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WATER SUPPLIES DEPARTMENT

STANDARD SPECIFICATION M-00-03

GENERAL SPECIFICATION

FOR

SUPPLY OF MECHANICAL PLANT

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CONTENTS

GENERAL SPECIFICATION FOR SUPPLY OF MECHANICAL PLANT

	<u>Page</u>
<u>Part 1 - General</u>	
1.1 Extent of Supply	1
1.2 Inspection, Testing and Reporting	1
<u>Part 2 - General Technical Requirements</u>	
2.1 Plant Design	2
2.2 Materials	3
2.3 Standards and Specification	4
2.4 Climatic Conditions	4
2.5 Qualifying Experience	4
2.6 Fluid Handled	5 - 7
2.7 Nameplates, Rating Plates and Labels	8
2.8 Waterworks Finish	8
2.9 Final Colours for Plant and Equipment	9 - 10
<u>Part 3 - Works Execution</u>	
3.1 Programme of Work	11
3.2 Progress Reports	11
3.3 Works Tests and Inspection	11
3.4 Site Tests and Commissioning	11

CONTENTS

Part 4 - Drawings and Instruction Manuals

4.1	Drawings	12 - 13
4.2	Instruction Manuals	13 - 18

Part 5 - Packing and Shipping

5.1	General	19
5.2	Equipment packing	19
5.3	Components Packing	19
5.4	Packing Containers	20
5.5	Wooden Containers for Packing	20

Part 6 - Recommended Tools and Spare Parts

6.1	Tools and Spare Parts	21
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GENERAL SPECIFICATION FOR SUPPLY OF MECHANICAL PLANT

Part 1 - General

1.1 Extent of Supply

This Specification covers the general design, manufacture, works testing, packing, supply and delivery of mechanical plants for Waterworks applications.

The Contractor shall supply all items necessary for a complete working unit irrespective of whether all required components are separately detailed in the Specification. Incomplete offers normally will not be considered.

Particular attention is drawn to the necessity of equipment offered being suitable for the proposed installation and system as a whole, not as individual units, unless supply in loose items is specified.

An itemised list of recommended maintenance tools and spares, where specified in the Particular Specification, shall be provided.

1.2 Inspection, Testing and Reporting

All plants supplied shall be subject to inspection, examination and test witnessed by an Independent Inspection Body (IIB). The detailed requirements on inspection, testing and reporting are stipulated in Water Supplies Department Standard Specification **EM-00-01**.

Part 2 - General Technical Requirement

2.1 Plant Design

The design and construction of the plant shall be in accordance with modern technique and the best current practices and shall facilitate operations, inspection, cleaning, lubrication and repair to ensure long life and satisfactory operation under all service conditions.

Unless otherwise specified, the plant shall generally be designed for 24 hours per day continuous operation with minimum maintenance and maximum safety at the duties and conditions specified with minimum attendance by the operators.

The plant shall operate smoothly and without undue vibration. All parts shall be designed to withstand the maximum stresses imposed on them under the most onerous operation and severe test conditions.

The limiting sound pressure level of the plant supplied under the Contract shall not exceed 90 dB(A) measured at any point 1 m away from the equipment unless otherwise specified.

Equipment which performs similar functions shall, as far as possible, be of a uniform type and standard manufacture in order to facilitate maintenance and to minimise stocking of spare parts. Corresponding parts shall be interchangeable. The use of components made in small quantities to meet special requirements such as close-tolerance components shall be stated clearly by the manufacturer and one complete set of spares supplied as part of each equipment.

Guards, electrical safety devices, thermal insulation, noise suppression devices, safety colours and the like shall be provided where needed. The requirements in the appropriate International Standards and regulations shall be followed. Protection guards on machinery shall be rigid, securely fixed and made so that they do not have to be removed during normal operation, running maintenance and routine inspection.

Routine maintenance and repair shall, as far as possible, not require the services of highly skilled personnel. Except for consumable items such as gland packing, carbon brushes etc. requiring more frequent replacement, no part subject to wear shall have a life from new to replacement or repair of less than five years of continuous normal operation. Where major dismantling is required to replace a part the life of such parts shall be not less than ten years.

2.2 Materials

Materials incorporated in the equipment shall be new and of first-class quality, free from imperfections and selected for long life and minimum maintenance. The materials shall be of suitable grade and robust construction for the intended purpose. All component parts shall be of corrosion-resisting materials. Materials shall have a high resistance to any change in their properties due to passage of time, exposure to light or any other cause which may have a detrimental effect upon the performance or life of the components.

Where dissimilar materials are in contact or proximity which can be bridged by an electrolyte producing a corrosive condition, the electrochemical potential difference between them shall not exceed 250 millivolts. In addition, where there is slight relative motion of two materials in contact, one or both being metals, suitable precaution shall be taken to prevent seizure by fretting.

Stainless steels which are to be welded shall not be subject to intergranular corrosion.

Suitable inhibitors shall be incorporated in brass and bronze where dezincification or dealuminification may occur.

Cadmium plated parts shall not be exposed to weather and high temperature at 50°C or above. Cadmium plated parts shall not be in contact with potable water.

Chromium should not be electro-plated directly onto ferrous parts.

Glass fibre or plastic components shall be of adequate design taking into account the effects of operating temperature and humidity and it shall be resistant to flame propagation.

The use of organic materials shall be avoided as far as possible but where these have to be used, they shall be treated to make them fire resistant and non-flame propagating.

Asbestos material in any form shall not be used in any part of the plant supplied.

2.3 Standards and Specification

Equipment offered shall comply with the requirements of the Specification, and shall be new, unused and manufactured to the highest commercial standards.

The equipment shall be designed, manufactured and tested in accordance with the latest editions of the relevant International Standards and the standards referred to in the Specification.

Manufacturers offering equipment to other standards shall supply duplicate copies of such standards in English or Chinese (if applicable) and S.I. units together with full details of any deviations from the relevant International Standards indicated.

2.4 Climatic Conditions

All plant and equipment shall be suitable for storage, installation and operation in a tropical climate with a maximum relative humidity of 100% and an average ambient temperature of 35°C over any 24 hour period and a maximum ambient temperature of 40°C for 4 hours.

2.5 Qualifying Experience

Owing to the requirement for extreme reliability, only equipment of proven design and manufacture will be accepted. On request of the Purchaser, the manufacturer shall state his experience in the manufacturing of the equipment and systems and provide a list of installed schemes of similar types and sizes as the manufacturer proposes to offer for this application.

2.6 Fluid Handled

2.6.1 Raw Water

When the plant is specified for Raw Water application, the water to be pumped will be untreated river water relatively free from solid particles. During high flows the water may contain large quantities of silt.

The chemical analysis of samples of the water is shown below:-
(Units in mg/l unless otherwise stated)

pH	5.9 - 8.8
Colour (H.U.)	<5 - 80
Turbidity (F.T.U.)	0.4 - 50
Conductivity ($\mu\text{S}/\text{cm}$ @ 20 °C)	25 - 200
Ammoniacal N	<0.01 - 3.62
Albuminoid N	<0.01 - 0.31
Nitrite N	<0.001 - 0.676
Nitrate N	<0.01 - 3.19
Oxygen Absorbed Value	<0.01 - 1.50
Total Dissolved Solids	15 - 130
Alkalinity (CaCO_3)	2 - 39
Total Hardness (CaCO_3)	4 - 45
Calcium (Ca)	0.4 - 15.2
Magnesium (Mg)	<0.1 - 2.4
Chlorides (Cl)	2 - 50
Sulphates (SO_4)	1 - 20
Ortho - PO_4 (PO_4)	<0.01 - 1.50
Fluorides (F)	<0.01 - 0.35
Iron (Fe)	<0.01 - 1.50
Manganese (Mn)	<0.01 - 2.00
Aluminium (Al)	<0.01 - 0.40
Silica (SiO_2)	0.3 - 18.6
Temperature °C	13.0 - 31.0
Dissolved Oxygen	0.9 - 9.5

The water shows a faint opalescence with a slight yellow/brown deposit.

In general, the raw water is soft and low in mineral content, occasionally with some microscopic organisms such as zooplankton and phytoplankton. The raw water may be chlorinated to a free residual of 1.0 mg/litre.

2.6.2 Treated Water

When the plant is specified for Treated Water application, the water to be pumped will be potable, filtered and chlorinated.

The chemical analysis of samples of the water is shown below:-
(Units in mg/l unless otherwise stated)

pH	6.4 - 9.2
Colour (H.U.)	<5 - 15
Turbidity (F.T.U.)	<0.1 - 2.5
Conductivity ($\mu\text{S}/\text{cm}$ @ 20°C)	33 - 266
Ammoniacal N	<0.01 - 0.05
Albuminoid N	<0.01 - 0.14
Nitrite N	<0.001 - 0.007
Nitrate N	<0.01 - 3.61
Oxygen Absorbed Value	<0.01 - 0.48
Total Dissolved Solids	26 - 160
Residual Chlorine	0.2 - 3.0
Alkalinity (CaCO_3)	4 - 53
Total Hardness (CaCO_3)	5 - 111
Calcium (Ca)	2.6 - 33.2
Magnesium (Mg)	0.2 - 10.2
Chlorides (Cl)	3 - 44
Sulphates (SO_4)	4 - 32
Ortho - PO_4 (PO_4)	<0.01 - 0.16
Fluorides (F)	0.05 - 1.11
Iron (Fe)	<0.01 - 0.10
Manganese (Mn)	<0.01 - 0.06
Aluminium (Al)	<0.01 - 0.19
Silica (SiO_2)	3.0 - 17.9
Temperature °C	13.0 - 31.0

2.6.3 Salt Water

When the plant is specified for Salt Water application, the salt water abstracted may contain high suspended solids and at high bacterial levels. The water is to be chlorinated for inhibiting marine growth in the pipelines. The water is highly corrosive calling for the use of high quality materials in the manufacture of equipment.

The chemical analysis of samples of the water before chlorination is shown below:-

(Units in mg/l unless otherwise stated)

Specific gravity	1.010 - 1.025
pH	7.4 - 8.9
Turbidity (F.T.U.)	0.3 - 20
Ammoniacal N	<0.01 - 1.0
Oxygen Absorbed Value	0.1 - 10
Chlorides (Cl)	6100 - 20900
Temperature °C	16.0 - 31.0

2.7 Nameplates, Rating Plates and Labels

Each item of the plant shall have a label or labels permanently attached in a conspicuous position detailing its design performance, function, system identification and manufacturer's information.

All labels, nameplates, rating plates and notices shall be permanently marked in English. The proposed style, label material, inscription, location and means of fixing shall be submitted to the Purchaser for approval before manufacture.

Where withdrawable or detachable equipment is provided, both the fixed and the moving or detachable portions shall be similarly labelled.

2.8 Waterworks Finish

All equipment supplied is to be given "Waterworks Finish" as per paragraph 2.9 prior to despatch from the manufacturer's works.

All equipment is to be thoroughly fettled and cleaned and one flat priming coat applied to all surfaces. Ungalvanised cast iron and steel parts which are to be painted shall be prepared internally and externally by grit or shot blasting and primed within four hours of blasting.

A second priming coat and an undercoat shall be applied. The second undercoat and top coats of final colour as specified in paragraph 2.9 shall be applied after the completion of works tests. The colour of the undercoats shall be of slightly different shade to adjoining coats.

All prominent fittings i.e. gland drains, plugs, cocks, etc. and small bore pipework are to be constructed in stainless steel.

Workmanship and the general finish of the equipment shall be of first class quality and in accordance with the best code of practice and shall be performed by persons skilled in their respective trades.

2.9 Final Colours for Plant and Equipment

Plant/Equipment to be Painted	Coding Colour	Colour Reference to BS 4800
Treated Water Pumps, Valves, Pipes and Fittings	Light Grey	18B21
Raw Water Pumps, Valves, Pipes and Fittings	Blue	18E51
Salt Water Pumps, Valves, Pipes and Fittings	Green	12D45
Diesel Engines	To match driven equipment	-
Exhaust Manifolds for Diesel Engines	Silver Aluminium	-
Bulk Fuel Oil Tank	Silver Aluminium	-
Fuel: Service Tanks, Pumps, Pipes and Fittings	Middle Brown	06C39
Lubricating Oil: Tanks, Pumps, Pipes and Fittings	Light Brown	08C37
Sump/Drain/Sludge Pumps, Pipes and Fittings	Black	00E53
Air Compressors, Valves, Pipes and Fittings	Blue	18E51
Air Receivers and Fittings	White	00E55
Surge Vessels and Fittings	Silver Aluminium	-
Air Blower and Fans	Light Grey/Silver Aluminium	18B21/-

Heat Exchanger	To match equipment colour	-
Ventilation Ducts and Grilles	To match wall colour	-
Ventilation Ducts for motor	To match motor colour	
Platforms and Ladders	Black	00E53
Handrailings except Stainless Steel and Aluminium Alloy	Blue	18E51
Overhead Cranes	Yellow	08E51
Crane Hook Block	Red	04E53
Mixture of Air/Hydrogen Pipes and Fittings	White with Crimson stripes of 50 mm wide	04D45
Hypochlorite Solution Pipes and Fittings	Violet with black/yellow stripes of 100 mm wide	22C37/10E53

Part 3 - Works Execution

3.1 Programme of Work

Within EIGHT weeks after acceptance of the tender, the Contractor shall submit to the Purchaser for approval a detailed programme showing the times of important activities and milestones, including design, ordering of materials and components, inspection, manufacture, testing and delivery to port for shipment of the various parts of the Works.

3.2 Progress Reports

Within THREE months after acceptance of the tender and at monthly interval thereafter, the Contractor shall submit to the Purchaser with a copy to the IIB a detailed progress report indicating the stages reached in design, ordering of materials, manufacture, inspection and despatch. The report shall be accompanied by bar charts of critical path analysis diagram of an approved form as may be required by the Purchaser.

The report shall be forwarded promptly to the Purchaser so that upon receipt the information will be no more than SEVEN days out of date.

3.3 Works Tests and Inspection

All plants supplied shall be subject to inspection, examination and testing in accordance with the Specification, quoted Water Supplies Department Standard Specifications and the appropriate International Standards. These inspections, examinations and tests shall only be carried out during the course of or/and on completion of manufacture of equipment. A full set of contract document and approved drawings shall be presented to the IIB prior to the inspection.

All tests as detailed in the Specification shall be carried out and witnessed unless otherwise agreed by the Purchaser.

3.4 Site Tests and Commissioning

In addition to the works tests as required by the Specification, all equipment supplied will be tested on site by the Purchaser within EIGHTEEN months after delivery of the plant to Hong Kong. Site testing of overhead cranes and lifting appliances shall be carried out by the Contractor in accordance with Clause 6 of Water Supplies Department Standard Specification **M-03-01**

Part 4 - Drawings and Instruction Manuals

4.1 Drawings

The drawings shall preferably be prepared by the computer using "AutoCAD" software. The format shall conform to the latest version of CAD Standard for Works Projects (CSWP) as posted on the web site of the Environment, Transport and Works Bureau of The Government of The Hong Kong Special Administrative Region "<http://www.etwb.gov.hk/cswp>".

Dimensions of all drawings shall be in S.I. Units. The selection of drawing size shall take account of legibility, the composition and complexity of the design. The final presentation of drawings on paper or equivalent media shall conform to the sheet sizes in BS EN ISO 5457. The preferable drawing sizes are B1, A1, A2, and A3. Sizes smaller than A3 will only be accepted if they are mass manufactured equipment supplied by the equipment manufacturer.

Within ONE month after award of Contract, the Contractor shall submit for approval two (2) copies each of the following drawings and on each drawing so submitted he shall certify that it has been checked for compliance with the Contract requirements.

- (a) General arrangement drawings of the plant and all ancillary equipment to be supplied under the Contract which shall include dimensions, weights and recommended foundation details.
- (b) Sectional drawings of plant items to be supplied under the Contract with parts and materials lists.
- (c) Detailed drawings or modification necessary to enable the design and construction of associated civil works to proceed, i.e. details of ducts, openings, trenches, foundations, foundation bolt holes, foundation bolts, etc.
- (d) Fully dimensioned drawings of each item of plant.
- (e) Diagram of connections for each item of electrical equipment together with a wiring diagram and/or cable schedule showing connections between the various items of equipment. The terminal markings on the diagrams shall correspond to those used on the equipment.

Within THREE weeks from approval of the drawings, the Contractor shall forward two (2) sets of approved drawings to the Purchaser in Hong Kong by air post. One (1) separate complete set of the approved drawings shall be submitted to the IIB on behalf of the Purchaser.

If the approval of any submitted or resubmitted drawings is subject to the incorporation of marked up comments or amendments, the Contractor shall, within THREE weeks, resubmit two (2) sets of the drawings incorporating the specified amendments to the Purchaser in Hong Kong by air post.

Unless specific instructions are given by the Purchaser in writing, no drawings other than the approved drawings shall be used for the manufacture of the equipment.

The Contractor should note that the approval of drawings will not relieve his responsibility for the soundness of design and suitability of materials on supply of equipment in accordance with the Specification for the intended purpose.

On despatch of equipment, the Contractor shall forward one (1) additional set of the approved drawings packed with the equipment.

For Contracts which cover also installation and/or commissioning of the Works, the Contractor shall supply two (2) sets of draft record drawings for approval THREE months prior to the completion of the installation. The drawings shall incorporate all alterations and amendments authorised by the Purchaser throughout the Contract period.

Within THREE weeks from the approval of the record drawings, the Contractor shall supply one (1) further set of the approved drawings as record drawings.

In addition to the drawings in paper form, the Contractor shall supply a CD-R containing "AutoCAD" data files.

4.2 Instruction Manuals

4.2.1 General

The contents of the instruction manuals shall comply with BS 4884 Part II and the presentation of the materials therein shall comply with BS 4884 Part III.

For individual mass manufactured items covered in a supply contract, e.g. sluice valves, reflux valves, motorised butterfly valves, air blowers, air compressors and sump pumps, standard printed manuals from the manufacturer may be acceptable provided that the requirements of this Specification are generally met.

For custom assembled equipment, standard printed manuals shall be supplemented by specially prepared type-written document with technical description, operating and maintenance procedures, and trouble shooting of the system as a whole.

4.2.2 Submission

Within SIX months from order of equipment, or prior to delivery whichever is earlier, the Contractor shall forward by air post two (2) sets of draft manuals to the Purchaser in Hong Kong for approval.

If, in the opinion of the Purchaser, the information supplied is insufficient, the Contractor shall supply further information as required at no additional charge.

A mere collection of manufacturer's descriptive leaflets shall not be acceptable.

Within THREE months from approval of the draft manuals, the Contractor shall supply four (4) new sets of the final manuals incorporating all necessary amendments.

For Contracts which cover also installation and/or commissioning of the Works, the Contractor shall supply two (2) additional sets of approved draft manuals within two (2) weeks from the approval of the draft manuals and four (4) sets of final manuals incorporating all necessary amendments shall be submitted within three (3) months.

In addition to the manuals in paper form, the Contractor shall also supply a CD-R containing electronic version of the final manual, including the drawings, in Adobe Acrobat format.

4.2.3 Presentation

Manuals shall be produced from A4 size papers, paginated and bound in heavy duty binders with hard covers and spines. The size of binders shall not exceed 320 x 240 x 90 mm (1 x w x d). Where ring binders are to be used, fixing clips shall be provided to fasten the sheets in position.

The project title, order reference and scope of supply shall be shown on the front cover and the spine of the manual with printed letters or in the form of a printed slip enclosed in a plastic envelope.

Where more than one volume is provided, these shall be clearly identified. Each volume shall be contained in a separate binder. The contents in a binder shall not exceed 60 mm in thickness.

A Contents/Index Section listing all sections and sub-sections of all volumes of the instruction manuals shall be provided. Each group of drawings shall be provided with a schedule giving drawings numbers used by both the manufacturer and the Contractor, date of issue, amendment number, and drawings description that would identify clearly the equipment and purpose of the drawing.

Each major topic, equipment or standard manual from manufacturers shall be in a section separated by tabbed, numbered or lettered dividers in the corresponding sequence being mentioned in the Contents/Index Section. Each set of printed catalogues or manufacturer's manuals shall be in a separate subsection.

For Contracts involving more than one location, separate instruction

manuals shall be provided for the plant of each location. If a common equipment forms part of the supply for Contracts covering more than one location, the instruction manuals of the common equipment shall be bound in each separate volume. Whereas identical equipment ordered under bulk supply contract, same volume may be used for all locations.

The provision of copies from stencil duplicators or wet type duplicating machines and photostat or Xerox copies of photographs shall not be acceptable.

Drawings prints larger than A3 size shall be neatly folded and placed in robust transparent plastic bags for binding into the manuals.

4.2.4 Contents

The contents of the instruction manuals shall include the following information :-

(1) General Information

A front over sheet showing the title of the Contract, order reference number and location of plant shall be provided. The scope of the Contract and the application of the equipment shall be briefly described.

(2) Health and Safety Information

The health and safety information including precautionary measures in relation to the installation, testing, commissioning, operations and maintenance of the plant supplied under the Contract shall be included.

(3) Operating Information

Description of the plant in general together with the principle of operations, performance, capacity and quantity of equipment supplied under the Contract shall be given. Reference to the design operating conditions and requirements for the safe use of the equipment shall be included.

A list of any by-products formed and the potential hazards during operation of the plant shall be described. A drawing/diagram showing all switches, adjustable controls, gauges, indications and alarms required for operating of the equipment shall be provided for use by operations and maintenance personnel.

Lists of any safety precautions, requirements on the setting and adjustment of interrelated equipment for start-up and shut-down shall be included. In additions, a step by step procedure for start-up and

shut-down of the equipment for all modes of operations shall be provided.

(4) Monitoring Information

A schedule showing the important parameters to be logged for monitoring of plant operations/performance shall be given. A sample log sheet with the parameters on a recommended recording time interval shall be provided.

Schedules of corrective measures stipulating the adjustments required for correcting the equipment performance deviation from pre-set values should be provided. Information including the adjustable ranges, the recommended values, special tools and relevant instructions shall be given.

(5) Trouble-Shooting Information

A list of all alarms and their corresponding implications including their causes and rectification shall be provided. In providing the rectification instructions, a trouble-shooting chart detailing the fault diagnosis and step by step procedures for correction of faults should be made. Exploded view sketches showing the location of faulty items and repair should also be included.

(6) Technical Information

A collection of the equipment data sheet shall be made such that the search of information during inspection and maintenance can be carried out systematically and efficiently. The equipment data can be obtained from the approved schedule of technical particulars for supply contracts. If amendment of the equipment operating characteristics is made during the contract period, the equipment data sheet should be duly updated to reflect the information of the plant furnished under the Contract.

All operating characteristic tables or curves of the equipment supplied under the Contract shall be provided.

(7) Handling, Installations, Storage and Transit Information

A list of required conditions, precautions and protective measures against deterioration and damage of the plant during transit and storage shall be mentioned. Clear instructions on unpacking of the equipment and the removal and safe disposal of protective and preservative packaging shall be stated.

With regard to the installation of equipment, instructions on proper handling of the equipment, drawings of lifting points and list of any special tools and treatments required for setting the equipment in

position shall be stated. A step by step procedure for proper installation of the equipment incorporating the acceptance criteria shall be supplied.

A list of any short-term and long-term storage requirements and method before and after the use of the equipment shall be provided. To facilitate routine maintenance and overhaul of the equipment, in addition to the storage requirement, a step by step procedure supplemented with exploded view diagrams for proper dismantling of the equipment and list of any special tools and required treatments shall be included.

(8) Commissioning, Inspection and Calibration Information

A schedule of settings including the corresponding recommended values for controlling instruments shall be provided. If special tools and treatments are required for the initial start-up of the equipment, they shall be covered in this section. In addition to the start-up requirement, details shall also be given for tuning the furnished plant to achieve its optimal performance. All the methods used and special tools required in monitoring the performance shall be mentioned.

Any calibration curve used during site testing of the equipment shall be included in this section. A collection of the works test reports and certificates shall also be included.

(9) Maintenance Information

A schedule of recommended lubricants and frequency of application/changing, and a drawing showing all lubrication points shall be provided.

To facilitate scheduling of maintenance requirements, information shall be in the form of a preventive maintenance chart detailing all routine and major overhaul operations to be carried out with associated operational periods or running hours. Exploded view sketches shall be used to explain the dismantling procedures for component replacement and overhaul.

(10) Spare Part Information

A comprehensive spare parts and special tools list including cross-reference information with the equipment and components drawings shall be provided. The list shall be furnished with the names of the spare parts, brief descriptions, part numbers and the corresponding stock level for maintaining the plant for one year operation.

If the Contract is for the supply of equipment under different manufacturers, manufacturers' information including names, fax

numbers, contact persons, etc shall be included in order to avoid undue delay for ordering of spares.

(11) Other Information

A collection of print of each of the approved record drawings and a comprehensive plant equipment register detailing the individual equipment by giving its equipment number/tag number, description, capacity, operating range, setting, power requirement, serial number, etc shall be provided.

Part 5 -Packing and Shipping

5.1 General

All materials supplied shall be adequately protected and packed so as to arrive at site intact and undamaged. The method of protection and packing must be suitable for withstanding any adverse climatic conditions which may be experienced in transit or at site. The packing shall also be suitable for withstanding rough handling and long period of storage out of doors in tropical climate unless otherwise approved.

All packing cases and other materials necessary for the safe package, conveyance and delivery to the site shall be included in the tender price.

Each package or case shall be clearly marked so that it can be identified with the relevant advice note. It shall contain or has securely attached thereon, a water-proof packing list such that each item contained can be identified by number or other marking. A copy of each packing list shall be sent by air post to the Purchaser.

5.2 Equipment Packing

The equipment shall be packed such that each package or case shall contain materials for one location only.

Equipment liable to be damaged during delivery or storage, such as instruments and relays shall be separately packed and individually enclosed in sealed polythene covers.

Major electrical equipment such as pump motors and control panels shall be packed in wooden containers regardless of whether these are shipped in freight metal containers.

5.3 Components Packing

Bearings and parts susceptible to damage by vibration shall be fitted with transit guard or clamps such that during temporary storage of up to six months, attendance to the equipment e.g. manual rotation by hand to avoid bearing brinnelling need not be more frequent than three-month intervals.

Parts with grease/oil lubrication elements shall be charged with the correct type and quantity of lubricant for normal operations prior to shipment unless recommended otherwise by the manufacturer. If the manufacturer recommends an alternative method of lubrication for shipment and storage, its details shall be supplied.

5.4 Packing Containers

Packing cases and other materials necessary for the safe package, conveyance and delivery to the site shall be deemed to have been included in the tender price.

Each package or case shall be clearly marked for identification against the relevant advice note. A waterproof packing list containing such details as the package number, identification marks and the weight shall either be enclosed in each package or be attached thereon. A duplicate copy of the packing list shall be despatched to reach the Purchaser prior to arrival of the equipment.

5.5 Wooden Containers for Packing

Wooden containers shall comply with BS 1133 Section 8. The following additional requirements shall be applicable for cases or containers exceeding 250 kg in weight or 2 m³ in volume:

- (a) Crush battens shall be used to prevent side crushing and to render additional support to the lid. One crush batten shall be used at each part likely to be handled by lifting-grabs.
- (b) Headers shall be used to distribute the load.
- (c) Corner posts be used in jointing sheathing elements.
- (d) Moisture content of timber used shall not cause moisture condensation when transported in freight containers and shall not exceed 20% in any event.
- (e) Skid or-sill type base shall be provided.
- (f) Bottom sheathing shall be run in the shorter direction.
- (g) Blocking method shall be used to prevent movement of load during mechanical and manual handling.
- (h) Sharp projections shall be padded with cellulose or equivalent wadding fixed in position with adhesive tape.

Part 6 - Recommended Tools and Spare Parts

6.1 Tools and Spare Parts

The Contractor shall provide a list of recommended tools and spare parts as required in Schedule of Prices and Particulars.

The Purchaser may order all, or any of the recommended spare parts and tools at his discretion.

Any parts ordered must be strictly interchangeable and suitable for use in place of the corresponding parts supplied with the Contract. They shall comply with the Specification and must be suitably packed, marked and numbered for identification, and prepared for storage by greasing, painting or packing to prevent deterioration

- End of Specification -