



**GOVERNMENT OF SINDH
FINANCE DEPARTMENT**

Karachi dated the 2nd January, 2025

NOTIFICATION

FD(CTC-D01(14)/2024-2025: In pursuance of Rule-31 read with proviso of sub-rules (4) and (5) of the Sindh Public Procurement Rules, 2010 (As amended from time to time); a Complaint Redressal Committee (CRC), is hereby constituted to redress the complaints / grievances of bidders that may arise during the hiring of Construction Contractor in respect of renovation / refurbishment works of rental premises situated at 01st Floor, State Life Building No. 11 Abdullah Haroon Road, Karachi, acquired for the offices / attached offices of Finance Department, Government of Sindh under the regular budgetary allocation for the financial year 2024-2025 with the following composition and ToRs:-

1.)	Special Finance Secretary (Sr/Admn), Finance Department, Government of Sindh.	Chairman
2.)	Representative of Accountant General Sindh (not below the rank of BS-17).	Member
3.)	An independent professional from the relevant field (to be nominated by the head of procuring agency).	Member

Terms of References (ToRs):-

- (i) The Complaint Redressal Committee upon receiving a complaint from an aggrieved bidder may, if satisfied;
- (a) Prohibit the procurement committee from acting or deciding in a manner, inconsistent with rules and regulations;
 - (b) Annul in whole or in part, any unauthorized act or decision of the procurement committee; and
 - (c) Recommend to the Head of Department that the case be declared a mis-procurement if material violation of Act, Rules Regulations, Orders, Instructions or any other law relating to public procurement, has been established; and
 - (d) Reverse any decision of the procurement committee or substitute its own decision for such a decision, provided that the CRC shall not make any decision to award the contract.
- (ii) The CRC shall announce its decision within Seven (07) Days and intimate the same to the bidder and the SPPR Authority within three (03) working days. If the committee fails to arrive at the decision within Seven (07) days, the complaint shall stand transferred to the Review Committee which shall dispose of the complaint in accordance with the procedure laid down in SPPRA Rule-32, if the aggrieved bidder files the review appeal within Ten (10) days of such transfer;
- (iii) The Procuring Agency shall award the contract after the decision of the CRC;
- (iv) Mere fact of lodging of a complaint shall not warrant suspension of the procurement proceedings, provided that in case of failure of the CRC to decide the complaint; the procuring Agency shall not award the contract, until the expiry of appeal period or the final adjudication by the Review Committee.

**FAYAZ AHMED JATOI
SECRETARY FINANCE**

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FD (CTC) 01(14)/2024-2025

Karachi, Dated the 2nd January, 2025

A copy is forwarded for information and necessary action to:

1. The Accountant General, Sindh, Karachi, with a request to nominate an Officer, not below BPS-17, as a member of the Complaint Redressal Committee.
2. The Chairman / Members of the Complaint Redressal Committee.
3. The R.O to Secretary to Government of Sindh, Finance Department, Karachi.
4. The P.S to SFS (Sr/ Admn), Finance Department, Govt. of Sindh, Karachi.
5. The P.S to AFS (Admn/Sr), Finance Department, Govt. of Sindh, Karachi.
6. The P.S to DS (Admn & Accounts), Finance Department, Govt. of Sindh, Karachi.
7. Office Copy.

(DR. MARJAN FATIMA)

SECTION OFFICER (ADMN-I)

For Secretary to Government of Sindh



GOVERNMENT OF SINDH FINANCE DEPARTMENT

Karachi dated the 02nd January, 2025

NOTIFICATION

FD(CTC)01(14)/2024-2025: In pursuance of Rule-7 of the Sindh Public Procurement Regulatory Rules, 2010 (As amended from time to time), the Procurement Committee is hereby constituted to hire the Construction Contractor for carry out the renovation / refurbishment works of rental premises situated at 01st Floor, State Life Building No. 11 Abdullah Haroon Road, Karachi, acquired for the offices / attached offices of Finance Department, Government of Sindh under the regular budgetary allocation for the financial year 2024-2025 with the following composition and ToRs:-

1.)	Additional Finance Secretary (Sr/Admn), <u>Finance Department, Government of Sindh.</u>	Chairman
2.)	Deputy Secretary (Admn & Accounts), <u>Finance Department, Government of Sindh.</u>	Member /Secretary
3.)	Executive Engineer (PBD-III), <u>Works & Services Department, Government of Sindh.</u>	Member

Terms of Reference (ToRs)::- The Procurement Committee shall be responsible for: -

- (1) Review and Modify (if required to) the Tender's Bidding Document furnished by the Consultant of Finance Department, Government of Sindh namely; M/s. IDG (Pvt.) Limited;
- (2) Carry out technical as well as financial evaluation of the bids with the coordination of Consultant of Finance Department, Government of Sindh namely; M/s. IDG (Pvt.) Limited;
- (3) Prepare evaluation report as provided in SPP Rule-45 with the coordination of Consultant of Finance Department, Government of Sindh namely; M/s. IDG (Pvt.) Limited;
- (4) Making recommendations for the award of contract to the competent authority; and
- (5) Perform any other function ancillary and incidental to the above.

FAYAZ AHMED JATOI
SECRETARY FINANCE

FD (CTC-I)01(14)/2024-2025

Karachi, Dated the 02nd January, 2025

A copy is forwarded for information and necessary action to the:

1. The Secretary, Works & Services Department, Govt. of Sindh, Karachi, with a request to nominate the said Officer, as a member of the Procurement Committee.
2. The Chief Engineer Buildings Karachi, Works & Services Department, Govt. of Sindh.
3. The Chairman / Members of the Committee.
4. The R.O to Secretary to Government of Sindh, Finance Department, Karachi.
5. The P.S to SFS (Sr/ Admn), Finance Department, Govt. of Sindh, Karachi.
6. The P.S to AFS (Admn/Sr), Finance Department, Govt. of Sindh, Karachi.
7. The P.S to DS (Admn & Accounts), Finance Department, Govt. of Sindh, Karachi.
8. Office Copy.


(DR. MARJAN FATIMA)
SECTION OFFICER (ADMN-I)
For Secretary to Government of Sindh



NO. FD (CTC-I) 01 (14) / 2024-2025
GOVERNMENT OF SINDH
FINANCE DEPARTMENT

Ph: 021-99222113

Karachi dated the 08th January, 2025

To,

The Director (Advertisement),
Information Department,
Government of Sindh,
Karachi.

Subject: NOTICE INVITING TENDERS (NIT) FOR HIRING OF THE CONSTRUCTION CONTRACTOR TO CARRY OUT THE RENOVATION / REFURBISHMENT WORKS OF RENTAL PREMISES ACQUIRED AT 1ST FLOOR, STATE LIFE BUILDING NO. 11, ABDULLAH HAROON ROAD, KARACHI

I am directed to refer to the subject noted above and enclosed herewith Seven (07) copies of subject NIT Advertisement for the publication in Three (03) leading daily newspapers English, Urdu & Sindhi i.e., Daily English 'Dawn / Express Tribune'; Daily Urdu 'Jang / Express'; Daily Sindhi 'Kawish' latest by **09th January, 2025.**

2. It is, further requested that each copy of above said newspapers having above advertisement may kindly be furnished to this department for record.

Encl. As above

NO. FD (CTC-I)01(14)/2024-2025

(MUHAMMAD ADEEL)
SECTION OFFICER (CTC)

Karachi dated the 08th January, 2025

A copy is forwarded for information & necessary action to: -

1. The Accountant General Sindh, Karachi.
2. The P.S to SFS (SR/Admn), Finance Department, Government of Sindh, Karachi.
3. The P.S to AFS (SR/Admn), Finance Department, Government of Sindh, Karachi.
4. The P.S to DS (Admn & Accounts), Finance Department, Government of Sindh, Karachi.
5. The R.O to Secretary to Government of Sindh, Finance Department, Karachi.
6. The Chief Information Officer, Information Management Unit, Finance Department, Government of Sindh, with the request to upload the same NIT & Bidding Document on Finance Department's Official website.
7. Office concerned Copy.

(MUHAMMAD ADEEL)
SECTION OFFICER (CTC)

Address:

Room No. 171, Care Taker Cell-I, Ground Floor, Finance Department, Government of Sindh, Building No. 06, A.K Lodhi Block, Sindh Secretariat, Kamal-Attaturk Road, Karachi, Pakistan.

Telephone No: +92-21-99222113

Website: www.finance.gos.pk

E-mail: procurementfd@finance.gos.pk



FINANCE DEPARTMENT GOVERNMENT OF SINDH

NOTICE INVITING TENDERS

(PROCUREMENT OF CONSTRUCTION CONTRACTOR'S SERVICES)

UNDER NATIONAL COMPETITIVE BIDDING

Procuring Agency: Finance Department, Government of Sindh

Assignment Title: Hiring of Construction Contractor for the provision of Renovation / Refurbishment Works of rental premises acquired at 1st Floor, State Life Building No.11, Abdullah Haroon Road, Karachi

Reference No: FD (CTC-I) 01 (14) / 2024-25

Date: 08TH January, 2025

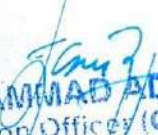
The Finance Department, Government of Sindh (the '**Procuring Agency**') intends to engage a reputable bidder for provision of Renovation / Refurbishment Works of Rental Premises acquired at 1st Floor, State Life Building No. 11, Abdullah Haroon Road, Karachi hired for the attached offices / units of Finance Department, Government of Sindh (the '**Assignment**').

2. The Procuring Agency in this regard invites the sealed Bids from the Bidders, i.e., the firm(s) for Renovation / Refurbishment Works of Rental Premises (the '**Assignment**') following the Sindh Public Procurement Rules, 2010 (As amended and in force till the issuance of this NIT) (the '**SPP Rules**').

3. The Bidding Procedure will be conducted through **National Competitive Bidding** using the **Quality and Cost Based Selection method** as prescribed under Rules-15(2)(b) followed by Rule-72(3) of SPP Rules, 2010 and is open to all the Bidders. The Contract will be awarded to a Bidder whose Bid found and declared as the **Most Advantageous Bid**, i.e., a Bid attaining the highest combined weighted technical and financial score according to criteria outlined in the Bidding Document, subject to the approval by the Competent Authority i.e., Secretary Finance.

4. The prospective Bidders obtaining the Bidding Document electronically, by downloading it from the websites of the Procuring Agency <http://finance.gos.pk> or SPPRA <https://portalsindh.eprocure.gov.pk/#/> and submit a written application along with a pay order / demand draft of Rs. 2,000/- in favor of **Deputy Secretary (Admn & Accounts), Finance Department, Government of Sindh** with effect from 09th January, 2025 to 26th January, 2025 during office hours at the address given below.

5. The Bid, Technical and Financial Proposals sealed separately, containing all the requisite documents must be submitted **electronically** through designated e-Procurement system i.e., E-Pak Acquisition and Disposal System (EPADS) of Sindh Public Procurement Regulatory Authority on or before 27th January, 2025 at 11:00 am (the '**Submission Deadline**'). **No Physical bids shall be allowed.** Any Bid(s) received late due to any reason whatsoever shall be rejected.


MUHAMMAD ADEEL
Section Officer (CTC)
Finance Department
Government of Sindh

Cont'd to page-2/-

6. The Bids (Technical Proposals only) will be opened publicly in the presence of the Bidders or their representatives, who may wish to attend, at the opening time period at **12:00 Noon on 27th January, 2024** at the office address specified under Bidding Document. However, in case of a public holiday announced by the Government or due to any unavoidable circumstances on the submission deadline, the Bids shall be considered and opened on the next working day (the '**Business Day**') at the same time and venue.

7. All the Bids submitted must remain valid for a period of **Ninety (90) days** effective from the Technical Proposals/ Bids' opening date and must be accompanied by a bid security equivalent to **5%** of the total quoted bid in the shape of Deposit at Call or Pay Order/ Demand Draft/ Bank Guarantee, valid for a period of twenty-eight (28) days beyond the bid validity period, issued by a scheduled bank of Pakistan in favor of '**Deputy Secretary (Admn & Accounts), Finance Department, Government of Sindh**'.

8. The original bid security instrument as a part of financial bid shall be required physically in a separate sealed envelope on or before bid's submission closing date and time period and a copy of the same instrument without disclose the bid security amount, to be required electronically, in a technical bid as well.

9. **Clarifications** may be requested **not later than five calendar days** prior to the date of opening of bids, only through the E-Pak Acquisition and Disposal System (EPADS) of Sindh Public Procurement Regulatory Authority i.e., <https://portalsindh.eprocure.gov.pk/#/>. No physical correspondence in respect of the clarification shall be accepted from the bidder(s). **For clarification of Bid purposes only, the Procuring Agency's address is:**

Attention: Additional Finance Secretary (Sr /Admn), Finance Department, Government of Sindh.
Address: Room No. 119, Sixth Floor, Finance Department, AK Lodhi Block, Building No. 06, Sindh Secretariat, Kamal-Atta Turk Road, Karachi.
Phone: +92 21 99222113
E-mail: procurementfd@finance.gos.pk
Website: <https://www.finance.gos.pk/>

10. **Note:** The Procuring Agency will issue clarifications (the '**Response Document**') against the prospective Bidders' queries, if any received within the time specified herein-above. The Response Document(s) will be posted on the EPADS & Procuring Agency's website and the same will be communicated to the prospective Bidders who obtained the Bidding Document from the Procuring Agency. The prospective Bidders are required to regularly access the websites to ensure seeking such updates relating to the Assignment.

11. The Procuring Agency reserves the right to reject any or all Bids subject to the relevant provisions of the SPP Rules, and may cancel the Bidding Process at any time prior to the acceptance of a Bid in terms of Rule-25 of the SPP Rules.

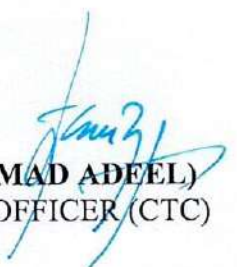
12. Eligibility / Evaluation Criteria attached with Tender / Contract Documents (Volume-I).


MUHAMMAD ADEEL
Secretary, Finance Department
Government of Sindh

Cont'd to page-3/-

13. For the submission of bid's security instrument purposes only, the Procuring Agency's address is:

Attention: Additional Finance Secretary (Sr /Admn), Finance Department, Government of Sindh.
Address: Room No. 171, Caretaker Cell-I, Ground Floor, Finance Department, AK Lodhi Block, Building No. 06, Sindh Secretariat, Kamal-Atta Turk Road, Karachi.
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Website: <https://www.finance.gos.pk/>


(MUHAMMAD ADEEL)
SECTION OFFICER (CTC)

Address:
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E-mail: procurementfd@finance.gos.pk



Ph: 021-99222113

GOVERNMENT OF SINDH
FINANCE DEPARTMENT
Karachi, Dated the 8th January, 2025

REVISED ANNUAL PROCUREMENT PLAN FOR THE CURRENT FINANCIAL YEAR 2024-2025
(GOODS & SERVICES)

Sr. No	Description of Procurement	Description of Item / Services	Quantity (where applicable)	Estimated Unit Cost (where applicable)	Estimated Total Cost (In Millions)	Budget Allocation (In Millions)	Object Code	Source of Funds (ADP / Non-ADP)	Proposed Procurement Method	Timing of Procurements			
										1 st Qtr.	2 nd Qtr.	3 rd Qtr.	4 th Qtr.
1.	Procurement of Miscellaneous items under Frame Work Contract	LOT-I: Supply of Petty & Edible Items on monthly Basis	-	N/A	8.50	10.00	A03970-493	Non-ADP	Single Stage One Envelope Procedure	-	Oct	-	-
		LOT-II: Supply of customized printing articles on monthly basis:	-	N/A	4.20	45.00	A03902			-	Oct	-	-
		LOT-III: Supply of Stationery items on monthly basis:	-	N/A	4.00	4.50	A03901			-	Oct	-	-
2.	Procurement of Original supplies (HP Cartridges) for HP Printers	Supply of Original Supplies (HP Toners) for HP Printers	662-Units	N/A	47.00	100.50	A03970-20	Non-ADP	Single Stage One Envelope Procedure	-	Oct	-	-
3.	Procurement of Imported White Top-Quality Papers for Printers & Photocopier Machines	A4 Size Papers (80-Grams) A4 Size Papers (70-Grams)	2500-Reams 3000-Reams	N/A	12.00			Non-ADP	Single Stage One Envelope Procedure	-	Oct	-	-
4.	Procurement & Installation of IT Hardware and Machinery Equipment for the Offices of Finance Department, Government of Sindh (Secretariat), Karachi.	Desktop Computers with LED Screens	40-Units	0.395	15.80	14.00	A09201	Non-ADP	Single Stage Two Envelopes Procedure	-	Oct	-	-
		Laser Printers	20-Units	0.160	3.20	2.40				-	Oct	-	-
		Standby UPS	40-Units	0.105	4.20	3.00				-	Oct	-	-
		Image Documents Scanners	20-Units	0.215	4.30	4.80				-	Oct	-	-
		Laptop Notebooks	10-Units	0.690	6.90	7.00				-	Oct	-	-
		Indoor Wall mounted Split Air Conditioners 2.0 Ton (Inverter)	20-Units	0.210	4.20	6.30	A09601			-	Oct	-	-
5.	Supply, Installation, testing and commissioning of Heavy-Duty Generator for Finance Department Building No.6 (Secretariat) Karachi	Heavy Duty Generator (500-KVA)	01-Unit	40.00	40.00	34.00	A09601	Non-ADP	Single stage Two Envelopes Procedure	-	Oct	-	-
6.	Hiring of a Consulting Services	Hiring of an engineering consulting Services regarding the design & supervision of renovation / refurbishment of rental premises situated 01 st Floor State life Building No. 11 Abdullah Haroon Road Karachi	01-Job	-	4.00	62.00	A03919	Non-ADP	QCBS Method	-	Oct	-	-
7.	Tender for Renovation / Refurbishment Works.	Hiring of Construction Contractor for Renovation / Refurbishment works of rental premises acquired at 1 st Floor, State Life Building No. 11, Abdullah Haroon Road, Karachi	01-Job	-	85.00	85.00	A03970-F92	Non-ADP	QCBS Method	-	-	Jan	-
- The estimated total cost has been calculated based on current market rates. - Enhancement of budget allocation as well as releases request are under process. - Any other Procurement item(s) required on need basis shall be part of procurement plan & Revised Plan shall be reported to Sindh Public Procurement Regulatory Authority with the approval of the Competent Authority													

(MUHAMMAD ADEEL)
SECTION OFFICER (CTC)
For Secretary to Government of Sindh
Section Officer (CTC)
Finance Department
Government of Sindh



FINANCE
DEPARTMENT
GOVERNMENT OF SINDH

**RENOVATION / REFURBISHMENT WORKS OF RENTAL PREMISES
ACQUIRED AT 1ST FLOOR, STATE LIFE BUILDING NO. 11,
ABDULLAH HAROON ROAD, KARACHI**



**TENDER / CONTRACT DOCUMENTS
(Volume – I)**

Instructions to Bidders
Bidding Data
Form of Bids & Appendices to Bid
Forms
General Condition of Contract
Particular Conditions of Contract

December 2024

IDG (PVT.) LIMITED
Architects Engineers Planners Interior Designers



SUMMARY OF CONTENTS

NOTICE INVITING TENDERS

ELIGIBILITY / EVALUATION CRITERIA

INSTRUCTIONS TO BIDDERS

BIDDING DATA

FORM OF BID AND APPENDICES TO BID

FORMS

PART-I: GENERAL CONDITIONS OF CONTRACT

PART-II: PARTICULAR CONDITIONS OF CONTRACT

ANNEXURE TO CONDITION OF CONTRACT PART-II

**NOTICE
INVITING
TENDERS**



FINANCE DEPARTMENT GOVERNMENT OF SINDH

NOTICE INVITING TENDERS

(PROCUREMENT OF CONSTRUCTION CONTRACTOR'S SERVICES)
UNDER NATIONAL COMPETITIVE BIDDING

Procuring Agency: Finance Department, Government of Sindh

Assignment Title: Hiring of Construction Contractor for the provision of Renovation / Refurbishment Works of rental premises acquired at 1st Floor, State Life Building No.11, Abdullah Haroon Road, Karachi

Reference No: FD (CTC-D) 01 (14) / 2024-25

Date: 08TH January, 2025

The Finance Department, Government of Sindh (the 'Procuring Agency') intends to engage a reputable bidder for provision of Renovation / Refurbishment Works of Rental Premises acquired at 1st Floor, State Life Building No. 11, Abdullah Haroon Road, Karachi hired for the attached offices / units of Finance Department, Government of Sindh (the 'Assignment').

2. The Procuring Agency in this regard invites the sealed Bids from the Bidders, i.e., the firm(s) for Renovation / Refurbishment Works of Rental Premises (the 'Assignment') following the Sindh Public Procurement Rules, 2010 (As amended and in force till the issuance of this NIT) (the 'SPP Rules').

3. The Bidding Procedure will be conducted through **National Competitive Bidding** using the **Quality and Cost Based Selection method** as prescribed under Rules-15(2)(b) followed by Rule-72(3) of SPP Rules, 2010 and is open to all the Bidders. The Contract will be awarded to a Bidder whose Bid found and declared as the **Most Advantageous Bid**, i.e., a Bid attaining the highest combined weighted technical and financial score according to criteria outlined in the Bidding Document, subject to the approval by the Competent Authority i.e., Secretary Finance.

4. The prospective Bidders obtaining the Bidding Document electronically, by downloading it from the websites of the Procuring Agency <http://finance.gos.pk> or SPPRA <https://portalsindh.eprocure.gov.pk/#/> and submit a written application along with a pay order / demand draft of Rs. 2,000/- in favor of **Deputy Secretary (Admn & Accounts), Finance Department, Government of Sindh** with effect from 09th January, 2025 to 26th January, 2025 during office hours at the address given below.

5. The Bid, Technical and Financial Proposals sealed separately, containing all the requisite documents must be submitted **electronically** through designated e-Procurement system i.e., E-Pak Acquisition and Disposal System (EPADS) of Sindh Public Procurement Regulatory Authority on or before **27th January, 2025 at 11:00 am** (the 'Submission Deadline'). **No Physical bids shall be allowed.** Any Bid(s) received late due to any reason whatsoever shall be rejected.

MUHAMMAD ADEEL
Section Officer (GTC)
Finance Department
Government of Sindh

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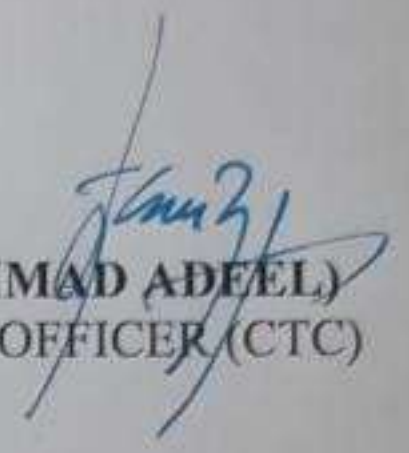
6. The Bids (Technical Proposals only) will be opened publicly in the presence of the Bidders or their representatives, who may wish to attend, at the opening time period at **12:00 Noon on 27th January, 2024** at the office address specified under Bidding Document. However, in case of a public holiday announced by the Government or due to any unavoidable circumstances on the submission deadline, the Bids shall be considered and opened on the next working day (the '**Business Day**') at the same time and venue.
7. All the Bids submitted must remain valid for a period of **Ninety (90) days** effective from the Technical Proposals/ Bids' opening date and must be accompanied by a bid security equivalent to **5%** of the total quoted bid in the shape of Deposit at Call or Pay Order/ Demand Draft/ Bank Guarantee, valid for a period of twenty-eight (28) days beyond the bid validity period, issued by a scheduled bank of Pakistan in favor of '**Deputy Secretary (Admn & Accounts), Finance Department, Government of Sindh**'.
8. The original bid security instrument as a part of financial bid shall be required physically in a separate sealed envelope on or before bid's submission closing date and time period and a copy of the same instrument without disclose the bid security amount, to be required electronically, in a technical bid as well.
9. **Clarifications** may be requested **not later than five calendar days** prior to the date of opening of bids, only through the E-Pak Acquisition and Disposal System (EPADS) of Sindh Public Procurement Regulatory Authority i.e., <https://portalsindh.eprocure.gov.pk/#/>. No physical correspondence in respect of the clarification shall be accepted from the bidder(s). **For clarification of Bid purposes only, the Procuring Agency's address is:**
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Phone: +92 21 99222113
E-mail: procurementfd@finance.gos.pk
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11. The Procuring Agency reserves the right to reject any or all Bids subject to the relevant provisions of the SPP Rules, and may cancel the Bidding Process at any time prior to the acceptance of a Bid in terms of Rule-25 of the SPP Rules.
12. Eligibility / Evaluation Criteria attached with Tender / Contract Documents (Volume-I).

MUHAMMAD ADEEL

Cont'd to page-3/-

13. For the submission of bid's security instrument purposes only, the Procuring Agency's address is:

Attention: Additional Finance Secretary (Sr /Admn), Finance Department, Government of Sindh.
Address: Room No. 171, Caretaker Cell-I, Ground Floor, Finance Department, AK Lodhi Block, Building No. 06, Sindh Secretariat, Kamal-Atta Turk Road, Karachi.
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(MUHAMMAD ADEEL)
SECTION OFFICER (CTC)

Address:
Room No. 171, Care Taker Cell-I, Ground Floor, Finance Department, Government of Sindh, Building No. 06, A.K Lodhi Block, Sindh Secretariat, Kamal-Atta Turk Road, Karachi, Pakistan.
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**ELIGIBILITY /
EVALUATION
CRITERIA**

**Additional Finance Secretary (Sr /Admn), Finance Department,
Government of Sindh**

**RENOVATION / REFURBISHMENT WORKS AT 1ST FLOOR,
STATELIFE BUILDING NO. 11, ABDULLAH HAROON ROAD,
KARACHI**

Eligibility Criteria / Mandatory Requirement

S. #	Description	Yes / No
1	Valid Registration for the year 2025 with Pakistan Engineering Council in category C-4 and above in the relevant specialized field i.e. CE-10, ME-02, EE-01 to EE-07	
2	Valid Registration with Federal Board of Revenue (NTN & GST) for Withholding Tax and GST.	
3	Valid Registration with Sindh Revenue Board for SST.	
4	Affidavit on stump paper of Rs.500/= (duly notarized) that the firm has never been blacklisted or debarred by any Federal / Provincial, Govt / Semi-Govt department.	
5	Affidavit on stump paper of Rs.500/= (duly notarized) by the contractors/ firms that the firm is not involve in any litigation department Rift, Abandoned or Unnecessary Delay in completion of any work in the Government as well as private organization. In case of litigation, firm should not be considered for participation.	
6	Documentary evidence / work order of at least 03 Nos. similar nature of work (Interior Decoration / Renovation / Refurbishment) issued in last 3 years having estimated cost of Rs. 80.00 Million with Government of Sindh.	
7	Documentary evidence / completion certificate at least 02 Nos. of completed project similar nature of work (Interior Decoration / Renovation / Refurbishment) issued in last 3 years having estimated cost of Rs. 80.00 Million with Government of Sindh.	
8	Documentary evidence of financial position, last 03 years Bank Statements and Audit Reports affirming average annual turn over of Rs. 150 Million.	

Client: **Additional Finance Secretary (Sr /Admn), Finance Department, Government of Sindh**

Project: **RENOVATION / REFURBISHMENT WORKS AT 1ST FLOOR, STATELIFE BUILDING NO. 11, ABDULLAH HAROON ROAD, KARACHI**

Sub Head: **Evaluation Criteria / Mandatory Requirement**

*(Assessment Criteria : minimum 80 qualifying marks)
(50% in each head / section is compulsory)*

S. #	Qualification Parameters	Criteria
		Max. Marks
1	Eligibility:	
1.1	Valid Registration for the year 2025 with Pakistan Engineering Council in category C-4 and above in the relevant specialized field i.e. CE-10, ME-02, EE-01 to EE-07 (Mandatory Requirement).	
1.2	Registration with Federal Board of Revenue for Withholding Tax and GST and Sindh Revenue Board for SST. (Mandatory Requirement).	
1.3	Completion Certificate at least 03 Nos. of completed projects of similar nature works (Interior Decoration / Renovation / Refurbishment) issued in last 3 years having estimated cost of Rs. 80.00 Million or above with Government of Sindh. (Mandatory Requirement).	
1.4	Work Order and Contract at least 02 Nos. of projects in progress of similar nature works (Interior Decoration / Renovation / Refurbishment) having estimated cost of Rs. 80.00 Million or above with Government of Sindh. (Mandatory Requirement).	
1.5	Detailed Bio-Data of professional Engineers (B.E.Civil, B.E.Electrical & B.E.Mech), must having valid registration with PEC and are working fulltime with the firm for the last three 03) years and would be deployed at this project. (Mandatory Requirement).	
1.6	Litigation	
(i)	Affidavit on stump paper of Rs.500/= (duly notarized) by the contractors/ firms that the firm is not involve in any litigation department Rift, Abandoned or Unnecessary Delay in completion of any work in the Government as well as private organization. In case of litigation, firm should not be considered for participation. (Mandatory Requirement).	
(ii)	Affidavit on stump paper of Rs.500/= (duly notarized) that the firm has never been blacklisted or debarred by any Federal / Provincial, Govt/Semi-Govt department. (Mandatory Requirement).	
2	Profile of Firm / Contractor:	
2 A (i)	Name, address, telephone, fax numbers and e-mail address of firm/individual;	
2 A (ii)	Ownership and Organizational Structure of the firm	
a	Type of Business Organization	
b	If Partnership, Names of Partners & their Positions along with Form-H/ Partnership deed	
c	If Corporation, Name and Title of Principals	
d	If Proprietorship, Name & Title of Owner	
e	Under Present Management Since	
2 (iii)	Year of establishment; (One Mark for every 10 years)	5.00
		5.00

Client: Additional Finance Secretary (Sr /Admn), Finance Department, Government of Sindh		
Project: RENOVATION / REFURBISHMENT WORKS AT 1ST FLOOR, STATELIFE BUILDING NO. 11, ABDULLAH HAROON ROAD, KARACHI		
Sub Head: Evaluation Criteria / Mandatory Requirement		
<i>(Assessment Criteria : minimum 80 qualifying marks) (50% in each head / section is compulsory)</i>		
S. #	Qualification Parameters	Criteria Max. Marks
3	Experience and past performance.	
(i)	(i) List of similar assignments of at least 03 Nos. similar nature of work (Interior Decoration / Renovation / Refurbishment) having estimated cost of Rs. 80.00 Million or above with Government of Sindh completed during last 03 years (Work Order and Completion Certificate must be attach); (05 for each assignment)	20.00
(ii)	(ii) List of similar assignments Currently in progress of at least 02 Nos. similar nature of work (Interior Decoration / Renovation / Refurbishment) having estimated cost of Rs. 80.00 Million or above with Government of Sindh (Work Order and Contract must be attach); (05 for each assignment)	20.00
	Completion / Performance certificates of assignments to be attached.	
		40.00
4	Key Personnel Qualification & Experience.	
(i)	Academic qualification: 01 No. BE (Civil) max marks 05 01 No. BE (Elect) max marks 05 01 No. BE (Mech) max marks 05	
(ii)	Experience: 01 No. BE (Civil) 10 Years experience 05 Projects max marks 05 01 No. BE (Elect) 10 Years experience 05 Projects max marks 05 01 No. BE (Mech) 10 Years experience 05 Projects max marks 05	15.00
	Brief CVs of key personnel be attached;	
		15.00
5	Equipment.	
(i)	Equipment Proposed for the Project. (i) Details of equipments, machineries and transport owned by firm/contractor; <i>If relevant equipment are owned by contractor.</i>	10.00
(ii)	Details of equipments, machineries and transport to be hired/leased by firm/contractor;	
		10.00
6	Financial.	
(i)	(i) Documentary evidence of financial position, bank statement or audited accounts of the last 03 years affirming average annual turn over of Rs. 150 Million.	20.00
(iii)	Income tax return for the last 03 years. (Mandatory Requirement).	
		20.00
7	Work Methodology along with implementation of Schedule of work	10.00
Total Marks		100.00

**INSTRUCTIONS
TO
BIDDERS**

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INSTRUCTIONS TO BIDDERS

(Note: These Instructions to Bidders along with bidding Data will not be part of the Contract and will cease to have effect once the contract is signed)

A. GENERAL

IB.1 Scope of Bid

- 1.1 The Employer as defined in the Bidding Data hereinafter called “the Employer” wishes to receive bids for the construction and completion of works as described in these Bidding Documents and summarized in the Bidding Data hereinafter referred to as the “Works”.
- 1.2 The successful bidder will be expected to complete the Works within the time specified in Appendix-A to Bid.

IB.2 Source of Funds

- 2.1 The Employer has applied for/received a loan/credit from the source (s) indicated in the Bidding Data in various currencies towards the cost of the project specified in the Bidding Data and it is intended that part of the proceeds of this loan/credit will be applied to eligible payments under the Contract for which these Bidding Documents are issued.

IB.3 Eligible Bidders

- 3.1 This invitation to Bid is open to only those Bidders who are pre-qualified for this purpose.
- 3.2 The Bidder shall submit minimum 3 names of specialist firms / sub-contractors (on the format at Appendix-E) for Employer's approval of any one of them.
- 3.3 If the Bidder does not provide the names and/or if any of the 3 specialist firms/sub-contractors are not acceptable to the Employer, then the option of nomination of such name (s) shall be exercised by the Employer which nomination(s) shall be acceptable and binding to the Bidder.
- 3.4 The successful Bidder shall submit to the Employer the agreement(s) executed between the specialist firms / sub contractors for each discipline listed in Appendix - E.

IB.4 One Bid per Bidder

- 4.1 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 (other than alternatives pursuant to Clause IB.16) will be disqualified.

IB.5 Cost of Bidding

- 5.1 The bidders shall bear all costs associated with the preparation and submission of their respective bids and the Employer will in no case be responsible or liable for those costs, regardless of the conduct or outcome of the bidding process.

IB.6 Site Visit

- 6.1 The bidders are advised to visit and examine the Site of Works and its surroundings and obtain for themselves on their own responsibility all information that may be necessary for preparing the bid and entering into a contract for construction of the Works. All cost in this respect shall be at the bidder's own expense.
- 6.2 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.

B. BIDDING DOCUMENTS**IB.7 Contents of Bidding Documents**

- 7.1 The Bidding Documents, in addition to invitation for bids, are those stated below and should be read in conjunction with any Addenda issued in accordance with Clause IB.9.

Volume I

1. Instructions to Bidders.
2. Bidding Data.
3. General Conditions of Contract, Part-I (GCC).
4. Particular Conditions of Contract, Part-II (PCC).
5. Form of Bid & Appendices to Bid.
6. Form of Bid Security.
7. Form of Contract Agreement.
8. Forms of Performance Security and Mobilization Advance Guarantee / Bond.

Volume II

9. Specifications – Special Provisions.
10. Specifications - Technical Provisions.

Volume III

11. Bill of Quantities.

Volume IV

12. Tender Drawings.

- 7.2 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 Bidder's own risk. Pursuant to Clause IB.26, bids which are not substantially responsive to the requirements of the Bidding Documents will be rejected.

IB.8 Clarification of Bidding Documents

- 8.1 Any prospective bidder requiring any clarification (s) in respect of the Bidding Documents may notify the Employer in writing at the Employer's address indicated in the Invitation for Bids. The Employer will respond to any request for clarification which he receives earlier than 28 days prior to the deadline for submission of bids.

Copies of the Employer's response will be forwarded to all purchasers of the Bidding Documents, including a description of the enquiry but without identifying its source.

IB.9 Amendment of Bidding Documents

- 9.1 At any time 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.
- 9.2 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.
- 9.3 To afford prospective bidders reasonable time in which to take an addendum into account in preparing their bids, the Employer may extend the deadline for submission of bids in accordance with Clause IB.20

C. PREPARATION OF BIDS

IB.10 Language of Bid

- 10.1 The bid and all correspondence and documents related to the bid exchanged by a bidder and the Employer shall be in the bid language stipulated in the Bidding Data and Particular Conditions of Contract. Supporting documents and printed literature furnished by the bidders may be in any other language provided the same are accompanied by an accurate translation of the relevant parts in the bid language, in which case, for purposes of evaluation of the bid, the translation in bid language shall prevail.

IB.11 Documents Accompanying the Bid**11.1 Each bidder shall:**

- (a) Submit a written power of attorney authorizing the signatory of the bid to act for and on behalf of the bidder;
- (b) Update the information indicated and listed in the Bidding Data and previously submitted with the application for prequalification, and continue to meet the minimum criteria set out in the prequalification documents which as a minimum, would include the following:
 - (i) Evidence of access to financial resources alongwith average annual construction turnover
 - (ii) Financial predictions for the current year and the two following years including the effect of known commitments
 - (iii) Work commitments since prequalification
 - (iv) Current litigation information
 - (v) Availability of critical equipment
 - (vi) Information of technical manpower to be posted at the site with particulars regarding name, qualifications and relevant experience
- (c) furnish a technical proposal taking into account the various Appendices to Bid specially the following:

Appendix-E to Bid	Proposed Construction Schedule
Appendix-F to Bid	Method of Performing the Work
Appendix-G to Bid	List of Major Equipment
Appendix-K to Bid	Organization Chart for Supervisory Staff
and other pertinent information such as mobilization programme etc;	

11.2 Bids submitted by a joint venture of two (2) or more firms shall comply with the following requirements:

- (a) The bid and in case of a successful bid, the Form of Contract Agreement shall be signed so as to be legally binding on all partners;
- (b) One of the joint venture partners shall be nominated as being in charge; and this authorization shall be evidenced by submitting a power of attorney signed by legally authorized signatories of all the joint venture partners;

Signature of Client

Signature of Contractor

- (c) The partner-in-charge shall always be duly authorized to deal with the Employer regarding all matters related with and/or incidental to the execution of Works as per the terms and Conditions of Contract and in this regard to incur any and all liabilities, receive instructions, give binding undertakings and receive payments on behalf of the joint venture;
- (d) All partners of the joint venture shall at all times and under all circumstances be liable jointly and severally for the execution of the Contract in accordance with the Contract terms and a statement to this effect shall be included in the authorization mentioned under Sub-Para(b) above as well as in the Form of Bid and in the Form of Contract Agreement (in case of a successful bid); and
- (e) A copy of the agreement entered into by the joint venture partners shall be submitted with the bid stating the conditions under which it will function, its period of duration, the persons authorized to represent and obligate it and which persons will be directly responsible for due performance of the Contract and can give valid receipts on behalf of the joint venture, the proportionate participation of the several firms forming the joint venture, and any other information necessary to permit a full appraisal of its functioning. No amendments / modifications whatsoever in the joint venture agreement shall be agreed to between the joint venture partner without prior written consent of the Employer.

11.3 Bidders shall also submit proposals of work methods and schedule, in sufficient detail to demonstrate the adequacy of the Bidders' proposals to meet the technical specifications and the completion time referred to in Sub-Clause 1.2 hereof.

IB.12 Bid Prices

12.1 Unless stated otherwise in the Bidding Documents, the Contract shall be for the whole of the Works as described in Sub-Clause 1.1 hereof, based on the unit rates and / or prices submitted by the bidder.

12.2 The bidders shall fill in rates and prices for all items of the Works described in the Bill of Quantities. 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 Bill of Quantities.

12.3 All duties, taxes and other levies payable by the Contractor under the Contract, or for any other cause, as on the date 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.

Additional / reduced duties, taxes and levies due to subsequent additions or changes in legislation shall be reimbursed / deducted as per Sub-Clause 70.2 of the General Conditions of Contract Part-I.

- 12.4 The rates and prices quoted by the bidders are subject to adjustment during the performance of the Contract in accordance with the provisions of Clause 70 of the Conditions of Contract. The bidders shall furnish the prescribed information for the price adjustment formulae in Appendix-C to Bid, and shall submit with their bids such other supporting information as required under the said Clause.

IB.13 Currencies of Bid and Payment

- 13.1 The unit rates and the prices shall be quoted by the bidder entirely in Pak rupees. A bidder expecting to incur expenditures in other currencies for inputs to the Works supplied from outside the Employer's country (referred to as the "Foreign Currency Requirements") shall indicate the same in Appendix-B to Bid. The proportion of the Bid Price (excluding Provisional Sums) needed by him for the payment of such Foreign Currency Requirements either (i) entirely in the currency of the Bidder's home country or, (ii) at the bidder's option, entirely in Pak rupees provided always that a bidder expecting to incur expenditures in a currency or currencies other than those stated in (i) and (ii) above for a portion of the foreign currency requirements, and wishing to be paid accordingly, shall indicate the respective portions in his bid.
- 13.2 The rates of exchange to be used by the bidder for currency conversion shall be the TT&OD Selling Rates published or authorized by the State Bank of Pakistan prevailing on the date 28 days prior to the deadline for submission of bids.

For the purpose of payments, the exchange rates used in bid preparation shall apply for the duration of the Contract.

IB.14 Bid Validity

- 14.1 Bids shall remain valid for the period stipulated in the Bidding Data after the Date of Bid Opening specified in Clause IB.23.
- 14.2 In exceptional circumstances, prior to expiry of the original bid validity period, the Employer may request that the bidders 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 bidder may refuse the request without forfeiting 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.15 Bid Security

- 15.1 Each bidder shall furnish, as part of his bid, a Bid Security in the amount stipulated in the Bidding Data in Pak Rupees or an equivalent amount in a freely convertible currency.

- 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 in Pakistan or from a foreign bank duly counter guaranteed by a Scheduled Bank in Pakistan in favour of Project Director, Cadet College Khairpur valid for a period 28 days beyond the Bid Validity date.
- 15.3 Any bid not accompanied by an acceptable Bid Security shall be rejected by the Employer as non-responsive.
- 15.4 The bid securities of unsuccessful bidders will be returned as promptly as possible, but not later than 28 days after the expiration of the period of Bid Validity.
- 15.5 The Bid Security of the successful bidder will be returned when the bidder has furnished the required Performance Security and signed the Contract Agreement.
- 15.6 The Bid Security may be forfeited:
- (a) if the bidder withdraws his bid except as provided in Sub-Clause 22.1;
 - (b) if the bidder does not accept the correction of his Bid Price pursuant to Sub-Clause 27.2 hereof; or
 - (c) In the case of successful bidder, if he fails within the specified time limit to:
 - (i) furnish the required Performance Security; or
 - (ii) sign the Contract Agreement.

IB.16 Alternate Proposals by Bidder

- 16.1 Should any bidder consider that he can offer any advantages to the Employer by a modification to the designs, specifications or other conditions, he may, in addition to his bid to be submitted in strict compliance with the Bidding Documents, submit any Alternate Proposal(s) containing (a) relevant design calculations; (b) technical specifications; (c) proposed construction methodology; and (d) any other relevant details / conditions, provided always that the total sum entered on the Form of Bid shall be that which represents complete compliance with the Bidding Documents.
- 16.2 Alternate Proposal(s), if any, of the lowest evaluated responsive bidder only may be considered by the Employer as the basis for the award of Contract to such bidder.

IB.17 Pre-Bid Meeting

- 17.1 The Employer may, on his own motion or at the request of any prospective 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, is as stipulated in the Bidding Data. All prospective bidders or their authorized representatives shall be invited to attend such a pre-bid meeting.
- 17.2 The bidders are requested to submit questions, if any, in writing so as to reach the Employer not later than seven (7) days before the proposed pre-bid meeting.
- 17.3 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 7.1 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.9 and not through the minutes of the pre-bid meeting.
- 17.4 Absence at the pre-bid meeting will not be a cause for disqualification of a bidder.

IB.18 Format and Signing of Bid

- 18.1 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.
- 18.2 All appendices to Bid are to be properly completed and signed.
- 18.3 No alteration is to be made in the Form of Bid nor in the Appendices thereto except in filling up the blanks as directed. If any such alterations be made or if these instructions be not fully complied with, the bid may be rejected.
- 18.4 Each bidder shall prepare by filling out the forms completely and without alterations one (1) original and number of copies, specified in the Bidding Data, of the documents comprising the bid as described in Clause IB.7 and clearly mark them "ORIGINAL" and "COPY" as appropriate. In the event of discrepancy between them, the original shall prevail.
- 18.5 The original and all copies of the bid shall be typed or written in indelible ink (in the case of copies, Photostats are also acceptable) and shall be signed by a person or persons duly authorized to sign on behalf of the bidder pursuant to Sub-Clause 11.1(a) hereof. All pages of the bid shall be initialed and stamped by the person or persons signing the bid.

- 18.6 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.
- 18.7 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.
- 18.8 Bidders should retain a copy of the Bidding Documents as their file copy.

D. SUBMISSION OF BIDS

IB.19 Sealing and Marking of Bids

- 19.1 Each bidder shall submit his bid as under:
- (a) ORIGINAL and each copy of the Bid shall be separately sealed and put in separate envelopes and marked as such.
 - (b) The envelopes containing the ORIGINAL and copies will be put in one sealed envelope and addressed / identified as given in Sub- Clause 19.2 hereof.
- 19.2 The inner and outer envelopes shall:
- (a) be addressed to the Employer at the address provided in the Bidding Data;
 - (b) bear the name and identification number of the contract as defined in the Bidding Data; and
 - (c) provide a warning not to open before the time and date for bid opening, as specified in the Bidding Data.
- 19.3 In addition to the identification required in Sub- Clause 19.2 hereof, the inner envelope shall indicate the name and address of the bidder to enable the bid to be returned unopened in case it is declared "late" pursuant to Clause IB.21
- 19.4 If the outer envelope is not sealed and marked as above, the Employer will assume no responsibility for the misplacement or premature opening of the Bid.

IB.20 Deadline for Submission of Bids

- 20.1 (a) Bids must be received by the Employer at the address specified no later than the time and date stipulated in the Bidding Data.

- (b) Bids with charges payable will not be accepted, nor will arrangements be undertaken to collect the bids from any delivery point other than that specified above. Bidders shall bear all expenses incurred in the preparation and delivery of bids. No claims will be entertained for refund of such expenses.
 - (c) Where delivery of a bid is by mail and the bidder wishes to receive an acknowledgment of receipt of such bid, he shall make a request for such acknowledgment in a separate letter attached to but not included in the sealed bid package.
 - (d) Upon request, acknowledgment of receipt of bids will be provided to those making delivery in person or by messenger.
- 20.2 The Employer may, at his discretion, extend the deadline for submission of bids by issuing an amendment in accordance with Clause IB.9, 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.21 Late Bids

- 21.1 (a) Any bid received by the Employer after the deadline for submission of bids prescribed in Clause IB.20 will be returned unopened to such bidder.
- (b) Delays in the mail, delays of person in transit, or delivery of a bid to the wrong office shall not be accepted as an excuse for failure to deliver a bid at the proper place and time. It shall be the bidder's responsibility to determine the manner in which timely delivery of his bid will be accomplished either in person, by messenger or by mail.

IB.22 Modification, Substitution and Withdrawal of Bids

- 22.1 Any bidder may modify, substitute or withdraw his bid after bid submission provided that the modification, substitution or written notice of withdrawal is received by the Employer prior to the deadline for submission of bids.
- 22.2 The modification, substitution, or notice for withdrawal of any bid shall be prepared, sealed, marked and delivered in accordance with the provisions of Clause IB.19 with the outer and inner envelopes additionally marked "MODIFICATION", "SUBSTITUTION" or "WITHDRAWAL" as appropriate.
- 22.3 No bid may be modified by a bidder after the deadline for submission of bids except in accordance with Sub-Clauses 22.1 and 27.2.
- 22.4 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 in pursuance to Clause IB.15.

E. BID OPENING AND EVALUATION**IB.23 Bid Opening**

- 23.1 The Employer will open the bids, including withdrawals, substitution and modifications made pursuant to Clause IB.22, in the presence of bidders' representatives who choose to attend, at the time, date and location stipulated in the Bidding Data. The bidders' representatives who are present shall sign a register evidencing their attendance.
- 23.2 Envelopes marked "MODIFICATION", "SUBSTITUTION" or "WITHDRAWAL" shall be opened and read out first. Bids for which an acceptable notice of withdrawal has been submitted pursuant to Clause IB.22 shall not be opened.
- 23.3 The bidder's name, total Bid Price and price of any Alternate Proposal(s), any discounts, bid modifications, substitution and withdrawals, the presence or absence of Bid Security, and such other details as the Employer may consider appropriate, will be announced by the Employer at the opening of bids.
- 23.4 Employer shall prepare minutes of the bid opening, including the information disclosed to those present in accordance with the Sub-Clause 23.3.

IB.24 Process to be Confidential

- 24.1 Information relating to the examination, clarification, evaluation and comparison of bid and recommendations for the award of a contract shall not be disclosed to bidders or any other person not officially concerned with such process before the announcement of bid evaluation report which shall be done at least ten (10) days prior to issue of Letter of Acceptance. 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. Any effort by a bidder to influence the Employer's processing of bids or award decisions may result in the rejection of such bidder's bid. Whereas any bidder feeling aggrieved may lodge a written complaint not later than fifteen (07) days after the announcement of the bid evaluation report; however mere fact of lodging a complaint shall not warrant suspension of the procurement process.

IB.25 Clarification of Bids

- 25.1 To assist in the examination, evaluation and comparison of bids, the Employer may, at his discretion, ask any bidder for clarification of his bid, including breakdowns of unit rates. The request for clarification and the response shall be in writing but no change in the price or substance of the bid shall be sought, offered or permitted except as required to confirm the correction of arithmetic errors discovered by the Employer in the evaluation of the bids in accordance with Clause IB.28.

IB.26 Examination of Bids and Determination of Responsiveness

- 26.1 Prior to the detailed evaluation of bids, the Employer will determine whether each bid is substantially responsive to the requirements of the Bidding Documents.
- 26.2 A substantially responsive bid is one which (i) meets the eligibility criteria; (ii) has been properly signed; (iii) is accompanied by the required Bid Security; and (iv) conforms to all the terms, conditions and specifications of the Bidding Documents, without material deviation or reservation. 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) adoption/rectification whereof would affect unfairly the competitive position of other bidders presenting substantially responsive bids.
- 26.3 If a bid is not substantially responsive, it will be rejected by the Employer, and may not subsequently be made responsive by correction or withdrawal of the non-conforming deviation or reservation.

IB.27 Correction of Errors

- 27.1 Bids determined to be substantially responsive will be checked by the Employer for any arithmetic errors. Errors will be corrected by the Employer as follows:
- (a) where there is a discrepancy between the amounts in figures and in words, the amount in words will govern; and
 - (b) where there is a discrepancy between the unit rate and the line item total resulting from multiplying the unit rate by the quantity, the unit rate as quoted will govern, unless in the opinion of the Employer there is an obviously gross misplacement of the decimal point in the unit rate, in which case the line item total as quoted will govern and the unit rate will be corrected.
- 27.2 The amount stated in the Form of Bid will be adjusted by the Employer in accordance with the above procedure for the correction of errors and with the concurrence of the bidder, shall be considered as binding upon the bidder. If the bidder does not accept the corrected Bid Price, his Bid will be rejected, and the Bid Security shall be forfeited in accordance with Sub- Clause 15.6(b) hereof.

IB.28 Evaluation and Comparison of Bids

- 28.1 The Employer will evaluate and compare only the Bids determined to be substantially responsive in accordance with Clause IB.26.

- 28.2 In evaluating the Bids, the Employer will determine for each Bid the evaluated Bid Price by adjusting the Bid Price as follows:
- (a) making any correction for errors pursuant to Clause IB.27;
 - (b) excluding Provisional Sums and the provision, if any, for contingencies in the Summary Bill of Quantities, but including competitively priced Daywork; and
 - (c) making an appropriate adjustment for any other acceptable variation or deviation.
- 28.3 The estimated effect of the price adjustment provisions of the Conditions of Contract, applied over the period of execution of the Contract, shall not be taken into account in Bid evaluation.
- 28.4 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, the Employer may require the bidder to produce detailed price analyses for any or all items of the Bill of Quantities 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.32 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.

F. AWARD OF CONTRACT

IB.29 Award

- 29.1 Subject to Clauses IB.30 and IB.34, 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 eligible in accordance with the provisions of Clause IB.3 and qualify pursuant to Sub-Clause IB 29.2.
- 29.2 The Employer, having credible reasons for, or *prima facie* evidence, of any defect in bidder's capacities, will determine to its satisfaction that the substantially responsive, lowest evaluated Bidder, whether already prequalified or not, is qualified to satisfactorily perform the Contract in accordance with the applicable Qualification Criteria including the following:
- (a) The Bidder should have successfully completed at least one similar project in the last five years either independently or as a lead partner; and
 - (b) the Bidder should have successfully completed in the last five years any specific project having value equal to or higher than the total Bid Price.

IB.30 Employer's Right to Accept any Bid and to Reject any or all Bids

- 30.1 Notwithstanding Clause IB.29, 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 except that the grounds for rejection of all bids 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.

IB.31 Notification of Award

- 31.1 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").
- 31.2 No Negotiation with the bidder having evaluated as lowest responsive or any other bidder shall be permitted, however, Employer may have clarification meetings to get clarify any item in the bid evaluation report.
- 31.3 The notification of award 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.
- 31.4 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.32 Performance Security

- 32.1 The successful bidder shall furnish to the Employer a Performance Security in the form and the amount stipulated in the Bidding Data and the Conditions of Contract within a period of 15 days after the receipt of Letter of Acceptance.
- 32.2 Failure of the successful bidder to comply with the requirements of Sub-Clause IB.32.1 or Clauses IB.33 or IB.35 shall constitute sufficient grounds for the annulment of the award and forfeiture of the Bid Security.

IB.33 Signing of Contract Agreement

- 33.1 Within 14 days from the date of furnishing of acceptable Performance Security under the Conditions of Contract, the Employer will send the successful bidder the Contract Agreement in the form provided in the Bidding Documents, incorporating all agreements between the parties.

- 33.2 The formal Agreement between the Employer and the successful bidder shall be executed within 14 days of the receipt of the Contract Agreement by the successful bidder from the Employer.

IB.34 General Performance of the Bidders

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, interalia, reject his bid and/or refer the case to the Pakistan Engineering Council (PEC). 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.

IB.35 Integrity Pact

The Bidder shall sign and stamp the Integrity Pact provided at Appendix-L 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 bidder non-responsive.

IB.36 Instructions not Part of Contract

Bids shall be prepared and submitted in accordance with these Instructions which are provided to assist bidders in preparing their bids, and do not constitute part of the Bid or the Contract Documents.

BIDDING DATA

Bidding Data

The following specific data for the Works to be bidden shall complement, amend, or supplement the provisions in the Instructions to Bidders. Wherever there is a conflict, the provisions herein shall prevail over those in the Instructions to Bidders.

Instructions to Bidders

Clause Reference

- 1.1 Name and address of the Employer:

**Additional Finance Secretary (Sr /Admn),
Finance Department,
Government of Sindh
Room No. 171, Caretaker Cell-I,
Ground Floor, Finance Department,
AK Lodhi Block, Building No. 06,
Sindh Secretariat, Kamal-Atta Turk Road,
Karachi**

- 1.1 Name of the Project & Summary of the Works:

**RENOVATION / REFURBISHMENT WORKS OF RENTAL REMISES
ACQUIRED AT 1ST FLOOR, STATE LIFE BUILDING NO. 11,
ABDULLAH HAROON ROAD, KARACHI**

The scope of work includes

**Necessary Demolition, Civil, Internal Electrification, Internal Plumbing /
Mechanical Works, Furniture Supply and installation for:**

- 2.1 Name of the Borrower/Source of Financing/Funding Agency:

Employer's own sources through Government of Sindh

- 8.1 Time limit for clarification:

7 days prior to the dead line for submission of Bid Documents

- 10.1 Bid language:

English language will be used for bidding and correspondence

- 13.1 Bidders to quote entirely in **Pak. Rupees**

13.2 **Delete in its entirety**

14.1 Period of Bid Validity:

The period of Bid validity shall be 90 days after the dead line for submission of tender.

15.1 Amount of Bid Security:

The Bid Security shall be 5% of the Bid Price in the form of Pay Order / Deposit at Call or a Bank Guarantee issued by a Scheduled Bank in Pakistan or from a foreign bank duly counter guaranteed by a Scheduled Bank of Pakistan in favour of Employer valid for a period 28 days beyond the Bid Validity date.

16 Alternate proposal by Bidder

Delete in its entirety

17.1 Venue, time, and date of the pre-Bid meeting:

A pre-bid meeting will be held, if required, the venue, time and date to be notified by the Employer

18.4 Number of copies of the Bid to be completed and returned:

Bidders must submit through EPADS one (1) original bid of the Technical Proposal, and one (1) original bid of the Financial Proposal (all Volumes)

19.2(a) Employer's address for the purpose of Bid submission:

The original and all copies of the Technical Proposal shall be placed through EPADS of SPPRA clearly marked "TECHNICAL PROPOSAL (ORIGINAL / PHOTOCOPY)" Similarly, the original Financial Proposal (if required under the selection method indicated in the Data Sheet) shall be placed through EPADS of SPPRA clearly marked "FINANCIAL PROPOSAL (ORIGINAL/PHOTOCOPY)" followed by name of the Assignment, and with a warning "DO NOT OPEN WITH THE TECHNICAL PROPOSAL." If the Financial Proposal is not submitted in separately duly marked as indicated above, this will constitute grounds for declaring the Proposal non-responsive.

The Proposals must be submitted through EPADS of SPPRA indicated in the Data Sheet and received by the Procuring Agency no later than the time and the date indicated in the Bidding Data until any extension to this date is made through a corrigendum or addendum. Any proposal received by the Procuring Agency after the deadline for submission shall not be accepted.

19.2(b) Name and Number of the Contract:

Not applicable

20.1(a) Deadline for submission of bids:

As notified by the Employer in invitation for Bids / Notice Inviting Tenders

23.1 Venue, time, and date of Bid opening:

Venue: **As notified by Employer in Notice Inviting Tenders**

Time: **As notified by Employer in Notice Inviting Tenders**

Date: **As notified by Employer in Notice Inviting Tenders**

32.1 Standard form and amount of Performance Security acceptable to the Employer:

Amount equal to 10% of the Contract Price in the form of a Bank Guarantee issued by a Scheduled Bank in Pakistan or a Bank Guarantee from a bank located outside Pakistan duly counter guaranteed by a Scheduled Bank in Pakistan.

**FORM OF BID
AND
APPENDICES TO BID**

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FORM OF BID AND APPENDICES TO BID

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FORM OF BID

Bid Reference No. _____

**RENOVATION / REFURBISHMENT WORKS OF RENTAL REMISES ACQUIRED AT 1ST
FLOOR, STATE LIFE BUILDING NO. 11, ABDULLAH HAROON ROAD, KARACHI**

To: **Additional Finance Secretary (Sr /Admn),
Finance Department,
Government of Sindh
Room No. 171, Caretaker Cell-I,
Ground Floor, Finance Department,
AK Lodhi Block, Building No. 06,
Sindh Secretariat, Kamal-Atta Turk Road,
Karachi**

Gentleman,

1. Having examined the Bidding Documents including Instructions to bidders, Bidding Data, Condition of Contract, Specifications, Drawings and Bill of Quantities and Addenda Nos. _____ for the execution of the above-named Works, we, the undersigned, offer to execute and complete such Works and remedy any defects therein in conformity with the Conditions of Contract, specifications, drawings, Bill of Quantities and Addenda for the sum of Rs. _____ (Rupees _____) or such other sum as may be ascertained in accordance with the said Conditions.
2. We understand that all Appendices attached hereto form part of this Bid.
3. As security for due performance of the undertakings and obligations of this Bid, we submit herewith a bid Security in the amount of Rupees _____ (Rs. _____) drawn in your favour or made payable to you and valid for a period of _____ days beginning from the date Bids are opened.
4. We undertake, if our Bid is accepted, to commence the Works and to complete the whole of the Works comprised in the Contract within the time stated in Appendix-A to Bid.

Signature of Client

Signature of Contractor

5. 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.
6. 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.
7. We do hereby declare that the Bid is made without any collusion, comparison of figures or arrangement with any other bidder for the Works.
8. We understand that you are not bound to accept the lowest or any Bid you may receive.

Dated this _____ day of _____ 20____.

Signature _____ in the capacity of _____ duly authorized to sign Bids for and on behalf of _____

(Name of Bidder in Block Capitals)

Address _____

Witness:

Signature: _____

Name: _____

Address _____

Occupation _____

Signature of Client

Signature of Contractor

SPECIAL STIPULATIONS**Clause
Conditions of Contract**

		Clause	
1.	Amount of Performance Security	10.1 IT-32	10% of Contract Price stated in the Letter of Acceptance.
2.	Time for furnishing Programme	14.1	Within 15 days from the date of receipt of Letter of Acceptance.
3.	Minimum Amount of Third Party Insurance	23.2	Rs. 300,000/- for person insurance, Rs. 2.0 Million for damage to property, in both cases number of incidences is unlimited.
4.	Time for Commencement	41.1	Within 07 days from the date of receipt of Engineer's Notice to Commence which shall be issued within seven (07) days after signing of Contract Agreement.
5.	Time for Completion	43.1 48.2	90 Calendar Days from the date of receipt of Engineer's Notice to Commence.
6	Amount of Liquidated Damages	47.1	0.1% (one tenth of one percent) of Contract Price for each day of delay in completion of the Works subject to a maximum of 10% of Contract Price. Under the clause, Contract Price will be considered the Price inclusive of the cost impact of variation orders issued under Clause 51 and increased / decreased in quantities.
7.	Defects Liability or Maintenance Period	49.1	12 calendar months from the effective date of Taking Over Certificate.
8.	Percentage of Retention Money	60.2	5% (five percent) of amount of Interim payment Certificate.
9.	Limit of Retention Money	60.2	No Limit. Retention Money shall be deducted from each Interim Payment Certificate.

Signature of Client

Signature of Contractor

		Clause	
10.	Minimum Amount of monthly Interim Certificate (Running Bills)	60.2	25% of Contract Price stated in the Letter of Acceptance.
11.	Period of payment from delivery of Engineer's Interim Payment Certificate to the Employer	60.10	28 days
12.	Mobilization Advance	60.12	10% of Contract Price as stated in the Letter of Acceptance on submission of Bank Guarantee from Schedule Bank of Pakistan.

Signature of Client

Signature of Contractor

FOREIGN CURRENCY REQUIREMENTS

Not Applicable

Signature of Client

Signature of Contractor

PRICE ADJUSTMENT UNDER CLAUSE 70 **OF CONDITIONS OF CONTRACT**

The source of indices and the weightages or coefficients for use in the adjustment formula under Clause 70 shall be as follows:

Cost Element	Description	Weightages	Applicable index
1	2	3	4
(i)	Fixed Portion	0.300	
(ii)	Local Labour	0.220	Monthly Statistical Bulletin, Government of Pakistan, the rate of labour (referred as "un-skilled labour" in the said Bulletin) per day shall be used.
(iii)	Cement – in bags	0.110	Monthly Statistical Bulletin, Government of Pakistan, the rate of Ordinary Portland and Sulphate Resistant Cement (referred as "cement" in the said Bulletin) per bag shall be used.
(iv)	Reinforcing Steel	0.300	Monthly Statistical Bulletin, Government of Pakistan, the rate of steel (referred as "iron bar ½" round M.S." in the said Bulletin) per tone shall be used.
(v)	High Speed Diesel (HSD)	0.070	Monthly Statistical Bulletin, Government of Pakistan, the rate of high speed diesel (referred as "high speed diesel" in the said Bulletin) per liter shall be used.
	Total	1.000	

Notes:

- 1) The base cost indices or prices shall be those applying 28 days prior to the latest day for submission of bids. Current indices or prices shall be those applying 28 days prior to the last day of the billing period.
- 2) Any fluctuation in the indices or prices of materials other than those given above shall not be subject to adjustment of the Contract Price.
- 3) For above, following are the base cost indices or prices for **Karachi** for the Month of **November 2024** specified in Monthly Bulletin of Statistics, GoP.

Signature of Client

Signature of Contractor

BILL OF QUANTITIES**A. Preamble**

1. The Bill of Quantities shall be read in conjunction with the Conditions of Contract, Specifications and Drawings.
2. The quantities given in the Bill of Quantities are estimated and provisional, and are given to provide a common basis for bidding. The basis of payment will be the actual quantities of work executed and measured by the Contractor and verified by the Engineer and valued at the rates and prices entered in the prices Bill of Quantities, where applicable, and otherwise at such rates and prices as the Engineer may fix as per the Contract.
3. The rates and prices entered in the priced Bill of Quantities shall, except insofar as it is otherwise provided under the Contract include all costs of Contractor's plant, labour, supervision, materials, execution, insurance, profit, taxes and duties, together with all general risks, taxes and other levies payable by the Contractor under the Contract, or for any other cause, as on the date 28 days prior to deadline for submission of Bids, shall be included in the rates and prices and the total Bid Price submitted by the Bidder.
4. A rate or price shall be entered against each item in the priced Bill of Quantities, whether quantities are stated or not. The cost of items against which the contractor will have failed to enter a rate or price shall be deemed to be covered by other rates and prices entered in the Bill of Quantities.
5. Unit rate against each item in the Bill of Quantities shall be written legibly both in words and figures. This is mandatory.
6. The whole cost of complying with the provisions of the Contract shall be included in the items provided in the priced Bill of Quantities, and where no items are provided, the cost shall be deemed to be distributed among the rates and prices entered for the related items of the Works.
7. General directions and description of work and materials are not necessarily repeated nor summarized in the Bill of Quantities. References to the relevant sections of the Bidding Documents shall be made before entering prices against each item in the priced Bill of Quantities.
8. Provisional sums included and so designated in the Bill of Quantities shall be expended in whole or in part at the direction and discretion of the Engineer in accordance with sub-clauses 58.2 of part-1, General Conditions of Contract.
9. Any arithmetic errors in computations or summations will be corrected by the Employer as follows:-
 - a) Where there is a discrepancy between amount in figures and in words, the amount in words will govern; and
 - b) Where there is a discrepancy between the unit rate and the total amount derived from the multiplication of the unit price and the quantity, the unit rate as quoted will govern.
10. Any item mentioned in the Bill of Quantities consist of furnishing all planrt, labour, equipment, machinery, appliances, materials, fittings, fittings, fixtures, fabrication, erection and installation required for completing the items / works. The work shall be done in accordance with the Bill of Quantities, Technical Specifications, Drawings and directions of the Engineer complete in all respect.

Signature of Client

Signature of Contractor

11. The "Ref Sec." indicates the specifications section number which as a whole or part (depending upon the Engineer's discretion) of these specifications are to be followed during execution of item of work in accordance with the applicable drawings.
12. Complete description of items of works in the Bill of Quantities, general directions, conditions and limitations of works, location and place of works, applicable methods, means to be adopted, type and quality of materials, use of tools, plants and machinery are not necessarily mentioned in the Bill of Quantities. These shall be referred to in accordance with the Technical Specifications and Drawings.
13. The Bidder may ensure himself of the correctness of quantities and applications of the individual items of works as per the Drawings, Technical Specifications and Contract Documents.
14. Notwithstanding provision of Clause 51 of the General Conditions of Contract, no claim for extra payment will be admissible on account of anticipated profit or variation in overheads expenditure for the works not actually performed nor will any adjustment in the unit rate set forth in the Bill of Quantities be made because of any increase or decrease in the quantities indicated therein.
15. Unless otherwise stated in the text of the Priced Bill of Quantities, the quantities have to be measured and paid in accordance with the measurement and payment of works clauses given in the relevant specifications or in accordance with implied meaning of the specifications. Any special method of measurement used as stated in text of Priced Bill of Quantities is limited to the concerned items only.
16. The rates quoted in the rate column are full value of unit prices as shown in unit column and are firm and final and shall be full compensation for the works involved as per Drawings, Specifications and Contract Conditions.

BILL OF QUANTITIES

B. Work Item

1. The Bill of Quantities contains the following Bills and Schedule:
 - Civil Works
 - Plumbing Works
 - Electrical Works
2. Bidders shall price the Bill of Quantities in Pakistani Rupees only.
3. Detailed Bill of Quantities is attached in Volume-III of Bid Documents.

BILL OF QUANTITIES

C. Summary

-	Civil Works	_____
-	Plumbing Works	_____
-	Electrical Works	_____
	Bid Price	_____

PROPOSED CONSTRUCTION SCHEDULE

Pursuant to Sub-Clause 43.1 of the General Conditions of Contract, the Works shall be completed on or before the date stated in Appendix-A to Bid. The Bidder shall provide as Appendix-E to Bid, the Construction Schedule in the bar chart (CPM, PERT or any other to be specified herein) showing the sequence of work items and the period of time during which he proposes to complete each work item in such a manner that his proposed programme for completion of the whole of the Works and parts of the Works may meet Employer's completion targets in days noted below and counted from the date of receipt of Engineer's Notice to Commence (Attach sheets as required for the specified form of Construction Schedule):

Description**Time for Completion**

a) Whole Works

90 calendar days

METHOD OF PERFORMING THE WORK

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

1. Organization Chart indicating head office and field office personnel involved in management and supervision, engineering, equipment maintenance and purchasing.
2. 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.
3. The method of executing the Works, the procedures for installation of equipment and machinery and transportation of equipment and materials to the site.]

LIST OF MAJOR EQUIPMENT – RELATED ITEMS

[The Bidder will provide on Sheet 2 of this Appendix a list of all major equipment and related items, under separate heading for items owned, to be purchased or to be arranged on lease by him to carry out the Works. The information shall include make, type, capacity, and anticipated period of utilization for all equipment which shall be in sufficient detail to demonstrate fully that the equipment will meet all requirements of the Specifications.]

LIST OF MAJOR EQUIPMENT

Owned Purchase d or Leased	Description of Unit (Make, Model, Year)	Capacity HP Rating	Conditio n	Present Location or Source	Date of Delivery at Site	Period of Work on Project
1	2	3	4	5	6	7
a. Owned						
b. To be Purchased						
c. To be arranged on Lease						

Signature of Client

Signature of Contractor

CONSTRUCTION CAMP AND HOUSING FACILITIES

The Contractor in accordance with Clause 34 of the Conditions of Contract 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.

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.).
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.).

LIST OF SUBCONTRACTORS

I/We intend to subcontract the following parts of the Work to subcontractors. In my/our opinion, the subcontractors named hereunder are reliable and competent to perform that part of the work for which each is listed.

Enclosed are documentation outlining experience of subcontractors, the curriculum vitae and experience of their key personnel who will be assigned to the Contract, equipment to be supplied by them, size, location and type of contracts carried out in the past.

Part of Works (Give Details)	Subcontractor (With Complete Address)
1	2

Signature of Client

Signature of Contractor

ESTIMATED PROGRESS PAYMENTS

Bidder's estimate of the value of work which would be executed by him during each of the periods stated below, based on his Programme of the Works and the Rates in the Bill of Quantities, expressed in thousands of Pakistani Rupees:

Quarter/ Year/ Period	Amounts
1	2
1 st Quarter	
2 nd Quarter	
Bid Price	

Signature of Client

Signature of Contractor

ORGANIZATION CHART
FOR THE
SUPERVISORY STAFF AND LABOUR

Signature of Client

Signature of Contractor

(INTEGRITY PACT)**DECLARATION OF FEES, COMMISSION AND BROKERAGE ETC.
PAYABLE BY THE SUPPLIERS OF GOODS, SERVICES & WORKS IN
CONTRACTS WORTH RS. 10.00 MILLION OR MORE**

Contract No. _____ Dated _____
 Contract Value: _____
 Contract Title: _____

..... [name of Supplier] hereby declares that it has not obtained or induced the procurement of any contract, right, interest, privilege or other obligation or benefit from Government of Pakistan (GoP) or any administrative subdivision or agency thereof or any other entity owned or controlled by GoP through any corrupt business practice.

Without limiting the generality of the foregoing, [name of Supplier] 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, consultant, 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 GoP, except that which has been expressly declared pursuant hereto.

[name of Supplier] 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 GoP and has not taken any action or will not take any action to circumvent the above declaration, representation or warranty.

[name of Supplier] 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 GoP under any law, contract or other instrument, be voidable at the option of GoP.

Notwithstanding any rights and remedies exercised by GoP in this regard, [name of Supplier] agrees to indemnify GoP for any loss or damage incurred by it on account of its corrupt business practices and further pay compensation to GoP in an amount equivalent to ten times the sum of any commission, gratification, bribe, finder's fee or kickback given by [name of Supplier] 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 GoP.

Name of Buyer:
 Signature:
 [Seal]

Name of Seller/Supplier:
 Signature:
 [Seal]

Signature of Client

Signature of Contractor

FORMS

**BID SECURITY
PERFORMANCE SECURITY
CONTRACT AGREEMENT
MOBILIZATION ADVANCE
GUARANTEE**

BID SECURITY
(Bank Guarantee)

Security Executed on _____
(Date)

Name of Surety (Bank) with Address: _____
(Scheduled Bank in Pakistan)

Name of Principal (Bidder) with Address _____

Penal Sum of Security Rupees _____ Rs. _____

Bid Reference No. _____

KNOW ALL MEN BY THESE PRESENTS, that in pursuance of the terms of the Bid and at the request of the said Principal (Bidder) we, the Surety above named, are held and firmly bound unto _____
(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 Bidder has submitted the accompanying Bid dated _____ for Bid No. _____
for _____ (Particulars of Bid) to the said Employer; and

WHEREAS, the Employer has required as a condition for considering said Bid that the Bidder furnishes a Bid Security in the above said sum from a Scheduled Bank in Pakistan or from a foreign bank duly counter-guaranteed by a Scheduled Bank in Pakistan, to the Employer, conditioned as under:

- (1) that the Bid Security shall remain in force up to and including the date 28 days after the deadline for validity of bids as stated in the Instructions to Bidders or as it may be extended by the Employer, notice of which extension(s) to the Surety is hereby waived;
- (2) that the Bid Security of unsuccessful Bidders will be returned by the Employer after expiry of its validity or upon signing of the Contract Agreement; and
- (3) that in the event of failure of the successful Bidder to execute the proposed Contract Agreement for such work and furnish the required Performance Security, the entire said sum be paid immediately to the said Employer pursuant to Clause 15.6 of the Instruction to Bidders for the successful Bidder's failure to perform.

Signature of Client

Signature of Contractor

NOW THEREFORE, if the successful Bidder shall, within the period specified therefore, 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 fifteen (15) 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 Surety shall forthwith pay the Employer the said sum 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 Surety at its address given above.

PROVIDED ALSO THAT the Employer shall be the sole and final judge for deciding whether the Principal (Bidder) 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 Surety shall pay without objection the said sum upon demand from the Employer forthwith and without any reference to the Principal (Bidder) or any other person.

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

SURETY (Bank)

WITNESS:

Signature _____

1. _____

Name _____

Title _____

Corporate Secretary (Seal)

Corporate Guarantor (Seal)

2. _____

Name, Title & Address

Signature of Client

Signature of Contractor

**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: _____
(Scheduled Bank in Pakistan)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 49, Defects Liability, 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.

Signature of Client

Signature of Contractor

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 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.

Witness:

1. _____

Corporate Secretary (Seal)

2. _____

Name, Title & Address

Guarantor (Bank)

Signature _____

Name _____

Title _____

Corporate Guarantor (Seal)

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) Special Stipulations (Appendix-A to Bid);
 - (e) The Particular Conditions of Contract – Part II;
 - (f) The General Conditions – Part I;
 - (g) The priced Bill of Quantities (Volume-III);
 - (h) The completed Appendices to Bid (B, C, E to L);
 - (i) The Drawings;
 - (j) The Specifications.
 - (k) _____ (any other)
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.

Signature of Client

Signature of Contractor

IN WITNESS WHEREOF the parties hereto have caused this Agreement to be executed on the day, month and year first before written in accordance with their respective laws.

Signature of the Contactor

(Seal)

Signature of Employer

(Seal)

Signed, Sealed and Delivered in the presence of:

Witness:

(Name, Title and Address)

Witness:

(Name, Title and Address)

Signature of Client

Signature of Contractor

MOBILIZATION ADVANCE GUARANTEE/BOND
(Bank Guarantee)

Guarantee No. _____ Date _____

WHEREAS _____ (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 the mobilization advance for the performance of his obligations under the said Contract.

AND WHEREAS, _____
(Scheduled Bank in Pakistan)
(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 fulfilment 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, 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 remain in force until the advance is fully adjusted against payments from the Interim Payment Certificates of the Contractor or until _____
_____ whichever is earlier.

(Date)

The Guarantor's liability under this Guarantee shall not in any case exceed the sum of Rupees _____ (Rs. _____).

Signature of Client

Signature of Contractor

This Guarantee shall remain valid up to the aforesaid date and shall be null and void after the aforesaid date or earlier if the advance made to the Contractor is fully adjusted against payments from Interim Payment Certificates of the Contractor provided that the Guarantor agrees that the aforesaid period of validity shall be deemed to be extended if on the above mentioned date the advance payment is not fully adjusted.

GUARANTOR

1. Signature _____
2. Name _____
3. Title _____

WITNESS

1. _____

Corporate Secretary (Seal)

2. _____
(Name Title & Address)
- _____ Corporate Guarantor (Seal)

PART – I

GENERAL CONDITIONS OF CONTRACT

PART – 1

GENERAL CONDITIONS OF CONTRACT

The General Conditions of Contract (Part-1) shall be based in the FIDIC “Conditions of the Contract for Works of Civil Construction, Part-1 General Conditions “Fourth Edition (1987) Reprinted in 1988, with editorial amendments, Reprinted in 1992 with further amendments. These Conditions of Contract are published by the “FEDERATION OF INTERNATIONALE DES INGENIEURS-CONSEILS” (FIDIC). FIDIC Secretariat, P.O. Box 86, 1000 Lausanne 12, Switzerland, e-mail: fidic.pub@fidic.org – FIDIC.org/bookshop.

The prospective Bidders are required to obtain copy of the above mentioned Conditions of Contract directly from Head office of FIDIC, on the address indicated above against payment of their usual charges.

The successful Bidder after award of work shall have to provide two (02) copies of the said FIDIC Conditions of Contract for Works of Civil Construction, one in original obtained from the publishers for incorporation of the same in the Contract Agreement of the Work.

PART – II

PARTICULAR CONDITIONS OF CONTRACT

PART-II – CONDITIONS OF PARTICULAR APPLICATION

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PART II – CONDITIONS OF PARTICULAR APPLICATION

1.1 Definitions

- (a) (i) The Employer is **Additional Finance Secretary (Sr /Admn), Finance Department, Government of Sindh, Room No. 171, Caretaker Cell-I, Ground Floor, Finance Department, AK Lodhi Block, Building No. 06, Sindh Secretariat, Kamal-Atta Turk Road, Karachi.**
- (a) (iv) The Engineer is **IDG (Pvt.) Limited, IDG House C-37, First Floor, Block-16, adjacent to Masjid Sharikatul Hussain, Gulistan-e-Jauhar, Karachi, Tel: 021 – 33323311 / 34019293** or any other competent person appointed by the Employer, and notified to the Contractor to act in replacement of the Engineer. Provided always that except in cases of professional misconduct, the outgoing Engineers is to be formulate his certifications / recommendations in relation to all outstanding matters, disputes and claims relating to the execution of the Works during his tenure.

Add the following paragraphs:

- (a) (vi) “Bidder or Tenderer” means any person or persons, company, corporation, firm or joint venture submitting a Bid or Tender.

- (b) (v) ***Add the following at the end of the paragraph:***

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

Add the following paragraph:

- (b) (ix) "Programme" means the programme to be submitted by the Contractor in accordance with Sub-Clause 14.1, and any approved revisions thereto.

- (e) (i) ***Delete the text and substitute:***

"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 therefrom as may be made and remedying of any defects therein In accordance with the provisions of the Contract.

2.1 Engineer's Duties and Authority

With reference to Sub-Clause 2.1(b) the following provision shall also apply;

The Engineer shall obtain the specific approval of the Employer before carrying out his duties in accordance with the following Clauses:

- (i) Approving sub contracting of any part of the works under Clause-4.1
- (ii) Certifying additional cost under Clause 12.
- (iii) Determining an extension of time under Clause 44.
- (iv) Issuing variation orders under Clause 51.
- (v) Fixing rates or prices under Clause 52.
- (vi) Examining and certifying contractor's bills for interim / final payment under Clause 60.
- (vii) Approving samples of materials under Clause 36.
- (viii) Approving concrete design mix under Clause 36.
- (ix) Any action under Clause 10 "Performance Security" and Clauses 21, 23, 24 & 25 "Insurance" of sorts.
- (x) Any action under Clause 40 "Suspension".
- (xi) Any action under Clause 47 "Liquidated Damages for Delay" or Payment of Bonus for Early Completion of Works (PCC Sub-Clause 47.3).
- (xii) Issuance of "Taking Over Certificate" under Clause 48.
- (xiii) Extra payment as a result of Contractor's claim under Clause 53.
- (xiv) Issuance of "Defect Liability Certificate" under Sub-Clause 62.1.
- (xv) Any change in the ratios of Contract currency proportions and payments thereof under Clause 72 "Currency and Rate of Exchange".

If in the opinion of the Engineer an emergency occurs affecting the safety of life or of the Works or of adjoining property, the Engineer may, without relieving the Contractor of any of his duties and responsibilities under the Contract, instruct the Contractor to execute all such work or to do all such things as may, in the opinion of the Engineer, be necessary to abate or reduce the risk. The Contractor shall forthwith comply with any such instruction of the Engineer. The Engineer shall determine an addition to the Contract Price, in respect of such instruction, in accordance with Clause 52 and shall notify the Contractor accordingly, with a copy to the Employer.

2.2 Engineer's Representative

Add the following paragraph:

The Employer shall ensure that the Engineer's Representative is a professional engineer as defined in the Pakistan Engineering Council Act 1975 (V of 1976).

Add the following Sub-Clauses:

2.7 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 materials, plant and equipment for construction of the Works and their parts 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 the 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 portion of the works.

2.8 Replacement of Engineer

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

Add the following Sub-Clause:

4.1 Sub-Contracting:

Add “/sublet” after ‘sub-contract’ in the first and second line of Sub-Clause 4.1 of General Conditions of Contract Part-1.

Add “/sub-letting” after word ‘sub-contracting’ occurring in first line of para (c), Sub-Clause 4.1 of General Conditions of Contract Part-1.

5.1 Languages and Law

- (a) The Contract Documents shall be drawn up in the English language.
- (b) The Contract shall be subject to the Laws of Islamic Republic of Pakistan.

5.2 **Priority of Contract Documents**

Delete the documents listed at (1) to (6) of the Sub-Clause and substitute:

- (1) The Contract Agreement (if completed);
- (2) The Letter of Acceptance;
- (3) The complete Form of Bid;
- (4) Special Stipulations (Appendix-A to Bid);
- (5) The Particular Conditions of Contract – Part II
- (6) The General Conditions of Contract – Part I
- (7) The priced Bill of Quantities;
- (8) The complete Appendices / Schedules to bid;
- (9) The Drawings;
- (10) The specifications; and

In case of discrepancies between drawings, those of larger scale shall govern unless they are superseded by a drawing of later date regardless of scale. All Drawings and Specifications shall be interpreted in conformity with the Contract and these Conditions. Addendum, if any, shall be deemed to have been incorporated at the appropriate places in the documents forming the Contract.

Add the following Sub-Clauses:

6.6 **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.

6.7 **As Built Drawings**

At the completion of the Works under the Contract, the Contractor shall furnish to the Engineer 6 copies and one reproducible of all drawings amended to conform with the Works as built. The price of such Drawings shall be deemed to be included in the Contract Price.

9.1 **Contract Agreement**

Read “Contractor” in place of ‘Employer’, occurring in 2nd line of Sub-Clause 9.1 of General Conditions of Contract Part-1.

10.1 Performance Security***Delete the text and substitute:***

The Contractor shall provide Performance Security to the Employer in the prescribed form. The said Security shall be furnished or caused to be furnished by the Contractor within 28 days after the receipt of Letter of Acceptance. The Performance Security shall be of an amount equal to 10% of the Contract Price state in the Letter of Acceptance. Such Security shall be in the form of Bank Guarantee from any scheduled Bank of Pakistan.

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

Add the following Sub-clauses:**10.4 Performance Security Binding on Variations and Changes**

The Performance Security shall be binding Irrespective of changes in the quantities or variations in the Works or extensions in Time for Completion of the Works which are granted or agreed upon under the provisions of the Contract.

Add the following Paragraph:**14.1 Programme to be submitted**

The programme shall be submitted within 15 days from the date of receipt of Letter of Acceptance, which shall be in the form of:

- i) A Bar Chart identifying the critical activities.

Add the following Paragraph:**14.3 Cash Flow Estimate to be submitted**

The detailed Cash Flow Estimate shall be submitted within 14 days from the date of receipt of Letter of Acceptance.

Add the following Sub-Clause**14.5 Detailed Programme and Monthly Progress Report**

- (a) For purpose of Sub-Clause 14.1, the Contractor shall submit to the Engineer detailed programme for the following:
 - (1) Execution of Works;
 - (2) Labour Employment;
 - (3) Local Material Procurement;
 - (4) Material Imports, if any; and
 - (5) Other details as required by the Engineer.
- (b) During the period of the Contract, the Contractor shall submit to the Engineer not later than the 8th day of the following month, 10 copies each of Monthly Progress Reports covering.
 - (1) A Construction Schedule indicating the monthly progress in percentage;
 - (2) Description of all work carried out since the last report;
 - (3) Description of the work planned for the next 56 days sufficiently detailed to enable the Engineer to determine his programme of inspection and testing;
 - (4) Monthly summary of daily job record;
 - (5) Photographs to illustrate progress; and
 - (6) Information about problems and difficulties encountered, if any, and proposals to overcome the same.
- (c) 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, deliveries of materials, quantity, location and assignment of Contractor's equipment.

Add the following Sub-Clauses:**15.2 Language Ability of Contractor's Representative**

The Contractor's authorized representative shall be fluent in the English language. Alternately an interpreter with ability of English language shall be provided by the Contractor on full time basis.

15.3 Contractor's Representative

The Contractor's authorized representative and his other professional engineers working at Site shall register themselves with the Pakistan Engineering Council.

The Contractor's authorized representative at Site shall be authorized to exercise adequate administrative and financial powers on behalf of the Contractor so as to achieve completion of the Works as per the Contract.

Add the following Sub-Clauses:**16.3 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. If the Contractor's superintending staff are not fluent in English language, the Contractor shall make competent interpreters available during all working hours in a number deemed sufficient by the Engineer.

16.4 Employment of local Personnel

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

Add the following Sub-Clauses:**19.3 Safety Precautions**

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.

19.4 Lighting Works at Night

In the event of work being carried out at night, the contractor shall at his own cost, provide and maintain such good and sufficient light as will enable the work to proceed satisfactorily and without danger. The approaches to the Site and the Works where the night-work is being carried out shall be sufficiently lighted. All arrangements adopted for such lighting shall be to the satisfaction of the Engineer's Representative.

20.4 Employer's Risks

Delete the text and substitute:

The Employer's Risks are:

- (a) Insofar as they directly affect the execution of the Works in Pakistan.
 - (i) War and hostilities (whether war be declared or not), invasion, act of foreign enemies,
 - (ii) Rebellion, revolution, insurrection, or military or usurped power, or civil war,
 - (iii) Ionizing radiations, or contamination by radioactivity from any nuclear fuel, or from any nuclear waste from the combustion of nuclear fuel, radioactive toxic explosive or other hazardous properties of any explosive nuclear assembly or nuclear component thereof,
 - (iv) Pressure waves caused by aircraft or other aerial devices traveling at sonic or supersonic speeds,
 - (v) Riot, commotion or disorder, unless solely restricted to the employees of the Contractor or of his Subcontractors and arising from the conduct of the Works;
- (b) Loss or damage due to the use or occupation by the Employer of any Section or part of the Permanent Works, except as may be provided for in the Contract;
- (c) Loss or damage to the extent that it is due to the design of the Works, other than any part of the design provided by the Contractor or for which the Contractor is responsible; and
- (d) Any operation of the forces of nature (insofar as it occurs on the Site) which an experienced contractor:
 - (i) Could not have responsibly foreseen, or
 - (ii) Could reasonably have foreseen, but against which he could not reasonably have taken at least one of the following measures;
 - (A) Prevent loss or damage to physical property from occurring by taking appropriate measures, or
 - (B) Insure against.

Add the following paragraph:**21.1 Insurance of Works and Contractor's Equipment****(d) General Requirements**

The Contractor shall insure with any one of the insurance companies approved for this purpose by the Employer. The insurance policies shall be in the joint names of the Employer, and the Contractor against all loss or damages as stated in the General Conditions of Contract Part-I and as stated herein. Notwithstanding the responsibilities of the Contractor for indemnities and insurances as described in Sub-Clauses 21 to 24 of General Conditions of Contract Part-I, the Contractor before commencing work on Site, must discuss fully with the Engineer and the Employer the insurance coverage provided under any general policies which are to be applied to this Contract to ensure that there are no contingencies left uncovered and to reduce, as far as practicable, duplication of coverage. Should any areas of omission be discovered that are not covered by definition of responsibilities set out in these conditions, the addition or reduction in premiums required to give such insurance coverage will be paid by the Contractor. Such policies shall be obtained by the Contractor with consent of the Employer.

The Contractor shall be responsible for deductibles and losses / damages not covered by insurances other than the excepted risks.

The insurance losses shall not affect the Employer's or the Contractor's rights and obligations under the contract.

The Contractor shall be responsible for compliance by his sub-contractors of insurances specified in these Sub-Clauses. Before each sub-contractor start work, the Contractor shall provide the Employer proof that the sub-contractor(s) are covered by insurances specified herein for the Contractor.

All policies shall state that:

- i) The Employer shall receive at least 30 days written notice of intended Cancellation or change affecting coverage.
- ii) The Contractor is fully protected so as to provide full indemnity to Employer in respect of liability against losses or damages assumed by the Contractor under the Contract.
- iii) The inclusion of more than one insured shall not affect the rights of any other insured.

- iv) If a loss occurs the Contractor and the Employer shall be paid in relation of their share of the loss.
- v) The Insurer has no subrogation rights against any person, corporation, or organization including directors, officers, employees, servants agents thereof which:
 - Is an insured under the policy or
 - Is controlled by, Owned by, or associated with an insured, or
 - Is a sub-contractor on the works, or has, before or a loss occurs, been released from liability by an insured.

Hold harmless provisions: The Employer, the Engineer and the Contractor shall be indemnified against all losses.

Employer use or occupancy: If the Employer uses or occupies all or part of the Works during the life of the insurance policy, the Contractor shall ensure that the policy continues in full force and the Employer shall pay any resulting extra cost of insurance.

Loss Procedure: If a loss occurs the Contractor shall, on behalf of the Employer and himself negotiate the value of the loss with the insurer. Unless directed otherwise by the Engineer, when agreement is reached the Contractor shall repair all damages and the Employer shall pay him in accordance with the Engineer's Certificate for that part of the repairs which is the Employer's responsibility.

If directed by the Engineer, instead of carrying out repairs, the Contractor shall pay to the party suffering the loss that part of the agreed value of the loss which is the Contractor's responsibility.

The provisions of this Sub-Clause 21.1(d) shall be applicable to their insurance covered by Sub-Clause 22, 23 and 24 of General Conditions of Contract Part-I.

(e) **Automobile Liability Insurance:**

The Contractor shall also provide automobile liability insurance of all licensed vehicles owned, hired and operated by the Contractor and the risk insured shall be bodily injury, death or person and property damage or loss.

Minimum Limit: As indicated in Appendix 'A' to the Form of The Tender inclusive each occurrence or Rs. 0.50 million.

21.4 Exclusions

Delete the text and substitute:

There shall be no obligation for the insurances in Sub-Clause 21.1 to include loss or damage caused by the risks listed under Sub-Clause 20-4 of (a) (i) to (iv).

Add the following Sub-clause:

25.5 Insurance Company

The contractor shall be obliged to place all insurance relating to the Contract (including, but not limited to, the insurances referred to in Clause 21, 23 and 24) with either the following National Insurance Company of Pakistan or any other insurance company operating in Pakistan and acceptable to the Employer.

Costs of such insurances shall be borne by the Contractor.

Add the following Sub-Clause:

31.3 Cooperation with other Contractors

During the execution of the Works, the Contractor shall cooperate fully with other contractors working for the Employer at and in the vicinity of the Site and also shall provide adequate precautionary facilities not to make himself a nuisance to local residents and other Contractors.

Add the following Sub-Clauses:

34.2 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 industry in which the Contractor is engaged are similar.

34.3 Employment of Persons in the Service of Others

The Contractor shall not recruit his staff and labour from amongst the persons in the service of the Employer or the Engineer; except with the prior written consent of the Employer or the Engineer, as the case may be.

34.4 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 if any provided by the Contractor shall be removed and the Site reinstated to its original condition, all to the approval of the Engineer.

34.5 Health and Safety

Due precautions shall be taken by the Contractor, and at his own cost, to ensure the safety of his staff and labour at all times throughout the period of the Contract. The Contractor shall further ensure that suitable arrangements are made for the prevention of epidemics and for all necessary welfare and hygiene requirements.

34.6 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.

34.7 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.

34.8 Arms and Ammunition

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

34.9 Festivals and Religious Customs

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

34.10 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 labor and for the preservation of peace and protection of persons and property in the neighborhood of the Works against the same.

34.11 Compliance by Subcontractors

The Contractor shall be responsible for compliance by his Subcontractors of the provisions of this Clause.

Add the following Sub-Clauses:**35.2 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.

35.3 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, notify the Engineer immediately by the quickest available means.

Add the following Sub-Clause:**36.6 Use of Pakistani Materials and Services**

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

41.1 Commencement of Works***Delete the text and substitute:***

The Contractor shall commence the Works on Site within the period named in Appendix "A" to Form of Bid from the date of receipt by him from the Engineer of a written Notice to Commence. Thereafter, the Contractor shall proceed with the Works with due expedition and without delay.

Add the following sub-clause:**48.2 Taking Over of Sections or Parts**

For the purposes of para (a) of this Sub-Clause, separate Time for Completion shall be provided in the Appendix-A to Bid "Special Stipulations".

Add the following sub-clause:**49.5 Extension of Defects Liability Period**

The provisions of this Sub-Clause shall apply to all replacements or renewals of plant and equipment carried out by the Contractor to remedy defects and damage as if the replacement and renewals had been taken over on the date they were completed. The Defects Liability Period for the Works shall be extended by a period equal to the period during which the Works cannot be used by reason of a defect or damage. If only a part of the Works is affected the Defects Liability Period extend beyond two (02) years from the date of taking over.

51.2 Instructions for Variations

At the end of the first sentence, after the word "Engineer", add the words "in writing".

52.1 Valuation of Variations

In the eighth line, after the words "suitable rates or prices", add the following:

using a markup of 25% to cover Contractor's overheads and profit including all taxes.

In the tenth line, after the words "Engineer shall", add the following:

within a period not exceeding one-eighth of the completion time subject to a minimum of 56 days from the date of disagreement whichever is later,

Add the following paragraph

The approval / finalization of rates of all variations shall not relieve the Contractor of his obligations under the Contract. The Contractor shall neither stop the work nor slow down progress of the works in awaiting the approval of rates of all variations.

53.4 Failure to Comply

Delete this Sub-Clause in its entirety.

54.5 Conditions of Hire of Contractor's Equipment***Add the following paragraph:***

The Contractor shall, upon request by the Engineer at any time in relation to any item of hired Contractor's Equipment, forthwith notify the Engineer in writing the name and address of the owner of the equipment and shall certify that the agreement for the hire thereof contains a provision in accordance with the requirements set forth above.

Add the following sub clause:**54.9 Vesting of Contractor's Plant, Equipment, Temporary Works and Materials****(a) Definitions**

For the purpose of Sub-Clause 54.

- i) The expression "Construction Plant" shall be deemed to exclude vehicles engaged in transporting any labour, equipment or materials to or from the Site.
- ii) The expression "Essential Hired Plant" shall mean all Constructional Plant, Equipment, Temporary Works and materials of Temporary Work the withdrawal of which in the event of termination under Sub-Clause 63 hereof might (having regard to the methods of construction employed prior to the termination) endanger the safety or stability of or result in serious disturbance to the execution of any part of the Works and which are held by the Contractor under any agreement for hire thereof.
- iii) The expression "Hired Plant" shall mean any Construction Plant, Equipment, temporary Works (other than essential hired plant) held by the Contractor under any agreement for hire thereof.

- iv) The expression “Agreement for Hire” shall be deemed not to include an agreement for hire purchase with an option to purchase or for conditional sale either of which is herein referred to as an “agreement for the purchase”.
- v) The expression “hire Purchase Plant” shall mean any Constructional plant, Equipment, temporary Works held by the Contractor under an agreement for hire purchase thereof.
- vi) The expression “Owner” mean the owner of the plant and equipment of any Hire Purchase Plant.

(b) Vesting of Certain Plant

All Constructional Plant, Equipment, temporary Works and materials owned by the Contractor or by any company in which the Contractor has a controlling interest shall when brought on to the Site (or in the case of hire purchase plant upon becoming the property of the Contractor) shall be and shall be deemed to become the property of the Employer.

(c) Conditions of Hire of Certain Plant

With a view to securing in the event of termination Sub-Clause 63 hereof the continued availability for the purpose of executing the Works of any essential hired plant and equipment the Contractor shall not bring on to the Site any essential hired plant unless the agreement for hired thereof contains a provision that the owner will on request in writing made by the Employer within 7 days after the date on which any such termination has become effective and on the Employer understanding to pay all hire charges in respect thereof on the same terms in all respects as the same was hired to the contractor save that the Employer shall be entitled to permit the use thereof by any other contractor employed by it for the purposes of completing the works under the terms of Sub-Clause 63 hereof.

(d) Costs for purpose of Sub-Clause 63

In the event of the Employer entering into any agreement for hire of essential hired plant pursuant to the provisions of Sub-Clause 54.8(c) all sums properly paid by the Employer under the provisions of any such agreement and all expenses incurred by it (including stamp duties) in entering into such agreement shall be deemed for the purpose of Sub-Clause 63 hereof to be part of the cost of completing the Works.

(e) Contractor's Certificate as to Hiring Provisions

The Contractor shall upon request made by the Engineer at any time in relation to any item of essential hired plant forthwith notify to the Engineer in writing the name and address of the owner and shall certify that the agreement for the hire thereof contains a provision in accordance with the requirements of Sub-Clause 54.8(c) hereof. The Contractor shall also upon request as aforesaid give a like notification (but without certificate) in regard to any hire purchase plant.

(f) Hire Purchase Payment by the Employer

The Employer shall in order to avoid seizure by the owner of any hire purchase plant be entitled to pay to such owner the amount of any overdue installment or other sum payable optionally or otherwise under any agreement of hire purchase and in the event of his doing so any amount so paid by him shall be debt due from the Contractor to the Employer and may be deducted by the Employer from any money due or that may become due to the Contractor under the Contract or may be recovered by the Employer from the Contractor at law.

(g) Irrevocability of Certain Plant etc.

No Constructional Plant, Equipment, Temporary Works or materials or any part thereof shall be removed from the site without the written consent of the Engineer which consent shall not be unreasonably withheld where the same is no longer immediately required for the purpose of completion of Works but the Employer will permit the Contractor the exclusive use of all such Constructional Plant, Equipment, Temporary Works and materials in and for the completion of the Works until the occurrence of any event which gives the Employer the right to expel the Contractor from the site and proceed with the completion of the Works.

(h) Re-vesting and Removal of Plant

Upon the removal with the consent of the Engineer of any such Constructional Plant, Equipment, Temporary Works or materials as have been deemed to have become the property of the Employer under Sub-Clause 54.8(b) the property therein shall be deemed to revert in the Contractor and, upon completion of the Works the property in the remainder of such Constructional Plant, Equipment, Temporary Works or materials as aforesaid shall subject to the provisions of Sub-Clause 63 be deemed to revert in the Contractor who shall remove the same together with any essential hire plant or hire purchase plant. If the Contractor shall fail to remove any Constructional Plant, Equipment, Temporary Works or materials as aforesaid or any essential hire plant or hire purchase plant within such reasonable time after completion of the Works as may be allowed by the Engineer then the Employer may.

- i) Sell any such Constructional Plant, Equipment, Temporary Works or materials as aforesaid, and
- ii) Return at the Contractor's expenses to the person firm or company from whom any Essential Hired Plant or any Hire Purchase Plant was held by the Contractor such essential hired plant or hire purchase plant, and after deducting from any proceeds of sale, the costs, charges and expenses of and in connection with such sale and return as aforesaid shall pay the balance (if any) to the Contractor but to the extent that the proceeds of any sale are insufficient to meet all such cost, charges and expenses the excess shall be a debt due from the Contractor to the Employer and shall be deductible or recoverable by the Employer accordingly as aforesaid.

- (i) Liability for loss or injury to plant

The Employer shall not at any time be liable for the loss of or injury to any of the Constructional Plant, Temporary Works or materials which have been deemed to become the property of the Employer under Sub-Clause 54.8(b) hereof save as mentioned in Sub-Clause 20 hereof.

- (j) Incorporation of Sub-Clause in Sub-Contracts

The Contractor shall when entering into any sub-contract for the execution of any part of the Works incorporate in such sub-contract (by reference or otherwise) the provision of this Sub-Clause in relation to Constructional Plant, Temporary Works or materials. Essential Hired Plant and Hire Purchase Plant to be brought on the Site by the sub-contractor.

- (k) Approval of Materials etc. not implied

The operation of sub Sub-Clause 54.8(b) hereof shall not be deemed to imply any approval by the Engineer of the materials or other matters referred to herein nor shall it prevent the rejection of any materials at any time by the Engineer.

Add the following sub-clauses:

59.4 Payments to Nominated Subcontractors

The Contractor shall pay to the nominated Subcontractor the amounts which the Engineer certifies to be due in accordance with the subcontract. These amounts plus other charges shall be included in the Contract Price in accordance with Clause 58 [Provisional Sums], except as stated in Sub-Clause 59.5 [Certificate of Payments].

59.5 Certification of Payments & Nominated Subcontractor

Before issuing a Payment Certificate which includes an amount payable to a nominated Subcontractor, the Engineer may request the Contractor to supply reasonable evidence that the nominated Subcontractor has received all amounts due in accordance with previous Payment Certificates, less applicable deductions for retention or otherwise. Unless the Contractor:

- a) Submit reasonable evidence to the Engineer, or
- b)
 - i) Satisfied the Engineer in writing that the Contractor is reasonably entitled to withhold or refuse to pay these amounts, and
 - ii) Submits to the Engineer reasonable evidence that the nominated Subcontractor has been notified of the Contractor's entitlement.

then the Employer may (at his sole discretion) pay direct to the nominated Subcontractor, part or all of such amounts previously certified (less applicable deductions) as are due to the nominated Subcontractor and for which the Contractor has failed to submit the evidence described in sub-paragraphs (a) or (b) above. The Contractor shall then repay, to the Employer, the amount which the nominated Subcontractor was directly paid by the Employer.

60.1 Monthly Statements

In the first line, after the words "shall", add the following:

“on the basis of the joint measurement of work done under Clause 56.1”

In Para (c) the words "the Appendix to Tender" are deleted and substituted with the following:

“Sub-Clause 60.11(a)(6) hereof”
(in case Clause 60.11 is applicable)

60.2 Monthly Payments

In the first line, "28" is substituted by "14".

Add the following paragraph:

- (c) Thirdly to the deduction of Advance Income Tax in accordance with Income Tax Ordinance 2000 or amendments enacted by the Government of Pakistan from time to time.

- (d) The Employer may suspend payment of the Interim Certificate in case it is directed by to do so, by Pakistan Custom, FIA and other competent government agencies till the matter is officially cleared by the Government.

60.8 Final Payment Certificate

Add the following paragraph:

- (c) Before release of the final payment by the Employer, the Contractor shall furnish a certificate issued by the Excise and Taxation Department to the effect that the professional Tax as required by the law has been paid by him to the Government.

60.10 Time for Payments

Delete the text and substitute:

The amount due to the Contractor under any Interim payment Certificate issued by the Engineer pursuant to this clause, or to any other terms of the Contract, shall, subject to Clause 47, be paid by the Employer to the Contractor within 28 days after such interim payment certificate has been jointly verified by Employer and Contractor, or, in the case of the Final Certificate referred to in Sub-Clause 60.8, within 60 days after such Final Payment Certificate has been jointly verified by Employer and Contractor.

Add the following sub-clause:

60.11 Secured Advance

- (a) The Contractor shall be entitled to receive from the Employer Secured Advance against an indemnity bond acceptable to the Employer of such sum as the Engineer may consider proper in respect of non-perishable materials brought at Site but not yet incorporated in the Permanent Works provided that:
- (1) The materials are in accordance with the Specifications for the Permanent Works;
 - (2) Such materials have been delivered to the Site and are properly stored and protected against loss or damage or deterioration to the satisfaction of the Engineer but at the risk and cost of the Contractor;
 - (3) The Contractor's records of the requirements, orders, receipts and use of materials are kept in a form approved by the Engineer, and such records shall be available for inspection by the Engineer;

- (4) The Contractor shall submit with his monthly statement the estimated value of the materials on Site together with such documents as may be required by the Engineer for the purpose of valuation of materials and providing evidence of ownership and payment therefore.
 - (5) Ownership of such materials shall be deemed to vest in the Employer and these materials shall not be removed from the Site or otherwise disposed of without written permission of the Employer and
 - (6) The sum payable for such materials on Site shall not exceed 75% of the (i) landed cost of imported materials, or (ii) ex-factory / ex-warehouse price of locally manufactured or produced materials, or (iii) market price of other materials.
- (b) The recovery of Secured Advance paid to the Contractor under the above provisions shall be affected from the monthly payments on actual consumption basis.

Add the following Sub-Clauses:

60.12 Financial Assistance to Contractor

Financial assistance shall be made available to the Contractor by the Employer by adopting following method:

Mobilization Advance:

- (a) An interest-free Mobilization Advance upto 10% of the Contract Price stated in the Letter of Acceptance shall be paid by the Employer to the Contractor in two equal parts upon submission by the Contractor of a Mobilization Advance Guarantee / Bond for the full amount of the Advance in the specified form. Such Security shall be in the form of Bank Guarantee from any scheduled Bank of Pakistan acceptable to the Employer:
 - (1) First part within 07 days after signing of the Agreement or date of receipt of Engineer's Notice to Commence, whichever is earlier: and
 - (2) Second part within 07 days from the date of payment of the first part, subject to the satisfaction of the Engineer as to the state of Mobilization of the Contractor.
- (b) This Advance shall be recovered in equal installments before the date of completion of the Works as per Clause 43 hereof.

60.12 Not Responsibility of the Engineer

Noting in the Contract shall place any responsibility on the Engineer for non-payments of any money due to the Contractor for which the Engineer has fulfilled his obligation under the Contract.

60.13 Withholding of Payment

- (a) The Employer may withhold the whole or part of any payment requested by the Contractor if it is necessary in the opinion of the Employer to protect himself against losses on account of the following reasons:
 - i) Defective work not rectified.
 - ii) Non-fulfillment of any due demand and guarantee.
 - iii) Claims of third parties raised against the Employer caused through the fault of the Contractor in connection with the Works.
 - iv) Damages caused by the Contractor or his personnel or any sub-contractor, to the Employer, or to a third party on the site.
 - v) Non-fulfillment of the Contract by the Contractor.
- (b) After the reasons for withholding of payments have been entitled, to the satisfaction of the Employer and the Engineer, payments to the Contractor will be undertaken by the Employer without delay.

63.1 Default of Contractor***Add the following paragraph:***

Provided further part in addition to the action taken by the Employer against the Contractor under this Clause, the Employer may also refer the case of default of the Contractor to Pakistan Engineering Council for punitive action under the Construction and Operation of Engineering Works Bye-Laws 1987, as amended from time to time.

65.2 Special Risks***Delete the text and substitute:***

The Special Risks are the risks defined under Sub-Clause 20.4 paras (a)(i) to (a)(v).

67.3 Arbitration

In the sixth to eighth lines, delete the words "shall be finally settled appointed under such Rules" and substitute the following:

shall be finally settled under the provisions of the Arbitration Act, 1940 as amended or any statutory modification or re-enactment thereof for the time being in force.

Also add the following paragraph:

The venue of Arbitration shall be Karachi, Pakistan

68.1 Notice to Contractor

Add the following paragraph:

For the purposes of this Sub-Clause, 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.

68.2 Notice to Employer and Engineer

For the purposes of this Sub-Clause, the respective addresses are:

(a) The Employer

Additional Finance Secretary (Sr /Admn),
Finance Department,
Government of Sindh
Room No. 171, Caretaker Cell-I,
Ground Floor, Finance Department,
AK Lodhi Block, Building No. 06,
Sindh Secretariat, Kamal-Atta Turk Road,
Karachi

(b) The Engineer:

M/s. IDG (Pvt.) Limited
IDG House C-37, First Floor, Block-16,
adjacent to Masjid Sharikatul Hussain,
Gulistan-e-Jauhar, Karachi
Pakistan.
Tel: 021-33323311 / 34019293

70.1 Increase or Decrease of Cost

Delete this Sub-Clause in its entirety, and substituted with the following:

The amount payable to the Contractor, pursuant to Sub-Clause 60.1, shall be adjusted in respect of the rise or fall in the cost of labor, materials, and other inputs to the Works, by applying to such amount the formula prescribed in this Sub-Clause.

(a) Other Changes in Cost

To the extent that full compensation for any rise or fall in costs to the Contractor is not covered by the provisions of this or other Clauses in the Contract, the unit rate and prices included in the Contract shall be deemed to include amounts to cover the contingency of such other rise or fall of costs.

(b) Adjustment Formula

The formula mentioned below is in its generalized form. The Employer/user shall determine the proportions of A, b, c, d, by appropriate rate analysis following the procedure enumerated herein below:

$$P_n = A + b \frac{L_n}{L_o} + c \frac{M_n}{M_o} + d \frac{E_n}{E_o} + e \frac{F_n}{F_o} \dots\dots\dots$$

where,

“P_n” is the Price Adjustment factor for the work carried out in the period “n”.

“A” is a constant or the Non-Adjustable Portion of the Price Adjustment Factor to be specified in Appendix-C to Bid, representing the Non-Adjustable Portion of the Contract Price.

“b, c, d.....” are Coefficients or weightages of the order of 0.xx (i.e., fractions rounded off to two decimals) for each specified element of adjustment in the Contract.

The sum of A, b, c, d, etc., shall be one.

“L_o, M_o, E_o.....” are the Base Date Prices/Indices for the specified (adjustable) elements.

“L_n, M_n, E_n.....” are the Current Date Prices/Indices of the specified (adjustable) elements for the period “n”.

If “P” is the amount payable (prior to adjustment) at the rates entered in the Price Schedule of the work carried out in period “n” then, Adjusted amount payable to the Contractor for the work carried out in the period “n” shall be equal to P_n×P.

For the purpose of calculating Pn, the coefficient for each element shall be used irrespective of the actual constituents of the work performed during the billing period.

(c) Sources of Indices and Weightages

The sources of Indices shall be those listed in Appendix-C to bid, as approved by the Engineer. As the proposed basis for price adjustment, the Contractor shall have submitted with his bid the tabulation of Weightages and Source of Indices if different than those given in Appendix-C to bid, which shall be subject to approval by the Engineer.

(d) Base, Current, and Provisional Indices

The base cost indices or prices shall be those prevailing on the day 28 days prior to the latest date for submission of bids. Current indices or prices shall be those prevailing on the day 28 days prior to the last day of the period to which a particular monthly statement is related. If, at any time, the current indices are not available, provisional indices as determined by the Engineer will be used, subject to subsequent correction of the amounts paid to the Contractor when the current indices become available.

(e) Adjustment after Completion

If the Contractor fails to complete the Works within the Time for Completion prescribed under Clause 43, adjustment of prices thereafter until the date of completion of the Works shall be made using either the indices or prices relating to the prescribed time for completion, or the current indices or prices, whichever is more favorable to the Employer, provided that if an extension of time is granted pursuant to Clause 44, the above provision shall apply only to adjustments made after the expiry of such extension of time.

(f) Weightages

The weightages for each of the factors of cost given in Appendix-C to bid shall be adjusted if, in the opinion of the Engineer, they have been rendered unreasonable, or inapplicable as a result of varied or additional work executed or instructed under Clause 51. Such adjustment(s) shall have to be agreed in the variation order.

Add the following Sub-Clauses:**73.1 Payment of Income Tax etc.**

The Contractor, Subcontractors and their employees shall be responsible for payment of all their income tax, super tax and other taxes on income arising out of the Contract and the rates and prices stated in the Contract shall be deemed to cover all such taxes.

73.2 Cost inclusive of duties and taxes

The rates and prices stated in the priced Bill of Quantities shall be deemed to include every element of duty or tax leviable on or in relation to the production, import, purchase, sale, delivery and transportation of materials and to the bringing thereof to the Site and no such duty or tax shall be separately reimbursable.

74.1 Integrity Pact

If the Contractor or any his Subcontractors, agents, servants is found to have violated or involved in violation of the Integrity Pact signed by the Contractor as Appendix-L to Bid, then the Employer shall be entitled to:

- (a) Recover from the Contractor an amount equivalent to ten times the sum of any commission, gratification, bribe, finder's fee or kickback given by the Contractor or any of his Subcontractors, agents or servants;
- (b) Terminate the Contract; and
- (c) Recover from the Contractor any loss or damage to the Employer as a result of such termination or of any other corrupt business practice of the Contractor or any of his Subcontractors, agents or servants;

The termination under Sub-Para (b) of this Sub-Clause shall proceed in the manner prescribed under Sub-Clauses 63.1 to 63.4 and the payment under Sub-Clause 63.3 shall be made after having deducted the amounts due to the Employer under Sub-Para (a) and (c) of this Sub-Clause.

75.1 Termination of Contract for Employer's Convenience

The Employer shall be entitled to terminate the Contract at any time for the Employer's convenience after giving 56 days prior notice to the Contractor, with a copy to the Engineer. In the event of such termination, the Contractor:

- (a) shall proceed as provided in sub clause 65.7 hereof; and
- (b) shall be paid by the Employer as provided in sub clause 65.8 hereof.

76.1 Liability of 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 assigns and the labour employed by them.

77.1 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 fulfillment 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.

78.1 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 Employer whose award shall be final.

79.1 Precaution for Pollution

Precautionary measures and facilities shall be provide by the Contractor at his own cost in carrying out the Works including dumping and disposal of spoils in sea, river and other areas, in the manner approved by the Engineer to prevent environmental pollution.

80.1 Coordination of Work at Site

The Contractor shall take cognizance that during the execution of the project. Other Contractor will be working concurrently on this site.

All works of his responsibility shall be coordinated by the Contractor so as to give the necessary facilities to other Contractors or their workmen or any other employees, who execute or supervise any work on the Site.

The Contractor shall ensure that the necessary safety precautions will be observed and interferences shall be avoided especially for the works executed side-by-side by different Contractors.

Due consideration must be given to permit access to sections of the work as required by other Contractors for the execution of their works. With a view to coordinate the works, the Employer's Representative may from time to time direct the order of the work to be carried out.

Allowances for coordination of work at site shall be made in his prices & programming.

81.1 Temporary Works and Facilities

81.1.1 Temporary Works

The Contractor shall submit drawings and full particulars of all temporary works to the Consultant before commencing the same. The Consultant may require modifications to be made if he considers them to be insufficient and the Contractor shall give effect such modifications but shall not be relieved of his responsibility for the sufficiency thereof.

81.1.2 Site Sign Board

The Contractor shall provide two site sign boards to the satisfaction and approval of the Consultant. The sign boards shall display the name and title of the project and the names of the Consultant, and to be maintained in clean and tidy state for the duration of the project.

81.1.3 Other Facilities

The Contractor shall provide and maintain adequate first aid facilities on the site to the approval of the Consultant including paying all costs in connection throughout the period of the Contract.

The Contractor shall provide temporary latrines for the use of all workmen employed on the site in a position to be approved by the Consultant and maintained in a thoroughly clean and sanitary condition throughout the period of the Contract.

The Contractor shall provide potable water for the use of all their workmen, staff as well as Client & Consultant's staff.

81.1.4 Samples

The Contractor shall provide at his own cost, samples of all materials and finishes for the works. These shall include but not necessarily be limited to samples of plaster, floor tiles, office furniture and fixtures, work stations, and panels, and all other items and materials specified, and as per the Specifications.

**ANNEXURE TO CONDITION OF
CONTRACT PART – II**

Bidders are requested to go-through Sindh PPRA Rules 2010
(amended 2017)
available on web site: www.pprasindh.gov.pk
which is to be followed for this project
along with amendments to date



FINANCE
DEPARTMENT
GOVERNMENT OF SINDH

**RENOVATION / REFURBISHMENT WORKS OF RENTAL PREMISES
ACQUIRED AT 1ST FLOOR, STATE LIFE BUILDING NO. 11,
ABDULLAH HAROON ROAD, KARACHI**



**TENDER / CONTRACT DOCUMENTS
(Volume – II)**

Specification for Civil Works
Specification for Plumbing Works
Specification for Electrical Works

December 2024

IDG (PVT.) LIMITED

Architects Engineers Planners Interior Designers



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SECTION – 02910	- FLAG POLES	02000-26 TO 02000-28
DIVISION – 03000	- CONCRETE WORK	
SECTION – 03310	- PLAIN AND REINFORCED CONCRETE	03000-1 TO 03000-36
SECTION – 03320	- WATER STOPPERS	03000-36 TO 03000-37
DIVISION – 04000	- MASONRY WORKS	
SECTION – 04200	- CEMENT CONCRETE BLOCK MASONRY	04000-1 TO 04000-6
SECTION – 04300	- BRICK MASONRY	04000-7 TO 04000-9
DIVISION – 05000	- METAL WORKS	
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SECTION – 05130	- STRUCTURAL WELDING	05000-9 TO 05000-15
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DIVISION – 07000	- THERMAL & MOISTURE PROTECTION	
SECTION – 07100	- ROOF WATER PROOFING AND HEAT INSULATION	07000-1 TO 07000-5

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DIVISION – 08000	- DOORS AND WINDOWS	
SECTION – 08110	- ALUMINIUM DOORS AND WINDOWS	08000-1 TO 08000-10
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DIVISION – 09000	- FINISHES	
SECTION – 09110	- ARCHITECTURAL HAND RAILS & RAILING	09000-1 TO 09000-6
SECTION – 09200	- PLASTERING	09000-7 TO 09000-11
SECTION – 09310	- CERAMIC & PORCELAIN TILE WORKS	09000-12 TO 09000-14
SECTION – 09320	- SPLIT TILE WORK	09000-15 TO 09000-16
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PLUMBING WORKS

ELECTRICAL WORKS

SPECIFICATIONS
FOR
CIVIL WORKS

DIVISION 01000 – GENERAL REQUIREMENTS**01010 SUMMARY OF WORK****01011 GENERAL**

Name of Project: **Renovation / Refurbishment Works of Rental Remises acquired at 1st Floor, State Life Building No. 11, Abdullah Haroon Road, Karachi**

01012 SCOPE OF WORK

The project's scope includes necessary Demolition, Civil, Internal Electrification, Internal Plumbing / Mechanical Works, Furniture Supply and installation and other related works to complete the works in accordance with tender / contract documents.

01013 SCOPE OF CONTRACT

The Contractor shall provide all materials and machinery / plant / equipment and perform all work necessary for the complete execution and completion of the Works as shown on drawings and mentioned in the tender documents / Bill of Quantities.

All the material tests will be carried out in the presence of Consultant from self-raised laboratories on site or approved laboratory (approved by the Consultant and the Client). Material testing and verification reports must be attached with all the IPCs (Interim Payment Certificates).

01014 WORK INCLUDED

Necessary Demolition, Civil, Internal Electrification, Internal Plumbing / Mechanical Works, Furniture Supply and installation and any other work required for completion of project are included in this contract.

01015 EMPLOYER FURNISHED ITEMS

No material or equipment shall be supplied by the Employer.

01040 COORDINATION**01041 PROJECT COORDINATION**

The Engineer's approval of the programme of works shall not absolve Contractor from his responsibility to properly co-ordinate his and his sub-contractor's work and he shall take such steps as are necessary at all times to ensure that the works are carried out and controlled in such a way that the contract is completed in a workmanlike manner and by the stipulated date of completion.

01042 PROGRESS AND IMPLEMENTATION

The Employer and the Engineer shall convene regular meetings with the Contractor, who shall report to the Engineer and the Employer his own and his subcontractors; progress and shall other matters affecting the works. The Contractor can also convene meeting to deal with outstanding technical matters if they can not be dealt with in regular meeting. The contents of the meeting shall be recorded in the form of minutes. The Employer may introduce procedures and systems from time to time for correspondence, meetings, submittals, approvals, variations, billings, invoicing, record keeping, testing and commissioning and the like through a regularly updated manual for implementation of the Works and taking over thereof. The Contractor shall strictly follow the instruction in the manual and act and supply information and data accordingly.

01310 CONSTRUCTION SCHEDULE, PROGRESS AND MONITORING REPORTS**01311 CONSTRUCTION SCHEDULES**

The Contractor shall within ten (10) calendar days from and after the Contractor's receipt of written Letter of Award, submit to the Engineer for approval a detailed EPC (Engineering, Procurement, and Construction) schedule based on a critical path analysis of construction activities and sequence of operations needed for the orderly performance and completion of any separable parts of any and all work in accordance with the Contract. The schedule shall be Critical Path Method (CPM) type in the form of a network diagram with resource and activity listings, the network and sub-networks diagrams shall be shown in detail and in the order of sequence of all relevant activities, their descriptions, duration and restraints necessary and required for completing all work and any separable parts thereof. The critical paths will be highlighted. The activity listing printouts shall be provided to the Engineer no later than thirty (30) days after acceptance of the network diagram. One listing shall be sorted by work items; and one shall be sorted by "early start" items; an one shall be sorted by "late finish: work items.

The activity listings shall show the following information for each activity on the network.

- Identification by work item number.
- Duration (by work day schedule)
- Description
- Earliest start and finish dates
- Latest start and finish dates
- Total float time

The Contractor shall pursue the steps of development and analysis so that the first full network diagram can be accepted and placed into unrestricted use no later than ten (10) days following the Letter of Award.

1. Conduct educational workshops to train and inform key project personnel, including subcontractor personnel, in the proper methods of providing data and utilizing the progress schedule information.
2. Establish regular procedures for monitoring, updating and reporting, coordinated with progress meeting dates and payment request dates.
 - Do not make non-essential changes in the logic before updating unless reviewed with the Engineer.
 - Updated when no longer possible to utilize the critical plan of work.

3. Engage a consultant who is a recognized expert in CPM schedule and operations, to assist with the progress schedule procedure. When demonstrated to the Engineer's satisfaction that Contractor's personnel are sufficiently skilled; experienced and equipped for CPM scheduling, the requirements for an engaged consultant may be waived.
4. Select and use an EDP software / hardware system which has programs that will provide the necessary output data, is intended for building construction progress schedule management, and is acceptable to the Engineer.

01312 PROCEDURES AND UPDATES

The Contractor shall establish procedures and processing routines and include data to whatever extent is consistent with the complexity of the work, and necessary to achieve a high degree of effectiveness and accuracy in the development of an "optimum" progress schedule. Use "one calendar day" as the unit of time.

- a) Activities: Before attempting to produce a network diagram, prepare a listing of activities involved: include every activity having a possible bearing on the time required to complete the work. List each activity's requirements in relation to other activities; impart the best logic which can be foreseen for the whole construction process.
- b) Organization: Utilize the preliminary progress schedule (if any), and sketch the first anticipation of a skeleton network to help understand the essence of a probable critical path.
- c) Processing: Input the prepared data to the EDP programme and process to produce the output or computer-drawn network (draw network by hand if equipment unable to do so). Revise data, reorganize necessary sequences, and reproduce within the limitations of the contract time. Display full network on a single (or pieced together) sheet, with critical paths marked and located near centre of network, and locate paths with most float near edges. Sub-networks are permissible on separate sheets for activities clearly off the critical path; however, a sub-network for typical floor structural and finishing should be included in the master network.
- d) Initial Issue: Prepare initial of progress schedule network from a listing of straight "early start total float" sort. For each identified and described activity, show associated events, duration, float and dates for early start/finish and late start/finish. In listing, identify which items are critical. Produce a listing of Pakistani rupees – volumes of total work performed calculated at intervals matching the projected times for payment requests. (Projected Cash Flow Curves).

The Contractor shall promptly inform the Engineer of any proposed change in the schedule and shall furnish a revised schedule within ten (10) calendar days after approval of such change. The schedule shall be kept up to date, taking into account the actual progress of work and shall be revised, if necessary, every thirty (30) calendar days. The revised schedule shall be sufficient to meet the requirements for the completion of the several parts of any and all work as set forth in the Contract.

01313 MANPOWER & PROCUREMENT SCHEDULE

The Contractor shall within ten (10) calendar days from and after the Contractor's receipt of written Notice to proceed, submit and obtain approval of a manpower schedule; equipment and material shipping (procurement) schedule and material and commodity schedule for the entire duration of the contract period. Thereafter, the Contractor shall resubmit every fifteen (15) calendar days an update of these schedules. Should the overall construction schedule be revised, new forecast schedules will be prepared by the

Contractor. Format, content and selection of items to be included shall be as directed by the Engineer.

01314 SUBMITTAL AND DISTRIBUTION

In preparing the man-hour schedule and equipment and materials quantity schedule, the Contractor shall utilize the same sub-division of work activities as developed in the construction schedule. The selection of specific activities and details of these reports will be mutually agreed so as to avoid having the Contractor keep two sets of books. As part of the above items the Contractor shall submit to the Engineer for acceptance 3 copies of the following data on a weekly basis:

- a) Use of Manpower – Technical, Skilled and Unskilled
- b) Use of Equipment / Machinery on site
- c) Material Procurement and its utilization
- d) Any related drawings / details if applicable.

01315 PROGRESS REPORTS

During the currency of the Contract, the Contractor shall submit to the Engineer, on a regular basis on an approved format, monthly progress reports in quadruplicate on the actual progress of the work. Such progress reports shall include the following:

- a) A copy of the construction summary and details level schedule outlining progress to date for the various major items of work together with the latest updated construction, manpower and other schedules mentioned herein.
- b) A list of the construction equipment used on work during the reporting period and any equipment idle during the reporting period.
- c) A list of the numbers of personnel by trade used on work during the reporting period, with such total stated separately as to office, supervisory and manual personnel.
- d) A manpower and equipment forecast for the succeeding thirty (30) calendar days, stating the total number of workers, and separately stating such total as to office, supervisory and manual personnel.
- e) A narrative summation of the first three items above indicating the status of the work performed and other pertinent activities including the actual percentage of work completed and an estimate of the percentage of work completion in the succeeding thirty (30) calendar days.
- f) Cash Flow Analysis and projected demands for the next three months based on anticipated progress projections.

01340 CONTRACTOR MATERIALS, EQUIPMENT, AND DRAWING SUBMITTALS**01341 SCHEDULE OF REQUIRED SUBMITTALS**

Within ten (10) calendar days after receipt of Letter of Award, the Contractor shall submit in duplicate, a schedule listing all material submittals, equipment submittals and drawings to be furnished for review and approval.

The schedule shall include, but not be limited to, shop drawings and materials submittals, equipment submittals and certificates; spare parts data; samples. The schedule shall indicate the type of items, contract requirement reference, the Contractor's proposed dates for submitting the above items and projected need for approvals, and procurement dates. In preparing the schedule, adequate time shall be allowed for review, approval and possible re-submittals, and revision and update of the schedule as required. Such revised schedules shall be made available to the Engineer for reviewing in the same manner as the original submittal.

The Contractor shall recognize and allow for the lead time required for manufacture, fabrication and delivery to the site and for subcontractor's and Engineer's review.

The Contractor shall arrange the schedule in orderly sequence with, as far as practicable, each item in the order in which it will be needed so as to cause no delay in the work.

Request for approval of substitutions materials or systems, or for deviations from the Contract Documents shall be submitted according to section 01636, SUBSTITUTIONS and shall Preliminary submittals with allowances for the time for review prior to submittal of material, equipment or drawing submittals.

01342 GENERAL

All Material, Equipment, or Drawing submittals shall be identified in accordance with the submittal numbering system. Shop drawings must show dimensions of all materials to be built in.

The Contractor shall make all corrections required by the Engineer and resubmit the required number of drawings of material or equipment submittals until all required corrections are made.

The Contractor shall direct specific attention in writing to all deviations from the Contract Documents in his original submittal.

Prior to receipt of drawings and submittals noted "Review Not Required: Work May Proceed" any action or commitment which the Contractor may make on the basis of said drawings or samples shall be at the Contractor's sole risk.

The Contractor shall not be relieved of responsibility for any deviation from the requirements of the Contract Documents by the Engineer's acceptance of shop drawings, or material or equipment submittals, unless the Contractor has informed the Engineer in writing of such deviation at the time of submission and the Engineer has given written acceptance to the specification. The Contractor shall not be relieved from responsibility for errors or omissions in the shop drawings, or material or equipment submittals, or samples by the acceptance thereof.

The Contractor shall direct specific attention, by notation on resubmitted shop drawings, or material or equipment submittals, to revision other than those requested by the Engineer on previous submittals.

No portion of the work requiring submission of shop drawings, or material or equipment submittals, shall be commenced until the submittal has been approved as provided herein. All such portions of the work shall be in accordance with approved submittals.

Where required by the specification lists of materials and equipment shall be submitted by the Contractor. These lists shall be sufficient descriptive material, such as catalogues, cuts, diagrams, and other data published by the manufacturer, as well as evidence of compliance with safety and performance standards, to demonstrate conformance to the specification requirement: catalogue numbers alone will not be acceptable.

Materials and equipment will not be approved for use at capacity ratings in excess of manufacturer's published data.

Approval of materials and equipment will be tentative subject to submission of complete shop drawings indicating compliance with the Contract Documents.

01343 MATERIAL SUBMITTALS

For every request for acceptance of material, the Contractor shall submit, as required by the Engineer, as a condition precedent to acceptance of the proposed material, certificates, samples, and other data and information related to following:

- Product Certification
- Manufacturer's Review
- Approved Application or installer
- On Site Instruction
- Manufacturer's Supervision

The Contractor shall submit a description of the complete system of which the proposed material forms a part, listing all proposed components and specifically denoting all, adjacent materials which are in contact with, or function as a part of the system.

Any certificate required for demonstrating proof of the compliance of the material with Specification requirements, including mill certificates, shall be executed in quadruplicate. It shall be the Contractor's responsibility to renew all certificates before submissions are made to the Engineer to ensure compliance with the Specification requirement.

Copies of laboratory test reports submitted with certificates shall contain the name and address of the testing laboratory and date or dates of the tests to which the report applies. Certification shall not be construed as relieving the Contractor from furnishing satisfactory material, if after tests are performed on selected samples, the material is found not to meet the specification requirements.

When the Contractor submits, in support of a material submittal, manufacturer's standard documents, the contractor shall:

- ** For drawings and similar documents printed from original transparencies: Modify drawings to delete information which is not applicable to the project, provide additional information where required and submit as a transparency.
- ** For brochures and other preprinted data: clearly mark each copy as follows:
 - Identify pertinent material, product, make,
 - Refer each item to applicable Contract Document or shop drawings;
 - Show dimensions and clearances required;

- Delete all options, or variations from the Contract Documents, except where such items are specifically noted as proposed deviations.
- Where proper installation of the work requires that other work be set to special detail, held to tolerance, or dimension be established, so indicate in the submittal.
- All catalogue data, materials lists and equipment schedules shall be submitted in English language.

The Contractor, at his expense, shall furnish for approval, of Engineer samples required by the Specifications or by the Engineer. Materials for which samples are required shall not be used in the works until approved by the Engineer.

Samples, in general, are required for all materials which are an exposed part of the finished project. Samples of concealed components and standard materials will be reviewed if submitted. However, such samples are not required unless specifically called for by the Engineer.

Typical samples shall be taken from production run material and shall be representative examples of proposed quality and finish.

Preliminary samples shall, as far as possible, anticipate the quality and finish of production run material.

Samples will be retained at the job site for comparison purposes. Samples of manufactured items will be returned to the Contractor for installation in the work at locations where directed after approval of materials.

Each sample shall be labelled and indicate:

- Name of project
- Name of contractor and subcontractor, if applicable
- Material or equipment represented
- Place of origin
- Name of producer and brand (if any)
- Location in project
- Specification, section and paragraph number
- Data submitted.

The Contractor shall transmit to the Engineer under separate cover a statement in triplicate for each shipment of samples containing the information required above. The Contractor shall, enclose a copy of this statement with the shipment. Approval of a sample shall be for the characteristics or use named in such approval and shall not be construed to change or modify any Contract requirement. Substitutions will not be permitted unless they are considered to be in the Employer's best interests.

Failure of any material to pass the specified tests will be sufficient cause for refusal to consider under this Contract any further samples of the same brand or make of that material.

Signature of Client

Signature of Contractor

The Employer reserves the right to disapprove any material which previously has proved unsatisfactory in service, whether on this Contract or elsewhere.

When tests are required, only one test of each sample proposed for use will be made at the expense of the Employer. Samples which do not meet specification requirements will be rejected. Re-testing of additional samples will be arranged by the Employer at the expense of the Contractor.

Sample Types:

- a) Preliminary Samples: Hand made or simulated examples of proposed materials submitted to demonstrate anticipated finished appearance.
- b) Product Samples: Representative examples of materials proposed for use.
- c) Range Samples: Samples showing extremes of variation in appearance, texture or color and the limits within which the Contractor agrees to hold the materials used in the work.
- d) Sample Installation: Trial run or initial example provided for review and acceptance by the Engineer before continuing with the work.
- e) Test Samples: Samples provided for purpose of physical or chemical test analysis. If samples are submitted directly to the testing laboratory, submit copy of letter of transmittal.

The Contractor shall submit all material submittals sufficiently in advance of manufacture, shipping, custom clearance requirements etc. to permit no less than forty five (45) calendar days for review and appropriate action by the Engineer.

If material submittals show variations from the Contract requirements because of standard shop practice or for, other reasons the Contractor shall briefly described such variations in the body of the submittal. If acceptable, the Engineer may approve any or all such variations, if Contractor fails to describe such variations, he shall not be relieved of the responsibility for executing the work in accordance with the Contract, even though items shown in such submittals have been permitted to proceed for procurement or manufacture.

If a material submittal describes variations as per the above paragraph and show a departure from the Contract requirements which the Engineer finds to be in the interest of the Employer and to be so minor as not to involve a change in the Contract price or time for performance, the Engineer may permit the Contractor to proceed with procurement of the material presented in the submittal.

Two (2) copies of each complete material submittal will be returned marked with one of the following notations:

Notation 1: Work may proceed

Notation 2 Work may proceed. Submit final documentation.

Notation 3: Revise and resubmit. Work may proceed subject to incorporation of changes indicated.

Notation 4: Revise and resubmit. Work may not proceed.

Notation 5: Review not required. Work may proceed

Signature of Client

Signature of Contractor

Copies of drawings returned to the Contractor marked with either Notation "1", "2" or "3" authorize the Contractor to proceed with the fabricating, manufacture, or local procurement of material depicted by such returned copies, provided that such fabrication, manufacture, or local procurement shall be subject to the comments, if any, shown on such returned copies. Although work may proceed on a Notation "3" review (with comments), the Contractor, shall incorporate the comments, resubmit, and obtain Notation "1" or "2" before the approval cycle is considered complete by the Engineer.

Permission to proceed shall not constitute acceptance or approval of design details, calculations, analysis, test methods, or material developed or selected by the Contractor and shall not relieve the Contractor from full compliance with contractual obligations.

The Contractor shall be responsible for, and bear all costs of damages which may result from the ordering of any material prior to receiving permission to proceed from the Engineer.

01344 DRAWING SUBMITTALS

The Contractor shall submit all drawings sufficiently in advance of fabrication/manufacture or construction requirements to permit not less fifteen (15) calendar days for review and appropriate action by the Engineer.

Drawings Types:

a) Shop Drawings

- (i) Preliminary Shop Drawings: Drawings and other data submitted prior to acceptance of systems and only required to show information necessary for evaluation and co-ordination with other work.
- (ii) Project Shop Drawings: Drawings and other data illustrating materials and assemblies proposed for the project.

b) Working Drawings

Drawing for temporary structures such as bulkheads, support of excavation, ground work, control systems, forming false work and for such other work as may be required for construction but does not become an integral part of the completed project.

c) As Built Drawings

Drawings worked-up by the Contractor on reproducible for as-built information for the work as completed.

A- **Shop Drawings:**

The Contractor shall submit one (1) reproducible and three (3) legible prints of all shop drawings to the Engineer to obtain permission to proceed with fabrication/manufacture or construction. These drawings shall be complete and detailed. Shop drawings shall include but not be limited to design, detail, fabrication, assembly, erection and, setting drawings, schedule drawings, manufacturer's scale drawings, wiring and control diagrams.

Shop drawings shall be checked and coordinated by the Contractor with the work of all disciplines involved before they are submitted to the Engineer and shall bear the Contractor's stamp of approval as evidence of such checking and coordination. Shop drawings submitted without this stamp of approval may be returned to the Contractor for resubmission.

All shop drawings shall have a blank area eight (8) cm high by ten (10) cm wide, located adjacent to the title block to accommodate the Engineer's review stamp.

The title block shall display the following:-

- Number and title of the drawing
- Date of drawing and revision
- Name of project building or facility
- Name of Contractor and sub-contractor, if applicable, submitting drawings.
- Clear identification of contents and location of the work.
- Specification section and paragraph number
- Contract title and number

Shop drawings shall be prepared by a qualified detailer and shall be complete including erection diagrams showing the fabrication and construction of all items required for complete assembly and shall:

- Provide pertinent information relating to installation and connection to work of other trades, and co-ordinate with work of other trades as required for proper placing, anchorage and support of the work. Indicate in detail the precise location and spacing of all embedded anchor bolts, sleeves and other features required to be placed in the concrete structural steel or masonry or otherwise required to be built into the structure.
- Identify details by reference to the Contract requirements because of standard shop practice or for other reason the Contractor shall briefly describe such variations in the drawing notes. If acceptable, the Engineer may approve any or all such variations. If the Contractor fails to describe such variations he shall not be relieved of the responsibility for executing the work in accordance with the Contract, even though work shown on such drawings has been permitted to proceed for fabrication, manufacture, or construction.

If the shop drawings as submitted describe variations per the above paragraph and show a departure from the Contract requirements which the Engineer finds to be in the interest of the Employer and to be so minor as not to involve a change in the Contract price or time for performance, the Engineer may permit the Contractor to proceed with the work shown on the shop drawings.

Shop drawings shall not indicate any material for which acceptance has not been received, unless accompanied by a separate request for approval. In no case shall Engineer's review and return of shop drawings constitute an acceptance of either specified or substitute manufactures or materials.

One reproducible and two (2) copies of each shop or working drawing, as further defined herein, will be returned marked with one of the following notations:

Notation 1:	Work may proceed
Notation 2:	Work may proceed. Submit final documentation.
Notation 3:	Revise and Work may proceed subject to incorporation of changes indicated.
Notation 4:	Revise and resubmit. Work may not proceed
Notation 5:	Contract title and number

Copies of drawings returned to the Contractor marked with either Notation "1", "2" or "3" authorize the Contractor to proceed with the fabrication, manufacture, or construction covered by such returned copies, provided that such fabrication, manufacture, or construction shall be subject to the comments, if any, shown on such returned copies. Although fabrication, manufacture, or construction may proceed on a Notation "3" review (with comments), the Contractor shall incorporate the comments, resubmit, and obtain Notation "1" or "2" before the approval cycle is considered complete by the Engineer.

Permission to proceed shall not constitute acceptance or approval of design details, calculations, analyses, test methods, or materials developed or selected by the Contractor and shall not relieve the Contractor from full compliance with contractual obligations.

Copies of drawings returned to the Contractor marked with Notation "4" shall be corrected as required, and such drawings shall be resubmitted in the same manner as before.

Copies of drawings returned to the Contractor marked with Notation "5" authorize the Contractor to proceed with the fabrication/manufacture or construction covered by such drawings.

Copies of drawings returned to the Contractor marked with either Notation "3" or "4" shall be resubmitted to the Engineer not later than five (5) calendar days after date of receipt by the Contractor of such copies of drawings and in no case later than ten (10) calendar days after the date of the Engineer's transmittal.

Review of the Contractor's drawings by the Engineer shall not be held to relieve the Contractor of any of his obligations to meet all the requirements of the Contract or relieve the Contractor of the responsibility for the correctness of such drawings. The Contractor shall, at its expense, make any changes in the design, which are necessary to make the work conform to the provisions and Intent of the Contract.

Resubmittals of drawings will be handled in the same manner as first submittals. On resubmittals the Contractor shall direct specific attention, on the resubmitted drawings, to revisions other than the comments made by the Engineer on previous submissions. The Contractor shall make any corrections required by the Engineer.

When the drawings have been satisfactorily completed, the Contractor shall carry out the fabrication, manufacture, or construction in accordance therewith and shall make no further changes therein except upon written instructions from the Engineer.

In the event that a change occurs to a previously reviewed drawing and the Contractor has received from the Engineer authorization to proceed with the change, the Contractor shall revise the previously reviewed drawing to reflect the latest reviewed change and resubmit the drawing to the Engineer. The Contractor shall be responsible for, and bear all costs of damages which may result from the ordering of any material or equipment or from proceeding with any part of the work prior to receiving permission to proceed from the Engineer.

Shop Drawing types to be as follows unless otherwise specified:

(01) Preliminary Shop Drawings

- i) Preliminary, shop drawings shall be provided for portions of the work where interpretations or variations from the Contract Documents are proposed, or otherwise required.

- ii) Show major dimensions, location of structure supports, working points, clearance lines and all other preliminary information required to determine the extent to which the proposed installation affect other portions of the work.
- iii) Include descriptions of all construction loads, dead loads and special details including clearances and tolerances required for installation.
- iv) Drawings as required to evaluate the total effect on the cost of the work will be required prior to approval of materials and manufacturer if building layout or detail changes are necessary.
- v) Additional changes and the cost thereof, after review of preliminary shop drawings will be the sole responsibility of the Contractor.

(02) Project Shop Drawings

- i) Project shop drawings shall be complete, consistent with preliminary shop drawings and mock-up shop drawings, as corrected. Show all changes to building details to co-ordinate with required modifications and indicate approval by other trades for required modifications to their work.
- ii) Where shop drawings are based on the use of a particular material, such material shall follow the normal material approval procedure independently of the shop drawings.

B- Working Drawings

"Working Drawings" shall mean Contractor's plans for temporary structures such as temporary bulkheads, support of excavation, ground water control systems, forming and false work and for such other work as may be required for construction but does not become an integral part of the completed project.

One (1) reproducible and three (3) legible copies of working drawings shall be submitted to the Engineer where required by the specifications, or requested by the Engineer, and shall be submitted at least ten (10) calendar days (unless otherwise specified by the Engineer) in advance of their being required for the work. The Engineer will review and return the drawings to the Contractor following procedures outlined above for Shop Drawings.

Working drawings as submitted shall be certified by a professional engineer whose qualifications are acceptable to the Engineer and shall convey, or be accompanied by, calculations or other sufficient information to completely explain the structure or system described and its intended manner of use. Prior to commencing such work, working drawings must have been reviewed and work shown on such drawings must have been permitted to proceed by the Engineer, which review and permission will not relieve the Contractor in any way from his responsibility with regard to the fulfillment of the terms of the Contract. All risks of error are assumed by the Contractor, and the Employer and the Engineer shall have no responsibility therefore.

Permission to proceed with the work shown on the Contractor's working drawings shall not relieve the Contractor of any responsibility, including but not limited to, responsibility for accuracy of dimensions and details, and for mutual agreement of dimensions and details. The Contractor shall remain responsible for agreement and conformity of its working drawing with the Contract Drawings and Technical Specifications.

C- As-Built Drawings

The Employer furnished drawings shall be marked up by the Contractor on reproducible for as-built information as the work is completed and shall be submitted to the Engineer together with six (6) copies of each on a continuous basis, but in all cases prior to issuance of the Certificate of Completion of the Works.

Contractor furnished drawings shall be revised up by the Contractor on reproducible of Mylar quality for as-built information as the work is completed and shall be submitted to the Engineer together with six (6) copies of each on a continuous basis, but in all cases prior to issuance of the Certificate of Completion of the Works.

01345 SUBMITTAL NUMBERING SYSTEM

The Engineer has established a drawing numbering system used to number the design drawings. The Contractor shall use the identical system to number and control all drawings created during construction including all material and equipment submittals, shop drawings, erection drawings and the like, being sure to assign to each a unique, previously unused number.

01400 QUALITY CONTROL**01401 QUALITY SYSTEM**

The Contractor shall prepare, manage, and control a quality system for the construction and installation of the Works in accordance with ISO 9002 as prescribed in Clause 36.8 of the Conditions of Particular Application Part II. ISO 9002 shall be regarded as a basic minimum requirement as to the proper execution of all quality assurance on the Works. The standards and controls stipulated herein are meant as supplement and introductory to the quality system to be introduced by the Contractor in accordance with Clause 36.8 mentioned above.

01402 QUALITY STANDARDS

Except where expressly, provided all material and equipment provided for incorporation into the permanent works shall be new. Where there is not a detailed specification to cover any item of material or equipment then the same shall be chosen to meet the demands of its intended use. All workmanship shall be in accordance with recognized practices acceptable to the Engineer.

All work shall be executed by suitably skilled craftsmen in strict accordance with the approved drawings and in a proper workmanlike manner.

Materials and equipment shall be installed in conformity with the instruction of their manufacturer and with requirements of the applicable code. Fabrication and installation shall be in accordance with the requirements of the drawings as to line, level and plumb. Due consideration shall be given to the necessity of adjustment for field connections and alignment with other works and for joints and intersections and for anchoring requirements. Anchors shall be designed such that expansions and contractions arising from temperature changes will not distort the Works nor over stress fasteners, fittings and connections, which latter shall as a general rule be concealed from view.

The quality levels specified are intended to serve as minimum standards for the Works. Except where otherwise provided the Contractor may (at his discretion and with the approval of the Engineer) exceed these standards within specified limits and tolerances. Where surface coatings are being applied or surface cladding or covering

put in place, the Contractor shall ensure prior to such activity that the surfaces to be coated or covered are clean, free from inequalities and projections, and that all necessary cants and chamfers have been provided. Surfaces shall conform to requirements prior to any application or installation being commenced. Where the application of solvents or other coating materials require special ventilation to ensure healthy and safe working conditions then the Contractor shall make suitable facilities available to achieve this goal.

01403 QUALITY CONTROL PROGRAMME

A- Quality Control Plan

The quality system including plan for quality control to be submitted by the Contractor as specified in section 1401 above shall detail the procedures which the Contractor will follow to ensure due and proper Quality Control, the documentation and reports to be produced and the chain of responsibility for Quality Control within the Contractor's Organization. No construction work shall commence until the Quality Control Plan relevant to such work has been approved by the Engineer.

The Quality Control Plan shall divide the overall Works into work packages where each work package shall consist of work of a particular kind. For each work package, the Quality Control Plan shall establish:

- The Quality Control Organization of the Contractor;
- Details of the quality inspectors, including number, qualifications, authority and responsibilities for the inspections;
- Details of the inspection methods, including arrangements for the inspection of work executed by sub-contractors;
- Testing methods and testing resources;
- Documentation and records to be established;
- The detailed instructions to which the Contractor's representative for quality for the relevant work package is subject with respect to the assurance for quality control.

B- Quality Meetings

After the Notice to Proceed the Contractor shall meet the Engineer formally to discuss and review Quality Control requirements.

The meeting shall agree upon the breakdown of the Works into work packages and upon the contents of each package. Levels of quality control for individual items within each package shall be agreed upon. The systems for ensuring Quality Control, for assurance of the implementation of Quality Control and the recording and documentation of the execution of the Works shall be agreed upon. The Engineer and the Contractor shall develop a mutual understanding of these systems, and of the roles to be played by the Engineer and by the Contractor in the implementation thereof.

C- Quality Control Personnel

The Contractor shall ensure that at all time the responsibilities for Quality Control defined in the Quality Policy and Plan are delegated to authorized and competent

members of the Contractor's staff who have been given the instructions necessary to perform their tasks.

D- Recurring Deficiencies

Where the recurrence of non-conformance during the construction of the Works indicates deficiencies in the Quality Control Plan then the Contractor shall propose to the Engineer the corrective action necessary to remedy such deficiencies.

E- Inspection

The inspection procedures determined upon for each work package shall be carried out by the Contractor. The Engineer shall have the right to observe all such inspections at his discretion, and the Contractor shall make available to the Engineer all information regarding the time and place of any such inspections, the access to the work to be inspected, and the drawings and documents relevant to such inspections.

The Engineer shall have full and free access to such premises of the Contractor, his subcontractors and suppliers as may be the location of fabrication or manufacture of any materials or equipment to be incorporated in the Works to ensure compliance with the requirements of the specifications.

Where any work is covered by the Contractor prior to an inspection by the Engineer to which due notice has not been given, then the Contractor shall bear the cost of the necessary uncovering and replacement. The failure by the Engineer to make any inspection or to discover any default in workmanship, materials or equipment, or payment by the Employer to the Contractor for any such work, material or equipment shall not relieve the Contractor of his responsibility in relation thereto nor prejudice the rights of the Engineer to correct or reject the same as provided in the Contract.

F- Test Procedures and Test Results

Where required by the Specifications, the test procedure and test results shall be provided by the Contractor in quadruplicate. All items required by the Specification shall be covered by test procedures.

01500 TEMPORARY FACILITIES AND SERVICES

01510 TEMPORARY UTILITIES

01511 ELECTRICITY

The Contractor shall make all necessary arrangements for a temporary electrical service, pay all expenses in connection with the installation, operation and removal thereof and pay the cost of electricity consumed by all trades including his sub-contractors. A temporary lighting system shall be furnished. Installed and maintained as required to satisfy the minimum requirements of safety and security.

01514 TELEPHONE AND RADIO COMMUNICATION FACILITY

The Contractor, after approval from the Employer and Engineer, shall provide and operate a radio communications system, for the purpose of communication between offices and the various locations within the job site, at his own expense. The Contractor shall be solely responsible for obtaining necessary permits and authorizations. He must only use those wave bands or radio frequencies as authorized and must not use functions. The Contractor shall cease to use this radio equipment if directed by the Employer.

01515 WATER

The Contractor shall supply in sufficient quantity all necessary potable and other water for all trades. He shall make arrangements and pay charges for water service installation, maintenance and removal thereof, and pay the cost of water for all trades including sub-contractors.

The Contractor shall provide satisfactory facilities to prevent the production of any substance or materials into any body of water including ground water which may pollute the water or constitute substances or materials therein which may be injurious to life.

01516 WASTE DISPOSAL

The Contractor shall make such temporary provisions as may be required in order to dispose of any chemicals, fuels, oils, greases, bituminous materials, waste and soil waste and the like without causing pollution to either the site or the environment. Disposal of all such materials and wastes shall be made outside the site in accordance with local authority's instructions and approvals.

01517 MEDICAL SERVICES

The Contractor shall provide first-aid services for all his employees and his subcontractor's employees employed on the works in accordance with the standards to be determined by the Ministry of Labor in collaboration with the Government of Pakistan.

The Contractor shall maintain a record of all employees and families inoculations and he shall arrange for the revaccination at no cost to them.

In the event any of the Contractor's employees or his subcontractor's employees requires the services of an ambulance, hospital or physician, Contractor or its subcontractor will promptly pay all charges thereof directly to the providers of such services.

In the event of an epidemic or if otherwise needed, the Contractor shall make appropriate arrangement to vaccinate all personnel as directed by the Ministry of Health and the World Health Organization.

01518 AIR POLLUTION CONTROL

The Contractor shall so perform its work as not to discharge into the atmosphere from any source whatever, smoke, dust or other air contaminant in violation of the laws, rules, and regulations of the governmental entities having jurisdiction.

01519 DUST CONTROL

The Contractor, for the duration of the Contract, shall maintain all excavations, embankments, haul roads, access roads, plant sites, waste disposal areas, borrow areas, and all other work areas free from dust, as determined by the Engineer.

Industry accepted methods of dust control suitable to the area involved, such as sprinkling, chemical treatment, light bituminous treatment or similar methods are acceptable.

01520 CONSTRUCTION SITE DRAINAGE

The Contractor shall:

- Take charge of and maintain the existing construction site drainage systems.
- Establish and construct additional temporary site drainage systems where required to adequately drain the surfaces so that storm water is diverted from the construction site. Such water shall drain into existing public drains, without hazard or damage to public streets, adjacent properties and existing utilities.

Where no public system is available for Contractor's use, he shall remove water by tanker truck as required.

Provide properly sloped drainage ditches at top of all slopes to prevent surface drainage from causing erosion on cut slopes. The Contractor shall cover cut slopes adjacent to existing structures and at construction driveways within the Site with polyethylene sheeting when not protected satisfactorily by other means.

01521 DEWATERING

Subsurface explorations indicate that structure foundations and basements will be below normal water table levels.

The Contractor shall provide and operate dewatering system including pumping, well-points and the like at his own cost, as required to maintain excavation free of standing water throughout the period underground work is in progress as described in relevant sections of these specifications.

Pumping shall be continued 24 hours daily, seven days each week, if necessary, until the permanent works are safe from damage by ground water, after which time the temporary dewatering apparatus shall be removed.

01540 SAFETY, FIRE PREVENTION AND SECURITY PROGRAMS

Within ten (10) days following the Notice to Proceed, and before any work is performed at the site, the Contractor shall, in addition of his responsibilities under Clause 19 of Conditions of Contract, "SAFETY, SECURITY, AND PROTECTION OF ENVIRONMENT", submit to the Employer for approval, his Safety, Fire Protection and Prevention, and Security Programs, in conformance with the following minimum requirements:

A- Safety Program

1. Provide for the designation of a Safety Representative who shall be responsible for the implementation and enforcement of the Contractor's Safety Program, and who shall coordinate matters of safety with the Employer.
2. Provide for specific review by the designated Safety Representative of all Contractor Work plans and methods.
3. Provide for periodic inspection by the designated Safety Representative of all Contractor's work and storage areas to assume safe conditions and practices.

4. Provide for the immediate reporting of all deaths, injuries, and property damage to the Employer.
5. Provide for availability of first aid and ambulance services.
6. Provide for full co-operation in the conduct of inspections by the Employer or other agencies of competent jurisdiction.
7. Provide for active compliance with all applicable laws and regulations of Pakistan and other agencies of competent jurisdiction.
8. Provide for the delegation to the designated Safety Representative of adequate authority to fulfill the responsibilities placed upon him by the Contractor's Safety Programme.

B- Fire Prevention and Protection Programme

1. Provide for the designation of a Fire Prevention and Protection Representative who shall be responsible for the implementation and enforcement of the Contractor's Fire Prevention and Protection Programme. This may be the same individual designated as Safety Representative.
2. Provide for the assignment of fire fighters, trained to prevent and/or control fire, for all welding and metal burning operations.
3. Provide for the proper identification, tagging, labelling, storing, handling and use of flammable material to prevent accidental ignition.
4. Provide adequate fire extinguishing equipment appropriate for the operation being performed, and provide employees training in the maintenance and use of fire extinguishing equipment.
5. Develop and provide evacuation procedures and conduct evacuation and fire drills as required by the Employer.
6. Security guard room facility and gate for main site entrance.

The Contractor shall remain solely responsible for safety, first aid, security, and fire prevention at the site.

01541 WEATHER PROTECTION AND VENTILATION

The Contractor shall provide protective covers and/or enclosures where and as required for protection of the work and shall protect materials against extremes of hot temperatures, precipitation, wind blown water, sand, dust, other foreign materials, sun or rapid drying.

The Contractor shall:

- Provide and maintain the enclosure of the building, or any portion thereof, for the entire term of the Contract.
- Exercise complete control over the adequacy of ventilation and proper drying out of the work in to the new building or any portions thereof, for the entire construction period until date of substantial completion. Any of the work damaged by dirt, abuses, cold or dampness, or by insufficient or abnormal heat, shall be removed and replaced to restore as new conditions as specified.

- Provide supplementary ventilation as required to control humidity and to promote drying and prevent damage to materials from excess or too rapid drying.

01580

PROJECT SIGN

The Contractor shall provide four (4) 2.5 x 3.5 m project signs of the site for the entire term of the Contract: Two English and two Urdu and shall locate the project signs as directed by the Employer.

The Contractor shall employ an expert sign painter to letter the sign according to drawings and directions provided by the Engineer. Sign lettering shall include the following items in "Helvetica" style letters ranging from 100 mm down to 40 mm and shall include the following:-

- Project Name
- Employer's Name
- Consultants / Sub-Consultants
- General Contractor
- Subcontractors (as directed)

The Contractor shall maintain sign in good repair and condition, and upon completion of the work of this contract, remove and dispose of sign.

Except for warning and other signs required by law and ordinance, the Contractor shall place no other signs or advertisements on the premises

01590

OFFICES, VEHICLES, SHEDS & EQUIPMENT

All offices, sheds, equipment, vehicles, and personnel etc. as required under terms of Clauses 54.9 to 54.13 of Conditions of Particular Application Part-II shall be furnished, constructed, operated, maintained, and removed from the site at appropriate time. The Contractor shall submit to the Engineer, prior to the commencement of any temporary installation, plans showing the details of proposed facilities. All habitable rooms shall be properly insulated, shall have dust sealed windows, with sun protection and fly screens and shall be equipped with electric lights, air conditioning and mechanical ventilation where required, and all supporting facilities including water, sewerage, and electrical facilities.

The Contractor shall, for his own use, furnish and maintain suitable offices, stores, and auxiliary facilities on the site. He shall also include for general use vehicle parking and a sample room.

01600**MATERIAL AND EQUIPMENT**

01610

MATERIAL HANDLING, STORAGE AND DELIVERY

The Contractor shall, where applicable, deliver all packaged materials to the site in manufacturer's original unopened containers.

The Contractor shall ensure proper packing of all materials in appropriate containers for shipment, identification of contents with piece marks referenced to shop drawings, and as far as possible in sequence of erection. The Contractor shall provide packing,

wrapping, and other protection as required to ensure satisfactory condition of materials and finishes at time of erection. Inspection and acceptance will be made on the basis of materials as delivered to the job Site.

The Contractor shall provide adequate quantities to allow for damage and breakage during shipment and delivery, and for replacement of all materials damaged prior to final acceptance. All such replacement of damaged materials shall be at no additional cost to Employer.

The Contractor shall store materials and equipment, which are subject to degradation by outside exposure in a weather tight enclosure.

01630 APPROVAL PROCEDURE AND PRODUCT SUBSTITUTIONS

01631 PRODUCT CERTIFICATION

Product certification is a statement by the manufacturer that to the best of his knowledge, the material has not failed to perform when previously used for similar purposes and under similar conditions of use.

The Contractor shall obtain and submit statements from manufacturers and fabricators of materials, assemblies and component parts of assemblies that the product as delivered conforms to their published data.

The Contractor shall obtain manufacturer's approval for all variations from published recommendations for installation, operations and conditions of use.

It shall be the duty of the Contractor to obtain from the supplier of any material on this work, upon request, evidence that his material is in compliance with the applicable codes, ordinances and standards referenced therein, in the method in which the material is used in this project.

01632 MANUFACTURER'S REVIEW

Manufacturer's review of documents and conditions of use is a statement by the manufacturer, his representative or his agent, that he has reviewed the documents pertaining to the work and verified the proposed use of the material, including the providing of details and instructions for its application or installation, a statement that the material is suitable for its intended purpose, and has performed satisfactorily under similar conditions of use.

The Contractor shall, whenever required, obtain and submit a statement from the manufacturer indicating that he has no objection to the proposed details or method of installation, or obtain instructions concerning which details, applications, or installation procedures are not in conformance with manufacturer's recommendations and all additional precautions or protective measures which should be taken.

Manufacturer's review shall recognize adjacent materials and state if there is, in his opinion, a serious question of compatibility including possibility of damage to other materials, or damage to the material or assembly of other materials. Such conditions shall be reconsidered and adjustments made previous approvals notwithstanding, at the Contractor's sole expense.

01633 APPROVED APPLICATOR OR INSTALLER

An approved applicator or installer is one whom the manufacturer has reason to believe is experienced and qualified in the work and is familiar with the product and with the manufacturer's recommendations for use and installation.

The Contractor shall obtain and submit a statement from the manufacturer that the proposed applicator or installer is approved and indicate whether or not this approval is subject to review and observation of the work by the manufacturer's representative.

The manufacturer shall not approve an applicator, if because of past history of performance or other reasons, there is a reasonable doubt that he cannot be relied upon to perform in accordance with the Contract Documents.

Upon completion of the work, the manufacturer shall certify that approved material in the proper quantities have been delivered to the approved applicator for use on the Project.

In the event that a manufacturer declines to approve a proposed applicator, the manufacturer shall submit a statement as to whether or not On Site instructions or manufacturer's supervision is recommended. Where these services are specified, they are considered to be an integral part of the proposed system. A proposal to delete any specified service will be considered as a reduction in scope, subject to general conditions for changes in the work.

If any of the services specified in this clause are not scheduled as a requirement but are normally recommended by the manufacturer, the Contractor shall notify the Engineer of such recommendation.

01634 ON SITE INSTRUCTION

On Site instruction is performed by a qualified representative of the manufacturer.

Where required by the Specification, the Contractor shall obtain and submit a statement from the manufacturer that his authorized representative will provide the specified inspection and instruction and submit a record of the date (s) on which specified services were provided.

Site Instruction Service shall consist of:

- Preliminary inspection of substrates and all other conditions which would affect the performance of the material or equipment to be installed.
- Giving notice of all unacceptable conditions and recommending remedial action.
- Verifying that workmen are qualified and have received proper instructions.

Where these services are specified, they are considered to be an integral part of the proposed system. A proposal to delete any specified service will be considered as a reduction in scope, subject to general conditions for changes in the work.

If any of the services specified in this section are not scheduled as a requirement but are normally recommended by the manufacturer, the Contractor shall notify the Engineer of such recommendation.

01635 MANUFACTURER'S SUPERVISION

Manufacturer's supervision, in addition to all services specified for on site onset instruction, consists of continuing inspection and verification that the work has been performed in accordance with the Contract. If required by the Engineer, the Contractor shall obtain and submit a statement from the manufacturer that complete

supervision will be provided. Where supervision is required, all costs are included in the Contract Price.

Upon completion of the manufacturer's supervision the Contractor shall obtain a report from the manufacturer giving dates of inspections, including pertinent information as applicable to the particular trade such as procedures, coats, coverage, and tests as necessary to verify conformance and certifying that the proper types and quantities of materials were installed.

Where these services are specified, they are considered to be an integral part of the proposed system. A proposal to delete any specified service will be considered as a reduction in scope, subject to general conditions for changes in the work.

If any of the services specified in this section are not scheduled as a requirement but are normally recommended by the manufacturer, the Contractor shall notify the Engineer of such recommendation.

01636

SUBSTITUTIONS

The Contract Documents indicate and call for certain articles, devices, products, materials and work by named or approved manufacturers. The Contract shall be based on materials and work manufactured and supplied by those named Manufacturers and trade names as specified to establish a standard. The fact that a product is named does not constitute a guarantee by the Engineer the named manufacturers have agreed to provide or to modify their product in order to meet all requirements of the Contract Documents. It is the responsibility of the Contractor to obtain assurances from his suppliers that the product he proposes to use will meet all requirements of the Contract Documents. The fact that material or manufacturer is a substitution shall not act to either increase or decrease the Contractor's responsibility for performance.

Substitutions will be considered for any manufacturer except those followed by the words "No Substitutions" in the Specifications.

In all cases where substitutions are proposed by the Contractor, it shall be the sole responsibility of the Contractor to provide adequate data and samples as required by the Engineer to evaluate the substitution.

Request for acceptance of substitution shall be presented at least 30 days in advance of the date on which a decision by the Engineer is needed and shall:

- Include all information required by this Specification.
- State the reason for the substitution.
- Include accurate cost data if the substitute material involves a change in the Contract Sum, or if so requested by the Engineer.
- Provide or make arrangements for the manufacturer to provide complete data describing the proposed substitution, including samples and itemized comparison with the specified materials and work, if requested by the Engineer.

The Engineer shall not be obliged to justify or give his reason for rejecting a proposed substitution.

In the event that a substitution is accepted conditionally on the Contractor's agreement to assume full responsibility for quality and equality of performance, the

Contractor shall provide a full value warranty and agree to make good all damages resulting from the failure of the substitute product.

01700 CONTRACT CLOSE-OUT

01710 PROJECT RECORD DOCUMENTS

A- Definitions

(01) Record Documents

Copies of the Contract Documents shop drawings and material submittals and samples maintained at the site for purpose of recording changes and other project information.

(02) Record "As-Built" Drawings

Except for "as-built" correction to the shop drawings the only record of as-built conditions required will be a clean copy of the Contractor's notations on the record drawings unless otherwise specified.

(03) All of the foregoing documents shall be furnished in English.

B- Drawings and Specifications at the Site

The Contractor shall maintain at the Site for the Employer and available to the Engineer one copy of all Drawings, Specifications, Addenda, approved Shop Drawings, Change Orders and other modifications, in good order and marked to record all changes made during construction.

Record Documents: At the date of final completion and as a condition precedent to Final Payment, the Contractor shall furnish the following documents to the Employer:-

- As Built Shop drawings showing the field changes affecting the general construction and other work and indicating the work as actually installed.
- The Contractor shall maintain at the job site one set of Construction Documents and indicate thereon each field change as it occurs.

C- Record Drawings

Record drawings are required to establish the location of concealed work and deviations from details or dimensions indicated on the original construction drawings. Where locations or dimensions of portions of the work are indicated by note on drawings or otherwise indicated to be at the option of the Contractor, the final determination of such options shall be indicated in the record drawings.

Final record copies of all shop drawings shall be submitted showing all corrections made and also indicating all field changes or other variations from the details as originally reviewed by the Engineer.

01740 WARRANTIES

The Contractor warrants all equipment, materials and labor furnished or performed under the Contract (unless furnished by the Employer) against defects in design, materials, and workmanship for a period of six (6) months, unless otherwise specified, from and after the date of the Certificate of Completion, regardless of whether the same were furnished or performed by the Contractor or by any of his

subcontractors of any tier. The Employer shall be entitled to receive, at no additional cost from the Contractor, the benefits of extended warrantee period which is a common industry practice or is available to the Contractor at no extra cost from any of its subcontractors or suppliers. Upon receipt of written notice from the Employer of any defect in any such equipment, materials, or labor during the six (6) months period herein specified, due to defective design, materials, or workmanship, the affected item or parts thereof shall be repaired or replaced by the Contractor at a time acceptable to the Employer.

The Contractor shall perform such tests as the Employer may require to verify that such repairs and replacements comply with the requirements of the Contract. All costs incidental to such repair, replacement and testing including the removal, replacement and reinstallation of equipment and materials necessary to gain access shall be borne by the Contractor. The Contractor warrants such repaired or replaced work against defective design, materials and workmanship for a period of six (6) months, unless otherwise specified, from and after the date of acceptance thereof. Should the Contractor fail to promptly make the necessary repair, replacement and tests, the Employer may perform or cause to be performed the same at the Contractor's expense. The Contractor and its surety or its sureties if any shall be liable for the satisfaction and full performance of the warranties as set forth herein.

Notwithstanding the direct warranty obligations placed upon the Contractor by this section, but complimentary thereto, the Contractor shall in every instance, obtain from manufacturers, subcontractors, and suppliers, warranties in favour of the Employer. Such warranties shall be of the types and obtained under the conditions outlined herein.

Warranties shall be submitted prior to requesting full payment for each item for which a warranty is required.

Each warranty shall acknowledge the responsibilities defined by the Contract Documents and shall specifically include:-

- A) The manufacturer's standard warranty that all materials comply with its published standards, comply with the requirements of the Specification and, if required by the Engineer, are adequate for the proposed use.
- B) The installing Subcontractor's warranty that all workmanship comply with the requirements of the Specification and of the Manufacturer.
- C) A statement by the Contractor acknowledging his overall warranty responsibility and accepting specific responsibility for any and all limitations imposed by the Manufacturer in its warranty, except insofar as such limitations have been previously accepted by the Engineer.

The type of warranty required in each case shall be determined by the Engineer at the time of approval of the Contractor's request for approval of materials, and such approval shall be conditioned upon obtaining such warranty from the Manufacturer. No limitation of warranty will be accepted by the Engineer unless submitted by the Contractor and accepted by the Engineer at the time of approval of materials.

Standard Warranties:

A special warranty is a warranty which offers, in addition to the terms normally offered as a standard warranty, other provisions, such as;

- 1 Acknowledgement of specified items specifically noted as being covered by the warranty.
- 2) Acknowledgement of specific conditions of use or exposure.
- 3) Extension of warranty to waive standard exceptions or to extend limits including time limits.
- 4) Requirements for specific performance by other specialties, including methods of protection or separation from, or means of assuring compatibility with, adjacent materials, which will affect the validity.

01770

COMPLETION AND FINAL ACCEPTANCE CERTIFICATE

The Contractor shall complete all of the works entrusted to him under the Contract, including such additions or changes as may be directed by the Engineer by virtue of the rights vested in him thereunder, so that the works may, in every respect, be complete and ready for issuance of the Certificate of Completion on the specified completion date.

Upon receipt of the Contractor's notice of completion of the Works, the Engineer will notify the Contractor of the date set for inspection and the names of the Engineer's representatives who will carry out the inspection after the inspection is made by these representatives and the Contractor, a report on the inspection shall be made in triplicate, one copy of which shall be given to the Contractor, and shall be signed by the representative and the Contractor.

If the inspection reveals that the Works have been completed as required, the Engineer will issue a Certificate of Completion for the Employer in respect of the Works and the date on which the Contractor notified the Engineer of his readiness to effect inspection shall be considered the date of completion of the Works and starting date of the Period of Maintenance.

If inspection reveals that the Works have not been completed as required, this shall be stated in the report. The Certificate of Completion in respect of the work will not be issued until all the Works have been found to have been completed in accordance with the Contract, and in such case the Period of Maintenance of the Works shall commence from the date of such certificate.

If the inspection detects repetitive faults at the site, the inspection will discontinue and will not resume until receipt of a written notice from the Contractor that such repetitive defects have been corrected throughout the entire area alleged to be completed.

*** End of Division 01000 ***

Signature of Client

Signature of Contractor

DIVISION 01000 – GENERAL REQUIREMENTS

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DIVISION 02000 – SITE WORK**02100 SITE PREPARATION****02101 GENERAL**

Under this section the Contractor shall carry out all work and anything therewith connected and/or necessary to prepare the site area shown on the drawings ready for the construction works. Generally the preliminary works shall include:

- Site Clearing
- Setting Out
- Demolition Works

02110 SITE CLEARING**02111 GENERAL**

The clearing and grubbing shall consist of clearing the designated area of all trees, down timber snags, bush, other vegetation, rubbish and all other objectionable material, and shall include grubbing stumps, roots, and matted roots, and disposal of all spoils material resulting from the clearing and grubbing. It shall also include the removal and disposal of structure that protrude/encroach upon, or otherwise obstructs the work, except when otherwise provided for on the plans or directed by the Engineer to be saved. The scope of this section of specifications is covered with detailed specifications laid down herein.

02112 LOCATION OF WORKS

The Engineer will define the limits of areas where clearing and grubbing is to be done. Normally it will include all land within the right of way and all other construction area including ditches, detours, minor road crossings and other areas shown on the plans or as specified or as directed by the Engineer. The Engineer will designate the fences, structures and debris and trees and bushes to be cleared where grubbing is not required. It shall not include clearing and grubbing of borrow or other pit areas from which material is secured. It shall not include the leveling or removal of blown sand dune or mounds within the site of works unless otherwise directed by the Engineer.

02113 EXECUTION**A- Grubbing and Cutting**

All roots and stumps within the limits of the site shall be grubbed and excavated unless otherwise specified or approved by the Engineer.

B- Disposal

All wood and bush shall be disposed off within ten (10) days after cutting or felling unless otherwise approved. No tree trunks, stumps or other debris shall be fallen, side cast or placed outside the limits of the Site. No debris shall be left within site unless approved in writing by the Engineer. The location of disposal areas shall be outside the limits of the site and shall be acquired by the Contractor at his own expense, acceptable to Tehsil Municipal Administration. Any useable material shall remain the property of the Employer.

C- Burning

There shall be no burning on or around the site area whatever. The Contractor shall ensure that neither his employees nor anyone whatsoever burns anything on or within specified limits around the site area.

D- Protection and Restoration

The Contractor shall prevent all damage to pipes, conduits, wires, cables or structures above or below ground. No land monuments, property markers, or official datum points shall be damaged or removed until the Engineer has witnessed or otherwise referred their location and approved their removal. The Contractor shall so control his operations as to prevent damage to trees and shrubs, which are to be preserved. Protection may include fences and boards lashed to trees to prevent damage from machine operations. The existing covered or open benchmarks should be relocated as directed by the Engineer. In the event that anything specified herein to be saved and protected is damaged by the Contractor such damages shall immediately be repaired or replaced by the Contractor at his own cost to the satisfaction of the Engineer. All areas cleared and grubbed must be approved by the Engineer or Engineer's Representative before the start of clearing operations.

02114 MEASUREMENT AND PAYMENT

No payment shall be made for the Works 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 unit rate of other items of the Bills of Quantities.

02120 SETTING OUT**02121 GENERAL**

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 of progress 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.

A- Instruments

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 points before being disturbed and accurately reset in their proper position upon completion of the work.

B- Submittals

Survey Record

Submit all survey data, computation field notes, drawings and all other survey records necessary to accomplish the work.

02122 EXECUTION**A Setting Out**

The Contractor shall trim trees, bushes and other interfering objects, not consistent with the plans, from survey lines in advance of all survey work to permit accurate and unimpeded work by his stakeout 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 or absence in or 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 period 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 therefor shall be furnished to the Engineer. All stakeout survey work shall be referenced to the centre lines 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 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 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 reference at each centre line station and at such intermediate station as the Engineer may direct. From computations and 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.

02123 MEASUREMENT AND PAYMENT

No payment shall be made for the Works 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 unit rate of other items of the Bills of Quantities.

02140 DEMOLITION WORKS**02141 GENERAL**

The work under this section of specifications consists of furnishing all plant, labour, equipment, appliances and performing all operations in connection with the demolition and removal of existing structure, if any, lying on the site at any elevation and position including disposal of demolished material to designated places. The demolition work shall be done in accordance with these specifications and as directed by the Engineer.

02142 EXECUTION**A- Demolition**

Before taking the work of demolition in hand, an inventory of all serviceable materials for which special care is to be exercised in demolition, handling or lowering down shall be made and the list shall be checked and duly approved by the Engineer or his authorized representative.

The Contractor shall be responsible for carrying out dismantling operations strictly in accordance with the specifications or direction of the Engineer, with appropriate tools and in such a manner as to avoid unnecessary damage or injury to other adjoining work, and those parts of work which are to be retained, and to render unserviceable as little of the material as possible.

The Contractor shall, if specified or directed by the Engineer, make good any damage to work caused during demolition and shall protect as far as possible all trees, shrubs, etc., near the work.

The Contractor shall at once remove all foul matter, if sewers or drains are to be removed or disturbed.

Unless otherwise stipulated or specified, no payment shall be made for shoring or under-pinning.

B- Sorting, Stacking and Disposal

Unless otherwise specified, all demolished materials shall be considered the property of the Employer and shall be disposed of as directed by the Engineer. The rate of an item shall always include the sorting out of any demolished materials, its stacking anywhere within 500 feet of the place of demolition and its safe custody till it is handed over to the Employer in accordance with the directions of the Engineer.

When so specified or directed by the Engineer, the contractor shall completely remove the whole or part of the dismantled material from the site of work and realize such profits as he can by disposing it off or pay for removing from the site and disposing it off.

02143 MEASUREMENT AND PAYMENT

No payment shall be made for the Works 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 unit rate of other items of the Bills of Quantities.

*** End of Section 02100 ***

Signature of Client

Signature of Contractor

02210 EARTH WORKS**02211 SCOPE OF WORK**

The works covered by this section of the specifications consist of furnishing all plant, labour, equipment appliances and materials and in performing all operations in connection with earthworks of all foundations, basements, underground supplies and services and for all structural units, stock piling of suitable excavated material, in accordance with this section of specifications and applicable drawings and subject to terms and conditions of the Contract.

02212 (1) GENERAL

- i. The Contractor shall acquaint himself with the nature of the ground, existing structures, foundations and subsoil, which might be encountered during excavation of earthworks.
- ii. The Subsoil stratification is indicated on the drawing for reference. However the Employer or the Engineer does not guarantee or warrant in any way that the material to be found in the excavation will be similar in nature to that of any samples which may have been exhibited or indicated in the Logs, Drawings or in any other Contract Documents or to material obtained from boring or trial holes. The Contractor shall be deemed to have made local and independent inquiries 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.
- iii. All excavations, cuttings, and fills shall be constructed to the lines, levels 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 cuttings and fills, structures and other works, caused by slips, falls or washings or any other Ground movement due to the Contractor's negligence shall be made good by the Contractor at his own cost.
- iv. Arrange for inspection by Local Authority to verify and approve the discharge of surface water and to verify the location of the sewer connection.

(2) DUST CONTROL

- i Control dust on and near the work and near off-site borrow areas if such dust is caused by the Contractor's operations during performance of the work or if resulting from the condition in which the Contractor leaves the Site.
- ii Thoroughly moisten surfaces as required to prevent dust being a nuisance to the public, neighbors, and concurrent performance of other work on the Site.

(3) ANTIQUITIES

Any ancient carvings, relics of antiquity, coins, or other curiosities, which are discovered or excavated during the progress of the work will remain the property of the Employer and are to be handed over to the Engineer.

02213 SUBMITTAL

The Contractor shall perform survey of the area where earthwork is required, plot the ground levels on the drawings and obtain approval from the Engineer before starting the earthwork.

02214 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 4.5 kg Rammer and 457 mm drop
ASTM D	2167	Density of soil in place by the Rubber-Balloon method
ASTM D	2216	Moisture content of soil

02215 EXECUTION**A- Site Preparation**

- i. The Contractor shall set out the works 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 works, the Contractor shall at his own expense rectify such error, to the satisfaction of the Engineer.
- ii. The Contractor shall construct and maintain accurate bench-marks so that the lines and levels can be easily checked by the Engineer.
- iii. The Contractor shall construct and maintain such ditches, in addition to those shown on the plans, as will adequately drain areas under construction at no extra cost to the Employer.
- iv. Clearing shall consist of filling and cutting up, or the trimming of trees and the satisfactory disposal of the trees and other vegetation designated for removal, together with downed timber, snags, bushes and rubbish occurring within the areas to be cleared. Trees, other vegetation, stumps, roots, and bushes in areas to be cleared shall be cut off flush with or below the original ground surface except such Individual trees, group of trees, and vegetation as may be indicated on the drawings or designated by the Engineer to be left standing. Individual trees, group of trees, and other vegetation, to be left standing shall be thoroughly protected from damage incident to construction operations, by the erection of the barriers or by such other means, as the circumstances require, as approved by the Engineer. Clearing operations shall be conducted, so as to prevent damage by falling trees to trees left standing, to existing structures and installations, and to those under construction, and to provide for the safety of workers, so as to provide for the safety of employees and others.
- v. Grubbing shall consist of the removal and disposal of all stumps, roots, larger than 1½" (38 mm) in diameter, matted roots in the designated grubbing areas. Stumps, roots, logs or other timber larger than 1½" (38 mm) in

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diameter, matted roots & other debris shall be excavated and moved to a depth not less than 18" (450mm) below any sub grade, shoulder or slope. In areas, where the cut is over 3ft (1.0m), grubbing shall not be necessary. In areas to be paved, or in areas indicated on the drawings as future paved areas, where, excess excavation from grading operations is placed, or in areas designated by the Engineer as future paved areas, where excess excavation from grading operations is placed, grubbing will be necessary.

- vi Timber and other refuse to be disposed off by burning, shall be burned at locations specified by the Engineer in a manner that will avoid all hazards such as damage to the existing structures, construction in progress, trees and vegetation. The Contractor shall be responsible for compliances with all pertinent laws and regulations. Disposal by burning shall be kept under constant attention until the fires have been burned out or have been extinguished. No materials will be permitted to be pushed or placed on adjacent private property without prior written approval of the Engineer.

Existing Utilities

Locate existing underground utilities in the areas of work. If utilities are to remain in place, provide adequate means of protecting during excavation operations.

Should uncharted, or incorrectly charted, piping or other utilities be encountered during excavation, consult the utility Employer immediately for directions. Cooperate with Employer and public and private utility companies in keeping their respective services and facilities in operation. Repair damaged utilities to the satisfaction of the utility Employer.

Do not interrupt existing utilities servicing facilities occupied and used by the Employer or others, except when permitted in writing by the Engineer and then only after acceptable temporary utility services have been provided.

Demolish and completely remove from the site existing underground utilities indicated to be removed. Coordinate with local utility companies for shut-off of services if lines are active.

Use of Explosives:

The use of explosive is not permitted without specific and written approval from the Engineer.

Protection of Person and Property:

Barricade open excavations occurring as part of this work, protect structures, utilities, side walks, pavements and other facilities from damage caused by settlement, lateral movement, under mining, washout and other hazards created by excavation operations.

B- Excavations

- i. Excavation shall include the removal of all material of every name and nature.
- ii. The Contractor shall give reasonable notice that he intends to commence any excavation and he shall submit to the Engineer full details of his proposals. The Engineer may require modifications to be made if he considers the Contractors proposals to be unsatisfactory and the Contractor shall give

effect to such modifications but shall not be relieved of his responsibility with respect to such work.

- iii. For bulk excavations, the Contractor shall submit for the prior approval of the Engineer full details and drawings showing the proposed method of supporting and strutting etc. The design, provisional constructions, maintenance and removal of such works shall be the responsibility of the Contractor and all cost in these respects shall be included in the unit rates for the permanent work.
- iv. The Contractor's attention is drawn particularly to his obligations under the General Conditions in respect of those works, which are in close proximity to existing buildings.
- v. Excavations shall be carried out in accordance with excavation plans and sections shown on the drawings and as directed by the Engineer.

The major portion of excavations shall be carried out by mechanical excavators and excavated materials disposed off to stock on spoil as per drawings or as directed by the Engineer. The excavation, which cannot be done by mechanical means including leveling, trimming and finishing to the required levels and dimensions shall be done manually. The materials suitable for and if required for fill and back-fill shall be stockpiled in or around the boundary of the Works with the approval of the Engineer.

- vi. The Contractor shall preserve the completed excavation from damage from slips and earth movements, ingress of water from any source whatsoever and deterioration by exposure to the sun and the effects of the weather.
- vii. All excavation of every description, in whatever material encountered shall be performed to the elevations and dimensions shown on the drawings in such a manner as to avoid interruption to work in other parts of the site. The Contractor shall be responsible for injury to the permanent works caused by excavation on other parts of the works.
- viii. Excavation shall extend to sufficient distance from walls and footing 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.
- ix. All excavations in foundations shall be taken to 6"/150 mm above the final excavation elevations shown on the drawings and the last 6"/150 mm 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 over site concrete by the end of the day. It is specifically brought to the notice of the Contractor that any excavation taken down to the trimmed elevation which is left overnight or for any length of time thereafter, uncovered by the blinding concrete, shall be required to be trimmed to such lower elevation as directed by the Engineer and any extra work or any consequent increase in the quantities caused thereby shall not be paid to the Contractor.

- x. No excavation shall be refilled nor any permanent work commenced until the foundation has been inspected by the Engineer and his permission to proceed given.
- xi. If excavations for substructures are carried below the required level, as shown in 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.
- xii. All excavation shall be performed in the dry. The placing of blinding concrete, placing of reinforcement and casting of the permanent works in the excavation shall be carried out in the dry and the Contractor shall have sufficient equipment for this purpose. Adequate precautions shall be taken to prevent any corrosion due to undercutting from underneath the previously constructed adjoining foundations.
- xiii. 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 hard-core 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.
- xiv. Excavations for deep retaining walls shall be protected from drying out by covering with tarpaulins or other means, if excavation is to stand open more than 24 hours. This is a precaution to prevent excessive surcharge loads acting on the wall, from the drying out and subsequent swelling of the clay soils when saturated either by rain or by capillarity of ground water.
- xv. If rock is encountered, it shall be removed carefully and without excessive noise and vibration. Blasting, if required shall be done by persons skilled in such work and as directed by the Engineer. Necessary permission for blasting should be obtained from respective Government Authorities by the Contractor. All necessary precautions shall be taken to see that the general public and the properties in the vicinity shall not receive any damage by such blasting. Rock, to receive footings shall be stepped and leveled.
- xvi. Existing utility lines, if any, 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 encountered during excavation and backfilling, and if damaged, shall be repaired by the Contractor at his 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.
- xvii. Excavated material suitable for use as filling material shall be stock piled at a suitable place with the approval of the Engineer. This stock piled material shall be transported back to places requiring fill or backfill. Surplus material unsuitable for use as filling shall be disposed off by the Contractor at his own cost, to location as acceptable to Tehsil Municipal Administration.

- xxiii. The bulk excavation work shall include excavation in above water table and excavation below water table. The contractor shall submit the proposal for dewatering from the areas of excavation for the approval of Engineer and shall provide all plant, equipment, pumps, sheeting, well points as required to keep the water table below 3.28 feet/1 m from the deepest foundation as shown on the drawings till the completion of, water proofing of foundation works, basement walls and footing.
- xix. The Contractor shall make independent enquiries and perform and make independent observations to ascertain the water table in the areas of excavations during the period when the construction works are in progress. The Contractor shall take whole risk of any nature for fluctuation of the water table from his own findings. The Employer does not bind in any way and shall not be responsible for any information given by him or any information, observations or values obtained from his reports, drawings and documents or anywhere in these documents.
- xx. Excavation for pits, cable trenches and equipment foundation and other structures shall be taken out to the levels and dimension shown on drawings or such other levels and dimensions as the Engineer may direct.
- xxi. Before starting the excavation, 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 profiles with cement concrete pillars.
- xxii. Excavation shall be carried out true to line, grade and width as shown on the drawings or as directed by the Engineer ensuring proper laying of the pipeline and bedding fill, construction of chambers for appurtenants and any other structures. The trench bottom shall be graded to provide even and substantial bearing over the specified bedding and of the structure.
- xxiii. The Contractor at his cost shall provide to the satisfaction of the Engineer all timbering, approved supports and shores and bracings to the sides of the excavated trench and foundations in such a manner to secure the sides of the trench and excavations from falling or adverse movement. All responsibility connected with such shoring shall rest with the Contractor.
- xxiv. Adequate clearance/working space on both sides of the structure/pipe line shall be provided for which no payment shall be made.
- xxv. The bottom of all excavations shall be carefully levelled. Any pockets of soft or loose material in the bottom of the pits and trenches shall be removed and the cavities so formed filled with lean concrete at the Contractor's expense.
- xxvi. The Engineer may require the Contractor to excavate below the elevations shown on the drawings or he may order him to stop above the elevations shown depending upon the suitable foundation material encountered.
- xxvii. If for any reasons, the levels grades or profiles of the excavations are changed adversely, 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.

C- Excavation Tolerances

Excavation shall be performed within the tolerances for excavation limits indicated on the drawings. Where no Tolerance limits are indicated, excavation shall be performed to tolerances established by the Engineer as acceptable for the design and type of work involved.

D- Backfilling

- i. After completion of foundation and basement walls and water proofing, the excavation shall be cleaned of trash and debris.
- ii. The backfilling shall include filling under the floors, around the foundations and basement walls, trenches, pipes, conduits, ducts and channels and bedding for pipes.
- iii. The backfilling work shall include loading, unloading, transporting, placing, stocking, spreading of earth, watering, rolling, ramming and compacting complete as specified herein.
- iv. Filling shall be approved selected material from excavation or other predominantly granular material and free from slurry, mud, organic or other unsuitable matter and capable of compaction by ordinary means.
- v. The stockpiled excavated material suitable for back filling shall be used for backfilling if approved by the Engineer and shall be transported by the Contractor anywhere required for the purpose of backfilling work in this contract.
- vi. The Contractor shall provide the approved quality fill and backfilling material as required to complete the fill/backfilling work.
- vii. Material for back filling shall be as approved by the Engineer and shall be placed in layers of 6"/150 mm measured as compacted material and saturated with only sufficient water and compacted by mechanical means to produce in-situ density not less than 95% of the maximum density at optimum moisture content, achieved in Test No. 15 of BS 1377.
- viii. All filled areas shall be left neat, smooth and well compacted the top surface consisting of the normal site surface soil unless otherwise directed.
- ix. Depending on the depth of fill the Engineer may instruct increased thickness of successive layers to be placed.
- x. Fill shall not be placed against foundation walls prior to approval by the Engineer. Fill shall be brought up evenly on the 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.
- xi. In case the Contractor has to arrange for the fill material the quality of the fill material will be subject to the approval of the Engineer. The Engineer shall require the Contractor to carry out various tests of the fill material. All such tests shall be made at an approved laboratory at the cost of the Contractor. Once a material from a specific source has been approved, the material for the same quality from that source only shall be used. Any fill material from borrow pits which has not been approved or the quality of which differs from the approved material shall be rejected out of hand and the Engineer reserves the right to order removal of any such materials brought to the site of the works at his discretion at Contractor's expense. In order to ensure satisfactory compaction, it will be necessary to carry out, depending upon the type of material, particle size distribution tests, determination of organic contents tests, maximum and minimum density tests and determination of optimum moisture content for the filling material.
- xii. The method of compaction, namely type of compactor, type of roller, weight of roller and number of passes proposed by the Contractor for any particular fill material shall be subject to the approval of the Engineer after the completion of satisfactory field tests, subsequent to the laboratory analyses,

using the materials and equipment proposed to be used for the earthwork in conditions similar to those likely to be encountered during construction. The final selection of the soil moisture content, the thickness of layers, the type of compaction equipment and the number of passes shall be decided after these tests, which shall be conducted at Contractor's expense.

- xiii. Having established the method of compaction to be used, no departure from this approved method shall be permitted without the prior approval of the Engineer. The adequate control of the fill and compacting operations shall be ensured by in-situ density tests and in order to obtain significant results, not less than two measurements shall be carried out per one hundred square meters of area compacted. The frequency of tests shall be determined on site and may be varied at the discretion of the Engineer as the work proceeds. Tests shall be carried out in accordance with British Standard 1377:1975 or to such other standards as approved by the Engineer. The standard of acceptance of the compaction will not be less than 95% in-situ density with respect to the maximum density, at optimum moisture content, achieved in Test No. 15 of BS 1377.
- xiv. The exact thickness of layers and the method of placing and compacting the fill shall be determined by the field tests, as stated above, but notwithstanding the results of these trials, fill shall not be placed in layers exceeding 8"/200 mm in thickness. In order to maintain control of the thickness of layers, timber profiles shall be used wherever feasible. The travelers of such profiles for each layer of fill shall be checked by the supervisory staff of the Engineer. The Contractor shall provide adequate supply of water and sufficient capacity of mechanical water carriers to ensure uniform and uninterrupted operation of compaction. The Engineer may forbid the Contractor to proceed with placing and/or compaction of fill and/or order removal and re-compaction of such fill when he finds that the Contractor has insufficient or defective equipment or that the fill has been improperly laid and/or compacted.
- xv. If it is found necessary to alter the moisture content of the fill material in any way, then very strict control shall be exercised over the wetting and/or the drying process and frequent moisture content tests.
- xvi. The fill material should be well graded non-cohesive and nearly silt-free (silt content between 5 to 10 percent) salt free and free of Organic material (less than 2%). It should also be free of stones larger than 4"/10 Cms maximum dimension.
- xvii. It should be of such nature and characteristics that it can be compacted to the specified densities in reasonable length of time. It shall be free of plastic clays, of all materials subject to decay, decomposition or dissolution and of cinder or other material which corrode piping and other metals.

E- Back Filling Tolerances

The stabilization of compacted backfill/fill surfaces shall be smooth and even and shall not vary more than 4" in 9.843 ft. or 100 mm in 3 meters from true profile and shall not be more than ½"/12.5 mm from true elevation.

F- Disposal of Surplus Material

The rejected unsuitable material and surplus excavated material shall be removed from site and disposed off by the Contractor through his own arrangement.

The disposal of surplus excavated material shall include loading, unloading, transporting, and disposing off as per Tehsil Municipal Administration acceptable location.

02216 MEASUREMENT AND PAYMENT**A- General**

Item numbers to be measured for payment have no relationship to the paras of same number in the specifications.

Except otherwise Specified herein or else-where 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 thereof shall be deemed to have been included in the quoted unit rate of the respective items of the Bill of Quantities.

- i) Dewatering to keep the basement areas upto the required depth, dry during construction of foundations and basement walls and floors,
- ii) Timber shoring, planking, strutting, sheet piling and providing slope for up-holding the sides of excavations including sheet piling left in place,
- iii) Any fill with approved material necessitated by over excavation due to fault or convenience of the Contractor,
- iv) Stockpiling of the excavated material at approved locations,
- v) Excavation and back filling involved in providing sufficient working space around basement walls and service line trenches,
- vi) All laboratory and field tests stipulated in these specifications,
- vii) Disposal of rejected unsuitable and surplus excavated material.

B- Excavation

Measurement:

Quantities of excavation shall be calculated / measured from the pre-work levels of natural 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 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 on the basis of vertical excavations required for the nominal concrete dimensions of the basements and the foundations including blinding concrete.

Quantities of excavation for service line trenches shall be measured for payment on the basis of vertical excavation faces for the Specified width as shown on the drawings.

Measurement for acceptably completed excavation works shall be made on the basis of number of cubic unit of material excavated for basements, foundations and service trenches as shown on the drawings or as directed by the Engineer.

Payment:

Payment will be made for acceptable measured quantity of excavation on the basis of unit rate per cubic unit quoted in the Bill of Quantities and shall constitute full compensation for all the works related to the item.

C- Imported Fills**Measurement**

Measurement for acceptably completed imported fill works will be made on the basis of number of cubic ft/m of compacted imported fill in position, lines and grade, and on the basis of pay line, as shown on the drawings or as directed by the Engineer for back-fill the pay line will be the same as per excavation. The quantity shall be excavation quantity minus displacement by permanent construction.

Payment

Payment will be made for acceptable measured quantity of backfill/fill on the basis of unit rate per cu.ft / cu.meter quoted in the Bill of Quantities and shall constitute full compensation for all the works related to the item.

*** End of Section 02210 ***

02310 TERMITE PROOFING**02311 GENERAL****A- SCOPE**

The work for anti-termite treatment includes spraying/injection of approved insecticide in sides and bottom of foundation trenches, floor sub-grade of the building or elsewhere as directed by the Engineer. The Scope also covers treatment of all wood works with insecticides before installation in position.

B- SUBMITTALS

- a. Samples of all the materials to be used for insecticides control for approval of the Engineer and testing in accordance with the specified standards.
- b. Method Statement for application of anti-termite chemical.

C- CODES AND STANDARDS

All methods of termite protection used herein shall be in accordance with the standard practice of National Pest Control Association, USA, and the British Wood Preserving Association, PCSIR.

D- QUALITY ASSURANCE**a. MANUFACTURER'S INSTRUCTIONS**

In addition to the requirements of these specifications, the manufacturer's instructions and recommendations for the work, including preparation of substrata and application shall be complied with.

b. APPLICATION

A professional operator shall be engaged who shall have license in accordance with regulations of governing authorities for application of soil treatment chemicals.

c. GUARANTEE

The Contractor is to guarantee that the building shall be free from termite (white ants), wood bores and other pests, which cause damage to wood or other organic material for 13 years from the date of acceptance of the building.

In the event of any damage caused within the guaranteed period, the contractor shall replace at his own cost such damaged material, finishes affected and suitably preserve and treat the entire premises with the best method known to the trade to prevent the spreading of termites.

02312 PRODUCTS**A- INSECTICIDES**

An emulsible concentrate termiticide specially formulated to prevent infestation by termites shall be used. Fuel oil will not be permitted as a diluent. A working solution of one of the following chemical elements and concentrations shall be provided.

Termidor, Dusban Tenekil Plus or an approved equivalent Chemical toxicant, emulsifiable i.e. 1 gallon in 80 gallons clear water.

Termiticide shall be obtained from the manufacturer or their authorized dealers or other approved source in sealed drums in quantity necessary for the requirement of works.

02313

EXECUTION

A- METHOD OF APPLICATION

- a. All mixing will be done at site and mixing proportion of termiticide with water shall be verified by the Engineer.
- b. Termiticide solution shall be applied with approved pressure spraying equipment maintaining a pressure of at least 30 to 40 psi to all applications, on or in earth.
- c. Soil treatment shall begin after all work of preparation of earth prior to installation of concrete has been done. After application, no additional earth moving or work upon sub grade should be done. No covering of earth or concrete should be applied over soil treatment until at least 2 hours after treatment.
- d. Termiticide solution should not be applied during wet weather, or when the earth surface is wet. Application should be made to all areas beneath raft, concrete slabs-on-grade, including sides of retaining walls extending at least 5 ft. beyond building line. Solution shall be applied in amounts of not less than of 4 liters of prepared emulsion/solution per 10.76 sq. ft. of area (4 liters of emulsion on 1 sq. meter). Termiticide shall penetrate to a depth of 3" penetration in the soil.
- e. Similar treatment as provided above shall be made at all locations where expansion joints, control joints, column bases, retaining wall faces and similar work occur at or below grade slabs.
- f. In the areas of application signs shall be fixed to show that soil treatment has been applied. Such signs shall be removed when areas are covered by other construction.
- g. Care shall be exercised to insure that no marks or damage occurs to the finished structure as a result of the work under this Section.
- h. All wood work for the entire project is to be termiticide treated (before application of solignum) in the case of material to receive both treatments. Termiticide shall be sprayed on all surfaces of all the wooden work viz. door frames, blocking, furring, planks, boards etc. before installation. Spraying is to be done at the site, after delivery and before installation. No spraying shall be necessary after fields sawing, jointing or installation of such material.

02314 MEASUREMENT AND PAYMENT**A- GENERAL**

No measurement and payment will be made for the under mentioned specified work related to the relevant items of the Bill of Quantities. The cost thereof shall be deemed to have been included in the quoted unit rate of the B.O.Q.

- a. Termite Control Treatment on wood works.
- b. Water required for mixing insecticide solution.
- c. Transportation of material and storage at site.

B- MEASUREMENT

Measurement of acceptably completed works of termite control treatment will be made on the basis of number of square feet of area treated by measuring the two dimensions (length and breadth or height) of the treated surface.

C- PAYMENT

Payment will be made for the number of square feet measured as above at the Contract unit rate per square feet and shall constitute full compensation for all the works related to the item.

*** End of section 02310 ***

02400 DEWATERING**02401 SCOPE**

The work covered by this section of Specifications shall consist of supplying all labor, materials and plant and the performance of all work necessary for lowering and continuously controlling the piezometric levels of the ground water in the subsurface material as well as the control and handling of surface water, in such a manner as to maintain the bottom and slopes of the excavations for the structures in a stable condition, and to perform in the dry, as required/shown on the applicable drawings and conditions of Contract. Dewatering drawings to be prepared by the Contractor as specified herein and as required by the Engineer.

02402 QUALITY ASSURANCE

The Contractor shall build, maintain and operate all channels, flumes, sumps and other temporary diversion and protective works needed to divert the surface water through or around the required excavations.

All excavations shall be dewatered and kept free of standing water, water seeping from the sides and bottom of the excavations above the free level or excessively muddy conditions as needed for proper execution of the excavation operations. The Contractor shall furnish, install, operate and maintain all drains, sumps, pumps and other equipment needed to dewater the excavation areas. Dewatering methods that cause a loss of fines from the bottom and slopes of the excavations shall not be permitted.

The work shall include designing, installing, operating, and maintaining a system complete with pumps and associated equipment, standby power arrangements, piezometers and all other equipment necessary to achieve the required control of the ground water and surface water in the areas as shown on the drawings, as specified herein and as required by the Engineer. The work shall also include the construction and maintenance of ditches and sumps as required to achieve the specified results.

02403 SUBMITTALS

Prior to commencement of the work, the Contractor shall supply to the Engineer for review and comments, complete plans and sketches for diverting surface water and dewatering of the required excavations. The Contractor shall submit detailed design calculations where required. To provide safe and stable excavations is the sole responsibility of the Contractor. Submission for review and comments of the required plans and sketches and any approval from Engineer shall not relieve the Contractor of any of his duties under the Contract.

The Dewatering System shall consist of the Basic Dewatering System, the Standby Power System, monitoring devices, ditches, wells, sumps, pumps and all associated equipment as specified herein or as may be required.

The basic Dewatering System shall be the minimum Dewatering system required to achieve the specified results.

The Standby Dewatering System shall be that system which may be required to achieve the specified results should part or all of the Basic Dewatering System becomes ineffective for maintenance or any reason other than a failure of the power supply.

The Standby Power System shall be the independent generating system, which may be required to keep the Dewatering system fully operational in the event of a power failure.

02404 DESIGN OF DEWATERING SYSTEM

The Contractor shall arrange to have the entire Dewatering System designed in detail, installed, maintained and operated by qualified and experienced personnel through out the course of the work.

Should the Contractor wish consideration to be given to some properly qualified Dewatering sub-contractor his name, qualifications, record of previous jobs of a similar nature, personnel to be employed on the work and other pertinent information shall be submitted to the Employer for approval with the Tender.

Two weeks prior to commencement of installation of the Dewatering System, the Contractor shall submit to the Engineer for his technical approval, complete final plans, details and descriptions of the Dewatering System.

The Contractor shall be responsible for the arrangements and location of the various Dewatering System components necessary to accomplish the specified work.

The Engineer's approval of the installed Dewatering system will be based on the demonstrated performance of the System and the effectiveness with which it satisfies the requirements for Dewatering the foundation areas during the entire period at least up to the elevation as marked on drawings and/or as directed by the Engineer.

Approval of the Dewatering System by the Engineer shall in no way relieve the Contractor from the responsibility for satisfying the Dewatering requirements as specified herein and to the satisfaction of the Engineer.

02405 DEWATERING OF THE EXCAVATION

The Contractor shall install maintain and operate the system which may include wells, trenches and pumps as required for the purpose of carrying out the excavations for the areas and subsequent construction of the structures and placement of back-fill in the dry.

The Dewatering of the excavations shall be accomplished in a manner that will prevent seepage, boils, loss of fines, corrosion, softening of the strata, and that will maintain the stability of the bottom and slopes of excavation. Should any damage to work, in the opinion of the Engineer, be due to the inadequacy or failure of the Dewatering System, in part or in whole then the supply of all labor, materials and plant & the performance of all work necessary to carry out additional or remedial work resulting from such damage shall be undertaken by the Contractor at no additional compensation.

The cost of any damage caused to the structures or the permanent works machinery and other equipment due to the failure of the Dewatering system shall be borne by the Contractor and shall be covered by proper insurance to be provided by the Contractor in accordance with the insurance clauses of the Conditions of Contract.

The Dewatering System shall be designed to operate on a continuous basis in such a manner that during excavation, water level as observed in all piezometers installed near the periphery of the excavation with their tips located below the prevailing excavation level, is at least 3-feet (one meter) below the prevailing excavation level, if the water level observed in any or all of the piezometers is higher than that specified, the excavation shall be stopped until remedial measures to the Dewatering System have been taken and the specified water levels in the Piezometers attained or until the Contractor demonstrates to the satisfaction of the Engineer that it is safe to proceed with the excavation. Piezometers tips shall be installed near the bottom of the hole drilled for that purpose.

During construction of structures and subsequent back-filling and associated work operations, the Dewatering System shall operate on a continuous basis in such a manner that the water level, as observed in the piezometers located below the level of the construction and back-filling and the water level in the piezometers is maintained at such a level till the concrete if any, has sufficiently hardened and until in the opinion of the Engineer, it is safe to allow the water level to rise up to a predetermined level.

The Dewatering System shall be maintained in operating condition so as to achieve the specified results until the construction of the structures, back-filling, and installation of machinery etc. reach a stage when, in the opinion of the Engineer Dewatering is no longer required. Thereafter the Dewatering system shall be shut off in stages as directed by the Engineer.

The Contractor shall not permit the accumulation of surface water within the confines of the excavation areas. The Contractor shall control, remove and divert surface water runoff, and water discharging from the Dewatering System away from the excavations, to a point outside the working area as required by the Engineer.

The Contractor shall perform all work including, but not limited to, the construction and maintenance of ditches and sumps and provide, install maintain and operate pumps and pipelines of adequate capacity as are necessary for the effective control of surface runoff and ground water not required to be intercepted by the Dewatering Systems.

The Contractor shall supply, install, maintain and operate as required the generators for power supply, which shall be of sufficient capacity to maintain all pumps and equipment for both the basic and standby systems, operating on a continuous basis.

The Contractor shall supply, install and maintain an alarm system, which will alert responsible personnel at the time of power failure and automatically activate the standby power units simultaneously.

The Standby Dewatering System shall be operated for a period of at least 3 hours duration each week to demonstrate its complete effectiveness. For such demonstration, no payment or compensation shall be made to the Contractor.

The Dewatering System shall be designed in such a manner that all or parts of the standby system may be directly connected to the Basic System. If during construction, it becomes necessary to make this connection, the Contractor shall expeditiously perform all work necessary to resolve the Standby Dewatering system to the requirements as hereto specified.

02406 OBSERVATIONS

The Contractor's Dewatering System shall include the supply, installation, data recording and maintenance of piezometers as may be required to demonstrate the satisfactory performance of the Dewatering System.

In order to ascertain the continuous effectiveness of the Dewatering System, the Contractor shall supply all equipment and perform all work necessary to obtain and correlate records of the water elevations in each of the piezometric observation well as records of the discharges from the Dewatering System. These data shall be obtained on a continuous basis and shall be properly compiled and copies of the compiled data shall be submitted to the Engineer daily, or as required. The Contractor shall also keep the Engineer advised on a regular basis on the equipment being utilized to effect the required results during the period when the Dewatering System is in operation.

02407 PAYMENTS

No payment shall be made for any works and operations falling within the scope of this section of specifications unless otherwise specifically stated in the Bill of Quantities.

The cost of dewatering is deemed to be included in the prices of other items of the Bill of Quantities.

*** End of Section 02400 ***

02510 PAVING AND SURFACING**02511 GENERAL****A. Description****(01) Principal Work**

Including:

- Laying Pre-cast concrete pavers (various sizes) in parking areas around the buildings and in Basement.

(02) Related Work Specified Elsewhere

-Concrete: Division 03000

B- Applicable Codes and Standards

The applicable standards of ASTM and British Standards shall include, but are not limited to following:

- ASTM C 150 Portland Cement
- ASTM C 33 Fine Aggregates
- ASTM C 172 Sampling
- ASTM C 143 Slump
- ASTM C 231 Air Content

Provisions of the American Concrete Institute (ACI) governing concrete.

C- Submittals

The Following submittals are required:

- Detail Drawings and/or Shop Drawings
- Manufacturer's Data
- Manufacturer's Standard Colour Charts
- Certificate of Compliances

02512 PRODUCTS**A. Materials****(01) Cement**

Portland cement type I or III, manufactured by an approved manufacturer and conforming to ASTM C 150. Use only one brand.

(02) Water

Clean, free of organic matter, salts, acid and alkaline substances. Water source shall be approved by the Engineer.

(03) Aggregates

Light-coloured and hard rock material suited for use as aggregates. The minimum compressive strength of aggregates shall be 1,500 kg/cm² when tested in accordance with testing procedures. Aggregates shall be clean and subject to the approval of the Engineer. They shall not contain harmful materials such as iron pyrites, mica, shale or similar laminated materials in sufficient quantity to adversely affect the strength or durability of the concrete.

- a) Coarse aggregate shall not have a percentage of absorption exceeding 5% when tested to standard method T -85-60 ASSHTO designation.
- b) Fine aggregate shall have a sand equivalent of not less than 75% when tested by standard method T-176-65 AASHTO designation.

(04) Pavers

Concrete pavers with the approved shapes and sizes and as indicated on the drawings shall be supplied. They shall have a cylinder strength of 2000 psi.

B- Setting Materials**(01) Sand for Setting Beds**

Fine aggregate complying with ASTM C 33.

(02) Sand for Joints

ASTM C 144, with gradation for unusually thin joints.

(03) Un-grouted Mortar less Setting Materials for Concrete Pavers

- a) Sand for Leveling Course: Fine aggregate complying with ASTM C 33.
- b) Sand for Joints: ASTM C 144, gradation for unusually thin joints.

02513 EXECUTION**A- Installation -General**

- 1) Do not use pavers with chips, cracks, voids, discolorations or other defects, which might be visible or cause staining in finished work.
- 2) Cut pavers with motor-driven saw equipment to provide clean, sharp, unchipped edges. Cut units to provide clean, sharp, unchipped edges. Cut units to provide pattern indicated and to fit adjoining work neatly. Use full units without cutting.
- 3) Set pavers in pattern shown and with uniform joints of width indicated.
- 4) Match existing paver patterns and jointing where indicated.

5) Tolerances

Do not exceed 1 mm unit-to-unit offset from flush, and a tolerance of 1 in 200, 1 in 500 from level of slope as indicated, for finished surface of paving.

B- Types of Paving

- 1) Hard Pavers layed and jointed in cement mortar (1:3) over 1 1/2" PCC (3000 PSI cylinder strength) over RCC slab including PCC kerb stone.
- 2) Hard Pavers jointed in and over 2" sand cushion over 4" thick compacted dry stone ballast sand grouted over compacted earth including PCC kerbstone.

C- Placing Concrete Pavers (Type 1)

Place Cement Sand mortar (1:3) for leveling course to a thickness of 40 mm.

Set concrete pavers hand tight in cement sand mortar (1:3), being careful not to disturb leveling base. Use string lines to keep straight lines. Use block splitter to cut edges when full-size units cannot be used. Select units from 4 or more blocks to blend colour and texture variations.

Finish concrete pavers as shown on the drawings.

D- Placing Concrete Pavers (Type 2)

Ascertain that the sub-grade is fully compacted and free of rust or humps, and is graded in such a manner as to fulfil the intent of the drawings which is to provide paving which is full free draining to the drainage devices or to the street.

The sand layer shall be leveled according to the lines and grades of the drawings. Deviations from the required transverse gradient of the pavement shall not exceed + 0.3%. The sand shall be kept damp until placing of the concrete block.

Place sand for leveling course and screed loose to a thickness of 40 mm taking care to ensure it remains loose until paving units are set and compacted.

Set concrete pavers hand tight being careful not to disturb leveling base. Use string lines to kept straight lines. Use block splitter to cut edges when full-size units cannot be used. Select units from 4 or more blocks to blend colour and texture variations.

Compact the pavement very carefully in order not to demolish the paving blocks and to guarantee sufficient compaction. Weight, frequency and kind of the vibrators rollers or plastic slabs shall be chosen accordingly.

Vibrate concrete pavers into leveling base with a plastic vibrator capable of a 3,500 to 5,000 lb compaction force. Perform this operation on installed areas of paving at end of each day of before any rain.

Materials and methods not specifically described but required for proper fabrication and installation of items in this section, shall be provided by Contractor subject to prior approval of Engineer, at no additional cost to Employer.

E- Repair

- 1) Remove and replace pavers which are loose, chipped, broken, stained or otherwise damaged, or if units do not match adjoining units as intended. Provide new units to match adjoining units and install in same manner as original units, with same joint treatment to eliminate evidence of replacement.

02514 MEASUREMENT AND PAYMENT**A. Measurement**

Measurement of concrete/tuff tiles Paving shall be made in Sq.Ft. of the actual surfaces completed and approved by the Engineer.

B- Rate and Payment

The acceptable quantities of Concrete/tuff tiles Paving for drive ways/side walks including excavation, preparation of sub-grade, spreading and compaction of sub-base will be paid for at the rate quoted. Such payment shall include full compensation for all materials, labour, equipment, plant and incidentals.

*** End of section 02510 ***

02910 FLAGPOLES**02911 GENERAL****A- Related Documents**

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1, Specification sections, apply to work of this section.

B- Description of Work

Extent and location of flagpoles are shown on drawings.

Refer to Division-03000 sections for 'Concrete Work' requirements.

Refer to Division-02000 sections for 'Earthworks' requirements.

C- Quality Assurance

Manufacturing Standards: Provide each flagpole as a complete unit produced by a single manufacturer including fitting accessories, bases and anchorage devices.

Design Criteria: Provide flagpoles and installations constructed to withstand a 90 mph wind velocity when flying flag of appropriate size. Use heavy pipe sizes if required for flagpole type and height shown.

Pole Construction: Construct pole and transport the same to site in one piece if possible. If more than one piece is necessary, provide snug-fitting, precision joints with self-aligning, internal splicing sleeve arrangement for weather-tight, hairline field joints.

D- Submittals

Product Data: Submit manufacturer's technical data and installation instructions for each type of flagpole required.

Shop Drawings: Submit shop drawings of flagpoles and bases, showing general layout, jointing and complete anchoring and supporting systems.

Samples: Submit samples of each finished metal for flagpoles, and accessories as may be requested.

E- Delivery. Storage and handling

Deliver flagpoles and accessories completely identified for installation procedure. Handle and store flagpoles to prevent damage or soiling.

02912 MATERIALS**A- Acceptable Manufacturers**

Subject to compliance with requirements, manufacturers offering products, which may be incorporated in the work, shall be acceptable.

B- Flagpole Type

Flagpoles: G. I. Pipes flagpoles made of type 304 alloy and having a taper of 1" every 7.14 feet. G. I. Pipes shall be in AISI # 4.

C- Flagpole Mounting

Provide manufacturers standards base system for the type of flagpole installation required.

Base Plate: For anchor-bolt mounting, furnish manufacturer's standards cast metal shoe base of same material as flagpole. Furnish and install anchor bolts and lightning ground spike as required.

Foundation Tube: For ground-set flagpoles, provide 12-guage (2.78mm) rolled steel tube, sized to suit flagpole and installation. Furnish complete with welded steel bottom base and support plate lightning ground spike, and steel centering wedges, all welded construction. Provide loose hardwood wedges at top for plumbing pole after erection. Galvanize steel parts after assembly, including foundation tube.

Provide manufacturer's standard flash collar, finished to match flagpole.

D- Fittings

FP Top Ball Manufacturer's standard flush seam ball, size as indicated, or if not indicated, to match pole butt diameter.

14 ga. (1.98mm) spun aluminium, finished to match pole shaft.

Truck: Ball bearing non-fouling, revolving, double-track assembly of cast metal, finished to match pole shaft.

Cleats: Two 225mm cast metal cleats with fasteners, finished to match Pole shaft.

Halyards: Provide 2 continuous halyards for each flagpole, as follow:

Polypropylene, white, braided.

Size 10mm (No.12)

Halyard Flag Snaps: Provide 2 swivel snaps per halyard, as follows:

Stainless steel finish.

02913 EXECUTION**A- Installation**

Refer to Division-03000 sections for 'Concrete Work' requirements.

Refer to Division-02000 sections for 'Earthworks' requirements.

Flagpole installation: Install flagpoles as shown and in compliance with final shop drawings and manufacturer's instruction.

Provide positive lighting ground for each flagpole installation.

Paint portions of ground-set flagpole below grade with a heavy coat of bituminous paint.

02914 MEASUREMENT AND PAYMENT

A- Measurement

All the items under this section of specifications shall be measured according to the standard method of measurement and shall be paid for at their respective unit rates as entered in the Bill of Quantities and as shown on drawings in accordance with the terms and conditions of the contract.

A- Rate and Payment

The unit rate shall be full compensation for all work described under this section - welding cutting and shaping to size, all paint material and painting. No separate payment shall be made for false work, any unspecified work done in fabricating workshops or yard or other erection expenses.

*** End of Division 02000 ***

DIVISION 03000 – CONCRETE WORK

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DIVISION 03000 – CONCRETE WORK**03310 PLAIN AND REINFORCED CONCRETE****03311 GENERAL****A- Scope of Work**

The work covered by this section of Specifications consists of furnishing all plant, labor, equipment, appliances and materials, and performing all operations in connection with the supply and installation of plain and reinforced concrete work, complete in strict accordance with this section of the Specifications and the applicable drawings, subject to the conditions of the Contract.

B- General Requirements

- a. Full co-operation shall be given to other trades to install embedded items.
- b. Suitable templates or instructions, or both will be provided for setting items not placed in the forms. Embedded items shall have been inspected, and tests for concrete and other material or for mechanical operations shall have been completed and approved, before concrete is placed.
- c. For special concrete finishes 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 finished concrete shall be obtained before Work is commenced.
- d. The Contractor shall also prepare bar bending schedule, and get the same approved by the Engineer, prior to commencement of work.
- e. Approximate equivalent conversion of F.P.S. and S.I. units are indicated in the text. The Engineer's decision on any specific conversion shall be final and binding on all parties.

C Codes and Standards

Latest editions of the following British, ASTM and ACI Standards are relevant to these Specifications where indicated:- (Equivalent Pakistan Standards are also applicable.)

(01) British Standards

B.S. 12-78	Portland Cement, Ordinary and Rapid Hardening (in lieu of C-1 50).
B.S. 410	Test Sieves.
B.S. 693	General Requirements for Oxyacetylene Welding of Mild Steel.
B.S. 822-1201	Concrete aggregates from Natural Sources.
B.S. 1141	Cold Worked Steel Bars for the reinforcement of Concrete. General Requirements for the Metal - Arc Welding of Mild Steel.

B.S. 1881	Methods of Testing Concrete.
B.S. 3148	Tests for Water for Making Concrete.
B.S. 4027	Sulfate-Resisting Portland Cement.
B.S. 4449	Hot Rolled Steel Bars for the Reinforcement of Concrete.
B.S. 4461	Cold Worked Steel Bars for the Reinforcement of Concrete.
B.S. 4466	Bending Dimensions and Scheduling of Bars for the Reinforcement of Concrete.

(02) ASTM Standards

A 615	Deformed Billet-Steel Bars for Concrete Reinforcement.
C 33	Concrete Aggregates.
C 39	Compressive Strength of Cylindrical concrete Specimens.
C 42	Standard Methods of Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.
C 94	Standard Specification for Ready Mixed Concrete.
C 138	Tentative Method of Test, for Weight per Cubic Foot, Yield, and Air Content (Gravimetric) of Concrete.
C 143	Standard Method of Test for Slump of Portland Cement Concrete.
C 150	Standard Specification for Portland Cement.
C 171	Standard Specification for Sheet Materials for Curing Concrete.
C 172	Standard Method of sampling fresh Concrete.
C 173	Standard Method of Test for Air Content of freshly Mixed Concrete by the Volumetric Method.
C 231	Tentative Method of Test for Air Content of Freshly Mixed Concrete by the Pressure Method.
C 260	Air Entraining Admixtures
C 309	Standard Specification for Liquid Membrane -Forming Compounds for curing Concrete.
E 329	Recommended practices for Inspection & Testing Agencies for Concrete & Steel as Used in Construction.
C 494	Chemical Admixtures for Concrete

(03) ACI Standards: ACI 214, 301, 308, 309, 315, 318, 347

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.

D- Submittals

All submittals shall be in accordance with the schedule of submittals prepared by the Contractor and approved by the Engineer according to section 01340.

a) **Proposed Mix Designs**

Submit proposed mix designs for trial design batches for each specified cylindrical strength of concrete along with samples of proposed materials. Submit proposed final mix designs for each specified cylindrical strength before concrete placement, along with samples of proposed materials which differ from those submitted previously, and reports of successful 28 calendar day strength tests.

b) **Protective Measures**

Submit to the Engineer procedures for the following:

- i) Both hot and cold weather concreting procedures shall be submitted to the Engineer by Contractor regardless of the need for the immediate implementation of such procedures. Procedures shall include insulation, enclosures and the like. Finishing procedures and timing and duration of curing shall be described.
- ii) Protection of concrete against injury due to mechanical contact and construction operations.
- iii) Welding of reinforcing bars and dowels.
- iv) Protection of curtain wall and other systems against damage.
- v) Protection of work by other trades.
- vi) Formwork removal and reshoring procedures shall be submitted by Contractor to Engineer. Procedures unique to hot and cold weather conditions shall be identified. Reshoring drawings and calculations shall be prepared under the supervision of and signed by a registered professional engineer practicing and licensed at the place the work is performed and engaged by and paid for by Contractor.
- vii) Contractor's construction procedures shall be typewritten and shall include charts and diagrams as applicable and necessary, to fully explain the subject procedures, methods and equipment operation in order to allow effective review by the Engineer, assist the Testing Agency's evaluation of the work, and to allow Contractor's personnel to perform work in full conformity with the Contract Documents.

c) **Placement Schedules**

Submit a placement schedule for review prior to start of concrete placement operations. Daily concrete pour schedules shall be submitted 24 hours in advance of planned pours.

d) **Formwork**

Submit for review copies of manufacturer's data and installation instructions for proprietary material including form coatings manufactured form systems, ties and accessories.

e) Certificates of Compliance

Submit certificates of compliance covering cement types, reinforcing steel, grout materials, additives, waterproofing mortar, waterproofing admix, waterproofing membranes, water bars, epoxy resins and other concerned materials. The certificates of compliance shall include the material or product manufacturer's statements that supplied items conform to Specifications.

f) Testing Programme

Submit test programme for all specified requirements along with the testing schedule according to section 01340.

g) Test Reports

Submit test reports showing the result of required tests and compliance with specified standards and codes. Test reports shall be certified by the Contractor and the Testing Agency.

h) Samples

Submit to the Engineer for acceptance prior to purchase, fabrication or delivery samples of materials as products where required by the Engineer.

Substitute products, materials or fixtures proposed by the Contractor shall be submitted as samples for approval. The samples shall be accompanied by detailed information about materials.

i) Shop drawings shall be submitted to the Engineer for acceptance in accordance with the requirements of the Contract Documents.

ii) Shop drawings furnished for this section shall conform to the best standards of the construction industry. Shop drawings shall be prepared by and under the supervision of competent engineering personnel. Prior to submittal, the Contractor shall check each shop drawing for compliance with the requirements of the Contract Documents.

iii) Shop drawings shall include plans, elevations, sections and complete details to describe clearly, at an ample scale, all work to be provided. Drawings shall be accurately dimensioned, where applicable, and shall be noted clearly.

iv) Work of Other Trades: Show in the shop drawings, and dimension thereon, holes required for passage of work of other sections through Cast-in-Place Concrete Work. Prepare and submit to the Engineer field work drawings for holes not shown in shop drawings.

v) Pan Joist Form Layout Drawings: The Contractor shall submit for Engineer's review and acceptance detailed shop drawings showing layout, arrangement, and details of installation and sealing of removable pan joist forms. Shop drawings shall show width, depth, taper, flange width, removal system as well as extent, control dimensions, slab thickness over forms, elevations, slopes, blockout details, penetrations, and all else required to provide a complete forming system ready to receive reinforcing steel, embedded items and concrete.

vi) Stay-in-Place Metal Form Drawings: Submit detailed shop drawings.

- vii) Submit shop drawings for curved and radial concrete formwork and identify the formwork materials proposed for use.
- viii) Construction joint and Crack-Control Joint Drawings: Show all construction joints and crack-control joints given in the drawings, specified herein, and required by Contractor to provide for the sequence of pouring. Submit in sufficient time to allow the orderly detailing of reinforcing steel. Reinforcing steel shop drawings shall be prepared in conformity with the accepted Construction Joint and Crack-Control Joint Drawings.
- ix) Reinforcing Steel, including welded wire fabric (WWF), shall be detailed in strict accordance with the methods and procedures provided in "ACI Detailing Manual". Reinforcing steel drawings shall be submitted simultaneously with related shop drawings. Prepare shop drawings, which provide for reinforcement, including dowels, properly positioned in all concrete work, so that material can be properly cut, bent and placed from information given in shop drawings. Reinforcing steel drawings shall show, to scale, all concrete work including pits, curbs, trenches, pads, equipment bases, steps, slopes radii, curves, openings, holes, blackouts and the like. Provide schedules and details showing placing sequences, bending, lengths and locations of all reinforcement.
- Show elevations of all concrete walls with top and bottom elevations, openings, ledges, pockets, construction joints, and all else needed to correctly locate all reinforcement. Detail top and bottom layers of two-way slab reinforcement on separate plans. Indicate all lap locations in the placing plans. Detail ledges, curbs, pads, trenches, openings and the like from information given in Architectural, HVAC, Plumbing, Electrical and other Contract Documents.
- x) Reinforcement for concrete work shall include all reinforcement shown or scheduled in drawings, including all reinforcement required by typical details and general notes. Provide reinforcing steel required by ACI Code 318 where such reinforcement exceeds that stipulated in drawings or specified herein.
- xi) Splices:
- Reinforcement shall be spliced in strict accordance with ACI 318. Where practical, stagger splices of adjacent bars.
 - Unless shown specifically to the contrary, all splices shall develop the full tensile capacity of the reinforcement.
 - Lapped splices shall not be used for bars larger than 35 mm (size No. 11).
 - Welded splices shall be detailed in strict accordance with Manufacturer's printed instructions.
 - Butt splices shall be detailed in strict accordance with Manufacturer's printed instructions.
 - Bars may be detailed to be placed in contact and securely wired together or separated in accordance with ACI 318 to permit embedment of the entire surface of each bar in concrete.

- xii) Detailing of reinforcing steel shall recognize the arrangement and dimensioning of individual bars, including the location of bend points, hooks and the like so as to preclude interference between bars, sets of bars, and embedded items and so as to allow clear spacing and concrete cover as provided in ACI 318. Prepare details and provided sections showing placement sequences to minimize congestion of reinforcing steel at splices, intersecting bars around openings and block-outs, and adjacent to embedded items. Illustrate and note correct placing arrangement and placing sequence to enable field placing crews to properly place and execute the work.

Provide sections to illustrate whether or not specific and typical details and notes fully clarify required placement locations. Provide suitable and necessary placing sequence information in shop drawings so as to properly instruct reinforcing steel placement personnel.

- Extend slab, joist, beam and girder reinforcement to the far face of supports except where lesser embedment is explicitly provided in the drawings.
- xiii) Submit coordinated drawings of the following:
- All sleeve locations, whether round or of other shape, penetrating exterior and interior walls, pits and other structural systems.
 - The position of all embedded items required to receive the work of other trade (such as elevators), including details needed to assure correct placement of both the embedded items and the reinforcing steel.
- xiv) Deviations: Should the Contractor desire a deviation from the Drawings or Specifications, or both, the Contractor shall call the specific deviation to attention of the Engineer in writing prior to the submittal of shop drawings showing deviations. Requests for deviations shall be submitted on Contractor's letterhead. Deviations not identified or identified only in letters of transmittal or in shop drawings, or both, without the required written description on Contractor's letterhead may not be accepted and shall be sufficient cause for the Engineer to reject and to return shop drawing including such deviations without further action. Acceptance of shop drawings including deviations not detected by the Engineer during shop drawing review, shall not relieve the Contractor from responsibility to conform strictly to the Contract Documents. Deviations will be allowed only where permitted by the Engineer in writing.
- xv) Resubmission of Shop Drawings: Prior to resubmission of shop drawings with additions, deletions, or corrections, the Contractor shall circle and identify all changes from the prior issue. Drawings submitted without each change both circled and identified clearly will be returned for resubmission.
- xvi) Detailing Personnel: Shop drawings shall be prepared by personnel completely familiar with Architectural, Mechanical, Plumbing, Electrical and other Drawings to avoid having concrete work which interferes with the work of other trades.
- xvii) Shop Drawing review: Only shop drawings marked with Notations 1, 2 or 3 may be used by the Contractor in the work. Shop drawings marked "Resubmit" shall be corrected or completed (or both) as required and shall be resubmitted to the Engineer. This process shall be repeated the number of times required to achieve the Notation 1 mark.

xviii) The Contractor shall note that the review of shop drawings by the Engineer is only for conformability with the design concept of the project and for information given in the Contract Documents. Non-conformities and errors detected during review will be noted in the shop drawings returned to the Contractor upon completion of review by the Engineer. The Engineer is not responsible for the completeness or accuracy of Contractor's shop drawings. Accepted shop drawings including deviations not detected during review will not relieve the Contractor from sole responsibility to provide work conforming strictly to the Contract Documents. Shop drawing review does not include engineering calculations except at locations where specifically and expressly indicated in the review or in individual shop drawings.

xix) Product Data

Submit printed manufacturer's literature for each manufactured item specified under "Products", along with test data as required.

xx) Mill Tests

Furnish the Engineer with certified mill test reports for cement and for steel reinforcement.

xxi) Name of Manufacturers/Suppliers Submit for acceptance by the Engineer:

- Aggregates
- Ready-mix concrete
- Reinforcing bars
- Welded steel wire fabric
- Concrete accessories
- Cement
- Admixtures
- Water proofing membranes
- Joint filler
- Waterstops
- Membrane curing, sealing, hardening and dust-proofing compound
- Bonding compound
- Waterproofing Concrete Admixture
- Waterproofing Mortar
- Feathering compound
- Non-shrink grout
- Form oil

03312 PRODUCTS

A- Materials

(01) Aggregates (Except for light-weight concrete)

- a. The sources of supply of all fine and coarse aggregates shall be subject to the approval of Engineer.

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- b. All fine and coarse aggregates shall be clean and free from clay, loam, silt, and other deleterious matter. If as required, Engineer reserves the right to have them washed by the Contractor at no additional expenses. 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.
- c. Fine aggregate shall be hard coarse sand, crushed stone or gravel screenings and shall conform to requirements of ASTM C-33.
- d. Coarse aggregate shall be gravel or broken stone or hard, durable material free from laminated structure and conforming to ASTM C-33 graded as follows for use in mass concrete such as in foundations:

<u>Total Passing</u>		<u>Percent by Weight</u>
2" B.S Sieve	(50.00 mm)	100
1-1 /2" Sieve	(38.10 mm)	95 - 100
3/4" Sieve	(19.00 mm)	35 - 70
3/8" Sieve	(9.50 mm)	10 - 30
No. 4 Sieve	(4.75 mm)	0 - 3

Coarse aggregate for all cast-in-place concrete other than mass concrete and thick fair faced cast-in-place concrete shall be graded with the following limits: -

<u>Total Passing</u>		<u>Percent by Weight</u>
1" Sieve	(25.00 mm)	100
3/4" Sieve	(19.00 mm)	95 -100
3/8" Sieve	(9.50 mm)	20 - 55
No. 4 Sieve	(4.75 mm)	0 -10

Coarse aggregate for thin fair faced cast-in-place concrete shall be graded as follows:-

<u>Total Passing</u>		<u>Percent by Weight</u>
1/2" Sieve	(12.50 mm)	100
3/8" Sieve	(9.50 mm)	85 -100
No. 4 Sieve	(4.75 mm)	10 - 30

- e. The nominal maximum size of aggregate for precast fair faced concrete, shall be smallest of the following:
 - i) One-fifth of the narrowest dimensions between sides of forms.
 - ii) One-third of the depth of slabs.
 - iii) Three-fourth of the minimum clear distance between reinforcing bars or between bars and form.
 - iv) ½" (12.50 mm).

- f. The nominal maximum size of the aggregate for normal weight precast concrete shall be smallest of the following: -
 - i) One-fifth of narrowest dimension between forms.
 - ii) One-third of depth of slab.
 - iii) Three-fourth of clear distance between bars.
 - iv) 1"
- g. The aggregate 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). The grading of the coarse and fine aggregate shall be tested at least once for every 50 tons (or 750 C. Ft.) supplied to ensure that the grading is uniform and the same as that of the samples used in the preliminary tests.

(02) Cement

- a. Cement shall conform to ASTM C - 150.
- b. Only one brand of each type of cement shall be used for concrete in any individual member of the structure.
- c. Cement shall be used in the sequence of receipt of shipment, unless otherwise directed. There shall be sufficient cement at Site to ensure that each section of Work is completed without interruption. If the cement is supplied by the Employer, the Contractor shall inform the Engineer of his requirement much before its use in construction.
- d. Cement reclaimed from cleaning of bags or from leaky containers shall not be used.
- e. The Contractor shall provide and erect, at his own cost, in a suitable place, dry, well ventilated, and water proof shed of sufficient capacity to store the cement.
- f. The 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 Contractor's expense. Any cement in containers, damaged so as to allow the contents to spill or access of the atmosphere to the cement prior to opening at the time of concrete mixing shall be rejected and removed immediately from the SITE at Contractor's expense.
- g. The mixing together of different types of cement shall not be permitted.

(03) Water

Water for washing aggregates and for mixing and curing concrete shall be clean and free from injurious matters such as oil, acid, alkali, organic matter, or other deleterious substances as determined by standard tests selected by the Engineer. It shall meet the following chemical requirements:

Water contaminants under no circumstance shall be greater than following limits: -

Oil	0.00 ppm.
Chlorides	1000 ppm
Sulphates	1000 ppm
Turbidity (Total Solids)	2000 ppm
PH Value	4.5 to 9.5

Potassium and Na OH 0.5 to 1.0% by weight of cement

(04) Reinforcement

- Reinforcement for concrete shall conform to the respective British, ASTM or other standards as specified in the Drawings and Contract Documents or as may be specified by Engineer.
- Unless otherwise specified, all plain reinforcing bars shall comply with the requirements of B.S. 4449 for plain mild steel bars and shall have a minimum yield strength of 36 ksi, (248 N/mm sq).
- Unless otherwise specified, all deformed reinforcing bars shall comply with the requirements of B.S. 4461 for deformed cold worked steel bars and shall have minimum yield strength of 60 ksi, (425 N/mm sq). With minimum elongation of 12%.
- Reinforcement shall be obtained only from the manufacturer(s), casting from Pakistan Steel Billet and approved by the Engineer. If and when required Contractor shall provide all necessary facilities to Engineer for the selection of test pieces and shall cause these to be prepared and submitted where directed for tests at Contractor's cost.
- If the reinforcement is to be supplied by the Employer, the Contractor shall inform Engineer of his requirements much before its use in construction.
- Contractor shall report immediately on receipt of any consignment, having any deviation in the standard weights of the reinforcing bars beyond those allowed in respective standards mentioned in sub-section clause (b) and (c) herein before.
- Contractor shall provide proper storage platform for reinforcement steel to protect from mud and other deleterious materials.

B- Mix Proportions

DESIGN MIXES TO PROVIDE NORMAL WT WITH THE FOLLOWING PROPERTIES

Comp: cylindrical strength (psi)	W/C Ratios (max:)	Cement content (min:) Lb/cft	Slump (max:)
5000	0.40	28	2.5" to 3"
4000	0.44	25	4" to 5"
3000	0.50	22	3"
2500	0.55	19	3"
1500	0.60	10	3"

(01) General

- The proportions of ingredients shall be such as to produce a mixture which will work readily into the corners and angles of the forms and around

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reinforcement by' the methods of placing and consolidation employed on the WORK, but without permitting the materials to segregate or excessive free water to collect on the surface. Specific approval of the Engineer is required to waive limitations on mixed proportions.

- b. The proportions of ingredients shall be selected in accordance with sub-section 06 hereafter to produce the proper placability, durability, strength and other required properties.

(02) Strength

The minimum Specified compressive strength of the concrete cylinder for Reinforced Concrete, shall be 3000 psi, (22 N/mm sq) except where otherwise noted (in Drawings. The equivalent cube strength shall be at least 25% higher than the specified cylinder strength. Strength requirements shall be based on the sampling and testing methods of ASTM C 39-72 (and BS 1881 for cube).

(03) Durability

Maximum permissible water-cement ratios for concrete in severe exposures to be as follows, unless lower water-cement ratio is required to meet specified strength limits:

(04) Slump

Unless otherwise permitted or specified, the concrete shall be proportioned and produced to have a slump of 3" (75 mm) or less. A tolerance of upto 1" (25 mm) above the indicated maximum shall be allowed for individual batches provided the average for all batches or the most recent 10 batches tested, whichever is fewer, does not exceed the maximum limit. Concrete of lower than usual slump may be used provided it is properly placed and consolidated. The slump shall be determined by the "Test for Slump for Portland Cement Concrete" (ASTM C-143).

(05) Admixtures

If required or permitted, admixtures used shall be in accordance with the manufacturer's instructions except as otherwise specified herein.

(06) Methods of Obtaining Mix Design

For concrete of normal weight, mix proportions to provide the desired characteristics shall be developed using the methods/ procedure covered by the latest edition of Recommended Practice for Selecting Proportions for Normal Weight Concrete ACI 211.1.

Trial mixtures having proportions and consistencies suitable for the Work shall be made based on ACI 211.1, using at least three different water-cement ratios which will produce a range of strengths encompassing those required for the Work. Trial mixes shall be designed to produce the specified slump. The temperature of concrete used in trial batches shall be reported.

For each water-cement ratio, compression test of cylinder/cube shall be made, cured, and tested in accordance with "ASTM C-39 or BS 1881". From the results of these tests a curve shall be plotted showing the relationship between the water-cement ratio and compressive strength. From this curve, the water-cement ratio to be used in the concrete shall be selected to produce the required/specified design strength. The cement content and mix proportions to be used shall be such that this water-cement ratio is not exceeded when slump is the maximum permitted. Control in the field shall be based upon maintenance of proper cement content and slump.

03313 EXECUTION**A- Plant and Workmanship****(01) Formwork**

- a. Forms shall be used, wherever necessary, to confine the concrete and shape it to the required dimensions. Forms shall have sufficient strength to withstand the pressure resulting from placement and vibration of the concrete and shall have sufficient rigidity to maintain specified tolerances.

Structurally adequate, formwork shall also conform to the requirements of the special architectural finishes of the in-situ Plain and Reinforced Concrete specified/or shown on the Drawings. Shop drawings of such form shall be subject to the approval of the Engineer prior to its use. Engineer shall refuse concreting of any part, which in his opinion may not yield specified finishes.

- b. Earth cuts shall not be used as forms for, vertical surface or reinforced concrete work unless required or permitted.
- c. Mud centering shall not be permitted without the prior approval of the Engineer.
- d. Formwork shall be made of either timber, steel, plywood, proprietary building boards and such special material, as may be shown on the drawings or approved by the Engineer which gives the even and fair finish to the surface of concrete. Wooden formwork shall be free from loose knots and shall be well seasoned.
- e. Formwork shall conform to the shape, lines and dimensions as shown on the plans, and be so constructed as to remain sufficiently rigid during the placing and compacting of concrete, and shall be sufficiently tight to prevent loss of cement slurry. The design and engineering of the formwork, as well as its construction, shall be the responsibility of Contractor. Where necessary to maintain the specified tolerances, the formwork shall be cambered to compensate for anticipated deflections in the formwork due to the weight and pressure of the fresh concrete and due to construction loads.
- Contractor shall establish and maintain in an undisturbed condition, and until final completion and acceptance of the Work, sufficient control points and benchmarks to be used for reference purpose to check tolerances.
- f. Requirements for facing materials are given in sub-section C "Finishing of formed surface". The maximum deflection of facing materials reflected in concrete surfaces exposed to view shall be 1/240 of the span between structural members.
- g. Where natural plywood form finish, grout cleaned finish, smooth rubbed finish, scrubbed finish, or sand floated finish is required, forms shall be smooth (faced with plywood, liner sheets, or prefabricated panels) and true to line, in order that the surfaces produced with required little dressing to arrive at true surfaces. Where any as-cast finish is required, no dressing shall be permitted in the finishing operation.
- h. Where as-cast surfaces, including natural plywood form finish, are specified, the panels of materials against which concrete is cast shall be arranged orderly with joints between panels planned in approved relations to opening, building corners, and other architectural features.
- i. Where panels for as-cast surfaces are separated by recessed or otherwise emphasized joints, the structural design of the forms shall provide for locating form ties within the, joints so that patches of tie holes will not fall within the panel areas.

- j. Forms shall not be re-used if there is any evidence of surface wear and tear or defect, which would impair the quality of the surface. Forms shall be thoroughly cleaned and properly coated before re-use.
- k. The formwork may be designed so that soffits of slabs and sides of beams, columns, and wall may be removed first leaving the forms to the soffits of beams and their supports in position.
- l. Positive means, wedges or jacks of accurate adjustment and proper shores and struts shall be provided and all settlement shall be taken up during placing of concrete. Forms shall also be securely braced against lateral deflections.
- m. Where concreting of narrow members is required to be carried out within formwork of considerable depth, temporary openings in the sides of the formwork shall be provided where necessary to facilitate the placing and consolidation of the concrete. Small temporary openings shall be provided at the bottom of the formwork to columns, walls and deep beams to permit the cleaning out of debris and observations immediately before concrete is deposit.
- n. Form ties shall be constructed so that the ends or end fasteners can be removed without causing appreciable spilling at the faces of the concrete. After the ends or end fasteners of form ties have been removed, the embedded portion of the ties shall terminate not less than twice the diameter or twice the minimum dimension of the tie from the formed faces of concrete to be permanently exposed to view except that in no case shall this distance be less than $\frac{3}{4}$ " (19 mm) when the formed face of the concrete is not to be permanently exposed to view, form tie may be cut off flush with the formed surfaces. Through bolts shall be permitted provided that they are greased to allow for easy withdrawal and the holes subsequently made good. Through bolts are not to be used on water-retaining structures.
- o. At construction joints, contact surface of the form sheathing for flush surfaces exposed to view shall overlap the hardened concrete in the previous placement by not more than 1" (25 mm). The forms shall be held against the hardened concrete to prevent offsets or loss of mortar at the construction joint and to maintain a true surface.
- p. Runways or planks for moving labor and equipment shall be provided with struts or legs and shall be supported directly on the formwork or structural member without resting on the reinforcing steel.
- q. All surfaces of the embedded items shall be cleaned and any accumulated mortar or grout from previous concreting and of all other foreign material is removed before concrete is placed in them.
- r. Board forms having joints opened by shrinkage of the wood shall be swelled until closed by wetting before concrete is placed. Plywood and other wood surface not subject to shrinkage shall be sealed against absorption of moisture from the concrete either by (1) a field applied, approved form oil or sealer, or (2) a factory applied non-absorptive liner. When forms are coated to prevent bond with concrete, it shall be done prior to placing of the reinforcing steel. Care shall be taken that such approved coating is kept out of contact with the reinforcement. Where as-cast finishes are required, materials, which will impart a stain to the concrete, shall not be applied to the form surfaces. Where the finished surface is required to be painted, the

material applied to form surface shall be compatible with the type of paint to be used.

- s. In normal circumstances generally where temperatures are above 68° F (20° C) where ordinary cement is used, forms may be struck after expiry of the following periods.

-Walls, columns and vertical sides of beams	48 hours or as directed by the Engineer.

-Slabs (Shores or- props left under, removal and refixing of props not permitted).	10 days

- Beams soffits (Shores or props left under, Removal and refixing of props not permitted)	14 days

- Removal of shores or props to slabs:

1. Spanning upto 14 ft.	10 days

2. Spanning over 14 ft.	21 days

- Removal of shores or props of beams:

1. Spanning upto 20 ft.	18 days

2. Spanning over 20 ft.	25 days

For rapid hardening cement ½ of the above period will be sufficient in all cases except vertical sides of slabs, beams and columns which should be retained for a minimum of 24 hours.

- t. Proper allowance shall be made for the decrease in rate of hardening of concrete in cold weather and the minimum periods must be increased when the mean daily temperature is below 68° F, (20° C).

- u. Top forms on sloping surfaces of concrete shall be removed as soon as the concrete has attained sufficient stiffness to prevent sagging. Any needed repairs or the treatment required on such sloping surfaces shall be performed at once and followed by the specified curing.

- v. All formwork shall be removed without such shock or vibration as would damage the reinforced concrete.

- w. When reshoring or re-propping is permitted or required, the operations shall be planned in advance and shall be subject to approval. While reshoring is underway no live load shall be permitted on the new construction. In no case during reshoring shall concrete in beams, slab, columns or any other structural member be subject to combined dead and construction loads in excess of the load permitted by Engineer for the developed concrete strength at the time of reshoring. Reshores shall be placed simultaneously with stripping operations are but in no case later than the end of working day on which stripping occurs.

Reshores shall be tightened to carry their required loads without over stressing the concrete. Reshores shall remain in place at least until representative tests of the concrete being supported have reached the strength/time specified in A.1.s.

- x. Floors supporting props or shores under newly placed concrete shall have their original supporting props or shores left in place or shall be reshored. The reshoring system shall have a capacity sufficient to resist the anticipated loads and in all cases have a capacity equal to at least one half of capacity of the shoring system above. The reshores shall be located directly under a shore position above unless other locations are permitted.

The reshoring or re-propping shall extend over a sufficient number of storeys to distribute the weight of newly placed concrete, forms, and construction live loads in such a manner that the design superimposed load of the floors supporting shores or props are not exceeded.

No loads, other than those permitted by the Engineer in connection with the actual work in hand, shall be allowed on suspended floors until 28 days after concreting where ordinary Portland cement is used and 14 days when rapid hardening Portland cement is used.

- y. It is required to give forms for reinforced concrete an upward camber to ensure that the beams or slabs including cantilever slabs do not have a sag when they have taken up their deflection. Camber, unless indicated otherwise on drawings, should be about 1/240 for supported beams and slabs and 1/180 for cantilevers.

(02) Reinforcement

- a. All metal for reinforcement shall be free from loose mill scale, loose rust, mud, oil, grease, or other harmful matter immediately before the concrete is placed.
- b. Reinforcement is to be accurately placed as shown in the Drawings; and secured against displacement by using 18-20 gauge black annealed wire ties or suitable slips at intersections and supported from the formwork by using concrete, metal or plastic chairs and spacers or hangers of an approved pattern. Where concrete blocks are used for ensuring the cover they shall be made of mortar not leaner than 1 part of cement to 2 parts of sand. Where the concrete surface will be exposed to the weather in the finished structure the portions of all accessories in contact with the formwork shall be galvanized or shall be made of plastic.
- c. Bars used for concrete reinforcement shall be fabricated in accordance with the dimensions shown in the Bending Schedule.
- d. The cutting tolerance for all bars shall be $\pm 1"$ ($\pm 25\text{mm}$).
- e. Where an overall or an internal dimension of a bent bar is specified in the schedule, the bending tolerance, unless otherwise stated, shall be as in Table 1.

Table 1 - Bending Tolerances

Dimensions of Bent Bars				Tolerance			
Over Inches	(mm)	Upto and Including Inches	(mm)	Plus Inches	(mm)	Minus Inches	(mm)
--	--	36	900	1/8	3	1/4	6.0
36	900	72	1800	1/4	6.0	1/2	12.0
72	1800	--	--	1/2	12.0	1	25.0

- f. Bars shall be placed to the following tolerances:
- | | | |
|------|---|---------------------------------|
| i. | Concrete cover to formed surface: | + /- ¼" (6.0 mm) |
| ii. | Minimum spacing between bars: | +/- ¼" (6.0 mm) |
| iii. | Top bars in slabs and beams: | |
| * | Members 8" (200 mm) deep or less: | +/- ¼" (6.0 mm) |
| * | Members more than 8" (200 mm) but not over 24" (600 mm) deep: | +/- ½" (12.0 mm) |
| * | Members more than 24" (600 mm) deep: | +/- 1" (25 mm) |
| iv. | Crosswise of member: | spaced evenly within 1" (25 mm) |
| v. | Lengthwise of members: | + /- 2" (50 mm) |
- g. Bars may be moved as necessary to avoid interference with other reinforcing steel, conduits, or embedded items. If bars are moved more than one bar diameter or enough to exceed the above tolerances, resulting arrangement of bars shall be subject to approval of the Engineer.
- h. Vertical bars in starter column shall be offset at least one bar diameter at lapped splices. To ensure proper placement, templates shall be furnished for all column dowels.
- i. Reinforcement shall not be bent or straightened in a manner that will injure the material. No bars shall be bent twice in the same place, nor shall they be straightened after bending.
- Unless permitted by the Engineer, reinforcement shall not be bent after being partially embedded in hardened concrete. Bars which depend for their strength on cold working shall not be heated for any reason (except for welding). Reinforcement larger than 1½" (38.0 mm) in dia may be bent by the use of heat at (not exceeding 1550°F). Bars bent shall not be cooled by quenching.
- j. No splice of reinforcement shall be made except as shown on working Drawings.
- k. Welding shall be permitted for bars only under suitable conditions and with suitable safeguards in accordance with B.S 693. 1856, or AWS D 12.1, provided the type of reinforcement bars have the required welding properties. Tack welding may be used to fix in position bars that cross each other, only with prior approval of the Engineer.
- l. Exposed reinforcement intended for bonding with future extensions is to be effectively protected from corrosion. Protection is also to be provided to reinforcement partly built into concrete exposed part to be built into later concrete.
- m. No concreting is to be carried out until the reinforcement has been checked and approved by the Engineer.

(03) Batching

- a. All cement, including cement supplied in bulk, shall be batched by weight. A bag of cement, unless marked otherwise, may be taken as 112 lbs (50 kg) or as directed by the Engineer
- b. Aggregate shall be batched by weight, due allowance being made for water content. Aggregate may be batched by volume only with the prior permission of Engineer. The apparatus for weight batching may be an integral part of the mixer, or a separate unit of a type approved by Engineer. It shall be accurate within 2% and shall be checked for accuracy at least once a week.
- c. Where the batching plant is of the type in which cement and aggregate are weighed in the same compartment, the cement shall be introduced into the compartment between two sizes of aggregate.
- d. Where volumetric batching of aggregate is permitted gauge boxes shall be provided for measuring the coarse and the fine aggregate. These shall be deep and narrow rather than shallow and wide. Tests for the bulking of sand shall be made at intervals and the necessary quantity of sand added.
- 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.

(04) Mixing

- a. The concrete shall be mixed in an Engineer-approved batch plant conforming to the requirement of B.S 1305. It shall be fitted with the manufacturer's plate stating the rated 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.
- b. Mixing shall continue for the period recommended by the mixer manufacturer or until apparently the mix is uniform in color, whichever period is longer. If it is desired to use a mixing period less than 1-½ minute 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% of their original height.
- e. Concrete shall be mixed only in quantities for immediate use. Concrete which has set shall not be retempered, but shall be discarded.

(05) Transport

- 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 or addition to ingredients. It shall be deposited as nearly as practicable in its final position so as to avoid rehandling or flowing. All skips 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 to minimize the loss of water/heat.

(06) Placing

- 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.
- b. No concrete is to be placed into the foundation trenches until the ground to receive the same has been examined and approved by Engineer for this purpose.
- c. The actual sequence of construction proposed by Contractor shall be subject to Engineers approval before construction starts on any part of the structure, and this sequence shall not be varied without Engineer's prior approval.
- d. The concrete shall be placed after it has been mixed as soon as 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 are 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, 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. Contractor shall ensure that the delay between mixing and placing does not exceed 30 minutes under any circumstances. Any concrete which does not satisfy this requirement shall not be used.

- e. The concrete shall be deposited as nearly as possible in its final position to avoid rehandling. In no circumstances may concrete be made to flow along the forms by the use of vibrators. Concreting shall be carried out on as a continuous operation using methods, which shall prevent separation or loss of ingredients.
- f. The free fall of concrete shall not be allowed to exceed eight feet and where it is necessary for the concrete to be lowered more than this amount, it is not to be dropped into its final position, but it is to be placed through pipe, the lower end of which shall be kept in, or close to the freshly deposit concrete. The dia. of the pipe shall be not less than 4 times the maximum size of aggregate.
- g. For mass concrete, concrete shall be placed in layers approximately 18" (450 mm) thick. Vibrator heads shall extend into the previously placed layer.
- h. The workmen carrying concrete to the SITE, and all other workmen moving about before the concrete is placed shall move only along runways or planks placed over the forms.

(07) Construction Joints

- a. Concreting shall be carried out continuously upto construction joints, the position and arrangement of which shall be predetermined with the approval of the Engineer.
- b. 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 Engineer. In general, they shall be located near the middle of the spans of slabs.
- c. All reinforcing steel shall be continued across joints. Key and inclined dowels shall be provided as directed by Engineer. Longitudinal keys at least 1½" (38 mm.) deep shall be provided in all joints in walls and between walls and slab or footings.
- d. When the work is 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.
- e. The hardened concrete of construction joints and of joints between footings and walls or columns, between walls or columns and joints in unexposed walls and all others not mentioned below shall be dampened (but not saturated) immediately prior to placing of fresh concrete.
- f. The hardened concrete of joints in exposed work, joints in the middle of 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 of similar proportions to the mortar in the concrete. The grout shall be as thick as possible on vertical surface and at least ½" (12.0 mm) thick on horizontal surface. The fresh concrete shall be placed before the grout has attained its initial set.
- g. Where the concrete has not fully hardened, all laitance shall be removed by scrubbing the wet surface with wire or bristle brush, care being taken to avoid dislodging 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" (150 mm) in thickness, and shall be well rammed against old work, particular attention being paid to corners and close spots.
- h. Stop ends for movement joints or construction joints shall be made by splitting them along the lines of 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 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.

(08) Embedded Items

- a. The material, design and location of water-stops in joints shall be as indicated in the Drawings. Each piece of premoulded water stop shall be of maximum practicable length in order that the number of end joints will be held to a minimum.

Joints at intersections and at end of pieces shall be made in the manner most appropriate to the material being used. Joints shall develop effective water tightness fully equal to that of the continuous water-stop material, and shall permanently develop not less than 50% of the mechanical strength of the parent section, and shall permanently retain their flexibility.

- b. 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 so as not to impair unduly the strength of the construction. Such sleeves, conduits in compression in 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" (50 mm) and are spaced at centers not less than thrice their diameter. Except when plans of conduits and pipes are approved by Engineer embedded pipes or conduits other than those merely passing through, shall not be larger in outside diameter than one-third the thickness of the slab, walls, or beam in which they are embedded nor shall be spaced closer than three diameters on center, nor so located as to impair unduly the strength of the construction. Sleeve pipes, or conduits within the limitations of this section may be embedded in concrete with the approval of Engineer, provided they are not considered to replace the displaced concrete.
- c. All sleeves, inserts, anchors, and embedded items required for adjoining work or for its support shall be placed prior to concreting.

All Contractors whose work is related to the concrete 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.
- d. Expansion joint material, water-stops and other embedded items shall be positioned accurately and supported against displacement. Voids in sleeves, inserts, and anchor slots shall be filled temporarily with readily removable material to prevent the entry of concrete into the voids.

(09) Consolidation

- a. All concrete shall be consolidated by vibration, so that the concrete is thoroughly worked around the reinforcement, around embedded items, and into corners of form, eliminating all air or stone pockets which may cause honeycombing, pitting, or planes of weakness. Internal vibrators shall have a minimum frequency of 800 vibrations per minute and sufficient amplitude to consolidate the concrete effectively.

Vibrators shall be inserted and withdrawn at points approximately 18" apart (450 mm). At each insertion, the duration shall be sufficient to cause consolidation, generally from 5 to 15 sec. A spare vibrator shall be kept on the Site during all concreting 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 affect an improvement in the quality of the concrete to the satisfaction of Engineer and in conformity with the provisions of sub-section 3312.B.
- c. Mechanical vibrators shall be of a type suited in the opinion of Engineer to the particular conditions.

- d. Over-vibration or vibration of very wet mix is harmful and should be avoided.

Vibrators shall not be allowed to contact the formwork for exposed concrete surface.

(10) 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 minimal 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 Engineer.

- b. For concrete surfaces not in contact with forms, one of the following procedure shall be applied immediately after completion and finishing:

- Ponding or continuous sprinkling.
- Application of absorptive mats or fabric kept continuously wet.
- Application of water proof sheet materials approved by Engineer.
- Application of other moisture retaining covering as approved.
- Application of curing compound conforming to ASTM C 309. The compound shall be applied in accordance with the recommendations of the manufacturer immediately after any sheen, which develops after finishing has disappeared from the concrete surface. It shall not be used on any surface against which additional concrete or other materials 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 area to receive bonded applications.

- c. Moisture loss from surface placed against wooden forms or metal forms exposed to heating by the sun shall be minimized by keeping forms wet until they can be safely removed. After form removal, the concrete shall be cured until the end of the limit prescribed in sub-section A-10.d. by one of the methods of sub-section A-10.b.

- d. Curing in accordance with sub-section A.10.a & A.10.b shall be continued for at least 14 days in the case of all concrete except concrete with Rapid hardening Portland cement for which the period shall be at least 7 days.

Alternatively if tests are made of cylinders/cubes kept adjacent to the structure and cured by the same methods, moisture retention measures, unless stated otherwise on drawings, may be terminated when the average compressive strength has reached 70 percent of the minimum specified works strength. If one of the first four curing procedures of subsection A.10.b is used initially, it may be replaced by one of the other procedures of that Clause any time provided the concrete is not permitted to become surface dry during the transition.

- e. When the mean daily outdoor temperature is less than 41 degree F (5° C) then temperature of the concrete shall be maintained between 50-68° F (10° C-20° C) for the required curing period of sub-section A.10.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 to concentration of heat. Combustion heaters shall not be used during the first 24 hours unless approved precautions are taken to prevent exposure of the concrete to exhaust gases which contain carbon dioxide.

- f. When necessary, provision for windbreak, shading for spraying, sprinkling, ponding or wet covering with a light colored material shall be made in advance of placement, and such protective measures shall be taken as quickly as concrete hardening and finishing operations will allow.
- 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 37° F (3° C) in any one hour or 50° F (10° C) 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 vibration. 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.

(11) Works in Extreme Weather

- a. Unless adequate protection is provided and approval is obtained concrete shall not be placed during rain. Rain water shall not be allowed to increase the mixing water nor to damage the surface finish.
- b. When the temperature of the surrounding air is expected to be below 40 degrees F (4.4° C) during placing or within 24 hours thereafter, the temperature of the plastic concrete, as placed shall be no lower than 55 degrees F (13° C) for sections less than 12" (300 mm) in any dimension nor 50° F (10° C) for any other sections.

When necessary, concrete materials should be heated before mixing and carefully protected after placing; in general, heating of mixing water alone to about 140° F (60° 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 gallons (25 liters) per bag of cement. If water or aggregate is heated above 100° F (38° 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 and aggregate having a temperature greater than 100° F (38° C).

- c. 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 90° F (32° C). For massive concrete this temperature should not exceed 70° F (21° C). When the temperature of the concrete exceeds 90° F (32° C), precautionary measures approved by Engineer shall be put into effect. When the temperature of the steel is greater than 122° F (50° C) steel forms and reinforcement shall be sprayed with water just prior to placing the concrete. The ingredients shall be cooled before mixing, or flake ice or well-crushed ice of a size that will melt completely during mixing may be substituted for all or 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 305R-91 shall also be adopted.

B- Test for Concrete Quality

(01) General

Contractor shall provide samples of concrete for testing at Engineer's direction. Proper facilities shall be provided for making and curing the test specimens in accordance with the specifications. A competent person shall be employed by Contractor whose first duty shall be to 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 and at Contractor's cost.

(02) Samples

Conduct strength tests on at least one test sample per 50 cubic yards of concrete (38 cu meters) with a minimum of one sample per concrete pour. Each test sample shall consist of no less than three concrete test cylinders/cubes made from a single sample of concrete from a randomly selected batch of concrete, taken at point of discharge from mixer or truck, cured under standard conditions. One cylinder/cube from each sample shall be tested at age 7 days and two at age 28 days unless otherwise directed by the Engineer.

(03) Adequacy of Mix

In case of concrete mix, the appropriate strength requirement shall be considered to be satisfied if none of the strengths of the specimen is below the specified strength or if the average strength of the three specimens is not less than the specified strength and the difference between the greatest and least strengths is not more than 20% of that average.

When the results of tests show that the strength of any concrete is below the minimum specified, Engineer may give instructions for the whole or part of the work concerned to be removed and be replaced at the expense of Contractor. 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, Engineer may order the proportions of that class of concrete to be changed in order to provide the specified strength.

C- Finishing of Formed Concrete

(01) General

- a. After removal of forms the surfaces of concrete shall be given one or more of the finishes specified below in locations designated by the drawing or as specified in sub-section C-05 below.
- b. When finishing is required to match a small sample furnished to Contractor, the sample finish shall be reproduced on an area at least 100 square feet in an inconspicuous location designated by ENGINEER before proceeding with the finish in the specified location.

(02) As-Cast Finishes**a. Rough Form Finish**

No selected form facing materials shall be specified for rough form finish surfaces. Tie holes and defects shall be patched, unless required to be retained if so directed by the Engineer. Fins exceeding ¼" (6 mm) in height shall be chipped off or rubbed off, otherwise, surfaces shall be left with the texture imparted by the forms.

b. Smooth Form Finish

The form facing material shall produce a smooth hard uniform texture on the concrete. It may be plywood, tempered concrete-form grade hardboard, metal, plastic paper, or other approved material capable of producing the desired finish. The arrangement of the facing material shall be orderly and symmetrical, with the number of seams kept to 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.

(03) Architectural Finishes**a. Textured Finishes**

Textured form liners may be of formed plastic sheet, wood, sheet metal, or other material designated on Drawings. Liner panels shall be secured in forms by cementing or stapling, but not by methods which will permit impressions of nail heads, screw heads washers, or the like to be imparted to the surface of the concrete, unless shown otherwise on the Drawings. Edges of textured panels shall be sealed to each other or to dividing strips, if specified or shown, to prevent bleeding of grout. The sealant used shall be non-staining to the surface.

b. Applied Finishes:

When finishes of plaster or similar trowelled materials are to be applied, the surface of the concrete shall be prepared to ensure permanent adhesion of the finish. If the concrete is less than 24 hours old, it can be roughened with a heavy wire brush or scouring tool. If the concrete is older the surface may be roughened mechanically or by etching with dilute hydrochloric acid. After roughening, the surface shall be washed free of all dust, acid, chemical retarder, and other foreign material before the final finish is applied.

(04) Rubbed Finishes

The following finishes shall be produced on concrete with a smooth form finish. Where smooth rubbed finish is to be applied, the forms shall have been removed and necessary patching completed as soon after the placement of the concrete as possible without compromising any structural requirements.

a. Smooth Rubbed Finish:

Smooth rubbed finish shall be produced on newly hardened concrete not later than a day following form removal.

Surfaces shall be wetted and rubbed with Carborundum brick or other abrasive until uniform color and texture are produced. No cement grout shall be used other than the cement paste drawn from the concrete itself by the rubbing process.

b. Grout Cleaned Finish:

No cleaning operations shall be undertaken until all contiguous surfaces to be cleaned are completed and accessible. Cleaning, as the work progresses shall not be permitted.

Mix 1 part Portland Cement and 1-½ part fine sand with sufficient water to produce a grout having the consistency of thick paint. White Portland Cement shall be substituted for a part of the Grey Portland Cement in order to produce a color matching the color of the surrounding concrete, as determined by a trial patch. Wet the surface of the concrete sufficiently to prevent absorption of water from the grout and apply the grout uniformly with a brush or a spray gun. Immediately after applying the grout, scrub surface vigorously with a cork float or stone and fill all air bubbles and holes. While the grout is still plastic, remove all excess grout by working the surface with a rubber float, sack or other means. After the surface whitens from drying (about thirty minutes at normal temperature) rub vigorously with clean burlap. The finish shall be kept damp for at least 36 hours after final rubbing.

c. Cork Floated Finish:

1. Remove forms at an early stage, within 2 to 3 days of placement where possible.
2. Remove ties, and all burrs and fins.
3. Mix 1 part Portland cement and 1 part fine sand with sufficient water to produce a stiff mortar.
4. Dampen surface.
5. Apply mortar with firm rubber float or with trowel, filling all surface voids.
6. Apply a small amount of water with a fog spray to prevent too rapid drying of compressed mortar.
7. Apply a small amount of water with a fog sprayer.
8. Produce the final texture with a cork float using a swirling motion.

(05) Unspecified Finishes

If the finish is not designated on the Drawings, the following finishes shall be used as applicable:

a. Rough Form Finish:

For all concrete surface not exposed to public view and / or are specified to have subsequent finishing.

b. Even & fair Form Finish:

For all concrete surfaces exposed to public view and or are not required to have subsequent finishing.

(06) Related Unformed Surfaces

Tops of walls or buttresses, horizontal offsets, and similar unformed surfaces occurring adjacent to formed surfaces shall be struck smooth after concrete is placed and shall be floated to a texture reasonably consistent with that of the formed surfaces. Final treatment on form surfaces shall continue uniformly across the unformed surfaces.

D- Repair of Surface Defects

(01) General

- a. Any concrete failing to meet the specified strength or not formed as shown on Drawings, concrete with surface beyond tolerances or with defective surfaces which cannot be properly repaired or patched in the opinion of Engineer shall be removed and replaced at Contractor's expenses. 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. Only in case of minor surface defects, Engineer may approve a surface treatment in accordance with the subsection D-02
- b. All ties and bolt holes and all repairable defective areas shall be patched immediately after the removal of forms.

(02) Repair of Defective Areas

- a. All honeycombed and other defective concrete shall be removed down to sound concrete. The area to be patched and area at least 6" (150 mm) 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 or an approved bonding agent shall then be well brushed/ applied into the surface.
- b. 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 2-½ parts sand by damp loose volume.
- c. The quantity of mixing water shall be not 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.
- d. 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 lose 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 one hour before being finally finished. The patched area shall be covered by approved curing compound.

- e. Where as-cast finishes are specified, the quantity of patched area shall be strictly limited. The combined total of patched areas in as-cast concrete surfaces shall not exceed 2 square ft. in each 1000 square feet of as-cast surface. This is in addition to form tie patches, if the project design permits to fall within as-cast areas.
- f. 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 color match with the concrete when both patch and concrete are cured and dry. After initial set, surface of patches shall be dressed manually to obtain the same texture as surrounding surfaces.
- g. 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.

(03) Tie and Bolt Holes

After being cleaned and thoroughly dampened, the tie and bolt holes shall be filled solid with patching mortar.

(04) Proprietary Materials

If permitted or required by 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 recommendation with prior approval of Engineer.

E- Concrete Construction Tolerance

Where tolerances are not stated in the Specifications or Drawing for any individual structure or feature, 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 completed work within the tolerance limits. These allowable tolerances shall not relieve Contractor of his responsibility for correct fitting of indicated materials. These tolerances are not cumulative.

(01) Variation from the plumb

- a. In the lines and surfaces of columns, piers and walls.
 - * Maximum for the entire length or height: 3/16" (4.5 mm)
- b. For exposed corner columns, control joint grooves and other conspicuous lines.
 - * Maximum for the entire length or height: 3/16" (4.5 mm)

(02) Variation from the levels or the grades indicated on Drawings

- a. In floors, ceilings, beam soffits, and in arises.
 - * In any 10 feet (3 meters) of length: 1/4" (6 mm)

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- * In any bay or 20 feet (6 meters) maximum: 3/8' (10 mm)
- * Maximum for the entire length: 3/4" (20 mm)
- b. For exposed lintels, sills, parapets, horizontal grooves, and other conspicuous lines:
 - * In any bay or 20 feet(6m) maximum: 1/4" (6 mm)
 - * Maximum for the entire length: 1/2" (12 mm)
- (03) Variation of the entire building lines from established position in plan and related position of columns, walls and partitions**
 - a. In any bay or 20 feet (6 m) maximum: 1/2" (12 mm)
 - * Maximum for the entire length: 1" (25 mm)
- (04) Variation of the size and location of sleeves, floor openings and wall openings: 1/4" (6m)**
- (05) Variation in cross-sectional dimensions of columns and beams and in the thickness of slabs and walls.**
 - Minus: 1/4" (6 mm)
 - Plus: 1/2" (12 mm)
- (06) Footings**
 - a. Variations in dimensions in plan.
 - * Minus: 1/2" (12 mm)
 - * Plus (plus variation applied to concrete only, not to bars dowels): 2" (50 mm)
 - b. Misplacement or eccentricity of concrete.
 - * 2 percent of the footing width in the direction of misplacement but not more than 2" (50 mm)
 - c. Reduction in thickness
 - * Minus 5 percent of specified thickness.
But not more than 1" (25 mm)
- (07) Variation in Steps**
 - a. Rise 1/8" (3 mm)
 - Tread: 1/4' (6 min)
 - b. In consecutive steps
 - Rise: 1/16" (1 mm)
 - Tread: 1/8" (3 mm)

(08) Tolerance for Precast Concrete

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 product will be within the following limits at the time of placement of these units in the structure, unless otherwise noted on Engineer's Drawings.

- a. Overall dimensions of members per 10 ft (3 mm): $\pm 1/16"$ (1mm)
- b. Cross-sectional dimensions Section less than 3" (75mm): $\pm 1/16"$ (1mm)
 Section over 3" (75mm) less than 18" (450mm): $\pm 1/8"$ (3 mm)
 Section over 18" (450 mm): $\pm 1/4"$ (6 mm)
- c. Deviations from straight lines in long sections. Not more than 1/8 inch per 10 ft (3mm / 3 m).
- d. Deviation from specified camber $\pm 1/16"$ (1.5 mm) per 10 ft (3m) of span. Maximum differential between adjacent units in erected position 1/4 inch (6 mm).

(09) Tolerance for Pavements

- a. Ramps
 - * Departure from established alignment $\pm 1/2$ inch (12 mm).
 - * Departure from established longitudinal $\pm 1/4"$ (6 mm) grade on any line.
 - * Departure from transverse template contour except at transverse joints $\pm 1/8$ inch (± 3 mm).
 - * Departure from transverse template control at transverse joints $\pm 1/4"$ (± 6 mm) in width of one traffic lane.

(10) Pavements for Parking Areas

Twice values listed for ramp pavements.

03314 ACCEPTANCE OF STRUCTURE**A- General**

- a. Completed concrete work which meets all applicable requirements will be accepted subject to the other terms of the Contract Documents.
- b. Completed concrete work which fails to meet one or more requirements and which has been repaired to bring it into compliance will be accepted subject to the other terms of the Contract Documents.
- c. Completed concrete work which fails to meet one or more 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 complies with the requirements.

B Dimensional Tolerances

- a. Formed surfaces resulting in concrete outlines smaller than permitted by the tolerances of Sub-Section 03313 E shall be considered potentially deficient in strength and subject to the provisions of Sub-Section 03314 D.
- b. Formed surfaces resulting in concrete outlines larger than permitted by the tolerances of Section 03313 E 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 Section.

C- Appearance

- a. Architectural concrete with surface defects exceeding the specified limitations shall be removed in accordance with this Section.
- b. Concrete members cast in the wrong location may be rejected if the strength, appearance or function of the structure is adversely effected or misplaced items interfere with other construction.
- c. Inaccurately formed concrete surfaces exceeding the limits of Section 6 & of Section 10 and which are exposed to view, may be rejected and shall be repaired or removed and replaced if required.
- d. Other concrete exposed to view with defects which adversely affect the appearance of the specified finish may be repaired only by approved methods.
- e. Concrete not exposed to view, but of defective appearance, may be accepted at the discretion of the Engineer.

D- Strength of Structure

- a. The strength of 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 Sub-Section 03313 B.
 - Reinforcing steel size, quantity, strength, position or arrangement at variance with the requirements of Sub-Section 03312 A (04) & 03313 A (02) of specifications.
 - 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 extreme temperature during the early stages of hardening and strength development.
 - Mechanical injury, construction fires, accidents or premature removal of formwork likely to result in deficient strength.
 - Poor workmanship likely to result insufficient strength.
- b. Structural analysis and/or additional testing may be required when the strength of the structure is considered potentially deficient.

- c. Core tests may be required when the strength of the structure is considered potentially deficient.
- d. 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 results evaluated in accordance with ACI Standard 318.
- e. Concrete work judged inadequate by structural analysis or by results of a load test shall be reinforced with additional construction, if so directed by Engineer or shall be replaced, at the Contractor's expense.
- f. The Contractor shall pay all costs incurred in providing the additional testing and/or analysis required by this Section.
- g. The Employer will not pay any costs of additional testing and/or analysis which is made at Engineer's request and which is not required by specifications, or the Contract Documents.

03315 METHODS OF MEASUREMENT OF CONCRETE WORKS**A- General**

- a. Unless otherwise specifically stated in the Bill of Quantities, or herein, all items shall be deemed to be inclusive of, but not limited to, the following:
 - i. Labor/plant and all costs in connection therewith.
 - ii. Materials, goods and all costs in connection therewith, e.g. conveyance, delivery, unloading, storing, returning, packing, handling, hoisting, lowering.
 - iii. Fitting and fixing materials and goods in position.
 - iv. Waste of materials, and square cutting.
 - v. Mixing, transporting, hoisting, placing in or at any level, compacting through vibration & curing etc. complete including the cost of all types of formwork & its removal (but excluding cost of reinforcement).
 - vi. Establishment charges, overhead charges and profit.
 - vii. All other expenses, charges and taxes specified in Conditions of Contract.
 - viii. Dewatering of foundations.
- b. Works shall be measured net as fixed in position as per drawings and instructions of Engineer. Each measurement shall be taken to the nearest 1/2" (12 mm). This rule shall not apply to any dimensions stated in the descriptions.

B Concrete

- a. Concrete shall be measured as executed but no deduction shall be made for the following:
 - Volume of any steel embedded in the concrete.
 - Volume occupied by water pipes, conduits etc., not exceeding 4 square inch each in cross-sectional area.
 - Voids not exceeding 1 square foot in work given in square feet. If any void exceeds above limit total void shall be deducted.

- Voids not exceeding 1 cubic foot in work given in cubic feet. If any void exceeds above limits, unit total void shall be deducted,
- b. Voids, which are not to be deducted as per Sub-Section "B.a" 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 deduction irrespective of size.
- c. Junctions between straight and curved works shall in all cases be deemed to be included with the work in which they occur.
- d. Concrete work shall be classified and measured separately as follows unless otherwise described elsewhere: -
 - Buildings, foundation beams, foundation slabs, footings, bases of columns, machine foundations, mass concrete etc., in cubic feet.
 - Floor slabs on ground with floor beams in cubic feet.
 - Walls in foundations, plinth and superstructure in cubic feet stating thickness.
 - Columns, piers, pilasters, pillars etc., in cubic feet.
 - Lintels, beams and brackets in cubic feet.
 - Suspended floors, roofs and ramps in square feet stating thickness.
 - Stairs (including landing) in cubic feet.
 - Railings in cubic feet, square feet, or linear feet stating description.
 - Parapets, thin walls and the like in cubic feet stating thickness.
 - Jali, blocks in square feet stating thickness & description.
 - Precast concrete items shall each be enumerated except if otherwise shown in the Bill of Quantities, separately stating the description.
- e. Measurement of walls shall be taken between attached columns, piers or pilasters. The thickness of attached columns, piers or pilasters shall be taken as the combined thickness of the wall and the columns, piers or pilasters, Attached or isolated columns, piers, pilasters 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 caused by openings in walls shall be classified as walls.

Columns shall be measured from the top of footings/beams or floor surfaces to the under side of beams or slabs as the case may be. Where the width of the beams is less than the width of columns, the extra width at the junction shall be included in the beam.

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 below or above the slab.

C- Formwork

- a. Formwork (if separate and extra payment is specifically stated in Bill of Quantities) shall be measured in square feet as the actual surface of the finished structure which is required to be supported during the deposition of

the concrete, including the upper surfaces to the work sloping more than 15 degree from the horizontal. No allowance shall be made for overlaps and passing at angles and no deduction shall be made for the following: -

- Voids not exceeding ten square feet.
- b. Formwork shall be deemed to be inclusive of, but not limited to items detailed in section 01 and the following: -
 - Batten, struts, reversed cut strings, bolting, oiling, wedging, easing, striking, removing and making good exposed faces of concrete after removal of formwork. Also yokes, wales sheathing, jack rods, jacks, working platforms and finishers, scaffolds, etc.
- c. Forming chamfers not exceeding 2" (50 mm) wide and forming splayed internal angles not exceeding ½" (12 mm) wide shall not be paid for extra.
- d. Temporary stop ends for constructed joints shall not be measured and paid for.
- e. Classification of formwork (if separate and extra payment specifically stated in the Bill of Quantities) shall be as follows:
 - To horizontal or sloping soffits of suspended slabs, floors, roofs, staircases, landings and the like.
 - To sloping upper surfaces of suspended slabs, floors, roofs and the like where more than 15 degree from horizontal.
 - To vertical or battering sides of foundations, foundation beams and slabs, ground beams, machine foundations and the like.
 - To vertical or battering sides of walls, solid balustrades and the like.
 - To vertical or battering sides.
 - To vertical or battering sides of stanchion castings, columns, piers, plasters and the like.
 - To sides and soffits of openings in walls, recesses in walls, projecting panels on walls and the like.
 - To sides and soffits of horizontal or sloping beam casings, beams, brackets, lintels, staircase, strings and the like.
 - To sloping upper surfaces of beam casings, beams, brackets, lintels, staircase-strings and the like where more than 15 degrees from horizontal.
 - To edges of beds, roads, footpaths, paving and the like.
 - To edges of suspended slabs, floors. roofs, landing and the like.
 - To risers of steps and staircases.
 - To sides of kerbs, upstands and the like.
- f. Formwork to throats, grooves, chases, rebates, chamfers over 2" wide (50 mm) splayed internal angles over ½" wide (12.5 mm) moldings and the like shall each be measured separately in linear feet stating the size.

D- Reinforcement

- a. The rate tendered for any type of reinforcement by the Contractor shall also be inclusive of the cost of binding wire, wastages, and the cost of concrete, metal or plastic chairs and spacers or hangers, etc.
- b. All reinforcement shall be provided in length shown in Drawings and as per Specifications.

Should the Contractor provide lengths of reinforcement which are greater than shown on the Drawings no payment of extra length shall be made. Overlaps, unless clearly shown in working Drawings, shall not be allowed and measured.

- b. The Contractor shall be paid for reinforcement by weight computed from Table-2 and from linear measurements of reinforcements actually used at Site as per the Drawings, Specifications and instructions of Engineer. No payment shall be made for steel chairs or wastage. Contractor shall not claim for the difference in the actual weights of bars and their standard weights given in Table -2.

Table-2

Nominal Bar Diameter (Inches)	Bar Number	Weight lbs/ft
1/4"	-	0.167
3/8"	#3	0.376
1/2"	#4	0.668
5/8"	#5	1.043
3/4"	#6	1.502
7/8"	#7	2.044
1"	#8	2.670
1 1/8"	#9	3.400
1 1/4"	#10	4.303
1 3/8"	#11	5.313
1 1/2"	#12	6.014
1 3/4"	#14	7.650
2 1/4"	#18	13.600
(mm)		(kg/m)
8		0.395
10		0.616
12		0.887
16		1.576
20		2.463
22		2.980
25		3.849
28		4.828
32		6.306
36		7.981

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03316 RATE AND PAYMENT

The unit rate for various types of Portland Cement Concrete shall be full compensation for all the work specified in this section and shall include all forms, false work, joints, weep-holes, drains, bearing pads, setting anchor bolts and dowels, surface finish and cleaning up as shown on the plans or as ordered by the Engineer.

*** End of Section 03310 **

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03320 WATER STOPPERS**03321 GENERAL****A- Scope of work**

The work covered by this section of the Specifications consists of furnishing all labor, tools, scaffolding, equipment for centrally and externally placed water stop profile, materials required for mechanical fixing etc. and in performing all operations in connection with procurement, transportation and delivery and application/installation etc. of all work classified as water stoppers, including all items supplied by other trades and customarily built-in and/or installed under this section or required to complete this work, in strict accordance with the requirements of the Drawings and as specified herein, and subject to the Terms and Conditions of the Contract Documents.

B- General

The water swelling type water stoppers suitable for all construction and expansion joints subject to hydrostatic pressure on one or both sides, and similar products are required to be installed at locations indicated on the Drawings and as directed by the Engineer.

C- Related Specifications

The material shall conform to the following standards:

* U.S. Corps of Engineers CRD-C572-74

* B.S. 2782 pt 3

03322 PRODUCTS**A- Materials**

The product shall be made of flexible polymer composites based on a newly developed polymer technology. The polymer composites should have high chemical resistance capable of storing water in their molecular structure by increasing their volume. The acceptable products shall include MASTERFLEX 610 as produced by (i) MBT Middle East LLC, P.O. Box 37127, Dubai, UAE, (ii) SPECTite Swellseal, PO Box. 61347, Dubai or approved equivalent product from a recognized manufacturer acceptable to the Employer.

B- Technical Data

Basis : Polymer Composites

Resistance to micro-organisms : Resistance

Water pressure resistance : 50m (5bar)

Water seepage (when placed in expansion joint) : None

Application temperatures : -30 °C to ≤ 50 °C

Freeze/thaw resistance : No influence before and after concreting.

C- Storage

Store under cover out of direct sunlight and protect from extremes of temperature. In tropical climates the product must be stored in an air-conditioned environment.

03323 EXECUTION**A- Preparation**

All joints to be waterproofed must first be cleaned. Free standing water and sharp protrusions must be prevented. The water stopper material can be applied on moist or frozen surfaces. The water stopper should be protected from accidental exposure to form release agents.

B- Placing

For normal joint widths of 200-400mm (8 to 16 inches), water stopper shall be placed in the middle of the joint. For additional safety thicker walls should be fitted with double quantity.

The water stopper shall be glued into the joint with a special adhesive as recommended by the manufacturer or mechanically fixed to the construction joint with nails.

Regardless of the method used for holding the water stopper in place, it MUST always be secured so that the water stopper is in close contact with the surface of the substrate, as otherwise the full waterproofing effect will not be obtained.

After placing the water stopper the joint area should be kept clean and free of loose dirt and stones before concreting. The minimum concrete cover of water swelling water stopper is 80mm.

Water swelling stopper should never be glued at butt joints, but laid with a 20mm overlap.

03324 RATE AND PAYMENT

Water stoppers, where indicated on the drawings shall be paid as per linear foot installed at site.

Payment shall only be made for those construction joints which are shown on the drawings, whereas no payment shall be made for those joints which are added by the contractor for his own convenience although approved by the Engineer.

*** End of Section 03320 ***

*** End of Division 03000 ***

DIVISION 04000 – MASONRY

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DIVISION 04000 – MASONRY WORKS**04200 CEMENT CONCRETE BLOCK MASONRY****04201 GENERAL****A- Scope of Work**

The work covered by this section of the Specifications consists of furnishing all labour, tools scaffolding, hoisting equipment and masonry materials of every kind; and in performing all operations in connection with procurement, transportation and delivery, erection and building in of all work classified as masonry work and/or included as such herein, i.e., concrete masonry units; masonry mortars; and all related items and appurtenances, including all items supplied by other trades and customarily built-in and/or installed under mason work or required to complete mason work, in strict accordance with the requirements of the Drawings and Schedules, as specified herein, and subject to the Terms and Conditions of the Contract Documents.

B- Codes and Standards

Unless otherwise specified or shown, the following codes and standards shall apply:

ASTM C 31	Making and curing concrete test specimen in the field.
ASTM C 39	Compressive strength of Cylindrical concrete specimen.
ASTM C 90	Hollow load bearing concrete masonry units.
ASTM C 144	Aggregate for masonry mortar.
ASTM C 270	Mortar for unit masonry.
ASTM C 404	Aggregate for masonry grout.
ASTM E 119	For tests of Building Construction and Materials.
UBC UL 618	Concrete masonry units, fire resistance index.
ACI 531	Building code requirements for concrete masonry structure.

C. Submittals**(01) Samples**

Submit three samples of each type of block required, and the full range of exposed texture to be used in the completed works. The review will be for texture only.

(02) Test Reports

Reports for compressive strengths of masonry units, grout and mortar.

04202 PRODUCTS**A. Materials for Blocks**

Cement, aggregate and water for concrete blocks shall conform to the requirements as specified in the section for "Plain and Reinforced Concrete".

B. Concrete Block Making

- a) The blocks shall be machine moulded. The block making machines shall be of the standard approved by the Engineer. They shall be operated according to the instructions laid down by the manufactures.
- b) The blocks shall be continuously water cured by sprinkling for a minimum of 10 days and covered between sprinkling operations with 4 mils thick polyethylene sheeting. After 10 days water curing period the blocks shall be air dried. Under no circumstances will blocks be used in the work until they are completely dry. During curing period no surface of the block will be allowed to dry.
- c) Cured concrete blocks shall be stored off the ground, stacked on level platforms which allow air circulation under stacked units. Units shall be covered and protected against wetting.
- d) Care shall be exercised in the handling of all concrete blocks. No damaged blocks shall be used in the work.
- e) The blocks cast on different dates shall be stacked separately and must be labelled showing the date on which they are cast.

C. Properties of Blocks

- a) Block sizes, unless otherwise indicated on drawings, shall be 16" x 8" and 16" x 4". Physical requirements shall comply with relevant ASTM or equivalent approved standards.
- b) For non-load bearing wall the cement, sand and coarse aggregate shall be volume batched in the minimum ratio of one part cement, three parts sand and six parts coarse aggregate and shall be mixed in a concrete mixer.
- c) For load bearing Hollow /Solid block wall the mix unless otherwise stated shall be proportioned to meet the following strength requirements:
 - i) Solid Load Bearing Concrete Masonry Units shall have a 28 days compressive strength of not less than 1800 psi (126 kg/cm.sq) average of 3 units tested or 1500 psi (106 kg/cm. sq) per individual unit tested.
 - ii) Hollow Load Bearing Concrete Masonry Units shall comply with ASMT C 90, grade N-1 (moisture controlled), and shall have a 28 day compressive strength of 1350) PSI (96 kg/cm sq.)

The compressive strengths shall be verified by tests in accordance with UBC section 2404, para 2.

- d) The Contractor shall provide test results proving the average minimum crushing strength of the blocks prior to the commencement of the construction. Further test results shall be provided as required by the

Engineer, to ensure that all batches of blocks have the minimum specified crushing strength.

- e) The test shall be carried out by an authority approved by the Engineer. Evidence shall be produced that the block manufacturer has an efficient method of quality control. The Engineer will require to periodically test samples of blocks, and the Contractor shall make any necessary arrangements.
- f) Hollow concrete block units wherever specified shall have cores with cross sectional area at least equal to the percent of gross area of block given below:

8 in. (200mm)	38 percent
6 in. (150mm)	30 percent
4 in. (100mm)	No requirement
- g) Minimum shell wall thickness be 1-1/4 in. (32mm).
- h) Permissible tolerance in size of block shall be 1/8 in (3mm) each way.
- i) Special shapes for lintels, corners jambs sash, clean outs, control joints and headers, bonding and other particular needs shall be provided where required.

D- Suction Rate

The Contractor shall, at his own cost satisfy the Engineer that the suction rate of the block when determined in accordance with Appendix 'A. of BS 3921 does not exceed 20g/dm.sq/min, or that the Contractor is able to adjust it so that it does not exceed this value on Site.

E- Soluble Salt Content

For exposed block work, the contents by weight percent of soluble sulphate, calcium magnesium, potassium and sodium radicals, shall not exceed 0.30, 0.10, 0.03 and 0.03 percent respectively, when ascertained in accordance with BS 3921 at the cost of the Contractor.

F- Mortar Constituents

(01) Cement

Cement shall conform to ASTM C-150, type II low alkali non-staining without air entertainment.

(02) Sand (Aggregate)

Sand and its grading shall comply with the requirements of ASTM C-144 (100% passing the U.S equivalent No. 16 sieve). Sand that has been in contact with seawater shall not be used unless it has been thoroughly washed to the satisfaction of the Engineer.

(03) Water

Water shall conform to the specifications set forth in Section of Plain and Reinforced Concrete.

(04) Lime

Hydrated lime shall conform to ASTM C-207 type S. If it is not available use quick lime according to ASTM C-5

(05) Mortar Proportion and Mixing

a) Cement, Lime and Sand shall be mixed in proportion, by volume, as follows: -

Type (1) 1:1:6 (Cement: Lime: Sand)

Type (2) Alternatively use 1:4 (Cement: sand) mix subject to the prior approval of the Engineer.

b) Mix only as much mortar in a mortar mixture as can be used in one hour for Type-1 and 30 minutes for Type-11 after water has been first mixed into the batch.

c) Do not retemper the mortar.

d) Where cement lime mortar is used, sand and lime shall be mixed first and cement to be added later on.

e) Compressive strength of mortar specimen tested in accordance with ASTM C 39 shall not be less than 3000 psi (210 kg/cm sq.).

G- Reinforcing and Anchors

a) Vertical and horizontal reinforcement, shall be as indicated on the drawing.

b) Block masonry anchors and ties required to connect masonry with structural member shall be 3/8" dia (9.5mm dia) bars every 3rd course, anchored 12" (300mm) in each jointing element.

c) Additional details of anchors, if any, are shown on drawings.

d) Alternate compatible anchoring system may be used subject to the approval of the Engineer.

e) All Reinforcing steel shall conform to ASTM A 615 Grade 40 M.S bars.

04203 EXECUTION**A- Installation**

a) Blocks shall be laid true to line, level and laid in accurately spaced courses in stretcher bond with vertical joints of each course located at centre of units in alternate courses below. Each course shall be properly bonded at corners and intersections of walls. Courses of block shall be kept plumb throughout, and corners reveals shall be true and in plumb.

b) Standard width of mortar joints for both horizontal and vertical joints shall be 1/2" (12.5mm) maximum. Mortar joints in walls shall have full mortar coverage on vertical and horizontal faces between the blocks. Mortar joints on wall including

struck joints, shall be thoroughly compacted and pressed tight against the edges of the blocks with proper tools. Block terminating against soffits of beam or slab construction shall be wedged tight with wedges and the joint shall be packed solidly with mortar between the top of the block and the bottom of slab or beam. Expansion joints shall be kept free from mortar or other debris.

Unless otherwise shown on the drawings or specified by the Engineer, the spaces around door frames and other material or built in items shall be solidly filled with mortar. Spaces around the door and window holdfasts shall be filled in with 3 ksi concrete. Work required to be built in with masonry including door frame anchors, wall plugs, dovetail anchors and accessories shall be built in as the erection progresses.

- c) The block work shall be carried up in uniform manner and no portion shall be carried more than 3. ft (1 metre) above the adjoining one at any time. All masonry shall be kept strictly true and square and the whole properly bonded together and leveled round each floor.
- d) Sleeves, chases and holes etc shall be built in as construction proceeds. Chasing of completed walls or the formation of holes shall only be carried out with the approval of the Engineer.
- e) Walls of blocks indicated as being non-load bearing shall not be constructed on the insitu concrete floor slab unit until the floor shuttering is struck and the concrete has obtained sufficient strength to support their weight. Toothing into load bearing walls shall not be permitted.

B- Curing

Masonry wall shall be cured by keeping it moist with water for at least 10 days after its construction. Engineer may direct additional curing if required.

C- Scaffolding

Contractor shall provide safe scaffolding of adequate strength for use of workmen at all levels and heights at his own expense. Scaffolding which is unsafe in the opinion of the Engineer shall not be used until it has been strengthened and made safe for use of workmen. Cost of scaffolding etc. shall be included by the Contractor in the unit rate for masonry items.

Damage to masonry from scaffolding or from any other object shall be repaired by the Contractor at his own cost.

D- Tolerances

All block work shall be erected plumb and true to line and level with the maximum variation in any storey height or any length of wall being 1/8" (3mm) in 10 feet (3 meter). The maximum tolerance in the length, height or width of any single masonry unit shall be + /- 1/8" (3mm).

04204 MEASUREMENT & PAYMENT

- a) Unless otherwise specifically stated in the Bill of Quantities or herein, all items shall be deemed to be inclusive of, but not limited to the following:
 - i) Labour and all costs in connection therewith.

- ii) Materials, goods and all costs in connection therewith e.g. conveyance; delivery; unloading; storing; returning packing; handling; hoisting; lowering; making curing etc.
- iii) All fixtures and all costs in connection therewith for precast works.
- iv) Fitting and fixing materials and goods in position.
- v) Use of plant and scaffolding.
- vi) Cutting and patching work required for installation of built-in-work.
- vii) Waste of materials.
- viii) Square cutting.
- ix) Establishment charges, overhead charges and profit.
- x) All other expenses, charges and taxes specified in Conditions of Contract.
- b) Works shall be measured net as fixed in position as per Drawings and instructions of the Engineer. Each measurement shall be taken to the nearest 1/2" (12.5mm). This rule shall not apply to any dimensions stated in descriptions.
- c) Masonry work will be paid for according to the actual net area of masonry work in square feet (Sq. M) for the required thickness or the actual net volume of masonry work in cubic feet (Cu. M) as described in the Bill of Quantities. All the openings left in the masonry walls will be deducted.
- d) Providing and fixing all reinforcing bars, reinforcing bar anchors and dovetail anchors shall be deemed to be included in the unit rate for masonry work.
- e) Due to different thicknesses of the slab in different areas or rooms or for any other reason whatsoever, if the chiseling of the masonry is required the Contractor shall do so at his own cost. Where for any reason whatsoever, the height of the wall is short of ceiling height; the remaining height shall be made good with ($f'c = 3000$ psi) concrete. This concrete shall neither be measured nor be paid under item of concrete but will be paid for under the item of masonry of the walls. In case where lintel heights are such that the Contractor has to chisel the masonry or provide cast-in-place concrete to make up the height of the course, no payment will be made for chiseling, but where such cast-in-place concrete is provided, payment for the same will be made at the unit rate for masonry.

*** End of Section 04200 ***

Signature of Client

Signature of Contractor

04300 BRICK MASONRY**04301 GENERAL****A- Scope of Work**

The work covered by this section of the specifications, consists of furnishing all plant, labour, equipment, applications and materials and in performing all operations in connection with the supply and installation of first class fire-brick masonry including wall ties, anchors, and expansion joints, complete in strict accordance with this section of the specifications and the applicable drawings and subject to the terms and conditions of the contract.

B- Applicable Standards

Latest editions of Pakistani, British and ASTM Standards are relevant to these specifications where applicable.

04302 PRODUCTS**A- GENERAL**

- i) All Portland cement for mortar shall be furnished by the Contractor and shall conform to the applicable requirements specified in the section "Plain and Reinforced Concrete",
- ii) All sand for mortar shall be furnished by the Contractor and shall conform to the applicable requirements for sand specified in the section "Plain and Reinforced concrete",
- iii) All water used in the manufacture of bricks and in the preparation of mortar shall be free from objectionable quantities of silt, organic matter, alkali, salts and other impurities, and will be tested and approved by the Engineer.

B- MORTAR

- i) Mortar for all brick masonry, expected where otherwise directed by the Engineer, shall consist of one part Portland Cement to four parts of damp loose mortar sand by volume and sufficient water to produce the proper consistency for the intended use. Where directed by the Engineer for increased workability, hydrated lime putty, approved by the Engineer, shall be added to the mortar but shall not exceed 25%, by volume of the dry cement.
- ii) Methods and equipment used for mixing mortar shall be such as will accurately determine and control the amount of each separate ingredient entering into the mortar and shall be subject to the approval of the Engineer. Mortar shall be mixed only in sufficient quantities for immediate use and all mortar not used within 30 minutes after addition of the water to the mix shall be wasted. Retempering of mortar will not be allowed. The mixers shall be thoroughly cleaned and washed at the end of each day's work.

C- BRICK

- i) All bricks shall be of first class quality made from good brick earth, free from saline deposits and shall be sand moulded. They shall be thoroughly burnt without being vitrified, shall be regular, uniform in shape and size with sharp and square edges parallel faces and of deep red or copper color. First class bricks shall be homogeneous in texture and emit a clear ringing sound when struck, and shall be free from flaws, cracks, chips, stones and nodules of lime. First class brick in an oven dried condition shall not absorb more than 1/5 of its weight of water immersed one hour in water of 21 to 27 degrees centigrade and shall show no signs of

efflorescence on subsequent drying. The average compressive strength of five representative first class than 5 N/mm.sq. for any individual brick.

- ii) Fire bricks shall be of best approved quality country made of same size as burnt bricks.
- iii) All bricks shall be manufactured by the Trench Kiln method or other standard methods approved by the Engineer. The earth used In manufacturing bricks shall be carefully selected and shall be free from objectionable quantities of lime, gravel coarse sand, roots, or' other organic matter salts shall not exceed 0.3 % and calcium carbonate shall not exceed 2.0%.
- iv) The moulds used in the manufacture of bricks shall be thoroughly sanded before each use and shall be sufficiently larger than the size of the bricks being manufactured to allow for shrinkage in drying and burning. Over size irregular and worn moulds shall be destroyed. Each finished brick for brick masonry shall be 9" by 4.56" by 3" in size and weigh between 3.2 to 4.2 Kilograms. All bricks shall have a "frog" ¼" deep on one face.

D- PLACING

- i) The methods and equipment used for transporting the bricks and mortar shall be such as will not damage the brick nor delay the use of mixed mortar. Brick shall not be placed during rains sufficiently heavy or prolonged to wash the mortar from the brick. Mortar already spread, which becomes diluted by rain shall be removed and replaced before continuing with the work. All brick to be used in brick masonry shall be moistened with water from three to four hours before they are used by a method, which will ensure that each is thoroughly and uniformly wetted. All bricks shall be free from water adhering to their surface when they are placed in the brick masonry.
- ii) Bricks shall be laid "Frog" upward with mortar Joints and in english bond as shown on the Drawings or as directed by the Engineer. Both bed and vertical Joints shall be ¼" in thickness completely filled with cement mortar as specified herein, and each brick shall be bedded by firmly tapping with the handle of the trowel. All horizontal Joints shall be parallel and all vertical Joints in alternate, courses shall be directly over one another. Excess mortar at the outer edges shall be removed and Joints drawn straight with the edge of a trowel and a straight edge. All anchors and similar work required to be embedded in the brick masonry shall be installed as the work progresses. At the completion of the work all holes or defective mortar joints shall be cut out and re-pointed.
- iii) The exterior faces of the walls shall be finished by striking the Joints as the work proceeds. The Joints shall be struck by raking the green mortar after the brick work has been laid and finishing the Joint with a pointing tool. Horizontal Joints shall be struck to form weathered Joints and vertical Joints shall be struck with a V notch. Care shall be taken that the striking tools do not develop a cutting edge, as the object of striking the joint is to compress the mortar into the joints.

E- CURING, REPAIR AND CLEANING

- i) All brick masonry shall be water cured and shall be kept wet for at least seven days by an approved method which will keep all surfaces to be cured continuously wet. Water used for curing shall meet the requirements of these specifications for water used in the manufacture of bricks.
- ii) If, after the completion of any brick masonry work, the brick is not in alignment or level, or does not conform to the lines and grades shown on the

Drawings, or shows a defective surface, it shall be removed and replaced by the Contractor at his expense unless the Engineer grants permission, in writing to patch or replaced the defective area. .

- iii) All finished fair face brick work shall be washed / cleaned with diluted oxalic acid as approved by the Engineer.

F- SCAFFOLDING

Contractor shall provide safe scaffolding of adequate strength for use of workmen at all levels and heights at his own expenses, scaffolding which is unsafe in the opinion of the Engineer shall not be used until it has been strengthened and made safe for use of workmen. Cost of scaffolding etc shall be included by the Contractor in the unit rate for masonry items.

Damaged masonry from scaffolding or from any other objection shall be repaired by the Contractor at his own cost.

G- TOLERANCES

The brick work shall be erected plumb and true to line at level with the maximum variation in any storey height many length of wall being One millimetre in One meter. The maximum tolerance in the length, height or width of any single masonry unit shall be $\pm 1/8"$ / $\pm 3\text{mm}$.

04303 MEASUREMENT AND PAYMENT

A- General

Except otherwise specified herein or else where In the Contract documents, on measurement and payment will be made for the under mentioned specified works related to the relevant items of the Bill of Quantities. .

- i) Cutting and Chiseling of masonry wherever required.
- ii) Cement sand mortar used in laying bricks including wastage.
- iii) Curing & repairing the masonry work.
- iv) All joint reinforcing bars, reinforcing anchor bars and dove tail anchors.

B- Measurement

Measurement of acceptable completed works of brick masonry will be made on the basis of number of cu.ft/cubic meter provided & installed in position as shown on the drawing or as directed by the Engineer.

C- Payment

Payment will be made for acceptable measured quantity of brick masonry on the basis of unit rate per cu.ft/cubic meter quoted in the Bill of Quantities & shall constitute full compensation for all the works related to the items

*** End of Division 04000 ***

DIVISION 05000 – METAL WORKS

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DIVISION 05000 – METAL WORKS**05120 STRUCTURAL STEEL WORKS****05121 GENERAL****A- Description**

This section covers structural steel where indicated on the drawings and specified herein.

B- Applicable Code and Standards

The standards and codes applicable to only a portion of the work specified in this section are referenced in the relevant parts or clauses. Standards and codes, which are generally applicable to the work of this section, are listed hereinafter:

AISC -American Institute of Steel Construction

M 010 Manual of Steel Construction

8302 Code of Standard Practice for Steel Buildings and Bridges.

8314 Specification for Structural Joints Using ASTM A 325 or ASTM A 490 Bolts.

ASTM -American Society for Testing and Materials:

A 36 Structural Steel

A 307 Carbon Steel Externally and Internally Threaded Standard Fasteners

A 325 High Strength Bolts for Structural Steel Joints including Suitable Nuts and Plain Hardened Washers

A 490 Quenched and Tempered Alloy Steel Bolts for Structural Steel Joints

E109 Dry Powder Magnetic Particle Inspection AWS

AWS - American Welding Society:

B 3.0 Standard Qualification Procedure

D 1.1 Structural Welding Code

ANSI American National Standards Institute, Inc.

B 18.2.2.1 Plain Washers

SSPC Steel Structures Painting Council

SP 1 Solvent Cleaning

Signature of Client

Signature of Contractor

SP 2 Hand Tool Cleaning

SP 3 Power Tool Cleaning

C- Submittals

The following submittals are required:

- Detail Drawings and/or Shop Drawings
- Assembly, Erection and Installation Drawings and Manuals
- Quality Assurances/Quality Control Procedure
- Material, Equipment and Fixture Lists
- Test Reports

D- Transportation, Handling, Storage and Protection

1) Handling

Do not handle structural steel until paint has thoroughly dried Exercise care to avoid abrasions and other damage.

2) Protection

Stack material out of mud and dirt and provide for proper drainage Protect from damage or soiling by adjacent construction operations.

3) Storage

Storage of fabricated steel at the job site shall be the responsibility of the Contractor. Store material at the job site in a manner which does not exceed design loads of existing or newly-constructed structures. Protect material against corrosion or deterioration.

E- Quality Control

1) Inspection and Testing Structural Steel

Testing and structural steel will be performed by a testing laboratory.

2) Inspection and Testing -Bolt Connections

Bolted connections will be inspected by a testing laboratory in accordance with AISC 314 and as shown.

3) Inspection and Testing-Welding

Welding will be Inspected and tested by a testing laboratory during fabrication and erection of structural steel as follows:

Certify all welders and make inspections and tests as required. Record types and locations of all defects found in the work, the measures required and performed to correct such defects.

In addition to visual inspection of all welds, magnetic particle, ultra-sonic and radiographic inspection will be made of all welds as specified elsewhere in the Contract Documents. Magnetic particle inspection will be made on the root pass and finished weld.

The method of magnetic particle inspection will be in accordance with ASTM E 109. Any type of crack or zone of incomplete fusion or penetration will not be acceptable.

Radiographic inspection technique and standards of acceptance will be in accordance with AWS D 1.1.

Ultra-sonic Inspection will be performed in accordance with AWS D 1.1.

4) Welder Identifying Symbols

Each bolting crew and welder shall be assigned an identifying symbol or mark and all shop and field connections shall be so identified shop and crew or person making the connection.

5) Testing Laboratory

The testing laboratory shall be responsible for conducting and interpreting the tests. It shall state in each report whether or not the test specimens conform to all requirements of the Contract Document and shall specifically note any deviations therefrom.

6) Repair and Re-inspection of Welds

Repair defective welds in accordance with AWS D 1.1, Article 3.7; or replace the weld; and re-examine repaired and replaced welds by the method used to examine the original weld in addition, when defective welds are found, the testing laboratory shall determine the cause of the defective welding and institute immediate corrective action.

05122 PRODUCT

A- Material

a) Structural Steel

ASTM A 36 unless otherwise shown.

b) High-Strength Bolts

ASTM A 325 or ASTM A 490, heavy hexagon bolts with nuts and hardened washers.

c) Unfinished Bolts

ASTM A 307 regular hexagon-bolts with nuts low carbon steel and washers conforming to ANSI B 18.2.2.1, type B.

d) Filler Metal – Electrodes for Carbon Steel

Conform to AWS D 1.1. Structural Welding Code.

e) Shop Primer Paint

SSPC – Paint 15 type I; compatible with finish coats of paint.

f) Final Paint

Epoxy resin paint.

B- Shop Fabrication

Fabricate structural steel in accordance with referenced standards.

a) Milling and Planing

Mill column and bearing stiffeners to give full bearing over the cross section. Plane contact surfaces of bearing plates. It is not necessary to plane bottom surfaces of plates on grout beds.

b) Drilling and Punching

Drill or punch holes at right angles to the surface of the metal, not more than 2 mm larger than the connector diameter. Do not make or enlarge holes by burning. Drill material having a thickness in excess of the connector diameter and material thicker than 10 mm. Holes shall be clean-cut without torn or ragged edges. Remove outside burrs resulting from drilling operations.

C- Connections

a) Requirements

Minimum connections shall comply with appropriate tables headed framed beam connections shown in the AISC Manual of Steel Construction. Seated connections may be used only when they do not interfere with architectural features.

b) Non-Composite Beam Connections

For non-composite beams, the connections used shall be adequate to provide for the reaction due to the maximum uniformly distributed load that the beam is capable of carrying for its span, based on the allowable unit stresses, except where higher reactions are shown or specified elsewhere.

c) Composite Beam Connections

For composite beams, connections shall be adequate to provide for reactions as shown.

d) Bolts and Welds

All connections shall be one of the following:

- Unfinished bolts
- High-strength bolts
- Weld

D- Bolting

a) Requirements

Bolts shall be of a length that will extend not less than 6 mm (1/4 in.) beyond the nuts. Enter bolts into holes without damaging the thread.

b) High-Strength Bolts

Use high-strength bolts in bearing or friction as shown. Make high-strength bolted joints without the use of erection bolts. Bring members tightly together with sufficient high-strength fitting-up bolts, which shall be retightened as all the bolts are finally tightened. Protect bolt heads from damage during placing. Bolts that have been completely tightened shall be marked for identification.

c) High-Strength Bolt Connection Contact Surfaces

The contact surface in high-strength bolted connections shall be free of oil, paint, lacquer, or other coatings.

d) Tightening

Final tightening of high-strength bolts shall be by turn-of-nut method unless properly calibrated wrenches are specifically required. Each wrench shall be checked for accuracy at least once daily.

e) Unfinished Bolts

Use unfinished bolts in locations where high-strength bolts are not shown or specified to be used. Draw unfinished bolt heads and nuts tight against the work with a suitable wrench. Peen bolt threads for unfinished bolts to prevent the nuts from backing off.

E- Welding

a) Requirements

Do not begin structural welding until joint elements are bolted or tacked in intimate contact and adjusted to dimensions shown with allowance for any weld shrinkage that is expected. Weld heavy sections and those having a high

degree of restraint with low hydrogen type electrodes. No members are to be spliced without approval.

b) Qualifications of Welders

Welding shall be performed by operators who have been qualified as per AWS B 3.0 within the preceding one year period under AWS standard qualification procedure for the type of work required.

F. Surface Preparation

a) Cleaning

Clean all surfaces not otherwise specified in accordance with SSPC SP 2 or SSPC SP 3 as determined by the Engineer.

b) Shop Coat

Cleaning shall be done after fabrication and immediately prior to shop painting or shipment. Apply shop coat of paint within 4 hours after cleaning and before rust-bloom.

G- Painting

a) Requirements

All structural steel shall receive a shop coat of primer paint except as follows:

- Members encased in concrete.
- Contact surfaces of welded connections and areas within 50 mm of field welds.
- Contact surfaces of high-strength bolted connections.
- Milled surfaces.
- Top surface of steel beam flanges to receive shear connectors.

b) Primer Application

Apply specified primer by brush, spray, roller, or other approved means to provide a minimum dry film thickness of 0.05 mm, except for milled surfaces. No painting shall be done when the surface temperature of the steel is below the temperature at which condensation will occur. Apply paint thoroughly and evenly to dry surfaces in accordance with manufacturer's directions.

c) Application of 1st Final Coat

The first final coat shall be applied to the steel structure in the shop. A dry film thickness of 0.05 mm shall be provided. Any damages of the primer coat shall be repaired prior to the application of the 1st final coat. The manufacturer's instructions are to be considered.

d) Application of 2nd Final Coat

The second final coat shall be applied after erection of the structures. All damages of the primer and 1st final coat shall be repaired prior to application of 2nd final coat. The dry film thickness shall be 0.05 mm at least.

H- Galvanizing

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 A 123 Standards Specifications for zinc (hot galvanized) coating on products fabricated from rolled, pressed, and forged steel shapes, plates, bars and strips.

05123 EXECUTION**A- Erection**

a) Plumbing, Leveling, and Aligning

Individual pieces shall be plumbed, leveled, and aligned in accordance with the requirements of the AISC S 302.

- Drift Pins: Drift pins may be used only to bring together the several parts. They shall not be used in such manner as to distort or damage the metal.
- Temporary Bracing and Guy Lines: Temporary bracing and guy lines shall be provided to ensure proper alignment and to adequately protect all persons and property.

B- Field Painting

a) Touch-up Painting

Field touch-up painting shall comply with the requirements specified in Sub-section 05122 A "Materials" and G. "Painting".

b) Cleaning

After erection, clean exposed surfaces of field connections, unpainted areas adjacent to field connections, and damaged areas in the shop coat according to the same standards required for the shop coat, and paint the same primer used in the shop coat.

05124 MEASUREMENT & PAYMENT

- a) Unless otherwise specifically stated in the Bill of Quantities or herein, all items shall be deemed to be inclusive of, but not limited to the following:
 - i) Labour, material, goods and all cost in connection therewith e.g. conveyance, delivery, unloading, storing, returning, packing, handling, hoisting, lowering.
 - ii) All fixtures and all costs in connection therewith including costs of nuts, bolts, screws, and rivet heads and the like.
 - iii) Fabricating, welding, riveting, fitting and fixing material and goods in position including costs of holding-down bolts, anchor plates and the like.
 - iv) Use of plant.
 - v) Waste of materials.
 - vi) Establishment charges, overhead charges and profit.
 - vii) All other expenses, charges and taxes specified in Conditions of Contract.
- b) Works shall be measured net as fixed in position as per drawings and instructions of the Engineer. Each measurement shall be taken to the nearest 1/2" (12.5 mm) to establish weight. This rule shall not apply to any dimensions stated in the descriptions.
- c) Unit rates for structural steel work shall be given in terms of their weights in metric tons calculated from the net measurement, as per sub-clause (b) above, on the basis of 490 lb per cubic feet or other appropriate unit of standard weights. In arriving at these weights, tolerances for rolling margin and other permissible deviations from standard weights shall be ignored. No addition shall be made for nuts, bolts, screws, rivet heads, fillet welds and the like.
- d) The cost of all painting and/or galvanization of structural steel works, both at the factory at the Site, shall be deemed to be included in the unit rates for the structures in question.
- e) All steel, iron or other metal fittings, fixtures, embedded items, etc., required for the operational process and other purposes, shall be classified as structural steel works and shall either each be enumerated separately, stating the description briefly by reference to the relevant drawings, or grouped together and given in metric tons. Where only fixing in position of such items is required of the Contractor, it will be specifically mentioned in the Bill of Quantities.

*** End of Section 05120 ***

Signature of Client

Signature of Contractor

05130 STRUCTURAL WELDING**05131 GENERAL****A. Description**

This section covers general welding requirements and a program of non-destructive examination (NDE) of welded joints of structural components.

B- Applicable Codes and Standards

The codes and standards applicable to only a portion of the work specified in this section are referenced in the relevant parts and clauses. Codes and standards, which are generally applicable to the work of this section, are listed hereinafter:

<u>Sponsor</u>	<u>Number</u>	<u>Subject</u>
ASME	SFA 5.4	Corrosion-Resisting Chromium and Chromium Nickel Steel Covered Welding Electrodes.
ASME	SFA 5.9	Corrosion-Resisting and Chromium-Nickel Steel Bare and Composite Metal Cored and Standard Arc Welding Electrodes and Welding Rods.
ASNT	SNT TC 1 A	Personnel qualification and Certification
ASTM	A 435	Straight-Beam Ultrasonic Examination of Steel Plates for Pressure Vessels.
ASTM	A 577	Ultrasonic Angle-Beam Examination of Steel Plates.
ASTM	E 94	Recommended Practice for Radio-graphic Testing.
AWS	D 1.1	Structural Welding Code, Steel

C- Submittals**(01) Test Reports**

- Welders Qualification Records
- NDE Personnel Qualification Records.
- Welding Examination and Inspection Reports: Detailed records showing evidence of the quality of welding. For each section of weld inspected, furnish a report, which clearly identifies the work, the welder's identification, the areas of inspection the acceptability of the welds, and the inspector's signature. Each report shall be completed by the inspector at the time of inspection. Furnish a complete set of reports at the completion of work. For radiographic examination, furnish a complete set of radiographs in addition to the report.

The inspector shall be allowed to view any or all of the examination and shall have access to all reports and radiographs. Reports shall be submitted on approval report forms.

(02) Procedures

Welding and weld repair procedures.

05132 PRODUCTS**A- Materials**

Shielded metal arc welding shall be performed with low-hydrogen electrodes when welding carbon steels that are not listed in AWS D 1.1 and that have a specified allowable carbon content above 0.30 percent.

For austenitic (300 Series) stainless steels, welding filler metal shall conform to ASME SFA 5.4, type ER 308 L and SFA 5.9, type ER 308 L. Welding filler metal for welds between carbon and stainless steel shall conform to ASME SFA 5.4, type E 309. A stainless steel filler material shall have a minimum delta ferrite of five percent based on the certified chemical analysis and the WRC Diagram.

Maintain the receipt and disbursal of all welding filler materials and fluxes under strict control. Perform the storage, baking and drying in accordance with the manufacturers recommendations.

B- Welding requirements**(01) Welding Processes**

The processes listed in AWS D 1.1 are permitted, subject to the restrictions of article "C " Welding Process Restrictions.

(02) Alternative Welding Processes

Other welding processes will be considered, providing:

- a) Ability to use the process can be demonstrated satisfactorily. Information submitted shall complete details of material and joint preparation, welding equipment, welding techniques, welding procedures, record of qualification tests for each specific application, and appropriate additional tests required.
- b) The in-process welding control program and post weld heat treatment procedure are accepted. Information submitted shall include the extent of non-destructive examination and all inspection techniques employed throughout production.

(03) Joints Subject to Lamellar Tearing

Welded joints where a member is subject to stress in the through-thickness direction shall be welded by one of the following low hydrogen processes:

- submerged arc welding (SAW),
- gas metal arc welding (GMAW),
- flux cored arc welding (FCAW),

- shielded metal arc welding using EXXX5, EXXX6, or
- EXXX8 electrodes.

C- Welding Process Restrictions

The following restrictions shall apply:

a) Thickness

The maximum individual layer thickness for submerged arc welds shall not exceed 13 mm for material 32 mm thick or greater, and 10 mm for material less than 32 mm thick.

For plates 25 mm thick and over use low hydrogen electrodes listed in AWS D 1.1

b) Starting and Stopping Tabs

For submerged-arc welding, use removable starting and stopping tabs for longitudinal welds.

An alloying flux shall not be used.

c) Gas Metal Arc Welding (GMAW)

GMAW in the short-circuit transfer mode is restricted to the following:

- Materials not exceeding 6 mm (1/4 in) nominal thickness.
- Non-structural/, non-pressure retaining attachments, such as insulation clip and nameplates where the material being attached does not exceed 5 mm nominal thickness.
- Tack welds, temporary attachments, double welded joints or other applications where weld metal deposited by the GMAW short-circuiting process is subsequently removed.

d) Electro Slag Welding (ESW) and Electro Gas Welding (EGW)

Impact qualified procedures per AWS D 1.1., Appendix C, are required as a minimum.

e) Peening

Peening may be used on intermediate weld layers of thick welds. Peening of root and cover passes will not be acceptable. The use of pneumatic tools for slag removal is not considered peening and is acceptable.

f) Joints

Make welded joints by completing each weld layer before succeeding weld layers are deposited. Block welding shall not be used without prior written approval of the proposed methods and controls.

- g) Shop Paint

Remove shop paint from areas to be welded.

D- Preheat and Interpass Temperature (P & IPT)

- a) Preheat

Preheat shall be as required in AWS D 1.1.

- b) Carbon Steels

Carbon steel not listed in AWS D 1.1 shall have a preheat and interpass temperature of 150°C minimum when the thickness at the joint exceeds 25 mm.

- c) Measuring Temperature

Determine preheat and interpass temperature by temperature-indicating crayons, contact pyrometers or other approved means.

- d) Temperature Requirements

Preheat and interpass temperature requirements listed above shall also apply to tack welding, fillet, welds, attachment welds, and thermal gouging and cutting.

- e) Austenitic Stainless Steels

The maximum interpass temperature for welding austenitic stainless steel shall be 177°

E- Postweld Heat Treatment (PWHT)

Postweld heat treatment when required shall be in accordance with AWS D 1.1. Postweld heat treat carbon steels with base metal thickness of 38 mm or greater such as column-truss and girder connections. Heat the weldment within a temperature range of 595 - 650°C for one hour per 25mm (1 in.) of thickness.

F- Workmanship, Visual Quality Examination and Inspection

- a) General

In addition to the requirements of AWS D 1.1, paragraph 8.15, each weld shall be visually free of slag, inclusions and porosity.

- b) Butt Welds

Butt welds shall be full penetration welds, unless otherwise specified and permitted.

- c) Temporary Attachments

Avoid the use of temporary welded attachments during fabrication as much as possible. After fabrication is completed, remove flush with the base material without encroaching on the minimum required base material thickness. After the surface has been restored, examine all areas from which temporary

attachments have been removed by the same methods required for permanent fillet welds.

d) Additional Requirements

Do not begin structural welding until joint elements are bolted or tacked in intimate contact and adjusted to dimensions shown with allowance for any weld shrinkage that is expected. Weld heavy sections and those having a high degree of restraint with low hydrogen type electrodes. No member shall be spliced without approval.

G- Inspection and Testing

a) Personnel

Personnel performing NDE shall be qualified and certified in accordance with ASNT TC 1 A.

b) Examination Methods

Use the following examination methods as specified. The following list is in descending order. When a particular examination method is specified for a joint and the method is impracticable to use, use the next highest method practicable. The alternative method will be subject to approval. NDE procedures and techniques shall be in accordance with AWS D 1.1, section 6.7.

- Radiographic Method: In addition to the requirements of AWS D 1.1 comply with ASTM E 94.
- Ultrasonic method.
- Magnetic particle method.
- Liquid Penetrate Examination Method: Visible-dye, solvent-removable method only.

c) Members Designated for Examination

- 1) Welded Plate girders and Built-Up Members: Examine 100 percent of flange-to-flange and web-to-web welding by the radiographic method. For all web-to-flange and pipe column seam welding, examine ten percent of each welder's work as follows.
 - Full penetration groove welds by the ultrasonic method,
 - Fillet welds and partial penetration groove welds by the magnetic particle method.
- 2) Moment Connection Joints:
 - Examine 100 percent of all flange-to-flange and web-to-web welding as follows:
 - Full welds and partial penetration groove welds by the magnetic particle method.

- For all web-to-flange welding, examine ten percent of each welder's work as follows:
 - Full penetration groove welds by the ultrasonic method,
 - Fillet welds and partial penetration groove welds by the magnetic particle method.
- 3) Floor Beam and Girder Connections: Where floor beams or girders are to be connected to their supporting members using clip angles welded to the web, completely examine ten percent of the clip angles (at least one clip angle) welded by each welder, Use the magnetic particle method.
- 4) Column Base Plates: Examine 100 percent of all welding of columns to base plates, including associated stiffeners, as follows:
 - Full penetration groove welds by the ultrasonic method.
 - Fillet welds and partial penetration groove welds by the magnetic particle method.
- 5) Truss Connections: Examine 100 percent of all welding of truss member connections as follows:
 - Full penetration groove welds by the ultrasonic method.
 - Fillet welds and partial penetration groove welds by the magnetic particle method.
- 6) Diagonal Bracing Connections: Examine 100 percent of all welding for connection of diagonal bracing as follows:
 - Groove welds by the ultrasonic method.
 - Fillet welds by the magnetic particle method.
- 7) Circular Pipe or wide flange Columns: Examine 100 percent of all welding for circular pipe columns by the ultrasonic method.
- 8) Joints Subject to Lemellar Tearing:
 - Welded joints where a member is subject to stress in the through-thickness direction shall be examined by ultrasonic testing for lamellar tears, unless the member subject to stress in the through-thickness direction has been fabricated from lamellar tear resistant steel as defined in Section 05120 - Structural Steel. Such joints shall be subject to all other specified examination, whether fabricated from lamellar tear resistant steel or not.
 - For plates 25 mm (1 in.) or more in thickness, ultrasonic testing for lamellar tears shall be made in an area 13 mm below the weld and up to 25 mm in thickness. Such testing shall be made in an area below the weld at the centre of the plate and outward from the edge of the weld up to a distance equal to the thickness of the plate.

- If possible, ultrasonic testing for lamellar tears shall be made with a straight beam from the plate surface opposite the weld in accordance with ASTM A 435. Otherwise, such testing shall be made by the angle-beam method in accordance with ASTM A 577.
- Indications which produce a response greater than 20 percent of the reference level shall be investigated to determine the identity, location, and shape of the source of the indication.
- Discontinuities interpreted as cracks or laminations (lamellar tears) within the test area shall be cause for rejection of the weld.
- Members with lamellar tears shall be repaired or replaced at Contractor's expense.

d) Requirement for Ten Percent Examination

- 1) Examine a 300 mm section of weld in each 3 m increment of each welder's work. If the examination meets the acceptance standards of AWS D 1.1, the 3 m of weld represented will be accepted.
- 2) If the examination fails to meet the acceptance standards, examine two additional 300mm sections in the 3 m increment. If both of these examinations meet the acceptance standards, the 3 m of weld represented will be accepted.

Repair the defects detected in the first examination and re-examine.

- 3) If one or both of the examinations fails to meet the acceptance standards, examine the remaining weld of the 3 m increment. Repair the areas that do not meet the acceptance standards and re-examine.

e) Repair or Replacement of Defective Welds

- 1) Welds found to contain defects which are prohibited by AWS D 1.1 shall be repaired by methods permitted by AWS D 1.1 or shall be replaced. Re-examine repaired and replaced welds by the same method and acceptance standard used to examine the original defective weld.
- 2) In addition to the above, when welds are found to contain prohibited defects, determine the cause of the defective welding and take immediate corrective action. Require shop inspectors to check and verify that corrective actions are instituted.

*** End of Section 05130 ***

05510 MISCELLANEOUS METAL WORKS**05511 GENERAL****A- Description**

This section covers miscellaneous metalwork where indicated on the drawings and specified herein.

This section includes furnishing, fabricating, delivering, and installing miscellaneous steel and iron components, including anchors, fastenings and other supplementary parts necessary to complete the miscellaneous metal work including ladders, railings, roll up shutters, gratings, protection screens over roof openings.

B- Applicable Codes and Standards

The standards and codes applicable to only a portion of the work specified in this section are referenced in the relevant parts or clauses. Standards and codes which are generally applicable to the work of this section are listed hereinafter. Standards and codes which are generally applicable to the work of this section are listed hereinafter.

ASTM -American Society for Testing and Materials:

ASTM	A 27	Mild - to Medium-Strength Carbon-steel Castings for General Application.
ASTM	A 36	Structural Steel
ASTM	A 47	Malleable Iron Castings
ASTM	A 48	Grey iron castings
ASTM	A 53	Pipe, Steel, Black and Hot Dipped, Zinc-Coated Welded and Seamless.
ASTM	A 108	Cold-Finished Carbon Steel bars and Shifting
ASTM	A 120	Black and Hot-Dipped Zinc-Coated Welded and seamless Steel Pipe for ordinary Use.
ASTM	A 123	Zinc (Hot-Galvanized) Coatings on Products Fabricated from Rolled, Pressed, and Forged Steel Shapes, Plates, Bars and Strip.
ASTM	A 153	Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
ASTM	A 159	Automatic Grey iron Castings.
ASTM	A 283	Low and Intermediate Tensile Carbon Steel Plates of Structural Quality.
ASTM	A 307	Carbon Steel Externally Threaded Standard Fasteners.
ASTM	A 325	High-Strength Bolts for Structural Steel Joints

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ASTM	A 366	Steel Sheets, Carbon, Cold-Rolled, Commercial Quality.
ASTM	A 385	Providing High Quality Zinc Coatings (Hot-Dip) on Assembled Products.
ASTM	A 386	Zinc Coating (Hot-Dip) on Assembled Steel Products.
ASTM	A 501	Hot-Formed Welded and Seamless Carbon Steel Structural Tubing.
ASTM	A 525	General Requirements for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process.
ASTM	A 526	Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process. Commercial Quality.
ASTM	A 536	Ductile Iron Castings.
ASTM	A 570	Hot-Rolled Carbon Steel Sheet and Strip, Structural Quality.
ASTM	A 663	Merchant Quality Hot-Rolled Carbon Steel Bars, Subject to Mechanical property Requirements.
ASTM	A 675	Steel Bars and Bar-Size Shapes, Carbon, Hot-Rolled Special Quality, Subject to Mechanical Property Requirements.

Federal Specification (General Service Admin):

FF-92A(1)	Washers. Metal, Flat (Plain)
FF-S-325	Shield, Expansion: Nail, Expansion; and Nail Drive Screw (Devices. Anchoring, Masonry)

AWS -American Welding Society:

D1.1	Structural welding Code

NAAMM -National Association of Architectural Metal Manufacturers:

Metal Bar Grating Manual

Pipe Railing Manual

SSPC -Steel Structures Painting Council:

PT	3-64	Basic Zinc Chromate-Vinyl Butyral Wash coat
SP	1	Solvent Cleaning
SP	3	Power Tool Cleaning
SP	7	Brush-Off Blast Cleaning

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Part -2	Red Lead, iron Oxide, Raw Linseed Oil and Alkyd Primer
Part -3	Red Lead, Iron Oxide, and Fractionated Linseed Oil Primer
Part -12	Cold Applied Asphalt Mastic (Extra Thick Film)

AASHTO -American Association of State Highway and Transportation Officials:

Standard Specifications for highway bridges.

AISC -American institute of Steel Construction:

S	326	Specification for the Design, Fabrication and Erection of Structural Steel for Buildings.

ANSI -American National Standards institute:

B	18.22.1	Plain Washers

FS-Federal Specification (U.S. Govt. G.S.A. Spec.):

FF-SO325, Shield Interim Amendment 3	Expansion; Nail, Expansion; and Nail, Drive Screw Expansion; Nail Drive Screw (Drives, Anchoring Masonry)

C- Submittals

The following submittals are required:

- a) Detail, Drawings and/or Shop Drawings and Outline Drawings showing erection mark numbers.
- b) Certificate of Compliance
- c) Design Analysis and Calculations as required
- d) Samples Railings including connections and attachments, not less than 150 mm (6 in.) long.
- e) Manufacturer's Data

Submit manufacturer's data sheets for each type of component.

D. Galvanizing

Iron or steel products to be zinc coated shall be hot-dipped after fabrication in according with ASTM A 123, A 375 as applicable. The zinc coating shall weight at least 0.61 kg/m² Fabrication shall include operations such as shearing, punching, bending, forming and welding. Unit shall be fabricated complete, or in the largest practical sections, before galvanizing. Surfaces on which the zinc coating is damaged shall be required by a thorough wire.

05512 PRODUCTS**A. Materials****a) General Requirements**

For fabrication of miscellaneous metal work which will be proposed to view in the finished work, use only materials which are smooth and free of surface blemishes including pitting, seam marks, roller marks, rolled trade names, and roughness.

b) Structural Steel

ASTM A 36

c) Steel Plates for Bending for Cold Forming

ASTM A 283 m Grade C Thickness shown for raised pattern safety plates is exclusive of projected pattern.

d) Steel Pipe

ASTM A 120 Schedule 40

e) Steel Tubing

ASTM A 501 hot-formed, furnace butt welded or seamless process.

f) Steel bars and Bar Size Shapes.

ASTM A 108, ASTM A 663, ASTM A 675, Grade 65, or ASTM A 36.

g) Cold Finished Steel Bars

ASTM A 108, grade as selected by fabricator

h) Cold Rolled Carbon Steel Sheet

ASTM A 366 and ASTM A 570

i) ASTM A 526 galvanized in accordance with ASTM A 525, Designation 90.**j) Grey iron Castings**

ASTM A 48, Class 30

k) Malleable Iron Castings

ASTM A 47, grade as selected by fabricator

l) ASTM A 48, Class 30 or ASTM A 159 Grade 63000

- m) Steel Pipe
- ASTM A 53, Type S, Grade A, suitable for close coiling, black finish unless galvanizing is required; standard weight (Schedule 40), unless otherwise indicated or required performance criteria
- n) Fasteners- Malleable Iron Castings
- ASTM A 47
- o) bolts and Nuts
- ASTM A 307 Grade A bolts
1. Unfinished Bolts ASTM A 307, Grade A, regular hexagon bolts with nuts of low carbon steel and washers conforming to ANSI B18221 Type B.
 2. Anchor Bolts
 - Headed Bolts and Nuts ASTM A 307, Grade A
 - Threaded Rods and Anchor Plates ASTM A 36
 - Washers ASTM A 325
 3. Sleeves for Anchor Bolts. Galvanized be steel not less than 0.4 mm (1/4 in.) thick or high polyethylene unless otherwise approved
- p) Rivets
- ASTM A 325 ASTM A 325
- q) Machine Screws
- Carbon steel, cross-recessed, Flathead minimum tensile strength 414 MPa (60,000 psi).
- r) Expansion Anchors
- Externally threaded wedge anchors conforming to the requirements of FA FF-S 325, Int. and 3, Group II, Type 4 Class I.
1. Bolts: Zinc plated, chromate dip, SAE Grade 5 or better
 2. Anchors: Wedge type with one-piece wrap around stainless steel clip
 3. Pull Out and Shear Values: Meet requirements of manufacturer's published equal
 4. Products Molly "Para-bolt", Phillips, "Wedge Anchors", Hilti "Quikbolt", or approved equal

- s) Concrete inserts
Threaded or wedge type, galvanized ferrous castings, either malleable iron ASTM A 47 or cast steel ASTM A 27. Provide bolts, washers, and shims as required hot-dip galvanized ASTM A 153.
- t) Wedge- Type Concrete Inserts
Wedge-type concrete insert shall be hot-dip galvanized box-type ferrous castings designed to accept 6 mm to 20 mm dia-meter bolts with special wedge-shaped heads. The carbon steel bolts with wedge-shaped heads, and the nuts, washers and shims shall be galvanized.
- u) Threaded- Type Concrete Inserts
Threaded-type concrete inserts shall be hot-dip galvanized ferrous castings threaded internally to receive 20 mm diameter machine bolts or threaded rods.
- v) High Strength Bolts
ASTM A 325.
- w) Plain Washers
Plain washers shall be round, general assembly grade, carbon steel and shall comply with FS FF-W-92A (1).
- x) Masonry Anchors
Masonry anchors shall comply with FS FF-S-325.
- y) Fasteners and Anchorage Devices
Type, Grade, Class, and style best suited for the respective purpose; galvanized for exterior use.
- z) Steel Chain
Galvanized welded type proof coil steel, 5 mm (3/16 in.) nominal size, minimum 33 links/m (10 links/ft) proof loading not less than 450 kg (1000lb). Provide complete with eye bolts and snap fasteners at each end.
- aa) Galvanizing
 - 1. ASTM A 153 for galvanizing Iron and steel hardware
 - 2. ASTM A 123 for galvanizing rolled, pressed, and forged steel shapes, plates, bars, and strip 3 mm (1/8 in.) thick and heavier.
 - 3. ASTM A 386 for galvanizing assembled steel products.
- bb) Paint
 - 1. Ferrous Metal Primer: SSPC Paint 3. compatible with finish coats of paint
 - 2. Galvanizing Repair Paint: Zinc-rich paint for repairing galvanized surfaces and field welds in galvanized steel.

3. For separating Dissimilar Metals: SSPC Paint 12
 4. Primer for Galvanized Ferrous Metal: Vinyl butyral washcoat conforming to the requirements of SSPC PT e.
 5. Asphalt on Cast Iron: Asphalt-base emulsion conforming to ASTM D 1187 paint conforming to SSPC-Paint 12 or other similar suitable material that is adherent, not brittle and without tendency to scale.
- cc) Ductile Iron
- ASTM A 536, Grade 60-40-18 or 65-45-12
- dd) Neoprene Gaskets
- Approved commercial product
- ee) Weld Metal
1. Typical: E 7028 low hydrogen or approved equal
 2. Galvanized Steel: For galvanized steel use E 7010/g or approved equal.

B- Workmanship

Metalwork shall be clean and free from loose mill-scale flake rust and rust pitting, and shall be well-formed and finished to shape and size, with sharp lines and angles, Metalwork bent by shearing or punching shall be straightened. Wide members shall be drilled or punched for the smaller members to pass through, and the small members shall be secured by spot welding. Similar members, where passing, shall be halved together, and abutting members shall be welded. All exposed fastenings shall be of the same material, colour and finish as the metal to which applied unless other wise shown.

Metal work shall be properly countersunk to receive the required hardware and shall be provided with the proper bevels and clearances. Plates for mounting hardware shall be welded in place.

C- Shop Fabrication

Detailing, fabricating and erecting miscellaneous metal shall conform to the requirements of AISC S 326

a) Supplemental Parts

Include supplementary parts necessary to complete miscellaneous metalwork through not definitely shown or specified herein.

b) Measurement and Dimensions

Verify measurements and dimensions at the job site and cooperate in the coordination and scheduling of the work of this section with the work of related trades (with particular attention given to the installation of items embedded in concrete and masonry) so as not to delay job progress.

c) Forming of Exposed Work

Form exposed work true-to-line, and level, with accurate angles and surfaces and straight, sharp edges. Ease exposed edges to a radius of approximately 1 mm (1/32 in.) unless otherwise shown. Form bent metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

d) Forming of Exposed Connections

Form exposed connections with hairline joints flush, and smooth; using concealed fasteners where possible. Exposed threaded portion of bolts and screws shall be cut off flush with adjacent metal. Cut drill, punch, and tpa as required for the installation and attachment of other work to miscellaneous metal work.

e) Forming Built-in Metal Work

Metal work built in with concrete or masonry shall be formed for anchorage, or be provided with suitable anchors, or other anchoring device shown or required to provide support for intended use. Furnish such metal work in ample time for setting and securing in place.

f) Welds

Make joints as strong and rigid as adjoining section. Make welds continuous along entire line of contact except where spot welding is indicated. Grind exposed welds flush and smooth to match and blend with adjoining surfaces. Where bolted or riveted connections are indicated, such connections may be welded.

g) Non-removable connections in weldable materials shall be welded unless otherwise shown. Welds shall be finished flush and ground smooth on surfaces which are exposed after installation. Welding shall be in accordance with AWS D1.1 Welded joints shall be completely sealed with not less than a 5 mm fillet weld.

h) Threaded Connections

Make thread connections up tight so that threads are entirely concealed. Abutting bars shall be shouldered and headed, doweled, and pinned. Rivet, bolt, and screw heads shall be flat and countersunk in exposed work and else where as required. Carefully machine, fit, and secure removable members by means of Allen set screws of proper size and spacing.

i) Galvanizing

All ferrous metal work at exterior and items embedded in concrete shall be galvanized after fabrication.

D- Shop Painting

1) General

Shop paint miscellaneous metal work, except members or portions of members to be embedded in concrete or masonry, surfaces, and edge to be field welded, and galvanized surfaces, unless otherwise specified.

2. Cleaning and Preparation
 - a) Clean and prepare metal surfaces before applying shop coat, Remove rust and mill scale in accordance with SSPC SP-3 except conform to SSPC SP-7 where required for special paint or coating. Achieve anchor profile between 0.025 mm (1 mil) to 0.075 mm (3 mils).
 - b) Remove oil, grease, and similar contaminants in accordance with SSPC SP-1.
3. Priming

Immediately after surface preparation, apply primer in accordance with manufacturer's instructions. Use painting methods which will result in full coverage and give a dry film thickness and 0.025 mm (2.0 mil) to 0.10 mm (4.0 mils).
4. Painting

Apply one shop coat to fabricated metal items, except apply two coats of paint to surfaces inaccessible after assembly or erection. Change colour of second coat to distinguish it from the first.
5. Coating

Coat cast iron frames and covers with asphalt evenly and smoothly on all surfaces.

E- Fabrication – Specific items

(01) Steel Ladder

- a) Provide steel ladders designed and constructed to support a live load of 115 kg (250 lbs) per rung or as specified, complete with stringer supporting brackets and rungs of the size and dimensions shown.
- b) Provide non-slip surface on the top of each rung, either by coating the rung with aluminium oxide granules set in epoxy resin adhesives, or by using a type of manufactured rung which is filled with aluminium oxide grout.
- c) Ladders, unless shown otherwise, shall be fabricated with 70 mm by 10 mm steel side rails and 20 mm diameter steel bar rungs at 200 mm centres. The ladders shall be securely bolted to the floor, at the top and intermediately on the wall at spacing of not over 2 m centres. Safety cages built-up of welded galvanized steel shapes shall be provided on the ladders where shown.

(02) Open Riser Stairs

- a) Provide open rise steel stairs designed and constructed to support a live load of 5 kpa (100 psf) or as specified.
- b) Provide stringers, supporting brackets, toe guards, carrying angles, treads, platforms, and railings of the size and dimensions shown. Comply with requirements specified hereinafter for railings.

- c) Tread shall be "Type IR4" (Reliance Steel Products Co.) or approved equal, with "Relgrint" abrasive nosing and plain bars, except checker plate nosing where shown.

(03) Sixty-Degree ladders

- a) Provide sixty-degree ladders designed and constructed to support a live load of 5 kpa (100 psf) or as specified.
- b) Provide stringers, supporting brackets, toe, guards, carrying angles, treads, platforms and railing of the size and dimensions shown. Comply with requirements specified hereinafter for railing.
- c) Treads shall be same as specified for open riser stairs.

(04) Ladder Rungs

Provide individual ladder rungs designed and constructed to support a live load of 114 kg (250 lbs) per rung. Rungs shall be of steel with abrasive surface consisting of aluminium oxide granules set in epoxy resin adhesive.

(05) Railings

- a) Provide steel railings of design and dimensions shown, with smooth bends and welded joints ground smooth and flush, designed and constructed to withstand a 91 kg (200 lb) load, or as specified, applied at any point, downward or horizontally, complete with all sleeves, brackets, bolts, and fastening devices as required for a complete installation.
- b) Provide gratings of steel or aluminium, as shown; exterior steel grating galvanized.
- c) Provide hinged and removable grating sections where shown, with end-banding bars for each panel and each openings, saddle clip anchors designed to fit over bearing bars, and stud bolts with washers and nuts, unless otherwise shown.

(06) Loose Lintels

- a) Provide loose steel lintels shown and as required over openings in masonry walls, partitions and shafts for installation under Division 4000 "Masonry Work".

Include lintels for mechanical openings as required. Provide lintels 0.3 m (12 in.) longer than the width of the openings at which they are installed.

- b) Where metal door frames are provided with the specified integral head reinforcement, provide loose lintels only for such openings 1 m (3 ft.) wide and wider.

(07) Miscellaneous Framing and Supports

- a) Provide steel framing and sub-framing shown on drawings and not specifically mentioned to be provided as part of the work of other trades.

- Fabricate miscellaneous units to sizes, shapes, and profiles shown or, if not shown, of required dimensions to receive adjacent other work to be retained by framing. Fabricate from structural steel shapes and plates and steel bars, of welded construction using mitred joints for field connection, except where otherwise shown. Cut, drill, and tap units, to receive hardware and similar items.
- Equip units with integrally welded anchors for casting into concrete or building into masonry. Furnish inserts if units must be installed after concrete is placed. Space anchors 0.6 m (24 in.) p.c. and provide minimum anchor units of 32 mm x 200 mm (1 1/4 in. x 8 in.) steel straps, except as otherwise shown.

(08) Structural Steel Door Frames

Fabricate shapes shown; fully weld joints unless otherwise shown. Provide hooked steel anchors, length as required for a minimum embedment in concrete of 150 mm (6 in.) unless otherwise shown. Weld anchors to frame jambs not more than 300 mm (12 in.) from bottom and head of frames and space anchors not more than 760 mm (30 in.) apart at heads and jambs. Extend frames to floor.

(09) Hatch Doors

Fabricate doors and frames as shown, joints at frame corners fully welded, doors leveled to a true plane, perimeter stiffener angles set to properly clear frames and welded to face plate with 20 mm {3/4 in.} long welds spaced not more than 150 mm (6 in.) along contact edges. Provide extra-heavy full surface welding-type hinges mounting plates as required. Provide latching dogs with suitable wedge-type keepers to seal doors tight all around and arranged so that door can be dogged and undogged from both inside and outside.

Secure rubber strip gaskets with adhesive recommended by the gasket material manufacturer. Run gaskets continuously along all edges of doors, with either mitered corner joins or integral corners. Keep gaskets free of paint.

(10) Angle Window Frames

Construct steel angle frames for lock-strip glazing gasket as shown, sides parallel and square, joints welded all around and ground smooth and surfaces in contact with glazing gaskets.

(11) Metal Stair Nosing

Cast aluminium with silicon carbide or aluminium oxide abrasive grits, sizes 1.59 mm to 1.07 mm {granule numbers 16 to 24}, uniformly spread and cast into walking surface, embedded not less than 0.8 mm {1/32 in.} at the rate of not less than 610 g/m² (2 oz/ft²) with plain unfluted walking surface and with wind-type anchors for screw application. Provide where shown at concrete stairs.

(12) Corner Guards

- a) Corner guards shall be single piece type of minimum 6 mm (1/4 in.) steel for each location securely anchored in place.
- b) Provide corner plates on chamfered external corners. Fabricate from 6 mm (1/4 in.) minimum thick steel plate as detailed.

- c) Column corner covers in vehicle areas shall be 75 mm x 75 mm x 6 mm (3 in. x 1/4 in) angle.
- d) All external corners in areas subject to vehicle or cart traffic require protection.

(13) Checkered Plate

Trench covers and covers for pits shall be raised pattern steel plate conforming to ASTM A 36, set in angle frames which are anchored to the concrete, thickness as shown. Continuous trench covers shall be cut in convenient lengths for handling and each shall be provided with finger holes. Provide standards two-way raised pattern. Thickness shown in nominal and does not include the height of raised pattern. Provide structural steel supports associated with checkered plate.

(14) Steel Frames

Steel frames for duct openings scuttles, mechanical equipment, louvres and other frames indicated as structural shapes, shall be neatly fabricated to the exact size required. Corners shall neatly joined, welded and ground smooth. Concealed anchors for securing to concrete or masonry shall be welded on the back at the spacing shown.

(15) Pipe Sleeves

Pipe sleeves through masonry or concrete walls, floors, and footings for piping, conduits, sub-drains, wall hydrants and similar items shall be standard-weight iron, mild steel or cast iron, sized to allow 8 mm between the sleeve and the pipe.

(16) Stairways

Metal stairways, platforms, and handrails shall be shop-assembled in the largest units suitable handling and shipping.

(17) Anchor Bolts

Anchor bolts shall be as detailed or as approved. Anchor bolts shall be carefully located and built into the connecting work. When anchor bolts are installed in pipe sleeves, the pipes shall be completely filled with grout at the time the grout pads are constructed or at the time the column bases or bearing assemblies are placed. Swede bolts installed in holes shall be set in epoxy- grout or other suitable material as approved.

(18) Traffic Barriers

Traffic barrier to be type Doorman Loon or equal an approved to the sizes here shown.

05513 EXECUTION

A- Installation

1. Bolts and Plugs

Except where otherwise specified for a particular item of work or for built-in work, fasten metal work to solid masonry with expansion bolts and to hollow block with toggle bolts. Fastening to wood plugs in masonry will not be permitted. Drill

holes for plugs or bolts to the exact diameter of the plug bolts, using a rotary drill for concrete and a percussion drill for other masonry. Provide screws threaded full length to the head of the screw.

2. Fastening

Install work as shown, plumb, level, and in-line with adjacent materials where required. Provide fastenings as indicated on the drawings, specified herein, or as shown on shop drawings.

3. Surface Protection

Protect finished surfaces against damage during subsequent construction operations and remove such protection at time of substantial completion.

4. Delivery

Deliver items, which are to be built into the work of other sections in time so as not to delay the progress of the work.

5. Vertical Ladders

Secure vertical ladders to masonry or concrete with a minimum of two 16 mm {5/8 in.) diameter expansion bolts at each bracket, unless additional attachments are required to sustain imposed loads.

6. Welding

Weld gratings to supporting steel, except for sections, which are hinged or required to be removable.

7. Touch-Up

Touch-up marred and abraded surfaces with the specified paint after erection in the field.

8. Anchor Bolts

Set anchor bolts accurately and hold in place by template. Centre sleeves on anchor bolts.

a) Use sleeves on bolts for mechanical equipment.

b) Use two nuts for anchor bolts securing vibrating equipment. After concrete is placed, the portion on anchor bolts shall be cleaned, coated with heavy grease, and wrapped with Kraft paper.

05514 MEASUREMENT & PAYMENT

a) Unless otherwise specifically stated in the Bill of Quantities or herein, all items shall be deemed to be inclusive of, but not limited to the following:

- i) Labor, materials, goods and all costs in connection therewith e.g. conveyance, delivery, unloading, storing, returning, packing, handling, hoisting, lowering.
- ii) All fixtures and all costs in connection therewith including costs of nuts, bolts, screws, rivet heads and the like.
- iii) Fabricating, welding, riveting, fitting and fixing materials and goods in position including costs of holding-down bolts, anchor plates and the like.
- iv) Use of plant.
- v) Waste of materials.
- vi) Establishment charges overhead charges and profit.
- vii) All other expenses, charges and taxes specified in Conditions of Contract.
- b) Works shall be measured net as fixed in position as per drawings and instructions of the Engineer. Each measurement shall be taken to the nearest 1/2" (12.5 mm) to establish weight. This rule shall not apply to any dimensions stated in the descriptions.
- c) Unit rates for all metal work shall be given in terms of their weights in metric tons calculated from the net measurement, as per sub-clause (b) above on the basis of appropriate standard weights. In arriving at these weights, tolerances for rolling margin and other permissible deviations from standard weights shall be ignored. No addition shall be made for nuts, bolts; screws rivet heads, fillet welds and the like.
- d) The cost of all painting and/or galvanization of miscellaneous metal works, both at the factory and at the Site, shall be deemed to be included in the unit rates for the metal work in question.
- e) All steel, iron or other metal fittings, fixtures, embedded items, etc., required for the operational process and other purposes, shall be classified as miscellaneous metal works and shall either each be enumerated separately, stating the description briefly by reference to the relevant drawings, or grouped together and given in metric tons. Where only fixing in position of such items is required of the Contractor, it will be specifically mentioned in the Bill of Quantities.

*** End of Division 05000 ***

DIVISION 07000 – THERMAL AND MOISTURE PROTECTION

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DIVISION 07000 – THERMAL AND MOISTURE PROTECTION**07100 ROOF WATER PROOFING AND HEAT INSULATION****07101 GENERAL****A- Scope of Work**

The work covered by this section of the Specifications consists of furnishing all plant, labour, equipment, appliances and materials and performing all operations in connection with installation of Water Proofing and Heat Insulation over RCC Roof Slab, flat or sloped as indicated on the Drawings, in strict accordance with this section of the Specifications, and subject to the terms and conditions of the Contract.

07102 PRODUCTS**A- Codes And Standards**

The ASTM and or BS standards and codes form a part of this section of specifications as though written in and/or attached here to and are intended to be used as a guide only to provide a minimum standard of kind quality and finish. The Engineer reserves the right to determine compliance and/or acceptability of the material and/or standards.

B- Submittals

The following submittals are required:

- Samples
- Certificates of Compliance

C- Materials

- a) 3mm thick Torch-on, APP Polymer modified bituminous sheet membrane (imported).
- b) Precast Heat Insulation Tiles shall be of high density thermopore embedded in concrete (1:2:4) using vibration process (self extinguishing/fire resistant) of minimum density 2 lbs per cu.ft (32 kg/m³). Thickness shall be 2" and/or as shown on Drawings, and as manufacturer's specifications.
- c) Cement, aggregate and water shall be in accordance with Specifications for, "Plain and Reinforced Concrete".
- d) Materials and methods not specifically described but required for proper installation, shall be provided by the Contractor subject to prior approval of Engineer, at no additional cost to the Employer.
- e) Samples of all materials proposed for use under this Section shall be submitted to the Engineer for his approval.

07103 EXECUTION**A- Product Handling and Delivery**

- a) Deliver materials to the job Site and store in a safe dry place with all labels intact and legible at time of installation.
- b) Protect materials before, during, and after installation and protect the installed work and materials of other trades.
- c) Do not leave insulation exposed to sunlight. Keep it covered with clean or light coloured material. Apply finish material soon after installation of the insulation. Brush off any sunlight degraded surface material prior to adhering insulation.
- d) Tiles chipped, cracked or squashed shall be rejected in the event of damage, immediately make repairs and replacements to the entire satisfaction of Engineer, at no additional cost to the Employer.

B- Preparatory Work

- a) Prior to work of this Section, carefully inspect the installed work of other trades and verify that such work is complete to the point where this installation may properly commence.
- b) Verify that building insulation may be installed in accordance with the original design and the manufacturer's recommendations.
- c) In the event of discrepancy, immediately notify the Engineer. Do not proceed with installation in areas of discrepancy until they have been fully resolved.
- d) All surfaces to receive waterproofing and insulation should be sound, clean, smooth, dry and free of debris, loose material or defects, which would otherwise have an adverse effect on the application, bonding, and performance.

C- Application of Roofing**(01) Base Layer (Screed)**

- a) Apply cement sand base layer to an average thickness of approximately 40mm, over concrete slab. Mix to consist of one part cement to four (4) parts sand aggregate to Engineer's approval.
- b) Wet concrete base slab before screeding.
- c) Spread and place screed to conform with slopes indicated on drawings. Applying in alternate bays not exceeding 250 sq. ft (25 Sq. M. Approx). Form canted fillets at upstands.
- d) Screeding and tamping shall be done immediately after spreading to achieve prescribed slope.
- e) The screed shall then be smoothened and consolidated to a uniform close textured surface with a wood float, to remove high and low spots exceeding 1/4 in (6mm) in 10 ft (3 M. Approx). Avoid excessive floating.

- f) Areas showing signs of laitance will be subject to rejection by the Engineer. These faulty areas shall be replaced at no additional cost to the Employer.
- g) Screed layer shall be cured for a minimum of 7 days after finishing.
- h) Allow sufficient time for screed to thoroughly harden and dry before allowing other work to be carried out.

(02) Water Proofing

- a) Surface Preparation

Examine all concrete surfaces to which the water proofing membrane is to be applied. Smooth, monolithic concrete surfaces are required for proper membrane adhesion. Surfaces must be free of voids, spalled areas, loose aggregate, and sharp protrusions, with no coarse aggregate visible. Broom finishes must not be used. Concrete must be cured and dry before application of 3mm thick Torch-on, APP Polymer modified bituminous sheet membrane (imported) to remove dust, loose stones, and debris.

- b) Priming

Apply Primer to all concrete or masonry mopping the surfaces with 0.05 lbs/sft (200-300 Grams/Sqm) with Dermaprimer (ASTM D4). Allow primer to dry one hour or until tack free. Prime only the area, which will be covered with membrane in a working day. Areas not covered with membrane in 24 hours must be reprimed. Metal or other dense surfaces do not require priming but must be clean, dry, free of loose paint, rust or other contaminants.

- c) Temperature

Apply Waterproofing Membrane only in fair weather when air and surface temperatures are above 5°C.

- d) Sealing Edges

For vertical applications, Waterproofing Membrane should be applied over the edge of the slab or over the top of the foundation or parapet wall. If the membrane is terminated on the vertical surface, a reglet or counter flashing may be used or the membrane may be terminated on the concrete by pressing very firmly to the wall. Press edges with a metal or hardwood tool such as a hammer or knife handle. Failure to use heavy pressure at terminations can result in a poor seal. Nailing of the membrane is usually not required.

Apply trowelled bead of Waterproofing Membrane Mastic to all vertical and horizontal terminations.

- e) Sealing Seams

All edge and end seams must be overlapped at least 65 mm. A guideline is printed on the membrane for this purpose.

f) Corner Details

Cover all inside and outside corners with an initial strip a minimum of 30 cm wide centered on the axis of the corner followed by the full width Waterproofing Membrane application. Outside corner must be free of sharp edges. Inspect surfaces adjacent to all corners and repair if necessary to provide a smooth dense surface. Inside corners should receive a fillet formed with latex modified cement mortar (such as Daraweld-C mixed in with cement mortar) and a double coverage of membrane as described above. Do not use fiber or wood cants.

g) Protection of Membrane

Waterproofing Membrane should be protected to avoid damage from other trades, construction materials. The Membrane Protection System should be used on terraces / balconies with protection layer of screed 3" (75 mm) thick or equivalent as recommended.

The Membrane Protection System should be laid the same day the membrane is applied immediately after 24-hour flood testing.

h) Certification

Certification of the material and its performance in accordance with the literature shall be furnished by the supplier from the manufacturer.

(03) Heat Insulation

Install roof insulation tiles over water proofing membrane.

D- Roof Finish

- a) Set tiles in patterns with 1/2" (12.5mm) mortar joints. Joints shall be grouted and tooled with cement sand mortar, tinted to match colour of tiles.
- b) Area to receive tiles shall be set out to correct alignment, gradients etc.
- c) Lay tiles with joints butted and aligned in both directions but not coincidental with insulation joints. Set out tiles to terrace / balconies areas so that distance remaining at perimeter walls, to receive in-situ concrete edge, are equal but are not less than 12 in (300mm) and not greater than 18 in (450mm).
- d) Cut tiles square to face to a tolerance of 1/8 in (3mm). Cutting shall be kept to a minimum.
- e) Ensure alignment is correct with adjacent tiles and evidence of movement or rocking is eliminated.
- f) Chipped, broken and cracked tiles shall be rejected.

- g) Deviations exceeding 1/4" (6mm) in 10 ft (3 M Approx) applied in all directions shall not be accepted.

07104**MEASUREMENT AND PAYMENT**

- a) Unless otherwise specifically stated in the bill of Quantities or herein, all items shall be deemed to be inclusive of, but not limited to the following: -
 - i) Contractor's establishment charges, overhead charges, profit, interest.
 - ii) All other expenses, charges, taxes specified in conditions of Contract.
 - iii) Labour and all costs in connection therewith.
 - iv) Use of plant, equipment and machinery and all costs in connection therewith, e.g. mobilization, demobilization, transporting, fuel, energy charges, grease oil, installing, operating, storing, watching, returning, replacing, handling, maintaining, idle stand, parking, removing, damaged, destroyed, salvage.
 - v) Material and goods e.g. marketing, selecting, conveyance, loading, unloading, storing, watching, returning, handling, hoisting, lowering, cutting, joining, fixing, wastage, destroyed, damaged, salvaged.
- b) Works shall be measured net as applied in position as per Drawings and instructions of the Engineer. Each measurement shall be taken to the nearest 1/2" (12.5mm). This rule shall not apply to any dimensions stated in descriptions.
- c) Waterproofing Membrane and Heat Insulation Tiles, except where otherwise stated shall be measured each separately as the net actual visible areas of the treated surface in sq. ft (square metres) describing the quality.
- d) Unit rates for water proofing membrane and heat insulation tiles shall be deemed to be inclusive of all preparatory work, scrapping, scratching, cleaning, priming / mopping and the like, complete as directed by the Engineer.
- e) Unit rates for water proofing membrane and insulation tiles shall be deemed to be inclusive of gravel strips, flashings, scuppers, roof drains, grouting of tiles joints, turn-ups, turn-downs and wedging of membrane, laps of membrane and the like as shown on drawings, complete as directed by the Engineer.

*** End of Section 7100 ***

Signature of Client

Signature of Contractor

07110 BASEMENT WATER PROOFING**A- Scope of Work**

The work covered by this section of the Specifications consists of furnishing all labour, tools scaffolding, equipment and water proofing materials of the required kind; and in performing all operations in connection with procurement, transportation and delivery and application / installation etc. of all work classified as water proofing work or included herein, all items supplied by other trades and customarily built-in and/or installed under waterproofing work or required to complete this work.

07112 EXTERNAL WATER PROOFING THROUGH BITUMINOUS MEMBRANE**A- Codes and Standards**

The ASTM and or BS standards and codes form a part of this section of specifications as though written in and/or attached here to and are intended to be used as a guide only to provide a minimum standard of kind quality and finish. The Engineer reserves the right to determine compliance and/or acceptability of the material and/or standards.

B- Submittals

The following submittals are required:

- Samples
- Certificates of Compliance

C- Transportation, Handling, Storage and protection**i) Storage**

All materials shall be stored in an approved manner and shall be protected from contact with soil and exposure elements.

ii) Roll Materials

All materials delivered in roll type packaging shall be stacked on end at all times

iii) Temperature control

Water proofing membrane shall be protected from freezing temperature or ambient temperatures above 38°C (100°F).

D- Products

4mm thick Torch-on, APP Polymer modified bituminous sheet membrane (imported).

E- Execution

Installation guide

- a) Surface Preparation: Concrete must be smooth and free of voids, loose aggregate and sharp protrusions. Concrete must be cured and dry before application.

- b) Priming: Apply by spray or mopping. Allow to dry one hour or until tack-free. Prime only areas to be covered with membrane within a working day.
- c) Membrane Application -Horizontal Surfaces: Apply Membrane from the low point to the high point so that laps shed water. All seams must be overlapped at least 65mm. Stagger end laps. Roll the entire membrane firmly and completely as soon as possible.
- d) Membrane Application -Vertical Surfaces: Apply Membrane vertically in lengths up to 2.5 metres. All seams are to be overlapped at least 65mm. Roll all membrane with hand roller.
- e) Protection of Membrane: The Membrane protection system should be used on foundation and horizontal surfaces.

07113 INTERNAL WATER PROOFING THROUGH SURFACE COATING

A- General

This part covers furnishing and installing concrete waterproofing through surface coating at all inside cast-in-place concrete surfaces of under ground water tank's slab and walls, green areas, water pond, flower troughs and as specified on the Drawings. In principle, the coating should have the capability to form insoluble crystals into water bearing capillaries and interstices to effectively block passage of water and to ensure permanent water tightness for the life of the structure.

B- Submittals

The following submittals are required:

- a) Detail Drawings and/or Shop Drawings

For the proposed system to be used and details of construction joint, expansion joint and edge treatment.
- b) Installation Manuals

Include application procedure, storage procedure and curing time.
- c) Samples

Concrete water proofing material, in sealed containers/ bags.
- d) Manufacturer's recommendations for applications.
- e) Test Reports

Include certified test report on material properties and field test reports.

C- Product Handling**a) Delivery**

Deliver manufactured materials to the site in original, unopened containers clearly indicating manufacturers name, brand name, and other identifying information.

b) Storage

Store material in a dry location, off the ground and in such manner as to prevent damage or intrusion of foreign matter. Replace materials which have become damaged or otherwise unfit for use during delivery or storage.

D- Products**a) Concrete Waterproofing Material**

Material shall be composed of a compound of chemicals, quartz sand and cement. It shall be supplied in powder form ready to be mixed with water and shall be applied as a slurry coat -that waterproofs by crystalline growth through the capillary voids in the concrete substrate. Acceptable products shall be one of the following or approved equivalent:

Master Hyseal, Ferro Hyseal or superior

b) Water

Treated (utility water quality), clean and free of deleterious materials which are determined to impair the strength or bond of the waterproofing materials.

E- Execution**(01) Condition of Surfaces**

Examine all concrete surfaces to which the waterproofing material will be applied. Waterproofing material shall be applied only to sound concrete. Concrete surfaces shall be clean and free from all form scale, laitance, formwork oil, curing agents and other foreign materials as per the recommendations of the approved manufacturer.

(02) Preparation

Prepare the concrete surface for waterproofing treatment in accordance with manufacturer's instructions. Prior to the specified final application of waterproofing material, initial applications to construction joints and repairs to form-tie holes, honeycombed pockets, faulty construction joints, and cracks shall be completed in accordance with manufacture's instructions.

(03) Mixing, Application and Curing

a) Slurry Coat

Apply first slurry coat of the product as per manufacturers recommendations over any primer if required. Apply second coat if recommended by the manufacturer after a specified time.

b) Mixing, Application and Curing

Mixing, application and curing of waterproofing material shall be completed by a qualified applicator in accordance with manufacturer's instructions.

(04) Cleaning

Upon completion of work, remove unused materials, containers and equipment from the site. Clean and repair surfaces that are stained, marred, or otherwise damaged by work under this section.

(05) Certification

Certification of the material and its performance in accordance with the literature submitted earlier for approval shall be furnished by the supplier from the manufacturer to the satisfaction of the Engineer.

07114 MEASUREMENT AND PAYMENT

Measurement and payment shall be made for acceptable measured quantity on the basis of unit rate per square foot quoted in the Bill of Quantities and shall constitute full compensation for all the works related to the item to complete the job as per specifications and BOQ.

*** End of Division 07000 ***

DIVISION 08000 - DOORS AND WINDOWS

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DIVISION 08000 – DOORS AND WINDOWS**08110 ALUMINIUM DOORS AND WINDOWS****08111 GENERAL****A- Scope of Work**

The work covered under this section comprises of the following:

- a) Fabricating, furnishing and installing in position aluminium doors and windows complete with handles, locks, nylon wheels, vinyl weather strips etc. and other finish hardware as shown on the drawings and specified hereunder.
- b) Furnishing and installing glass glazing of specified quality and colour to windows and doors.

B- General Requirements**(01) Codes And Standards**

The ASTM and or BS standards and codes form a part of this section of specifications as though written in and/or attached here to and are intended to be used as a guide only to provide a minimum standard of kind quality and finish. The Engineer reserves the right to determine compliance and/or acceptability of the material and/or standards.

(02) Design Requirements

All doors and windows will be designed for a positive and negative wind loads based on section 2311 of UBC for a basic wind speed of 80 mph Exposure C, and will comply with AAMA 302.8 specification p .A 2.50. All sectional dimensions shown on drawings are only indicative. The Contractor shall be responsible to determine the adequacy of these with respect to actual structural and performance requirements. All extrusions shall be of adequate strength, not only to meet the structural performance, but also to minimize the risk of distortion in the finished surfaces.

(03) Work Sizes

All dimensions given on drawings are between structural openings and/or between finished surfaces and allowances shall be made for variation due to constructional tolerances. The Contractor shall be responsible to measure the final dimensions from the Site before fabrication of doors, windows and other assemblies/units.

(04) Weather Tightness

Weather tightness and operations shall suit the weather conditions prevailing in Islamabad. All doors and windows will be fabricated as completely air and water tight units including gaskets for glazing, weather stripping, latches, locks, bolts for fixing etc.

(05) Air Tightness

The fixed glazed windows shall be as far as possible 100% air tight under all weather conditions. Air infiltration for opening windows and doors when fully closed shall not

exceed $3\text{m}^3/\text{hr}$ /meter length of opening joint at a test pressure of 498 N/M^2 as tested in accordance with B.S. 4315 part 1.

(06) Acoustic Performance

Windows when installed shall provide an average sound reduction of 28 dB over a frequency range of 100-3150Hz.

C. Technical and Fabrication Requirements.

(01) Appearance

- a) Provide units composed of aluminium shapes with visible portions of profile matching detail indicated on the drawings, and free from additional slots, grooves, fins or other non-functional details.
- b) Fabricate and assemble all work in the shop wherever possible and otherwise profit as required to reduce field fabrication to minimum.
- c) Fit member neatly and to hairline accuracy with profile extending into joints without additional trim. Match flush joints to form perfectly smooth plane; match offset joints to hairline butt fit to flat surface by one point of tangency of corner radius. Units using extra trim to conceal misalignment will not be acceptable.
- d) Make all connections by means of concealed fasteners; exposed fasteners will be permitted where essential to proper adjustment of door units. Use only countersunk flathead machine screws for exposed fasteners.
- e) Where additional strength of section is required to meet structural requirements, provide additional wall thickness or stiffeners inside the extrusion. Width of face (sight line) dimensions indicated on the drawings are maximum permissible exposed surface.
- f) Manufacturer's standard sections will be acceptable only when such extrusions are substantially in accordance with the profiles indicated on the drawings as accepted by the Engineer.
- g) Surface Smoothness: Submit samples and obtain approval for extent of the lines permissible in all "as extruded" materials.

(02) Design

Design anchors to allow for horizontal and vertical expansion. Screws, nuts, washers, bolts and reinforcements shall be aluminium, AISI Series 300 stainless steel or other material compatible with aluminium, and of adequate strength for the proposed use.

(03) Structure

- a) All extrusions, where used structurally, including column covers: Not less than 3.2 mm (0.125 in.) wall thickness, except where otherwise detailed.
- b) Non-structural covers: Not less than 2 mm (0.080 in.) wall thickness, except as otherwise indicated on drawings.
- c) Snap-on glazing or applied trim: Not less than 1.6 mm (0.60 in.) except as otherwise indicated on drawings.

- d) Internal stiffeners: As indicated on the drawings and as standard with the manufacturer for the required strength.

D- Submittals

(01) General

Refer to "Schedule of Required Submittals", section of Division 01000, and other sections referenced therein for special instructions relating to submittals.

(02) Manufacturer's Coordination and Services

- a) Product Certification: Certification of proper use and compatibility for aluminium sealing and lacquer.
- b) Certification of alloy for integral colour finishes.
- c) Certification by Aluminium Association designation for class of anodizing and finish.
- d) Maintenance instructions.

(03) Warranty

- a) All organic coating including PVF₂ "Kynar" shall be warranted by the manufacturer for a period of not less than 10 years or such longer periods the manufacturer normally provides.
- b) The fabricator shall certify compliance with all of manufacturer prerequisites for maximum warranty.

(04) Samples

- a) Submit Samples in accordance with section 01343 of Division 01000.
- b) Before any work is performed, the following samples shall be submitted:
 - Three sets of 300 mm x 300 mm (12 in. x 12 in.) sheets (pairs indicating range) of samples of each type of aluminium finish specified herein. The integral colour anodized samples must demonstrate the limits of colour range within which production materials will be processed.
 - Submit samples of all components, including all hardware trim, weather stripping and typical extrusions.
 - Representative samples of welded connections, mitred joint, and butt weld and typical brake form and bend for bar and sheet stock to show final finished appearance.
- c) Identify samples as to treatment, anodic film thickness, alloy, colour, and portion of the work to which the sample applied. Make samples on sections of similar shape as proposed materials and large enough to establish good comparison.
- d) For project reference, one set of record samples will be retained by the Engineer, and kept available at the job site and one returned to the Contractor.

(05) Shop Drawings

Submit shop drawings in accordance with section 01344 of Division 01000.

Coordinate shop drawings with material description to show location and extent of various finishes.

Identify finish by reference to Aluminium Association designations and to numbered samples established for the project. '

(06) Maintenance Instructions

Prepare and deliver to the Engineer a complete maintenance manual in accordance with the requirements of the "Project Record Documents" section 01720 of Division 01000.

Such documents are an integral part of the requirements of these Specifications and require close cooperation between the basic metal manufacturer, the fabricator and the finisher.

Reference information shall include:

- Complete description of alloy, temper, and finish of each type of material as delivered.
- Description of method by which finish was produced.
- Location in the building of each type.

Maintenance information shall include specific instructions for:

- Routine cleaning instructions with recommendations for materials and schedule applicable to locality and exposure.
- Recommendations for major cleaning as required to maintain anodized appearance and prevent development of oxidation.
- Instructions for re-finishing and restoration of original appearance.

Appropriate publications shall be included but these shall not be regarded as taking the place of required specific instructions.

08112 PRODUCTS**A- Materials****(01) Aluminium**

- a) Sheet Aluminium
 - Natural Colour Anodized Sheet: No 55 Architectural Sheet or Anoclad Type 01.
 - Sheets to receive Integral Colour Finish: See "Aluminium Finishes".
- b) Extruded Aluminium
 - Natural Colour Anodized Extrusions: 6063- T5 alloy with a minimum wall thickness of 3.2 mm (1/8")

- Natural Colour for Snap-in Beads: 6063- T6 alloy.
- Structural Shapes, except where integral colour finish is indicated: 6063- T6 alloy. Extrusions for Integral Colour Finish: Special alloy, see "Aluminium Finishes".

c) Cast Aluminium

- Anodized Castings: 214 alloy.
- Structural Castings: 356- T6 alloy.

(02) Support Devices

- a) Fasteners used in assembling sections: Exactly matching adjacent surfaces where exposed or AISI 300 series stainless steel where concealed.
- b) Steel Anchors: Hot dip galvanized, or AISI 300 series stainless steel.
- c) Inserts: For required anchorage into concrete or masonry work furnish inserts of cast iron, malleable iron or 2.8 mm (12 gauge) steel hot-dip galvanized after fabrication.
- d) Expansion Anchor Devices: Fed. Spec. FF-S-325 Group II, Type 4, Class I, Int. Amendment 3; Molly "Parabolt" or equal.

(03) Accessory Materials

- a) Joint Filler: Expanded cellular neoprene, closed cell, tape, coated with non-staining adhesive on surface: ASTM D 1056 "Testing Sponge and Expanded Cellular Rubber Products", type SC-41 ; shape as required.
- b) Thermal Barrier: Solid neoprene, 60 durometer.
- c) Bituminous Paint: Koppers 50 or SSPC Paint 12 (0.03 in. per coat).
- d) Protective Coverings: After finishing procedures have been completed apply protective wrappings of paper or plastic film. Keep material dry until wrappings are removed.

B- Aluminium Finishes

Finish designations are indicated herein in accordance with the standards of the Aluminium Association.

(01) Natural Colour Anodizing

Aluminium Association AA-A41 and A-31.

- a) Exterior Aluminium: Architectural Class 1AA A-41 with a minimum coating weight of 5 mg/cm² (27 mg/sq. in.) and a minimum anodic film coating of 0.018 mm (0.7 mils).
- b) Interior Aluminium: Architectural Class II, AA-A31 , or as indicated, with a minimum coating of 0.01 mm (0.4 mils)
- c) Pre-treatment: Pre-treat aluminium specified as NCA in general as listed below. See drawings for finish in each specific location.

- Typical Finish unless otherwise specified: Clean and caustic etch AA C12-C21.
- Other Items: As called for on drawings by Aluminium Association designations on drawings and specified under sections or paragraphs dealing with specific item.
- d) Testing Standards:
 - Minimum Anodic Film Coating: (ASTM B 244)
 - Minimum Film Weight: (ASTM B 137)
 - Corrosion: no pitting at 500 hours (ASTM B 117).
 - Staining: ASTM B 136.
 - Mill Finish noted M10: As extruded but not to exceed 90 micro inch, 100 RMS surface roughness.
- e) Lacquer Coating: Clear lacquer coating, apply uniform 0.08 to 0.012 mm (0.3 to 0.5 mil); equivalent to electrostatic gun application, free of runs or brush marks.

(02) Kynar Coating

- a) Finish coating shall be a factory applied oven baked finish based on Kynar 500 "Kynar 500/DURANAR XLE" (Poly vinylidene Fluoride/PVFP₂). Formulation shall contain a minimum of 70% poly vinylidene fluoride by weight. Licensed formulator shall identify the finish which he supplies as meeting the minimal requirements for formulation as set forth in Penwalt's licensing agreement.
- b) Application of the finish based on Kynar 5000 shall be performed under specifications issued by the licensed formulator and by an applicator specifically approved by one (or more) of the formulators. Said applicator shall provide written notification of approval by a formulator prior to application of the finish.
- c) Primer coat shall be corrosion resistant epoxy based primer with dry film thickness averaging from 0.0025 to 0.005 mm (.1 mil to .2 mils). The finished coat based on Kynar 5000 shall have a dry film thickness averaging 0.04 mm (1.5 mils).
- d) Testing Standards
 - Weatherometer: In accordance with ASTM E 24 withstand 500 hours exposure in the Sunshine Aro Weatherometer Model XW-R under 60/60 Dew Cycle conditions without evidence of chalking or withstand 2,000 hours exposure in Atlas Twin/Arc Weatherometer without evidence of chalking or film failure.
 - Humidity: In accordance with ASTM D 2247 withstand 3000 hours at 100 % relative humidity with no more than 5 % of surface showing blisters no larger than No.4 (ASTM D 714).
 - Salt Spray: In accordance with ASTM B 117 withstand 3000 hours at 5% salt fog at 35° C (95° F) with no more than a few blisters no larger than No.4

ASTM D 714 and no more than 1.6 mm (1/16 in.) creepage and loss of adhesion from line scribed to metal.

- Pencil Hardness: F-H.
 - Gloss: 35 ± 5% on 60° gloss meter in accordance with ASTM D 523.
 - Adhesion: No removal of finish after 1.6 mm (1/16 in.) cross-hatching (ASTM D-3359) to bare metal, impacting to point of metal rupture and subjecting to application and quick removal of scotch cellophane tape.
 - Abrasion Resistance: 60 Litres/mil minimum ASTM D-968.
- e) Colour: As approved by the Engineer.

C- Dissimilar Materials

(1) Dissimilar Metals

Aluminium materials placed in contact with, or fastened to dissimilar metals should be separated from such metals by application of bituminous coating, non absorptive tape or gaskets or sealants.

(2) Masonry, Concrete or Plaster

Where aluminium materials are placed in contact with, or built into, masonry, concrete, or plaster, apply a heavy brush coat of alkali resistant bituminous paint, 1 mm (40 mils) dry film thickness.

08113 EXECUTION

A- Construction Requirements

The aluminium doors and windows shall be manufactured by an approved manufacturer in this trade.

The Contractor shall provide shop drawings based on Architectural drawings for the approval of the Engineer before orders are placed with the manufacturers.

The manufacturer shall use the latest and approved method of jointing employed in the manufacture of high class work viz. mechanical jointing, reinforced with concealed welding shall be used in the manufacture of doors and windows.

The workmanship of metal doors and windows shall conform to applicable provision of B.S. 990:1970.

(01) Wind Pressure

The Design wind speed to which the various elements of glazing and framing will be subjected to shall be calculated in accordance with B.S. CP-3 and the wind speeds of 80 mph are to be taken into account.

All assemblies must be of appropriate shape, thickness and sections, to enable them to resist the loads produced by repeated imposed wind pressures. The maximum deflection over clear span of any member shall be such that it does not induce cracking in glass panels and render the assembly unsafe. No member shall suffer any permanent deformation. No part of the work shall rattle in use.

(02) Fixing

The fixing of doors and windows to concrete openings shall be carried out in an approved method as indicated on the drawings or as directed by the Engineer. Provision of necessary groove or rebate and hold fasts in the concrete shall be made in the form work and no holing or drilling shall be allowed in the exposed concrete finishes. These shall be erected in position after the building structure is completed and by using proper hold fasts as shown on drawings or counter sunk bolts and screws as directed by the Engineer in accordance with site requirements.

(03) Handling

Care shall be taken in handling metal doors and windows, during transportation and at job site. These shall be stored under cover and shall be installed only by skilled mechanics, set plumb, level, in alignment and properly braced to prevent distortion.

B- Protection

- (1) The joint between window and door frames and the building shall be caulked with approved building mastic for total weather proofing.
- (2) After installation, doors and windows shall be protected from construction hazards that will interfere with their operation or damage their appearance or finish. They shall be cleaned on inside and outside of all mortar, plaster, paint or other foreign matter to present a neat appearance. Hardware and moving parts shall be lubricated.

C- Glazing**(01) General**

The work of fixing glazing to doors, windows shall be carried out with the type and special quality of glass specified for each door and window and as indicated on the drawings or as directed by Engineer.

The sizes of glass indicated on the drawings are approximate only, and the actual sizes required shall be determined by measuring the frames to receive the glass. All glass shall be factory labelled on each pane and the label shall not be removed until finally approved by the Engineer. Glass will be fixed with best quality mastic compound of approved make suitable for the type of glass or as directed by Engineer. Special rubber lining and weather proof brush joints for sliding surfaces shall be provided where required.

(02) Glazing Gaskets

Structural Rubber Glazing Gaskets consisting of Dense Neoprene extrusions with injection molded corner units, fabricated into frames, with either integral or separate locking strips (Zippers); shall comply with ASTM C 542 black.

(03) Standards and Performance

Watertight and airtight installation of each piece of glass is required, except as otherwise shown. Each installation must withstand normal temperature changes, wind loading impact loading for operating sash and doors without failure of any kind including loss or breakage of glass, failure of sealants or gaskets to remain watertight and air-tight, deterioration of glazing materials and other defects in the work.

Protect glass from edge damage at all times during handling installation and operation of the building.

Comply with combined recommendations of glass manufacturer and manufacturer of sealants and other materials used in glazing, except where more stringent requirements are shown or specified, and except where manufacturer's technical representatives directs otherwise.

Inspect each piece of glass immediately before installation, and eliminate any which have observable edge damage or face imperfections.

Cut and install tinted glass as recommended in "Technical Services Report No.104" by PPG Industries.

Install polysulfide sealants as recommended by Thiokol Chemical Corp., except as otherwise recommended by the sealant manufacturer.

(04) Preparation for Glazing

Clean the glazing channel, or other framing members to receive glass, immediately before glazing. Remove coatings which are not firmly bonded to the substrate. Remove lacquer from metal surfaces wherever elastomeric sealants are used.

Apply primer or sealer to joint surfaces wherever recommended by sealant manufacturer

Do not attempt to cut, seam, nip or abrade glass which is tempered.

Force sealants into channel to eliminate voids and to ensure complete "wetting" or bond of sealant to glass and channel surfaces.

Tool exposed surfaces of glazing liquids and compounds to provide a substantial "wash" away from the glass. Install pressurized tapes and gaskets to protrude slightly out of the channel, so as to eliminate dirt and moisture pockets.

Clean and trim excess glazing materials from the glass and stops or frames promptly after installation, and eliminate stains and discolorations.

Where wedge-shaped gaskets are driven into one side of the channel to pressurize the sealant or gasket on the opposite side, provide adequate anchorage to ensure that gaskets will not "walk" out when subjected to dynamic movement. Anchor gasket to stop with matching ribs, or by proven adhesives, including embedment of gasket tail in cured heel bead.

(05) Cure, Protection and Cleaning

Cure glazing sealants and compounds in compliance with manufacturer's instructions and recommendations, to obtain high early bond strength, internal cohesive strength and surface durability.

Protect glass from breakage immediately upon installation, by attachment of crossed streamers to framing held away from glass. Do not apply markers of any type to surfaces of glass.

Remove and replace glass which is broken, chipped, cracked, abraded or damaged in other ways during the construction period, including natural causes, accidents and vandalism.

Maintain glass in a reasonably clean condition during construction, so that it will not be damaged by corrosive action and will not contribute (by wash-off) to the deterioration of glazing materials and other work.

Wash and polish glass on both faces not more than 4 days prior to Employer's acceptance of the work in each area. Comply with glass manufacturer's recommendations.

08114 Measurement and Payment

A- Measurement

Payment for doors and windows will be made by measuring clear opening area in block work or concrete in square feet.

B- Rate and Payment

Rates for all the items under this Section shall cover the cost of furnishing all the materials labour, scaffoldings and appliances at Site and performing all operations in connection with their installation in accordance with instructions of the Engineer. It is particularly mentioned that the rates for fixing doors and windows etc. shall include fixing of all finished hardware iron mongery fittings such as locks, peg, stays, handles, push plates, kicking plates, door closers, glazing, flexible compounds, rubber lining and appliances at site and performing all operations in accordance with the instructions of the Engineer and specifications.

The wastage for glazing due to breaking, cutting to sizes and replacement during maintenance period shall not be paid for separately and the rates shall be deemed to be inclusive of all these costs.

*** End of Section 08110 ***

08120 FINISH HARDWARE**08121 GENERAL****A- Description**

This section covers fabricating, furnishing, and installing finish hardware.

B- Applicable Codes and Standards

The codes and standards applicable to only a portion of the work specified in this section are referenced in the relevant paragraphs. Codes and standards, which are generally applicable to the work of this section, are listed hereinafter:

<u>Sponsor</u>	<u>Number</u>	<u>Subject</u>
ANSI	A 156.1	Butts and Hinges
ANSI	A 156.2	Locks and Lock Trim
ANSI	A 156.3	Exit Devices
ANSI	A 156.4	Door Controls-Closers
ANSI	A 156.5	Auxiliary Locks & Associated Products
ANSI	A 156.6	Architectural Door Trim
ANSI	A 156.13	Mortise Locks and Latches
ANSI	311	Door Controls Overhead Holders
ANSI	501	Auxiliary Locks
ANSI	1201	Auxiliary hardware
ANSI	1301	Materials and Finishes
ANSI	80	Fire Doors and Windows

C- Submittals

The following submittals are required:

1. Installation Manuals
Includes complete installation and adjusting instructions.
2. Samples
Representative samples of complete finished units as may be requested.
3. Manufacturer's Data
4. Operations and Maintenance Manuals
Include instructions for operating parts and maintenance of exposed finishes.

5. Certificates of Compliance

Certificates of qualified independent testing laboratories certifying that a prototype of each item of hardware has been tested in accordance with the applicable BHMA or ANSI testing procedures and meets the requirements of the specified standard and grade.

D- Quality Assurance

1. Manufacturer

Obtain each kind of hardware (latch and lock sets, hinges, closers, flush bolts, holders, etc.) from only one manufacturer.

2. Fire-Rated Openings

a) Provide hardware for fire-rated openings in compliance with NFPA Standard No.80. This requirement takes precedence over other requirements for such hardware. Provide only hardware which has been tested and listed by UL, or an approved equal fire rating agency, for the types and sizes of doors required, and complies with the requirements of the door and door frame labels.

b) Where panic exit devices are required on fire-rated doors, (with supplementary marking on UL door label or approved equivalent indicating "Fire Door to be Equipped with Fire Exit Hardware") provide UL label or approved equivalent on exit device indicating "Fire Exit Hardware".

E. Product Handling

Provide secure lock-up for hardware delivered to the project, but not yet installed. Control the handling and installation of hardware items which are not immediately replaceable, so that the completion of the work will not be delayed by hardware losses, both before and after installation.

F- Job Conditions

1. Coordination

Coordinate hardware with other work. Tag each item or package separately with Identification related to the final hardware schedule, and Include basic installation instructions in the package. Furnish hardware items of proper design for use on doors and frames of the thicknesses, profile, swing, security and similar requirements indicated, as necessary for proper installation and function.

2. Templates

Furnish templates to fabricators of other work which is to be factory prepared to receive finish hardware.

G. Tools and Spare Parts

1. Tools

Three sets of all special tools required for use in adjustments, maintenance, assembly, and removal and replacement of builder's shall be furnished for

each different type of hardware furnished. The use of each special tool shall be indicated.

2. Unused Parts

Deliver to designated personnel all miscellaneous accessories accompanying hardware which are not incorporated in the work, such as leftover equipment, special wrenches for hardware, screws, extra strikes, emergency type keys and other similar parts.

H- Shipping

Packing each item separately, with identification related to the approved hardware schedule. Include basic installation instructions in the packages.

I- Security Control Hardware

1. Coordination with Other Work

Various items of hardware for security control, such as electrical hinges, electrically operated locksets, balanced magnetic switches, electric strikes, solenoid operated panic devices, electric power transfers and similar devices are included in another section of the works. Verify and confirm the extent and details of such other work, and coordinate and cooperate with the work of such other section.

08122 PRODUCTS

A- Materials

(01) General Metals and Finishes

For all items in each hardware set at each opening furnish base materials and exposed finishes as set forth below, Finish code numbers specified are from BHMA 1301; finishes shall comply therewith. Match the finish of every hardware unit at each door or opening to the greatest extent practicable, except as otherwise indicated. Limit differences in colour and textures as much as commercially possible where the base metal or metal forming process is different for individual units of hardware exposed at the same door or opening, including items with factory painted finishes. In general, match all items to the manufacturer's standard finish for the latch and lock set (or push-pull units if no latch-lock sets) for colour and texture. Provide protective lacquer coating on all exposed hardware finishes of brass, bronze and aluminium, except as otherwise indicated. The suffix "-NL" is used with standard finish designations to indicate "no lacquer".

- a) Butts and Hinges at Exterior Doors: Type 304 stainless steel with satin finish, code 630.
- b) Hinges at Exterior Gates: Stainless steel with satin finish, code 630
- c) Butts and Hinges at Interior Doors: Steel, satin chromium plated, code 652.
- d) Knobs, Panic Bars and Accompanying Trim: Stainless steel with satin finish, code 630.
- e) Other Stainless Steel Items: Satin finish, code 630.
- f) Concealed Closers: Satin chrome plated, code 626, on exposed portions.

- g) Surface Closers and Covers: Satin chrome plated, code 626, unless otherwise specified.
- h) Padlocks: Hardened steel shackles, satin chrome, code 626.
- i) Rust Resistant Finish (-RP): For iron and steel base metal, required for exterior work (and also when designated with the suffix "-RP", provide 0.005 mm (0.2 mil) thick copper coating on base metal before applying brass, bronze, nickel or chromium plated finishes, or prime painting with weather-resistant epoxy primer.
- j) Aluminium Finish: Furnish all aluminium manufactured items with a BHMA 628 finish, clear anodised aluminium; or 671, a flat black coated aluminium, where scheduled.
- k) Keys: Nickel silver.
- l) Other Items: Brass or bronze, satin chromium plated, code 626, unless otherwise specified.

(02) Templates

Where templates are furnished for preparation of other work to receive builder's hardware, provide hardware conforming to the templates.

(03) Hand of Door

The drawings show the swing of each door leaf. Furnish each item of hardware for proper installation and operation of the door swing as shown and for hand of door conforming to final hardware schedule.

(04) Bi-Lingual Identification

Where words are required on hardware (such as "push" or "pull") provide them in both Urdu and English.

(05) Fasteners

- a) Furnish necessary screws for installation of each hardware item. Provide Phillips flat-head screws except as otherwise indicated. Finish exposed and partially exposed screws to match the hardware finish or, if exposed in surfaces of other work, to match the finish of such other work as closely as possible, including "prepared for paint" in surfaces to receive painted finish. Do not provide hardware which has been prepared for self-tapping sheet metal screws except as specifically indicated. Furnish wood screws for all connections to wood doors, and machine screws for all connections to metal parts and assemblies.
- b) Provide concealed fasteners for hardware units which are exposed when the door is closed, except to the extent no standard-manufacturer units of the type specified are available with concealed fasteners.
- c) Fasten closers on doors with hex bolts.
- d) Fasten items mounted on hollow plaster, stone, marble and ceramic tile partitions with machine screws into metal backing plates secured to studs.

- e) Provide fasteners which are compatible with both the unit fastened and the substrate and which will not cause corrosion or deterioration of hardware, base material or fasteners.

(06) Butts and Hinges

ANSI A 156.1, Grade 1 where specified and where heavy weight hinges are required, others Grade 2; full mortise, template, fast button tips, square cornered, non-removable pins at hinges exposed at exterior, unless otherwise specified or scheduled.

- a) Bearings: Ball bearings at fire rated doors; ball or anti-friction bearings at other doors; plain bearings only where specified. Provide ball or oil-impregnated porous metal bearings at all doors with closers, except do not use oil-impregnated bearings at fire doors.
- b) Number of Hinges: Provide 1 1/2 pair hinges (butts) on each door leaf more than 1.52 m (60 in.) high and up to 2.29 m (90 in.) high; provide one additional hinge on each leaf for each additional .762 m (30in.) of height, or fractions thereof, in excess of 2.29 m (90 in.). For each leaf less than 1.52 m (60 in.) high provide one pair of hinges.
- c) Hinges Sizes:
- Heights: except as otherwise scheduled, provide heights and weights as follows for doors 44 mm (1 3/4 in.) thick:

Door Leaf Width mm (in.)	Hinge Height mm (in.)	Weight	Thickness mm (in.)
914 (36") or less	114 (4 1/2)	Standard	3.4 (.134)
Over 914 (36") to 1066 (42")	127 (5)	Standard	3.7 (.146)
Over 1066 (42") to 1219 (48")	127 (5)	Heavy	4.8 (.190)

- Provide heavy weight hinges conforming to Note "A", Paragraph 1.9, ANSI A 156.1 for doors 50 mm (2 in.) or more thick and for other heavy doors.
 - Widths: Provide hinge widths equal to twice the door thickness plus trim projection. For doors thicker than 63 mm (2 1/2 in.) add an additional 6 mm (1/4 in.) to hinge width. If width so determined is not a standard size for the specified height, provide next larger standard width.
- d) Spring hinges: Bommer No.4010-4, McKinney-Chicago 2002-4 or approved equal, single acting, square corners, standard template hinge, or approved equal, installed reversed to hold door open approximately 30 degrees.

(07) Pivots

- a) Centre Hung Interior: ANSI A 156.1, A 2742 pivot set, concealed, double acting, as scheduled.
- b) Offset Pivots: ANSI A 15.61, as scheduled.

(08) Locksets and Latchets

ANSI A 156.13, Operational Grade 1, Security Grade 2, mortise type, Products whose functions are identified by NBHA numbers shall be identical in all other respects to the ANSI standards specified. All locksets and Latchets shall be products of the same manufacturer.

- a) Knobs and Trim:
 - Knobs and Trim: Conform to ANSI A 156.2, Paragraph 7.2, with design similar to Schlage Lock Company 83, Sargent SBS, or approved equal.
- b) Deadlocking: Provide locks for doors at exterior, corridors and halls with automatic deadlocking latch bolts.
- c) Strikes: Wrought box type; lips curved and returned to door frame or frame trim, or to astragal or face of door at pairs of doors, with minimum projection necessary for protection of frame and trim.
- d) Exiting Function: All locks shall be open able from the inside without use of a key or any special knowledge or effort.
- e) Auxiliary locks shall conform to ANSI A 156.5 as scheduled.

(09) Cylinders

- a) Seven pin tumblers; finish-exposed surfaces to match lock trim.
- b) Furnish all cylinders with "Best-Suffix B" Key-removable interchangeable cores.
 - Furnish all exterior cylinders with "Best 1 E784" dust covers.
 - Control key shall function on all seven pin tumblers.
 - Furnish bottom pins in hardened steel, and mushroom type pins for master pins.
 - Furnish all cylinders with internal concealed setscrews.
 - All cylinder core faces shall be drill resistant.
 - Furnish cylinders and cores for all scheduled locks. including electric locks furnished by others.
 - All permanent cores and keys shall be shipped by manufacturer to Client. Installation of cores will be by Client.

(10) Padlocks

BHMA 501, E 18121 with shackles modified when required to properly fit item locked, cases, shackles and all inner parts plated for corrosion resistance, keyed in the keying system, alike or differently as directed or scheduled in the final schedule.

(11) Keying and Master Keying

- a) General: All locksets, padlocks and cylinders shall be great grandmaster-keyed, grand master-keyed, master-keyed and change-keyed at the factory where records shall be established and maintained. Key locks as directed.
- b) Special design and markings are required for control keys, and a separate special design and marking system are required for all other keys. The Contractor shall prepare a comprehensive keying plan for approval by the Engineer.
- c) Identification: Identify all great grandmaster, grandmaster and master keys with a registry number, not with "Master" or the letter "M". Stamp individual change keys with a plain identification number, not a key cut. Factory cut all keys and stamp with "Do Not Duplicate". Make key markings in Urdu one side, English on other side, except numbering shall be in English only. Provide lists of identification numbers for each key showing the room names and door numbers for each key, corresponding to the identification numbers stamped on the keys. Indicate on the lists which keys are great grandmaster, grandmaster and master keys. Maintain lists in confidence; deliver directly to the Engineer.
- d) Construction Keys: All locksets, padlocks and cylinders shall be construction keyed.
- e) Key Quantity:
 - Change keys: Three each lock
 - Master Keys: 12 each master key group
 - Great Grand Master Keys: 6 each great grand master key group.
 - Construction master Key: Twenty four.
 - Uncut Keys: 20 percent of total. Match key way and special standard designs, artwork, and markings as applicable, for other keys specified in this section.
 - Control Keys: 6 for each control key group

(12) Exit Devices

ANSI A 156.3. Provide outside knob and trim to match those on locksets as closely as practicably.

- a) Surface Mounted Strikes: Roller type
- b) Strikes Not Otherwise Required: Mortise type

(13) Closers

ANSI A 156.4 conforming to following unless otherwise specified:

- a) Materials: Manufacturer's Standard
- b) Surface Closers: Grade 2 modern type, regular or parallel arm as required for mounting closers on inside face (room side) of doors. Provide drop brackets

on doors with narrow top rails. Bracket mounting of closers in the opening is not permitted. Provide soffit brackets for arms of parallel arm closers.

- c) Concealed Closers: Overhead concealed with concealed arm, Grade 2, to fit within narrow transom bars shown.
- d) Floor Closers: ANSI A 156.4, single-acting Type C 06023 centre pivoted with top pivot.
- e) Coordinating Devices: ANSI A 156.3. Provide wherever the leaves of pairs of doors equipped with closers might close in the wrong sequence for proper meshing of automatic flush bolts, astragal rabbets, latches, bolts or exit devices.
- f) Sizes: Provide closers continuously adjustable through the entire size range.

(14) Flush Bolts

BHMA 1201, Type L 14081 or L 14091 as applicable, minimum length 300 mm (12 in.), longer lengths as required so that levers of top bolts are not more than 1.930 m (76 in.) above floor. Provide dust proof strikes, Type L 14011, at bottom bolts, except where threshold construction provides non-recessed strike for bolt.

(15) Surface Bolts

BHMA 1201, Type L 14132 or Type L24132

(16) Automatic Flush Bolts

Door Controls, Inc., 840 series for metal doors, 940 series for wood doors, provide at top and bottom of inactive leaves, provide No.80 dust-proof strike for each pair.

(17) Push Plates

ANSI A 156.6,J 300, Powder coated stainless steel plate, 100 mm x 400 mm x 1.27 mm (4 in. x 16 in. x 0.050 in.).

(18) Pull Plates

ANSI A 156.6,J 400, Powder Coated stainless steel, 100 mm x 400 mm (4 in. x 16 in.), style to match push plates, grip projection 49 mm (1 15/16 in.), 130 mm (5 1/8 in.) centre to centre of grip mountings.

(19) Push Bars

As schedule in Attachment A.

(20) Offset Pulls

Powder Coated Stainless Steel bar 25 mm (1 in.) diameter full length between grip contact surfaces with doors, 250 mm (10 in.) c/c of grip mountings, 57 mm (2 1/4 in.) clearance, 83 mm (3 1/4 in.) projection, offset approximately 64 mm (2 1/2 in.)

(21) Stops

BHMA 1201, Grade 1. Provide floor type stops except where otherwise scheduled. Provide roller bumpers only where scheduled.

a)	Floor Stops: Type L 12121, L 12141 or L 12161 as required to properly engage bottom of door. Provide risers as required for carpet and as required to properly engage bottoms of doors.	
b)	Wall Stops: Type L 12011, or L 12021 as applicable to wall material.	
c)	Combination Bumper/Coat Hook: Bobrick B-212, Mokinney 1048 B, Watrous W-1654, or approved equal.	
d)	Roller Bumpers: Grade 1.	
e)	Anchor Plates: Builders Brass Works	8017
	Quality	530
	Trimco	1268

(22) Holders

BHMA 1201, Grade 1. Provide wall type holders except where there is no suitable location for wall mounting, in which case provide floor type. Provide automatic type except where manual type is scheduled.

- a) Automatic Wall Holders: Same as Type L 11301 except with wall mounted strike adjustable 45 degrees left and right for proper contact with doors.
- b) Manual Wall Holders: Type L 11341 or L 11351 as applicable to wall material.
- c) Automatic Floor Holders: Type L 11301
- d) Manual Floor Holders: Type L 11361 or L 11371 as applicable to floor material.
- e) Electro-Magnetic Holders: ANSI A 156.15, C 00021 or C 00031 floor mounted, as applicable, C 00011 wall mounted where scheduled.

(23) Overhead Holders

BHMA 311, Grade 1, concealed, C 11511 exterior doors, C 14531 at interior doors, unless otherwise scheduled.

(24) Thresholds

ANSI A 156.6., J 600, design, shapes and sizes as shown, extruded aluminium unless otherwise scheduled. Lengths to allow notching around fixed stopps on doorframes provide light duty thresholds unless heavy duty is specified. Provide thresholds where shown.

a) Minimum Thicknesses

	Directed Tread surfaces	Secondary Tread Surfaces	Unexposed Flanges and Legs
Light duty	3 mm (1/8 in.)	2.5 mm (1/8 in.)	1.6 mm (1/16 in.)
Heavy duty	6 mm (1/4 in.)	4.8 mm (3/16 in.)	3.0 mm (1/18 in.)

- b) Exterior Thresholds: Corrugated type, modified to 6 mm (1/4 in.) high with 13 mm (1/2 in.) drop offset, 140 mm (5 1/2 in.) wide, unless otherwise shown.
- c) Interior Thresholds: Plane, smooth top surface without abrasive; 13 mm (1/2 in.) high, 100mm (4 in.) wide, tapered sides similar to corrugated type, unless otherwise shown.

(25) Head and Jamb Weather-strip

Pemko 114 PF PS, or approved equal.

(26) Stripping and Seals

Adjustable bumper type sound stripping with closed cell extruded sponge neoprene, ribbed face insert retained in adjustable metal strip by captive adjustment screws, with metal housing; forming a combination door stop and seal; extruded aluminium, 1.6 mm (1/16 in.) minimum thickness of main walls and flanges. Thickness of seals mounted on stops -13 mm (1/2 in.); seals mounted directly on frames -not over 24 mm (15/16 in.) thick and with 16 mm (5/8 in.) contact face.

- a) Automatic Door Bottoms: Automatic drop-seal, centre mortise, flush recessed, or surface type as scheduled with closed cell sponge neoprene seal bar retained in extruded aluminium bar, capable of operating to close a 19 mm (3/4 in.) gap from door bottom to floor or threshold, housed in extruded aluminium 1.6 mm (1/16 in.) thick.
- b) Finish: Mill finish suitable for paint priming, unless otherwise scheduled.

(27) Astragal Seals

Builders Brass Works 9604, Pemki 352AR, or approved equal.

(28) Magnetic Astragals

Pemki 351AM, Zero 371, or approved equal.

(29) Lock Astragals

Builder Brass Works 9615-1, or approved equal.

(30) Kick Plates

ANSI A 156.6, Type J 100, stainless steel, B3E, 250 mm (10 in.) x width of door less distance to clear door stops by 3 mm (1/8 in.), satin finish, code 630.

(31) Armour Plates

Same as specified for kick plates except 760 mm (30 in.) high unless otherwise shown or scheduled in Attachment A.

(32) Roller Latches

BHMA 501, Type E 19101

(33) Unscheduled Hardware

- a) Silencers: GHMA 1201; Type L 03011 for metal frames. Provide 3 for each single doorframe and 4 for each double door frame as applicable.
- b) Set for Locksmith Equipment and Supplies: Provide all of the following as a set, if individual items are scheduled separately provide only the scheduled items. All shall be as manufactured by Best Lock Corporation unless otherwise specified.
 - Key Duplicating Machine: Le Gard L 1011 (for keys for locks other than specified in this section.
 - Key Combinator: AD 432-4 or to suit keying system provided.
 - Combining Kit: CD 431-4 or to suit keying system provided.
 - Letter and Number Dies: DD 502 and DD 503. In addition provide dies comparable to the foregoing including Urdu numerals and complete Urdu alphabet. Size 2.38 mm (3/32 in.)
 - Core and key Marking Plate: DD 514
 - Core Capping Press: CD 517
 - Mortise Cylinder Assembly Tool: ED 212
 - Mortise Cylinder Wrenches: ED 211; provide three.
 - Uncombined Cores: Matching cores for locksets provided; quality equal to 20 percent of the number of locksets provided under this section.
 - Pin segments, Caps, and Springs: Quality and quantity required to combine specified number of uncombined cores.
 - Cylinders: Completely assembled, matching cylinders for locksets provided, less cores; quantity equal to 10 percent of the number of locksets provided under this section.
 - Padlock Shakless and Other Padlock Repair Parts: As required for replacement and repair of 10 percent of padlocks provided under this section, but not less than for 10 padlocks
 - Powdered Graphite Gun: CD 535
Graphite: CD 535 AI two containers, each containing 0.45 kg, (1 lb).
 - Copy of Factory Key Code: Maintain confidentiality; deliver to personnel designated by the Engineer, directly from the manufacturer.
 - Service Manual: include instructions for keying cores, core information, cutting keys in key machines, and servicing of key machines.
 - Training Programme: Provide as specified in section 01765.

(34) Bi-Fold Door Hardware

- a) Bi-Fold Hardware Sets: ANSI A 156.9, Type D 8631, complete set with hinges.
- b) Knobs: BHMA 201, Type D 12132 cabinet knobs.

(35) Hardware

Furnish hardware not specifically mentioned, and not specified in another section, corresponding in quality, sizes, function and finish to that specified for similar and corresponding applications, as necessary for proper installation and function. Furnish hardware sets as specified.

08123 EXECUTION**A- Shipping**

Package each item separately, with identification related to the approved hardware schedule. Include basic installation instructions in the packages.

B- Installation**(01) General**

All installation shall be in accordance with manufacturer's written instructions and recommendations.

(02) Locations

Mount hardware units at heights recommended in "Recommended Locations for Builders' Hardware for Custom Aluminium Doors and Frames" by NGHHA, except as otherwise specifically indicated or required to comply with governing regulations, and except as may be otherwise directed.

(03) Removal for Finishes

Wherever cutting and fitting is required to install hardware onto or into surfaces which are later to be painted or finished in another way, install each item completely and then remove and store in a secure place during the finish application. After completion of the finishes, re-install each item. Do not install surface-mounted items until finishes have been completed on the substrate.

(04) Alignment

Set units level, plumb and true to line and location. Adjust the reinforcement of the attachment substrate as necessary for proper installation and operation.

(05) Preparation for Fasteners

Drill and countersink units which are not factory-prepared for anchorage fasteners. Space fasteners and anchors in accordance with industry standards.

(06) Surface Closers

Mount on inside face of doors.

(07) Thresholds

- a) Cut and fit threshold and floor covers to profile of door frames, with mitered corners and hair-line joints. Extend thresholds to frames below weather-stripping and sound seals. Notch ends around stops, which are integral with frames.

- b) Screw thresholds to substrate with 5.0 mm (No.10) or larger screws, of the proper type for permanent anchorage and of stainless steel or other metal, which will not corrode in contact with the threshold metal.
- c) At exterior doors, and elsewhere as indicated, set each edge and close each open end of thresholds in a seal strip of butyl rubber sealant or polyisobutylene mastic sealant.

(08) Kickplates and Armour Plates

Mount with uniform reveal two sides and bottom. Mount on side of doors opposite hinges unless otherwise scheduled or shown.

(09) Lubrication

Lubricate moving parts with lubrication recommended by manufacturer (graphite if no other recommended) .

(10) Instructions

Instruct designated personnel in proper adjustment and maintenance of hardware and hardware finishes, during the final adjustment of hardware.

(11) Key Tagging and Verification

Verify keying of all cylinders and suitably tag each and identify each cylinder to indicate its location, including emergency keys.

C. Inspection and Testing

After the hardware has been installed, various units shall be inspected, adjusted and placed in proper operating condition. Adjust door control devices to compensate for final operation of heating and ventilating equipment. Replace units, which cannot be adjusted and lubricated to operate freely and smoothly as intended for the application made. Wherever hardware installation is made more than one month prior to acceptance or occupancy of a space or area, return to the work during the week prior to acceptance of occupancy and make a final check and adjustment of all hardware items in such space or area. Clean and relubricate operating items as necessary to restore proper function and finish of hardware and doors.

08124 MEASUREMENT AND PAYMENT

No separate payment shall be made for finish hardware as contained in this section of the specifications and it shall be included in the rate of the relevant item of the Bill of Quantities.

*** End of Section 08120 ***

08130 STEEL DOORS**08131 GENERAL****A- Description**

The work covered under this section of the Specifications consists of furnishing all plant, labour, equipment, appliances and materials and in performing all operations in connection with the installation of steel doors, complete in strict accordance with this section of the Specifications; and the applicable drawings and subject to the terms and Conditions of the Contract.

B- Applicable Codes and Standards

The codes and standards applicable to only a portion of the work specified in this section are referenced in the relevant paragraphs.

C- Submittals**(01) Shop Drawings**

Contractor shall submit shop drawings, which shall show full construction details, quantities and locations with metal gauges, reinforcing, cut outs, hold fasts and attachment to adjacent construction and materials. Shop drawings shall be submitted at the appropriate time to allow for approved checking, revisions, and time to permit manufacturer the product delivery and the start of installation work. All operations shall conform to the construction programme.

(02) Sample

Contractor shall submit representative samples of a typical steel door, hardware, accessories and any other material instructed by the Engineer for his approval well in advance of its installation. For steel doors, the Contractor shall similarly submit corner sections of typical welded frames, in the specified thickness, showing reinforcing, welding and prime paint coat.

(03) Installation Manuals**(04) Manufacturer's Data****(05) Operation and Maintenance Manuals****(06) Quality Standard**

All steel doors shall be the product of reputable manufacturer as approved by the Engineer. They shall be of the type indicated on the drawings and shall conform to the requirements shown and as specified herein.

08132 PRODUCTS**A- Steel Doors**

All frames shall be made of mill quality cold rolled steel, exterior frames and doors shall be galvanised steel.

All contours and arises shall be as true and sharp as can be produced in the thickness of metal required.

Construction joint of steel work be welded to full depth and width or equivalent splice plates shall be welded on unexposed faces of frames. Exposed surfaces of welded joints shall be dressed and ground smooth to produce invisible connections.

The finished work shall be strong and rigid, neat in appearance and free from defects. Plain surfaces shall be smooth and free from warp or buckle. Moulded members shall be clean, straight and true. Fastenings shall be concealed where practicable.

Reinforcement and stiffeners shall be welded to inside of frame surfaces.

All frames shall be secured to the structure with strong wrought iron Holdfasts. Holdfasts shall be 50 mm wide and 6 mm thick and shall be screwed to frames. Attachment shall be concealed.

All exterior doors, frames, anchors, reinforcing and related items shall be fabricated from hot dipped galvanised steel, conforming to B.S. 729, Part I. Following fabrication, touch up all welds with liquid zinc.

All surfaces of doors, frames, holdfasts and related item shall be cleaned, followed with bonding or phosphating processes. One coat of zinc chromate or synthetic resin primer in a light grey colour shall then be applied for subsequent application of specified paint.

08133 EXECUTION

A- Product Delivery and Storage

Place finished doors individually in a manner, which will ensure complete protection of all door surfaces. Keep doors in up right position, under cover, in a manner preventing rust and damage.

Supply frames with removable angle spreaders securely fastened to the bottom of each joint, do not remove spreader until frames are secured in place. Store frames the same way as doors.

Deliver doors in a manner preventing damage to units and store of the ground, undercover in a manner preventing rust or damage.

B- Installation

The Contractor shall be responsible for the proper protection and installation of all items furnished. Should the prime coat be damaged, or rust or scale appears, he shall at his own expense and at the Engineer's direction have all exposed surfaces cleaned to bare bright and re- primed with an approved priming coat before finish painting.

All items shall be installed plumb and square and shall be solidly anchored in a good workmanlike manner in accordance with the approved shop drawings. The Contractor shall be responsible for the protection of installed items from damage by other trades. All items shall be left in operating, neat and clean condition, free from dirt, finger marks, etc. The Contractor shall be responsible for final cleaning before final acceptance.

C- Cleaning and Protection

(01) Cleaning

Upon completion of the installation of steel door, clean all exposed metal surface as recommended by the manufacturer.

(02) Protection

Protect the work. Repair or replace damaged work as required by the Engineer.

08134 MEASUREMENT AND PAYMENT**A- Measurement**

Payment for doors and windows will be made by measuring clear opening area in block work or concrete in square feet.

B- Rate and Payment

Rates for all the items under this Section shall cover the cost of furnishing all the materials labour, scaffoldings and appliances at Site and performing all operations in connection with their installation in accordance with instructions of the Engineer. It is particularly mentioned that the rates for fixing doors and windows etc. shall include fixing of all finished hardware iron mongery fittings such as locks, pegs, stays, handles, push plates, kicking plates, door closers, glazing, flexible compounds, rubber lining and appliances at site and performing all operations in accordance with the instructions of the Engineer and specifications.

*** End of Section 08130 ***

08210 WOODEN DOORS**08211 GENERAL****A- Scope of Work**

The work covered under this section of Specifications consists of furnishing all labour and materials and performing all operations in connection with installation of all wood work, mill work, construction, assembly and surface finish treatment, building in of all cabinet type of items, complete in every respect, including all related items, supports etc. of wood or metal and incidentals, associated wood work appurtenances, the application of all 'Hardware' in connection with finished wood work, in strict accordance with requirements of Drawings, as specified herein subject to the terms and conditions of the Contract Documents and to the entire satisfaction of the Engineer. The work under this section shall further conform to the requirements of the British Standard Codes of Practice, e.g. Cp. 161: Part 11: 1957, CP.112.100: 1952 and all the British Standards relied therein and/or bearing relevance to this item of work.

B- Submittals

The following submittals are required:

Detail Drawings and/or Shop Drawings

Assembly, Erection and Installation Drawings and Manuals

1. Samples
 - a) Solid wood for transparent finish. Submit finished samples, 19 mm by 75 mm by 300 mm (3/4 inch by 3 inch by 12 inch) for each species.
 - b) Plywood or veneer for transparent finish. Submit three finished samples, 300 mm (12 in.) square, for each species and cut.
 - c) One unit of each type and finish of exposed hardware.
 - d) One unit of each type of material to be used under this section.
2. Manufacturer's Data

C- Quality assurance

1. Quality Standards

Except as otherwise shown or specified, comply with specified provisions of the AWI "Quality Standards or WIC Manual of Mill work.
2. Measurements

Before proceeding with woodwork required to be fitted to other construction, obtain measurements and verify dimensions and shop drawing details as required for accurate fit.
3. Optimum Moisture Content

Kiln dry woodwork to an average moisture content within 6 to 11 percent, or as otherwise recommended by applicable quality standards for the regional climatic conditions involved.

4. Matched Wood Veneers

Fabrication and installation of all architectural woodwork with blueprint or sequence matched wood veneers shall be provided by one firm.

D- Product Delivery Storage and Handling

1. General

Protect woodwork during transit, delivery, storage and handling to prevent damage, soiling and deterioration.

2. Storage

Do not deliver woodwork until painting, wet work, grinding and similar operations which could damage, soil or deteriorate woodwork have been completed in storage or installation areas.

E- Job conditions

Do not install woodwork until the required temperature has been stabilized in installation areas.

Maintain temperature and relative humidity as required for a tolerance of plus or minus 1 percent of the specified optimum moisture content until woodwork receives specified finishes. Maintain temperature until acceptance of the work.

08212 PRODUCTS

A- Materials

(01) Timber

Materials for the work included in this section shall conform to the following:

a) General Characteristics

The timber shall be in accordance with the requirements of BS:1186 'Quality of Timber and Workmanship in Joinery', Part 1, 'Quality of Timber'.

First quality timber shall be from the heart of a sound tree, the sap wood being entirely removed, the wood being uniform in substance, straight in fibre, free from large or dead knots, flaws, shakes or blemishes of any kind. The colour of good timber shall be uniform through out and among coloured timbers, darkness of colour is an apparent indication of strength and durability.

For first quality teak wood, the size of the knot shall not be more than 1/2" and there should not be more than one knot in every 9 Sft. of timber.

For first quality deodar wood, the size of the knot shall not be more than 1" and there shall not be more than one knot in every 4 Sft. of timber.

b) Seasoning of Timber

Timber shall be properly seasoned. It shall be kiln or air dried to reduce the moisture content to a minimum of 20% of its natural weight.

The methods of seasoning timber are as follows:

- Air Seasoning: This consists of sawing the logs into planks or rectangular sections of convenient size for use and stacking them in such a way that air can circulate around the wood, preferably in open sided sheds. The moisture contents will be reduced to about 16%. The time depends on the type of wood, its thickness and the weather. Generally, soft wood takes 2 to 3 months and hard wood about 8 to 12 months for every inch thickness.
- Kiln Seasoning: This process consists of drying the wood in a kiln. The process consists of fanning a blend of warm dry air and warm moist air over the wood at a controlled humidity. Kiln drying is preferable for internal joinery and furniture as air seasoning does not reduce the moisture contents sufficiently to ensure a stable equilibrium. Time taken to kiln dry hard woods varies from a few days in the case of thinner boards upto 3 to 4 weeks for 3 inch planks.

c) Preservation of Timber

Preservatives may be applied in a variety of ways including pressure impregnation, hot and cold open-tank treatment, dipping, brushing and spraying depending upon the use of timber and class of the preservative treatment according to the British Standard Code of Practice CP: 98:1964. Local proprietary products of chemical wood preservatives under the label of "WOOD GUARD" or equivalent shall be used alongwith their implied methods of use etc.

d) Timber Quality

The requirements set forth in BS:1186, Part 1, shall serve as a general guide in selecting timber including plywood of suitable quality.

e) Adhesives

For joiners work animal glues complying with BS:745, 'Animal Glues for Wood' casein glues complying with BS:745, 'Cold Setting Casein Glue for Wood', or synthetic resin adhesive complying with BS:1204, 'Cold Setting Synthetic Resin Adhesives for Construction Work in Wood' shall be used. For flush doors and other forms of construction that rely mainly upon the adhesive, and particularly where exposure conditions are severe and prolonged dampness is likely to occur, one of the more moisture resistant shall be employed, the choice depending upon the severity of the conditions to which the work will be exposed.

f) Nails and Screws

For joiners work, wire nails, chequered head, lost head round or panel pins complying, with BS:1202, 'Wire Nails and Cut Nails for Building Purposes' or wood screws in accordance with BS:1210 shall be used. The gauge of nail or screw used shall be suited to the woods being fixed and to which a fixing is being made, and the length shall be such as will give a sufficiently strong and secure fixing. CP: 112. 'The Structural Use of Timber in Buildings' shall be followed which gives relationship between gauge, amount of penetration and strength. All nails and screws used with reactive timber (becoming stained and disfigured by reaction with ferrous metals) shall be of non-ferrous metals or shall be protected in some manner before use if the wood work is likely to be subjected to moist conditions, e.g. external doors.

(02) Ply Wood

BS:565:1963 Section 5, 'Glossary of Terms Applicable to Ply Wood', defines ply wood as 'an assembled product made up of plies and adhesives, the chief characteristic

being the crossed plies which distribute the longitudinal wood strength'. The term plywood in general sense includes similar products such as laminated board, block board and batten board. BS: 1455:1963 shall be used for acceptable standards of plywood.

a) Three Ply and Multiply Ply Wood

Three-ply construction includes a 'face' a 'back' and a core or inner ply. Multiply includes a face, a back and a core of three or more inner plies. With very few exceptions the grain of each veneer in the core runs at right angles to that of the veneers on either side of it.

The construction of plywood may be balanced with an odd number of veneers arranged symmetrically or unbalanced. The tendency of the finished board to distort is reduced by adopting a balanced construction.

The construction may vary for a given panel thickness by the inclusion of veneers various thickness. This will affect the strength properties.

Ply wood according to BS: 1455:1963 is classified into two main types, viz interior and resin bonded.

Interior type plywood is suitable for most interior work including flush doors, door panels wall panelling, balustrades, subflooring, kitchen fitments, and any location where resistance to moisture is not required. Adhesive used include casein, soya, blood albumen and animal glues as well as synthetic resin extended with other substances.

Synthetic resin bonded plywood while being suitable for the same purpose as interior type, has a much greater resistance to moisture. The more resistant types are suitable for external flush doors and door panels, wall sheathing, shop front fascias, sign boards, shuttering and form work for concrete and for any purpose where it may be exposed to moisture. Adhesives used include urea, melamine phenol and resorcinol formaldehyde (arranged in order of increasing moisture resistance).

The Contractor shall procure plywood according to various grades specified in BS: 1455, "Ply Wood Manufactured from Tropical Hard Woods" and are briefly given as under for guidance.

Grade 1 Veneer: Shall be of one or two pieces of firm smoothly cut veneer. When of two pieces, the joint shall be approximately at the centre of the board. The veneers shall be free from knots, worm and beetle holes, splits, dots, glue stains, filling or inlaying of any kind or other defects. No end joints are permissible.

Grade 11 Veneer: Shall present a solid surface free from open defects. Veneers, when jointed need not necessarily be matched for colour or be of equal width. A few sound knots are permitted with occasional minor discoloration and slight glue stains, isolated pinholes not along the plane of the veneer. Occasional splits not wider than 1/32 inch and not longer than 1/10 of the length of the panel or slightly opened joints may be filled with a suitable filler. No end joints are permissible.

Grade 111 Veneer: May include wood defects including work holes which are excluded from Grade 1 and 11 above in number and sized which will not impair the serviceability of the ply wood. It may also include manufacturing defects such as rough cutting, overlaps, gaps or splits provided these do not affect the use of the ply wood. No end joints are permitted.

The uses, for which ply wood made with the grades defined above are considered useful, are outlined hereunder:

Grade 1 For use in its natural state.

Grade 11 For use where subsequent painting and/or veneering is intended.

Grade 111 For use where it is not normally visible.

Under the Specifications where combinations of above grade are required, these combined grades may range from 1/11, 11/11 and 11/111, as additional grades of these Specifications.

b) Laminated Board

This is built-up board, with narrow strip 3 to 7 mm wide, faced both sides with either one or two veneers from 1.2 mm to 3.7 mm thick. Where single or double face veneers are used, the grain usually runs at right angles to the grain of the core strip. This type of board when available varies between 1/2 inch to 1 inch and is an ideal base for the highest class of veneered wood. For detailed Specifications, BS:3444, 'Block Board and Laminated Board' shall be used.

c) Block Board

This board is of similar construction to laminated board but core is built-up of blocks upto 1 inch wide. It is used as a base for veneering and for painted work but is considered slightly inferior to laminated board for the former use. The range of size and thicknesses in which it is manufactured are similar to those of laminated board. For detailed Specifications BS:3444: 1961, 'Block Board and Laminated Board' shall be used.

d) Fabrication

Ply wood can be worked by all normal wood working tools, both hand and machine and can be fixed by panel pins, screws, rivets, gluing, grooving, into framing, tonguing and grooving and by metal tooth plate or split ring connectors. For exterior work, galvanized and copper nails and also waterproof adhesives shall be used.

(03) Boards

The proprietary boards are known as fibre building boards and chip boards or particle boards. The fibreboards include hard boards insulation boards and straw boards. These boards follow the description in the following order:

a) Fibre Building Boards

Fibre building boards form the largest category with the number of different types as detailed hereunder:

- Hard Board: Density from 30 to 50 lbs per cft. There are three main sub-divisions, being medium (30-50) lbs per cft.) standard medium (50 lbs per cft.) tempered hard board/standard hard board treated to increase hardness and resistance to water.
- Insulation Board: Maximum density 25 lbs per cft. minimum thickness 7/16 inch, maximum thermal conductivity (K) 0.45. They have five sub-divisions, viz homogeneous, laminated bitumen bonded, bitumen impregnated, acoustic (of low density and specially designed often with perforated surface

to increase sound absorption). These boards have good qualities of thermal insulation and sound absorption and are recommended accordingly.

- Straw Boards: These are compressed straw slabs, consisting of straw formed into slabs 2 inches thick by heat and pressure and with proprietary paper glued to the sides. Edges too are bound with paper. The slabs are fairly stiff and have thermal conductivity (K) of 0.6.
- Wood -Chip Board (Particle Board): Chip boards are made from wood particles in the form of chips or shavings of a controlled size combined with a thermosetting synthetic resin glue binder and formed into panels under the influence of mechanical pressure and heat. The process of adhesion is controlled resulting in a variety of boards with different, but predictable physical properties. Chipboard lends itself well to uses such as sheathing, flooring and sub-flooring, wall panelling, partitions, shelves, furniture and veneered boards, core stock. It is little affected dimensionally by changes in atmospheric humidity, but in wet conditions it has a limited resistance to moisture.

The mechanical strength properties are good for high density boards. In the density range 30.55 lbs/cft typical value of the modulus of rupture lies between 1600 to 3000 lbs/sq. inch. An average value for the modulus of elasticity is 300,000 lbs/sq. inch.

The surface finish of standard boards is comparatively rough and to support a good quality paint or varnish finish requires sanding and filling. Special grade of the board are prepared for painting which have a paper surface permanently bonded to the board during manufacture.

Particle boards are made in grades of high, medium and low density but the bulk production has been of medium density mainly in thickness of 1/2" and 3/4". These Specifications rely on BS:2504, 'Medium Density Resin Bonded Wood Chip Board' for quality of the board and requirements for density, strength and other properties. The density range of this board is from 30 lbs/cft to 50 lbs/cft and thermal conductivity is of the order of 0.7 to 1.0 B. T.U. in/ft²/h, BS: 1811 will be relied upon for testing of the wood chip board.

08213 EXECUTION

A- Carpentry Work

(01) General

All work specified in the Bill of Quantities and shown on working Drawings and details is to be carried out in proper manner and to the satisfaction of the Engineer. The Contractor has to provide all loose planks, battens, trestles and ladders and to construct all scaffolding necessary for the proper execution of the work and to remove the same on completion.

(02) Preservative Treatment

Where preservative treatment is specified, the timber is to be of the correct moisture content and free from surface moisture and dirt. In general, all portions of timber built into or against or close to masonry or concrete, and all junctions or rafters, purlins, framing scribe pieces and wall plates etc. shall be given two coats of hot solignum, creosote or other wood preservative Approved by the Engineer. Preservative material

shall be applied in strict accordance with recommendations of the preservative manufacturer and shall be given to all woodwork which comes in contact with or built into any wall, floor, ceiling or any other structure. All rough woodwork which is not the finished and exposed woodwork whether abutting any structure or not shall be given a preservative treatment. No extra payment shall be made for such coating and will be considered inclusive in the rate of the respective item quoted by the Contract. Treatment is to be carried out after all cutting and shaping is completed and care is to be taken to avoid damage. A liberal application of preservatives is to be made to cut or damaged surface, CP 112: 100, 'Preservative Treatment for Timber used in Buildings' shall be relied upon regarding preservatives and methods in relation to uses of timber.

(03) Moisture Content

The timber prior to preservative treatment is to be properly seasoned. Timber fit for carpentry is considered seasoned when it loses 1/5 of its weight and fit for joinery when about 1/3 of its weight has been lost after felling.

(04) Workmanship and Construction

'Unwrought' timber shall be 'left from the saw', and shall be full to the dimensions stated except that occasional slight variation in sawing is permissible.

All framing shall be jointed as specified and/or as determined by the Engineer as most appropriate in the circumstances. The joints shall be as per standard practice depicted through architectural details and constructed so that load and stress to which they will be subjected are properly transmitted. The execution of all jointing shall be to the satisfaction of the Engineer.

Unless otherwise stated all joints shall be secured with a suitable type and sufficient number of nails. A butt joint shall, wherever possible, be secured with nails driven from the far side of the flanking member, if any. The joining surfaces of all connections exposed to the weather shall be thickly primed except where adhesives are specified. Where joints are designed in critical relation to loads, the size, spacing, type, positioning and number of nails, wood screws, bolts, washers and timber connectors shall be provided by the Contractor true to design details.

(05) Procedure

The operations shall be planned and coordinated keeping in view the requirements and convenience of all tradesmen concerned in the work.

The Contractor shall order materials for sizes and quantities as required to complete the job as per working Drawings and details. All work is to be set out and constructed to the dimensions given and as described on the Drawings and details.

(06) Protection of Materials

All materials and assembled units shall be protected from weather and stored in such a way as to prevent attack by fungus, decay and/or insect.

(07) Inspection

Facilities shall be given to the Engineer to inspect all work in progress in the workshops and on Site. All work under this section should be first Approved by the Engineer before being fixed in the building.

(08) Joinery Work**a) General**

All work specified in the Bill of Quantities and shown on working Drawings and details shall be carried out in proper manner and to the satisfaction of the Engineer.

The Contractor shall manufacture, deliver to Site and fix in place all joinery described and shown on the Drawings including supply and fixing of metal, straps, lugs and dowels, priming, preservatives, polishing and all hardware specified and/or shown on the Drawings. Except where special finish is specified the joinery work shall be cleaned and scrubbed. The Contractor shall leave whole of his work in good order and to the complete satisfaction of the Engineer.

b) Preservative Treatment

Same as in Clause as above

(c) Moisture Contents

Same as in Clause as above

(d) Priming

Where priming is specified, the timber shall be coated with a thick mixture of red or white lead and linseed oil and priming shall comply with BS: 2521. The Contractor shall provide for priming and touching up primer where necessary during the progress of work.

Aluminium base primers may be used when timber is particularly resinous. Where synthetic paints are used, Manufacturers must be consulted on the type of primer.

(e) Workmanship and Construction

All "Wrought" timber is to be sawn, planed, drilled or otherwise machined or worked to the correct sizes and shapes shown on the drawings and/or specified.

The arrangement of jointing and fixing of all joinery works shall be such that shrinkage in any part and in any direction shall not impair the strength and appearance of the finished work; Reasonable tolerance shall be provided at all connections between joinery works and the building Caracas, whether of masonry or R.C.C. frame construction, so that any irregularities, settlements or other movements shall be adequately compensated.

The joiner shall perform all necessary mortising, tenoning, grooving, matching, tonguing, rebating and all other works necessary for correct jointing. He shall also provide all metal plates, screws, nails and other fixings that may be necessary for the proper execution of the joinery works specified. The joiner shall also carry out all works necessary for the proper construction of all framings, linings, holdfasts and other contrivances as per architectural details and/or instructions of the Engineer for their adequate support and fixing in the building.

Loose joints are to be made where provision is required to be made for shrinkage or other movements acting in the direction other than that of the stresses because of loading. Glued joints are to be used where provision need not be made for shrinkage or other movements in the connection, and where sealed joints are required. All glued joints shall be cross-tongued or otherwise reinforced. All nails, springs etc. shall be punched and puttied. All cutting edges of tools shall be sharp to avoid burnishing.

All wood work, as far as practicable, shall be assembled in shop, finished and prime coated before delivery for fixing. In addition to machine sanding, all woodwork shall be smoothed by hand using "00" sand paper to give the required smooth surface, free from machine and tool marks, abrasions, raised grains and other undesirable defects. All woodwork shall be fitted to plaster and other finished work in a careful manner so as not to injure these surfaces. Where plaster or other work is damaged or disturbed, it shall be restored to its original state by the Contractor at no additional cost.

All woodwork shall be neatly finished to the exact dimensions specified. All nails and screws shall be of approved type. Hammer shall not be used for driving in or starting in the screws. All screws shall be dipped in oil before they are inserted in the wood. The heads of nails or screws shall be sunk and puttied or dealt with as directed by the Engineer.

The Contractor shall give at least 7 days notice to the Engineer in writing where any timber is to be covered in the ground or in walls or otherwise. Failing this, the Engineer may order it to be uncovered at the Contractor's expense.

- Door Frames: Door Frames shall be fabricated of first class Deodar wood where so specified according to design, sizes and sections shown in the Drawings. The wood shall be smoothly planed and all the joinery shall be perfect and strong.

The frames shall be secured to masonry or concrete with m.s. holdfasts 9" to 13" long of type approved by the Engineer. These holdfasts shall be screwed and not nailed to the frames. The holdfasts shall be free of dust, scales, rust etc., and shall be painted with 2 coats of anticorrosive paint before they are secured to masonry or concrete. The holdfasts shall be cast in concrete work. The minimum number of holdfasts used shall be (3x2) unless otherwise specified.

- Flush Doors: The Flush doors shall be obtained from approved manufacturers and shall be of the quality and kind as per these Specifications and of dimensions as shown on Architectural Drawings and shall comply to the requirement of Pakistan Standard No.142.

- Flush doors shall be constructed of plywood as specified earlier. It shall be synthetic resin bounded plywood suitable for both internal and external flush doors and shall be of the grades 1 and 11 as specified earlier. The facing shall be teak or commercial ply as specified with a minimum thickness of 1/8".

The core shall be made up of solid laminated wood or as specified and shown on drawings. It shall have 3" wide solid wood edge rail of deodar wood all around and lock block of minimum 10" wide. The shutter shall be lipped and edged all around with hard wood. The core shall be chemically treated to be anti termite without affecting the inherent qualities of the core material and shall be fabricated with the grain running parallel to the grain of face veneer. Core material shall be accurately machined on all sides to ensure tight fitting core, free of voids throughout the core assembly.

The adhesives used in the door manufacture shall be special urea-resin type (liquid or powder), unaffected by oil, gasoline, solvents, resistant to the growth of fungus and bacteria, immune from insects and shall be such as to remain un-affected by paint and lacquer solvents. It should weigh approximately 10 lbs. per gallon when mixed for use having approximately 60% of solids content.

- Fitting, Hanging and Trimming: Doors shall be fitted, hung and trimmed as indicated on the Drawings. Hinges shall be counter sunk into the doorframes as well as leaves. The recesses being cut to the exact size and depth of the hinge. No subsequent packing shall be allowed. Brass screws shall be used with brass fittings unless otherwise specified. Hardware shall be fixed as specified in the drawings. Locks and

other hardware items shall be fixed at heights as shown on the Drawings or as directed by the Engineer.

(09) Finish Hardware And Mongery

Hardware shall be imported of best quality and make the Contractor shall obtain prior approval from the Engineer for quality, shape, pattern and brand of all hardware materials by providing samples and catalogue etc. and shall provide, fix only the approved hardware materials.

a) Ironmongery

(Ironmongery means any type of mongery e.g galvanized iron, brass, stainless steel whichever specified on drawings).

The Contractor shall provide and fix the ironmongery required as per schedule shown on the Drawings complete, including all necessary screws, bolts, plugs and other fixings. The use of nails for fixing ironmongery will not be permitted. The Contractor shall hand over all work in a finished state and to the satisfaction of the Engineer.

All ironmongery shall be of first quality and shall be obtained from an approved manufacturer.

The Contractor will be required to submit for approval samples of all items of ironmongery he proposes to use.

b) Fitting and Testing

All screws used for fixing ironmongery shall be of the correct type, material, finish, size and shape to the satisfaction of the Engineer.

The hinges on which doors, windows, fly screen doors, etc., are hung shall be carefully housed or let into the door, window, fly screen doors, etc., and to the frames.

All fittings shall be removed before commencing any painting operations and shall be re-fixed in place after all painting work are completed and approved by the Engineer.

All ironmongery shall be carefully wrapped and protected until completion of the work and any items or parts which are damaged or defaced or found to be defective shall be replaced at the Contractor's expense before handing over.

On completion of all locks, catches and similar items of ironmongery they shall be properly cleaned, tested and oiled, and all keys shall be clearly labelled with metal tags approximately 50 x 20mm and securely fixed to the keys and handed to the Engineer.

Door closers shall be fitted a maximum of two weeks before handover.

All floor and door springs are to be fully charged with oil and their operation checked to the satisfaction of the Engineer.

c) Standard Ironmongery for Internal Doors

Each door leaf is to be fitted with 1-1/2 pairs of 100 x 75mm satin anodised aluminium or stainless steel washered butts hinges unless otherwise noted in the particular specification and drawings.

(10) Glazing

Glazing wherever shown on the drawing shall be as given in the schedule of Doors and Windows and shall conform to latest revised B.S 952.

(11) Painting

Over the primer coat, two coats of approved specified colour shall be applied as per manufacturer's specification.

(12) Made Good Defective Works

Should any shrinkage or warping occur or any other defects appear in the joiner's work, before the end of Defects Liability Period, such defective work shall be taken down and replaced to the Engineer's satisfaction and any other work disturbed shall be made good at the Contractor's expense.

08214 MEASUREMENT AND PAYMENT**A- Measurement**

The measurement shall be made in Sq.Ft/m of the actual surfaces completed and approved.

B- Rate and Payment

All woodwork shall be paid at the rate as per complete item entered in the Bill of Quantities and in accordance with the Conditions of Contract. Such payment shall constitute full compensation for all material, equipment, labour including frames, all incidentals, necessary to complete the work including fly proofing, glazing, all finished hardware, door lock, iron mongery, fittings and painting and polishing etc.

*** End of Section 08210 ***

08900 STRUCTURAL GLAZED CURTAIN WALL AND SKYLIGHTS**08901 GENERAL****A- Scope of Work**

Furnish all necessary materials, labour and equipment for the complete installation of Glazed Curtain Wall and skylights as shown on the drawings and specified herein.

B- General Performance Requirements:

Propose a Framing system (main and sub-frame), which shall be compatible with:

- Structural Frame work of the building;
- Positive and negative pressures withstanding Capability
- Mechanical/Electrical System inside
- Accommodation of structural movements
- Moisture penetration resistance
- Air infiltration resistance
- Automatic window washing/cleaning equipment and catering for such additional loads
- Internal drainage system
- Thermal Performance
- Accommodation of Thermal expansion and contraction of panels and framing

C- Design Requirements

- a) The Design wind pressure to which the various elements of glazing and framing will be subjected to shall be calculated in accordance with B.S. CP-3 for a wind speed of 100 MPH (160 km/hr.)

All assemblies must be of appropriate shape, thickness and sections, to enable them to resist the loads produced by repeated imposed wind pressures. The maximum deflection over clear span of any member shall be such that it does not induce cracking in glass panels and render the assembly unsafe. No member shall suffer any permanent deformation. No part of the work shall rattle in use.

Structural performance shall be based on:

- * Maximum deflection of 1 /175 of the span.
- * Allowable stress with a safety factor of 1.65.

- b) Work Sizes: All dimensions given on drawings are between structural openings and/or between finished surfaces. Allowances shall be made for variation due to constructional tolerances. The Contractor shall be responsible to measure the final dimensions from the Site before fabrication of Curtain Wall and other assemblies/units.

- c) Weather Tightness: Weather tightness and operations shall suit the weather conditions prevailing in Islamabad. All sections will be fabricated as completely air and water tight units.
- d) Air Tightness: The fixed part shall be as far as possible 100% air tight under all weather conditions. Air infiltration for openable part when fully closed shall not exceed 3m³ /hr /meter length of opening joint at a test pressure of 498 N /M² as tested in accordance with B.S. 4315 part 1 or when tested with ASTM E 283 air infiltration shall not exceed 0.50 CFM per ft. of opening joint when tested at 1.56 psf.
- e) Water Tightness: When tested in accordance with ASTM E 331, no water penetration at a test pressure of 8.0 P.S.F with water applied at 5 gallons/sft./hour.
- f) Acoustic Performance: When installed shall provide an average sound reduction of 28 dB over a frequency range of 100-3150Hz.
- g) Uniform wind load test: No structural deformation or glass breakage at a uniform wind load of 30 psf first in positive inward direction and then in a negative outward direction and deflection shall not exceed 1/175 of span, when tested according to ASTM E-330.

D. Technical and Fabrication Requirements

(01) Appearance

- a) Provide units composed of aluminium shapes with visible portions of profile matching detail indicated on the approved shop drawings, and free from additional slots, grooves, fins or other non-functional details.
- b) Fabricate and assemble all work in the shop wherever possible and otherwise prefit as required to reduce field fabrication to minimum.

(02) Design

- a) Design anchors to allow for horizontal and vertical expansion. Screws, nuts, washers, bolts and reinforcements shall be aluminium, AISI Series 300 stainless steel or other material compatible with aluminium, and of adequate strength for the proposed use.

(03) Workmanship

- a) Fit member neatly and to hairline accuracy with profile extending into joints without additional trim. Match flush joints to form perfectly smooth plane; match offset joints to hairline butt fit to flat surface by one point of tangency of corner radius. Units using extra trim to conceal misalignment will not be acceptable.
- b) Make all connections by means of concealed fasteners; exposed fasteners will be permitted where essential to proper adjustment of units. Use only countersunk flat head machine screws for exposed fasteners.
- c) Where additional strength of section is required to meet structural requirements, provide additional wall thickness or stiffeners inside the extrusion.
- d) Manufacturer's standard sections will be acceptable only when such extrusions are substantially in accordance with the profiles indicated on the approved shop drawings as accepted by the Engineer.
- e) Surface Smoothness: Submit samples and obtain approval for extent of the finish permissible in all "as extruded" materials.

E- Submittals**(01) General**

Refer to "Schedule of Required Submittals", section of Division 01000, and other sections referenced therein for special instructions relating to submittals.

(02) Shop Drawing

- a) Project Shop Drawings: All fabricated materials and assemblies.

(03) Manufacturer's Coordination and Services

- a) Product Certification: Certification of proper use and compatibility for aluminium sealing and lacquer.
- b) Certification of alloy for integral colour finish.
- c) Certification by Aluminium Association designation for class of powder coating and finish.
- d) Maintenance instructions.

(04) Warranty

- a) All Aluminium powder coating shall be warranted by the manufacturer for a period of not less than 10 years or such longer periods the manufacturer normally provides.
- b) The fabricator shall certify compliance with all of manufacturer prerequisites for maximum warranty.

(05) Samples

- a) Submit Samples in accordance with submittals section 01343 of Division 01000.
- b) Before any work is performed, the following samples shall be submitted:
- i) Three sets of 300 mm x 300 mm (12 in. x 12 in.) sheets (pairs indicating range) of samples of each type of aluminium finish specified herein. The integral powder coated samples must demonstrate the limits of colour range within which production materials will be processed.
- ii) Submit samples of all components, including all hardware trim, weather stripping and typical extrusions.
- iii) Representative samples of welded connections, mitred joint, and butt-weld and typical brake form and bend for bar and sheet stock to show final finished appearance.
- c) Identify samples as to treatment, powder coating thickness, alloy, colour, and portion of the work to which the sample applied. Make samples on sections of similar shape as proposed materials and large enough to establish good comparison.
- d) For project reference, one set of record samples will be retained by the Engineer, and kept available at the job site and one returned to the Contractor.

(06) Maintenance Instructions

Prepare and deliver to the Engineer a complete maintenance manual in accordance with the requirements of the "Project Record Documents" section 01720 of Division 01000.

Such documents are an integral part of the requirements of these Specifications and require close cooperation between the basic metal manufacturer, the fabricator and the finisher.

Reference information shall include:

- Complete description of alloy, temper, and finish of each type of material as delivered.
- Description of method by which finish was produced.
- Location in the building of each type.

Maintenance information shall include specific instructions for:

- Routine cleaning instructions with recommendations for materials and schedule applicable to locality and exposure.
- Recommendations for major cleaning as required to maintain powder coated appearance and prevent development of oxidation.
- Instructions for re-finishing and restoration of original appearance.

Appropriate publications shall be included but these shall not be regarded as taking the place of required specific instructions.

08902 PRODUCTS**A- Materials****(01) Materials Specification**

All sections to comply with B.S. 4873 or equivalent in respect of materials, work sizes and manufacture. The Contractor shall be responsible to determine the adequacy of sections with respect to structural and performance requirements. All extrusions shall be of adequate strength, not only to meet the structural performance, but also to minimize the risk of distortion in the finished surfaces.

(02) Aluminium

- a) Sheet Aluminium where specified or required:
 - Natural Colour Sheet: No 55 Architectural Sheet or Anoclad Type 01.
 - Sheets to receive Integral Colour Finish: See Aluminium Finishes".
- b) Extruded Aluminium: Powder coated, dark green Metallic Colour Matching with glazing.
 - Natural Colour Powder Coated Extrusions: 6063-T5 alloy.
 - Natural Colour Powder Coated Snap-in Beads: 6063- T6 alloy.

- Structural Shapes, except where integral colour finish is indicated: 6063- T6 alloy.
- Extrusions for Integral Colour Finish: Special alloy, see "Aluminium Finishes".
- c) Cast Aluminium where Specified or required:
 - Anodized Castings: 214 alloy.
 - Structural Castings: 356- T6 alloy.

(03) Support Devices

- a) Fasteners used in assembling sections: Exactly matching adjacent surfaces where exposed or AISI 300 series stainless steel where concealed.
- b) Steel Anchors: Hot dip galvanized, or AISI 300 series stainless steel.
- c) Inserts: For required anchorage into concrete or masonry work, furnish inserts of cast iron, malleable iron or 2.8 mm (12 gauge) steel hot-dip galvanized after fabrication.
- d) Expansion Anchor Devices: Fed. Spec. FF-S-325 Group II, Type 4, Class I, Int. Amendment 3; Molly "Para bolt" or equal.

(04) Accessory Materials

- a) Joint Filler: Expanded cellular neoprene, closed cell, tape, coated with non-staining adhesive one surface: ASTM D 1056 "Testing Sponge and Expanded Cellular Rubber Products", type SC-41 ; shape as required.
- b) Thermal Barrier: Solid neoprene, 60 durometer.
- c) Bituminous Paint: Koppers 50 or SSPC Paint 12.
- d) Protective Coverings: After finishing procedures have been completed, apply protective wrappings of paper or plastic film. Keep material dry until wrappings are removed, if used, must be completely removed.

B. Powder Coating

(01) Material

Fluoropolymer powder coating on chromated Aluminium or superior metal.

Metal Substrate	Chromated A1 (DIN 50939)

Stoving Schedule	12 min at 200°C

- a) Finish coating shall be a factory applied finish in approved colour and in accordance with the standards of Aluminium Association based on kynar 500/Duranar XLE or superior.
- b) Application of the finish based on above coating shall be performed under specifications issued by the licensed formulator and by an applicator specifically approved by one (or more) of the formulators. Said applicator shall provide written notification of approval by a formulator prior to application of the finish.

- c) Primer coat shall be corrosion resistant epoxy based primer with dry film thickness averaging from 0.0025 to 0.005 mm (.1 mil to .2 mils). The finished coat shall have a dry film thickness averaging 60 microns.
- d) Testing Standards:
- Weatherometer: In accordance with ASTM E 24 withstand 500 hours exposure in the Sunshine Aro Weatherometer Model XW-R under 60/60 Dew Cycle conditions without evidence of chalking or withstand 2,000 hours exposure in Atlas Twin/Arc Weatherometer without evidence of chalking or film failure.
 - Humidity: In accordance with ASTM D 2247 withstand 3000 hours at 100 % relative humidity with no more than 5% of surface showing blisters no larger than No. 4 (ASTM D 714).
 - Salt Spray: In accordance with ASTM B 117 withstand 3000 hours at 5% salt fog at 35° C (95° F) with no more than a few blisters no larger than No. 4 ASTM D 714 and no more than 1.6 mm (1/16 in.) creepage and loss of adhesion from line scribed to metal.
 - Pencil Hardness: F-2H.
 - Gloss: 50/90 on 60° glossmeter in accordance with ASTM D 523.
 - Adhesion: No removal of finish after 1.6 mm (1/16 in.) cross-hatching (ASTM D-3359) to bare metal, impacting to point of metal rupture and subjecting to application and quick removal of scotch cellophane tape.
 - Abrasion Resistance: 60 litres/mil. minimum ASTM D-968.
- e) Colour -As approved by the Engineer.

C- Dissimilar Materials

1. Dissimilar Metals

Where aluminium materials are placed in contact with, or fastened to dissimilar metals they should be separated from such metals by application of bituminous coating, non absorptive tape or gaskets or sealants.

2. Masonry, Concrete or Plaster

Where aluminium materials are placed in contact with, or built into, masonry, concrete, or plaster, apply a heavy brush coat of alkali resistant bituminous paint, 1 mm (40 mils) dry film thickness.

08903 EXECUTION

A- Construction Requirements

The Curtain Wall shall be manufactured by an approved manufacturer in this trade.

The Contractor shall provide shop drawings based on Architectural drawings along with computations for the approval of the Engineer before orders are placed with the manufacturers.

The manufacturer shall use the latest and approved method of jointing employed in the manufacture of high class work viz. mechanical jointing, reinforced with concealed welding shall be used.

The workmanship shall conform to applicable provision of B.S. 990

B- Fixing

The fixing of Curtain Wall to concrete structure shall be carried out in an approved method as indicated on the drawings or as directed by the Engineer. Provision of necessary groove or rebate and holdfasts in the concrete shall be made in the form work and no holing or drilling shall be allowed in the exposed concrete finishes. These shall be erected in position after the building structure is completed and by using proper holdfasts as shown on drawings or counter sunk bolts and screws as directed by the Engineer in accordance with site requirements.

C- Handling

Care shall be taken in handling various components of the Curtain Wall during transportation and at job site. These shall be stored under cover and shall be installed only by skilled mechanics, set plumb, level, in alignment and properly braced to prevent distortion.

D- Protection

- i) The joints should be caulked with approved building mastic for total weather proofing.
- ii) After installation, Curtain Wall shall be protected from construction hazards that will damage its appearance or finish. It shall be cleaned on inside and outside of all mortar, plaster, paint or other foreign matter to present a neat appearance. Hardware and moving parts shall be lubricated.

E- Glazing

a) General

The work of fixing glazing to Curtain Wall shall be carried out with the type and special quality of glass specified and as indicated on the drawings or as directed by Engineer.

The sizes of glass indicated on the drawings are approximate only, and the actual sizes required shall be determined by measuring the frames to receive the glass. All glass shall be factory labelled on each pane and the label shall not be removed until finally approved by the Engineer. Glass will be fixed with best quality mastic compound of approved make suitable for the type of glass or as directed by Engineer. Special rubber lining and weather proof brush joints for openable panels shall be provided where indicated.

b) Glass Performance data

Glass Type:	Reflective glass Solarban 550-18(3) solex	
Aesthetics:	Green sapphire	
Visible Light:	Transmittance	-15%
	Reflectance	-32% (Out door)
		-25% (In door)

Total solar:	Transmittance	-8%
	Reflectance	-16%
U-value:	(Winter night time)	
	Imperial	0.44 Winter night 0.53 Summer day
	Metric	2.5 Winter night 3.0 Summer day
Shading Coefficient:		.033
c)	Curtain Wall	Structural Silicon glazing (frame not visible from outside).
	Outer layer	Float glass 6 mm thick reflective fixed with coating facing void.
	Inner layer	Float glass 6mm thick plain clear glass.
d)	Structural Glazed Skylights	Structural Silicone glazing (frame not visible from outside)
	Outer layer	6 mm poly carbonate sheet clear.
	Inner layer	Laminated glass consisting of 6 mm reflective float glass and 6 mm plain float glass (As per 'b' above)
e)	Standards and Performance	
	Watertight and airtight installation of each piece of glass is required, except as otherwise shown. Each installation must withstand normal temperature changes, wind loading, impact loading for operating sashes without failure of any kind including loss or breakage of glass, failure of sealants or gaskets to remain watertight and airtight, deterioration of glazing materials and other defects in the work.	
	Protect glass from edge damage at all times during handling installation and operation of the building.	
	Comply with combined recommendations of glass manufacturer and manufacturer of sealants and other materials used in glazing, except where more stringent requirements are shown or specified, and except where manufacturer's technical representatives directs otherwise.	
	Inspect each piece of glass immediately before installation, and eliminate any, which have observable edge damage or face imperfections.	
	Cut and install glass as recommended in "Technical Services Report No.104" by PPG Industries.	
	Install polysulfide sealants as recommended by Thiokol Chemical Corp., except as otherwise recommended by the sealant manufacturer.	

f) Preparation for Glazing

Clean the glazing channel, or other framing members to receive glass, immediately before glazing. Remove coating, which are not firmly bonded to the substrate. Remove lacquer from metal surfaces wherever elastomeric sealants are used.

Apply primer or sealer to joint surfaces wherever recommended by sealant manufacturer.

Do not attempt to cut, seam, nip or abrade glass, which is tempered.

Force sealants into channel to eliminate voids and to ensure complete "wetting" or bond of sealant to glass and channel surfaces.

Tool exposed surfaces of glazing liquids and compounds to provide a substantial "wash" away from the glass. Install pressurized tapes and gaskets to protrude slightly out of the channel, so as to eliminate dirt and moisture pockets.

Clean and trim excess glazing materials from the glass and stops or frames promptly after installation, and eliminate stains and discolorations.

Where wedge-shaped gaskets are driven into one side of the channel to pressurize the sealant or gasket on the opposite side, provide adequate anchorage to ensure that, gaskets will not "walk" out when subjected to dynamic movement. Anchor gasket to stop with matching ribs, or by proven adhesives, including embedment of gasket tail in cured heel bead.

g) Cure, Protection and Cleaning

Cure glazing sealants and compounds in compliance with manufacturer's instructions and recommendations, to obtain high early bond strength, internal cohesive strength and surface durability.

Protect glass from breakage immediately upon installation, by attachment of crossed streamers to framing held away from glass. Do not apply markers of any type to surfaces of glass.

Remove and replace glass which is broken, chipped, cracked, abraded or damaged in other ways during the construction period, including natural causes, accidents and vandalism.

Maintain glass in a reasonably clean condition during construction, so that it will not be damaged by corrosive action and will not contribute (by wash-off) to the deterioration of glazing materials and other work.

Wash and polish glass on both faces not more than 4 days prior to Employer's acceptance of the work in each area. Comply with glass manufacturer's recommendations.

08904 MEASUREMENT AND PAYMENT**A- Measurement**

Payment for Curtain Wall and Sky Lights will be made by measuring surface areas actually completed and approved in square feet/m.

B- Rate and Payment

Rates for all the items under this Section shall cover the cost of furnishing all the materials labour, scaffoldings and appliances at Site and performing all operations in connection with their installation in accordance with instructions of the Engineer. It is particularly mentioned that the rates for fixing Curtain wall shall include fixing of all finished hardware iron mongery fittings such as locks, peg, stays, handles, push plates, kicking plates, door closers, glazing, flexible compounds, rubber lining and appliances at site and performing all operations in accordance with the instructions of the Engineer and specifications.

The wastage for glazing due to breaking, cutting to sizes and replacement during maintenance period shall not be paid for separately but the rates shall be deemed to be inclusive of all these costs.

*** End of Division 08000 ***

DIVISION 09000 - FINISHES

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DIVISION 09000 – FINISHES**09110 ARCHITECTURAL HAND RAILS & RAILING****09111 GENERAL****A- Description**

This section covers fabricating, furnishing and installing architectural handrails and railings including special finishing.

B- Applicable codes and Standards

The codes and standards applicable to the work specified in this section are referenced in the relevant paragraphs. Codes and standards which are generally applicable to the work of this section are listed hereinafter:

Sponsor	Number	Subject
AISC		Manual of Steel construction, specifications for the design, Fabrication, and Erection of Structural Steel for Buildings.
AISI		Specification for the Design of Cold-Formed Steel Structural Members.
AWS	D1.1	Structural Welding Code-Steel
ICBO		Uniform Building Code (UBC)

C- Submittals

The following submittals are required:

- a. Detail Drawings and /or Shop Drawings
- b. Manufacturer's Data
- c. Assembly, Erection and Installation Drawings and manuals
- d. Samples

D- Mock-Ups**(01) Handrails**

Prior to beginning production of handrails, furnish a full-size section with the proposed finishes, and typical attachments, together with bent section of minimum applicable radius. Upon approval, the mock-up may be used in the final work.

(02) Glass Railings

Prior to beginning production of glass railings, furnish a full size section, consisting of 3 glass modules, with the proposed finishes and typical attachments, together with bent section of minimum applicable radius. Upon approval the mock-up may be used in the final work.

09112 PRODUCTS**A- Materials****(01) Aluminium Section**

Powder coated dark green colour matching with glazing.

Alloy: B.S. 1472 and B.S. 1470

(02) Steel Pipe

M.S. pipe with Powder coating 2½" dia as per design / drawing.

ASTM A 53, Grade A, type as selected by fabricator, Schedule 40, black unless another finish is indicated.

(03) Brackets, Flanges, and Anchors

Cast or formed metal of the same type material and finish as supported rails, unless otherwise indicated and / or specified.

(04) Grout

Non-shrink, non-ferrous grout, one of following or approved equal.

- a) Crystex by L & M construction Chemicals or equal and approved.
- b) Rapid setting grout similar to Upco Bostik 275 using less than full unit of powder so that mix is pour able.

(05) Glass for Railings

Dark green, tempered glass 12mm (1/2 in.) thick unless otherwise shown.

(06) Sleeves

Galvanized steel meeting ASTM A 120

(07) Sealants and Gaskets

Provide sealants and gaskets in the fabrication, assembly and installation of the work, which are recommended by the manufacturer to remain permanently elastic, non-shrinking non-migrating, and weather proof for the life of the building. At butt joints provide interior silicone rubber sealant. Colour at setting bed, black, unless otherwise indicated.

(08) Clearance, Primers, and Sealers

Type recommended by sealant or gasket manufacturer.

B- Design Requirements.**(01) General**

Provide handrails and railings of the design shown, fabricated and installed to withstand a minimum of a 90 kg (200 lb) load applied at any point, downward or horizontally, without damage.

(02) Load

Uniform loads shall conform to the requirements of the ICBO "Uniform Building Code" for handrails and the following:

Load on Rail	Design Load N/m (lbf/ft)	Without Damage N/m (lbf/ft)	Without Collapse N/m (lbf/ft)
Lateral	730 (50)	1100 (75)	1825 (125)
Vertical	1460 (100)	2190 (150)	3650 (250)

C- Railings and Handrails**(01) General**

Provide rails, sized as indicated.

(02) Securing

Secure handrails to wall with wall brackets and end fittings. Provide brackets of stainless steel or malleable iron castings as indicated with not less than 75 mm (3 in) clearance from inside of handrails to wall surface. Drill wall plate portion of the bracket for concealed anchorage. Locate brackets and incubated or if not indicated, at not more than 2.44 m (8 ft.) centers.

(03) Wall returns

Provide wall return fittings of flush-type, with the same projection as that specified for wall brackets. Secure wall brackets and wall return fittings to building construction as follows.

- a) For concrete and solid masonry anchorage, use bolt anchor expansion shields and machine bolts.
- b) For hollow masonry anchorage, use toggle bolts having square heads.
- c) For stud partitions, use bolts set into backing between studs as indicated. Coordinate stud installation for accurate location of backing members. 04.

D- Fabrication**(01) Workmanship**

Use materials of the size and thickness indicated, or if not indicated, of the required size and thickness to produce adequate strength and durability in the finished product for the intended use, and to comply with the specified design requirements. Work to the dimensions indicated or accepted on shop drawings, using proven details of fabrication and support. Use the materials indicated and/or specified for the various components of work.

(02) Forming

Form exposed work true to line and level with accurate angles and surfaces and straight sharp edges. Ease exposed corners to a radius of approximately 0.8 mm (1/32 in.) unless otherwise indicated. Vee cut far side where necessary and form bend-metal corners to the smallest radius possible without causing grain separation or otherwise impairing the work.

(03) Welding

Weld corners and seams continuously and in accordance with the recommendations of AWS. At exposed connections grind exposed welds smooth and flush to match and blend with adjoining surfaces.

(04) Connections

Form exposed connections with hairline joints, which are flush and smooth, using concealed fasteners wherever possible. Use exposed fasteners of the type indicated or, if not indicated, use Phillips flathead (countersunk) screws or bolts on bottom or concealed face.

- a) Provide anchorage, coordinated with the supporting structure. Fabricate and space anchoring devices to provide adequate support for the intended use of the work.

(05) Non-Welded Connections

When approved, intermediate post-to-rail connections may be made using internal pipe sleeve locks and Allen screw fasteners. Locking devices which do not produce flush, smooth, rigid, hairline joints will not be acceptable.

(06) Welded Connection

Cope intersections of rails posts, weld joints, and grind smooth. But weld end-to-end joints of tubing or use welding connector, at fabricator's option. Finish after welding.

- a) At connections to steel supports, weld post directly to steel supports, unless otherwise indicated.

(07) Bent Rails

Tubing bent at corners instead of joining shall be uniformly formed in jigs, with cross-section of tubing maintained throughout the entire bend smooth and free from surface irregularities.

09113 EXECUTION**A- Inspection**

Examine the areas and conditions under which items are to be installed. Do not proceed with the work until unsatisfactory conditions have been corrected.

B- Installation**1. General**

Install handrails and railing as indicated and specified and in accordance with final shop and installation drawings and manufacturer's instructions.

2. Fastening to In-Place Construction

Provide anchorage devices and fasteners where necessary for securing the work to in-place construction; including expansion anchors for concrete and masonry inserts, toggle bolts, through-bolts, lag bolts, and other connectors as required; otherwise comply with requirements of section "Miscellaneous Metal Works".

- a) Steel Bar Railing, Handrails, and Guardrails: Attach posts to galvanized steel inserts as indicated. Provide galvanized bolts at bolted connections. Secure posts in sleeves in concrete with rapid setting grout.

3. Cutting, Fitting and Placement

Perform cutting, drilling and fitting required for the installation of the work. Set the work accurately in location, alignment and elevation, plumb, level, true, and free of rack, measured from established lines and levels. Provide temporary bracing or anchor in form work for items which are to be built into concrete, masonry, of similar construction.

4. Exposed Connections

Fit exposed connections accurately together to form tight hairline joints. Weld connections, which, are not to be left as exposed joints, but cannot be shop welded because of shipping size limitations. Grind joints smooth and touch-up shop paint coat.

5. Field Welding

Do not field weld unless joint is not visible or weld can be finished to match finish of welded items. Comply with AWS D 1.1 for the procedures of manual shielded metal-arc welding, the appearance and quality of weld made, and the methods used in connecting welding work.

6. Adjusting

Adjust railings prior to securing in place to ensure proper matching at butting joints and correct alignment throughout their length. Space posts not more than 2.44 m (8 ft.) centres, unless otherwise indicated. Plumb posts in each direction. Except as otherwise indicated or specified, secure posts and rail ends to building construction as follows:

- a) Anchor posts in concrete by core drilling holes not less than 25mm (1 in.) greater than the greatest outside cross-sectional post dimension. Clean holes of all loose material, insert posts and fill the space between post and concrete with specified non-shrink, non-ferrous grout. Hold grout 19 mm (3/4 in.) below surface and seal with sealant as specified.
- b) Anchor posts to steel by welding directly to steel supports.

C- Cleaning and Protection

1. Cleaning

Maintain handrails and railings in a reasonably clean condition throughout the construction period so that they will be without evidence of deterioration or damage (other than the effects of normal weathering) at the time of final acceptance and methods of cleaning which will promote the achievement of uniform appearance and stabilized colours and textures for materials that weather or age with exposure.

2. Protection

Protect the work. Repair or replace damaged work as required by the Engineer.

3. Final Cleaning

Immediately before the time of final acceptance clean architectural handrails and railings thoroughly.

09114 MEASUREMENT AND PAYMENT

A- Measurements

All the items under this section of specifications shall be measured according to the standard method of measurement and shall be paid for at their respective units rates as entered in the Bill of Quantities and as shown on drawings in accordance with the terms and conditions of the Contracts.

B- Rate and Payment

The unit rate shall be full compensation for all work described under this section welding cutting and shaping to size, all paint material and painting. No separate payment shall be made for false work, any unspecified work done in fabricating workshops or yards, or other erection expenses.

*** End of section 09110 ***

09200 PLASTERING**09201 GENERAL****A- Scope of Work**

The work covered under this section of Specifications consist of furnishing all materials, labour and performing all operations in connection with plastering/rendering complete in every respect in accordance with the requirements of the Drawings and Specifications, and as directed by the Engineer and subject to the terms and conditions of the Contract Documents.

The work carried under this section shall further conform to the requirements of ANSI A 42.2 or B.S. CP: 211 and CP: 221 and all the Standards and other documents relied therein.

B- General

Except as may be otherwise shown or specified, all plaster shall be cement sand plaster. Plastered ceilings and walls shall include partitions, piers, columns, pilasters, plastered jambs and other returns, reveals and backs of recesses, alcoves, and jambs and heads of windows and doors, unless otherwise specified or shown on Drawings. Plaster on walls shall be carried down to Dado, Skirting and projection bases. Plaster work shall also include all plaster work on and under all concrete surfaces to be left exposed and concrete not required Fair Faced, until and unless specified otherwise. It shall be the Contractor's responsibility to ensure that all electrical conduits, hidden or items to be embedded, ducts, pipes, brackets, doors, windows, ventilators and all other fixtures on walls, ceiling, columns or required elsewhere have been fixed in place before the plastering is started.

09202 PRODUCTS**A- Materials**

Portland cement shall be as described in Section 3310 "Plain and Reinforced Cement Concrete".

Sand shall comply with the requirements of ASTM designation C 35, British Standard 1199, Table 1.

Water shall be clean, free from harmful amounts of deleterious matter and from any unusual proportion of dissolved salts. Sea water, tidal estuary or brackish water shall not be used.

Metal lathing used as background for plastering should not weigh less than five (5) lbs/sq. yard for sanded plaster and (3) lbs/sq. yard for light weight gypsum plasters and shall comply with B.S. 1369 Metal Lathing (steel) for Plastering.

Galvanized wire netting where required to provide a mechanical key, 22 SWG galvanized wire netting of mesh not greater than 2" and complying with BS 1485, Galvanized Wire Netting, shall be used.

09203 EXECUTION**A- Proportioning of Plaster**

All plaster shall be Portland Cement plaster, except otherwise noted all coats of which shall be mixed in the proportions by volume as indicated on Drawings.

Volume batching shall be done by proper gauge boxes.

B- Mixing

Plaster ingredients in the specified proportions shall be thoroughly mixed by Mechanical means.

All coats of plaster in liquid retaining structures shall be waterproofed by the addition of an Approved compound in liquid or solid form used at an Approved dose. The waterproofing compound shall be commercially pure with no oils or other ingredients, which may be detrimental to the cement.

C- Care of Tools and Plant

All tools shall be cleaned by scrapping and washing at the end of each day's work, or between uses with different materials. Metal tools shall be cleaned and if necessary greased after each operation. All tools shall be examined and thoroughly cleaned before plastering is begun.

D- Mechanical Mixer

Plaster mix shall be mixed for two or three minutes, after which the batch shall be discharged and not left in the mixer. When the mixer is not in continuous use, it shall be washed out after every mix as soon as the batch is discharged. When in continuous use the mixer shall be washed out about four times a day.

E- Cleanliness and Protection

Cleanliness is essential in carrying out plaster work. Adequate protection shall be given to all existing work and fittings which are liable to be damaged not only in the areas of plastering operations but in the approaches thereto by covering up with boards, dust sheets etc. as necessary. This is particularly important when mechanical methods of application are used.

On completion, all works affected by plastering operations shall be left clean. Special care will be taken when removing set plaster from glass to avoid damaging the surface.

F- Fixing Applied Back Grounds

Metal lathing shall weigh not less than five (5) lbs/sq. yard for sanded plaster and shall be protected by black bitumen paint or be galvanized.

All metal lathing shall be of 3/4" or 1" mesh and be fixed with the long way of the mesh across the supports. Metal lathing with stiffening ribs shall be fixed with the ribs uppermost towards and across the supports. If the supports are more than 14" apart, the gauge of metal shall be increased above that normally used to give sufficient stiffening.

The standards in various sheets shall all slope in one direction; in vertical work, they shall slope inwards and downwards from the plaster face.

Metal lathing minimum 8" wide to be fixed at the junction of RCC elements and block/brick work shall be fixed by galvanized nails or staples at 4" centres. End laps shall not be less than 1" when laps occur in the bearers and not less than 2" when the laps occur between bearers. They shall not occur at angles or grooves and shall preferably occur only at supports. The sheets shall be lapped and securely tied together with 11 SWG galvanized tie wire. The metal lathing shall not be provided on plaster on outer side of walls. Instead grooves shall be given.

Side laps shall not be less than 1" and wired together with similar gauge tie wire at 16" centre. Metal lathing shall be as tight as possible, this is best achieved by nailing the sheet in the centre and then working towards each end. Ends of wiring for fastening shall be bent inwards and not towards the plaster coat.

After erection all cut edges and damaged metal lathing, staples or nail heads shall be given a protective coat of bitumen paint.

G- Back Grounds

1. Characteristics of the Background

The back ground shall not have received any prior treatment such as painting or impregnation which is incompatible with adequate bond.

2. Preparation of Background

Preparatory Treatment: The preparatory treatment as necessitated for the application of plastering systems shall be as per British Standard Code of Practice and/or in accordance with the Engineer's instructions.

3. Treatment of Mixed Background

Where plastering is to be continued across back grounds of different classes, expanded metal shall be fixed across the junction to minimize cracking due to differential movements. Where small width of one material is involved e.g. concrete column dividing block panels, the column width shall be bridged completely by fixing expanded metal over building paper into the material abutting the concrete in order to isolate the plaster from any movement of the column.

H- Application of the Various Coats

(01) General

The work shall not be started until the back ground is in a proper state as specified, and suitable weather conditions prevail. As far as practicable, it is important that a newly rendered surface shall be prevented from drying out too rapidly, although protection from the sun and wind or spraying with water, may only be necessary in hot and dry weather. In sunny weather, the work shall be carried out in the shade whenever possible, following the sun, as the day passes.

Under coat shall be allowed to dry out for as long as possible before the subsequent coat is applied. It is desirable to wait at least twenty four (24) hours even in the hot dry weather. Before applying any subsequent coat, the preceding coat shall be brushed down to remove any dirt and loose particles and, if of a porous nature and very dry, shall be wetted.

When rendering on metal lathing or expanded metal, back rendering, wherever it can be applied, shall be done when the first under coat on the face is hard enough to permit. The work shall then be allowed to dry as completely as possible before applying further coats, in order to prevent cracking.

When specified plaster thickness is 3/4" or more plaster shall be applied in three (3) coats on lath and 3 or 2 coats on masonry and concrete surfaces as per ANSI A 42.1 paragraphs 3.4, 3.5 and 3.6. Unless otherwise indicated on the Drawings or directed otherwise, the plastering shall be carried down to the skirting of the floor.

(02) Undercoat

This may be applied either by laying on with or throwing from the trowel. The surface to receive the under coat shall be thoroughly cleaned and evenly dampened before the plastering begins.

The undercoat shall be as uniformly thick as possible and in no case shall be more than 1/2" thick in anyone trowel laying. After it has been left long enough to set firm, the surface shall be combed or scratched. care being taken to leave the scratch marks sufficiently deep to provide a key for the following coat but not so deep as to penetrate the rendering.

It shall be applied with sufficient pressure to fill the raked out joints in block/brick work to prevent air pockets and to secure a good bond. It shall be kept moist with fog spray for two (2) days and then be allowed to dry out.

(03) Finishing Coat

Finishing coat shall not be applied until the undercoat has been cured for seven (7) days. Just before application of the finish coat, the under coat shall again be wetted evenly with fog spray.

It shall not be less than 1/4" or more than 3/8" thick and shall be applied with a laying trowel and finished with a wood, felt, cork, or other suitably faced float. A steel trowel shall not be used and over working shall be avoided. Water shall not be applied to the surface of the finishing coat whilst working up, but patches showing signs of premature drying may be patted with a damp float.

It shall be kept moist with a fog spray for at least two days and thereafter shall be protected against rapid drying until properly and thoroughly cured.

I- Water Proof Plaster for Water Retaining Structures

All surfaces continuously exposed to wet conditions shall be given water proofing treatment.

The water proofing treatment shall be done in plaster by using water proofing cement compound (PUDLO) especially made for such purpose. It shall be applied as plaster in two successive layers of 3/4" each on all surfaces. The plaster shall be made by mixing the waterproofing compound in the cement sand mix of 1: 4 by volume according to the Manufacturer's instructions. Water proofing compound shall be supplied in sealed containers only. Only water proofing compound duly approved by the Engineer shall be allowed for use. Minimum five (5) lbs of water proofing compound shall be used for each bag of cement in preparation of water proof plaster. In water tanks, all corners, vertical as well as horizontal shall have triangular cant strips 6"x6" size in mortar 1 :4. The surface to receive water proofing treatment shall be made rough by hacking and chiselling the concrete lightly to give a rough surface for bonding. After the surface has been made rough, metal lath (diamond mesh) shall be nailed to the entire surface in an approved manner. The first layer of water proofing plaster 3/4" thick shall then be applied and its surface shall be made rough by the use of a brush or other suitable instrument. The first layer shall be allowed to cure for a minimum of forty eight (48) hours before the second layer of water proofing plaster with metal lath as in first layer is applied. The second layer of plaster shall also be 3/4" thick and its surface shall be trowel finished by means of steel trowel to give a smooth and even surface from the inside. The plaster shall be cured for a minimum of fourteen (14) days after laying of second layer of water proofing plaster. Water proofing plaster work shall not be started until all pipes have been installed by the Contractor. Any damage or leak discovered in the tank shall be repaired by the Contractor at his own cost.

J- Sampling of Plaster

Samples may be taken by the Engineer at any time from plaster work in place for testing.

K- Patching

Plaster containing cracks, blisters, pits, checks, or discolouration will not be accepted. Such plaster shall be removed and replaced with plaster conforming to this Specification with the approval of the Engineer.

09204 MEASUREMENT AND PAYMENT**A- Measurement**

All plaster work shall be measured and paid for the actual work executed in accordance with the standard methods of measurements as Approved by the Engineer and paid for at the unit rates entered in the Bills of Quantities appended hereto and in accordance with the terms and conditions of the Contract.

B- Rate and Payment

The unit rate shall include the cost of furnishing all the materials, labour, scaffolding, appliances, tools and performing all operations in accordance with the specifications, drawings and instructions of the Engineer. The cost of plastering shall be deemed to be inclusive of groves, metal lathing, mesh and preparation of surfaces. The rate quoted shall be taken as full compensation for all services and materials to be provided for finishing the work and in connection thereto.

*** End of Section 09200***

09310 CERAMIC & PORCELAIN TILE WORKS**09311 GENERAL****A- Scope of work**

The work covered under this section comprises of providing and laying glazed ceramic and fine Porcelain tiles of approved quality size and pattern wherever required or shown on the drawings or mentioned in the Bill of Quantities.

B- Submittals

The following submittals are required:

- Detail Drawings and/or Shop Drawings
- Manufacturer's Data
- Manufacturer's Standard Colour Charts
- Certificates of Compliance

09312 PRODUCTS**A- Materials****(01) Tiles**

Except as otherwise specified the following British Standards and Code of Practice shall be applicable to materials and fixing methods for ceramic tile work: -

- i) British Standard 1281: "Glazed Ceramic Tiles and Tile Fittings for internal wall"
- ii) British Standard C.P. 212: for fixing methods and workmanship.
- iii) Fine Porcelain tiles (polished) Grade – I fully vitrified Grannitto of Al Khaleej Ceramics UAE or equivalent (ISO 9001 certified).

(02) Joint Filler

Joint Filler shall be white Portland Cement grout which shall bond to dry tile, shall be non-shrinking, strain resistant, permanent in colour, and shall not inhabit fungus and bacterial growth. It shall be odourless non-toxic, of smooth consistency for easy preparation and neat, rapid installation, and shall contain non-metallic material. Grout shall be water resistant and shall not wash out under water.

(03) Adhesives

Adhesives for ceramic tiling as specified in the British Code of Practice C.P.212 or Dry Bond Floor and wall thin set mortar as manufactured by approved manufacturer.

B- Samples and Tests

The samples shall be furnished in sizes and colours and adequate in number for testing in the laboratory as and when ordered by the Engineer.

C- Shop Drawings

The Contractor shall prepare shop drawings on the basis of drawings produced by the Engineer for all the ceramic tile work to be carried out on the project. These drawings will show clearly the sizes, method of fixing, jointing and the anchorage to

be used in the process and the Contractor shall get approval in writing from the Engineer well in time before the actual start of the work.

09313**EXECUTION****A- Construction Requirements****(01) In Cement Sand Mortar**

Surfaces to receive the ceramic tiling shall be clean and free of dirt, dust, oil, grease or other objectionable matter. Setting beds and tile shall be installed with their respective surfaces to true planes, level or pitched to offsets as required by the drawings, so that the surface of the completed tiling work will be at the elevations and grades shown. Retempering of mortar will not be permitted. Tiles shall be laid out from the centre lines of each space outward and adjustments made along walls, partitions and borders, if any, so as to symmetrize the pattern with a minimum of cut tiles.

Joint between tiles shall be of uniform width and the same as the tile installed. Fractional changes in dimensions without varying the uniformity of joint widths shall be permitted. Tile shall be cut with a suitable cutting tool and rough edges shall be rubbed smooth. Cut-tile misfits shall be laid to the straight edges. Straight edges shall be accurately set to the lines established and reset at suitable intervals to keep the joints parallel over the entire area.

Over the existing bed a topping of 2-1/2" thick 3000 psi concrete shall be laid. Scratch coats for application as foundation coats shall be not less than 1/2" thick and shall be composed by volume of 1 part Grey Portland Cement to 3 parts dry sand, mixed with the minimum amount of water necessary to produce a workable mass. Mortar for scratch coats shall be used within one hour after mixing and rettempering will not be permitted. Scratch coats shall be applied in sufficient quantity and with sufficient pressure to cover the entire area and to form good keys, shall be deeply scoured or scratched and cross-scratched, shall be protected and kept moist during the curing period. Scratch coats shall be thoroughly damp-cured, and an interval of not less than 24 nor more than 48 hours shall be permitted between application of scratch coats and application of float coats.

Float coats shall be composed by volume of 1 part Grey Portland cement to 2 parts dry sand, mixed with a minimum amount of water necessary to produce a workable mass. Float coats shall be applied in sufficient quantity to entire area and to form a good key shall be brought out flush with the temporary screeds or guide strips so placed as to give a true even surface at the proper distance from the finish suitable for reception of tiles.

Joints shall be straight, level perpendicular and of even width throughout. Vertical joints shall be maintained plumb for the entire height of the tile work. Each tile shall be brought to true level and plane by uniformly applied pressure under a straight edge or rubber faced block. Tiles that are out of true plane or misplaced shall be removed and reset. Damaged or defective tile shall be replaced. The tile shall be installed as follows:-

Wall tile shall be set by troweling a skim coat of neat white Portland cement on the float coat or by applying a skim coat to the back of each tile unit and immediately floating the tile into place. After tile has set remove mortar using a minimum of water. Replace damage tiles.

After the tiles have been thoroughly set, joints shall be grouted full with a plastic mix of neat, white cement immediately after a suitable area of tile has been set. The joints shall be struck flush and excess mortar shall be cut off and wiped from the mortar

joints after grout has been cleaned from the surface shall be roughened at once and filled flush with the tile edge, before the mortar begins to harden. Tile skirting and coves shall be solidly backed with mortar.

(02) In Thin Set Mortar

Tiles laid in Thin Set Mortar shall be applied as per details shown on drawings and shall consist of a 3000 psi concrete base of specified thickness. Tiles shall be set by troweling a skin coat of tile unit to Dry Bond Mortar on the base coat and combed with a notched edge of trowel. Back butter each tile unit to ensure 100% mortar coverage and float the tile into place, tapping the tile to ensure maximum bond strength. All other installation requirements shall be as per specifications mentioned above.

09314 MEASUREMENT AND PAYMENT

A- Measurement

The measurement shall be made in Sq. Ft. of the actual surfaces completed and approved.

B- Rate and Payment

The payment shall be made at the unit rates per Sq.Ft. stated in the Bill of Quantities.

Such payment shall constitute full compensation for all materials, equipment labour including all incidentals, necessary to complete the work. The cost of PCC base & pigment is included in the cost of tile work.

*** End of Section 09310 ***

09320 SPLIT TILE WORK**09321 GENERAL****A- Scope of Work**

The work included in this Section shall comprises of fixing in position split tiles of the following kinds wherever shown on the drawings and/or mentioned in the Bill of Quantities.

- Glazed
- Rough Glazed
- Double Rough Glazed
- Un-Glazed

09322 PRODUCTS**A- Materials****(01) Tiles**

Split Tiles shall be of manufactured by National Tiles and Ceramic Limited or approved equivalent and shall conform to German Standard specified DIN-18166.

(02) Adhesive/Joint Filler

The adhesive and joint filler shall be Dry Bond Thin Set Mortar as manufactured by M/s. Shabbir Tiles & Ceramics Limited in collaboration with Laticrete International Inc. U.S.A. or approved equivalent.

B- Samples and Tests

The tile samples shall be furnished in sizes and colours, adequate in number for testing in the laboratory as and when ordered by the Engineer.

09323 EXECUTION**A- Construction Requirements****(01) Tile Base**

Tile base for floors shall be 1-1/2" thick P .C. C. of 3000 PSI and for steps 1-1/2" thick P.C.C of 3000 PSI, and for walls 1-1/2" thick cement sand mortar (1:3) the surface of the base shall be clean and free of dirt, dust, oil, grease or other objectionable matter. The base surface shall be level and true both horizontally and vertically. To form good key with the bedding mortar of tiles the base shall be scoured or scratched and crosshatched.

(02) Laying, Jointing and Grouting of Tiles

The split tiles of the kind indicated in drawings and or BOQ, shall be laid in bond (Thin Set) mortar and grouted with the same material, over the tile base as specified in the preceding para.

Split tiles on walls and columns shall be fixed and grouted in Dry Bond Mortar over rough cast base plaster of cement sand as specified.

Joints shall be straight, level, perpendicular, and of even width throughout. Vertical joints shall be maintained plumb for the entire height of the tile work. Each tile shall be brought to true level and plane by uniformly applied pressure under a straight edge or rubber faced block. Tiles that are out of true plane or misplaced shall be removed and reset. Damaged or defective tile shall be replaced.

09324 MEASUREMENT AND PAYMENT

A- Measurement

The measurement shall be made in Sq. Ft. of the actual surfaces completed and approved

B- Rate and Payment

The payment shall be made at the unit rates per Sq. Ft. as stated in the Bill of Quantities and shall include P. C.C. base/CS Plaster.

Such payment shall constitute full compensation for all materials. Equipments, labour including all incidentals, necessary to complete the work.

*** End of Section 09320 ***

09380 TAXILA STONE TILES**09381 GENERAL****A- Scope of Work**

The work covered under this section of specifications, consist of providing all material, labour, plant, equipment, appliances and performing all operations required for installation and providing of Taxila Stone tiles including finishing, at the podium including steps, complete in all respect and strictly in accordance with this section of the specifications and the applicable drawings.

B- Submittals

The Contractor shall submit manufacturer's specifications and other product data for each type of Taxila Stone tiles required including instructions for handling, storage, installation and production.

Shop drawings shall be submitted showing sizes, dimensions, sections and profiles of slab and tile units, arrangement and provisions for jointing, anchoring, fastening and supports and other necessary fixing details. Indicate locations, layouts and pattern arrangements for stone of each type and colour.

Submit three range samples 1¼" thick 9"x9" in size of each type of stone tiles showing colour grade, finishing and texture for approval of the Engineer.

C- Delivery, storage and Handling

Materials shall be protected from damage during loading, delivery and storage, Non-standing materials for blocking and packing shall be used. Stack the stone tiles at Site in accordance with manufacturer's recommendations and as required to prevent staining, scratching, etching or breakage.

09382 PRODUCTS**A- General**

Obtain each stone tiles type from a single quarry and ensure consistent colour range and texture throughout the work.

Providing stone tiles for continuous areas, intersecting planes, to provide continuous matching units.

Provide stone tiles of type, colour and finish for each area of use as approved by the Engineer.

Provide stone tiles of thickness shown, machine cut with chisel marks on exposed surfaces and saw-cut back surfaces, which will be concealed in finished work.

B- Type

All stone tiles are to be selected and approved by the Engineer for quality, colour and texture.

C- Beds and Backings

Where applicable mortar beds and backing mixed and proportioned by volume shall be as follows:

Ordinary Portland Cement Grey 1 part and Sand 4 parts.

D- Podium, Steps

Where specified on the drawing or as directed by the Engineer proprietary adhesives, joint grouts and sealants; suitable types as required and recommended for specific application; colour match joint grout and sealants to colour of stone shall be used.

09383 EXECUTION**A- Paving on Podium and steps**

Apply cement slurry coat surfaces of substrate immediately prior to placing setting bed. Limit area of application to avoid premature drying out.

Install setting bed to thickness required and set stone tiles units before initial set occurs. Apply a thin layer of real cement paste to bottom of each unit; set, tamp, and level units immediately. Set units in pattern required, with uniform joint widths.

Point joints as soon as possible after initial set. Force grout into joints; strike flush and tool slightly concave.

Remove mortar and grout from surface while still moist and as the work progresses.

B- Repair and Cleaning

Remove and replace stone tiles units which are broken, chipped, stained or otherwise damaged. Where directed, remove and replace units which do not match adjoining stone work or is not in line and levels as shown on drawings. Provide new matching units, install and point joints to eliminate evidence of replacement. Repoint defective and unsatisfactory joints to provide neat, uniform appearance.

C- Protection

Provide covers, boards, supports and all other necessary materials to protect finished work from collapse, deterioration, discoloration or damage during installation and until contract completion.

09384 Measurement and Payment**A- General**

Except otherwise specified herein or else where 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 thereof shall be deemed to have been included in the quoted unit rate of the respective items of the Bill of Quantities.

- a) Finishing washing, repair, cleaning and protection of stone tiles in position.
- b) Proprietary adhesives, joint grouts for fixing stone tiles where specified on the drawings or directed by the Engineer.

- c) Cement concrete setting beds and backings for stone tiles.
- d) Preparation of concrete substrate for laying sand stone tiles.

B- Measurement

Measurement of acceptably completed works of Taxila Stone Tiles will be made on the basis on net actual area in Sft laid in position as shown on the drawings or as directed by the Engineer.

C- Payment

Payment will be made for acceptable measured quantity of Taxila Stone Tiles on the basis of unit rate per Sft quoted in the Bill of Quantities.

*** End of Section .9380 ***

09410 TERRAZZO WORK**09411 GENERAL****A- Scope of Work**

The work under this section consists of making terrazzo floor in conformity with British Standard Code of Practice CP 204. In situ flooring Part-I, "General" and Part-3, 'Terrazzo Flooring' as applicable to the work shown on the drawings and specified in the Bill of Quantities including terrazzo skirting, terrazzo (Dado) and terrazzo on stairs.

B- Submittals

The following submittals are required:

- Detail Drawings and/or Shop Drawings
- Quality Assurances
- Manufacturer's Standard Colour Charts
- Certificates of Compliance 09412 PRODUCTS

09412 PRODUCTS**A- Material Requirements**

Cement, Sand, Aggregate for concrete and Water shall conform to relevant specifications.

Marble Chips shall be crushed marble, and shall be best quality white, it shall have an abrasive hardness of not less than 16 and the size shall vary from No.4 to 8. (Refer ASTM C 241 and National Bureau of Standards Report BM/S98).

Dividing Strips shall be brass or aluminium (3mm) conforming to the requirements of the B.S. "Cold Rolled Brass Sheets or aluminium strips" or glass strips 5mm thick and 1-1/2" (38mm) deep or marble strips as called for on the drawings or Bill of Quantities.

B- Samples

All materials used for Terrazzo work as well as samples for terrazzo floor shall be approved by the Engineer and the same type of material will be used throughout the work. If the Engineer requires the material to be tested, the Contractor will do so at his own cost from a laboratory approved by the Engineer.

09413 EXECUTION**A- Construction Requirements in Situ Terrazzo Flooring**

The floor shall consist of a wearing surface of consistency and net thickness as specified in Bill of Quantities, laid over 2-1/4" thick Pcc 3000 Psi concrete base of the specified thickness. The thickness specified for wearing surface shall be that obtained after grinding and polishing, 3000 PSI concrete shall be mixed and laid in the manner specified for cement concrete floor, using a minimum quantity of water for workability.

The cement concrete shall be levelled with a trowel and straight edge, consolidated and finished with steel trowels to an even but rough surface. The top layer of cement marble chips mixed in the proportion of 1:2 (1 White cement and 2 marble chips) shall be laid over it within 24 hours. The cement and marble chips must be mixed dry in such quantities as are sufficient for a unit of one specified shade. Water shall be added in only such quantities as can be mixed thoroughly and consumed in less than 30 minutes, the quantity of water being the minimum for workability. Mixing must be done on water tight platform and any mix not used within 30 minutes shall be discarded and removed from site. A layer of cement and marble chipping mixture should be well trowelled into the surface of the base concrete before filling to the top level of the screeds. The layer should be well compacted and all voids shall be filled in. A layer of neat cement, of the specified colour shall then be well trowelled into the surface leaving a plain smooth surface.

Floors shall be laid in panels of about 4.0'x4'-0 (1.2 X 1.2 meter) or of size as shown on the drawings. Dividing strips of aluminium/brass/glass/marble as specified shall be provided and fixed to exact levels making an allowance for grinding. Aluminium strips shall not be less than 3mm thick and of width equal to the total thickness of cement concrete base and Terrazzo Topping.

Three days after laying, the top layer must be evenly and smoothly machine ground with Carborundum blocks of coarse, medium and fine grades so as to ensure that all marble chippings are evenly exposed all over the surface. If marble chips are not evenly exposed the Contractor shall pull down the surface and relay it at his own cost. After the first grinding, the floor shall be thoroughly grouted with the same cement and colour composition as specified for the terrazzo mix. The grout shall be of the consistency of thick cream and shall be brushed over the floor to eliminate all impressions and thoroughly fill the surface for final grinding. Not less than 72 hours after application, the grouting coat shall be removed by grinding with fine grade abrasive stones. The surface after grinding shall be left un-disturbed and cured for 2 or 3 weeks, after which it shall be cleaned of dirt and dust by rubbing gently with pumice stone or washing soda in sufficient water. Three days after the surface has been cleaned it shall be rubbed hard with 1 : 10 solution of oxalic acid using felt. The surface shall then be cleaned and washed with plenty of water. After the surface has dried a final gloss shall be given by polishing the surface to the satisfaction of the Engineer. The walls and all surfaces of the finished works of other trades shall be properly protected from damage and spoiling during the process of grinding and washing of the terrazzo. After the finish grinding has been completed and the surface treatment applied, the terrazzo work shall be covered and protected with material approved by the Engineer until completion of the work of all other trades.

B- Terrazzo Dado and Skirting

The marble chips and cement shall conform to specification for floor. Mixing shall be done in the same manner and proportion. The plastered surface over which the dado/skirting is to be applied shall be well roughened and watered. Cement mortar of specified ratio shall then be plastered over this well roughened surface to indicated thickness. Before the base course has set the layer of terrazzo mixture (of the specifications for flooring) shall be well trowelled into the surface of the base to a thickness which after grinding shall result in the finished thickness as per Bill of Quantities. A layer of neat cement of the specified colour shall then be well trowelled into the surface leaving a plain smooth surface. After the period specified for floors above, the Contractor shall start finishing as for floors specified above. Terrazzo skirting shall be provided around all terrazzo floors unless shown otherwise. Skirting and dado shall be straight, level and in plumb. Intersections at floors shall be straight and flush.

C- Terrazzo on Stairs

The stair risers and treads shall be finished according to exact sizes including the terrazzo topping making allowance for grinding of terrazzo. The nosing shall be flush with the terrazzo toppings, and shall be protected by aluminium angles as specified or shown on Drawings. The angles shall be firmly secured, by means of counter-sunk brass screws and cast together with the step.

09414 MEASUREMENT AND PAYMENT**A- Measurement**

Work for floor and dado shall be measured in Sq. Ft. of wall and floor area, skirting shall be measured in Lin. Ft./M.

B- Rate and Payment

The rate for all items of work under this section shall cover the cost of furnishing all materials, labour, scaffolding framework laying, curing, grinding, polishing, finishing and appliances at site and performing all operations at any height in accordance with drawings, Bill of Quantities and as specified. The rate shall include the cost of base concrete, furnishing & installing metal fixings, dividing strips for floors, dados, nosing, angles aluminium U-channels and screws for stairs etc., and providing all assistance to other trades for built in items to the satisfaction of the Engineer.

*** End of Section 09410 ***

09510 SUSPENDED CEILING**09511 GENERAL****A- Scope of work**

The work covered under this Section of the Specifications comprises furnishing of all labour, plant, equipment, appliances and materials and performing all operations in carrying out and in connection with the furnishing, fabricating and fixing of Suspended Ceiling and all related items, such, as suspension system, fastenings, rawl plugs, and other items supplied and customarily built in and/or installed in strict accordance with the instructions of the Engineer.

B- Applicable Code and Standards

Sponsor	Number	Subject
ASTM	C 635	Suspension System for Acoustical Tile and Lay-in Panel Ceilings.
ASTM	C 636	Installation of Suspension System for Acoustical Tile and Lay-in Panels.

C- Submittals

The following submittals are required:

- a) Detail Drawings and/or Shop Drawings
- b) Assembly, Erection, and Installation Drawings and Manuals.
- c) Samples
 - i) Ceiling panels showing the panels and the support system, 600mm x 600 mm (24 in. x 24 in.).
 - ii) Each type of exposed moulding, 300 mm (12 in.) long.
- d) Manufacturer's Data
- e) Manufacturer's Standard Colour Charts

D- Mock-Up

Prior to beginning production of the ceiling system, furnish a full-size section of the system with the proposed finishes and typical attachment. Upon approval the mock-up may be used in the final work. Size of mock-up shall be at least 1.83 m (6 ft.) square and large enough to exhibit typical joint, edge, corner, and end conditions.

09512 PRODUCTS**A- Material**

Following types of Suspended Ceilings are specified in the Schedule of Finishes and the Bill of Quantities.

- i) Aluminium plain/perforated tile ceiling 1'x1', 1'x4' and 2'x2', Powder coated in colour suspension system in the same colour, DAMPA / HUNTER DUGLAS / Thermac or approved superior.

- ii) Same as above but with metallic finish.
- iii) Aluminium strip ceiling in metallic finish DAMPA 100 / HUNTER DUGLAS / Thermac or approved Superior.
- iv) Laminated Gypsum Board Ceiling aluminium foil backing including revealed G. I suspension system with groove, Thai Gypsum Product or approved superior.
- v) Plain Gypsum Board ceiling with aluminium foil backing with suspension system in aluminium, Thai Gypsum Product or approved superior.

B- Suspension System Materials

(01) General

- a) Standard: Comply with requirements of ASTM C 635, as applicable to the suspended ceilings system.
 - Structural Classification: Heavy-duty system, unless otherwise shown
 - Exterior Applications: Provide a rigid suspension system capable of meeting the specified design requirements. All steel used in exterior work shall comply with ASTM A 36, galvanized in accordance with ASTM A 123, G. 90 coating.
- b) Coordination of Components: Provide suspension system which is coordinated with the indicated limitations and requirements for hanging from structure and supporting light fixtures, HVAC components, and similar work shown to be supported by or located in suspended ceilings. Include the necessary components for a complete suspension system including (as applicable) inserts, anchors, hangers, carrying channels, access members, edge moulding, splices, clips, fasteners, tie wires, and similar members, devices and accessories
- c) Corrosion Protection: Provide finishes as specified but not less than required by ASTM C 635 for normal use environments. For exterior applications, provide finishes on all components as recommended by the manufacturer for exterior use in a moist coastal climate.
- d) Attachment Devices and Concrete Inserts: Type recommended by suspension system, manufacturer, sized for pull-out resistance of not less than five times the hanger design load for the structural classification indicated (ASTM C 635, Table 1, Direct-Hung). For wire-type inserts, provide units of not less than 4.1 mm (8 gauge) galvanized wire construction. Devices with sharp edges, which could cut the hanger wire, shall not be acceptable.
- e) Hanger Wire: Carbon steel wire, ASTM A 641, soft temper, prestretched, Class 1 coating. Provide wire sized so that stress at three times hanger design load (ASTM C 635, Table 1 Direct Hung) will be less than yield stress of wire, but provide not less than 2.6 mm (12 gauge) wire.
- f) Carrying Channels: Hot rolled or cold-rolled steel or aluminium channels for support of ceiling with maximum deflection of 1/360 of span; but in no case more than required by governing regulations or for fire resistance ratings. Channels shall have protruding tabs designed to hold the panels and allow a uniform space of approximately 19 mm (3/4 in.) between panels.

g) Carriers:

Carriers shall be formed from aluminium alloy 3005-H26 or equivalent, minimum 1.0 mm (0.039 in.) thick.

- Carriers shall be hat section members minimum 29 mm (1 1/8 in.) deep and formed with protruding ears to allow space between panels and to provide a firm grip for the panels. Carriers shall be designed for snap on installation and removal of panels without the use of tools.
- Provide holes in carriers at regular intervals to accommodate wire hangers. Provide carrier splices, minimum 150 mm (6 in.) long, with matching holes.

(02) Edge Mouldings

- a) General: Unless otherwise shown, provide manufacturer's standard units of the metal and shapes recommended for the application indicated.
- b) Provide recessed mouldings for support at edges of ceiling, at walls, and partitions, as indicated on the drawings.

09513 EXECUTION**A- Installation**

All ceilings shall be straight and perfectly horizontal, hung true and plumb, to the satisfaction of the Engineer.

(01) General

- a) Install ceiling as shown and in accordance with manufacturer's instructions and final installation drawings, Comply with governing regulations and industry standards applicable to the work.
- b) Ceiling Pattern: Arrange and orient panels as shown by the reflected ceiling plans to produce the ceiling patterns shown.
- c) Reinforcing: Provide and install reinforcing or supports where shown and as required to support mechanical and electrical items installed in the ceiling. See mechanical and electrical drawings for items installed in the ceiling.

(02) Suspended Ceiling Installation

- a) General: Comply with ASTM C 636 as applicable to ceilings except to the extent more stringent requirements are indicated or required for compliance with governing regulations.
- b) Suspension systems shall be supported from overhead construction in a rigid and permanent manner, capable of carrying all imposed loads, including the weight of electrical and mechanical fixtures. Deflection shall not exceed 1/360 of the span of any member. Where ceilings cannot be suspended directly from structure due to mechanical ducts, piping, or other interferences, furnish and install trapeze supports as required. Do not support ceilings from mechanical, electrical, or plumbing work.
- Secure to structural steel and steel joists, including intermediate framing members, by attaching to metal clips designed for the type of member involved or, where possible, by looping and wire-tying directly to members.

- Secure to concrete by wire tying to cast-in-place hanger wires or hanger inserts, or by wire tying to eye bolts inserted into concrete anchorage devices of the type, which will not melt or deteriorate and weaken at elevated temperature. Do not use lead-shield type anchors. Anchors or power-driven devices shall be kept at a sufficient distance from concrete edges so that precast will not be damaged.
- Up through a 4.8 mm (3/16 in.) diameter hole driven through the flat bottom of flutes, back through a second hole a minimum 50 mm (2 in.) from first hole, and wire tying immediately under the deck. Do not use openings in metal decking which acts as permanent formwork.
- Hanger wires supporting fixtures shall be capable of supporting four times the weight of the fixture.
- Space hanger wires along each suspension system member, unless otherwise shown, and provide a hanger wire not more than 150 mm (6 inch) from each end of each member. Space hangers as required to limit deflection to 1/360 of the so-an of any member.
- Space carriers at maximum 1.22 m (4 ft.) intervals, unless otherwise shown. Install carrier splices at abutting ends of carriers for rigidly.
- c) Cope intersecting members so that faces are flush.
- d) Install edge mouldings of the type shown at edges of each ceiling area.
 - Sealant bed: Apply continuous ribbon of acoustical sealant on back of vertical leg before fastening to vertical surface. Locate so that sealant will not be exposed after installation is completed.
 - Secure mouldings to building construction by fastening through holes drilled in vertical leg. Space holes not more than 75 mm (3 inch) from each end and not more than 400 mm (16 inch) centres, between end holes. Draw-up fasteners for tight set against vertical surfaces.
 - Miter or cope corners of mouldings accurately to provide hairline joints.
 - Level mouldings with ceiling suspension system, to a tolerance of 3 mm in 3 m (1/8 inch in 10 ft.)
- e) Do not kink or bend suspension system hangers as a means of levelling.
- f) Install panels in coordination with suspension system. Align panel straight spacing unless otherwise indicated. Stagger end joints in adjacent runs a minimum of 300 mm (12 in.), and stagger end joints a minimum of 600 mm (24 inch) in every third run to provide random end joint spacing throughout. Snap ceiling panels over protruding ears of carriers. Install interior splice members. Scribe and cut for accurate fit at borders and around work which penetrates ceilings.
- g) Install access units.
- h) Install end plugs as required to conceal edges which would otherwise be exposed to view after completion of the work.
- i) Install filler strips in all exterior work
- j) Lay acoustical installation across top of interior ceiling panels and between the carriers. Provide tight joints between insulation. Tape top surface of end joints

between adjoining installation. Omit installation above mechanical diffusers, grilles, registers, lighting fixtures, access units, and exterior soffits. Hold insulation back 75 mm (3 in.) from return air slots.

B- Coordination

All necessary coordination shall be extended to other contractors at the Site. Special coordination shall have to be undertaken with the installation of luminaries and air devices especially HVAC ducts, piping etc. their compatibility with the Ceiling Systems.

C- Tools & Equipment

The Contractor shall provide all tools and equipment for his work and safety equipment required for the job.

D- Samples

Samples of all major components such as profiles, runners, hangers etc. accompanied by manufacturer's literature must be submitted for the approval of the Engineer sufficiently in advance of the start of this portion of the Works in order that the completion of the Works is not delayed.

E- Quality:

The Contractor shall ensure that the materials and components are of adequate strength and quality in keeping with the required applications. The Contractor shall provide guarantees against sagging, deshaping, discolouration, and misalignment etc. of profiles or suspension system or any component thereof. All guarantees/warranties normally provided by the manufacturer shall be provided in favour of the Employer.

F- Job site Conditions:

- a) Installation of ceiling shall not commence until all wet work such as concrete, plastering, terrazzo, marble etc. has completely dried out and all dust producing work such as grinding of terrazzo, marble etc. has been completed.
- b) Installation of ceiling shall not commence until the building has been closed to effects of weather and suitable ventilation is provided. These conditions shall be maintained prior to, during and after installation.
- c) The materials and components for the ceiling shall be delivered at the Site in manufacturer's unopened packages, and shall be opened only when the materials/components are ready to be installed. The packages shall be opened prior to this only if authorized by the Engineer.

09514 MEASUREMENT AND PAYMENT**A- Measurement**

Measurement of acceptably completed work shall be made according to the units in the Bill of Quantities. The area of luminaries, air devices and other fixtures and installations shall not be deducted.

B- Payment

The unit rate shall include the cost of furnishing all the materials, labour, scaffolding, appliances, tools and performing all operations in accordance with the specifications, drawings and instructions of the specifications, drawings and instructions of the Engineer for satisfactory completion and finishing of the work. No extra payment shall be made for making provisions, for suspension systems and frames for light fittings and fixtures, ducts, diffusers adhesive etc. protection and maintenance of work as specified and the rates shall be deemed to be inclusive of all such costs and charges. No extra payment shall be paid for the maintenance materials as specified.

*** End of section 09510 ***

09600 GRANITE WORK OVER FLOOR / WALL**09601 GENERAL****A- Description**

The work included under this section shall comprise of providing and fixing granite slabs in floor, walls, skirting at locations shown on the drawings.

B- Related documents

All work performed under the requirements of this section shall be subject to the conditions set forth under "Contractual Conditions", and shall comply with all requirements contained under Division 1, "General Requirements" as far as applicable to this portion of the work.

Applicable portions of other sections of these Specifications are hereby included by reference to establish minimum quality standards and shall become a part of this section as if written out in full herein.

C- System**(01) Typical Granite Fixing**

- a) Setting: Dry Bond mortar bed (STILE) as per manufacturer specifications.

D- Submittals

- 1. General

Refer to "Schedule of Require Submittals", section of Division 01000, and other sections referenced therein for special Instructions relating to submittals.

- 2. Shop Drawings

Shop drawings to clearly identify every panel for detail and to be numbered

E- Samples

Submit for approval three samples 200mm x 300mm (8 inch x 12 inch) taken from stock proposed for shipment of each colour or texture of stone. Select samples to show range of colour.

Submit sample and lay panels 1.2m x 2.4m (4 ft. x 8 ft.) showing pattern, jointing and texture of proposed stone wall and flooring.

09602 PRODUCTS**A- Granite**

- a) Approved samples are on file and available for reference at the office of the Engineer.
- b) Select granite from available stock at the quarries as may be necessary to ensure supplying and installing granite with uniformity in the selected colours, quality and texture through out and matching the approved samples.

- c) Granite Colour: Special attention will be given to colours of proposed granite and any variations from colour of approved reference samples unless specifically accepted as within allowable range will be cause for rejection.

B- Fixing Materials

- a) Portland Cement: ASTM C 150, Type II or Type V; meet test requirements specified in section 03300; same brand from same lot for all work; white where specified.
- b) Sand: ASTM C 144 or ASTM C 404, Size 2; clean, sharp, 100% natural dry sand with not less than 98 % retained on 0.15 mm (No.100) sieves.
- c) Water: Clean, free from injurious amounts of oils, acids, alkalis, organic materials, or other deleterious substances.
- d) Admixtures: Secure approval of the Engineer for any admixture proposed for use in mortar. Admixtures containing calcium chloride or antifreeze agents will not be accepted.
- e) Dry Bond Mortar: As manufactured by Shabbir Tiles and ceramic limited or equivalent.
- f) Stainless Steel anchorage device: As shown on the drawings or as directed by the Engineer or any other system proposed by the Contractor and approved by the Engineer.

C- Mortar

Mix materials thoroughly and accurately to a uniform consistency in a mechanical mixer. Add water in quantities to produce a consistent workable, stiff mortar. Discard mortar, which has been allowed to set more than 1/2 hour before use.

09603 EXECUTION

A- Preparation

Clean sub-base to remove dirt, dust, debris and loose particles. Saturate concrete sub base with clean water before placing setting bed. About one hour prior to placing setting bed remove surface water and dry it.

Apply slush coat of cement grout over surface of concrete sub-base about 15 minutes prior to placing setting bed. Limit area of slush coat to avoid drying out prior to placement of setting bed and apply by trowel or brush. Do not exceed 1.6 mm (1 /16 in.) thickness for cement such coat.

B- Layout and Finish

Except where otherwise indicated, make joints as follows:

- a) Veneers, Vertical Surfaces: 2 mm (1/8 inch).
- b) Paving and Steps: Not to exceed 2 mm (1/8 inch).
- c) Hold Joints at intersection with other materials, openings: 12 mm (1/2 in.)

C- Cutting Stone

Do all necessary cutting to accommodate work of other trades as indicated on the drawings and to meet job conditions. Do all cutting at the finishing shop where practicable. Hold same tolerances for field cutting as specified for shop cutting.

D- Granite Stair, Treads, Copings

Fabricate stair treads from cubic stock as detailed, with joints and profiles indicated on the drawings.

E- Installation**1. Setting**

- Place setting bed to approximately one half total thickness.
Bring setting bed to proper level.
- Grout back of each stone with Dry Bond Mortar. Set stone while still wet and tamp with mallet as necessary to produce complete bond at proper level.
- Set and level each unit immediately in pattern shown, true to surface and with uniform joints. Do not set large areas and level or move after initial set.

Fill joints, except at expansion and control joints, with grout mixture consisting of one part pigmented white cement to two-part granite dust brought to proper consistency. Hold joint level with surface and compact by tooling to obtain densest possible fill in all joints.

2. Expansion Joint

- a) Form expansion joints as indicated on the drawing and as directed by the Engineer.
- b) Edge Joints: Locate 12mm (1/2 in) wide joints at perimeters, or at intersection with other materials, at walls and at planters, columns, pool, similar items projecting above flooring.

3. Protection and Curing

- a) Cure grout by maintaining in a moist condition for seven days.
- b) Remove grout spillage from face of stone as work progresses.
- c) Do not permit traffic on horizontal stone surfaces during setting of units and for at least 24 hours after final grouting of joints.

4. Stainless Steel Anchorage Device

Where height is more than storey height (10 Ft.), install slabs with the help of "Stainless Steel Anchorage System" as shown on the drawing. For further detail refer to Section 9950.

F- Cleaning and Pointing

Thoroughly clean all masonry, working from the top down using clean water, detergent, and fibre brushes to remove all dirt, mortar, stains, and similar soil. Rinse surface with clean water.

As the cleaning progresses, examine the wall surface to locate cracks, holes or other defects in mortar joints. Fill and point all such cracks or holes with mortar to match texture of adjacent surface. Replace damaged units.

Cleaning with wire brushes will not be permitted.

G- Protection and Maintenance

The Contractor shall be responsible for protection and maintenance of all granite during the process of completion and till the expiry of maintenance period set forth in the Contract. The completed works or parts thereof shall be protected by the Contractor against any damage. The works shall be handed over to the Engineer in perfect condition. If any damage is incurred then the Contractor shall remove and/or replace the same as directed by the Engineer at no additional costs to the Employer. The Contractor shall exercise all care to protect the works at no additional cost to the Employer.

09604 MEASUREMENT AND PAYMENT

A- Measurement

The granite tile work under this Section shall be measured and paid for as quoted against the respective item of work in the Bill of Quantities. Measurement shall be made in sq. ft/m of the actual surfaces completed and approved by the Engineer.

B- Rate and Payment

The rate for granite tile work shall cover the cost of furnishing all materials, Base, mortar bed and grouting, dry bond, including anchorage devices, labour, scaffolding, appliances, tools and plants and performing all operations in accordance with specification, drawings and instructions of the Engineer for satisfactory completion and finishing of the work.

No separate payment shall be made for polishing or for producing samples of materials and workmanships, tests to be carried out, protection and maintenance of granite work as specified and the rates for construction items shall be deemed to be inclusive of all such costs and charges including making and filling of expansion and edge joints. No extra payment shall be made for dismantling work determined by the Engineer to be faulty and subsequently made good.

*** End of Section 09600 ***

09700 TEXTURED WALL COATING**09701 GENERAL****A- Scope of Work**

The work covered under this section consists of furnishing all labour, materials, equipment and performing all operations in connection with the work to complete external or internal wall coating work on well cured smooth plastered surface. The work shall be of generally 2mm thickness of coating.

B- Submittals

The contractor shall submit manufacturer specifications and product data and submit 3 (three) samples of product indicating the pattern and color selected by the Engineer.

09702 PRODUCT**A- Acrylic Based Wall Coating (Sand Tex)**

The composition of this product shall consist of imported natural quartz, pigments at high temperature, acrylic resins in water emulsion, anti-fungus and anti-bacterial additives.

B- Mixing

The coating shall be readily mixed to a uniform consistency and presence of fine aggregate shall be apparent but there shall be no sign of caking, granulation or hardening of the material in the container.

C- Application

The coating shall be applied to the well cured even surface of the base coat (plaster), not less than 2mm or as approved by the Engineer. It shall compose of acrylic resins specially graded natural marble chips of different colours, viscosity setting agents additives against bacteria, fungi and other harmful insects using water as solvent. It shall be applied with a stainless steel trowel and after the application has been worked over, smoothen out the application, compact until uniform surface is achieved.

Apply coating on large surfaces by dividing surface into panels with tape to avoid irregular joints.

D- Cleaning Up

Remove protective materials and any other material from adjacent surface.

09703 WARRANTY

The contractor shall provide manufacturer warranty (3 years) against any defect during or after execution of work.

09704 MEASUREMENT AND PAYMENT

A- Measurement

Measurement of acceptably completed works of coating to surfaces will be made on the bases of net actual area in Sft coated as shown on the drawings or as directed by the Engineer.

B- Payment

Payment will be made for acceptable measured quantity of coating to surfaces on the basis of unit rate per Sft quoted in the Bill of Quantities and shall constitute full compensation for all the works related to the items.

*** End of Section 09700 ***

09710 CEMENT / GRANOLITHIC FLOORING**09711 GENERAL****A- Description**

This section covers the furnishing of all labour, material and equipment in accordance with the laying of hardened cement concrete floors as per drawings.

B- Applicable codes and Standards

The standard and codes applicable to only a portion of the work specified in this section are referenced in the relevant parts or clauses. Standards and codes, which are generally applicable to the work of this section, are listed hereinafter.

BS British Standards Institute

BS 12 Ordinary Portland Cement

BS 882 Sand

C- Submittals

The following submittals are required:

- Detail Drawing and / or Shop Drawings.

09712 PRODUCT**A- Materials**

1. Cement

Cement shall be ordinary Portland cement conforming to BS 12 or as specified in Section 3300, Concrete.

2. Sand

All fine sand shall be obtained from approved sources; the grading shall conform to B. S. Grading Zone 1 and 2 of which the gradation limits are as follows:

Percent (by weight) passing

B.S. Sieve	Grading Zone 1	Grading Zone 2
3/8" (9.53mm)	100	100
3/16" (4.765 mm)	90-100	90-100
No. 7	60-95	75-100
No. 14	30-70	55-90
No.25	15-34	35-59
No. 52	5-20	8-30
No. 100	0-10	0-10

3- Coarse Aggregate

Coarse aggregates shall be crushed gravel or crushed stone having angular or rounded shape and shall have granular or crystalline or smooth surface free from friable, flaky and laminated pieces, mica and shale. It shall not contain matter injurious to concrete. All coarse aggregate shall conform to BSS No. 882 and shall be graded as follows:

B.S. Sieve		% passing by weight
1"	(25.40 mm)	100
3/4"	(19.05 mm)	90-100
3/8"	(9.53 mm)	20-25
3/16"	(4.765 mm)	0-10

The aggregate shall be stored on properly constructed paving or bins as approved by the Engineer.

There shall be a physical partition between the stockpiles of coarse and fine aggregates. If required aggregates shall be washed and screened to the satisfaction of the Engineer. Sieve analysis of all the aggregates to be used in the works shall be carried out as and when required by the Engineer. All material shall be subject to the approval of the Engineer.

Any aggregates not found to be of the specified / approved standards shall be rejected by the Engineer and all such rejected material shall have to be removed from site without delay.

Floors, sub-base or base constructed with rejected aggregates shall be dismantled and rebuilt at the expense of the contractor.

4. Water

Water used for mixing concrete, curing or any other operation of the works specified herein shall be fresh, clean and free from organic or inorganic matters in solutions or suspension. Only water of the approved quality shall be used for all construction purposes by buffing, as specified. The preservative material shall not discolour the flooring not leave a tacky or sticky finished film of the surface after buffing.

09713**EXECUTION****A- Cement Concrete Flooring**

The material for cement concrete flooring shall be same as already specified.

1. Composition of Concrete

Concrete shall be composed of Portland cement, sand, coarse aggregates and water, all well mixed and brought to the proper consistency. The proportions of the various ingredients shall be determined on the basis of the required compressive strength of the class of concrete. Tests shall be made

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of samples of the aggregates and the resulting concrete. The mix proportions and appropriate water-cement ratio will be adjusted on the basis of required workability, density, impermeability, durability and required strength.

2. **Mixing Concrete**

The concrete ingredients shall be mixed in a batch mixer for not less than 1 1/2 minutes after all ingredients, except the full amount of water, are in the mixer. The Engineer reserves the right to increase the mixing time when the charging and mixing operations fail to produce a concrete batch of the specified quality. The operations shall be controlled in a manner that the ingredients are uniformly mixed and the consistency is uniform throughout. The concrete shall be uniform in composition and consistency from batch to batch except water shall be added prior to, during and following the mixer of water to maintain the required concrete consistency. The concrete of variable consistency will not be permitted.

3. **Ferrous Floor Hardener**

Ferrous Floor hardener is a composition of high grade iron filings and dust of high grade steel with a further composition of calcium chloride and an emulsified base. It shall be mixed in cement as per manufacturer's specifications.

The base course of the floor shall be a layer of concrete of the required grade and thickness laid in panels of the sizes as indicated on the drawings and approved by the Engineer.

After the cement concrete bed has been cured, as directed by the Engineer, it shall be roughened and well watered before floor finishing is laid. The floor shall compose of cement concrete of required grade and shall be laid in panels to the required thickness as shown on the drawings and/or directed by the Engineer. The concrete after laying will be thoroughly rammed and mortar worked up to the top and smoothed with a steel trowel. The edge of each panel into which the floor is divided should be defined by glass strips of the approved width and of a depth equal to the depth of floor concrete. Completed floor portions as finished shall be covered with thoroughly damp empty gunny bags or a layer of sand, as directed by the Engineer.

B- Dado/Skirting

The plaster on the portion of the wall to be provided with skirting or dado shall be left in a rough state by brooming or by using wire brushes of approved type so as to provide a bond between this base plaster and the dado or skirting. The surface of the wall shall be cleaned of all foreign matter and shall be thoroughly wetted to control the suction. Only so much mix shall be mixed with water that could be utilized within 30 minutes. This mix of cement sand shall be applied to the wall and trowelled hard to a smooth surface, proper in line both vertical and horizontal. Finishing for the cement sand skirting shall conform to specifications for plasterwork.

09714 MEASUREMENT AND PAYMENT

A- Measurement

The measurement for Cement Concrete floor shall be made in Sq. Ft/Sq. m. of the actual surfaces completed and approved. Cement sand skirting shall be measured in Lin. Ft./M.

B- Rate and Payment

The payment for floor shall be made at the unit rate stated in the Bill of Quantities and shall constitute full compensation for all materials, labour and equipment, including all incidentals necessary to complete the work.

*** End of section 09710 ***

09910 PAINTING AND POLISHING**09911 GENERAL****A- Scope of Work**

The work covered by this section of Specifications consists of furnishing all labour, painting and polishing equipment, scaffolding, protective covering and materials, including that classified in particular as "Paint" hereinafter; and painting in performing as such, all plastered wall and ceiling surfaces, including soffits, sides of beams, etc. and the painting and polishing of all exposed interior metal work; miscellaneous and ornamental iron, steel and sheet metal and all wood work. The work under this section shall further conform to the requirements of British Standard Code of Practice CP: 231: 1966, "Painting of Building" and all the British Standards relied therein or bearing relevance.

B- Submittals

The following submittals are required:

- Quality Assurances
- Material, formula, application instructions
- Manufacturer's Data Colour Samples
- Test Reports

C- General

Where the word or term Paint and Polish is used or referred to 'as such' throughout the Specifications, it shall be interpreted to mean and include the surface finish treatment consisting of any, all or some of the following items:

Sealers, primers, fillers, body and final coats, emulsions, varnish, shellac, stain or enamels, as more specifically defined hereinafter as to kind and quality and function for various surfaces and finishes.

All paint, polish and accessory material incorporated in or forming a part thereof shall be subject to the approval and selection for colour, tint, finish etc. by the Engineer.

In connection with the Engineer's determination of colour or tint of any particular surface, the depth of any colour or tint selected or required shall in no instance be a subject for an additional cost or charge to the Employer.

Painting of wood, except if specified otherwise and for plaster surfaces shall be three-(03) coat work in addition to the shop protection coats.

All paints shall be as manufactured locally and approved by the Engineer and shall be brought to the Site in sealed containers and used without any admixture or adulteration except where recommended in the Manufacturer's printed instructions.

09912 PRODUCTS**A- Materials**

The basic materials entering into the compounding and/or manufacture of all paints, varnishes, shellac and other finish treatments shall be of the best grade and quality of

their respective kinds for the intended purposes. They shall be the products or formulas of recognized and reputable Manufacturers of known reliability and integrity, subject to the approval of the Engineer.

The Engineer reserves the right to select and/or accept only the best grades of standard products, which in his opinion will provide a finish or recognized performance and characteristic suitable for their respective surfaces.

All materials shall be delivered to the premises in their original unbroken containers or packages and bear the Manufacturer's name, label and brand, and formula and be mixed and applied in accordance with his directions and/or instructions. The mixing of all paint or other covering finish treatments shall be done in the premises when required and as approved by the Engineer.

Paints shall be well-ground, shall not settle badly, cake or thicken in the container, shall be readily broken up with a paddle to a smooth consistency and shall show easy brushing properties. The paint shall be suitable for spraying when thinned with not more than twelve (12) percent by volume of mineral spirits.

Paints shall be lime-proof where used on concrete blocks, concrete or plaster.

Unless specified or directed otherwise, distemper shall be Paintex vinyl emulsion (ICI) or SPD (Berger), colour wash shall mean coloured chalk applied with gum at the rate of five (5) pound per bag of chalk, and snow-cem shall be Durocem or superior. Synthetic enamel paint shall be of approved manufacturer. Vinyl Emulsion paint shall be Robbialac, Dulux, or superior approved by the Engineer.

B- Protective Paints to be Applied

Unless otherwise specified all exterior and interior ferrous metal except reinforcing steel, bolts, rough hardware and metals with nonferrous coatings shall be given a shop coat of protective paint of approved quality. Surface to be painted shall be thoroughly cleaned of scale, dirt and rust by the use of steel scrapers, wire brushes and blast or other equally suitable tools or methods. Oil and grease shall be removed with benzene or other suitable solvent. Paint shall be kept well stirred whilst it is being applied.

No paint shall be used after it has caked or hardened. Paint shall be well worked into all joints and corners; paint shall not be applied to damp surfaces nor when the temperature is below 40⁰F.

C- Sample and Test

Samples of each type of paint and each colour proposed for use shall be submitted to the Engineer and Approval thereof received before the material, represented by the sample, is used on the Project. Samples shall consist of one pint and three displays of each type and colour of paint applied to wood strips 2" by 6", Wood used for display stains, shall be the same kind as that on which the stain is ultimately to be applied. In addition to the submission of samples, the Contractor shall submit authenticated reports of tests of the materials proposed for use as required by the Engineer,

09913 EXECUTION

A- Preparation of Surface and Application of Paint

(01) General

Hardware, accessories, plates, lighting fixtures and similar items in place shall be removed prior to painting operations or shall be otherwise protected. All surfaces to

be painted shall be clean, smooth, dry and free from dust, grit and other objectionable materials. All work shall be done in a workmanlike manner, leaving the finished surfaces free from drips, ridges, waves, laps and brush marks. Except if specified or required, cement water paints shall be applied under dry and dust free conditions and shall not be applied when the temperature is below 40°F nor when a temperature drop of 20°F or more is forecast. All primer and intermediate coats of paint shall be unscrapped and completely integral at the time of application of each succeeding coat. Each coat of paint shall have a slight variation of colour to distinguish it from the preceding coat. Sufficient time shall be allowed between coats to ensure proper drying. Paints shall be thoroughly stirred and kept at a uniform consistency during the application and shall not be timed in excess of the printed directions of the Manufacturer. Paint containers shall not be opened until required for use. Paint shall preferably be applied by the spray /brush/ roller or as directed by the Engineer. Floors, roofs and other adjacent work shall be properly protected by drop cloths or other coverings.

(02) Concrete and Masonry

Concrete and masonry surfaces to be painted shall be prepared by removing all dirt, dust, oil and grease for good adhesion.

Surfaces to be painted with cement water paint shall be thoroughly dampened with a fine spray of water before application of the paint. The interval between coats of cement-water paint shall be not less than twenty four (24) hours, and the first coat of cement-water paint shall be slightly dampened before application of the second coat. The paint shall be applied with a stiff brush, and thoroughly worked into the surface to seal all pores, cracks and voids. The paint shall be cured by wetting the surface between coats, and at intervals for a period of not less than two (2) days after the application of the finish coat. Nails and similar exposed metal occurring in concrete or masonry surfaces shall be coated with shell or oil paint before the cement water paint is applied. Masonry surface to be painted with oil base paint shall be free from alkali and shall be thoroughly dry before paint is applied.

(03) Metal Work

Shop primed metal work shall be kept clean and free from corrosion following installation. Surfaces shall be retouched prior to finish painting, using the same type of paint as the priming coat.

(04) Plaster Work

Plaster shall be at least two (2) months old (or less if allowed by the Engineer) and shall be thoroughly dry, clean, and free from grit, loose plaster, and surface irregularities before paint is applied. Cracks and holes shall be repaired with patching plaster such as plaster of Paris properly keyed to the existing plaster. All plaster surfaces shall be tested for the presence of Alkali, which if present, shall be removed with a solution of Zinc Sulphate mixed in the proportion of 2-1/2 to 3 pounds to a gallon of water. After drying, the precipitate shall be removed by brushing. Plaster patches shall be worked to match the appearance of the adjoining plaster.

(05) Wood Work

Small dry seasoned knots shall be thoroughly cleaned and scraped and shall be given a thin coat of orange shellac varnish before the priming coat is applied. Large, open, unseasoned knots and all beads or streaks of pitch shall be heated by a blowtorch and then scrapped off, or if the pitch is still soft, it shall be removed with mineral or denatured alcohol. Resulting voids, if any, shall be filled with putty. Nails

shall be set. Painting shall proceed only when in the opinion of the Engineer the wood is satisfactorily dry.

a) Priming

All mill work specified to be painted, shall be primed in the shop before delivery to the job.

b) Puttying and Glazing

After the priming coat has been applied, nail holes, cracks, and other depressions waviness shall be filled flush with putty, coloured to match the finish coat and sand papered smooth. Putty shall be dry before subsequent painting.

Glazed doors shall be given one coat of primer before glazing. A minimum of two subsequent coats of paint shall be applied and the surface finished to the entire satisfaction of the Engineer.

B- Schedule of Paint Finishes

1. Chalk/Colour Wash

Three coats of approved quality shall be applied to all ceilings and other places as directed.

2. Distemper

Three coats of approved washable oil bound distemper shall be applied to internal wall or at locations as directed by the Engineer as per Manufacturer's instructions and direction. The distemper shall be of required shade and shall be the product of a reputable Manufacturer subject to the approval of the Engineer.

3. Emulsion Paint to Plastered Surfaces

The plastered surfaces required to be painted with emulsion paint shall be painted with ready made approved paint of the kind. The paint shall be applied in coats strictly according to Manufacturer's instructions after preparing base. The paint may preferably be applied by spray or roller method of application unless permitted otherwise by the Engineer.

4. Enamel Paint to Plastered Surfaces

The plastered surfaces required to be painted with enamel paint shall be painted with ready-made approved paint of the kind. The paint shall be applied in 2 coats strictly according to manufacturer's instructions after preparing base. The painted surfaces shall finally exhibit glossy /matt finish as approved. This will also apply to metal/wood work or wherever required by the Engineer.

5. White Wash/Colour Wash

Concrete, concrete block and plaster shall be painted where required with three (3) coats or white/colour wash.

The lime should be slaked at Site with an excess of water to the consistency of paste/cream and should remain under water for forty eight (48) hours. The mixture shall then be strained through coarse cloth and gum water added (having 60 gramme gum to one (1) pint of water).

Colour washing shall be prepared as for white wash and colour added. The colouring matter is to be boiled and gum added to it and strained into white wash.

6. Painting to Wood Work

Wood work required to be painted shall be painted with approved synthetic enamel paint as follows.

After surface preparation as specified apply one coat of wood primer.

After wood primer has thoroughly dried, apply (2) synthetic enamel paint coats of approved manufacturer directly from containers strictly according to the Manufacturer's instructions.

7. Painting on Metal Work

All metal work shall have, one coat of anti-corrosive red oxide primer in addition to the two coats of enamel paint.

C- **Buried Piping**

All steel piping and all exposed threads of galvanized piping, where run in or through concrete or masonry, or buried under ground, shall be given one (1) coat of approved asphalt varnish where specified.

D- **Samples**

Prior to the start of the application of any paint and/or finish treatment otherwise, the Contractor shall apply samples of the required finish treatments to specific representative wall and ceiling surfaces or other areas or surfaces where indicated by the Engineer. The sizes of the sample paint finishes shall be as determined by the Engineer.

E- **Protection**

Contractor shall protect all the work against damage or injury by his employees, or by the materials tools or utensils used in connection with the work of this Contract. Any and all work damaged as a result of the execution of this Contract shall be repaired at the Contractor's expense, or if in the opinion of the Engineer it cannot be properly repaired it shall be replaced with new work by the Contractor without additional compensation therefore beyond the Contract amount. At all times, the general and liberal use of drop cloths shall be a primary requirement for protection purposes.

F- **Touching up**

At the completion of all Work specified herein all painted work shall be touched up and restored where damaged or defaced and the entire Work left free from blemishes to the complete satisfaction of the Engineer.

G- **Cleaning**

The Contractor shall clean all paint, spots, daubs, oil and stains, entirely from all floors, wood-work, glass, hardware, metal work and all similar items upon completion and level the work in perfectly clean condition in every respect to the entire satisfaction of the Engineer.

All cloth and cotton waste, which might constitute a fire hazard shall be placed in metal containers or destroyed at the end of each work day. Upon completion of all work all staging, scaffolding, and containers shall be removed from the Site or destroyed in a manner satisfactory to the Engineer.

H- Polishing Deodar Wood Doors and Frames**i) Wax Polish**

Surfaces to be Wax Polished shall be rubbed down to a smooth surface filled as necessary, dusted off and rubbed over with mineral oil well rubbed in with a circular motion. The surface afterwards being wiped dry. After an interval of at least 48 hours wax polish shall be applied in two coats and shall be polished to an approved finish.

ii) Lacquer Polish

Same as above but lacquer polish.

09914 MEASUREMENT AND PAYMENT**A- Measurement**

The painting and finishing on all surfaces, other than timber steel and piping works and plant and equipment works which shall be deemed to be inclusive of painting and finishing in their own items of work shall be measured in accordance with the standard method of measurement and paid for at the unit rates entered in the Bill of Quantities, appended to the Contract and in accordance with the terms and conditions of the Contract. Where separate quantities, they shall be taken to have been already included in the rate of items to be finished and painted.

B- Rate & Payment

The payment shall be made at the unit rates as stated in the Bill of Quantities. Such payment shall constitute full compensation for all materials, equipment, labour scaffolding including all incidental, necessary to complete the work.

*** End of Section 09910 ***

09950 GRANITE WORK OVER FACE**09951 GENERAL****A- Description**

The work under this section consists of furnishing all labour, materials, equipment, incidentals and operations to complete all external surface rendering/Granite Work on Masonry, Concrete or any other surfaces as shown on the drawings.

B- Related documents

All work performed under the requirements of this section shall be subject to the conditions set forth under "Contractual Conditions", and shall comply with all requirements contained under Division 01000, "General Requirements" as far as applicable to this portion of the work.

Applicable portions of other sections of these Specifications are hereby included by reference to establish minimum quality standards and shall become a part of this section as if written out in full herein.

C- Typical Granite Fixing

Stainless Steel Anchorage System as shown on the drawing.

D- Submittals**1. General**

Refer to "Schedule of Required Submittals", section of Division 01000, and other sections referenced therein for special instructions relating to submittals.

2. Shop Drawings

Shop drawings to clearly identify every panel for detail and to be numbered.

E- Samples

Submit for approval three samples 300mm x 300mm (12 inch x 12 inch) taken from stock proposed for shipment of each colour or texture of stone. Select samples to show range of colour.

Submit sample and lay panels 4.8m X 4.8m (16 ft. x 16 ft.) showing pattern, jointing and texture of proposed stone wall.

09952 PRODUCTS**A- Granite**

- a) Approved samples are on file and available for reference at the office of the Engineer.
- b) Select granite from available stock at the quarry as may be necessary to ensure supplying and installing granite which is uniform in colour, quality and texture through out and matching the approved samples.
- c) Granite Colour: Special attention will be given to colour of proposed granite and any variations from colour of approved reference samples unless specifically accepted as within allowable range will be cause for rejection.

B- Anchorage Material

Stainless Steel Anchorage system by an approved manufacturer. Stainless Steel conforming to ASTM A 167 type 302 or 304.

C- Fabrication**1. General**

Fabrication as shown and as detailed on final drawings and in compliance with the recommendations of the applicable marble association. Provide holes and sinkages cut or drilled for anchors, fasteners and supports as shown and as necessary to secure Granite in place. Cut and back-check as required for proper fit and clearance. Shape beds to fit supports. Provide reinforcing backing as required for adequate strength, firmly adhered in place.

Provide necessary "Expandable Bolt", stainless steel "L-Anchor", stainless steel "Clip", and other miscellaneous steel items. For fixing Granite units to other supporting and adjacent units provide anchors vertically @ 2' c/c and horizontally @2' c/c.

2. Contiguous

Provide chases, reveals, openings and similar spaces and features as required for contiguous work, coordinate with drawings and final shop drawings showing contiguous work.

3. Cutting

Cut to shape and dimensions shown on final shop drawings, maintaining fabrication tolerances specified.

- a) Dress joints (bed and vertical) straight and at 90 degree angle to face, unless otherwise shown or specified.
- b) Joint Width: Cut to provide joint widths 2.0 mm (1/16 in.) or as shown on final shop drawings.

4. Thickness

Provide stone of the thickness shown.

D- Fabrication Tolerances**1. Dimensional Tolerances**

Fabricate granite units in accordance with the following dimensional tolerances, unless otherwise shown.

-	Length or width	1 mm (1/16 in).
-	Thickness (depth)	1 mm (1/16 in.)
-	Horizontal and vertical alignment (deviation from straight lines parallel to centre line)	1 mm (1 /16 in.) per 3 m (10 ft) of length
-	Out of square (differences in length of two diagonal measurements).	1 mm (1 /16 in.) per 3m (10 ft) length

09953 EXECUTION**A- Inspection and Preparation****1. General**

Do not use Granite units with chips, cracks stains, or other defects which might be visible in the finished work.

2. Preparation

Clean stone before setting by thoroughly scrubbing with fiber brushes followed by a thorough drenching with clear water. Use only mild cleaning compounds that contain no caustic or harsh fillers or abrasives.

B- Installation**1. Setting Stone**

Employ skilled stone setters at the site.

2. Contiguous Work

Provide chases, reveals, openings and other spaces as shown or required for contiguous work.

3. Setting

Set Granite in accordance with drawings and final shop drawings. Provide anchors, supports, fasteners and other attachments shown or necessary to secure granite in place. Shim and adjust accessories as required from proper setting of granite.

C- Erection**1. General**

Installation shall be in accordance with reviewed shop drawings. Each unit, piece, or panel shall be set in position assigned on the reviewed shop drawings, carefully plumbed and aligned and securely anchored to the structural backing as detailed.

- a) For items penetrating stone units that cannot be located accurately before panel fabrication, drill stone in the field with a diamond core drill and cover the opening with an escutcheon of approved material and finish.

2. Erection Process

All units shall be erected level, plumb, square and true within the allowable tolerances. They shall be positioned so that cumulative dimensional error is not allowed. Horizontal and vertical joints shall be correctly aligned and maintained. Each unit shall be securely fastened in place as indicated on the reviewed shop drawings. Adjustments or changes in connections, which could involve additional stresses in the products or connections, will not be permitted without approval. Units shall be erected in a sequence indicated on the shop drawings.

3. Installation Tolerances

Install stone without exceeding the following tolerance limits:

- a) Variations from plumb: 1 mm (1/16 in.) in any run.
- b) Variations from level or elevations: 1 mm (1/16 in.) in any run.
- c) Offsets in alignment of adjacent members at any joints: 0.75 mm (1/32 in.) maximum.
- d) Regardless of the above tolerances, placement of erected units shall be visually accurate. Granite units shall not be perceptibly out of alignment at vertical or horizontal joints. Any face, which shows an undulating or irregular surface even though it may within the limit given, will not be accepted.

D- Adjust and Clean**1. Replacement**

Remove and replace Granite units, which are broken, chipped, stained or otherwise damaged. Where directed, remove and replace units, which do not match adjoining work. Provide new matching units; install as specified and point-up joints to eliminate evidence of replacement. Repoint defective and unsatisfactory joints as required to provide a neat, uniform appearance.

2. Cleaning

Clean Granite work after completion of work, using clean water and stiff bristle brushes. Do not use wire brushes, acid type cleaning agents or other cleaning compounds with caustic or harsh fillers.

3. Protection

Take precautions as required to protect the stone work from collapse, deterioration, discoloration and damage during construction.

09954 MEASUREMENT AND PAYMENT**A- Measurement**

The measurement of Granite work covered under this Section shall be made in sq. ft/m of the actual surfaces completed and approved. Deductions will be made for all opening for doors, windows, ventilators etc.

B- Rate and Payment

The rate for Granite under these specifications shall cover the cost of furnishing all materials, labour, scaffolding, laying, curing, grinding, polishing, finishing, cleaning and appliances at Site and performing all operations at any height in accordance with the drawings, Bill of Quantities and as specified.

*** End of Division 09000 ***

Signature of Client

Signature of Contractor

SPECIFICATIONS
FOR
ELECTRICAL WORKS

ELECTRICAL WORKS

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SPECIFICATIONS FOR ELECTRICAL WORKS

1.1 CONDUIT PIPES & CONDUIT ACCESSORIES

1.1.1 Conduit Pipe

The conduit for wiring of lights, socket outlets and other systems shall be made of PVC manufactured under the trade names conforming to BSS 3505/1968 Class-0.

The conduit shall have following wall thickness and standard weights: -

Pipe Size	Wt/100Rft.	Wall thickness
¾" dia	3.4 Kg.	.04" to .05"
1" dia	4.5 Kg.	.045" to .055"

Steel conduit shall conform to BSS 31/latest and shall be of brands. The conduit shall be enameled with good quality non-cracking and non-flaking black paint.

1.1.2. Flexible Pipe

Flexible conduit shall be furnished and installed where necessary for convenient dismantling and/or avoiding vibrations to be transmitted. Flexible conduit shall be spiral-interlocked type made of steel strip construction and coated with zinc.

1.1.3 Conduit Accessories

1.1.3.1. The use of factory made round PVC junction boxes 2-¼" dia and 2-¼" long, conforming to BSS 31/latest having nipples to receive PVC pipe with force fit shall be used for ceiling outlets. The wall type junction box shall also be of cast iron having minimum dimensions of 2-¼" dia and 1-¼" long. Each junction box shall be provided with one-piece cover, which shall be fitted on the box with chromium plated screws.

1.1.3.2 Conduit accessories such as switch boxes, socket outlet boxes, pull boxes and inspection boxes shall be made of 16 SWG sheet having dust tight covers. All boxes shall have required number of conduit entry holes and earth terminals for connecting E.C.C. All the rectangular or square shaped boxes shall have nipples to receive PVC conduit with force fit. All these boxes shall be painted inside and outside with black enamel, over a base coat of red oxide antirust paint. Shapes and sizes of these boxes shall be determined on each application.

1.1.3.3. The use of lopping in box shall be allowed in places where floor slab thickness permits 90-degree bends in conduit.

1.1.4. INSTALLATION INSTRUCTIONS

The contractors shall furnish all labour and material for the installation of conduit as required.

1.1.4.1. Conduit shall be installed concealed in RCC ceiling slabs, columns, walls and floors etc. recessed conduit shall be laid over the first tier of reinforcement and under the second tier of reinforcement before pouring of concrete. All conduit outlet boxes to be concealed shall be laid firmly flush with the soft of the slab or beam. The conduit should be tied to the reinforcement firmly so that the alignment is not disturbed by vibrators. All the outlet boxes installed shall be stuffed and their cover plates fixed so as to prevent concrete entering the outlet boxes. Do not make any chases in RCC structure for concealing conduit work.

1.1.4.2. The drawings do not show conduit routes and all the planning for the Contractor to the satisfaction of the Engineer shall carry out arranging conduit routes.

1.1.4.3. Adequate expansion joints shall be provided in all conduit runs passing across the expansion joints in the concrete slabs of the buildings.

1.1.4.4. Pull boxes shall be installed in conduit runs at intervals mentioned below to facilitate the pulling length of wires: -

i)	Straight runs	-	20 meters
ii)	Runs with one 90 Degree bends	-	15 meters
	Runs with two 90 Degree bends	-	10 meters

The minimum length of inspection/pull boxes should be four times the cable manufacturer's recommended bending radius of the cable.

1.1.4.5. The conduit shall be terminated at pull boxes distribution boards and switchboards in an approved manner to the satisfaction of the Engineer without any additional cost to the Owner.

1.1.4.6. All conduits of a system shall be run at least 6" away from the other systems one of the other systems and services where conduit one of system crosses the other it shall do so at right angle i.e. 90 degree.

1.1.4.7. No conduit less than 20mm dia shall be used for point wiring and 25mm dia for circuit wiring. The size of conduit shall however be determined from the number of wires required in the conduit run according to number of wires allowed as per IEE Regulations.

1.1.5 MEASUREMENT

1.1.5.1. All conduit Work including all accessories shall be measured on the basis of actual numbers of light points, fan points, call bell points and/or 5A or 15A socket outlet points installed as shown on the drawings. Conduit required for circuit wiring shall be deemed to have been included in the point wiring.

1.1.5.2. For other systems the conduit Work shall be on actual measurement basis on the running length installed in feet or meters as the case may be.

1.1.5.3. Make:

PVC Conduit & Accessories

Pakistan PVC (Sharyl)
GALCO

1.2 WIRES, CABLES AND CORDS**1.2.1 Wires & Cords**

The wires & cords for conduit wiring shall be single core, made of stranded copper conductors, PVC insulated, tested to BS 6004, 1975. The voltage grade shall be 300/500 volts or 450/750 V unless otherwise specified on drawings and Bill of Quantities. The size of the wire shall be as follows: -

For light or fan point wiring with 1.5 mm square (or 3/. 029) or as specified in the BOQ.

For light circuit wiring with 2.5 mm square (or 7/. 029) or as specified in the BOQ.

For power plug 15A wiring with 4 mm square (or 7/. 036) or as specified in the BOQ.

For Main to Sub Main wiring 7/. 004 (6 mm square), 7/. 064 (16 mm square), 19/. 044 (25 mm square) or as specified in the BOQ.

1.2.2 INSTALLATION INSTRUCTIONS

1.2.2.1 The wiring of the installation shall be strictly in accordance with the scheme, cable sizes and circuit details as shown on drawings.

1.2.2.2 All wiring shall be continuous between terminations and use of connector or joints is not allowed. Spur and Tee connections are strictly prohibited. Looping in system shall be followed throughout.

1.2.2.3 Not more than three circuits' wire shall be bunched in the same conduit. Wires of two different phases, however, shall not be run or terminated in the same outlet box for single phase wiring of lights, switches and sockets.

1.2.2.4 Porcelain or molded plastic connectors shall be provided for a joint between light point wiring and light fixture wiring and housed in the outlet box provided for this purpose. The connector after terminations are made shall be wrapped in PVC insulation tape.

1.2.2.5 The quantity and the size of the wire contained in any one conduit shall not be in excess of the numbers permitted by I.E.E. regulations.

1.2.2.6 All points and circuits wiring shall be solidly earthed by 14 SWG (2.5 mm square) insulated wire to serve as E.C.C., which shall be run inside the conduit.

1.2.2.7 All 5A & 15A sockets shall be wired separately and distinctly from light point wiring.

1.2.2.8 Make:

Pakistan Cable, Pioneer Cable, ASE Cables.

1.3 POINT WIRING, CIRCUIT WIRING AND SOCKET OUTLET WIRING:**1.3.1 General**

The Work included under this Section consists of furnishing all labour, material, services and skilled supervision necessary for the construction, erection, installation and connection of all circuits and equipment specified herein or shown on the drawings.

1.3.2 MEASUREMENT**1.3.2.1 Point Wiring**

For the purpose of measurement of light/fan point wiring the following Work shall be deemed to constitute the Work point wiring: -

Providing and fixing conduit from a switch to wall/ceiling outlet of fan/fixture including final Sub-circuit conduit from distribution board to the switch as described in Section 1.1.

Providing and pulling of wires from switch to fan/fixture outlet including providing and pulling of final Sub-circuit wiring in the conduit laid as in (a) above and as described in Section 1.2.

1.3.2.2 Socket Outlet Wiring

For 5A sockets on the light switchboard and also away from the board the basis of the measurement.

For 15A/20A sockets outlets the Work shall comprise as under: -

Providing and fixing conduit from distribution board to the socket outlet as described in Section 1.1.

Providing and pulling of wires in the conduit (a) above described in Section 1.2.

1.3.2.3 Call Bell Point Wiring

This shall be identical to Section 1.4.1. i.e. wiring for light points.

1.4 FANS

- 1.4.1 All fans shall be capacitor type Deluxe models and suitable for operation on 200/220 volts, 50 Hz. AC Supply. All ceiling fans shall be from the same manufacturer.

1.4.1.1 Fan Dimmer

The electronic fan dimmer shall be recessed type.

1.4.1.2 Fan Hook

The fan hook shall be made of 5/8" (15.85 mm) dia mild steel rod bent to shape of approved design. It should be in the form of a loop about 3-1/4" (87.5 mm) long and about 2" (50 mm) wide. The rod shall be bent to have at least 8" (200 mm) extension on both sides for tying it to the reinforcement steel of the slab.

1.4.2 INSTALLATION INSTRUCTIONS

- 1.4.2.1 All fans shall be installed at a height of 10 feet from the finished floor level.

1.4.2.2 The installation of fan shall include fixing of down rod, clamp, fan blades, fan regulator and extension of wiring through down rod from ceiling rose to the fan terminals, testing and commissioning.

1.4.3 EXHAUST FANS

The exhaust fans will have dynamically blade wheel at specified operating speed. The motor shall be split phase capacitor type with low starting torque and the bearing shall be permanently lubricated sleeve type. A strong and suitable finished fixing frame shall be provided with protecting guard on motor and discharge side with gravity operated heavy duty balanced shutters etc.

1.4.4 MEASUREMENT

For the purpose of measurement this item shall be as actual number of fans of various sizes installed.

1.5 LIGHT FIXTURE (INTERNAL)**1.5.1 General**

All light fixtures shall be furnished in standard color schemes as mentioned in the manufacturer's catalogue for respective fixtures, unless specifically stated in the specifications, drawings or bill of quantities or directed by the Engineer.

The wiring between ceiling rose and fixture shall be with three core 0.75 Sq.mm and 1 Sq.mm. flexible cable, PVC insulated, PVC sheathed cable respectively for circuits protected by 10 Amps and 15/20 Amps. MCB's.

1.5.2 INCANDESCENT LIGHT FIXTURES

Surface mounted fixtures shall have white stove enameled sheet steel body. It may also be stain brass or aluminum anodized finish as required. The fixing holes shall match the outlet box. Wall bracket light fixtures shall have back plates with matching holes of the outlet box and decorative finish as required.

All light fixtures shall have bi-pin/screw lamp holders and Philips GLS/SL lamps; to BSS 161/latest clear or frosted and having a minimum useful life of 1000 hours.

1.5.3 FLUORESCENT LIGHT FIXTURES

All the light fixtures shall have lamps and efficient ballasts of the wattage specified. The fluorescent lamp shall be either 2 ft-18 watts or 4 ft-36 watts and the colour shall generally be daylight. The fluorescent lamps shall be Philips to BSS 1853 but having a minimum useful life of 5000 hours. The new generation of 26mm dia 18 watts and 36 watts energy efficient lamps shall be preferred.

All lights fixtures shall be provided with power factor improvement capacitors. The following capacitor combinations shall be used/wired on 'du' circuits. For 2x36 watts fixture 3.7 mfd capacitor 380 volts. Other combinations on single circuit shall be as under: -

For 1x36 watts fixture 4.5 mfd capacitor 250V.

For 2x36 watts fixture 4.5 mfd capacitor 250V.

For 1x18 watts fixture 3.7 mfd capacitor 250V.

The lamp holder shall be lock-in rotary type.

The starters shall have radio-interference suppressors.

Pendent type of fixtures shall have 2 Nos. ½" dia chromium plated pendent tubes for suspension or as per detail shown on drawings.

1.5.4 INSTALLATION INSTRUCTIONS

The light fitting shall be installed according to manufacturer recommendations or as approved by the Engineer.

The Contractor shall provide flexible connecting wires from outlet box to the fixture. Connector made of porcelain or thermoplastic material shall be provided and installed in the outlet boxes for connecting flexible wires to the point wires.

Outlet boxes or any openings in the ceilings are walls shall be covered with appropriately fabricated accessories to provide and architectural entity to conceal them.

Get approval of suspension / hanging rods prior to its manufacture for installation of light fixtures where shown on drawings.

1.5.5 MEASUREMENT

Actual numbers of units installed shall be taken as the basis for measurement.

1.5.6 Make:

Clifsal, Phillips, Global Lighting.

Signature of Client

Signature of Contractor

1.6 POWER CABLES

1.6.1 General

Power cables conforming to these Specifications, described in the B.O.Q and as shown on drawings shall be supplied, tested and installed.

1.6.2 H.T. CABLES (11 kV POWER CABLES)

1.6.2.1 All XLPE cables shall be manufactured to I.E.C standard 502 or BSS-5467.

1.6.2.2 Galvanized Steel Wire Armouring is provided underneath an overall PVC sheath.

1.6.2.3 11 kV XLPE cables shall be manufactured by M/s. Pakistan Cables Limited or Pioneer Cables Ltd.

Signature of Client

Signature of Contractor

1.7 L.T. CABLES

- 1.7.1 The Low Tension (L.T.) cables shall be manufactured to the requirements of B.S. 2004, B.S. 6004, B.S. 3346, B.S. 6346 latest or VDE 0271 and Rated at 250/400 and 600/1000 volts as the case may be.
- 1.7.2 The conductors shall be annealed copper conductors, single or stranded, circular or shaped as the case may be, to B.S.S. 6360/69.
- 1.7.3 The conductors specified for use in the cables shall be of at least 98% IASC conductivity.
- 1.7.4 The reference temperature for the purpose of determining the standard resistance of the conductors shall be 20 degree centigrade.
- 1.7.5 The conductors shall be insulated with poly-vinyl-chloride insulation. The minimum thickness of the insulation shall be in conformity with the Specifications to which it is manufactured.
- 1.7.6 On all multi-core cables proper markings for core identification shall be provided to B.S. Specifications.
- 1.7.7 Power cables shall be multi-core cables, insulated and sheathed, armoured or unarmoured as required.
- 1.7.8 Various conductors forming the cables shall be laid together and voids shall be filled with soft plastic or fibrous materials so as to give a circular shape to the cable.
- 1.7.9 Although PVC shall be extruded over the cable so as to cover the insulated conductors and fillers.
- 1.7.10 Where armoring is required, a soft PVC jacket shall be provided over the laid up cable. Steel wire armoring shall be applied on a tough PVC sheathed extruded over the cable so as to cover the insulated conductors, fillers, jacket and armoring.
- 1.7.11 Complete identifications of the cable together with Owner's identifications markings if required shall be embossed on the final over sheath of the cable at every meter length.
- 1.7.12 CABLES TERMINATIONS

All PVC power cables shall be terminated with suitable tinned brass cable glands for securing the armour wires and incorporating a packing ring for exclusion of water and moisture. The cables shall be secured at required spacing by means of cleats fixed to walls or roofs or hangers and where multiple runs occur perforated metal tray made of heavy gauge galvanized steel shall be used.

1.7.13 CABLE MARKERS

For underground installation cable position markers shall be sited in the ground where cables change direction and at 30 meters intervals along straight runs of the cables. Markers shall also be provided to locate the position of joints. Cable markers shall be made of cast iron. Any one to the following words shall be embossed/engraved for the identification of cable routes.

11000 V	cable
440 V	cable
11000 V	cable joint
440 V	cable joint

The markers shall comprise of a cast iron circular disc of 115mm dia and 10 mm thick to which angle iron 25x3 mm bar 710 mm long shall be riveted at one end. The end of the bar shall be fork-opened upto a length of 75 mm. This end shall be embedded in a cement concrete block of ratio 1: 3:6 to a length, of 180 mm. The concrete block shall have a shape of truncated pyramid with base dimensions of 305x305 mm and top dimensions of 152x152 mm and a vertical height of 200 mm. the cable marker shall be buried in the ground such that its total height above ground level is 267 mm.

1.7.14 CABLES JOINTS

Generally cable joints are not allowed. The Contractor shall be in possession of a cable jointing kit and a bonafide and experienced cable jointer shall make all termination. All cable termination boxes kits and glands shall be of recognized makes and complete with claw clamps, ferrules, lugs, tapes, solders and jointing compounds.

1.7.15 INSTALLATION INSTRUCTIONS

The Contractor shall be under obligations to provide all labour, material and accessories for the installation of cables shown on drawings and listed in the BOQ conforming to the Specifications in this section.

1.7.16 For underground cable installation the depth of digging the trench shall be such that the top surface of the cable shall not be less than 900 mm and more than 1100 mm from the finished ground level.

1.7.17 Cable routes indicated on the drawings shall be followed unless otherwise specified or agreed to by the Engineer. Where change in direction of the cable is necessitated, the bending radius of the cable shall not be less than the diameter of the cable drum or 12 times the diameter of the cable which ever is greater.

1.7.18 At all road crossings the cables shall pass through 100/150 mm dia PVC pipes shrouded in cast concrete, the mouths of which shall be sealed with cable bitumen compound of approved quality after drawing the cable. The road cuts shall be first filled with mud and 50 mm size ballast upto 182 mm level below the road surface and after ramming it properly 150 mm thick layer of cement concrete 1:3:6 shall be laid over it.

1.7.19 The cushion of sand to be provided in the trench before laying the cable shall not be less than 75 mm and after laying the cable 150 mm. the total depth of cushion of sand shall be not less than 225 mm. over the final layer of sand, cable marking tiles/bricks or concrete masonry blocks of adequate strength 2" thick and 300mmx200mm in size. The rest of the trench shall be back filled with earth in 150 mm layers and rammed properly before dressing.

1.7.20 All trenches and holes dug for laying the cables shall not be left open and unprotected for any length of time without completing the job and back filling. Where trenches are left open due to some un-avoidable reasons the Contractor shall exhibit suitable danger signals such as banners, red flags and red lamps etc.

1.7.21 All cables shall always be lead out or lead into the ground through 2.5-meter long G.I. pipe of 75 mm length of the pipe in the ground shall be 600 mm. The pipe should be attached to the poles with approved clamps.

1.7.22 Markers of approved design and inscription shall be installed as specified.

1.7.23 MEASUREMENT

For the purpose of measurement this item shall be treated as actual lengths of cables installed in meters at site.

1.7.24 Make:

Pakistan Cable, Pioneer Cable, AGE,
Cable Accessories: 3M

Signature of Client

Signature of Contractor

1.8 MAIN L.T. SWITCHBOARD**1.8.1 General**

The L.T. switchboard shall be indoor type, free standing, free supporting, floor mounted, totally enclosed, sheet steel clad, dust and vermin proof, completely wired, factory assembled and suitable for operation on 3 phase 4 wire system, 415 V, 50 Hz, AC supply. The switchboard shall be designed to suit service conditions and ensure security and safety during operation, inspection, operation, cleaning and maintenance. The switchboard shall be designed and tested to IEC recommendations. Each panel shall withstand strain of 2000 volts insulation level for one minute power frequency test.

1.8.2 AIR CIRCUIT BREAKERS

1.8.2.1 The Air Circuit breaker shall be triple pole of specified rating, fixed type, trip free, spring charged, quick make, quick break manually operated mechanism and visual ON/OFF position indicator. The circuit breaker shall be suitable for continuous duty for the rated current for indefinite period of time under service conditions. The circuit breaker shall have 50/65 KA (or as specified) breaking capacity and shall be capable of the following make/break operations:

Electrical	–	500 cycles
Mechanical	–	8000 cycles

The A.C.B. shall conform to BS 4752/1977. The contacts of the A.C.B shall be heavy duty, spring charged and silver-plated. Replaceable arcing contacts and chutes shall be provided. The operating handles if made of metal shall be either earthed or additionally insulated to withstand full insulation voltage. A certified copy of full type tests carried to by an independent agency on identical breakers shall be acceptable in lieu of the following type and routine tests: -

Making capacity, breaking capacity and short time current tests.

Mechanical and Electrical life endurance tests.

Temperature rise test.

Power frequency with stand test.

Milli volt drop test.

1.8.2.2 The relays shall have three elements, two for the over current and one for the earth fault: These shall be inverse over-current definite minimum time induction type with inverse characteristics. The relays shall be AC operated and provided with time and current setting adjustment of suitable range.

1.8.2.3 Three single pole resin filled current transformers, 15VA burden, suitable for metering and manufactured and tested to IEC publication 185 shall be provided. The standard accuracy class shall be 0.5%. The rated short time thermal current rating and the rated dynamic peak current rating shall be according to IEC recommendations.

C.T.'s conforming to B.S. 3938/1973 are also acceptable.

1.8.2.4 The following instruments shall be provided unless otherwise specified:-

KWH meter

Voltage 0-500 volts.

Voltmeter phase selector switch.

Ammeter commensurate with rating of ACB.

Ammeter phase selector switch.

All the instruments shall be flush mounted and back connected in a transparent dust proof cover with 144x 144mm (6"x6") dial which shall have prominent black graduations on white surface. The instruments shall be manufactured and tested in accordance with IEC Publications 51 or B.S. 89 Part 1/1970.

1.8.3 MOULDED CASE CIRCUIT BREAKERS

The Moulded Case Circuit Breakers shall be triple pole and of the rating specified in the schedule of quantities and/or shown on drawings. The M.C.C.B shall be of fixed type, having trip free, manually operated mechanism and ON/OFF/Trip position indicators. The MCCBS shall comprise of adjustable hydraulic magnetic releases for overload protection and instantaneous adjustable protection. The tripping devices shall have related time current characteristics so that positive discrimination and selective tripping is obtained assuring the tripping under fault ahead of the fault location. The MCCB shall have a rupturing capacity of 35 KA (or as specified) and shall be and manufactured tested to IEC publication 157-1 Part 1 or BS 4752/1977 or BSS 3871 parts I & II. The MCCBS manufactured by Terasaki and Merlin Gerin or approved equivalent.

1.8.4 LOAD BREAK SWITCHES

The load break switches shall be on load type having quick make and quick break mechanism with spring-loaded handles and ON/OFF visual indications. The load break switches shall be designed for continuous operation on rated current, rated voltage and rated frequency to BSS 861 (Part-2)/1972.

1.8.5 HRC FUSES

The HRC fuses shall be manufactured and tested to BSS 88/1967 (Part-1) for category of duty AC 33 (or as Specified). A supplement of 100% spare fuses of each size shall be supplied with the switchboard.

1.8.6 BUS BARS AND CONNECTIONS

A set of four bus bars, three for phases and one for neutral, made of copper having 98% IASC conductivity shall be provided. The bus bars in panels and chambers shall be tin plated, Air insulated having minimum clearance of 50mm between phase to phase and 25 mm between phase to earth. The neutral bar shall be of the same section. All the bus bars shall be mounted on insulators at suitable intervals and should be extensible on both ends. The marking and arrangement of bus bars, main connections and small wiring shall conform to BS 158/1961. Bus bars and bus bar connections shall conform to BS 159/1957.

1.8.7 ENCLOSURES

The enclosures shall be fabricated from 3mm thick high-grade sheet steel and shall be designed to house all the live parts that shall be accessible through front doors. The enclosure shall be tropical in design completely dust and vermin proof and liquid repellent, with special regard to danger of flashover both in service and in isolated position. Hinged lockable doors shall be provided on the front and bolted plates at the rear. Adequate air circulation by means of vent covered with suitable metal gauze shall be provided in the enclosures. All exterior and interior surfaces of the enclosure shall be thoroughly cleaned and freed of dust, rust and greasy matter. The enclosures shall be given three coats of paint. The primer shall be Zinc Chromate and/or iron oxide. The second and third coats shall be top quality battleship grey enamel. Enclosure for each panel shall be provided with designation labels.

1.8.8 EARTHING

The switchboard shall be effectively earthed by means of a Copper strip of 25 mm x 3mm (1"x1/8") cross-section bolted to connections near the bottom of the switchboard.

1.8.9 ACCESSORIES

Designation labels, lifting lugs, foundation bolts, interconnecting nuts bolts, and washers, thimbles, lugs, leveling shims cable glands and/or cable end boxes for all the sizes of incoming and outgoing cable shall be supplied with the switchboard.

1.8.10 TESTING

The following tests shall be conducted on each completed switchboard:-

Type Test

Temperature rise test.
Mechanical endurance test.
Making/Breaking Capacity test.

Routine Test

High Voltage test.

The switchboard shall be tested to British/Electricity Council Standard 41-5 and manufactured by M/s. Siemens (Pakistan), Libra or approved equivalent. Preference shall however, be given to switchboards fabricated from all components manufactured by only one manufacturer.

1.8.11 INSTALLATION INSTRUCTIONS

The Contractor shall provide all labour, equipment, tools and plant required to complete the installation. The switchboard shall be fixed firmly on the floor in perfect line, plumb and level position. All incoming and outgoing cable connections shall be made including Earth connections.

1.8.12 MEASUREMENT

For the purpose of measurement each L.T. switchboard shall be treated as a lumpsum job.

1.9 SUBMAIN BOARDS

The Sub-main boards shall be similar to the Main L.T. Board and the Components in its fabrication may differ and shall comprise of the components as shown on drawings and as described or listed in the schedule of quantities. The rupturing capacity of the each component for Sub Main Boards shall be as under: -

1)	Air circuit breakers (or as specified)	-	35KA
2)	Moulded case circuit breaker	-	25KA
3)	Load break switches	-	25KA
4)	HRC fuses category	-	AC 33

All other details and Specifications as in Section 1.8 shall be applicable to this section.

1.9.1 MEASUREMENT

For the purpose of measurement each Sub-Main Board shall be treated as a lump sum job.

Signature of Client

Signature of Contractor

1.10 DISTRIBUTION BOARDS**1.10.1 General**

The distribution boards shall be free standing, cubicle type or wall mounting type suitable for surface and/or recessed mounting. Each distribution board (d.b.) shall be tropical in design, fully dust and vermin proof and liquid repellent. The cabinet housing the main components shall be fabricated from mild steel sheets 16 SWG thick and reinforced with structural steel members welded to it. Front access, mechanically locked and hinged doors, fully gasketed, having one or two leaves depending upon the size of the cabinet shall be provided on each Cabinet. A load distribution chart shall be provided in each DB showing areas fed by each circuit and a suitably sized pocket inside the front door shall be provided for the purpose. Each db shall be delivered complete with all instrument accessories, rating plates and designations.

Suitable cable entry glands shall be provided as required for floor mounted boards on the incoming cables but for outgoing cables and/or wall mounted boards exact number of conduit entry holes as are required shall be provided with male brass bushes. The bushes shall be tin plated and fully shrouded or housed in gasketed compartments.

1.10.2 COMPONENTS

The Main components e.g. Moulded case circuit breakers, load break switches, HRC fuses and instruments that are required for db's as shown on drawings and as described in schedule of quantities. However miniature circuit breakers (MCB's) used in db's are briefly described hereunder: -

1.10.3 MCB's

The incoming shall have triple pole mcb's suitable for use on 415V 50 Hz, AC and the outgoing mcb's shall be single pole or single phase for use on 220V, 50Hz, AC. The ratings are as shown in drawings and/or describe in the Schedule of Quantities.

The mcb's shall be manufactured and tested to BSS 3871/1966, and shall have a rupturing capacity of 7.5 KA. The final circuit mcb, on the outgoing, shall however be rated 5KA. The mcb's manufactured by Terasaki or approved equivalent are acceptable. The Distribution Boards shall be manufactured by intellectual manufacturer.

1.10.4 INSTALLATION INSTRUCTIONS

The Contractor shall provide all labour, equipment, tools, plant and accessories required to complete the installation shall be provided by the Contractor. The distribution board shall be fixed required in perfect line and plumb. All incoming and outgoing cables shall be terminated properly. All earth terminations shall be made on the neutral block.

1.10.5 TESTING

All db's shall be tested at manufacturer's Works and the Engineer without incurring any additional expense to the Owner shall witness tests.

1.10.6 MEASUREMENT

Each distribution board for the purpose of measurement shall be treated as a lumpsum job.

1.10.7 Make:

Terasaki, ABB, Siemens, Legrant.

1.11 EARTHING**1.11.1 General**

The Contractor shall be under obligation to supply all material and labour for the completion of the Earthing System as shown on drawings, listed in the Schedule/Bill of Quantities and conforming to Specifications laid down hereinafter. The completed installation shall, in general, conform to British Code of Practice CP 1013/1965 and regulations of Pakistan Electricity Act.

1.11.2 EARTH CONTINUITY CONDUCTOR

The earth continuity conductors and earthing leads shall be solid hard drawn, insulated electrolytic copper wires of sizes given on the drawings and Bill of Quantities. All fixing accessories such as saddles, copper bolts, nuts, and washers shall be provided. The size of conductor above 19/083 shall be of 1-1/8" flat copper strip or as specified.

1.11.3 EARTH POINT

The earth point shall comprise a 600x600x5mm (2'x2'x1/4") thick electrolytic copper plate, tinned for protection against corrosion. The edges of the copper plate shall be chamfered. The plate shall have two holes for connecting each earthing lead or tape to earth terminals. The terminals shall comprise of 5/8" dia copper bolts and nuts and double spring washers. 1/2" dia G.I. pipe with a tee at the top end shall be provided for watering purpose during dry seasons.

1.11.4 EARTH CONNECTING POINT

The earth connecting point in switch room or Sub-station shall comprise 300 mm x 50 mm x 5 mm (1'x2'x1/4") electrolytic copper bar having as many terminals of 3/8" dia copper bolts, nuts, and washers as are required. The earth bar shall be fixed on bus bar insulators of appropriate size. The fixing bolts shall be galvanized and provided for fixing the bar on the wall. The bar shall be tinned for protection against corrosion. Copper tapes from various equipment and earth point shall be terminated on this bar.

1.11.5 EARTH ELECTRODE

For the earthing of poles or any device or equipment rated less than 15 kW, earth assembly as shown on the drawing shall be installed.

1.11.6 MANHOLE

Cast concrete inspection manhole covers shall be provided on each earth point, as shown on drawings.

1.11.7 INSTALLATION INSTRUCTIONS

1.11.7.1 The earth continuity conductor (ECC) shall be run, inside, all along the installation. The ECC shall be insulated as specified elsewhere.

1.11.7.2 The E.C.C or copper strip shall be laid all along the length of perforated metal tray or walls of masonry ducts, fixed at 3' intervals. At terminations the ECC or tape shall be bolted firmly to the equipment as per standard practice. Copper tape at straight through joints shall be brazed or cad welded. Joints between stranded ECC shall be avoided or cad welded.

1.11.7.3 Earth plate shall be buried upright 1' below the natural Sub-soil water level but not less than 20 ft. below the ground level. A mixture of salt and charcoal shall be laid and packed upto 12" all around the plate. 1/2" dia G.I. pipe with a Tee at the top shall be provided for watering arrangement during dry seasons and/or where no Sub soil water is available.

1.11.7.4 The earth lead shall be laid 18"/24" below the natural ground level. Sleeves of 50 mm dia PVC pipe may be provided where ECC is laid across slabs, walls and/or foundations.

1.11.8 MEASUREMENT

1.11.8.1 Each earth point and earth manhole shall be treated as lumpsum job for the purpose of measurement.

1.11.8.2 ECC or tape, for the same purpose shall be measured as actual length installed.

1.11.8.3 For ECC in conduit wiring no separate measurement shall be taken and it shall be deemed to have been included in the rates of cable.

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1.12 LIGHT FIXTURES (EXTERNAL)**1.12.1 General**

The lighting fixture types are given on the drawing, and each type is specified in detail in the Bill of Quantities. In all cases a definite manufacturer's type and catalogue number is specified to illustrate the type of fixture required.

- 1.12.2 Lighting fixtures for High-pressure mercury vapor lamps or given on the drawings or mentioned in BOQ shall be manufactured to conform to the requirements of BS 1788/latest and shall also comply with British Standard Code of Practice BS 5489 (formerly CP 1004).
- 1.12.3 The light fixtures body shall be shaped out of pressed or cast aluminum or aluminum alloy. The prismatic glass reflector shall be of vacuum-formed type for diffusing lights. The material used in the manufacture of bowl shall be either stabilized transparent polycarbonate, clear acrylic or heat resistant glass.
- 1.12.4 All fixings and clips shall be of stainless steel to provide a firm and corrosion free attachment.
- 1.12.5 The fitting shall be suitably wired at the factory with appropriate length of copper cables having heat resistant insulation capable of withstanding maximum temperature up to 350 degree centigrade. The internal wiring shall be terminated on a porcelain terminal block with tinned brass terminals and pressured type screwing arrangement. Screws which directly press into the cables shall not be acceptable.
- 1.12.6 The fitting complete with control gear shall be suitable for use with high-pressure mercury vapor, metal halide or high pressure sodium lamps of the sizes specified in the BOQ.
- 1.12.7 Lamp shall have a rating as specified in the BOQ. The rating of the control gear shall correspond with the rating of the lamp.
- 1.12.8 A compensating capacitor of suitable rating to improve the p.f. to 0.8 p.f. lagging shall be provided with the fixture.
- 1.12.9 The choke shall be noise and vibration free; polyester filled and compacts in design.
- 1.12.10 Get approval of suspension/hanging rods prior to its manufacture for installation of light fixture where shown on the drawings.

1.13 LAMPS

- 1.13.1 Mercury vapor/sodium/MDI/HAL/HIT/HIE lamps shall be high pressures self-igniting type rate to function at 220 volts 50 Hz single-phase alternating current in conjunction with suitable low power factor ballast. The interior of the lamps shall be coated with rare earth phosphor to give better lumen out put and good colour rendering.
- 1.13.2 The cap shall be suitable for fitting into E 40 or E-27 design lamp-holder.
- 1.13.3 The lamp shall rated at 125 watts or as specified.
- 1.13.4 The objective life shall not be less than 5000 burning hours.
- 1.13.5 The lamp shall be capable for burning in any direction.
- 1.13.6 Each lamp shall be complete with a ballast and p.f. Compensating capacitor.

1.14 GARDEN/FLOOD LIGHT POLES

1.14.1 Poles for mounting lighting fixtures shall be made of sheet steel. The steel used in the manufacture shall have the following properties: -

Tensile strength min:	39.7 Kg/mm square
Max:	56.3 Kg/mm square
Yield point min:	24.7 Kg/mm square

1.14.2 The poles shall be fabricated from welded carbon sheet steel.

1.14.3 The working stress at lower level of each section shall be as under: -

Safe working load	-	115 Kg
Breaking load	-	290 Kg

1.14.4 The minimum dimension of the bottom section of each pole shall be as under: -

-	Outer diameter of the section	:	200 mm
-	Thickness of section	:	10 mm

1.14.5 The overall height for garden lighting pole shall be as shown in Drawing.

1.14.6 For 18 meter high flood light mast shall be hot dipped in and out steel galvanized (conforming to BSS 729/71) Octagonal tapered pole with dished flange base plate, anchor bolts (steel galvanized bitumen dipped) pole/head frame painted with 3 coats of anti corrosive paint and three coats of head frame suitable to mount 20 fixtures type as given on the drawing. Pole base has weather proof inspection door 100% vandal proof suitable to hold control gear of the floodlights. Pole having climbing clips for access to head frame as mentioned in BOQ.

1.14.7 Tolerances in the manufacture of poles shall be as follows: -

A-	Overall length of the pole	+	2.5%
B-	Outside diameter	+	1%
C-	Tube thickness	+	1%
D-	Weight	+	3%

The poles shall be straight within 1/300 of the length.

1.14.8 The welds shall be ground off to give smooth finish to the poles. The poles shall be relived of all drawing and welding stressed and thoroughly cleaned of all oxidation, scales, oil, grease and contaminants before finishing.

1.14.9 After through cleaning the exterior surface from top to the bottom of the poles shall be painted with two coats of red lead based primer. The surface to be buried below ground line and inner side throughout shall be painted with two coats of bitumen paint.

1.14.10 The poles shall be tested at manufacturer's end for transverse loading test and tensile test.

1.14.11 For transverse loading test poles shall be tested to failure and a load equal to twice the full test load applied at the points shown in the drawing. The test load shall be 115Kg.

1.14.12 Any permanent deflection after the application and removal of the full test load shall mean non-compliance with this specification. Failure at or before 2.5 times the test load shall also mean non-compliance with these Specifications.

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- 1.14.13 The tensile test shall be carried out in accordance with ASTM A370-68. For the tensile test at least 3 test pieces from the pole shall be taken. In case more than one piece fails to the test it shall mean non-compliance of these Specifications.
- 1.14.14 The Contractor shall make arrangements to get the tests witnessed by the Engineer at his own expense.
- 1.14.15 The Owner may require special markings to be engraved on the poles supplied to him for proper identification and Contractor shall comply with such instructions.
- 1.14.16 Each pole shall be earthed as shown in the drawing.
- 1.14.17 A 16"x16"x $\frac{1}{2}$ " square shape base plate or as mentioned in BOQ shall be welded to the bottom of the pole. The top of the pole shall be provided with an approved cap.
- 1.14.18 The base plate shall be grouted in a standard concrete foundation cast in site.
- 1.14.19 The connection from the cable junction box to light fixture shall be by 2 core PVC/PVC cable size 2.5 sq. mm. The cable entry to the poles shall be through proper male brass bushes.
- 1.14.20 Make:
Bega, Clipsal, Phillips.

1.15 SERVICE TERMINAL BOXES

- 1.15.1 Power cables in the system shall be terminated by tinned brass cable glands to be saddled neatly in rust proof and water tight terminal boxes designed to take two cables of size upto 2.5 mm square garden light cable & 1 cable size 2x4 mm square PVC/PVC cable.
- 1.15.2 The terminal boxes shall be metal clad and deep enough to take the cable leads comfortably without undue twisting and pressure.
- 1.15.3 The size of the terminal plate shall be 12"x5" or according to pole manufacturer's standards.
- 1.15.4 The terminal plate shall be fixed in the pole.
- 1.15.5 Neoprene glands and screws bushes shall be provided for sealing the entries.
- 1.15.6 The service box shall be provided with lockable hinged front cover.
- 1.15.7 The terminal block shall consist of brass terminals adequately insulated with either a molded phenolic compound or a neutral block housed in glazed porcelain housing shall be provided for connecting up the incoming and outgoing cables.
- 1.15.8 Compression type lugs shall be used for terminating the cables.
- 1.15.9 The terminal block shall be tested for temperature rise and also subjected to heat cycle test besides dielectric strength test.
- 1.15.10 The temperature rise of the terminals shall not exceed 30 degree centigrade, at a frequency of 50 Hz, 400 Volts, unit power factor and rated maximum current.
- 1.15.11 The insulation between all terminals and all metal parts including the frame shall withstand the applications of an alternating test voltage of 2000 volts (r.m.s.).
- 1.15.12 A porcelain fuse base and fuse carrier rated at 30 Amps with a cartridge fuse link rated at 1.5 amps for lamps shall also be housed in the service box. The cartridge fuse links shall be to BS 1362. Alternatively a suitably rated mcb as specified shall also be installed.
- 1.15.13 All the exposed terminals excluding the fuse and barkers nobbs shall be covered by 3 mm thick Bakelite sheet.
- 1.15.14 The Contractor shall submit a sample of a complete terminal plate and obtain prior approval of the Engineer before proceeding with the fabrication of total requirements.
- 1.15.15 The lid shall be fully gasketed and provided with triangular head screws of captive type. One key for every ten terminal boxes or part there of shall be provided.
- 1.15.16 The terminal box door shall have finish similar to pole.

1.16 SUBSTATION EQUIPMENT**1.16.1 High Tension Switchgear**

1.16.1.1 The Switchgear shall be 11000 volt metal clad type of 350 MVA braking capacity for indoor application. It shall be triple pole and all the three poles shall be coupled so as to operate simultaneously.

1.16.1.2 The switchgear shall comprise of vacuum circuit breaker / load break switches.

1.16.1.3 The switchgear shall be supplied and tested in accordance with the following International Electro Technical Commission Publications:

IEC Publications	56-1	
IEC Publications	56-1A	
IEC Publications	56-1B	
IEC Publications	56-2	
IEC Publications	56-3	
IEC Publications	56-4	
IEC Publications	185	Specifications for current Transformers.
IEC Publications	51	Specifications for Instruments.

1.16.1.4 The switchgear shall be supplied in the form of single panels for quick assembly at site in the form of a switchboard.

1.16.1.5 Each panel shall comprise of a draw-out type circuit breaker and all its associated equipment and accessories shall be self-contained and self-supporting. Each panel shall be capable of being supporting. Each panel shall be capable of being connected to a switchboard on either side.

1.16.1.6 In each panel the circuit breaker shall be equipped with a mechanism for moving it physically between the connected and disconnected positions and also equipped with self-aligning and self-coupling primary and secondary disconnecting devices.

1.16.1.7 All secondary circuit wiring, instruments, meters and relays etc, shall as far as possible be isolated by grounded metal barriers from all primary circuit elements with the exception of short lengths of wires such as instrument transformer terminals.

1.16.1.8 All removable components of the same type and rating in a switchboard shall be physically and electrically interchangeable.

1.16.1.9 The breaker shall have mechanical "ON", "OFF" and "EARTHED" position indicator.

1.16.1.10 Mild steel rails shall be provided at the base to guide smooth entry of the breaker carriage into the panel.

1.16.1.11 The terminals and interconnections between parts shall be designed to ensure permanently low resistance contacts. The power carrying circuits shall be capable to carry its rated current at rated voltage and rated current continuously shall not be seriously impaired. The Contractor shall furnish the manufacturer's literature and technical data to prove this point.

1.16.1.12 The mechanical strength and physical characteristics of the insulation structure shall be in accordance with the classification of IEC Publication No. 85.

1.16.1.13 Circuit breakers shall be so constructed that the interval between the contacts of the individual pole touch or separate shall not exceed 10 ms during closing or opening operation.

1.16.1.14 The rods or tubes used for raising or lowering the moving contacts of the securely pinned at each end to prevent rotation or displacement of the contacts.

1.16.1.15 Ventilation outlets from circuit breaker shall be so arranged that any discharge of oil and/or gases or both will not cause Electrical breakdown and shall be directed away from a likely place where an operator may have to be in the course of his ordinary duties. The construction shall be such that gas cannot collect at any point where fire can be caused during or after operation, by sparks arising from normal worming of the circuit breaker or its ancillary equipment.

1.16.1.16 A set of 6 male and 6 female silver-plated self-aligning isolating contacts shall be provided for separating the breaker from the Sub-bars. These shall be interlocked and protected by automatic shutters with locking facility. The shutters shall be marked "BUS-BARS" and "CABLES" and distinctly colored. No operation shall cause exposure of the high voltage bus or equipment. The shutters shall operate with certainty upon the withdrawal and replacement of a removable portion but shall be so arranged as to permit the cover over a set or sets of live contacts to be locked by hand in the closed position while the cover over the dead contacts may be opened.

1.16.1.17 Silver plated plug contacts shall be provided between separate units to complete the secondary circuits. They shall be pressure loaded self-aligning types.

The temperature rise of the main circuit of a circuit breaker shall not exceed the values given in Table I of ICE Publication 56-2. The maximum temperature of auxiliary circuits and devices when the circuit breaker is carrying the rated current and voltages and when tested in accordance with Clause II of IEC Publication N. 56-2 shall not exceed the values given in Table I. The reference ambient temperature shall be taken as 50 degree centigrade.

These circuit breakers shall have the following characteristics:

S.No.	Characteristics
1-	Current Rating
2-	Voltage Rating
3-	Frequency
4-	Breaking Capacity
5-	Breaking Current Sym
	Breaking Current Asym
6-	Making Capacity
7-	Power Frequency withstand Voltage
	Type Test
	Routine Test
8-	Impulse withstand voltage
9-	Operating duty
10-	Total maximum break time

1.16.1.18 The circuit breakers shall be capable of breaking any power upto their rated breaking capacity. For all recovery voltages between the two rated voltages the breaking capacity ratings in amperes shall be inversely proportional to the voltage. For recovery voltages below rated voltages the braking capacity expressed in amperes shall have a constant value corresponding to the lower rated voltage.

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1.16.1.19 The operating mechanism shall be charged spring power mechanism with manual push button for closing and opening the breaker. The closing spring shall be hand charged.

1.16.1.20 The mechanism shall be trip free.

1.16.1.21 The closing mechanism shall not prevent or delay the opening of the circuit breaker beyond the standard interrupting time.

1.16.1.22 Latches shall be so designed as to not require delicate or frequent adjustments.

1.16.1.23 The mechanism shall be such as to give a minimum of 1000 operations without wear, breaking or adjustments. Each operation shall consist of complete opening and closing of the circuit breaker.

1.16.1.24 The mechanism shall be of robust construction and of rust proof materials, it shall be capable of withstanding shocks and prevent in advertent operations causes.

1.16.1.25 The mechanism shall be provided with means to prevent operation during maintenance.

1.16.1.26 The following routine tests shall be made on all circuit breakers and manufacturer's certificate shall accompany each breaker.

Temperature rise test (IEC Publication 56-2 Clause 15).

Test for operating Conditions (IEC Publication 56-3 Clause 37).

Power frequency dry voltage (IEC Publication 56-4 clause – 17).

Tests on auxiliary circuits (IEC Publication 56-4 Clause-19).

Oil Tank leakage tests by any one of the following methods:-

- A. Compressed Air Test.
- B. Oil or Water Pressure Test.
- C. Penetrating liquid without Pressure.

1.16.1.27 The Contractor shall make suitable arrangements for the Engineer to witness such tests at the manufacturer premises or any recognized test laboratory without any expense to the Owner.

1.16.1.28 A set of three bus bars made of 98% I.A.S.C. Electrical conductivity copper of current rating of 1000 Amps shall be provided.

1.16.1.29 The bus bars shall be fully covered with insulation capable of withstanding the full line voltage. These shall be supported on porcelain insulators and air insulated. The bus bars shall be tinned at all joints and a drawing showing details and method of jointing shall accompany the breakers.

1.16.1.30 Bracing of sufficient mechanical strength shall be provided to withstand forces of short circuit current to the extent of 23 kA.

1.16.1.31 The bus bars shall be capable of extension on either side and have adequate provision for expansion and contraction due to temperature variations over a range of 80 degree centigrade.

1.16.1.32 Single pole, epoxy resin insulated, dry type self-contained indoors current transformers suitable for mounting in switchgear shall be supplied.

1.16.1.33 The current transformers shall be manufactured and tested in accordance with IEC Publication 185 (1966) and particulars listed therein.

1.16.1.34 The transformation ratio shall be as stated in the Bill of Quantities.

1.16.1.35 The current transformers shall have two core construction and each core shall be designed for protection and metering. Both cores shall be identical.

1.16.1.36 Three phase, self-contained, indoor drawout type voltage transformers shall be supplied as required and detailed in the Bill of Quantities. The transformers shall be epoxy resin insulated.

1.16.1.37 The rated frequency shall be 50 Hz and voltage ratio shall be 11000/415 volts. The accuracy and tests shall have the above noted frequency and voltage ratio as reference.

1.16.1.38 The characteristics shall be as follows: -

I- Rated Burden VA 100 per Phase

II- Accuracy Limit 0.6%

1.16.1.39 The voltage transformer shall withstand for one second the mechanic and thermal stresses resulting from a short circuit on the secondary terminals with full voltage maintained on the primary terminals.

1.16.1.40 The following tests shall be carried out on the voltage transformer: -

Dielectric test of low frequency.

Impulse test on high voltage windings only.

Ratio and phase angle tests at one standard burden.

Temperature rise tests.

Impedance Test.

The dielectric test voltage shall be as under: -

		Impulse Test Voltage		
Rated Primary	Low Frequency Test Voltage (rms.)	Chopped Wave Crest Voltage	Min. time Flash over	Full wave Crest Voltage
11 kV	34 kV	110 kV	1.8 Microseconds	95 kV

1.16.1.41 The voltage transformers shall be equipped with fuse and fuse links in accordance with BS 88/1967.

1.16.1.42 Back connected dust proof, semi-flush, switchboard type protective relays with transparent removable and sealable covers shall be provided. These shall be preferably plug-in with drawable type and all operations for removal and replacement shall be carried out from the front side of the panel.

1.16.1.43 The relays shall be suitable for climatic conditions described in these Specifications and capable of 5000 electrical operations when tested at rated quantities and at a rate which will not result in overheating. The relays shall withstand a test-voltage of 2000 volts (rms.).

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1.16.1.44 All relays shall be A.C. operated and provided with time and current setting adjustments with suitable range.

1.16.1.45 The rated error of all the protective relays shall be not more than 7.5% at all settings. The relay minus 7.5% with changes in ambient temperature of plus or minus 10 degree centigrade from the reference temperature of 25 degree centigrade and with changes in frequency of plus 2% and minus 6% from the rated frequency.

1.16.1.46 The following type of tests shall be carried out: -

Limits of error.

Temperature rise test.

Overload test.

Contact rating test.

Mechanical Durability.

Variation characteristics with ambient conditions and frequency.

The manufacturer shall supply certified test result by an independent agency on the type of relays.

1.16.1.47 All live parts of the panel including bus bars, connections, circuit breaker, isolators, voltage transformer, current transformers shall be suitably enclosed. Access for normal maintenance shall be through doors with locking facilities. The enclosure shall have hinged door in front and bolted plates in rear. However, the incoming panels will be provided with hinged doors with locks in the rear as well.

1.16.1.48 The enclosure and the breaker shall be completely derusted and degreased. It shall be given a priming coat of zinc chromate and iron oxide or any other equivalent.

1.16.1.49 The following instruments shall be installed on the incoming panels: -

One voltmeter 0-12 kV range, moving iron spring controlled in a pressed steel case.

One ammeter of suitable range conforming to the CT ratio, moving iron, spring controlled in pressed steel case.

One voltmeter phase selector switch.

One ammeter phase selector switch.

One kWh meter with MDI

One KVARh meter.

1.16.1.50 The indicating instruments shall be flush mounted back connected, dust proof with a transparent dust proof cover. The dials shall be white with permanent, black graduations.

1.16.1.51 The instruments shall be manufactured and tested in accordance with IEC Publication 51.

1.16.1.52 CT operated kWh and KVARh meters shall also be installed where required. The meters shall be manufactured and tested in accordance with I.E.C. Publication 43.

1.16.1.53 The panel or the switch board as described in the Bill of Quantities shall be delivered complete at site ready wired complete with name plate, designation labels, circuit labeling. The small wiring shall be tested at 2000 Volts D.C.

1.16.1.54 The following data shall appear on the nameplate of each circuit break:

Manufacturers Name and Address.

Manufacturer, type, designation and serial number.

Year of Manufacture.

Owner's Identification Mark.

Standard to which Manufactured.

Rated Normal Current.

Rate Frequency.

Rated Normal Current.

Rate Impulse Withstand Voltage.

Symmetrical Breaking Capacity.

Asymmetrical Breaking Capacity.

Rated Short Time Current.

Making Capacity.

Rated operating Duty.

Total Break Time at rated Breaking Current.

Control and Tripping Voltage.

1.16.1.55 The switch-gears as detailed in the Bill of Quantities shall be delivered tested and commissioned at Site under this Contract and shall be complete in every aspect, and manufactured by M/s. Siemens (Pakistan), M/s. ALSTOM (Pakistan).

1.16.1.56 Installation of the switchgear

The Electrical Contractor shall provide all labor, equipment and tools necessary for complete installation as well as all shimming of the supporting steel frame that may be required to set the switch-gear in level position. The equipment shall be fixed firmly on the floor according to the manufacturer's recommendations. All outgoing and incoming cable connections shall be made and special care should be taken in fixing cable terminations and cable connections so that no danger of damage during operation is possible. All terminal block connection shall be checked for any looseness.

1.16.1.57 Measurement

This job shall be treated as lump sum job for measurement purposes.

1.16.1.58 Make:

Siemens, ABB, Legrant, Terasaki.

1.16.2 POWER FACTOR IMPROVEMENT PLANT

1.16.2.1 General

The Power Factor Improvement Plant shall be indoor type, free standing, floor mounting, sheet steel clad, totally enclosed, completely dust proof, fabricated from 3mm thick mild steel sheet suitably ventilated with vermin proof louvers, supplied fully assembled, readily wired, as one integral unit and capable of alignment to Main L.T. Switchboard. The use of mechanical forced ventilation is allowed. The plant shall be designed to house all delicate components e.g. p.f. meter, sensing relay, Main and auxiliary indicator lights, control fuses with bases etc. in dust proof enclosures.

The fabricated plant housing shall be completely cleaned, degreased and derusted, before applying one coat of antirust primer and two coats of battleship grey enamel.

The plant shall be designed to meet the service conditions at site and provide reasonable assurance of performance in mechanical and electrical adjustments. The plant shall be suitable for use on 415V, 50 Hz, 3-Phase 4 wire, A.C. supply.

1.16.2.2 Components

1.16.2.2.1 Each capacitor shall have rating of not more than 25/50 KVAR and shall conform to BS 1650/1971. Full capacitance of the plant as specified shall be capable of being switched in 10 equal steps. The capacitors shall be rated 525 V. The capacitor bank shall consist of single phase capacitors arranged in star formation with solidly grounded neutral.

1.16.2.2.2 A 12 stage-sensing relay with time delay characteristics shall be provided for carrying out all switching operations automatically.

1.16.2.2.3 A manual control switch shall be provided to carry out manual switching if and when required.

1.16.2.2.4 Magnetic contactors suitable for 380/420 volts operation shall be provided in sufficient numbers to carry out automatic switching operations. Then Contractor shall conform to BS 775/latest.

1.16.2.2.5 Suitable discharge resistors and hoods shall be provided.

1.16.2.2.6 A 6"x6" dia flush mounted power factor meter shall be supplied.

1.16.2.2.7 The PFI plant shall be manufactured by M/s. Siemens (Pakistan), M/s. ALSTOM (Pakistan) or J&P.

1.16.2.3 Testing

1.16.2.3.1 The capacitors shall be charged by application of full voltage for a period of one minute and then discharged through resistors. This will constitute one cycle and the tests shall be carried out for 5 such cycles.

1.16.2.3.2 The sensing relay shall be tested in accordance with tests specified in BS 142.

1.16.2.3.3 All small wiring shall be subjected to a high voltage test at 2000 volts for one minute.

1.16.2.3.4 The plant as a whole shall be tested by the application of inductive load.

1.16.2.4 Measurement

This job shall be treated as a lumpsum job for the purpose of measurement.

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1.16.3 POWER TRANSFORMERS

1.16.3.1 Three phase Power Transformers for indoor use having transformation ratio of 11000/415 volts at frequency of 50 Hz and KVA ratings as given in the Bill of Quantities shall be supplied and erected by the Contractor.

1.16.3.2 The Transformers shall be manufactured, supplied and tested in accordance with the following standards: -

British Standard 171/1959 – Power Transformers.

British Standard 358/1959 – Measurement of Voltage with sphere gaps.

British Standard 923/1940 – Impulse voltage testing.

British Standard 2757/1964 – Classification of insulating materials for electrical machinery and apparatus on the basis of thermal stability in service.

American Standards Association C. 57.12.1956 – Requirements terminology and test code for distribution power and regulating transformers and distribution power and regulating transformers and reactors other than current limiting reactors.

I.E.C. Publication 76 – Recommendations for Power Transformers.

I.E.C. Document 14 (Secretariat) 53.

I.E.C. Document 14 (Secretariat) 54.

I.E.C. Document 14 (Secretariat) 55.

I.E.C. Publication 60 – High Voltage test techniques.

1.16.3.3 The transformers shall be oil-immersed types with core and winding immersed in natural mineral oil. The core shall be of a laminated construction made of high-grade Electric steel sheet rigidly packed and free of vibrations due to frequency and stresses.

1.16.3.4 The windings shall be uniformly insulated. The thermal class of insulating material shall be Class-A. Test voltages shall be based on highest of the system voltage i.e. 12 kV. Power frequency voltage shall be 28 kV and impulse voltage to be 95 kV. The wave being 1/50 microseconds.

1.16.3.5 The insulation to earth of the winding shall be uniform.

1.16.3.6 The limits of temperature rise above ambient of the windings, cores and oil shall be as under: -

Winding	–	50 Degree Centigrade
Core	–	50 Degree Centigrade
Oil	–	40 Degree Centigrade

1.16.3.7 The transformer shall be designed and constructed to withstand, without damage, the effects of short circuit of magnitude equal to 25 times the symmetrical r.m.s. value of valid current for 2 seconds.

1.16.3.8 The transformer shall be capable of withstanding, without damage on any tapings, under service conditions, the electromagnetic forces arising under short circuit conditions as determined from the symmetrical peak value of the current in the winding which shall be taken as not greater than 2.55 times the over current derived.

1.16.3.9 The transformer shall be provided with regulating taps. The adjusting tapping shall be $+2\frac{1}{2}\%$, normal, $-2\frac{1}{2}\%$, -5% and $-7\frac{1}{2}\%$. The tapings being located on the higher voltage winding.

1.16.3.10 Tap changing shall be affected by means of an externally operated off circuit switch capable of being locked in position. It shall be accessible with safety.

1.16.3.11 When tapings are used to compensate for variation of voltage the transformer shall be capable of operation at its rated KVA capacity on any tapping without injury. The tap changing gear shall be capable of carrying the same currents, due to external short circuits.

1.16.3.12 The method of cooling shall be natural air; the method of circulation of oil shall be by natural thermal head and would be indicated by symbol ON.

1.16.3.13 The primary windings shall be "delta" connected and the secondary winding shall be "Star" connected internally. The star point shall be brought out as neutral. The internal connections shall be clearly indicated on the nameplate together with tap changing connections. The vector group DY-11 of the transformer shall also be indicated on the nameplate.

1.16.3.14 The tank shall be tested for any leaks by any of the following methods:-

Compressed Air Test.

Oil water Pressure Test.

Penetrating liquid without Pressure.

1.16.3.15 An oil conservator tank fitted with a dehydrating breather and oil level indicator shall be internally fitted to the transformer tank.

1.16.3.16 The complete assembled tank shall be tested to withstand without deformation or leakage a pressure of 15 lbs./sq. in (1.05 Kg/sq.cm).

1.16.3.17 The tank finish shall be battleship grey colour. The paint shall be highly resistant to the effects of high temperatures and shall have a long life under the normal working conditions. As a minimum it shall consist of a priming coat and two finish coats applied after complete derusting and degreasing of the tank. The thickness of the paint shall not be less than 0/12 mm.

1.16.3.18 The oil level indicator shall be visual glass type with minimum oil level marking at 30 degree centigrade and with two additional marks "Empty" and "Full" to be provided. These corresponding to the upper and lower temperatures for which the transformer is required to operate on site.

1.16.3.19 Compound filled cable end boxes for Bus tie duct XLPE cable on H.T. side and on L.T. side shall be provided for connecting the transformer to relevant switchgear. Arrangement for solidly grounding the neutral shall be made.

1.16.3.20 The following routine tests shall be carried out on the transformers:

Temperature Rise Test.

Impedance Test.

Ratio and Phase angle test at one Standard Load.

Dielectric Test of Low Frequency.

1.16.3.21 A certified copy of a complete type tests carried out by and identical transformer shall accompany each transformer failing which the Contractor shall make arrangements to carry out these tests in the presence of Engineer without any extra expense to the Owner.

1.16.3.22 The following fittings shall be provided with each transformer.

Rating Plate.

Terminal Marking Plate.

Lifting Lugs.

Earthing Terminals for Tank.

Oil filling holes and plug.

Oil level indicator.

Drain valve with built-in sampling device.

Conservator.

Air Vent.

Dehydrating Breather.

Dial type thermometer with maximum temperature indicator.

Single Float Buchholz Relay complete with auxiliary relay on the panel.

Steel Rollers with rolling direction parallel to the longer side.

1.16.3.23 The rating plate shall carry the following information: -

Manufacturers Name.

Manufacturers Serial Number.

Year of Manufacture.

Owner's Identification Mark.

Rated KVA

No. of Phases.

Frequency.

Rated Voltage at no load (Higher Voltage/Lower Voltage).

Percent Impedance Voltage.

Rated current (Higher Voltage/Lower Voltage).

Winding connections and phase displacement symbols of vector diagram.

Type of Cooling.

Total weight of the transformer.

Total quantity and weight of the oil.

Weight of core and winding assembly.

1.16.3.24 The terminal marking plate shall carry the following information: -

Vector Group Symbol.

Winding connections of high voltage and low voltage sides.

Tapings with subscripts.

Voltage ratios at various tapping the lower voltage being kept constant.

Rated Current (Higher Voltage/Lower Voltage).

Letters ABC shall be used for the high voltage side and a b c shall be used for low voltage side.

1.16.3.25 The transformers shall be manufactured by M/s. Siemens (Pakistan), PEL, Climax or J&P.

The transformer of the ratings as given in the Bill of Quantities shall be supplied tested erected and commissioned under this Contract and shall be complete in every respect with first filling of dehydrated mineral oil specified herein after.

1.16.3.26 Measurement

This job shall be treated as lump sum job for measurement purposes.

1.16.3.27 Payment

Payment shall be made for each transformer unit as specified in the Bill of Quantities.

1.16.4 OIL FOR TRANSFORMERS

1.16.4.1 Oil for transformers shall conform to British Standard 149.

1.16.4.2 Insulating oil shall be straight run mineral oil obtained from fractional distillation of crude petroleum, refined specially for use as an insulating and cooling medium in oil immersed transformers.

1.16.4.3 For satisfactory service of the equipment the oil dielectric strength above 40 kV will not be required when tested according to BS 148.

1.16.4.4 Measurement

No measurement is involved for this item, as each equipment using this oil is reckoned complete with oil.

1.16.4.5 Payment

Payment of oil is included with the equipment using the oil.

1.16.4.6 Make:

Siemens, PEL.

1.17 TESTING**1.17.1 General**

Upon completion of the installation the Contractor shall perform field tests on all equipments, 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 furnish, install and maintain all tools, instruments, test equipment, material, connections, etc. and furnish all personnel including supervision and "Standby" and adjustment of all electrical facilities and their component parts, including putting the same into operation.

All tests shall be made with the proper regard for the protection of the equipment, and the Contractor shall be responsible for adequate protection to all personnel during such tests.

1.17.2 Insulation Test

Insulation resistance tests shall be made on all electrical equipment, using a self-contained instrument such as the direct indicating ohmmeter of the generator type. Direct current potentials shall be used in these tests and shall be as follows: -

Circuit fewer than 230 volts – 500 volts test.

Circuit fewer than 500 volts – 1000 volts test.

The minimum acceptable insulation resistance value will be 5 Mega-ohms.

The Contractor will furnish the test equipment for insulation testing.

Before making connections at the ends of each cable run, the insulation resistance test of each cable shall be made. Each conductor of a multicore cable shall be tested individually to each other conductor of the group and also to 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 the new cable tested.

All equipment shall be given an insulation resistance measurement test to ground after installation but before any wiring is energized. 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 that specified above, the cause of the low reading shall be determined and removed. Corrective measures shall include dry-out procedure by means of heaters if equipment is found to contain moisture. Where corrective measures have been necessary and the insulation resistance reading taken after the correction has been made it should satisfy the requirements specified herein. Repeated insulation resistance maintenance test shall be made twice and at least 12 hours apart. The maximum range for each reading on the 3 successive tests shall not exceed 20% of the average value. After all tests have been made successfully, the equipment shall be reconnected.

1.17.3 Earth Resistance Tests

The Contractor shall make each resistance tests on the Earthing system, separating and re-connecting each earth connection as may be required by the Engineer.

1.18 TELEPHONE AND INTERCOM SYSTEM**1.18.1 General**

The work included under this section consists of furnishing all labour, materials, services and skilled supervision necessary for the construction erection, installation and connection of all facilities specified herein or shown on the drawings and or normally required for the complete telephone and Intercom system and its delivery to the Employer upon completion in all respects and ready for use except telephone/intercom sets.

1.18.2 Telephone Services

The telephone services entrance locations shall be coordinated with the Pakistan Telegraph and Telephone Department. This installation shall include.

a) Main Telephone Cable Entry into Building:

This shall consist of G.I Pipe for loading the cable into telephone junction box located inside the building. The Contractor shall coordinate the actual specific details with the Pakistan Telegraph Department.

b) Pull wire shall be furnished and installed in the duct line as recommended by Pakistan Telegraph and Telephone Department.

1.18.3 Telephone And Intercom Conduit Systems

a) The telephone and intercom conduit system including telephone feeder conduit and outlet boxes shall be furnished and installed as shown on the drawings.

b) Underfloor trunking

Telephone floor trunking shall be installed in PVC ducting in the floor slab.

c) Junction boxes

Junction boxes of dimension approx. 150 x 150 mm or Standard sizes available shall be made of 16 SWG (1.63mm) mild steel according to the relevant standard.

d) Distribution box

Distribution point boxes incl. sub-distribution boxes shall be constructed from galvanized mild steel sheets of thickness 1.50 mm and with 12 mm thick plywood backing for terminal tag mounting / heavy duty plastic suitable also for wall mounting. Distribution boxes shall have the same number of ways indicated in the drawings and shall comply with the necessary number of jumper rings.

e) Type of cables

The cables shall be suitable for operation on a 50V DC service for use in the telephone installation system

The cables shall comprise the necessary numbers of wires, each PVC insulated, laid up in pairs and served with an extruded PVC sheath

The conductor shall comprise tinned annealed copper wires, smooth drawn, pliable, uniform in quality and free from all defects, having a min. diameter of 0.5 mm or 0.63 mm.

Insulation of conductors, colour coded as per standards and codes.

f) Wiring points

All telephone points shown in the drawings shall be provided with cables. The number of cables cores required can be calculated acc. to the required number of points incl. 20% spare for each main-section.

Every final point shall be terminated to an approved plug-in unit from its junction box.

g) Earthing

The earthing system consist of earthing termination points, inspection chambers and covers and interconnected 1,5mm x 20mm (0.0625" x 0.75") copper tape between termination points.

The earthing termination points shall consist of 16mm x 5,5m (0.625" dia x 18ft. length) copper rods driven into the ground. The total earthing resistance of the complete system shall not exceed 5 Ohms.

1.18.4 Make:

Telephone Cables :

Siemens Germany
Pakistan Cables
Clipsal

Telephone Junction Boxes:

Hussain & Co.
Sunbeam Engineer
Clipsal
Babar – Brothters.

1.19 FIRE DETECTION AND ALARM SYSTEM**1.19.1 Description:**

- A. This section of the specifications includes the furnishing, installation, and connection of the microprocessor-controlled fire alarm equipment required to form a complete coordinated system. It shall include, but not be limited to, alarm initiating devices, alarm notification appliances, control panel, auxiliary control devices, annunciators, power supplies, and wiring as shown on the drawings and specified herein.
- B. The fire alarm system shall comply with requirements of NFPA Standard No. 72 except as modified and supplemented by this specification. The system shall be electrically supervised and monitor the integrity of all conductors.
- C. Basic System Functional Operation
 - 1. Alarm Detection: When an alarm condition is detected by one of the system initiating devices, the following functions shall immediately occur:
 - a. The System Alarm LED on the panel shall flash.
 - b. A local sounding device in the panel shall be activated.
 - c. The corresponding LED on the initiating zone(s) in alarm shall flash.
 - d. All automatic programs assigned to the alarm point shall be executed and the associated indicating devices and relays activated. As each indicating circuit or control relay is activated, its green LED shall be illuminated.
 - e. If used, the Remote Signaling (NFPA 72C) or Municipal Tie (NFPA 72 B) connection shall be activated.
 - 2. System Trouble Detection: When a trouble condition is detected by one of the system initiating or indicating circuits, the following functions shall immediately occur:
 - a. The System Trouble LED shall flash.
 - b. A local sounding device in the panel shall be activated. This sound shall be distinct from the alarm sound from this device.
 - c. The trouble LED for the corresponding initiating or indicating circuit shall flash on its respective module. If the trouble condition is caused by a CPU or Power Supply Trouble, the corresponding LED on the CPU shall flash.

1.19.2 Guaranty:

All work performed and all material and equipment furnished under this contract shall be free from defects and shall remain so for a period of at least one (1) year from the date of acceptance.

1.19.3 Contract Maintenance:

- A. Complete maintenance and repair service for the fire alarm system shall be available from a factory trained authorized representative of the manufacturer of the major equipment for a period of five (5) years after expiration of the guaranty.
- B. As part of the submittal work, include a quote for a maintenance contract to provide all maintenance test and repair as required after the warranty period. Include also a quote of hourly rates, response time and technician travel costs. Submittals which do not include a complete statement of maintenance costs will not be accepted.

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1.19.4 Applicable Publications:

The publications listed below form a part of this specification. The publications are referenced in text by the basic designation only.

A. National Fire Protection Association (NFPA) - USA:

- No. 70-90 National Electrical Code (NEC)
- No. 71-89 Central Station Signaling Systems
- No. 72-90 Protective Signaling Systems
- No. 72E-90 Automatic Fire Detectors
- No. 72G-89 Notification Appliances for Protective Signaling Systems
- No. 72H-88 Testing Procedures for Signaling Systems.
- No. 101-91 Life Safety Code

B. Underwriters Laboratories Inc. (UL) - USA:

- No. 50 Cabinets and Boxes, May 16, 1987
- No. 268 Smoke Detectors for Fire Protective Signaling Systems, July 20, 1987
- No. 864 Control Units for Fire Protective Signaling Systems, May 26, 1987
- No. 268A Smoke Detectors for Duct Applications.
- No. 521 Heat Detectors for Fire Protective Signaling Systems.
- No. 228 Door Closers-Holders for Fire Protective Signaling Systems.
- No. 464 Audible Signaling Appliances.
- No. 38 Manually Actuated Signaling Boxes.
- No. 346 Waterflow Indicators for Fire Protective Signaling Systems.
- No. 1481 Power supplies for Fire Protective Signaling Systems.
- No. 1971 Visual Indicating Appliances.

C. Local and State Building Codes**D. All requirements of the Authority Having Jurisdiction (AHJ).****1.19.5 Approvals:****A. Each system must have proper listing and/or approval from the nationally recognized agency responsible for the particular area.**

- UL Underwriters Laboratories, Inc.
- FM Factory Mutual
- ULC Underwriters Laboratories Canada

- B. The Fire Alarm Control, Panel shall meet the modular listing requirements of Underwriters Laboratories Inc. Each subassembly of the FACP, including all printed circuit boards, shall include the appropriate UL modular label.

1.19.6 Make:

Gent (UK), Simplex (USA), Deota (Italian).

1.20 SOLAR POWER EQUIPMENT

Solar PV system should consist of following equipment:

- i. Solar Power Generation system consisting of required number of PV Modules.
- ii. Efficient On-Grid/Hybrid Inverters
- iii. Mounting structures
- iv. Cables and hardware
- v. Miscellaneous Item
 - a. Junction box and distribution boxes
 - b. Earthing kit
 - c. Lightning arrestors
 - d. PVC pipes and accessories
 - e. Control room and civil pedestals

The supplied equipment must comply the below mentioned specifications:

PANEL MOUNTING STRUCTURE

- (i) The PV solar panel mounting metallic structure should be fixed mount L2 or L3 structure where required with 12 Gauge thickness, mounted on concrete base 6 inches above ground level. The tilt angle should set to year round compromise (Equal to latitude).
- (ii) The entire mechanical structure should be hot dipped galvanized and powder coated for longer life of the structure. Structure should be hot dip galvanized upto 90 micrones.
- (iii) The Surface azimuth angle of PV Module 180° and the Tilt angle (slope) of PV Module should be according to the site location.
- (iv) The mounting structure must be engineered for wind resistance and safety as per geographical location of site.
- (v) Module should be fixed with the frame through SS bolts. The bolts should be tightened at the required angle.
- (vi) The Nuts, Bolts & Washers for modules & Mounting structures must be stainless steel material with appropriate gauge.
- (vii) Shading shall be avoided all over the year (around) from 30 minutes after the sunrise to 30 minutes before sunset (For installation purpose only).
- (viii) To allow regular cleaning of the solar modules, they should be easily accessible for personnel (For installation purpose only).

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PV MODULE

- (i) The provided PV Module should be of best quality available in market. The PV module should have over nineteen percent (19%) cell efficiency.
- (ii) The PV module(s) shall contain Mono crystalline (PERC) silicon solar cells.
- (iii) The PV module have an ability to Works well with high-voltage input Inverters/ charge controllers
- (iv) The PV Panel must have clear anodized aluminum frame with Anti-reflection cover glass.
- (v) The power output of the module(s) under STC should be at optimum level.
- (vi) The operating voltage corresponding to the power output must be mentioned.
- (vii) The open circuit voltage of the PV modules under STC must be mentioned.
- (viii) The terminal box on the module should have a provision for opening for replacing the cable, if required and it should be waterproof
- (ix) The Solar Panel shell meet the requirement set in IEC 61215:2000, IEC61730, IEC TS 62941.
- (x) A specification sheet containing the following details should be laminated on module so as to be clearly visible from front/back side.
 - (a) Name of the manufacturer or distinctive logo.
 - (b) Model or Type No.
 - (c) Serial number
 - (d) Year of manufacturing
 - (e) Peak Watt Rating
 - (f) Voltage and Current at Peak Power
 - (g) Open Circuit Voltage
 - (h) Short Circuit Current
 - (i) Maximum input voltages
- (xi) Limited performance guarantees: panel power, in standard conditions, should not be less than 90% of nominal power for first 10-years of operation and at least 80% for the 20 years of operation with 12-year product warranty and 25- year linear power warranty.
- (xii) Solar panel should have to pack for safe transportation on non-metallic roads.

Note: Bidder should justify the specs with appropriate lab test reports / certifications from the principle manufacturer.

POWER AND CONTROL CABLES

Power Cables of adequate rating as per IEC standard shall be required for interconnection of:

- Modules/panels within array
 - Array & Hybrid Inverter
 - Charge Controller & Battery
 - Automatic Distribution Box & Loads
- (i) The cable shall be A grade, heavy duty, stranded flexible copper conductor, PVC type A insulated, galvanized steel wire/strip armored, flame retardant low smoke (FRLS) extruded PVC type ST-1 outer sheathed. The cables shall, in general conform to IS-1554 P+I & other relevant standards.
- (ii) External cables should be specifically adapted to outdoor exposure (see IEC 60811). Especially the outer insulation must be sunlight (UV)-resistant, weatherproof and designed for underground installation. Preferably rubber-coated and PE-coated cables shall be used.
- (iii) The temperature resistance of all interconnecting wires and cables should be $> 75^{\circ}\text{C}$. The minimum acceptable cross-section of the wire in each of the following sub-circuits is as in ISO IEC prescription:
- (iv) Notwithstanding the ISO /IEC requirements, all wires must be sized accordingly to keep line voltage losses to less than 3% between PV generator and battery, less than 1% between battery and charge regulator, and less than 3% between battery and load, all of them at the maximum current conditions. (specifically for service providers)
- (v) All wiring shall be color-coded (and/ labeled in case of service providers)
- (vi) All supplied wires must be in UV-resistant conduits or be firmly fastened to the building and/or support structure. Cable binders, clamps and other fixing material must also be UV-resistant, preferably made of polyethylene.(for the case of service providers)
- (vii) All connections should be properly terminated, soldered and/or sealed using MC4 connectors for outdoor and indoor elements. Relevant codes and operating manuals must be followed.

Inverters

The DC power produced is fed to inverter for conversion into AC. In a grid interactive system AC power should be fed to the grid at three phase bus. Inverter should comply with IEC 61683/IS 61683 for efficiency and measurements and should comply IEC 60068-2 (1, 2, 14, 30) / Equivalent BIS Standard for environmental testing. Inverter should supervise the grid condition continuously and in the event of grid failure (or) under voltage (or) over voltage, Solar System should be disconnected to share with National Grid circuit Breaker / Auto switch provided in the inverter. Two types of inverters i.e. Grid Tie and Hybrid Inverters has been recommended based on the site design. Technical specifications of both the inverters has been mentioned below:-

Grid-Tied Inverters/ On-Grid Inverters

Important Features/Protections required in the Grid-Tie Inverter are-

- (i) The grid-connected inverters shall comply with UL 1741 standard.
- (ii) Power generated from the solar system during the day time is utilized fully by powering the all building loads and feeding excess power to the grid as long as grid is available. In cases, where solar power is not sufficient due to more demand or cloud cover etc. the building loads should be served by drawing power from the grid. The inverter should always give preference to the Solar Power and will use Grid power only when the Solar Power is insufficient to meet the load requirement.

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- (iii) The output of the inverter must synchronize automatically its AC output to the exact AC voltage and frequency of the grid.
- (iv) Inverter equipped with array ground fault detection option.
- (v) Grid voltage should also be continuously monitored and in the event of voltage going below a pre-set value and above a pre-set value, the solar system should be disconnected from the grid within the set time. Both over voltage and under voltage relays should have adjustable voltage (50% to 130%) and time settings (0 to 5 seconds).
- (vi) Metal Oxide Visitors (MOVs) should also be provided on DC and AC side of the inverter.
- (vii) The inverter control unit should be so designed so as to operate the PV system near its maximum Power Point (MPP), the operating point where the combined values of the current and voltage of the solar modules result in a maximum power output.
- (viii) The inverter should be a pure sine wave inverter for a grid interactive PV system.
- (ix) The degree of protection of the outdoor inverter panel should be at least IP-65.
- (x) Typical technical features of the suggested inverters must mention as per following sequence.
 - Continuous output power rating (1.1 times for 60seconds)
 - Nominal AC output voltage and frequency
 - Accuracy of AC voltage control $\pm 1\%$
 - Accuracy of frequency control $\pm 0.5\%$
 - Grid Frequency Control range ± 3 Hz
 - Maximum Input DC Voltage range
 - MPPT Range DC
 - Ambient temperature -10 deg C to 55 deg C
 - Humidity 95 % non- condensing
 - Protection of Enclosure IP-65 (minimum)
 - Grid Voltage tolerance -20 % and + 15 %
 - Power factor control 0.95 inductive to 0.95 capacitive
 - No-load losses < 1% of rated power
 - Inverter efficiency (minimum) plus 97%
 - Liquid crystal display should at least be provided on the inverters front panel or on separate data logging/display device to display following
 - a. DC Input Voltage
 - b. DC Input current
 - c. AC Power output(kW)

- d. Current time and date
 - e. Time active
 - f. Time disabled
 - g. Time Idle
 - h. Temperatures (C)
 - i. Converter status
 - Following should also be displayed like Protective function limits, Over voltage, AC under voltage, Over frequency, under frequency, ground fault, PV starting voltage, PV stopping voltage, over voltage delay, under voltage delay over frequency, ground fault delay, PV starting delay, PV stopping delay.)
- (xi) Nuts & bolts and the inverter enclosure should have to be adequately protected taking into consideration the atmosphere and weather prevailing in the area.
 - (xii) Dimension and weight of the inverter should be indicated by the bidder in the offer.
 - (xiii) All doors, covers, panels and cable exits should be gasketed or otherwise designed to limit the entry of dust and moisture. All doors should be equipped with locks.
 - (xiv) Operation Mode:
 - (xv) Night or sleep mode: where the Inverter is almost completely turned off, with just the timer and control system still in operation, losses shall be less than 2 W per 5 kW.
 - (xvi) Standby mode: where the control system continuously monitors the output of the solar generator until pre-set value is exceeded (typically 10 W).
 - (xvii) Operational of MPP tracking mode: the control system continuously adjusts the voltage of the generator to optimize the power available. The power conditioner should automatically re-enter standby mode input power reduces below the standby mode threshold. Front panel should provide display of status of the inverter.

Grid Tied Hybrid Inverter

Hybrid inverter(s) (system configuration) with provision for net-metering and battery back-up, should convert DC power produced by SPV modules in to AC power and adjust the voltage & frequency levels to suit the local grid conditions. Pure Sine wave output. Ground Fault Protection. Residual Current Detection (RCD) protection. Monitoring software for real-time status display and fault control. The unit should be able to operate in a high ambient temperature environment. Efficiency must be 96% or above at full load. The inverter must conform to the latest edition of IEC 61727, IEC 61000-6-1, IEC 610006-2, IEC 62109 and IEC 62116 standards Other important Features/Protections required in the INVERTER

- (i) The grid-connected hybrid inverters shall comply with UL 1741 standard.
- (ii) Power generated from the solar system during the daytime should be utilized fully by powering the critical building loads and feeding excess power to the grid as long as grid is available. In cases, where solar power is not sufficient due to more demand or cloud cover etc. the building loads should be served by drawing power from the grid. The inverter should always give preference to the Solar Power and will use Grid/DG power only when the Solar Power is insufficient to meet the load requirement.
- (iii) The output of the hybrid inverter must synchronize automatically its AC output to the exact AC voltage and frequency of the grid.
- (iv) Inverter equipped with array ground fault detection option.

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- (v) The offered On-Grid Inverter must be of Hybrid type has an ability to synchronize with battery bank as backup system.
- (vi) On-grid hybrid Inverters should have anti-islanded features built in and should continuously monitor the condition of the grid and in the event of grid failure; the inverter automatically switches to off-grid supply within 20-50 milliseconds and synchronize with battery bank and fulfil shortcoming from battery bank as PV-Battery hybrid system. The solar system should be resynchronized with the grid within two minutes after the restoration of grid or DG set.
- (vii) Grid voltage should also be continuously monitored and in the event of voltage going below a pre-set value and above a pre-set value, the solar system should be disconnected from the grid within the set time. Both over voltage and under voltage relays should have adjustable voltage (50% to 130%) and time settings (0 to 5 seconds).
- (viii) The inverter control unit should be so designed so as to operate the PV system near its maximum Power Point (MPP), the operating point where the combined values of the current and voltage of the solar modules result in a maximum power output.
- (ix) The inverter should be a true sine wave for a grid interactive PV system.
- (x) The degree of protection of the outdoor inverter panel should be at least IP-65.
- (xi) Typical technical features of the suggested inverters must mention as per following sequence.
- Continuous output power rating (1.1 times for 60seconds)
 - Nominal AC output voltage and frequency
 - Accuracy of AC voltage control $\pm 1\%$
 - Accuracy of frequency control $\pm 0.5\%$
 - Grid Frequency Control range ± 3 Hz
 - Maximum Input DC Voltage range
 - MPPT Range DC
 - Battery Input voltages + 48 VDC or Plus
 - Ambient temperature -10 deg C to 55 deg C
 - Humidity 95 % non- condensing
 - Protection of Enclosure IP-55 (minimum)
 - Grid Voltage tolerance -20 % and + 15 %
 - Power factor control 0.95 inductive to 0.95 capacitive
 - No-load losses < 1% of rated power
 - Inverter efficiency (minimum) plus 97%
 - Following should also be displayed like Protective function limits, Over voltage, AC under voltage, Over frequency, under frequency, ground fault, PV starting voltage, PV stopping voltage, over voltage delay, under voltage delay over frequency, ground fault delay, PV starting delay, PV stopping delay.)

Note: Bidder should justify the specs with appropriate lab test reports/certifications from the principle manufacturer.

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SYNCHRONIZING EQUIPMENT

Solar PV systems should be provided with synchronizing equipment having three input for comparison i.e. grid supply vs. solar output, DG output vs solar output so as to connect the Solar PV systems in synchronism with grid or DG. In case of grid failure, solar PV system should be disconnected from the grid and out of synchronization for a period DG supply is not restored. PV system should be synchronized with the DG supply after DG is started.

PROTECTIONS AND CONTROL

- (i) PV system software and control system should be equipped with islanding protection as described above. In addition to disconnection from the grid (islanding protection i.e. on no supply) , under and over voltage conditions , PV systems should be provided with adequate rating fuses, fuses on inverter input side (DC) as well as output side (AC) side for overload and short circuit protection and disconnecting switches to isolate the DC and AC system for maintenances are needed. Fuses of adequate rating should also be provided in each solar array module to protect them against short circuit.
- (ii) A manual disconnect switch and change over switch beside automatic disconnection to grid should also be provided at utility end to isolate the grid connection by the utility personal to carry out any maintenance. This switch should be locked by the utility personal.

INTEGRATION OF PV POWER WITH GRID:

The output power from Solar PV system would be fed to the Hybrid inverter which feed some portion to battery bank for backup in case of grid failure and major portion converts DC produced by SPV array to AC and feeds it into the main electricity grid after synchronization. In case of grid failure, or low or high voltage, solar PV system shall be out of synchronization and shall be disconnected from the grid and feed power to the load as PV-Battery backup hybrid system. Once the DG set comes into service PV system shall again be synchronized with DG supply and load requirement would be met to the extent of availability of power. The connection of the grid connected SPV power plant with the existing power supply system is shown in the diagram stated below

HARMONICS STANDARD:

As per the standard of IEEE 519, the permissible individual harmonics level shall be less than 3% (for both voltage and current harmonics) and Total Harmonics Distortion (THD) for both voltage and current harmonics of the system shall be less than 5%.

BATTERY BOX

- i) The battery bank should be housed in a vented compartment that prevents users from coming in contact with batteries terminals. This compartment should be strong enough to accommodate the weight of the batteries. A mechanism to prevent opening and entry of the batteries should be provided.
- ii) The entire enclosure must be constructed to last at least twenty years without maintenance and should be protected against corrosion. The battery Bank enclosure should have a clean and neat appearance.

BATTERY

Lithium-ion batteries of appropriate capacity with complete battery management system should be used in hybrid and off grid system where required.

The following testing information must be provided by the bidders:

- (i) Charge/Discharge Efficiency
- (ii) Self-Discharge
- (iii) The batteries must conform to the latest edition of IEC 62133 and/or IEC 61960 (whichever is applicable).
- (iv) The battery bank should provide backup to a critical load of building.
- (v) The battery must ensure safe and reliable operation in the whole range of ambient temperatures from -10° C to + 50° C.
- (vi) The maximum permissible self-discharge rate is 5 percent of rated capacity per month at 25 C.
- (vii) Cycle life of the batteries must be greater than 6000 when discharged down to depth of discharge (DOD) of 80% percent discharge rate.
- (viii) The battery shall have a certificate of compliances, issued by a recognized laboratory.
- (ix) Batteries should be packaged in order to withstand transportation on non-metallic road.
- (x) The performance guarantee shall cover at least 05 years.

Note: Bidder should justify the specs with appropriate lab test reports / certifications from the principle manufacturer.

MISCELLANEOUS ITEMS FOR INSTALLATION

EARTHING MATERIAL:

- (i) Earthing is essential for the protection of the equipment & manpower. Two main grounding must be used for power equipment protection are:
 - DC Earthing
 - AC Earthing
- (ii) DC and AC earthing should be installed separately where required as per standard.
- (iii) In case of equipment earth all the non-current carrying metal parts are bonded together and connected to earth to prevent shock to the man power & also the protection of the equipment in case of any accidental contact.
- (iv) To prevent the damage due to lightning the terminal of the lightning protection must be earthed separately. The provision for lightning & surge protection of the solar PV power source is required to be made as per standard.
- (v) In case the solar PV Array could not installed close to the equipment to be powered & a separate earth has been provided for solar PV Panel.
- (vi) Earth resistance shall not be more than 3 ohms. It shall be ensured that all the earths are bonded together to make them at the same potential.
- (vii) The Earthing conductor rating shall be rated for the maximum short circuit current. & shall be 1.56 times the short circuit current. The area of cross-section shall not be less than 2.5 sq. mm in any case.

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- (viii) The array structure of the PV modules shall be grounded properly using adequate numbers of earthing pits. All metal casing/ shielding of the plant shall be thoroughly grounded to ensure safety of the power plant.

WIRING PVC/GI CHANNEL DUCTS

A product of good quality standard material with suitable size to be provided / used.

FLEXIBLE PVC PIPE

The flexible PVC pipe should be of good quality material with suitable size should be used.

COMBINER BOX

Combiner Box should be manufactured through GI material with 100% copper strip in it for termination of PV Arrays must be IP65 for outdoor installation.

JUNCTIONS BOXES OR COMBINERS

Dust, water and vermin proof junction boxes of adequate rating and adequate terminal facility made of fire resistant Plastic (FRP) shall be provided for wiring.

Each solar shall be provided with fuses/ Circuit breakers of adequate rating to protect the solar arrays from accidental short circuit.

CIVIL WORKS

The following civil works should be carried out.

- (i) Site grading, levelling, drilling exploratory bore holes and consolidation of the area pertaining to the installation of SPV modules.
- (ii) Embedment of structures suitable for mounting PV modules.
- (iii) Laying of earthing equipment /structures and connecting to the main ground as per the statutory requirements.
- (iv) Construction of control room
- (v) Cutting of cable trenches etc. wherever necessary

OTHER FEATURES:

- (i) The PV Module(s) should be warranted for a minimum period of 10 years from the date of supply, inverter with five years and the battery should be warranted for a period of 5 years from the date of installation. The warranty card to be supplied with the system must contain the details of the system. The manufacturers can also provide additional information about the system and conditions of warranty as necessary.
- (ii) Adequate space should be provided behind the PV module/array for allowing unobstructed airflow for passive cooling.
- (iii) Cable of appropriate size should be utilized to keep electrical losses to a bare minimum.
- (iv) The control electronics should not be installed directly with the battery. All wiring should be in proper conduit of capping casing. Wire should not be hanging loose.

(v) Instruction and O&M manuals

- Two copies of Instruction and Operation and Maintenance Manual in English and the local language should be provided with the system.
- The manual shall be furnished at the time of dispatch of the equipment and shall include the following aspects:
 - (a) Precautions during unpacking
 - (b) Instructions for handling at site
 - (c) Erection drawings with written assembly instructions that would enable the Purchaser to carry out erection with his own personnel if opted by him.
 - (d) Detailed instructions and procedures for the installation operation and maintenance.
 - (e) Pre-commissioning tests.
 - (f) About solar PV system – its components and expected performance.
 - (g) Principle of Operation of various equipment
 - (h) Safety and reliability aspects
 - (i) About power conditioning unit's software and controls
 - (j) Clear instructions on regular maintenance and trouble shooting of solar power plant.
 - (k) Name and address of the person or service centre to be contacted in case of failure or complaint.
 - (l) Outline dimension drawings showing relevant cross sectional views, earthing details, constructional features. Rated voltages and current etc.

Technical and interconnection requirements

Overall conditions of service	State Distribution/Supply Code	State Distribution/Supply Code
Overall Grid Standards	Central Electricity Authority (Grid Standard) Regulations 2010	Central Electricity Authority (Grid Standard) Regulations 2010
Equipment	BIS / IEC / IEEE	BIS / IEC / IEEE
Meters	Central Electricity authority (Installation & operation of meters) Regulation 2006 as amended time to time	Central Electricity authority (Installation & operation of meters) Regulation 2006 as amended time to time
Safety and supply	Central Electricity Authority(measures of safety and electricity supply) Regulations, 2010	Central Electricity Authority(measures of safety and electricity supply) Regulations, 2010
Harmonic Requirements Harmonic Current	IEEE 519 CEA (Technical Standards for Connectivity of the Distributed Generation Resources) Regulations 2013	IEEE 519 CEA (Technical Standards for Connectivity of the Distributed Generation Resources) Regulations 2013
Synchronization	IEEE 519 CEA (Technical Standards for Connectivity of the Distributed Generation Resources) Regulations 2013	Photovoltaic system must be equipped with a grid frequency synchronization device. Every time the generating station is synchronized to the

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		electricity system. It shall not cause voltage fluctuation greater than +/- 5% at point of connection.
Voltage	IEEE 519 CEA (Technical Standards for Connectivity of the Distributed Generation Resources) Regulations 2013	The voltage-operating window should minimize nuisance tripping and should be under operating range of 80% to 110% of the nominal connected voltage. Beyond a clearing time of 2 second, the photovoltaic system must isolate itself from the grid.
Flicker	IEEE 519 CEA (Technical Standards for Connectivity of the Distributed Generation Resources) Regulations 2013	Operation of Photovoltaic system should not cause
Frequency	IEEE 519 CEA (Technical Standards for Connectivity of the Distributed Generation Resources) Regulations 2013	When the Distribution system frequency deviates outside the specified conditions (50.5 Hz on upper side and 47.5 Hz on lower side), There should be over and under frequency trip functions with a clearing time of 0.2 seconds.

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DC injection	IEEE 519 CEA (Technical Standards for Connectivity of the Distributed Generation Resources) Regulations 2013	Photovoltaic system should not inject DC power more than 0.5% of full rated output at the interconnection point or 1% of rated inverter output current into distribution system under any operating conditions.
Power Factor	IEEE 519 CEA (Technical Standards for Connectivity of the Distributed Generation Resources) Regulations 2013	The photovoltaic system in the event of fault, voltage or frequency variations must island/disconnect itself within IEC standard on stipulated period.
Overload and Overheat	IEEE 519 CEA (Technical Standards for Connectivity of the Distributed Generation Resources) Regulations 2013	The inverter should have the facility to automatically switch off in case of overload or overheating and should restart when normal conditions are restored.
Paralleling Device	IEEE 519 CEA (Technical Standards for Connectivity of the Distributed Generation Resources) Regulations 2013	Paralleling device of photovoltaic system shall be capable of withstanding 220% of the normal voltage at the interconnection point.

Any minor equipment and material may not be specifically mentioned in this specifications but are required to make the system complete in a every respect in accordance with technical specification shall be deemed to have been covered under the scope of this specification and shall be provided by the tenderer/supplier within the quoted

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1.21 PRODUCTS**1.21.1 Equipment And Material, General:**

- A. All equipment and components shall be new, and the manufacturer's current model.
- B. All equipment and components shall be installed in strict compliance with manufacturers' recommendations.
- C. All Equipment shall be attached to walls and ceiling/floor assemblies and shall be held firmly in place. (e.g., detectors shall not be supported solely by suspended ceilings). Fasteners and supports shall be adequate to support the required load.

1.21.2 Conduit And Wire:**A. Conduit:**

- 1. Conduit shall be in accordance with The National Electrical Code (NEC), local and state requirements.
- 2. Conduit fill shall not exceed 40 percent of interior cross sectional area where three or more cables are contained within a single conduit.
- 3. Cable must be separated from any open conductors of Power, or Class 1 circuits, and shall not be placed in any conduit, junction box or raceway containing these conductors, as per NEC Article 760-29.
- 4. Conduit shall be 3/4 inch (19.1mm) minimum.
- 5. Conduit shall not enter the Fire Alarm Control Panel, or any other remotely mounted Control Panel equipment or backboxes, except where specified by the factory.

B. Power Supply:

- 1. The Main Power Supply for the Fire Alarm Control Panel shall provide all control panel and peripheral device power needs, as well as 3 amperes of 24 VDC power for Audio-Visual alarm indicating devices.
- 2. Provisions will be made to allow the Audio-Visual power to be increased as required by adding modular expansion Audio-Visual power supplies. All Power Supplies shall meet UL and NFPA requirements for power-limited operation on all indicating and initiating circuits.
- 3. Positive-temperature-coefficient thermistors, circuit breakers, or other over-current protection shall be provided on all power outputs. The power supply shall provide an integral battery charger for use with batteries up to 25 AH, or may be used with external battery and charger systems. Battery arrangement may be configured in the field.

- 4. The Main Power Supply shall continuously monitor all field wires for Earth Ground conditions, and shall have the following LED indications:

Negative Ground Fault LED

Positive Ground Fault LED

Battery Fail LED

AC Power Fail LED

- 5. The power supply shall include provisions to add battery voltmeter and ammeter.

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C. Duct Smoke Detectors:

Duct Smoke Detectors shall be 24 VDC type with visual alarm and power indicators, and a reset switch. Each detector shall be installed upon the composite supply/return air ducts(s), with properly sized air sampling tubes.

D. Automatic Heat Detectors:

1. Automatic Heat Detectors shall be combination rate of rise and fixed temperature rated at 135 degrees Fahrenheit for areas where ambient temperatures do not exceed 100 degrees, and 200 degrees for areas where the temperature does not exceed 150 degrees.
2. Automatic Heat Detectors shall be low profile, ceiling mount type with positive indication of activation.
3. The rate of rise element shall consist of an air chamber, a flexible metal diaphragm, and a factory calibrated, moisture-proof, trouble free vent, and shall operate when the rate of temperature rise exceeds 15 degrees F. per minute.
4. The fixed temperature element shall consist of a fusible alloy retainer and actuator shaft.
5. Automatic Heat Detectors shall have a smooth ceiling rating of 2500 square feet.

E. Water flow Switches:

1. Shall be integral, mechanical, non-coded, non-accumulative retard type.
2. Shall have an alarm transmission delay time which is conveniently adjustable from 0 to 60 seconds. Initial settings shall be 30-45 seconds.
3. All water flow switches shall be of a single manufacturer and series.
4. Water flow switches shall be provided and connected under this section and installed by the mechanical contractor.
5. Where possible locate flow switches a minimum of one (1) foot from a fitting which changes the direction of the flow and a minimum of three (3) feet from a valve.

F. Sprinkler and Standpipe Valve Supervisory Switches:

1. Each sprinkler system water supply control valve riser or zone control valve, and each standpipe system riser control valve shall be equipped with a supervisory switch. Standpipe hose valves, and test and drain valves shall not be equipped with supervisory switches.
2. PIV (post indicator valve) or main gate valve shall be equipped with a supervisory switch.
3. Mount switch so as not to interfere with the operation of the valve and adjust to operate within two revolutions toward the closed position of the valve control, or when the stem has moved no more than one-fifth of the distance from its normal position.

4. The mechanism shall be contained in a weatherproof aluminum housing, which shall provide a 3/4 inch conduit entrance and incorporate the necessary facilities for attachment to the valves.
5. Switch housing to be finished in red baked enamel.
6. The entire installed assembly shall be tamper proof and arranged to cause a switch operation if the housing cover is removed, or if the unit is removed from its mounting.
7. Valve supervisory switches shall be provided and connected under this section and installed by mechanical contractor.

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1.22 EXECUTION**1.22.1 Installation:**

- A. Installation shall be in accordance with the NEC, NFPA 72, local and state codes, as shown on the drawings, and as recommended by the major equipment manufacturer.
- B. All conduit, junction boxes, conduit supports and hangers shall be concealed in finished areas and may be exposed in unfinished areas. Smoke detectors shall not be installed prior to the system programming and test period. If construction is ongoing during this period, measures shall be taken to protect smoke detectors from contamination and physical damage.
- C. All fire detection and alarm system devices, control panels and remote annunciators shall be flush mounted when located in finished areas and may be surface mounted when located in unfinished areas.

1.22.2 Test:

Provide the service of a competent, factory-trained engineer or technician authorized by the manufacturer of the fire alarm equipment to technically supervise and participate during all of the adjustments and tests for the system.

- 1. Before energizing the cables and wires, check for correct connections and test for short circuits, ground faults, continuity, and insulation.
- 2. Close each sprinkler system control valve and verify proper supervisory alarm at the FACP.
- 3. Verify activation of all flow switches.
- 4. Open initiating device circuits and verify that the trouble signal actuates.
- 5. Open and short indicating appliance circuits and verify that the trouble signal actuates.
- 6. Ground initiating device circuits and verify response of trouble signals.
- 7. Check all alarm notification devices.
- 8. Check installation, supervision, and operation of smoke detectors.
- 9. Verify that each initiating device alarm signal is properly received and processed by the fire alarm control panel (Walk Test).
- 10. Conduct tests to verify trouble indications for common mode failures, such as alternating current power failure. Consult the manufacturer's manual for other common mode failures and conduct the described testing procedures.

1.22.3 Final Inspection:

At the final inspection a factory trained representative of the manufacturer of the major equipment shall demonstrate that the systems function properly in every respect.

1.22.4 Instruction:

Provide instruction as required to the building personnel and fire and safety personnel. "Hands-on" demonstrations of the operation of the system shall be provided.

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SPECIFICATIONS
FOR
PLUMBING WORKS

PLUMBING WORKS

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SPECIFICATIONS FOR PLUMBING WORKS

1.1 Water Supply Piping and Specialties:

1.1.1 Scope of Work:

The Contractor shall furnish all labour, materials, tools, and equipment to complete the plumbing work and plumbing services as shown on drawings and as herein described, ready for service to the satisfaction of the Consultants.

The work includes, in general, the following:

- (i) Cold Water, Water Piping Systems.
- (ii) All valves, strainers, etc., shown, specified or needed.
- (iii) Services and connections to utilities.
- (iv) Other items as may be specified or shown on the drawings.

1.1.2 Piping Material:

Cold water and Hot Water Piping shall be galvanized steel conforming to BSS 1387 of 1967 (Medium Weight) as manufactured by Karachi Pipe Mills (KPM) or International Industries Limited (IIL). Pipe below 100mm dia shall be threaded and pipes 100mm dia and above shall be provided with threaded galvanized flanged joints conforming to ASA B16.5 suitable for 150 Psi SWP. All elbows, tees, wyes, reducers, unions, etc., shall be galvanized iron fittings of imported China origin. All piping and fittings shall be in perfect condition, without any pitting, corrosion, dents and flattening.

1.1.3 Valves and Strainers:

- (a) Gate Valves upto 50mm shall be with threaded ends, bronze body, with union bonnet, non-rising stem and wedge disc. Hand wheel nut, disc and body shall be of bronze. Hand wheel shall be of malleable iron. Packing shall be graphited asbestos. Stem shall be manganese bronze. Gate valves 65mm and above shall be cast iron body bronze mounted, with flanged ends.

These shall be of the solid wedge disc type, with outside screw and yoke. Body and bonnet shall be of cast iron. Wedge shall be of cast iron with bronze discs. Seat rings shall be bronze. Packing shall be graphited asbestos. Packing gland shall be cast iron. Yoke shall be of cast iron and yoke nuts shall be of bronze. Hand wheel shall be of cast iron.

All valves for water supply services shall be rated for 150 Psi. SWP and 120 C. Valves shall be as manufactured by Kitzawa of Japan.

- (b) Installation: All valves having stem over 7 feet (2m) height shall be provided with galvanized chain operators. Valves in horizontal lines shall be installed with stem horizontal or above. Isolation gate valves shall be installed on each side of each piece of equipment as pumps, and other similar items; at the mid point of all looped mains; and at any other points indicated or as required for draining, isolation or sectionalizing purpose.

Strainers shall be installed wherever necessary to protect equipment and control valves, where proper functioning would be affected by dirt on the seat

or scoring of the seat. Strainers shall be arranged not to clog piping and allow easy dis-connection for change. All strainers 2 inches (50mm) and above shall be provided with 3/4 inch (20mm) dia ball valves for blow-off. Strainers shall allow removal of accumulated dirt and screen replacement without disconnecting main piping.

1.1.4 Installation of Piping, Valves and Fittings:

- (a) General: Pipes shall be cut accurately to measurements established at the job site and worked into place without springing or forcing, properly clearing all windows, doors and other openings. Excessive cutting or other weakening of the building structure to facilitate piping insulation will not be permitted without written approval.

Shop drawings by Contractor shall show locations of all supports, the load imposed on each fastening or anchor, typical details for special anchorages, and details for special anchorages for supports attached to metal roof decking, for suspended piping, valves, tank, pumps, converters, and other mechanical equipment. Supports shall be attached to metal decking. Where supports are required between structural framing members, suitable intermediate metal framing shall be provided and detailed. Pipe shall have burrs removed by reaming and shall be installed to permit free expansion and contraction without damage to joints and hangers. Changes in direction shall be made with fittings, except that bending of pipe 4 inches (100mm) and smaller will be permitted provided a pipe bender is used and wide-sweep bends are formed. The centre line radius of bends shall not be less than 6 diameters of the pipe. Bent pipe showing kinks, wrinkles, flattening or other malformations will not be accepted. All piping shall be installed with sufficient pitch to ensure adequate drainage and venting. Piping connections to equipment shall be provided with unions or flanges. Open ends of pipelines or equipment shall be properly capped or plugged during installation to keep dirt and other foreign matters out of the system.

- (b) Screwed joints shall be used on pipes of diameter 2 inches (50mm) and below. Screwed joints shall be made with tampered threads properly cut. Joints shall be made tight with polytetrafluoroethylene (TEFLON) Tape, or other approved thread joint compound applied to the male thread only. Not more than three threads shall show after the joint is made up.

For galvanized pipe threaded flanges shall be used for 100mm dia pipe and above.

- (c) Flanges and Unions shall be faced true. Flanges shall be provided with 1/16 inch (1.6mm) asbestos gasket, and made square and tight. Union or flange joints shall be provided in each line immediately preceding the connection to each piece of equipment or such as coils, pumps, control valves & other similar items.
- (d) The run and arrangement of all pipes shall be approximately as shown on the drawings and as directed during installation and shall be as straight and direct as possible, forming right angles or parallel lines with building walls and other pipes, and shall be neatly spaced. Offsets will be permitted only where required to permit the pipes to follow wall, standard fittings shall be used for offsets. All risers shall be erected plumb and true, and shall be parallel with walls and other pipes and shall be neatly spaced. This Contractor shall at all times work in conjunction with other contractors in order to avoid interference of pipes and unnecessary cutting of floors and walls. All pipes running underground or concealed in floors or wall construction shall be installed before the construction is closed up.

- (e) All horizontal runs of piping, except where concealed in partitions, shall be kept as high up as possible and close to walls. Consult with other trades so that grouped lines will not interfere with each other. Where plans call for offsets, same shall be kept close to underside of beams and slabs, and run along side of beams, girders of partition.
- (f) The arrangement, positions and connections of pipes, fixtures, drains, valves, etc., as shown on the drawings shall be taken as a close approximation and while they shall be followed as closely as possible the right is reserved by the Architect/ Consultants to change the location etc., to accommodate any conditions which may arise during the progress of work prior to installation without additional compensation to this Contractor for such change. The responsibility for accurately laying out the work and coordinating his installation with other contractors rests with this Contractor. Should it be found that any of his work is laid out so that interference will occur, he shall so report that to the Architect/Consultants.
- (g) All of the pipes shall be concealed in walls, slabs unless otherwise shown on drawings or directed by the Architect/ Consultants.
- (h) Special precaution shall be taken in the installation of piping concealed underground or in the building construction, to see that the piping is properly installed. Should it be necessary to correct piping so installed, this Contractor shall be held liable for any injury caused to other work in the correction of his piping.
- (i) All screwed pipe throughout the job shall be reamed smooth before being installed. Pipe shall not be split, bent, flattened nor otherwise injured either before or during the installation.
- (j) Fixture connections, shown to be installed concealed in building construction, shall in general, be carried concealed to points above floor (near fixtures) where they shall break-out and rise exposed to fixtures, all as required or approved.
- (k) Reducing fittings, unless otherwise approved in special cases, shall be used in making reduction in size of pipe. Bushings will not be allowed unless specifically approved.
- (l) Exterior piping shall not be laid in water or when trench or weather conditions are unsuitable for the work, except by permission of the Architect/Consultants.
- (m) Fittings at bends or tees in buried water pipe lines shall be wedged against concrete thrust block poured between the vertical face of the trench and the fittings, to prevent the fittings from being blow off the lines when under pressure. The size of the blocks shall be based on the working pressure plus 3 bars, the pipe size and the bearing capacity of the soil, all as recommended in the Journal of the American Water Works Association.
- (n) Where chrome plated piping is installed, this Contractor shall cut and thread his pipe so that no unplated pipe threads are visible when the work is complete.
- (o) Unions and flanges shall be provided at suitable intervals to enable easy assembly and disassembly of the pipes. All piping installation shall allow means of easy disassembly for cleaning and maintenance.

1.1.5 Pipe Supports:

- (a) General: Pipe hangers, brackets, saddles, inserts, clamps and pipe rolls including rods, bolts, turn buckles, bases and protection shields shall conform to standard recommended engineering practice. Design generally accepted as exemplifying good engineering practice, using stock or production parts, shall be utilized wherever possible. Chain, wire, strap or other make shift devices will not be permitted as hangers or supports. Pipe hangers shall be capable of supporting the pipe in all conditions of operations. Hangers shall be supported with from beams, clamps, concrete inserts Phillips concrete fasteners, and powder actuated drive pins. Concrete inserts when used shall be installed in the exact location prior to the pouring of the concrete.
- (b) Suspended Horizontal Piping shall be supported by adjustable hangers or supports, which shall provide a means of vertical adjustment after erection. Unless otherwise indicated on drawings maximum spacing between pipe supports for straight runs of pipe shall be in accordance with recommended spacing shown in accordance with recommended spacing shown in the table given below:

Nominal Pipe Size Inches (mm)	0.5 (13)	0.75 (20)	1 (25)	1.5 (40)	2 (50)	2.5 (65)	3 (75)	4 (100)	5 (125)	6 (150)
Maximum Span Feet (Meters)	5 (1.5)	6 (1.8)	7 (2.1)	9 (2.7)	10 (3.0)	11 (3.3)	12 (3.6)	14 (4.2)	16 (4.8)	17 (5.1)
Rod Size dia mm	10	10	10	10	10	13	13	16	16	19

Pipe hangers and supports shall be spaced not over 5 feet (1.5m) apart at heavy fittings and valves. A hanger shall be installed not over 1 foot (0.3m) from each change in direction of piping.

- (c) Vertical Piping shall be guided or supported in the centre of each riser but not over 15 ft. (4.5m) on centres and shall be supported at the base of the riser on a base elbow or tee with a pipe stand only where required.
- (d) Piping in Trenches: Pipes shall rest on suitable wall or floor supports with rollers.
- (e) Pipe Sleeves: Pipes passing through concrete or masonry walls or concrete floors or roofs shall be provided with pipe sleeves fitted into place at the time of construction or afterwards if necessary. Each sleeve shall extend through its respective wall, floor or roof and shall be cut flush with each surface. Sleeves shall be of such size as to provide a minimum of ¼ inch (6mm) all around clearance between bare pipe and sleeve, or between jacket over insulation and sleeve. Sleeves in non-bearing walls shall be steel or cast iron pipe. Sleeves in non-bearing walls, floors, or ceilings may be steel pipe, cast iron pipe or G.I. sheet metal 14 gauge 0.08 inch (2.03mm) with lock type longitudinal seam. Sleeves in bearing walls shall be steel or cast iron pipe. Sleeves in exterior walls and pits shall be of steel and shall have anchor flanges with the space between the pipe and the sleeve caulked water-tight.

1.1.6 Underground Piping:

Piping specified to be laid directly underground or below floors, shall be laid in an excavated trench with a minimum of 450mm of soil cover. The trench bottom shall be smooth and of uniform grade with either undisturbed ground, or a layer of selected and compacted backfill so that no settlement shall be expected. Pipe must bear on this material through its entire length. Where rock is encountered in trench, it shall be removed to a point at least 75mm below the grade line of the trench and the trench shall be backfilled to grade with sand tamped in place. If soft material of poor bearing qualities are found at the bottom of the trench, stabilization shall be achieved by over excavating at least two pipe diameters and bringing up to grade with fine grade or crushed stone or a concrete foundation. Such concrete foundation shall be bedded with sand tamped in place so as to provide a uniform bearing for the pipe between joints.

Care shall be exercised in backfilling trenches. Loose earth free of rocks, broken concrete, broken chips and other rubble shall be placed in the trench in 150mm layers and tamped in place. Care shall be taken to thoroughly compact the backfill under and beside the pipe to be sure that the pipe is properly supported. Proper alignment shall be maintained.

1.1.7 Cutting and Patching:

Cutting will be done under specifications of other trades. This Contractor is called upon to set sleeves for pipes accurately before the concrete slabs or beams are poured or masonry wall put-up, or may set boxes on the forms so as to leave openings in the floors in which the required sleeves can be subsequently located, in which case he is called upon to fill in the concrete voids around the sleeves.

All patching will be done under specifications of other trades. Should this Contractor neglect to perform his preliminary work and should cutting be required in order to install his piping or requirement, then the expense of the cutting and restoring of surfaces to their original condition shall be borne by this Contractor.

1.1.8 Protective Painting shall be carried out on pipes as specified hereinafter under Clause 2.7 "Painting, Coating & Stenciling".

1.1.9 Testing

- (a) Hydraulic testing to following pressures shall be carried out on the complete cold & hot water piping:

For Cold & Hot Water Piping - 150 Psi.

No loss of pressure shall be indicated for 2 hours. Tests shall be conducted in the presence of the Consultant/Owner's Representative.

- (b) Defects disclosed by the tests shall be repaired or if required by the Consultants defective work shall be replaced with new work without any extra charge to the Owner. Test shall be repeated as directed, until all work is proven satisfactory.
- (c) This Contractor shall furnish & pay for all devices, materials, supplies, labour and power required in connection with all tests. All tests shall be made in the presence of and to the satisfaction of the Consultant and other Inspectors of the City and Public Utility Inspectors having jurisdiction.

- (d) This Contractor shall also be responsible for the work of other trades that may be damaged or disturbed by the tests, or the repair or replacement of his own work, and he shall without extra charge to the Owner, restore to its original condition, work of the trades so damaged and disturbed, engaging the original Contractors to do the work of restoration.

1.1.10 Payment:

Payment shall be made as per the accepted rates per running foot of the pipe, which cost shall include the supply and installation of pipes including the cost of all tees, elbows, reducers, unions, nipples and other pipe fittings, the cost of all hangers, supports, sleeves and fittings, cutting and patching, protective painting, anti-corrosion treatment, stenciling and tagging, excavation and backfilling for underground pipes, testing, etc., complete in all respects.

1.2 Soil and Waste Water Piping and Specialties:**1.2.1 Scope of Work:**

The work includes in general the following:

- (a) External Soil and Waste Water Piping
- (b) Internal Soil, Waste Water, and Vent Piping
- (c) All specials shown, specified or needed
- (d) Services and Connection to Utilities
- (e) Other items specified, or shown on drawings.

1.2.2 Piping Material

- (a) Internal Soil and Waste Water line and to a maximum of 3m outside the building, unless otherwise shown on plans, shall be uPVC pipe heavy duty, of the bell and spigot type. Each pipe shall be tested at the manufacturer's works at 20 Psi, and shall show no leakage, sweating or other defects. Pipes shall be coated by immersion in a booth containing an uniformly heated composition of bitumastic base. Pipes supplied shall be accompanied by a test certificate and each pipe shall be so stamped. Pipes shall be (20 Psi) as manufactured by Dura Plast System.
- (b) External Soil & Waste Lines, unless otherwise shown on plans, shall be non-reinforced cement concrete pipes, conforming to ASTM C14, as manufactured by Pakistan Pipe & Construction Company Ltd. Joints shall be with plain collar.

1.2.3 Installation:

- (a) Each pipe shall be examined on arrival, defective pipes shall not be used. Drain shall be laid in straight lines and to even gradients between the levels shown, with pipes and fittings, of the type and diameter as shown on the drawings. Great care shall be exercised in setting out and determining pipe levels and the Contractor shall provide suitable instruments and set up and maintain and sight rails, and bench marks etc., necessary for the purpose. Cut pipe shall have smooth regular ends at right angles to arise of pipes. uPVC pipe to be cut with an approved cutter. All drain shall be kept free from earth debris, superfluous cement and other obstructions during laying and until the completion of the contract when they shall be handed over in a clean condition. Pipes shall be laid with the sockets leading uphill and shall rest on solid and even concrete foundations for the full length of the barrel as shown on drawings.

No pipes shall be laid on their collar or on blocks, tiles or other temporary supports.

- (b) Drainage line shall be accurately laid and shall be perfectly true to line and gradient from point to point in both vertical and horizontal planes. Every main shall be straight from manhole and any change in direction shall take place inside the manhole by the use of the curved main channels, similar changes in internal diameter in drain shall be made in manhole by the use of tapers or bends.

- (c) Easily accessible cleanouts, flush with the floor finish should be provided at each bend and bottom of stacks and at all points shown on drawings. The cleanouts should be made of "WYE" of full size, the minimum size should be 75mm dia.
- (d) Special fittings required in the installation not generally cast by manufacturers shall be got specially cast by Contractor matching with the shell thickness specified.
- (e) Joint of PVC pipes to cast iron socket shall be made by means of purpose made cast iron sleeves jointed as indicated at sub-clause (f) of this clause.
- (f) All sewerage pipes laid underground shall be on a concrete bed as shown on drawing. All sewer pipe crossing roads shall be completely encased in concrete as shown on drawings.
- (g) All soil and waste lines hung from the ceiling shall be supported at not more than 2m centres for horizontal pipe and 3m for vertical pipes. Provide supports at all special fittings. Supports shall generally conform to specifications given at Clause 2.5.6 hereinbefore.

1.2.4 Testing and Inspection:

- (a) The entire drainage and vent system and building sewer shall be subjected to testing after installation to ensure a leak-proof installation under operation conditions.

All the openings in the piping system shall be tightly closed by inserting test plug so that heavy rubber gasket fits snugly all around the opening. The highest point will be left open to supply water and may be raised if necessary by temporary jointing to develop a minimum head of five (5) meters of water at each section of the system.

Water is filled to the point of overflow and any drop in the level of water will indicate a leak that will be found by inspection. The water level will be checked for no drop for at least 15 to 30 minutes. No section will be tested at a pressure more than 6m of water. Height stacks will be tested in sections, starting from the top section and then connecting top section to next lower section.

- (b) A final test of the completed drainage and vent system will be conducted by smoke to ensure that connection for water closets are absolutely gas and water tight and that fixture traps are sound.

All the traps will be filled with water and a thick smoke produced by burning oil, waste, tar paper or similar material in the combustion chamber of a smoke test machine, will be introduced into the entire system. When smoke appears at highest point it will be closed and pressure equivalent to 25mm of water column will be built and maintained.

The drainage pipe and building sewer will also be inspected for slopes which must conform to the slopes specified. The slopes will be checked with precision angle measuring equivalent like universal protector, plumb and level. Any portion found not laid according to the given slope will be rectified at the Contractor's expenses. The Contractor shall be required to inform the Consultants before any laid pipes are backfilled and approval obtained.

After the pipe is laid, the joints completed between manholes, and the trench practically backfilled leaving the joints exposed for examination, the newly laid piping shall be checked for alignment by flashing a light between manhole. If illuminated interior of the pipe line shows poor alignment, the displaced pipe, or any other defects, shall also be checked for the given slopes, and if found unsatisfactory, shall be repaired at the Contractor's expense.

- (c) This Contractor shall furnish & pay for all devices, materials, supplies, labour and power required in connection with all tests. All tests shall be made in the presence of and to the satisfaction of the Engineer Incharge, Plumbing Inspector of the City and Public Utility Inspectors having jurisdiction.
- (d) This Contractor shall also be responsible for the work of other trades that may be damaged or disturbed by the tests, or the repair or replacement of his work and he shall, without extra charge to the Owner, restore to its original condition, work of the trades so damaged and disturbed, engaging the original contractors to do the work of restoration.
- (e) Defects disclosed by the tests shall be repaired, or if required by the Engineer Incharge. Defective work shall be replaced with new work without extra charge to the Owner. Test shall be repeated as directed, until all work is proven satisfactory.
- (f) This Contractor shall notify the Engineer Incharge, Plumbing Inspector and others having jurisdiction at least ten days in advance of making the required tests, so that arrangements may be made for their presence to witness the tests.

1.2.5 Payment:

All payment for R.C.C., uPVC & G.I. pipes shall be made per running foot of the installed length of the pipes, which shall include all fittings such as elbow, wye, tee, collars, junction box, cowl, etc. No additional payments shall be made for supports, excavation and backfilling, testing and any other work required for the C.C. Pipes, and the rates per foot submitted by the Contractor for this item of the Bill of Quantities shall be deemed to include all such ancillary requirements.

1.3 Sewerage Line Specialties:**1.3.1 Manhole:**

Manholes shall be constructed of 200mm thick masonry walls. Bottom of manholes shall be a 150 mm thick 1:2:4 RCC pad with nominal reinforcement. Top slab of the manhole shall be a 150mm thick 1:2:4 RCC slab. The depth of the manhole shall be upto the invert level shown on the drawings. The civil construction conform to the specifications of the Civil Works. The internal surface of the manhole shall be provided with a 15 mm thick Puddlo plaster.

Manhole shall be constructed with cast iron frames and covers as shown on the drawings. The invert channels shall be smooth and accurately shaped to a semicircular bottom conforming to the adjacent sewer section. Inverts shall be formed directly in the concrete of the manhole base. Steep Slopes outside the invert channels shall be avoided. Changes in size and grade shall be made gradually and evenly. Changes in direction of the sewer and entering branches shall have true curves of a radius as large as the size of the manhole will permit. Manhole shall be provided with built-in steps of M.S. iron. The rungs shall be not less than 250 mm in width and spaced at intervals of approximately 300 mm, and alternative rungs shall be staggered or off-set 150mm. Bars or rods when used for steps shall not be less than 20 mm in diameter.

The manhole frame shall be carefully embedded in the top slab of the manhole as neatly as possible.

1.3.2 Intercepting Manhole:

Intercepting Manholes shall conform to specifications given above, except that it shall be provided with an RCC intercepting trap of the same diameter on the main pipe line.

1.3.3 Sewer Connections:

The Contractor shall be responsible for obtaining necessary permits, licenses, etc., from the concerned authorities for the sewerage connections. He shall give notice to local authorities of intention to connect to the public sewer.

The work of breaking into the existing public sewer and forming a connection should be carried out by permission from and under the supervision of the authorised representative of the relevant authorities.

Breaking into the sewer should be effected by the cautious enlargement of a small hole, and every precaution should be taken to prevent foreign material from entering the sewer. The express consent of the local authority must be obtained before any temporary obstruction is made to the flow of the public sewer.

1.3.4 Cleanouts:

Cleanouts shall be locally manufactured, but shall be similar to those marketed by ZURN INDUSTRIES INC. of U.S.A., whose model Nos. are noted below. The tenderer may refer the catalogue available in the Consultant's office. A sample cleanout shall be submitted for approval to the Consultants.

Cleanout for Finished Floor Areas shall be similar to ZURN Model No. Z-1323. These shall be of the cast iron, designed to provide an air tight seal with the CI pipe bell. The cleanout shall be provided with a threaded brass plug that shall fit into the hub and provide an airtight seal. A key to un-screw the plug shall be provided. A brass ferrule shall be provided, that shall screw into the hub with the capacity of level adjustment. The ferrule shall be provided with a round scoriated brass top and a long brass screw threaded into the plug below, shall hold down the top cover.

1.3.5 Floor Drains:

Floor Drains shall be of uPVC with 5" (125 mm) dia opening. The drain shall be provided with a P-Trap having a minimum water seal of 50 mm. The drain grating shall be of stainless steel.

1.3.6 Vent Cows:

All vent-lines terminating above the building shall be provided with best quality uPVC cowl.

1.3.7 Manhole Frame and Covers:

Manhole Frame and Covers shall be of water tight quality manufactured from good quality cast iron. Weight of frame and cover shall be as follows:

The bottom slab of the manholes shall be of 1:2:4 concrete side works shall be of 8 inch thick concrete solid blocks. The top slab shall be of 1:2:4 concrete suitably reinforced as required by structural code. The top slab shall be neatly finished on top with cement plaster. The internal surfaces of the manhole shall be provided with $\frac{3}{4}$ inches thick plaster with pudlo.

Heavy duty manhole covers weighing approximately 55 lbs. including frame shall be provided on all manholes. The frame shall be carefully embedded in the top slab of the manhole as neatly as possible.

After the pipe is laid, the joints completed, and the trench practically backfilled leaving the joints exposed for examination, the newly laid piping shall be checked for alignment by flashing a light between manholes. If illuminated interior of the pipe line shows poor alignment, the displaced pipe, or any other defects, shall be repaired at the Contractor's expense. The system shall also be checked for the given slopes, and if found unsatisfactory, shall be repaired at the Contractor's expense.

Measurement and payment shall be made for complete construction of the manholes, as per the unit price quoted in the B.O.Q., and shall include all works necessary for installation, complete in all respects, including all excavation, backfilling, all structural work, cast iron manhole frame and covers etc.

Size - mm.	Weight - Kg.
300 x 300	12
750 x 750	50

1.3.8 Gully Trap Chamber shall be constructed of 1:2:4 R.C.C., and shall be provided with a deep-seal 'p' trap with cast iron frame and cover of 12" x 12" (300 mm x 300 mm) size, weighing 26 Lbs. (12 Kgs.). Gully Trap Chamber shall be made as instructed and approved by the Engineer Incharge, prior to its construction.

Payment shall be made for complete construction of the Gully Trap, as per the unit price quoted in the B.O.Q. and shall include all works necessary for construction and installation, complete in all respects, including the cost of excavation, backfilling, structural works, frame and cover, etc.

1.4 Plumbing Fixtures and Accessories:**1.4.1 General:**

- (a) All fixtures shall be free from imperfections, true as to line, angles, curves and colours, smooth water tight and complete in every respect.
- (b) All fixtures specified to be of vitreous ware, shall be fired vitreous china ware of the best quality, non-absorbent and burned so that the whole mass is thoroughly fused and vitrified producing a material white or colored, which when manufactured will show a homogeneous mass, close grained and free from pores. The glazing and vitreous china fixtures shall be of a colour approved by the Consultant/Architect, thoroughly fused, and united to the body, without discoloration, chips, or flows and shall be free from craze. Wrapped or other imperfect fixtures will not be accepted.
- (c) All plumbing fixtures proposed to be supplied shall be indicated at the time of tendering, and all fixtures should be approved by the Architect/Consultant, prior to installation.
- (d) All fixtures shall be furnished by one manufacturer unless otherwise specified.
- (e) All fittings, cast brass set screws, escutcheons faucets, traps exposed piping etc., shall be of brass chrome plated over nickel plate with polish finished. Any hanger nuts visible shall likewise be chrome plate over nickel plate. Generally all fittings shall be best quality from MASTER INDUSTRIES LTD.
- (f) After installation of plumbing accessories, the Contractor shall ensure their protection against damage, misuse and general deterioration. Fixture outlets shall be plugged with suitable material to prevent entry of external debris All chrome plated and other metallic fittings shall be provided with a coat of grease to prevent their deterioration. All items prior to handling over must be in perfect condition in the visual and operational sense.
- (g) All fixtures and accessories shall be first quality, locally manufactured, unless otherwise indicated.

1.4.2 Plumbing Fixtures:

- (a) Counter Top type Wash Basin shall be 494mm x 612mm of approved colour as manufactured by I.C.L. Model OVAL VANITY BASIN, with MASTER mixer fitting, tee stop cock with flexible connections, wall flanges, 32 mm P.V.C. bottle trap with P.V.C. waste pipe. Hand Wash Basin will be complete in all respects as approved by the Architect/ Consultants.
- (b) Western Type Water Closet shall be locally made, vitreous China, as manufactured by I.C.L. Model 'ICL-IFO' or approved equivalent of approved colour. It shall include 'S' or 'P' trap with vitreous china 2½ Gallons flushing cistern including the cost of tee stop cock as Manufactured by MASTER, ½" dia C.P. brass supply pipe to cistern, best quality solid plastic seat cover, etc., complete in all respects as per approval of the Consultants.
- (c) Muslim Shower shall be local make best quality C.P. brass "T" Stop Cock at height of 18" from finished floor level, complete with 3/8" flexible stainless steel hose 30" long and nozzle C.P. brass hose hook including the cost of all cutting, binding and making good, complete in all respects.

1.4.3 Plumbing Accessories:

- (a) Soap Tray shall be of chromium finish of Japanese origin or approved equivalent.
- (b) Towel Rail shall be of chromium finish brass rails of 25mm Ø, 600 mm long with brackets of Japanese origin or approved equivalent.
- (c) Paper Holder shall be of chromium finish of Japanese origin or approved equivalent.
- (d) Coat Hooks shall be of chromium finish of Japanese origin or approved equivalent.
- (e) Bib Cock shall be 15mm Ø of CP brass, best quality, local make MASTER, or approved equivalent.

NATURAL GAS SUPPLY PIPES & FITTINGS:

General: Gas supply piping shall include supply and installation of all pipes and fittings such as elbows, tees, reducers, unions, nipples etc., required for the complete gas supply system as shown on the project plans. All stop valves, gate valves, gas locks, pressure gauges and other specialties as required for the proper operation of the system shall be provided. All work on gas lines shall be done by a firm approved by the Gas Co.

Installation: The fun and arrangement of all pipes shall be approximately as shown on the drawings and as directed ruing installation and shall be straight and direct as possible forming right angles or parallel lines with building walls and other pipes, and shall be neatly spaced. Offsets will be permitted only where required to permit the pipes to follow wall, standard fittings shall be used for offsets. All pipes shall be installed strictly in accordance with the latest regulations of local gas company.

This Contractor shall at all times work in conjunction with the Heating, Ventilation, air-conditioning and electrical Contractors in order to avoid interferences of pipes and unnecessary cutting of floors and walls. All pipes running underground or concealed in floors or wall construction shall be installed before the construction is closed up. The responsibility for accurately laying out the work and coordinating his installation with other Contractors rests with this Contractor. Should it be found that any of his work is laid out so that interference will occur, he shall so report that to the consultants.

All screwed pipe throughout the job shall be reamed smooth before being installed. Pipe shall not be split bent flattened nor otherwise injured either before or during the installation.

Reducing fittings unless otherwise approved in special cases shall be used in making reduction in size of pipe. Bushings will not be allowed unless specifically approved. All piping interiors shall be thoroughly cleaned of foreign matter before installation and shall be kept clean during installation by plugging or otherwise approved means. Exterior piping shall not be laid in water or when trench or weather conditions are unsuitable for the work, except by permission of the Consultants. Unions shall be provided at suitable intervals to enable easy assembly and disassembly of the pipes. All piping installation shall allow means of easy disassembly for cleaning and maintenance. All pipes buried directly underground shall be provided with an anti-corrosion treatment consisting of using Bitumastic tap 1/8" thick. All edges shall be overlapped.

Testing: The entire gas supply system shall be subjected to testing after installation to ensure a leak-proof installation under operation conditions. Each test shall be conducted in the presence of the Consultant or their authorized representatives and all tests shall be in accordance with the latest local gas company's requirements.

Signature of Client

Signature of Contractor

GREASE TRAPS:

Grease traps shall be constructed of 4 inch thick 1:2:4 cement concrete walls. Bottom of grease traps shall be a 6" thick 1:2:4 RCC slab with nominal reinforcement. The clear inner size of the grease trap shall be as shown on the drawing. A C.I. cover of size 18" x 18" and frame shall be installed embedded in the top slab. The internal surface of the chamber shall be provided with ½" thick pudlo plaster. The Construction shall conform to the specifications of civil works.

Measurement and payment shall be made for complete construction of the grease trap, as per the unit price quoted in the BOQ, and shall include all works necessary for installation, complete in all respects including all excavation, backfilling, structural work, C.I. cover frame etc.

FIRE FIGHTING EQUIPMENT

Fire Hose Cabinet: It shall be as shown on drawings. It shall have hinged glass door with locking arrangement. Glass shall be 4mm thick. It shall have a valve of 65mm dia meter and a 6 Kg. dry chemical powder Fire Extinguisher. Cabinet shall be painted internally and externally with two coats of synthetic "KROMIC" red lead paint and two coats off synthetic enamel red coloured paint. A sample construction of the cabinet shall be submitted to the Engineer for approval, prior to final fabrication. The whole equipment shall be installed as shown and shall be tested in the installed position.

Cabinet shall be recessed type, constructed of 18 gauge sheet metal with angle iron reinforcement. Cabinet size shall be 39 inches high, 39 inches wide and 10 inches deep.

Cabinet shall have tow compartments, each with an independent door. The smaller compartment shall have a 6 Kg. dry chemical powder extinguisher. The longer compartment shall have the following components.

- a) A 2½" hydrant valve, brass construction.
- b) 100 Ft. of 1½" canvas fire fighting hose.
- c) Hose Rack for pleated storage of hose.
- d) Quick coupling, brass construction, suitable for fire hose and hydrant valve.
- e) Spanner to operate nuts on the hydrant valve.
- f) Nozzle, Brass construction, suitable for fire hose.
- g) One fire fighting hatchet.

Payment shall be made as per rate quoted for complete supply and installation of each unit.

Portable Fire Extinguishers: Specific type Portable Fire Extinguishers shall be installed at locations shown on the drawings. Extinguishers shall be installed on purpose made books at a suitable height as approved by the Engineer. The extinguishers shall be of the following types.

- a) Dry Chemical Powder Fire Extinguishers:

These shall be suitable for fighting Class A,B,C & E fires. Extinguisher shall conform to BSS 5306 Part B and BSS 5423 and shall contain Dry Chemical Powder. Weight off Extinguisher shall be 6 Kg.

Siamese Inlet: The Contractor shall supply and install Fire Department Connection (Siamese Connection) size 65x65x100mm of brass body and plate. The connection should be complete with chain caps and quick coupling etc.

MEASUREMENT AND PAYMENT

a) Fire Fighting Equipment:

Measurement for Hydrant valve cabinet, portable fire extinguishers and siamese inlet shall be made as per actual number provided and installed and shall be for complete work specified herein or as shown on drawing.

Payment for Hydrant cabinet, portable fire extinguisher and siamese connections shall be made at the applicable unit price per number bid for the respective item in the Bill of Quantities. The amount bid shall be full payment for the work specified herein.



FINANCE
DEPARTMENT
GOVERNMENT OF SINDH

**RENOVATION / REFURBISHMENT WORKS OF RENTAL PREMISES
ACQUIRED AT 1ST FLOOR, STATE LIFE BUILDING NO. 11,
ABDULLAH HAROON ROAD, KARACHI**



**TENDER / CONTRACT DOCUMENTS
(Volume – III)**

BILL OF QUANTITIES

December 2024

IDG (PVT.) LIMITED

Architects Engineers Planners Interior Designers



SUMMARY OF COST

Renovation / Refurbishment Works at 1st Floor, State Life Building No. 11,
Abdullah Haroon Road, Karachi.

Summary of Cost

S.#	DESCRIPTION	TOTAL AMOUNT (Rs.)
1	Cost of Civil Works	
2	Cost of Furniture Works	
3	Cost of Plumbing Works	
4	Cost of Electrical Works	
5	Cost of HVAC Works	
	Total Cost of Works (Rs.)	

CIVIL WORKS

Name of Client: Additional Finance Secretary (Sr /Admn), Finance Department, Government of Sindh
 Name of Project: Renovation / Refurbishment Works at 1st Floor, State Life Building No. 11,
 Abdullah Haroon Road, Karachi.
 Sub-Head 1.1: Civil Works

S.NO#	Description	Qty	Unit	RATE (RS)	AMOUNT (RS)
	DEMOLISHING WORK				
1	Clearing site & Layout as per drawing & instruction of Architect.				
		17,801	P.Sft		
2	Dismantling of cement concrete Plain including disposal of rubbish as per instruction of Architect.				
		53	P.Cft		
3	Dismantling of solid block masonry wall 4"- 6" thick including disposal of rubbish as per instruction of Architect.				
		1,917	P.Sft		
4	Dismantling RCC & separating reinforced cement from concrete cleaning and straightening the steel including disposal of rubbish as per instruction of Architect.				
		53	P.Cft		
5	Removing /Taking out existing old false Ceiling as per instruction of Architect.				
		105	P.Sft		
6	Removing /Taking out old electrical wiring board etc as per instruction of Architect.				
		1	Job		
7	Taking out old damaged wooden wall Panelling with frame & Staking servicable material at site as directed /instruction of Architect.				
		2,100	P.Sft		
8	Repairing of existing window Jams with mortar / putty filling etc, making good as per instruction of Architect.				
		792	P.Rft		
9	Cutting/Removing of old damaged CC floor as per instruction of Architect.				
		2,100	P.Sft		
10	Repair of Cracks/wall as per instruction of Architect.				
		134	P.Rft		
11	Cleaning, Repair of old aluminium windows (size 1'-6"x5'-0") i/c replacement of broken hardware as directed & as per instruction of Architect.				
		61	Each		

S.NO#	Description	Qty	Unit	RATE (RS)	AMOUNT (RS)
12	Taking out Existing Aluminium Partition with glass carefully & Staking servicable material at site as directed /instruction of Architect.				
		2,100	P.Sft		
13	Refixing of old Aluminium Partition with glass as directed /instruction of Architect.				
		2,100	P.Sft		
	NEW WORK (INTERIOR)				
1	Providing Anti-termite by Neptachlar 0.5% Emulsion as an overall per construction treatment in slab type construction under the slab and along attached perches or entrance etc,complete as per instruction of Architect.				
		17,800.65	P.Sft		
2	Providing & Laying RCC 1:2:4 cylindrical strenth in the field 3000 psi as per ACI214, with the specified consistency the cost wirh shuttering,compaction with copmactor,as per instruction of Architect.				
		210.27	P.Cft		
3	Providing & laying 1 : 3 : 6 cement concrete solid block masonry wall 4"-6"and below in thickness set in 1: 6 cement mortar in first floor Super Structure including rakingout joints & curringetc, complete as per instruction of Architect				
		1,302.74	P.Sft		
4	Providing & laying 1:3:6 cement concrete Hollow block masonry wall 6" thickness set in 1: 6 cement mortar in first floor Super Structure including rakingout joints & curring etc, complete as per instruction of Architect.				
		1,440.83	P.Sft		
5	Providing and laying Cement Sand Internal New Plaster of wall 1:4 3/4" thick as per approved design ,drawing & as per instruction of Architect.				
		5,521.00	P.Sft		
6	Providing and laying Cement Sand Internal Patch Plaster of Ceiling & Wall 1:4 12' height 3/4" thick as per approved design, drawing & as per instruction of Architect.				
		105.00	P.Sft		

S.NO#	Description	Qty	Unit	RATE (RS)	AMOUNT (RS)
7	Providing & Laying Porcelain Glazed Tile 24"x24" on existing floor of Approved Shade Design Set in tile bond & SBR including Chipping , washing & grouting etc complete as per Spec, as per approved design, drawing & as per instruction of Architect.				
		8,860.11	P.Sft		
8	Providing & Laying Porcelain Glazed Tile 24"x48" on existing floor of Approved Shade Design Set in tile bond & SBR including chipping, washing & grouting etc complete as per Spec , as per approved design ,drawing & as per instruction of Architect.				
		380.63	P.Sft		
9	Providing & Laying Porcelain Tile skirting 24"x 4" of Approved Shade Design Set in tile bond & SBR i/c chipping washing & grouting etc complete as per Spacification as per approved design ,drawing & as per instruction of Architect.				
		2,664.35	P.Rft		
10	Providing & Laying Porcelain Matt Tile 24"x24"on existing floor of Approved Shade Design Set in tile bond & SBR including Chipping washing & grouting etc complete as per Spec , as per approved design ,drawing & as per instruction of Architect.				
		7,102.96	P.Sft		
11	Providing & Laying Porcelain Matt Tile Skirting 24"x 4" on existing wall of Approved Shade Design Set in tile bond & SBR i/c chipping , washing & grouting etc complete as per Spacification as per approved design ,drawing & as per instruction of Architect.				
		303.27	P.Rft		
12	Providing & Laying Porcelain bath Tile in Flooring & Dado of Approved Shade Design Set in tile bond & SBR including Washing & grouting etc complete as per Spacification as per approved design ,drawing & as per instruction of Architect.				
		2,088.19	P.Sft		

S.NO#	Description	Qty	Unit	RATE (RS)	AMOUNT (RS)
13	Providing and fixing Wooden Floor of approved design ,drawing as per manufacturar Specification & per instruction of Architect.				
		1,416.31	P.Sft		
14	Providing and fixing 2-1/2" high Wooden Skirting as per approved design ,drawing & .as per instruction of Architect.				
		339.68	P.Rft		
15	Providing & Laying CC 1:2:4 CC sub floor 3" (Av) thick as per instruction of Architect.				
		52.50	P.Sft		
16	Providing and fixing PVC Doors shutter etc fixed in position i/c frame ,hold fasts hinges iron tower bolts etc complete & instruction of Architect. (Note Shop drawings & material should be got approved by the consultant prior to start of work)				
		165.38	P.Sft		
17	Providing and fixing Malysian Ply Doors shutter (Termite treated) etc fixed in position i/c Chowkat ,hold fasts hinges iron tower bolts cleats handles etc 1-3/4" thick i/c Polishing both face etc complete & instruction of Architect. (Note Shop drawings & material should be got approved by the consultant prior to start of work)				
		668.85	P.Sft		
18	Providing and fixing Steel Doors including frame heavey etc complete as per drawing & instruction of Architect. (Note Shop drawings & material should be got approved by the consultant prior to start of work)				
		100.80	P.Sft		
19	Providingand fixing Architrave of approved design/shape having width not less than 2-1/2" inches etc complete & instruction of Architect.				
		1,014.30	P.Rft		
20	Providing and fixing approved quality Door lock adjustable, over the style surface.etc complete & instruction of Architect.				
		56.00	Each		

S.NO#	Description	Qty	Unit	RATE (RS)	AMOUNT (RS)
21	Providing & Fixing door closer i/c fixing on door of approved quality with screws & adjusting speed on required etc complete.& instruction of Architect.				
		5.00	Each		
22	Providing & Fixing 4" thick MDF low height Partition with Laminated Sheet both face as per drawing & instruction of Architect. (Note Shop drawings & material should be got approved by the consultant prior to start of work)				
		1,033.20	P.Sft		
23	Providing & Fixing 4" thick Dry/ C-Stud Partition on Gypsum board 12mm thick both face with all accessories as per manufacturer specification , as per drawing & instruction of Architect. (Note Shop drawings & material should be got approved by the consultant prior to start of work)				
		13,849.90	P.Sft		
24	Providing & Fixing Fixed Silver Aluminium Glazing with glass plain/tinted as per drawing & instruction of Architect. (Note Shop drawings & material should be got approved by the consultant prior to start of work)				
		845.25	P.Sft		
25	Providing & Fixing Wood clour UPVC Door i/c Door lock , Fixed with glass plain/tinted as per drawing & instruction of Architect. (Note Shop drawings & material should be got approved by the consultant prior to start of work)				
		220.50	P.Sft		
26	Providing and Installing Logo on internal wall stainless steel / brass with letters / figures i/c fastening accessories etc complete in all respect as per approve shop drawing & as per instruction of Architect. (Note Shop drawings & material should be got approved by the consultant prior to start of work)				
		2.00	No		

S.NO#	Description	Qty	Unit	RATE (RS)	AMOUNT (RS)
27	Providing and Installing Name Plate of room on internal wall stainless steel/brass with lettering & figuring i/c fastening accessories etc complete in all respect as per approve shop drawing & as per instruction of Architect. (Note Shop drawings & material should be got approved by the consultant prior to start of work)				
		30.00	Each		
28	Providing & Fixing Window Blind per drawing & instruction of Architect.				
		529.20	P.Sft		
29	Providing & Fixing 12 mm Glass door with cancelled floor door closer ,D lock etc complete & all other accessories as per drawing & instruction of Architect. (Note Shop drawings & material should be got approved by the consultant prior to start of work)				
		117.29	P.Sft		
30	Providing & Fixing Aluminium clading/Alcubond 3mm etc complete as per design shape drawing , as per manufacturer specification & instruction of Architect. (Note: Shop drawings & material should be got approved by the consultant prior to start of work)				
		189.00	P.Sft		
31	Providing & Fixing Industrial False Ceiling as per instruction of Architect. (Note: Shop drawings & material should be got approved by the consultant prior to start of work)				
		2,481.41	P.Sft		
32	Providing & Fixing Gypsum board false Ceiling including frame,hanger accessories etc completeas per instruction of Architect. (Note: Shop drawings & material should be got approved by the consultant prior to start of work)				
		8,211.60	P.Sft		

S.NO#	Description	Qty	Unit	RATE (RS)	AMOUNT (RS)
33	Providing & Pasting Frosting /Branding sheet as per approved design ,drawing & instruction of Architect. (Note: Shop drawings & material should be got approved by the consultant prior to start of work)				
	On Fixed Glazing & Glass Door				
		1,575.00	P.Sft		
34	Providing & Fixing Clading of approved make ,design & asper instruction of Architect. (Note: Shop drawings & material should be got approved by the consultant prior to start of work)				
		1,323.00	P.Sft		
35	Providing & Applying Wall Painting Texture as per approved design/ Pattern & instruction of Architect.				
		525.00	P.Sft		
36	Providing & Applying Painting with Graphics as per approved design, drawing & instruction of Engineer Incharge.				
		105.00	P.Sft		
37	Providing & Fixing Vanity/ Pantry & Kitchen Counter as per drawing & instruction of Architect. (Note Shop drawings & material should be got approved by the consultant prior to start of work)				
		96.60	P.Sft		
38	Preparing the surface and painting with Plastic emulsion paint of approved make & Shade I/c scraping old paint , rubbing the surface (filling the voids with putty ,applying First coat premix, making the surface smooth and than painting 3 coats with plastic emulsion of approved make etc.complete on Old surface (including 2nd & subsequent coat). & as per instruction of Architect				
		9,600.10	P.Sft		

S.NO#	Description	Qty	Unit	RATE (RS)	AMOUNT (RS)
39	Preparing the surface and painting with Plastic emulsion paint of approved make & Shade I/c scraping old paint , rubbing the surface (filling the voids with putty ,applying First coat premix, making the surface smooth and than painting 3 coats with plastic emulsion of approved make etc.complete on New surface (Gypsum Board False Ceiling) (including 2nd & subsequent coat). & as per instruction of Architect				
		8,211.60	P.Sft		
40	Preparing the surface and painting with Water Matt finish paint of approved make & Shade I/c scraping of old paint rubbing the surface (filling the voids with puty ,applying First coat premix, making the surface smooth and than painting 3 coats with water matt finish of approved make etc.complete on Old surface (including 2nd & subsequent coat). & as per instruction of Architect				
		20,443.46	P.Sft		
41	Preparing the surface and painting with Water Matt finish paint of approved make & Shade I/ rubbing the surface (filling the voids with puty ,applying First coat premix, making the surface smooth and than painting 3 coats with water matt finish of approved make etc.complete on New surface (including 2nd & subsequent coat). & as per instruction of Architect.				
		29,377.95	P.Sft		
42	Preparing the surface and painting with weather coat of approved make & Shade I/c scraping of old paint rubbing the surface with rubbing brick/sand paper, filling the voids with putty and then painting with weather coat of approved make using long ladder or jhoola for each coat on Old surface (including 2nd & subsequent coat) & as per instruction of Architect.				
		1,449.00	P.Sft		
43	Preparing the surface and painting with enamel paint of approved make & Shade (including 2nd & subsequent coat) & as per instruction of Architect.				
		52.50	P.Sft		
Total for Civil Works					

FURNITURE WORKS

Name of Client: Additional Finance Secretary (Sr /Admn), Finance Department, Government of Sindh
Name of Project: Renovation / Refurbishment Works at 1st Floor, State Life Building No. 11,
Abdullah Haroon Road, Karachi.
Sub-Head 1.2: Furniture Works

S.NO#	Description	Qty	Unit	RATE (RS)	AMOUNT (RS)
	FURNITURE WORK				
A	File Racks, Work Stations & Cabinets				
1	Providing & Fixing Steel File racks Double side with 7 shelves (Size 11'-3"x3'-0") 10'-0" high powdered coated Shelves with GI frame 2" L shape as per approved design, drawing & instruction of Architect. (Note Shop drawings & material should be got approved by the consultant prior to start of work)				
		58.00	Each		
2	Providing & Fixing Steel File racks Single side with 7 shelves (Size 11'-3"x1'-6") 10'-0" high powdered coated shelves with GI frame as per approved design ,drawing & instruction of Architect. (Note Shop drawings & material should be got approved by the consultant prior to start of work)				
		5.00	Each		
3	Providing & Fixing Steel File racks Single side with 7 shelves (Size 7'-0"x1'-6") 10'-0" high powdered coated with GI frame as per approved design ,drawing & instruction of Architect. (Note Shop drawings & material should be got approved by the consultant prior to start of work)				
		1.00	Each		
4	Making Reception Counter with MDF Laminated Board i/c wooden frame & Marble Top as per approved design ,drawing & instruction of Architect. (Note Shop drawings & material should be got approved by the consultant prior to start of work)				
		26.25	P.Sft		
5	Making Work Station 4'-0"x2'-0" with MDF Laminated board with On drawer & Key board Tray as per approved design ,drawing & instruction of Architect. (Note Shop drawings & material should be got approved by the consultant prior to start of work)				
		537.60	P.Sft		

S.NO#	Description	Qty	Unit	RATE (RS)	AMOUNT (RS)
6	Making File Cabinet as per approved design, drawing & instruction of Architect. (Note: Shop drawings & material should be got approved by the consultant prior to start of work)				
		157.50	P.Sft		
7	Providing & Fixing LED 40" of approved make i/c all accessories instruction of Architect.				
		6.00	Each		
8	Providing & Fixing LED 60" of approved make i/c all accessories instruction of Architect.				
		1.00	Each		
9	Supplying Stainless Steel Planter Pot with Plant as per approved design & instruction of Architect.				
		15.00	Each		
10	Supplying Artifical Plant in Exist external Flower Bed as per approved design & instruction of Architect.				
		40.00	Each		
11	Supplying & Fixing Painting/Potrate as per approved design & instruction of Architect.				
		10.00	Each		
12	Supplying & Fixing wall clock as per approved design & instruction of Architect.				
		10.00	Each		
B	SOFA				
1	Making Sofa 3 seater as per approved design & instruction of Architect.				
		5.00	Each		
2	Making Sofa 2 seater as per approved design & instruction of Architect.				
		9.00	Each		
3	Making Sofa single seater as per approved design & instruction of Architect.				
		2.00	Each		

S.NO#	Description	Qty	Unit	RATE (RS)	AMOUNT (RS)
C	TABLE				
1	Making Executive Officer's Table as per approved design & instruction of Architect.				
		1.00	Each		
1	Making PD & IG Table as per approved design & instruction of Architect.				
		2.00	Each		
2	Making Director Table as per approved design & instruction of Architect.				
		4.00	Each		
3	Making Officer Table as per approved design & instruction of Architect.				
		4.00	Each		
4	Making Office Table as per approved design & instruction of Architect.				
		15.00	Each		
6	Making Centre Table as per approved design & instruction of Architect.				
		2.00	Each		
7	Making Side Table as per approved design & instruction of Architect.				
		7.00	Each		
8	Making Side Racks with drawer,lock hardware ,glass as per approved design & instruction of Architect.				
		23.00	Each		
9	Making Conference Table 12 Seater as per approved design & Instruction of Architect.				
		1.00	Each		
C	CHAIRS				
1	Supplying Revolving Chair Executive as per approved make, design & instruction of Architect.				
		1.00	Each		
1	Supplying Revolving Chair IG & PD as per approved make, design & instruction of Architect.				
		2.00	Each		
2	Supplying Revolving Chair for Director Table as per approved make ,design & instruction of Architect.				
		5.00	Each		
3	Supplying Revolving Chair for Officer Table as per approved make design & instruction of Architect.				
		4.00	Each		
4	Supplying Revolving chair for work station & Reception as per approved make,design & instruction of Architect.				
		160.00	Each		

S.NO#	Description	Qty	Unit	RATE (RS)	AMOUNT (RS)
7	Supplying Wooden Chair for Visitor as per approved design & instruction of Architect.				
		2.00	Each		
8	Supplying Waiting 4 seater for Visitor as per approved design & instruction of Architect.				
		6.00	Each		
9	Supplying Waiting 3 seater SS Steel for Visitor as per approved design & instruction of Architect.				
		2.00	Each		
10	Supplying Revolving Chair for Conference Table as per approved design & instruction of Architect.				
		18.00	Each		
11	Supplying 3 seater Chair for Conference Table as per approved design & instruction of Architect.				
		2.00	Each		
Total for Furniture Works					

PLUMBING WORKS

Name of Client: Additional Finance Secretary (Sr /Admn), Finance Department, Government of Sindh
 Name of Project: Renovation / Refurbishment Works at 1st Floor, State Life Building No. 11,
 Abdullah Haroon Road, Karachi.
 Sub-Head 1.3: Plumbing Works

S.NO#	Description	Qty	Unit	RATE (RS)	AMOUNT (RS)
	<u>PLUMBING FIXTURES.</u>				
	Supply, Installation of plumbing fixtures & faucets complete in all respects including all accessories, support, hangers, etc. ready to use as per specifications, drawings and instructions of Consultant.				
1	Providing and fixing squatting type white glazed earthen ware W.C. pan (Durr / Morgan) with front flush inlet & complete with including the cost of flushing cistern with internal fitting and flush pipe with bend and making requisite number of holes in walls, plinth & floor for pipe connection & making good in cement concrete 1:2:4. (Foreign Quality)(23 inch) earthen ware trap and plastic thumble.	2	Nos.		
2	Providing and fixing European type white glazed earthen ware wash down W.C. pan (Durr / Morgan) complete with & including the cost of white / black plastic seat and lid with C.P. brass hinges best quality and buffers 3 gallons white glazed earthen ware low level flushing cistern with siphon fitting 1½ " dia white porcelain enameled flush bend dia and making requisite number of holes in walls, plinth & floor for pipe connection & making good in cement concrete 1:2:4.	8	Nos.		
3	Supplying & fixing C.P muslim shower with double bib cock and ring pipe etc. complete in all respect.	10	Nos.		
4	Providing and fixing 24"x18" lavatory / vanity basin in white glazed earthen ware (Durr / Morgan) complete with & including the cost of W.I. or C.I. cantilever bracket 6 inches built into wall, painted white in two coats after a primary coat of red lead paint, a pair of 1-1/2" dia chrome plated pillar taps, 1-1/2" rubber plug & chrome plated brass chain 1-1/4" dia malleable iron or C.P. brass traps malleable iron or brass unions and making requisite number of holes in walls, plinth & floor for pipe connection & making good in cement concrete 1:2:4 etc. complete.	8	Nos.		

S.NO#	Description	Qty	Unit	RATE (RS)	AMOUNT (RS)
5	Toilet accessories complete set.				
i	Supplying & fixing soap tray with fine finishing with C.P. screws etc. complete.	8	Nos.		
ii	Providing and fixing towel rail 24"x3/4" round or with brackets screws nuts & cleats etc. complete.	9	Nos.		
iii.	Providing and fixing C.P. brass toilet paper brackets complete.	11	Nos.		
	WATER SUPPLY SYSTEM.				
	Supply, installation, testing and commissioning of complete pipe work for cold and hot water system including all accessories required to complete systems ready to operate as per specification, drawings & instruction of Consultant.				
1	Providing, laying, fixing, testing and disinfecting, polypropylene pipelines for cold and hot water supply as per DIN 8077/8078 PN-20 for pipe and DIN 16962 PN-25 for fittings or equivalent BS specification Dadex, CPVC by Prestige plastics, IIL, Formul, Pilsa, G.F. (Hakan), BETA make as approved by the Engineer Incharge complete in all respects to their entire satisfaction, including specials such as tee, cross, reducer, bend, union, elbow, plug, socket etc., supported on walls or suspended from slab or run in chases (chased in walls shall be made by using electric cutter) including supports, cutting and making good the same as necessary to the structure complete in all respects. (all hot and cold water pipes shall run under the ceiling of lower floors, galvanized hangers and rawl bolts shall be IINK, Sikla, Fisher or Hilti make shall be used.)				
i	Dia. OD 25 mm	200	Rft.		
ii	Dia. OD 32 mm	100	Rft.		
iii.	Dia. OD 40 mm	50	Rft.		
iv.	Dia. OD 50 mm	50	Rft.		
v.	Dia. OD 65 mm	50	Rft.		

S.NO#	Description	Qty	Unit	RATE (RS)	AMOUNT (RS)
2	Providing, fixing and testing PPRC ball valve Dadex, popular, IIL, Formul, Pilsa, G.F. (Hakan), BETA make or as approved by the Engineer Incharge complete in all respects to their entire satisfaction including all accessories and jointing material complete in all respects.				
i	Dia. OD 25 mm	5	Nos.		
ii.	Dia OD 32 mm	3	Nos.		
3	Supply of Electric Water Heater	2	Nos.		
	<u>SOIL, WASTE VENT AND RAIN WATER DRAINAGE SYSTEM.</u>				
	Supply, fixing, testing and commissioning of equipment, pipe work required to complete the soil, waste, vent and rain water systems in all respects with accessories ready to operate as per specifications, drawings and instructions of Consultant.				
1	Providing, laying, fixing and testing uPVC soil, waste, vent and rain water as per BSS 4514 & 5255 or equivalent BS specifications including uPVC fittings with solvent cement jointing or rubber ring joints Dadex Nikasi, Popular, Beta or Tetraplast make as approved by the Engineer Incharge complete in all respects, including, clamps, bends, tees, Y-tees, cowls, reducers, clean out etc., embedded in floors and walls, clamped to walls, suspended from slab, painted MS horizontal and vertical pipe hangers of approved design making requisite no. of holes and making good the same complete in all respects. (all soil, waste and vent pipes shall run under the ceiling of lower floors, galvanized hangers and rawl bolts shall be Sikla or Hilti make shall be used.)				
i.	Dia. 50mm	50	Rft.		
ii	Dia. 75mm	100	Rft.		
iii	Dia. 100mm	100	Rft.		
2	Providing, laying, fixing and testing floor drain (multifloor trap) UPVC including extension grating and stainless steel cover grating best quality local make Dadex, Beta or Tetraplast make as approved Engineer Incharge complete in all respects to their entire satisfaction.				
i.	FT- with 4" P - trap	17	Nos.		

S.NO#	Description	Qty	Unit	RATE (RS)	AMOUNT (RS)
3	Floor Clean Out for soil, waste of approved make.				
i.	For 4" dia. Pipe with SS floor cover plate	2	Nos.		
4	Supply, installation, testing and commissioning of complete pipe (MS-Sch 40) work for Natural Gas system including all accessories required to complete systems ready to operate as per specification, drawings & instruction of Consultant				
i	Ø 20mm	100	Rft.		
5	Ball valves for Natural Gas				
i	Ø 20mm	2	No.		
Total for Plumbing Works					

ELECTRICAL WORKS

Name of Client: Additional Finance Secretary (Sr /Admn), Finance Department, Government of Sindh
 Name of Project: Renovation / Refurbishment Works at 1st Floor, State Life Building No. 11,
 Abdullah Haroon Road, Karachi.
 Sub-Head 1.4: Electrical Works

S.N O#	Description	Qty	Unit	RATE (RS)	AMOUNT (RS)
A	Internal Wiring				
1	Supply & installation of following sizes PVC/UPVC Conduits including all accessories such as bends, sockets, j-boxes, flexible conduits, metal saddles e.t.c for Main / Sub Main Power, Telephone & Data Cables, concealed / surface on wall as per design drawings.				
i	PVC conduit 3/4 inch	1,500	Rft		
ii	PVC conduit 1 inch	750	Rft		
iii	PVC conduit 1-1/2 inch	300	Rft		
iv	PVC flexible conduit 3/4 inch	500	Rft		
v	PVC flexible conduit 1 inch	500	Rft		
vi	PVC flexible conduit 1-1/4" inch	500	Rft		
2	Supply & installation of following sizes PVC/UPVC Channel including all accessories such as bends, sockets, j-boxes, flexible conduits, metal saddles e.t.c for Main / Sub Main Power, Telephone & Data Cables, concealed / surface on wall as per design drawings. Provide MS Pull boxes where ever required				
i	PVC Channel 1 inch	1,000	Rft		
ii	PVC Channel 1-1/4" inch	500	Rft		
iii	MS powder coated perforated 16 SWG Cable tray 4"x 4"	150	Rft		
iv	MS powder coated perforated 16 SWG Cable tray 6"x 4"	150	Rft		

S.N O#	Description	Qty	Unit	RATE (RS)	AMOUNT (RS)
3	Supply and installation of following M.S Boxes (DAWIS) of 18 SWG sheet. Complete in all respects as per details and drawings.				
i	Floor	50	No		
ii	Fan	10	No		
iii	Light	150	No		
iv	Pull	50	No		
4	Wiring for light, fan or plug point with PVC insulated wire copper conductor wire in 3/4" dia PVC conduct recessed in the wall column, roof etc, including 1 sq.mm single core PVC insulated wire as ECC as required				
i	1.5 mm sq Single core (Pak Cable)	5,000	Rft		
ii	2.5 mm sq Single core (Pak Cable)	3,000	Rft		
iii	4 mm sq Single core (Pak Cable)	2,000	Rft		
iv	6 mm sq Single core (Pak Cable)	2,000	Rft		
v	2.5 mm sq ECC (Pak Cable)	1,000	Rft		
vi	1.5 mm sq ECC (Pak Cable)	1,000	Rft		
vii	2 core 23/.076 pvc cable (Pak Cable)	2,000	Rft		
viii	2 core 40/.076 pvc cable (Pak Cable)	1,500	Rft		
5	Supply, installation, connection and commissioning of following control cables PVC/PVC manufactured and laid in concealed in walls, floors, slabs.				
i	10mm sq 4core PVC/PVC +6 sqmm ECC (Pak Cable)	150	Rft		
ii	16mm sq 4core PVC/PVC +6 sqmm ECC (Pak Cable)	150	Rft		
iii	35mm sq 4core PVC/PVC +6 sqmm ECC (Pak Cable)	150	Rft		

S.N O#	Description	Qty	Unit	RATE (RS)	AMOUNT (RS)
6	Supply and installation of following 10 Amps, one-way gang type switches with plate including 16 SWG sheet steel back boxes recessed / surface on wall or as per design drawings.				
i	1 -1 Gang switch(Clopal)	20	No		
ii	1 -2 Gang switch(Clopal)	20	No		
iii	1 -3 Gang switch(Clopal)	50	No		
iv	1 -4 Gang switch(Clopal)	50	No		
v	1- 6Gang switch(Clopal)	50	No		
vi	1 -8 Gang switch(Clopal)	10	No		
7	Supply and installation of following 10/13/15/20 Amps socket outlets including 16 SWG sheet steel back boxes recessed / surface on wall or as per design drawings.				
i	3 Pin 10 Amps(Clopal)	20	No		
ii	3 Pin 13 Amps Duplex(Clopal)	100	No		
iii	3 Pin 15 Amps(Clopal)	20	No		
iv	3 Pin 20 Amps(Clopal)	30	No		
v	Round Pin 20 Amps(Clopal)	10	No		
B	Supply at site, installation, testing and commissioning of the following LED light fittings , complete with fixing accessories, earthing terminal, make as specified or by any one of the manufacturers complete in all respects.				
i	Down light LED SMD 36 W Compact	66	No		
ii	Surface LED SMD 18 W Compact	200	No		
iii	False Ceiling LED SMD 18 W Compact	200	No		
iv	Hanging light LED 36 W Compact	20	No		
v	Mirror light 18 W LED	5	No		
vi	Ceiling Fan 56" Inverter (Pak Fan)	10	No		
vii	Wall Bracket Fan 18" Inverter(Pak Fan)	10	No		
viii	Exhaust fan 6" Plastic body	5	No		

S.N O#	Description	Qty	Unit	RATE (RS)	AMOUNT (RS)
C	Supply, Installation, testing & commissioning and Alteration of following Distribution Boards as shown on drawing made with 14 SWG sheet steel housing including all installation accessories such as Rawal bolt etc. Complete in all respects. Supply of all the accessories required for the installation are included. Note: (Refer Single Line Diagram) 1) All the DB should be front accessible and maintainable. 2) Cost of Lighting Control Relays & Power Supplies should be Included in Distribution Boards. 3) The transportation and placement of DB's to the dedicated location is also included in the work scope, complete in all respects including leveling, grouting				
	4) Laser engraved tags required as mention in SLDs. 5) Space for circuit tagging required with permanent installation on protective sheet via rivets. 6) 20% space required in DB for future provision. 7) Tinplated Imported Cu bus bar with heat shrink color coded sleeves to be used. 8) Hinged protective metallic door required with knob/handle. 9) Braided Door earth required. 10) Lockable handle required for main door. 11) As-built drawing pocket. 12) Cable hanging arrangement. 13) Mimic display to be used.				
i	MDB	1	No		
ii	DB-1	1	No		
iii	DB-2	1	No		
iv	DB-3	1	No		
v	DB- AC	1	No		

S.N O#	Description	Qty	Unit	RATE (RS)	AMOUNT (RS)
D	Supply, Installation, testing and commissioning of following items for Addressable Fire Alarm System comprising of following equipments including all accessories required for the completion of the system in all respects.				
i	Addressable Fire Alaram System	1	No		
ii	Smoke Detector	25	No		
iii	Glass Brake	9	No		
iv	Wiring	1,300	Rft		
v	Fire Extinguisher Foam type 12 Ltr	10	No		
vi	Fire Extinguisher Dry Powder 6 Kg	10	No		
vii	Fire Extinguisher Dry Powder 2 Kg	10	No		
E	Supply, installation, testing and commissioning of following items for voice and data communication system including all material, labor, tools, accessories etc. Complete in all respects. Different colors of voice and data cables shall be used.				
i	50 Pair Cat -5 Cable	1,800	Rft		
ii	Cat -6 Patch Cord 1M	96	No		
iii	Cat -6 Patch Cord 3M	85	No		
iv	Patch Panel for Data	4	No		
v	Patch Panel for Voice	3	No		
vi	Communication Racks	2	No		
vii	Wi Fi Router	6	No		
viii	Biometric Machine	2	No		
ix	24 Port managed Switch layer-3 (Provided by Client)	4	No		
x	Duplex face plate with 1 No. RJ-45 I/O for data CAT-6	85	No		

S.N O#	Description	Qty	Unit	RATE (RS)	AMOUNT (RS)
xi	Premium High Speed HDMI: Up to 4K resolution with high dynamic range (HDR) at up to 60Hz refresh rate (Minimum 15Meter Length With Both Ends Punched with Port.	2	No		
xii	Front Cable Organizer for voice & data patch panels / wiring blocks with complete labeling and dressing for incoming cable management.	5	No		
xiii	Following Main / Sub-Main Telephone Junction Boxes (MTJB/SMTJB) made with 16 SWG sheet steel housing, powder coated paint of approved color, consisting of specified Distributor Blocks / Tag Blocks for incoming and outgoing PTCL lines from ONU . Item includes all interconnecting jumper wiring and termination.				
a.	MDF-PABX (1x1100Pair wiring Tag Block)	1	No		
b.	Supply and Installation of IP-PABX (5 lines IN &100 lines OUT) including Operating Console Make Panasonic or Equivalent	1	No		
xiv	CAT-6 UTP Cables for Data, Voice & Wifi communication system from Com Rack to each workstation in already laid PVC Conduit as per drawings including termination and tagging at both ends. Complete in all respects. (500Rm./Coil)	10,000	Rft		
Total for Electrica Works					

HVAC WORKS

Name of Client: Additional Finance Secretary (Sr /Admn), Finance Department, Government of Sindh
 Name of Project: Renovation / Refurbishment Works at 1st Floor, State Life Building No. 11,
 Abdullah Haroon Road, Karachi.
 Sub-Head 1.5: HVAC Works

S.NO#	Description	Qty	Unit	RATE (RS)	AMOUNT (RS)
	All Air Conditioning, Mechanical Ventilation Works shall be completed, tested and commissioned as per drawings, specifications, ready to operate and as per the instruction of Client/Consultant.				
1	Supply, Unloading, rigging, lifting, placement at respective location, installation, testing and commissioning of DX multi split type air conditioning units of different capacities (as per mentioned in schedule) complete in all respects, ready to operate. Including supply of supports, brackets, flexible duct connection, rubber isolator, flashing, gas charging, control wiring & power wiring (connection) in G.I. for external / PVC for internal from outdoor unit to indoor unit complete in all respects ready to operate as per specification, drawings and as per instruction of Consultant.				
i	FF-AC-FINANCE-SECRETARY-01/FF-CU-FINANCE-SECRETARY-01 (TR=1.4)	2.00	Nos.		
ii	FF-AC-CONFERENCE-RM-01/FF-CU-CONFERENCE-RM-01 (TR=1.4)	2.00	Nos.		
iii	FF-AC- D.I.G-TREASURIES-01/FF-CU-D.I.G-TREASURIES-01 (TR=2.0)	1.00	Nos.		
iv	FF-AC- D.I.G-TREASURIES-02/FF-CU-D.I.G-TREASURIES-02 (TR=1.0)	1.00	Nos.		
v	FF-AC-DEPUTY-DIRECTOR-01/FF-CU-DEPUTY-DIRECTOR-01 (TR=1.0)	1.00	Nos.		
vi	FF-AC-DIRECTOR-01/FF-CU-DIRECTOR-01 (TR=1.0)	1.00	Nos.		
vii	FF-AC-I.G TREASURIES-01/FF-CU-I.G TREASURIES-01 (TR=2.0)	1.00	Nos.		
viii	FF-AC- ASSTT-IG-TREASURIES-03/FF-CU-ASSTT-IG-TREASURIES-03 (TR=1.0)	1.00	Nos.		

S.NO#	Description	Qty	Unit	RATE (RS)	AMOUNT (RS)
ix	FF-AC-TREASURY-02/FF-CU-TREASURY-02 (TR=1.0)	1.00	Nos.		
x	FF-AC-TREASURY-01/FF-CU-TREASURY-01 (TR=1.0)	1.00	Nos.		
xi	FF-AC-PROJECT-DIRECTOR-01/FF-CU-PROJECT-DIRECTOR -01 (TR=1.0)	1.00	Nos.		
xii	FF-AC-SURVEILLANCE-RM-01/FF-AC-SURVEILLANCE-RM-01 (TR=2.0)	1.00	Nos.		
2	Supply, installation, testing and commissioning of refrigerant pipes (liquid + gas) with hangers,supports and ref pipe tray including 19mm thick expended rubber foam insulation, PVC tape wrapping + control wiring from indoor to outdoor including Gas charging if required and installation of branch distributor (supplied with units) complete in all respects ready to operate as per specification, drawings and as per instruction of Consultant. Ready to operate as per specification, drawings and as per instruction of Consultant.				
i	REF. LIQUID PIPE	250.00	Rft		
ii	REF. GAS PIPE	250.00	Rft		
3	Supply, Installation & Commissioning of U-PVC piping condensate drain with 10 mm thick rubber foam insulation (indoor application) and 13 mm thick (for outdoor application) or other applicable for riser or big size for condensate drain, including all core cutting, chiseling, fixing fitting, laying, cleaning and making good. Complete in all respect as per drawings and specifications.				
i	1" Diameter	335.00	RFT		
Total for HVAC Works					

RENOVATION / REFURBISHMENT WORKS OF 1ST FLOOR, STATE LIFE BUILDING NO. 11, ABDULLAH HAROON ROAD, KARACHI.



TENDER / CONTRACT DOCUMENTS (Volume – IV)
December, 2024

Client



IDG (Pvt.) Limited

Architects Engineers, planners Interior Designers





Project :

RENOVATION / REFURBISHMENT
WORKS OF 1ST FLOOR, STATE LIFE
BUILDING NO. 11, ABDULLAH
HARON ROAD, KARACHI.

Consultant :

IDG (Pvt.) Limited

ARCHITECTS, ENGINEERS, PLANNERS

Head Office :I.D.G House C-37 First Floor,
Block-16 adjacent to Masjid Sharkatul Hussain,
Gulistan-e-jauhar, Karachi

Tel:3332331 & 34019293 Email: idg12@cyber.net.pk

STRUCTURAL:

Electrical:

MECHANICAL:

[illegible]

No.	DATE	DESCRIPTION
REVISIONS		

North:



Date of Issue	December, 2024
Issued To	Client
Issued For	Tender

ARCHITECTURE

Status: **TENDER**

Drawing Title :

Existing Plan
First Floor Plan

Designed : SNK	Checked : SNK	Approved : SKMN
Drawn : MJQ	Date : Dec.2024	Scale / Sheet : 3/32"=1'-0"@A1

Rev. : 0

Drawing No. : IDG-FDGS-A1-0100

Drawing No. : IDG-FDGS-A1-0100



Project :

RENOVATION / REFURBISHMENT
WORKS OF 1ST FLOOR, STATE LIFE
BUILDING NO. 11, ABDULLAH
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STRUCTURAL:

Electrical:

MECHANICAL:

[illegible]

No.	DATE	DESCRIPTION
REVISIONS		

North:



Date of Issue	December, 2024
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ARCHITECTURE

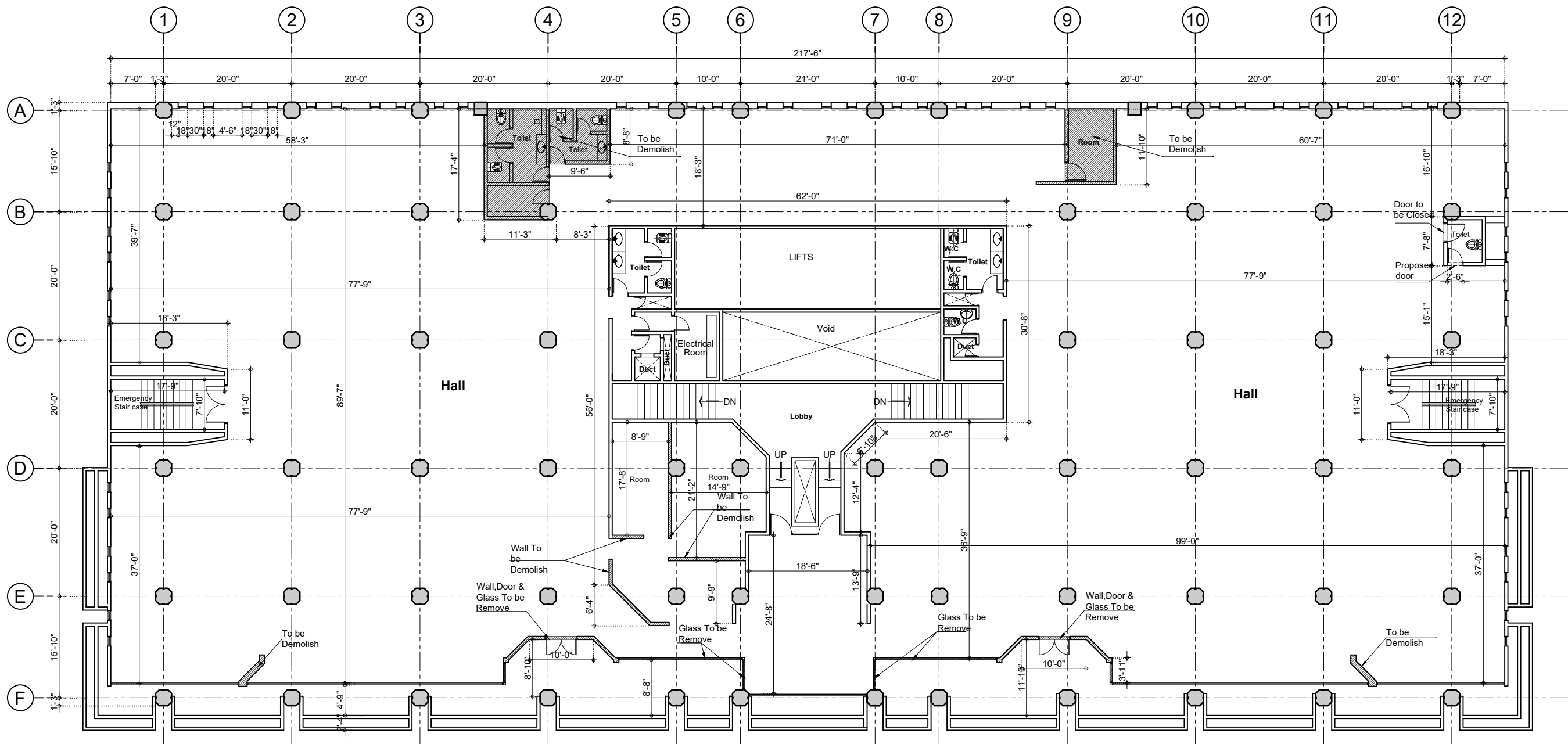
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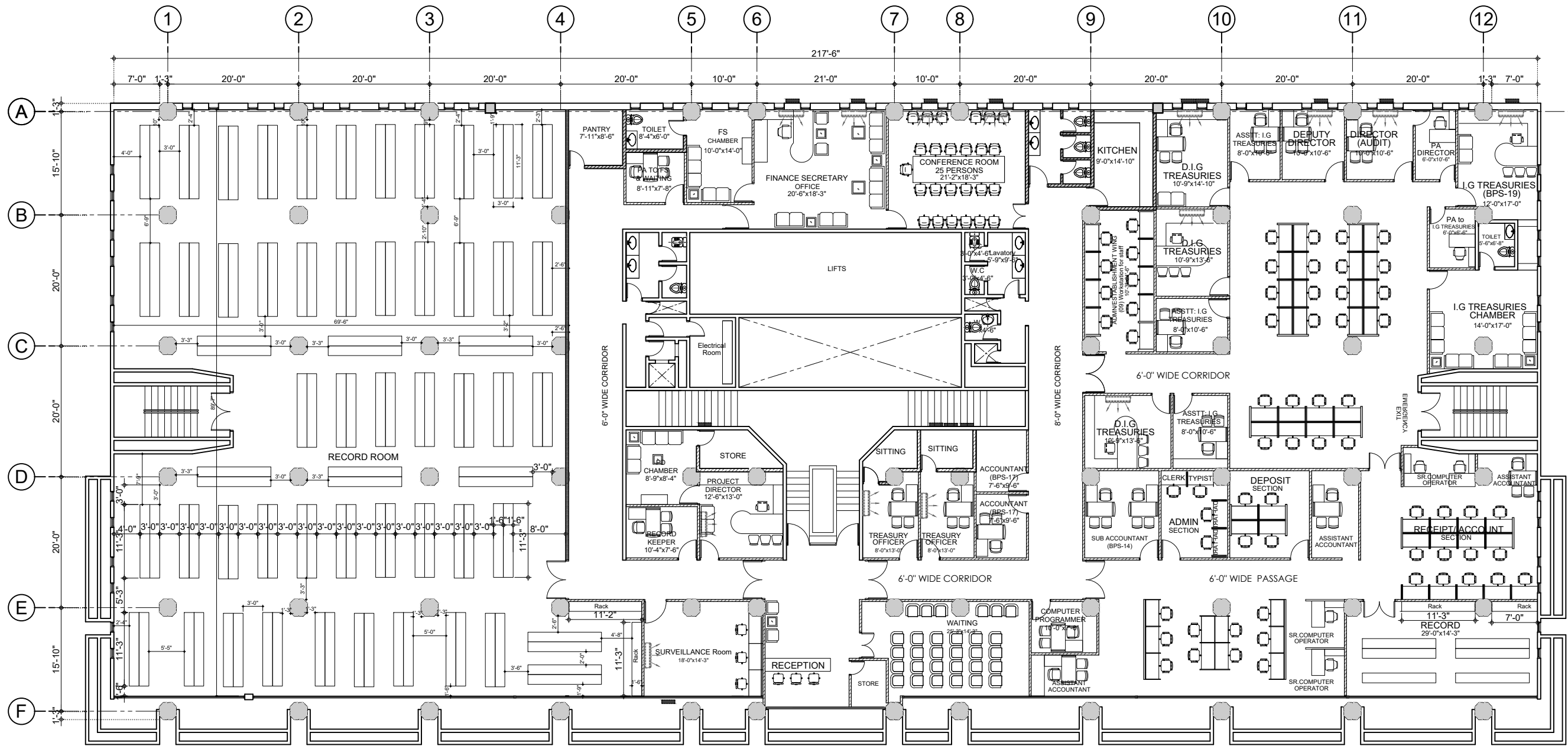
Existing Plan
Demolition Plan

Designed : SNK	Checked : SNK	Approved : SKMN
Drawn : MJQ	Date : Dec.2024	Scale / Sheet : 3/32"=1'-0"@A1

MJQ	Dec.2024	3/32"=1'-0"@A1
Rev. :		
		0

Drawing No. : IDG-FDGS-A1-0101







FINANCE
DEPARTMENT
GOVERNMENT OF SINDH

Client :

Project :

RENOVATION / REFURBISHMENT
WORKS OF 1ST FLOOR, STATE HOUSE
BUILDING NO. 11, ABDULLAH
HAROON ROAD, KARACHI.

Consultant :

IDG (Pvt.) Limited

ARCHITECTS, ENGINEERS, PLANNERS
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Block-16 adjacent to Masjid Sherkatul Hussain,
Gulistan-e-jauhar, Karachi
Tel:3332331 & 34019293 Email: idg12@cyber.net.pk

STRUCTURAL:

Electrical:

MECHANICAL:

No.	DATE	DESCRIPTION
REVISIONS		

North:



Date of Issue	December, 2024
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ARCHITECTURE

Status:

TENDER

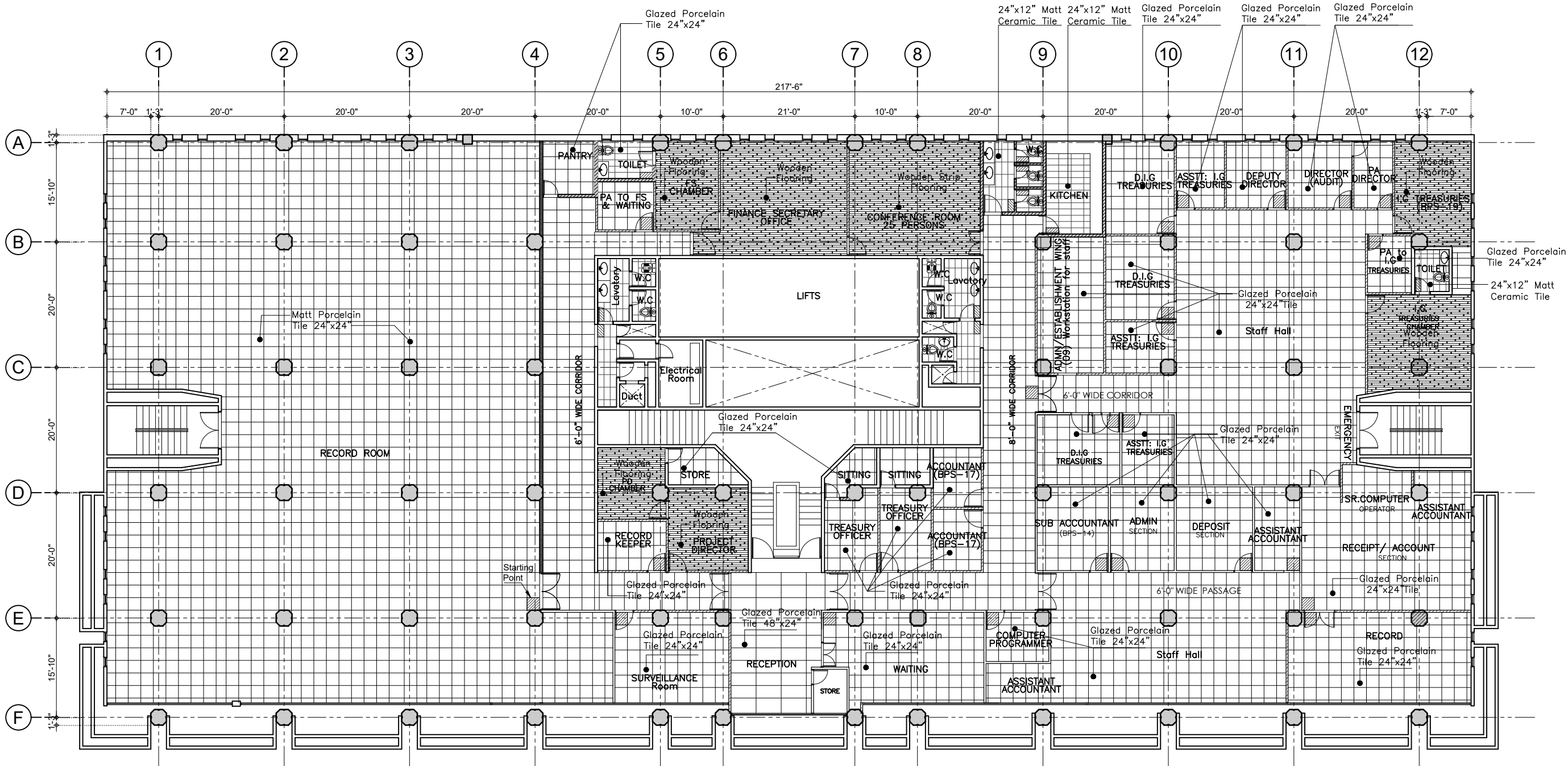
Drawing Title :

Proposed
Furniture Layout Plan

Designed :	Checked :	Approved :
SNK	SNK	SKMN
Drawn :	Date :	Scale / Sheet :
MJQ	Dec 2024	3/32"=1'-0"@A1
Rev. :	0	

Drawing No. :

IDG-FDGS-A1-0300





FINANCE DEPARTMENT
GOVERNMENT OF SINDH

Client :

Project :

RENOVATION / REFURBISHMENT
WORKS OF 1ST FLOOR, STATE FINANCE
BUILDING NO. 11, ABDULLAH
HAROON ROAD, KARACHI.

Consultant :

IDG (Pvt.) Limited

ARCHITECTS, ENGINEERS, PLANNERS
Head Office :D.G House, C-37 First Floor,
Block-16 adjacent to Masjid Sharkatul Hussain,
Gulistan-e-Jauhar, Karachi
Tel:3332331 & 34019293 Email: idg12@cyber.net.pk

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Electrical:

MECHANICAL:

No.	DATE	DESCRIPTION
REVISIONS		

North:


Date of Issue	December, 2024
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ARCHITECTURE

Status:

TENDER

Drawing Title :

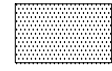
Flooring Plan
Proposed Layout Plan

Designed :	Checked :	Approved :
SNK	SNK	SKMN
Drawn :	Date :	Scale / Sheet :
MJQ	Dec 2024	3/32"=1'-0"@A1
Rev. :	0	

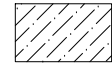
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IDG-FDGS-A7-0100

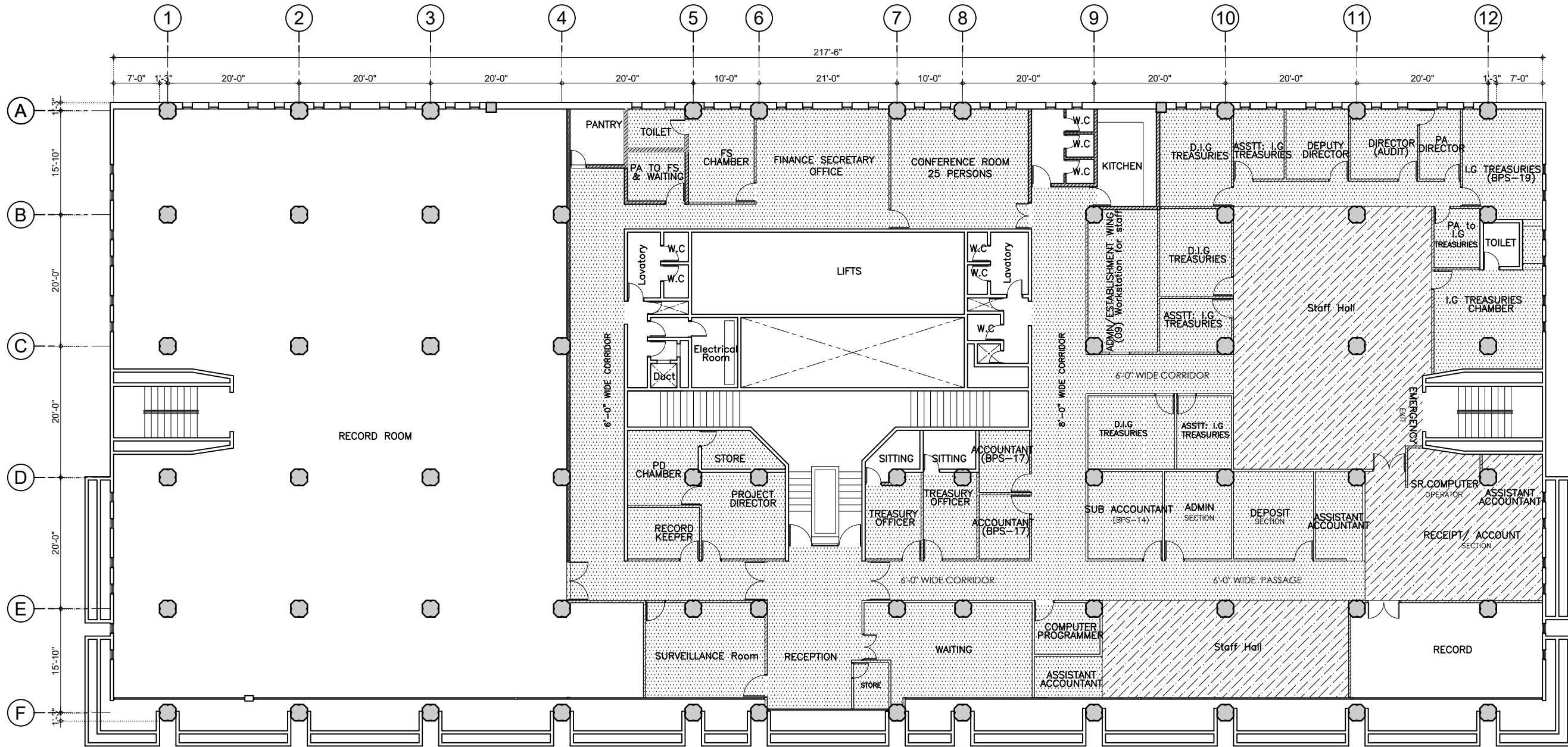
LEGEND:



GYPSUM BOARD CEILING



INDUSTRIAL CEILING



Client :



Project :

RENOVATION / REFURBISHMENT
WORKS OF 1ST FLOOR, STATE LIFE
BUILDING NO. 11, ABDULLAH
HAROON ROAD, KARACHI.

Consultant :

IDG (Pvt.) Limited
ARCHITECTS, ENGINEERS, PLANNERS
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Tel:3332331 & 34019293 Email: idg12@cyber.net.pk

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Electrical:

MECHANICAL:

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ARCHITECTURE

Status:

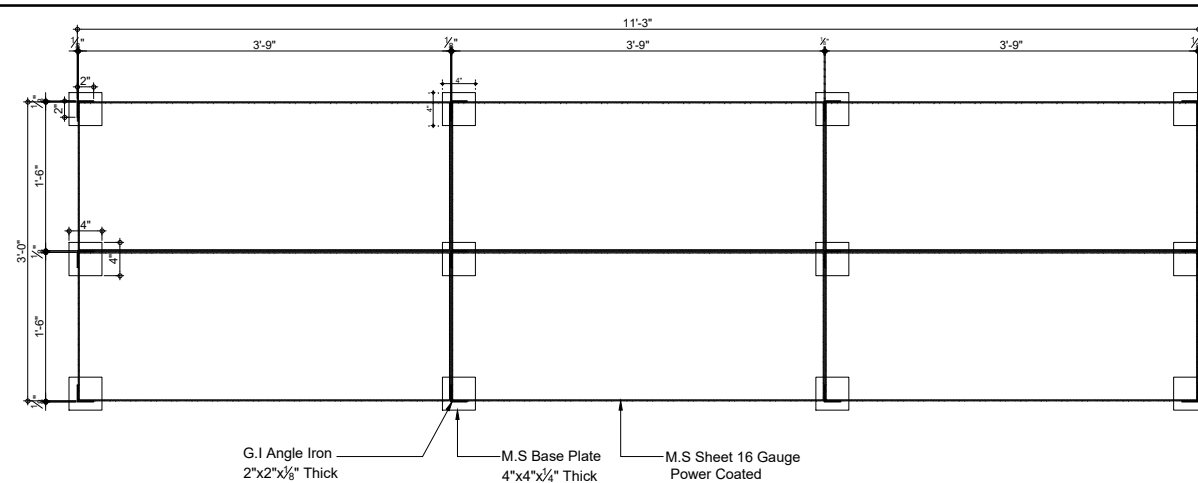
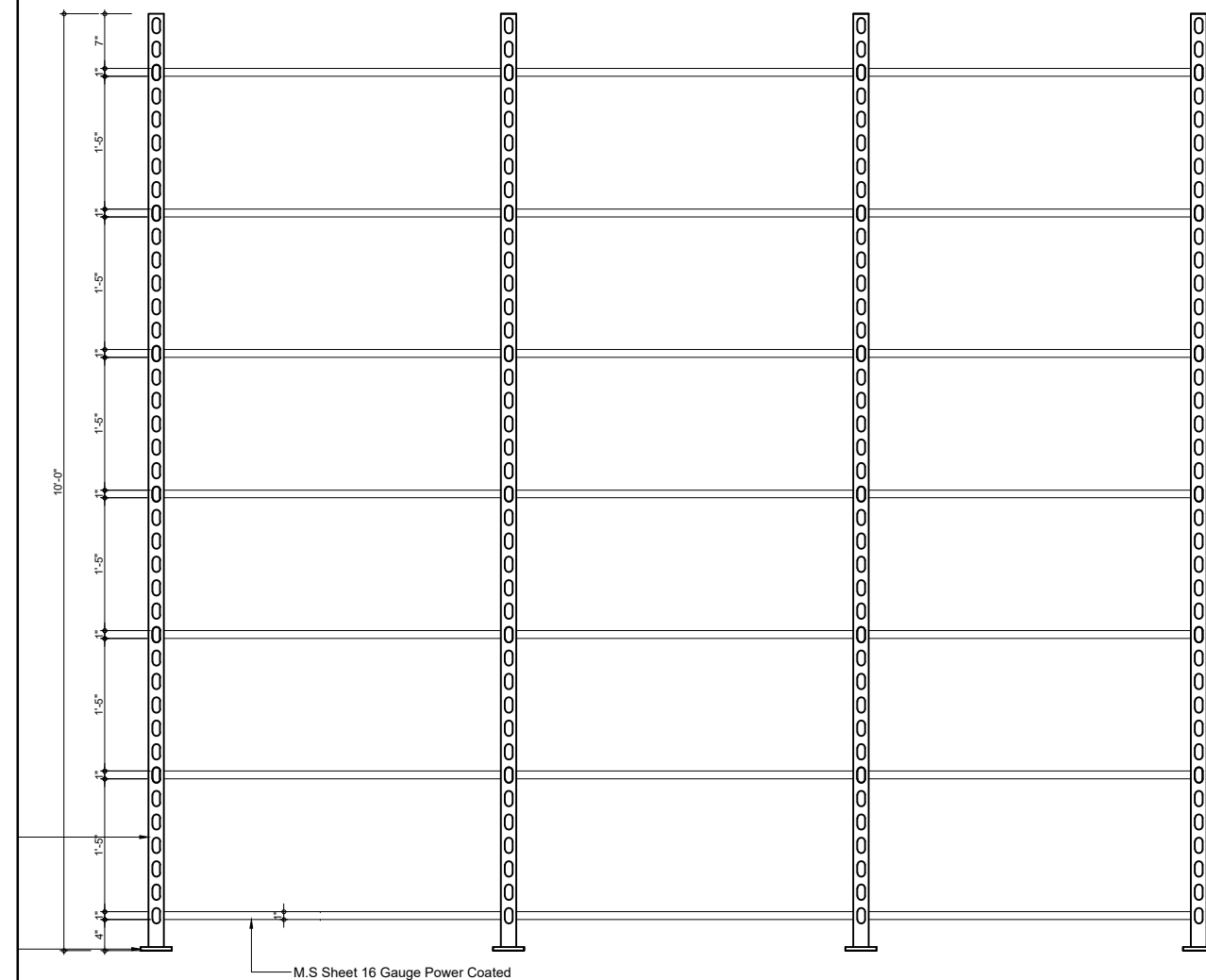
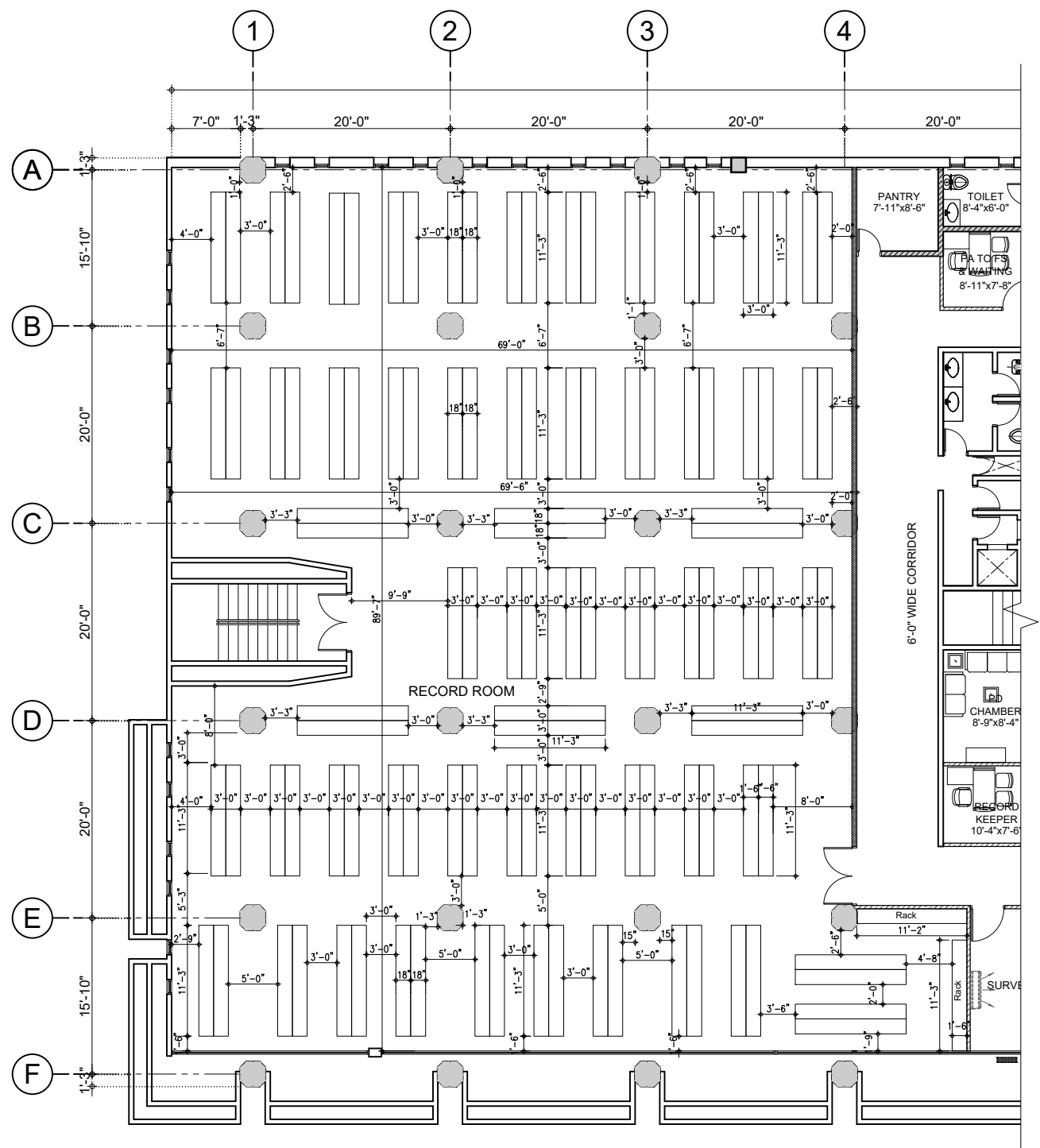
TENDER

Drawing Title :

Proposed
False Ceiling Plan

Designed :	Checked :	Approved :
SNK	SNK	SKMN
Drawn :	Date :	Scale / Sheet :
MJQ	Dec.2024	3/32"=1'-0"@A1
Rev. :	0	

Drawing No. :
IDG-FDGS-A8-0100

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