

**Lampiran 4****KONTRAK PUSAT BAGI PEROLEHAN MEMBEKAL, MEMASANG, MENGUJI DAN MENTAULIAH ALAT PEMADAM API MESRA ALAM AEROHUB® AEROSOL FIRE SUPPRESSION SYSTEM DAN 1MY227 CLEAN AGENT FIRE SUPPRESSION SYSTEM DI BANGUNAN KERAJAAN DI SELURUH SEMENANJUNG MALAYSIA****LATAR BELAKANG**

1. Kementerian Kewangan telah bersetuju memberi kontrak baharu untuk Kontrak Pusat Kementerian Kewangan bagi Alat Pemadam Api Mesra Alam AEROHUB® *Aerosol Fire Suppression System* dan 1MY227 *Clean Agent Fire Suppression System* untuk tempoh selama lima (5) tahun mulai 1 Ogos 2017 hingga 31 Julai 2022 dengan Hub Technologies (M) Sdn Bhd dan selepas ini disebut sebagai Kontraktor.
2. Butiran lengkap Kontraktor adalah seperti berikut:

<b>Syarikat/ No. Kontrak</b>	<b>Alamat/ No. Telefon/ No Faks</b>	<b>Perincian Bank</b>
Hub Technologies (M) Sdn Bhd PERB/PK/1/2017	No. 27, Jalan Sungai Jerluh 32/196, Seksyen 32 40460 Shah Alam Selangor Darul Ehsan  Tel: 03-5525 4422 Faks: 03-5525 4499	RHB Islamic Bank Berhad Cawangan Kota Kemuning No. 1, Ground Floor Jalan Anggerik Vanilla X31/X Kota Kemuning, Seksyen 31 40460 Shah Alam Selangor Darul Ehsan  No Akaun: 26260700004448

**AGENSI PENGGUNA**

3. Agensi pengguna terdiri daripada Kementerian, Jabatan Persekutuan, Kerajaan Negeri, Badan Berkanun Persekutuan dan Pihak Berkuasa Tempatan di Semenanjung Malaysia sahaja tidak termasuk Sabah, Sarawak dan Wilayah Persekutuan Labuan.

**HARGA**

4. Harga adalah dalam Ringgit Malaysia tidak termasuk semua jenis cukai yang dikenakan oleh Kerajaan Malaysia. Kadar harga bagi membekal, memasang, menguji dan mentauliah Alat Pemadam Api Mesra Alam AEROHUB® *Aerosol Fire*

*Suppression System* adalah ditetapkan mengikut isi padu bilik/ kawasan '*normally unoccupied*' sebanyak RM370.00 per meter padu termasuk aksesori dan rekabentuk.

5. Kadar harga bagi membekal, menguji dan mentauliah Alat Pemadam Api 1MY227 *Clean Agent Fire Suppression System* adalah ditetapkan mengikut isi padu bilik/ kawasan '*normally occupied*' sebanyak RM370.00 per meter padu termasuk aksesori dan rekabentuk.

6. Kos-kos yang tidak termasuk di dalam kadar harga kontrak pusat di atas, jika perlu, seperti berikut:

- a. naik taraf bekalan elektrik;
- b. integrasi dengan lain-lain sistem berkaitan (seperti *Main Fire Alarm Panel*);
- c. penghantaran barang (mengikut keperluan khas projek, pulau dan kawasan terpencil);
- d. pemeriksaan tapak;
- e. insurans;
- f. sampel bahan dan ketukangan;
- g. sistem pembumian tambahan;
- h. pengawasan dan mesyuarat tapak (*site meeting*);
- i. salinan *operation and maintenance manual* yang melebihi tiga (3) salinan;
- j. gambar foto kemajuan kerja; dan/atau
- k. alat-alat pengujian dan pentauliah (*testing and commissioning*).

Walau bagaimanapun, Kementerian/Agensi hendaklah memastikan keperluan item-item di atas dibincangkan dan dipersetujui secara berasingan antara Kontraktor dan JKR atau Kontraktor dan Pegawai Teknikal Kementerian/Agensi. Perkara-perkara ini hendaklah diputuskan terlebih dahulu oleh Kementerian/Agensi sebelum perolehan dibuat sebagai kos awalan (*preliminaries*).

## **SKOP KONTRAK**

7. Skop kontrak yang ditetapkan adalah seperti berikut:

- a. Mereka bentuk, membekal, memasang, menguji dan mentauliah Alat Pemadam Api Mesra Alam AEROHUB® Aerosol *Fire Suppression System* dan 1MY227 *Clean Agent Fire Suppression System*;
- b. Skop kontrak hanya terpakai untuk projek bangunan baharu Kerajaan yang ditawarkan secara konvensional. Projek baharu secara reka dan bina tidak tertakluk kepada Kontrak Pusat ini. Bagi bangunan Kerajaan sedia ada,

penggantian sistem sedia ada adalah berdasarkan keperluan “*as and when required*”;

- c. Alat pemadam api mesra alam AEROHUB® Aerosol Fire Suppression System adalah untuk ‘*normally unoccupied*’ . ‘*Normally unoccupied*’ bermaksud bilik/kawasan yang tidak berpenghuni hanya dimasuki bagi tujuan penyelenggaraan seperti bilik jana kuasa, bilik elektrik, bilik bateri/*Uninterruptible Power Supply* (UPS) dan bilik suis; dan
- d. Alat pemadam api mesra alam 1MY227 Clean Agent Fire Suppression System adalah untuk ‘*normally occupied*’. ‘*Normally occupied*’ bermaksud bilik/kawasan yang ada penghuni atau yang kerap kali dimasuki seperti bilik stor, bilik fail, bilik server dan bilik kebal.

### **SKOP KERJA**

8. Skop kerja yang ditetapkan adalah seperti berikut:
  - a. Penggantian kepada sistem sedia ada (Halon/CO2) adalah berdasarkan keperluan Kerajaan dari semasa ke semasa yang ditentukan oleh Agensi/ Jabatan Teknikal tertakluk kepada peruntukan semasa yang disediakan oleh Agensi berkenaan;
  - b. Reka bentuk dan pemasangan sistem hendaklah memenuhi keperluan statut, Jabatan Bomba dan Penyelamat Malaysia (JBPM) dan diperakukan oleh Jurutera Perunding Mekanikal & Elektrikal bertauliah; dan
  - c. Membuka dan memasang sistem pencegahan kebakaran yang baharu dalam bangunan sedia ada termasuk dalam skop kerja Kontraktor. Kaedah pelupusan sistem pencegahan yang lama setelah pemasangan sistem baharu adalah di bawah tanggungjawab Agensi mengikut peraturan pelupusan yang sedang berkuat kuasa. Agensi hendaklah juga mematuhi statut dan peraturan Jabatan Alam Sekitar/ Kementerian Tenaga, Teknologi Hijau dan Air yang sedang berkuatkuasa.

### **KAEDAH PELAKSANAAN**

9. Kaedah pelaksanaan pemasangan/ penggantian Alat Pemadam Api Mesra Alam AEROHUB® Aerosol Fire Suppression System dan 1MY227 Clean Agent Fire Suppression System ditetapkan seperti berikut:

- a. Jabatan Kerja Raya Malaysia (JKR) akan menyelaraskan dan memantau pelaksanaan projek bangunan baharu Kementerian/Agensi yang dilaksanakan oleh JKR sahaja. Manakala bagi projek bangunan baharu yang dilaksanakan oleh Kementerian/Agensi masing-masing tanpa penglibatan JKR perlu diuruskan dan dipantau oleh Kementerian/Agensi tersebut; dan
- b. Projek penggantian bagi bangunan sedia ada akan dipantau oleh JKR atau Kementerian/Agensi.

### **TEMPOH JAMINAN**

10. Tempoh jaminan bagi Alat Pemadam Api Mesra Alam AEROHUB® *Aerosol Fire Suppression System* dan 1MY227 *Clean Agent Fire Suppression System* adalah dua belas (12) bulan dari tarikh penyerahan dan disah terima oleh Agensi/JKR.
11. Penyelenggaraan selepas tamat tempoh jaminan tidak termasuk di dalam skop kontrak ini. Walau bagaimanapun, Agensi dengan peruntukan sendiri boleh menggunakan khidmat Kontraktor sekiranya sistem tersebut memerlukan penyelenggaraan.

### **ANGGARAN KEPERLUAN**

12. Agensi dikehendaki membuat perancangan perolehan tahunan serta mengemukakan anggaran keperluan dan jangka masa pelaksanaan yang diperlukan kepada Kontraktor untuk membolehkan Kontraktor membuat perancangan pelaksanaan. Satu salinan jadual perancangan hendaklah dikemukakan kepada Bahagian Perolehan Kerajaan, Kementerian Kewangan.
13. Sekiranya Agensi tidak mematuhi arahan pada perenggan 12, Kontraktor tidak boleh dipersalahkan jika berlaku kelewatan pelaksanaan kelak.
14. Setelah menerima anggaran keperluan, Kontraktor hendaklah membuat penyiasatan tapak (jika perlu) dan menyediakan lukisan reka bentuk untuk diserahkan kepada Agensi/ JKR/ JBPM supaya perkara-perkara lain yang tidak termasuk dalam skop kontrak seperti keperluan elektrik, struktur dan sivil dapat disediakan.
15. Agensi akan membuat pesanan setelah urusan reka bentuk dan lain-lain perkara berkaitan selesai.

**PESANAN DAN TEMPOH SIAP PROJEK**

16. Semua pesanan hendaklah dibuat terus kepada Kontraktor dengan mencatatkan nombor kontrak, isi padu, bilangan dan jenis bilik/kawasan yang akan dipasang alat pemadam api. Pesanan akhir oleh agensi mestilah diserahkan kepada Kontraktor tidak lewat daripada enam (6) minggu sebelum tarikh kontrak tamat.

17. Agensi adalah dikehendaki memberi alamat yang lengkap serta nama pegawai dan nombor telefon masing-masing kepada Kontraktor supaya perolehan dapat dibuat dengan lancar dan tepat ke tempat yang ditetapkan.

18. Agensi juga dinasihatkan supaya mengemukakan pesanan kepada Kontraktor melalui fax pada tarikh ia ditandatangani bagi memastikan perolehan dapat disempurnakan di dalam tempoh yang ditetapkan.

19. Agensi dan Kontraktor dikehendaki menetapkan tempoh siap projek. Sekiranya Kontraktor gagal menyiapkan projek dalam tempoh yang telah dipersetujui bersama tanpa alasan yang munasabah, maka pihak Kontraktor boleh dikenakan Denda Atas Kelewatan (*Liquidated Ascertained Damages*) berdasarkan formula berikut:

$$\frac{(\text{Harga Perolehan} \times \text{Base Rate (BR) Bank Negara}) \times \text{Bilangan Hari Lewat}}{365 \text{ hari}}$$

(BR pada hari Pesanan dikeluarkan)

20. Kementerian/Agensi hendaklah memastikan Kontraktor menyerahkan polisi insuran yang berkaitan. Walau bagaimanapun, Kementerian/Agensi tidak perlu mengenakan Bon Pelaksanaan.

**PEMERIKSAAN**

21. Agensi hendaklah memeriksa peralatan yang dipasang untuk memastikan bahawa model dan jumlah alat pemadam api yang dibekalkan adalah sama seperti mana yang dipesan. Sekiranya, didapati jumlah peralatan tersebut kurang, Kontraktor hendaklah diminta menggantikan jumlah yang kurang dengan segera tanpa sebarang kos tambahan.

22. Semua peralatan yang dipasang mestilah baharu, tulen, berada dalam keadaan baik dan memuaskan. Sekiranya peralatan tersebut didapati rosak atau cacat semasa penyerahan, peralatan tersebut hendaklah ditolak dengan serta-merta secara bertulis. Kontraktor hendaklah diminta menggantikannya dengan peralatan yang baharu tanpa sebarang kos tambahan.

23. Agensi hendaklah memastikan Kontraktor menguji peralatan pemadam api yang dipasang dan disahkan oleh Agensi/JKR serta memberi latihan pengoperasian kepada Agensi. Kontraktor juga dikehendaki menyerahkan tiga (3) Salinan '*Operation and Maintenance Manual*' beserta '*As Built Drawing*'.

### **PEMBAYARAN BIL**

24. Pembayaran bil yang dikemukakan oleh Kontraktor hendaklah dibuat mengikut tatacara semasa yang ditetapkan dan masih berkuatkuasa. Bagi pesanan yang telah disempurnakan oleh Kontraktor dengan memuaskan beserta Perakuan Siap Kerja, bil mengenainya hendaklah dijelaskan dalam tempoh empat belas (14) hari dari tarikh bil itu diterima.

25. Walau bagaimanapun, peraturan penerimaan yang diamalkan oleh sesuatu Agensi, pengesahan penerimaan perolehan mestilah dibuat dengan segera pada hari perolehan disempurnakan untuk membolehkan Kontraktor mengemukakan bil tuntutan seberapa segera. Bayaran hanya perlu dijelaskan setelah mendapat bil tuntutan daripada Kontraktor berserta Perakuan Siap Kerja. Walau bagaimanapun, bayaran mengikut kemajuan kerja boleh dibuat tertakluk kepada persetujuan bersama.

### **MODEL DAN SPESIFIKASI**

26. Model Alat Pemadam Api Mesra Alam AEROHUB® *Aerosol Fire Suppression System* yang dibenarkan adalah SS-20 dan jenama 1MY227 *Clean Agent Fire Suppression System* adalah 1MY227. Spesifikasi teknikal bagi peralatan yang berkaitan dan lukisan pemasangan adalah seperti di **Lampiran A**.

### **PENGGUNAAN KONTRAK**

27. Semua Agensi hendaklah menggunakan 1PP ini sepenuhnya dan tidak dibenarkan memperoleh daripada punca lain tanpa kelulusan Bahagian Perolehan Kerajaan, Kementerian Kewangan atau Pegawai Kewangan Negeri mengikut mana yang berkenaan.

**HAL-HAL LAIN**

28. Jika terdapat sebarang kemusykilan dan aduan mengenai prestasi Kontraktor, Agensi boleh merujuk kepada:

Ketua Setiausaha Perbendaharaan  
Kementerian Kewangan  
Aras 3, Blok Utara  
Kompleks Kementerian Kewangan,  
Presint 2  
Pusat Pentadbiran Kerajaan Persekutuan  
(u.p: Timbalan Setiausaha Bahagian Perolehan Kerajaan  
Sektor Pengurusan Kontrak)

No. Tel: 03-8882 8862 atau 03-8882 3245

No. Faks : 03-8882 4291

## Lampiran A

**SPESIFIKASI TEKNIKAL BAGI ALAT PEMADAM API MESRA ALAM AEROHUB®  
AEROSOL FIRE SUPPRESSION SYSTEM DAN 1MY227 CLEAN AGENT FIRE  
SUPPRESSION SYSTEM**

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**A. TOTAL FLOODING FIRE EXTINGUISHING SYSTEM AEROHUB AEROSOL  
FIRE SUPPRESSION SYSTEM****1. TECHNICAL SPECIFICATION****1.1 GENERAL**

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

The fire extinguishing and detection system shall include but not limited to the following:

- i. Fire extinguishing panel;
- ii. Smoke detector;
- iii. Heat detector;
- iv. Alarm bell;
- v. Twin Flashing Light; and
- vi. Isolate Key Switch

The control system shall be operated on 24 volt DC supply and in accordance to MS 1745: Part 4: 2004 or BS EN 54-4: 1998. All circuits shall be designed such that the controllers will perform their functions in an ambient temperature up to 50°C.

The control functions and indication on the Fire Extinguishing Panel shall be in accordance to the MS 1745: Part 2: or BS EN 54-2: 1997 + A1: 2006 and of type approved by Fire and Rescue Department Of Malaysia.

Locations of all fire extinguishing panel, smoke detectors, heat detectors, alarm bell, twin flashing light and isolate key switch are approximately as per standard.



## 1.2 **DESIGN STANDARDS AND VERIFICATIONS**

The agent shall be approved by Fire and Rescue Department Of Malaysia or listed by National Fire Protection Association (NFPA) 2001 (Clean Agent Fire Extinguishing System) or NFPA 2010 (Aerosol System).

The extinguishing agent shall satisfy the following requirements:

- i. Extinguishing fire class A,B,C and E;
- ii. Aerosol fire extinguishing agent that does not leave a residue upon evaporation;
- iii. Aerosol fire extinguishing agent that does not react, corrode and damage the apparatus, equipment and system in place and certified by manufacturer; and
- iv. Electrically non-conductive.

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

## 1.3 **SYSTEM DESIGN**

### 1.3.1 **General**

Aerohub® Aerosol Fire Suppression System does not have any pressure at normal operating condition, or traditional pipe and nozzle networks, or engineered hydraulic calculations determine nozzle orifices.

The installer only needs to determine the size and number of Aerohub® canisters required as well as their location within the enclosure. A System Design Approval Certificate has been included in the later pages which gives a step guide on how to carry out these simple design calculations.

### 1.3.2 **Method of Design**

The outline for design of Aerohub® Aerosol Fire Suppression total flooding system generally involves the following at a minimum:

- i. Identify all possible hazards within the protected enclosure. For fire hazard/fuel types that are unsuitable for use with Aerohub®, please refer the query to an Authorized Aerohub® representative;

- ii. Identify possible points of agent loss within the protected enclosure;
- iii. Determine volume of the protected enclosure. It may be necessary to derive the net to protected volume in enclosures containing large impermeable structures/machinery identify if the required coverage extends to the ceiling void and/or raised floor and determine the protected volume for these;
- iv. Calculate the quantity of agent required for the hazard and fuel type within the enclosure. Factors such as non-closeable openings, forced ventilation, low altitude, low temperature and other conditions may affect the quantity of agent required; and
- v. Select the model and quantity of canisters required to achieve the minimum design quantity.

### **1.3.3 Factors of Design**

Aerohub® Aerosol Fire Suppression System design calculations refer not to the design concentration of actual extinguishing agent - aerosol, but to the design factor, which is the mass of condensed aerosol generating element per unit of enclosure volume required to extinguish a specific type of fire, including a safety factor.

- i. Aerohub® Aerosol Fire Suppression System design factor is expressed in 100 g/m<sup>3</sup>;
- ii. Aerohub® Aerosol Fire Suppression System minimum design factor for Class B fires, involving nonflammable liquids such as petrol, diesel, hydraulic oil and automotive distillate is 100 g/m<sup>3</sup>;
- iii. Aerohub® Aerosol Fire Suppression System minimum design factor for Class A surface for involving non-smoldering combustible solids such as wood, textile and ordinary plastics is 100 g/m<sup>3</sup>;
- iv. Aerohub® Aerosol Fire Suppression System minimum design factor for Class A non – surface involving dense cable is 100 g/m<sup>3</sup>; and
- v. Advice from HUB or authorized Aerohub® Representative should be sought for any fire/fuel type not covered by the above minimum design factors.

The type of Aerohub® Aerosol Fire Suppression System canisters selected is typically based on several considerations as follows:

- i. Height of Protected Enclosure: Aerohub® Aerosol Fire Suppression System canisters chosen must be appropriate for the height of the protected enclosure. Please refer the height limitation list;
- ii. Minimum Clearance: Minimum clearance is an essential criterion to ensure that the possibility of damage due to heat of the discharge is minimized. Please refer to minimum clearance list;
- iii. Distribution of Aerosol: Although Aerohub® aerosol has tree-dimensional distribution of a gas; the even and rapid attainment of the minimum extinguishing concentration throughout the protected enclosure would obviously be desirable. In applications such the protection of cable ducts and trenches, which are typically long and narrow, it would be appropriate to select several smaller units and spread them out evenly along protected volume although one large unit may full fill the agent quantity requirement;
- iv. Mounting Locations: Certain protected enclosures may have specific permissible mounting locations. This may influence and orientation of the unit selected;
- v. Cost Factors: The best cost option without sacrificing technical requirements is the elements id good design should be practice. The contractor at design stage shall consider and address possible fire hazards within the protected area. The proposed total flooding 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.

#### **1.4 ENCLOSURE**

The enclosure shall be adequate integrity to retain the design concentration for a required minimum holding time. The area of unlosable 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 suppression system.

## **1.5. SYSTEM EQUIPMENTS**

### **1.5.1 Total Flooding Canisters**

Each Aerohub® Aerosol Fire Suppression System canister is comprised of an insulated stainless steel housing containing the aerosol forming compound, initiator, insulating medium and internal element for oxidation and cooling of the aerosol stream prior to its discharge from the unit. The initiator utilizes a secure two wire connector for electrical activation. Each canister is sealed with a non-permeable membrane to maintain the internal integrity of the unit and to insure their reliability in the even the most severe operating environments. The Aerohub® Aerosol Fire Suppression System canisters are protected under the patent in Malaysia 2006-1308.

### **1.5.2 AerohubFire Extinguishing Panel**

Aerohub® Fire Extinguishing Panel works like normal fire control panel to receive and send signals to activate fire suppression system.

### **1.5.3 Smoke Detector**

Any smoke detector acceptable to the authority having jurisdiction may be used to operate the Aerohub® Aerosol Fire Suppression System.

### **1.5.4 Heat Detector**

Any heat detector acceptable to the authority having jurisdiction may be used to operate the Aerohub® Aerosol Fire Suppression System.

### **1.5.5 Alarm Bell**

A horn/strobe alarm shall be used in conjunction with the Time Delay to provide an audio and/or visual alert to personnel in the area that a system discharge is imminent and that the protected area must be evacuated.

**1.5.6 Red & Green Indicator/ Twins Flashing Light**

Red & Green indicator light acceptable to the authority having jurisdiction may be used to operate the Aerohub® Aerosol Fire Suppression System.

**1.5.7 Manual Key Switch**

Manual Key Switch acceptable to the authority having jurisdiction may be used to operate the Aerohub® Aerosol Fire Suppression System.

**1.5.8 Isolate Switch**

A system isolate switch (located outside the protected area) shall be used in areas where personnel may present for further safety application. The operation of the system shall be manual only when personnel are present. While the system isolate is active the automatic activation of the system is inhibited, but fire detection and alarm system shall continue to function. The system returns to full automatic control when the switch is reactivated. The operation of the system isolates and earths each conductor of the wiring to the canisters and initiates a visual indicator of status at the control station.

**1.5.9 Fire Extinguishing Panel**

The Contractor shall supply and install the Fire Extinguishing Panel as detailed in the requirements. This panel shall incorporate the alarms, indications and controls for the following systems (applicable only where specified):

- i. Fire Detection and Manual Alarm System;
- ii. Standby Power Supplies; and
- iii. Other as shown in the tender drawings.

The Fire Extinguishing Panel shall be constructed from mild steel sheets, adequately braced. The compartments for the storage of the 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 red colour or other if request by the Supervising Officer.

Each alarm circuit shall include distinctive audio (buzzer) and visual signals (indicating lights) for alarm indication and fault indication with four (4) functions: "ALARM TEST – NORMAL – ISOLATE – FAULT TEST)" switches incorporated. These control

switches and indicating lights shall be mounted on the back perspex with black perspex with white or red labels engraved lettering to designate each function of the equipment in each zone.

## **1.6 SYSTEM OPERATION**

The system shall operate from an output voltage of 240V AC, 50Hz supplied to the power charger module within the fire extinguishing panel. This voltage is transformed and rectified within the panel to 24V DC. A 24V DC SLA 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. 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 fire extinguishing 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.

## **1.7 POWER SUPPLY**

The control and indication equipment shall be adaptable for operation either on the mains electrical supply or storage battery exclusive for this system. The power supply equipment shall also include battery charger, transformer, protective circuit fuses, ammeter, voltmeter and fault warning devices.

## **1.8 BATTERY SUPPLY**

The batteries shall be of heavy duty Sealed Lead Acid (SLA). The battery supply shall be capable of supplying a minimum alarm load for a period of at least an hour.

The Contractor shall submit calculations on the battery loadings to the Supervising Officer to ensure its capacity satisfies the conditions stated above.

The battery charger shall be capable of bringing the batteries to full charge within 8 hours operation on mains supply. It shall incorporate

trickle charge rate, and fault warning devices shall be included to indicate any charging failure of mains failure.

### 1.9 **WARNING AND INSTRUCTION SIGNS**

The following Warning and Instruction Signs shall be firmly attached to the specified locations by the installer on the completion of Aerohub® installation in unoccupied areas, where people may enter the enclosure.

- i. Label to be displayed at entrance to enclosure (from outside):

THIS AREA IS FITTED WITH AEROHUB FIRE SUPPRESSION  
SYSTEM  
DO NOT ENTER UNLESS THE FIRE SUPPRESSION SYSTEM  
IS ISOLATED  
AFTER AEROSOL DISCHARGE DO NOT ENTER UNTIL AREA  
HAS BEEN THOROUGHLY VENTILATED

- ii. Label to be displayed at entrance to enclosure (from inside):

THIS AREA IS FITTED WITH AEROHUB FIRE SUPPRESSION  
SYSTEM  
EVACUATE AREA ON SOUND OF ALARM  
AFTER AEROSOL DISCHARGE DO NOT ENTER UNTIL AREA  
HAS BEEN THOROUGHLY VENTILATED

- iii. Label to be displayed at System Isolate Switch:

AEROHUB ISOLATE SWITCH  
BEFORE ENTERING, ISOLATE THE SYSTEM TO PREVENT  
INADVERTENT DISCHARGE

- iv. Label to be displayed at Manual Key Switch

AEROHUB MANUAL KEYSWITCH  
ENSURE THE AREA IS EVACUATED BEFORE RELEASING OF  
AEROSOL

### 1.10 **WIRING**

The wiring from the equipment terminal strips to make up for the complete installation within each Fire Suppression System shall be done by the Contractor.

#### 1.10.1 **Above Ground**

The wiring above ground shall be Polyvinyl Chloride (PVC) Insulated Cable and the size shall as specified in the Design Requirements. PVC insulated cable of 450/750 V grade to MS 136 and 600/1000 V grade to MS 274. The conductors shall be of stranded plain annealed copper to MS 69 and MS 280. The insulation shall be suitable for continuous operation at a maximum cable temperature of 70°C and comply with MS 138.

All wiring shall be run in conduit and shall be concealed or hidden from view. All steel conduits shall be heavy duty type. Fire detector and actuating circuit shall be run in separate conduit and shall not share the same conduit with any other wiring. Minimum size of G.I. conduit shall be 19 mm diameter.

#### **1.10.2 Under Ground**

Underground cable shall be carried in PVC / SWA / PVC armoured cable conforming to BS 6346: 1997. The size and type of the cable shall as specified in the Design Requirements. All underground cable shall be armoured cable and shall be individually linked back to the central (main) control panel.

Cable marker shall be provided for all the underground cable with suitable distance. The underground cable shall be laid on a 50 mm (2") thick compact sand bed and at least 900 mm below ground level c/w a layer of hard baked brick along its routes. Cable connections shall be made to a socket integral with the back-plate. All underground cables shall be provided for by others.

#### **1.10.3 Surge Protector**

The Contractor shall provide surge protector for automatic fire detection and alarm panel to protect from any transient voltage and lightning strike.

#### **1.10.4 Incoming Power Supply**

Incoming power supply from Distribution Box (DB) to alarm panel shall be for provided by others.

### **1.11 TESTING AND COMMISSIONING**

The fire extinguishing and detection system shall be tested according to the related standard and shall be done in the presence of Supervising Officer or his representative, or a representative from the Main Contractor.



The power supply to the site shall be provided for by the Client, If the power supply is not available, the testing and commissioning of the fire extinguishing and detection system shall be conducted using a battery supply.

Testing and commissioning of the system shall be done by a way of a system discharge simulation method only.

#### **1.12 PAINING**

All items to be painted shall be first cleaned and prime coated. The final colour shall be applied in two coats. The paints shall be red colour and gloss-finish type.

#### **1.13 SAMPLE OF MATERIAL FOR SUBMISSION AND APPROVAL**

The Contractor shall prepare sample board of typical material proposed to use in work or samples of workmanship (mock up) to the approval of the Supervising Officer, prior to commencement of the installation work. The sample board comprise of but not limited to the conduit, conduit fittings, and underground and above ground cables, smoke and heat detectors, hanger and support system, alarm bells, break glass and etc

## 2. TECHNICAL SPECIFICATION AEROHUB AEROSOL FIRE SUPPRESSION AND FIRE DETECTION SYSTEM

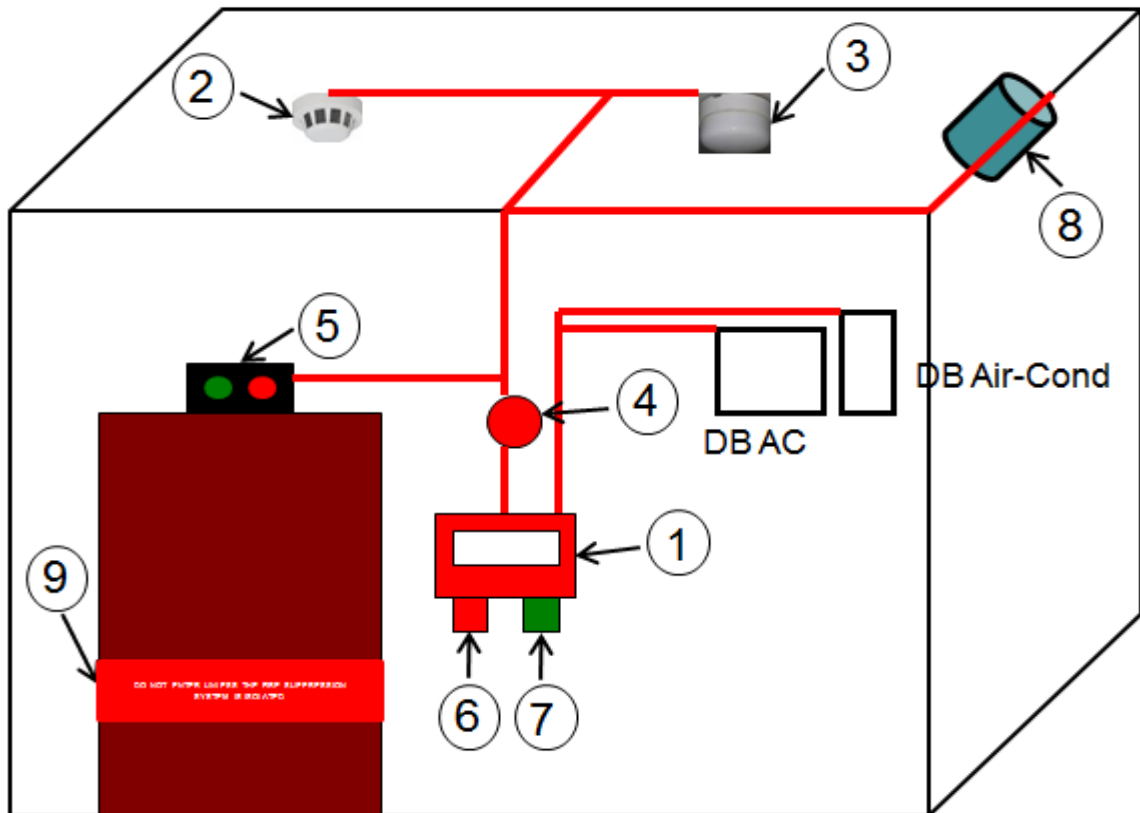
No.	Items	Aerohub®'s Specification
<b>1.0 General</b>		
a	Agent Name	Aerohub®
b	Manufacturer	Hub Technologies (M) Sdn Bhd
c	Country Of Origin	Malaysia
d	Lowest Observable Adverse Effect Level	N/A
e	No Observed Adverse Effect Level	N/A
f	Safety Margin	≤ 30%
g	Oxygen Depletion	≤ 0.5%
h	Max. Exposure Time	N/A
i	Conforming Standard & Protocols	AS/NZS 4487:1997, NFPA 2010 UL 1058 & UL2775
<b>2.0 Canister</b>		
a	Manufacturer	Hub Technologies (M) Sdn Bhd
b	Type & Model	Stainless Steel / SS20-10 and SS20-20
c	Filled Weight	≤ 13/18 Kg
d	Filled Volume	100%
e	Test Pressure	≤ 75 psi
f	Pressure Gauge	N/A
g	Mounting Of Cylinder	Wall/Ceiling/Floor Mounting
h	Quantity Provided	As Requirement
<b>3.0 Approval/Certificates Attached</b>		
a	Jabatan Bomba Dan Penyelamat Malaysia	Bomba Cert: Sijil Perakuan Bahan 2011/2012 Alat Kelengkapan Fire Suppression System. AK/Aerosol/764/2010(P3) Dated: 28/12/2016 – 27/12/2017
b	SIRIM	AS/NZS4487:1997, NFPA 2010 UL 1058, UL 2775
c	Universiti Kebangsaan Malaysia	Acute Toxicity - Certification (Dermal)
d	Universiti Kebangsaan Malaysia	Primary Skin Irritation - Certification
e	TUV	Acute Inhalation Toxicity – Certificate

<b>4.0 Fire Extinguishing Panel</b>		
a	Manufacturer / Brand	1. Aerohub® 2. Program 3. Industronics 4. Micron 5. EP 203 (Context Plus) 7. Unity / Unitronic 8. Guard 9. Demco 10. Or Equivalent.
b	Type & Model	Fire Extinguishing Panel
c	Construction Material	Mild Steel
d	Finish	Red Color
e	Power 'On' Indicator	Yes
f	Normal, Fault & Fire Condition Indicator	Yes
g	Reset Indicator	Yes
h	Fault Buzzer	Yes
i	Fault Buzzer Cancel Button	Yes
j	Bell Silence Switch	Yes
k	Quantity Provided	As Requirement
<b>5.0 Battery</b>		
a	Manufacturer / Brand	1. MSB 2. Master 3. Hub 4. CSB 5. Powerup 6. Enersys 7. Or Equivalent
b	Rated Voltage	12v
c	Ampere Hour (Fully Charged)	12 Ah
d	Quantity Provided	As Requirement
<b>6.0 Smoke Detector</b>		
a	Manufacturer / Brand	1. Apollo 2. Context Plus 3. Hub 4. Demco 5. Everyday 6. Or Equivalent
b	Model Of Operation	Photo-Electric Detection
c	Operating Voltage	Nominal: 12/24 Vdc Minimum: 8.5 Vdc Maximum: 35 Vdc
d	Alarm Indication	Red L.E.D
e	Effective Coverage Area	9m(L) X 9m(W) X 7m(H)
f	Quantity Provided	As Requirement










<b>7.0 Heat Detector</b>		
a	Manufacturer/ Brand	1. Apollo 2. Context Plus 3. Hub 4. Demco 5. Everyday 6. Or Equivalent
b	Model Of Operation	Thermistor
c	Operating Voltage	Nominal: 12/24 Vdc Minimum: 8.5 Vdc Maximum: 35 Vdc
d	Alarm Indication	Red L.E.D
e	Effective Coverage Area	7m(L) X 7m(W) X 6m(H)
f	Quantity Provided	As Requirement
<b>8.0 Alarm Bell</b>		
a	Manufacturer / Brand	1. Apollo 2. Context Plus 3. Hub 4. Demco 5. Kawapi 6. Or Equivalent
b	Operating Voltage	Nominal: 24 Vdc
c	Sound Output	95db
d	Quantity Provided	As Requirement
<b>9.0 Twins Flashing Light</b>		
a	Manufacturer / Brand	1. Sri 2. Demco 3. Hub 5. Kawapi 6. Industronic 7. Or Equivalent
b	Operating Voltage	Nominal: 24 Vdc
c	Type	L.E.D
d	Quantity Provided	As Requirement
<b>10.0 Manual Key Switch</b>		
a	Manufacturer / Brand	1. SRI 2. Demco 3. Hub 5. Kawapi 6. Industronic 7. Or Equivalent
b	Contact Load	0.5 Amp Max.
c	Quantity Provided	As Requirement
<b>11.0 Isolate Switch</b>		
a	Manufacturer / Brand	1. SRI

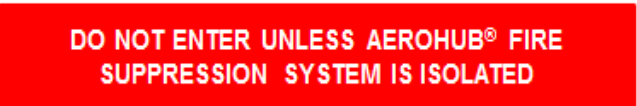
		2. Demco 3. Hub 5. Kawapi 6. Industronic 7. Or Equivalent
b	Contact Load	0.5 Amp Max.
c	Quantity Provided	As Requirement
<b>12.0 Curtain Device</b>		
a	Manufacturer / Brand	1. SRI 2. Demco 3. Hub 5. Kawapi 6. Or Equivalent
b	Operating Voltage	Nominal: 24 Vdc
c	Quantity Provided	As Requirement

**3. INSTALLATION FOR SINGLE AEROHUB® CANISTER (Wall Mounted)**

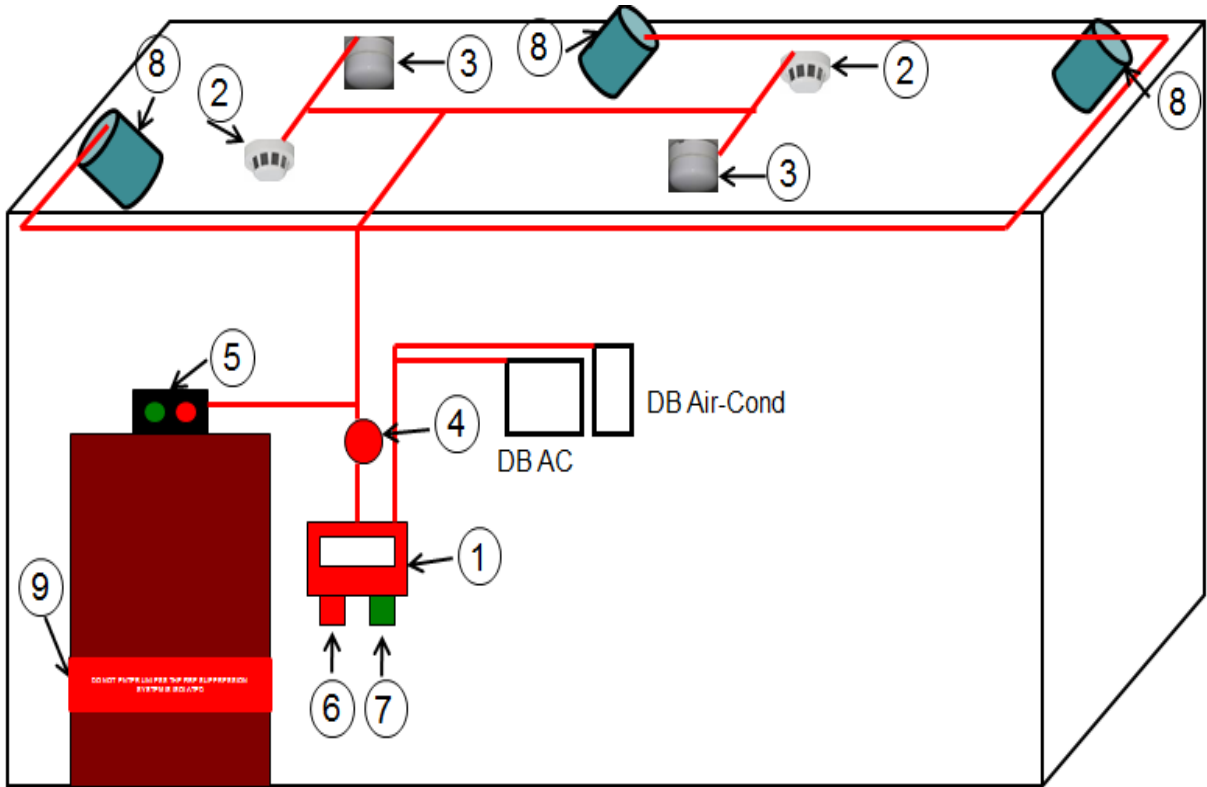


Note: This is base installation for cabin size 3m x 3m x 2.5m(H)

Legend:-	
①	 <b>AEROHUB</b> control Panel
②	 Smoke Detector
③	 Heat Detector
④	 Alarm Bell
⑤	 Twins Flashing Light
⑥	 Manual Keyswith
⑦	 Isolate Switch
⑧	 <b>AEROHUB®</b>
⑨	 Warning Signages

Legend:-	
⑨	 <b>DO NOT ENTER UNLESS AEROHUB® FIRE SUPPRESSION SYSTEM IS ISOLATED</b> Display at Entrance of Enclosure (Front)

**4. INSTALLATION FOR MULTIPLE AEROHUB® CANISTER (Wall Mounted)**

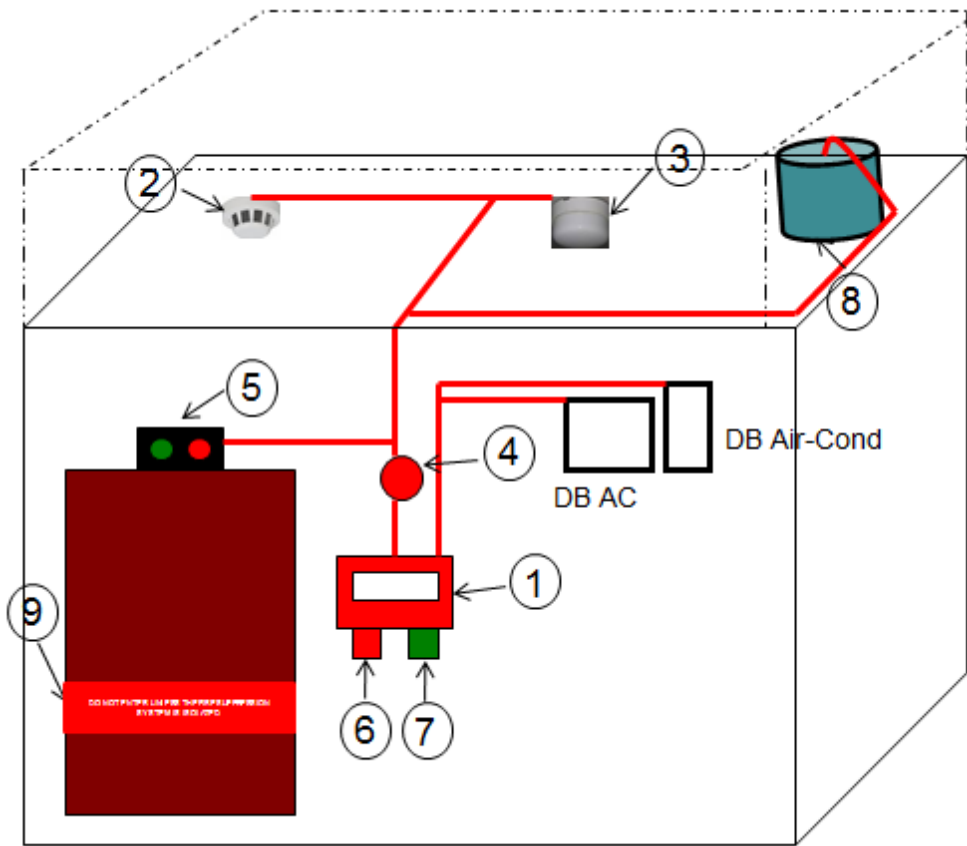


Note: This is base installation for cabin size 6m x 6m x 3m(H)

Legend:-		
①		<b>AEROHUB</b> control Panel
②		Smoke Detector
③		Heat Detector
④		Alarm Bell
⑤		Twins Flashing Light
⑥		Manual Keyswitch
⑦		Isolate Switch
⑧		<b>AEROHUB®</b>
⑨		Warning Signages

Legend:-	
⑨	<b>DO NOT ENTER UNLESS AEROHUB® FIRE SUPPRESSION SYSTEM IS ISOLATED</b>
	Display at Entrance of Enclosure (Front)

**5. INSTALLATION FOR SINGLE AEROHUB® CANISTER (Ceiling Mounted)**



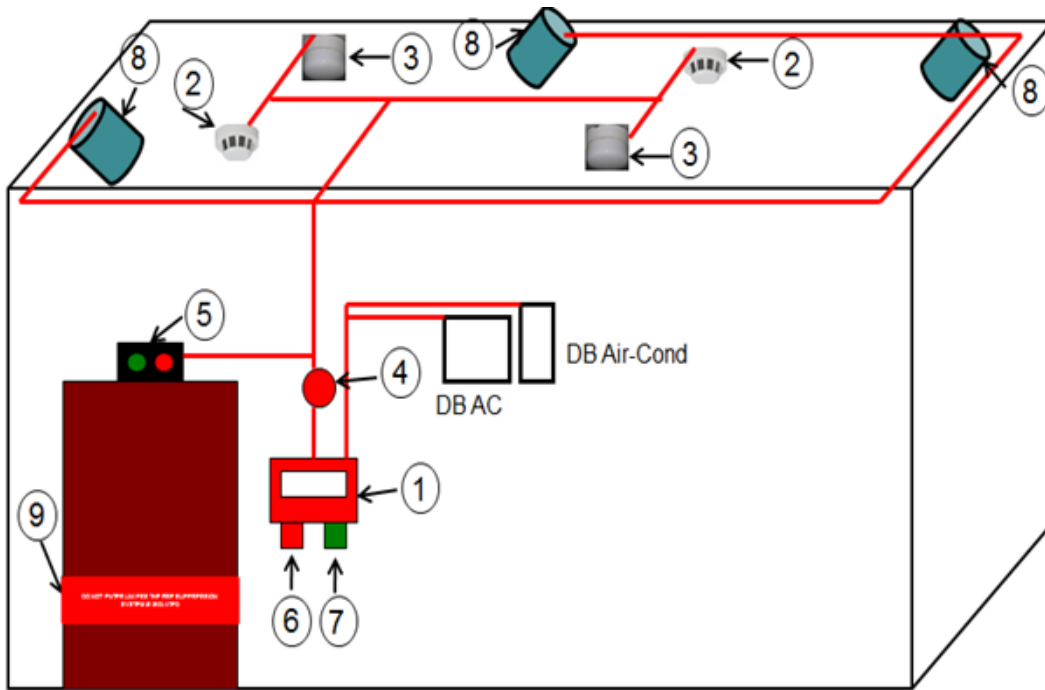
Note: This is base installation for cabin size 3m x 3m x 2.5m(H)

Legend:-		
①		AEROHUB control Panel
②		Smoke Detector
③		Heat Detector
④		Alarm Bell
⑤		Twins Flashing Light
⑥		Manual Keyswitch
⑦		Isolate Switch
⑧		AEROHUB®
⑨		Warning Signages

Legend:-	
⑨	<b>DO NOT ENTER UNLESS AEROHUB® FIRE SUPPRESSION SYSTEM IS ISOLATED</b> Display at Entrance of Enclosure (Front)



**6. INSTALLATION FOR MULTIPLE AEROHUB® CANISTER (Ceiling Mounted)**



Legend:-		
①		AEROHUB control Panel
②		Smoke Detector
③		Heat Detector
④		Alarm Bell
⑤		Twins Flashing Light
⑥		Manual Keywitch
⑦		Isolate Switch
⑧		AEROHUB®
⑨		Warning Signages

Legend:-	
⑨	 Display at Entrance of Enclosure (Front)

Note: This is base installation for cabin size 6m x 6m x 3m(H)

**B. TOTAL FLOODING FIRE EXTINGUISHING SYSTEM CLEAN AGENT  
1MY227 FIRE SUPPRESSION SYSTEM****1. TECHNICAL SPECIFICATION****1.1 GENERAL**

The work specified in this Section consists of furnishing, installing and testing of a complete conventional fire alarm, smoke detection and Clean Agent 1MY227 Total Flooding Fire Extinguishing System, including all components and accessories required for a complete and functioning system.

**1.2 DESIGN STANDARDS AND VERIFICATIONS**

The agent shall be approved by Fire and Rescue Department Of Malaysia or listed by NFPA 2001 (Clean Agent Fire Extinguishing System).

The extinguishing agent shall satisfy the following requirements:

- i. Extinguishing fire class A,B and C;
- ii. Gaseous fire extinguishing agent that does not leave a residue upon evaporation;
- iii. Gaseous fire extinguishing agent that does not react, corrode and damage the apparatus, equipment and system in place and certified by manufacturer; and
- iv. Electrically non-conductive.

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

**1.3 SYSTEM DESIGN**

The contractor at design stage shall consider and address possible fire hazards within the protected area. The proposed total flooding 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 cylinders 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. The cylinders shall be mounted in rows and installed in a suitable location as shown in the drawings.

The suppression 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.

#### **1.4 ENCLOSURE**

The enclosure shall be 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 suppression system.

#### **1.5 SYSTEM EQUIPMENTS**

##### **1.5.1 Total Flooding Cylinders**

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

Storage cylinders 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 cylinder shall have a permanent name plate specifying the number, filling weight and the pressurization level.

**1.5.2 Fire Suppression Control Panel**

Fire Suppression Control Panel works like normal fire control panel to receive and send signals to activate fire suppression system.

**1.5.3 Smoke Detector**

Any smoke detector acceptable to the authority having jurisdiction may be used to operate the Fire Suppression System.

**1.5.4 Heat Detector**

Any heat detector acceptable to the authority having jurisdiction may be used to operate the Fire Suppression System.

**1.5.5 Alarm Bell**

A horn/strobe alarm shall be used in conjunction with the Time Delay to provide an audio and/or visual alert to personnel in the area that a system discharge is imminent and that the protected area must be evacuated.

**1.5.6 Red & Green Indicator/ Twins Flashing Light**

Red & Green indicator light acceptable to the authority having jurisdiction may be used to operate the Fire Suppression System.

**1.5.7 Manual Key Switch**

Manual Key Switch acceptable to the authority having jurisdiction may be used to operate the Fire Suppression System.

**1.5.8 Isolate Switch**

A system isolate switch (located outside the protected area) shall be used in areas where personnel may present for further safety application. The operation of the system shall be manual only when personnel are present. While the system isolate is active the automatic activation of the system is inhibited, but fire detection and alarm system shall continue to function. The system returns to full automatic control when the switch is reactivated. The operation of the system isolates and earths each conductor of the wiring to the canisters and initiates a visual indicator of status at the control station.

### **1.5.9 Fire Extinguishing Panel**

The Contractor shall supply and install the Fire Extinguishing Panel as detailed in the requirements. This panel shall incorporate the alarms, indications and controls for the following systems (applicable only where specified):

- i. Fire Detection and Manual Alarm System;
- ii. Standby Power Supplies; and
- iii. Other as shown in the tender drawings.

The Fire Extinguishing Panel shall be constructed from mild steel sheets, adequately braced. The compartments for the storage of the 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 red colour or other if request by the Supervising Officer.

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

## **1.6 SYSTEM OPERATION**

The system shall operate from an output voltage of 240V AC, 50Hz supplied to the power charger module within the fire extinguishing panel. This voltage is transformed and rectified within the panel to 24V DC. A 24V DC SLA 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. 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 fire extinguishing 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 cylinders. All cylinders supplying the same manifold outlet for distribution of agent shall be interchangeable and of one selected size and charge where applicable.

### **1.7 POWER SUPPLY**

The control and indication equipment shall be adaptable for operation either on the mains electrical supply or storage battery exclusive for this system. The power supply equipment shall also include battery charger, transformer, protective circuit fuses, ammeter, voltmeter and fault warning devices.

### **1.8 BATTERY SUPPLY**

The batteries shall be of heavy duty Sealed Lead Acid (SLA). The battery supply shall be capable of supplying a minimum alarm load for a period of at least an hour.

The Contractor shall submit calculations on the battery loadings to the Supervising Officer to ensure its capacity satisfies the conditions stated above.

The battery charger shall be capable of bringing the batteries to full charge within 8 hours operation on mains supply. It shall incorporate trickle charge rate, and fault warning devices shall be included to indicate any charging failure of mains failure.

### **1.9 WARNING AND INSTRUCTION SIGNS**

The following Warning and Instruction Signs shall be firmly attached to the specified locations by the installer on the completion of system installation in occupied areas, where people may enter the enclosure.

- i. Label to be displayed at entrance to enclosure (from outside):

THIS AREA IS FITTED WITH 1MY227 FIRE SUPPRESSION  
SYSTEM  
DO NOT ENTER UNLESS THE FIRE SUPPRESSION SYSTEM  
IS ISOLATED  
AFTER 1MY227 DISCHARGE DO NOT ENTER UNTIL AREA  
HAS BEEN THOROUGHLY VENTILATED

- ii. Label to be displayed at entrance to enclosure (from inside):

THIS AREA IS FITTED WITH 1MY227 FIRE SUPPRESSION SYSTEM  
EVACUATE AREA ON SOUND OF ALARM  
AFTER 1MY227 DISCHARGE DO NOT ENTER UNTIL AREA  
HAS BEEN THOROUGHLY VENTILATED

- iii. Label to be displayed at System Isolate Switch:

1MY227 ISOLATE SWITCH  
BEFORE ENTERING, ISOLATE THE SYSTEM TO PREVENT  
INADVERTENT DISCHARGE

- iv. Label to be displayed at Manual Key Switch

1MY227 MANUAL KEYSWITCH  
ENSURE THE AREA IS EVACUATED BEFORE RELEASING  
OF 1MY227

## 1.10 **WIRING**

The wiring from the equipment terminal strips to make up for the complete installation within each Fire Suppression System shall be done by the Contractor.

### 1.10.1 **Above Ground**

The wiring above ground shall be Polyvinyl Chloride (PVC) Insulated Cable and the size shall as specified in the Design Requirements. PVC insulated cable of 450/750 V grade to MS 136 and 600/1000 V grade to MS 274. The conductors shall be of stranded plain annealed copper to MS 69 and MS 280. The insulation shall be suitable for continuous operation at a maximum cable temperature of 70°C and comply with MS 138.

All wiring shall be run in conduit and shall be concealed or hidden from view. All steel conduits shall be heavy duty type. Fire detector and actuating circuit shall be run in separate conduit and shall not share the same conduit with any other wiring. Minimum size of G.I. conduit shall be 19 mm diameter.

### 1.10.2 **Under Ground**

Underground cable shall be carried in PVC / SWA / PVC armoured cable conforming to BS 6346: 1997. The size and type of the cable shall as specified in the Design Requirements. All underground cable shall be armoured cable and shall be individually linked back to the central (main) control panel.

Cable marker shall be provided for all the underground cable with suitable distance. The underground cable shall be laid on a 50 mm (2") thick compact sand bed and at least 900 mm below ground level c/w a layer of hard baked brick along its routes. Cable connections shall be made to a socket integral with the back-plate. The above shall be provided for by others.

#### **1.10.3 Surge Protector**

The Contractor shall provide surge protector for automatic fire detection and alarm panel to protect from any transient voltage and lightning strike.

#### **1.10.4 Incoming Power Supply**

Incoming power supply from Distribution Box (DB) to alarm panel shall be provided by others.

### **1.11 TESTING AND COMMISSIONING**

The fire extinguishing and detection system shall be tested according to the related standard and shall be done in the presence of Supervising Officer or his representative, or a representative from the Main Contractor.

The power supply to the site shall be provided for by the Client, If the power supply is not available, the testing and commissioning of the fire extinguishing and detection system shall be conducted using a battery supply.

Testing and commissioning of the system shall be done by a way of a system discharge simulation method only.

### **1.12 PAINTING**

All items to be painted shall be first cleaned and prime coated. The final colour shall be applied in two coats. The paints shall be red colour and gloss-finish type.

### **1.13 SAMPLE OF MATERIAL FOR SUBMISSION AND APPROVAL**

The Contractor shall prepare sample board of typical material proposed to use in work or samples of workmanship (mock up) to the approval of the Supervising Officer, prior to commencement of the installation work. The sample board comprise of but not limited to the conduit, conduit fittings, and underground and above ground cables, smoke and heat detectors, hanger and support system, alarm bells, break glass and etc.



**2. TECHNICAL SPECIFICATION****1MY227 CLEAN AGENT FIRE SUPPRESSION AND FIREDETECTION SYSTEM**

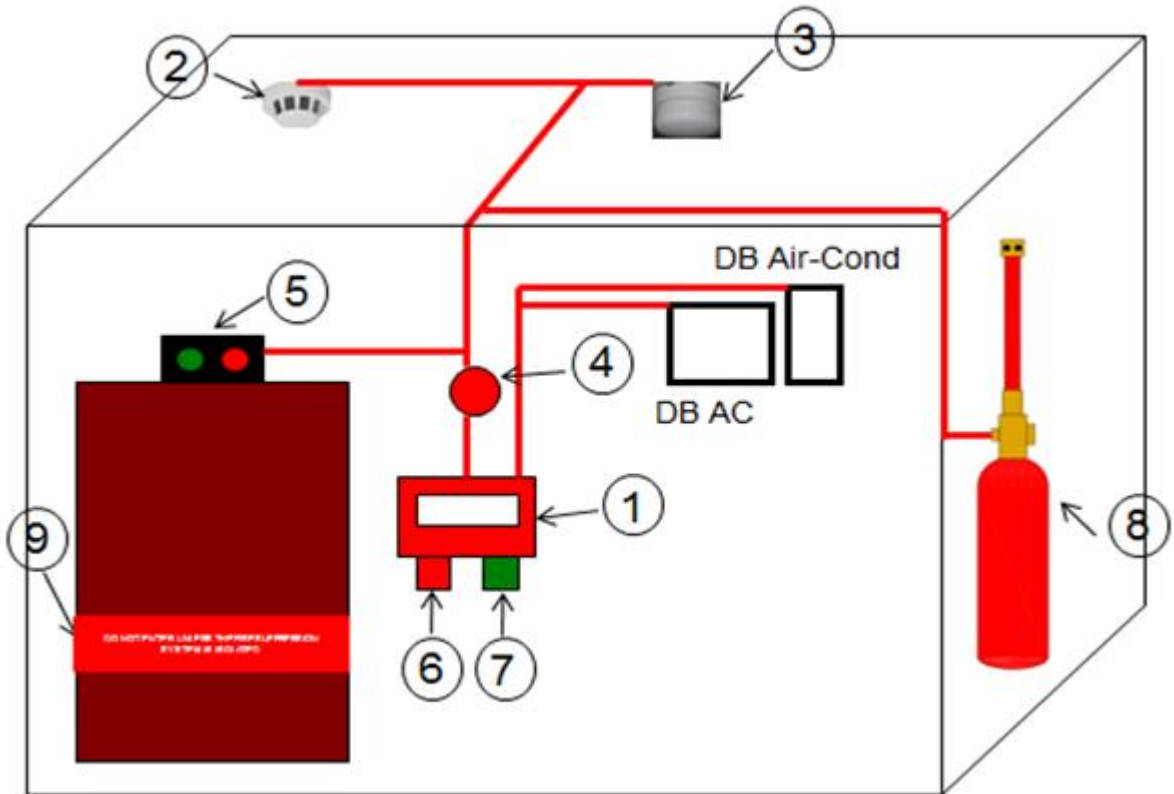
No.	Items	1MY227 Specification
<b>1.0 General</b>		
a	Agent Name	1MY227
b	Manufacturer	Hub Technologies (M) Sdn Bhd
c	Country Of Origin	Malaysia
d	Lowest Observable Adverse Effect Level	N/A
e	No Observed Adverse Effect Level	N/A
f	Safety Margin	≤ 30%
g	NOAEL	9.0 %
h	LOAEL	10.5 %
i	Chemical Formula	CF3CHF3
j	Purity, by mass	99.60%, min.
k	Acidity, by mass	3 x 10 <sup>-6</sup> , max.
l	Suspended Matter	Non Visible
m	Vapour Pressure	3.91 bars (52.36psi)
n	Conforming Standard & Protocols	NFPA 2001 : Standard on Clean Agent Fire Extinguishing Systems MS ISO 14520 Part 9 : Standard on Gaseous Fire Extinguishing Systems
<b>2.0 Cylinder</b>		
a	Manufacturer / Brand	1MY227
b	Type/Size	Mild Steel 3lb - 520lb
c	Operating Pressure	240psi (16.9kgf/cm <sup>2</sup> ) to 360psi (25.3kgf/cm <sup>2</sup> ) at 70°F/21.1°C)
d	Manufacturing Standard	UL299 or DOT 4BW500
e	Quantity Provided	As Requirement
<b>3.0 Approval/Certificates Attached</b>		
a	Fire and Rescue Department Of Malaysia	Bomba Cert: Sijil Pemasangan Keselamatan Kebakaran Approval No. JBPM/IP/BKK: 700-7/2/22-167(9)
b	Underwriters Laboratories (Clean Agent& Components)	UL File EX16293

<b>4.0 Fire Extinguishing Panel</b>		
a	Manufacturer / Brand	1. Aerohub® 2. Program 3. Industronics 4. Micron 5. EP 203 (Context Plus) 7. Unity / Unitronic 8. Guard 9. Demco 10. Or Equivalent.
b	Type & Model	Fire Extinguishing Panel
c	Construction Material	Mild Steel
d	Finish	Red Color
e	Power 'On' Indicator	Yes
f	Normal, Fault & Fire Condition Indicator	Yes
g	Reset Indicator	Yes
h	Fault Buzzer	Yes
i	Fault Buzzer Cancel Button	Yes
j	Bell Silence Switch	Yes
k	Quantity Provided	As Requirement
<b>5.0 Battery</b>		
a	Manufacturer / Brand	1. MSB 2. Master 3, Hub 4. CSB 5. Powerup 6. Enersys 7. Or Equivalent
b	Rated Voltage	12v
c	Ampere Hour (Fully Charged)	12 Ah
d	Quantity Provided	As Requirement
<b>6.0 Smoke Detector</b>		
a	Manufacturer / Brand	1. Apollo 2. Context Plus 3. Hub 4. Demco 5. Everyday 6. Or Equivalent
b	Model Of Operation	Photo-Electric Detection
c	Operating Voltage	Nominal: 12/24 Vdc Minimum: 8.5 Vdc Maximum: 35 Vdc
d	Alarm Indication	Red L.E.D
e	Effective Coverage Area	9m(L) X 9m(W) X 7m(H)
f	Quantity Provided	As Requirement
<b>7.0 Heat Detector</b>		

a	Manufacturer/ Brand	1. Apollo 2. Context Plus 3. Hub 4. Demco 5. Everyday 6. Or Equivalent
b	Model Of Operation	Thermistor
c	Operating Voltage	Nominal: 12/24 Vdc Minimum: 8.5 Vdc Maximum: 35 Vdc
d	Alarm Indication	Red L.E.D
e	Effective Coverage Area	7m(L) X 7m(W) X 6m(H)
f	Quantity Provided	As Requirement
<b>8.0 Alarm Bell</b>		
a	Manufacturer / Brand	1. Apollo 2. Context Plus 3. Hub 4. Demco 5. Kawapi 6. Or Equivalent
b	Operating Voltage	Nominal: 24 Vdc
c	Sound Output	95db
d	Quantity Provided	As Requirement
<b>9.0 Twins Flashing Light</b>		
a	Manufacturer / Brand	1. Sri 2. Demco 3. Hub 5. Kawapi 6. Industronic 7. Or Equivalent
b	Operating Voltage	Nominal: 24 Vdc
c	Type	L.E.D
d	Quantity Provided	As Requirement

<b>10.0 Manual Key Switch</b>		
a	Manufacturer / Brand	1. SRI 2. Demco 3. Hub 5. Kawapi 6. Industronic 7. Or Equivalent
b	Contact Load	0.5 Amp Max.
c	Quantity Provided	As Requirement
<b>11.0 Isolate Switch</b>		
a	Manufacturer / Brand	1. SRI 2. Demco 3. Hub 5. Kawapi 6. Industronic 7. Or Equivalent
b	Contact Load	0.5 Amp Max.
c	Quantity Provided	As Requirement
<b>12.0 Curtain Device</b>		
a	Manufacturer / Brand	1. SRI 2. Demco 3. Hub 5. Kawapi 6. Or Equivalent
b	Operating Voltage	Nominal: 24 Vdc
c	Quantity Provided	As Requirement

**3. TYPICAL INSTALLATION FOR 1MY227**



Note: This is base installation for cabin size 3m x 3m x 2.5m(H)

Legend:-		
①		AEROHUB control Panel
②		Smoke Detector
③		Heat Detector
④		Alarm Bell
⑤		Twins Flashing Light
⑥		Manual Keywitch
⑦		Isolate Switch
⑧		1MY 227 Cylinder
⑨		Warning Signages

Legend:-	
⑨	 <b>DO NOT ENTER UNLESS 1MY 227 FIRE SUPPRESSION SYSTEM IS ISOLATED</b> Display at Entrance of Enclosure (Front)