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JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)
COMISION EJECUTIVA PORTUARIA AUTONOMA (CEPA)

THE DETAILED DESIGN ON PORT REACTIVATION PROJECT IN LA UNION PROVINCE OF THE REPUBLIC OF EL SALVADOR

FINAL REPORT

(DRAFT) BIDDING DOCUMENTS

Package A: Civil and Building Works

VOLUME III-A
SPECIFICATIONS

OCTOBER 2002

NIPPON KOEI CO., LTD.

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Volume III-A

Specifications

CONTENTS

Page

Part I: General Requirements

Part II: Specifications for Civil Works

Part III: Specifications for Building Works

Part IV: Specifications for Utility Works

Part I

General Requirements

LA UNION PORT DEVELOPMENT PROJECT

Bidding Documents
for
Package A : Civil and Building Works

Volume III-A

Specifications
Part I: General Requirements

CONTENTS Page

SECTION 10500 CONTRACTOR'S FACILITIES

SECTION 10600 CONTRACTOR'S MANAGEMENT OF THE WORKS

SECTION 10700 WORKMANSHIP PLANT AND MATERIALS

SECTION 11100 EMPLOYER'S AND ENGINEER'S FACILITIES

SECTION 11200 DEMOLITION AND SITE CLEARANCE

SECTION 11300 DAYWORKS

PART I : GENERAL REQUIREMENTS

SECTION 10100 THE WORKS

10101 Project Particulars

The Project consists of the entire port development works to be executed at La Unión Port, under the Loan Agreement No. ES-P5 dated October 25, 2001. The Project is divided into three (3) separate contract packages as follows:

Package A – Civil and Building Works

Package B – Procurement of Cargo Handling Equipment

Package C – Procurement of Tugboats

The Works to be executed under this Contract comprise the Package A – Civil and Building Works.

10102 Scope of Works

The scope of Works of the Package A includes the execution and completion of the following components, all being more particularly indicated and described in the Drawings and other documents comprised in the Contract.

a) Civil Works

* Construction of quaywall

Container Berth	Depth: -14.0m	Length: 340m
Multi-purpose Berth	Depth: -14.0m	Length: 220m
Passenger Berth	Depth: -9.5 m	Length: 240m

* Construction of access channel and turning basin

Outer channel	Depth: -14.5m	Width: 137m
Inner Channel	Depth: -14.0m	Width: 140m
Turning Basin	Depth: -14.0m	Diameter: 600m

* Constructions of Revetments

East Revetment	About 250m
West Revetment	About 400m

* Construction of Roads and Pavement
  Access Road
  Yard Pavement
* Construction of Drainage Facilities
* Construction of Lighthouse
* Provision of Navigation Aids
  1 Lighthouse, 16Light Buoys, and 3Light Beacons

b) Building Works

* Construction of Administration Building
* Construction of Container Freight Station (CFS)
* Construction of Maintenance and Repair Shop
* Construction of Container Gate
* Construction of Cargo Gate
* Construction of Power Supply Station
* Construction of Fuel Station
* Construction of Water Pump Station

c) Utility Works

* Water Supply System including deep well, water pump, water storage tank, and distribution pipe
* Sewage System
* Wastwater Treatment
* Firefighting Facilities
* Oil Separator for Maintenance and Repair Shop
* Power Supply System including receiving station, emergency power station and distribution substation
* Provision of Area Lighting, Yard Lighting and Road Lighting
* Power Supply for Buildings
* Provision of Communication System

10103 Scope of Specifications

The Specifications applicable to all Works to be performed under the Contract, are included in the Bidding Documents Volume III-A in four Parts as follows:

a) Part I : General Requirements

b) Part II : Specifications for Civil Works

c) Part III : Specifications for Building Works

d) Part IV : Specifications for Utility Works

The specification documents are referred to herein and in other documents comprised in the Contract collectively as the "Specification" and/or "Specifications". The specifications shall be read in conjunction with all of the remaining documents forming part of the Contract.

Part I : General Requirements applies to and prevails over all of the above noted Specifications. Any matter not provided in the Specifications shall be determined through consultation between the Engineer and the Contractor.

Unless otherwise expressly noted, all of the requirements of the Specifications shall be deemed to be included by the Contractor in the rates and prices contained in the Contract Price, whether or not separate pay items are included therefor in the Bidding Documents Volume IV-A Bill of Quantities (BOQ).

10104 Details not to be Published

The Contractor shall treat the details of the Contract as confidential for his own information only and shall not publish or disclose them in any trade or technical paper or elsewhere (except as necessary for the purposes of the Contract), without prior consent in writing of the Employer.

SECTION 10200 THE SITE AND DATUM

10201 Site of Works

The site of the Works, La Unión Port, is located in La Unión Bay in the Fonseca Gulf, which lies in La Unión Province in the eastern end of the Republic of El Salvador, which is located at about 185km from the capital city of San Salvador

The existing access to the La Unión Port site is by the Pan-American Highway (CA-1) or Litoral Highway (CA-2). Currently one must cross the central part of La Unión city to reach the existing port, named Cutuco Port. All the road is paved, however it is expected that a bypass road will be available at the commencement of port construction to bypass La Unión city. Details of the Site are shown on the Drawings.

10202 Climatic Conditions

The following general description of climate is given only as a guide and the Contractor must verify for himself the actual conditions prevailing:

The climate of the Project area is characterized as belonging to the tropical rain forest and subtropical forest zones with a rainy season from May to October and a dry season from November to April .

Climatic data on the project area collected in the last five years (1996 to 2000) from the Ministry of Agriculture and Cattle (MAG: Ministerio de Agricultura y Ganadería) of El Salvador shows the principal climate is characteristics as follows:

Description	5-Year Average
Annual average temperature	27°C to 30°C
Highest temperature reported	37.2°C
Lowest temperature reported	18.1°C
Annual average rainfall	1,780mm
Maximum average monthly rainfall	448mm (Sept)
Minimum average monthly rainfall	174mm (October)
Average number of days with rainfall	117 days

[Source: MAG]

During the summer (November to April) the average temperature at the site is about 28.5°C, while in the winter (May through October) it ranges from about 20.5°C to 36.8°C, and averages about 27.9°C.

In La Unión Bay the winds are predominant in the NE direction from November to February and the SW from March to October. The average wind speed is 3 m/s from January to April and 2 m/s from May to December.

The following table shows the wind data collected at La Unión from 1970 to 1985.

Monthly Average Wind Velocity and Dominant Wind Direction (1970-1985)

(Unit: m/sec)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ave.
1970										2.0	2.6	3.3	2.6
										SW	NE	E	-
1971	3.3	3.3	3.6	4.2	2.8	2.1	1.8	2.1	2.2	2.0	2.0	2.6	2.6
	E	SW	E	SW	SW	SW	E	SW	SW	SW	SW	E	SW
1972	3.0	3.7	3.3	3.2	2.3	2.5	2.8	2.4	2.0	1.9	1.9	2.7	2.6
	E	SW	SW	SW	SW	SW	E	E	E	SW	S	E	SW
1973	3.7	3.8	3.3	3.3	2.6	2.2	2.2	2.1	2.0	1.7	2.0	2.8	2.5
	E	E	S	S	S	SW	E	S	S	E	E	E	E-S
1974	3.2	4.0	3.2	3.6	2.9	2.0	2.2	2.5	2.0	2.0	2.2	3.0	2.7
	E	E	S	E	S	S	NE	E	S	NE	NE	E	E
1975	3.5	3.3	3.2	3.5	2.7	2.1	2.2	1.9	1.8	1.7	1.8	2.6	2.4
	E	S	S	S	S	S	S	S	S	SW	NE	NE	S
1976	3.8	4.2	3.5	2.8	2.5	1.8	2.6	2.3	2.0	1.9	2.9	2.8	2.7
	NE	NE	E	S	SW	SW	NE	NE	S	S	NE	NE	NE
1977	3.4	3.4	3.4	3.3	2.4	2.0	2.8	2.2	2.1	1.9	2.2	2.3	2.6
	NE	NE	S	NE	S	NE	E	SE	SE	SE	NE	NE	NE
1978	3.3	3.5	3.3	2.7	2.5	1.9	1.8	1.9	1.8	1.6	1.9	2.7	2.3
	NE	NE	NE	S	SW	NE	NE	SW	SW	SW	SW	NE	NE
1979	3.1	3.6	3.4	2.9	2.2	1.8	1.5	1.5	1.6	1.7	2.0	2.4	2.2
	NE	NE	SW	SW	SW	SW	SW	SW	SW	SW	NE	NE	SW
1980	2.6	3.1	3.1	3.1	2.3	1.8	1.8	1.7		1.6	1.8	2.7	2.3
	-	-	E	SW	SW	SW	SW	SW	SW	SW	NE	NE	SW-NE
1981	2.7	3.3	2.7	3.2	2.1		1.6	1.8	1.6	1.6	1.9	2.1	2.2
	NE	NE	SW	E	S	SW	SW	SW	S	SW	NE	NE	SW
1982	2.3	2.5	2.8	2.5	2.0	1.5	1.9	2.1	1.8	1.7	2.0	2.4	2.1
	E	E	E	SW	SW	SW	E	E	SW	SW	E	E	E
1983	2.8	2.4	2.7	2.4	2.5	1.8	1.9	1.6	1.5				2.1
	NE	SW	SW	SW	SW	SW	E	E	SW	-	-	-	SW
1984	2.4	2.6	2.4	2.6	2.0	1.5	1.5	1.4	1.3	1.3	1.6		1.8
	NE-E	NE	SW	SW	SW	SW	E	SW	SW	SW	NE	NE	SW
1985			2.8	2.2	1.7	1.6	1.4	1.3	1.2	1.1			1.6
	E	E	E	SW	SW	SW	NE	SW	SW	SW	SW	NE	SW
Ave.	3.0	3.3	3.1	3.0	2.3	1.9	2.0	1.9	1.8	1.7	2.0	2.6	

[Note: Monthly average of instantaneous wind velocity of daily records at 7:00, 14:00 and 4:00 Source: MAG]

The annual precipitation in La Unión Bay varies from 1,600 to 1,800 mm. The data from 1996 to 2000 show an average value of 1,780 mm. The minimum rainfall during the period was 1,272mm and the maximum was 2,123mm in 1998.

Monthly Average Rainfall in La Unión (1996-2000)

(Unit: mm)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1996	0	10	1	32	586	209	324	184	297	202	20	0	1,865
1997	2	3	0	19	72	474	146	47	316	133	58	2	1,272
1998	0	0	17	1	164	284	363	304	200	482	308	0	2,123
1999	0	0	2	0	188	365	223	155	649	259	13	5	1,859
2000	0	0	0	8	304	203	165	180	779	118	25	1	1,783
Ave.	0	3	4	12	363	307	244	174	448	239	85	2	1,780

Number of Rainy Days in La Unión (1996-2000)

(Unit: day)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1996	1	2	1	7	20	17	21	16	26	16	8	0	135
1997	1	1	0	3	6	20	9	9	21	12	8	2	92
1998	0	0	3	2	7	16	19	23	17	26	11	2	126
1999	0	0	1	1	11	23	17	18	27	21	5	1	125
2000	0	0	0	2	15	17	15	17	26	12	5	1	110
Ave.	0	1	1	3	12	19	16	17	23	17	7	1	117

[Source: MAG]

10203 Regional Geology

The Republic of El Salvador is situated at the intersection of the tectonic plates of the circum-Pacific Belt and characterized by four structural alignments. The east-west trend, presumably the oldest alignment, is repeatedly reactivated until recent time with the subordinate north-south alignment. The north-west trend, accompanied by the north-east alignment, is associated with horizontal movement. Especially the east-west trend contributes to the occurrence and distribution of volcanoes.

The topography of El Salvador can be classified into four categories: (1) the coastal plain, (2) the coastal block mountains, (3) the main volcanic chain of Pleistocene and recent cones lying within the median through the interior valley, and (4) the northern mountains. The coastal plain, composed of the alluvial volcanic sediments, is the flat coastal belt along the Pacific coast with a maximum height of about 50 m above sea level. The coastal block mountains include the Balsam and Jucuaran ranges that are separated and delimited by east-west trend faults. The main volcanic chain is a line of volcanoes, including the Santa Ana, San Salvador, San Vicente, Tecapán, Usulután, San Miguel, and Conchagua volcanoes.

The geology of El Salvador consists mainly of Tertiary to Holocene volcanic rocks and the overlying pyroclastic deposits.

The project site is located north of the Conchagua Volcano (1,243 m above sea level). There is no record of strong earthquakes within 40 km from the project area. No evidence has been found to indicate that active faults are present around the project site. However, the Volcano Conchagua is still active. The latest eruptions of the volcano occurred in February 23, 1868 and January 26, 1947, accompanied by a small quake.

10204 Datum and Levels

The project datum (DL 0.00) is defined as 1.285m below Mean Sea Level set by CNR. The authorized benchmark for vertical control for the project is named "Punta Gorda" established by CNR. Its coordinates in Local Lambert System and Geograficas NAD27 as well as its elevation are as shown below:

Punta Gorda	Local Lambert	Geograficas NAD27
Coordinates	245,249.00	13°19´24.4066N
	628,215.81	87°48´59.6859W
Vertical Height	DL + 1,863	

The Contractor shall be responsible for the establishment, maintenance and protection of suitable permanent and temporary benchmarks and control points throughout the duration of the construction works. Levels for the Works are to be related to Datum Level (DL) and the following levels have been assumed and referred to the Drawings and Contract Documents:

Mean Springs High Water Level (HWL)	CD + 3.374m
Mean Sea Level (MSL)	CD + 1.652m
Chart Datum Level (DL)	CD ±0.000
Mean Springs Low Water Level (LWL)	CD - 0.128m

The water levels shown on the Drawings and referred to in the Documents are derived from the best information available.

The actual water level may vary from the predicted levels from day to day. The Contractor shall make due allowance for any such variations which may affect his operations.

The dimensions and levels of the Site shown on the Drawings are believed to be correct but the Contractor must verify the same and shall be held responsible for the consequences of any error contained therein or any omission thereof.

SECTION 10300 DOCUMENTS TO BE PROVIDED BY ENGINEER

10301 Admnistrative Systems

The administrative documentation system to be followed in the execution of the Contract will be issued by the Engineer within 28 days after the commencement of the Contract. These will cover but not be limited to the following:

a) Project Correspondence

b) Filing References

c) Drawing Control

d) Requests for Approval (RFA)

e) Payments

f) Instructions

g) Inspections

These procedures will be finalized after review and discussion among the Contractor, the Employer and the Engineer.

SECTION 10400 PREPARATIONS OF SHOP DRAWINGS

10401 Scope of Preparation of Shop Drawings

10401.1 General

The Contractor shall be responsible for preparations of the shop drawings on the following systems, items of Plant, material or components, forming a part of the Permanents Works, as well as the particular designs in order to clarify that the proposed system by him shall have the required specifications and particular performances stipulated in the Specification.

a)	Employer's/Engineer's Office and Laboratory	SECTION 11100
b)	Navigation Aids	SECTION 21700
c)	Air Condition Control System	SECTION 40200
d)	Water Storage Tank	SECTION 40500
e)	Water Supply System	SECTION 40500
f)	Water Purification System	SECTION 40500
g)	Wastewater Treatment Facility	SECTION 40600
h)	Fuel Station	SECTION 40700
i)	Weighing Bridge and Monitoring System	SECTION 41000
j)	Transmission Line and Substation	SECTION 45200
k)	Fire Alarm System	SECTION 45700
l)	Telephone and Data Network	SECTION 45800

10401.2 Design of Other Items

In addition to the above listed items, the Contractor shall be responsible for the design of any particular items of Plant, materials and or components thereof, where the Drawings or Specifications describe such items as shop drawings or specify such items or components required performance standard.

The Contractor shall design the Works and supply all labor, Plant, materials, equipment and services, whether specifically called for or not, but which in the opinion of the Engineer are necessary to complete all systems, equipment and facilities in accordance with the Specification and the system performance requirements.

10401.3 Warranty

In support of these design obligations, the Contractor shall provide to the Employer, in a form approved by the Engineer, a ten (10) year warranty, under which the Contractor is responsible for any significant failure or substantial reduction in performance, in the systems, Plant, materials or any component thereof.

10401.4 Integration of System

The Contractor shall take action as required to ensure that all Plant when installed and in operation results in integrated operating systems.

Any item of the above listed Plant or material, or any other components or items for which the design is the responsibility of the Contractor, shall be compatible with its required functions and the function and performance of each system as a whole. An item of Plant, or material or component thereof previously approved may not be accepted if the system, of which it is part, does not give the required performance. It is the Contractor's responsibility to ensure the adequate functioning of entire

systems.

10402 Design Standards

10402.1 General

Plant and materials forming part of the Works shall comply in all respects with any relevant international regulations, local Statutory Regulations, by-laws and Orders currently in force.

In the event any standard, recommendation or regulation mentioned above should be revised after the issue of the Specifications, the Contractor shall submit to the Engineer in writing any modifications to Specifications that may be necessitated in the light of the governing standards or regulations. No modification to the work shall be carried out unless so approved by the Engineer in writing.

10402.2 Provision of Standards and Regulations

The Contractor shall submit copies of full complete English volumes of Standards and Regulations for equipment to be provided and to be installed, in accordance with SECTION 10700 of the Specifications. If any standards and recommendations are not published in English by the authorities, the Contractor shall translate the non-English language into English by competent translator.

10402.3 Metric System

Dimensions on Drawings shall conform to the metric system except where specifically indicated otherwise. If these dimensions fail to coincide with standard nominal sizes available, the Contractor shall apply to the Engineer for approval of Deviation/Alternative.

10403 Design Deviations

10403.1 General

Systems, Plant and materials shall meet the quality and performance standards established in the Contract.

10403.2 Proposal for Deviation

If the Contractor finds it necessary to deviate from requirements involving an individual sub-system, piece of equipment or component, he shall describe the proposed deviation therefrom, state the reason and the improvement to be expected. Acceptance or rejection of deviations shall be made with the approval in writing of the Engineer.

10403.3 Deviation due to Special Manufacturer

If certain characteristics of Plant or material, such as dimensions, power requirements and external connections, etc., depend on a particular manufacturer, any requirement of the Drawings and Specifications affected by such characteristics may be varied by the Contractor at his own expense, to suit the equipment proposed, but always subject to the prior approval of the Engineer.

10404 Design-Environmental Conditions

10404.1 Atmospheric

The Plant, materials and systems shall be fully tropicalized unless otherwise specified. There shall be no degradation in performance when the equipment and facilities are operated under the following environmental conditions:

- For Outdoor Facilities:

a) Ambient temperature up to 50 degrees Celsius

b) Relative humidity up to 100%

c) Rainfall up to 12 cm per hour

d) Wind speed up to 136 km per hour, unless otherwise specified

e) Salt laden air

- For Indoor Facilities:

a) Ambient temperature up to 45 degrees Celsius

b) Relative humidity up to 90%

10404.2 Design Seismic Force

Horizontal Seismic Force of 0.15 x Dead Load shall be considered

10404.3 Power Supply:

In designing power supply to the equipment and plant, the required performance shall be satisfied within the specified voltage changes ±10% and frequency changes ±5%.

10405 Design and Manufacture

10405.1 General

1) In complying with the requirements of the Specifications, both with respect to arrangements and details, the design shall conform to the best and most up-to-date engineering practice.

2) Plant, materials and systems shall be designed to take account of the standardization and interchangeability of components and parts, and interfacing with any other Plant, materials or systems.

3) The essence of design shall be simplicity and reliability in order to give long continuous service with high economy and low maintenance and operation cost.

4) The design, dimensions and materials of all parts shall be such that they will not suffer damage or instability of performance, as a result of stresses under the most severe service conditions.

5) The materials used in the construction of the Plant shall be of the highest quality, compatible to each other and selected particularly to meet the duties required of them.

6) Subcontracted materials and equipment shall be of the same quality and compatibility.

7) Workmanship and general finish shall be of the highest class throughout.

8) All similar parts of the Plant or systems shall be interchangeable.

9) All Plant shall operate without undue vibration and with the least possible amount of noise and shall not cause nuisance.

10) All Plant shall be so designed and manufactured as to ensure safety for all personnel involved.

11) All Plant shall be designed to minimize the risk of fire and damage which may be caused in the event of fire.

12) All Plant shall be designed to prevent ingress of all vermin, accidental contact with live parts and to minimize the ingress of dust and dirt. The use of materials which may be liable to attack by termites or other insects shall be avoided.

13) Keyed door locks, keyed electrical or equipment cabinet locks and the like, shall be designed to form part of one master key system for all Works and to match with any master key system specified for the remainder of the Project.

14) Sizes of equipment shall be not be significantly bigger than may be shown on the Drawings or otherwise shall generally be selected to fit into the space

allocated thereof.

15) Lightning and power line surge protection shall be provided for all Plant and systems.

10405.2 Design Approval

The Contractor shall submit the design documents to the Engineer for approval within forty-five (45) days after the Commencement Date.

10405.3 Procedure and Requirements for Change

The Engineer shall be advised if any change in design is found necessary after original approval is granted. The Engineer will require detailed explanation from the Contractor if such changes involve changes in concept, approach, quantity, size or weight, power requirements, and performance, and the Engineer retains the right to disapprove such change.

Compliance listings showing in simple tabulated form a comparison listing of all pertinent items of the Specification and the actual items proposed, indicating compliance yes or no.

The Contractor shall make on-Site presentations of design concepts as required by the Engineer before preparation of shop drawings.

Further design documents shall be provided in support of the requirements of this Division and according to the requirements of the Specifications.

10406 Design for Tropical Use

10406.1 Cover for Air Inlet and Holes

Air inlets and holes for pipes or cables through racks, panels, walls, slabs or the like, shall be covered with wire mesh or canvas, etc. for preventing ingress of insects and dust.

10406.2 Finish for Plant and Materials

In choosing the finishes for Plant and materials, due regard shall be given to the humid tropical conditions under which such Plant is to work. Wherever possible Plant shall be hermetically sealed and tropical grade finishes materials shall be used.

10406.3 Prevent Rusting

Iron and steel shall in general be galvanized or by exception may be painted with the approval of the Engineer. Indoor parts may alternatively have chromium or copper-nickel plating or other approved protective finish. Small iron and steel parts (other than rustless steel) of all instruments and electrical equipment, the cores of electromagnets and the metal parts of relays and mechanisms shall be treated in an approved manner to prevent rusting. Cores etc., which are built up of laminations or cannot for any other reason be anti-rust treated, shall have all exposed parts thoroughly cleaned and heavily enameled, lacquered, or compounded.

10406.4 Use of Dissimilar Metal in Contact

When it is necessary to use dissimilar metal in contact, these should, if possible, be so selected that the potential difference between them in the electro-chemical series is not greater than 0.5 volts. If this is not possible, the contact surfaces of one or both of the metals shall be electroplated or otherwise finished in such manner that the potential difference is reduced to within the required limits or, if practicable, the two metals shall be insulated from each other by an approved insulating material or a coating of approved varnish compound.

10406.5 Screw, Pivot and Other Parts

The use of iron and steel shall be avoided in instruments and electrical relays wherever possible. Screws for metal works, when used, are to be zinc, cadmium, or chromium plated or, when plating is not possible owing to tolerance limitations, shall

be of corrosion resisting steel. Screws for wood work shall be nickel plated brass or of other approved finish. Pivots and other parts for which nonferrous materials are unsuitable shall be of an approved rustless steel wherever possible.

10406.6 Fabrics, Cork and Similar Materials

Fabrics, cork, paper and similar materials, which are not subsequently to be protected by impregnation, shall be adequately treated with an approved fungicide. Sleeves and fabrics treated with linseed oil or linseed oil varnishes shall not be used.

10406.7 Use of Wood in Equipment

The use of wood in equipment shall be avoided so far as possible. When used, woodwork shall be of thoroughly seasoned teak or other approved wood which is resistant to fungal decay and shall be free from shakes and warp, sap and wane, knots, faults and other blemishes. All woodwork shall be suitably treated to protect it against the ingress of moisture and from the growth of fungus and termite attack, unless it is naturally resistant to those causes of deterioration. All joints in woodwork shall be dovetailed or tongued and pinned as far as possible. Metal fittings where used shall be of nonferrous material.

10406.8 Adhesive

Adhesive shall be specially selected to ensure the use of types which are impervious to moisture, resistant to mould growth and not subject to the ravages of insects. Synthetic resin cement only shall be used for joining wood. Casein cement shall not be used.

10407 System Design

10407.1 Complete Systems

The minimum general system design requirements for systems, equipment and facilities to be supplied by the Contractor shall be complete operating systems, including any part, material or process which is essential to this requirement, whether or not specifically called for, detailed or defined and shall be entirely suitable for the purpose intended, of high quality consistent with the specified requirements. Each system shall be designed to perform the required service with the maximum reliability.

10407.2 System Design Drawings

Unless otherwise specified, the Contractor shall supply the following design drawings, as a minimum for each system, for the Engineer's approval:

a) System flow diagrams,

b) Electrical power, control and instrumentation

10407.3 Load Computation

a) Contractor shall prepare and submit a single line diagram indicating the ratings such as capacity, etc. of every equipment and protective, metering or any ancillary devices based on the requirements of his proposed equipment. A detailed load computation shall accompany the diagram complete with brochures for each major item to be used.

b) Engineer's approval is required prior to manufacturing and construction work.

10408 Plant/ Equipment Design

10408.1 General

The design to be used in the construction of Plant shall be as specified in the Drawings and detailed equipment specifications.

The following general specifications shall also be met:

a) Reliability: Equipment shall be designed for continuous operation in the

environment specified above. Equipment outages shall be held to the very minimum.

b) Human Engineering: Designs shall take into account human Engineering considerations.

c) Personnel Safety: Precautions shall be taken in the design of equipment to ensure the safety of personnel. These shall include, as a minimum the requirements of Safety Design specified below.

10408.2 Safety Design

- Personnel Safety

a) Protection for human body shall be taken into consideration when designing, manufacturing and installing any Plant to prevent any accident.

b) Guards shall be provided for moving mechanical parts such as gears, fans or belts to prevent accidental contact by personnel.

c) Sharp projections shall be avoided on cabinets, doors and similar parts.

- Grounding

a) The outside cabinet, rack, equipment chassis, external parts which are accessible without opening interlocked access doors, shall be at ground potential when the equipment is installed and in operating condition.

b) Antenna and transmission line terminals shall be at ground potential for DC and AC power line frequencies but shall permit normal passage of RF frequencies.

10408.3 Maintenance

a) All Plant shall be designed and constructed so that all parts, terminals, and wiring are accessible for circuit checking, adjustment, maintenance, and repair. Parts most likely to fail shall be easily replaced. The necessity for readjustment of the Plant as a result of the replacement of any components shall be minimized.

b) All Plant shall be designed for ease and simplicity of installation, adjustment, operation, maintenance and replacement.

c) All Plant shall employ, to the greatest extent practicable, the use of plug-in modular construction. Plug-in units shall be mechanically secured in place to prevent being dislodged during shock and vibration.

d) Mechanical and electrical interchangeability shall exist between similar assemblies, sub-assemblies, and replaceable parts.

e) The case, units, air filters, motors, etc. which are to be detachable for maintenance, shall be designed for detaching by simple manipulation.

f) Equipment provided in duplicate to function as working and standby units shall be arranged, so far as possible, to allow either unit to be set up and tested independently of the other unit, to ensure that the equipment are in working order.

10408.4 Design/Provision for Testing

a) Test points shall be provided with terminals which are readily accessible for maintenance purposes without opening interlocked doors or covers. Measurements shall be performed as far as possible without affecting equipment operation.

b) Plant shall be provided with integral metering sufficient to enable

performance of all normal operating adjustments without the use of external test equipment. The accuracy and stability of metering facilities shall be adequate for this purpose.

c) Standard tools shall be used to the greatest extent practicable for installation and maintenance. Type and variety of tools required shall be kept to the absolute minimum.

10409 Electrical Design

10409.1 Circuit Design

Circuit designs shall assure conservative operation of electronics parts for long life and minimum maintenance.

10409.2 Electromagnetic Interference (EMI) Control

Plant shall be designed to prevent degradation of its own performance due to undesirable internal coupling, and to prevent radiation of undesirable signals which could degrade the performance of other equipment. Control of such interference shall include but not be limited to the following measures:

a) Proper care in shielding of Plant compartments, cabinets and in the use of RF lines and connectors to ensure that they are RF tight.

b) Operation of Plant in such a manner as to prevent the generation of transients and harmonics of the desired signal.

c) Proper filtering of RF output circuit to suppress harmonics beyond acceptable levels, which are generated as a normal function of equipment operation.

d) Observation of correct grounding practices to prevent undesirable coupling and cross-modulation.

10409.3 Overload Protection

Protective devices shall be provided within the equipment for primary circuits and for protection of the equipment from damage due to overload or excessive heating. Equipment protective fuses shall be readily replaceable and shall be located directly on front panels or behind hinged doors on panels. All parts likely to carry an overload due to malfunction of circuits, poor adjustments, antenna failures, shall be designed to withstand the overload. Where this is impracticable, circuit breakers, relays, fuses or other devices shall be provided. The use of secondary protective devices shall be placed on the ungrounded side of the wiring. Overloads in one phase of multi-phase devices shall operate to remove power to the device from all phases.

10409.4 Wiring and cabling shall be neat and sturdy, in accordance with the following criteria

a) Cables: Insulated wires shall be formed into cables, except where operation of the equipment is adversely affected, or where physically impracticable for example when resulting cables become so large as to interfere with the operation or maintenance of the equipment.

b) Coaxial Cable and Optical Fiber Bends: Coaxial and twin-conductor RF cable bends shall be made high radius of bend as large as practicable. The radius of the bend shall always be greater than 10 times the outer diameter of the RF cable.

c) Solid and Stranded Wire: Stranded wire shall be used for wires and cables which are normally flexed in use and servicing of the equipment, such as cables attached to the movable half of detachable connectors, and hinging cables attached to removable or movable doors, shields, etc. In all other applications, either solid or stranded wire may be used, provided that stranded

wire shall be used where so indicated by good Engineering practice.

d) Wire Identification: All insulated wire used in circuit connections shall be identified by color coding wherever this is necessary for the case of replacement of wires after removal.

e) Wiring Identification for Polarized Parts: Wires connecting to polarized part shall be secured or arranged so that when the part is installed according to the polarity markings it will be obvious technically how to connect the leads for proper polarity.

f) Standard Colour Code: A uniform code of standard colours shall be used in chassis wiring for the purpose of identifying circuits associated with electronic devices.

g) Panel-door Cables: Parts mounted on a hinged door shall be wired to the other parts by means of a single cable. However, if physical separation between wires is essential for electrical reasons, or if the number of wires involved is so great as to make a single cable impracticable, more than one flexible cable may be employed.

h) Connection Methods: Wires shall be secured by soldering, or by the use of solderless terminals, except that this is not mandatory in RF circuits provided the method of connection used insures uniformly secure and low resistance connections. Non soldered wrapped wire connections are not allowed in non-conditional environments.

i) Lugs Connected to Screw Terminals: Where wires are connected to solderless or solder lugs which are clamped under screw terminals so as to be removable by loosening or removing the screws, not more than one wire shall be attached to each lug. Not more than two lugs shall be attached to each screw terminal.

j) Connector Wiring: Not more than one wire shall be connected to each contact of cable connectors.

k) Shielded Wire Termination: Shielded wires and cables shall have the shield braid terminated so that the insulation is not damaged by soldering heat or mechanical pressure. Compression type sheath connector shall not be used for shielded wire termination in circuits operated above 100 MHz.

l) Splices: Wires and cables shall not be spliced, except where the wire or cable is longer than that of normally obtainable single roll, or unless otherwise specified.

10409.5 Circuit Directories

a) Circuit directories shall be provided for each electrical panel or control cabinet. Directories shall be laminated in plastic and mounted in an approved frame inside the door.

10410 Mechanical Design

10410.1 General

- Cooling means shall be employed to maintain the required performance, life and reliability of parts under any probable combination of service conditions specified herein or elsewhere in the Specifications.

- Motors for ventilation and cooling systems shall be of the totally enclosed type and shall be designed for continuous duty. The design and quality of the motors shall be such as to ensure a life expectancy of 50,000 hours of operation. Commutators, or slip-rings, shall not be incorporated in the motors.

- Impellers shall be securely attached to the motor shaft with set screws or an

equivalent means which will readily permit removal of the impeller from the motor shaft. The impeller shall produce the required air flow with minimum noise and vibration. Impellers for unit bearing type motors shall be in accordance with the motor manufacturer's recommendations. Impellers shall be enclosed or guarded to eliminate hazards to personnel.

- Centrifugal type blower units and motors driving propeller fans shall be mounted in an manner which will preclude or minimize transmission of vibration from the rotating equipment to the supporting structure.

- When air filters are required, they shall be mounted in a manner which will permit easy and quick removal and replacement. They shall not require replacement or cleaning more frequently than once in thirty days under normal operating conditions. The filters shall be of the maximum practical size.

- The ventilation design shall be such that the ventilated space is maintained under a positive static pressure higher than the surrounding air pressure.

- With the ventilated equipment operating under normal service conditions, the exhaust air temperature measured at just ahead of point of egress inside the equipment shall not exceed the input air temperature measured outside the equipment just ahead of the point of input by more than 15 degrees celsius.

- Brackets, lugs, flanges, inserts, bolts and other fixing, securing and mounting arrangements shall retain components and parts securely when the equipment is subjected to service conditions.

- Parts made of aluminum, magnesium, plastic, or other soft materials shall be assembled or mounted by the following means:

a) Metallic tapped bushing, nuts or inserts permanently secured to the structure, where frequent disassembly and re-assembly will be required.

b) Through-bolt secured by a locknut: A flat washer shall be used under the head of the bolt.

c) Tapped hole protected against wear by applicable thread insert.

- Brittle castings, or parts made of ceramic or other brittle material, shall not be over-strained by the means used to secure them. Not more than three points of contact shall be used between the brittle part and the mounting surface, unless the mating faces are accurately machined. Mounting washers of suitable plastic, rubber, or soft copper, having slight compressibility, shall be provided to prevent local breakage or cracking of the parts. Lead washers shall not be used.

- Screws or similar devices employed for retaining front panels or removable cover plates shall be preferably of captive types and shall employ knurled heads compatible in appearance with the general hardware. Quarter turn fasteners may be used as panel and cover plate retaining devices only for non-structural applications.

- Bolts, nuts and screws shall conform to the metric thread of ISO (International Organization for Standardization).

- Terminals, such as lugs, and binding posts shall support the wires connected thereto. Terminals shall not turn or loosen when the equipment is subjected to specified service conditions.

- Terminal spacing or barriers shall be employed to prevent corona or breakdown or low leakage resistance under the specified service conditions of high humidity, including condensation, and low barometric pressure.

10410.2 Painting:

a) Painting color and material samples shall be provided when requested by the Engineer.

b) Surfaces of the Plant and materials shall be painted after rust-preventive treatment as required.

c) Moisture and fungus resistant paint treatment shall be provided where required by the conditions or if specified.

10410.3 Identification Marking/Identification

a) All Plant. Equipment, panels, valves, parts and assemblies shall be marked for identification in a permanent and legible manner.

b) All markings shall be in the Spanish language.

c) Identification shall generally be with nameplates which shall be of laminated plastic material of approved size, color, shape and fixing.

d) Scribing and stamping colors shall generally be black, unless otherwise specified.

i) Identification plates shall be securely fastened to each complete equipment, and major component. The characters of Employer's name, item functional description, manufacturer's classification, type number, serial number, year of manufacture and manufacturer's name shall appear on the plate. Other useful information may also be included.

f) Cables: Each cable assembly shall be marked with its designation as it appears on wire-run lists or cable schedules. The marking shall be permanently affixed at each end of the cable. Connectors and check terminals shall be clearly labeled for proper connection of cables and wiring.

g) Parts Reference Designations: Each part having a function in an electric circuit shall be identified by an appropriate reference designation. The reference designation shall be marked on the chassis or other mounting surface in a visible manner. The reference designations shall be the same as those used for identifying parts on all types of data including drawings, diagrams, and spare parts lists prepared for the equipment. Where space is at a premium reference designation need not be marked, provided that equipment handbooks include photographs or other media for circuit identification.

h) Panel Markings: The visible surface on panels, adjacent to panel-doors and connector panels, facilities such as connectors, controls, indicators, jacks, keys, switches and fuse holders shall be marked with a suitable abbreviation, indicating the use or purpose of the part. These markings shall be located so that the operator can readily identify the function of the panel facility. Continuously variable-operating controls shall be provided wherever applicable with markings that permit the operator to set the control easily and correctly to a predetermined point.

i) Adjusting positions shall be marked with reference points or position numbers and markings shall be in sequence as much as possible.: Positions that require special measuring instruments and tools for adjustment and thus cannot be adjusted at a place other than the factory shall be marked with 'Factory Adjustment Only" in red characters.

j) Battery Circuit Marking: Components designed to operate from internal batteries shall be marked in a convenient form for use by operating or maintenance personnel. The markings to be applied shall include the battery type number, battery location and position, polarity, nominal voltage and interconnection between batteries, if two or more are used. The markings shall be applied on or adjacent to the battery compartment or holder, and on

or adjacent to terminals, connectors, contacts, removable leads, etc., that are part of the battery circuit but not of the battery itself. When necessary for clarity a block or pictorial wiring diagram of the battery circuit and batteries shall be provided instead of, or in addition to, the markings. The diagram shall be located on, or as close as practicable to, the battery compartment. When batteries are used in a component, a notice shall be included in a prominent location to indicate that the batteries shall be removed when the component is out of service for an extended period of time.

k) Caution Plate: Each electronic component of the overall equipment having circuits which operate at potentials in excess of 220 volts with respect to ground shall bear sign with a red background and white letters and with the following marking: "Danger High Voltage". When the door handles of cabinets accommodating high voltage circuits are grooved and interlocked, they shall be so indicated by filling the grooves with red paint; non-interlock shall be indicated by filing the grooves with blue paint. Door panels that are interlocked shall be marked by a red arrow and an "S" character at the closed position of the switch.

l) Ampere Rating: The ampere ratings of fuses shall be indicated at mounting positions of fuse holders. A SB symbol shall also be marked if a slow-blow fuse is used.

10411 System Certifications

Certification shall be provided for each item of Plant or System certifying compliance with the requirements of the Contract. At the discretion of the Engineer, these shall be provided either by the Contractor, the manufacturer or an independent testing agency.

SECTION 10500 CONTRACTOR'S FACILITIES

10501 Contractor's Site

The Contractor shall be entirely responsible for the provision, erection, maintenance and removal on completion of the whole of his offices, workshops, stores, services, and for the provision of accommodation, recreation facilities and the like either on or off the Site.

Before any work is carried out on Site the Contractor shall submit to the Engineer for approval, final detailed proposals for setting all offices, stores, workshops, and the like. Upon approval of the same by the Engineer, the Contractor shall prepare the sites and erect the buildings expeditiously. In this respect, the Contractor shall consult with the local labor and health authorities concerning buildings for his employees.

The whole of the Contractor's site facilities and the area provided shall be erected to the approval of the Engineer.

The Contractor shall be responsible for all communications on and off-site. The Employer will bear no responsibility for the Contractor's inability to obtain or delay in obtaining relevant approvals or licenses for the use of radio or any communication equipment.

10502 Area for Contractor's Facilities

The available area for the Contractor's temporary facilities for the Works (which is deemed to be a part of the Site) is indicated on the Drawings. The Contractor shall be allocated a portion of this area and he shall confine all of his activities within the boundary limits of this area.

10503 Temporary Facilities

The Contractor shall provide temporary facilities which include but are not limited to the following:

a) Office building,

b) Storage buildings and warehouses,

c) First aid room and facilities including snake-bite antiserum,

d) Canteen with washing and sanitary facilities,

e) Toilets in the Contractor's facilities area,

f) Mobile toilets sufficient for the number of personnel and labor on site,

g) Temporary jetty, if required, and

h) Concrete mixing plant, if required

The Contractor's office shall include a drawing office, fully equipped with a CAD facility compatible with that of the Engineer and drawing printing/copying facilities.

Staff or labor will not be allowed to live at the Site. Dormitories/bunkhouses for labor or staff will not be allowed on or adjacent to the Site. The Contractor shall make alternative arrangements for this at his own expense.

10504 Maintenance for Contractor's Establishment and Temporary Facilities

10504.1 General

The Contractor shall maintain all temporary facilities in a clean, safe and good sanitary condition. Consequently the Contractor shall be responsible for providing at least the following services:

a) Safety, health and welfare;

b) Rubbish disposal;

c) Rodent, pest and mosquito control;

d) Cleaning;

e) Fire extinguishers, hose-reels and fire protection services; and

f) Sanitary facilities

10504.2 Survey and Measuring Equipment
The Contractor shall keep on the Site, maintain and regularly re-calibrate according to his own schedule or as requested by the Engineer, all necessary laser and other surveying and measuring equipment at his own expense.

10504.3 Water Supply
The Contractor shall not be allowed to use the existing piped water supply for temporary or permanent works.

The Contractor shall make his own arrangements at his own expense for the supply, treatment, storage and distribution of water.

The Contractor shall be allowed to provide his own bored wells if he so requires. These shall be in locations and of types to be approved by the Engineer. Upon completion, these wells shall not be removed or capped but shall be turned over to the Employer in their existing condition.

10504.4 Electric Power Supply
The Contractor shall not be allowed to use the existing electric power supply for temporary or permanent works.

The Contractor shall make his own arrangement and at own expense for the supply and distribution of electric power.

10504.5 Sewage and Waste Disposal
The Contractor shall make his own arrangements for the collection, storage, removal and proper treatment of sewage and wastewater form the site according to national standards.

10504.6 Disposal of Surface Water and Effluents
The Contractor shall keep the Site free from surface water and effluents from whatever sources at all times and shall provide such temporary drains, channels, ditches, soakaways and/or connections to drainage systems as are necessary to keep the project area free of water and to prevent pollution of existing drains, rivers or other water courses.

10504.7 Construction Equipment
The location of the Contractor's equipment storage must be proposed by the Contractor for approval of the Engineer.

Temporary fuel storage for the Contractor's equipment shall be constructed properly with a concrete bund surrounding the facility to secure any leakage of oil from the bund and shall be well ventilated.

Spillage or leakage from the equipment shall be avoided at all times. The Contractor

shall take particular care and maintain the Contractor's equipment, keeping it free from fuel, lubricant or hydraulic leaks.

Any paved area in the CEPA's premises shall be free from leakage of oil from the equipment of the Contractor and his subcontractors.

In the case of contamination of asphalt or bituminous pavements identified as such by the Engineer, the Contractor shall repair it by cutting out the affected areas and reinstating with new material.

10505 Access Roads

Within 28 days after receipt of the Notice to Proceed, the Contractor shall submit detailed proposals for the access road and other temporary roads to the Site for the approval of the Engineer and the Employer.

The existing roads through La Unión City shall not be used for handling construction plant and equipment, construction materials and other goods for the construction work.

Once approved, the construction roads shall be constructed as agreed and no deviation shall be permitted without further approval bythe Engineer and the Employer.

On completion, if instructed by the Engineer, the roads shall be demolished and the ground restored, as far as physically possible, to its original condition.

During the Construction Period, unsurfaced temporary roads shall be maintained in good condition by watering, rolling, grading or similar methods. Surfaces of temporary roads shall be kept free of dust, rubbish and debris and regularly maintained as required.

The Contractor shall propose for approval of the Engineer temporary bridges or crossing points over all creeks and rivers or above ground pipes, cables, or the like. The Contractor shall be responsible for any damage to any railways or above ground pipes at these bridges or crossing points.

The Contractor shall take all necessary steps to prevent any interruption of traffic on roads and bridges and shall, if deemed necessary by the Engineer, provide temporary supports for the same before any excavation or demolition operations are commenced.

Buried or concealed utility facilities shall be protected as they become exposed and shall be supported as necessary.

The Contractor shall ascertain the exact locations and routes of all utility facilities before any excavation or demolition is commenced and he shall be responsible for any subsequent damage and for paying all charges in connection with their repair or reinstatement.

No claim shall be considered on the grounds of lack of knowledge of the Site conditions.

The Contractor shall ensure that the Engineer is informed immediately, if any existing utility facilities are encountered during the Works, of any damage caused thereto, and of necessary diversion or disconnection.

Due care must be taken to protect adjoining buildings from dust, dirt, vibration and damage and the Works are to be executed in such a manner as to minimize inconvenience, disturbance or nuisance to the adjoining occupants.

10506 Temporary Jetty and

Contractor shall make arrangement as necessary to secure such temporary jetty and moorings. The location of the areas proposed by the Contractor shall be subject to the approval of the Engineer. The Contractor will be responsible for the provision

Moorings

maintenance during the duration of the Works and removal on completion of the Works, of all temporary jetties and moorings necessary for the safe transfer of all personnel and safe operation of al floating plant and craft. All such jetties and moorings shall comply with all relevant regulations and by-laws and be subject to the approval of the Engineer.

Complete details, in duplicate of the proposed temporary jetty and moorings shall be submitted to the Engineer for his approval a minimun of twenty eight (28) calendar days prior to the construction of such works.

10507 Damage and Restoration

Damage to existing or newly placed facilities caused by movement of equipment or other operations, whether accidental or due to the Contract requirements, shall be restored at the Contractor's expense and as directed by the Engineer.

The restored conditions shall be equal to or better than the structural qualities or performance capacities of the original works and finishes shall match the appearance as closely as possible of existing adjacent work. Restorations shall be subject to approval by the Engineer.

Work which, in the opinion of the Engineer has not been properly restored shall be removed, replaced completely or re-executed as directed by the Engineer, entirely at the Contractor's expense.

10508 Scaffolding

10508.1 General

Scaffolding shall be provided where construction works are required to be performed at a height of 2 m or more from the ground which could result in a possible fall of workmen.

If it is difficult to provide a scaffold, a protective net shall be stretched and each worker shall be instructed to secure himself with a life-line to protect him against an accidental fall.

Scaffold shall be erected securely and with sufficient care using materials and construction methods best suited to the kind, size, place and working period of each individual work. Adequacy and safety shall be ascertained by structural calculation and subject to the approval by the engineer.

Scaffold materials shall be in good condition and materials which are of an inferior type or suffer from deformation or corrosion will not be permitted

Special attention shall be paid to the safety of scaffold during erection and demolition. The Contractor shall check periodically all scaffolds and keep them in perfect service condition at all times

The Contractor shall determine the maximum loading capacity of the scaffold considering the erection method and materials of the scaffold. The Contractor shall refrain from placing on the scaffold anything, including workmen, the weight of which is greater than the scaffold's loading capacity.

The cost of providing necessary scaffolding shall be included in the pay items of the respective work in BOQ.

10508.2 Tubular Scaffold

All the tubular scaffolds, prefabricated independent scaffolds and binding fixtures shall satisfy the requirements of JIS A 8951 "Tubular Steel Scaffolds" or equivalent.

Sole plates, base plates, base angles and braces shall be used to prevent scaffold from collapse and deformation

Scaffolds shall be rigidly reinforced with transverse braces to withstand lateral forces imposed by wind and earthquakes. Wall ties and braces shall be used to prevent

scaffold from falling down.

When scaffold is erected near overhead electric cables, the Contractor shall shield them with a suitable insulating device or temporarily relocate the cables. The Contractor shall be responsible for all arrangements with responsible third parties for this and the payment of all cost.

10508.3 Wooden Scaffold
Wooden scaffold shall be barked timber free from cracks, worm bores, knots and other imperfections which may weaken its strength.

Binding materials shall be new, and made of annealed steel wires with a diameter of 3.2 mm or more

10508.4 Suspended Scaffold
Safety of suspended scaffold shall be ascertained by structural calculation with applicable safety standard. The hanger members shall have the following safety factors structurally:

Member Name	Safety Factor
Wire rope hanger, steel wire hanger	10
Chain hanger, and hook	5
Steel strap hanger, (steel)	2.5
Lower or upper support (wood)	5

Before commencing the day's work on the suspended scaffold, the scaffold shall be carefully inspected. If any abnormality is detected, it shall be repaired immediately and not used until re-inspected.

10508.5 Movable Scaffold
Stability of scaffold shall be checked regularly during work and its stability shall be tested before use by trial movement.

Safety for scaffold shall be verified by strength calculation with applicable safety standards.

10508.6 Overhanging Scaffold
Safety of workmen and stability of overhanging scaffold shall be ascertained by structural calculation.

10508.7 Ascending Ramp and Staircase
Ascending ramps and staircases shall be constructed rigidly so as to avoid accidents and to suitable gradient, tread and riser.

10508.8 Guard-rail

Secure guard-rails of at least 75 cm height shall be provided in working places higher than 2 m from the ground.

SECTION 10600 CONTRACTOR'S MANAGEMENT OF THE WORKS

10601 Management and Staff

The Contractor shall provide all management and staff necessary for the execution, completion and maintenance of the Works and the remedying of any defects therein, both on Site and at his head office.

The Contractor shall be solely responsible for the adequate supervision throughout the duration of the Works and shall discharge his duties in this respect in a diligent and professional manner.

10602 Control of Quality

The Contractor shall develop and operate a formal Quality Assurance System.

Within 28 days after the Commencement Date, the Contractor shall submit, for approval by the Engineer, a statement describing the organization and resources which he proposes to provide to control the quality of the Works, including the work of subcontractors. The statement must include the number and type of staff responsible for quality control, with details of their qualifications and duties.

10603 Control of Time

10603.1 Basic Program

The Basic Program for the Works together with any agreed modifications thereto will be incorporated in the Contract and shall be referred to as the Contract Program.

10603.2 Working Program

Within the time period prescribed in Conditions of Contract Clause 14.1, the Contractor shall submit his detailed program for the Works (referred to as the "Working Program") to the Engineer for his consent. This Program shall cover all the time required for completion as indicated on the contract Program.

The Working Program shall be same in overall logic and timing as the Contract Program but with more detail.

The Working Program shall incorporate any other programs produced by the Contractor or sub-contractors and form a program hierarchy with clearly defined inter-relationships. The Working Program shall clearly demonstrate the plan for execution of the Works at both summary and detailed level.

The Working Program shall include the following information:

a) Activities for which the Contractor or his sub-contractors/suppliers are responsible, including the preparation of drawings, fabrication of parts, delivery to site, installation, inspection, testing, commissioning, etc.

b) Any other works concurrent with the Contract based on information provided.

c) Matters for which the Employer or the Engineer is responsible to the Contractor, e.g. issue of detailed drawings prepared prior to the Contract, other design information collected during the design prior to the Contract, or approvals.

The Working Program shall be prepared on the latest version of Microsoft Project for the latest version of Windows. It shall be presented as bar charts with links to show essential logic and critical path. The Contractor shall provide a copy of his Working Program on disk to the Engineer.

The Contractor shall forward four (4) licensed copies of all necessary software to the Engineer for the revision of the Working Program.

10604 Progress Control

The Contractor shall constantly monitor progress always using the Working Program as a basis (or the Contract Program prior to or in the absence of the Working Program).

The Contractor shall review the program, to take into account the effect of the latest available information on activities completed and any activities in progress or not yet started.

Progress monitoring and recording shall include the key quantities, on a weekly timescale. Reports on key quantity progress shall be by pro-forma or other suitable format in agreement with the Engineer.

The Contractor shall not modify the Working Program unless specifically instructed to do so by the Engineer according to Conditions of Contract Clause 14.2.

The Engineer shall hold bi-weekly meetings and such regular site meetings as are necessary for proper management and co-ordination of the Works, and the Contractor's official representative shall attend such meetings.

The Contractor shall prepare all necessary reports and data for these meetings in a manner and format to be agreed with the Engineer, covering each of the following items that will be reviewed at these meetings:

a) Progress programmed and progress achieved, with the Contractor giving reasons for any delay and stating action being taken, if necessary.

b) Actual status of labour and construction plant assigned, against the planned requirement, with the Contractor stating action being taken, if necessary.

c) Any difficulties and delays in the execution of the works, with the Contractor stating action being taken, if necessary,

d) Any outstanding information/actions required by the Employer.

e) Any outstanding information/actions required by the Engineer.

f) Any outstanding information/actions required by the Contractor.

The Contractor shall inform subcontractors when their attendance is required.

The Engineer will take and distribute the minutes of these meetings. The discussion on progress at these regular meetings will be at a summary level, with details by exception only. The detailed progress reports comparing the program and trend curves should therefore be submitted to the Engineer, and discussed and a summary report agreed prior to each meeting

The Contractor shall prepare and submit to the Engineer a weekly report in such format as the Engineer may require, covering the following:

a) List of works proposed for the following week

b) Anticipated arrival dates of major Plant or materials

c) Records of Contractor's Equipment and Labour

d) Weather report

The Contractor shall prepare and submit to the Engineer a monthly report in such format as the Engineer may require, covering the following:

a) Actual progress against anticipated (planned) progress

b) Information required by the Contractor

c) Summary of the Contractor's Equipment and Labour

d) Time lost due to any cause

e) Progress photographs

f) Safety report

g) Testing report

On a quarterly basis, the Monthly Report shall include the updated Cash flow schedule.

10605 Control of Security

The Contractor shall be wholly responsible for security on the Site and any other areas being used for the purposes of the Contract.

The Contractor shall be responsible and shall himself control his personnel (including labour), and that of all partners, subcontractors or others associated with the Works to ensure that security is not violated or abused in any way.

The Contractor shall be entirely responsible for the control of visitors to the Site and shall take such precautions as are necessary for their Security and safety as may be agreed with the Engineer and the security section of CEPA.

10606 Control of Safety

Within 28 days after the Commencement Date, the Contractor shall update the safety plan issued at the Bid stage and prepare for approval by the Engineer a working Safety Plan, containing adequate control measures in accordance with the relevant local laws and regulations regarding prevention of accidents, fires and public nuisances upon commencement of the Works, and shall implement the same properly and diligently throughout the execution of the Works.

The Contractor's Safety Plan shall take into account, among other items, demolition; scaffolding; deep excavations; working in water; Contractor's Equipment; hand held power tools; percussion guns; air compressors and hoses; electrical equipment; hazardous materials including asbestos, dust, chemicals and fuels; use of dust masks, ear protectors, safety helmets and safety shoes.

The Contractor shall appoint a full time Safety Manager for the Works, who shall be responsible for implementing the Safety Plan and providing. of necessary seminars to the workers periodically on environmental protection.

The Contractor shall ensure that his staff and workmen are all fully trained in and aware of good and safe working practices.

All temporary and partially completed works shall be protected by way of barriers, lights, notices and the like.

The Contractor shall ensure that all precautions are taken to safeguard the general public and operating staff from any dangers created.

All excavations and the like are to be protected by barriers at all times and floodlighted at night.

Warning and diversion signs concerning road works shall be suitably placed to give motorists ample warning. During the movement of heavy vehicles across roads or onto roads, men, bearing red flags, shall be in attendance to warn other road users and to generally control traffic in a safe manner

The Safety Plan shall also consider work at the Site and include requirements for proper warning and protection, for example of overhead and underground cables, pipes or obstructions, or voids, openings, pits and trenches. The Contractor shall ensure that all appropriate measures are implemented.