Lusail Real Estate Development Company

Health, Safety, Security, Environment, Logistics & Quality Department

STANDARD OPERATION PROCEDURE – FIRE SCOPE AND GENERAL REQUIREMENTS

Document No	LUS-HSE-SP2-446-006.01			Rev	1
Uncontrolled Copy		Controlled Copy	X	Date	01-Apr-2015

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Amendment Record

This document is reviewed to ensure its continuing relevance to the systems and process that it describes. A record of contextual additions or omissions is given below:

Rev .No	Description / Comments	Prepared By	Checked By	Approved By	Issue Date
1	(Pg. 1) Company Propriety Information – Not controlled if printed has been added.	HSE Working Group	Michael Ford	Uwe Krueger	1st April 2015
1	(Pg. 2) Revised Amendment Table	HSE Working Group	Michael Ford Michael Ford	Uwe Krueger	1st April 2015

INTRODUCTION

Fire is an issue that is getting a huge attention in the State of Qatar like anywhere else. Consultant and Contractors are the main Parties involved in this issue as well as Client and Authorities. The Fire Safety work is not controlled and done properly in the meantime due to lack of knowledge, responsibility, loyalty and regularity unfortunately . Therefore, we in Lusail came up with some procedures and requirements for this critical issue and make it mandatory to control the Fire Safety and Protection Work.

PURPOSE

QDREIC Fire Protection framework of this General Requirements is to regulate the work of Fire Safety during all Project stages with Parties involve and their duties towards fire work from design to operation.

This General Requirements include the Specification of design, installation, execution of works, tender's information, drawings, equipment, materials, systems, standards, testing, commissioning, guarantees and warrantees, certification, maintenance, inspection during maintenance period and routine inspection.

The goal of this General Requirements is to standardize and ensure implementation of fire safety protection in Lusail City, upon commissioning of every Lusail Project , this General Requirement must be documented and archive for maintenance, inspection and helping the Qatar Civil Defence in case of fire incident and/ or court process when needed.

Contents

PART A - SCOPE AND GENERAL REQUIREMENTS

1.0 SCOPE OF SPECIFICATION

1.1. INSTALLATION TO COMPLY WITH SPECIFICATION

This General Specification details the intrinsic properties (including material and workmanship) required of a fire Service installation including hydrants/hose reel System, Sprinkler System, gas extinguisher alarm system, audio/visual advisory system, emergency lighting, exit signs, emergency generator, ventilation and air conditioning control system, pressurization of staircases system, smoke extraction system and associated electrical equipment and wiring carried out for or on behalf of Lusail / QD to meet with Qatar Civil Defense Department, the state of Qatar.

1.2. SCOPE OF THE WORK

The Scope of the Work in this General Specification consist of the whole of the labor and all material necessary to form a complete installation, commissioning, adjustments, tests and maintenance as necessary. It shall include not only the major items of Project and equipment shown or specified but all the components necessary together with the cost of labor for installing such components for the completion of the work and the proper and functional operation and maintenance of the installation whether these components are mentioned in details in the Contract. It shall also include co-operation with other contractors involved on the Contract site in respect of Coordination, Programming, Scheduling and Sequencing of installation of the works in all circumstances where stipulated in the Contract or Proven as necessary.

1.3. DEFINITIONS, INTERPRETATION & ABBREVIATION

In this General Specification, the following words or expressions shall have meaning hereby assigned to them except when the context otherwise requires:

1.4. TERMINOLOGY & GLOSSARY OF TERMS

- **APPROVED OR ACCEPTED** - Approved or accepted by the consultant.
- **CONSULTANT** - The Person, company or firm appointed form time to time by the Employer and notified in writing to the Contractor to act as a consultant for the Purpose of the Contract.
- **CONTRACTOR** - The Person, firm or company whose tender has been accepted by the Employer for building construction, including the Contractor's Personal representative, Successors and Permitted assigns.
- **CONTRACT** - The Article of agreement, the Tenderness and the acceptance thereof by the Employer, Drawings, Specification and priced Bills of Quantities and any modification of such drawings approved in writing by the consultant.
- **EMPLOYER** - The Lusail / QD.
- **MAINTENANCE PERIOD -** The Maintenance Period named in the Appendix to the Form of Tender commencing on the day following the date of Completion of the works.
- **SPECIFICATION** - The specification referred to in the Contract and modification or addition as May from time to time by furnished in writing or approved in writing by the Consultant.
- **SPECIFIED** - Specified elsewhere in General Specification or on the Drawings.
- **TEMPORARY WORK -** All temporary works of every kind required for Construction, completion and maintenance of the Works.

- **WORK - T**he work or Services including work or Services to be carried out by Nominated Sub-Contractors to be constructed, completed, maintained and / or supplied in accordance with the Contract and includes Temporary Works.

1.4.1 ABBREVIATIONS

- **ANSI** - American National Standard Institute.
- **ASTM** - American Society for Testing and Materials.
- **FM** - Factory Mutual, USA.
- **UL** - Underwriters Laboratory, USA.
- **NFPA** - National Fire Protection Association, USA.
- **BS** - British Standards including specification, codes of Practice Published By the British Standards Institution.
- **BS EN** - European Standards Adopted as British Standards.
- **LPCB** - Loss Prevention Certification Board, UK.
- **LPC** - Loss Prevention Council, UK.
- **ISO** - International Operation for Standardization Publications.
- **QCDD** - Qatar Civil Defence Department.
- **QSC** - Qatar Specification Committee

2.0 STATUTORY OBLIGATIONS AND SPECIFICATIONS

2.1. INSTALLATION TO COMPLY WITH OBLIGATIONS, REGULATION AND SPECIFICATION.

The installation shall comply with this General Specification, and with the following statutory obligations and specifications currently in the State of Qatar.

a.) **NFPA -** National Fire Protection Association.

b.) **QCDD -** Qatar Civil Defence Department.

c.) **QCS** - Qatar Committee for Standardization.

d.) **BS** - British Standards

e.) **OSHA** - Occupational Safety and Health Association.

f.) **NEBOSH** - National Examination Board in Occupational Safety & Health

The installation shall comply with all the current requirement in the statutory regulations and codes and to the approval of QCDD as the minimum whether they are shown in this General Specification, the Drawings and the Particular Specification or not.

2.2. TECHNICAL AND QUALITY STANDARDS REFERRED TO

The NFPA codes, British Standards, Q.C.D.D. standards, and other standards referred to within this General Specification indicated in the basic requirements. Material, equipment or Products conforming to alternative internationally equivalent recognized standards acceptable to Q.C.D.D. whenever offered shall be demonstrated to be equivalent in terms of the type of Construction, Functions, Performance, General appearance and standards of quality to the relevant of American standards and British standards or other standards specified in this General Specification.

2.3. DESIGN RESPONSIBILITY

Where design is specified, the contractor shall design the fire service installation to comply with Q.C.D.D. requirement and the requirement in specification. Where design is no specified, the contractor shall develop the design shown in the drawings, complete the detailed design and installation details of the fire service installation and select the equipment design to comply with the Q.C.D.D. requirement and requirement of the specification.

All design drawings, calculation and installation drawings shall be submitted to the consultant for approvals. Where design is specified, all design shall be checked and endorsed by a Registered Professional Engineer in the State of Qatar or (Equivalent approved Professional Qualification) specialized in fire service installation design employed by the contractor and approved by Q.C.D.D. All design should be checked and endorsed by a staff of the contractor having the highest Professional / Technical qualification within the contractor's company.

2.4. EQUIPMENT APPROVAL BY QATAR CIVIL DEFENSE DEPARTMENT

All fire service equipment used shall be approved type and shall possess the relevant approval by Q.C.D.D. as required. The fire service equipment requiring Q.C.D.D. approval shall follow the Q.C.D.D. requirement. The Contract shall only submit to the Consultant for approval equipment and material that have been approved by Q.C.D.D. A copy of the approval letter from Q.C.D.D. shall be submitted together with the catalogue for approval. Where any equipment has been exempted from approval by Q.C.D.D. or does not require the approval by Q.C.D.D., the Contractor shall provide the necessary information and/or evidence on the exemption in the submission to the Consultant. For special equipment and installation or new type of equipment that has not used in the state of Qatar, the Contractor shall submit them to the Q.C.D.D. for approval or for exemption.

All fire Service equipment shall be provided with necessary facilities, accesses and Laundries for it proper maintenance, overhaul, testing and servicing after installation. Fire equipment with consideration of maintenance provisions to the satisfaction of the Q.C.D.D. shall not be accepted.

2.5. DATE COMPLIANCE

No value for current or future date/time will cause any interruption to operation which will affect the Performance or functionality of all or part of the systems and/or equipment including any supplied or supported embedded systems, hardware, software, firmware, micro-code and Programmed.

3.0 EXECUTION OF WORK

3.1. REGISTERED CONTRACTORS

The Works shall be carried out by a Contractors registered and licensed by the Qatar Civil Defence Department in accordance with the Fire Service (Installation Contractors) Regulation, Fire Services Ordinance.

Where electrical works are involved, the Contractors shall possess the relevant registration as required in the Electricity Ordinance and the work shall be carried out by electrical workers registered in the grade relevant to the type of installation concerned.

Where ventilation works in building are involved, the Contractors shall possess the relevant registration required in the Building Ordinance.

3.2. PROGRAMME OF WORKS

The Contractors shall submit a detailed program of works showing the intended method, stages and order of proceeding with the Works in co-ordination with the building construction program, together with the period of time estimated for each and every stage of Work. The program shall include at least the following:

a) Dates of order of equipment and materials.

b) Dates of delivery of equipment and materials to site.

c) Dates of commencement and completion of every stage of Works in line with the building construction program, i.e. each floor level and/or zone area.

d) Dates of expected completion of builder's work requirement, e.g. water tank, pump room, control valve room, etc.

e) Dates of requirement of temporary and permanent electricity and water supply.

f) Dates of submission of drawings to the Q.C.D.D.

g) Dates of submission for obtaining relevant licenses.

h) Dates of completion, commissioning and testing.

i) Dates of submission and inspection by the Q.C.D.D.

Short term program showing the detailed work schedules of coming weeks and months shall also be provided to the Consultant. Program shall be regularly updated to reflect the actual progress and to meet the obligation under the Contract.

In addition, detailed schedules and program showing the installation drawing submission, equipment offer submission, and commissioning and testing shall be submitted to the Consultant for approval. The formats and information of the schedules shall be as required by the Consultant.

3.3. BUILDER'S WORK

Where there is no Building Contractor carrying out the building work for a particular project, all builder's work for the fire service installation and all work by the Building Contractor in the Specification shall be carried out by the Contractor.

Where there is a Building Contractor carrying out the building work for a particular project, unless otherwise stated, all builder's work including forming openings, holes through the building structure, partition walls and all concrete bases, supports, ducts etc. required for the installation as shown on the Drawings will be carried out in the building work by the Building Contractor. Any additional items beyond those already included will also be carried out by the Building Contractor provided that the Contractor shall submit in good time to the Consultant for approval, full details of such requirements, so that due consideration may be given before the Building Contractor commences work in the areas concerned.

Following approval by the Consultant, the Contractor shall be responsible for marking out the exact positions and sizes of all such work and for providing detailed information to the Building Contractor to facilitate him to carry out such work as it proceeds.

The Contractor shall be liable for all expenses incurred which are brought by the Contractor's failure to comply with the above requirements.

Approved pipe sleeves and pipe collars, and approved fire rated pipe sleeves and fire rated pipe collars where necessary, shall be supplied and installed by the Contractor for all fire serviced pipes and the like passing through compartments, walls, floors and any structural openings. Puddle flanges for inlet and outlet pipes of the tanks for fire service shall be supplied by the Contractor and will be installed by the Building Contractor unless otherwise specified.

3.4. CO-ORDINATION OF CONTRACT WORKS

The Contractor shall co-ordinate the proposed program of works and the actual work on site with the Building Contractor and any other contractors and sub-contractors and shall make any modification reasonably required to suit the coordination or as necessary to the satisfaction of the Consultant in order to adhere to the approved overall construction program.

Where there are fire service installations, related fire service installations and related fire services provisions in a particular project not carried out by the Contractor or not carried out by the Q.C.D.D. the

Contractor shall co-ordinate, check and confirm their completion and readiness for fire service inspection by Q.C.D.D.

The Contractor shall co-ordinate, obtain the drawings and information from relevant parties and include all such fire service installations, related fire service installation and related fire service provisions in the submission to the Q.C.D.D. for comment and inspection.

The Contractor shall report the status of such co- ordination and non-compliance with the requirements of Q.C.D.D. where found on the works carried out by others to the Consultant.

The Contractor shall co-ordinate with relevant parties, inspect and witness the final tests on all related fire service installations, related fire service provisions and fire service installation in a particular project not included in the Works under Fire Service Installation or not carried out by a registered fire service contractor to identify any non-compliance with the, Q.C.D.D. Requirements.

Any works found not complying with the fire service requirement of the Q.C.D.D. shall be rectified when they are included in the Works or be reported to the Consultant when such works are carried out by others before arranging inspection with the Q.C.D.D. The Contractor shall co-ordinate with relevant parties to carry out the final functional test and performance test.

The Contractor shall co-ordinate to check that all fire service installations/requirement and items to be inspected by Q.C.D.D. are tested, rectified where necessary and certified by relevant parties before arranging inspection with the Q.C.D.D. Unless otherwise specified, witnessing and inspection of such works of others by the Contractor shall be limited to Q.C.D.D. requirements.

3.5. CO-OPERATION WITH OTHER CONTRACTORS

The Contractor shall co-operate at all times with the Building Contractor and all other contractors and sub-contractor in order to achieve efficient working on site. Unless otherwise stated in the Contract, the Contractor shall be responsible for co-coordinating the work with others and for timely and satisfactory completion of the Contract.

Any significant problems beyond the Contractor's control shall promptly be reported to the Consultant for advice and/or decision.

No extra claim for delay either financially or by extension of the Contract Period will be allowed if the Contractor fails to properly and adequately co-ordinate and program the work at all times.

3.6. TRAINING OF EMPLOYER'S STAFF

The Contractor shall provide training for the operation and where necessary maintenance of sophisticated equipment. The training shall include all training facilities, material and handout etc.

The Contractor shall submit a training schedule and proposal at least three (3) months prior to completion of the Works for the Consultant's approval.

The Contractor shall provide adequate training to the Employer's staff to operate the fire alarm control system and to monitor and to reset/mute alarms in the fire service installation at completion of the Works and before the commencement of the Maintenance Period.

The Contractor shall provide adequate training to the Employer's staff on the operation of the fire service installation during fire alarm, fault alarm, warning alarm and other emergency situations as appropriate.

The Contractor shall provide contact telephone list as necessary to the Employer's staff.

The Contractor shall provide facilities and training program to ensure that the Employer's operation and maintenance staff, as available, acquire full knowledge and appreciation of all aspects of the design, day-to-day operation, diagnosis and where necessary, breakdown and routine maintenance, and hence operate and maintain reasonably effectively and efficiently the system/equipment.

4.0 INFORMATION REQUIRED FROM TENDERED

4.1. INFORMATION FURNISHED WITH TENDER

The Tenderer shall complete the Equipment Schedule attached to the Tender Documents and also furnish the following information, where applicable, without which the Tender shall be considered incomplete:

a) Name of manufacturer, country of manufacture, type and catalogue number, and full technical performance details, of all major items of equipment offered.

b) Voltage of operation and current consumption, for all equipment and those for automatic heat, smoke and flame detectors, (a) under normal conditions and (b) under alarm conditions.

c) Type and major size of wiring for alarm circuits.

d) Evidence, or a signed statement, to the effect that all items of equipment requiring the approval of the FSD, LPCB, FM, or the listing of UL are so approved or listed.

e) Copies of test certificates showing compliance with the specified standards of the major offered equipment and materials issued by the British Standards Institution or any other internationally recognized testing authorities.

f) Illustrated technical brochures in Arabic or English showing all major items of equipment and their installation requirements.

g) Full technical details for engineered and pre-engineered systems.

5.0 DRAWING AND MANUALS

5.1. CONTRACT DRAWINGS

Should the arrangement and dimensions shown in the drawings be considered inadequate for the Contractor to properly proceed with the work as specified, the Contractor shall draw the attention to the fact within twenty-eight (28) calendar days after the commencement of the Work together with details of amendments required.

5.2. INSTALLATION DRAWINGS

Installation drawings including manufacturer's shop drawings shall be prepared and submitted to the Consultant for perusal by the Contractor in sequence with the construction program. They shall contain plan layouts, sectional drawings (elevation and plans), vertical plumbing line diagrams, schematic wiring diagrams, installation details, schematic air side diagram for ventilation and air conditioning control, etc. and shall show the following particulars:

a) Service routings and levels relative to the structure and other services.

b) Plant and equipment location with dimensions and weights.

c) Service joints, supports and fixing details together with their locations.

d) Maintenance accesses, facilities and all necessary details relating to the proper operation and maintenance of the systems.

e) Calculation and data for gaseous extinguishing system, drencher system and other fire service installations.

f) Methods of control in ventilation and air-conditioning control system.

g) Location and type of interfacing with other services for ventilation and air conditioning control system, firemen's lift audio/visual advisory system.

The drawings shall include all design accessories and shall be drawn to match the materials and

equipment supplied by the Contractor. Drawing showing details in spatial zones shall be prepared subsequent to proper co-ordination with the building Contractor and other trades on site.

The manufacturer's shop drawings are drawings for equipment or plant to be manufactured by a specialist manufacturing supplier away from the contract site. The clearance for Maintenance, etc. immediate after placing of any order or at any event within four (4) weeks unless otherwise agreed in writing by the Consultant, the Contractor shall forward to the Consultant for comment and, where necessary, approval four copies of manufacturer's shop drawing indicating detailed construction, principal dimensions and weights, clearance for withdrawals and/or cleaning etc. No work shall proceed on or off the site unless these shop drawings have been approved in writing by the Consultant.

The Contractor shall submit a detailed installation drawing submission schedule and program to the Consultant. The Contractor shall allow adequate time in the program for vetting of the installation drawings by the Consultant and for drawing re-submission as necessary.

Four (4) sets of the preliminary installation drawings shall be submitted to the Consultant who will then check, endorse and return two (2) sets to the Contractor for onward submission to the Q.C.D.D. for perusal. Works can only be commenced upon receipt of a set of drawings chopped/recorded by the Q.C.D.D. and written approval from the Consultant. Six (6) sets of all such approved drawings shall then be submitted to the Consultant. If there are changes in the course of installation, the Contractor shall submit the updated installation drawings which shall reflect the as-built installation to the Q.C.D.D. for perusal prior to the Q.C.D.D. inspection.

The Contractor shall keep on site a set of updated approved installation drawings available for inspection by the Consultant at all times. The drawings shall be marked up with any modifications made during installation and commissioning and testing.

5.3. CONTRACTOR WORK DRAWINGS

Unless otherwise agreed by the Consultant, the Contractor shall submit to the Consultant, within six (6) weeks of the award of the Contract, six (6) copies of drawings showing details of all builders' work required for the fire service installation, and showing the weight and the load on each support of the equipment. Such drawings shall clearly indicate the details and positions of all holes, trenches and cutting required for pipe work, drains, ventilation requirements, etc. and construction details for foundation plinths and equipment bases.

5.4 AS-BUILT DRAWINGS

Supply three (3) sets of the first draft prints of as-built drawings at least fifty-six (56) calendar days prior to the commencement of commissioning of the installation/services/equipment. Any details not available at that time (e.g. commissioning and testing results) shall be provided with the penultimate drafts.

The Consultant will check the drafts and return a set of marked up copies to the Contractor within forty-two (2) calendar days from the date of submission by the Contractor, together with comments necessary for final and approved documents.

The finalized approved as-built drawings shall be in three (3) sets of soft copies, two (2) sets of computer disk, one (1) set of reproducible copy and three (3) sets of hard copies shall be submitted as soon as possible but not later than one month after the completion of the Contract whichever date is earlier.

5.5. SIZES OF DRAWING

Each drawing submitted shall conform to one or other of the following standards sizes:

a) 841 x 1189 mm (A0)

b) 594 x 841 mm (A1)

c) 420 x 594 mm (A2)

d) 297 x 420 mm (A3)

e) 210 x 297 mm (A4)

5.6. OPERATION AND MAINTENANCE MANUALS

Supply three (3) sets of the first draft of operation and maintenance manuals and the lists of recommended spare parts, recommended spare parts for one year's operation and special tools complete with prices to the Consultant for comment at least sixty (60) calendar days prior to the commissioning and testing of the plant and equipment. Any details not available at that time (e.g. commissioning and testing results) shall be provided with the penultimate drafts.

The Consultant will check the draft and return it to the Contractor within forty-two (42) days from the date of submission by the Contractor with comments necessary for final and approved documents.

The three (3) sets of finalized manuals shall be submitted as soon as possible but not later than one month after the installation/services/equipment has been commissioned. One set of the manuals shall be the original.

The detailed requirements, structure and contents of the operation and maintenance manuals shall be as specified in the Preliminaries of the Contract. All commissioning and testing results, certificates and record photographs as necessary shall be included in the final manuals. In addition, the lists of recommended spare parts and special tolls complete with prices shall be included in the final manuals.

The final manuals shall have pages of A4 size with A3 folder where necessary. The pages shall be good quality paper that is sufficiently opaque to avoid "see through". Unless otherwise specified in the Preliminaries of the Contract, the manuals shall be bound in durable hard covers.

The number of separate manuals volumes required depends on the size and complexity of the installation concerned. The Consultant's agreement is too obtained on this at the draft manual stage.

The Contractor shall include a set of original or certified true copies of all the licenses required in Section A2.8 for the intellectual property rights in the manuals, together with the operation and maintenance manuals, the Contractor shall submit a key data summary sheet for all the installed equipment and system for use as a maintenance inventory records.

Detailed and format of the key data summary sheet shall be submitted to the Consultant for approval and shall include key data such as the type of equipment, rating and capacity of equipment, brand name and model number, code (barcode) of equipment where provided, construction material of the equipment, location of equipment/installation, total number of equipment of the same type, total length of pipes, key dimensions and thickness of equipment, agents in equipment, and other key data necessary for facilities management and inventory record.

Three (3) hard copies and three (3) soft copies in CD-ROMS of approved software format of the key data summary sheet shall be submitted.

5.7. ADDITIONAL REQUIREMENT FOR ADDRESSABLE SYSTEM

Where addressable fire alarm, detection, control or similar system is supplied and installed, the operation and maintenance manuals and as-built drawings submitted shall include, but not limited to, the following details, in addition to all requirement as mentioned above:

a) As-built interconnecting field wiring diagrams, or wiring lists, of the complete field installed system with complete, properly identified, ordering number of each device and system component.

b) Operator manual with step-by-step procedures. The manuals shall be indexed, and shall have a separate tabled section for each operator function.

c) Operator's/Programmer's Manual with complete description of all programming functions, including sample written programs.

d) Layout plan showing the fire control panel, field device location and field device point list.

e) Schedule of set points of the system.

f) Complete description of the sequence of operation of the fire alarm control system with flow charts and decision trees.

The Contractor shall provide all the keys and passwords required for accessing all parts of the addressable system without restriction.

5.8. ACCEPTANCE OF INSTALLATION/SHOP DRAWINGS, TECHNICAL LITERATURE AND MATERIAL SAMPLES

Where delays because of late drawing submission by the Contractor and/or the effect of re-submissions (and particularly multi-resubmissions), the Contractor may be held responsible for any financial losses incurred and to the extent that the adverse effects can be demonstrated to have been incurred by the Contractor for having failed to produce acceptable drawings in reasonable and good time unless the delays is due to late comments/approval by the Consultant.

The time allowed for comments and resubmission shall be in accordance with the General Conditions of the Contracts and Special Conditions of Contracts.

The above conditions can also apply to submission and acceptance of other items such as technical literature and material sample.

6.0 GENERAL REQUIREMENTS OF THE WORK

6.1. GENERAL EQUIPMENTS ON MATERIALS, EQUIPMENT AND INSTALLATION STANDARDS

6.2. MATERIAL AND EQUIPMENT STANDARDS

All materials, equipment and installation work shall be carried out by adoption of the best available quality materials and workmanship and shall, where applicable, comply with the latest edition of the appropriate standards and/or codes of practice issued by the relevant international Institutes and Standards and as specified in this General Specification. This requirement shall be deemed to include all amendments to these standards and codes up to the date of tendering.

6.3. COMPATABILITY OF MATERIALS AND EQUIPMENT

Where different components of equipment are interconnected to form a complete system, their characteristics performance and capacities shall be matched in order to ensure efficient, economical, safe and sound operation of the complete system.

6.4. EQUIPMENT CATALOGUE AND MANUFACTURER'S SPECIFICATION

Equipment catalogue and manufacturer's specification related to proposed items of equipment shall be specific and shall include all information necessary for the Consultant to ascertain that the equipment complies with this General Specification and the Contractor shall submit catalogues and manufacturer's specification of the proposed equipment for the examination and approval of the Consultant in writing before any equipment is ordered.

6.5. EQUIPMENT DEVIATIONS

Subsequent to the award of the Contract, and only in exceptional circumstances where it is demonstrated in writing by the Contractor that the original equipment offered cannot be obtained, the Consultant may consider and accept, in writing, alternative equipment and materials proposed by the Contractor provided always that these are fully in compliance with the relevant Specification and Drawings and do not impose any additional contractual or financial liabilities on to the Employer.

The Contractor shall bear in mind that submission of alternatives usually causes delay because of additional time required by the Consultant to process further approval. The consequences of such delay shall be borne by the Contractor. Subject as always to the Consultant approval, where the Contractor

proposes to use items of equipment other than those specified and dimensionally different from the Drawings, the installation of which items requires any redesign of the structure, partitions, foundations, piping, wiring or any other part of the mechanical, electrical or architectural layout, then drawings showing the layout of the proposed equipment and any redesign involved shall be prepared by the Contractor at the Contractor's own expenses and be submitted to the Consultant for approval.

Where the equipment deviation involves significant changes to the building, e.g. a larger plant room, this will unlikely be agreed unless the enlargement presents no significant problem and the Contractor is prepared to pay for the building alterations involved.

Where such approved deviation necessities a different quantity and arrangement of piping, structural supports, equipment, controls, motors, starters, electrical wiring and conduits, and any other additional materials together with all necessary accessories form that originally specified or indicated in the Drawings, the Contractor shall and install such piping, structural supports, equipment, controls, motors, starters, electrical wiring and conduits, and any other additional materials together with all necessary accessories required by the system at no additional cost to the Employer.

The contractor shall also be responsible for all other expenses by other contractors in view of the change. Any deduction of cost due to the change shall be deducted from the Contract.

6.6. MANUFACTURER'S TECHNICAL SUPPORT

All equipment requiring approval by the Q.C.D.D. shall be supplied through authorized agencies/sub-agencies of the manufacturers in the state of Qatar. The Contractor may be required to produce such authorization from the supplier when required.

6.7. MATERIAL DELIVERY PROTECTION AND SECURITY ON SITE

For the purpose of accurate interim payment certification, all material delivered to site shall be accurately listed and recorded in the site record books maintained by the representatives of the Consultant on site.

Once material and equipment delivered to site and paid for in interim payment, these material and equipment shall be the Employer's property and shall not be removed from site without the approval of the Consultant in writing and appropriate deduction shall be made in the next interim payment in accordance with the Contract.

Where the Building Contractor is in overall control of the site, the Building Contractor may also be required to record details of all incoming/outgoing materials. In this case the Contractor shall comply with the Building Contractor's arrangement.

6.8. PROTECTION

Unless the responsibility is clearly defined in the Contract that the protection on site for delivered equipment, material and installation is solely by other contractors, the Contractor shall be responsible for the safe custody of all material and the equipment as stored or installed by the Contractor until finally inspected, tested and accepted.

Also unless otherwise specified, the Contactor shall protect all work against theft, fire, damage or inclement weather and carefully store in a safe and place all material and equipment received on site but not yet installed.

All cases of theft must immediately be reported to the Police, the Building Contractor, the Consultant and the Consultant representatives on site with full details of materials stolen.

In the case of fire, a similar report must be made to the nearest Fire Services Station, the Building Contractor, the Consultant and the Consultant representative on site. Where necessary the Contractor shall provide steel container type lockable storage or other equally secure enclosures placed within a securely fenced-in compound where the latter is to be provided by the Building Contractor on the site.

If rooms are required to secure the storage of sensitive and/or expensive items, the Contractor shall co-ordinate and shall ensure that the Building Contractor will provide clean, decorated, finished and

lockable secure accommodation before their installation. If the Building Contractor fails to concede to such request, the Contractor shall report the shortcoming of the accommodation to the Consultant. If there is no Building Contractor, all the storage facilities and spaces shall be provided by the Contractor.

6.9. SELECTION OF EQUIPMENT

Selection of equipment shall be based on this General Specification, the Particular specification, and the technical data contained in the Drawings for a particular installation.

Where items of equipment are interconnected to form an integral part of the complete fire service installation, their characteristics of performance and capacities shall be so matched as to give safe, reliable, efficient and economical operation of the complete air conditioning installation.

6.10. TRADESMEN AND SUPERVISION

All tradesmen must be experienced in the trade and the work carried out shall be consistent with god practice in the State of Qatar and to the satisfaction of the Consultant.

The Contractor shall employ for the control and supervision of all work, one or more qualified and competent supervising engineers. The qualified and competent supervising engineer shall have minimum 5 years on site experience for similar type and scale is installation works. In case of minor nature of installation, the Contractor may propose to undertake the duties of the supervising engineer by the onsite foreman as specified below. Approval by the Consultant, found to be inadequate for the particular work.

6.11. TOOLS AND EQUIPMENT

Proper tools shall be used for the works. Adequate and accurate testing/measuring instruments shall be used to demonstrate compliance of the installation with the relevant specifications and regulations.

The Consultant has the right to stop any work in which the correct tools and/or instruments are no used.

Instruments used for acceptance tests shall be calibrated at an interval time of one year unless otherwise as required in the Contract for a particular project.

6.12. WORKMANSHIP STANDARD

The installation works shall be in line with the good practice accepted by the local industry and verified by commissioning and testing results.

The installation works shall be in compliance with this General Specification, Particular Specification and Drawings of a particular project.

The installation shall be in compliance with the statutory requirements in respect of labor safety, fire safety, structural safety, electrical safety and environmental protection.

Apart from those requirements as stipulated in this General Specification and other statutory requirements, due care shall be taken to secure public safety and health both during the execution of the works and in the selection of equipment and materials.

6.13. QUALITY STANDARDS

All material and equipment shall be manufactured by factories with acceptable quality assurance procedures.

Factories having ISO 9001 OT ISO 9002 certification are deemed to have acceptable quality assurance procedures. Other similar quality assurance standards may be accepted by the Consultant on their individual merits. Details of such other quality assurance standards shall be submitted with the Equipment Schedule.

7.0 PERFORMANCE BASED FIRE ENGINEERING

7.1. GENERAL

Where performance based Fire Engineering, Fire Safety Engineering, Fire Protection Engineering or similar approaches, studies, analysis and application are specified for the assessment, design, analysis, Selection and evaluation of the Fire service equipment, materials, system, design and performance.

The Contractor shall employ competent and qualified professional engineers specializing and experienced in Fire Engineering approved by Q.C.D.D. to carry out the works on PBFE. The Fire Engineering approved by Q.C.D.D. should be specialized in Fire service installation design with additional Professional/academic qualification and experience on Fire Engineering.

7.2. STANDARDS AND GUIDES

The Performance based Fire Engineering approaches, studies, analysis and application or similar works shall follow internationally accepted Fire Safety Engineering standards, codes and guides approved by the Q.C.D.D.

7.3. COMPUTER SOFTWARE AND TOOLS

Where the completion of PBFE requires the use of computer software and tools for modeling, analysis and calculation, the cost of all such facilities and computing works including the access to and the use of the software shall deem to be included. Hard and soft copy of the computed result shall be submitted.

The Contractor shall allow the cost for demonstrating to the Q.C.D.D. the computed result locally on the computer facilities provided by the Contractor.

The Contractor shall provide accreditation/validation certificate, evidence and/or substantiation showing the acceptance of the computer software by internationally recognized bodies.

The Contractor shall give details of the principles, formulae and calculation adopted in the computer software when and where required.

All calculation and computed results shall be checked and endorsed by the professional engineer employed by the Contractor.

7.4. TESTS

Where the completion of PBFE require site tests and laboratory tests for completion of the studies and evaluation, all such tests including mock-up tests, simulation tests, fire tests, field tests and trial tests, onsite and off-site, shall deem to be included in the Works.

7.5. INDEPENDENT CHECKING

Where PBFE is used for the fire service/safety design, selection of fire service system/equipment, evaluation of alternate solutions for compliance with statutory requirements, evaluation of new fire service system, major modification works, and assessment of building/structural fire protection and life safety provisions such as fire compartments and occupant evaluation, the Contractor shall employ an independent qualified professional checking engineer specialized in PBFE to the approval of the Q.C.D.D. to check, validate and audit on all the design, calculations, computer models, submission and work on PBFE by the Contractor and to report all the findings independently to the Q.C.D.D.

The professional qualification and experience of the independent checking engineer for PBFE shall be least equal to or better than that of the professional than that of the professional engineer employed by the Contractor and shall be approved and accepted by the Q.C.D.D.

7.6. PROGRAMME AND SUBMISSION

The Contractor shall provide a detailed program for the PBFE including the time allowed for consultation with various authorities and parties. Since the results of fire engineering will affect the provisions of fire

service installation, the Contractor shall allow for carrying out the fire engineering studies and applications in the early stage of the Contract before commencement of the installation works.

The Contractor shall collect all the data, statistics and information for the study and evaluation in fire engineering.

The Contractor shall allow the cost for making interim submissions, re-submissions and discussion with relevant parties and authorities before finalizing the study and evaluation.

The Contractor shall submit the result of the PBFE and reports in a format acceptable to the Q.C.D.D. covering details of methodologies, principles, assumptions, statistics, data, formulae, risk analysis, computer modeling, figures, diagrams, models, evaluation, results, solutions, recommendation and other relevant information.

The Contractor shall submit and re-submit as necessary to the Q.C.D.D. both hard and soft copy (stored in CD-ROMs) of the documents on the results/reports of the PBFE and at least three (30 copies each are required. The soft copy shall be in file format as specified or approved, the Contractor shall submit and obtain the approval of relevant authorities such as Q.C.D.D. and Building Authority on the results, solutions and recommendations.

The professional engineer employed by Contractor shall endorse all documents before making the submission. The documents shall also be endorsed by the independent checker where provided. After approval by relevant parties, the Contractor shall include the result and reports of PBFE in the operation and maintenance manuals.

Before carrying out the detailed PBFE study, the Contractor shall submit preliminary report to seek comments From the Q.C.D.D. and Building Authority on the approach and scope in the study. The preliminary report shall cover but not limited to the following:

a) Objectives.

b) Assumptions.

c) Acceptance criteria and risk level.

d) Hazard identifications.

e) Fire scenarios.

f) Functional, performance and code requirements.

g) Alternate solution/trial concept design to be investigated.

h) Evaluation method and level.

i) Tools/tests/software to be used.

The final reports of PBFE shall include but not limited to the following:

a) Objectives, code requirements, assumptions, functional statements, performance statements, alternate solutions, recommendation and all other sections as required in relevant standards, codes and guides.

b) Qualitative assessment and quantitative assessment (deterministic and probabilistic) for item (a).

c) Sensitivity analysis of the assumptions and data.

d) Risk assessment, except for simple case where comparative method and verification method are applicable.

e) Assessment on the safety factors, redundancy and contingency provided in the solution.

f) Precaution and requirement in the study to be observed and followed by the users/operators in future.

7.7. ACCEPTANCE CRITERIA

PBFE aim to improve the fire safety in the buildings and the analysis and evaluation shall target to improve the building and fire service design and provisions to satisfy the most appropriate fire safety requirement and the concerns on the risk particularly for those part of the design not adequately covered in the prescriptive based fir codes and regulations.

The Contractor shall not use fire engineering as the tool to reduce the building and fire service provisions in the prescriptive based fire codes and regulations as redundancy, standby, spare, safety factor and contingency may have been built into the provisions for the purpose of fire safety.

The Contractor shall allow adequate safety margin, redundancy and allowances in the fire engineering studies and applications to maintain equivalent or better fire safety standards in comparison to other buildings in the territory.

The Contractor shall not use PBFE as the tool to delete any requirement in the prescriptive based fire codes and regulations unless otherwise alternate and/or additional fire safety measures to the approval of the Q.C.D.D.

Use of PBFE to prove the building is fire safe on deleting some requirement in the prescriptive based fire codes and regulations but without corresponding alternate/additional measures will not be approved.

The following are the minimum criteria to be considered in the assessment:

a) Occupants /public life safety.

b) Fire fighter's life safety.

c) Fire spread to adjacent compartments and buildings.

d) Property loss/structural fire protection.

e) Loss of business operation/opportunities as appropriate.

f) Damage to heritage building where applicable.

g) Environmental and community impact as appropriate.

h) Cost effectiveness where appropriate and not at the sacrifice of fire safety.

7.8. RESULT OF THE STUDY

Where the approved result of PBFE indicates or required modification of the design, materials, equipment and installation details of the fire service installation or building design to comply with the requirement in the statutory regulations, unless otherwise specified, all such works and/or modifications shall be deemed to be included in the Works at no additional cost and at the approval of the Q.C.D.D.

Where the result of fire engineering indicates the deletion of some parts of fire service system or fire resistance materials in whole in a zone or in a room can be made, the deletion of such system or material shall not be carried out without the prior approval of the Q.C.D.D. and the cost savings for the deletion of such part of the fire service systems shall be assessed and the Contract Sum will be adjusted in accordance with the Contract as appropriate.

PART B - COMMISSIONING, TESTING AND MAINTENANCE

1.0 COMMISSIONING AND ACCEPTANCE TEST

1.1. ADJUSTMENTS, COMMISSIONING, FUNCTIONAL AND PERFORMANCE TESTS

The contractor shall commission the installation and carry out complete functional and performance tests for all equipment and system installed by him/her or them, make all necessary adjustments, including setting all controls and checking the operation of all protective and safety devices in accordance with the manufacturers' instructions, the requirements of the statutory rules and regulations and to the satisfaction of the Consultant before the installations will be accepted. Prior to any tests, the Contractor shall submit detailed commissioning and testing procedures, methods, format of test records and a program for the commissioning and testing to the Consultant for approval at least three (3) months after commencement of the Contract whichever is earlier.

The detailed procedures shall be prepared in two main parts covering the following:

a) Testing that is required to be carried out during the construction period when part of the Works is installed.

b) Commissioning and testing required for certifying completion of the Works and before commencement of the Maintenance Period.

They shall be updated as the works that are required to be tested during construction and shall be submitted in good times for approval.

Immediately after each test, the Contractor shall sign the data record sheet on site with endorsement by the Consultant's representative witnessing the test, irrespective whether the test is successful or not, and submit a copy of the data record sheet to the Consultant. For testing that is required to be carried out during the construction period, the Contractor shall submit a formal commissioning and testing report or certificate for each test and endorsed by the Contractor within fourteen (14) calendar days after the test.

Commissioning and testing shall include, but not limited to:

a) Factory tests and off-site tests.

b) Visual inspection and checking.

c) Setting to work, safety and quality tests.

d) Commissioning, regulations, tuning and adjustment.

e) Functional tests.

f) Performance tests.

g) Final mock-up tests.

h) Statutory tests and inspections.

Visual inspection and checking shall include verification of the installed equipment being the approved models. The Contractor shall submit relevant documents including delivery orders and payment vouchers to substantiate the equipment installed on site being the approved models if the identification of the manufacturer and model name cannot be seen easily on site.

The Contractor shall note that completion of commissioning and testing and the associated statutory inspection by Q.C.D.D. Is one of the considerations for certifying completion of the Works? The Contractor shall make a detailed plan on the program of the commissioning and testing works at the

commencement of the Contract, in order to ensure that all of such works can be completed within the Contract period.

The commissioning and testing program submitted shall detail the types if commissioning and testing works required, the breaking down of the program into floor-by-floor and area-by-area basis, the tests that are required during construction and at the time before the completion of the Works, the period of tests with float time allowed, the milestone dates on connection of fire alarm direct link, final mock-up test and statutory/licensing inspections, and the program for the completion of various builder's works such as pump rooms, control rooms, water supply, electrical supply, etc. The Contractor shall in particular plan the program so as to minimize the overlapping of different tests arranged simultaneously in different locations.

The Contractor shall arrange to enable the Consultant or the Consultant's representative t o witness all the commissioning and testing. Unless otherwise approved by the Consultant, commissioning and testing carried out by the Contractor in the absence of the Consultant or the Consultant's representative shall not be accepted.

The Contractor shall give at least (72) hours notice, in writing, when any part of the installation will be tested.

Any defects of workmanship, material and performance, maladjustments or other irregularities which become apparent during commissioning and testing shall be rectified by the Contractor at no additional cost to the Employer and the relevant part of the commissioning or testing procedure shall be repeated at the Contractor's expenses.

If considered appropriate, the Contractor shall be required to carry out demonstration to dismantle those parts/components of the installation which are considered difficult/impossible for maintenance access. The Contractor shall be responsible for carrying out all necessary modification work at no extra charge to the Employer to alleviate the difficulties associated with dismantling or maintenance access.

The Contractor shall not wait for completion of every part of the work but shall arrange for a progressive commissioning program to achieve practical overall completion and have the whole work ready to be handed over by a date to suit the Contract completion date or any other agreed program date.

1.2. FACTORY TEST AND OFF-SITE TEST

Factory test shall deem to be included. Factory test and off-site tests shall be carried out at the manufacturer's works or by an approved independent testing body/laboratory where specified, or elsewhere as approved. Where indicated, 'type-tests' on items of equipment to demonstrate compliance shall be carried out. 'Type-tests' certificates shall be submitted in duplicate to the Consultant. Factory quality and general inspection test recommended by the manufacturer shall be required. Where indicated or necessary, factory performance test shall be carried out for each of the offered equipment before delivery. Factory test certificate certified by qualified factory engineer shall be submitted in duplicate to the Consultant for approval. This approval shall normally be required before the materials or equipment is dispatched from the manufacturer's works. Factory test shall be witnessed by an independent approved agency where indicated.

The Contractor shall note that the Consultant may require witnessing tests and inspections of manufactured equipment during construction at the manufacturer's works. Where this requirement is indicated in the Contract, the Contractor shall allow for making the necessary arrangements.

1.3. VISUAL INSPECTION AND CHECKING

Site inspections of 'works in progress will be made by the Consultant or the representative from time to time. The Contractor shall keep such inspection record for checking from time to time. Works to be permanently covered up shall be subjected to inspection, pressure test and other tests before cover up. During the inspection, if he Consultant discovers any work that has been covered up before inspection and testing, this work shall be uncovered for inspection and testing to the Consultant's satisfaction. The cost involved in uncovering the work, inspecting, testing and re-concealing the work together with any consequential losses shall be paid by the Contractor at no additional cost to the Employer. Any defective

works and installation of poor workmanship found during visual inspection shall be rectified or replaced before proceeding with further tests.

1.4. SETTING TO WORK, SAFETY AND QUALITY TESTS

Prior to any commissioning and testing works, the Contractor shall check the completion of the works, the associated builder's work, the related fire services provisions and the associated building services installations, to ensure that commissioning can be proceeded without obstruction.

Before any installation is subjected to commissioning and site testing, it shall be thoroughly cleaned both internally and externally.

The Contractor shall be responsible for initially setting the plans to work including:

a) Preliminary checks to ensure that all systems and system components are in a satisfactory and safe condition before start up.

b) Preliminary adjustment and setting of all plant and equipment consistent with eventual design performance.

c) Carrying out pressure test, hydraulic test and other tests required before energizing the equipment and plant.

d) Checking the proper functioning of the protective devices and safety valves in the installation and carrying out all necessary safety testing.

e) Energizing and setting to work on all plants.

f) Initial regulation and demonstration that the installation delivers the correct rate of flow at the conditions specified in the Contract.

The Contractor shall arrange for any specialist plant or equipment to be commissioned and tested by the specialist equipment manufacturer's skilled commissioning engineer and/or technician.

1.5. COMMISSIONING, REGULATIONS, TUNING AND ADJUSTMENT

The Contractor shall regulate, balance, tune, commission and adjust the installation and equipment as appropriate and necessary to deliver the conditions and requirements specified in the Contract. The Contractor shall allow carrying out such adjustment and re-adjustment as necessary until all the requirements are met and the installation is accepted by the Consultant.

1.6. FUNCTIONAL TESTS

The Contractor shall demonstrate to the satisfaction of the Consultant the functioning of the installation, system and equipment complying with the operational and functional intent and the requirement in the Contract. The Contractor shall demonstrate and test the proper operational mode, control and the sequence of the operation in various parts of the system and installation.

1.7. PERFORMANCE TESTS

The Contractor shall carry out tests to prove the performance of the installation, system and equipment in term of flow, pressure, current, sound level, and other technical/design aspects complying with the requirements in the Contract and the statutory requirements.

The Contractor shall regulate, balance, tune, adjust and modify the installation; system and equipment as necessary till the performance requirement are met. The final setting and operational parameters of all equipment shall be recorded. Where necessary, the Contractor shall carry out full load test by simulation or other approved method to prove the performance of the installation at full load condition.

1.8. LABOUR AND MATERIALS

The Contractor shall dispatch competent and experienced commissioning engineers and technicians to carry out the commissioning and testing of the installation. All labor and material necessary for carrying out the work shall be provided by the Contractor, except that the Building Contractor will supply

electricity and water as required unless otherwise specified. The Contractor shall supply and necessary diesel, gas or other fuel oil for engine-driven pumps and generators provided in the Works, sufficient gases required for the discharge tests of the gaseous extinguishing system installation, etc.

The Contractor shall employ a competent and experienced commissioning engineer in-charge, approved by the Consultant to be responsible for the overall arrangement, co-ordination, supervision and certification of the commissioning and testing of all fire service installation and equipment. And shall have minimum 5 years on site experience for similar type and scale of commissioning and testing works. And shall oversee and check with relevant parties the completion of all related fire service installation and provisions required in Pressurization of Staircase System. And shall be responsible for the submission of detailed commissioning and testing methodologies and procedures, co-ordination of the program and sequence of commissioning and testing works, arranging the test and re-test of the installations, supervising the commissioning and testing works, and certifying results of the tests. And shall lead and co-ordinate the finals mock-up test as well as the statutory inspection with Q.C.D.D. The Contractor shall submit details together with the commissioning and testing program to the Consultant for approval.

The Contractor shall replenish all fir extinguishing media and other materials expended or used during the test and ensure that the entire installation is in “as new” condition at the conclusion of the tests.

The Contractor shall properly drain the water and exhaust the gas during and after the test as required. The Contractor shall provide and adopt measures to avoid damage to the building, installations, decorations and fixtures during the tests for any fixed fire service installation and equipment.

1.9. WATER SYSTEM TESTS

Water system and circuits shall be tested hydraulically to a minimum pressure of 1000 kPa or 1.5 times the working pressure whichever is higher applied at the highest point of the system and held for a period of not less than 15 min without leaks appearing.

All pipe work shall be thoroughly cleaned and flushed before test. The Contractor shall ascertain that there is adequate drainage nearby to discharge by large hose in order to ensure flooding of low level areas will not occur. Where necessary, the Contractor shall be performed on the hydrant/hose reel system in accordance with the requirement of the Code of Practice for Minimum Fire Service Installations and Equipment.

A water supply test with the drain and test valves fully opened shall be made on the sprinkler system in accordance with the requirements of the NFPA Rules for Sprinkler Installations. An alarm test for at least thirty (30) seconds on the water gong shall also be carried out by opening the test valve to ensure that it shall sound continuously after water flow in the system is detected. All controls and air supply system for the pre-action system, recycling pre-action system and dry pipe system shall be tested.

An actual water discharge test shall be performed on the drencher/deluge/water spray/water mist system and where required for other automatic fixed installations using water to test the water flow and discharge pattern of the nozzles.

For street hydrant system without pumps, the Contractor shall test the incoming water supply pressure at a nearby supply point and at such time as agreed with the Consultant before the completion of the installation to establish the adequacy of the water supply pressure. If the supply pressure is inadequate, the Contractor shall propose remedial measures for the Consultant.

The Contractor shall find and select the most appropriate nearby supply point for the test.

The Contractor shall provide whatever hoses or drainage channels required to safety remove the test water discharged while carrying out these tests in order to ensure that no damage to the building and property will be caused by the test water.

The Contractor shall submit hydraulic test certificate/reports that shall be signed by the Contractor and by the Consultant or the representative who has witnessed the test. The test certificate/reports shall contain the following particulars:

- Date of test

- Apparatus or section under test
- Makers number (if any)
- Nature, duration and conditions of test
- Result of test
- Name of Contractor's representative (in block letter) in charge of test
- Name of employer's representative at witness the test

1.10. ELECTRICAL AND ALARM SYSTEM TESTS

Electrical wiring system shall be tested generally as required by the General Electrical Specification. Low voltage wiring shall be insulation tested to a D.C. voltage of twice the normal working voltage of the system. Any tests that are liable to cause damage to the delicate components such as those incorporation electronic circuits shall be carried out with the components disconnected.

Smoke detectors shall be checked for correct sensitivity settings by means of manufacturer's test set and for operation by simulated smoke tests.

Rate-of –rise heat detector shall be tested by gentle application of heat source such as hair dryer. Fixed temperature heat detectors must not be tested other than using simulated tests. Battery capacity shall be tested by discharging through the alarm circuits and being charged via the incorporated charger unit. The specific gravity of the electrolyte shall be tested with a clean hydrometer where applicable.

The Contractor shall arrange power failure load tests to prove proper functioning of the fire service installation and the associated control during power failure and fire mode. The input D.C. supply to the alarm supervisory circuitry shall be checked for correct voltage and stability such as to match the signal and alarm triggering devices.

For fire direct link to Q.C.D.D. the Contractor shall initiate applications to the appropriate agencies within three (3) months after commencement of the Contract to allow the fire alarm direct link to be connected and tested before statutory inspections.

The Contractor shall submit a copy of the application document to the Consultant for record.

The Contractor shall co-ordinate and shall closely monitor the status of completion of fire alarm direct link and the telephone line before fire service inspection by Q.C.D.D.

The Contractor shall apply for and provide at the Contractor's own cost the required telephone point for connection of the fire alarm direct link as required. If the Contractor cannot complete the fire alarm direct link by the date of fire service inspection by Q.C.D.D., the Contractor shall be responsible to provide all necessary manpower and telephone equipment, at the Contractor's own expenses, solely for the purpose for a 24-hour/day full attendant service to substitute the fire alarm direct link up to the date f the completion of the fire alarm direct link. The fire alarm direct link shall be tested after connection.

1.11. GASEOUS EXTINGUISHING SYSTEM TESTS

Gaseous extinguishing system and manifolds shall be tested in accordance with Q.C.D.D. Requirement. Pipe work shall be tested for ten (10) minutes of 1.5 times the operating pressure of the system and 10 bars whichever is larger. A 'puff' test(s) to the installed pipe work is required.

The Contractor shall allow carrying out on-site full discharge test after completion of the installation when required by Q.C.D.D. to confirm the design conditions can be met and to the satisfaction of Q.C.D.D. The Contractor shall follow relevant Q.C.D.D. of discharge tests.

The Contractor shall refill the gas cylinders with the design agents and reset all equipment after the discharge test.

1.12. EMERGENCY LIGHTING AND EXIT SIGN TESTS

Each self-contained luminaries and internally illuminated exit sign shall energize from its battery by simulation of a failure of the normal supply to the lighting for a period of the rated duration of the battery. During this period all luminaries and/or signs shall be examined and tested in accordance with NFPA-72 to ensure that they are functioning correctly.

Each central battery system shall be energized form its battery by simulation of a failure of the supply to the normal lighting for a period of the rated duration of the battery. During this period all luminaries and/or signs shall be examined and tested in accordance with NFPA-72 to ensure that they are functioning correctly. All tests required in the Code of Practice for Minimum Fire Service Installations and Equipment and Inspection, Testing and Maintenance of Installation and

Equipment shall be carried out and recorded.

For those emergencies lighting system with battery and backed up by emergency generators, each emergency generators shall be started up and allowed to energize the emergency lighting system for a continuous period of at least one (1) hour. During this period all luminaries and/or signs shall be examined visually to ensure that they are functioning correctly.

For emergency lighting system and exit sign provided with central monitoring, testing and logging system, the system shall be tested in accordance with the manufacturer's specification and to meet the requirements in the Code of Practice for Minimum Fire Service Installation and Equipment and Inspection, Testing and Maintenance of Installations and Equipment.

Where specified that there are the emergency lighting installation and/or exit signs in a particular project not included in the Works under Fire Service Installation or not carried out by a registered fire service contractor, the Contractor shall co-ordinate with relevant parties, inspect and witness the final test on the emergency lighting installation and/or exit signs to identify any non-compliance with the Q.C.D.D. Requirement. Any works found not complying with the fire service requirement of the Q.C.D.D. shall be rectified when they are included in the Works or be reported to the Consultant when such works are carried out by others before arranging inspection with the Q.C.D.D. The Contractor shall co-ordinate with relevant parties to carry out the final functional test and performance test. The Contractor shall include the emergency lighting installation in the submission to Q.C.D.D.

1.13 EMERGENCY GENERATORS TESTS

The Contractor shall carry out full visual inspection, safety check, functional and performance test for the emergency generator installation. The tests shall include measurement on noise confirming compliance with the statutory requirement required by the Environmental Protection Department, Ministry of Environment.

After full test of the fire service installations in a building or premises have been carried out, with all systems connected to the mains electricity supply, the mains electricity supply shall be switched off to simulate power failure and the emergency generators shall start automatically.

When the emergency generator has gained its capacity and is ready to accept the fire service load, each fire service installation shall be switched on until all installations are in operating conditions. If an automatic starting program or device is provided for controlling the starting sequence of the equipment using emergency power supply, the program or device shall last for a continuous period of one (1) hour. During this period the performance of each fire service installation shall be monitored and recorded.

After one (1) hour of testing, the emergency generator set shall be examined and all instruments, safety devices etc. shall indicate normal running of the generator. Where specified that there is emergency generator installation in a particular project not included in the Works under Fire Service Installation or not carried out by a registered fire service contractor, the Contractor shall co-ordinate with relevant parties, inspect and witness the final tests on the emergency generator to identify any non-compliance with Q.C.D.D. Requirements. Any works found not complying with the fire service requirements of the Q.C.D.D. shall be rectified when they are included in the Works or be reported to the Consultant when such works are carried out by others before arranging inspection with the Q.C.D.D. The contractor shall

co-ordinate with relevant parties to carry out the final functional test, performance test of the emergency generator installation and on load test of all fire service installations and equipment using the emergency generator power supply. The Contractor shall include the emergency lighting installation in the submission to the Q.C.D.D

1.14 HOT SMOKE TEST

Hot smoke test shall be carried out where specified or required. The Contractor shall arrange, co-ordinate and carry out the hot smoke test to meet the purpose for simulating the prototype of a real fire under specific dynamic buoyant flow of smoke and heat intensity in a controlled manner and for assessing the performance of smoke management system, smoke control system and smoke extraction system with the given building geometry. The “Smoke Management System” shall follow the approved international standards and practices and to the approval of Q.C.D.D. The Contractor shall obtain comments from Q.C.D.D. and all relevant parties on the detailed requirements and arrangement for the hot smoke test at early stage of the Contract.

The Contractor shall provide all, materials, equipment, facilities, fuels, manpower and the like for hot smoke test. The Contractor shall co-ordinate and arrange with the Building Contractor to provide all necessary temporary protection to the building finishes, parts, fixture, furniture and other building works during the test. The Contractor shall submit the detailed of such requirement to the Building works during the test. The Contractor shall submit the detailed of such requirements to the Building Contractor in good time before the test and to the Consultant for approval. The Contractor shall supply and install all necessary protection and allow all appropriate provisions to other parts of the building not covered by the Building Contractor so as not to cause any damage, and to keep any disturbance to the possible minimum to any occupants or services during hot smoke test.

The Contractor shall co-ordinate with the Building Contractor and the Q.C.D.D. and shall propose a suitable location and a suitable fire size to the approval of Q.C.D.D. for carrying out the hot smoke test. The Contractor shall carry out a risk assessment of the hoe smoke test and allow adequate protection and provisions for the risk. The Contractor shall employ a standby fire fighting team during hot smoke test for the purpose of fire safety. The Contractor shall deem to allow all necessary insurance coverage for the hot smoke test such or any part of it is not covered under the general insurance policy of the Building Contractor for the site of a particular project.

The Contractor shall arrange and co-ordinate with relevant parties in carrying out the hot smoke test. The Contractor shall employ a qualified professional engineer to arrange the details and co-ordinate the hot smoke test. The engineer employed shall be a Registered Professional Engineer the State of Qatar.

Where hot smoke test indicate deficiency in smoke management system, smoke control system, smoke extraction system and the like included in the Works, the Contractor shall allow to rectify them to the satisfaction of the Consultant and Q.C.D.D. and no additional cost. Where the smoke management system is not included in the Works, the Contractor shall report the deficiency to the Consultant and propose improvement measures. The Contractor shall submit a detailed test report at the end of the test that shall include all the recommendation and improvement measures.

1.15. GENERAL ARRANGEMENT

The hot smoke test can be conducted in existing buildings or in new development just prior to final completion. Until the specific performance requirements for the system can resemble the conditions under which the system is intended to operate including criteria as differential pressures, air velocities and exhaust rates etc. the hot smoke test shall be arranged for Q.C.D.D. inspection.

All detailed on the arrangement / objectives / methods / apparatus / test set up of the required operational and functional tests shall be agreed with Q.C.D.D. and be approved by the Consultant before such test(s) be commenced. The submission shall include. But not limited to, the following items:

a) Submission shall include drawings presented in the format as set out in the Q.C.D.D. Requirement and Circular Letters issued with associated schematic diagrams which fully explain the operation of the installation including at least information on “normal”, “fire”, and “no

power", modes as well as a fully written description thereof.

b) The Contractor shall submit proposal and list out the procedures for equipment set up, test process and safety precaution necessary for carrying out the hot smoke test. The full set up shall be carefully sized for safe application and simulation of the anticipated interior fire conditions to the building envelope including the dimension of equipment, the estimated quantity of fuel required to suit individual building geometry, acceptable designed fire size, fire load, active fire suppression system and fire growth rate etc.

c) The Contractor shall submit all details, certificates, etc. concerning the accuracy and reliability of all test equipment on item-by-item basis or on a complete system basis.

d) The Contractor shall ensure that the installation of dynamic extraction systems shall be completed; satisfied the design intent and functioning correctly before the final full and demonstration take place with Q.C.D.D.

e) The Contractor shall submit full set of test and functional operation check records to and request for the attendance of Q.C.D.D. Accompanying the records, the submission shall be checked and signed by the Registered Professional Engineer employed by the Contractor stating the Registered Professional Engineer's satisfaction that the installation are operating in accordance with the requirement of Q.CD.D.

f) Full and complete records shall be taken of tests and the results thereof including not less than:

i. Make serial no., type and owner of all instruments used, with a copy of the calibration certificates.

ii. Data on actual measurements taken.

iii. Data on corrected measurement, if any.

iv. Data on resulting air flows.

v. Make serial no., type and use of every device checked.

vi. Date and time of test.

vii. Signature of operator or supervisor and any witness for each test.

viii. Signature on acceptance of whole system by the Registered Professional Engineer.

1.16. HOT SMOKE TEST PREPARATION

The Contractor shall ensure all smoke management system under normal operating mode shall be capable of handling the smoke volume generated during the test under reasonable time period to the satisfaction of the Consultant and Q.C.D.D. Furthermore, the systems in the test compartment shall be operated continuously and shall be under closely monitoring such that no adverse internal environmental conditions caused by air stratification and air velocities are generated.

The format / method / procedures / apparatus of the required operational and functional test for hot smoke test shall be agreed with Q.C.D.D. before any tests be commenced. The hot smoke test shall be used to validate the effectiveness of the smoke removal system against the following and with reference to the latest version of all corresponding international standards (e.g. NFPA 92A).

a) The air flow patterns (i.e. scouring or cross flow effect with low level supply and high level extract).

b) Smoke removal rate.

c) Integration between smoke extraction and detection system.

The Contractor shall provide all test apparatus, equipment and materials for the test that shall include but not limited to the following. The Contractor shall agree with Q.C.D.D. on the detail arrangement and any other extra equipment or apparatus used in performing the test and all details shall be submitted to the Consultant for approval.

a) Smoke generators.

b) Fire chamber.

c) Stainless steel tray load cell; water bath & sand base.

d) Combustion fuel.

e) Temperature monitoring tree.

f) Fire fighting equipment.

g) Safety measures and procedures to be agreed with Q.C.D.D.

Some guidelines for hot smoke test are listed below for reference. The Contractor shall obtain the approval of the Consultant and Q.C.D.D. for the criteria used in respective test.

- **Test Fire Size**: 1MW to 2 MW or as agreed by Q.C.D.D.
- **Minimum Smoke Clear Height**: 2.5m
- **Temperature at Plume & Smoke Layer Interface**: Not less than 10 C below temperature rating of ceiling sprinkler, around 45 C to 50 C
- **Combustion Fuel**: Non-contaminating industrial grade methylated spirit.
- **Smoke Generator**: Non-toxic oil-based Type
- **Safety Measures**: Fire Suppression Equipment & Personnel

1.17. FIRE SAFETY DURING HOT SMOKE TEST

The Contractor shall prepare flowchart & working procedures for the hot smoke test and perform trials runs before the actual testing be conducted with Q.C.D.D. The Contractor shall employ a team of experienced fire fighters / fire watchers to the approval of the Consultant to oversee the test procedure and who shall be present throughout the test. These personnel shall be equipped with full fire fighting apparel including self-contained breathing apparatus, fire extinguisher and charged fire brigade hose.

The Contractor shall employ an auxiliary team of experienced fire fighters to the approval of the Consultant fully equipped with fire fighting apparatus acting as the standby safety officers in order to monitor the impact of smoke movement, cumulative smoke layers and internal temperatures and to take all necessary action to ensure that the test will not generate any adverse effect caused to the observers and damage to the property.

The Consultant or the Contractor can terminate the test if it is considered that continuation of the test may cause damage to the property or may have a great adverse effect to the people inside the building. The Contractor shall re-arrange the hot smoke test at no additional cost until the test is completed to the satisfaction of the Consultant and the Q.C.D.D. The Contractor shall ensure sufficient number of personnel station in appointed position to control the test fire and providing guidance to the observers / attendees. The Contractor shall provide sufficient training to all the Contractor's employees and staff present in the test to aware that prolonged exposure to tracer smoke may cause irritation and breathing difficulties.

The Contractor shall ensure that the temperature of hot smoke plume shall be carefully controlled for not causing damage to building structure and finishing and not triggering the automatic sprinkler system.

1.18. TESTS ON OTHER FIRE SERVICE INSTALLATIONS

Tests on fire service installations other than those in Section A.9 to A.14 shall be in accordance with Q.C.D.D. Requirements, and the approved testing and commissioning procedures proposed by the Contractor and approved by the Consultant. The Contractor shall propose and submit detailed testing and commissioning procedures for all fire service installations for approval by the Consultant where such details of testing and commissioning for pressurization of staircase systems, smoke extraction

system, etc. the testing and commissioning procedures submitted shall be comprehensive and sufficient to demonstrate the functioning and performance of all the systems and equipment.

1.19. FINAL MOCK-UP TEST

Before arranging statutory inspections with Q.C.D.D. the Contractor shall arrange a final mock-up test with the Consultant to demonstrate all the items required for the statutory inspections have been completed and tested to the satisfaction of the Consultant.

Before the final mock-up test, the Contractor shall ensure that all documents required for statutory inspections shall be available on site. Further mock-up tests shall be required if the installation fails to meet with the satisfaction of the Consultant in the test.

The Contractor shall not arrange inspection with Q.C.D.D. till the satisfaction acceptance of the mock-up test by the Consultant.

The Contractor shall allow adequate time in the commissioning and testing program for re-testing of the system in case of failure. The Contractor shall indicate the mock-up test and the inspection by Q.C.D.D. as the milestone events in the critical path program to be submitted to the Consultant at the commencement of the Works.

1.20. FIRE SERVICES DEPARTMENT INSPECTIONS AND WITNESS OF TESTS

Additional tests, where not specified above, shall also be carried out to meet the requirements of the Codes of Practice for Minimum Fire Service Installation and Equipment to the satisfaction of Q.C.D.D. The Contractor shall make all necessary applications to Q.C.D.D. and attend inspections conducted by their representative for the purpose of these tests and inspections. The Contractor shall note that completion of the statutory inspection and acceptance if the fire service installation by Q.C.D.D. is one of the considerations for certifying the completion of the Works.

1.21. TESTING OF FIRE SERVICE INSTALLATION NOT INSTALLED BY REGISTERED FIRE SERVICE CONTRACTOR OR INSTALLED BY OTHERS

The Contractor shall carry out and allow the cost for inspecting, checking, witnessing the finals tests and coordinating all fire service installation and equipment and meet the requirement of Q.C.D.D. in a particular project not installed by a registered fire service contractor and/or installed by others, and to identify any non-compliance of the installation with the Q.C.D.D. Requirement. Any works found not complying with the fire service requirement of Q.C.D.D. shall be rectified when they are included in the Works or be reported to the Consultant when such works are carried out by others before arranging inspection with Q.C.D.D. The inspection, checking and witnessing the final tests on works by other shall be confined only to those items that are required for inspection by Q.C.D.D. and/or required to satisfy the requirement of Q.C.D.D.

The Contractor shall co-ordinate on the inspection, checking and witnessing the final testing of the fire service installations and equipment after completion by relevant parties. Upon completion of the testing certified by relevant parties and with no non-compliance found by the Contractor, the Contractor shall co-ordinate, obtain the drawings and information from relevant parties and include all fire service installations and equipment, related fire service installations and related fire service provisions in the submission to the Q.C.D.D. for comment and inspection.

Where some fire service works in a particular project are carried out by other registered fire service contractors, the Contractor shall be responsible to co-ordinate with relevant parties to confirm the completion of the installation and testing of such fire service works and to include them in the submission to Q.C.D.D. for comment and inspection.

1.22. CLEANING OF DETECTORS

The Contractor shall allow where necessary cleaning of all the detectors using manufacturers'

recommended methods before the test as well as before inspection by Q.C.D.D. Before the time of test and during building construction, the Contractor shall supply and install suitable protection to the detectors to protect them from dirt and dusts after they are installed. After inspection by the Q.C.D.D. the Contractor shall further allow to take down and clean “in-situ” and test if necessary, all the detectors in accordance with manufacturer’s recommendation at completion of the Works at the time when the users of the building will occupy the building.

The Contractor shall co-ordinate on the time program for carrying out such cleaning work and shall obtain the approval of the Consultant on the program especially when the users of the building may arrange fitting-out works. Cleaning of detectors carrying out without notifying the Consultant shall not be accepted and the Contractor shall be required to clean the detectors again no matter whether they have done so or not.

1.23. COMMISSIONING AND TESTING REPORT AND CERTIFICATE OF COMPLETION

All commissioning and testing results shall be properly recorded during commissioning and testing at the witness of the Consultant. Immediately after the commissioning and testing, the Contractor shall endorse the data record sheet on site with endorsement by the Consultant representative witnessing the commissioning and testing, irrespective whether the test are successful or not, and submit a copy of the data record sheet to the Consultant. A full commissioning and testing report shall forwarded to the Consultant within fourteen (14) calendar days after completion of commissioning and testing of the installation. The report shall be and the checklist required by Q.C.D.D. The report shall be checked, verified, certified and signed by the Registered Professional Engineer in the State of Qatar approved by the Consultant for minor installation, be checked, verified, certified and sign by a staff of the Contractor having the highest professional /technical qualification within the Contractor’s company. And shall check, verify, certify, and sign the report before the endorsement by the Registered Professional Engineer. Different parts of the report shall also be signed and certified by relevant parties such as registered electrical contractors/workers employed for the electrical fire service installation/electrical installation, registered professional engineers employed for the smoke extraction system, pressurization of staircases, hot smoke test and emergency generators, relevant contractors of related fire service installation and related fire service provisions, qualified persons for the surveyor certificates, design engineers as appropriate, independent checker where provided, etc. the commissioning and testing report shall also be included as an appendix in the operation and maintenance manual.

Together with these, a certificate of completion signed by the Contractor shall be issued to the Consultant with a copy forwarded to the Director of Q.C.D.D.

1.24. COMPLETION OF OUTSTANDING WORKS

Within one month of receiving the Consultant’s substantial completion certificate, the Contractor shall complete all outstanding works listed thereon and rectify any defects that have arisen up to that time.

2.0 MAINTENANCE DURING MAINTENANCE PERIOD AND FINAL TESTING

2.1. GENERAL MAINTENANCE REQUIREMENTS

The Contractor shall furnish free maintenance services for the complete fire service installation for the whole Maintenance Period unless otherwise specified. This free maintenance services shall include the following:

a) Routine quarterly inspections, tests and maintenance services, and routine inspections, tests and maintenance services as necessary.

b) Emergency inspections, tests and repairs.

c) Final inspections, tests and maintenance services, and annual inspections, tests and maintenance services.

d) All the services and requirements in Section I.

All inspections, tests, maintenance services and repairs shall be carried out generally in accordance with the manufacturers' recommendations/instructions and to the satisfaction of the Consultant. The maintenance service is to maintain the fire service installation in a good and functional working condition. The maintenance service shall include preventive maintenance and all spare parts and spares required in the Maintenance Period.

The Contractor shall dispatch competent and experienced engineers and technicians equipped with the appropriate testing instruments, tools, equipment, etc. to inspect service, test, adjust and maintain the fire service installation in a satisfactory operating condition. The Contractor shall allow for carrying out such inspection, service, testing, adjustment and maintenance at a time outside normal office hours including general holidays where and when required. The Contractor shall submit a list with at least two names, telephone and numbers and addresses of the Contractor's English speaking and Arabic – speaking representative to who services calls should be directed.

Particularly in the case of complex fire service installation, the Contractor shall provide at least two senior servicemen being thoroughly familiarized with all aspects of such installation to be responsible for inspection, maintenance and testing of the installation. In this type of installation the Contractor must be prepared to provide a high level of service, allowing for more frequent service of environmentally sensitive equipment and when necessary, to ensure prompt rectification of the faults resulting in unacceptably high rate of unwanted alarms all at the expenses of the Contractor.

All labor and materials necessary, e.g. fire alarm contacts, detectors, bells, buzzers, lamp bulbs, etc., including cleaning materials, lubricants, battery electrotype, tools, instruments, replacement of parts, etc., and transportation required for carrying out routine and emergency inspections, tests, repairs, replacement and maintenance services shall be included in the Contract. Any renewals or repairs necessitated by reason of negligence or misuse of the equipment or by reason of any other cause beyond the Contractor's control (with the exception of ordinary wear and tear) shall be carried out at an additional cost with prior notice to the Consultant.

The Contractor shall also replenish at the Contractor's own cost all fire extinguishing media and other materials expended or used during the tests including diesel or petrol fuel and ensure that the entire installation are in a satisfactory operational condition at the conclusion of each visit.

The Contractor shall be responsible for all repairs necessary to maintain the fire service installation in a safe, reliable and operative condition at all times. The Contractor must ensure that the Contractor's servicing staff shall carry out the necessary repairs by utilizing manufacturer's original replacement parts. Any component taken down for services shall be reinstated within two (2) hours or otherwise replaced by a spare unit at the Contractor's expenses.

The Contractor shall ensure minimum interruption to the functioning of the fire service installation during each inspection, testing, repair or maintenance service. The Contractor shall inform Q.C.D.D. of the commencement and completion of each job whenever the disconnection, reconnection or testing of the fire service communication direct line is involved. Where any part of the fire service installation is out of service temporarily during the progress of work, the Contractor shall place a suitable notice in a prominent position on the control panel so that the client is aware of the situation and the Q.C.D.D. will not be called out unnecessarily. This is, however, not to be construed as an authority to leave any part inoperative for an undue length of time.

The Contractor shall, as and when instructed by the Consultant, repair or replace at the Contractor's own cost any part of the system proved to be defective by reason of Contractor's negligence, faulty design, inadequate routine maintenance and supervision, workmanship or materials. No claim such repair or replacement if it is within the scope of the Contractor's responsibility.

After each routine quarterly inspection, testing and maintenance service, the Contractor shall furnish to the Consultant within fourteen (14) calendar days report complete with the following details:

a) Date and time of inspection, testing and maintenance service.

b) Persons carrying out the task.

c) Details of inspection and maintenance service.

d) Results of all tests performed.

e) Any external factors significantly affecting the service and test results.

f) Any follow-up actions as required.

g) The record of all fault callout in Section 2.2 since last routine quarterly inspection, testing and maintenance service.

h) The record of the fire alarm direct link being temporarily disconnected since last routine quarterly inspection with date and time.

The Contractor shall, at the Contractor's own expenses, make all suitable arrangements to avoid damage too properly or installations provided by others during the course of the Works. The Contractor shall be responsible for all losses and claims for injury or damage to any person or property arises out of or in consequence of the execution of the maintenance work.

A log book shall be provided by the Contractor and retained in the fire service plant room, fire control centre, management office or building supervisor's office as approved by the Consultant for recording all events for the fire service installation in the Maintenance Period. The Contractor shall record all the details of operation: faults and corrective actions taken, routine servicing, maintenance and periodic operation, inspection, testing, results, actions, etc. including dates, time of calls, time of attending, hour meter readings, cause of faults, time to remove faults, workers/supervisors names and signatures, location and identification of faults, description of equipment serviced, etc. for all the fire service equipment, materials, system and installation. The Contractor shall also record the date, time and period on any temporary disconnection of the fire alarm direct link in the log book and in the routine quarterly report submitted to the Consultant.

Where fire retardant paint or spray are applied on site to any surface to meet with requirements of the rate of surface spread of flame, the fire retardant paint/spray shall be repainted at the end of maintenance Period.

The Contractor shall carry the final inspection, testing and maintenance of the fire service installation at the end of the Maintenance Period. Where the Maintenance Period is longer than one, the Contractor shall also carry out annual inspection, testing and maintenance of the fire service installation annually in the Maintenance Period complying with the requirement of Q.C.D.D. the requirements of annual inspection, testing and maintenance shall be the same as that of the final inspection, test and maintenance unless otherwise required by Q.C.D.D.

2.2. EMERGENCY INSPECTIONS, TESTS AND REPAIRS

Emergency service including overtime work for minor repairs and adjustments shall be included under the Contract.

The Contractor shall be responsible for immediate answering of breakdown calls during the day or night including public holidays, whether true or false, and attention to such calls both inside and outside the normal working hours in the shortest possible time and using quickest means of transport. In general a response time of less than one (1) hour will be expected unless special arrangement is made and approved for very remote locations.

Any necessary repair shall be carried out with the most practicably expeditious means to ensure minimum interruption to the operation of the fire service installation.

The Contractor shall arrange to refill the gas cylinders for the gaseous extinguishing system upon discharge and put the system into normal operation within a time as short as possible but in no case shall be longer than seven (7) calendar days. Unless otherwise there are evidences that the discharge of gases in the gaseous extinguishing system is due to a fire, smoke that generated a fire alarm, or the default operation/act of the occupiers of the building, the cost for refilling the gas cylinders of the gaseous extinguishing systems after discharge in the Maintenance Period shall be borne by the

Contractor.

The Contractor shall keep a clear and legible record of all fault callouts and shall submit this record within three (3) calendar days upon request by the Consultant for inspection. The Contractor shall also include the record of all fault callouts in the report in Section C2.1 submitted after each routine quarterly inspection, testing and maintenance service. The record shall indicate the date, time of callout, time of attending, persons attending, brief description of the fault, location/identification of fault, cause of fault, and subsequent time of clearance for each occasion. The record will be submitted and kept by the Consultant at the end of the Maintenance Period during the handover inspection of the installation.

2.3. ROUTINE QUARTERLY INSPECTION, TESTING AND MAINTENANCE OF FIRE DETECTION AND ALARM SYSTEM

The Contractor shall visit the installation at least once every three months to carry out tests, repairs and adjustment. All environmentally sensitive devices, e.g. smoke and heat detectors, air filters at the end of the probes for duct type detectors, electronic sensors, relay contacts, plug and socket contacts, printed circuit boards, edge connectors, etc. shall be inspected, cleaned, adjusted, and calibrated. During the visits, the following tests and checks shall be made:

a) A test sequence shall be carried out in accordance with the manufacturer's instructions. The test sequence shall prove:

b) That the condition of the wiring, controls and indicating equipment of all zone circuits are in good working order.

c) That the alarm condition on each zone will activate the common alarm circuits. If the manual call points are fitted the alarm condition shall also be initiated by the operation of one such call point in each zone. A different manual call point shall be used on each occasion and a record must be kept by the Contractor.

d) That activating the common alarm circuits will result in the operation of the alarm bells and satisfactory transmission of the alarm signal to Q.C.D.D. agency if equipped with a fire alarm direct line connection.

e) That activating the common alarm circuits will result in the starting/stopping of the ventilating fans and/or fire booster pumps as desired and result in the operation of any lift, if control circuits for such operation are provided in the system

The operation of alarm bells and the transmission of the alarm signal may be suppressed during tests (a) and (b). Test (c) and (d) will prove that all system alarms and relevant control are operating correctly.

In the course of the test sequence, the correct operation of all indicators including fault warnings and all alarm bells shall be noted and checked. All indicating lamps shall be checked and if found defective shall be replaced by the Contractor at the Contractor's own expenses.

About 20% of the detectors chosen at random with at least one unit in each zone shall be subjected to a simulated functional test. Smoke detectors shall be tested with simulated smoke and rate-of-rise heat detectors with an artificial heat source, e.g. hair dryer.

Battery and chargers shall be examined and tested to ensure are in good and proper serviceable condition. Battery terminals and connectors shall be tightened and the former shall be cleaned and protected with petroleum jelly. Electrolyte shall be topped up as necessary and its specific gravity shall be measured and corrected to the appropriate value if required. Battery shall also be discharged and recharged to ensure compliance with the specified requirements.

When false alarm from the fire detection system is reported in the Maintenance Period, the Contractor shall take down, clean 'in-situ' and test all detectors in the Works irrespective whether such detectors have caused the alarm. All detectors that cannot pass the test or cannot be cleaned shall be replaced with new one at the cost of the Contractor. Where the detectors are required to be factory-cleaned, all detectors removed for factory cleaning shall be replaced with spare units to cover the unprotected areas as resulted. All the expenses for the above work shall be borne by the Contractor. The Contractor shall

check and re-adjust the setting of the detector and control panel as necessary.

The Contractor shall also check and identify the causes of the alarm and submit a full report to the Consultant. All faults shall be rectified immediately to the satisfaction of the Consultant and Q.C.D.D. Unwanted alarm that is the alarm caused by uncommon human activities in the area at the time of alarm such as welding, smoking, etc. will not be counted as false alarm. All other alarm with or without known reason except true fire alarm shall be taken as false alarm. All alarms reported shall be recorded in the log book and in the routine quarterly report submitted to the Consultant.

2.4. FINAL/ANNUAL INSPECTION, TESTING AND MAINTENANCE OF FIRE DETECTION AND ALARM SYSTEM

At the final/annual inspection, the Contractor shall, in addition to the quarterly inspection and testing, take down all smoke detectors, clean them 'in-situ' in accordance with the manufacturer's instructions, test them for correct operation with the manufacturer's test set before reinstate them for service. Any defective detectors shall be replaced or 'factory cleaned' to the manufacturer's recommendation before reinstated for service. Any smoke detectors subjected to dust and dirt accumulation shall also be dispatched for factory cleaning as instructed by the Consultant. All detectors removed for factory cleaning shall be replaced with spare units or alternatively a separate surveillance system shall be supplied and installed to cover the unprotected areas as resulted. All expenses for the above work shall be borne by the Contractor. All equipment reaching expiry date of service life shall be replaced.

2.5. ROUTINE QUARTERLY INSPECTION, TESTING AND MAINTENANCE OF GASEOUS EXTINGUISHING SYSTEM

The Contractor shall visit each installation at least once every three months and carry out the following tests including necessary repairs and adjustments:

a) All electrical components, cables, detectors, relays, alarm panel and bells, batteries, etc. shall be tested and examined as specified in Section B.3.

b) All automatic/manual release mechanism shall be checked and serviced in accordance with the manufacturer's instruction to ensure their proper operation. The Contractor shall be responsible for ensuring that all such mechanism are properly lubricated and kept free from corrosion.

c) All pipes and fittings shall be checked for leakage and corrosion and repaired or repainted as necessary. All valves shall be checked for freedom of operation and nozzles shall be cleaned by removing the dust, dirt and other obstacles deposited on them.

d) All cylinders containing the chemical extinguishing agents shall be checked to ensure that the contents are up to the specified standards and are so marked with paint on the outside of cylinders. The Contractor shall recharge any cylinders to the specified content level I carbon dioxide cylinders are found to exhibit a 10% loss and other gas cylinders a 5% loss of content by weight except where the discharge (usually total) is due to genuine fire, false alarm or accident caused by others. However, where the discharge is due to a faulty detector or other part of the equipment the Contractor shall recharge the system at the Contractor's own expenses.

e) All warning notices and operating instructions shall be checked to ensure that they are fixed in the proper position, are in a readable condition and are both in English and Chinese unless otherwise confirmed in writing by the Consultant.

f) All time delay and lock-off devices shall be inspected and tested to ensure that they are in correct working condition.

g) The coincident unit shall be checked for proper function by actuating detectors of two separate zones.

h) All ancillary functions of the system such as shutting off air-conditioning/ventilation plant, lowering fire shutters/dampers or curtains, etc. shall be checked for proper operation.

2.6. FINAL/ANNUAL INSPECTION, TESTING AND MAINTENANCE OF GASEOUS

EXTINGUISHING SYSTEMS

The Contractor shall carry out the same amount of work as the quarterly inspection, testing and maintenance services. All equipment reaching expiry date of service life.

2.7. ROUTINE QUARTERLY INSPECTION, TESTING AND MAINTENANCE OF FIXED FIRE PROTECTION SYSTEM USING WATER AS AN EXTNGUISHING AGENT

The Contractor shall visit the installation at least once every three months and carry out the following inspections, tests, adjustment and repairs:

a) All electrical components including cables, alarm panel and bells, batteries, control relays, starters, etc. shall be inspected and tested as specified in Section B.3.

b) All pipes and fittings shall be checked for leakage and corrosion and repaired or repainted as necessary. All valves shall be checked for freedom of operation, all control valve kept locked in the 'open' position by strapping as applicable, inlet valves correctly bonded to earth, water supplies maintained in service, etc.

c) Inspection shall be carried out to ensure that all sprinkler heads are maintained in good working condition, clean and free from corrosion and are not covered with distemper, paint, dust, fluff, etc. any sprinkler heads found defective and suspected of being defective shall be replaced.

d) Water and air pressure gauges must be inspected to ensure that correct pressures are maintained. Gauges shall be calibrated at regular intervals. Water levels and air pressure in pressure tanks must be checked to ensure that they are maintained in proper condition.

e) An alarm test shall be made on the sprinkler system by opening the test valve and the time taken to sound the alarm gong noted. The alarm shall be allowed to ring for about thirty (30) seconds in order to ascertain that it is not ringing intermittently. Any repairs or adjustments which may prove to be necessary after the test shall be carried out with no delays.

f) All metallic elevated, priming and pressure tanks constructed by the Contractor shall be inspected for sediments, rust and corrosion. The Contractor shall remove sediments, rust and repaint the corroded parts as necessary.

g) The Contractor shall grease the valves, the bearing and other relevant mechanical parts of the pumps, motors and engines as recommended by the manufacturers. An automatic pump starting test and a test run of at least 10 min. shall be performed on each pump to ensure the pumping system are in satisfactory operating condition. Engine driven pumps shall be capable of starting in 30 sec. or less. All Manual and automatic starting and control mechanism, components, switches, etc. shall be checked for proper functioning.

h) All sprinkler flow switches shall be checked for correct functioning.

The Contractor shall replace as required all parts such as bearings, valve sets, packing, etc. due to wear and tear. In addition the Contractor shall maintain in good working order the engines, the motor and the electrical power supply to the pumps form its electrical isolator or switch, including changeover switches, starters, fixed and flexible conduits between isolator/switch and cables therein. The Contractor shall also maintain all pump control pressure and level switches in good order and inspect circuitry as previously indicated for electrical systems.

2.8. FINAL/ANNUAL INSPECTION, TESTING AND MAINTENANCE OF FIXED FIRE PROTECTION SYSTEM USING WATER AS AN EXTINGUISHING AGENT

At the final/annual inspection, the Contractor shall, in addition to the quarterly inspection and testing, carry out the following inspections, tests, adjustment and repairs as required:

a) Inspection and testing, by means of wet drill on the hydrant and hose reel installation, shall be carried out in accordance with the Fire Services Department requirements. The wet drill shall consist of coupling lengths of hose to two or more hydrants and opening the valve to produce water at the nozzles. Great care and precise liaison with all concerned must be exercised by the

Contractor to guards against flooding and seepage of water. The Contractor shall be liable to bear the full cost of any damage due to flooding and seepage. Hydrant not used at the wet drill shall each be fitted with a blank cap over the outlet, and checked by opening and closing the valve and spindle to ensure that they are free in operation.

Testing of the pressure and flow of the water supply on the hydrant and hose reel installation shall be done from the outlets at the highest point. The opening of two or more outlets and directing the water from the roof tank is sufficient to indicate the state of the water supply, but if there is any doubt as to the flow or pressure of the water, a more accurate test with suitable gauges shall be carried out.

b) Each length of hose shall be uncoiled, laid out straight and examined, particular care being taken to see that the washers in the female couplings are intact and in good condition and that the hose is not damp or attacked by mildew.

c) Each water supply to the sprinkler installation shall be tested individually. Before making the test on any one water supply, it is necessary to shut off all the other supplies. The test shall be made with the drain and test valves fully open in accordance with the requirement of the LPC Rules for Sprinkler Installation.

d) After shutting off all water supplies and draining the installation via the flow test/drain valve, the Contractor shall remove the sprinkler control valve front cover to inspect and maintain its internal components. The work shall include checking the freedom of movement of the main clapper assembly and cleaning as required, greasing and replacing worn seals and gaskets, replacing all valve glands as necessary and replacing any worn seats in small bore valves, etc. The sprinkler control valve front cover shall then be replaced and the installation shall be re-commissioned.

e) The concrete water tanks constructed by the builder shall be inspected for rusting and sediments. The Contractor shall inform the Consultant in writing if any cleaning and rectification on the tanks are necessary.

2.9. ROUTINE WEEKLY/MONTHLY INSPECTION, TESTING AND MAINTENANCE OF EMERGENCY LIGHTING AND EXIT SIGNS

The Contractor shall visit each installation at least once every month (or once every week if weekly voltage test on emergency luminaries is involved) and carry out the following tests including necessary repairs and adjustment:

a) Each self-contained luminaries and internally illuminated exit sign shall be energized from its battery by simulation of a failure of the supply to the normal lighting for a period of at least one (1) minute at 10-hour discharge rate and sufficient to ensure that each lamp is illuminated. The period of simulated failure shall not exceed one quarter of the rated duration of the fully charged battery or sign. During this period all luminaries and/or signs shall be examined and tested in accordance with BS 5266 to ensure that they are functioning correctly. At the end of this test period the supply to the normal lighting shall be restored and any indicator lamp or device checked to ensure that it is showing that the normal supply has been restored.

b) Each central battery system shall be energized form its battery by simulation of failure of the supply to the normal lighting for a period of at least one (1) minute at 10-hour discharge rate and sufficient to ensure that each lamp is illuminated. The period of simulated failure shall not exceed one quarter of the rated duration of the fully charged battery. During this period all luminaries and/or signs shall be examined and tested in accordance with BS 5266 to ensure that they are functioning correctly. All tests required in the Code of Practice for Minimum fire Service Installations and Equipment shall be carried out and recorded. At the end of this period the

supply to the normal lighting shall be restored and any indicator lamp or device checked to ensure that it is showing that the normal supply has been restored.

c) For emergency lighting system backed up by emergency generators, the emergency lighting shall be tested during on-load test of the emergency generator. After the emergency generator was started up, it shall be allowed to energize the emergency lighting system for a continuous period of at least one (1) minute and sufficient to ensure that each lamp is illuminated. During this period all luminaries and/or signs shall be examined visually to ensure that they are functioning correctly. At the end of this test period the normal supply to the lighting shall be restored and any indicator lamp or device checked to ensure that it is showing that the normal supply has been restored.

d) Where central battery system is supplied and installed, the Contractor shall in addition visit the installation at least once every week and carry out weekly voltage and hydrometer test.

2.10. FINAL /ANNUAL INSPECTION, TESTING AND MAINTENANCE OF EMERGENCY LIGHTING AND EXIT SIGNS

The Contractor shall carry out the following tests annually and at the end of the Maintenance Period including necessary repairs and adjustments:

a) Each self-contained luminaries and internally illuminated exit sign shall be energized form its battery by simulation of a failure of the normal supply to the lighting for a continuous period of half of the rated duration of the fully charged battery. During this period all luminaries and/or signs shall be examined and tested in accordance with BS 5266 to ensure that they are functioning correctly. At the end of this test period the normal supply to the lighting shall be restored and any indicator lamp or device checked to ensure that it is showing that the normal supply has been restored.

b) Each central battery system shall be energized from its battery by simulation of a failure of the normal supply to the lighting for a continuous period of half of the rated duration of the fully charged battery. During this period all luminaries and/or signs shall be examined and tested in accordance with BS 5266 to ensure that they are functioning correctly. All tests required in the Code of Practice for Minimum Fire Service Installation and Equipment and Inspection, testing and Maintenance of Installation and Equipment shall be carried out and recorded. At the end of this test period the normal supply to ensure that it is showing that the normal supply has been restored.

c) For those emergencies lighting system backed up by emergency generators, the emergency lighting shall be tested during on-load test of the emergency generator. After the emergency generator was started up, it shall be allowed to energize the emergency lighting system for a continuous period of at least ten (10) minutes. During this period all luminaries and/or signs shall be examined visually to ensure that they are functioning correctly. The test shall be repeated for five (5) minutes with the emergency generator shut off and the lighting supplied by the battery system only. At the end of the test period the normal supply to the lighting shall be restored and any indicator lamp or device checked to ensure that it is showing that the normal supply has been restored. The fuel tanks shall be filled up and the oil and the coolant levels topped up as necessary.

Where the emergency lighting installation and/or exit are not included in the Works under Fire Service Installation, the Contractor shall co-ordinate with relevant parties and collects the information on the final/annual inspection/testing on emergency lighting installation/exit signs to confirm their compliance with the requirements of the FSD. Any works found not complying with the fire service requirement of the FSD shall be reported to the Consultant.

All equipment reaching expiry date of service life shall be replaced.

2.11. ROUTINE MONTHLY INSPECTION, TESTING AND MAINTENANCE OF EMERGENCY GENERATORS

The Contractor shall visit each installation at least once every month and carry out the following tests including necessary repairs and adjustment:

a) The emergency generator shall be run once per month under design load conditions for a period of not less than thirty (30) minutes. During this running period all operating conditions shall be checked. Following this running period functional tests shall be carried out on all automatic and manual starting devices and safety controls.

b) The Contractor shall record all the details of operation: faults and corrective actions taken, routine servicing, maintenance and periodic operation, inspection, testing, results, actions, etc.; including dates, time of calls, time of attending, hour meter readings, cause of faults, time to remove fault, workers/supervisors names and signatures, location and identification of faults, description of equipment serviced, etc. in the log book in section I.1 for the unit, batteries, compressors, etc.

2.12. FINAL/ANNUAL INSPECTION, TESTING AND MAINTENANCE OF EMERGENCY GENERATORS

The Contractor shall carry out the following tests including necessary repairs and adjustments:

The emergency generator shall be run under design load conditions for a period of one (1) hour. During this running period all operating conditions shall be checked. Following this running period functional tests shall be carried out on all automatic and manual starting devices and safety controls' Where the emergency generator installation is not included in the Works under Fire Service Installation, the Contractor shall co-ordinate with relevant parties and collects the information on the final/annual inspection/testing on the emergency generator and on all fire service installations and equipment using the emergency generator power supply to confirm their compliance with the requirements of the Q.C.D.D. Any works found not complying with the fire service requirement of the Q.C.D.D. shall be reported to the Consultant.

2.13. QUARTERLY AND FINAL/ANNUAL INSPECTION AND MAINTENANCE OF PORTABLE FIRE EXTINGUISHERS

Portable fire extinguishers and appliances supplied and installed by the Contractor shall be inspected and checked quarterly to ensure that they are in good working condition. Any extinguisher and appliances found not in proper working condition shall be reconditioned and/or recharged/replaced to the required standard. All equipment reaching expiry date of service life shall be replaced.