPICAL PERFORMANCESFrequency Response ±1dB (20Hz to 20kHz, MIC to Mix O/P +60dB input gain Power Source AC 100V to 240V, 50Hz/60HzPower Consumption 25WDimensions 482(W)x105(H)x310(D)mm / 18.98(W)x4.14(H)x12.21(D)in Weight 5.78kg / 12.7416	Job	1		
14	**MD-110 or Equivalent Dynamic Microphone** Super-cardioid pick-up pattern -Effective, built-in spherical wind and pop filter. - Shock-mount system cuts down handling noise - Includes Integrated On/Off Switch - Frequency response tailored for multi-purpose vocals -High sensitivity, low impedance (600Ω) -Shocks and vibration-resistant metal body -Noiseless XLR cable (5m) Dynamic (Moving Coil) Polar Pattern Super Cardioid Frequency Response 55Hz 16kHz Sensitivity -75dB ±3dB (0dB=1v/uBar at 1kHz) Output Impedance 600Ω±30% (at 1 kHz) Weight 250g 10g	Job	5		
15	**Audio Flexible Cable** black copper Ultra Flexible Oxygen Free 4 AWG Power Cable Stranded CCA (COPPER) Color: Black Ultra Flexible & Oxygen Free. Providing of eight wireless Mic	Job	1		

PAKISTAN SPORTS BOARD					
SOUND AMPLIFICATION SYSTEM (Jinnah Stadium)					
Bill of Quantities					
Sr. No.	**Description**	**Unit**	**Quantity**	**Unit Price (Rs.)**	**Amount (PKR)**
16	Installation and commissioning of speaker wiring	Job	1		
17	Installation,testing and commissioning of sound amplification system complete in all respect including services and warranty for 5 years.	Job	1		
18	All civil work of control room including tilework of good quality, paint work(internal & external), windows, upvc doors, ceiling and any thing not mentioned here is deemed to be included in the item	Job	1		
				Total Price(Rs.)	

PAKISTAN SPORTS BOARD					
SOUND AMPLIFICATION SYSTEM (Hamidi Hall)					
Bill of Quantities					
Sr. No.	**Description**	**Unit**	**Quantity**	**Unit Price (Rs.)**	**Amount (PKR)**
	Design , Supply, installation, testing and commissioning of Sound System for stadium complete in all respects including all material, labor, tools, accessories etc. as per latest applicable international standards EN-54 , IEC 60268, IP66 , and technical specifications attached herewith. **Note:** **1) The bidder shall submit the OEM designed proposal (System should be single OEM with native integration,) Each sport avenue should be able to operate independently and club with all other avenue Centrally announcements . along with accoustic report and design caculations at the time of bid submission.** **2) The Bidder shall provide all BoQ items as per Technical Specifications of Bidding Documents, brands shown and approved by consultant.** **3) Contractor is advised to check the health of already installed wiring and cables and confirm the cable running lengths as per site conditions before commencement of work.** **4) The shown information are representative/conceptual only. Detailed assessment and engineering is the responsibility of the EPC Contractor.** **5) Any other item required for completion of system not covered in BOQ or specifications / drawings in accordance with the same standards and brands shown and approved by consultant. All such items shall be covered in the rates quoted in the below given item but complete description & quantity required and brands shall be mentioned separately .**				
1	**Power Amplifier** High Performance Class-D Power PA Amplifier High performance 3CH/4CH Class-D Power amplifiers produce 300W rated power each channel. (DPA-300T/TO: 3CH, DPA-300Q/QO: 4CH) Emergency Power Back Up (24VDC) capability. The unit operates on a 24VDC battery power supply for emergency back up without UPS (DPA- TO/QO models are not included with Emergency Power Back Up (24VDC)). - Rated Output Power Via DC Backup Supply Output power can be maintained as AC power when 24VDC power supplied.- Advanced Power Circuitry Design The combination Class-D type amplification circuitry combined with SMPS creates a high efficiency amplifier offering reduced power consumption and low heat dissipation and weight. High Quality Sound Design. The total harmonic distortion is reduced to less than 0.03% THD, with a high signal to noise S/N ratio of over 103dB	per Watt	1200		
2	**Line Speaker** Use unit having excellent sound articulation/durability Indoor type, 100V/70V line of high impedance steel model Available to reproduce not only announcement but also high quality music Providing 2 models to choose 120W power depending on the application Applying high performance matching transformer to maximize the characteristics of dedicated speaker driver Screw Terminal for easy installation and connection (attached) Provide dedicated wall bracket which can be adjustable up to 11 degrees downward and left and right angles to 70 degrees. Built-in high-end tweeter which can reproduce clean and clear sound at high frequencies Wood enclosure	per Watt	720		
3	**Line Speaker** Use unit having excellent sound articulation/durability Indoor type 100V/70V line of high impedance steel model Available to reproduce not only announcement but also high quality music Providing 2 models to choose 60W power depending on the application Applying high-grade matching transformer to maximize the characteristics of dedicated speaker driver Screw Terminal for easy installation and connection (attached) Provide wall mount bracket which can be adjustable up to 11 degrees downward and left and right angles to 70 degrees. Built-in high-end tweeter which can reproduce clean and clear sound at high frequencies Wood enclosure	per Watt	480		

PAKISTAN SPORTS BOARD					
SOUND AMPLIFICATION SYSTEM (Hamidi Hall)					
Bill of Quantities					
Sr. No.	**Description**	**Unit**	**Quantity**	**Unit Price (Rs.)**	**Amount (PKR)**
4	**Dynamic Microphone** Super-cardioid pick-up pattern -Effective, built-in spherical wind and pop filter -Shock-mount system cuts down handling noise -Includes Integrated On/Off Switch -Frequency response tailored for multi-purpose vocals -High sensitivity, low impedance (600Ω) -Shocks and vibration-resistant metal body -Noiseless XLR cable (5m) Dynamic (Moving Coil) Polar Pattern Super Cardioid Frequency Response 55Hz~ 16kHz Sensitivity -75dB ±3dB (0dB=1v/uBar at 1kHz) Output Impedance 600Ω ± 30% (at 1 kHz) Weight 250g ±10g	Job	1		
5	Audio Flexible Cable black copper Ultra Flexible Oxygen Free 4 AWG Power Cable Stranded CCA (COPPER) Color: Black Ultra Flexible & Oxygen Free.	Job	1		
6	Installation and commissioning of speaker wiring	Job	1		
7	Installation,testing and commissioning of sound amplification system complete in all respect including services and warranty for 5 years.	Job	1		
				Total Price(Rs.)	

PAKISTAN SPORTS BOARD					
SOUND AMPLIFICATION SYSTEM (Liaquat Gymnasium)					
Bill of Quantities					
Sr. No.	**Description**	**Unit**	**Quantity**	**Unit Price (Rs.)**	**Amount (PKR)**
	Design , Supply, installation, testing and commissioning of Sound System for stadium complete in all respects including all material, labor, tools, accessories etc. as per latest applicable international standards EN-54 , IEC 60268, IP66 , and technical specifications attached herewith. **Note:** **1) The bidder shall submit the OEM designed proposal (System should be single OEM with native integration,) Each sport avenue should be able to operate independently and club with all other avenue Centrally announcements . along with accoustic report and design caculations at the time of bid submission.** **2) The Bidder shall provide all BoQ items as per Technical Specifications of Bidding Documents, brands shown and approved by consultant.** **3) Contractor is advised to check the health of already installed wiring and cables and confirm the cable running lengths as per site conditions before commencement of work.** **4) The shown information are representative/conceptual only. Detailed assessment and engineering is the responsibility of the EPC Contractor. 5) Any other item required for completion of system not covered in BOQ or specifications / drawings in accordance with the same standards and brands shown and approved by consultant. All such items shall be covered in the rates quoted in the below given item but complete description & quantity required and brands shall be mentioned separately .**				
1	**Power Amplifier** High Performance Class-D Power PA Amplifier High performance 3CH/4CH Class-D Power amplifiers produce 300W rated power each channel. (DPA-300T/TO: 3CH, DPA-300Q/QO: 4CH) Emergency Power Back Up (24VDC) capability The unit operates on a 24VDC battery power supply for emergency back up without UPS (DPA-TO/QO models are not included with Emergency Power Back Up (24VDC)). - Rated Output Power Via DC Backup Supply Output power can be maintained as AC power when 24VDC power supplied.- Advanced Power Circuitry Design The combination Class-D type amplification circuitry combined with SMPS creates a high efficiency amplifier offering reduced power consumption and low heat dissipation and weight. High Quality Sound Design. The total harmonic distortion is reduced to less than 0.03% THD, with a high signal to noise S/N ratio of over 103dB	per watt	7200		
2	**Line Speaker** Use unit having excellent sound articulation/durability Indoor type, 100V/70V line of high impedance steel model Available to reproduce not only announcement but also high quality music Providing 2 models to choose 120W power depending on the application Applying high performance matching transformer to maximize the characteristics of dedicated speaker driver Screw Terminal for easy installation and connection (attached) Provide dedicated wall bracket which can be adjustable up to 11 degrees downward and left and right angles to 70 degrees. Built-in high-end tweeter which can reproduce clean and clear sound at high frequencies Wood enclosure	per watt	4800		

PAKISTAN SPORTS BOARD					
SOUND AMPLIFICATION SYSTEM (Liaquat Gymnasium)					
Bill of Quantities					
Sr. No.	**Description**	**Unit**	**Quantity**	**Unit Price (Rs.)**	**Amount (PKR)**
3	**Line Speaker** Use unit having excellent sound articulation/durability Indoor type, 100V/70V line of high impedance steel model Available to reproduce not only announcement but also high quality music Providing 2 models to choose 60W power depending on the application Applying high performance matching transformer to maximize the characteristics of dedicated speaker driver Screw Terminal for easy installation and connection (attached) Provide dedicated wall bracket which can be adjustable up to 11 degrees downward and left and right angles to 70 degrees. Built-in high-end tweeter which can reproduce clean and clear sound at high frequencies Wood enclosure	per watt	1,800		
4	**Clear Horn** Horn Speaker provides high sound pressure, high directivity and sturdiness as made with synthetic resins. It can adjust pointing angle of up-and down 130°, left-to-right 135°and is easy to install on 4 the wall or ceiling Indoor or outdoor use Wide frequency range with remarkable vocal clarity Excellent for public address systems Easy to installation Dispersion control	per watt	480		
5	**Pre mixers** MIC INPUT Impedance XLR3 type female Electrically Balanced/<2.2KΩ Nominal level 60dBu to-16dBu Hi-Z INPUT Impedance TRS Jack socket Electrically Balanced/>50KΩ Nominal level -34dBu to +10dBuSTEREO INPUT Impedance TRS Jack socket Electrically Balanced/ >10KΩ Nominal level -20dBu to +10dBuRETURN INPUT Impedance TRS Jack socket Electrically Balanced >10KΩ Nominal level 0dBu(+20dBu max)OUTPUT MIX OUTPUT Minimum Load XLR3 type male Electrically Balanced/>600Ω Nominal level 0dBu (+20dBu max) GROUP OUTPUT Minimum load TRS Jack socket Unbalanced/>2KΩ Nominal level 0dBu (+20dBu max) AUX OUTPUT Minimum load TRS Jack socket Unbalanced/	Job	1		
	>2KΩ Nominal level 0dBu (+20dBu max) MONITOR OUTPUT Minimum load TRS Jack socket Unbalanced/>2KΩ Nominal level 0dBu (+20dBu max) PHONES OUTPUT Minimum load TRS Jack socket Unbalanced/ 100mW / 600Ω PHANTOM POWER >35Ω Nominal level Voltag XLR 3 type female / +48V TYPICAL PERFORMANCESFrequency Response ±1dB (20Hz to 20kHz, MIC to Mix O/P +60dB input gainPower Source AC 100V to 240V, 50Hz/60HzPower Consumption 25WDimensions 482(W)x105(H)x310(D)mm / 18.98(W)x4.14(H)x12.21(D)inWeight 5.78kg/12.741b				

PAKISTAN SPORTS BOARD					
SOUND AMPLIFICATION SYSTEM (Liaquat Gymnasium)					
Bill of Quantities					
Sr. No.	**Description**	**Unit**	**Quantity**	**Unit Price (Rs.)**	**Amount (PKR)**
6	**Dynamic Microphone** Super-cardioid pick-up pattern -Effective, built-in spherical wind and pop filter -Shock-mount system cuts down handling noise -Includes Integrated On/Off Switch -Frequency response tailored for multi-purpose vocals per -High sensitivity, low impedance (600Ω) -Shocks and vibration-resistant metal body per 51,450.00 5.00 257,250.00 -Noiseless XLR cable (5m) Dynamic (Moving Coil) Polar Pattern Super Cardioid -75dB ±3dB Frequency Response 55Hz~ 16kHz Sensitivity (0dB=1v/uBar at 1kHz) Output Impedance 600Ω± 30% (at 1 kHz) Weight 250g 10g	Job	1		
7	Audio Flexible Cable black copper Ultra Flexible Oxygen Free 4 AWG Power Cable Stranded CCA (COPPER) Color: Black Ultra Flexible & Oxygen Free.	Job	1		
8	Installation and commissioning of speaker wiring	Job	1		
9	Installation,testing and commissioning of sound amplification system complete in all respect including services and warranty for 5 years.	Job	1		
				Total Price	

PAKISTAN SPORTS BOARD					
SOUND AMPLIFICATION SYSTEM (Naseer Bunda)					
Bill of Quantities					
Sr. No.	**Description**	**Unit**	**Quantity**	**Unit Price (Rs.)**	**Amount (PKR)**
	Design , Supply, installation, testing and commissioning of Sound System for stadium complete in all respects including all material, labor, tools, accessories etc. as per latest applicable international standards EN-54 , IEC 60268, IP66 , and technical specifications attached herewith. **Note:** **1) The bidder shall submit the OEM designed proposal (System should be single OEM with native integration,) Each sport avenue should be able to operate independently and club with all other avenue Centrally announcements . along with accoustic report and design caculations at the time of bid submission.** **2) The Bidder shall provide all BoQ items as per Technical Specifications of Bidding Documents, brands shown and approved by consultant.** **3) Contractor is advised to check the health of already installed wiring and cables and confirm the cable running lengths as per site conditions before commencement of work.** **4) The shown information are representative/conceptual only. Detailed assessment and engineering is the responsibility of the EPC Contractor.** **5) Any other item required for completion of system not covered in BOQ or specifications / drawings in accordance with the same standards and brands shown and approved by consultant. All such items shall be covered in the rates quoted in the below given item but complete description & quantity required and brands shall be mentioned separately**				
1	**Power Amplifier** High Performance Class-D Power PA Amplifier High performance 3CH/4CH Class-D Power amplifiers produce 300W rated power each channel. (DPA-300T/TO: 3CH, DPA-300Q/QO: 4CH) Emergency Power Back Up (24VDC) capability. The unit operates on a 24VDC battery power supply for emergency back up without UPS (DPA-TO/QO models are not included with Emergency Power Back Up (24VDC)). - Rated Output Power Via DC Backup Supply Output power can be maintained as AC power when 24VDC power supplied.- Advanced Power Circuitry Design The combination Class-D type amplification circuitry combined with SMPS creates a high efficiency amplifier offering reduced power consumption and low heat dissipation and weight. High Quality Sound Design. The total harmonic distortion is reduced to less than 0.03% THD, with a high signal to noise S/N ratio of over 103dB	per watt	3000		
2	**Line Speaker** Use unit having excellent sound articulation/durability Indoor type, 100V/70V line of high impedance steel model Available to reproduce not only announcement but also high quality music Providing 2 models to choose 120W power depending on the application Applying high performance matching transformer to maximize the characteristics of dedicated speaker driver Screw Terminal for easy installation and connection (attached) Provide dedicated wall bracket which can be adjustable up to 11 degrees downward and left and right angles to 70 degrees. Built-in high-end tweeter which can reproduce clean and clear sound at high frequencies Wood enclosure	per watt	1200		
3	**Line Speaker** Use unit having excellent sound articulation/durability Indoor type 100V/70V line of high impedance steel model Available to reproduce not only announcement but also high quality music Providing 2 models to choose 60W power depending on the application Applying high-grade matching transformer to maximize the characteristics of dedicated speaker driver Screw Terminal for easy installation and connection (attached) Provide wall mount bracket which can be adjustable up to 11 degrees downward and left and right angles to 70 degrees. Built-in high-end tweeter which can reproduce clean and clear sound at high frequencies Wood enclosure	per watt	960		

PAKISTAN SPORTS BOARD					
SOUND AMPLIFICATION SYSTEM (Naseer Bunda)					
Bill of Quantities					
Sr. No.	**Description**	**Unit**	**Quantity**	**Unit Price (Rs.)**	**Amount (PKR)**
4	**Clear Horn Speaker provides high sound** pressure, high directivity and sturdy synthetic resins. It can adjust pointing angle of up-and down 130°, left-to-right 135° and the wall or ceiling. Indoor or outdoor use Wide frequency range with remarkable sound Excellent for public address systems Easy to installation Dispersion control	per watt	240		
5	**Pre mixers** MIC INPUT Impedance XLR3 type female Electrically Balanced/<2.2KΩ Nominal level 60dBu to-16dBu Hi-Z INPUT Impedance TRS Jack socket Electrically Balanced/>50KΩ Nominal level -34dBu to +10dBuSTEREO INPUT Impedance TRS Jack socket Electrically Balanced/ >10KΩ Nominal level -20dBu to +10dBuRETURN INPUT Impedance TRS Jack socket Electrically Balanced/ >10KΩ Nominal level 0dBu(+20dBu max)OUTPUT MIX OUTPUT Minimum Load XLR3 type male Electrically Balanced/>600Ω Nominal level 0dBu (+20dBu max) GROUP OUTPUT Minimum load TRS Jack socket Unbalanced/>2KΩ Nominal level 0dBu (+20dBu max) AUX OUTPUT Minimum load TRS Jack socket Unbalanced/	Job	1		
	>2KΩ Nominal level 0dBu (+20dBu max) MONITOR OUTPUT Minimum load TRS Jack socket Unbalanced/>2KΩ Nominal level 0dBu (+20dBu max) PHONES OUTPUT Minimum load TRS Jack socket Unbalanced/ 100mW / 600Ω PHANTOM POWER >35Ω Nominal level Voltag XLR 3 type female / +48V TYPICAL PERFORMANCES Frequency Response ±1dB (20Hz to 20kHz, MIC to Mix O/P +60dB input gainPower Source AC 100V to 240V, 50Hz/60HzPower Consumption 25WDimensions 482(W)x105(H)x310(D)mm / 18.98(W)x4.14(H)x12.21(D)inWeight 5.78kg/12.741b				
6	***Dynamic Microphone*** *Super-cardioid pick-up pattern* *-Effective, built-in spherical wind and pop filter* *-Shock-mount system cuts down handling noise* *-Includes Integrated On/Off Switch* *-Frequency response tailored for multi-purpose vocals* *-High sensitivity, low impedance (600Ω)* *-Shocks and vibration-resistant metal body* *-Noiseless XLR cable (5m) Dynamic (Moving Coil)* *Polar Pattern Super Cardioid* *Frequency Response 55Hz~ 16kHz Sensitivity -75dB ±3dB* *(0dB=1v/uBar at 1kHz) Output Impedance 600Ω ± 30% (at 1 kHz)* *Weight 250g ± 10g*	Job	1		
7	Audio Flexible Cable black copper Ultra Flexible Oxygen Free 4 AWG Power Cable Stranded CCA (COPPER) Color: Black Ultra Flexible & Oxygen Free.	Job	1		
8	Installation and commissioning of speaker wiring	Job	1		
9	Installation,testing and commissioning of sound amplification system complete in all respect including services and warranty for 5 years.	Job	1		
				Total Price(Rs.)	

PAKISTAN SPORTS BOARD					
SOUND AMPLIFICATION SYSTEM (ROSHAN KHAN)					
Bill of Quantities					
Sr. No.	**Description**	**Unit**	**Quantity**	**Unit Price (Rs.)**	**Amount (PKR)**
	Design , Supply, installation, testing and commissioning of Sound System for stadium complete in all respects including all material, labor, tools, accessories etc. as per latest applicable international standards EN-54 , IEC 60268, IP66 , and technical specifications attached herewith. **Note:** **1) The bidder shall submit the OEM designed proposal (System should be single OEM with native integration,) Each sport avenue should be able to operate independently and club with all other avenue Centrally announcements . along with accoustic report and design caculations at the time of bid submission.** **2) The Bidder shall provide all BoQ items as per Technical Specifications of Bidding Documents, brands shown and approved by consultant.** **3) Contractor is advised to check the health of already installed wiring and cables and confirm the cable running lengths as per site conditions before commencement of work.** **4) The shown information are representative/conceptual only. Detailed assessment and engineering is the responsibility of the EPC Contractor. 5)** **Any other item required for completion of system not covered in BOQ or specifications / drawings in accordance with the same standards and brands shown and approved by consultant. All such items shall be covered in the rates quoted in the below given item but complete description & quantity required and brands shall be mentioned separately .**				
1	**Power Amplifier** High Performance Class-D Power PA Amplifier High performance 3CH/4CH Class-D Power amplifiers produce 300W rated power each channel. (DPA-300T/TO: 3CH, DPA-300Q/QO: 4CH) Emergency Power Back Up (24VDC) capability. The unit operates on a 24VDC battery power supply for emergency back up without UPS (DPA-TO/QO models are not included with Emergency Power Back Up (24VDC)). - Rated Output Power Via DC Backup Supply Output power can be maintained as AC power when 24VDC power supplied.- Advanced Power Circuitry Design The combination Class-D type amplification circuitry combined with SMPS creates a high efficiency amplifier offering reduced power consumption and low heat dissipation and weight. High Quality Sound Design. The total harmonic distortion is reduced to less than 0.03% THD, with a high signal to noise S/N ratio of over 103dB	per Watt	1200		
2	**Line Speaker** Use unit having excellent sound articulation/durability Indoor type, 100V/70V line of high impedance steel model Available to reproduce not only announcement but also high quality music Providing 2 models to choose 120W power depending on the application Applying high performance matching transformer to maximize the characteristics of dedicated speaker driver Screw Terminal for easy installation and connection (attached) Provide dedicated wall bracket which can be adjustable up to 11 degrees downward and left and right angles to 70 degrees. Built-in high-end tweeter which can reproduce clean and clear sound at high frequencies Wood enclosure	per Watt	720		

PAKISTAN SPORTS BOARD					
SOUND AMPLIFICATION SYSTEM (ROSHAN KHAN)					
Bill of Quantities					
Sr. No.	**Description**	**Unit**	**Quantity**	**Unit Price (Rs.)**	**Amount (PKR)**
3	**Line Speaker** Use unit having excellent sound articulation/durability Indoor type 100V/70V line of high impedance steel model Available to reproduce not only announcement but also high quality music Providing 2 models to choose 60W power depending on the application Applying high-grade matching transformer to maximize the characteristics of dedicated speaker driver Screw Terminal for easy installation and connection (attached) Provide wall mount bracket which can be adjustable up to 11 degrees downward and left and right angles to 70 degrees. Built-in high-end tweeter which can reproduce clean and clear sound at high frequencies Wood enclosure	per Watt	480		
4	**Dynamic Microphone** Super-cardioid pick-up pattern -Effective, built-in spherical wind and pop filter -Shock-mount system cuts down handling noise -Includes Integrated On/Off Switch -Frequency response tailored for multi-purpose vocals -High sensitivity, low impedance (600Ω) -Shocks and vibration-resistant metal body -Noiseless XLR cable (5m) Dynamic (Moving Coil) Polar Pattern Super Cardioid Frequency Response 55Hz~ 16kHz Sensitivity -75dB ±3dB (0dB=1v/uBar at 1kHz) Output Impedance 600Ω ± 30% (at 1 kHz) Weight 250g ±10g	Job	1		
5	Audio Flexible Cable black copper Ultra Flexible Oxygen Free 4 AWG Power Cable Stranded CCA (COPPER) Color: Black Ultra Flexible & Oxygen Free.	Job	1		
6	Installation and commissioning of speaker wiring	Job	1		
7	Installation,testing and commissioning of sound amplification system complete in all respect including services and warranty for 5 years.	Job	1		
				Total Price(Rs.)	

PAKISTAN SPORTS BOARD					
SOUND AMPLIFICATION SYSTEM (RODHAM HALL)					
Bill of Quantities					
Sr. No.	**Description**	**Unit**	**Quantity**	**Unit Price (Rs.)**	**Amount (PKR)**
	Design , Supply, installation, testing and commissioning of Sound System for stadium complete in all respects including all material, labor, tools, accessories etc. as per latest applicable international standards EN-54 , IEC 60268, IP66 , and technical specifications attached herewith. **Note:** **1) The bidder shall submit the OEM designed proposal (System should be single OEM with native integration,) Each sport avenue should be able to operate independently and club with all other avenue Centrally announcements . along with accoustic report and design caculations at the time of bid submission.** **2) The Bidder shall provide all BoQ items as per Technical Specifications of Bidding Documents, brands shown and approved by consultant.** **3) Contractor is advised to check the health of already installed wiring and cables and confirm the cable running lengths as per site conditions before commencement of work.** **4) The shown information are representative/conceptual only. Detailed assessment and engineering is the responsibility of the EPC Contractor.** **5) Any other item required for completion of system not covered in BOQ or specifications / drawings in accordance with the same standards and brands shown and approved by consultant. All such items shall be covered in the rates quoted in the below given item but complete description & quantity required and brands shall be mentioned separately .**				
1	**Power Amplifier** High Performance Class-D Power PA Amplifier High performance 3CH/4CH Class-D Power amplifiers produce 300W rated power each channel. (DPA-300T/TO: 3CH, DPA-300Q/QO: 4CH) Emergency Power Back Up (24VDC) capability. The unit operates on a 24VDC battery power supply for emergency back up without UPS (DPA- TO/QO models are not included with Emergency Power Back Up (24VDC)). - Rated Output Power Via DC Backup Supply Output power can be maintained as AC power when 24VDC power supplied.- Advanced Power Circuitry Design The combination Class-D type amplification circuitry combined with SMPS creates a high efficiency amplifier offering reduced power consumption and low heat dissipation and weight. High Quality Sound Design. The total harmonic distortion is reduced to less than 0.03% THD, with a high signal to noise S/N ratio of over 103dB	per Watt	1200		
2	**Line Speaker** Use unit having excellent sound articulation/durability Indoor type, 100V/70V line of high impedance steel model Available to reproduce not only announcement but also high quality music Providing 2 models to choose 120W power depending on the application Applying high performance matching transformer to maximize the characteristics of dedicated speaker driver Screw Terminal for easy installation and connection (attached) Provide dedicated wall bracket which can be adjustable up to 11 degrees downward and left and right angles to 70 degrees. Built-in high-end tweeter which can reproduce clean and clear sound at high frequencies Wood enclosure	per Watt	720		
3	**Line Speaker** Use unit having excellent sound articulation/durability Indoor type 100V/70V line of high impedance steel model Available to reproduce not only announcement but also high quality music Providing 2 models to choose 60W power depending on the application Applying high-grade matching transformer to maximize the characteristics of dedicated speaker driver Screw Terminal for easy installation and connection (attached) Provide wall mount bracket which can be adjustable up to 11 degrees downward and left and right angles to 70 degrees. Built-in high-end tweeter which can reproduce clean and clear sound at high frequencies Wood enclosure	per Watt	480		

PAKISTAN SPORTS BOARD					
SOUND AMPLIFICATION SYSTEM (RODHAM HALL)					
Bill of Quantities					
Sr. No.	**Description**	**Unit**	**Quantity**	**Unit Price (Rs.)**	**Amount (PKR)**
4	**Dynamic Microphone** Super-cardioid pick-up pattern -Effective, built-in spherical wind and pop filter -Shock-mount system cuts down handling noise -Includes Integrated On/Off Switch -Frequency response tailored for multi-purpose vocals -High sensitivity, low impedance (600Ω) -Shocks and vibration-resistant metal body -Noiseless XLR cable (5m) Dynamic (Moving Coil) Polar Pattern Super Cardioid Frequency Response 55Hz~ 16kHz Sensitivity -75dB ±3dB (0dB=1v/uBar at 1kHz) Output Impedance 600Ω ± 30% (at 1 kHz) Weight 250g ±10g	Job	1		
5	Audio Flexible Cable black copper Ultra Flexible Oxygen Free 4 AWG Power Cable Stranded CCA (COPPER) Color: Black Ultra Flexible & Oxygen Free.	Job	1		
6	Installation and commissioning of speaker wiring	Job	1		
7	Installation,testing and commissioning of sound amplification system complete in all respect including services and warranty for 5 years.	Job	1		
				Total Price(Rs.)	

PAKISTAN SPORTS BOARD					
SOUND AMPLIFICATION SYSTEM (Swimming Pool)					
Bill of Quantities					
Sr. No.	**Description**	**Unit**	**Quantity**	**Unit Price (Rs.)**	**Amount (PKR)**
	Design , Supply, installation, testing and commissioning of Sound System for stadium complete in all respects including all material, labor, tools, accessories etc. as per latest applicable international standards EN-54 , IEC 60268, IP66 , and technical specifications attached herewith. **Note:** **1) The bidder shall submit the OEM designed proposal (System should be single OEM with native integration,) Each sport avenue should be able to operate independently and club with all other avenue Centrally announcements . along with accoustic report and design caculations at the time of bid submission.** **2) The Bidder shall provide all BoQ items as per Technical Specifications of Bidding Documents, brands shown and approved by consultant.** **3) Contractor is advised to check the health of already installed wiring and cables and confirm the cable running lengths as per site conditions before commencement of work.** **4) The shown information are representative/conceptual only. Detailed assessment and engineering is the responsibility of the EPC Contractor.** **5) Any other item required for completion of system not covered in BOQ or specifications / drawings in accordance with the same standards and brands shown and approved by consultant. All such items shall be covered in the rates quoted in the below given item but complete description & quantity required and brands shall be mentioned separately .**				
1	**Power Amplifier** High Performance Class-D Power PA Amplifier High performance 3CH/4CH Class-D Power amplifiers produce 300W rated power each channel. (DPA-300T/TO: 3CH, DPA-300Q/QO: 4CH) Emergency Power Back Up (24VDC) capability. The unit operates on a 24VDC battery power supply for emergency back up without UPS (DPA- TO/QO models are not included with Emergency Power Back Up (24VDC)). - Rated Output Power Via DC Backup Supply Output power can be maintained as AC power when 24VDC power supplied.- Advanced Power Circuitry Design The combination Class-D type amplification circuitry combined with SMPS creates a high efficiency amplifier offering reduced power consumption and low heat dissipation and weight. High Quality Sound Design. The total harmonic distortion is reduced to less than 0.03% THD, with a high signal to noise S/N ratio of over 103dB	per watt	3000		
2	**Line Speaker** Use unit having excellent sound articulation/durability Indoor type, 100V/70V line of high impedance steel model Available to reproduce not only announcement but also high quality music Providing 2 models to choose 120W power depending on the application Applying high performance matching transformer to maximize the characteristics of dedicated speaker driver Screw Terminal for easy installation and connection (attached) Provide dedicated wall bracket which can be adjustable up to 11 degrees downward and left and right angles to 70 degrees. Built-in high-end tweeter which can reproduce clean and clear sound at high frequencies Wood enclosure	per Watt	1200		

PAKISTAN SPORTS BOARD					
SOUND AMPLIFICATION SYSTEM (Swimming Pool)					
Bill of Quantities					
Sr. No.	**Description**	**Unit**	**Quantity**	**Unit Price (Rs.)**	**Amount (PKR)**
3	**Line Speaker** Use unit having excellent sound articulation/durability Indoor type 100V/70V line of high impedance steel model Available to reproduce not only announcement but also high quality music Providing 2 models to choose 60W power depending on the application Applying high-grade matching transformer to maximize the characteristics of dedicated speaker driver Screw Terminal for easy installation and connection (attached) Provide wall mount bracket which can be adjustable up to 11 degrees downward and left and right angles to 70 degrees. Built-in high-end tweeter which can reproduce clean and clear sound at high frequencies Wood enclosure	per watt	960		
4	**Clear Horn Speaker provides high sound** pressure, high directivity and sturdy synthetic resins. It can adjust pointing angle of up-and down 130°, left-to-right 135° and the wall or ceiling. Indoor or outdoor use Wide frequency range with remarkable sound Excellent for public address systems Easy to installation Dispersion control	per watt	240		
5	**Pre mixers** MIC INPUT Impedance XLR3 type female Electrically Balanced/<2.2K Nominal level 60dBu to-16dBu Hi-Z INPUT Impedance TRS Jack socket Electrically Balanced/>50KΩ Nominal level -34dBu to +10dBuSTEREO INPUT Impedance TRS Jack socket Electrically Balanced/ >10KΩ Nominal level -0dBu (+20dBu max) OUTPUT MIX OUTPUT Balanced/ >600Ω Nominal level 0dBu (+20dBu max) GROUP OUTPUT Minimum load TRS Jack socket Unbalanced/>2KΩ Nominal level 0dBu (+20dBu max) AUX OUTPUT Minimum load TRS Jack socket Unbalanced/	Job	1		
	>2KΩ Nominal level 0dBu (+20dBu max) MONITOR OUTPUT Minimum load TRS Jack socket Unbalanced/>2KΩ Nominal level 0dBu (+20dBu max) PHONES OUTPUT Minimum load TRS Jack socket Unbalanced/ 100mW / 600Ω PHANTOM POWER >35Ω Nominal level Voltag XLR 3 type female / +48V TYPICAL PERFORMANCES Frequency Response ±1dB (20Hz to 20kHz, MIC to Mix O/P +60dB input gainPower Source AC 100V to 240V, 50Hz/60HzPower Consumption 25WDimensions 482(W)x105(H)x310(D)mm / 18.98(W)x4.14(H)x12.21(D)inWeight 5.78kg/12.741b				
6	***Dynamic Microphone*** *Super-cardioid pick-up pattern* *-Effective, built-in spherical wind and pop filter* *-Shock-mount system cuts down handling noise* *-Includes Integrated On/Off Switch* *-Frequency response tailored for multi-purpose vocals* *-High sensitivity, low impedance (600Ω)* *-Shocks and vibration-resistant metal body* *-Noiseless XLR cable (5m) Dynamic (Moving Coil)* *Polar Pattern Super Cardioid* *Frequency Response 55Hz~ 16kHz Sensitivity* *-75dB ±3dB* *(0dB=1v/uBar at 1kHz) Output Impedance 600Ω ±* *30% (at 1 kHz)* *Weight 250g ± 10g*	Job	1		

PAKISTAN SPORTS BOARD					
SOUND AMPLIFICATION SYSTEM (Swimming Pool)					
Bill of Quantities					
Sr. No.	**Description**	**Unit**	**Quantity**	**Unit Price (Rs.)**	**Amount (PKR)**
7	Audio Flexible Cable black copper Ultra Flexible Oxygen Free 4 AWG Power Cable Stranded CCA (COPPER) Color: Black Ultra Flexible & Oxygen Free.	Job	1		
8	Installation and commissioning of speaker wiring	Job	1		
9	Installation,testing and commissioning of sound amplification system complete in all respect including services and warranty for 5 years.	Job	1		
				Total Price(Rs.)	

PAKISTAN SPORTS BOARD					
SOUND AMPLIFICATION SYSTEM (Swimming Pool)OUT DOOR					
Bill of Quantities					
Sr. No.	**Description**	**Unit**	**Quantity**	**Unit Price (Rs.)**	**Amount (PKR)**
	Design , Supply, installation, testing and commissioning of Sound System for stadium complete in all respects including all material, labor, tools, accessories etc. as per latest applicable international standards EN-54 , IEC 60268, IP66 , and technical specifications attached herewith. **Note:** **1) The bidder shall submit the OEM designed proposal (System should be single OEM with native integration,) Each sport avenue should be able to operate independently and club with all other avenue Centrally announcements . along with accoustic report and design caculations at the time of bid submission.** **2) The Bidder shall provide all BoQ items as per Technical Specifications of Bidding Documents, brands shown and approved by consultant.** **3) Contractor is advised to check the health of already installed wiring and cables and confirm the cable running lengths as per site conditions before commencement of work.** **4) The shown information are representative/conceptual only. Detailed assessment and engineering is the responsibility of the EPC Contractor.** **5) Any other item required for completion of system not covered in BOQ or specifications / drawings in accordance with the same standards and brands shown and approved by consultant. All such items shall be covered in the rates quoted in the below given item but complete description & quantity required and brands shall be mentioned separately .**				
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2	**Line Speaker** Use unit having excellent sound articulation/durability Indoor type, 100V/70V line of high impedance steel model Available to reproduce not only announcement but also high quality music Providing 2 models to choose 120W power depending on the application Applying high performance matching transformer to maximize the characteristics of dedicated speaker driver Screw Terminal for easy installation and connection (attached) Provide dedicated wall bracket which can be adjustable up to 11 degrees downward and left and right angles to 70 degrees. Built-in high-end tweeter which can reproduce clean and clear sound at high frequencies Wood enclosure	per Watt	1200		
3	**Line Speaker** Use unit having excellent sound articulation/durability Indoor type 100V/70V line of high impedance steel model Available to reproduce not only announcement but also high quality music Providing 2 models to choose 60W power depending on the application Applying high-grade matching transformer to maximize the characteristics of dedicated speaker driver Screw Terminal for easy installation and connection (attached) Provide wall mount bracket which can be adjustable up to 11 degrees downward and left and right angles to 70 degrees. Built-in high-end tweeter which can reproduce clean and clear sound at high frequencies Wood enclosure	Job	960		
4	**Clear Horn Speaker provides high sound** pressure, high directivity and sturdy synthetic resins. It can adjust pointing angle of up-and down 130°, left-to-right 135° and the wall or ceiling. Indoor or outdoor use Wide frequency range with remarkable sound Excellent for public address systems Easy to installation Dispersion control	Job	240		
5	**Pre mixers** MIC INPUT Impedance XLR3 type female Electrically Balanced/<2.2K Nominal level 60dBu to-16dBu Hi-Z INPUT Impedance TRS Jack socket Electrically Balanced/>50KΩ Nominal level -34dBu to +10dBuSTEREO INPUT Impedance TRS Jack socket Electrically Balanced/ >10KΩ Nominal level -0dBu (+20dBu max) OUTPUT MIX OUTPUT Balanced/ >600Ω Nominal level 0dBu (+20dBu max) GROUP OUTPUT Minimum load TRS Jack socket Unbalanced/>2KΩ Nominal level 0dBu (+20dBu max) AUX OUTPUT Minimum load TRS Jack socket Unbalanced/	Job	1		

PAKISTAN SPORTS BOARD					
SOUND AMPLIFICATION SYSTEM (Swimming Pool)OUT DOOR					
Bill of Quantities					
Sr. No.	**Description**	**Unit**	**Quantity**	**Unit Price (Rs.)**	**Amount (PKR)**
	>2KΩ Nominal level 0dBu (+20dBu max) MONITOR OUTPUT Minimum load TRS Jack socket Unbalanced/>2KΩ Nominal level 0dBu (+20dBu max) PHONES OUTPUT Minimum load TRS Jack socket Unbalanced/ 100mW / 600Ω PHANTOM POWER >35Ω Nominal level Voltag XLR 3 type female / +48V TYPICAL PERFORMANCES Frequency Response ±1dB (20Hz to 20kHz, MIC to Mix O/P +60dB input gainPower Source AC 100V to 240V, 50Hz/60HzPower Consumption 25WDimensions 482(W)x105(H)x310(D)mm / 18.98(W)x4.14(H)x12.21(D)inWeight 5.78kg/12.741b				
6	***Dynamic Microphone*** *Super-cardioid pick-up pattern* *-Effective, built-in spherical wind and pop filter* *-Shock-mount system cuts down handling noise* *-Includes Integrated On/Off Switch* *-Frequency response tailored for multi-purpose vocals* *-High sensitivity, low impedance (600Ω)* *-Shocks and vibration-resistant metal body* *-Noiseless XLR cable (5m) Dynamic (Moving Coil)* *Polar Pattern Super Cardioid* *Frequency Response 55Hz~ 16kHz Sensitivity* *-75dB ±3dB* *(0dB=1v/uBar at 1kHz) Output Impedance 600Ω ±* *30% (at 1 kHz)* *Weight 250g ± 10g*	Job	1		
7	Audio Flexible Cable black copper Ultra Flexible Oxygen Free 4 AWG Power Cable Stranded CCA (COPPER) Color: Black Ultra Flexible & Oxygen Free.	Job	1		
8	Installation and commissioning of speaker wiring	Job	1		
9	Installation,testing and commissioning of sound amplification system complete in all respect including services and warranty for 5 years.	Job	1		
				Total Price (Rs.)	

PAKISTAN SPORTS BOARD, ISLAMABAD		
ELECTRONIC TIMING DEVICES		
SUMMARY OF BILL OF QUANTITIES		
Note:	The system cost also includes 5% spare parts for the equipment.	
Sr. No.	**Description**	**Amount (PKR)**
1	Jinnah Stadium	
2	Swimming Pool	
Grand Total		

PAKISTAN SPORTS BOARD					
JINNAH STADIUM					
BILL OF QUANTITIES					
TIMING SYSTEM					
Sr. No.	**Item**	**Unit**	**Quantity**	**Unit Price**	**Amount (PKR)**
	Approved Manufacturer of IAAF for Electronic Timing Systems for Athletics **a. Swiss Timing Switzerland** **b. Colordo Timing USA** **c. Time Tronics European Union or equivalent as per the mentioned criteria.** **The Mabufacturer and his subsidaries should have suppling, installed and commissioning of Eectronic Displays Boards and Electronic Timing Systems for Athletics and Swimming Events in diffeent major international psorts events, Football Worldcup , Olympic and Asian Games** **Preference will be given to the vendor combining experience of Electronic Bpards and Timing Devices. In case, such combinaton does not exist in th market, then mandatory clarification shall apply.** **Clarification:** Supply, wiring, tagging, termination, design, installation, testing and commissioning of following system complete in all respects including all material, labor, tools, accessories etc, International Sports Software with 10 years license as per latest applicable international standards and technical specifications attached herewith.All types of terminations and connections with the existing system and with the display score board is included.				
1	**Photo Finish System** Scanovision Camera Model 10 with Lens Photo finish color cameras Scan vision camera system Model-10 including all software and cables Multipurpose tripods Ethernet cables Scalder camera with accessoories Complete System with Transportation cases **Clarification:** **Photo Finish System (Complete System): (3 x Cameras)** Technical Specification Of Scanovision Camera: Lens (included in camera housing) **Zoom ratio:** 10x **Vertical field angle:** 6.5 to 58.8 **Max. aperture:** F1.4 **Minimum object distance:** 1.2m **Remote control:** Zoom, Aperture, Focus **Acquisition speed:** Mini. 500 to 2'000 lines per seconds **Resolution:** 2048 pixels (at any speed) **Number of color per pixels :** >16 millions **Time base precision:** ±0.1ppm **Temperature:** (a) Working: 0oC to +50oC (b) Storage: -20oC to +70oC **Protection:** IP55 **Laptop:** 2 Nos Core i7 latest generation (HP or Dell) Compatible with Scanovision camera and Having operating system windows11, Screen resolution: 1920x1080 pixels, Hard disk SSD minimum 1TB,USB port and UPS of appropriate rating. **Software and Hardware** including license,Camera Switcher, Multipurpose tripods, Ethernet cables, Ethernet Switch 8 port layer 2,Poe Injector, Scaider camera with accessories and Transportation cases, life time licensing.	Job	1		
2	**Start and False Systems:** Starting Blocks. False & Start Devices with complete systems & all cables E. Gun with Heat set and transport case Loud Spakers" **Clarification:** **Starting Blocks(Relay Break Detection/False Start Detection System)** **Dimensions (LxWxH):** Standard (depend to the position of the footrest) **Acoustic signals:** False start: 104 dB @ 1m **Gun shot:** 114 dB @ 1m **Operating temperature:** 0 to +50°C **Storage temperature:** -10°C to +60°C Protection: IP44 **Hardwares & Software:** Start System with complete system for minimum 08 lanes including GUN headset,E-GUN Electronic Start Device,Transportation case,Cable AC power,Thermo paper roll, Terminator connector for winder, Distribution cable, Hex key,Screwdriver, Cable Tu,Winder contains atleast 20 m long cable,Starting block with loudspeaker, software USB compatible with system and its licensing.	Job	1		
3	**Electronic Distance Measurement:** E D M with all accessories and cabling systems & all cables **Clarification:** Equipment shoul be fast, easy to operate and capable of high-accuracy measurements with large graphic display and double side scoreboard.**Technical Specifications:** **Battery life :** Minimum 6 - 8 hours **Maximum range :** atleast 3000 m (prism), 250 m (reflective tape), 150 m (reflectorless) **Minimum range :** 1.5 m **Accuracy :** 2 mm **Measuring time :** 1.5 s **Scope magnification :** 30x **Measurement method :** Phase mode (infrared laser) **Display :** B/W LCD atleast 320 x 240 pixel **Interface language :** selectable **Bluetooth :** yes **Operating temperature:** -20 to 50°C (operating) **Storage temperature :** -40 to 70°C (storage) **Humidity :** 95% (noncondensing) **Protection :** IP54 **Hardwares & Software:** Three-legs support,Transport case, Battery charger, External battery, Target mirror,reflective tape targets for pole vault events, interface cable, Field Software Package for athletics with license.	No.	2		
4	**Integrated Wind Gauge :** Complete Systems with LED Display **Clarification:** **Ultrasonic Wind Gauge** with integrated scoreboard capable of connecting to the Scan'O'Vision photofinish by cable or wireless by BlueTooth and minimum 4 steps of luminosity, automatically adjusted with a light sensor. **Techanical Specifications:** Measurement duration: 5, 10 or 13 seconds1, to 30 seconds **Display:** LED, 250mm height Display duration: 3 minutes after each measurement **Internal battery autonomy:** ~12 hours* at maximum luminosity ~60 hours* at minimum luminosity. **Wind speed range:** -9.9m/s to +9.9m/s **Wind speed accuracy:** ±0.1m/s **Operating temperature:** 0oC to +50oC **Storage temperature:** -25oC to +70oC **Moisture protection:** IP54 (IP65 for the head) **Dimensions (closed):** Upto 850 x 760 x 200 mm **Dimensions (maximum open):** 850 x 1390 x 415 mm Lap Counter LED Display	Job	1		

Sr. No.	Item	Unit	Quantity	Unit Price	Amount (PKR)
5	**LAP Counter LED Display** having 3-faces scoreboard with LED Display up to 199 Laps and visible at 360 degree. **Technical Specifications** **(a) Scoreboard:** Dimension without tripod: Upto 750 x 650 x 510 mm Weight without tripod: Max 16kg Height of digits: Mini 260 mm Viewing distance, up to: 130 m Horizontal viewing angle: 110 degree Display type: LED (Mini 150 LEDs per digit) Display luminosity: Minimum 15 steps adjusted manually or automatically with a light sensor. Protection: IP54 Working temperature: 0°C to 50° C Temperature storage: -30 to 85° C **(b) Keyboard:** Dimensions without cable: Upto 160 x 95 x 31 mm Cable length: ~3m Weight: Max 0.5 kg Display (number of characters): Minimum 2 x 16 Number of keys: 20 Working temperature: 0°C to 50° C Temperature storage: -30 to 85° C	Job	1		
	Field Result Display Set				
	Complete Package For All Athletics Events				
6	**Atheletic Switcher:** capabale to connect and switch atleast 3 photofinish (Primary & Secondary) cameras and laptops with false start system, timing scoreboards, wind gauge, finish photocells, headset, **Protection:** IP42 (indoor use) Working temperature: 0°C to 50° C Temperature range storage: -30 to 85°C	Job	1		
7	**Fixed Athletics Cabling:**control room to be connected to the track using underground cables. Fix Boxes compatible with atheletic switcher with atleast2 connectors . **Laying of Cables and conduit:** 16 x 2 x 0.25 sqmm shileded flexible copper conductor Optical Fibre Multimode, CAT6 cable	Job	1		
8	Coonection with the main Score board and Civil works as per Drawing, Design & Instruction/Direction of the engineer in charge, complete in all respects.	Job	1		
9	Floor standing Air Conditioner, Capacity 2 ton. (Heat and cool) Inverter	Job	1		
	Total Price				

PAKISTAN SPORTS BOARD ISLAMABAD					
SWIMMING POOL					
BILL OF QUANTITIES					
TIMING SYSTEM FOR SWIMMING POOL SYSTEM					
Sr. No.	**Item**	**Unit**	**Quantity**	**Unit Price**	**Amount (PKR)**
	Approved Manufacturer of IAAF for Electronic Timing Systems for Athletics **a. Swiss Timing Switzerland** **b. Colordo Timing USA** **c. Time Tronics European Union or equivalent as per the mentioned criteria.** **The Mabufacturer and his subsidaries should have suppling, installed and commissioning of Eectronic Displays Boards and Electronic Timing Systems for Athletics and Swimming Events in diffeent major international psorts events, Football Worldcup , Olympic and Asian Games** **Preference will be given to the vendor combining experience of Electronic Bpards and Timing Devices. In case, such combinaton does not exist in th market, then mandatory clarification shall apply.** **Clarification:** Supply, Wiring, tagging, termination, design, installation, testing and commissioning of following Electronic timing systems for swimming pool 50x21 meter (overflow) with permanent standup for 8 lanes(Latest models) from FINA approved (One Stop Shop Solution for Complete Sytem) complete in all respects upto the entire satisfaction of The Engineer /Client including all material, labor, tools, accessories etc, International Sports Software with 10 years license as per latest applicable international standards (FINA and RoHS ,IEC Compliant) and technical specifactions attached herewith. All types of terminations and connections with the existing system and with the display score board is included.				
1	**Touchpad System for Swimming:** Size 240x90cm FINA along-with mounting and spare maintenance material. A dianometer and tester to check the pad touch. **Clarification:** **Double Sided Touchpad System for Swimming:** **Size:** Minimum 2.4 meters wide x 1.0 meter high. Pressure Sensitivity: Registers touch with 1.5-2.5 kg of pressure. **Waterproof:** Resistant to chlorine and chemicals. Surface: Non-slip, durable.	Job	1		
2	**Touchpads Storage Trolley:** Touchpads storage trolley for upto 10 Touch pads 190x90cm or 240x90cm. **Clarification:** **Touchpads Storage Trolley:** **Material:** Durable, corrosion-resistant materials (e.g., aluminum or stainless steel). **Dimensions:** Sufficient to hold multiple touchpads and accessories securely (typically 1.5-2 meters in length). **Weight:** Lightweight yet sturdy for easy mobility. **Touchpad Holders:** Secure compartments for holding 2-4 touchpads. **Accessory Storage:** Additional space for cables, connectors, and other Accessories. **Padding:** Protective padding inside to prevent damage to touchpads **Wheels:** Equipped with lockable, swivel wheels for easy transport and secure positioning. **Handles:** Ergonomic handles for easy pushing or pulling.	Job	1		
3	**Touchpads Cover Protection:** PVC cover protection intended to preserve the touchpads during the storing period. For up to 10 touchpads 190 x 90 cm or 240x 90 cm. to be used with the storage trolley. **Clarification:** Lightweight Aluminum Easy Assemble Non Marking Wheels Fits through standard doors Holds up to 10 – 60" or 78" Touchpads **Dimensions:** 82"L x 24.5"W x 49.75"H 5-Year Limited Warranty	No.	1		
4	**Start Time V acoustic Start Device** Cable TU 4pM -TU 4pF (Imm2) - 50m on winder Cable UTS 10PFC UTS 10 PMC -20m on winder **Clarification:** **Start Time V acoustic Start Device** along with E Gun and Microphone:	Job	1		

Sr. No.	Item	Unit	Quantity	Unit Price	Amount (PKR)
5	Timing system laptop compatible along with online printer and internal power supply along with system transportation case.	Job	1		
	Harness System: Setof 10 lanes Primary mobile harness Harness programmer with primary harness Set of 10 mobile loudspeakers with 3m cables starting block with RBD - set of 10 (blue) **Backstroke Ledge:** Backstroke ledge OBL2 Pro for OSB starting block with footrest The ideal complement to the starting blocks OSB 11, OSB12 and OSB14 for the backstroke swimming Adjustable on 5 positions Increased robustness and safety clasp already mounted this device is used for competitions at highest level Full FINA compliance **Dimension:** 800x150x130mm				
6	**Clarification:** **Harness System:** **Material:** High-strength, durable materials (e.g., nylon or polyester) for the harness. Comfort: Soft, padded interior to prevent discomfort during use. **Weight:** Lightweight design to minimize swimmer distraction. **Adustability:** Fully adjustable straps to accommodate various swimmer sizes. Connection Points: Secure, quick-release clips or buckles to easily attach and detach from timing system sensors. **Size:** Suitable for swimmers of all ages and body types, typically designed to fit a range of 30-100 kg. **Sensor Attachment:** Compatible with timing sensors that track swimmer's start and finish via a secure attachment point (e.g., near the waist or chest). **Cable Management:** Includes integrated clips or channels to manage cables, ensuring no tangling during the race. **Quick Release:** Emergency release mechanism to ensure swift detachment in case of malfunction or swimmer distress. **Non-restrictive:** Ensures that the swimmer's movement isn't hindered. **Waterproof:** The harness system should be resistant to water, chlorine, and saltwater. **Corrosion-Resistant:** All metal components must be resistant to rust or corrosion. **Standard Compliance:** Meets relevant international standards for equipment used in swimming competitions, ensuring reliability and safety.	Job	1		
7	**Swimming Starting Blocks & Backstroke Ledge:(Relay Break Detection/False Start Detection System)** Backstroke ledge OBL2 Pro for OSB starting the idea! complement to the starting blocks block with footrest. OSB11, OSB12 and OSB14 for the backstrokeswimming. Adjustable on 5 positions. Full FINA compliance. **Dimension:** 800x150x130 mm	Job	1		
8	**Backstroke Ledge Trolley:** Backstroke Ledge strong trolley for up to 12 backstroke ledges. **Dimension:** 464x800x1405mm **Clarification:** **Backstroke Ledge Trolley:** Backstroke Ledge strong trolley for up to 12 backstroke ledges. **Dimensions:** Compact enough for easy transport and storage but large enough to hold backstroke ledges securely (typically around 1.2-1.5 meters in length) **Ledge Holder:** Secure compartments for storing 1-2 backstroke ledges. **Material:** stainless steel	Job	1		
9	**Computer Equipped with interfaces-full version:** 4U computer rack with - 1xRS422 input card - 1xHd-SDI/HDMI input card - 4xH-SDI Input/output card - Quick button For full version (software included)	Job	1		
10	**Sport in The Box Full:** - Sport in the box full (software download on website) - Multiple Screen controllers - Multiple Video inputs - Video output - Record Replay - Combined Output - DMX Control Input - Network Master/Slave control **Clarification:** - 3x Cameras as per Manufacturers (Outside & Inside Water)	Job	1		
11	Civil works will be carried out at the site as per Drawing, Design & Instruction/ Direction of the engineer in charge, complete in all respects.	Job	1		
12	Floor standing Air Conditioner, Capacity 2 ton. (Heat and cool) Inverter	Job	1		
	Complete Package For All Swimming Events.				
	Total Price FOR SWIMMING POOL				

PAKISTAN SPORTS BOARD ISLAMABAD

DIESEL GENERATOR SET

Summary of BOQ

Sr.No	Description of Items	Total Quoted Amount
(a)	(b)	(c)
	Diesel Generator Sets	

PAKISTAN SPORTS BOARD ISLAMABAD

DIESEL GENERATOR SET

BILL OF QUANTITIES

Sr.No	Description of Items	UNIT	QTY.	UNIT RATES	AMOUNT (Rs.)
(a)	(b)	(c)	(d)		
	Diesel Generator Sets				
	Ref. Spec. Sec.8001,8111, 8133, 8212, 8240				
1	Supply, installation , testing and commissioning of New 500 kVA, Prime Rating 415 volt D.G. Set skid mounted including control / Instrument Panels, generator Panel, fuel day tank(08 Hours on full load) SKID MOUNTED ,Exhaust Silencer Ducting/Cladding and radiator 500KVA Diesel Generator set , Battery and battery cables and all accessories along with Sound proof Canopy, manufactured for 500 kVA Prime D.G. Set. etc. complete in all respect including testing at factory Permises expenditure as mentioned in Clause 13 of Section 8001 as approved by the Engineer. Note: In case the exact rating of genset is not available with any Brand then higher rating will be Considered.	Job	3		
2	Supply and Installation of four wheel trolley as per specifications	Job	1		
3	Supply and Installation of fabricated ATS Panel (With Imported Components including MCCB, MC, Bus-bars as per drawings complete in all respect) with built in MOR assuming one WAPDA meter and load of WAPDA matching with Gen-set complete in all respects.				
i	1000 ACB MOTRIZED FP RC 65 KA	Job	9		
ii	UVT	Job	27		
iii	SHUNT	Job	27		
iv	MOTOR MECHANISM WITH CLOSING COIL	Job	27		
v	U/O VOLTAGE PHASE FALIURE RELAY	Job	27		
vi	ATS MODULE CONTROLLER DEEPSEA	Job	3		
vii	BATTERY CHARGER	Job	3		
viii	CONTROL RELAY	Job	3		
ix	ON OFF LIGHT	Job	27		

Sr.No	Description of Items	UNIT	QTY.	UNIT RATES	AMOUNT (Rs.)
(a)	(b)	(c)	(d)		
x	PHASE INDICATORS	Job	27		
xi	CONTROL MCB	Job	12		
xii	LOUVERS	Job	3		
xiii	DOOR LIGHT (on/off) LIGHT 220 V	Job	27		
xiv	DOOR LIMIT SWITCHES	Job	6		
xv	EX. FAN FULL	Job	6		
xvi	THERMOSTATE	Job	9		
xvii	1600 AMPS TPN & E BUS BARS (120*10)mm	Rm	30		
xviii	ENCLOSURE STEEL SHEET: 14 SWG power coated including all acessories.	Cm	30		
4	Supply, laying and termination of 70 mm², single core, PVC insulated wire in all kinds of existing or given conduit/cable duct as ECC required.(ECC)	Rm	300		
5	Providing , fixing testing and commissioning of 240 mm² Cu.PVC/PVC Std. 600/1000 V, single core, insulated cable in all kinds of existing or given conduit/cable duct Complete in all respect as approved by the Engineer.	Rm	2,000		
6	Supply& laying of 100 mm (4") dia PVC conduit with all Accesories such as bends, sockets, Junction etc recessed in the wall or floor Complete in all respect as approved by the Engineer.	Rm	1,600		
7	Excavation in all kind of material including back filling, compaction, layer of bricks 9" in width and warning tape, trench width 2' & height 3' complete in all respect as per specifications and as directed by the Engineer	Cm	500		
8	Sealing of conduits after cable pulling with jute & Plaster of Paris as per Engineer's Instructions.	Job	20		
9	PCC foundation suitable for ATS PANEL. The PCC foundation shall have dimensions and structural strengths as per as Technical requirements, technical specification and standards.	Job	2		
10	PCC foundation suitable for GENERATOR 500 KVA. The PCC foundation shall have dimensions and structural strengths as per as Technical requirements, technical specification and standards.	Job	2		

Sr.No	Description of Items	UNIT	QTY.	UNIT RATES	AMOUNT (Rs.)
(a)	(b)	(c)	(d)		
11	Rod Type Earth comprising of 12.7mm dia, 3m long Copper deposited steel rod, including appropriate clamp for clamping of the down conductor. The copper deposited steel rod shall be hammered into the ground to the depth of 300mm below the ground surface. The earth electrode includes excavation, backfilling, etc.	Job	6		
12	Following sizes of perforated G.I. sheet powder coated cable trays with cover including joints, bend, mounting brackets hanger complete with all accessories.				
i)	12" x 4"	m	300		
ii)	8" x 3"	m	100		
Total Cost				**Rs.**	

PAKISTAN SPORTS BOARD

TECHNICAL SPECIFICATIONS

BIDDING DOCUMENTS
VOLUME – III

"DESIGN, SUPPLY, INSTALLATION, TESTING AND COMMISSIONING OF SOUND AMPLIFICATION SYSTEM, ELECTRONIC TIMING DEVICES & DG SETS AT DIFFERENT FACILITIES OF PAKISTAN SPORTS COMPLEX, ISLAMABAD"

Contract No. PSB/Islamabad/04/2026

November, 2026

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SECTION - 0120

CONTRACTOR'S CAMP

1. SCOPE

2. PAYMENT OF WORK

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1. SCOPE

The work to be done under this item consists of construction, erection, installation and maintenance of the Contractor's Project Site Offices or main camp and the Contractor's sub-camps or temporary camps, if any, and shall include all offices, shops, warehouses, and other operational buildings; all housing and related facilities including accommodations for the Contractor's personnel.

The location of the Contractor's camps, including all buildings, utilities and facilities thereof, and of the camps or establishments of all persons/parties in the vicinity operating or associated with the Contractor shall be subject to approval of the Engineer.

The work to be done under this item will terminate upon the actual Completion Date. However, if directed by the Engineer or the Employer, the Contractor shall continue such work to the extent required by the Contractor's personnel during the period of maintenance. No compensation shall be paid for the continued operation and maintenance of the Contractor's Camps during the period of maintenance.

Upon completion of the Works, or at such time within the period of maintenance as directed by the Engineer, the Contractor shall remove all buildings utilities and other facilities from the Site and restore all camp areas to a neat and clean condition.

The Employer shall not be responsible to provide any space to the Contractor for building his construction and labour camps and any other facilities in this respect. The Contractor shall make his own arrangements for space for his construction and labour camp at his own risk and cost.

The construction, operation and maintenance of all camps of the Contractor shall comply with all applicable provisions of current Pakistan Labor Camp Rules.

The Contractor shall furnish, make arrangements for, and carry out adequate maintenance for the Contractor’s camp areas at each camp to provide a neat, well kept camp in all respects with pleasant and healthful surroundings and conditions for all occupants of their camp. The Contractor’s camps shall be kept clean, well graded, and free from undergrowth and brush and adequately drained. Roads and streets shall be kept in good condition. All utilities shall be adequately and properly, operated and maintained to provide services and conditions meeting the requirements of these specifications in all respects.

Adequately equipped and properly staffed portable first aid stations or dispensaries shall be provided by the Contractor at camps and other strategic locations to administer first aid treatment at any time required and free of charge to all persons on the Site, including employees of the Engineer and the Employer.

The Contractor shall facilitate the Engineer in use of his site office if and when required by the Engineer in performance of his duties regarding the supervision of project.

2. PAYMENT OF WORK

No payment shall be made for the work involved within the scope of this section of Specifications unless otherwise specifically stated in the Bills of Quantities or herein.

The cost thereof shall be deemed to have been included in the quoted rates of other items of the Bills of Quantities.

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SECTION - 0130

STAKE-OUT SURVEY

1. SCOPE
2. MATERIAL AND EQUIPMENT
3. SUBMITTALS
4. EXECUTION
5. PAYMENT OF WORK

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1. SCOPE

Under this item the Contractor shall make the stakeout survey for construction purposes with competently qualified men, consistent with the current practices. The work shall proceed immediately upon the award of the contract and shall be expeditiously progressed to completion in a manner and at a rate satisfactory to the Engineer. The Contractor shall keep the Engineer fully informed as to the progress of the stakeout survey. The scope of this section of specifications is covered by detailed specifications as laid down herein.

2. MATERIAL AND EQUIPMENT

All instruments, equipment, stakes and other material necessary to perform all work shall be provided by the Contractor. These instruments and equipment shall be available to Engineer at all times for the purpose of checking the work of the Contract.

All stakes used shall be of a type approved by the Engineer, clearly and permanently marked so as to be legible at all times. It shall be the Contractor's responsibility to maintain these stakes in their proper position and location at all times. Any existing stakes or markers defining property lines and survey monuments which may be disturbed during construction shall be properly tied into fixed reference point before being disturbed and accurately reset in their proper position upon completion of the work.

3. SUBMITTALS

Submit all survey data, computations, field notes, drawings and all other survey records necessary to accomplish the work.

4. EXECUTION

The Contractor shall trim trees, bushes and other interfering objects, not consistent with the plan, from survey lines in advance of all survey work to permit accurate and unimpeded work by his stake-out survey crews and the Engineer's survey crews. The exact position of all work shall be established from control points, which are shown on the plans or modified by the Engineer. Any error, apparent discrepancy in or absence of data shown or required for accurately accomplishing the stakeout survey shall be referred to the Engineer for interpretation or furnishing when such is observed or required.

The Contractor shall be responsible for the accuracy of his work and shall maintain all reference points, stakes, etc. throughout the life of the contract. Damaged, destroyed or inaccessible reference points, bench marks or stakes shall be replaced by the Contractor. Existing or new control points that will be or are destroyed during construction shall be re-established and all reference ties recorded thereon shall be furnished to the Engineer. All stakeout survey work shall be referenced to the centerlines shown on the Plans. All computations necessary to establish the exact position of the work from control points shall be made and preserved by the Contractor. All computations, survey notes and other records necessary to accomplish the work shall be kept neatly and made available to the Engineer upon request and furnished to the Employer upon Contract completion.

The Engineer may check all or any portion of the stakeout survey work or notes made by the Contractor and any necessary correction to the work shall be immediately made. Such checking by the Engineer shall not relieve the Contractor of any of his responsibilities for the accuracy or completeness of his work.

Reference points, base lines, stakes and benchmarks for borrow pits shall be established by the Contractor.

All required right-of-way and easement limits shall be established, staked and referenced by the Contractor concurrent with the construction stakeout survey.

The Contractor shall place at least two offset stakes or references at each centre lines station and at such intermediate stations as the Engineer may direct. From computations and

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measurements made by the Contractor, these stakes shall be clearly marked with the correct centre line, station number, offset and cut or fill so as to permit the establishment of the true centre line location during construction. He shall locate and place all cut, fill, slope, line grade or other stakes and points as the Engineer may direct to be necessary for the proper progress of the work.

5. PAYMENT OF WORK

No payment shall be made for the work involved within the scope of this section of Specifications unless otherwise specifically stated in the Bills of Quantities or herein.

The cost thereof shall be deemed to have been included in the quoted rates of other items of the Bills of Quantities.

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SECTION - 0150

DISMANTLING AND DEMOLITION WORKS

1. SCOPE

2. GENERAL

3. SPECIAL INVESTIGATIONS

4. METHOD OF STATEMENT

5. EXECUTION

6. UTILITY SERVICES

7. TEMPORARY WORK

8. MEASUREMENT AND PAYMENT

NATIONAL ENGINEERING SERVICES PAKISTAN (PVT) LTD.
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1. SCOPE

This Section specifies the requirements for dismantling and demolition and removal of buildings, structures and related service utilities, disposal of materials arising from dismantling and demolition work, and procedure or methods or process to be followed for dismantling and demolition.

All available plans of the structure where dismantling and demolition works are to be carried out are to be examined and where the nature of the construction is uncertain a special investigation is to be carried out as agreed with the Engineer.

2. GENERAL

The Contractor is to inspect determine for himself the work involved and the equipment and the materials required for the specified dismantling and demolition work.

All materials arising from the dismantling and demolitions are to be disposed off as directed by the Engineer.

Materials arising shall be cleared from the site as the work proceeds in an approved manner. Removal operations for materials arising should be conducted with the least interference to the public and not be started until approved by the Engineer. The Engineer has the right to reject off-site disposal plans if disposal would leave an unsightly condition anywhere.

The Contractor is to provide safeguards, including warning signs, barricades, temporary fences as required for the protection of the public and Site personnel during dismantling and demolition and removal operations. The safeguards are to be maintained until dismantling and demolition and removal operations are complete.

The Contractor shall conduct his operations in a manner that minimizes the spread of flying particles and dust. Rubbish and debris shall to be sprinkled with water to keep dust to a minimum.

In addition, the following safety rules shall be observed in the performance of the work:

a) no wall or part of wall shall be permitted to fall outwardly from structures.

b) ways are to be kept free of obstructions and debris.

c) wherever a cutting torch or other equipment that might cause a fire is used, provide and maintain fire extinguishers nearby ready for immediate use.

d) Isolated walls should not be left un-shored unless they are structurally stable against wind and other forces likely to affect them.

3. SPECIAL INVESTIGATIONS

The Contractor is to ascertain from the responsible authority whether any mains or services need to be redirected or cut-off. The Contractor shall conform to any procedures prescribed by the relevant authority and the Engineer.

4. METHOD OF STATEMENT

The Contractor is to prepare a method statement which shall detail all aspects proposed dismantling and demolition work and associated procedures before commencing any dismantling and demolition work. The method statement shall be approved by the Engineer before any dismantling and demolition work commences.

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The design of any shoring and supports necessary to maintain the stability of any structure retained after the dismantling and demolition of adjoining property are to be submitted to the Engineer for approval. The responsibility for the sufficiency of the design is to rest with the Contractor, notwithstanding the approval of the Engineer.

5 EXECUTION

5.1 The Contractor shall completely or partially demolish and remove structures, including all services related or connected thereto.

5.2 Debris, including brick, concrete, stone, metals and similar materials are to be disposed off by the Contractor off the Site.

5.3 Once dismantling and demolition work has started, the same is to be continued till the completion, promptly and expeditiously.

5.4 The Contractor is responsible for removing any additional small “out” or miscellaneous structures that have not been indicated in the documents unless otherwise instructed by the Engineer.

5.5 Operations necessary for the removal of an existing or part of an existing structure or obstruction, which may damage new construction, are to be completed prior to placing the new work unless otherwise specified in the documents.

6. UTILITY SERVICES

6.1 The Contractor is to arrange for the disconnection of all utilities that serve buildings and/or provide as per the requirements alternate arrangements for the services in accordance with the respective requirements and regulations of the relevant authority.

6.2 The Contractor shall liase directly with the service utility authorities to assertion correct procedures and safe working practices related to disconnection of each particular utility service.

6.3 The Contractor shall demolish and remove external utility service lines as follows:

(a) abandoned portions of utility lines located outside areas of new buildings, that are less than 650 mm below proposed finished ground levels.

(b) abandoned portions of utility lines which occur within areas of new buildings

(c) abandoned utility lines that would interfere with installation of new utility lines

(d) other abandoned lines not specified that interface with performance of the work of this contract.

Unless otherwise stated elsewhere in the Documents, the point of disconnection of utility services shall be at a point agreed with by the utility owner.

7. TEMPORARY WORK

7.1 The Contractor is to provide temporary works for protection of existing pavements, utilities, and structures where and when necessary.

7.2 Support is to be provided for members of framed structures before cutting them.

7.3 Where a structure’s stability may be affected by the dismantling and demolition of a member, temporary bracing, and guys, are to be provided to restrain the remaining members.

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8. MEASUREMENT AND PAYMENT

8.1 DISMANTLING AND DEMOLITION OF SUB AND SUPER STRUCTURE

All sorts of salvage material obtained from dismantling and demolition of existing sub and superstructure shall become the property of Contractor. No extra payment shall be made for dismantling and demolition works and cost thereof shall be considered equivalent to the cost of salvage material.

SECTION - 1000

GENERAL REQUIREMENTS

1001 GENERAL

1002 TEMPORARY FACILITIES

1003 PAYMENT OF WORK

NATIONAL ENGINEERING SERVICES PAKISTAN (PVT) LTD.
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1001 GENERAL

01. LOCATION

The Project is located at Pakistan Sports Complex Islamabad, Pakistan.

02. SITE OF WORKS

The site of the works is the area for the Earthwork, Construction of Roads, Drainage, Water Supply & Sewerage System within the boundaries and limits shown on the drawings and such additional areas adjacent thereto as may be designated by the Engineer from time to time for the construction to be performed under the contract.

The Employer will give to the Contractor possession of as much of the area designated and defined as the site and is shown on the drawings in parts or in full as may be required to implement the works when the Engineer's Order to commence work is given.

03. CODES AND STANDARDS

A. Applicable Standards

Except as otherwise provided by these Specifications or the Drawings, all materials, equipment and fabrication and testing thereof shall conform to the latest applicable standards and codes referred in the Specifications by use of the abbreviations explained below:

ACI - American Concrete Institute (USA)
AISI - American Iron and Steel Institute (USA)
AISC - American Institute of Steel Construction (USA)
ANSI - American National Standard Institute (USA)
ASTM - American Society for Testing and Materials (USA)
AASHTO -American Association of State Highway & Transportation Officials.
AWS - American Welding Society (USA)
BS - British Standards (UK)
CP - Codes of Practice (UK)
PS - Pakistan Standards (Pak)
SSPC - Steel Structures Painting Council (USA)
UBC - Uniform Building Code (USA)
USBR - United States Bureau of Reclamation (USA)
MUTCD - Manual on Uniform Traffic Control Devices (USA)

If the Contractor, at any time and for any reason, wishes to deviate from the above standards or desires to use material or equipment not covered by the above standards, he shall state the exact nature of the changes, the reason for making the change and shall submit complete specifications of the materials and equipment to the Engineer for approval.

B. Standards other than those Specified

Where requirements for materials or equipment are specified by reference to a standard which has its origin in one country, it is not the intention to restrict the requirements solely to that standard and that country. Other standards, including standards of other countries, will be accepted provided the requirements thereof, in the sole opinion of the Engineer, are at least equal to the requirements of the standard specified. The Contractor may propose to the Engineer an equivalent standard other than that specified, in which case he shall submit the proposed standard and all other information required and shall submit written proof that his proposed standard is equivalent in all significant respects to the standard specified. All submissions must be made in the English language.

C. Codes and Standards at Site

The Contractor shall supply and have at his site office :-

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a) Copies of all latest editions of codes and standards referred to in these Specifications or equivalent codes and standards as approved by the Engineer.

b) Catalogues and published recommendations from manufacturers supplying products and materials for the project.

c) The Contractor shall provide manufacturer's or supplier's materials which must meet the requirements of a specific code or standard as stated in these Specifications.

04. UNITS OF MEASUREMENTS

The FPS and MKS Systems of Units shall be used throughout the Project.

05. PLANT, EQUIPMENT AND TOOLS

The Contractor shall provide at his cost modern and in good condition plant, equipment and tools, adequate and befitting to the nature, magnitude and size of this Contract, in strict compliance with the requirements of the General Conditions of Contract and Technical Specifications.

06. STORAGE & HANDLING FACILITIES

The Contractor shall make his own arrangements for providing the necessary space for the storage of plant, equipment and materials and for Contractor's temporary office, in and around the site of works, during the currency of the Contract.

07. FIELD LABORATORY AND TESTING

A. General

The Contractor shall provide and maintain a field laboratory equipped with approved equipment to perform all the tests required by the Engineer. The quality control testing shall be performed by the Contractor's competent personnel in accordance with a site testing and quality control programme to be established by the Contractor and approved by the Engineer. The Engineer may however, require certain tests to be performed in any other laboratory designated by him.

The Contractor shall provide laboratory helpers to the Engineer for testing. The laboratory shall be run by a qualified material Engineer and Laboratory Technician to be employed by the Contractor.

The Field Laboratory, including all equipment and staff shall be placed at the disposal and direction of the Engineer during the Contract.

The Contractor shall keep a complete record of all quality tests performed on site.

All quality control and tests shall be carried out in accordance with applicable standards and codes.

B. Field Laboratory Equipment Requirements

The Laboratory shall be equipped with new unused and latest Equipment to perform tests as per Technical Specifications and General Conditions of Contract. Additional equipment/materials shall be supplied by the Contractor as and when required by the Engineer to perform any specified test, at no additional cost to the Employer.

The laboratory shall also be equipped with new unused furniture, fittings and fixtures. If any equipment, furniture, fitting or fixture becomes unserviceable for any reason what so ever, the Contractor shall promptly replace the same as and when directed by the Engineer.

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C. Method of Payment

The cost of providing running and maintenance of the laboratory, equipment, materials and staff, testing charges for materials supplied by the Employer and all other tests to be performed in any other laboratory designated by the Engineer shall be deemed to be included in the quoted unit rates of other items of the Bill of Quantities and no separate claim for payment on this account shall be entertained by the Engineer.

In case the Contractor does not provide the specified equipment and testing facility, cost of testing plus 100 percent overheads shall be recovered from his bills.

08. SURVEYING INSTRUMENTS

A. General

Contractor shall use state of the art surveying equipment. All surveying equipment shall be in good working condition. The quantity of all survey equipment shall be maintained throughout the Contract Period and replaced by the Contractor free of charge in case of damage or loss. The survey equipment shall be supplied to the Engineer at the same time when the Contractor takes over the site and provides the temporary office of the Engineer.

The Survey equipment shall be placed at the disposal and direction of the Engineer during the Contract.

The Contractor shall provide required number of qualified Surveyors and Survey Helpers to the Engineer's Representative for the surveying work.

B. Surveying Equipment Required

The Contractor shall provide and maintain the following surveying equipment for the Exclusive use by the Engineer's Representative at site.

a)	Electronic distance measuring device complete with (400 grades) Universal Theodolite with data logger, aiming head and standard equipment supplied by the manufacturer, including tripod, control unit stand, batteries, charging unit, pole reflector, single prism reflector, three, six and nine prism reflectors complete with tripods and Traverse Equipment for Theodolite.	2 Nos.
b.	Automatic Levels with tripods	4 Nos.
c.	Measuring tapes 50 m long	8 Nos.
d.	Measuring tapes 20 m long	8 Nos.
e.	Steel measuring tapes 5 m long	12 Nos.
f.	Measuring poles w/tripods	18 Nos.
g.	Measuring steel staff (at least 4 meter long)	4 Nos.

All miscellaneous tools, equipment and materials required in surveying.

The Contractor shall provide adequate supplies of the following e materials, i.e. pencil, rubbers and inks drawing papers, pegs, brushes and paints as required by the Engineer's Representative.

09. CONSTRUCTION DRAWINGS

After award of the Contract, the Tender Drawings will be replaced by the Drawings issued for Construction including Supplementary Specifications if necessary. Such Drawings and Specifications shall be deemed to be Further Drawings and Instructions referred in the Conditions of

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Contract. The Drawings Issued for Construction will include Tender Drawings reissued, Tender Drawings as may be modified, and additional drawings as required. The Drawings issued for Construction will be the drawings from which shop, reinforcing steel detail, erection, concrete placing, formwork, or other construction detail drawings shall be prepared by the Contractor. The work shall be executed in conformity with the Drawings Issued for Construction from time to time in accordance with the sequence and schedule of construction.

The Contractor shall check all Construction Drawings carefully as soon as practicable after receipt thereof, and shall promptly advise the Engineer of any errors or inconsistencies discovered.

10. SHOP DRAWINGS AND SCHEDULES

A. Shop/Reinforcement Drawings and Bar Bending Schedule

All shop drawings required for the work(except such drawings that are specified to be furnished by others under separate supply contracts) including reinforcing steel detailing, bending and cutting drawings/bar bending schedules, field erection and layout and construction detail drawings shall be furnished by the Contractor for approval of the Engineer.

Written drawing matter shall be in English. If more detailed drawings are necessary to complete any part of the work, such detailed drawings shall
All drawings shall be complete and shall be submitted in due time and in logical order to facilitate proper coordination. If required by the Engineer, the Contractor shall also submit detailed design calculations to substantiate the shop drawings.

Drawings showing proposed methods of construction and other drawings additional to those referred to herein above, required by the Specifications, shall also be submitted to the Engineer for approval.

B. Submittals

Except as otherwise specified, four (4) white copies of each drawing for approval or review shall be furnished as herein required. Within fifteen calendar days after receipt, the Engineer will send one copy to the Contractor marked Approved, Approved Except as Noted, or Returned for Noted which shall authorize the Contractor to proceed with the work covered by such drawings subject to the corrections, if any, indicated thereon. When prints of drawings have been Returned for Correction, the Contractor shall make the necessary revisions on the drawings and shall resubmit prints for revisions made during the life of the Contract shall be shown by number, date and subject in a revision block. The size of the shop drawings shall be same as the tender drawings.

All of the applicable requirements of this sub-section with reference to drawings to be prepared by the Contractor shall apply equally to catalogues, illustrations, printed specifications, or other data submitted for approval.

Where adjoining work requires shop drawings the Contractor shall prepare and submit composite shop drawings which shall show and define the work under all affected trades. If the Contractor installs work before coordinating with other trades so as to cause interference with work of those trades, he shall make changes necessary to correct the conditions without extra cost to the Employer.

No changes shall be made by the Contractor in the resubmitted shop drawings in excess of the corrections spelled out by the Engineer and in a separate note on the shop drawings.

No work in the shop shall be started and no material or equipment ordered until the Engineer has approved the shop drawings. It shall be the responsibility of the Contractor to submit the shop drawings on a schedule that allows reasonable time for checking and approval and subsequent fabrication. Failure to submit shop drawings in ample time for checking, correcting, and rechecking

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will not justify a delay in time for completion of work.

11. CONSTRUCTION SCHEDULE AND PROGRESS REPORTS

A Construction schedule shall be maintained in accordance with the provisions of the General Conditions of Contract.

The schedule shall be accompanied with sufficient data and information including all necessary particulars of construction plant, equipment, machinery, temporary Works, arrival of plant, equipment at site and their installation, method of operation, work forces employed, etc., for all activities of the Works.

Should the Engineer/Engineer's Representative consider any alteration or addition in the Programme and time schedule, the Contractor shall conform thereto without any cost to the Employer.

Whenever necessary and wherever the progress of the actual works shows departure, the programme and time schedule shall be updated and submitted to the Engineer for his approval.

The Contractor shall submit weekly three copies & monthly six copies of progress reports as per provision of GC-II in a format as agreed by the Engineer. The reports should include updated bar charts, schedules and photographs (in original) taken at appropriate stages of construction of works, a construction schedule indicating the progress in percentage, a description of all works carried out since the last report and a description of the works planned for the next two months, sufficiently detailed to enable the Engineer/Engineer's Representative to determine his programme of inspection and testing.

Progress meetings shall be held at site weekly or at intervals as directed by the Engineer. Representatives of the Contractor, who should be the director or partner, the Engineer, Engineer's Representative or Resident Engineer and if required, the Employer shall review the progress achieved and discuss the plans and requirements for the future.

12. SAMPLES

The Contractor shall furnish for approval of the Engineer with reasonable promptness all samples as directed by the Engineer/Engineer's Representative or specifically called for in these Specifications. The Engineer shall check and approve such samples with reasonable promptness only for conformance with the design concept of the Works and for compliance with the information given in the Contract Documents. All work shall be in accordance with approved samples.

Samples shall be furnished so as not to delay construction or fabrication, allowing the Engineer reasonable time for consideration of the sample submitted.

Each sample shall be properly labeled with the name and quality of the material, manufacturer's name, name of the project, the Contractor's name and the date of submission, and the Specifications Article number to which the sample refers.

The manufacturer's installation directions shall be provided with each sample. The Contractor shall pay all transportation costs and deliver samples to the Engineer's office, Site or testing laboratory as directed by the Engineer/Engineer's Representative.

Samples shall be of adequate size to permit proper evaluation of the material by the Engineer. Where variations in colour, texture, dimensions or other characteristics are to be expected, the Contractor shall submit samples showing the maximum range of variation. Materials exceeding the range of variation of the approved samples shall not be used on the Work.

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If both Shop Drawings and samples are required for the same item, the Engineer may require both to be submitted before approving either.

No acceptance or approval of any Shop Drawings or sample, or any indication or request by the Engineer on any Shop Drawings shall constitute an authorization for any increase in the Contract Sum unless specifically approved by the Engineer.

13. AS BUILT DRAWINGS

The Contractor shall, at all times, keep on site a separate set of prints on which shall be noted neatly, accurately and promptly as the work progresses all significant changes between the work shown on the drawings and that which is actually constructed.

At the completion of the works, the Contractor shall at his expense, supply the Engineer with three copies of these drawings.

14. PROTECTION OF THE WORKS

The Contractor shall whenever necessary cover up and protect the works from weather and damage by his own or other workmen performing subsequent operation. He shall provide all necessary dust sheets, barriers and guard rails and clear away the same at completion.

15. RESTORATION AND CLEANING

Upon completion of the works the Contractor shall restore all items covered by the Contract to the satisfaction of the Engineer.

The Contractor shall do regular cleaning and cleaning away all rubbish and excess materials that may accumulate from time to time on completion and before handing over. Upon completion of the works he shall obliterate all signs of temporary construction facilities such as work areas, structures, foundations of temporary structures, stock piles of excess or waste materials, or any other vestiges of construction, as directed by the Engineer.

16. CONSTRUCTION PROCEDURES

The Contractor shall advise the Engineer of proposed construction procedures in accordance with the General Conditions of Contract.

If the Engineer shall see that the work progress is slow in such away that the work will not be complete in the time specified, then he shall order the Contractor to work overtime or in more shifts and the Contractor shall obey these orders free from additional payments and without any objections or request for compensation.

17. NOTIFICATION TO ENGINEER

The Engineer shall be notified in writing of the nature and location of the Works the Contractor intends to perform the next 15 days so as to enable necessary inspection and measurement to be carried out. The Engineer may, if necessary, direct that longer notice be given of certain operations.

18. NIGHT WORK

When work is done at night the Contractor shall maintain from sunset to sunrise such lights on or about his work and plant as the Engineer may deem necessary for the proper observations of the work and the efficient execution thereof.

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19. WEATHER

No work is to be undertaken when, in the opinion of the Engineer, the weather is so unsuitable that proper protection of the work cannot be ensured.

20. CO-ORDINATION WITH OTHER CONTRACTORS

It shall be the responsibility of the Contractor to co-ordinate and keep-up good relations with other Contractors employed on site by the Employer. The Contractor shall adjust his work plan to facilitate efficient performance of work being carried out by other contractors/persons at site.

21. ACCIDENT PREVENTION, PROTECTIVE EQUIPMENT

The Contractor shall comply and enforce compliance also by all his sub-contractors (if possible) with the highest standards of safety and accident prevention in accordance with international standards and in compliance with all applicable laws, ordinances and statutory provisions.

All requisite barriers, fences, warning signs, lights and other safety precautions as required for the protection of persons and property on or adjacent to the site shall be provided at the Contractor's cost.

All falsework, scaffolding and hand rails shall be well constructed and secured at all times. Where overhead work is being carried out, warning signs shall be installed at ground level clearly warning of the overhead work.

All warning signs shall be in two languages, English and Urdu, and shall at all times be maintained in a clean and legible condition, to the satisfaction of the Engineer/Engineer's Representative.

Trash shall be removed at frequent intervals to the satisfaction of the Engineer/Engineer's Representative.

1002 TEMPORARY FACILITIES

The Contractor shall provide, erect or install, maintain alter as necessary and remove on completion when directed by the Engineer all temporary facilities and services including access roads as described hereinafter and/or in the Contract Document and/or instructed and approved by the Engineer.

01. Facilities for the Engineer

A. Site Office

As indicated in Sub-Clause 15.5, of Special Provisions of Contract.

B. Transport

As indicated in Clause 16, of Special Provisions of Contract.

02. Temporary Roads

The Contractor shall construct, operate and maintain such temporary roads as may be necessary, from the site to the nearest road and also within the Project limits. Such roads shall be positioned strictly in accordance with the Engineer's instructions and the Contractor shall reduce or control any dust nuisance by spraying with water as directed.

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03. Temporary Services

A. Temporary Water Supply

The Contractor shall supply in sufficient quantity all necessary potable and other water for construction purposes for all trades at point within a reasonable distance of any road or pavement being constructed. He shall make arrangements and pay charges for water service installation, maintenance and removal thereof, and pay the costs of water for all trades.

At completion of the work the temporary water services equipment and piping shall be removed by the Contractor at his own expense.

B. Temporary Electricity

The Contractor shall make all the necessary arrangements for a temporary electricity service, pay all expense in connection with the installation, operation and removal thereof and pay the costs of electricity consumed by all trades.

In the event that the site can not be connected to a local electricity network or where the available power is insufficient the Contractor has to make his own temporary provision for electricity generation and maintain such temporary installation.

A temporary lighting system shall be furnished, installed and maintained by the Contractor as required to satisfy the minimum requirements for safety and security and to the satisfaction of the Engineer/Engineer's Representative.

Any expense, loss or damage suffered by the Contractor as a result of any interruption in power supply shall be born by the Contractor alone.

C. Waste Disposal

The Contractor shall make such temporary provisions as may be required in order to dispose of any chemicals, fuels, oils, grease, bituminous materials, waste and soil waste and the like without causing pollution to either the site or the environment. Disposal of any materials, wastes, effluents, garbage, oil, grease, chemicals and the like shall be in areas specified by the concerned local authority proposed by the Contractor and subject to the approval of the Engineer. If any waste material is dumped in unauthorized areas the Contractor shall remove the material and restore the area to the condition of the adjacent undisturbed area. If necessary, contaminated ground shall be excavated, disposed off as directed by the Engineer and replaced with suitable fill material compacted and finished with topsoil all at the expense of the Contractor.

Contractor shall provide concrete washout areas as specified in the specifications or as directed by the engineer.

D. Fire Protection

The Contractor shall provide and maintain adequate fire protection in the form of barrels of water with buckets, fire bucket tanks, fire extinguishers, or other effective means ready for instant use, distributed around the project and in and about temporary inflammable structures during construction of the works.

Gasoline and other flammable liquids shall be stored in and dispensed from safety containers

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approved by the Engineer and storage shall not be within building.

Torch-cutting and welding operations performed by the Contractor shall have the approval of the Engineer before such work is started and a chemical extinguisher is to be available at the location where such work is in progress.

The Contractor shall follow the instructions and specifications of the Civil Defence Department.

1003 PAYMENT OF WORK

No payment shall be made for the works involved within the scope of this section of specification unless otherwise specifically stated in the Bills of Quantities or herein.

The cost thereof shall be deemed to have been included in the quoted unit rate of other items of the Bills of Quantities.

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SECTION - 1100

EARTHWORK

1. SCOPE

2. SUBMITTALS

3. CODES AND STANDARDS

4. EQUIPMENT

5. EXECUTION

6. MEASUREMENT AND PAYMENT

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1. SCOPE OF WORK

The work under this section of the specifications consists of furnishing all plant, labor, equipment, appliances and materials and in performing all operations in connection with earthwork of all underground services and structural units, roads and temporary drainage, stock piling of suitable excavated material, disposal of unsuitable and surplus excavated material in accordance with this section of specifications, the applicable drawings and subject to terms and conditions of the Contract. The Contractor shall make his own arrangement (including obtaining permissions from the concerned agencies/authorities for the use of land/areas in the immediate vicinity of the Project Site and the payments in this regard if any) for the acquisition of areas to be used for stockpiling of suitable excavated material. This section includes stripping of top soil, general excavation, flattening of cut slopes structural excavation, trench excavation, backfilling, construction of embankments, filling depressions or low lying areas and disposal of all unsuitable and surplus material as required to construct roads, utilities, and other structures

2. SUBMITTALS

The Contractor shall perform a joint survey with the Engineer's Representative, of the area where earthwork is required, plot the ground levels on the drawings and obtain approval from the Engineer before starting the earthwork.

3. CODES AND STANDARDS

Material, construction and testing shall comply with the following codes and standards:

ASTM C 136	Sieve or screen analysis of fine and coarse aggregate
ASTM D 1556	Density of soil in place by the sand cone method
ASTM D 1557	Moisture - Density relation of soils using 10 Lbs Hammer and 18 inches drop
ASTM D 2167	Density of soil in place by the Rubber- Baloon method
ASTM D 2216	Moisture content of soil

Other testing methods equivalent to ASTM methods given above shall be allowed after prior approval of the Engineer/Engineer's Representative. In case of any dispute regarding above mentioned codes and standards, the latest codes and standards being used by National Highway Authority, Ministry of Communication, Government of Pakistan shall be used.

4. EQUIPMENT

The Contractor shall submit, as stipulated in the "Instructions to Tenderer" a detailed list of plant and equipment which he shall undertake to bring to the site to carry out the work. The list shall satisfy the Engineer/Engineer's Representative as to type, size and quantity. The list shall include for each piece of equipment the type, manufacturer, model, identification number and year of manufacture. The Contractor shall place on the site of the work all of the equipment listed and all subsequent equipment required for approval of the detailed program of work and such equipment which may be directed by the Engineer/Engineer's Representative. All equipment which is proposed to be used on the work shall be of sufficient size and in such mechanical condition as to meet requirements of work and produce a satisfactory quality of work. In no case shall the Contractor remove from the site the plant and equipment without the written approval of the Engineer/Engineer's Representative. The Contractor shall supply all plant and equipment necessary for the construction of each phase of the work and it must be on site, inspected and approved by the Engineer/Engineer's Representative. If after use of the equipment the Engineer/Engineer's Representative determines that the work provided does not meet the Contract requirement, the equipment shall be changed and the deficient work shall be removed and corrected as directed by the Engineer/Engineer's Representative.

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5. EXECUTION

The Contractor shall be deemed to have made local and independent inquires as to, and shall take the whole risk of, the nature of the ground subsoil or material to be excavated or penetrated and the Contractor shall not be entitled to receive an extra or additional payment nor to be relieved from any of his obligations by reasons of the nature of such ground subsoil or material.

All excavations, cuts and fills shall be constructed to the lines, levels, slopes and gradients specified with any necessary allowance for consolidation, settlement and drainage so that at the end of the Defects Liability Period the ground shall be at the required lines, levels and gradients. During the course of the Contract and during the Defects Liability Period any damage or defects in cuts and fills, in structures and other works or rolling of stones/boulders caused by blasting or otherwise, slips, falls of wash-ins or any other ground movement due to the Contractor's negligence shall be made good by the Contractor at his own cost.

All materials from stripping of top soil and excavation shall be used unless otherwise declared unsuitable or surplus by the Engineer/Engineer's Representative.
The Contractor shall jointly survey the area marked for roads, service lines, buildings or other structures or any area designated by the Engineer/Engineer's Representative and prepare the survey drawings showing natural ground profile and cross-sections at 25ft interval and submit to the Engineer/Engineer's Representative for approval prior to start of any earthwork operation.

All suitable material from stripping of top soil and excavations shall be transported to and placed in fill areas or stockpiled at locations designated by the Engineer/Engineer's Representative.

If any existing service lines, utilities and utility structures which are to remain in service are uncovered or encountered during the operations, shall be safe guarded, protected from damage and supported at Contractor's risk and cost as directed by the Engineer/Engineer's Representative.

The Contractor shall provide drainage outlets, ditches or channels as may be necessary to effect proper drainage before rains and will not start work in any water course unless alternate arrangements for the flow are made.

If any part of work is damaged due to bad weather or any other reason the contractor will restore the same at his own expense.

The Contractor shall construct side ditches, interception ditches, and inlet and outlet ditches as shown on the Drawings or where ordered by the Engineer/Engineer's Representative whether for temporary or permanent drainage. In order to keep water away from the embankment or filling during construction, the Contractor shall at all times ensure adequate drainage by so scheduling ditch and outlet construction that the drainage is operative before work is begun on the embankments or filling.

Where indicated on the drainage or when required by the Engineer, the Contractor shall take cross-sections of existing stream channels, and in collaboration with the Engineer/Engineer's Representative, mark them with details of the excavation required for the relocation of the stream channel. Work shall not proceed without written approval of the marked cross- section by the Engineer/Engineer's Representative.

5.1 SITE PREPARATION

5.1.1 The Contractor shall set out the work and shall be responsible for true and perfect setting out of the same and for correctness of the positions, levels, dimensions and alignments of all parts thereof. If at any time any error in this respect shall appear during the progress of the work, the Contractor shall at his own expense rectify such error, to the satisfaction of the Engineer/Engineer's Representative.

5.1.2 The Contractor shall construct and maintain accurate bench marks so that the Lines and Levels can be easily checked by the Engineer/Engineer's representative.

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5.2 EXCAVATIONS

5.2.1 The Contractor shall set out the work and shall be responsible for true and perfect setting out of the same and for correctness of the positions, levels, dimensions and alignments of all parts thereof. If at any time any error in this respect shall appear during the progress of the work, the Contractor shall at his own expense rectify such error, to the satisfaction of the Engineer/Engineer's Representative.

5.2.2 The excavation may be done by mechanical excavators and/or by normal means and the excavated materials be disposed off to stock on spoil as directed by the Engineer. Unless otherwise specified by the Engineer, leveling, trimming and finishing to the required levels and dimensions shall be done manually. The material suitable for fill and backfill if approved by the Engineer shall be stockpiled in and around the Project Site at locations designated and approved by the Engineer.

Excavated material unsuitable for use as fill and backfill shall be disposed off by the Contractor at safe and suitable locations, as approved by the Engineer.

5.2.3 The Contractor shall give reasonable notice that he intends to commence any excavation and shall submit to the Engineer full details of his proposals. The Engineer's approval shall not relieve the Contractor of his responsibility with respect to such work.

5.2.4 The Contractor shall preserve the completed excavation from damage due to slips and earth movements, ingress of water from any source whatsoever and deterioration by exposure to the sun and the effects of the weather.

All excavations shall be kept free of water and shall be maintained dry to the satisfaction of the Engineer. Prevent surface water and sub-surface water from flowing into the excavation and flooding the project site and surroundings.

Do not allow water to accumulate in excavations, remove water from excavations to prevent softening of foundation bottoms, under cutting footings and soil changes detrimental to the stability of sub-grades and foundations. Provide discharge lines necessary to convey the water away from the excavations. Convey water, removed from excavation and rain water, to outside the limits in manner that no damages are caused to the surrounding services properties.

5.2.5 Excavation for pits, cable trenches, equipment-foundations and other structures shall be taken out to the levels and dimensions shown on Drawings or such other levels and dimensions as the Engineer may direct.

5.2.6 Excavation shall extend to adequate distance from walls and footings to allow for placing and removal of forms, installations of services and for inspection, except where the concrete for walls and footings is authorized to be deposited directly against excavated surfaces. Undercutting will not be permitted. The additional excavation for placing and removal of forms, installation of services, for inspection and generally for working area on slopes for stability shall not be measured for payment and shall be deemed to be included in the rates for excavation as measured net.

5.2.7 All excavations in foundations shall be taken to 6 inch above the final excavation elevations shown on the drawings and the last 6-inch shall be trimmed carefully to a smooth and level surface. Immediately after trimming to the final elevation, a layer of blinding concrete shall be placed to the thickness shown on the drawings. All excavations for foundations which have been trimmed and disturbed shall be compacted and covered by lean concrete by the end of the day.



5.2.8 No excavation shall be refilled nor any permanent work commenced until the foundation has been inspected by the Engineer and his permission to proceed is given.

5.2.9 If excavation for sub-structures are carried below the required level, as shown on the Drawings or as directed by the Engineer, the surplus depth shall be filled in with concrete of same grade as of blinding concrete at the sole cost of the Contractor.

5.2.10 The placing of blinding concrete, placing of reinforcement and casting of the permanent works in the excavation shall be carried out in the dry condition.

5.2.11 Shoring, where required during excavation, shall be installed to protect workmen and the bank, adjacent paving, structures and utilities. The term shoring shall also be deemed to cover whatever methods the Contractor elects to adopt, with prior approval of the Engineer, for upholding the sides of excavation and also for planking and strutting to excavation against the side of roadways and adjoining properties in existing hardcore of any other material. The Contractor will be held responsible for upholding the sides of all excavations and no claim for additional excavation, concrete or other material will be considered in this respect.

5.2.12 Existing utility lines that are shown on the drawings or the locations of which are made known to the Contractor prior to excavation and that are to be retained, as well as utility lines constructed during excavation and backfilling, and if damaged, shall be repaired by the Contractor at his own expense. Any existing utility lines which are not known to the Contractor in sufficient time to avoid damage, if inadvertently damaged during excavation, shall be repaired by the Contractor and adjustment in payment will be made as approved by the Engineer. When utility lines which are to be removed, are encountered within the area of operations the Contractor shall notify the Engineer in ample time for the necessary measures to be taken to prevent interruption of the service.

3.2.13 Where applicable the excavation work shall include the excavation above water table and excavation below water table. The Contractor shall provide all plant, equipment, pumps, sheeting, well points as required to keep the water table 3.0 feet below the deepest foundation as shown on the drawings till the completion of foundation works.

3.2.14 Before starting the excavation for pipelines, the Contractor shall ensure the correct alignment of the pipeline on the ground the depth and width of excavation of the trench, all in accordance with the Drawings and instructions of the Engineer. The Contractor shall make profile with cement concrete pillars.

Excavation shall be carried out true to lines, levels, grades and widths as shown on the drawings or as directed by the Engineer ensuring proper laying of the pipe line, the bedding fill, construction of chambers for appurtenances and any other structures. The trench bottom shall be graded to provide even and substantial bearing over the specified bedding and of the structure.

Without the written permission of the Engineer, not more than 600 feet of the trench shall be opened in advance of the completed pipeline.

3.2.15 The Engineer may require the Contractor to excavate below the elevations shown on the drawings or may order him to stop above the elevations shown depending upon the suitable foundation material encountered.

3.2.16 If for any reason, the levels, grades or profiles of the excavations are changed adversely by the Contractor, the Contractor shall at his own cost, be liable to bring the excavations to the required levels and profiles as shown on the drawings or as directed by the Engineer.

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5.3 EXCAVATION TOLERANCES

All slopes, lines and grades shall be true, correct and accurate to those shown in the plans or otherwise directed and approved by the Engineer. The sub-grade in cuts shall be accurate to the authorized profile grade for the sub-grade to ± one inch (1"). Where discrepancies are found in the work the Contractor shall make the necessary corrections.

5.4 FILL AND BACKFILL

5.4.1 The backfilling shall include filling under the floors, around the foundation trenches/walls, pipes, conduits, ducts and channels.

The backfilling shall include loading, unloading, transporting, placing, stacking, spreading of earth, watering, rolling, ramming and compacting, etc., complete as specified herein.

5.4.2 Backfill shall be either using granular backfill material or common backfill as directed and approved by the Engineer. Granular backfill materials shall meet the following requirements.

a) Grading Requirements

Mm	Inch	A	B
25	1"	100	100
19	3/4"	60 – 100	75 – 100
4.75	No. 4	50 – 85	55 – 100
2.0	No. 10	40 – 70	40 – 100
0.425	No. 40	25 – 45	20 – 50
0.075	No. 200	0 – 15	5 – 15

b) Material satisfying the requirements of coarse sand falling under soil classification A–3 (AASHTO). In case coarse sand is utilized for granular fill it shall be ensured that the same is confined properly with approved material.

c) The material shall have a plasticity index of not more than six (6) as determined by AASHTO T – 89 and T – 90.

5.4.3 The excavated material if found suitable shall be stockpiled. This material shall be used for filling/back-filling if approved by the Engineer and shall be transported by the Contractor anywhere required for the purpose of filling/back-filling work in this Contract. The surplus stockpiled material left over after the completion of fill and back-filling works shall be disposed off by the Contractor and the area to be cleaned up and left in a condition as was prior to its use for stockpiling.

5.4.4 The Contractor shall provide the approved quality of backfill and fill material required to complete the fill and back-filling work from the places as designated by the Engineer.

Deep filling shall be predominantly granular material and free from slurry mud, organic or other unsuitable matter and capable of compaction by ordinary means.

5.4.5 Material for backfilling shall be as approved by the Engineer and shall be placed in layers not exceeding six (6) inches measured as compacted material with sufficient water and compacted to produce in-situ density not less than 95% of the maximum dry density at optimum moisture content.

Depending on the depth of fill the Engineer may instruct increased thickness of successive layers to be placed.

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The filling shall be compacted by mechanical means or as approved by the Engineer.

5.4.6 Filling around pipes and cables shall be carefully placed with fine material to cover the pipe or cable completely before the normal fill is placed.

5.4.7 Backfilling of trenches/foundations shall be carried out only after the pipe line/structural works within the excavations have been inspected, tested and approved by the Engineer.

5.4.8 Fill shall not be placed against foundation walls prior to approval by the Engineer. Fill shall be brought up evenly on each side of the walls as far as practicable. Heavy equipment for spreading and compacting the fill shall not be operated closer to the wall than a distance equal to the height of the fill above the top of footing.

5.4.9 Before the start of fill and backfill, the Contractor shall satisfy himself as to the levels and slopes of the fills and backfill shown on the Drawings, the requirements of compaction, the possibility of settlement & all other particulars whatsoever in connection with the filling works.

5.4.10 All filled areas shall be left neat, smooth and well compacted, the top surface consisting of the normal site surface soil, unless otherwise directed.

5.5 TOLERANCES

The stabilization of compacted backfill/fill surface shall be smooth and even and shall not vary more than 3/8 inch in 10 feet from true profile and shall not be more than 1/2 inch from true elevation.

5.6 DISPOSAL OF SURPLUS EXCAVATED MATERIAL

5.6.1 The rejected unsuitable material and surplus excavated material shall be disposed off at locations approved by the Engineer. No compensation of any lead/lift is admissible and rates quoted shall be deemed to include the same. The surplus excavated material shall be so placed that it will present a neat appearance and not offer any danger to abutting properties.

5.6.2 The material shall be declared unsuitable if the soaked CBR (96 hours) is less than five (5) percent or if falls under A-6 or A-7 of AASHTO soil classification.

5.6.3 The disposal of surplus/unsuitable excavated material shall include loading, unloading, transporting, stacking, spreading and leveling and as directed by the Engineer.

6. MEASUREMENT AND PAYMENT

6.1 General

Except otherwise specified herein or else where in the Contract Documents, no measurement and payment will be made for the under mentioned works related to the relevant BOQ items. The cost thereof shall be deemed to have been included in the quoted unit rate of the respective items of the Bill of Quantities.

6.1.1 Timber shoring, planking, strutting and providing slope for upholding the sides of excavations.

6.1.2 Any fill with approved material necessitated by over excavation due to fault or convenience of the Contractor except under structural members.

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6.1.3 Stockpiling the excavated material and transporting back suitable material to places requiring fill or backfill.

6.1.4 Specified foundation bed preparation.

6.1.5 Excavation involved in providing adequate working space around sides of foundation and service line trenches.

6.1.6 Providing approved quality fill/backfill material obtained from excavated material as designated by the Engineer.

6.1.7 Excavation in rock, control of and removal of water during or after earthwork operations.

6.1.8 Rolling, leveling, watering & compacting the fill and backfill to required density.

6.1.9 All laboratory and field tests stipulated in these specifications.

6.1.10 Disposal of rejected surplus and unsuitable excavated material and left-over stockpiled suitable material at locations approved by the Engineer. No compensation of any lead/lift is admissible and rates quoted shall be deemed to include the same.

6.1.11 De-watering to keep the foundations dry during construction.

6.1.12 Obtaining permissions from the concerned agencies/authorities for the use of land/areas in the immediate vicinity of the Project Site and the payments in this regard if any for stockpiling of suitable excavated material.

6.2 Excavation

6.2.1 Measurement

Quantities of excavation shall be calculated/measured from the pre-work levels of leveled and graded ground taken jointly by the Contractor and the Engineer before commencement of the work.

The quantities set out for excavation and its subsequent disposal shall be deemed to be the bulk quantity before excavating and no allowance shall be made for any subsequent variations in bulk or for any extra excavation.

Unless otherwise shown on the Drawings quantities of excavation shall be measured of acceptably completed works on the basis of vertical excavations required in accordance with lines of concrete.

Quantities of excavation for laying service line trenches shall be measured for payment on the basis of vertical excavation faces for the specified width for the trench as shown on the drawings.

Measurement for acceptably completed excavation works shall be made on the basis of number of cubic feet of material excavated for foundation and service trenches as shown on the Drawings or as directed by the Engineer.

6.2.2 Payment

Payment will be made for acceptably measured quantity of excavation on the basis of unit rate per cubic feet quoted in the Bills of Quantities and shall constitute full compensation for all the works related to the item, including but not limiting to back filling.

6.3 Backfill/Fills

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6.3.1 Measurement

Measurement for acceptably completed backfill/fill works will be made on the basis of number of cubic feet of compacted backfill/fill in position in accordance with the lines, levels and grade as shown on Drawings or as directed by the Engineer.

6.3.2 Payment

Payment will be made for acceptably measured quantity of backfill/fill on the basis of unit rate per cubic feet quoted in the Bills of Quantities and shall constitute full compensation for all the works related to the item.

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SECTION - 2230

GENERAL EXCAVATION

2231 GENERAL

2232 EXECUTION

2233 MEASUREMENT AND PAYMENT

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2231 GENERAL

This work shall consist of excavation for road way, side slopes, and other areas and shall include removal, loading, transportation/haulage, unloading and disposal of all kind of soil/ materials wet or dry of whatever nature encountered including rocks, boulders, gravels and conglomerate if any and regardless of the manner in which they are removed, unless otherwise specified upto any lead and lift within the project boundary at locations designated or approved by the Engineer/Engineer's Representative. Excavation shall be performed to the lines, grades and levels as shown on the plans or as directed by the Engineer/Engineer's Representative.

01. GENERAL EXCAVATION

General excavation shall consist of the removal and satisfactory disposal of all unsuitable or surplus material. General excavation shall include all materials of whatever nature encountered during execution of works and no classification for surface or sub-surface shall be made. It would also include such excavation as is necessary for temporary ditches and channels.

All materials removed from excavation shall be used in the formation of embankment or filling the relatively lower level areas, and at other such locations as directed, unless it is declared unsuitable or surplus by the Engineer/Engineer's Representative.

Excessive or Surplus material removed from excavation shall be disposed off on the expense of the contractor to the locations approved by the engineer. No additional compensation will be made for such diposal.

Any information concerning properties of soil which may be shown in the soil report, in the Bill of Quantities or as a result of discussion with the Engineer/Engineer's Representative or others shall not be a basis for the Contractor's determination of bid prices.

General Excavation shall also be performed for temporary drainage so that the area of the site and the area immediately surrounding the site and effecting operations at the site will be continually and effectively drained. Water shall not be permitted to accumulate in crawl-space areas and in the excavation. The excavation shall be drained by satisfactory methods to prevent softening of the foundation bottom, undercutting of footings, or other action detrimental to proper construction procedures.

02. ROCK EXCAVATION

Authorized "Rock Excavation" to be measures in cubic meters shall consist of the area that is necessary to provide the design section and grade or as directed by the engineer. Any over breakage beyond the lines shown on the plans and outside of the tolerances set for subgrade in cuts shall not be paid for. The engineer shall define the beginning and ending points of the areas classified as "Rock Excavation". Any area over excavated in the subgrade shall be reinstated at the cost of contractor as directed by the engineer.

The pay quantity for "Rock Excavation" shall be computed by means of average end area method from approved cross-sections based on original ground elevations after the authorized removal of unsuitable or overburden materials, if required.

For disposal of excavation rock material, same procedure shall be followed as described above for the "General Excavation".

Rock Excavation shall be classified as under:



a. Hard Rock

Any rock which can not be removed with ripper of a 200 HP Bulldozer and constitutes a firm and continuous bed of rock only

b. Soft Rock

Any rock which can be removed with the blade of 200 HP Bulldozer. This item will be termed as soft rock, irrespective of the fact that it is removed by blasting.

03. EXPLOSIVES

Where explosives are used the Contractor shall provide suitable buildings or warehouses in approved positions for the storage of explosives, which shall be stored in the manner and quantity approved by the Engineer/Engineer's Representative. Such storage places shall be accessible only to authorized personnel. They shall be properly marked, all doors or accesses thereto shall be constructed of materials as directed by the Engineer/Engineer's Representative, and provided with secure locks and all necessary means of preventing access by unauthorized persons.

The Contractor shall be responsible for the prevention of any unauthorized issue or improper use of any explosives. The handling of explosives shall be entrusted only to experienced and responsible men, shall be to the satisfaction of the Engineer/Engineer's Representative, and in conformity with the statutory regulations.

All drilling and blasting shall be done in such a manner as to bring excavation as close as possible to the required cross sections, and to disturb as little as possible the material to be left in place. Blasting by means of drill holes, tunnels, or any other method shall be performed at the entire risk and responsibility of the Contractor who shall have no claim to payment for extra work occasioned by breakage outside the approved cross-sections.

The greatest care shall be taken by the Contractor during all blasting operations, to ensure no injury be done to persons or damage to property or to the finished work. Shots shall be properly loaded and capped and only a moderate charge shall be used in each hole . A register of all explosives used showing locations and amounts shall be kept by the Contractor for checking by the Engineer/Engineer's Representative.

Where directed by the Engineer/Engineer's Representative, the Contractor shall provide heavy mesh blasting mat for protection of persons, property and the work. If found necessary, blasting shall be restricted to times prescribed by the Engineer/Engineer's Representative.

The Engineer/Engineer's Representative may prohibit blasting and order the rock to be excavated by other means, if, in his opinion it would be dangerous to persons or adjacent structures, or is being carried out in a reckless manner.

2232 EXECUTION

Suitable equipment shall be used for carrying out excavation. Excavation shall be done to the lines, grade and levels as shown on the plan or ordered by the Engineer/Engineer's Representative.

Water in excavation shall be controlled and removed/discharge through temporary ditches or by pumps and shall be wasted at locations as approved. Surface drainage shall be diverted away from the work. Any damage to work attributable to wetting through failure to provide such adequate surface drainage or sub-surface drainage shall be immediately repaired by the Contractor.

Sheeting and bracing shall be provided and installed when required to support the wall of excavation as approved. The width of excavations shall allow for the space occupied by sheeting

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and bracing.

Where areas have been over excavated, the elevations shown shall be re-established as approved.

The Engineer/Engineer's Representative may order the removal of material resulting from landslides, the construction of benches in or above the cut slope or in the embankment slope or where in his opinion the slope shows signs of instability, the flattening of the slope.

Excavation shall be performed within the tolerances for excavation limits indicated on the drawings. Where no tolerance limits are indicated such as for preparation of sub-grade, the excavation surface tolerance shall not vary more than four (4) inches from true profile unless the excavated surface is sub- grade.

2233 MEASUREMENT AND PAYMENT

No separate payment will be made for blasting, control of or removal of water during or after earthwork operations. The cost of blasting, blasting mesh, sheeting, shoring, cofferdams, pumping and draining shall be included in the bid prices for earthwork The Contractor shall provide necessary facilities for dewatering and for draining or diverting water courses when necessary for the protection of the contract work and where required by the Engineer/Engineer's Representative.

When payment is specified on volume basis in the Bill of Quantities, the quantities shall be computed by the Contractor on the basis of pre-work levels attested by the Engineer/Engineer's Representative. The contractor may opt the survey already carried out by the consultants/employer for planning and designing of the project if agreed mutually. The Engineer/Engineer's Representative shall check all or any part of the work to determine conformation with the lines, levels, elevations and cross- sections submitted by the Contractor before attestation.
No separate measurement or payment shall be made for excavation for contractor's temporary roads and for other temporary works for contractor's own use.

The quantities determined as provided above shall be paid for at the contract unit price for the pay item shown in the Bill of Quantities which price shall constitute full compensation for the cost involved in the proper completion of the work as specified.

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SECTION 2300

PLAIN AND REINFORCED CONCRETE

1. SCOPE

2. APPLICABLE STANDARDS

3. SUBMITTALS

4. MATERIALS

5. DELIVERY, STORAGE AND HANDLING

6. EXECUTION

7. TEST OF CONCRETE QUALITY

8. FINISHING OF FORMED SURFACES

9. REPAIR OF SURFACE DEFECTS

10. CONCRETE CONSTRUCTION TOLERANCES

11. ACCEPTANCE OF STRUCTURE

12. MEASUREMENT & PAYMENT

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1. SCOPE

The work under this section of the specification consists of furnishing all plant, labour, equipment, appliances and materials and in performing all operations in connection with the supply and installation of plain and reinforced concrete work complete in any floor and at any height as per drawings except where specifically stated in the relevant item of Bill of Quantities, in strict accordance with this section of the specifications and the applicable drawings, and subject to the terms and conditions of the Contract. The scope of this section of specification is covered with detailed specifications as laid down herein.

2. APPLICABLE STANDARDS

Latest editions of the following Pakistan, British and ASTM Standards are relevant to these specifications wherever applicable.

2.1 ASTM (AMERICAN SOCIETY FOR TESTING AND MATERIALS)

B 370	Copper sheet and strip for building construction.
C 33	Concrete Aggregates.
C 40	Organic impurities in sand for concrete.
C 87	Effect of organic impurities in fine aggregates on of mortar.
C 88	Soundness of aggregates.
C 94	Ready mixed Concrete.
C 109	Compressive strength of hydraulic cement mortars.
C 117	Material finer than No.200 (0.075mm) sieve.
C 123	Light-weight pieces in aggregates.
C 125	Concrete and concrete aggregates.
C 127	Specific gravity and absorption of coarse aggregate.
C 128	Specific gravity and absorption of fine aggregate.
C 131	Resistance to abrasion of small size coarse aggregates.
C 136	Sieve or screen analysis of fine and coarse aggregate.
C 142	Clay lumps and friable particles in aggregates.
C 143	Slump of Portland Cement Concrete.
C 144	Aggregate for masonry mortar.
C 150	Portland Cement.
C 156	Water retention by concrete curing material
C 171	Sheet material for curing concrete.
C 185	Air content or hydraulic cement mortar.
C 188	Density of hydraulic cement.
C 191	Time of setting of hydraulic cement by vicat needle.
C 260	Air entraining admixtures for concrete.
C 289	Potential reactivity of aggregate.
C 309	Liquid membrane-forming compounds for curing concrete.
C 330	Lightweight aggregates for structural concrete.
C 331	Lightweight aggregates for concrete masonry.
C 332	Lightweight aggregates for insulating concrete.
C 494	Chemical admixtures for concrete.
C 535	Resistance to abrasion of large size coarse aggregates.
C 567	Unit weight of structural lightweight concrete.
D 75	Aggregate sampling.
D 994	Preformed expansion joint filler for concrete.
D 1190	Concrete joint sealer (hot poured elastic type).
D 1751	Preformed expansion joint filler for concrete paving and structural construction.
D 1752	Preformed sponge rubber and cork expansion joint fillers for concrete paving and structural construction.
D 1850	Concrete joint sealer (cold application type).
E 11	Wire cloth sleeves for testing purposes.
E 96	Water vapor transmission of materials in sheet form.
E 154	Materials for use as vapor barrier under concrete slabs.
E 337	Relative humidity by wet and dry bulb psychrometer.

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2.2 ACI (AMERICAN CONCRETE INSTITUTE)

211.1 Recommended practice for selecting proportions for normal and heavy weight concrete.
214 Recommended practice for evaluation of strength test result of concrete
301 Specifications for structural concrete for buildings.
304 Recommended practice for measuring, mixing, transporting and placing concrete.
305 Hot weather concreting.
306.1-90 Standard Specifications for Cold Weather Concreting
306R-88 Cold Weather Concreting
308 Recommended practice for curing concrete.
309 Recommended practice for consolidation of concrete.
318 Building code requirements for reinforced concrete.
347 Recommended practice for concrete formwork.
512 Pre-cast structural concrete in building.
517 Low pressure steam curing.
533 Fabrication, handling and erection of pre-cast concrete wall panels.

2.3 BRITISH STANDARDS

BS 12	Portland cement, ordinary and rapid hardening.
BS 410	Test Sieves.
BS 812	Methods for the sampling and testing of mineral aggregates, sands and fillers.
BS 882	Coarse and fine aggregates from natural sources.
BS 1305	Batch Mixer.
BS 1881	Methods of testing and sampling concrete.
BS 3148	Tests for water for making concrete.
BS 3837	Expanded polystyrene boards.
BS 5328	Structural Concrete.,
BS 3869	Rigid expanded polyvinyl chloride for thermal insulation.
BS 3927	Phenolic foam materials for thermal insulation and building applications.
BS 4027	Sulphate-resisting Portland cement.
BS 8110	Structural use of concrete.
CP 114	Structural use of reinforced concrete in buildings.
CP 116	Structural use of precast concrete.
CP 5337	The structural use of concrete for retaining aqueous liquids.

In addition, the latest editions of other Pakistan and British Standards, American Concrete Institute Standards, American Society for Testing and Materials Standards and other Standards as may be specified by the Engineer for special Materials and Construction are also relevant.

3. SUBMITTALS

3.1 Suitable templates or instructions or both shall be provided for setting out items not placed in the forms. Embedded items and other materials for mechanical and electrical operations shall have been completed, inspected, tested and approved before concrete is placed.

3.2 For special concrete finish and for special methods of construction (e.g. slip forms) formwork shop drawings shall be designed and prepared by the Contractor, at his own cost. Approval of shop drawings as well as that of actual samples of concrete finish shall be obtained before work is commenced.

3.3 The Contractor shall supply to the Engineer at fortnightly intervals, test certificates with the appropriate standard in respect of the samples of cement from the work-site. These tests shall be carried out in a laboratory approved by the Engineer.

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3.4 The grading of the coarse and fine aggregates shall be tested at least once for every 100 tons supplied, to ensure that the grading is uniform and same as that of the samples used in the preliminary tests.

3.5 Where doubt exists as to the suitability of the water, it shall be tested in accordance with BS 3148.

3.6 The Contractor shall provide Mix design by weight for each class of concrete.

Manufacture 12 test cubes for each 3 mix design batches (6 x 6 x 6) inches in accordance with the Mix design batching by weight and test 3 cubes each at 3,7,14 & 28 days intervals in the presence of Engineer's Representative and submit all relevant data and results of tests for approval of the Engineer. The Contractor shall obtain approval from the Engineer in writing for each Mix design before producing the actual concrete for the Works.

3.7 'Workability' of Concrete shall be determined by either the slump or compaction factor tests as directed by the Engineer and these shall be performed in accordance with the methods given ASTM C 143.

The slump or compaction factor for each class of concrete shall be determined during the preliminary Test mixes and the value obtained shall not be modified without the written consent of the Engineer.

3.8 Manufacturer's recommendations and instructions along with the sample of material shall be submitted to the Engineer for his approval.

3.9 The Contractor shall, at his own cost, make optimum mix design and testing for approval of the composition of Non Shrinking grout and Non Shrink second stage Concrete Grout, prior to Commencement of the work.

3.10 The Contractor shall be required to submit a sample of pre-cast unit for the approval of the Engineer; all pre-cast units shall strictly conform to the approved sample. The proposal for transporting and erecting pre-cast units in position shall also be submitted by the Contractor for the approval of the Engineer.

4. MATERIALS

4.1 Aggregates

4.1.1 The sources of supply of all fine and coarse aggregates shall be subject to the approval of the Engineer.

4.1.2 All fine and coarse aggregates shall be clean and free from clay, loam, silt and other deleterious matter. If required, the Engineer reserves the right to have them washed by the Contractor at no additional expense. Coarse and fine aggregates shall be delivered and stored separately at site. Aggregates shall not be stored on muddy ground or where they are likely to become dirty or contaminated.

4.1.3 Fine aggregate shall be hard coarse sand, crushed stone or gravel screenings and shall conform to requirements of PS 243 and/or BS 882 and/or ASTM C 33. Only fine aggregate of grading zones 1 to 3 (BS 882) shall be used.

4.1.4 Coarse aggregate shall be gravel or crush stone of hard, durable material free from laminated structure and conforming to PS 243 and/or BS 882 and/or ASTM C 33 graded as follows for use in mass concrete as in foundations:

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Total Passing B.S. Sieve			Percent by weight
3 in.	(76.20 mm)	:	100
1.5 in.	(38.10 mm)	:	95-100
0.75 in.	(19.05 mm)	:	30-70
0.38 in.	(9.52 mm)	:	10-35
0.19 in.	(4.76 mm)	:	0-5

Coarse aggregate for all cast-in-place concrete other than mass concrete as for foundations shall be graded with the following limits:

Total Passing B.S. Sieve			Percent by weight
1.5 in.	(38.10 mm)	:	100
0.75 in.	(19.05 mm)	:	95-100
0.38 in.	(9.52 mm)	:	25-55
0.19 in	(4.76 mm)	:	0-10

4.1.5 Wherever feasible, the nominal maximum size of aggregate for cast- in- place reinforced concrete slabs and other members shall be 3/4 inch. If there are difficulties in placing such concrete the maximum size may be restricted to 1/2 inch provided the requirements for strength are satisfied. The grading requirements of 1/2 inch or 3/8 inch down aggregate shall be agreed to with the Engineer as per relevant ASTM/BS standards.

4.1.6 The nominal maximum size of the aggregate for precast concrete shall not be larger than one fifth of the narrowest dimension between sides of forms, or one-third of the depth of slabs or three-fourths of the minimum clear distance between reinforcing bars or between bars and forms, whichever is least. In Precast columns the nominal maximum size of the aggregate shall be limited as above but shall not be larger than two-thirds of the minimum clear distance between bars.

4.1.7 Coarse aggregates in precast concrete of normal weight may be of one maximum size for all concrete placed in 1 day when quantities to be placed are too small to permit economical use of more than one mix design.

When a single mix design is so used, the maximum nominal size shall be as required for the most critical condition of concreting, in accordance with the requirements of clause (4.1.6) above.

4.1.8 Except were it can be shown to the satisfaction of the Engineer that a supply of properly graded aggregate of uniform quality can be maintained over the period of the work, the grading of the aggregates shall be controlled by obtaining the 19.05 mm maximum nominal size, the different size being stocked in separate stock piles and recombined in the correct proportion for each batch at the batching plant. The materials shall be stock-piled for a period before use so as to drain nearly to constant moisture content (as long as site and other conditions permit, preferably for atleast a day). The grading of the course and fine aggregates shall be tested atleast once for every 100 tons supplied to

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ensure that the grading is uniform and the same as that of the samples used in the preliminary tests.

4.1.9 For use in fireproof concrete, the aggregates shall be fire clay and semi-acidic fine ground. The use of broken fire clay bricks as coarse aggregate and waste of semi-acidic refractory particles as fine aggregate can be allowed.

4.2 CEMENT

4.2.1 The cement shall be fresh and of approved origin and manufacture. It shall be one of the following as may be specified by the Engineer.

- Ordinary or Rapid Hardening Portland cements complying with the requirements of PS 232 or BS 12 or ASTM C 150.

- Sulphate Resisting Portland/Cement complying with the requirements of PS 612 or BS 4027 or ASTM C 150.

4.2.2 Unless otherwise specified, ordinary Portland cement complying with the requirements of BS 12 shall be used.

4.2.3 For all fair faced concrete it will be necessary to use approved cement with a view to obtain light shade concrete as approved by the Engineer.

4.2.4 Only one brand of each type of cement shall be used for concrete in any individual member of the structure. Cement shall be used in the sequence of receipt of shipment, unless otherwise directed.

4.2.5 There shall be sufficient cement at site to ensure that each section of work is completed without interruption.

4.2.6 Cement reclaimed from cleaning of bags or from leaky containers shall not be used.

4.2.7 The Contractor shall provide and erect (at his own cost) in a suitable plane, dry, well ventilated, weather-proof and water proof shed of sufficient capacity to store the cement.

4.2.8 Cement shall be used as soon as possible after delivery and cement which the Engineer considers has become stale or unsuitable through absorption of moisture from the atmosphere or otherwise shall be rejected and removed immediately from the site at the Contractor's expense. Any cement in containers damaged so as to allow the contents to spill or permitting access of the atmosphere prior to opening of the container at the time of concrete mixing shall be rejected and removed immediately from the site at the Contractor's expense.

4.2.9 The mixing together of different types of cement will not be permitted.

4.3 WATER

Only clean water from the city supply, tube well installed at the site or from other sources approved by the Engineer shall be used. The Contractor shall supply sufficient water for all purposes, including mixing the concrete, curing and cleaning plant and tools. Where water can be shown to contain any sugar or an excess of acid, alkali or salt, the Engineer may refuse to permit its use.

In case of doubt, the Engineer may require that concrete mixed with water proposed to be used should not have a compressive strength lower than 90 percent of the strength of concrete mixed with distilled water.

4.4 ADMIXTURES

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4.4.1 General

Admixtures shall be furnished by the contractor and used only with the written permission of the Engineer. If air entraining agents, water reducing agents , set retarders or strength accelerators are permitted to be used they shall not be used in greater dosages than those recommended by the manufacturer, or permitted by the engineer, and shall conform to the requirements for each of the agents specicified by the manufacturer. Admixtures shall be well agitated to ensure uniformity before use in concrete. The contractor may use a retarder to facilitate preparation of construction joints, subject to the approval of Engineer as to the composition of retarder and its time of application.

4.4.2 Specifications

Air entraining admixtures shall comply with ASTM Designation C-260.All other admixtures shall comply their relevant section of ASTM Designation C-494 Typed. Admixtures shall not contain calcium chloride. Approval shall be given on certification of conformance provided by an independent laboratory, and after checking their performance in trial mixes. Admixtures shall be well subject to sampling and testing. Admixture shall be handled and stored in accordance with the manufacturer's recommendations.

4.4.3 Removal of Unsatisfactory Material

If tests prove that any admixture, which has been delivered, is unsatisfactory, it shall be promptly removed from the site.

4.4.4 Batching

Each Admixture shall be accurately batched by mechanical batcher and shall be added in a manner which ensures uniform distribution throughout the batch.

4.4.5 Compatibility

The compatibility of different admixtures used in the same batch shall be established to the satisfaction of the engineer.

4.4.6 Air Entraining Agent

Field Tests on air-entrained mixes shall be made in accordance with ASTM Designation C-231.Concrete produced with air contents exceeding the specified limits shall be rejected by the engineer.

4.4.7 Storage

Admixtures shall be stored in suitable containers, which will maintain them in uniform solution and will protect them from weather and contamination.

4.4.8 Storage Time

Admixtures, which have been in storage for more than 6 months, shall not be used unless retest proves tem to be satisfactory. Costs of all such retests shall be borne by the Contractor. Rejected materials shall be removed immediately from the site.

4.4.9 Measurement

Measurements of admixtures for acceptably completed works shall be made separately on the basis of litres of each admixture used during concreting.

All additives such as foaming and water proofing agents shall be from a manufacturer approved by the Engineer.

4.5 NOMINAL CONCRETE MIXES

4.5.1 Proportions of Mix

a) Cement and aggregates:

Cement, fine aggregate and the coarse aggregate shall be weighed separately. The proportions of cement to fine aggregate and coarse aggregate shall be adjusted so as to provide the concrete of the required crushing strength when tested as set out in Table 1.

b) The Contractor shall regulate and arrange mixing of the ingredients for the designed mix of the concrete by weight batching. The cost of designing the mix shall be borne by the Contractor.

c) Water/Cement ratio:

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The quantity of water used shall be just sufficient to produce dense concrete of adequate strength and workability for its purpose. For all concrete, water/cement ratio shall not exceed 0.45, except that for water retaining structures water/cement ratio shall not exceed 0.40.

d) Workability:

The workability shall be controlled by direct measurement of the water content, allowance being made for any water in the fine and coarse aggregates. The concrete shall be just sufficiently workable to be placed and compacted, without difficulty, by the available means.

Unless otherwise permitted or specified, the concrete shall be proportioned and produced to have a slump of 3 inch or less for consolidation by vibration. A tolerance of upto 1 inch above the indicated maximum shall be allowed for individual batches provided the average for all batches or the most recent 10 batches tested, which ever is fewer, does not exceed the maximum limit. Concrete of lower than usual slump may be used provided it is properly placed and consolidated.

4.5.2 Strength requirements for concrete

a) Concrete made with Portland cement shall comply with the cube strength requirements of Table 1, columns 5 & 7 (Works Test). Cylindrical Compressive Strength shall comply with ACI 214.

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Table 1: Cube Strength requirements for Portland concrete with aggregates complying with BS. 882.

Strength and Durability Requirements for Concrete are given below:

Class of Concrete	Specified Cylinder Compressive Strength at 28 days MPa / psi
A1	35.0 / 5,000
A	28.0 / 4,000
B	21.0 / 3,000
C	17.0 / 2,500
D	8.0 / 1,150
E	5.0 / 725

The flexural strength of concrete for pavement shall be 4.5 MPa (650 psi) at 28 days as per ASTM C 78 with minimum cement content of 340Kg of cement per cubic metre (10 kg of cement per cubic feet) of concrete. The flexural strength requirement is the governing factor, excess cement if any used to achieve the required flexural strength shall not be payable.

b) The strengths given in Table 1 are based on the assumption that average temperature is 20 degree C. Where accurate records of temperature are kept, allowance may be made for change of temperature or the cubes may be tested at the equivalent maturity.

c) All structural concrete shall conform to BS 5328 or ACI 301M.

4.6 PVC WATER STOP/HYDROFOIL

All PVC water stops/hydrofoil shall be central bulb type from a manufacturer approved by the 'Engineer'. The specific gravity of PVC water stop/hydrofoil shall not be less than 1.37 and full stretch Break cut intensity when tested at normal temperature shall not be less than 1875 psi.

The material shall have a modulus of rigidity of 850 psi at +10° C and 10,500 psi. at 20° C.

5. DELIVERY, STORAGE AND HANDLING

5.1 Except where it can be shown to the satisfaction of the Engineer that a supply of properly graded aggregate of uniform quality can be maintained over the period of the work, the grading of the aggregates shall be controlled by obtaining the 3/4" maximum nominal size, the different sizes being stocked in separate stock piles and recombined in the correct proportion for each batch at the batching plant. The materials shall be stockpiled for a period before use so as to drain nearly to constant moisture content (as long as site and other conditions permit, preferably for at least a day).

5.2 The Contractor shall provide and erect (at his cost) a suitable plain, dry, well ventilated, weatherproof and water proof shed of sufficient capacity to store the cement.

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6. EXECUTION

6.1 CAST-IN-SITU CONCRETE WORK

6.1.1 Batching

a) The Contractor shall submit to the Engineer for review the plans and capacity of the concrete batching plant and delivery equipment, which shall comply with ASTM C-94.All cement, including cement supplied in bulk, shall be batched by weight. A bag of cement may be taken as weighing 110 lb. with the prior approval of the Engineer.

b) Aggregates shall be batched by weight, due allowance being made for water content. Aggregates may be batched by volume through conversion of weigh batching, only with the prior permission of the Engineer. The apparatus for weight batching may be an integral part of the mixer or a separate unit of a type approved by the Engineer. It shall be accurate within 2% and shall be checked for accuracy at least once a week.

c) The quantity of additives i.e. foaming and water proofing agents etc. shall be as prescribed by the manufacturer or as directed by the Engineer.

d) Where the batching plant is of the type in which cement and aggregates are weighed in the same compartment, the cement shall be introduced into the compartment between two sizes of aggregates.

e) Each batch shall be so charged into the mixer that some water will enter in advance of the cement and aggregates. Water shall continue to flow for a period, which may extend to the end of the first 25 percent of the specified mixing time. Controls shall be provided to prevent batched ingredients from entering the mixer before the previous batch has been completely discharged.

6.1.2 Mixing

a) The concrete shall be mixed in an approved batch mixer conforming to the requirements of BS 1305 or ACI 304R (ASTM C685). It shall be fitted with the manufacturer's plate stating the rates, capacity and the recommended number of revolutions per minute and shall be operated in accordance therewith. It shall be equipped with a suitable charging mechanism and an accurate water-measuring device. The mixer shall be capable of thoroughly combining the aggregates, cement and water into a uniform mass within the specified mixing time and of discharging the concrete without harmful segregation.

b) Mixing shall continue for the period recommended by the mixer manufacturer or until there is apparently a uniform distribution of the materials and the mass is uniform in colour, whichever period is longer. If it is desired to use a mixing period of less than 1-1/2 minutes, the Engineer's approval shall be obtained in writing.

c) Controls shall be provided to ensure that the batch cannot be discharged until the required mixing time has elapsed. At least three quarters of the required mixing time shall take place after the last of the mixing water has been added.

d) The interior of the mixer shall be free of accumulations that will interfere with mixing action. Mixing blades shall be replaced when they have lost 10 percent of their original height.

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e) Concrete shall be mixed only in quantities for immediate use. Concrete which has set shall not be retempered, but shall be discarded.

6.1.3 Transporting

a) The concrete shall be transported from the place of mixing to the place of final deposit as rapidly as practicable by means, which will prevent segregation or loss of ingredients. All skip vehicles, or containers used for transporting the concrete shall be thoroughly cleaned.

b) During hot or cold weather, concrete shall be transported in deep containers, on account of their lower ratios of surface area to mass, which reduces the rate of loss of water, by evaporation during hot weather and loss of heat during cold weather.

6.1.4 Placing

The Contractor shall note that placing of concrete will be done with concrete pump as mentioned in Appendix-G to Tender, Volume-I of Tender Documents. No other method of placing of concrete will be allowed.

a) Before placing of concrete, formwork shall have been completed; water shall have been removed; reinforcement shall have been secured in place; expansion joint material, anchors and other embedded items shall have been kept in position; and the entire preparation shall have been approved by the Engineer.
No concrete is to be placed into the foundation trenches until the ground to receive the same has been examined and approved by the Engineer for this purpose.

b) The actual sequence of construction proposed by the Contractor shall be subject to the Engineer's approval before construction starts on any part of the structure, and this sequence shall not be varied without the Engineer's approval.

c) The concrete after it has been mixed shall be placed as soon as it is practicable. Once the concrete has left the mixer, no more water shall be added, although the concrete may be mixed or agitated to help maintain workability. The concrete shall not be used if, through any cause, the workability of the mix at the time of placing is too low for it to be compacted fully and to an acceptable finish by whatever means available.
The time between mixing and placing should be reduced, if the mix is richer or the initial workability of the mix is lower than normal, or if a rapid hardening cement or an accelerator is used, or if the work is carried out at a high temperature or exposed to a drying atmosphere.
The Contractor shall ensure that the delay between mixing and placing including consolidation does not exceed 45 minutes under any circumstances. Any concrete which does not satisfy this requirement shall be rejected.

d) Concrete shall be deposited as nearly as possible in its final position to avoid segregation due to rehandling or flowing. In no circumstances may concrete be railed or made to flow along the forms by the use of vibrators.

e) The free fall of concrete shall not be allowed to exceed 6 feet. Where it is necessary for the concrete to be lowered more than this depth, it is not to be dropped into its final position, but shall be placed through pipes fed by a hopper. When a pipe is used for placing concrete the

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lower end shall be kept inside or close to the freshly deposited concrete. The size of the pipe shall be not less than 9 inch in diameter.

f) The workmen carrying concrete to the site, and all other workmen moving about on the reinforcement before the concrete is placed, shall move only along runways or planks placed for the purpose and no person shall be allowed to walk on the reinforcement itself.

g) Prior to the laying of concrete on load bearing masonry walls, bearing plates and at other points, as may be directed by the Engineer, the surface will be brought to a true, hard and smooth level surface using cement sand mortar in the ratio of 1 volume of cement to 3 volumes of sand. Two layers of building paper weighing .082 lb./ft^2 will then be laid flat to separate the concrete from the surface on which it is to be laid.

h) Concrete shall be deposited continuously, or in layers of such thickness that no concrete will be deposited on concrete, which has hardened sufficiently to cause the formation of seams or planes of weakness within the section. If a section cannot be placed continuously, construction joints shall be located as shown in the Contract Documents or as approved by the Engineer. Placing shall be carried out at such a rate that the concrete which is being integrated with fresh concrete is still plastic. Concrete which has partially hardened shall not be deposited. Temporary spreaders in forms shall be removed when the concrete placing has reached an elevation rendering their services unnecessary. They may remain embedded in the concrete only if made of metal or concrete and if prior approval has been obtained.

i) Every Contractor whose work is related to the concrete or services or must be supported by it shall be given ample notice and opportunity to introduce and/or furnish embedded items before the concrete is placed.

6.1.5 Construction Joints

a) Construction Joints not shown on the drawings shall be so made and located as to least impair the strength of the structure and shall need prior approval of the Engineer. In general, they shall be located near the middle of the spans of slabs and beams unless a secondary beam intersects a main beam at this point, in which case the joint in the main beam shall be offset a distance equal to twice the width of the secondary beam. Joints in walls and columns shall be at the underside of floors, slabs or beams and at the top of footings or floor slabs. Beams, brackets, columns capitals, haunches and drop panels shall be placed at the same time as slabs. Joints shall be perpendicular to the main reinforcement.

b) All reinforcing steel shall be continued across joints. Keys and inclined dowels shall be provided as directed by the Engineer. Longitudinal keys at least 1-1/2 inches deep shall be provided in all joints in walls and between walls and slabs or footings.

c) When the work has to be resumed on a surface which has hardened, such surface shall be roughened in an approved manner which will expose the aggregate uniformly and will not leave laitance, loosened particles of aggregate or damaged concrete at the surface.

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d) The hardened concrete of construction joints and of joints between footings and walls or columns, between walls or columns and beams or floors they support, joints in un-exposed walls and all others not mentioned herein shall be dampened (but not saturated) immediately prior to placing of fresh concrete.

e) The hardened concrete of joints in exposed work, joints in the middle of beams, and slabs; and joints in work designed to contain liquids shall be dampened (but not saturated) and then thoroughly covered with a coat of cement grout similar in proportions to the mortar in the concrete. The grout shall be as thick as possible on vertical surfaces and at least 1/2 inch thick on horizontal surfaces. The fresh concrete shall be placed before the grout has attained initial set.

f) Where the concrete has not fully hardened, all laitance shall be removed by scrubbing the wet surface with wire or bristle, and brushed, care being taken to avoid dislodgment of particles of aggregate. The surface shall then be coated with neat cement grout. The first layer of concrete to be placed on this surface shall not exceed 6 inch in thickness, and shall be well rammed against old work, particular attention being paid to corners and closed spots.

g) Stop ends for movement joints or construction joints shall be made by splitting them along the lines of reinforcement passing through them, so that each portion can be positioned and removed separately without disturbance or shock to the reinforcement or the concrete. Stop ends made of expanded metal or similar material may only be left permanently in the concrete with prior written approval of the Engineer. Where such stop ends are used, no metal may be left permanently in the concrete closer to the surface of the concrete than the specified cover to the reinforcement.

6.1.6 Expansion Joints

Expansion joints shall be provided wherever indicated on the Drawings or as directed by the Engineer. In no case shall the reinforcement, corner protection angles, or other embedded items be permitted to extend continuously through any expansion joint.

All expansion joints shall be carefully placed so as not to be displaced during concreting. The method of placing the expansion joints shall be strictly in accordance with the Drawings and/or as directed by the Engineer.

6.1.7 Placing and Connection of Water-Stops

The water-stops and expansion joint material shall be positioned accurately and supported against displacement as shown on the drawings.

6.1.8 Embedded Items

a) Electric conduits and other pipes which are planned to be embedded shall not, with their fittings, displace more than four percent of the area of the cross section of a column on which stress is calculated or which is required for fire protection. Sleeves, conduits, or other pipes passing through floors, walls, or beams shall be of such size or in such location as not to impair unduly the strength of the construction; such sleeves, conduits, or pipes may be considered as replacing structurally in compression the displaced concrete, provided that they are not exposed to rusting or other deterioration, are of uncoated or galvanized iron or steel not thinner than standard steel pipe, have a nominal inside diameter not over 2 inch and are spaced not less than three diameters

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on centers. Except when plans of conduits and pipes are approved by the Engineer, embedded pipes and conduits other than those merely passing through, shall not be larger in outside diameter than one third the thickness of the slab, wall, or beams in which they are embedded nor so located as to impair unduly the strength of the construction. Sleeve pipes, or conduits of any material not harmful to concrete and within the limitations of this section may be embedded in concrete with the approval of the Engineer provided they are not considered to replace the displaced concrete.

b) All sleeves, inserts, anchors, and embedded items required for adjoining work or for its support shall be placed prior to concreting. Voids in sleeves, inserts and anchor slots shall be filled temporarily with readily removable material to prevent the entry of concrete into the voids.

6.1.10 Consolidation

a) All concrete shall be consolidated by vibration, spading, rodding or forking so that the concrete is thoroughly worked around the reinforcement, around embedded items and into corners of forms, eliminating all air or stone pockets which may cause honeycombing, pitting, or planes of weakness. Internal vibrators shall have a minimum frequency of 8000 vibrations per minute and sufficient amplitude to consolidate the concrete effectively. They shall be operated by competent workmen. Use of vibrators to transport within forms shall not be allowed. Vibrators shall be inserted and withdrawn at points approximately 18 inch apart. At each insertion, the duration shall be sufficient to consolidate the concrete but not excessive so as to cause segregation, generally from 5 to 15 sec. A spare Vibrator shall be kept on the job site during all concrete placing operations.

Where the concrete is to have an as-cast finish, a full surface of mortar shall be brought against the form by the vibration process, supplemented, if necessary, by spading to work the coarse aggregate back from the formed surface.

b) If there is any tendency for the mix to segregate during consolidation, particularly if this produces excessive laitance, the mix proportions shall be modified to effect an improvement in the quality of the concrete to the satisfaction of the Engineer and in conformity with the provisions of Clause 5.

c) Vibrator shall not be allowed to contact the formwork for exposed concrete surfaces.

d) Mechanical vibrators shall be of a type suited in the opinion of the Engineer to the particular conditions.

e) Over-vibration or vibration of very wet mixes is harmful and should be avoided.

6.1.11 Curing and Protection

a) Beginning immediately after placement, concrete shall be protected from premature drying, excessively hot or cold temperatures and mechanical injury and shall be maintained with minimum moisture loss at a relative constant temperature for the period necessary for hydration of the cement and hardening of the concrete. The materials and methods of curing shall be subject to approval of the Engineer.

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b) For concrete surfaces not in contact with forms, one of the following procedures shall be applied immediately after completion of placement and finishing:

- Ponding or continuous sprinkling.

- Application of absorptive mats or fabric kept continuously wet.

- Application of waterproof sheet materials approved by the Engineer.

- Application of other moisture-retaining covering as approved.

- Application of a curing compound conforming to ASTM C 309.

The compound shall be applied in accordance with the recommendations of the manufacturer immediately after any water sheen, which may develop after finishing has disappeared from the concrete surface. It shall not be used on any surface against which additional concrete or other material is to be bonded unless it is proved that the curing compound will not prevent bond, or unless positive measures are taken to remove it completely from areas to receive bonded applications.

c) Moisture loss from surfaces placed against wooden forms or metal forms exposed to heating by the sun shall be minimized by keeping the forms wet until they can be safely removed. After form removal the concrete shall be cured until the end of the time prescribed for curing.

d) Curing in accordance with sub-clause 'a' & 'b' above shall be continued for at least 10 days in the case of all concrete except concrete with rapid-hardening Portland Cement for which the period shall be at least 3 days. Alternatively, if tests are made of cubes kept adjacent to the structure and cured by the same methods, moisture retention measures may be terminated when the average compressive strength has reached 70 percent of the minimum specified works cube strength. If one of the first four curing procedures of sub-clause 'b' is used initially, it may be replaced by one of the other procedures of that sub-clause any time after the concrete is one day old provided the concrete is not permitted to become surface dry during the transition.

e) When the mean daily outdoor temperature is less than 5 degree C (41 deg. F) temperature of the concrete shall be maintained between 10 and 20 degrees C (50 to 68 deg. F) for the required curing period of sub-clause'd'.

When necessary, arrangements for heating, covering insulation or housing the concrete work shall be made in advance of placement and shall be adequate to maintain the required temperature without injury due to concentration of heat. Combustion heaters shall not be used during the first 24 hours unless precautions are taken to prevent exposure of the concrete to exhaust gasses, which contain carbon dioxide.

f) During hot weather when necessary, provision for wind-brakes, shading for spraying, sprinkling, ponding or wet covering with a light coloured material shall be made in advance of placement. Such protective measures shall be taken as quickly as concrete hardening and finishing operation will allow.

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g) Changes in temperature of the air immediately adjacent to the concrete during and immediately following the curing period shall be kept as uniform as possible and shall not exceed 3 deg. C (37 deg. F) in any one hour or 10 degree C (50 deg. F)in any 24 hour period.

h) During the curing period, the concrete shall be protected from damaging mechanical disturbances, such as load stresses, heavy shock and excessive vibrations. All finished concrete surfaces shall be protected from damage by construction equipment, materials or methods by application of curing procedures, and by rain or running water. Self-supporting structures shall not be loaded in such a way as to over stress the concrete.

6.2 WORKS IN EXTREME WEATHER

6.2.1 Unless adequate protection is provided and approval is obtained from the Engineer, concrete shall not be placed during rain.

Rainwater shall not be allowed to increase the mixing water nor to damage the surface finish.

6.2.2 When the temperature of the surrounding air is expected to be below 5 deg. C during placing or within 24 hours thereafter, the temperature of the plastic concrete, as placed, shall be no lower than 13 deg. C for sections less than 12 inch in any dimension nor 10 deg. C for any other sections.

When necessary, concrete material should be heated before mixing and carefully protected after placing, in general, heating or mixing water alone to about 60 deg. C may be sufficient for this purpose. Dependence should not be placed on salt or other chemicals for the prevention of freezing. No frozen material or materials, containing ice shall be used. All concrete damaged by frost shall be removed. It is recommended that concrete exposed to the action of freezing weather should have entrained air and the water content of the mix should not exceed 5.5 gallon/bag of cement.

If water or aggregate is heated above 38 deg. C the water shall be combined with the aggregate in the mixer before cement is added. Cement shall not be mixed with water or with mixtures of water & aggregate having a temperature greater than 38 deg. C.

6.2..3 During hot weather, the temperature of the concrete as placed shall not be so high as to cause difficulty from loss of slump, flash set, or cold joints and should not exceed 32 deg. C. For massive concrete, this temperature should not exceed 21 degree C. When the temperature of the concrete exceeds 32 degree C, precautionary measures approved by the Engineer shall be put into effect. When the temperature of the steel is greater than 50 deg. C, steel forms and reinforcement shall be sprayed with water just prior to placing the concrete. The ingredients shall be cooled before mixing, or flaked ice or well crushed ice of a size that will melt completely during mixing may be substituted for all part of the mixing water if, due to high temperature, low slump, flash set or cold joints are encountered.

Other precautions recommended by ACI Standard 305-72 shall also be adopted.

7. TEST OF CONCRETE QUALITY

7.1 The Contractor shall provide samples of concrete for testing at the Engineer's direction. Proper facilities shall be provided for making and curing the test specimens. A competent person shall be employed by the Contractor whose first duty shall be to

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supervise all stages in the preparation and placing of the concrete. All test specimens shall be made and site tests carried out under his direct supervision.

7.2 Preliminary cube tests and works cube test shall be performed in accordance with the discretion of the Engineer. The standard of acceptance for preliminary and works tests shall be as given below.

7.3 The usual test for concrete with maximum size of aggregate upto 1-1/2 inch is the 6 inch cube tested in compression. Details of the testing are given in Part 8 of BS 1881.

7.4 For all grades of concrete, preliminary cube strength test with the mixes and materials to be used shall be performed in accordance with BS 1881 before the work is begun and subsequently whenever any change is to be made in the materials or in the proportions of materials to be used, or as required by the Engineer. The strengths shall comply with the standard of quality specified in accordance with Table 1 for preliminary tests. The cost of such testing shall be borne by the Contractor.

7.5 Test sample shall be taken at the mixer or as directed by the Engineer. The test specimens shall be cured in accordance with BS 1881.

Records shall be kept of all test cubes identifying the mix used the section of work for which the concrete was used and the date poured.

7.6 Five test cubes are to be tested for compressive strength as specified in BS 1881. These tests shall be carried out at site or in a laboratory approved by the Engineer. Two cubes shall be tested at the age of seven days and three at 28 days and the strengths determined are to comply with the standard of quality specified. The laboratory tests shall be carried out by an independent organization, such as Government Testing Laboratory or such other undertakings approved by the Engineer. The original test reports received from the above authorities should be submitted to the Engineer.

7.7 For all grades of concrete, the appropriate strength requirement shall be considered to be satisfied if none of the strengths of the cubes is below the specified cube strength or if the average strength of the three cubes is not less than the specified cube strength and the difference between the greatest and the least strength is not more than 20% of the average.

7.8 When the results of works cube tests show that the strength of any concrete is below the minimum specified, the Engineer may give instructions for the whole or part of the work concerned to be removed and replaced at the expense of the Contractor. The Contractor shall bear the cost of any other part of his, or any other contractor's work, which has to be removed and replaced as a result of the defective concrete. If any concrete is held to have failed, the Engineer may order the proportions of that class of concrete to be changed in order to provide the specified strength.

8. FINISHING OF FORMED SURFACES

8.1 GENERAL

8.1.1 After removal of forms, the surfaces of concrete shall be given one or more of the finishes specified below in locations designated by the Contract Documents.

8.1.2 When finishing is required to match a small sample furnished to the Contractor, the sample finish shall be reproduced on an area at least 100 Sq. ft. in an inconspicuous location designated by the Engineer before proceeding with the finish in the specified location.

8.1.3 Allowable deviations from plumb or level and from the alignment profile grades and dimensions are specified in clause 10. Tolerances for concrete construction and defined as tolerances that are to be distinguished from

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irregularities in finish as described herein. The finish requirements for concrete surfaces shall be as generally specified in this clause and as indicated on the Drawings. Finishing of concrete surfaces shall be performed only by workmen who are skilled in concrete finishes.

The Contractor shall keep the Engineer advised as to when finishing of concrete will be performed. Unless inspection is waived in each specific case, finishing of concrete shall be performed only in the presence of the Engineer. Concrete surfaces will be tested by the Engineer where necessary to determine whether surface irregularities are within the limits herein after specified. Surface irregularities are classified as abrupt or gradual.

Offsets caused by displaced or misplaced form sheeting or lining or sections, or otherwise defective form lumber will be considered as abrupt irregularities, and will be tested by direct measurements. All other irregularities will be considered as gradual irregularities, and will be tested by use of a template, consisting of a straight edge or the equivalent thereof for curved surfaces. The length of the template will be 6.5 ft. for testing of formed surfaces and 10 ft. for testing of unformed surfaces.

8.2 AS-CAST FINISHES

Unless otherwise specified or indicated on the Drawings the classes of finish shall apply as follows:

8.2.1 Rough form finish:

No selected form facing materials shall be specified for rough form finish surfaces. Tie holes and defects shall be patched. Fins exceeding 1/4" in height shall be chipped off or rubbed off. Otherwise, surfaces shall be left with the texture imparted by the forms.

8.2.2 Fair face finish:

Fair face finish applies to concrete formed surfaces, the appearance of which is considered by the Engineer to be of special importance, such as surfaces of structures prominently exposed to public inspection. Surfaces of concrete structures requiring fair face finish is shown in the Drawings. Surface irregularities, measured as described in sub-clause 8.2.1, 'Rough form finish', shall not exceed 1/4 inch for gradual irregularities and 1/8 inch for abrupt irregularities, except that abrupt irregularities will not be permitted at construction joints. Abrupt irregularities at construction joints and elsewhere in excess of 1/8 inch and gradual irregularities in excess of 1/4 inch shall be reduced by grinding so as to conform to the specified limits. Abrupt irregularities at construction joints shall be ground on level of 1 to 20 ratio of height to length.

Unless otherwise approved, repair of imperfections in formed concrete shall be completed within 24 hours after removal of forms. The form facing material shall produce a smooth, hard, uniform texture on the concrete. It may be plywood, temperated concrete-form-grade hardboard, metal, plastic paper, or other approved material capable of producing the desired fair face finish. The arrangement of the facing material shall be orderly and symmetrical, with the number of seams kept to the practical minimum. It shall be supported by studs or other backing capable of preventing excessive deflection. Material with raised grain, torn surfaces, worn edge, patches, dents, or other defects which will impair the texture of the concrete surface shall not be used. Tie holes and defects shall be patched. All fins shall be completely removed.

8.3 FINISHES OF UNFORMED SURFACES

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8.3.1 Monolithic Concrete Floor Finish

Where monolithic concrete floor finish is shown on the Drawings, placing shall proceed continuously for the full thickness of the course or RCC slab without change in concrete mix. Mixing water shall be the minimum required for proper placing, and will be as specified by the Engineer. After placing, floors, and other surfaces shall be floated with a wood float to a true surface and to elevation as shown on the Drawings. Where indicated on the Drawings, floor surfaces shall be steel trowel finished. Trowelling shall be the minimum amount consistent with maintaining a smooth dense surface, and shall not be done until the mortar has hardened sufficiently, to prevent excess fine material from being worked to the surface, and shall produce a dense uniform surface, free from blemishes and trowel marks.

Gradual surface irregularities shall not exceed 1/16 inch. The addition of water, dry cement, or dry cement mortar, to the surface of the concrete to facilitate finishing will not be permitted.

9. REPAIR OF SURFACE DEFECTS

9.1 GENERAL

9.1.1 Any concrete failing to meet the specified strength or not formed as shown on drawings, concrete out of alignment, concrete with surfaces beyond required tolerances or with defective surfaces which cannot be properly repaired or patched in the opinion of the Engineer shall be removed at Contractor's cost. The Engineer may reject any defective concrete and order it to be cut out in part or in whole and replaced at the Contractor's expense.

9.1.2 All ties and bolt holes and all repairable defective areas shall be patched immediately after form removal.

9.2 REPAIR OF DEFECTIVE AREAS

9.2.1 All honeycombed and other defective concrete shall be removed down to sound concrete. The area to be patched and an area at least 6 inch wide surrounding it shall be dampened to prevent absorption of water from the patching mortar. A bonding grout shall be prepared using a mix of approximately 1 part cement to 1 part fine sand passing No.25 BS Sieve and shall then be well brushed into the surface.

9.2.2 The patching mixture shall be made of the same material and of approximately the same proportions as used for the concrete, except that the coarse aggregate shall be omitted and the mortar shall consist of not more than 1 part cement to 2-1/2 parts sand by damp loose volume. White Portland cement shall be substituted for a part of the gray Portland cement on exposed concrete in order to produce a colour matching the colour of the surrounding concrete, as determined by a trial patch.

9.2.3 The quantity of mixing water shall be no more than necessary for handling and placing. The patching mortar shall be mixed in advance and allowed to stand with frequent manipulation with a trowel, without addition of water, until it has reached the stiffest consistency that will permit placing.

9.2.4 After surface water has evaporated from the area to be patched, the bond coat shall be well brushed into the surface. When the bond coat begins to loose the water sheen, the premixed patching mortar shall be applied. The mortar shall be thoroughly consolidated into place and struck off so as to leave the patch slightly higher than the surrounding surface. To permit initial shrinkage, it shall be left undisturbed for at least 1 hour before being finally finished. The patched

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area shall be kept damp for 7 days. Metal tools shall not be used in finishing a patch in a formed wall, which will be exposed.

9.2.5 Where as-cast finishes are specified, the quantity of patched area shall be strictly limited. The combined total of patched areas in as-cast surfaces shall not exceed 2 sq.ft. in each 1000 sq.ft. of as-cast surface. This is in addition to form tie patches, if the project design permits ties to fall within as-cast areas.

9.2.6 Any patches in as-cast architectural concrete shall be indistinguishable from surrounding surfaces. The mix formula for patching mortar shall be determined by trial to obtain a good colour match with the concrete when both patch and concrete are cured and dry. After initial set, surfaces of patches shall be dressed manually to obtain the same texture as surrounding surfaces.

9.2.7 Patches in architectural concrete surfaces shall be cured for 7 days. Patches shall be protected from premature drying to the same extent as the body of the concrete.

9.3 TIE AND BOLT HOLES

After being cleaned and thoroughly dampened, the tie and bolt holes shall be filled solid with patching mortar. If architectural appearance requires, these holes may be filled partially creating the desired round clear holes pattern on surfaces exposed to view.

9.4 PROPRIETARY MATERIALS

If permitted or required by the Engineer, proprietary compounds for adhesion or as patching ingredients may be used in lieu of or in addition to the foregoing patching procedures. Such compounds shall be used in accordance with the manufacturer's recommendations with prior approval of the Engineer.

10. CONCRETE CONSTRUCTION TOLERANCES

Where tolerances are not stated in the specifications or drawings for any individual structure or feature thereof, maximum permissible deviations from established lines, grades and dimensions shall conform to the following. The Contractor is expected to set and maintain concrete forms so as to ensure complete work within tolerance limits. These allowable tolerances shall not relieve the Contractor of this responsibility for correct fitting of indicated materials. These tolerances are not cumulative.

10.1 Variation from the plumb (or the specified batter for inclined walls.)

10.1.1 In the lines and surfaces of columns, piers, walls and in arrises:

In any 10 feet of length or height	1/4 inch
In any storey or 20 feet length	3/8 inch
Maximum for the entire length or height.	1 inch

10.1.2 For exposed corner columns, control joint grooves and other conspicuous lines.

In any bay or 20 feet maximum	1/4 inch
Maximum for the entire length or height	1/2 inch

10.2 Variation from the level or from the grades indicated on the drawings.

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10.2.1 In floors, ceilings, beams soffits and in arrises measured before removal of supporting shores.

In any 10 feet of length	1/4 inch
In any bay or in any 20 feet length	3/8 inch
Maximum for the entire length	3/4 inch

10.2.2 For exposed lintels, sills, parapets, horizontal grooves and other conspicuous lines.

In any bay or 20 feet length	1/4 inch
Maximum for the entire length	1/2 inch

10.3 Variation of the linear building lines from established position in plan and related position of columns, walls and partitions.

In any bay or 20 feet of length	1/2 inch
Maximum for the entire length	1 inch

10.4 Variation in the sizes and locations of sleeves, floor openings and wall openings. ±1/4 inch

10.5 Variation in cross-sectional dimensions of columns and beams and in the thickness of slabs and walls.

Minus	1/4 inch
Plus	1/2 inch

10.6 Footings

10.6.1 Variation in dimensions in plan

Minus	1/2 inch
Plus (plus variation applied to concrete only, not to reinforcing bars or dowels).	2 inch

10.6.2 Misplacement or eccentricity

2 percent of the footing width in the direction of misplacement but not more than (applies to concrete only, not to reinforcing bars or dowels).	2 inch

10.6.3 Thickness

Decrease in specified thickness	5%
Increase in specified thickness	No limit

10.7 Variation in Steps

10.7.1 In a flight of stairs

Rise	± 1/8 inch
Tread	± 1/4 inch

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10.7.2 In consecutive steps

Rise	± 1/16 inch
Tread	± 1/8 inch

10.8 Tolerances for Pre-cast concrete construction

Forms must be true to size and dimensions of concrete members shown on the plans and be so constructed that the dimensions of the finished products will be within the following limits at the time of placement of these units in the structure, unless otherwise noted on structural-architectural drawings:

10.8.1	Overall dimensions of members	1/16 inch per 10 feet
10.8.2	Cross-sectional dimensions	
	Sections less than 3 inch.	1/16 inch
	Sections over 3 inch and less than 18 inch.	1/8 inch
	Sections over 18 inch.	1/4 inch
10.8.3	Deviations from straight line in long sections.	
	Not more than	1/8 inch per 10 feet.
10.8.4	Deviation from specified camber	± 1/16 inch per 10 feet span.
	Maximum differential between adjacent units in erected position	1/4 inch

11. ACCEPTANCE OF STRUCTURE

11.1 GENERAL

11.1.1 Completed concrete work which meets all applicable requirements will be accepted subject to the other terms of the Contract Documents.

11.1.2 Completed concrete work which fails to meet one or more of the requirements and which has been repaired to bring it into compliance will be accepted subject to the other terms of the Contract Documents.

11.1.3 Completed concrete work which fails to meet one or more of the requirements and which cannot be brought into compliance may be accepted or rejected as provided in these Specifications or in the Contract Documents. In this event, modifications may be required to assure that remaining work complies with the requirements.

11.2 DIMENSIONAL TOLERANCES

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11.2.1 Formed surfaces resulting in concrete outlines smaller than permitted by the tolerances of clause 10 shall be considered potentially deficient in strength and subject to the provisions of sub clause 11.4.

11.2.2 Formed surfaces resulting in concrete outlines larger than permitted by the tolerances of clause 10 may be rejected and the excess material shall be subject to removal. If removal of the excess material is permitted, it shall be accomplished in such a manner as to maintain the strength of the section and to meet all other applicable requirements of function and appearance. Permission is required if excess material is to be removed in accordance with this clause.

11.2.3 Concrete members cast in the wrong location may be rejected if the strength, appearance or function of the structure is adversely affected or if misplaced items interfere with other construction.

11.2.4 Inaccurately formed concrete surfaces exceeding the limits of Clause 10 or of Clause 6.1.6 of Section 'Formwork' and which are exposed to view, may be rejected and shall be repaired or removed and replaced if required.

11.3 APPEARANCE

11.3.1 Architectural concrete with surface defects exceeding the limitations of Sub-clause 6.1.6 of the Section, 'Formwork' shall be removed and replaced.

11.3.2 Other concrete exposed to view with defects which adversely affect the appearance of the specified finish may be repaired only by approved methods.

11.3.3 Concrete not exposed to view is not subject to rejection for defective appearance.

11.4 STRENGTH OF STRUCTURE

11.4.1 The strength of the structure in place will be considered potentially deficient if it fails to comply with any requirements, which control the strength of the structure, including but not necessarily limited to the following conditions.

- Concrete strength requirements not considered to be satisfied in accordance with Clause 6 hereof.
- Reinforcing steel size, quantity, strength, position or arrangement at variance with the requirements as listed under specification of 'Reinforcement' or in the Contract Documents.
- Concrete which differs from the required dimensions or location in such a manner as to reduce the strength.
- Curing less than that specified.
- Inadequate protection of concrete from extremes of temperature during early stages of hardening and strength development.
- Mechanical injury, construction fires, accidents of premature removal of formwork likely to result in deficient strength.
- Poor workmanship likely to result in deficient strength.

11.4.2 Structural analysis and/or additional testing may be required when the strength of the structure is considered potentially deficient.

11.4.3 Core tests may be required when the strength of the concrete in place is considered potentially deficient.

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11.4.4 If core tests are inconclusive or impractical to obtain or if structural analysis does not confirm the safety of the structure, load tests may be required and their result evaluated in accordance with British Standard BS 8110 or ACI Standard 318.

11.4.5 Concrete work judged inadequate by structural analysis or by results of a load test shall be reinforced with additional construction if so directed by the Engineer or shall be replaced, at the Contractor's expense.

11.4.6 The Contractor shall pay all costs incurred in providing the additional testing and/or analysis required by this section.

11.4.7 The Employer will pay all costs of additional testing and/or analysis which are made at his request and which is not required by these Specifications, or by the Contract Documents.

11.5 Testing of Material

a) All tests shall preferably be done at site. Only the test which are not possible to be carried out in the site laboratory shall be referred to the laboratory approved by the Engineer. All testing charges thereof shall be borne by the Contractor.

For testing of reinforcement steel bars, the samples shall be referred to the laboratory approved by the Engineer at the cost of the Contractor.

b) Cement shall be tested as prescribed in ASTM C -150.

c) Aggregates shall be tested as prescribed in British Standard BS 812 & 882. In addition fine aggregate shall be tested for organic impurity in conformance with ASTM Standard C.40.

12. MEASUREMENT AND PAYMENT

12.1 General

Except otherwise specified herein or elsewhere in the Contract Documents, no measurement and payment will be made for the under mentioned specified works related to the relevant items of the Bills of Quantities. The cost thereof shall be deemed to have been included in the quoted unit rate of the respective items of the Bills of Quantities.

The rates quoted by the Contractor in the Bill of Quantities shall include work to be executed under these specification in any floor and at any height except where otherwise specifically stated in the relevant item of Bill of Quantities and the Contractor shall not be entitled to any claim or claim any compensation on this account.

12.1.1 Providing, fixing, striking, etc. of formwork.

12.1.2 Providing, placing and fixing of anchor bolts or any other embedded parts.

12.1.3 Providing and installing all type of joints in concrete structure, including expansion joints.

12.1.4 Providing and fixing water stoppers.

12.2 Plain and Reinforced Concrete

12.2.1 Measurement

Concrete shall be measured as executed but no deduction shall be made for the following:

- Volume of any steel embedded in the concrete.

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- Volume occupied by water pipes, conduits etc. not exceeding 10 square inches each in cross-sectional area.
- Voids not exceeding 4 square inch in work given in square feet. If any void exceeds 4 square inch, total void shall be deducted.

Voids, which are not to be deducted as specified above, refer only to openings or vents which are wholly within the boundaries of measured areas.

Openings or vents which are at the boundaries of measured areas shall always be subject to deductions irrespective of size.

Concrete work shall be classified and measured separately as listed under items of Bills of Quantities.

Junction between straight and curved works shall in all cases be deemed to be included with the work in which they occur.

Measurement of walls shall be taken between attached columns piers or pilaster. The thickness of attached columns, piers or pilaster shall be taken as the combined thickness of the wall and the columns, piers or pilaster.

Attached or isolated columns, piers, pilaster, and the like (except where caused by openings) having a length on plan not exceeding four times the thickness shall be classified as columns. Those having a length over four times the thickness and are caused by openings in wall shall be classified as walls.

Columns shall be measured from the top of footing/footing beams or floor surfaces to the underside of beams or slabs as the case maybe. Where the width of beams is less than the width of columns, the extra width at the junction shall be included in the beams.

The depth of the beams shall be measured from bottom of the slab to the bottom of the beams except in case of inverted beams where it shall be measured from top of slab to the top of beam. The cross-section of the beam shall be the actual cross-section below or above the slab.
Measurement of acceptably completed works of plain and reinforced cement concrete will be made on the basis of number of cubic feet of concrete placed and compacted in position within the neat lines of the structure as shown on the Drawings or as directed by the Engineer.

Measurement of curing agents/chemicals for plain & reinforced concrete will be made on the basis of area treated.

12.2.2 Payment

Payment will be made for the acceptable measured quantity of plain and reinforced cement concrete on the basis of unit rate per cubic feet quoted in the Bills of Quantities and shall constitute full compensation for all the works related to the item.

Payments will be made separately for the quantity of curing agents sprayed over the concrete surface.

Payments will be made for acceptable measured quantity of admixtures used in the concrete.

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SECTION - 3000

STRUCTURAL STEEL WORKS

1. SCOPE

2. APPLICABLE STANDARDS

3. SUBMITTALS

4. MATERIAL

5. CONNECTIONS

6. EXECUTION

7. INSPECTION AND TESTS

8. MISCELLANEOUS STEEL WORKS

9. MEASUREMENT AND PAYMENT

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1. SCOPE

The work covered by this section, consists of supply of all material, labour, plant, equipment and appliances including welding, bolts, nuts, washers, anchor bolts, embedded parts etc, fabrication, erection and painting in accordance with the specifications and as per drawings and as directed by the Engineer.

2. APPLICABLE STANDARDS

Latest edition of the following standards are relevant to these specifications wherever applicable:

AISC	Code of standard practice
AISC	Specifications for Design, Fabrication and Erection of Structural Steel for Buildings.
AISC	Specifications for structural joints using ASTM A325 or A490 Bolts.
ASTM	Specifications for materials
AISC/ SSPC	Guide to shop painting of structural steel
AWS	Specifications for welding of steel structures
BS 449	Use of structural steel in Buildings

3. SUBMITTALS

Design drawings shall be prepared by the Engineer and supplied to the Contractor. These shall contain main dimensions, sizes of members, typical details of joints.

Workshop drawings shall then be prepared by the Contractor from the design drawings supplied and submitted to the Engineer for approval.

4. MATERIAL

All the components shall be sound and free from injurious matter, cracks, air-holes, blows, wounds, scales, spitted grains and blunt rises. Except otherwise stated in the drawings, the material specifications shall conform to the following. Wherever necessary the Contractor may use equivalent alternative material subject to approval of the Engineer.

4.1 STRUCTURAL STEEL

Structural steel for structures shall conform to the requirements of ASTM A-36 or equivalent

4.2 STEEL SHEETS & PLATES

Steel sheets and plates, where required, shall conform to the requirements of BS 1449 “Steel Plates, Sheet and Strips”.

4.3 STEEL FORGING

Steel forging shall conform to the requirements of ASTM A235.

4.4 STEEL CASTING

Steel casting shall conform to the requirements of ASTM A27.

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4.5 WELDING

Welding Electrodes for manual shielded metal arc welding shall conform to AWS A 5.1 latest edition or the A 5.5 latest edition. Equivalent locally manufactured electrodes may be used subject to the approval of the Engineer.

4.6 STEEL BOLTS

Except where otherwise shown in the Drawings, the steel bolts shall conform to the applicable requirements of ASTM A307 "Specification for Low Carbon Steel Externally and Internally Threaded Standard Fasteners."

4.7 COMMON BOLTS, ANCHOR BOLTS, NUTS AND WASHERS

Common Bolts, Anchor Bolts, Nuts and Washers Bolts and Nuts shall conform to the requirements of ASTM A 307.

4.8 HIGH STRENGTH BOLTS

High strength carbon steel bolts including nuts and washers shall conform to the requirements of ASTM A325 latest editions and of AISI B18.2

4.9 WASHERS

Cut Washers: Shall be of structural grade steel and shall conform to the dimension of the manufacturer's regular standard for plain washers for the size of bolts used.

4.10 CAST IRON

Shall conform to the requirements of latest edition of ASTM A 48.

5. CONNECTIONS

5.1 DESIGN OF CONNECTION

All connections shall be designed and detailed for forces shown on the drawings, if any or 50% of the effective capacity of the member, whichever is greater.

Shop connections may be welded or bolted. Field connections shall be bolted unless noted otherwise on design drawings.

5.2 INSTALLATION OF BOLTS

High strength bolts shall be installed in accordance with AISC "Specifications for Structural Joints using ASTM A 325 or A 490 bolts".

5.3 MINIMUM SPACING OF BOLTS

The distance between centers of bolt holes shall not be less than 3d, where d is the diameter of the bolt in inches.

5.4 MINIMUM EDGE DISTANCE

The minimum edge distance i.e. center of standard hole to edge of connected part shall be as given in the table below:

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NOMONAL BOLT DIAMETER (INCHES)	AT SHEARED EDGES (INCHES)	AT ROLLED EDGES OR PLATES, SHAPES OR GAS CUT EDGES (INCHES)
1 / 2	1.5 TIMES THE DIAMETER OF BOLTS	3 / 4
5 / 8		7 / 8
3 / 4		1
7 / 8		1 – 1 / 8
1		1 – 1 / 4

5.6 ALLOWABLE STRESSES

Allowable design stresses for structural steel members and their connections, including temporary bracings and shorings shall be in accordance with AISC Specifications.

6. EXECUTION

6.1 FABRICATION

The Contractor shall notify the Engineer about any problems or doubts/errors discovered in the drawings for clarification/rectification well in time to prevent any fabrication errors. Fabrication shall not be commenced until approval has been obtained from the Engineer.

6.1.1 Straightening of Material

Rolled material, before being worked upon must be straightened within tolerances by ASTM specifications A6 Straightening, necessarily shall be done by mechanical means or by the application of a limited amount of localized heat. The temperature of heated areas, as measured by approved methods, shall not exceed 1100°F for A 514 steel or 1200°F for other steels.

6.1.2 Cutting

As far as possible cutting must be done by shearing, Oxygen cutting shall be done where shear cutting is not possible and shall preferably be done by Machine. All edges shall be free from gauges, notches or burs. If necessary the same shall be removed by grinding.

Metal sections shall be well formed, to shape and size, with sharp line or angles. Shearing and punching shall leave clean, true lines and surfaces. The metal sections shall be thoroughly straightened by methods that will not injure it, before being laid off or worked in any way. The members shall be so straightened that they are not, more than 1/16", away from a straight plane in either direction, for the full length of members. All members shall be so cut and formed that they can be accurately assembled without being unduly cracked, strained or forced into position.

6.1.3 Holes Punching Drilling

Holes shall be punched where thickness of the material is not greater than the diameter of bolt + 1/8". Where the thickness of the material is greater the holes shall either be drilled or sub-punched and reamed to size. The die for all sub-punched holes and the drill to all sub-drilled holes shall be at least 1/16" smaller

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than the nominal diameter of the rivet or bolt. Holes for A514 steel plates over 1/2" thick shall be drilled.

6.1.4 Welding

a) General:

The execution and inspection of welding will be done in accordance with the provisions of the American welding society code for welding in Building construction, D1.0. No welding for piping/electrical supports shall be made transversely to any tension flanges of trusses, beams or columns.

b) Automatic sub-merged Arc Welding:

For all built-up members, i.e. sections fabricated from plates and flat bars or compound rolled sections, plate and box girders, where long continuous, welding is to be done, should be executed by Automatic submerged Arc Welding process in accordance with relevant AWS specifications.

c) Maximum and minimum size and lengths of fillet welds shall be in accordance with AISC specifications.

Surface to be welded shall be free from loose scale, slag, rust, grease, paint or any other foreign matter except mill scale, which withstands vigorous wire brushing.

d) Tolerances

- A variation of l mm is permissible in the over all length of members with both ends finished for Contact bearing. The bearing surfaces prepared to a common plane by milling.
- Members without end finished for contact bearing which are to be framed to other steel parts of the structure shall have a variation from detailed length not greater than 1/8" for length over 30 feet and not greater than 1/16” for length.
- Members with ends finished for contact bearing shall have a variation 1/32” in the over all length.

6.2 TEST ASSEMBLY

6.2.1 After fabrication and before galvanization or painting, test assembly of complete Structural Components shall be done on the shop floor as directed by the Engineer.

6.2.2 Each test assembly will be inspected by the Engineer and will be dismantled only after his approval in writing

6.3 SURFACE PREPARATION/PAINTING

6.3.1 Surface Preparation

a) All structural steel material i.e. rolled steel sections, plates, pipes, flat bars, chequered plates shall be cleaned free from loose scale, rust, burrs slag, etc. by means of sand blasting.

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6.3.2 Painting

a) Immediately after surface preparation all material shall be given one prime coat of rust preventive paint.

b) After fabrication one shop coat of prime paint and then one coat of enamel paint shall be applied.

c) One final coat of enamel paint shall be applied after erection of all components.

d) The type of primer and enamel paints to be applied shall be as specified on the drawings and the thickness of each coat of the paint shall be in accordance with the specifications of the paint manufacturer.

e) All other requirements for the specified paint system shall be in accordance with the paint manufacturer's specification / recommendations.

f) The Contractor shall use the best quality of the type of paint specified and shall get the same approved by the Engineer.

g) Steel work/Surfaces not to be painted

i) Steel work to be encased / embedded in concrete or surface in contact with concrete or grout shall not be painted, but shall be given a cement wash after sand blasting.

ii) Machined finished surfaces shall not be painted but shall be coated with rust preventive compound, (approved by the Engineer) immediately after finishing. Such surfaces shall also be protected with wooden pads or other suitable means for transportation. Unassembled pins, keys, and bolt thread shall be greased and wrapped with moisture resistant paper.

iii) Contact surfaces of connections using high strength bolts in friction type connections shall not be painted. Such surfaces of all components after fabrication shall be cleaned free of all paints, grease, burrs slag by means of sand blasting. No coating whatsoever shall be applied to these surfaces. The surface roughness for high strength friction grip bolts is a very important factor and the components therefore will not be erected unless approved by the Engineer.

6.3.3 Zinc Coating

Components should be galvanized after complete fabrication i.e. welding, drilling etc. The process should consist of removal of rust and mill scale by pickling in hydrochloric acid or sulphuric acid followed by water wash and pre-fluxing in tanks containing zinc ammonium chloride and then fluxing with ammonium chloride. The fluxed components should then be passed through a drying oven prior to immersion in a bath of virtually pure molten zinc.

Wherever specified by the Engineer, zinc coating shall be applied in a manner and of a thickness and quality conforming to the requirements of ASTM A123 Standard Specifications for zinc (hot galvanized) coating on products fabricated from rolled, pressed and forged steel shapes, plate bars and strips.

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6.4 ERECTION

6.4.1 Bracing

The structure shall be carried up true and plumb within the limits defined in the AISC code of standard practice. Temporary bracing shall be introduced wherever necessary to take care of all loads of which the structure may be subjected including the equipment and the operation of the same. Such bracings shall be left in place as long as required for safety.

6.4.2 Alignment

Bolts tightening as specified by ASTM A 325 shall not be done at site during erection until the structure has been fully aligned and leveled.

6.4.3 Joints using High Strength Bolts

All structural joints using high strength bolts shall be executed and inspected in accordance with "AISC Specification for structural joints using ASTN A 325 or A 490 bolts".

6.4.4 Stubs

Stubbs of trusses before being embedded in concrete shall be erected in position timely aligned using stub setting templates.

7. INSPECTION AND TESTS

7.1 Manufacturer's Work Test Certificate for all material used shall be furnished by the contractor for Engineer's scrutiny and approval.

7.2 Rolling tolerance of all shapes and profile according to AISC shall be in accordance with the provisions of the American Society for Testing and Materials Designation A.6. The Contractor shall check these before being worked upon and these shall be rejected if found not within limits.

7.3 The Contractor shall arrange for analysis and test of all material rolled locally at a testing laboratory selected by the Engineer.

7.4 Inspection of Welding.

The inspection of welding shall be performed in accordance with the American Welding Society specifications, as directed by the Engineer.

7.5 Rejection

Materials or workmanship not in reasonable conformance with the provisions of these specifications shall be rejected at any time during the progress of the work or the completion and erection at site.

8. MISCELLANEOUS STEEL WORKS

8.1 General

The work covered shall include furnishing, fabricating, installing and painting miscellaneous steel work including the following:

- Steel doors and windows
- G.I. Flashings
- Steel pipe handrail
- Steel embedded plates anchor bolts and other miscellaneous items

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- Steel protection angles and channels
- Structural Steel Trusses

The Contractor shall submit shop drawings for each item showing in sufficient detail the material, its fabrication, surface preparation and other relevant information so as to conform to the applicable requirements of relevant clauses of these specifications for Engineers Approval. After the approval of drawing the Contractor shall erect a mock-up sample showing exactly the finished item as it will be fabricated/erected. Only after the approval of the mock-up sample the Contractor shall start the fabrication of items to be installed in place. Any proposed deviation due to field conditions and availability of local material shall be submitted to the Engineer for approval.

9. MEASUREMENT & PAYMENT

9.1 General

Except otherwise specified herein or elsewhere in the Contract Documents, no measurement and payment will be made for the under mentioned specified works related to the relevant items of the Bill of Quantities. The cost there of shall be deemed to have been included in the quoted unit rate of the respective items of the Bill of Quantities.

The rates quoted by the Contractor in the Bill of Quantities shall include works to be executed under these specifications in any floor and at any height.

9.1.1 Nuts, bolts, screw, rivets, heads, fillets, welds welding rods, locks, rollers, rolling tracks, pivot hinges, etc.

9.1.2 Anti-corrosive prime coat.

9.1.3 Cleaning with sand blasting.

9.1.4 Painting.

9.1.5 Embedding/fixing of steel pipe hand rail in concrete work and wooden covering.

9.1.6 All hardware in steel doors, locks, hold fasts, etc.

9.1.7 All metal embedded parts, metal fittings and fixtures required for the operational process.

Providing 2 hour fire resistant doors, UL listed fabricated from 16SWG MS sheet and the core filled with heavy density foam injected polyurethane of low U factor (< .069) and full width door frame fabricated from 14 SWG M.S sheet including painting etc. complete in all respects as per per design, approved shop drawings/mock-up samples of the type FRD1.

Glazing in steel door/windows including seals and gaskets and providing/fabricating louvers.

Epoxy primer to internal surfaces of door frame and shutter including frame.

9.2 Steel Doors & Windows

9.2.1 Measurement

Measurement of acceptably completed works of respective types of Steel Doors & Windows will be made on the basis of net actual area in square feet fabricated and installed in position as shown on the Drawings or as directed by the Engineer. Net area will be measured in accordance with plastered masonry opening in between jambs and plastered head and bottom of shutter.

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9.2.2 Payment

Payment will be made for acceptable measured quantity of respective types of Steel Doors & Windows on the basis of unit rate per square feet quoted in the Bill of Quantities against respective item and shall constitute full compensation for all the works including all hardware & fittings like locks, tower bolts, push plates etc. as per details shown on drawings.

9.3 Steel Handrail

9.3.1 Measurement

Measurement of acceptably completed works of respective types of Steel Hand railing will be made on the basis of actual length in feet fabricated & installed in position as shown the drawings or as directed by the Engineer.

9.3.2 Payment

Payment will be made for acceptable measured quantity of respective types of Steel Hand railing on the basis of unit rate per feet quoted in the Bills of Quantities and shall constitute full compensation for all the works related to the item.

9.4 Structural Steel Trusses

9.4.1 Measurement

Measurement of acceptably completed works of structural steel trusses will be made on the basis of number of metric tons of structural steel provided & erected in position as shown the drawings or as directed by the Engineer.

9.4.2 Payment

Payment will be made for acceptable measured quantity of structural steel trusss on the basis of unit rate per metric ton quoted in the Bills of Quantities and shall constitute full compensation for all the works related to the item.

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SECTION - 8001

GENERAL SPECIFICATIONS FOR ELECTRICAL WORKS

1.0 SCOPE OF WORK

2.0 RULES & REGULATIONS

3.0 AMBIENT CONDITIONS

4.0 STANDARDS

5.0 SYSTEM DATA

6.0 EQUIPMENT

7.0 DRAWINGS AND DATA TO BE FURNISHED BY THE CONTRACTOR

8.0 MANUFACTURER'S INSTRUCTIONS

9.0 GUARANTEE

10.0 DANGER BOARDS WITH SIGNS, DESIGNATION AND SHOCK / FIRST AID CHARTS AND FIRE FIGHTING EQUIPMENT

11.0 ASSOCIATED CIVIL WORKS

12.0 INSTALLATION INSTRUCTIONS - GENERAL

13.0 FACTORY TESTS

14.0 TESTING - GENERAL

15.0 APPENDICES TO BE FILLED IN BY THE BIDDER

16.0 PAYMENT



1.0 SCOPE OF WORK

The works related to the electrical system which is included in the Scope of this Contract as shown on the Drawings, stated in the Specifications and Bill of Quantities and explained in these Specifications. The works shall broadly include but not limited to the following:

- General Specifications for Electrical Works
- Low Voltage D.G. Set
- Indoor power Transformer
- H.T. Switchboards
- L.T Switchboards
- LT Distribution Boards
- Motor Control Centre
- Light Fixtures
- Low Tension Cables
- Wiring Accessories
- Conduits and Pipes
- Earthing
- Lightning Protection System
- Miscellaneous Items
- Structured Cabling Network
- Fire Alarm System
- Closed Circuit Television System
- Public Address System
- Cable Antenna TV System

The Contractor shall also be responsible to supply any other equipment not specifically mentioned in these Documents but which is necessary for proper operation of the works/system included in the scope of this Contract. The Contractor shall solely be responsible for ensuring proper functional requirements of different equipment. He shall also be responsible for furnishing any additional piece of equipment and for making modification in the equipment as desired and/or approved by the Engineer to achieve proper co-ordination with various equipment offered in the bid and also with those installed by others.

2.0 RULES & REGULATIONS

The entire electrical installation/work shall be carried out by licensed Contractor, authorised to undertake such work under the provisions of the Electricity Act 1910 and The Electricity Rules 1937 as adopted and modified upto date by the Government of Pakistan.

All works shall be carried out in accordance with the latest edition of the Regulations of the Electrical Equipment of Buildings issued by the Institute of Electrical Engineers-London, the Contract Documents, The Electricity Rules 1937 and bye-laws that are in force from time to time. Any discrepancy between these Specifications and any other rules and regulations shall be brought to the

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notice of Engineer for his instructions and the discussion of the accepting/controlling shall be final and conclusive.

The Contractor shall be responsible for completing all formalities and submitting the test certificates as per prevailing rules and regulations, and shall have the installation passed by the Government Electric Inspector of that region. All requirements of the Electric Inspector and the WAPDA / MEPCO shall be complied with.

3.0 AMBIENT CONDITIONS

All material and equipment supplied and installed shall be designed, manufactured and tested to meet the following ambient conditions unless specifically stated otherwise for any material/ equipment.

Maximum indoors ambient temperature	:	45-Degree Celsius
Minimum indoors ambient temperature	:	Zero Degrees Celsius
Maximum outdoors-ambient temperature	:	50-Degree Celsius
Minimum outdoors-ambient temperature	:	Zero Degrees Celsius
Maximum Relative humidity	:	100 Percent
Maximum Altitude of project	:	220 meters above the mean sea level.

The atmospheric conditions are tropical and highly humid.

4.0 STANDARDS

The latest standards and codes of reputable organisations shall be applicable for the material and equipment specified herein and for installation work. Such organisations to be BSS, VDE, NFPA 99, NEC Article 517 etc. In case the Specifications laid down herein differ from those given in the standards, then the equivalent or better specifications shall govern. Wherever applicable the equipment shall also conform to the requirements of Pakistan Standard Institution (PSI).

Contractor shall maintain at the site office one copy of the standards / codes applicable to the works.

5.0 SYSTEM DATA

Unless otherwise specified elsewhere, all equipment and material shall be designed to operate satisfactorily with the following minimum requirements without any de-rating.

a) Voltage rating of equipment :	HT :	11 kV, 3 phase, +/- 10%
	LT :	400 V, 3 phase, +/- 10%
		230 V, 1 phase, +/- 10%



b) Frequency : 50Hz ± 2Hz

In general, the electrical colour coding of switchgear cubicles, control panels, desks etc., shall be in accordance with the respective IEC Recommendations.

Live parts of electrical connections shall be colour coded according to IEC 446 as follows:

	Conductor Designation	**Coding Alphanumeric**	**Colour**
A.C. Network	Phase 1	L 1	red
	Phase 2	L 2	yellow
	Phase 3	L 3	blue
	Neutral	N	black
D.C. Network	Positive	L+	white
	Negative	L-	black
Earthing	Protective Earth	PE	green/yellow
	Earth	E	green/yellow

The colour coding for the secondary circuits of isolated power panel board is as follows:

Orange-Isolated Phase Conductor
Brown- Isolated Neutral Conductor
Green-Isolated Ground Conductor

Conductor insulation of secondary circuits of isolated power panel board shall be XLPE and PVC sheathed.

Control Cables

The Control Cables shall be manufactured according to specifications for L.T. Cables. The Control Cables shall be of multi-core, PVC insulated type withstanding without deterioration the conditions prevailing at the place of installation. The cross section of cable shall be as per the requirement of the system.

All the cores should be numbered and/or colour coded or otherwise properly identified. At-least 20% spare cores shall be provided in all Control Cables.

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No separate payment is admissible for supplying, installing, testing and commissioning of control cables and is deemed to have been included in the BOQ rates of the respective equipment.

Distance in between power, communication and control cables shall be kept as per requirements laid down by NEC800, NFPA 70 and EN50174-2.

6.0 EQUIPMENT

6.1 IP Degree of Protection

The equipment shall have IP degree of protection as follows, unless mentioned other wise:

- IP 42 for indoor areas
- IP 54 for indoor damp areas
- IP 65 for outdoor areas

If properly rated equipment is not available, the Contractor shall provide field enclosures to attain the required IP degree of protection. If necessary cooling/exhaust fans and / or anti condensate heaters shall also be provided. No separate payment shall be made to attain the required IP degree of protection.

6.2 Identification & Labelling

All devices, meters, cabling, wiring and auxiliaries shall be properly labeled for identification. Labeling of equipment shall be done by means of flameproof material using indelible ink/marking. The labeling shall be such as to ensure uniformity and shall facilitate study of control diagrams/ drawings during operation and maintenance.

All labeling shall be of suitable size to be visible from the operating conditions/positions at site.

6.3 Lamp Test Facility

All equipment / switchboards, etc. shall be provided with common lamp test facility.

7.0 DRAWINGS AND DATA TO BE FURNISHED BY THE CONTRACTOR

The shop drawings, as-built drawings and/or technical data to be furnished by the Contractor for each electrical equipment, LT cable distribution layout & shall include, but not limited to the following:

(a) Structural drawings showing foundations, RCC details dimensional plans



elevation and sections on a suitable scale.

(b) Electrical drawings showing:

- Line diagrams of Switchboards, Motor Control Centres, distribution boards and isolated power panels with detailed wiring diagrams, elevations/internal component layout and other standard details.
- LT Cabling, Grounding/Earthing including all cable routing and support details.
- Necessary execution details such as no. of cable/wires, size of conduits, cable routes, cable trays and cable trenches, etc.
- Substation and Generator Room Equipment installation detail.
- Manhole/Duct works.

(c) Layouts of all LT cable routes with coordinates and levels.

(d) Technical literature and manufacturer's characteristic data with the description of materials and weights of all equipment as instructed by the Engineer.

At least three (3) copies of the shop drawings and/or technical data of the equipment shall be submitted to the Engineer for checking and approval.

8.0 MANUFACTURER'S INSTRUCTIONS

The Contractor shall supply to the Engineer in properly bound form six (6) copies of manufacturer's instruction manuals for installation, testing, commissioning, operation and maintenance of the specified equipment including manuals of spare parts and tools of the equipment. At least two copies of the documents shall be submitted in original. The installation instructions shall be submitted 2 weeks prior to commencement of installation of each equipment, and operation and maintenance instruction at the time of commissioning. If the Contractor fails to provide the documents the Engineer shall withhold issuance of requisite certificates and deduct suitable amount from the payments to the Contractor.

9.0 GUARANTEE

The Contractor shall furnish written guarantee of the manufacturer or supplier with respect to satisfactory performance of each equipment. Guarantee shall be given for replacement and repair of part or whole of the equipment, which may be found defective in material or workmanship. The guarantee shall cover the duration of Maintenance Period as defined in the Conditions of Contract. This guarantee shall not relieve the Contractor of his obligations and he will be fully

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responsible for the repair or replacement of any defective material in time, so as not to cause any undue delay in carrying out the repairs and/or replacements.

10.0 DANGER BOARDS WITH SIGNS, DESIGNATION AND SHOCK / FIRST AID CHARTS AND FIRE FIGHTING EQUIPMENT

Danger Boards having signs and designation of the room shall be installed on the external door of HT, LT, Power transformer, Low Voltage DG Set Rooms. Shock/First Aid Charts shall be installed in H.T, L.T and Low Voltage DG Set Rooms.

Potable fire fighting extinguisher suitable to control electrical fire shall be provided in H.T, L.T, Power Transformer and Low Voltage DG Set Rooms.

All the above items shall also be provided, wherever required to comply the requirements of the Pakistan Electricity Rules/Electric Inspector.

Laminated single line and adequate detail drawings on proper boards highlighting the main system features shall be displayed/ fixed in respective electrical and communication rooms.

11.0 ASSOCIATED CIVIL WORKS

Except where separately stated in the Bill of Quantities the cost of all civil works associated with any BOQ item of electrical works, such as excavation and back filling of earth, compaction of the earth, foundation pads, chiselling, making openings, etc. shall be included in the price quoted against respective items. No separate payment for such works will be made. Such works will also include repair of any damage to civil works caused by the Contractor during electrical installation.

12.0 INSTALLATION INSTRUCTIONS - GENERAL

The Contractor shall furnish all labour, materials, tools and equipment required to install, connect, test and commission all electrical equipment specified herein, whether or not such equipment is furnished by him or by others.
For all equipment to be installed by the Contractor, the Contractor shall supply and install all erection materials such as foundation bolts, washers, nuts, etc. as required and without any additional costs.

The Contractor shall set out the works himself as per Specifications and Drawings and shall properly position the equipment on specified foundation/location. In general, the manufacturer's instructions for installation shall be followed. Any defect or faulty operation of equipment due to the Contractor not following the manufacturer's instructions shall be corrected and repaired by the Contractor at his own cost.

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For any deviation from the working drawings or specification that are deemed necessary by the Contractor due to site conditions, he shall submit the details and obtain the Engineer approval before starting such works.

13.0 FACTORY TESTS

All type and routine tests on Low Voltage D.G Set, Power Transformer, H.T Switchboards, LT Switchboards, Motor Control Centre, H.T Cables, LT Cables, and all other equipment shall be performed at the manufacturer's works in the presence of the Engineer or his Representative.

Equipment to be supplied under this Contract shall be subject to inspection and testing by two (02) representative engineers of Employer and two (02) representative engineers of the Consultant at its point of original manufacture or final shop assembly before its packing & dispatch to site. The Contractor shall make necessary arrangements and provide all the facilities required for the representative engineers of Employer and Consultant for conducting such inspection, at Contractor's cost. The cost of travel including overseas travel, arranging of Visas, boarding and lodging of Employer's and Engineer's representatives shall be the responsibility of the Contractor.

In addition, the Contractor shall provide daily allowance (US$ 200 per day) for out-of-pocket expenses to each of Employer's and Consultant's representative engineers nominated for inspection. The number of days shall be actual days spent in travel calculated from the dates of travel from and to hometown of the concerned representative. The daily allowance in cash (US$) shall be provided before start of travel from hometown.

The Contractor shall submit tests procedures / protocols for approval of Employer and Consultant well in advance to the set date of pre-shipment inspection. All relevant submittals, shop drawings and requisite technical data should be approved by the Engineer prior to start production.

The Contractor shall give at least 3 (three) weeks' notice to the Employer & Consultant for attending such inspections/tests.

14.0 TESTING - GENERAL

14.1 Scope

Upon completion of the installation, the Contractor shall perform field tests on all equipment, materials and systems. All tests shall be conducted in the presence of the Engineer for the purpose of demonstrating equipment or system compliance with Specifications. The Contractor shall submit for Engineer's approval complete details of tests to be performed describing the procedure, test observations and expected results.

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The Contractor shall furnish all tools, instruments, test equipment, materials, etc., and all qualified personnel required for the testing, setting and adjustment of all electrical equipment and material including putting the same into operation.

All tests shall be made with proper regard for the protection of the personnel and equipment and the Contractor shall be responsible for adequate protection of all personnel and equipment during such tests. The cost of any damages or rectification work due to any accident during the tests shall be the sole responsibility of Contractor.

The Contractor shall record all test values of the tests made by him on all equipment. Four (4) copies of all test data and results certified by the Engineer shall be given to the Engineer for record purposes. These shall also include details of testing method, testing equipment, diagrams, etc.

The witnessing of any tests by the Engineer does not relieve the Contractor of his guarantees for materials, equipment and workmanship, or as any other obligations of Contract.

14.2 **Low Voltage D.G. Set**

Prior to the tests, the contractor shall submit manufacturer's recommended detailed description of the test procedures to be conducted for Engineer's approval.

The Contractor shall carry out full site load and no load tests in accordance with IEC, ISO or BS Specifications for site commissioning. The inspection and tests shall include but not be limited to:

Basic Tests:	Insulation Resistance Earth Continuity Earth Loop Impedance Polarity Phase Rotation Voltage and Frequency Starting System Protection Equipment
Battery:	Nominal Voltage Discharge Voltage Specific Gravity of Electrolyte Level of Electrolyte Charging System
Lubrication:	Check as required by manufacturer
Operational Check at	Oil Pressure

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Start-up	Fuel Oil Leaks	
	Operation of Safety Devices	
	Operational Speed	
	Automatic Control	
	Instrument Check	
	Exhaust Check	
	Undue Vibration	
Operational Check	Oil Pressure	
After one hour's run:	Oil Leaks	
	Cooling System	
	Oil Temperature	
Commissioning Test:	25% of full load	2 hrs.
	50% of full load	5 hrs.
	75% of full load	8 hrs.
	100% of full load	8 hrs.
	110% of full load	1 hr.

All commissioning and test results shall be recorded and compared with design data. A retest/commissioning shall take place if results are not satisfactory. All the tools, labour, POL, required for the testing and commissioning shall be provided by the Contractor at no extra cost. If required load is not available at site for testing the generators, the Contractor shall provide dummy load at site at no extra cost to the Employer. The correct functioning of the control equipment shall also be proved.

Battery Charger

Battery charger shall be static type and shall provide for both trickle and boost charging of the batteries when the engine is not in operation. The charger shall be of suitable capacity to fully recharge the completely discharged batteries within four hours at boost charge.

Control Panel

The Control Panel shall provide all the necessary control and monitoring devices of the Diesel Generating Sets. All the control and monitoring of the safety devices, alarms, protections, meters, lamps, etc. as mentioned in this Specifications and required as per good engineering practices for such an installation shall be provided in the Control Panel.

14.3 Transformer Tests

In addition to the insulation resistance test of the transformer, a polarity and phase rotation test shall also be made. Buchholz relay shall be tested for proper operation. Di-electric test shall be carried out on transformer oil prior to putting the same in operation.

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14.4 HT / LT Switchboards

Each circuit breaker shall be operated electrically and mechanically. All interlocks and control circuits shall be checked for proper connections in accordance with the wiring diagrams given by the manufacturer.
The Contractor shall properly identify the phases of all switchgear and cables for connections to give proper phase sequence.

Trip circuits shall be checked for correct operation and rating of equipment served. The correct size and function of fuses, disconnect switches, number of interlocks, indicating lights, alarms and remote control devices shall be in accordance with approved manufacturer drawings. Nameplates shall be checked for proper designation of equipment served. Protective relays shall be tested and set at site prior to commissioning of the equipment.

14.5 Insulation Resistance Test

Insulation resistance test shall be made on all electrical equipment by using a meggar of 500 volts for circuits upto 250 volts and 1000 volt for circuits between 250 and 500 volts. For testing of 11 kV circuits, upto 5 kV meggar shall be used; the exact voltage shall be as advised by the equipment manufacturer unless otherwise advised by the Engineer.

The insulation resistance values of cables, transformer, switchgears, etc., shall be as per BSS, IEEE, NEC, ICEA and Pakistan Electricity Rules.

Before making connections at the ends of each cable run or joint between cables, the insulation resistance test of each cable section shall be made. H.T. cables shall be subjected to high voltage test as per recommendations of standard to which the cable is manufactured. Each conductor of a multi-core cable shall be tested individually with each of the other conductor of the group and also with earth. If insulation resistance test readings are found to be less than the specified minimum in any conductor, the entire cable shall be replaced and tests repeated on new cable. If cable joint is provided, then each cable section shall be tested, and joint made only after the tests have been made satisfactorily. Finally the completed cable length including the joints shall be tested.
The transformer and switchgears shall be given an insulation resistance measurement test after installation, but before any wiring is connected. Insulation tests shall be made between open contacts of circuit breakers, switches and between each phase and earth.

If the insulation resistance of the circuit under test is less than the specified value, the cause of the low reading shall be determined and removed. Corrective measures shall include dry-out procedure by means

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of heaters, if equipment is found to contain moisture. Where corrective measures are carried out, the insulation resistance readings shall be taken after the correction has been made and repeated twice at 12 hours interval. The maximum range for each reading in the three successive tests shall not exceed 20% of the average value. After all tests have been made, the equipment shall be reconnected as required. Polarity test shall be made on single pole switching devices.

14.6 **Earth Resistance Test**

The Contractor shall make Earth resistance tests on the Earthing system, separating and reconnecting each earth connection.

If it is indicated that soil treatment or other corrective measures are required to lower the ground resistance values, the Engineer will determine the extent of such corrective measures.

The electrical resistance of the ECC together with the resistance of the Earthing leads measured from the connection with earth electrode to any other position in the complete installation shall not exceed one ohm.

Earth resistance test shall be performed as per Electrical Inspector's requirements. Where more than one earth electrodes are installed, the earth resistance test of each electrode shall be measured by means of resistance bridge instrument.

The complete lightning protection system shall be tested for continuity and earth resistance. The combined earth resistance at any point in the lightning protection system shall not exceed 10 ohms.

14.7 **Completed Tests**

After any equipment has been tested, checked for operation, etc., and is accepted by the Engineer the Contractor shall be responsible for the proper protection of that equipment so that subsequent testing of other equipment do not cause any damage to the already tested equipment.

14.8 **Expenses**

All expenses, i.e., travelling, boarding and lodging for carrying out the tests and witnessing by the Engineer shall be borne by the Contractor and are deemed to have been included in the BOQ rates of the respective equipment(s) by the Contractor.

14.9 **Spare Parts**

Contractor shall provide spare parts as identified in relevant appendix

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The cost of each spare parts shall be carried over to relevant BOQ item and no extra payment shall be admissible in this regard.

14.10 Special Tools

Contractor shall provide special tools as indicated in Appendix-IV and as may be deemed essential for assembly, adjustment, dismantling, installation and maintenance reasons.

No separate payment shall be made for any special tools and cost shall be deemed to be included in the cost of the Contract.

15.0 APPENDICES TO BE FILLED IN BY THE BIDDER

The details regarding equipment manufacturers, deviations, etc., are to be furnished in the appendices attached with form of Bids, in accordance with the provisions of the clause "Requirements of Electrical Works" given in the instructions to Bidder, Volume - I.

16.0 PAYMENT

No separate payment shall be made for work involved within the scope of this section unless specifically stated in the Bill of Quantities or herein.

*** End of Section 8001 ***

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SECTION - 8111

LOW VOLTAGE D.G. SET

1.0 SCOPE OF WORK

2.0 GENERAL

3.0 APPLICABLE STANDARDS/CODES

4.0 MATERIAL

5.0 INSTALLATIONS & TESTING

6.0 MEASUREMENT AND PAYMENT

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1.0 SCOPE OF WORK

The work under this section consists of supply, installation, testing and commissioning of all material and services of the complete Diesel generator set, Auto Main Failure (AMF) Panel and other equipment, as specified herein, shown on the Tender Drawings and given in the Bill of Quantities.

The Contractor shall discuss the electrical layout with the Engineer and co-ordinate at Site with other services for exact location and position of the Diesel Generator Set, Auto-Main Failure (AMF) Panel, underground / above ground storage tanks and routing of cables.

The Diesel generator set, Instrument/Control Panel, auto main failure panel and accessories shall comply with the General Specifications for Electrical Works, Section-8001, and other relevant provisions of the Tender Document.

2.0 GENERAL

The Diesel generator set shall be a standard design of reputed manufacturer, who shall have similar units in operations for similar applications and field conditions. The manufacturer shall also have adequate maintenance facilities in the vicinity of Project with technically qualified and experienced personnel trained for operation and on-site maintenance of equipment offered by the Contractor in the tender bid.

The set shall be rated for continuous duty and suitable for indoor installation with protection rating IP23. It shall be capable for unbalance loads upto 30% of actual load and for continuous part load operation. The set shall be capable of starting and operation at the rated output at 0°C and at an altitude of 15 meters above mean sea level. The ratings must be substantiated with manufacturer's standard published data.

The Diesel Generator set shall, after reducing the power absorbed by the auxiliaries, deliver continuously rated power output under the site conditions. All auxiliaries, accessories and connections between systems alongwith all necessary cables, fittings, hardware, etc., for complete installation of Diesel Engine, Generator, Control / Instrument Panel, Auto-Main Failure (AMF) Panel, Duty Selection Switch, Fuel and Oil Storage, Batteries, Exhaust System, etc., shall be furnished by the Contractor.

The engine shall be directly coupled to the generator, and shall have a rated speed of 1500 rpm. The set shall be capable of sustaining without damage, 15% over speed under any abnormal operating condition.

The engine-generator set shall be mounted on suitable rigid steel frame skid with vibration isolators. Heavy duty lifting eyes and jacking screws shall be provided on the skid. The foundation bolts and all other material/hardware for complete installation of the set shall be furnished with the set. Any excessive tensional vibration shall be avoided for both engine and alternator.



The set shall be suitable for full load starting. When the generator is operating at no-load, the application of full load current, taking into account the surge due to starting of equipment, should be possible with maximum transient voltage drop of 15% of the rated voltage, and the time taken to restore the generator voltage to 97% of rated value should not exceed 1.5 seconds.

The set shall be capable for parallel operation.

The Contractor shall submit the equipment layout and other installation details as per manufacturer's recommendations for approval of the Engineer at least 60 days prior to the installation of the set.

Necessary provision, including connections and a Local / OFF / Remote control switch shall be made in the Generator Panel of each of the D.G. Set. The cost of such provision, connection, testing and commissioning are deemed to be included in the Cost of D.G. Sets and no separate payment shall be made against such works.

3.0 APPLICABLE STANDARDS/CODES

The Diesel engine and generator shall conform to the following standards as applicable.

- BS 5514 - Reciprocating Internal Combustion Engine.
- BS 4999 - General Requirements for Rotating Electrical Machines.
- BS 5000-99 - Rotating Electrical Machines of particular types or for Particular application.

For other equipment and materials related to the Diesel generator set, the Contractor shall follow relevant international standards, details of which shall be submitted to the Engineer for approval.

4.0 MATERIAL

4.1 Diesel Engine

The Diesel Engine shall be four strokes, compression ignition, suitable for continuous duty.
Starting shall be through electric starter motor operated on DC supply from lead acid batteries mounted on the skid. The batteries shall be furnished with the set.

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The engine shall be equipped with an alternator type automatic charging system to charge the batteries during running of engine. A static battery charger installed in the control panel shall also be provided to charge the batteries when the engine is not running. Suitable interlocks shall be provided to prevent simultaneous operation of both charging systems.

The batteries shall be adequate to satisfy the following requirements:

a. Crank the engine at firing speed for at least 15 seconds.

b. If the engine does not start on the first attempt, crank the engine two more times for the above duration at an interval of 30 seconds between each cranking operation.
Engine shall be rated for continuous duty with overload capability for operating at least 10% above the rated capacity for 1 hour continuously in any 12 hours operation.

4.1.1 Air Intake

Air intake shall be through turbo charger and equipped with dry type filter. Suitable attenuators shall be installed to reduce noise at the air inlet.

4.1.2 Engine Lubrication

A gear type positive pressure lubrication pump shall be provided with efficient filtration arrangement for the lubrication system.

The heater shall be designed for automatic switching to ensure that temperature of oil is maintained for proper operation of the engine.

Engine shall have a constant oil level regulator, gravity fed from an engine mounted lube oil reservoir. Reservoir shall be equipped with an oil level gauge. Size of the reservoir should be suitable for 30 days continuous operation at full load.

A crankcase pressure release valve shall be provided to operate during excess pressure.

4.1.3 Engine Cooling

Engine shall have a forced air draft, water-cooled radiator supplied with a core guard. Cooling system shall have an engine driven centrifugal pump for cooling water circulation. Cooling shall be thermostatically controlled. An engine shut down timer shall be provided to keep the engine running on no-load after any operation

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of set, so that the engine is sufficiently cooled to start again instantly, if required, without rise in temperature above safe limits.

4.1.4 Exhaust System, Noise, Pollution

Exhaust system shall be equipped with a residential type silencer complete with muffler, exhaust manifold, flexible connector, exhaust elbow, exhaust pipe, rain cap, and associated fittings. The exhaust line shall be taken outside the building through the shortest possible and practical route, without any undue bends. This exhaust line shall be adequately covered with thermal insulation material over its entire length i.e. from the engine to the termination point. All supports for exhaust system shall be furnished.

The sound level in the diesel generator room shall not exceed the values of the noise rating curve NRC 95 to ISO TI 43-1961 standard, measured at 1 m distance from the object but in no case greater than 85 dB (A) under all operating conditions.

The exhaust fumes shall be burnt completely and be free of solid matters before escaping to the air.

4.1.5 Speed Governor

The speed governor shall be electronic type. Governor shall regulate engine speed so as to maintain the generator frequency within plus or minus 0.25% of the rated frequency. Stable engine speed shall be attained within 15 seconds after the engine has been started. Stable engine speed shall be restored within 10 seconds of any sudden change in load, from no load to full load. During this change of load or surge, the speed shall not vary by more than plus or minus 5% of the rated speed.

4.2 Fuel System

Engine of the generator shall operate on commercial high speed Diesel oil. A fuel oil strainer/filter shall be provided in the fuel line. Fuel system for Diesel engine shall be through explosion proof self-priming pump. The fuel system shall comprise:

- Underground fuel storage tank. (Common for both D.G. Sets)
- Fuel transfer pump(s). (Separate for each D.G. Set)
- Fuel piping network. (Separate for each D.G. Set)
- Fuel day tank. (For each D.G. Set)



4.2.1 Underground Fuel Storage Tank

The underground outdoor fuel storage tank shall have the capacity as mentioned in BOQ item or shown on the drawings to store fuel for operation of the set at the rated output. The tank shall have high and low level float switches for monitoring the fuel level in the tank. The high and low level switches shall provide an annunciation while the low level switch shall in addition to above annunciation also prevent starting of set and to stop the set when the fuel in storage tank is at this level. The tank shall be provided with overflow, vent, supply and discharge valves, inspection cover, drain valve and glass sight gauge.

The fuel storage tank shall be of mild steel plates and shall be designed, fabricated and finished in accordance with the requirements of DIN 6608 - Horizontal Steel Tanks for underground storage of Petroleum Products in Liquid Form.

Underground fuel storage tank and supports shall be fabricated in accordance with the specified code and the following:

- Tank shall be capable to withstand maximum loads encountered during installation and operation for all conditions from empty tank to tank filled to capacity or overflow.
- Tanks shall be capable to withstand safely the forces and moments imposed by connecting piping.
- The buried tank shall be capable of sustaining lateral backfilling load of equivalent fluid pressure.
- The tank shall be capable of resisting flotation by providing concrete beams or saddles installed over the top of the tank or by hold-down straps bolted to a concrete foundation pad.
- The thickness of tank elements shall be increased over the thickness required by code requirements by 2mm for corrosion allowances.
- The tanks shall be provided with at least two lifting eyes.
- A nameplate shall be attached to manhole flange marked in accordance with the requirements of the code, and shall include following information:
  - Manufacturer's name/mark and year of fabrication,

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- Manufacturer's serial number,
- Design gauge pressure,
- Test gauge pressure,
- Design temperature,
- Applicable code stamp,
- Fluid stored,
- Storage capacity,
- Tank size.

Welding procedure qualifications, electrodes, preheat, post weld treatment, welder performance tests and submittals shall be in accordance with relevant international codes and standards.

Shell plate joints shall be butt welded with complete penetration and fusion. All joints in the attachments to the shell shall be fully seal welded to prevent rust staining.

Sharp welds and sharp corners shall be ground smooth and blended into the base material. All bottoms of the shell connections shall be flush with the inside of the shell unless otherwise indicated.

The interior surfaces of the tank shall be cleaned of all mill scale, cuttings, weld spatter and other foreign matter and shall receive a commercial sandblast in accordance with SSPC-SP 5.
All openings shall be sealed immediately after the last shell joint is made.

The exterior surfaces of all tank and piping shall be given a protective coating of the epoxy-phenolic-amine type.

All interconnecting steel pipes shall be seamless in accordance with ASTM-A 53 or approved equivalent. Pipe fittings shall be butt-welded type according with ASTM-A 53. All underground pipe and fittings shall be buried in accordance with ASTM D 1557. The pipe surface shall be given a protective coating of the epoxy-phenolic-amine type.

Welds shall be inspected in accordance with section VIII of the ASME Code, DIV-I.

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Non-destructive examination procedures shall be submitted for approval before they are implemented.

Results of non-destructive inspection shall be submitted prior to installation as per requirement of section VIII, DIV-I of the ASME Code.

Tank shall be hydrostatically shop tested as required by ASME code, section VIII DIV-I, and shall be dried immediately after the test.

Before a hydrostatic test procedure is implemented it shall be submitted for approval, and shall include the recommended minimum and maximum hydro-test pressure with the corresponding minimum and maximum temperature.

4.2.2 Fuel Transfer Pumps

An explosion proof electric self-priming, fuel pump of suitable capacity to fill the fuel day tank from the outdoor underground fuel storage tank in 30 minutes or lesser time shall be provided. A manual fuel pump shall also be furnished and connected in parallel to the electric fuel pump, with a capacity to fill the tank in 2 hours maximum. All interconnected piping, valves, etc., for parallel connection of the two pumps shall be furnished. The electric starter, circuit breaker, wiring, etc., for the electric pump shall be provided alongwith the Fuel Storage Tank by the Contractor without any extra cost.

4.2.3 Fuel Piping Network

The fuel piping network separate for each D.G. Set to be furnished shall include fuel supply pipe from storage tank to day tank in the skid of the D.G. set, over flow pipe from the tank to the set, drain pipe from the tank to a location approved by the Engineer.

The arrangement of pipe work with respect to the location of equipment shall be prepared by the Contractor and submitted to Engineer for approval. A full flow oil filter shall be installed in the fuel supply lines with a by-pass arrangement.

4.2.4 Fuel Day Tank

The engine generator skid mounted fuel day tank for each D.G. Set shall have capacity to store fuel for 8 hours operation of the set at the rated output. The tank shall have level switch for monitoring low fuel level in the tank. The low level switch shall provide an annunciation and prevent starting of set and to stop the set when

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the fuel in storage tank is at this level. The tank shall be provided with overflow, vent, supply and discharge valves, inspection cover, drain valve and glass sight gauge.

4.3 Generator

Generator shall be synchronous. The generator shall be capable of carrying continuously for 1 hour in every 12 hours, overload equal to 10% of rated output with field set for normal rated load excitation.

4.3.1 Excitation

Excitation shall be from brushless rotating diodes mounted on the main shaft for 3-phase full wave rectification.

4.3.2 Windings

Alternator windings shall have Class-F insulation and shall be impregnated for tropical use. The temperature rise of winding under normal operating conditions and at rated load shall not exceed the limits specified for Class-B insulation. Anti-condensate heaters shall be provided for windings. The heaters shall be thermostatically controlled for switching ON after the set has stopped. The thermostat range shall be adjustable and set to prevent overheating of windings. For protection of windings from damage due to overheating, thermostats shall be embedded to stop the set in case the temperature of winding rises above the safe value.

4.3.3 Voltage Regulation

Voltage regulator shall be solid state with provision for manual setting. Regulator shall be so designed to protect the exciter when the set is running at reduced speed during starting or idling of the prime mover.

Voltage regulation shall be plus or minus 0.25% from no-load to full load. Transient voltage drop shall be less than 15% at full load and 0.8 power factor. Time required to restore to steady state conditions after transient voltage fluctuation shall not exceed 10 seconds.

4.3.4 Short Circuit Capability

Generator shall be capable of withstanding without injury, a 30 seconds three-phase short circuit at its terminal when operating at rated output and power factor with fixed excitation.



4.3.5 Deviation Factor

The deviation factor of the open-circuit line-to-line terminal voltage shall not exceed 0.1

4.4 Control / Instrument Panels

The Control / Instrument Panel for each generator shall be designed for front access, completely assembled, wired and tested. The control panel shall conform to the constructional requirements as stated in these specifications for Switchboards. The panel shall comprise but not limited to the following main components.

4.4.1 Generator Panel

This shall incorporate protection and control equipment, measuring instruments, control and instrument transformers, voltage regulator, governor controls, battery charger, indicating lamps, etc.

4.4.1.2 Instruments

i) Ammeter with selector switch.
ii) Voltmeter with selector switch.
iii) Frequency meter.
iv) Kilowatt-meter.
v) Local / OFF / Remote Control Switch.

4.4.2 Engine Panel

An instrument panel on the skid shall have calibrated gauges/meters to measure the following:

i) Engine speed.
ii) Lube oil pressure.
iii) Lube oil temperature.
iv) Engine running hours

4.4.3 Safety Devices

Following safety devices shall be provided. The audible alarm shall operate on any fault condition and shall be resettable manually and automatically through a timer after 15 minutes whichever is earlier:

A = Alarm SD = Shutdown TD = Adjustable Time Delay

i) Engine Over speed A SD



ii)	Low lube oil pressure	A SD
iii)	High water temperature	A SD
iv)	Over voltage	A SD (TD=0-30 Sec)
v)	Under voltage	A -
vi)	Low level in fuel day tank	A SD (TD=0-5 min.)
vii)	High level in fuel day tank	A -
viii)	Charger failure	A -
ix)	Over crank	A SD
x)	Low crankcase oil level	A -
xi)	High crankcase oil level	A -
xii)	Charging alternator failure	A -

After shut down, the set shall lockout and it shall not be possible to start it unless manually reset after the cause of fault has been removed.

4.4.3 Batteries & Battery Charger

The batteries provided with each D.G. Set shall be of sufficient capacity to perform all required functions; including the operation and control of AMF Panel and Automatic Transformer Switch (ATS).

Battery charger shall be static type and shall provide for both trickle and boost charging of the batteries when the engine is not in operation. The charger shall be of suitable capacity to fully recharge the completely discharged batteries within four hours at boost charge.

4.4.5 Lamp Test Facility

A common lamp test facility shall be provided for each control panel/instrument panel.

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4.5 Automatic Transfer Switch (ATS)

The Automatic Transfer Switch shall be 4 pole and rated for cumulative capacity of the two generators. ATS shall employ two numbers motorized Air Circuit Breakers to feed the load from the main supply or generators.

5.0 INSTALLATIONS & TESTING

The Diesel generator set and associated equipment with accessories shall be installed at location shown on the drawing. The Contractor shall ensure co-ordination with the civil works for providing any openings, holes, etc. to avoid any breakage to completed works. In case the provisions in civil works for installation of electrical equipment are not made or made incorrect the same shall be rectified by the Contractor at his own cost and to the satisfaction of Engineer. The Contractor shall provide foundation bolts and grout them in cement concrete floor using non-shrinkable material with the approval of Engineer.

All installation materials for physically installing the Diesel generator set and associated equipment, such as bolts, nuts, washers, supporting steel, etc., shall be provided and installed by the Contractor. The generator shall be installed upright and in level and shall be firmly and rigidly bolted to the steel frame skid with vibration isolators.

The Diesel generator set shall be completely erected as per manufacturer's instructions and as approved by the Engineer. Loose parts dispatched by the manufacturer shall be installed and connected as per assembly drawing provided by the manufacturer. Any safety locking of meter, relays, etc., provided by the manufacturer for safe transport shall be released only after the generator/ control panel is erected in position.
The incoming and outgoing cables shall be connected as recommended by cable manufacturer. The cable armour shall be connected effectively to ground.

The Diesel generator and associated equipment body shall be connected to earth as per instructions given in section “Earthing" of these Specifications. The Diesel generator set shall be tested and commissioned in the presence of the Engineer. The tests to be carried out are described in article “Testing" of General Specifications for Electrical Works, Section-8001 of these Specifications.

The tank shall be installed in accordance with best engineering practice/international codes, the approved shop drawings, applicable code requirements and manufacturer's instructions.

6.0 MEASUREMENT AND PAYMENT

6.1 General

The Contractor's bid amount against each item of Bill of Quantities as given below shall include supply, installation, testing, commissioning and

completion for all work specified herein and/or as shown on the Tender Drawing/B.O.Q. related to the item.

6.2 Diesel Generator Set

6.2.1 Measurement

Measurement shall be made for each Diesel Generator Set including Fuel Day Tank, Control/Instrument Panel, Gravity Louvers, and Control Wiring to Control/Instrument Panel of other generator, AMF Panel, L.T switchboard etc. acceptably supplied and installed by the Contractor as a complete job.

6.2.2 Payment

Payment shall be made for the number of jobs measured as provided above at the Contract unit price each for supply, installation, testing, commissioning and completion of the Diesel Generator Set, including its reinforced concrete foundation, Fuel Day Tank, Gravity Louvers matching with radiator, Control / Instrument Panels and accessories, control wiring between D.G. set and Control/Instrument Panel, AMF Panel, L.T switchboard fixing arrangements, all testing arrangements, etc.

6.3 Fuel System

6.3.1 Measurement:

Measurement shall be made for Fuel System comprising underground Fuel Storage Tank of capacity mentioned in BOQ/drawings including pumps all accessories and piping acceptably supplied and installed by the Contractor as a complete Job.

6.3.2 Payment

Payment shall be made for the number of jobs measured, as provided above at the Contract unit price each and shall constitute full compensation for supply, installation, testing and commissioning of underground fuel storage tank with excavation, backfilling, sand filling, reinforced concrete foundation/structure (including reinforcement) and fixing / supporting structure and all other accessories complete with all type of valves, fuel transfer pumps (both electric and manual) float switches control / power wiring, control panel for automatic operation of the pumps, for each generator fuel piping network with required filters for each

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generator as per Specifications and required for normal operation of both D.G. set.

6.4 Spare Parts

6.4.1 Measurement

Measurement shall be made for the spare parts of Diesel generator set as listed in form of Tender Volume-I, acceptably supplied by the Contractor as a complete lot.

6.5.2 Payment

Payment will be made for the complete job of spare parts as provided above at the Contract unit price and shall constitute full compensation for supply, tagging, and packing of spare parts including wooden/steel storage boxes as required.

*** End of Section 8111 ***

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SECTION - 8132

LT SWITCHBOARDS

1.0 SCOPE OF WORK

2.0 GENERAL

3.0 APPLICABLE STANDARDS/CODES

4.0 MATERIAL

5.0 INSTALLATIONS

6.0 MEASUREMENT AND PAYMENT

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1.0 SCOPE OF WORK

The work under this section consists of supplying, installing, testing, connecting, commissioning of all material and services of the complete LT Switchboards as specified herein and/or shown on the Bidding Drawings and given in the Bill of Quantities.

The Contractor shall discuss the electrical layout with the Engineer and coordinate at site with other services for exact route, location and position of the LT Switchboards.

The LT Switchboards shall also comply with the General Specifications for Electrical Works Section-8001 and with other relevant provisions of the Bidding Documents.

2.0 GENERAL

The LT Switchboards shall be of sheet steel fabricated, floor mounting, cubicle type, totally enclosed, dust tight and vermin proof. It shall be complete in all respect with material and accessories, factory assembled, tested and finished all according to the specifications and to the normal requirements. The IP rating of LT Switchboards shall be at least IP54.

The switchboard with all components and accessories shall be suitable for front operation only and shall:

- have a rated service short circuit breaking capacity, (Ics) at 415 V AC conforming to IEC 60947-2 as shown on the drawings.

- be provided with adequate clearance from live parts so that flashovers cannot be caused by switching, vermin, pests, etc.

- have all components rated for insulation class of 600-volt minimum.

- be designed for flush mounting of all instruments on the front side.

- have all incoming and outgoing connection from the top or bottom as required.

- have the components mounted so as to facilitate ease of maintenance from the front.

- have common lamp test facility for all lamps.

- have wiring diagram in the pocket on the inside of each door of the panel.

- be suitable for 415 volts AC, 3 phase 4 wire, 50 Hz system.

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- be labeled with stainless steel nameplate on the front side of door for each incoming and outgoing circuit.

- have doors grounded by flexible copper cable/strip.

- have arrangements for extension of panel in future.

3.0 APPLICABLE STANDARDS/CODES

The latest editions of the following standards and codes shall be applicable for the materials specified within the scope of this Section:

IEC 60947-3	-	Low Voltage Switchgear and Control Gear-Switches, Disconnector, Switch-disconnector and Fuse Combination Units.
IEC 60947-2	-	Low Voltage Switchgear and Control Gear-Circuit Breakers
IEC 60831	-	Power Capacitors
IEC 60439	-	Low Voltage Switchgear and Control gear Assemblies
IEC 60073	-	Colours for indicator lights and push buttons
BS EN 60529	-	Specifications for degrees of protection provided by enclosures (IP Code).
IEC 60044-1	-	Instrument Transformers - Current Transformers
IEC 60044-2	-	Instrument Transformers – Inductive Voltage Transformers
IEC 60051-1, 2, 3, 5 & 8	-	Direct acting indicating analogue electrical measuring instruments and their accessories
BS 88	-	Cartridge fuses for voltage upto and including 1000 V a.c and 1500 V d.c

4.0 MATERIAL

4.1 Sheet Metal Work

The LT Switchboards shall be fabricated, welded, grinded, finished with angle iron framework and cladded with 14/16 SWG MS sheet. It shall be suitably divided into panels and compartments for accommodating the required number of circuit components, instruments and accessories.

The switchboard shall be supplied complete with foundation bolts and other installation materials as recommended by the manufacturer. Proper size cable clamping channels with galvanized steel clamps and brass

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cable glands respectively for unarmoured and armoured cables shall be provided. All holes, cutout shall be tool or jib manufactured and free from burrs and rough edges. An earth bar of appropriate cross section shall be provided and connected to the bodies of all sections of the switchboard. Two external earth terminals shall be provided for main earth connection to the body of switchboard. The doors shall be earthed by means of flexible copper strip. Means shall be provided to limit the opening angle of doors to about 100^0.

The cabling inside the switchboard shall be suitably numbered and harnessed by means of straps or cords. Wiring to door mounted components shall be in flexible PVC conduit. All indicating, selecting and control equipment shall be suitably arranged and clearly labelled by means of flame proof material using indelible ink/marking indicating the rating of fuse, switches, etc. The nameplates provided on the front of panel shall be of flame retardant material preferably stainless steel. Use of plastic or any inflammable material shall not be permitted for nameplates.

All metalwork of the switchboards shall be cleaned down to bare shining metal phosphated and the surfaces chemically prepared for powder coating. Then these shall be coated with powder of colour RAL 7032 and then baked in oven. The thickness of powder coating shall not be less than 100 microns.

4.2 Components

The switchboards shall be provided with all components as specified or shown on the Drawings and as necessary for the satisfactory operation of the switchboard and of the electrical system. Typical specifications are given hereunder.

4.2.1 Bus Bars

The bus bars shall be made of 99.99% pure high conductivity electrolytic tinned copper and shall be completely isolated and mechanically braced for the specified fault level according to relevant IEC standard. The phase identification of bus bars shall be by providing colours sleeves on bus bars ends and these shall be red, yellow and blue for phase and black for neutral. The earth bus bar shall be green.

The bus bars shall be triple pole, neutral & earth and shall be of appropriate size to meet the electrical and mechanical requirements of the system. The temperature rise shall not exceed 30^0C at rated current.

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Neutral bus bar shall be of the same cross section as phase bus bars. Earth bus bar shall be of half cross section area as phase bus bars.

4.2.2 Circuit Breakers

The circuit breaker shall be triple pole, current limiting type, manually operated or motor operated, spring charged type as shown on the drawings with front drive grip handle. ON-TRIP-OFF indication shall be provided on circuit breakers. The all circuit breakers shall have the following protections and setting range unless otherwise shown on the drawings:

- Adjustable three pole, manual reset thermal overload release of setting range 80 to 100% of rated current.

- Magnetic triple pole short circuit release having range according to manufacturer's standard range.

The incoming circuit breakers of main LT panel (normal and emergency) shall be air circuit breakers whereas outgoing circuit breakers shall be moulded case type, unless stated otherwise on the drawings.

The incoming circuit breaker shall have two numbers normally open and two numbers normally closed auxiliary contacts rated for 2 Amp, 230 VAC. The incoming circuit breaker shall also have ON-TRIP-OFF indicating lamps. Where shown on the drawings indication lamps shall also be provided for outgoing circuit breakers. The circuit breaker shall have specified rupturing capacity without the use of back-up fuses. Auxiliary release and trip coils shall be provided for desired operation and/or interlockings as stated on the drawings.

The motor operated, spring charged type circuit breakers shall be provided with anti-pumping circuit to prevent repeating cycle of TRIP reset and ON even if the close command is given while the circuit breaker has tripped due to fault.

4.2.3 Switch - Fuse Units

The switch-fuse unit shall comprise a triple pole on load isolating switch with HRC fuses. The fuse shall be supplied complete with the fuse base and shall conform to BS-88 Class Q1 with a fusing factor of 1.5.

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4.2.4 Ammeters and Voltmeters

All meters shall be flush mounting, moving iron, spring controlled. The front dimensions shall be 96 x 96 mm for meters.

The meters shall be of accuracy class 1.5 according to relevant IEC standard. The ammeter shall be suitable for connection to 5 Amps secondary of current transformers or directly through shunt as shown on drawings. The ammeters and voltmeters shall have measuring range as indicated on the drawings.

4.2.5 Current Transformers

Air-cooled, ring type current transformers shall be provided having transformation ratio as indicated on the drawings. The current transformers shall be of suitable burden having accuracy class 1.0 according to relevant IEC standard. The current transformers shall have 5 amps secondary.

4.2.6 Selector Switches

Ammeter and voltmeter selector switches shall be complete with front plate and grip handle. R-Y-B and OFF position for ammeters and RY-YB-BR-RN-YN-BN and OFF position for voltmeters shall be marked on the respective selector switches.

The selector switches for controls shall be rotary cam type, having required number of positions. It shall be provided complete with knob and front plate showing all positions as required.

4.2.7 Air Break Contactors

The contactors shall be air break, triple pole 400 VAC type and suitable for the AC3 type of duty to be performed. The main contacts shall be silver tipped, butt type with double break per pole. Each contactor shall be provided with single phase 230 VAC operating coil and minimum one spare normally open and one normally closed auxiliary contact. The number of working auxiliary contacts shall be provided according to the system requirements.

4.2.8 Push Buttons

The push buttons shall be illuminating momentary make/break contact type (normally open/normally close) and suitable for flush mounting. The push button for on and off switching shall be red and green respectively.

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4.2.9 HRC Fuses

HRC fuses shall be provided complete with fuse bases, fuse etc. The fuses shall have a fusing factor as specified for class Q1 in accordance with BS 88.

4.2.10 Indicating Lamps

Indicating lamps shall be suitable for flush mounting, complete with base, 230 volt AC incandescent lamp and shall have rosettes of suitable colour.

4.2.11 Line up Terminals

Line up terminals wherever provided for control and power circuits shall be suitable for voltage and size of conductors as indicated on drawing.

The line-up terminals for controls shall be suitable for channel mounting. All necessary accessories such as end plates, fixing clips, transparent label holder caps and label sheets with marking shall be provided.

4.2.12 Power Factor Improvement Plant

The power factor improvement plant shall be used for improving the power factor of the system on 415 Volts side. The plant shall be automatic-cum-manual.

The power factor improvement plant shall be aligned with the Main LT Switchboard. The control panel for the plant shall be a part of Main LT Switchboard, whereas the power factor correction capacitors shall be mounted in a separate ventilated panel. The capacitors shall be suitable for three phase, 440/415 volts, 50 Hz system and shall be self cooled, designed for indoor use in tropical climate for maximum ambient temperature as specified in section - 8001, General Specifications for Electrical Works. The capacitors shall be in the form of banks divided for required stages. Each capacitor bank unit shall be of kVar capacity as shown on drawings. Each capacitor unit shall be complete with discharge resistors and internal fuses and shall be connected with control panel with proper size of single core PVC insulated cables.

The control panel of the plant with all accessories shall be installed within LT Switchboard. The panel shall be supplied complete with a set of 3-phase, full capacity, insulated copper busbars, interconnections, risers, designation labels, cable

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sockets, holdings down bolts, wiring with cleats and ferrules, earthing sockets and studs, etc. The control panel shall at least accommodate, but not limited to the following:

- 1 No. Multi-stage power factor correction relay for automatic/manual control.

- 1 No. 3-phase, 4 wire, 415 volts, unbalanced load power factor indicator.

- 1 No. Current transformer with 5 amps secondary current, having suitable output burden and accuracy.

- 3 Nos. Instrument potential fuses.

Following equipment shall be provided for every capacitor bank:

- 1 No. triple pole 415 volts air break contactor with auxiliary contacts (125/63/40 amps for 50/25/12.5 kV Air bank respectively).

- 1 Set 3 Nos. HRC back-up fuses with base and carrier having the fuse factor as required for capacitors in accordance with BS- 88 (125/63/40 amps for 50/25/12.5 kVA bank respectively).

- 1 No. Auto-Off-Manual selector switch.

- 1 No. Red lamp for 'ON' indication of the contactor.

The cost of control panel and power factor connection capacitors panel shall deemed to be included in relevant BOQ item for LT Switchboard and no extra payment shall be admissible in this regard.

5.0 INSTALLATION

The LT Switchboards shall be installed at location shown on the drawing or as advise by the Engineer. The concrete pedestal shall be constructed as per relevant specifications for civil works. The Contractor shall be responsible to ensure co-ordination with the civil works for providing any openings, holes, etc., to avoid any breakage to completed works. In case the provisions in civil works for installation of electrical equipment are not made or made incorrect the same shall be rectified by the Contractor at his own cost and to the satisfaction of Engineer.

The Contractor shall provide foundation bolts and grout them in cement concrete floor using non-shrinkable material with the approval of Engineer.

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All installation materials for physically erecting the switchboard, such as bolts, nuts, washers, supporting steel, etc., shall be provided and installed by the Contractor. The switchboard shall be installed upright and in level and shall be firmly and rigidly bolted to the floor and concrete supports.

The switchboard shall be completely erected as per manufacturer's instructions and as approved by the Engineer. Loose parts dispatched by the manufacturer shall be installed and connected as per assembly drawing provided by the manufacturer. Any safety locking of meter, relays, etc., provided by the manufacturer for safe transport shall be released only after the switchboard is erected in position. The incoming and outgoing cables shall be connected as recommended by cable manufacturer. The cable armour shall be connected effectively to ground.

The switchboard body shall be connected to earth as per instructions given in section "Earthing" of these Specifications. The switchboard shall be tested and commissioned in the presence of the Engineer.

The LT Switchboards shall be tested before energizing as per instructions contained in article "Testing" of General Specifications for Electrical Works, Section-8001 of these Specifications.

6.0 MEASUREMENT AND PAYMENT

6.1 General

The Contractor's bid amount against Bill of Quantities item as given below shall include design, fabrication, supply, installation, testing, commissioning and completion for all works specified herein and as shown on the Bidding Drawings related to the item.

6.2 LT Switchboards

6.2.1 Measurement:

Measurement shall be made for the number of each LT Switchboards given in BOQ acceptably supplied and installed by the Contractor as a complete job.

6.2.2 Payment:

Payment shall be made for the total number of each type of job measured, as provided above, at the Contract unit price each and shall constitute full compensation for design, fabricating, supplying, installing, connecting, testing and commissioning of the LT Switchboards as per single line diagram shown on the drawing including Power Factor Improvement Plant (including complete control panel and power factor connection capacitors

panel), all erecting material such as foundations bolts, supporting steel channels, nuts, washers, cable glands etc., complete with foundation and all related Civil works.

*** End of Section 8132***

SECTION - 8133

LT DISTRIBUTION BOARDS

1.0 SCOPE OF WORK

The work under this section consists of supplying, installing, testing, and commissioning of all material and services of the complete Low Tension (LT) Distribution Boards as specified herein, shown on the Tender Drawings and stated in the Bill of Quantities.

The Contractor shall discuss the electrical layout with the Engineer and co-ordinate at site with other services for exact location and position of the each L.T. Distribution Board.

The Low Tension Distribution Board with accessories shall also comply with the General specifications for Electrical Works, section - 8001 and with other relevant provisions of the Tender Document.

2.0 GENERAL

The Low Tension Distribution Board (DB) shall be sheet steel fabricated suitable for surface/recessed mounting on wall or floor standing totally enclosed, dust tight and vermin proof. It shall be complete in all respect with material and accessories, factory assembled, tested and finished according to the Specifications and to the normal requirements.

The Low Tension Distribution Board shall be front operation type and shall:

- have a rated service short circuit breaking capacity, (Ics), conforming to IEC 60947-2 as shown on the drawings.
- be provided with adequate clearance from live parts so that the flashovers can not be caused by switching, vermin, pests etc.
- be suitable for 415 Volts, 3 phase 4 wire, 50 Hz system.
- be designed for flush mounting of all instruments on the front side.
- have incoming and outgoing cable termination arrangement, terminal block/line up terminals.
- be provided with stainless steel name plate on the front side of door.
- have all incoming and outgoing connections from top or bottom as per requirement of site conditions.
- have door grounded by flexible copper strip/cable.
- have wiring diagram in the pocket inside the door of Distribution Board

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3.0 APPLICABLE STANDARDS/CODES

The latest editions of the following standards and codes shall be applicable for the materials specified within the scope for this section:

IEC 60051	-	Direct setting electrical measuring instruments
IEC 60073	-	Colours for indicator lights and push buttons
IEC 60947-2	-	Low voltage switchgear and control gear
IEC 60439	-	Low Voltage Switchgear and Control gear Assemblies.
BS 4752	-	Circuit Breaker
BS 3871	-	Miniature & Moulded Case Circuit Breakers
BS 88	-	HRC fuses
BS 89/90	-	Ammeters and Voltmeters
BS 3938	-	Low voltage current transformers
BS 1432	-	Bus Bars

4.0 MATERIAL

4.1 Sheet Metal Work

The Low Tension Distribution Board (DB) shall be fabricated with 16 SWG sheet steel recess / surface mounting as approved by the Engineer. All the components shall be installed on a common component mounting plate inside the enclosure and protected from the front with screwed sheet steel front plate. The enclosure shall be provided with rubber gasketting and a lockable hinged door with cam fastener.

The distribution board shall be supplied complete with all installation materials as recommended by the manufacturer. The incoming and outgoing cable connections shall be according to the wiring requirements. If required, an adapter box for accommodating the cables and conduits may be provided. The box shall be of the same material and finish as the DB. All holes, cutout etc. shall be tool and free from burrs and rough edges.

The cabling inside the DB shall be suitably harnessed by means of straps or cords. Colour sleeves shall be provided on each cable lugs connected to the bus bars, circuit breakers or terminals for phase identification. An earth bar shall be provided for connection of incoming and outgoing earth conductors. The earth bar shall be permanently connected to the body of DB at two points. Flexible copper strip shall be provided for earthing of the door of DB.

Circuit numbers/ designation on all circuits shall be conspicuously marked to facilitate connection and maintenance.

All metal work of the DB shall be cleaned down to bare shining metal, phosphated and the surfaces chemically prepared for powder coating.

Then these shall be coated with powder of colour RAL 7032 and then baked in oven. The thickness of powder coating shall not be less than 120 microns.

4.2 Components

The Low Tension Distribution Boards (DB) shall be provided with components as specified, as shown on the Tender Drawings and required for the satisfactory operation of the distribution board and of the electrical system.

Typical component specifications are given below:

4.2.1 Bus Bars

The Bus bars shall be made of 99.9% pure high conductivity electrolytic copper and shall be completely isolated and mechanically braced for the specified fault level. The identification of bus bars shall be by providing colours sleeves on bus bar ends and these shall be red, yellow and blue for phases and black for neutral. The earth bus bar shall be green.

The bus bars shall be for three phase, neutral and earth and shall be of appropriate size to meet the electrical and mechanical requirements of the system. The temperature rise shall not exceed 30°C at rated current.

4.2.2 Moulded Case Circuit Breaker (MCCB)

The MCCBs shall be moulded case triple pole 440 Volts or single/double pole 250 Volts of current ratings as shown on the drawings. These shall have fixed magnetic short circuit and adjustable/fixed thermal overload protection.

Under voltage and shunt trip etc. shall also be provided when so required for safe operation and interlock.

The MCCBs shall be installed such that their switching levers are accessible through the front plate for operation.

The single and triple pole MCCBs shall have short circuit rupturing capacity suitable for the distribution system as approved by the Engineer or as shown on the drawings. The MCCBs shall be suitable for working on lighting and power circuits.

4.2.3 Three Phase Energy Meters (Kilowatt Hour Meters)

Three phase energy meters of frequency 50 Hz and accuracy class of 1.0 with proper meter base, cover, frame, terminal block, terminal cover, auxiliary circuit etc. shall be provided for use with instrument transformers. The meter shall be approved by WAPDA/IESCO.

The construction of meter shall be suitable for its purpose in all respect and shall give reasonable assurance of permanence in all mechanical, electrical and magnetic adjustments. The construction shall be such that the meter is not prone to produce appreciable noise in use.

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The meter shall have a dust proof case, which can be sealed in such a way that the mechanism of the meter is only accessible after breaking the seal. The case shall be made of metal or toughened glass of a sufficient strength to ensure adequate protection of the internal parts.

The direction of rotation shall be marked by a clearly visible indelible arrow.

Electronic meters with same accuracy class can also be provided subject to no additional cost and approval from WAPDA/IESCO.

Any test(s) to confirm accuracy and confirmation of requirements of specifications and WAPDA/IESCO shall be made. No additional payment shall be admissible for all such tests and is deemed to be included in the cost of the equipment.

4.2.4 Ammeters and Voltmeters

All meters shall be flush mounting, moving iron, spring controlled. The front dimensions shall be 96 x 96 mm for meters.

The meters shall be of accuracy class 1.5 according to BS-89 and 90. The ammeter shall be suitable for connection to 5 Amps secondary of current transformers or directly through shunt as shown on drawings. The ammeters and voltmeters shall have measuring range as indicated on the drawings.

4.2.5 Current Transformers

Air cooled, ring type current transformers shall be provided having transformation ratio as indicated on the drawings. The current transformers shall be of suitable burden having accuracy class 1.0 according to BS 3938. The current transformers shall have 5 amps secondary.

4.2.6 Selector Switches

The ammeter and voltmeter selector switches shall be complete with front plate, grip handle R-Y-B and OFF position for ammeters, and RY-YB-BR-RN-YN-BN and OFF position for voltmeters shall be marked on the respective selector switches.

4.2.7 Air Break Contactors

The contactors shall be air break, triple pole 415 VAC type and suitable for the type of duty (at least utilization Category AC3) to be performed. The main contacts shall be silver tipped, butt type with double break per pole. Each contactor shall be provided with single phase 230 VAC operating coil and minimum one spare normally open and one normally closed auxiliary contact. The number of working auxiliary contacts shall be provided according to the system requirements.

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4.2.8 **Push Buttons**

The push buttons shall be illuminated, momentary make/break contact type or latch type (push-on/push-off) as required and approved by the Engineer and suitable for flush mounting. The push button for ON and OFF switching shall be red and green respectively. They shall be provided as shown on the drawing.

4.2.9 **Indicating Lamps**

Indicating lamps shall be LED type suitable for flush mounting, complete with base. They shall be suitable for operation on 230 V AC and it shall have rosettes of suitable colours as approved by the Engineer. These shall be provided for R, Y, B phases on each distribution board.

4.2.10 **Line up Terminals**

Line up terminals wherever provided for control or power circuits shall be suitable for voltage and size of conductors as indicated on drawing.

The line-up terminals for controls shall be suitable for channel mounting. All necessary accessories such as end plates, fixing clips, transparent label holder caps and label sheets with marking shall be provided.

5.0 INSTALLATION

The location of low tension distribution boards (DB) are shown diagramatically on the drawings. The actual location shall be determined at site, keeping in view the site conditions and in co-ordination with other equipment, as approved by the Engineer.

Low tension distribution board for recessed mounting in wall shall be installed such that the door shall finish flush with the surface of wall. The recess mounted distribution board shall be installed before the plastering of walls. The DB shall be protected to avoid any damage due to the civil work. Any cuttings, dismantling of the existing wall required for fixing the DB shall be coordinated at site with the approval of Engineer. Any damage done to civil structure shall be made good by the Contractor.

All loose parts dispatched separately with the DB shall be installed as per manufacturer instructions and all adjustments or setting shall be made as required. All screws, nuts and bolts used for fixing the distribution board shall be galvanized.

The distribution boards installation shall include connecting all incoming and outgoing cables. The cable entry in the boards shall be provided from top or bottom as required and/or as approved by the Engineer.

The distribution boards shall be tested as per instructions contained in article "Testing" of General Specifications for Electrical Works, Section-8001 of these Specifications.

6.0 MEASUREMENT AND PAYMENT



6.1 General

The Contractor's bid amount against each item of Bill of Quantities as given below shall include design, fabrication, supply, installation, testing, commissioning and completion for all works specified herein and/or as shown on the Tender Drawings related to the item.

6.2 LT Distribution Boards (SMDBs/DBs)

6.2.1 **Measurement:** Measurement shall be made for the number of each LT distribution board acceptably supplied and installed by the Contractor as a complete job.

6.2.2 **Payment**: Payment shall be made for the number of jobs measured, as provided above, at the Contract unit price each and shall constitute full compensation for design, fabricating, supplying, installing, connecting, testing and commissioning of the LT distribution boards, including fixing arrangement, adapter box and other accessories for complete installation.

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SECTION - 8212

LOW TENSION CABLES

1.0 SCOPE OF WORK

2.0 GENERAL

3.0 APPLICABLE STANDARDS/CODES

4.0 MATERIAL

5.0 INSTALLATIONS

6.0 MEASUREMENT AND PAYMENT

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1.0 SCOPE OF WORK

The work under this section consists of supplying, installing, testing and commissioning of all material and services of low tension (LT) cables and the accessories as specified herein or as shown on the Bidding Drawings and stated in the Bill of Quantities.

The Contractor shall discuss the electrical layout with the Engineer and coordinate at site with other services for exact route, location and position of the L.T. cables.

The LT cables with accessories shall also comply with the General Specifications for Electrical Works, Section-8001 and with other relevant provisions of the Bidding Document.

2.0 GENERAL

All multi-core and single core PVC insulated and sheathed cables LSZH for light circuits, socket outlets and circuits operating upto 250 volts shall be 300/500 volts grade. All single core PVC insulated, non-sheathed cables shall be of 450/750-volt grade. Power cables for main feeders, main to sub main feeders, power equipment, etc., armoured or unarmoured shall be of 600/1000 volt grad/XLPE. Armouring of multi-core/ single core cables shall be done with appropriate size galvanized steel/aluminium wire as per relevant codes.

The conductors shall be stranded high conductivity, soft annealed copper. Conductors of single core cables shall be circular, whereas of multi-core cables may be circular or shaped according to standard practices and codes. The PVC insulation, bedding and overall sheath shall be of extruded PVC compound having good flexibility, resistance to ageing and ability to withstand deformation at high temperatures. Non-hygroscopic filler shall be provided in multicore cable to fill empty gaps between the cores to make the cable a smooth round finish. In all shaped cables a non-hygroscopic high strength binding tape shall be provided on the core assembly. All cables shall be treated for vermin proofing and be protected against rodents during storage, laying and all protective pipe/sleeves shall be plugged to attain the same after installation.

Embossed marking on the oversheath at 3 meters intervals shall give the following information :

- name of Manufacturer
- year of Manufacture
- No. of cores and size of cable in sq.mm.
- voltage grade
- type of cable i.e. Cu./PVC/SWA/PVC



3.0 APPLICABLE STANDARDS/CODES

The latest editions of the following standards and codes shall be applicable for the materials specified within the scope of this section:

BS 6004	-	Electric cables PVC insulated, non armoured cables for voltages upto and including 450/750 volts for electric power, lighting and internal wiring
BS 6346	-	Electric cables PVC insulated, armoured cables for voltages of 600/1000 V and 1900/3300 V
BS 6746	-	PVC insulation for electrical cables
BS 6360	-	Copper conductors
BS 6500	-	Insulated flexible cords
BS 7846	-	Electric cables 600/1000 V armoured fire resistant cables having thermosetting insulation and low emission of smoke and corrosive gases when affected by fire
BS 7889	-	Electric cables. Thermosetting insulated, unarmoured cables for a voltage of 600/1000 V
BS EN 50266	-	Common test methods for cables under fire conditions

4.0 MATERIAL

4.1 General

The power, lighting and control cables shall be furnished and installed in accordance with the routes and requirements shown on the drawings.

All cables shall have phase identification colours on insulation of each core. The colour code for three phase circuits shall be red, yellow and blue for phase conductors and black for neutral conductor. Where insulated earth conductor is installed, it shall have green or green-yellow colour insulation.

Single-phase circuits shall have insulation of red colour for phase/line, black colour for neutral and green or green-yellow colour for earth conductor.All DC circuits shall have insulation of white colour for positive, black colour for negative and green or green-yellow colour for earth conductor.



The ends of each length of multi-core armoured or unarmoured cables shall be properly marked for clock-wise and anti clock-wise sequence of core colours.

4.2 Cables for Conduit or Channel Wiring

All cables/wiring in concealed or surface mounted PVC conduits or in covered channel shall be single core PVC insulated LSZH of specified grade and size, unless specifically shown on the drawings or given in BOQ.

The contractor shall wire all power receptacles/points from the panels using copper stranded conductor having proper insulation and PVC sheathing. Under no circumstances shall wire pulling compound be used when pulling the wire for isolated circuits. All wiring shall be color-coded in accordance with applicable standards.

4.3 Cables on surface/concrete trenches/cable trays

Cables for distribution system to be installed on surface, in cable ducts, in concrete trenches or on trays shall be single or multi-core PVC insulated and PVC sheathed of specified voltage grade and size, unless specifically shown on the drawings or given in BOQ.

4.4 Cable Accessories

All cable accessories shall be provided for the complete cabling and wiring system without any additional cost unless specifically mentioned in BOQ. These shall include but not limited to the items such as saddles, clamps, fixing channels, connectors, cable joints (where necessary and as approved by the Engineer), clips, lugs, colour sleeves, identification tags, bushes, glands, etc.

5.0 INSTALLATION

5.1 General

All installation material, labour, tools, cable rollers and accessories for cable installation shall be furnished by the Contractor. The cable and accessories shall be installed as described in accordance with these Specifications, drawings and manufacturer's instructions.

The Contractor shall confirm the exact cut lengths for cable by actual measurements at site prior to the ordering. The cable lengths where shown on the drawings or in BOQ are tentative and only for general guidance. The Contractor shall be solely responsible for furnishing



correct lengths of cable to avoid joints in cable length except where necessary, after obtaining approval of the Engineer.

No separate payment for such joints is admissible.

Necessary precautions for safety of cables shall be taken during the laying of cables to avoid scratches/ cuts to the cable surface. Pulling force on cable at all times shall remain well within the manufacturer's recommended limits.

Prior to installation of jointing and termination kits, the cable lengths shall be checked and tested to ensure that the cables are in sound condition, and no damage has been done during handling and installation. After installation, these shall again be tested prior to commissioning as per recommendations of the standards according to which the cable is manufactured.

5.2 Conduit or Channel Wiring

The wiring through conduit shall be started only after the conduit and channel system is completely installed and all outlet boxes, junction boxes, etc., are fixed in position.
The wires shall be pulled in conduit or channel with care, preferably without the use of any lubricant. Where necessary and if approved by the Engineer, the cable manufacturer's recommended lubricant may be used. Where several wires are to be installed in the same conduit, they shall be pulled together along with the earth conductor. All wires of same circuit shall be run in one conduit.

The wires shall not be bent to a radius less than ten times the overall diameter of the wire, if otherwise recommended by the manufacturer.

The wiring shall be continuous between terminations and looping-in system shall be followed throughout. Any joint in wires shall not be allowed. The use of connectors shall only be allowed at locations where looping-in is rendered difficult. The consent of the Engineer shall be required for using connectors. The connector shall be of suitable rating having porcelain body with sunk-in screw terminals. The connector shall be wrapped with PVC insulation tape after its installation. A minimum of 150 mm extra length of cable/wire shall be provided at each termination to facilitate repairs in future.

5.3 Cables on Surface/Trenches/Cable Trays

All cables for installation on surface of wall, column, ceiling, trenches, etc., shall be fixed to the surface by means of galvanized steel clips secured to a steel channel using suitable stud plate, nuts and washers. The distance between each cable clip shall be such so as to support the

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entire weight of the cable and that distance between the cable & surface and also the vertical clearance between two adjacent cables at any point is 50mm minimum. Common mounting channels are to be furnished for cable along the same route. The Contractor can offer alternate cable fixing arrangement, which shall be approved by the Engineer before commencement of installation.

6.0 MEASUREMENT AND PAYMENT

6.1 General

The Contractor's bid amount against each Bill of Quantities item as given below shall include supply, installation, testing, commissioning and completion for all work specified herein and/or as shown on the Bidding Drawing related to the item.

6.2 Light Circuit Wiring

6.2.1 Measurement

Measurement shall be made for the total number of light circuit wiring from LT distribution board to point/switch/push button including wiring between switches/push buttons on the same circuit, acceptably carried out by the Contractor as a complete unit.

6.2.2 Payment

Payment shall be made for the total number of units measured, as provided above, at the Contract unit price each and shall constitute full compensation for supplying, installing, connecting, testing, commissioning and completion of the circuit wiring from the LT distribution board to point/switch/push button including wiring between switches/push buttons on the same circuit complete with specified type of surface mounted/concealed conduit, (PVC or steel) required No. specified size single core PVC insulated cable, earth continuity conductor, accessories, etc.

6.3 Wiring of Light/Fan Point (Point to Switch/ Impulse Relay, Point to Point, or Group Controlled Light Points)

6.3.1 Measurement

Measurement shall be made for the total no. of wiring of light/fan points (point to switch, point to point, or group controlled light point), acceptably carried out by the Contractor as a complete unit.

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6.3.2 Payment

Payment shall be made for the total number of units measured, as provided above, at the Contract unit price each, and shall constitute full compensation for supplying, installing, connecting, testing, commissioning and completion of the wiring between light point to switch/ impulse relay, point to point or group controlled points including required no. of specified size single core PVC insulated cable, specified type of surface mounted/concealed conduit (PVC or Steel), earth continuity conductor, flexible cable, ceiling rose, one way or two way 10A light control switch, sheet steel box and other accessories, etc.

6.4 Wiring of Power Circuits (Distributor to socket outlets & between sockets)

6.4.1 Measurement

Measurement shall be made for the total number of each type of wiring acceptably carried out by the Contractor as a complete unit.

6.4.2 Payment:

Payment shall be made for the total number of units measured, as provided above, at the Contract unit price each and shall constitute full compensation for supplying, installing, connecting, testing, commissioning and completion of wiring of socket outlets etc. from distributor to sockets or between sockets with specified size and number of single core PVC cables LSZH cables including specified type of surface mounted / concealed conduit (PVC or Steel), ECC and all other accessories etc.

6.5 LT Cables

6.5.1 Measurement:

Measurement shall be made for the total running meter for each size and type of LT cable acceptably supplied and installed by the Contractor.

6.5.2 Payment:

Payment shall be made for the total running meter of each size and type of LT cable measured, as provided above, at the Contract unit price each and shall constitute full compensation for supplying, installing, connecting, testing and commissioning of the LT cables including all accessories such as cable joints, lugs,

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colour sleeves, glands, bush, etc. complete with plugging of protective pipe/ sleeve ends for water tightening.

*** End of Section 8212 ***

SECTION - 8220

WIRING ACCESSORIES

1.0 SCOPE OF WORK

The work under this Section consists of supplying, installing, and commissioning of all material and services of the complete Wiring Accessories including switches, switch sockets, etc., as specified herein, as shown on the Tender Drawings and explained in the Bill of Quantities.

The Contractor shall discuss the electrical layout with the Engineer and coordinate at Site with other services for exact location and position of all wiring accessories.

The wiring accessories such as switches, switch socket outlets, socket outlets and ceiling roses, etc. shall also comply with the General Specifications for Electrical Works Sec. 8001 and with other relevant provisions of the Tender Documents.

2.0 GENERAL

The locations of the wiring accessories such as switches, sockets, etc. are tentatively shown on the drawings. The Contractor shall ensure the exact positions and locations of wiring accessories in coordination with other services drawings, as per site requirements and as directed by the Engineer. The Contractor shall be responsible for proper functioning of wiring accessories after installation and commissioning.

The description of switches, switch sockets, socket outlets etc. are given in the Bill of Quantities, stated as drawings and in this section. The Contractor shall submit sample of each and every item of wiring accessories for the approval of the Engineer.

3.0 APPLICABLE STANDARDS/CODES

The latest edition of following standards & codes shall be applicable for the materials specified within the scope of this section :

BS 3676	-	Switches for domestic and similar purposes.
BS 4343	-	Industrial plugs, socket outlets and couplers for AC and DC supplies.
BS 2135	-	Capacitors for radio interference suppression.
BS 67	-	Ceiling roses.
BS 546	-	2-pole and earthing pin plugs, socket outlets and socket outlet adaptors.
BS 1362	-	Specification for general purpose fuse links for domestic and similar purposes.

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BS 1363 (Part 4-1995)	-	Specification for 13A fused connection units: switched and unswitched.
BS 5733 (1995)	-	Specification for general requirements for electrical accessories.
DIN EN 60669-1	-	Switches for household and similar fixed electrical installations.

4.0 MATERIAL

4.1 Switches/Blank Face Plates

Switches for controlling light and fan points shall be single pole, rated for 10 Amps, 250 volts AC. The body of the switches shall be of thermoplastic with faceplate suitable for flush mounting and colour as approved by the Engineer. The switches shall be gang type having silver tipped contacts and shall operate with snap action.

Unless otherwise specified wherever switches control only the light points, these shall be plate type gang switches installed on common outlet boxes. Where only sheet steel back box is indicated on drawings, blank face plates shall be provided of same make and model as that of switches.

Where specified weather proof or metal front plates shall be used with single grid type switches. The plate shall be finished in specified colour or as otherwise directed by the Engineer.

The bell push switches shall be spring loaded type with the identification symbol embossed on it.

Two-way and intermediate switches shall be used to control lights from two or more different locations particularly in staircase as shown on the drawings.

4.2 5A/15A Switch-Socket Outlets

Switch socket units shall be 3 pin, 5 Amps, 15 Amps 250V, AC with faceplate of colour as approved by Engineer. The outlets shall be heavy-duty type suitable for mounting on sheet steel outlet box. The 15 Amps Switch socket outlets shall have sheltered live contacts and designed such that the earth pin of plug is engaged to socket earth before making of live contacts.

Where metal plate switches are installed, the switch socket units shall also be provided with front plate of similar design.

4.3 16A Schuko Socket Outlets

16 Amps Socket Outlets shall be 2 pin + earth, 250V AC German type (Schuko) socket outlets with faceplate of colour as approved by the Engineer. Duplex 16 Amps Schuko units shall consist of 2 Nos. 2 earth German Type (Schuko) socket outlets prewired with 3(

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sq.mm) PVC cable with a common face plate of colour as approved by the Engineer.

The outlets shall be heavy-duty type suitable for mounting on sheet steel outlet box. The 16 Amps Schuko Socket Outlets shall be designed such that the earth pin of plug is engaged to socket earth prior to making contact to the live contacts.

4.4 Duplex 13/5 Amps Switch – Socket Outlets

Duplex units shall consist of 2 Nos. 3 pin, 13/5 Amps, 250V AC switch socket outlets with face plate of colour as approved by the Engineer. The outlets shall be heavy-duty type suitable for mounting on sheet steel outlet box.

4.5 16A/32A/63A Industrial Socket Outlets

The 16A/32A or 63A, 230/400 V, single/ 3 Phase plus neutral & earth 3/5 pin, industrial type socket outlets shall be weather proof conforming to the standard and requirements of relevant IEC codes.

The socket outlets shall be of heavy-duty type suitable for outdoor installation. The socket outlets shall be mounted on polycarbonate enclosure and have gasketed cover and window, captive cover screw type. All industrial socket outlets shall be supplied with matching plugs.

4.6 Connection Units (Spur outlets)

Connection Units shall be used to supply power to appliances such as Fan coil units, Hand drier, Water heaters, etc., where so specified or shown on drawings.

It shall be rated for 13A, 250V AC or as shown on drawings/BOQ. The body shall be of thermoplastic material. Installation shall be surface/ concealed as required.

Face plate and colour to be as per approval of Engineer.

Connectors shall be of best quality (for Phase, Neutral and Earth) and suitable for the size of wiring.

The connection unit shall have the following features as per requirement in B.O.Q or as shown on drawing.

- 20 A Double Pole Switch
- Fuse – Rating as per requirement of appliance
- Neon Indication light
- Grommetted outlet on face plate suitable for flexible wiring connection to appliance

4.7 Fan Dimmers

The fan regulator/dimmer shall be made of low voltage electronic components with essential radio frequency compressor and shall be designed for smooth speed control/variation of fans. The regulators/dimmer and fan control switches shall be of same make and colour as that of the approved wiring accessories. The regulator/dimmer

and fan-controlling switch shall preferably be mounted on same face plate. They shall be suitable for flush mounting on a sheet steel outlet back box.

4.8 Sheet Steel Back Boxes

The sheet steel boxes for installation of switches, fan dimmers, socket, outlets and blank face plates shall be made of 16 SWG sheet steel having appropriate dimensions. The box shall have suitable arrangement for receiving the conduit(s). An earth terminal shall be provided for connecting at least three earth wires of 4-sq.mm size. The outlet box shall be finished in powder-coated paint. The sheet steel back box shall be as approved by the Engineer.

4.9 Ceiling Roses

The ceiling roses shall be suitable for 5 amps 250 volts single-phase ac. It shall have white plastic moulded base plate and copper or brass terminals suitable for connecting at least two wires of 2.5 sq. mm size. The ceiling rose shall have a cover with cable inlet hole suitable for multicore PVC insulated and PVC sheathed cable.

5.0 INSTALLATION

5.1 General

The mounting heights of all wiring accessories are stated on the drawings. In case the mounting height is not mentioned, the instructions of the Engineer shall be obtained before fixing.

5.2 Wiring Accessories Installation

All wiring accessories such as Switches, Blank Face Plates, 5A/15A Switch Socket, 16A Schuko Socket Outlets, Duplex 13/5 Amp Switch-Socket Outlets, 16A/32A/63A Industrial Socket Outlets & Connection Units shall be installed on 1.63 mm (16 SWG) thick sheet steel box recessed in wall/column/floor. The faceplate shall be fixed on sheet steel box by means of flat head galvanized or brass screws sunk in the faceplate so as to finish flush with the surface. Matching screw caps shall be installed on the opening for screw in faceplates.

The industrial type sockets in polycarbonate enclosure shall be installed on wall as shown on drawing.

6.0 MEASUREMENT AND PAYMENT

6.1 General

The Contractor's bid amount against each Bill of Quantities item as given below shall include supply, installation, testing, commissioning and completion for all work specified herein and/or as shown on the Tender Drawing related to the item.

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6.2 5A/15A Switch Socket Outlets, 16A Schuko Socket Outlets, Duplex 13/5 Amps Switch Socket Outlets, 16A/32A/63A Industrial Socket Outlets & Connection Units

6.2.1 **Measurement:** Measurement shall be made for the total number of each type of socket outlet complete with sheet steel back boxes, polycarbonate enclosure and all accessories acceptably supplied and installed by the Contractor as a complete unit.

6.2.2 **Payment:** Payment shall be made for the total number of units measured, as provided above, at the Contract unit price each and shall constitute full compensation for supplying, installing, connecting, testing and completion of each type and rating of outlet including screws, screw caps, sheet steel box, polycarbonate enclosure, nuts, bolts and other accessories as required.

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SECTION - 8230

CONDUITS AND PIPES

1.0 SCOPE

The work under this section consists of supplying, installing and commissioning of all material and services of the complete Conduits and Pipes as specified herein and/or shown on Tender Drawings and stated in the Bill of Quantities.

The Contractor shall discuss the electrical layout with the Engineer and co-ordinate at Site with other services for exact route, location and position of the conduits and pipes.

The conduits and pipes with accessories shall also comply with the General Specifications for Electrical Works, Section-8001 and with other relevant provisions of the Tender Document.

2.0 GENERAL

The extent of works shown on the drawing does not indicate the exact position of conduits and pipes. The Contractor shall ensure exact location and route of conduit and pipes in coordination with other services drawings, as per site requirements and as directed by the Engineer.

The conduit system shall be continuous with manufacturer's recommended accessories.

The quality and material for the accessories of conduits and pipes such as sockets, end cap, elbows, bushings, bends, inspection/pull boxes, round boxes, etc., necessary for the complete installation shall be similar to that of conduits or pipes. All the accessories shall be supplied by the Contractor without any extra cost and deemed to have been included in the price of conduits/pipes.

Pull wire shall be laid in all empty conduits.

Normal and emergency circuits shall run in separate conduits.

3.0 APPLICABLE STANDARD/CODES

The latest edition of the following standards and codes shall be applicable for the materials specified within the scope of this section:

BS 31 - Specification. Steel conduits and fittings for Electrical Wiring.

BS 4607 - Non-mettalic conduits and fittings for electrical installations.

BS 1387 - Galvanized Iron (GI) pipes and fittings.

BS 3505 - uPVC pressure pipe and fittings.

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4.0 MATERIAL

4.1 Galvanized Iron (G.I.) Conduits and Accessories

G.I. conduits shall be used on surface for lighting and power circuits wherever specified and required, as shown on drawings or given in BOQ.

The G.I. conduits shall be made of medium gauge mild steel, galvanized inside and outside by hot dip galvanized process. The conduit shall be free from stains, burrs or any other defects. The accessories for G.I. conduit such as sockets, bends etc. shall also be galvanized inside and outside and of the same quality and specification as the conduit. Each length of conduit shall be furnished with threaded ends.

The round junction boxes for ceiling light points shall have minimum dimensions of 64mm diameter and 64mm depth. The junction boxes for wall light points shall have minimum dimensions of 64mm diameter and 40mm deep. Round junction boxes shall be provided with one piece cover plate fixed to the box by means of brass screws.

4.2 PVC Conduits and Accessories

The PVC conduits and accessories for lighting and power circuits shall be furnished by the Contractor as shown on the drawings or given in BOQ. The PVC bends shall have enlarged ends to receive conduit without any reduction in the internal diameter at joint. Manufactured smooth bends shall be used where conduit changes direction. Bending of conduits by heating or otherwise will be allowed in special situations only for which the consent of the Engineer shall be required. The use of sharp 90 degree bends and tees will not be allowed for concealed wiring.

The round PVC junction boxes for ceiling light or fan points shall have minimum dimensions of 63 mm diameter and depth. The junction boxes for wall light points shall have minimum dimensions of 63 mm diameter and 38 mm deep. Round junction boxes shall be provided with one piece PVC cover plate fixed to the box by means of brass screws.

4.3 Inspection/Pull and Adaptable Boxes

Inspection/Pull boxes and adaptable boxes shall be provided in conduit runs wherever required to facilitate pulling operation. The drawings are diagrammatic and do not indicate the position and spacing of inspection/pull boxes or adaptable boxes. However, these shall be as per Engineer's approval.

4.4 Galvanized Iron (G.I.) Pipes and Accessories

Galvanized iron pipes shall be used on surface or underground installation wherever specified and required at entry into manholes and as shown on drawings. The Specifications for G.I. pipes and accessories shall be same as given in Clause 4.1, G.I. Conduits and Accessories.

The underground G.I. pipes and accessories shall be provided with one thick coat of bituminous paints on the outer surface prior to installation.

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4.5 uPVC Pipes and fittings

Unplasticised PVC pressure pipes and fittings shall conform to BS 3505:1968 and shall be of class-D (working pressure - 12 bars). The buried uPVC pipes should be able to withstand the external load acting upon it by continuous movements of heavy duty vehicles such as trucks, cranes, forklift etc. where pipe changes direction, manufacturer smooth bend shall be used.

Fittings and accessories for use with uPVC pressure pipes shall be of the same class and manufacture as the pipe and shall have the required shapes and dimensions of turned ends to fit the uPVC pressure pipes. uPVC pipes and accessories shall be suitable for jointing with rubber rings or solvent.

Bending of pipes by heating or otherwise will not be allowed. The use of sharp 90 degree bends and tees will not be allowed. The bends shall conform to same specifications as given for PVC conduits. For joining of pipe all precautions and procedures recommended by manufacturer shall be allowed.

Hard PVC or reinforced concrete pipe range spacers shall be used if there is more than one pipe running in parallel. The distance between range spacers shall be maximum 2 meters. Range spacers shall be prefabricated/precast and decay resistant.

Flexible pipes shall be used as deemed essential or as approved by the Engineer.

5.0 INSTALLATION

5.1 Galvanized Iron (G.I) Conduits and Accessories

The G.I. conduits on surface shall be installed where shown on drawings/ mentioned in BOQ. The conduits shall be installed parallel or perpendicular to the surface of walls, structural members, ceiling, etc., by means of C.I. saddles and clamps of approved design. The conduits shall be kept at least 150 mm away from any other services pipes.

The saddles shall be installed on surface by means of nylon or wooden plugs and galvanized screws. Appropriate size of holes in structure shall be made by drilling, the thickness of saddles shall not be less than 6mm and clamps shall be of 16 SWG G.I. The surface conduits shall be supported at a maximum of one metre spacing along horizontal and vertical runs. All accessories for complete installation of conduit system shall be provided by the Contractor. The pull boxes, etc. if required shall be used for surface conduit system. The entire conduit system alongwith the accessories shall be galvanized.

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5.2 PVC Conduits and Accessories

5.2.1 Concealed PVC Conduit

Where concealed PVC conduit system is shown on drawings/ mentioned in BOQ, the conduit shall be installed concealed in roof, wall, column, etc. Conduits shall be laid under floor only where specifically stated. The entire conduit system shall be installed and checked before wring is carried out. Any obstruction found shall be cleared before the installation of cable.

When concealed, the conduit shall have a minimum of 32mm cover of concrete measured from the top of conduit to finished surface. In the reinforced cement concrete (RCC) work the conduit shall be laid before pouring of concrete. Under no circumstances shall chases be made in the RCC structure for concealing conduit and accessories after pouring of concrete. The conduit shall be supported on top of bottom reinforcement of slab. All outlet boxes to be firmly supported and installed such that they finish flush with the soffit of slab or beam.

Where conduits have to be concealed in cement concrete (CC) work after concreting or in block masonry, chase shall be made with appropriate tools and shall not be made deeper than required. The conduit shall then be fixed firmly in the recess and covered with cement concrete mixture. The work of cutting in the cement concrete work or block masonry work shall be coordinated with the civil work. The Contractor shall obtain approval from the Engineer before starting chasing and cutting.

The termination of conduits at or near the equipment / switchboard is shown diagrammatically on the drawings. The exact locations of the termination shall be coordinated with the equipment/ switchboard to be installed. Any extension of conduit to suit the site condition shall be made without any extra cost. Conduit ends pointing upwards or downwards shall be properly plugged in order to present the entry of foreign materials. All openings through which concrete may leak shall be carefully plugged in order to prevent the entry of foreign materials. All opening through which concrete may leak shall be carefully plugged and boxes shall be suitably protected against filling with concrete. At all terminations of conduit, sharp edges of conduit ends shall be prevented to avoid the cutting or damaging of wires or cables during pulling through the conduits.

Under floor conduit shall be installed at a minimum depth of 2 inch from the finished floor level or as shown on the drawings. The conduits shall be installed empty, before finishing of floor or in RCC work, with an 18 SWG steel wire drawn through the conduit for pulling cable. No conduits shall be laid under floor in bathroom.

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5.2.2 Surface PVC Conduits

The surface PVC conduits shall be installed where shown on drawings / mentioned in BOQ. The conduits shall be installed parallel or perpendicular to the surface of walls, structural members, ceiling, etc., by means of PVC saddles and clamps of approved design. The conduits shall be kept at least 150 mm away from parallel runs of flues, steam pipes and hot water pipes.

The saddles shall be installed on surface by means of nylon or wooden plugs and galvanized screws. Appropriate size of holes in structure shall made by drilling, the thickness of saddles and clamps shall be at appropriate thickness and prime quality.

The surface conduits shall be supported at maximum of one meter spacing along horizontal and vertical runs. The Contractor shall provide all accessories for complete installing of conduit system. The pull boxes, etc. as stated for concealed conduits shall also be applicable for surface conduit system.

5.3 Galvanized Iron (G.I.) Pipes and Accessories

The underground galvanized iron pipes shall be installed at a minimum depth of 900 mm measured from the top of pipes to finished ground level. The G.I. pipes shall be laid and checked for soundness before completion of civil works. The pipes at the entrance of the buildings and in concrete shall be installed at locations as shown on the drawings.

At all joints the G.I. pipes shall be firmly screwed and cotton yarn with waterproof compound shall be used to make the joint waterproof.

At each termination, the pipe end shall have threads and socket screwed on thread for installing soft metal bush. The soft metal bush shall be of approved quality and shall be male type.

The installation of pipes shall be completed in all respects including its fixing at terminations before the work is started. All sharp edges and burrs shall be removed by using reamer or any approved device. The pipe shall be checked before installation of cable for any obstruction. If found, it shall be cleared without damaging the installation. All pipe ends shall be plugged to prevent entry of water, rodents etc.

5.4 uPVC Pipes and Fittings

uPVC pipes shall be installed as shown on the drawings. The depth of the pipe shall vary according to the conditions at site, and approval of Engineer shall be obtained prior to installation. In general the pipes shall be installed underground at the following depths measured from the top of the pipe.

- Under roads/pavements: 900 mm below finished surface.
- When crossing other services: 250/500 mm vertical/horizontal.

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The trench of required dimensions shall be excavated and the bottom of trench cleaned and leveled. A 100 mm bed of fine sand shall be provided over which the PVC pipes installed after proper alignment. Where two or more pipes are installed in the same trench the clearance between pipes shall not less than 50 mm. This shall be done by the provision of pipe range spacers as per Engineers approval. After laying of pipe the trench shall be backfilled with clean screened sand at least 100 mm above the top most pipes. The remaining portion of trench shall be backfilled with selected earth in layers well compacted.

After installation, the ends of the pipe shall be plugged with manufactured end cap impervious to water and chemicals. All joints shall be sealed adequately not only to prevent entry of foreign elements bu water tightness shall be ensured.

The installation of pipes shall be completed in all respects including its fixing at terminations, before cabling work is started. All sharp edges and burrs shall be removed by using reamer or any approved device. The pipe shall be through cleaned of dirt and dust from inside, the pipes shall be installed in proper co-ordination with other works.

The protective PVC pipe for cable entering building shall be installed so as to lead cable into the cable trench. The required number of pipes shall be fixed before completing the work in the plinth. If an opening is provided to the cable trench from outside, the required number of pipes shall be installed and part of the opening remained unutilized shall be properly packed and sealed using suitable packing material impervious to water and chemical to make it completely water-tight.

Spare pipes shall be provided with 5 mm dia rope pulled from end to end and plugged with manufactured end cap.

Flexible pipes of compatible material and size shall be used wherever deemed essential.

6.0 MEASUREMENT AND PAYMENT

6.1 General

The Contractors bid amount against each item of Bill of Quantities as given below shall include supply, installation, testing, commissioning and completion for all work specified herein and/or as shown on the Tender Drawings related to the item.

6.2 Underground G.I./PVC Conduits and Pipes

6.2.1 Measurement

Measurement shall be made for the total running feet of each type and size of underground conduits / pipes and accessories acceptably supplied and installed by the Contractor as a complete unit.

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6.2.2 Payment

Payment shall be made for the total running feet of each type and size of underground conduits or pipes measured as provided above at the contract unit price each and shall constitute full compensation for supplying, installing and completion of the laying of the conduits and pipes including all accessories related to the item.

No separate payments shall be made for the under mentioned specified work related to the supply and installation of conduits and pipes. The cost thereof shall be deemed to have been included in the quoted rates of above work.

- Excavation and backfilling.
- Dewatering during excavation and backfilling.
- Providing and filling of fine sand in trenches.
- Providing pipe range spacers.
- Providing flexible pipes and accessories, jointing material/ compound, saddles, sockets, elbows, bend, junction boxes reducers, 16SWG GI pull wire for empty conduit, and 5 mm dia rope for empty pipe, soft metal bush, making threads and plugging of pipe with manufactured end cap etc. whether used or left spare
- Compacted backfilling of trenches with specified material and disposal of surplus and rejected material.
- Watertight sealing of any unutilized opening to the buildings after installing the protective pipes entering the buildings.

6.3 Surface Mounted G.I./PVC Conduits and Pipes

6.3.1 Measurement

Measurement shall be made for the total running feet of each type and size of surface mounted conduits / pipes and accessories acceptably supplied and installed by the Contractor as a complete unit.

6.3.2 Payment

Payment shall be made for the total running feet of each type and size of surface mounted conduits or pipes measured as provided above at the contract unit price each and shall constitute full compensation for supplying, installing and completion of the laying of the conduits and pipes including all accessories such as bends, sockets, elbows, saddles, rawl plugs, screws, pull wires, etc.

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SECTION - 8240

EARTHING

1.0 SCOPE OF WORK

2.0 GENERAL

3.0 APPLICABLE STANDARDS/CODES

4.0 MATERIAL

5.0 INSTALLATIONS

6.0 MEASUREMENT AND PAYMENT

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1.0 SCOPE OF WORK

The work under this section consists of supplying, installing, testing and commissioning of all material and services of the complete Earthing system as specified herein, as shown on the Tender Drawings and given in the Bill of Quantities.

The Contractor shall discuss the electrical layout with the Engineer and co-ordinate at Site with other services for exact route, location and position of the earth electrode and ECC etc.

The Earthing system shall also comply with the General Specifications for Electrical Works Section - 8001 and with other relevant provisions of the Tender Documents.

2.0 GENERAL

The earthing system consists of earth electrodes, earthing leads, earth connecting points, earth continuity conductors and all accessories necessary for the satisfactory operation of the associated electrical system.

3.0 APPLICABLE STANDARDS/CODES

The latest editions of following standards / codes shall be applicable for the materials specified within the scope of this section:

BS 951	-	Earthing clamps
BS 7430	-	Earthing
BS 2874	-	Nuts, bolts, washers, screws and rivets fixing for use on copper
BS 6346	-	PVC insulated cables

4.0 MATERIAL

4.1 Earth Electrode

4.1.1 Plate Type

Earth Electrode for earthing shall comprise of 75 mm x 4877 mm x 6 mm thick copper plate with 4 Nos. 6 mm dia brass nuts, bolts and washers 70 sqmm HDHC Copper wire as earthing leads. A 100 mm dia Medium Duty GI pipe shall be used with 10 mm dia holes @500 mm c-c. The total length of this GI pipe should be 45 ft.

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A 150 mm dia 60 ft long hole should be drilled in ground by percussion method and above mentioned 100 mm dia medium duty GI pipe should be fixed in this hole simultaneously up to the depth of 45 ft from NSL.

When the drilling up to 60 ft depth is complete, The above mentioned earth electrode shall be drop down to the bottom of the hole with the help of 2 Nos 70 sqmm earth leads. Once the plate is in place fill in the hole with moisture retaining bentonite slurry with tremie method up to the top. When the bentonite settle down cast a (1:4:8) concrete manhole 700 mm x 700 mm & 500 mm deep as shown in the drawing. Place a medium duty CI cover as shown in the drawing.

4.1.2 Copper Clad Steel Rod Type

This type of earth electrode shall comprise a 3 metre long, 20 mm dia. copper clad steel rod having flat head at drive end and pointed conical tip at the driven end. The tip shall be hardened to facilitate driving. At the top of the rod, a brass clamp for bolted connections shall be provided suitable for connection to the down conductor or earthing lead as required. The thickness of Cu coating on the Galvanized Steel Rod should be 250 micron.

The inspection chamber with C.I. cover shall be provided as instructed by the Engineer.

4.2 Earthing Lead

The earthing lead shall connect the earth electrode to earth connecting point or equipment in the building. It shall be of stranded bare electrolytic copper of size shown on the drawings. The cost of earthing leads deemed to have been included in the price of earth electrode and no separate payment shall be made for it.

4.3 Earth Continuity Conductor

Earth continuity conductor (ECC) shall be stranded bare copper wire or single core PVC insulated copper conductor cable of sizes indicated on the drawings. All thimbles, lugs, sockets, nuts, washers & other accessories necessary for the complete installation of ECC shall be provided by the Contractor without any extra cost.

The specifications for single core PVC insulated cables used as ECC shall be same as those given in section "LT Cables" of the technical specifications. PVC insulated cables when used as ECC shall be green or green/yellow.

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4.4 Earth Connecting Point

Earth connecting points shall comprise tinned copper bar, rectangular in shape, having dimensions of 300 x 50 x 6 mm. At least six terminals for connection shall be arranged on the bar, which can be increased or decreased as required by the Engineer.

The terminals shall have brass or tinned copper bolts, nuts and washers for protection against corrosion. Two holes shall be provided off centre of the copper bar for fixing to the wall by means of 10 mm dia. nut and bolt and shall be insulated by means of rubber gaskets/washers.

5.0 INSTALLATION

5.1 General

Complete earthing systems as shown on the drawing shall be installed by the Contractor. The earthing system shall give earth resistance, including the resistance of soil, earth leads and ECC equal to or less than one ohm.
At all connections of earth continuity conductor to Generator, Transformer, LT Switch Board, LT Distribution Board, or any other metallic body, proper size copper or brass sockets, thimbles or lugs shall be used to which the copper wire shall be connected by copper brazing. The soldering of copper wire at joints or terminations shall not be allowed. All tee-off connections shall be by copper brazing using suitable socket and clamps. After brazing, the jointed surface shall be protected by oxide inhibiting compound of low electrical resistance. For connections to metallic body, the surface shall be thoroughly cleaned before bolting the lug or socket.

The earth continuity conductor shall in general run in cable trench or in conduits/pipes as shown on the drawings. For under floor runs, these shall be installed in pipe/conduit of appropriate sizes. Where laid along underground cables, these shall be laid directly underground in unpaved areas and in pipes under paved areas.

The earthing system shall be tested after complete installation of earth electrodes.

5.2 Earth Electrode

5.2.1 Plate Type

The electrode plate shall be installed at a minimum depth of 5 metres from finished ground level or 1 metre below permanent water level whichever is less. The minimum horizontal distance between earth electrodes shall be 3 metres. Bentonite slurry with tremie method shall be made and buried alongwith the copper

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plate in the ground to increase the soil conductivity. The electrode shall be installed as per details shown on the drawings. The inspection chambers shall be constructed at locations approved by the Engineer.

5.2.2 Copper Clad Steel Rod Type

In case the soil conditions at site permit and approved by the Engineer this type of earth electrode may be installed by hammering the electrode in soil, until the top of the rod is about 300 mm below the proposed finished ground level. If hammering down of rod is not possible due to site conditions, a pit shall be first excavated in bare ground upto the required depth and electrode shall be installed upright in the pit. The excavated pit shall be backfilled in layers of 500 mm, each layer tamped and compacted.

5.3 Earth Continuity Conductor

The earth continuity conductor of sizes shown on the drawing shall be installed all along the cable runs and connected to the earthing bar/terminals provided in equipment. The body of generator, transformer and all switchboards shall also be connected to earth by specified size of ECC. All other metal work shall also be connected to earth by specified size of ECC.

At any joint or terminations, the ECC shall be connected using proper accessories. No connection shall be made by twisting of earth conductors.

5.4 Earth Connecting Point

The earth connecting point shall be installed at locations shown on the drawings. It shall be fixed on wall surface by means of brass screws with nuts, washers and other insulating material as instructed by the Engineer.

6.0 MEASUREMENT AND PAYMENT

6.1 General

The Contractor's bid amount against each Bill of Quantities item as given below shall include supplying, installation, testing, and commissioning of all work specified herein, as shown on the Tender drawing related to the item.

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6.2 Earth Electrode

6.2.1 Measurement:

Measurement shall be made for the total no. of each type of earth electrode acceptably supplied and installed by the Contractor as a complete unit.

6.2.2 Payment:

Payment shall be made for the number of units measured, as provided above, at the Contract unit price each, and shall constitute full compensation for supplying, installing, testing, commissioning and completion of earth electrodes including copper plate or copper clad steel rod, earthing leads, excavation, backfilling, lime and charcoal, inspection chamber with cover, GI pipes for earthing leads/watering, nuts, bolts, washers, lugs, brazing and all related civil works.

6.3 Earth Continuity Conductor (ECC)

6.3.1 Measurement:

Measurement shall be made for the total running feet of each size and type of earth continuity conductor (ECC) acceptably supplied and installed by the Contractor.

6.3.2 Payment:

Payment shall be made for the total running feet of each size and type of ECC measured, as provided above, at the Contract unit price and shall constitute full compensation for supplying, installing, connecting, testing and completing of ECC including all accessories such as sockets, thimbles, lugs, bolts, nuts, washers, brazing, etc.

6.4 Earth Connecting Point

6.4.1 Measurement:

Measurement shall be made for the total no. of earth connecting points acceptably supplied and installed by the Contractor as a complete unit.

6.4.2 Payment:

Payment shall be made for the total number of units measured, as provided above, at the Contract unit price each and shall

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constitute full compensation for supplying, installing and completion of earth connecting point and all other associated accessories such as nuts, bolts, washers, lugs, etc.

*** End of Section 8240 ***

SECTION – 8312

STRUCTURED CABLING

1.0 SCOPE OF WORK

The work under this section consists of supplying, installing, testing and commissioning of all material and services for provision of Structured Cabling as specified herein, as shown on Tender Drawings and stated in the Bill of Quantities.

The Contractor shall discuss the Structured Cabling Layout with the Engineer and co-ordinate at site with other services for exact route, location and position of the system.

The Structured Cabling work with accessories shall also comply with the General Specifications, Section – 8001 and with other relevant provisions of the Tender Document.

2.0 GENERAL

To ensure optimum performance, components of the structured cabling shall be sourced from the one manufacturer. This shall eliminate potential problems such as electrical and mechanical mismatch between different manufacturers.

Structured Cabling shall be covered under the manufacturers Certified Installation Program and installed by Certified Installation Company. Under this arrangement, the supply of components from the one manufacturer will facilitate the manufacturers Certification requirements of sole supply.

The Structured Cabling shall support the following systems, but not be limited to these systems.

Data Processing

Mainframe access, Client Server, Enterprise Server, Messaging Systems and Electronic Mail, common document utilization, Client Database, Voice and Video, etc.

Data Communications

EIA-232-D, RS-422, RS-423, ISDN, Ethernet (10 Base-T, 100 Base-T and 1000 Base-T), 100 Base VG Any LAN, Token Ring, Fibre Distributed Data Interface (FDDI), Twisted Pair-Physical Medium Dependant (TP-PMD) and ATM (155 Mbs and 622 Mbs), etc.

3.0 APPLICABLE STANDARDS AND CODES

The following standards and all “normative addendums” shall be applicable to this document and must be adhered to for any installation work performed.



EIA/TIA 568-A	Commercial Building Telecommunications Cabling Standard.
EIA/TIA 569-A	Commercial Building Telecommunications Cabling Standard Pathways and Spaces.
TSB 67	Transmission Performance Specifications for Field-Testing of Unshielded Twisted-Pair Cabling Systems.
IEEE 802.3	Wire Speed Performance
IEEE 802.1Q	VLAN

All copper/optical fibre cabling, components and connecting hardware shall be in accordance with latest revision of ISO/IEC 11801, ISO/IEC/TR3 8802-1, ISO/IEC/8802-3, ISO/IEC 61935-1, IEC 60364-1, IEC 60950, EN50173, EN50174-1, EN50174-2, and EIA/TIA TSB 72/73.

4.0 MATERIALS

4.1 Category – 6 UTP Cable

The horizontal cabling shall be Category – 6 UTP, 4 pair cable with gigabit support and specified up to 250MHz. The cable employed shall have excellent electrical characteristics and shall posses low weight, have slim design and shall be non corrosive (to IEC 60754-2), low smoke (to IEC61034), and flame retardant (to IEC 60332-3) and DIN VDE 0472, Part 804, test type C). The cable shall meet the requirements for EN 55022 Class B emission and EN 55024 immunity to be compliant with standards of electromagnetic compatibility and shall comply with following specifications:

Electrical Specification

• DC Resistance	-	< 200 milli Ohms
• DC Resistance Imbalance	-	< 50 milli Ohms
• Insulation Resistance	-	> 500 Mega Ohms min
• Wiring Sequence	-	TIA/EIA 568 A+B
• Delay Skew	-	< 1.25 nanoseconds

Mechanical Specification

• Diameter of Copper	-	AWG 23
• Wire Insulation	-	Zero Halogen foam - skin Material
• Sheath Material	-	Zero Halogen, Flame Retardant
• Deployment Area	-	Dry and Damp Rooms
• Temperature Range (moving)	-	0 °C to +50 °C
• Operating Temperature	-	-20 °C to +60 °C
• Min. Bend Radius for Single Flexure	-	≥ 40 mm
• Min. Bend Radius during Installation		≥ 60 mm



4.2 Category – 6 Outlets

The horizontal cabling shall be terminated on RJ-45 outlets on white plastic wall plate. The category-6 outlets shall have provision of two outlets and shall accommodate one or two inserts (as per BOQ). To maintain security, the module shall not be removable from the front of wall plate. The RJ-45 outlets shall be protected by a spring-loaded shutter which will cover the outlet when not in use. Outlets shall comply with following specifications:

Electrical Specification

- DC Resistance - < 200 milli Ohms
- DC Resistance Imbalance - < 50 milli Ohms
- Insulation Resistance - > 500 Mega Ohms min
- Wiring Sequence - TIA/EIA 568 A+B
- Delay Skew - < 1.25 nanoseconds

Mechanical Specification

Jack Contact

- Material of RJ45 pins - Copper alloy
- Plating of RJ45 pins - Gold plate 1.4 μm
- Operating Life (number of RJ45 Insertions) - 1500
- Plastic Housing (material type) - Polycarbonate (VO)

IDC Block

- Material of metal terminals - Copper alloy
- Wire Accommodation (diameter range) - AWG 22-24
- Tool Accommodation (required or not) - NO

7 Gas Tight IDC Cable Termination (yes/no) YES

- Plastic Housing (material type) - Polycarbonate (VO)
- Operating Life (number of re-terminations) up to 5

4.3 Patch Cord:

The patch cords should be designed for applications up to 250 MHz and provides transmission performance meeting Category 7 specifications. Cables should be low skew products. I.e. the difference in propagation delay between the individual pairs is very low. Additional features are the slim design and low weight of the cables. The cable should meet or exceed the requirements for EN 55022 Class B emission and EN 55024 immunity allowing for networks to be built that are compliant with the standards on electromagnetic compatibility.

4.4 Patch Panel:

Industry Standard 19" Patch panel capable of accommodating 24 No. Category – 6 UTP outlets. The patch panel should be modular having 1U height with integral strain relief. Front panel of patch panel should be made of high-grade steel.

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4.5 Fiber Optic Cable

Backbone cabling from the system equipment (Data Centre) to the telecommunication closet shall be connected with optical fibre cable in Star-topology with failover optical fibre link to connecting floor.

Fiber optic cabling shall be multi-strand 50/125 micron for core/cladding diameter multimode graded index fibers, tightly jacketed. The sheath shall be colored orange or some other bright colour to help distinguish fiber media from other wiring. The cable construction should be metal free to avoid requirement of grounding, lightening protection etc.

4.6 Fiber Optic Patch Cord

Fiber-optic patch cords shall be provided for connections with active networking hardware. The cable shall be manufactured from single pair optical fiber. Each patch cord shall be terminated at switch end with SC/MT-RJ/LC connector plugs design to be pushed on and pulled off active device as applicable to facilitate administration. The patch panel end shall be terminated with duplex SC connectors.

4.7 Fiber Optic Patch Panel

Fiber-optic patch panel in the Data center shall be high-density SC type terminating maximum number of cables in least space. The Data center patch panel should be equipped with SC connectors, which have permanent cabling, connected at the rear and present forward facing SC sockets allowing patching with cords fitted with SC connectors. Provision shall be available for storing extra length of fibers and their dressing.

Optical fiber patch panels on the floors shall be equipped with SC-type connectors, which have permanent cabling, connected at the rear and present forward facing SC sockets, allowing patching with cords fitted with SC connectors at both ends.

Patch panels shall have sliding drawer construction of facilitate easy access to the terminated fibers. Provision shall be available for storing extra length of fibers and their dressing. All fiber-optic cables shall be terminated using fusion-splicing technique via factory-finished pigtails with SC connectors. Patch Panel should have provision to provide secure storage to the fusion spliced pigtails by the use of splice tray/splice cassettes.

4.8 Racks

All racks, shall be 19 inch racking products. In all cases the backbone cabling sub-system shall be terminated into rack mounted panels and presented as MTRJ fibre connectors. The rack shall have Plexiglas door with pivoted handle and square key. Earthing point, multi socket strip for supplying power to the active components of data network and roof ventilator shall be provided in each rack.

Cable management shall be provided with manageable patching facility. Horizontal management side rings shall provide an environment for ongoing

maintenance of all future patching and enable move and changes to be handled easily.

The Contractor shall be responsible for all records and labeling of the rack mounted panels, both fibre and UTP, to the convention provided by the Client.

4.9 Optical Fibre Management System (OFMS)

The OFMS shall provide a facility to efficiently terminate, protect, manage and present optical fibers to the user for utilization.

The OFMS shall be 19 inch rack mountable, 1U in height, fabricated in mild steel and power coat finished.

The OFMS shall facilitate up to 24 fibre outlets in the one unit and shall be fully self contained to securely terminate and manage the incoming fibre, providing the following features;

- Grommetted rear and side cable entry
- Cable strain relief posts.
- Internal fibre looping
- Fibre splice tray accommodation
- Slide off lid to facilitate access to splice tray
- Caution label affixed to warn of laser radiation.
- Integral labeling to identify ports, and configured according to EIA/TIA 568-A standard (AB/BA sequencing).
- Mechanical protection of patch leads attachment to OFMS.

The incoming optical fibre shall be directly terminated on MTRJ connector.

4.10 Cable Management

Cable management facilities within each rack at the Wiring Closet Sub-system are a mandatory requirement.

The cable management channels shall be made up of power coated mild steel 19-inch rack mount panels with integrated “fingers” in which to route the patch leads. The horizontal channel formed by these fingers shall be enclosed by a snap-on ABS plastic cover at both ends of panel separate ABS plastic rings shall be mounted using the rack mount bolts of the panel to create a vertical ring run up the rack. These rings shall be sufficiently large enough to comfortably accommodate in excess of 50 patch leads, yet narrow enough not to overhang the width of the rack or obscure the horizontal ring run segment.

The cable management panels should be mounted on the patching facility between active and passive rows of RJ45 ports. In this way, patch leads from every RJ 45 patch panels port are directed to the cable management panels above or below the outlet, so that at no time even when fully populated, outlets are obscured by patch leads. Such a layout shall ensure the patching facility, when cable management is properly utilized, does not go out of control and can be efficiently utilized for adds, moves and changes over

life of the Structured Cabling System.

The plastic rings shall be sufficiently large enough to comfortably accommodate in excess of fifty (50) patch leads at any time.

In view of the dynamic nature of the patching facility, the "fingers" of the cable management panels shall be made of mild steel and integral to the metal panel, so that excessive force on the patch leads do not deform the channel formed within the "fingers". The cable management panel shall be supplied with a snap on cover to discretely conceal the patch leads when the patching facility is static.

To facilitate effective patching during the life of the Structured Cabling System, the rack shall be laid out for minimal clutter and the shortest reasonable route for patch cords.

4.11 Access Switch

Access switch should be rack mountable and shall serve the floor users and should have provision to connect to the core switch via fiber optic backbone. Access switch shall have following specifications:

24 10/100 ports with 2 Nos. SFP Gigabit ports
2 Nos.1000 Base-SX-SFP
48 10/100 ports with 2 Nos. SFP Gigabit ports
2 Nos. 1000 Base-SX SFP

Switching capacity:

24 Port Switch 8.8 Gbps;
48 Port Switch 13.6 Gbps

Forwarding rate:

24 Port Switch 6.6 Mpps
48 Port Switch 10.1 Mpps
Store-and-forward switching; latency <12 μs

Layer 2 Switching

MAC Address 8K MAC addresses
VLANs (IEEE 802.1Q)
Link Aggregation IEEE 802.1ad (LACP), Gigabit ports only
Auto-negotiation
Auto-negotiation of port speed, duplex, and connection (MDI/MDIX)
Traffic control IEEE 802.1w full-duplex flow control
Support for Broadcast Storm Suppression (3,000 pps threshold)
STP/RSTP IEEE 802.1w Rapid Spanning Tree Protocol (RSTP)
Backward-compatible with STP
Fast-start mode
Spanning tree enable/disable per port

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Layer 3 Switching

Hardware based routing
Multi-netting (multiple IP interfaces per VLAN)
RIP (Routing Information Protocol), v1 and v2
7 Split Horizon
8 MD5 authentication of the RIP packets
9 Password authenticated RIP packets
10 Host route advertisements
Multicast Filtering for 64 multicast groups
IGMP (Internal Group Management Protocol) snooping on Layer 2 interfaces
IGMP 1 and v2
IGMP Querier
Network protocol DHCP (Dynamic Host Configuration Protocol) Helper/Relay
UDP Helper
ARP, ARP Proxy

Convergence

Priority Queues for hardware queues per port
Weighted Round Robin queuing
Traffic Prioritization Priority based on:
7 DSCP (DiffServ Code Point)
8 IEEE 802.1p Class of Service (CoS) VLAN priority
9 TCP/UDP destination port number
10 Default port priority
11 Auto classification of 3Com NBXR telephony traffic
Bandwidth Management Port-based bandwidth management:
7 1 Mbps increments (10/100 ports)
8 8 Mbps increments (Gigabit ports)

Security

Network Login IEEE 8.2.1X user authentication
Access Control Lists Port-based ACLs
Switch Protocol Security MD5 cipher-text and clear-text authentication for RIP v2 packets
Switch Management Local or RADIUS management of switch passwords
Trusted IP Management Addresses
Telnet

Management

Remote Management SNMP v1
Telnet
Web-based
SNMP
Mirror port/RAP (Roving Analysis Port) One-to-one
RMON (Remote Monitoring) four groups: statistics, history, alarm and events

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5.0 INSTALLATION

All cable installations shall be completed according to the local regulatory board and conform to EIA/TIA 568-A and shall comply with the following criteria:

5.1 UTP Cable Installation

Cables shall be installed in already laid steel cable trunking (within suspended ceilings) suitably anchored to the building structure, and in conduit in floor and partitions (concealed). Cables shall be secured every 600mm using hook and loop fastening ties. Due care shall be taken to not over tighten ties and place undue strain on the cabling infrastructure.

Cables shall be bundled to a maximum of 24 UTP cables and each bundle individually supported within the cable trunking.

Bend radius shall be limited to 10 times the cable diameter (UTP).

During the installation of a UTP cable (maximum 90 metres) the pull distance should not exceed 30 metres at any one time.

5.2 Optical Fibre Cable

Cables shall be installed in powder coated steel trunking with over including all accessories, supports, etc. as per site requirements, care shall be taken to ensure minimum bending radius requirements as per manufacturer's recommendations for optic fibre cable are maintained.

6.0 TESTING AND COMMISSIONING

The following tests shall be carried out and the results shall be documented and maintained to from part of the "AS BUILT" drawings.

1. Test all of the STP copper cable installation for termination and twisted pair integrity, including continuity, polarity, pin-assignment and colour codes

2. Perform visual inspections to ensure that each pair of wires remain twisted as close as possible to the termination point, to maintain the impedance and minimize attenuation losses.

3. Test that the STP cable pairs comply with the Specification using measuring device for Near End Cross-talk and Signal Attenuation complying with EIA/TIA 568-A.

4. Test each termination Optical Fibre in both directions, recording all results of the calibrated optical power. Make sure in all cases that measurements are within those provided in the specification.

The documentation required at the completion of the installation phases shall contain all of the following information, together with any other information the installer has acquired during the installation.

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1. "As-Built" documentation, showing total cabling and connection installed, utilizing floor space plans and cable record sheets. This documentation shall show all cables and outlets incorporating the full numbering and marking convention supplied.

2. All test results and certification information, identified by cable, connection and numbering convention, necessary for all Optical Fibre and copper cables.

All components of the Structured Cabling should be sourced from one manufacturer to ensure minimal impedance mismatch and best possible NEXT performance and to guarantee the Category-6 performance from end to end.

The Structured Cabling System should operate without introducing or being affected by electromagnetic radiation from other sources. Maintaining segregation from other services or screening are to be ensured to achieve acceptable immunity.

7.0 MEASUREMENT AND PAYMENT

7.1 General

The Contractor's bid amount against each Bill of Quantities item as given below shall include supply, installation, testing, commissioning and completion for all work specified herein and/or as shown on the Tender Drawings related to the item.

7.2 Backbone Cabling

7.2.1 **Measurement**: Measurement shall be made for the total running feet of backbone optical fibre cable acceptably supplied and installed by the Contractor.

7.3.2 **Payment**: Payment shall be made for the total running feet measured as provided above at the Contract unit price each and shall constitute full compensation for supply, installing, testing and commissioning of the backbone optical fibre cable including fibre management system and all accessories.

7.3 RJ 45 Socket Outlet

7.3.1 **Measurement**: Measurement shall be made for the total number of RJ 45 socket outlet acceptably supplied and installed by the Contractor as a complete unit.

7.3.2 **Payment**: Payment shall be made for number of units measured as provided above at the contract unit price each and shall constitute full compensation for supplying, installing and completion of the RJ 45 socket outlet including all civil works and other accessories.

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7.4 Patch Panels/Cable Management/Racks

7.4.1 **Measurement**: Measurement shall be made for the total number of each patch panel/cable management/racks acceptably supplied and installed by the Contractor as a complete unit.

7.4.2 **Payment**: Payment shall be made for number of unit measured as provided above at the contract unit prices each and shall constitute full compensation for supplying, installing, testing, commissioning and completion of the patch panel/cable management/racks including interconnecting cable trays between racks and all accessories.

7.5 Wiring of RJ 45 Socket Outlets

7.5.1 **Measurement**: Measurement shall be made for the total number of wiring of RJ 45 socket outlet acceptably carried out by the Contractor as a complete unit.

7.5.2 **Payment**: Payment shall be made for the total no. of units measured, as provided above at the Contract unit prices each and shall constitute for supplying, installing connecting, testing, commissioning and completion of the wiring between RJ 45 socket outlet and patch panel and between patch panels including required pair of multi-core data cable, appropriate size conduit and all accessories.

7.6 Switches

7.6.1 **Measurement:** Measurement shall be made for the total number of each type of switch, acceptably supplied and installed by the contractor as a Complete Unit.

7.6.2 **Payment:** Payment shall be made for the number of unit measured as provided above at the contract unit price each and shall constitute full compensation for supplying, installing, testing and commissioning of the Member / Master Switch including connectivity with the fibre optical panel and Master Switch and all accessories.



SECTION – 8312

STRUCTURED CABLING

1.0 SCOPE OF WORK

The work under this section consists of supplying, installing, testing and commissioning of all material and services for provision of Structured Cabling as specified herein, as shown on Tender Drawings and stated in the Bill of Quantities.

The Contractor shall discuss the Structured Cabling Layout with the Engineer and co-ordinate at site with other services for exact route, location and position of the system.

The Structured Cabling work with accessories shall also comply with the General Specifications, Section – 8001 and with other relevant provisions of the Tender Document.

2.0 GENERAL

To ensure optimum performance, components of the structured cabling shall be sourced from the one manufacturer. This shall eliminate potential problems such as electrical and mechanical mismatch between different manufacturers.

Structured Cabling shall be covered under the manufacturers Certified Installation Program and installed by Certified Installation Company. Under this arrangement, the supply of components from the one manufacturer will facilitate the manufacturers Certification requirements of sole supply.

The Structured Cabling shall support the following systems, but not be limited to these systems.

Data Processing

Mainframe access, Client Server, Enterprise Server, Messaging Systems and Electronic Mail, common document utilization, Client Database, Voice and Video, etc.

Data Communications

EIA-232-D, RS-422, RS-423, ISDN, Ethernet (10 Base-T, 100 Base-T and 1000 Base-T), 100 Base VG Any LAN, Token Ring, Fibre Distributed Data Interface (FDDI), Twisted Pair-Physical Medium Dependant (TP-PMD) and ATM (155 Mbs and 622 Mbs), etc.

3.0 APPLICABLE STANDARDS AND CODES

The following standards and all “normative addendums” shall be applicable to this document and must be adhered to for any installation work performed.



EIA/TIA 568-A	Commercial Building Telecommunications Cabling Standard.
EIA/TIA 569-A	Commercial Building Telecommunications Cabling Standard Pathways and Spaces.
TSB 67	Transmission Performance Specifications for Field-Testing of Unshielded Twisted-Pair Cabling Systems.
IEEE 802.3	Wire Speed Performance
IEEE 802.1Q	VLAN

All copper/optical fibre cabling, components and connecting hardware shall be in accordance with latest revision of ISO/IEC 11801, ISO/IEC/TR3 8802-1, ISO/IEC/8802-3, ISO/IEC 61935-1, IEC 60364-1, IEC 60950, EN50173, EN50174-1, EN50174-2, and EIA/TIA TSB 72/73.

4.0 MATERIALS

4.1 Category – 6 UTP Cable

The horizontal cabling shall be Category – 6 UTP, 4 pair cable with gigabit support and specified up to 250MHz. The cable employed shall have excellent electrical characteristics and shall posses low weight, have slim design and shall be non corrosive (to IEC 60754-2), low smoke (to IEC61034), and flame retardant (to IEC 60332-3) and DIN VDE 0472, Part 804, test type C). The cable shall meet the requirements for EN 55022 Class B emission and EN 55024 immunity to be compliant with standards of electromagnetic compatibility and shall comply with following specifications:

Electrical Specification

• DC Resistance	-	< 200 milli Ohms
• DC Resistance Imbalance	-	< 50 milli Ohms
• Insulation Resistance	-	> 500 Mega Ohms min
• Wiring Sequence	-	TIA/EIA 568 A+B
• Delay Skew	-	< 1.25 nanoseconds

Mechanical Specification

• Diameter of Copper	-	AWG 23
• Wire Insulation	-	Zero Halogen foam - skin Material
• Sheath Material	-	Zero Halogen, Flame Retardant
• Deployment Area	-	Dry and Damp Rooms
• Temperature Range (moving)	-	0 °C to +50 °C
• Operating Temperature	-	-20 °C to +60 °C
• Min. Bend Radius for Single Flexure	-	≥ 40 mm
• Min. Bend Radius during Installation		≥ 60 mm

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4.2 Category – 6 Outlets

The horizontal cabling shall be terminated on RJ-45 outlets on white plastic wall plate. The category-6 outlets shall have provision of two outlets and shall accommodate one or two inserts (as per BOQ). To maintain security, the module shall not be removable from the front of wall plate. The RJ-45 outlets shall be protected by a spring-loaded shutter which will cover the outlet when not in use. Outlets shall comply with following specifications:

Electrical Specification

- DC Resistance - < 200 milli Ohms
- DC Resistance Imbalance - < 50 milli Ohms
- Insulation Resistance - > 500 Mega Ohms min
- Wiring Sequence - TIA/EIA 568 A+B
- Delay Skew - < 1.25 nanoseconds

Mechanical Specification

Jack Contact

- Material of RJ45 pins - Copper alloy
- Plating of RJ45 pins - Gold plate 1.4 μm
- Operating Life (number of RJ45 Insertions) - 1500
- Plastic Housing (material type) - Polycarbonate (VO)

IDC Block

- Material of metal terminals - Copper alloy
- Wire Accommodation (diameter range) - AWG 22-24
- Tool Accommodation (required or not) - NO

7 Gas Tight IDC Cable Termination (yes/no) YES

- Plastic Housing (material type) - Polycarbonate (VO)
- Operating Life (number of re-terminations) up to 5

4.3 Patch Cord:

The patch cords should be designed for applications up to 250 MHz and provides transmission performance meeting Category 7 specifications. Cables should be low skew products. I.e. the difference in propagation delay between the individual pairs is very low. Additional features are the slim design and low weight of the cables. The cable should meet or exceed the requirements for EN 55022 Class B emission and EN 55024 immunity allowing for networks to be built that are compliant with the standards on electromagnetic compatibility.

4.4 Patch Panel:

Industry Standard 19" Patch panel capable of accommodating 24 No. Category – 6 UTP outlets. The patch panel should be modular having 1U height with integral strain relief. Front panel of patch panel should be made of high-grade steel.

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4.5 Fiber Optic Cable

Backbone cabling from the system equipment (Data Centre) to the telecommunication closet shall be connected with optical fibre cable in Star-topology with failover optical fibre link to connecting floor.

Fiber optic cabling shall be multi-strand 50/125 micron for core/cladding diameter multimode graded index fibers, tightly jacketed. The sheath shall be colored orange or some other bright colour to help distinguish fiber media from other wiring. The cable construction should be metal free to avoid requirement of grounding, lightening protection etc.

4.6 Fiber Optic Patch Cord

Fiber-optic patch cords shall be provided for connections with active networking hardware. The cable shall be manufactured from single pair optical fiber. Each patch cord shall be terminated at switch end with SC/MT-RJ/LC connector plugs design to be pushed on and pulled off active device as applicable to facilitate administration. The patch panel end shall be terminated with duplex SC connectors.

4.7 Fiber Optic Patch Panel

Fiber-optic patch panel in the Data center shall be high-density SC type terminating maximum number of cables in least space. The Data center patch panel should be equipped with SC connectors, which have permanent cabling, connected at the rear and present forward facing SC sockets allowing patching with cords fitted with SC connectors. Provision shall be available for storing extra length of fibers and their dressing.

Optical fiber patch panels on the floors shall be equipped with SC-type connectors, which have permanent cabling, connected at the rear and present forward facing SC sockets, allowing patching with cords fitted with SC connectors at both ends.

Patch panels shall have sliding drawer construction of facilitate easy access to the terminated fibers. Provision shall be available for storing extra length of fibers and their dressing. All fiber-optic cables shall be terminated using fusion-splicing technique via factory-finished pigtails with SC connectors. Patch Panel should have provision to provide secure storage to the fusion spliced pigtails by the use of splice tray/splice cassettes.

4.8 Racks

All racks, shall be 19 inch racking products. In all cases the backbone cabling sub-system shall be terminated into rack mounted panels and presented as MTRJ fibre connectors. The rack shall have Plexiglas door with pivoted handle and square key. Earthing point, multi socket strip for supplying power to the active components of data network and roof ventilator shall be provided in each rack.

Cable management shall be provided with manageable patching facility. Horizontal management side rings shall provide an environment for ongoing

maintenance of all future patching and enable move and changes to be handled easily.

The Contractor shall be responsible for all records and labeling of the rack mounted panels, both fibre and UTP, to the convention provided by the Client.

4.9 Optical Fibre Management System (OFMS)

The OFMS shall provide a facility to efficiently terminate, protect, manage and present optical fibers to the user for utilization.

The OFMS shall be 19 inch rack mountable, 1U in height, fabricated in mild steel and power coat finished.

The OFMS shall facilitate up to 24 fibre outlets in the one unit and shall be fully self contained to securely terminate and manage the incoming fibre, providing the following features;

- Grommetted rear and side cable entry
- Cable strain relief posts.
- Internal fibre looping
- Fibre splice tray accommodation
- Slide off lid to facilitate access to splice tray
- Caution label affixed to warn of laser radiation.
- Integral labeling to identify ports, and configured according to EIA/TIA 568-A standard (AB/BA sequencing).
- Mechanical protection of patch leads attachment to OFMS.

The incoming optical fibre shall be directly terminated on MTRJ connector.

4.10 Cable Management

Cable management facilities within each rack at the Wiring Closet Sub-system are a mandatory requirement.

The cable management channels shall be made up of power coated mild steel 19-inch rack mount panels with integrated “fingers” in which to route the patch leads. The horizontal channel formed by these fingers shall be enclosed by a snap-on ABS plastic cover at both ends of panel separate ABS plastic rings shall be mounted using the rack mount bolts of the panel to create a vertical ring run up the rack. These rings shall be sufficiently large enough to comfortably accommodate in excess of 50 patch leads, yet narrow enough not to overhang the width of the rack or obscure the horizontal ring run segment.

The cable management panels should be mounted on the patching facility between active and passive rows of RJ45 ports. In this way, patch leads from every RJ 45 patch panels port are directed to the cable management panels above or below the outlet, so that at no time even when fully populated, outlets are obscured by patch leads. Such a layout shall ensure the patching facility, when cable management is properly utilized, does not go out of

control and can be efficiently utilized for adds, moves and changes over the life of the Structured Cabling System.

The plastic rings shall be sufficiently large enough to comfortably accommodate in excess of fifty (50) patch leads at any time.

In view of the dynamic nature of the patching facility, the "fingers" of the cable management panels shall be made of mild steel and integral to the metal panel, so that excessive force on the patch leads do not deform the channel formed within the "fingers". The cable management panel shall be supplied with a snap on cover to discretely conceal the patch leads when the patching facility is static.

To facilitate effective patching during the life of the Structured Cabling System, the rack shall be laid out for minimal clutter and the shortest reasonable route for patch cords.

4.11 Access Switch

Access switch should be rack mountable and shall serve the floor users and should have provision to connect to the core switch via fiber optic backbone. Access switch shall have following specifications:

24 10/100 ports with 2 Nos. SFP Gigabit ports
2 Nos.1000 Base-SX-SFP
48 10/100 ports with 2 Nos. SFP Gigabit ports
2 Nos. 1000 Base-SX SFP

Switching capacity:

24 Port Switch 8.8 Gbps;
48 Port Switch 13.6 Gbps

Forwarding rate:

24 Port Switch 6.6 Mpps
48 Port Switch 10.1 Mpps
Store-and-forward switching; latency <12 μs

Layer 2 Switching

MAC Address 8K MAC addresses
VLANs (IEEE 802.1Q)
Link Aggregation IEEE 802.1ad (LACP), Gigabit ports only
Auto-negotiation
Auto-negotiation of port speed, duplex, and connection (MDI/MDIX)
Traffic control IEEE 802.1w full-duplex flow control
Support for Broadcast Storm Suppression (3,000 pps threshold)
STP/RSTP IEEE 802.1w Rapid Spanning Tree Protocol (RSTP)
Backward-compatible with STP
Fast-start mode

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Spanning tree enable/disable per port

Layer 3 Switching

Hardware based routing
Multi-netting (multiple IP interfaces per VLAN)
RIP (Routing Information Protocol), v1 and v2
7 Split Horizon
8 MD5 authentication of the RIP packets
9 Password authenticated RIP packets
10 Host route advertisements
Multicast Filtering for 64 multicast groups
IGMP (Internal Group Management Protocol) snooping on Layer 2 interfaces
IGMP 1 and v2
IGMP Querier
Network protocol DHCP (Dynamic Host Configuration Protocol) Helper/Relay
UDP Helper
ARP, ARP Proxy

Convergence

Priority Queues for hardware queues per port
Weighted Round Robin queuing
Traffic Prioritization Priority based on:
7 DSCP (DiffServ Code Point)
8 IEEE 802.1p Class of Service (CoS) VLAN priority
9 TCP/UDP destination port number
10 Default port priority
11 Auto classification of 3Com NBXR telephony traffic
Bandwidth Management Port-based bandwidth management:
7 1 Mbps increments (10/100 ports)
8 8 Mbps increments (Gigabit ports)

Security

Network Login IEEE 8.2.1X user authentication
Access Control Lists Port-based ACLs
Switch Protocol Security MD5 cipher-text and clear-text authentication for RIP v2 packets
Switch Management Local or RADIUS management of switch passwords
Trusted IP Management Addresses
Telnet

Management

Remote Management SNMP v1
Telnet
Web-based
SNMP
Mirror port/RAP (Roving Analysis Port) One-to-one
RMON (Remote Monitoring) four groups: statistics, history, alarm and events

5.0 INSTALLATION

All cable installations shall be completed according to the local regulatory board and conform to EIA/TIA 568-A and shall comply with the following criteria:

5.1 UTP Cable Installation

Cables shall be installed in already laid steel cable trunking (within suspended ceilings) suitably anchored to the building structure, and in conduit in floor and partitions (concealed). Cables shall be secured every 600mm using hook and loop fastening ties. Due care shall be taken to not over tighten ties and place undue strain on the cabling infrastructure.

Cables shall be bundled to a maximum of 24 UTP cables and each bundle individually supported within the cable trunking.

Bend radius shall be limited to 10 times the cable diameter (UTP).

During the installation of a UTP cable (maximum 90 metres) the pull distance should not exceed 30 metres at any one time.

5.2 Optical Fibre Cable

Cables shall be installed in powder coated steel trunking with over including all accessories, supports, etc. as per site requirements, care shall be taken to ensure minimum bending radius requirements as per manufacturer's recommendations for optic fibre cable are maintained.

6.0 TESTING AND COMMISSIONING

The following tests shall be carried out and the results shall be documented and maintained to from part of the "AS BUILT" drawings.

1. Test all of the STP copper cable installation for termination and twisted pair integrity, including continuity, polarity, pin-assignment and colour codes

2. Perform visual inspections to ensure that each pair of wires remain twisted as close as possible to the termination point, to maintain the impedance and minimize attenuation losses.

3. Test that the STP cable pairs comply with the Specification using measuring device for Near End Cross-talk and Signal Attenuation complying with EIA/TIA 568-A.

4. Test each termination Optical Fibre in both directions, recording all results of the calibrated optical power. Make sure in all cases that measurements are within those provided in the specification.

The documentation required at the completion of the installation phases shall

contain all of the following information, together with any other information the installer has acquired during the installation.

1. "As-Built" documentation, showing total cabling and connection installed, utilizing floor space plans and cable record sheets. This documentation shall show all cables and outlets incorporating the full numbering and marking convention supplied.

2. All test results and certification information, identified by cable, connection and numbering convention, necessary for all Optical Fibre and copper cables.

All components of the Structured Cabling should be sourced from one manufacturer to ensure minimal impedance mismatch and best possible NEXT performance and to guarantee the Category-6 performance from end to end.

The Structured Cabling System should operate without introducing or being affected by electromagnetic radiation from other sources. Maintaining segregation from other services or screening are to be ensured to achieve acceptable immunity.

7.0 MEASUREMENT AND PAYMENT

7.1 General

The Contractor's bid amount against each Bill of Quantities item as given below shall include supply, installation, testing, commissioning and completion for all work specified herein and/or as shown on the Tender Drawings related to the item.

7.2 Backbone Cabling

7.2.1 **Measurement**: Measurement shall be made for the total running feet of backbone optical fibre cable acceptably supplied and installed by the Contractor.

7.3.2 **Payment**: Payment shall be made for the total running feet measured as provided above at the Contract unit price each and shall constitute full compensation for supply, installing, testing and commissioning of the backbone optical fibre cable including fibre management system and all accessories.

7.3 RJ 45 Socket Outlet

7.3.1 **Measurement**: Measurement shall be made for the total number of RJ 45 socket outlet acceptably supplied and installed by the Contractor as a complete unit.

7.3.2 **Payment**: Payment shall be made for number of units measured as provided above at the contract unit price each and shall constitute full compensation for supplying, installing and completion of the RJ 45 socket outlet including all civil works and other accessories.

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7.4 Patch Panels/Cable Management/Racks

7.4.1 **Measurement**: Measurement shall be made for the total number of each patch panel/cable management/racks acceptably supplied and installed by the Contractor as a complete unit.

7.4.2 **Payment**: Payment shall be made for number of unit measured as provided above at the contract unit prices each and shall constitute full compensation for supplying, installing, testing, commissioning and completion of the patch panel/cable management/racks including interconnecting cable trays between racks and all accessories.

7.5 Wiring of RJ 45 Socket Outlets

7.5.1 **Measurement**: Measurement shall be made for the total number of wiring of RJ 45 socket outlet acceptably carried out by the Contractor as a complete unit.

7.5.2 **Payment**: Payment shall be made for the total no. of units measured, as provided above at the Contract unit prices each and shall constitute for supplying, installing connecting, testing, commissioning and completion of the wiring between RJ 45 socket outlet and patch panel and between patch panels including required pair of multi-core data cable, appropriate size conduit and all accessories.

7.6 Switches

7.6.1 **Measurement:** Measurement shall be made for the total number of each type of switch, acceptably supplied and installed by the contractor as a Complete Unit.

7.6.2 **Payment:** Payment shall be made for the number of unit measured as provided above at the contract unit price each and shall constitute full compensation for supplying, installing, testing and commissioning of the Member / Master Switch including connectivity with the fibre optical panel and Master Switch and all accessories.

