SECTION 3.7 TECHNICAL SPECIFICATION FOR TOTAL FLOODING FIRE EXTINGUISHING SYSTEM

1 GENERAL

The designated area shall be protected by the total flooding fire extinguishing system incorporating with automatic alarm fire detection and suppression system.

2 DESIGN STANDARDS AND VERIFICATIONS

The agent shall be approved by Jabatan Bomba dan Penyelamat Malaysia for normally occupied area.

2.1 Comply with the following Codes and Authorities:

i) Listed by NFPA 2001 (Clean Agent Fire Extinguishing System) or NFPA 2010 (Aerosol System).

ii) BS EN 15004-1:2008; Gas extinguishing systems – Design, installation and maintenance.

iii) MS ISO 14520; Gases Fire Extinguishing System Physical Properties and System Design.

iv) Jabatan Bomba dan Penyelamat Malaysia.

2.2 The agent shall satisfy the following requirements:

i) Gaseous fire extinguishant that does not leave a residue upon evaporation.

ii) Gaseous fire extinguishant that does not react, corrode and damage the apparatus, equipment and system in place and certified by manufacturer.

iii) Electrically non-conducting.

iv) Where Oxygen Depletion is used as means of extinguishing fire the minimum oxygen level shall be greater than 10%.

v) Maximum exposure time of not longer than 3 minutes.

vi) Tenaga Nasional Berhad (TNB) – applicable for use at TNB Sub-Station.

The designed system components and the installed system shall be according to pre-tested limitations as approved or listed by a recognised testing laboratory.

Submittals:

(1) Detailed and dimensioned design drawings.
(2) Data of equipment and manufacturer's catalogues.
(3) Calculation data sheet.
(4) Permits and Approval by relevant authorities.

3 APPOINTMENT OF APPROVED SUPPLIER/MANUFACTURER

The contractor shall appoint a supplier**/**manufacturer approved by Jabatan Bomba dan Penyelamat Malaysia to supply the specific agent and experienced in the specific area as required by the government.

The approved supplier/manufacturer shall be responsible for the approval of **design, supervision** and **testing** of the system.

The contractor shall take full and unequivocal responsibility for the suitability, functionality, maintainability and safety of the design and for the adequacy, stability and safety of all site operations and methods of construction.

4 SYSTEM DESIGN

The contractor at design stage shall consider and address possible fire hazards within the protected area. The proposed total flooding fire extinguishing system shall provide the highest degree of fire protection for designated areas.

The installation shall be designed and installed for extinguishing of fire in accordance with approved standards.

The quantity of extinguishing agent shall be sufficient to ensure rapid extinction of any fire in the protected areas and with adequate spare capacity.

The agent shall be discharged within a nominal discharge time of not exceeding 60 seconds upon activation of the container valve.

All devices shall be designed for the service encountered and shall not be readily rendered inoperative or susceptible to accidental operation. They shall be located, installed or suitably protected against mechanical, chemical or other damage, which may render them inoperative.

All devices for shutting down supplementary equipment shall be considered integral parts of the system and shall function with system operation.

Each system shall have its own pipe and nozzle. If hazard require more than one container, all systems protecting the same hazard area are actuated simultaneously.

All total flooding containers should be located as close to the protected hazard area as possible. The containers shall be located in an environment protected from the weather.

The cylinders shall be mounted in rows and installed in a suitable location as shown in the drawings.

The total flooding agent shall be filled in to the storage cylinders according to the manufacturer's filling instruction.

If the protected volume has a floor or ceiling void, the spaces shall be included in the protected volume, employing a minimum design concentration not below that of the main room compartment.

The protected volume shall be of adequate tightness to retain the design concentration according to the requirements of the relevant authority.

5 ENCLOSURE

The enclosure shall be of adequate integrity to retain the design concentration for a required minimum holding time. The area of unclosable openings shall be kept to a minimum.

To prevent loss of agent through openings to adjacent hazards or work areas, opening shall be permanently sealed or equipped with automatic closures. The false ceiling space, room and floor void (conceal space exceeding 800 mm) shall be protected with the total flooding fire extinguishing system.

6 SYSTEM OPERATION

The system shall be able to perform independently via the interlocking automatic detection system as well as manual actuation under emergency situation.

The automatic detection system shall comprise cross-zone detection to activate before activation of the total flooding fire extinguishing system. The Contractor shall provide all switchboard and necessary relay for alarm connection to Main Fire Alarm Panel (MFAP).

Upon activation of the total flooding fire extinguishing system, it shall cut off the operation of the air-conditioning system. The Contractor shall provide and connect all the necessary controls, relay, cable, conduit, etc to effect this interlocking operation.

The system shall operate from an output voltage of 240V AC, 50Hz supplied to the power charger module within the switchboard panel. This voltage is transformed and rectified within the panel to 24V DC. A 24V DC nickel-cadmium standby battery need to be provided in case of mains voltage failure. This battery will automatically and instantaneously be switched into use as soon as the mains supply fails. Such a failure shall be indicated both visually and audibly at the panel. The battery shall be trickle charged during normal operating conditions.

The system shall consist of two or more combination heat and smoke detectors. When one of these detectors goes into the alarm condition, a signal lamp on the detector's body will illuminate as well as the fire lamp on the control panel and audible warning will be given via the alarm bell.

In order to discharge the extinguishing agent automatically, both smoke and heat detectors must be activated (double knock). This mode of operation obviates the possibility of false discharge due to one detector operating to conditions which are regarded as normal.

A disconnection to the detector circuit wiring would be indicated as a fault at the switchboard panel both visually and audibly by a fault lamp and buzzer. Remote indication of alarm and fault conditions shall be provided at the master alarm and indicator panel.

Each system shall have a permanent name plate specifying the agent, number, gross weight/filling weight/nominal agent volume and the pressurization level of the containers.

All containers supplying the same manifold outlet for distribution of agent shall be interchangeable and of one selected size and charge where applicable.

7 SYSTEM EQUIPMENTS

The system equipment offered shall be a complete system supplied from one manufacturer. Otherwise, the manufacturer/supplier shall submit letter of undertaking to provide the technical support and be responsible for all system compatibility and performance.

7.1 Containers

Agent shall be stored in containers designed to hold that specific agent at ambient temperature. The design pressure shall be suitable for the maximum pressure developed at 55 °C or at the maximum controlled temperature limit.

The containers used in the system shall be designed, fabricated, inspected, certified and stamped in accordance with section VIII of the ASME *Boiler and Pressure Vessel Code*.

Storage containers and accessories shall be located and arranged so that inspection, testing, recharging and other maintenance activities are facilitated and interruption of protection is held to a minimum.

Each container shall have a permanent name plate specifying the number, filling weight and the pressurization level.

7.2 Discharge Nozzle

Discharge nozzles shall be listed for the intended use. Listing criteria shall include flow characteristics, area coverage, height limits and minimum pressures. Discharge orifices and discharge orifice plates and inserts shall be of a material that is corrosion resistant to the agent used and the atmosphere in the intended application.

Special corrosion-resistant materials or coatings shall be required in severely corrosive atmospheres. Discharge nozzles shall be permanently marked to identify the manufacturer as well as the type and size of the orifice.

7.3 Pipework and Fittings

Material of pipework and fittings to be as specified below:-

Item	Pipe Size (mm)	Material
Pipe	above 20mm	Carbon steel to BS 3602-2:1991 Grade 410 Schedule 80 or API Schedule 80
	20mm and below	Carbon steel to BS 3602-2:1991 Grade 410 Schedule 40 or API Schedule 40
Fitting	All sizes	Forged Steel to BS 3799:1974

All valves shall be listed or approved for the intended use.

All gaskets, o-rings, sealants and other valve components shall be constructed of materials that are compatible with the agent. Valves shall be protected against mechanical, chemical or other damage.

7.3.1 Piping Installation

Cutting of pipes to be carried out with pipe cutters and thread tapings to be done with proper dies.

All bends before connection to any equipment to be suitably anchored and the supports, guides, brackets, etc. to be adequately fastened to the structure by means of concrete inserts or expansion type devices.

7.3.2 Pipe Arrangement

Typical arrangement of pipe shall be as per drawing.

For pipe hanger below the roof shall be fixed to steel bar of suitable size and provided by the contractor.

7.4 Automatic Detectors

Provide heat and smoke detectors in duel circuit in the hazard area as shown in the Tender Drawings.

7.4.1 Heat Detector

The type and class of heat detectors shall be as indicated in the Schedule of Design Requirements twin circuited type.

Fixed Temperature Heat Detectors shall comply to BS EN 54-5:2001 (Grade 1 response) and shall be the Thermistor Operated Type with automatic reset upon cooling of the fixed temperature element.

The heat detectors shall be operated either by the bimetallic or fusible alloy ejection type and shall be U.L. or F.M. listed.

The heat detector shall be suitable for ceiling mounted and its casing shall be corrosion resistant.

The detector head shall be installed in closed or open circuit system with continuous supervision.

All offers of detector shall be supported by copies of the current test certificates from **SIRIM** or recognised laboratory.

7.4.2 Smoke Detector

The smoke detector shall operate on the photo electric principal from a constant power supply and calibrated for detection of 1% - 2% smoke density per U.L and F.M standard. It shall be fully transistors with solid switching and shall fully conform with requirements of BS EN 54-7:2001.

The smoke detector shall be suitable for ceiling mounted and its casing shall be corrosion resistant.

All offers of detector shall be supported by copies of the current test certificates from **SIRIM** or recognised laboratory.

7.5 Remote Manual Control

The remote manual control shall be of a manual pull box and of the 'Break glass' type. The break glass element shall consist of a square tempered glass.

7.6 Audible and Visual Alarms

The audible alarms shall be of the electrically operated dome-type alarm bells, installed on the locations as shown in the Tender Drawings. The bells shall be of robust construction and weather proof. The gong and striker shall be of hardened steel.

Each bell shall have an adequate audible power rating. The gong size shall be a minimum of 150mm.

The bell shall have an operational requirement complying to MS 1745: Part 3 : 2004 or BS EN 54-3 : 2001. The bell shall be minimum 150mm (6") in diameter with pressed steel gong finished in red. The bell shall be the solenoid operated type rated at 24V DC. The sound level produced shall be at least as indicated in the Schedule of Design Requirements.

Clear visual indication shall be provided at each entrance to be protected space to show whether the total flooding fire extinguishing system is on automatic or manual control. Two differently coloured lamps shall be used for the visual indicator above the door of the protected space.

Colour of Lamp	Status
Red	Agent Discharge
Green	Normal

7.7 Warning Signs

All visual and audible warnings and instruction signs at entrances to and inside protected areas to be provided and fixed at prominent positions.

An approved notice with the words "**JANGAN MASUK KE BILIK INI BILA GAS DI LEPASKAN**" to be provided on the door of the room protected by total flooding fire extinguishing system.

7.8 Fire Curtain

Gravity shutters shall be of glass fiber curtain approved by the Jabatan Bomba dan Penyelamat Malaysia, able to withstand temperatures up to 600°C, and shall be installed as indicated in Tender Drawings. The curtains shall be rolled up, weighed and held by mild steel mounting brackets and cable guides c/w tripping device and

24V D.C. actuator for each piece of curtain. On actuation and immediately before the discharge of gas (after confirmed detection or second zone), each curtain shall be released and dropped with the help of gravity such that the full opening of any ventilation louvers, louvered doors, etc. shall be covered to prevent escape of the discharge agent.

7.9 Switchboard Panel

The Contractor shall supply and install the total flooding switchboard panel as detailed in the Tender Drawings. This panel shall incorporate the alarms, indications and controls for the system.

The panel shall be constructed from 18 s.w.g. mild steel sheets, adequately braced and complete with removable panels. The compartments for the storage of batteries shall have adequate vents and corrosion resistant treatment. The panel shall be properly cleaned and phosphate sealed, followed by two coats of baked enamel of standard white colour or other if request by the S.O.

Each alarm circuit shall include distinctive audio (buzzer) and visual signals (indicating lights) for alarm indication and fault indication. Rotary four (4) position "ALARM TEST - NORMAL - ISOLATE - FAULT TEST" switches shall also be incorporated. These control switches and indicating lights shall be mounted on black perspex with white on red engraved lettering to designate each function of the equipment in each zone.

Each visual indication shall consist of dual lamps or dual filament lamps.

The control functions and indication on the panel shall be in accordance to the MS 1745: Part 2 : 2004 or BS EN 54-2 : 1998 and of type approved by Jabatan Bomba Dan Penyelamat Malaysia.

(1) The charger to be able to provide booster and trickle charging. It shall be complete with voltmeter, ammeter, DC fuse and relays. The charger to be capable of charging the fully discharged battery within 24 hours by its normal charging method to a fully charged condition.

(2) In areas where the panel are exposed to weather, the panel to be suitably weather-proofed.

(3) A device shall be incorporated into the system to shutdown any exhaust fans and activate solenoid operated curtains across louvers before discharge

The panel shall be provided with **interfacing unit** to indicate on the MFAP any event of fire.

8 LIGHTNING AND SURGE PROTECTOR

The Contractor shall provide lighting and surge protector for the control panel, fire alarm panels, etc. to protect them from any transient voltage and lightning strike.

9 TOTAL FLOODING'S CONTENT VERIFICATION

To provide verification of total flooding net weight/volume in the system cylinder by using approved weighing apparatus/pressure gauge at the site. Where applicable, the weighting apparatus shall be supplied and sent to the site for total flooding content verification prior to certification of practical completion of systems' installation.

10 TESTING AND COMMISSIONING

The contractor shall inspect all works to ascertain that the protected space(s) have be adequately and properly sealed.

The contractor shall include the cost of the inspection and competent person/body to carry out of test as follows:

(1) Room integrity test
(2) Agent integrity test.
(3) Discharge integrity test.
(4) Component functional test.
(5) Integrity functional test.

where total flooding fire extinguishing system has been installed. The contractor shall be responsible for the success of the above testing and a full written report shall be produced.

The contractor shall take all necessary precautions and safety measure to ensure all equipment and personnel are duly warned and protected. Any damage caused by the discharged shall be made good by the contractor.

11 CERTIFICATION

The Contractor shall provide certificate of approval from organization that is acceptable to the authority having jurisdiction and concerned with evaluation of products or services:

(1) Containers
(2) Manifolds
(3) Actuator
(4) Valve assembly
(5) Pipe and fittings
(6) Discharge nozzles

12 SAMPLE OF MATERIAL FOR SUBMISSION AND APPROVAL

The Contractor shall prepare sample board of typical material proposed to use in the work and/or samples of workmanship (mock up) to the approval of the S.O, prior to commencement of the installation work. The sample board and/or samples of workmanship (mock up) shall comprise of but not limited to the pipe work and fitting, conduit and fittings, cables, hanger and support system, discharge nozzle, fire curtain and etc.

The cost of the sample board or samples of workmanship (mock up) is deemed to be

included in the Contract.

---------- END OF SECTION 3.7 ----------