SECTION 3.5 TECHNICAL SPECIFICATIONS FOR AUTOMATIC FIRE DETECTION AND ALARM SYSTEM (CONVENTIONAL)

1 GENERAL

The fire alarm system shall include but not limited to the following:

(1) Manual Call Points.
(2) Audible Alarms.
(3) Automatic Detection Device.
(4) Flashing Light and Relays.
(5) Fire Alarm Panels.
(6) System of Wiring.
(7) Power Supply.
(8) Battery Supply.
(9) Painting.
(10) Mode of Operation.

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 Alarm Panel shall be in accordance to the MS 1745: Part 2: 2004 or BS EN 54-2:1997+A1:2006 and of type approved by Jabatan Bomba Dan Penyelamat Malaysia.

Locations of all audible alarms, automatic detectors, manual call points, flashing lights and Fire Alarm Panel are approximately shown in the Tender Drawings.

The Contractor shall be required to furnish complete layout of the controls for the Fire Alarm Panel including mimic diagrams and wiring circuits for the control systems for the approval of the S.O. before fabrication of the units.

2 FIRE ALARM PANEL

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

(1) Fire Detection and Manual Alarm System.
(2) Standby Power Controls.
(3) Other as shown in the tender drawings.

The Fire Alarm Panel shall be constructed from 18 s.w.g. mild steel sheets, adequately braced. 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 or red labels engraved lettering to designate each function of the equipment in each zone.

Mimic diagram shall be provided to show the particular zones or floors served by the Fire Detection and Alarm System. The mimic diagram shall be first submitted to the S.O. for approval.

The control functions and indication on the Fire Alarm Panel shall be in accordance to the MS 1745: Part 2: 2004 or BS EN 54-2:1997+A1:2006 and of type approved by Jabatan Bomba Dan Penyelamat Malaysia.

The Fire Alarm Panel shall be connected to the nearest Jabatan Bomba Dan Penyelamat Malaysia as indicated in the Schedule of Design Requirements. All associated fees for this service shall be deemed to be included in the tender price and paid by the contractor.

2.1 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, rectifier, transformer, protective circuit fuses, ammeter, voltmeter and fault warning devices.

2.2 Battery Supply

The batteries shall be of the heavy duty Nickel Cadmium rechargeable type. Its capacity shall not be less than as indicated in the Schedule of Design Requirements such that power is available to supply quiescent load resulting from the disconnection or failure of the mains electrical supply, for a minimum period of 72 hours. The battery supply shall be capable of supplying a maximum alarm load for a period of at least an hour.

The Contractor shall submit calculations on the battery loadings to the Superintending 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 dual charging rate, one for quick boosting and the other for trickle charge. Fault warning devices shall be included to indicate any charging failure or mains failure.

3 MODE OF OPERATION

All alarm call points in each zone or floor for each of the system as listed shall be connected to the particular indication light on the Fire Alarm Panel. On the actuation of an alarm, the corresponding alarm indication bulbs shall light up and automatically trigger off the audible alarms in the respective zone.

The alarm system shall be in two stages, whereby a preliminary alert alarm shall activate automatically on the actuation of a call point in a particular zone or floor and subsequently after a preset interval, the second stage of alarm for evacuation shall activate in all the zones. A separate manual switch for evacuation alarm shall also be provided.

The audible alarms shall continue unless silenced manually by the operation of a switch specially provided for this purpose. The operation of a switch shall automatically result in an audible signal by the buzzer incorporated at the Fire Alarm Panel. This audible signal shall only be silenced until the Fire Alarm System has been reset.

Zone indicators shall be arranged to flash to show a newly initiated alarm. When the audible alarms are silenced manually by the operation of the silence switch, the flashing signal shall cease and be replaced by a steady signal on the indication bulbs.

Any fault warning, which the control equipment may show at any one time, shall not prevent the fire alarms and indications for the same zone being operated.

The system shall also be arranged such that on the onset of the first stage of audible alarms the fire and smoke control system (staircase pressurization fans, smoke spill, lift, etc.) shall be brought into operation. At the same time the air handling unit operating in that particular zone or floor shall also be switched off. Silencing the audible alarms shall not automatically stop the fire and smoke control system, which shall be reset by operation of a separate switch provided.

4 MANUAL CALL POINTS

The manual call points shall be of the break glass type with corrosion resistant casing suitable for flush or surface fixing.

Each manual call point shall have the words "API - PECAH KACA" inscribed on it.

Ingress Protection shall be IP 54.

Manual call points shall comply with MS 1745: Part 11: 2004 or BS EN 54-11:2001. All manual call points shall have alternative provisions to enable open or closed circuit systems.

Manual call point shall be mounted at a height of 1.4 metres from the floor, easily accessible, well illuminated and conspicuous positions free from obstruction.

All offers of manual call point shall be supported by copies of the current test certificates from **SIRIM** or recognised laboratory

5 AUDIBLE 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 150 mm.

The bell shall have an operational requirement complying with MS 1745: Part 3: 2004 or BS EN 54-3 2001. The bell shall be minimum 150 mm (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.

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

6 FLASHING LIGHTS AND RELAYS

Flashing relays shall be of a type suitable for 24V DC operation.
The rate of flashing shall be even and not less than 110 $\pm$ 30 flashes per minute with an on/off time ratio of between 4:1 and 2:1.

Each flashing light shall have a red cap of not less than 50 mm in diameter.

The lamps shall continue to flash even if the call point is reset (if the call point is reset at the moment of acknowledgement, lamps will go out and otherwise the lamps will show a steady light).

7 AUTOMATIC DETECTION DEVICE

7.1 Heat Detectors

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 and fire resistant.

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

7.2 Smoke Detectors

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 to requirements of BS EN 54-7:2001.

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

7.3 Duct Smoke Detectors

All smoke detector in air-handling unit shall be optical smoke detector smoke detector or volumetric duct type comply with BS 5445: Part 7. The contract rating shall be 1 amp 24V DC or O.5V at 24V AC.

The housing of the air duct detector shall be made of mild steel. The probes shall be

made 25mm mild steel. The duct housing box must be air tight and other equipment shall be fixed to any part of the housing. The air duct detector shall be designed to operate in air flow of between 1 and 10 metres per second. The optical smoke detector also shall be mounted in a special housing to function in difficult high speed air flow conditions.

The fire fighting contractor shall include all the cost for supply and installation these detectors including all wiring from detectors to equipment terminal strips and the wiring from the terminal strips to make up for the complete installation of the fire detection and alarm system.

Note: ***Smoke detectors for air-handling unit (duct) shall be supplied and installed by the Fire Fighting Contactor. The wiring from the equipment terminal strips to make up for the complete installation shall be done by Fire Fighting Contractor.***

When duct sensors are required to be installed in air-conditioning ducting system, the smoke sensor shall be of a type suitable for the intended application and shall comply with BS EN 54-7:2001.

7.4 Other Type of Detectors

Other type of detectors shall be as indicated in the Schedule of Design Requirements.

List down other type of detectors:

(1) Beam detector
(2) Ionization detector
(3) UV/flame detector

NOTES

1) The wiring from the equipment terminal strips to make up for the complete installation of the Automatic Fire Detection and Alarm System (Conventional) shall be done by the **Fire Fighting Contractor**.

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

8 SYSTEM OF WIRING

The system of wiring shall be surface wiring, concealed wiring, surface conduit wiring or concealed conduit wiring as indicated in the Drawings and/or Schedule of Design Requirements. The wiring systems shall comply with MS IEC 60364-5-52.

All wiring shall be run neatly and in an orderly manner. They shall be routed parallel to building wall and column lines in a coordinated manner with other services. The wiring throughout shall be on the ‘looping-in system’ and no ‘tee’ or other types of joints are allowed. No reductions of the strands forming the conductors are allowed at all terminals. All strands shall be effectively secured by approved means.

Wiring which are not embedded in concrete or concealed behind plaster shall be run in an accessible manner on the beams, underside of slabs or below pipes, ducts, and

down drops shall be run on the surface of columns or walls. Concealed wiring shall be installed in such a way that plaster can be applied over their thickness without being subjected to spalling or cracking. Cables serving different operating voltages and functions shall be segregated.

All cables shall be legibly marked on the external surface with at least the following elements; Manufacturer's identification, Voltage designation, Nominal area of conductor and Standard Numbers. Standard colour coded cable shall be used for three phase circuit to identify the phase conductors, neutral conductor and protective conductor respectively.

Opening on floor, wall or partition through which cable, trunking, conduit or other wiring passes through shall be sealed according to the appropriate degree of fire resistance after the installation.

Chipping and cutting of concrete are not allowed unless otherwise approved by the S.O.'s Representative. The Contractor is required to work in conjunction with the building contractor for the provision of openings, trenches, core-holes, chases etc. as the building concreting work progresses.

In steel frame structures, the wiring system shall be rigidly and securely supported and fastened in place onto the structural steel beams, purlins and columns by fasteners such as clamps, clips, anchors, straps, hangers, supports or similar fittings. The fasteners shall be designed and installed as not to damage either to steel structures or wiring system.

The fasteners shall be installed at intervals not exceeding 1000 mm, and within 300 mm of every outlet box, junction box, device box, cabinet or fitting. Fasteners shall be of spring steel and/or galvanised steel, and where wires, rods or threaded rods are used with fasteners, they shall be of rolled carbon steel. The fasteners shall be finished with zinc coatings to resist rusting. Samples for the fasteners used shall be submitted to S.O.'s Representative for approval before they are used.

Unless otherwise approved by S.O.'s Representative, no welding on and/or drilling holes into any members or components of the steel frame structures for the installation of fasteners are allowed.

8.1 Above Ground

The wiring above ground shall be PVC Insulated Cable and the size shall as specified in the Schedule of 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 70ºC 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.

8.2 Under Ground

Underground cable shall be carried in PVC/SWA/PVC. The Armoured Cable shall be manufactured and tested in accordance with MS 274 or BS 6346 and shall have high conductivity plain copper stranded conductors insulated with PVC suitable for a voltage of 600/1000V laid together and bedded with PVC, armoured with galvanised steel wires and sheathed with PVC.

The size and type of the cable shall as specified in the Schedule of 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.

8.3 Wiring in Conduit/Trunking (Surface or Concealed)

The cables used in conduit wiring, unless otherwise specified shall be similar to that described above. Unless otherwise specified in the Drawings and/or Schedule of Design Requirements, the conduits shall be of galvanised steel and conduit fittings shall be of galvanised steel or alloy materials. Cables above false ceiling shall be run in conduit or trunking.

The conduit shall generally be run on the underside of the floor slabs by mild steel brackets or suspenders. The trunking shall be suspended from the floor slabs or mounted against the wall by mild steel brackets. The mild steel brackets shall be anti-rust treated, painted with a primer and finished in orange enamel. The suspension structure shall be robust in constructions and adequately installed such that the conduit/trunking will not sag.

Flexible conduit shall be used for termination to equipment, which is subjected to movement or vibration. However, the length of this flexible conduit shall not exceed 400mm unless approved by the S.O.'s representative.

8.4 Metallic Conduits

Steel conduits shall be of galvanised, heavy gauge, screwed type complying with MS 275-1, MS 1534:PT.1, MS 1534:PT.2:Sec1, IEC 60423, IEC 61386-1 and IEC 61386-21. All steel conduit fittings shall comply with MS 275-2, MS 1534:PT.1, MS 1534:PT.2:Sec1, IEC 61035-1, IEC61035-2-1, IEC 61386-1 and IEC 61386-21. The steel conduits shall be fitted with brass bushes at the free ends and expansion devices at appropriate intervals. The ends of each length of steel conduit shall be properly reamed. The termination to the distribution boards, consumer units, switchgears and outlet boxes shall be effected by brass type smooth-bore bushes. All steel conduits shall be effectively earthed.

For laying underground steel conduit shall be used and buried at a minimum depth of 450 mm below ground level or 100 mm below floor slab or hard standing. Junction boxes, outlet boxes etc. shall be of galvanised sheet steel or alloy material or malleable cast steel. The covers shall be galvanised sheet steel or alloy material with thickness not

less than 1.2 mm. Accessories such as junction boxes down dropping to luminaries shall have die-cast cone-shaped metal cover.

8.5 Cable Trunking

Cable trunkings shall comply with IEC 61084. They shall be fabricated from galvanised sheet steel and finished with two coats of standard enamel paint. They shall be equipped with removable covers at suitable intervals. They shall be supplied in lengths to suit the installation and shall have the following minimum wall thickness: -

NOMINAL SIZE (mm x mm)	MINIMUM WALL THICKNESS (mm)
50 x 50 and below	1.0
75 x 50 to 100 x 100	1.2
150 x 50 to 300 x 150	1.6
Above 300 x 150	2.0

All trunking elbows, offset and combination elbows, adaptors and tees shall be of same thickness as the straight trunking and shall be the type manufactured and supplied by the same trunking manufacturer.

The trunking shall be supported by fixing brackets so that the trunking will not be in contact with the walls or floor slabs. The brackets shall be installed at intervals not greater than 1500 mm for vertical runs and not greater than 1000 mm for horizontal runs. The brackets shall be derusted, finished in a primer and coated with standard enamel paint.

Wherever the trunking passes through a floor or a fire resistant wall, fire-resisting barrier shall be provided. At these positions the cables shall be sealed with non-hygroscopic fire resisting material of minimum 2-hour fire rating. In addition, the floor openings and wall openings shall be sealed with similar type of compound.

Cables running in the trunking shall carry conductor identification colours and shall be supported by split hard wood racks securely fixed at the base of the trunking and spaced not more than 600 mm apart.

Cables for each final circuit shall be properly bunched together and labelled. Where conduit is tapped off from the trunking, suitable brass type smoothbore bushes shall be fitted at all conduit termination. Unless otherwise specified, all trunkings shall have either tinned copper tape of dimension not less than 25 mm x 3 mm as circuit protective conductor or earth cable of appropriate size. In the latter case, all trunking joints shall be bridged by means of tinned copper tape of dimension not less than 25 mm x 3 mm.

8.6 Cable Trays

Cable trays system shall comply with MS IEC 61537 and shall be fabricated from perforated galvanised sheet steel complete with all necessary bends, tee pieces, adaptors and other accessories. The minimum thickness of the sheet steel shall be 1.5 mm for cable trays with widths up to and including 300 mm and 2.0 mm for cable trays with width exceeding 300 mm. However minimum thickness for the sheet steel of the perforated hot dipped galvanised cable trays shall be 2.0 mm. Cable trays may either be suspended from floor slabs by hangers or mounted on walls or vertical structure by

brackets at 600 mm intervals.

However where the above methods of installation are not feasible or practical, suitable floor mounted mild steel structures shall be provided. All supports, hangers and structures shall be robust in construction and adequately installed to cater for the weights of the cables and trays supported on them so that cable trays and cables will not sag. All supports, hangers, bracket and structures shall be anti-rusted, finished in primer and coated with standard enamel paint.

All supports, hangers, bracket and structure for the perforated hot dipped galvanised cable trays shall also be of hot dipped galvanised type. Fixing clips and cleats for cables on trays shall be installed by means of bolts, washers and nuts.

All tees, intersection units, adaptor units etc. shall be the type manufactured by the cable tray manufacturer unless otherwise approved by the S.O.'s Representative. Wherever cable tray pass through a floor or a fire resistant wall, fire-resisting barrier as mentioned above shall be provided.

8.7 Cable Ladder

Cable ladder system shall comply with MS IEC 61537 and fabricated from mild steel and finished in hot-dipped galvanised or epoxy powder coat complete with all necessary horizontal elbow, horizontal tee, horizontal cross, reducer straight, outside riser, inside riser, reducer left, reducer right, cable clamp, cantilever arm, hold down clip/clamp, hanger bar, vertical splice plate and horizontal splice plate for welded type and screwed type. The minimum thickness of the sheet steel shall be 2.0 mm.

Cable ladder may either be suspended from floor slabs by hangers or mounted on walls or vertical structure by cantilever arm. Cable ladder shall be supported rigidly and adequately by external spring hangers mounted on channel base. The cable ladder shall be supported at maximum intervals of 3000mm for in contact with the wall or floor slab surfaces. The spring hangers shall be supplied by the cable ladder manufacturer. All supports, hangers, and structures shall be robust in construction and adequately installed to cater for the weights of the cables and ladder supported on them so that cable ladder and cables will not sag.

Rungs shall be spaced at 300mm nominal centres, welded to the rail sections by approved welding procedures. All rungs shall be perforated in accordance to the manufacturer’s design.

The cable ladders shall be supplied fully assembled with preparations for connections to straight sections or accessories using splice plates mechanically bolted together. Allowance shall be provided for longitudinal adjustments and expansion. The cable ladders when completed shall be smooth, free from all sharp edges and shall be capable of discharging any water that may be retained due to normal weathering.

All accessories shah be the type manufactured by the cable ladder manufacturer unless otherwise approved by the S.O.’s representative. Wherever cable ladder pass through a floor or a fire resistant wall, fire-resisting barrier as mentioned above shall be provided.

8.8 Lightning Protection

The Contractor shall provide lightning protection against lightning. In addition, all

main panel and sub panel shall be earthed.

8.9 Overvoltage Protector

The main power supply to control panel shall be protected from transient over voltages. A suitable protector, furse (415/240V) or equivalent shall be used to provide effective protection from transient and be able to restrict transient over voltages to below the damage threshold of the equipment circuitry.

9 TESTING

The fire alarm and detection system shall be tested according to the related standard and shall be done in the presence of S.O or his representative.

10 PAINTING

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

11 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 conduits, conduit fittings, underground and above ground cables, smoke and heat detectors, hanger and support system, alarm bells, break glass 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 3.5 ----------