

1 GENERAL SPECIFICATION

1.1 Introduction

1.1.1 Before submitting his tender, the tenderer shall go through the following documents in detail:-

- (1) The General Conditions of Contract for Minor Works;
- (2) The General Specification (this part of the tender documents);
- (3) The Particular Specification; and
- (4) The Tender Drawings.

1.1.2 In the event of conflict between any of the requirements of the above, the order of preference shall be decided by the Engineer.

1.1.3 The tender shall comply fully with the requirements stated in the tender documents. In addition, the tenderer shall furnish all information, drawings, and details as required in the various parts of the tender documents during the submission of his tender. Tenders without the information required shall not be considered.

1.1.4 The tender shall cover all items as specified in the Scope of Works. Tenders providing only part of the Works shall not be considered.

1.2 Climatic Conditions

1.2.1 All equipment and materials provided shall be suitable for continuous/ intermittent operation under the following conditions:-

	<u>Outdoor</u>	<u>Indoor</u>
Ambient Temperature	40°C Max. 0°C Min.	40°C Max. 0°C Min.
Relative Humidity	100% Max.	100% Max.
Wind Speed : Sustained Gust	140 km/hr 222 km/hr	- -
Average Rainfall	100 mm/hr 2,225 mm annually	- -
Atmosphere	coastal type	dusty

1.3 Site Storage

1.3.1 The Contractor shall note that there shall be no storage area available on Site. He shall therefore arrange his work including material delivery to cope with his programme and the civil works programme. He shall also make his own arrangement for temporary storage and safe custody of materials and tools on Site.

1.4 Utilities

1.4.1 The Contractor shall be responsible for the arrangement of electricity, water supply and other utility services as deemed necessary on Site for the execution of the Works and shall be responsible for the settlement of all such costs incurred.

1.5 Supports and Fixings

1.5.1 Unless otherwise stated, the Contractor shall be responsible for supplying all foundation bolts, shims, clips, fixing channels, cable trays/cleats, conduits etc., required for the satisfactory installation of the Works. Their cost shall be included in the prices against items in the Schedules of Quantities. No bolts are to be shot into the building structure without the prior approval of the Engineer.

1.6 Accommodation for Workmen

1.6.1 Workmen are not permitted to dwell on Site.

1.7 Standards and Statutory Regulations

1.7.1 Where reference is made in the Specification to a British Standard (abbreviated to "BS") it shall be a standard issued by the British Standards Institution and shall be the latest revision of that standard at the time of submission of tender.

1.7.2 Where no standard is stated in the tender or agreed in the Contract, all details, materials, equipment and workmanship shall be in accordance with the relevant British Standards or other acceptable national or international standards.

1.7.3 Where standards other than British Standards are proposed by the tenderer/Contractor, the acceptance will be subject to such standards being equal or superior to the relevant British Standards. The tenderer/Contractor shall be required to submit copies of all alternative standards with a list comparing, item by item, the discrepancies between the quoted British Standards and the proposed alternative standards. In the event that the proposed standards are not written in English, the tenderer/Contractor shall

also submit their English translation prepared by an authority acceptable to the Engineer.

1.7.4 All mechanical and electrical works shall comply with the technical details stated in the Particular Specification.

1.7.5 Standards for electrical installations shall be in compliance with:-

(a) The Electricity (Wiring) Regulations issued by the Hong Kong Government;

(b) Code of Practice for the Electricity (Wiring) Regulations issued by the Electrical and Mechanical Services Department;

(c) "Regulations for Electrical Installations" issued by the Institution of Electrical Engineers (I.E.E. Wiring Regulations, the latest Edition);

(d) General Specification for Electrical Installation in Government Buildings - B.S.B., E.M.S.D. the latest Edition (the General Electrical Specification);

(e) Local electricity supply company's requirements;

1.7.6 All Site work to be carried out shall comply with: -

(a) The Construction Site (Safety) Regulations enforced by the Labour Department, and

(b) The Noise Control Ordinance enforced by the Environmental Protection Department.

1.7.7 The Works shall comply with Statutory Ordinances, Regulations or Orders having the force of Law in Hong Kong.

1.7.8 In the event of conflict between any of the technical requirements of the above, the order of preference shall be decided by the Engineer.

1.8 Drawings and Information to be Provided

1.8.1 The tenderer/Contractor shall provide the following information during tendering and at various stages of the tender/Contract. All

information given shall be in English. For the case where the information is not given in English, the tenderer/Contractor shall arrange for the English translation prepared by an authority acceptable to the Engineer and the tenderer/Contractor shall be responsible for the costs of translation. The tenderer/Contractor shall not use confidentiality or proprietary information as a reason for withholding the supply of relevant documentation required by the Engineer or his representative. Any charges for such material required shall be included in the tender/Contract.

1.8.2 By the Tenderer together with his Tender

- (a) Preliminary arrangement drawings in plan and sectional elevation of the equipment to be supplied, in duplicate;
- (b) Outline and sectional drawings as necessary to indicate the leading features and dimensions of the main items of equipment, in duplicate;
- (c) Detailed specification of various items of equipment and materials in duplicate, including copies of manufacturers' descriptive literature;
- (d) The completed Schedule of Particulars, the Schedule of Quantities and the Price Summary. Detailed breakdown prices shall be provided and a single lump sum shall not be accepted;
- (e) Where appropriate, equipment performance data in duplicate;
- (f) The net weight and overall dimensions of each major item of equipment;
- (g) The heaviest lift and hook headroom required for erection and for normal maintenance;
- (h) The minimum door opening required for installation of the equipment;
- (i) Design calculations, performance data, performance curves, etc., as specified in the Particular Specification;
- (j) Product catalogues and associated technical literature.

1.8.3 By the Contractor After the Award of Contract

- (1) Unless otherwise stated in the Particular Specification, the Contractor shall, within 3 weeks from the date of the tender acceptance letter, submit in quadruplicate the following documents and drawings to the Engineer for approval:-
 - (a) Organization chart showing the names and ranks of the staff to be engaged in the project. The organization chart shall also show the telephone numbers or pager numbers, etc of the staff to enable the Engineer or his representative to have efficient contact with any member of staff as mentioned in the organization chart during any stage of the project.
 - (b) Detailed drawings of the general arrangement, builder's work requirements of the equipment showing the forces to be transmitted to the civil structure, all apertures, holes, trenches, ducts considered necessary by the Contractor for the completion of the Works;
 - (c) Equipment details giving equipment loadings, dimensions, fixing methods, cable access requirements, schematic and wiring diagrams and cable schedules with estimated route lengths and cable sizes;
 - (d) Equipment drawings with sectional details of all items of equipment, and
 - (e) Additional drawings of particular items, if required by the Engineer.
 - (f) Sample board containing samples of all compact-sized materials and accessories to be used on the work. Written acceptance of all samples shall be obtained from the Engineer or his representative before commencement of any installation work for which these materials are required. A label in English bearing the name of the Contractor, the title of the Contract, the name of the manufacturer and the specific service for which the material or accessory is to be used, is to be attached adjacent to each item. The sample board shall be displayed in the Site Office during the entire Contract period. Additionally, the Contractor shall supply sufficient samples of materials as are required in this Specification for testing purposes. This, where required and stated, shall mean testing to destruction.
- (2) The Contractor may apply to the Engineer for additional copies of any tender Drawings which the Contractor considers useful in the manufacture of the equipment, provided that the Engineer is satisfied

that the request is reasonable. Two copies of the Drawings will be provided without charge. Additional copies if required may be obtained at cost. The Contractor shall treat the copies of Drawings as confidential and shall not use them other than for the purpose for which they are provided.

- (3) The manufacture of equipment shall not commence until the approval of all relevant drawings, parts lists and materials have been obtained in writing. All costs resulting from failure to comply with this requirement shall be borne by the Contractor.
- (4) Original (and in quadruplicate) official type test certificates for major components and all plant equipment shall be submitted to the Engineer at least 4 weeks before the components/equipment depart from the manufacturer's factory and prior to shipment.
- (5) The Contractor shall, before starting work on his drawings for approval, ascertain from the Engineer whether any modifications on the tender drawings have been made since the date of the tender.
- (6) If the drawings are not approved, one set will be returned to the Contractor marked to indicate the alterations required. Upon approval, one copy will be marked "Approved" and returned to the Contractor. Approval of the Contractor's drawings given by the Engineer shall not absolve the Contractor from his contractual responsibility to fulfil the requirements of the Contract.
- (7) Within 2 weeks after approval of the drawings, a further four sets shall be provided for the use of the Engineer.
- (8) All drawings shall be specific to the Works and shall be titled in the bottom right hand corner with the Contract title and Contract number..

1.8.4 By the Contractor Prior to the Completion of Works

- (1) At least two months before the commissioning of the installation, the Contractor shall submit two copies of draft "Operation and Maintenance" Instruction Manual to the Engineer for approval.
- (2) After the draft Instruction Manual is approved, the Contractor shall supply five copies of the approved version of the manual which shall be properly bound in book form with hard and durable covers and properly indexed to facilitate easy reference. The manual shall include the followings:-

- (a) General arrangement drawings of equipment including complete wiring, cabling and control diagrams;
- (b) Drawings showing the internal construction of major items, with part lists and reference numbers for spares identification and ordering purposes;
- (c) Detailed specification and operating instructions for each item of equipment, including drawings indicating the positions of all the greasing and oiling points;
- (d) A list of recommended lubricants and other consumable materials, if any;
- (e) A list giving the names and addresses of manufacturers and their local agents for each item of equipment;
- (f) A preventive maintenance programme and procedures for all individual items of equipment;
- (g) Procedures to facilitate diagnosis of faults and emergency breakdown;
- (h) The Contractor shall furnish one permanent, reproducible transparency and three prints of each drawing of the Works complete with parts list and materials list approved during the course of the Contract.
- (i) The Contractor shall softcopy of as-fitted drawings in both Acrobat and AutoCAD format.

1.8.5 Importance of Information Submission as regards to Completion of Works

- (a) The Contractor shall note particularly that the Works shall not be considered "completed" unless and until the information specified in sub-paragraphs 1.8.2, 1.8.3, 1.8.4 has been received and accepted by the Engineer and the Contractor shall also be fully responsible for any possible consequence which may arise from his late submission of the said technical information.

1.9 Training Programme on the Operation and Maintenance of Equipment for Local Staff

- 1.9.1 Unless otherwise stated in the Particular Specification, the Contractor shall arrange a training programme for the local operational staff of various grades to familiarize themselves with the detailed operation and maintenance procedure of the equipment. The Contractor shall prepare and submit the training programme for approval 2 months after the acceptance of tender. The training programme shall be comprehensive and of sufficient details to enable the operational and maintenance staff to handle confidently, safely, and efficiently the operation and maintenance of the complete installation.

1.10 Contractor's Programme of Work

- 1.10.1 The Contractor shall, within 7 days after the acceptance of the tender, submit a provisional programme of his work to the Engineer for approval.
- 1.10.2 The date of manufacture of each and every items of equipment, shipping, delivery to Site, installation, testing and commissioning of the completed assembly shall be clearly shown on the programme in bar chart form.
- 1.10.3 Once the programme has been approved by the Engineer the Contractor shall not deviate from the programme without approval from the Engineer.

1.11 Work Progress Reports and Meetings

- 1.11.1 From time to time the Engineer may call project progress meetings in his office or at Site, as he deems necessary for the control of the Contract. Normally these meetings will be held at intervals of one month. The Contractor shall arrange his approved Site representative or other responsible person to attend such meetings.

1.12 Delivery of Equipment and Materials

- 1.12.1 No constructional plant, equipment or materials shall be delivered to Site until approval in writing has been obtained from the Engineer.
- 1.12.2 The Contractor shall be responsible for reception on Site of all constructional plant, equipment and materials delivered for the purpose of the execution of the Contract, its transfer to the proper storage space, its safety and its transfer to the place of installation at the appropriate time.

1.13 General Requirements, Workmanship and Design of Equipment

- 1.13.1 All equipment and materials shall be brand new, of sound workmanship and robust field-proven design, and as far as practicable from standard production.
- 1.13.2 The general mechanical and electrical design of the equipment and particularly that of the bearings, contacts, and other wearing parts shall be governed by the need for long periods of service without frequent maintenance and attention being necessary. For the purpose of this Clause, "long periods" shall mean a period of not less than 3 years.
- 1.13.3 Unless otherwise specified, all items shall be designed for at least 15 years' operating life and shall be suitable for 24 hours per day continuous service with capability to be operated intermittently at the specified duties under the prevailing atmospheric and operational conditions on the Site.
- 1.13.4 The design shall also include all considerations such as safety requirements, minimum maintenance commitment, ease of operation and maintenance access etc. in order to obtain an overall efficient installation.
- 1.13.5 All components shall be manufactured to a strict system of limits and complete interchangeability of similar parts is required.
- 1.13.6 All items for which spare parts may be required shall have attached to them untarnishable metal plates clearly showing the manufacturer's name, serial numbers and basic information as to rating, etc., in sufficient details to allow the unit or assembly to be identified in correspondence when spare parts are to be ordered.
- 1.13.7 All parts subject to wear shall be readily accessible.
- 1.13.8 Adequate and, as far as practicable, automatic means of lubrication shall be provided for all moving parts.
- 1.13.9 The positions of all greasing and oiling points shall be arranged so that they are readily accessible for routine servicing. Where necessary suitable extension pipes shall be fitted.
- 1.13.10 Lubrication grease points shall comply with **BS 1486-1:1959** Lubricating nipples. Lubricating nipples and adaptors for use on machinery and vehicles except where the lubrication required is of a special nature. In such event they shall be fitted with metal labels in both English and Chinese to indicate the special lubricant required.

- 1.13.11 Where continual grease or oil feeding is required, the capacity of the reservoir shall be sufficient for not less than seven days' continuous service. Indications of the reservoir content in the form of gauges, meters or visual alarms shall be provided.
- 1.13.12 All pipes and shafting shall be checked for alignment and mating of flanges or connections before being secured.
- 1.13.13 If during the Guarantee Period any moving parts show in the opinion of the Engineer signs of undue wear or unsuitability for the purpose for which they are installed then they shall be replaced free of charge notwithstanding that they may otherwise be working in a satisfactory manner.

1.14 General Requirements on Electrical Works

- 1.14.1 All metal works associated with the electrical installation shall be bonded together and shall be solidly and effectively earthed.
- 1.14.2 The available electricity supply is 380/220 volts, three phase 50 Hz. In view of the supply voltage in some old installations is still at 346/200 volts, the equipment offered shall also be capable of operating at both 380/220 and 346/200 volts.
- 1.14.3 In accordance with the Electricity Ordinance, the Contractor shall employ a Registered Electrical Contractor/Worker to carry out all electrical installations within the scope of this Contract. After the electrical installation of the Contract is completed, it shall be inspected, tested and certified by a Registered Electrical Worker to confirm that the requirements of the Wiring Regulations have been met. The Registered Electrical Worker and Contractor shall sign the Work Completion Certificate for their individual electrical installation and submit it to the Engineer before the electrical installation is energised.
- 1.14.4 Adequate sized multi-core PVC SWA PVC cables shall be supplied and installed in outdoor underground G.I. pipes and PVC cables of adequate size shall be used indoor and shall be run in concealed conduits.
- 1.14.5 Junction boxes shall be supplied and installed for connecting outdoor armoured cables with indoor PVC cables. Cable entries into a building shall be resealed by approved means to prevent the ingress of moisture and vermin. Armoured cables shall be terminated in a gland fitted with an armoured clamp. A watertight seal shall be made between the

gland and the inner PVC cable sheath. A PVC shroud shall be fitted to cover the body of the gland and the armoured wires.

- 1.14.6 Motors shall comply with British Standards **BS 4999-0:1987** General requirements for rotating electrical machines. General introduction and information on other Parts and shall be of such size and type to adequately drive the equipment under all normal conditions of service without overloading. Insulation shall be of minimum Class F for tropicalised conditions.
- 1.14.7 Each starter for the motor shall comply with **BS EN 60470:2001, IEC 60470:2000** High-voltage alternating current contactors and contactor-based motor starters **BS EN 60947-4-1:2001** Specification for low-voltage switchgear and controlgear. Contactors and motor-starters. Electromechanical contactors and motor-starters and shall be provided with an adjustable motor overload protection device and undervoltage release suitable for the motor load and having manual resetting facilities. Direct-on-line starters shall be used for motors smaller than 3.8kW and for motors over 3.8kW, star-delta starters shall be used instead.
- 1.14.8 All secondary wiring shall be complete with numbered ferrules for identification which shall be carried out in a neat and systematic manner and finished at a terminal board at the junction of small wiring and the incoming cables.

1.15 Surface Preparation

- 1.15.1 All steel works shall be protected against corrosion. The protective treatment shall accord with the recommendation of **BS 5493:1977** Code of practice for protective costing of iron and steel structures against corrosion unless otherwise specified.
- 1.15.2 All steel surfaces shall be thoroughly cleaned of all dust, oil, grease, scale, rust or other contaminants.
 - (a) Degreasing
 - (1) Grease and dirt should be removed by emulsion cleaners followed by thorough rinsing with water, or by steam-cleaning or by controlled high pressure water jets, wherever practicable.
 - (2) Where it is necessary to use organic solvents to remove oil or grease, the Contractor must make sure that the solvent

is compatible with the type of paint to be used after degreasing. The recommendations from the paint manufacturer shall be followed in choosing the correct type of cleaner/solvent.

(b) Removal of Scale and Rust

- (1) Unless specially specified in the Drawings / Particular Specification, rust and mill-scale must be removed before painting by manual cleaning.
- (2) Manual cleaning shall be carried out by a power tool with rotary wire brush and then followed by vacuum cleaning to remove all loosened material.
- (3) Excess burnishing of the metal through prolonged application of rotary wire brushes shall be avoided. Visible peaks and ridges produced by the use of mechanical cleaning tool shall be removed.
- (4) If blast cleaning is required, it shall be carried out in accordance with **BS 5493:1977** Code of practice for protective coating of iron and steel structures against corrosion. The quality of blast-cleaning shall be to second quality as given in **BS 7079-0:1990** Preparation of steel substrates before application of paints and related products. Introduction. unless otherwise specified. The Contractor should select the most appropriate method of blast-cleaning according to the shape and size of the steel work and the type of surface deposit to be removed.
- (5) The maximum grade of metallic abrasive permitted shall be as specified in **BS7079-0:1990** Preparation of steel substrates before application of paints and related products. Introduction. The abrasive used for blasting shall be free from harmful contamination and any recovered material shall be filtered and cleaned before reuse.
- (6) The blast-cleaned surface shall have a small profile size. Blast-cleaned surfaces shall be dusted by brush or vacuum and shall not be touched by hand or other contaminated materials.

1.16 Coating System

- 1.16.1 All steel surfaces supplied under this Contract shall be coated with 2 layers of Rust Oleum #769 Damp-Proof Red Primer, or equivalent, and then with a finish layer of Industrial Enamel paint of approved colour.
- 1.16.2 For high temperature application up to 400°C, the material surface shall be applied with 2 layers of Rust Oleum #4268 rust inhibitive heat-resistant red primer, or equivalent, and then a finish layer of Rust Oleum #4200 system, or equivalent, heat-resistant finish of approved colour. For application higher than 400°C, the types of paint used shall be submitted for approval before use.
- 1.16.3 Methods of Application

(a) Priming

The application of primer to prepared steel surfaces shall be by hand brushing. Painting should only be carried out on dry surfaces when the relative humidity is less than 80% with an ambient temperature above 5°C and material surface temperature at least 3°C above dew point, or in accordance with paint manufacturer's recommendation. Each layer shall be applied within 4 hours after the previous layer is completely dry.

(b) Finishing

The finishing coat shall be applied by spraying or other approved method. It shall be carried out in a dry, draught-free atmosphere to avoid the work becoming spoiled by condensed moisture, dust etc. The finish shall be reasonably smooth.

1.17 Spares and Packing

- 1.17.1 Spares shall be readily interchangeable with the parts they replace, and shall comply with the Specification.
- 1.17.2 Spares shall be packed and protected for storage to **BS 1133: Sections 1 to 3:1989** Packaging code. Introduction to packaging **BS 1133-4:1991** Packaging code. Mechanical aids in package handling **BS 1133-5:1985** Packaging code. Protection against spoilage of packages and their contents by micro-organisms, insects, mites and rodents **BS 1133-6.1:1991** Packaging code. Protection of metal surfaces against corrosion during transport and storage. Cleaning and drying of metal surfaces **BS 1133-6.2:1991** Packaging code. Protection of metal surfaces against corrosion during transport and storage. Temporary protectives and their application **BS 1133-8:1991** Packaging code.

Wooden boxes, cases and crates **BS 1133-19:1986** Packaging code. Use of desiccants in packaging. Electrical equipment shall be sealed in polythene or similar bags with a liberal supply of desiccant. Other items shall be protected so as to avoid corrosion for a minimum of twenty-four months after delivery. Each package shall have attached to it an untarnishable metal plate giving information for identification. This shall include the maker's name and reference descriptions which must correspond fully to those given in the relevant drawings and parts book. Each spare part shall be permanently marked with its part number.

1.17.3 The packages of spares shall be delivered by the Contractor into consignments of reasonable size and then packed in secure cases each of which shall contain a content list.

1.17.4 Where electrical items are involved, the cases shall be of tongue-and-groove boarding, or of durable plastic containers. Each case shall be durably marked with the contract number and site address, and shall be sent to Site or to a Government store after detailed instructions for despatch have been received from the Engineer.

1.18 Delivery of Spares

Spares delivered to Site or other location as instructed by the Engineer shall be received by the Engineer or Engineer's Representative. They shall not be delivered until instructions for their reception have been obtained from the Engineer.

1.19 Protection of Equipment

1.19.1 All equipment shall be carefully packed for transport in such a manner that it is protected against all climatic conditions.

1.19.2 Special precaution shall be taken to protect all journals where they rest on wooden or other supports likely to contain moisture. At such points, wrappings impregnated with rust-resisting materials shall be used. The wrappings shall have sufficient strength to resist chafing through.

1.19.3 All crates shall be marked with standard international symbols relating to lifting points and other relevant markings.

1.19.4 For other means of protection not mentioned above but considered necessary for the protection of the Works, the Contractor shall submit

his proposals for the approval of the Engineer.

- 1.19.5 All equipment delivered to Site shall be properly protected so that it does not deteriorate in any manner. The Engineer may order the Contractor to adopt such methods of storage and protection as the Engineer thinks necessary to avoid such deterioration. The adoption of such methods shall be at no extra cost to the Government.
- 1.19.6 Any damage occurring to any item brought to Site or stored on the Site shall immediately be brought to the attention of the Engineer. The Contractor shall submit to Engineer his proposals for remedial works to the damage, and no remedial work shall be done without approval on those proposals. The Engineer reserves the right to reject entirely any damaged items which in his opinion are not restorable to a satisfactory condition for use in the Works.
- 1.19.7 The Contractor shall make good at his own expenses to the satisfaction of the Engineer any deterioration of the protective coatings, paint work, etc., which may occur during transportation, erection, commissioning, etc., until the Works are taken over.
- 1.19.8 Items of equipment which are finish painted at the manufacturer's place of work shall be suitably encased in wood for their protection before despatch. Any deterioration of, or damage to paint work etc., which may occur during the intervening period until the equipment is taken over shall be made good at the Contractor's expense.
- 1.19.9 Electrical items shall be properly protected from ingress of water/moisture.
- 1.19.10 Within one week after delivery of all items of equipment to Site, the Contractor shall provide four copies of the complete schedule listing all items of equipment in sufficient details to enable them to be readily identified.

1.20 Testing, Inspection and Commissioning

- 1.20.1 If the Contractor is required by the Contract or ordered by the Engineer to carry out any examination, measurement or test, then the Contractor shall give notice to the Engineer specifying the procedures that the Contractor intends to adopt and the time and location of the examination, measurement or test. If no period of notice is specified in the Contract then reasonable notice shall be given by the Contractor having regard to the type and location of the material, equipment and workmanship to be examined, measured or tested.

1.21 Testing and Inspection before Installation on Site

- 1.21.1 The Contractor shall offer all materials and components of the installation for inspection, examination and witnessed testing to ascertain satisfactory functioning of the equipment before assembly and installation on Site and shall inform the Engineer of the firm dates for inspection and witnessed testing giving four weeks' notice.
- 1.21.2 General tests as described in (a) to (j) below shall be adopted by the Engineer for the examination of all materials and components, sub-assemblies and unit assemblies. Details of these tests shall be in accordance with the specification for that particular item described elsewhere in the Specification.
- (1) Physical inspection;
 - (2) Dimensional check;
 - (3) Electrical check;
 - (4) Calibration;
 - (5) Output check;
 - (6) Operational test;
 - (7) Reliability test;
 - (8) Load testing;
 - (9) Insulation test and
 - (10) Others as deemed necessary.
- 1.21.3 If the tests are beyond the resources of the manufacturer, the Contractor shall make arrangements for these to be carried out elsewhere. Any variation of this requirement shall be agreed and confirmed in writing obtained from the Engineer.
- 1.21.4 The Contractor shall carry out tests as stated in the current appropriate British Standards, performance tests and such other tests as are necessary, in the opinion of the Engineer, in order to verify that the workmanship, equipment or materials are in compliance with the

Specification either under test conditions in the manufacturer's place of work, or on Site.

- 1.21.5 All cast or fabricated metal components which will be subjected to high stresses during operation, e.g. pump impellers, shall if considered necessary by the Engineer, be subjected to non-destructive testing in accordance with **BS EN 1369:1997** Founding. Magnetic particle inspection **BS EN 1371-1:1997** Founding. Liquid penetrant inspection. Sand, gravity die and low pressure die castings **BS EN 12680-1:2003** Founding. Ultrasonic examination. Steel castings for general purposes and **BS EN 10228-3:1998** Non-destructive testing of steel forgings. Ultrasonic testing of ferritic or martensitic steel forgings **BS EN 10228-4:1999** Non-destructive testing of steel forgings. Ultrasonic testing of austenitic and austenitic-ferritic stainless steel forgings.
- 1.21.6 Where tests and inspection have been completed to the Engineer's satisfaction, and when the test certificates, curves, etc., have been checked, he will confirm acceptance in writing. The equipment shall not be delivered to Site until this acceptance has been received.
- 1.21.7 Two copies of all test certificates and curves shall be supplied to the Engineer within two weeks of completion of any witness tests.
- 1.21.8 Where witnessed tests are not required the test certificates and curves shall be forwarded to the Engineer within two weeks after instruction to waive witnessed tests have been received.
- 1.21.9 On each test certificate, sufficient information including the specification, contract number and equipment details, shall be given for the ready identification of the material or equipment to which the certificate refers. The format of the test certificate shall be subjected to approval.
- 1.21.10 No inspection or approval by the Engineer of the workmanship, equipment or materials covered by this Contract, whether carried out or supplied by the Contractor, shall release him from any of his obligations under the Contract.
- 1.21.11 The Engineer reserves the right to require the Contractor to meet any extra costs which are occasioned by failure of the Contractor to comply with the above testing and inspecting requirements, including the provision of test certificates, curves, etc., or which in the opinion of the Engineer are due to insufficient care having been taken by the Contractor or his Sub-contractor before presenting the equipment for inspection or tests. If unauthorized delivery has taken place, the

Contractor may be required to arrange for additional inspection and/or witness testing by the Engineer at the Contractor's expenses.

- 1.21.12 All apparatus, instruments and connections required for the tests shall have been calibrated by approved authorities for accuracy within the preceding 12 months. The Contractor shall be responsible for the costs of all such calibrations and present calibration certificates to the Engineer for approval.
- 1.21.13 Any equipment used in the testing of the Works shall in all respects comply with the appropriate safety regulations.
- 1.21.14 For testing/inspection at a sub-contractor's place of work, the Contractor's representative shall accompany the Engineer or Engineer's Representative on each visit.

1.22 Commissioning Tests

- 1.22.1 As soon as practical after individual equipment, sub-assemblies and assemblies have been properly installed, tested to the satisfaction of the Engineer, the Contractor shall carry out the commissioning tests for the complete installation.
- 1.22.2 The Contractor shall notify the Engineer three weeks in advance of the commencement of commissioning tests, and furnish a detailed programme and description of methods of carrying out such commissioning tests for approval. Unless otherwise agreed the tests shall take place within ten days after the said date, on such date or dates as the Engineer shall in writing notify the Contractor.
- 1.22.3 The installation shall then be operated continuously by the Contractor for 24 hours or such time as the Engineer may specify, during which time the Engineer will check that the installation is complete, in safe working order and fulfils the functions for which it is intended.
- 1.22.4 Any defects of workmanship, materials, performance, design of equipment, maladjustments or other irregularities which become apparent during the tests shall be rectified by the Contractor and the tests repeated at the Contractor's expense to the satisfaction of the Engineer.
- 1.22.5 If any portion of the Works fails to pass the tests, tests of the said portion shall, if required by the Engineer or by the Contractor, be repeated within a reasonable time under the same terms and conditions, save that all reasonable expenses to which the Government

may be put by the repetition of tests shall be deducted from payments due to the Contractor.

1.23 Costs for the Testing, Inspection and Commissioning

1.23.1 The Contractor shall be responsible for all the costs associated with testing, inspection and commissioning of the Works. These include the costs for the provision of assistance, instrument, machines, labour, consumable materials such as water, fuels and chemicals, etc and other facilities as may be necessary.

1.24 Labels

1.24.1 Each item of equipment shall have permanently attached to it in a conspicuous position a label upon which the manufacturer's name, type and serial number of the equipment shall be engraved or stamped.

1.24.2 Labels shall comply with the requirements as stipulated Section 3.4 of "The General Electrical Specification". Embossed materials and the like will not be accepted.

1.24.3 All indicators, instruments, relays, control switches, push-buttons, fuses and other ancillary apparatus shall be provided with labels clearly stating their functions. All label inscriptions shall be subject to the approval of the Engineer.

1.24.4 All labels shall be fixed square to the equipment by means of screws or rivets. Labels affixed with adhesive will not be accepted.

1.24.5 Labels indicating normal operational procedures, circuit designations and warning labels, shall be inscribed in English and Chinese characters.

1.25 Prevention of Mosquito Breeding

1.25.1 All items on Site, including constructional plant, and equipment capable of retaining water shall be so stored, covered or treated as to prevent water collecting and the Contractor shall allow for the cost of so doing.

1.25.2 The Contractor shall, at his own expense, obtain and display prominently posters upon all structures or temporary offices on Sites in both English and Chinese, drawing attention to the dangers of allowing the breeding of mosquitoes. These posters, which may be

obtained from Food and Environmental Hygiene Department, shall be removed on completion of the Works.

1.26 Advertising on Site

1.26.1 No advertising notice boards of any kind are to be erected on Site.

1.27 Appointment of Contractor's Site Representative

1.27.1 Within 7 days of acceptance of his tender, the Contractor shall submit to the Engineer the name of an English and Cantonese speaking Site representative together with his experience and academic particulars for approval. If the Contractor intends to change his Site representative, he shall give 7 days' advance notice and forward all particulars of the proposed new Site representative to the Engineer for approval.