

**EMPLOYER'S REQUIREMENT  
FOR  
CIVIL WORKS**

**CHAPTER 10  
CIVIL WORKS - EMPLOYER'S REQUIREMENTS**

## **CHAPTER 10**

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## **CHAPTER 10**

### **CIVIL WORKS - EMPLOYER'S REQUIREMENTS**

#### **10.1 Scope of Work**

##### **General introduction**

This section lays out the requirements of the Employer regarding the Civil Works for the project. The final arrangement of the works shall be developed and construction by the Contractor to best exploit the local physical conditions while maintaining the fitness for purpose inherent in the outline requirements. Nonetheless contractor is responsible to substantiate these requirements to ensure complete functional performance of Pumping Station and Fulfillment of his obligations under this Contract.

The Employer's Requirements have been prepared in consideration of the Conditions of Contract for EPC/ Turnkey Project.

#### **10.2 Contractor's responsibilities**

The Contractor shall perform or cause to be performed all works and services necessary for the design, engineering, procurement, construction start-up demonstration and testing of the Works, and remedying of defects in the Works. The Contractor shall provide all materials and equipment, machinery, tools, labour, transportation, administration and other services and items required to complete the Works on a turnkey basis and otherwise in accordance with the Contract (defined as the "Services").

The Contractor shall perform for the Services and other work hereunder in accordance with Good Industrial Practices, all applicable laws, sound engineering and construction practices, and the safety precautions. Each part of the Works shall be designed and constructed by the Contractor so as to be fit for use for their respective purposes and when completed the works shall be fit for the purposes for which the Works are intended.

The parameters and criteria for the design specified herein shall be used to develop a series of design briefs, tender drawings, data and construction specifications to be submitted by the Contractor. These memoranda, drawings, data and specifications shall be developed from information provided by the Employer, additional studies and field investigations carried out by the bidder and other requirements of these contract documents. The Contractor shall be responsible for ascertaining the validity of all informations made available by the Employer. The detailed design shall be performed by the Contractor based upon the basic design criteria stated herein, the design memoranda submitted with this bid, and additional design memoranda and design analyses as necessary to complete the design of the works. The referred documents, design parameters, loads and similar items given herein are to be considered minimum standards to which the works are to be designed.

The contractor shall use a more conservative approach to the design where in his professional judgment as appropriate.

Temporary works shall be designed to be safe, reliable, adequate for all loads and

uses, and where they are to be incorporated into the permanent works, temporary works shall be designed in strict compliance with the criteria adopted for permanent works.

Without limiting the foregoing, the Services shall include those described in the following Sub-sections.

### **10.3 Engineering and design**

The Contractor shall provide all engineering and design services necessary for completion of the Works in conformity with the Contract, including but not limited to site investigations and research, conceptual design engineering and design necessary to describe and detail the Works, provision of criteria for the detailed design by suppliers of equipment, material and systems for incorporation into the Works, and preparation of drawings, plans, bills of materials, schedules and estimates. The Contractor shall review and be fully responsible for and will co-ordinate and integrate engineering and design services provided in relation to the Works by Sub-Contractors and suppliers.

The Contractor shall be solely responsible for the interpretation of the data contained in the Employer's various Preliminary Design Documents.

### **10.4 Basic design criteria and applicable codes**

The design of all structures shall be carried out preferably based on BS Standards and Codes of Practice. The design standards adopted should, as far as possible, be from a single authority and be available in the language of the Contract.

Structure shall be designed and constructed in accordance with latest issues of following British Codes of Practice and Specifications:

- a. BS 8110 : The structural use of reinforced concrete
- b. BS 8007 : The structural use of reinforced concrete
- c. CP 1140 : The structural use of reinforced concrete
- d. CP 3 : Code of basic data for design of buildings  
Chapter-V Loading  
Chapter-IX Durability

The analyses shall determine the critical load case for each structure and structural member, verify the structural member verify the stability of each structure and calculate the critical loads to be borne by each of the member within the structure. The design shall size each structure and structural member to safety and economically to carry the required load using the prescribed materials.

The allowable stresses for concrete and steel shall be in accordance with accepted international and local codes and standards.

Seismic Factor: Seismic design and detailing shall be applicable in design of all structures as per criteria prevailing in the project region and as published by Sindh Building Control Authority.

All building such as office block, Pump House, H.T. Panel room, switch room, Power sub-station etc. and the like shall have RCC foundations and RCC construction with RCC framed structure, cement concrete Block Walls, etc. complete.

Bearing capacity of the soil is given in report of preliminary soil assessment work, copy attached.

Depending on soil investigation or if during construction of foundation works of buildings and structures any soft soil or treacherous soil is encountered, foundation design shall be carried out to demonstrate the safety / stability of structure with adequate factors of safety.

Any variation on this account shall be deemed to be included in the contract price.

The design of civil works shall at least meet the following requirements.

- a. The structures shall remain stable during and after construction with appropriate factors of safety under all probable loads and load combinations.
- b. Factor of buoyancy shall also be considered for all water retaining structures.
- c. All water retaining structures shall be leak proof and water tight.
- d. Internal stresses shall not exceed recognized limits.
- e. Foundation materials shall not be overstressed.
- f. Properly designed expansion and construction joints with suitable water stops and anchored covering shall be provided.
- g. Pump room structure shall be water proof (from subsoil water )

The Contactor shall be responsible for safety and stability of the structure and water tightness of the water retaining structures.

#### **10.4.1 Design load & load combinations**

All building structure shall be designed for the loads to which they will be subjected.

- a. Dead load
- b. Live load
- c. Impact or dynamic effect of the live load
- d. Wind load
- e. Horizontal forces due to water current
- f. Earth Pressure
- g. Earth quake stresses

#### **Compliance to authorities**

In addition to the basic design criteria, the design shall also conform to the requirement of all relevant local, provincial and federal authorities where approval for that section of works is needed from the relevant authorities.

#### **Mix design of concrete**

Method of concrete mix design of strength requirement adopted for the design shall be specified by the contractor.

## **10.5 Units of measurement**

All units of measurement shall be SI (Kg m.) units.

## **10.6 Economic life of works**

The design of civil works shall be based on useful economic life of 50 years.

## **10.7 Bid submissions**

### **Design brief**

#### **a. General**

Clause 7.1 of Material & Workmanship defines the scope of work. The Employer requires that each bidder be prepared to define in detail, the elements of his offer during the tendering process. This shall be done through a design brief covering all elements to be designed by Contractor. Through this brief the contractor shall provide evidence that consideration has been given to all other items. The design brief is to be supported by drawings and are intended to represent the type and quality of information required to evaluate the bids and to highlight;

- (1) Design parameters and methodology
- (2) Design criteria of the project and its components parts.

### **Construction Specifications**

All designs, equipment materials and construction methodology not completely detailed in referenced or proposed documents or design criteria shall conform to acceptable industrial practice. During the evaluation period, the Employer may request to submit Construction Specifications for the purpose of clarifying and defining the bid. The format of the Specifications shall be as follows:

- a. General
- b. Detail Description
- c. Related Works
- d. Reference Specifications
- e. Submittals
- f. Design Requirements

### **Contractor staff qualification**

All staff must be proficient in the English language.

The Project Manager, Project Design Manager and Project Design Engineer should be graduates of recognized colleges.

The Bidders shall submit with their Bids the name of the nominees for each of the designated positions together with detailed resumes of their experience and qualifications.

### **Design Programme**

## **10.8 Detailed design submission**

The Contractor shall submit to the Employer a Design Programme showing the order and procedure in which he proposes to carry out the Design and Engineering services with a schedule of submission of design documents and drawings for completing the Works within 28 days after the “Notice to Commence”, and also to match with the Work Programme (Sub-Clause 8.3 of the Conditions of Contract). Such Design Programme shall be subject to review and revision by the Contractor in Consultation with the Employer in order to achieve completion of the Works within the time for completion.

The number of copies of the report and other documents to be submitted to the Employer by the Contractor is specified in Sub-Clause 2.8.

### **Detailed design submission**

The Contractor shall carry out structural analysis of the structures and its foundations to confirm the stability under site specific seismic loads.

Detailed reinforcement drawings and bar bending schedules shall be prepared for all concrete structures. Where the structural design for earthquake loading relies in ductile behavior of structural elements then anchorage, splicing of bars and shear provision shall comply with current earthquake detailing practice.

The design works shall cover determining the hydraulic conditions relevant for long term operational efficiency and safety in the approach to through all water conveyance elements.

Within 2 (two) months of commencement date and prior to beginning any construction work, the Contractor shall submit to Employer for consent a Detailed Project Report (DPR). The DPR shall define all finished structural dimensions and / or performance characteristic of all elements of the project except those dependent on subsurface geotechnical conditions. Geotechnical investigation report is enclosed. The bidder however shall ensure that the estimates are based on the Contractor’s own confirmatory investigations and / or interpretations. The results and interpretations of the geotechnical investigations shall be presented in the DPR.

The DPR should include at least the following:

- a. The result and interpretations of the geotechnical investigations (including construction materials.)
- b. The results and interpretations of the hydrological investigations.
- c. The results and interpretations of topographic surveys.
- d. The geotechnical, hydraulic and structural design including design standards, criteria and calculations.
- e. Drawings to a detail sufficient to show all significant structural and plant features.
- f. Justifications supported by calculations and drawings.
- g. Details of specifications to be adopted.
- h. Quality Control plan for construction stage.

### **Drawings & documents**



As part of the Design Documentation, the Contractor shall provide a complete and clear set of stability check calculations, specifications and drawings of all construction works, service utilities, and materials as well as of his temporary works design.

The Contractor shall successively submit structural design, documents and drawings for the review, comment and consent of the Employers in accordance with the schedule of submission of design documents and drawings in the Contractor's Work Programme as stipulated in above. The Employer shall give his consent / Comments on all design and drawings referred to him within 15 days for submissions prepared by the Contractor and submitted to the Employer at Site, and 28 days of the date of receipt in the Employer main design office for submissions prepared by the Contractor and reviewed by the Employer from the main design offices.

### **Submission Drawings**

The details of drawings / documents which will be submitted for the Employer review and consent or for information are as below:

- (1) Detailed technical specifications wherever necessary.
- (2) General arrangement and layout drawings.
- (3) Concrete outline drawings.
- (4) Assembly drawings.
- (5) Foundation design and treatment drawings.
- (6) General reinforcement arrangement for structures.

The drawings in the following category will be submitted only for information and record of the Employer:

- a. Detailed Reinforcement drawings.
- b. Design Calculations.
- c. Sub-assembly Drawings.

In case of consent of a submission of drawings / documents by the Employer, one set of drawings / documents will be returned to the Contractor within the stipulated review period, marked "Consented".

In case the drawings / documents are accepted in principal, but minor comments are made, the drawings / documents will be marked "consented with comments" and the comments shall be explained in a covering letter and / or clearly marked in the drawings / documents, which will be returned to the Contractor within the stipulated review period. Further design construction shall proceed, considering the comments. Amended drawings / documents will be submitted after completion of the works.

In case of substantial disagreement with the drawings / documents, these will be marked "returned for review" and will be returned to the Contractor within the stipulated review period with the reasons for disagreement spelt out in detail in the covering letter. Technical discussions shall, if required, be held thereafter without delay to address the concerns of the Employer. The drawings / documents will be reviewed, appropriately revised and resubmitted for information with the response, explanation or action to the comments of the Employer.

### **Approved drawings**

In case consent or comments of the Employer have not been communicated within the stipulated review period then the drawings shall be deemed to have been consented to and the Contractor can then act on them and shall inform the Employer accordingly.

The Contractor shall furnish to the Employer the following number of copies of approved drawings, reports and other technical documents:

- a. One transparent copy and 3 paper copies of drawings, which are submitted for information only.
- b. One transparent copy, three paper copies A1 size and three paper copies of minimum A-3 size of drawings, which are submitted for consent. One paper copy shall be returned to the Contractor with consent or comments.
- c. Consent drawings in sets of two transparent copies and ten paper copies of minimum A-3 size.
- d. As-built drawings in sets of one transparent copy, and ten paper copies of minimum A-3 size.
- e. Report and other documents in five copies and approved manual in ten copies for Employer's reference and records.
- f. Progress reports in five copies.

### **Amendment / revision of drawings**

No comment, amendment or revision to a report or design or its redesign made or requested by the Employer which is for reasons caused by an error or mistake by the Contractor or is deemed necessary for the proper fulfillment of the Scope of the Works defined in the Contract shall not be grounds for additional time or payment. Any request of the Employer that can be shown to be a requirement outside of the scope of the Works of the Contractor shall be notified as such by the Contractor and the Employer will decide whether such additional work will be required. If outside the scope of the works and required by the Owner this shall imply that such additional works shall constitute a Variation.

### **Defect**

If either the Contractor or the Employer become aware of an error or defect of a technical nature in a document which was prepared for use in executing the Works, which has any effect on the execution of the Works and needs to be clarified, prompt notice shall be given to the other party of such error or defect, if errors are found in the documents produced by the Contractor, the documents and the Works shall be corrected at the Contractor's cost, notwithstanding any consent by the Employer.

The Contractor is responsible to liaise and co-ordinate his design with that of the different disciplines and subcontractors / suppliers, including incorporating the interface requirements,

### **Consent or approval**

Consent or approval of the Employer to any or all of Contractor's documents, programme, schedules, designs and drawings etc. shall not relieve the Contractor

of design and construction responsibilities / liability or obligations to complete and commission the Works as per provisions of the Contract.

## **10.9 Construction and construction management**

The contractor shall manage and carry out the construction of the works and ensure the expeditious construction thereof in accordance with the terms and provisions of the Contract. The Contractor shall inspect or cause to be inspected all material and equipment to be incorporated in the Works and shall reject those items determined to be not in compliance with the Contract.

The Contractor shall establish and maintain works management control systems and provide construction management services in accordance with the requirements of the Contract and otherwise necessary for the achievement of the Contractor's obligations under the Contract.

The Contractor will co-ordinate and integrate the construction of the Works including those performed at interfaces between the engineering disciplines responsible for the construction services provided by him and the construction work carried by Subcontractors.

## **10.10 Procurement**

The contractor shall procure and pay for, in the Contractor's name as an independent contractor and not as agent for Employer, all the Contractor and Subcontractor labour, materials, equipment, supplies, manufacturing and related services (whether on or off the site) for construction of an incorporation into the Works which are required for completion of the works in accordance with the Contract. The Contractor warrants that all such items shall be new and of the quality, reliability and performance, where no express requirements are set out in the Contract, of a quality reliability and performance consistent with best engineering practices.

## **10.11 Standards of design and works**

All the design and construction of all permanent works shall comply with codes referred in the Contract.

The works shall be executed in a neat, controlled and workmanlike manner, shall be designed to the codes referred in the Contract for the class of duly specified. All materials shall be of good quality and approved by Employer. The specified service life is 50 years for Civil Works.

## **10.12 Testing**

All materials, related to or intended for incorporation in the works shall be, while in the process of procurement subjected to such tests and inspections as may be necessary, to prove compliance with the requirements of the Contract Documents.

Acceptance of pertinent test certificates, or waiving of inspections and tests, shall in no way relieve the contractor of his contractual obligations for furnishing the works in accordance with the provisions of the Contract.

The contractor shall upon reasonable notice, grant the Employer, at all time, free access to the factories and workshops, both local and overseas and afford full facilities for unrestricted inspection and witnessing of assembly and tests and shall furnish him with such information as may be required.

### **10.13 Design control**

The Contractor's design shall be checked and consented by the Employer. The verification procedure shall establish that the design meets the Employer's Requirements, the applicable standards and best Engineering practices.

Design verification may require qualification tests of components or assemblies. Qualification tests shall provide testing under the most adverse design conditions for the features being verified or enable results to be extrapolated to such condition. Procedures for such testing shall be prepared by the Contractor and agreed with the Employer prior to testing.

### **10.14 Contractor's tests**

The Contractor shall provide the services of competent Engineering staff to test all items of Material and Plant in a safe and efficient manner.

The Contractor shall establish, along with his detailed design, procedures for testing of all Materials and Equipment in accordance with specified standards and shall promptly produce certificates of such testing including all test certificates for proprietary materials. Testing procedures shall be in accordance with those give in the General Conditions.

At site the Contractor shall set up a laboratory for testing of construction materials. The tasks, which cannot be performed at the site laboratory, will be done by the Contractor at other laboratories approved by the Employer.

The participation of the Employer or his Representative in any inspection and test activity will not relieve the Contractor of his responsibility for ensuring that the requirements of the specifications are met.

### **10.15 General description of Civil Works (scope of work)**

The principal elements of the Civil Works are:

- a. Provision of Materials;
- b. Provision of Services;
- c. Provision of Temporary Works;
- d. Construction of Permanent Works;
- e. Demobilization, site rehabilitation, clean up mitigation in accordance with national and local regulations of all environment impacts form construction, and disposal of excess materials and debris.

The descriptions given in the document are outline descriptions only. Such descriptions do not include or give full details of all materials or other items to be supplied or all works and services to be executed by the Contractor in order to fulfill its obligations under the Contract.

### **10.16 Construction of the permanent works**

## **10.17 General**

The Permanent Works to be performed by the Contractor are described below;

## **10.18 Inlet works**

The inlet and screen chambers and suction well shall be R.C.C structure having fair face finish. The design shall conform to the standard codes and requirements as given out under the relevant items.

## **10.19 Pump House at Ground floor level:**

(i) The ground floor shall have the following facilities:

- (1) Motor hall
- (2) PLC/SCADA control room
- (3) Transformer room
- (4) Panel room

(iii) R.C.C columns shall be fair face finish and provided with corbel for gentry crane.

(iv) R.C.C floor / slab with openings for lowering the pumps etc. shall have removable covers of aluminum alloy chequered plate of non-slip pattern min. 4.5 mm thick.

(v) Cable trenches / pits shall have fair face finish and provided with aluminum alloy chequered plate steel plate covers/flooring of non-slip pattern. The plate shall be minimum 4.5 mm thick.

(vi) The height of the building shall be enough to accommodate the designed motors and pumps and overhead crane.

(vii) Finish to the exterior surface of the building shall be as detailed under relevant clauses & as directed by the Engineer.

(viii) Plinth protection shall be provided around the building with a semi circular cement concrete lined drain.

(ix) Sun – shades shall be provided to the Windows and Ventilators to match external architecture.

(x) Windows and ventilators shall be provided with galvanized steel wire mesh of 20 mm square.

(xi) Windows shall be sliding type

(xii) Windows / ventilator in the office will be provided with double glazing

(xiii) Windows in the motor hall shall be provided with mechanism for opening

(xiv) Proper drainage arrangements from the building shall be provided.

(xv) Plumbing works shall be complete using uPVC-100 pipe and fixtures of the best quality available preferably Masters.

#### **10.20 Pump house at basement level and suction channel**

The pump house shall be an R.C.C structure having fair face finish. The design shall conform to the standard codes and requirement as given out under the relevant clauses.

#### **10.21 Chambers:**

The chamber shall be R.C.C. fair face finish concrete and chamfered edges. The chamber shall be minimum 300 mm above the finished ground level. Where the chambers are covered, the covers shall be of heavy duty galvanized iron covers and frame.

#### **10.22 KESC sub-station:**

The building shall be as per approved drawing of the KESC.

#### **10.23 External site drainage:**

Site drainage shall be properly designed and provided with drainage pipes road crossings and precast covers wherever required.

#### **10.25 Access road and parking areas:**

Existing road / walkways where dismantled shall be restored to its original condition. New roads and parking areas shall be made in cement concrete and should be of adequate dimensions. Cross drainage structures shall be RCC type & to be provided at suitable location along the alignment and elsewhere deemed necessary.

#### **10.26 Site development:**

Site development around the pump house and ancillary structure including culverts, leveling, grading, landscaping and grass & shrubs areas shall be minimum 2000 sq. meters as per approval of the Employer

#### **10.27 Civil Works Requirements (General)**

##### **10.28 Excavation**

This section covers excavation both surface and underground, required for the foundation of structures, the extraction of material for borrow areas and underground excavation works, in soil rock, including loading, transportation and disposing for all parts of the works.

Disposal of material is classified either to be transferred for further processing and subsequent as for concrete aggregates, to construct embankments and roadfills, disposal of surplus and / or unsuitable materials in permanent deposits.

The Contractor's excavation equipment shall be of recent type and shall be provided and kept in good operating condition.

#### **10.29 Clearing Site**

The Contractor shall clear the ground on which the works are to be erected, by removing trees and roots, bushes, grass and other superficial obstructions. The material cleared shall be disposed off by the Contractor by controlled burning or in some other approved manner.

The Contractor shall clear the ground on which the works are to be erected, by removing trees and roots, bushes, grass and other superficial obstructions. The material cleared shall be disposed off by the Contractor by controlled burning or in some other approved manner.

#### **10.30 Exploration of Borrow Areas and Quarries**

Borrow or quarry material shall be obtained from the areas designated by the Contractor in his design investigations. Borrow areas and quarries shall be exploited only in so far as the suitable materials cannot be obtained from required excavations.

All negotiations with the owners of property outside the right of way (RoW) provided by the Employer to the Contractor on which any borrow or quarry pit will be situated, and obtaining the relevant licenses for exploiting such areas will be undertaken by the Contractor. The contractor will also obtain licenses, if required for exploiting the RoW for stone, gravel, sand and other materials.

The Contractor shall carry out sufficient tests on the material being excavated from borrow or quarry pit in order to satisfy the specified requirements for the particular purpose for which it is to be used.

If there is any doubt concerning the quality of borrows or quarry material being excavated at any time the Contractor shall notify the Employer immediately, and in any case before such material is processed. The results of all tests carried out by the Contractor shall be submitted to the Employer at timely intervals.

On completion of borrow operations remaining final slopes shall be prepared to be kept in stable conditions as consented by the Employer.

#### **10.31 Excavation in Soil**

The excavations may be widened and flattened beyond the lines and levels shown on the Contractors drawings as necessary to ensure the stability of the slopes associated with the excavation. Where the excavation is for a structure, the nominal excavation profile will allow space for the placing and bracing of formwork.

#### **10.32 Shoring of Existing Structures**

The area (site) of construction generally lies in open land, with existing structure / water supply line, etc. The Contractor / Bidder shall shore up the structures /

water supply lines the stability of which is liable to be endangered by the execution of the work. The Contractor shall be fully responsible for all damages to persons or properties resulting from any accident to structures / water supply lines etc.

### **10.33 Slips, fall and Excess Excavation**

The Contractor shall prevent slips and falls of material from the sides of the excavation and embankments.

In the event of slips or falls occurring in the excavations, and where excavations are made in excess of the dimensions of the permanent works, the voids so formed shall be filled by the Contractor. When such voids, in the opinion of the Employer, may affect the stability of the ground for the support of the works, or of the adjacent structures and services, the Contractor shall fill the void soil with concrete 10 / 20. In other cases the Contractor shall fill the voids with selected excavated material placed and compacted to the approval of the Employer. This shall be at no extra cost to the Employer.

Particular care shall be exercised by the contractor to ensure that over excavation beyond specified levels is not carried out. In case of over excavation the volume excavated shall be replaced by Concrete of class 10 / 20 at his cost. Filling of voids due to over excavation shall be in accordance with relevant Para hereof.

### **10.34 Dewatering**

The Contractor shall keep each structure and pipeline excavation clear of water during construction and, in the case of structures being constructed in saline groundwater for such further period as may be necessary to avoid the submersion of concrete within 3 days of it being placed. The method of keeping excavation clear of water, dewatering, and disposal of water shall be subject to the approval of the Employer. The Contractor shall ensure that sufficient standby plant is on Site at all times to avoid any interruption or discontinuity of the dewatering process.

### **10.35 Excavation of Foundation**

In vicinity of the existing conduit and other structures, dewatering shall be carried out by establishing control points, lowering of the groundwater level to below the required excavation level and maintaining the same till concrete is cast and minimum 3 days old.

Sump well points for dewatering shall be located at safe distance from the foundation of the existing conduit to avoid any settlement or other damage to the same.

The contractor shall submit his dewatering plan with details of equipment, for approval of the Employer minimum 28 days in advance of excavation.

Use of jack hammers and vibratory tools in proximity of the existing structure shall not be allowed. No blasting is permitted within the limits of site. The vertical sides of all excavations shall be excavated to the specified excavation limits.

Excavated surfaces which will remain permanently exposed on completion of the Works shall be cleared of all loose material, pieces of rock, debris, rubbish and



shall be left neat and tidy.

#### **10.36 Disposal of Surplus Material**

Surplus excavation material shall be disposed off in the areas as directed by the Employer.

#### **10.37 Preparation of Foundations**

After an area has been excavated and cleared the Contractor shall clean, the foundations surface so that the foundation surface can be inspected by Employer for any faults, cracks, and other defects in the rock if encountered.

When any excavated surface is ready for concreting the Contractor shall request the Employer for inspection and formal consent. No foundation will be covered before this consent has been given.

#### **10.38 Concrete and Reinforcement**

This Clause specifies basic and minimum standards for materials and workmanship for preparing, transporting, placing, compacting, and finishing of concrete.

Concrete shall be composed of suitable materials such as Portland cement, SR cement, water, fine and coarse aggregate and admixtures.

The design of concrete mixtures shall be based upon securing a plastic, workable mixture suitable for the specific conditions of placement and, when properly cured, a product having durability, impermeability, and strength in accordance with all the requirements of the structures.

The Contractor shall submit for review all detailed concrete mix designs complete with mix proportions, gradations, specific gravities, absorption, unit weights, compressive strength at all specified ages, water cement ratio, slump, air content, air temperature at the time of mixing and placing temperature of the concrete.

#### **10.39 Materials**

##### **a. Cement**

Cement for concrete mortar and grout shall be Portland cement or Sulphate Resistant Cement and shall conform to the standards specified in the Contractors design. Cement shall be free from lumps, ungrounded clinker, and other foreign materials.

Transportation of cement to the batching plant shall be accomplished in adequately designed weather tight trucks or other means which will protect the cement completely from exposure to moisture.

Each type of cement shall be stored separately of other types. The amount of cement stored shall meet the requirement for at least 20 days of concrete placement. Immediately upon receipt at the Site of the Works, cement shall be stored in a dry weather tight and properly ventilated structure with adequate

provisions for the prevention of absorption of moisture.

#### **b. Admixtures**

Admixtures shall be delivered to site in suitably labeled containers and stored and used in accordance with the manufacturer's specifications and recommendations.

#### **c. Water**

The water used for making and curing concrete shall generally be of drinking water quality and shall be from a source approved by the Employer and at the time of use shall be free from polluting matter in any quantity and shall not have the following characteristics:

- (1) Pollutants affecting the initial setting time of the cement by more than 30 minutes or reduces the compressive strength of test cubes by more than 20% when tested in accordance with BS 3148.
- (2) Prevents the achievement of the specified test cube strengths at 28 days for the appropriate class of concrete.
- (3) Produces discoloration or efflorescence on the surface of the hardened concrete.

The water shall be free from hydrocarbons and from suspended organic matter. Inorganic matter in solution shall not exceed 500 mg/l by weight and in suspension shall not exceed 50 mg/l by weight.

The water which the Contractor proposes shall be tested to the approval of the Employer before use in the permanent works.

Regular tests of the water shall be made during construction of the Works. The water shall be sampled at the point of discharge into the mix and the frequency of sampling shall be as approved by the Employer. The Contractor shall supply two copies of each test result to Employer.

### **10.40 Aggregates**

Aggregate shall consist of hard, tough durable, clean, and uncoated particles suitable to produce the required concrete grades and tested for alkali reaction.

The area of the deposit or quarry from which aggregates are to be produced shall be carefully cleared of trees, roots, brush, sod, soil, unsuitable material and other objectionable matter. Materials including stripping, removed from deposits or quarries within the project limits and not used in the Project shall be disposed of in a manner not to form unsightly places. The Contractor shall arrange the spoil area at his cost.

#### **Fine Aggregate**

Fine aggregate shall be well graded from fine to coarse and the gradation shall conform to the following requirements as delivered to the mixer:

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Sieve Size	Percentage of total mass passing Sieve
9.5 mm	100
4.75 mm	95 – 100
2.46 mm	80 – 100
1.18 mm	50 – 85
0.60 mm	25 – 60
0.30 mm	10 – 30
0.15 mm	2 – 10
0.074 mm	0 - 8

Fine aggregate shall be stored and maintained in such a manner as to avoid the inclusion of any foreign materials in the concrete.

Storage of aggregates shall be such that it prevents segregation or contamination. Sufficient aggregates shall have been produced before the start of concrete operations to permit continuous placement of concrete.

### Coarse Aggregate

Coarse aggregate shall be separated into nominal sizes.

The grading of the aggregate within the separated size groups as delivered to the mixer shall be as follows:

Nominal Size Range	Min. Percentage retained in sieve indicated
4.75 to 9.5	NA
9.5 to 19.0	25 on 16.0 mm
19.0 to 37.5	25 on 31.5 mm
37.5 to 75.0	25 on 63 mm

The particle shape of coarse aggregate shall be generally rounded or cubical.

Coarse aggregate storage piles shall be such that it avoids the inclusion of any foreign material in the concrete and prevents segregation and excessive breakage.

## 10.41 Batching and Mixing

### a. Plant

The Contractor shall provide a modern and dependable batching and mixing plant. Dust control equipment on all batching plants and cement silos shall be provided.

The equipment shall be capable of combining the concrete components into a uniform mixture within the time limit required for such operation and of discharging this mix without segregation.

### b. Measuring

Cement shall be weighed separately on an individual scale. Water shall be weighed separately on an individual scale or may be measured by volume.

All other ingredients shall be measured by mass except admixtures which may be

measured by mass or volume.

Standard test weights and other auxiliary equipment required for checking the operating performance of each scale or other measuring device from zero to full capacity of the scale or device shall be provided. Scale accuracy shall be within 1.0% of the scale capacity.

### **c. Mixing**

The mixing plant may be located at or away from the aggregate and cement, batching plant. The mixing plant shall consist of batch type mixers. The mixing plant shall be equipped with suitable devices for obtaining representative sample from each mixer and delivering samples to a test area at ground level.

The mixing plant shall include a device for counting and automatically recording the number of batches mixed.

The batching and mixing plant shall have arrangements for reading wastage of any material or concrete that is improperly batched, mixed or held in the mixers too long.

### **d. Testing and inspection facilities**

Facilities shall be provided by the Contractor at the Contractor's batching plant and mixing plant for concrete control testing. The facilities shall include a plant inspector's enclosure with desk and platforms for obtaining handling and testing samples of aggregates and plastic concrete.

### **e. Conveying**

The method of transporting concrete from the batching plant to the position of placing shall be such that segregation does not occur.

### **f. Placing**

No concrete shall be placed in any location until all transport and placing arrangements, formwork, installation of reinforcement and embedded parts and preparation of surfaces against which the concrete is to be placed have been prepared and checked in accordance with the Contractors control procedures.

Surfaces upon which concrete is to be placed shall be free from standing water mud debris, oil and loose or unsound fragments.

Concrete shall be worked readily into the corners and angles of the forms and around all reinforcement and embedded items without permitting the component concrete materials to segregate.

The Contractor shall provide equipment adequate for handling and placing concrete containing the maximum aggregate size and low slump concrete mixes.

Concrete shall be deposited, in all cases, as nearly as practicable, directly in its final position and shall not be caused to flow such that the lateral movement will permit or cause segregation of the coarse aggregate, mortar, or water from the

concrete mix.

Once placement of concrete has commenced in a location, placement shall not be interrupted by diverting the placing equipment to other locations.

All concrete that can be properly placed within specification requirements for slump and temperature, and can be properly consolidated without re-tempering, shall be classified as being placed within the time limit.

#### **g. Concreting during Hot Weather**

During the placing of concrete during hot weather the Contractor shall comply with the recommendations contained in the Manual of Concrete Practice Part 2 1989, "Hot Weather Concreting – American Concrete institute 3058 77"

#### **h. Joint Spacing**

The joint spacing including construction, control and contraction joints shall be as shown on the Drawings or as otherwise consented by the Employer.

#### **i. Lift in Concrete**

The maximum permissible depth of concrete placed in one lift or course shall be as shown on the Drawings for each structure or as otherwise consented by the Employer.

#### **j. Consolidation of Concrete**

Concrete shall be compacted with the aid of mechanical vibrating equipment and may be supplemented by hand spading, tamping and rodding as required and consented to by the Employer. Consolidation of concrete shall be by electric or pneumatic drive immersion type vibrators or form or surface vibrators of sufficient power and capacity to consolidate the concrete effectively and quickly.

The duration of vibration shall be limited to that necessary to produce satisfactory consolidation without causing objectionable segregation.

#### **k. Placing concrete in Conduit**

Concrete in the conduit shall be placed by pumping or other non-pneumatic methods. If pumped, the end of the discharge line shall be kept well buried in the concrete during placing to assure complete filling, after the concrete has been built up to the crown. Special care shall be taken to force concrete into all irregularities and to completely fill the corners.

### **10.42 Construction Joint Treatment**

Construction joint shall be clean and wet when covered with fresh concrete. Construction joint shall be prepared by cleaning with high pressure water blasting. The operation shall be continued until all loose or defective concrete and all surface skim of mortar, laitance, coatings, stains, debris, and other foreign

materials are removed.

#### **10.43 Water Stops**

Water stops shall be installed as per BS8007 where required and in joints as shown on the Contractor's Drawings.

All Water Stops shall be installed so as to form a continuous watertight diaphragm in each joint. Adequate arrangement shall be made to support and completely protect the water stops during the progress of the work. Water Stops punctured or otherwise damaged shall be replaced or repaired.

Particular care shall be taken to ensure that concrete in the vicinity of water stops is adequately compacted whilst avoiding damage to the Water stop.

#### **10.44 Forms**

Forms shall be used wherever necessary, to confine the concrete and shape it to the required lines. Forms shall have sufficient strength to withstand the pressure resulting from placement and vibration of the concrete and shall be maintained rigidly in correct position. Forms shall be sufficiently tight to prevent loss of mortar from the concrete.

Forms for exposed surfaces or water passages shall be constructed so as to produce a uniform and consistent texture and pattern on the face of the concrete. The forms shall have Formica cladding.

The forms shall be constructed so that the structure components will be true to line and grade. The forms shall be checked before concreting to produce structures within specified tolerances. Tolerances shall be indicated, in the Contractors Drawings.

At the time concrete is placed in the forms, the surfaces of the forms shall be free from encrustation of mortar, grout, or other foreign materials that would contaminate the concrete or interfere with the finish of formed surfaces.

Before concrete is placed the surfaces of the forms shall be oiled with a commercial form oil that will effectively prevent sticking and will not stain the concrete surfaces

Forms shall be removed carefully, so as to prevent damage to the concrete.

#### **10.45 Curing and Protection**

All concrete shall be moist cured for a period of not less than 14 consecutive days by an approved method or combination of methods applicable to local conditions. All equipment needed for adequate curing and protection of the concrete shall be available and ready to install before actual concrete placing of each placement begins.

The Contractor shall protect all concrete against damage until final acceptance.

#### **10.46 Finishes and Finishing**

The class of finish shall be to suit the Contractors Design and shall be indicated

on the Contractors Drawings.

Class F1: General for unexposed surfaces such as those against which backfill or further concrete will be placed. The surface shall be free from void and honeycombed areas.

Class F2: For surfaces permanently exposed to view but where the highest standard of finish is not required. Finish is intended to be left as struck. Minor blemishes and discoloration will be permitted.

Class F3: Formwork shall be lined with Formica or a material that produces a smooth finish of uniform texture and appearance. The lining material shall leave no stain on the concrete and shall be so joined and fixed to its backing that it imparts no blemishes.

Class U1: The concrete surface shall be uniformly leveled and screeded to produce a plain even uniform surface to the profile shown on the, Construction Drawings. No further work shall be carried out to the surface unless it is used as the first stage.

Class U2: Floated Finish After the concrete has hardened sufficiently the Class U1 surface shall be floated by hand or machine sufficiently only to produce a uniform free from screed marks.

Class U3: Trowelled Finish. When the moisture films have disappeared and the concrete has hardened sufficiently to prevent laitance from being worked to the surface, the Class U3 surface shall be steel trowelled under firm pressure to produce a dense, smooth, uniform surface free from trowel marks.

Class U4: Brushed Finish. The surface shall be treated as U2 and then lightly brushed with a stiff brush to produce a textured finish.

## **10.47 Steel Reinforcement**

### **a. General**

All steel reinforcement including rods, wire fabric, and anchor bars shall be detailed, furnished cut bent and placed as shown on the Drawings. All reinforcement shall be free from loose flaky rust and scale, and from oil, grease, mud, mortar, or other coatings which might destroy or reduce its bond with concrete or grout.

### **b. Cutting and Bending**

Steel reinforcement may be mill or field bent. All bending shall be in accordance with standard approved practice and shall be performed by approved mechanical methods. Heating of reinforcement for bending will not be permitted. Bars with kinks or bends not shown on the Drawings shall not be used.

### **c. Type**

Steel reinforcement shall conform to the standards defined in the Contractors Design and consented by the Employer. As a minimum the reinforcing steel shall comply with the requirements of ASTM A615M, Grade 300 or 420. However, reinforcing steel for earthquake resisting frames shall comply with the

requirements of ASTM A706M. The use of locally available reinforcing steel meeting the requirements of this section is acceptable. Each delivery of reinforcement delivered to site shall be individually identifiable by suitable tags and accompanied with the associated test certificates confirming the test results.

#### **d. Splicing**

All splices in reinforcement shall be as shown on the Drawings. Adjacent sheet of mesh reinforcement shall be spliced by lapping as shown on the Contractor's Drawings.

#### **e. Supports**

All reinforcements shall be secured in place by use of approved metal or concrete supports, or ties. Such supports shall be of sufficient strength and of sufficient number to maintain the reinforcement in place throughout the concreting operation. The supports shall be used in such a manner that they will not be exposed or contribute, in any way, to the discoloration or deterioration of the concrete.

#### **f. Quality Control**

The Contractor shall control the quality of his work. To this end the Contractor shall submit his quality control and quality assurance procedures to the Employer for consent.

### **10.48 Fill**

#### **Scope**

This section covers all work for the construction of fills including backfill behind structures and protective layers.

Selection of fill material for the Permanent works shall be as required by the Contractors Design. Fill shall be placed in positions as shown on the contractor's drawings.

#### **Drawings**

The Contractor Design shall specify the classification and type of compaction to be employed.

#### **Compaction of fill**

Wherever a density requirement of a soil or gravel layer is specified in terms of a percentage density the Contractor shall be at liberty to employ any type of compaction equipment the he may choose in order to achieve such density over the full specified depth of the layer, provided that the equipment employed is adequate and suitable for the purpose and is in no way detrimental to any part of the Works and the successive layers bind together all to form an integral mass.

The dimensions of fills shall be in accordance with the type of cross section details shown on the Contractor's Drawings.

The thickness of individual layers shall depend on the type of material used and



the maximum size of the particles in such material.

Where the material can generally be broken down to a maximum size of 200 mm, the layer thickness shall not exceed 250 mm after compaction except in the case of cohesion less sands where layer thicknesses of up to 400 mm may be employed.

In the case of material that cannot be reduced to a maximum size of 200 mm or less after removal of the oversize material, thicker layers shall be constructed but the thickness of the loose layer shall not be more than is necessary to ensure that the maximum particle size is generally not more than the completed layer thickness.

Fill shall be placed in successive horizontal layers parallel to the final fill surface, and the construction of tapered layer shall be restricted to the bottom layers of fill where it may be unavoidable due to cross fall or tapering out of fills.

Rock material containing rock particles greater than 200 mm in size shall not be used at a depth of less than 150 mm below the top of fill level unless consented by the Employer.

### **Finishing of Slopes**

Fill slopes shall be finished to neat lines with all loose rocks and uncompacted material removed. The degree of finish required shall depend on the nature of the material used for the fill slopes but it shall be as smooth as is consistent with the material involved and good workmanship.

### **Protection of Fills**

All permanent drains shall be constructed as soon as possible plus sufficient additional temporary drains as may be necessary to protect the fill, and they shall be maintained in good working order. Ruts and potholes developing in the fill after completion shall be repaired, and damaged sections of the fill shall be reshaped and re-compacted.

All fill slopes shall be maintained by the Contractor until acceptance of the fill. All erosion and floor damage to slope shall be promptly repaired.

## **10.49 Architectural Finishing**

### **General**

This Clause covers the architectural finishing and works required under the Contract.

The Contractor shall develop a schedule of finishes and associated specifications for the Employer's consent. Types of finishes and fittings shall be shown on the Contractor's Drawings and shall be consistent with the agreed schedule.

The Contractor shall submit, to the Employer for his consent, specimens of materials for colour and finish for the items requiring the Employer's Consent, at least 28 days prior to the date he wishes to place order.

All building construction and finishing work shall be performed by experienced skilled labour.

Finishing Works shall not commence until the area concerned is arid, such adjacent areas which may affect the finishing work have been weatherproofed, and the concrete or other materials have dried out sufficiently.

Permanent openings shall be finished neatly and the Contractor shall furnish and cut as required such special shapes of materials as are required for neat finishing at edges. Where required in suspended ceilings access openings neatly finished at edges shall be formed by the Contractor and fitted into the openings in such a manner as to blend with the ceilings.

Where walls, floors or ceiling are to receive a plastered, tiled or painted finish, the Contractor shall prepare for consent of Employer, trial panels, approximately one meter square, be erected in the locations where the particular types of finish are required. The trial panels will be required to demonstrate the final appearance of the finish which may be required at a particular location.

The Contractor shall provide and maintain adequate protection from damaging of the finishing throughout the Contractor period.

### **Concrete Work**

Reinforced or plain Cement Concrete.

Concrete in structures and chambers etc. shall be in all circumstances fair faced finish and in no case repair shall be allowed. Any fins shall be removed and finished smooth with a rich cement slurry.

Edges where exposed shall be chamfered to a size of 1-1/2" x 1-1/2"

### **Block Work**

Block work shall confirm BS 6073 Part 1. Type B with average compressive strength not less than 7.0 N/mm<sup>2</sup>.

Block shall be solid, hollow or cellular, bedded and jointed in mortar average 10 mm thick. Cellular blocks shall be laid with cavity downwards.

Internal faced work for painted finish shall have flush jointing as BS 5628, and be left fair clean face ready decoration.

Internal wall shall be solid block 150 mm thick.

External walls shall be 600 mm thick in cavity design.

Where block work is to be rendered or plastered joints shall be raked out to a depth of 12 mm.

Metal anchors for fixing block work to concrete shall be stainless steel conforming to BS 1449, min: tensile strength of 400 N/mm<sup>2</sup>, 4.5 mm thick x 35 mm min: width length to such cavity.

Stainless steel butterfly wall ties shall be built into cavity.

### **Plastering**

Internal plastering shall be 12.5 mm thick carried out in accordance with BS 5492 using cement mortar in the ratio of 1:4.

External rendering shall conform to BS 5262 and the surfaces shall have 18.75 mm thick cement plaster with mechanical spray plaster finish in white cement with colour pigment and white marble chips of zero "0" No. in the ratio 1:2. Panels 900x900 with engraved separation joints (visual) shall be made.

Stainless steel angle bead conforming to BS shall be fixed at all external angles.

### **Floor Finishes**

The floor finish shall be over the base course in case of ground floor or directly on reinforced concrete slab. The floor finishes shall be either cement concrete, Mosaic, Marble or Ceramic tiles, to suit the requirements of the location and as approved by the Employer. The Contractor shall be responsible for ensuring that the background or sub base to which the specified finish is to be applied, has properly cured and is properly finished and is completely adequate to receive the specified finish.

All materials likely to reduce adhesion of the finish shall be removed prior to the application of the specified finish and the surface left dust free and clean and protected from contamination until time of laying finish.

Surfaces to receive adhesives and fixatives shall be thoroughly dry.

Surfaces that are to receive cement mortars shall be roughened and dampened prior to the application of the mortar;

All traffic and loads shall be kept off completed work at least until bonding has set. If possible, areas shall be locked up on completion of finishing work.

### **Plain Cement Concrete Floor**

Plain cement concrete floor shall be laid in the ratio of 1:2:4 of minimum thickness 75 mm over the base concrete. Floor of the Transformer Room shall be in cement concrete.

### **Terrazzo Floor**

Terrazzo floor shall be laid in the Motor Hall and Store Room in grey cement. Marble chips shall be No. 1 to 4 of approved colour having an abrasive hardness of min: 16 as determined by National Bureau of Standard Report BMS 98. The flooring shall be laid in panels using 25 mm thick plate glass strips for separation.

### **Butecena Marble Tiles**

Butacena Marble floor Tiles of approved colour shall be laid in office, control rooms and SCADA room. The size of the tiles shall be 450 x 450 mm laid over

min: 37.5 mm thick CC 1:2:4 base.

### **Acid Resistance Tiles**

Acid Resistance Tiles flooring shall be laid in Battery room.

### **Non-Skid Ceramic Tile**

Non-skid Ceramic Tile flooring shall be provided to Bath rooms. The tiles shall conform to BS 1281 and of colour and size 300 mm x 200 mm as approved by the Employer.

### **Wall Finishes**

The Contractor shall ensure that the background or sub base to which the specified finish is to be applied has properly cured and is properly finished and is completely adequate to receive the specified finish.

Surfaces which are to receive finishes shall be cleaned free from loose materials fines, encrustations, oil, paint, dirt and any other material that might percent satisfactory bond.

Surfaces to receive adhesives or fixatives shall be thoroughly stained with Masking tape where necessary to prevent staining of adjoining work such as windows and door frames.

#### **a. Tiling / Dado / Skirting**

In general it shall conform to BS 5385

The Contractor shall submit to the Employer for his consent, loose samples of each type of tile or other unit finish required. Samples shall be sufficient in number to illustrate the extremes and average of the ranges of colour, size and texture.

Only whole tiles are to be used, where practicable equal margins of cut tiles larger than half a tile.

Joints in all tiled panels shall be set out to the manufacturer's recommendations.

Tiles shall be kept free of traffic for a minimum period of 72 hours after laying.

Protection following laying shall be adequate to withstand all damage.

The Contractor shall furnish additional spare materials of the same type, quality and colour equal to 1 per cent of quantity of each type laid. These tiles and skirting's shall be packed and labeled suitable for storage.

Tiling shall be glazed ceramic wall tiles conforming to BS 1281 and will be provided in Bathroom's upto 2100 mm height.

Skirting shall be in Butacena brown marble tiles and provided to office room upto 150 mm height.

Dado in glazed ceramic brown marble tiles 400 x 400 smoke colour shall be provided in Motor Hall, SCADA room and control room upto 2100 mm height. The tiles in addition to normal procedure for fixing with chemical bond shall be fixed

with galvanized iron screws and surface finished smooth to match.

#### **b. Stairs**

Stairs to basement (motor hall) from ground floor shall be RCC and have chequered surface finish.

Stair treads and risers to Motor Hall from finished ground shall be 1875 mm thick marble tiles laid over 37.5 mm thick CC 1:2:4 bases.

#### **c. Doors**

Frames for the doors shall be of steel conforming to BS 1245 and BS 4737 Part 1 and galvanized in accordance with BS 729. Frames shall be built in as work proceeds with the fixing camps securely bedded into the clock work courses without disturbing any damp proof course. Frames shall be painted externally with an approved gun applied buty or poly sulphine non-setting mastic and finish to match with the finish of the doors.

Doors shall be double or single leaf panel doors made from 1st quality. Deodar wood and timber coating finish, or enamel paint finish as approved by the Employer.

Steel door where required shall be of an approved type. These shall be manufactured from steel sheet conforming to BS 1449, part 1 and of all welded construction with internal angle reinforcing grid. Facing sheets shall be minimum 1.6 mm thickness cold rolled leveled sheets. External doors shall be 44 mm thickness and internal doors 35 mm thick with all necessary reinforcement for hangers, locks and other furniture.

#### **d. Roller Shutter Doors**

Roller shutters shall be sliding type installed in accordance with the manufacturer's requirements and from minimum 18 gauge steel employing convex type lath.

Unless otherwise shown in the Contractors Drawings and consented to by the Employer, roller shutter shall be manually operated on the inside of the building. The mechanism shall be lockable.

Not less than 28 days before proceeding with fabrication the Contractor shall submit shop drawings of the roller shutter to the Employer showing sections, dimensions, fixings and other information as may be required by the Employer for his consent.

#### **e. Door Furniture**

All hardware shall be manufactured to a strong, durable and secure pattern. The Contractor shall submit to the Employer for consent samples of door furniture to be used in the works.

Unless otherwise shown in the Contractors Design, iron or steel for building into brick, stone or concrete masonry shall be hot dip galvanized or coated with 2 coats of aluminum paint. All other iron and steelwork shall be given two coats of rust inhibiting paint before fixing.

#### **f. Windows and Ventilators**

Minimum 20% area of the wall surface exposed to the outer atmosphere shall be provided with fully double glazed aluminum windows and ventilators. The windows and ventilators will be of aluminum. The Contractor shall submit to the Employer for consent samples of windows to be used in the works.

Prior to installation, all items of windows and ventilators shall be protected from the weather, stored level on the ground and stacked in the way that allows free air circulation around the items. Installed windows and ventilators shall be protected from mechanical damage as required.

The frames shall be accurately set out and assembled square and true. All necessary accessories and fixings for the proper completion of the Works shall be provided.

Window and ventilators shall be plumb, Square and level and firmly fixed by approved devices.

The frames shall be from an approved manufacturer and fabricated from H9 aluminum alloy in accordance with BS 4873. They shall be of the type and to the dimensions shown on the Drawings, fully weather stripped. Surface finish shall be anodizing to BS 3987 to provide an anodic coating of 25 micron average thickness over mechanical stain finish.

Fittings shall be manufacturers standard type. All windows and ventilators should be provided with 20 mm square galvanized steel wire mesh.

Pre-finished surfaces shall not be allowed to rub or slide against each other and shall be well protected during transportation and storage.

Glazing shall comply generally with BS 6262. Glass shall unless otherwise shown be 5 mm thick clear ordinary glazing quality complying with BS 952 except where required to be thicker minimum 12 mm in accordance with BS 6262.

Reinforced glass shall be 12 mm 6 mm thick with straight wires both ways to form 13 mm squares in accordance with BS 952.

Glass panels for offices and Panel room shall be reinforced glass min 12.0 mm thick with aluminum framework as approved by the Employer.

Putty shall be approved metal casement type of approved colour for metal and hardwood frames and linseed oil type complying with BS 544 for softwood frames. Rebates shall be sealed before glazing with primer for softwood frames and the finish varnish for hardwood frames.

All glass shall be left clean inside and out free from all scratches or other blemishes on completion.

#### **g. Plumbing Fittings & Fixtures**

HDPE - 100 pipe and fittings shall be used in all plumbing works.

The pipes in the wall shall be encased or ducted and in the floor in covered ducts only. Fixtures shall be of Master or equivalent make and as approved by the Employer.

The whole of the plumbing fittings, fixtures and their installation complete shall be in accordance with all relevant regulations of the appropriate local Authority or Government Authority.

Generally all pipework shall be embedded in walls, placed in wall chases to be provided and tiled in or taken up in ducts and concealed from view.

Surface mouthed pipework shall be adequately and suitably fixed in position in accordance with the best practice and in accordance with the applicable specifications.

The Contractor shall furnish and install the fittings and features in the locations as shown on Contractor's Drawings.

Wash basins and toilet pans shall be defined in the Contractor Drawings.

Wash Basins toilet pans shall be white vitreous china of the best quality made in Pakistan.

Bath for the office shall be provided with one European type pan toilet pan and one wash basin mirror and rack.

Bath for the staff shall be provided with one Asian type toilet pan and one European type. The two pans shall be further provided with partitions and separate doors. Wash basin shall be common.

### **Contractor's Facilities**

#### **Contractor's Site office**

The Contractor shall provide the Site office and other facilities for its own use at a place approved by the Employer.

#### **Engineer's Site Office:**

The contractor shall provide Site office of 200sqm. for Engineer's having following facilities:

- a. 3 Rooms fully furnished for site staff
- b. One conference room to accommodate 18 persons with conference table and chairs.
- c. One Kitchen with cooking facility and crockery
- d. One store room
- e. Toilet block etc.

#### **Contractors Laboratory Facilities**

The Contractor shall, for the duration of Contract, supply, maintain and operate a materials testing laboratory at site necessary for sampling preparing and testing materials as specified. The Contractor may also use an off-site testing laboratory to perform certain of the specified tests Both the laboratory and the test shall be to the approval of the Employer such approval shall not be given if significant delays in obtaining results are likely, or if the results may be unreliable. The Contractor shall make all the necessary arrangements and provide all transport and labor for

conveying the samples to the Employer promptly. The Employer approval will be withdrawn if the service proves in any way unsatisfactory.

The Contractor shall provide trained and experienced Material Engineer technician and skilled labor to carryout specified tests to the satisfaction of the Employer. The Material Engineer and technicians shall be approved by the Employer. In case of unsatisfactory performance such approval will be withdrawn and the Contractor shall arrange for suitable replacement for approval by the Employer.

The Employer and his supervisory staff shall have access to the laboratory to supervise testing and to witness verification tests ordered by the Employer or his staff.

The Contractor shall keep record of all tests he conducts in connection with compliance with, and as, required by the Specifications, and shall supply copies of the results of such tests to the Employer as soon as practicable after each test is made.

Notwithstanding the above the Contractor shall supply, maintain and operate all the necessary apparatus for certain tests which shall be carried out within the Permanent Works or elsewhere on the Site as directed by the Employer. The Contractor shall locate the laboratory at location approved by the Employer.

- Concrete cube crushing strength testing machine & 01 No  
3 sets of cube moulds.
- Determination of dry density/moisture content, 01 Set  
relationship of soil
- Aggregate moisture test for determination of water 02 Sets  
cement ratio (200 mm dia complete test)
- Slump cone with base plate 03 Nos
- Cement briquette moulds 02 Sets
- Field density measuring equipment (sand cone) 03 Sets

The Employer Site Laboratory shall be provided with testing equipment with consumables for following tests and maintained for the duration of the Contract.

## **10.50 Security, health and safety**

The Contractor will provide the Employer with a security, safety and health manual within one month of Notice to Proceed, covering all aspects mentioned in sub-clauses and other relevant clause of the EPC Contract, Laws and Regulations of Government of Pakistan and Government of Sindh relevant international standards, tradition & customs of Sindh and in accordance with relevant section of this Volume.

## **10.51 Furniture and equipment for the office at Site.**

The Contractor shall supply the furniture, fittings and equipment listed below and installs them in the Employer offices at Site. They shall be for the sole use of the Employer and his staff and employees of the Employer. All furniture, fixtures and equipment shall be supplied new, and manufacturer's description or sample shall



have been approved by the Employer before any item is ordered. The Contractor shall keep insured all furniture, fitting and equipment supplied to the Employer to their full local value (including duty) until the end of the Defects Liability Period when the same will be handed over to the Employer in satisfactorily working condition and shall remain Employer's property.

The offices shall be adequately furnished equipped and maintained for proper use and functioning, all to the satisfaction of the Employer. The furniture and equipment listed herein is the minimum and may be varied or substituted by the Employer with other or additional items to meet his requirements.

**a) Furniture:**

All furniture will be made from best quality Oak wood, stainless steel metal work, best quality lock, and polish on the wood work of high quality, all as approved by the Employer.

1	Officers table 5½'x 3' with 4 drawers and glass top along with attached side rake 3'x½' also glass top	2 Nos
2	Table 5'x3' with 3 drawers on each side	4 Nos
3	Conference Table 21'x5'	1 No
4	Central Table 3½'X3½' with glass top	2 Nos
5	Officers chair revolving with arms and upholstered	2 Nos
6	Upholstered chair with arms.	4 Nos
7	Upholstered chair with arms for conference room	15 Nos
8	Steel filing cabinets with locks & suspended filing system	2 Nos
9	Steel racks for tools with lockable drawers -6'x4'x1.5'	2 Nos
10	A/C 1.5 ton	8 Nos
11	Waste paper baskets	4 Nos
12	Glass Ash trays	4 Nos

Construction of New 65 MGD Pump House(Equipped with M&E Pumping Machineries)  
at Gharo, Karachi. Package # 2

13	Sundry office items like letter tray, punch, paper, stapler, pencil holder, pencils, sharpeners and erasers	10 sets
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**b) Kitchen items**

1	No frost fridge -10 cft	1 Nos.
2	Tea cattle stainless steel – 1 Litre	1 Nos
3	Electric cattle -1 litre	1 No
4	Tea mugs china ware	12 Nos
5	Tea cups with saucers china ware	12 Nos
6	Half plates china ware	12 Nos
7	Quarter plates china ware	12 Nos
8	Sugar pot china ware	2 Nos
9	Milk pot china ware	2 Nos
10	Table spoon stainless steel	24 Nos
11	Tea spoon stainless steel	24 Nos
12	Sauce pan stainless steel	2 Nos
13	Spoons for item	4 Nos
14	Service cabinet 6'x2½'x3'	2 Nos
15	Medium size serving dishes	4 Nos
16	Medium size service bowl	4 Nos
17	Forks stainless steel	12 Nos
18	Service trays	4 Nos
19	Water glasses	12 Nos
20	Water jugs	4 Nos

The Kitchen to be provided with suitable fittings and fixtures.

**c) Wash rooms**

Wash rooms to be provided with best quality fittings and fixtures of local origin but with prior approval of the Employer.

**10.52 Surveying Instruments and Surveyors**

The Contractor shall provide and maintain the following survey equipment on site for the sole use of the Employer and his staff for the duration of the Contract.

- a. Total Station (One second Accuracy)
- b. Automatic Level
- c. Level Staff
- d. Ranging Rods
- e. Tripod Stan
- f. Prism
- g. Prism Holder
- h. Measuring Steel Tape 100 meter

The contractor shall provide a competent and experienced surveyor with two assistants and necessary labour along with transport for the survey work. The survey staff and transport for surveyors shall be maintained with driver consumables, POL, spares and insurance and shall be solely at the disposal of the Employer and his staff.

On completion of the work, the survey instruments and the transport will be returned to the contractor.

**10.53 Transport for the Employer**

The Contractor shall provide new approved vehicles as listed in the Schedule of Prices, for the use of the Employers and his staff and Employer.

Vehicles shall be equipped with spare water and fuel containers, roof rack and be suitable for tropical use. Kerb weight and tyre pressures shall be stated on each vehicle and the vehicles shall conform in all respects to the regulations of the appropriator registration authority.

The Contractor shall provide competent drivers to the approval of the Employer for the vehicles used on site. The Contractor shall provide all fuel, lubricants, etc and shall license, insure (as detailed below), servicer and maintain the vehicles in a roadworthy state. The Contractor shall be obliged to have ready access to spare parts appropriate to the number, type and duty of the vehicles supplied. If in the opinion of the Employer the Contractor should default in this respect and deprive the Employer of use of vehicle(s) made unserviceable by normal use in the condition's and demands of the Site, the Contractor shall provide suitable alternative transport to the approval of the Employer. If the Contractor fails to provide this service the Employer shall be entitled to withhold the issue of a Payment Certificate until the service is resumed.

Insurance for vehicles must be comprehensive and include:

Cover for the Employer and his staff driving the vehicle;

Liability to third parties (including passengers whether the Employer his staff or others) for an unlimited indemnity in respect of death or personal injury and for the maximum indemnity reasonable obtainable in respect of loss, destruction or damage to property.

The vehicles shall be handed over to the Employer at the end of the Defects Liability Period or earlier if order by the Employer and transferred in the name of the Employer.

For a site movement of Employer Supervision staff for inspection of Contractor's works or in connection with the works, the Contractor shall make available suitable transport as required. No direct payment shall be made for this and the cost thereof is deemed to be included in the contract price.

#### **10.54 Telephones**

The Contractor shall provide following communication facilities for the sole use of the Employer and his staff.

The Contract price shall be deemed to have included cost for four (04) nos smart mobile phone as approved by employer and cost of rupees Sixteen thousands (Rs 16,000) per month pertaining to telephone use in shape of Pre paid mobile cards.

One landline telephone shall be provided in the site office of Employer The Contractor shall bear the cost of installation, instruments and payment of telephone bills regularly to keep telephone in service continuously until the end of Defects Liability Period.

One completion of work, the telephone (other than mobile phone) and Fax machine will be the property of the Employer and will be handed over to him.

#### **10.55 Health and Safety**

The Contractor shall provide for the health and safety of its employers, any employees of Employer and any other persons who are at any time directly or indirectly effected by the performance of the Work by an application of a suitable or acceptable health and safety policy that ensures attention to the safety of work sites, to safe methods of working, to the suitability of personnel by training or placement and by adequate supervision.

The Contractor shall be under an obligation to take all reasonable safety measures in relation to the type of services undertaken and shall conduct itself and all personnel assigned to the Work and perform the Work in such a way as to comply at all times with its obligation and duties under laws, regulation, rules, order and other enactments in force from time to time relating to health and safety matters, including the Employer's safety requirements.

The Contractor shall in addition observe and follow all guides, codes and recommendations issued or made by the government, professional or trade organization or other official or responsible organization relating to health and safety at work as applicable to the project.

At every site where the work is being performed under this Contract the Contractor will appoint a safety who will be responsible for all personnel engaged in the performance of the work under this contract including those of the Contractor's sub-contractor. The contractor will draw up and ensure compliance with safety regulations commensurate with the hazardous nature of work.

#### **10.56 Quality assurance / quality control**

The Contractor will instigate a QA/QC programmed in accordance with the relevant Clause of the EPC Contract.

#### **10.57 General**

##### **a. Description**

The Contractor shall be completely responsible for implementing a Quality Assurance Plan covering all the Works contained in the Contract including the design. The Quality Assurance Plan will be prepared by the Contractor and reviewed and authorized by the Employer and will be implemented by the Contractor. It will be especially managed by the Contractor's Resident Quality Assurance Manager. The contractor's Quality Assurance Plan means by which the Contractor ensures the control and quality of all design function, all fabrication by his vendors and sub-contractors and all construction activities carried out by his sub-contractors.

#### **10.58 The Contractor's Quality Assurance Plan**

The Contractor's Quality Assurance Plan shall meet all the requirements of the International Standards Organizations known as ISO 9001. As appropriate the Contractor will impose on his designers, Vendors, fabricators and sub-contractors the requirements of ISO 9002, ISO 9003 and ISO 9004. The Quality Assurance Plan will be prepared and presented in three different volumes namely:

- Volume 1 Quality Plan
- Volume 2 Quality Assurance Procedures
- Volume 3 Quality Control Procedures

Collectively the three Volumes will comprise of the Contractor's Quality Assurance Plan. Each volume will address the issues enumerated in the following Articles of this Section.

The Quality Assurance Plan shall recognize the necessity for revision during the project at which time reauthorization shall be sought from the Employer.

Within twenty-one (21) days of the date of the Notice to Proceed the Contractor shall produce and submit to the Employer an outline of the QA Plan. Within a further 28 days of the above submittal date the Contractor will submit the detailed QA Plan incorporating the comments made by the Employer. The authorized detailed QA Plan will be supplemented by comprehensive details for specific work activities at least 28 days prior to their commencement.

The Contractor's Quality Assurance Plan will be managed and directed by a dedicated Resident Quality Assurance Manager who will be physically on the project Site throughout the implementation and will report directly to both the Contractor's Site Project Manager and independently and directly to the Contractor's Home Office Senior Management.

## **10.59 Requirements of the Contractor's Quality Assurance Plan**

### **Volume 1 : Quality Plan**

This section of the Contractors Quality Assurance Plan will address the following topics:

- (1) Purpose and Scope Policy
- (2) Organization and Responsibilities
- (3) Project Manager Review
- (4) Applicable Standards
- (5) Definitions

The purpose scope and policy chapters will establish the general philosophy and parameters that the Contractors Senior Management require for the Quality Assurance Plan.

Organization and responsibilities will clearly present the detailed Contractor's Organization as it pertains to Quality Assurance and Quality Control activities. A description of assigned responsibilities is required.

Project Management Review will address the Contractors procedures for addressing quality issues raised by the Resident Quality Assurance Manager to the Site Project Manager and Head Offices Senior Management.

The standards that will be used to support the Contractors Quality Assurance Plan are required to be listed. This will include all applicable industry codes, standards and practices and specifically those referenced in the contract Document and Employer's Requirements.

For clarity in the use of the Contractor's Quality Assurance Plan document by Contractor's personnel it is required that a glossary of specific terms used in the documents be itemized (Definitions).

### **Volume 2 : Quality Assurance Procedures**

This Volume will present clearly the procedures developed by the Contractor to provide a planned and disciplined approach for the achievement of project quality objectives. The procedures, in general require the prompt detection and correction of deviations, which are or may be detrimental to quality and generate documentation necessary to provide objective evidence of achievement of quality objectives during design, fabrication, construction and commissioning phases of the project.

As a minimum the QA procedures will include but not limited to:

- (1) Contractors procedures addressing the requirements of ISO standards.
- (2) Plant Management Procedures.
- (3) Construction Schedule Management.

- (4) Progress Reporting Procedures.
- (5) Design Procedures.
- (6) Procedures for selecting and appointing sub-contractors and vendors.
- (7) Procedures for obtaining, reviewing and approving sub-contractors and vendors quality procedures.
- (8) Procedures for auditing sub-contractors and vendors.
- (9) Contractors Method Statements for all work activities.
- (10) Document Control Procedures.
- (11) Environmental Management Procedures.
- (12) Health and Safety Procedures.
- (13) Audit and Surveillance Program and Schedule by Resident QA Manager.
- (14) Non-Conforming Reporting (NCR) and Deviation Report (DR) procedures.
- (15) Training Procedures.
- (16) Interim Payment Procedures.
- (17) "As-Built" drawings and information procedures.
- (18) Operation and Maintenance Manual Procedures Change Control of Project Quality Procedures.

### **Volume 3 : Quality Control Procedures**

This volume is dedicated solely to the procedures and systems that the Contractor will perform to maintain an effective Quality Control (QC) program. In general the Contractor will perform sufficient checks, inspection and tests on all items of the work including:

- (1) The Design Engineer
- (2) Vendors
- (3) Sub-contractors
- (4) Contractor's Site Work Activities

And so ensure conformance with respect to the design, materials, workmanship, construction, finish and functional performance.

The Contractor's QC system shall be implemented by a separate QC organization headed by a full time QC Manager who will report to the Resident QA Manager. The QC organization will include personnel trained, specialized and qualified to inspect and test all the categories of the work. This work will include the Design Operations. Vendors and Subcontractors Consortiums operations as well as the Contractor's own off-site and on-site operations.

The quality Control Plan shall include adequate provision for access by the Employer to inspect any and all facilities of the project and facilities such as laboratories etc required to implement the plan.

Specifically Volume 3 will address the following items as a minimum:

- (1) The QC organization.
- (2) The number and qualifications of personnel to be used.
- (3) Authority and responsibility of QC personnel.
- (4) Methods and procedures of QC control for all the Work including design vendors and sub-contractors.
- (5) Inspection and Testing Plan.
- (6) Details of the site laboratory including the physical layout stalling and proposed on-site testing equipment.

- (7) Details of any off-site laboratory testing.
- (8) Details of the physical site tests and laboratory tests proposed for all the construction materials with emphasis on cement, concrete, soils and rock testing Frequency of Testing shall be included.
- (9) Method of documenting and procedures to be followed for QC operations, inspection and testing for each section of the technical provisions. Details of proposed forms are to be included.
- (10) Off site testing of manufactured items and type testing.
- (11) Procedures that will ensure that the latest applicable Drawings, Shop Drawings, Specifications and instructions required by the Contract Documents, as well as authorized changes, are used for fabrication, construction, and inspection and testing.
- (12) Procedure for the issuance, tracking and close-out of Non-Conforming Reports (NCR's) and Deviation Reports (DR's). This procedure shall prioritize the NCRs and ensure the closeout of such matters in a timely manner to the satisfaction of the Employer.

#### **10.59.1 Employer's Quality Assurance Program**

It is intended that the Employer will establish his own Quality Assurance Programme, which will be independent of the Contractor's QA/QC programs. The Employer's QA program will be under the control of the Employer's Site Resident QA Manager who together with his staff will have the responsibility to evaluate and verify the Contractor's QA/QC operations.

Observations, inspection, tests or approvals by the Employer's Resident QA Manager or any other person shall not relieve the Contractor from his obligations to perform the Work in accordance with the Contract Documents.

The Employer has the right to visual inspection of all Contractor's Work. If Work is to be covered, Contractor shall notify Employer's Resident QA Manager of Work completion and Employer's Resident QA Manager must inspect within reasonable time. If any Work is covered without such notification, it must, if requested by Employer's Resident QA Manager, be uncovered for observation. Such uncovering shall be at Contractor's expense unless Contractor has given Employer's QA Manager reasonable notice of Contractor's intention to cover such Work and Employer's Resident QA Manager has not acted with reasonable promptness in response to such notice. "Reasonable Notice" shall never be less than 24 hours, excluding Sundays and holidays.

The Employer also has the right to carry out any physical testing of the Contractor's Work. Samples of Site work (e.g. concrete, soils, cement, rock, reinforcing steel etc) will be supplied by the Contractor at no charge. Furthermore, the Employer will have the right to utilize the site laboratory and staff (if necessary) to carry out verification testing, at no charge. Such verification testing by the Employer's Resident QA Manager will be performed in an efficient and timely manner so that the Contractor's QA/QC program is not disrupted.

The Employer will also have the right to perform any offsite testing of materials. Samples for such testing will be supplied at no cost by the Contractor. Should any off-site testing indicate materials not meeting Contract requirements, the costs of the Employer off-site testing will be charged to the Contractor.



## **10.60 Environmental Compliance**

### **General**

Reference is made to the environmental requirements given in:

- a. The law and Regulation of Government of Pakistan and Government of Sindh.
- b. Employer's Requirements for Environmental Protection given in this Volume.
- c. Sub-Clauses 4.18 [Protection of environment], 4.22 [Security of the Site], 4.23 [Contractors Operation at Site], 4.24 [Fossils], 6.6 [facilities for staff and Labour], 6.7 [Health and Safety], 7.3 [Inspection], 14.5 [Plant and Material Intended for the Works], 16.3 [Cessation of Work and Removal of Contractor Equipment] of General Condition of Contract and any other clause or sub-clause having any relevance to Environment.
- d. Local traditions and customs of Sindh.

### **Miscellaneous**

- a. The Contractor shall within one month of receipt of Notice to Proceed, appoint an Environmental Inspector for the Works, whose broad responsibilities are to guide the construction personnel on environmental matters, to communicate and to make liaison with the Employer, Government of Sindh and local elders.
- b. The Contractor shall provide Environment Management Plan of the Site as defined in this Volume.

### **Environmental management**

- a. The Contractor shall comply with all legal duties and obligations regarding the protection of the environment as laid down laws and Regulations of Governments of Pakistan and Sindh. Where there is any conflict between laws and Regulations, and clause in this specification, the more stringent requirement shall be adopted.
- b. Within fourteen (14) days of the date of the letter of Acceptance the Contractor shall submit to the Employer an outline of the Contractors environmental management plan for complying with the environmental management requirements, especially as described here in this Specification. Within twenty-eight (28) days thereafter the Contractor shall submit for the Employer's approval a detailed environmental management plan that consists of proper account of all comments made by the Employer on the outline environmental management plan. The management plan shall include, but not be limited to, the Contractors proposed arrangements for abatement and mitigation measures for environmental protection and reporting, and his organization chart showing how he delegates environmental management responsibilities on the site.

### **Air Quality**

- (i) Burning of waste will not be permitted either on or off the site.

- (ii) Dust shall be kept to a minimum on the Site and at the residence area by appropriate water spray at all times.

### **Noise**

- (i) The Contractor shall take all reasonable precautions to minimize nuisance caused by noise and vibration. This may require the modification of plant where noise emissions are excessive, the construction of screens or a restriction on working hours. Where appropriate, the contractor shall provide ear protectors for staff working in the vicinity of noisy plant on site.
- (ii) The Contractor will be responsible for complying to ensure the noise levels at the boundary of the project site, the worker and staff's camp should not exceed 65 dB(A) during day time and 55 dB(A) during night times. Where the noise levels exceed those recommended, the Contractor shall propose measures that he intends to take to improve the noise levels and when approved by the Employer shall implement the proposals at no additional cost and without delay.

### **Waste Management**

- (i) The Contractor is fully responsible for the day-to-day management on waste collection and disposal. The Contractor must make arrangements for waste management for the collection and the disposal of domestic and industrial refuse, by handling, transporting or storage of schedule wastes outside the premises and its safe disposal at a location approved by the Employer.
- (ii) The Contractor must ensure that all the necessary utensils such as proper storage containers or bins for refuse and kitchen wastes, special storage containers for scheduled wastes, temporary sewerage plants or toilet facilities are provided at the premises.

The Contractor must also comply with the following environmental conditions throughout the construction stage:

- (i) Temporary sewage treatment for toilet facilities in accordance with the specifications as prescribe by the Law and Regulation must be provided at the Contractor's site office and worker's camp before the commencement of any works;
- (ii) Open burning of solid waste including biomass waste and construction debris is strictly not permitted;
- (iii) Handling and disposal of scheduled wastes must comply with the requirements of the laws and regulations of Government of Pakistan

### **Avoidance of Nuisance**

- (i) The Contractor shall take all reasonable precautions to avoid causing a nuisance with dust, noise or vibrations arising from his operations. This provision is in addition to but not in substitution for the provisions of the Conditions of Contract.
- (ii) The Contractor shall not obstruct as far as possible, the normal rights of way of the users of the public roads and where this is necessary and unavoidable, he

shall provide barriers, roads signs, warning lights, etc. required for proper traffic control including getting the necessary permits from the Police Department and other local authorities and paying all fees in connection therewith.

- (iii) The Contractor shall be liable and shall indemnify the Employer in respect of any claims or proceedings arising out of his neglect in taking care to avoid creating a nuisance when carrying out the Works.
- (iv) Necessary Noise level controls shall be exercised by the Contractor in accordance with the limits said in this section subject to the approval of the Employer.

### **Prohibition of Advertising**

- (i) The Contractor shall treat the contract and everything written as private and confidential in particular, the Contractor shall not publish any information, advertisement, drawing or photograph relating to the Works and shall not use the Site for advertising purposes, except with the written consent of the Employer and subject to such conditions as he may prescribe.

## **10.61 Training Programme**

### **General**

With reference to item 5.5 of the Conditions of Contract, the Contractor shall provide the services of competent staff (prior to the details of qualifications shall be submitted) who shall train Employer's staff or other as the Employer may nominate in the operation, servicing and maintenance of the Plant, including items of Plant supplied by sub-contractor. Training shall cover start-up, shutdown, normal and exceptional operation. Plant shall cover all electrical and mechanical equipment, all hydraulic steel structures and all instrumentation and control equipment and structures.

The Contractor shall provide a training program in operation and maintenance for the Employer's O&M personnel generally to meet the requirements stated in Volume II of Bid Documents.

### **Setting out of works**

Setting out data such as BENCH MARK, DATUMS and original setting out points shall be provided by the Employer.

### **Plant, materials and services**

All materials used in the Permanent Works and workmanship shall generally be of standard quality available in Pakistan and except where otherwise specifically instructed or where specific standards are referred to, comply with any of the latest issues of the relevant Standards and Codes of Practices.

### **Statutory requirements**

The Contractor shall comply with the pertinent statutory requirements. Concerning explosives, the Contractor shall provide suitable bunkers at approved locations for the storage of all explosives. Storage, transportation, handling, charging, etc. shall

be performed by experienced personnel using approved equipment in accordance with the relevant statutory regulations and to the satisfaction of the Employer. The Contractor shall obtain the requisite permission and diligences from the concerned agencies for transportation, use and storage of explosives.

### **Photographs**

The Contractor shall take photos in digital camera during progress of work, which shall be attached to the monthly progress report. Each of these photos shall be submitted in 6-fold as paper copies in colour and two CD's. The sizes of the photos shall be 10 x 15 cm. Every month at least ten colour photos for each report shall be supplied.

The Contractor shall supply colour prints of photographs, not less than 200 mm by 225 mm, of each portion of the Works in progress and completed, as may be directed by the Employer and specified herein. The digital CDs shall be the property of the Employer and shall be delivered to the Employer with the prints. No prints shall be supplied to anyone without the written permission of the Employer.

The photographs shall be of two categories:

- a. Progress photographs;
- b. Record photographs;

Both categories of photographs shall be properly referenced to the approval of the Employer. Each print shall have the recorded date of the photographs, the direction in which the camera was facing and identifying description of the subject and the reference.

Photographs taken for record purposes as ordered by the Employer shall be supplied with two prints, having on the reverse of one print the signatures of the Contractor and the Employer (or their authorized representatives) for the purpose of attestation. If required, the Contractor may at his own cost have an additional print.

The Contractor shall supply the CD and two prints of each progress photograph ordered by the Employer. He shall supply sets of four additional prints of progress photographs selected by the Employer for incorporation in albums. He shall supply albums, mount the prints and title the prints and albums all to the approval of the Employer.

The contractor shall make available a digital camera with 8 MB smart Ram and accessories for the sole use of the Employer for the purpose of the project, all at his cost. At the end of the contract the camera & accessories shall become the property of the Employer.

### **Office for the Employer**

Office spaces prepared and provided for the Employer shall be maintained for the duration of the Contract and serviced as specified. For the purpose of this Chapter the office space provided shall be known as the Employer's site office. On completion of the Contract all fixtures fitting, furnishings and equipment shall be

handed over to the Employer and will continue to remain Employer's property.

### **Laboratory**

The Employer site Laboratory shall be provided with testing equipment with consumables for following test and maintained for the duration of the contract.

The laboratory shall be provided with working shelves and stools beside storage shelves. A curing tank shall also be provided outside the laboratory building.

1	Concrete cube crushing strength testing machine & 3 sets of cube moulds	01 No
2	Speedy moisture tester (20 gms) complete test	02 Sets
3	Determination of dry density/moisture content relationship of soil	01 Set
4	Aggregate moisture test for determination of water cement ratio (200 mm dia complete test)	02 Sets
5	Slump cone with base plate	03 Nos
6	Cement briquette moulds	02 Sets
7	Flakiness index test equipment for aggregate	2 Nos
8	Field density measuring equipment (sand cone)	03 Sets

The laboratory shall be provided with working shelves and stools besides storage shelves. A curing tank shall be provided outside the laboratory building.

### **Area of offices**

The building for the site office block shall be made suitable for the climate with air-conditioning, all to the approval of the Employer.

The floor area of the office block shall be about 2500 Sq.ft as directed by the Employer.

The office block shall be furnished.

### **Servicing and maintenance**

The Contractor shall service and maintain all ancillary works, Employer's site office, furniture, fixtures and equipment including provision of security janitorial services and refuse disposal services, until the end of the Defects Liability Period. The Contractor shall replenish consumable items and all office supplies, stationery, copying paper and miscellaneous items of office use as and when required. In addition, at the end of the Defects Liability Period, the furniture, fittings and equipment shall be cleaned, repaired or replaced, as necessary, to bring them into good condition, and they shall remain the property of the Employer

at the conclusion of the Contract.

### **Assistance to the Employer**

The Contractor shall provide following competent office staff and workers approved by the Employer continuously as may be required by the Employer, to assist him in running his site office, in connection with the Works.

•	Office Secretary	1
•	Word Processors / Typist	2
•	Office Assistants	2
•	Messengers	2
•	Tea Boys	2

The messengers shall be provided with conveyance by the Contractor to deliver messages and mail to the offices of Employer, Contractor and the Employer etc. the contractor's rates shall include for any overtime work.

In case the performance of any of such staff is considered by the Employer as unsatisfactory, the Contractor shall replace the same forthwith with acceptable personals.

### **Drainage and Sewerage System**

The Contractor shall design, execute and maintain a sewerage system to the approval of the Employer.

### **Access Roads and Development of Site Area.**

The contractor shall provide access roads (cement concrete or bituminous over a Sub Base) to all building and parking areas including crossings structures. The parking areas shall be paved with cement concrete of designed mix over the under bed of lean concrete. The work shall be executed to the satisfaction of the Employer.

### **Automatic Door Closers**

Automatic door closer shall be face fixing type suitable for the weight of door to which attached, hydraulically operated with steel arms and steel or aluminum body capable of door opening to 180 degree and having adjustable hydraulic check.

#### **a. Ladders & Railings**

Galvanized iron ladders and railings shall be provided to all chambers, Inlet channel & openings in the motor hall and at places as shown in the drawings or indicated by the Employer and essentially required.

It shall be of approved size, and suitable for location and strong enough to withstand the stresses and strains of movement. Galvanized iron ladder shall conform to BS code.

Stainless steel ladders & railings in office and first floor passage shall be provided

## **b. Gauge Measure**

Calibrated Metallic strip water depth measuring gauge shall be provided and fixed at the two ends of the Inlet channel. The figures shall be visible in the night darkness. Along with the calibration table (chart) or graph shall be designed to indicate the rate of flow (mgd) with respect to the depth of water its corresponding wetted area and velocity of flow and supplied.

The metallic strip shall be of rust proof and unbreakable material. The figures shall be written in an indelible material. The strip shall be fixed in a recessed space.

## **10.62 Project Meetings**

### **General**

#### **a. Description**

The Contractor shall schedule and administer throughout the progress of the works:

- (1) Pre-design meetings
- (2) Periodic design progress meetings
- (3) Preconstruction meetings
- (4) Periodic construction progress meetings, and
- (5) Specially called meetings

In addition the Employer may call extraordinary meetings as necessary. Pre design, preconstruction and progress meetings shall be held during both the design and construction phases on a schedule satisfactory to the Employer, but at least on a monthly basis at a minimum.

#### **b. The Contractor shall:**

Prepare agenda for meetings. Proposed agenda for all meeting shall be submitted to the Employer at least 7 days prior to each meeting.

Distribute written notice of each meeting 14 days in advance of meeting date.  
Make detailed graphically supported presentations regarding the status of the Work.

Record the minutes include all significant proceedings, decisions, and action requirements.

Reproduce and distribute copies of minutes within 3 days after each meeting.

To all participants in the meeting.

- (1) To all parties affected by decisions made at the meeting.
- (2) Representatives attending the meeting from the Contractor, the Contractor's design engineer, sub-contractors and suppliers shall be qualified and authorized to act on behalf of the entity each represents.
- (3) Employer will attend meetings to monitor progress of the Work and shall be

given the opportunity to confirm and sign the minutes of the meeting before distribution.

**a. Design Meetings**

Pre-Design meeting agenda shall include, but not limited to:

- (1) Distribution and review of design progress schedule.
- (2) Proposed additional investigations.
- (3) Contacts with regulatory agencies
- (4) Equipment supply contracts
- (5) Procedure for submittal and review of design documents
- (6) Quality assurance procedures
- (7) Project Configuration
- (8) Technical Matters

**b. Design Progress Meetings**

The design progress meeting's agenda shall be held at a minimum quarterly and the agenda shall include but not limited to:

- (1) Review and approval of previous meeting minutes
- (2) Review of progress since previous meeting
- (3) Status of submittals and approvals
- (4) Problems which impede design progress schedule
- (5) Corrective measures to regain projected progress schedule
- (6) Revisions to progress schedule
- (7) Proposed progress during succeeding work period
- (8) Status of review by regulatory agencies
- (9) Status of Equipment supply contract

**c. Construction Meetings**

- (1) Pre-Construction Meeting

The pre-construction meeting agenda shall include discussion of:

- (i) List of major sub-contractors and suppliers.
- (ii) Progress Schedule.
- (iii) Critical work sequencing.
- (iv) Major equipment deliveries and priorities.
- (v) Project Coordination.
- (vi) Designation of responsible personnel.
- (vii) Procedures and processing of:
- (viii) Field decisions.
- (ix) Proposal Requests.
- (x) Submittals
- (xi) Application for payment.
- (xii) Adequacy of distribution of Contract Documents.
- (xiii) Procedures for maintaining Record Documents.
- (xiv) Use of site and Site Installation:
- (xv) Office, work and storage areas.
- (xvi) Employer's requirements.



- (xvii) Construction facilities and controls.
- (xviii) Quality control / Quality Assurance procedures.
- (xix) Temporary utilities.
- (xx) Safety and first-aid procedures
- (xxi) Security procedures.
- (xxii) Field observation by regulatory agencies.

#### **d. Construction Progress Meetings**

The construction progress meeting shall occur once per calendar month which shall address an agenda including but not limited to:

- (i) Review and approval of minutes of previous meeting.
- (ii) Review of work progress since previous meeting.
- (iii) Field observations, problems, conflicts.
- (iv) Problems which impede Progress Schedule.
- (v) Review of off-site fabrication delivery schedules.
- (vi) Corrective measures and procedures to regain projected schedule.
- (vii) Revisions to Progress Schedule.
- (viii) Plan progress and establish schedule for succeeding work period.
- (ix) Review submittal schedule expedite as required.
- (x) Maintenance of quality standards.
- (xi) Review proposed changes for effect on progress Schedule and on completion date.
- (xii) Status of periodic field observation by regulatory agencies.

### **10.63 Schedule & Construction Progress Record**

#### **General**

#### **a. Schedule**

The Contractor shall submit the proposed Schedule for the design and execution of the Works in a format and media approved by the Employer. The proposed programme shall be in two levels of details as follows:

The Overall Programme which shows the major work items of the Works.

The detailed Working Programme which shows further breakdown of the major work items into activities involved in the sub-items.

The Contractor shall use Critical Path Analysis (CPA) to analyze and identify critical activities and key dates and shall present the programme in bar chart form and network diagram indicating activities and dates critical to completion of the work on time.

The Contractor shall produce all schedules using the latest revision of the Primavera scheduling software and form one data-base so that the programmes are inter-linked and fully coordinated. The programme shall show increasing detail, each succeeding programme level sub-dividing activities in the preceding level.

The Contractor shall submit an explanatory report covering any aspect of the chart or network that the Contractor cannot show on the chart. The Contractor

shall agree with the Employer on the work section, activities, sub-activities, interface and other critical dates which the Contractor has to identify in the programmes. This shall become the Overall Works Programme based on which the Contractor shall complete the Work in time. This Overall works Programme shall not be changed unless agreed with the Employer.

The Overall Works Programme shall show every significant activity required for the completion of the contract including:

- (1) Contractor's own detail design
- (2) Supplies design and manufacturing plans
- (3) The submittal of drawings and information to and reviewed by the Employer.
- (4) Approval required from statutory authorities and agencies.
- (5) Appointment of major sub-contractors and suppliers.
- (6) Mobilization, time on site and removal of major items of Contractors Plant and temporary facilities.
- (7) Procurement and off-site testing, and delivery of major equipment and material to the site.
- (8) Construction and installation of the works on the site.
- (9) Off-site activities such as prefabrication of components.
- (10) Inspection, testing and commissioning.
- (11) Forecast labour plants and equipment requirements.

The major work items of the works to be shown on the overall work Programme shall consist of, but not limited to the following:

- (1) General
- (2) Mobilization
- (3) Site Office & General Items
- (4) Site Installations

#### **10.64 Detailed Engineering Design**

##### **Civil works for Pump house and Infrastructure:**

- (1) Mechanical & Electrical Works
- (2) Procurement of equipment, mechanical and electrical
  - (i) Imported
  - (ii) Local
- (3) Pump Station and Control Rooms
- (4) Excavation of foundations
- (5) Concreting works
- (6) Basement of Pump Station
- (7) Ground floor of pump station and associated facilities
- (8) Finishing works
  - (i) Block Masonry
  - (ii) Plaster and Dado
  - (iii) Doors, windows & ventilators
  - (iv) Flooring
  - (v) Painting
  - (vi) External Plan protection
  - (vii) Miscellaneous

- (9) Plumbing and Sanitary Fittings and Fixtures (Internal & External)
- (10) External development work
- (11) K.E.S.C. Sub-Station
- (12) Suction Well
- (13) Screen Chamber
- (14) All Miscellaneous Works
- (15) Chambers
- (16) Erection
- (17) Testing and Commissioning
- (18) Initial Running Maintenance
- (19) Final Handing-Over
- (20) Cleaning-up Work
- (21) Final Documentation
- (22) Demobilization

Each activity in the Overall Works Programme shall have the following information:

- (1) Activity code, description, duration and the sequence with other activities.
- (2) The earliest and latest start finish dates with available float.
- (3) The party responsible for each activity e.g Contractor, Sub-Contractor, Employer, etc.
- (4) The cost weighing for each activity by the Contractor with respect to the total cost of all the activities must add upto 100%.
- (5) The installation Quantities and forecast man-hour.
- (6) The relevant price breakdown item shown in the contract shall be easily identified in the work Programme.
- (7) The Detail Working Programme shall contain the items, which are breakdowns of the major items. The Programme shall identify any interface requirements affecting the work. The main quantities of material and other agreed relevant information.
- (8) The Contractor shall provide a concise master network diagram. The Contractor shall analyze the CPM network using the precedence diagram method. The work breakdown structure (WBS) will be the same as that for the Overall Works Programme, and each major activity shall relate to the price breakdown headings.
- (9) The activities presented in the programme shall be capable of indicating the required information stated above.

#### **10.65 Detailed Progress Report**

Each month the Contractor shall report on a day in a format and media approved by the Employer the progress and financial status of the works of the previous month. The report shall accurately estimate the work completed on each activity including the design activities shown on the accepted Overall Works Programme and the Working Programme. The contractor's progress report shall include relevant progress photographs. The Contractors shall agree with the Employer and shall implement progress control procedures.

The Contractor's progress report shall identify

**a. Detailed Progress Report**

- (1) Total work progress as of the end of previous month with a progress chart showing progress achieved in % against scheduled progress.
- (2) Activities re-scheduled or re-estimated since previous progress.
- (3) Activities added or deleted since the previous report.
- (4) Works progress achieved during the previous month.
- (5) Major activities undertaken in the previous month with photos attached.
- (6) Major activities to be carried out in the next period, and the effect on the programme on the latest available information.
- (7) Areas of concern.
- (8) Actions to be taken to solve the problem(s)
- (9) Forecast completion dates and milestone dates.

**b. Resources**

- (1) Staff returns
- (2) Labour return
- (3) Plant return
- (4) Material delivered to site

**c. Commercial**

- (1) Schedule of information required
- (2) Material on site

**d. Financial**

- (1) Anticipated cash flow forecast
- (2) Schedule of Guarantees
- (3) Schedule of Insurance
- (4) Particulars of Sub-contractor and Suppliers
- (5) The Contractor's execution of the construction work shall not deviate from the sequence shown in the approved Overall Work Programme without prior written permission from the Employer.

**10.66 Weekly Progress Meeting**

Within four (4) weeks of the Commencement Date the Contractor and the Employer will agree on a programme schedule for weekly progress meetings covering the total duration of the Works. The Contractor shall make himself available for any other meetings called for by the Employer outside the schedule.

The Contractor shall prepare the following programme with increasing detail to demonstrate the Contractor's shorter-term and detailed planning of the execution of activities

- a. Detailed Working Programme
- b. Weekly Detailed Working Programme

The Detailed Working Programme shall be submitted to Employer for approval monthly to cover the period for the next following month's planned work. The hard copy of the programme must also include the previous one (1) month progress. The electronic copy of the programme must also include progress for the period

from the beginning of the Contract.

The Weekly Detailed Working programme shall be submitted to the Employer for approval weekly and must show at least previous week's progress and the future two (2) week's planned work.

The Weekly Detailed Working Programme shall contain details of all critical activities in delay and any delays the contractor can foresee to future critical activities. The Contractor shall report the likely effect on the programme and the remedial action, the Contractor proposes to rectify the delay such as but not limited to:

- a. Increase resources
- b. Increasing the worked hours
- c. Carrying out activities in parallel

The Contractor shall issue relevant short-term programmes with the method statements required in the Contractors project Quality Assurance Plan. To accurately reflect the status of the Works, the Contractor shall monitor, update, revise the programmes, and submit them to the Employer in the regular progress meetings or at such other time as instructed by the Employer. All the programmes submitted to the Employer shall be in electronic format and in hard copy.

#### **10.67 Explosives**

- a. The Employer shall have the power to regulate restrict or prohibit the use of explosives, explosive powered tools, or the like in the Works if in his opinion it is necessary to do so for the safety of persons or property or to safeguard the Works.
- b. No blasting shall be carried out in any part of the Works without the written permission of the Employer. Such permission shall not absolve the Contractor from any of his obligations or liabilities under the Contract and he shall take all necessary precautions including the use of blasting nets or mats to avoid damage, loss or injury to persons and to public or private property.
- c. The Contractor shall keep the Employer fully informed at all times when blasting is proposed to be carried out and of any details that may be required by the Employer concerning strength of charges and their positions.
- d. Explosives shall not be used within 50 ft, or such greater or lesser distance as the Employer may direct, of concrete placed in the Works, of any existing structure, pipeline electric cable or overhead power or telephone lines etc.
- e. The Contractor shall obtain at his own expenses the necessary licenses for the use, handling, transporting and storage of explosive and shall comply at all times with the requirements of the Police Department, and other authorities having jurisdiction in the area of the works, as may be conditional upon the granting of such licenses.

#### **10.68 Project Signs General**

### **a. Project Signboard**

The Contractor shall design, supply, erect and maintain one signboard, approximately 10 ft wide by 7 ft high, at the entrance of the Site or at a location to be agreed by the Employer. The Employer shall review and agree the Contractor's design. The Contractor shall employ an experienced sign- writer to prepare the signboard.

The Contractor shall remove the signboard and associated footings on completion of the Works and leave the site in the specified condition.

The Contractor shall not display any advertisements within or around the Site without the prior written approval of the Employer.

### **Taking Over**

#### **General**

#### **a. Substantial Completion**

- (1) When Contractor considers the work is substantially pursuant to Clause 10, the General Conditions of EPIC, he shall submit to Employer:
  - (i) A written notice that the work, or designated portion thereof, substantially complete and a letter of certification stating the Project has been constructed in accordance with the Contract Documents; and,
  - (ii) A list of items to be completed or corrected.
- (2) Within a reasonable time after receipt of such notice. Employer will determine the status of completion on the basis of his On-site observations.
- (3) Should Employer determine that the work is not substantially complete:
  - (i) Employer will promptly notify the Contractor in writing giving the reasons thereof;
  - (ii) Contractor shall remedy the deficiencies in the work and send a second written notice of substantial completion to the Employer; and
  - (iii) Employer will re-evaluate the work.
- (4) When Employer concurs that the work is substantially complete, Contractor will:
  - (i) Prepare a Taking Over Certificate for Mechanical, Electrical & Civil works accompanied by:
    - Contractor's list of items to be complete or corrected, as verified and amended by the Employer;
    - Complete list of As-Built Drawings
    - List of detail specifications of As-Installed plant and equipment
    - Details of the As-constructed civil works
    - List of As-supplied spare parts, tools and equipment
    - List of O&M manuals And
  - (ii) Submit the Certificate to Employer and Contractor for their written acceptance of the responsibilities assigned to them in the Certificate.

#### **b. Move-Out of Site Installation**

- (1) After completion of the Works, the Contractor, with prior approval of the

Employer, shall:

- (i) Remove all buildings, installation and temporary facilities. The Contractor shall fill with earth all basements and underground areas, clean up and restore the terrain to its quasi-original condition. The Contractor shall also treat the excavations executed for his own convenience, such as temporary roads, in a way acceptable to the Employer. If the Contractor refuses to remove the buildings, plant, equipment and installations or if the operation is not made as specified within 2 months from completion of the Works, such buildings, plant equipment and installations may be removed by the Employer and the removal costs shall be deducted from the Contractor's final payment.

The Employer shall have the right to take over a part or all of such buildings and installations at no extra cost. All buildings and installations shall be handed over in good condition.

Prior to Taking-Over of the Works, roads and access branches whose construction and maintenance was an obligation of the Contract shall be left in good condition of service. With regards to provisional roads constructed for the Contractor's use, the Employer shall indicate in which condition the areas shall be left, and the Contractor shall establish this condition at his own cost.

### **c. Final Inspection**

- (1) When Contractor considers the work is complete, he shall submit written certification that:
  - (i) Contract Documents have been reviewed;
  - (ii) Work has been inspected for compliance with Contract Documents;
  - (iii) Work has been completed in accordance with Contract Documents;
  - (iv) Equipment and systems have been tested in the presence of the Employer and are operational; and
  - (v) Work is completed and ready for final inspection
- (2) Employer will make an onsite visit to verify the status of completion with reasonable promptness after receipt of such certification.
- (3) Should Employer consider that the work is incomplete or defective:
- (4) Employer will promptly notify the Contractor in writing, listing the incomplete or defective work:
- (5) Contractor shall take immediate steps to remedy the stated deficiencies, and send a second written certification to Employer that the work is complete; and
- (6) Employer will re-evaluate the work.
- (7) When the Employer finds that the work is acceptable under the Contract Documents, he shall request the Contractor to make closeout submittals.

## **10.69 Final Application for Payment**

Contractor shall submit the final Application for Payment in accordance with procedures and requirements stated in the conditions of the Contract.

## **10.70 Taking Over Submittals**

### **a. General**

#### **(1) Project Record Documents and Samples**

- (i) Contractor shall maintain one record copy of:
  - Contract Drawings
  - Specifications
  - Addenda
  - Change Orders and Other Modifications to the Contract
  - Reviewed Shop Drawings, Product Data and Sample
  - Field Test Records
  - Inspection Certificates
  - Manufacturer's Certificates
- (ii) Record Documents and Samples shall be stored in Field Office apart from documents used for construction. Files, racks and secure storage for Record Documents and samples shall be provided
- (iii) Record Documents shall be maintained in a clean, dry and legible condition. Record Documents shall not be used for construction purposes.
- (iv) Record Documents and samples shall be available for inspection by Employer.

#### **(2) Recording**

- (i) Contract Drawings: On a daily basis, the Contractor shall legibly mark in ink or indelible pencil, to record actual construction, the following information:
  - Location of internal utilities and appurtenances concealed in construction referenced to visible and accessible features of structure.
  - Field changes of dimensions and details
  - Changes made by Change Order or Employer's Supplemental Instructions.
  - Details not on original contract drawings
- (ii) Specifications and Addenda: The Contractor shall legibly mark up each Section to record.
  - Manufacturer, trade name, catalog number and supplier of each product and item of equipment actually installed.
  - Other matters not originally specified.
- (iii) Shop Drawings: The Contractor shall maintain as record documents and legibly annotate the following drawings to record changes made after review:
  - Mechanical submittal
  - Metal fabrications

#### **(3) Submittal**



- (i) At completion of project, Contractor shall deliver Record Documents to Employer including the Contract Drawings in reproducible ink-on-mylar sheets that match the contract documents (size, sheet content and title block).
- (ii) Accompany submittal with transmittal letter, in duplicate containing:
  - Date
  - Project title and number
  - Contractor's name and address
  - Title and number of each record document
  - Certification that each document as submitted is complete and accurate
  - Signature of Contractor, or his authorized representative

#### **(4) As-Built Documents**

The Contractor shall consider the preparation of As-built Documents and operation and maintenance manuals as part of his site installation. The "As-built" Documents shall be prepared in a way to satisfy the requirements of the Employer. The drawings shall be in digital copies in AutoCAD 14 Format and six (6) blue prints, indicating the accurate location and dimensions of all structures with reference to a permanent survey network. Before establishing the "As-built" Documents the Contractor shall submit an advance copy to the Employer for approval.

#### **(5) Operation and Maintenance Data**

- (i) Submit two sets prior to final inspection, bound in 8-1/2" x 11" text pages, three D size ring capacity expansion binders with durable plastic cover.
- (ii) Prepare binder covers and edge with printed title Operation and maintenance Instructions, title of project, and subject matter of binder when multiple binders are required.
- (iii) Internally subdivide the binder contents with permanent page dividers, logically organized as described below; with tab tiling clearly printed under reinforced lamina led plastic.
- (iv) Contents: Prepare a Table of Contents for each volume, with each Product or system description identified type on 24 pound white paper
  - Part 1: Directory, listing names, addresses and telephone numbers of Construction Manager, Contractor, sub-contractors and major equipment suppliers.
  - Part 2: Operation and maintenance instructions arranged by system and subdivided by specification section. For each category, identify names, addresses, and telephone numbers of sub-contractors and suppliers. Identify the following:

- (i) Significant design criteria
- (ii) List of equipment

- (iii) Parts list for each component
- (iv) Operating instructions
- (v) Maintenance instructions for equipment and systems
- (vi) Maintenance instructions for special finishes, including recommended cleaning methods and materials and special precautions identifying detrimental agents.

- Part 3: Project documents and certificates, including the following:

- (i) Shop drawings and product data
- (ii) Certificates
- (iii) Photocopies of warranties
- (v) Submit one copy of completed volumes in final form 15 days prior to final inspection. This copy will be returned after final inspection, with Employer comments. Revise content of documents as required prior to final submittal.
- (vi) Submit six copies of final volumes revised, within ten days after final inspection

## **(6) Warranties and Bonds**

- (i) Provide duplicate notarized copies
- (ii) Execute and assemble documents from sub-contractors, suppliers, and manufacturers
- (iii) Provide Table of Contents and assemble in three D side ring binder with durable plastic cover
- (iv) Submit prior to final application for Payment
- (v) For items of Work delayed beyond, Taking-Over, provide updated submittal within ten days after acceptance, listing date of acceptance as start of warranty period.