ENGINEERING STUDY OF BEST NEW ALTERNATIVE SOLUTIONS/SCHEMES ON THE EXISTING FIRE PROTECTION SYSTEM OF DAP BUILDING IN PASIG AND PREPARATION OF THE TECHNICAL ENGINEERING STUDY REPORTS (INITIAL & FINAL), INCEPTION REPORT, FIRE SAFETY COMPLIANCE REPORT AND DETAILED ENGINEERING PLANS & SUPPLEMENTAL TECHNICAL DOCUMENTS INCLUDING BID TENDER DOCUMENTS ON MANAGEMENT APPROVED OR CHOSEN SCHEME/OPTION.

SAN MIGUEL AVENUE, ORTIGAS CENTER, PASIG CITY

FIRE DETECTION AND ALARM SYSTEM

TECHNICAL SPECIFICATION

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development academy of the philippines

SECTION 284600

FIRE DETECTION AND ALARM SYSTEM

PART 1 - GENERAL

1.1 SCOPE OF WORKS

A. The scope of work under this head shall include design, supply, and installation of additional Fire Alarm System devices to the whole building complex. The work under this system shall consist of supply, installation, testing, training & handing over of all materials, equipment's and appliances and labor necessary to commission the said system, complete with Addressable fire alarm system for all common areas. The system shall comprise of Smoke Detectors, Heat Detectors, Alarm Notification Devices, Manual Pull Stations, Modules, and Relays for interfacing with other systems. It shall also include laying of cabling, necessary for installation of the system as indicated in the specification and Bill of Quantities. Any openings/chasing in the wall/ceiling required to be made for the installation shall be made good in appropriate manner.

1.2 DESCRIPTION

A. Provide fire detection and alarm system in accordance with the Contract Documents.

B. The fire detection and alarm system shall be a stand-alone system operating independently of other control systems. It shall have an automatic dial-up feature to the BFP Fire Station.

C. Related work specified in other divisions of these specifications:
   1. Sprinkler water flow and tamper switches.
   2. Magnetic door holders and electric door locking hardware.
   3. Public Address Emergency Announcement
   4. Life Safety Equipment Interfaces

1.3 RELATED DOCUMENTS

A. All work specified in this specification is subject to the provisions of Electronics General Provisions.

B. Refer to the following specification of related work in connection with the Fire Detection and Alarm System:
   1. Background Music (BGM) and Public Address (PA) System

1.4 QUALITY ASSURANCE

A. Fire Department approval of fire detection and alarm system.

B. Manufacturer and equipment supplier shall have a minimum of ten (10) years experience as contractor of fire detection and alarm system and shall have at least five (5) completed or on-going FDAS installation in the Philippines.

C. Equipment supplier shall have twenty four (24) hour parts and labor service available with a maximum four (4) hour response time.

D. Prior to making required submittals, system supplier shall meet with the Fire Department and make an informal presentation of the fire alarm and detection system. Meeting minutes shall be issued and comments incorporated into the required submittals.

E. Engineer In-Charge supervising the work shall be a duly registered Electronics Engineer supervised by a Professional Electronics Engineer as required by RA 9292 and the revised IRR of The National Building Code of the Philippines.

1.5 STANDARDS

1. Fire Department Requirements
2. National Building Code of the Philippines
3. National Fire Protection Association (NFPA 72, 101, 5000)
4. RA 9514 Revised Fire Code of the Philippines of 2008 and its IRR

1.6 ABBREVIATIONS

The following abbreviations are used in this document:

A	Fire Alarm Annunciator
FACP	Fire Alarm Control Panel
FTS	Firefighter's Telephone System
FCC	Fire Command Center
FATC	Fire Alarm Terminal Cabinet
IM	Input Module
M	Addressable Module
OM	Output Module
SL	Strobe Light with Speaker

1.7 SUBMITTALS

A. Minutes of system supplier's meeting with the Fire Department.

B. Manufacturer's product data sheets for equipment including Fire Marshal listing numbers.

C. Floor plans showing device locations and interconnecting conduit and wire. Floor plan of the FCC indicating fire management system equipment, equipment furnished by others, tables, plan racks, and required clearances. Elevations of each wall of the FCC.

D. Riser diagram showing devices, equipment, and interconnecting conduit and wire. Indicate points of connection to other equipment such as fire pump controllers, dry pipe sprinkler systems, elevator machine rooms and shafts and kitchen hood fire protection systems.

E. Scaled detail drawings of FACP

F. Wiring diagram for each device.

G. Wiring diagrams for smoke control sequence.

H. Voltage drop calculations.

I. Interface installation shop drawing for magnetic door holders, and electric door locking hardware.

J. List of all devices with address identification.

K. Lay-out of Fire Alarm panels.

L. Seismic restraint calculations.

1.8 FIELD QUALITY TESTING

A. Wiring shall be inspected and tested for continuity and short circuits. The minimum allowable resistance between any two conductors or between conductors and ground is ten mega ohms measured with a 500 volt megger.

B. Field Test Reports
   1. Certification that equipment has been properly installed and is in satisfactory operating condition.
   2. Sensitivity settings for smoke detectors.

3. Detailed operational test report in matrix form indicating each initiating device, each signaling device, each communication device, and each control and indicating light on each piece of equipment. Report shall certify the following:
   3.1 Successful operation of each alarm and supervisory initiating device.
   3.2 Successful operation of each signaling device.
   3.3 Successful operation of automatic smoke control sequences.
   3.4 Successful operation of FACP
   3.5 Successful operation of Firemans Telephone Systems
   3.6 Successful operation of line supervision devices.
   3.7 Successful operation of offsite alarm monitoring system connection (optional).
   3.8 Successful operation of unlocking electronically locked doors.

1.9 IDENTIFICATION

A. Provide an identification nameplate for each equipment cabinet.

1.10 SEQUENCE OF OPERATION

A. A computerized intelligent addressable, non-coded, two stage evacuation system complete with integrated emergency voice two way communication system will be provided. The system will be designed using National Building Code and Fire Code of the Philippines and other related standards such as NFPA as reference.

B. The main design principle of the proposed system is to provide localized microprocessor based intelligent Fire Alarm Control Panel, FACP with Emergency Voice Evacuation System, Detectors and system are able to identify maintenance points, malfunctioning and line discontinuity.

C. The primary means of detection/suppression will be a system of smoke detectors integrated with the automatic sprinkler system. Smoke detectors will be provided in all areas of the building to comply with local codes, and will be supplemented by the following types of early warning detection.

D. All detectors and zone control and monitor modules will be connected on an addressable loop and will each posses a unique address to allow specific identification in the case of alarm or malfunction and environmental adjustment.

E. Upon activation of any alarm, initiating devices the system will send signal to:
   1. Transmit an evacuation broadcast to the fire floor and floor above.
   2. Transmit an alert broadcast, IF:
      2.1 Fire alarm within the floor is not acknowledged within 5 minutes.
      2.2 Manual pull station is activated within the fire alarm floor.
      2.3 Sprinkler flow switch/ supervisory switch is activated.
      2.4 Another detector is triggered/ activated within the floor.
   3. Automatically stop all building floors recirculating air handling systems (fans).
   4. Automatically start all smoke removal and pressurization fan systems as well as open/close appropriate dampers.
   5. Activate all fire shutters to stage position.
   6. Release all secured door magnetic locks.
   7. Annunciate all functions at the Fire Alarm Control Panel at the Ground Floor.
   8. Should the initial alarm not be acknowledge within five minutes, an evacuation broadcast will be transmitted to the entire building complex.
   9. Transmit signal to the local fire department.
   10. A hard copy printout to be initiated at the printer.

F. A selective paging system will be integrated with the signaling system to allow authorized announcements.

G. An integrated UL or equivalent listed dedicated two way fire fighter’s telephone system will be provided at each exit stair entry to allow direct communication between the fire fighters and the Fire Command Center.

H. The main control panel will consist of a central processing unit, printer and color LCD unit annunciator with a complete graphics package identifying all fire zone status.

I. The printer shall be as an event and status printer, it shall be laser jet type with a minimum speed of 200 characters per second at 10 characters per inch.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

A. Fire Detection and Alarm System components shall be the manufacturer going to be installed in the building complex.
B. Contractor must have at least ten (10) of experience and existence.

2.2 GENERAL

A. Alarm and trouble signals shall be digitally encoded by listed electronic devices onto a NFPA Style 6 or 7 (Class A) looped multiplex communication system.

B. Alarm and trouble signals from all addressable devices shall be digitally encoded NFPA Style 6 or 7 (Class A) signaling line conduit.

C. Digitized electronic signals shall employ check digits or multiple polling.

D. Response time between alarm initiation and recording is not to exceed five (5) seconds.

E. The fire alarm control panel (FACP) shall consist of low current, solid-state integrated circuits, and shall be powered from centralized emergency power line source and centralized standby battery power source.

F. Power for initiating and signaling devices may be from the fire alarm control panel to which they are connected.

G. A single ground or open on any system signaling line circuits, i.e., communication network (multiplex loop) shall not cause system malfunction or loss of operating power.

H. Alarm signals arriving at the FACP shall not be lost following a power failure (or outage) until the alarm signal is transmitted and recorded.

I. Speaker circuits shall be electrically supervised for open and short circuit per smoke zone.

J. Two-way telephone communication circuits shall be arranged so as to allow communication between the fire command center and remote telephone locations.

K. It shall be possible to connect the telephone circuits to the speaker circuits to allow voice communication over the speaker circuit from a telephone handset.

2.3 LINE SUPERVISION

A. All system equipment and wiring shall be supervised.

B. Style 7 wiring shall be arranged so that the system shall not be affected by a single open, short, or ground condition. Report trouble condition and automatically switch over to alternate wiring path.

C. Style Y wiring shall utilize end of line resistors.

D. Addressable Channel Wiring: Style 6.

E. Multiplex Channel Wiring: Style 7.

F. Non Addressable Initiating Device Wiring: Style Y.

G. VCS and FTS Device Wiring: Style Y.

2.4 STANDBY BATTERIES

A. Provide sufficient battery (NiCd) capacity to operate the entire system upon loss of power under maximum normal load for a minimum period of 24 hours with a minimum of 5 minutes of alarm operation at the end of this period.

B. The system shall automatically transfer to the standby batteries upon power failure. Battery charging and recharging shall be automatic.

2.5 FIRE ALARM CONTROL PANEL (FACP)

A. Solid state, microprocessor based, modular design, fully supervised. Steel enclosure in standard finish, with hinged, locking door. Integral power supply, standby batteries, and battery charger.

B. Provide power on LED, power failure LED, system trouble LED, system reset switch, alarm silence switch, trouble silence switch, manual evacuation switch, alarm acknowledge switch, trouble acknowledge switch, supervisory service acknowledge switch, lamp test button, tone alert, battery supervision LED, auxiliary relays, and other system indicators and controls necessary for process in alarm and signaling functions. Indicating lamps shall be LED type.

C. Provide appropriate permanent identification labeling of control and indicating functions.

D. Annunciation: Serial annunciator with back lit, alphanumeric, 80 character liquid crystal display indicating clear language information as to the type of alarm (device type), point status (alarm or trouble), number of alarms on the system, and a custom location label. Ability to scroll back through prior system actions.

E. System shall utilize analog type smoke detection with alarm verification, self-test feature, individual sensor automatic timed sensitivity adjustment, individual smoke sensor field adjustable sensitivity set from FACP, and automatic maintenance alarm feature.

F. Provide at least one (1) spare loop for maintenance purposes.

G. Networking Capable Panel (for FACP Interconnection) for integration with other building facilities, for future expansion or for addition of initiating and notification devices during fit-out.

2.6 FIRE ALARM INITIATING DEVICES

A. GENERAL
1. Intelligent Addressable type.
2. Provide auxiliary relays where required to satisfy system operational requirements.
3. Smoke detectors shall be intelligent analog type.

B. AUTOMATIC FIRE DETECTORS
1. The manufacturer shall have available the following types of analogue addressable automatic sensors, for direct connection to the system addressable loops:
1.1 Ionisation smoke sensors
1.2 Photoelectric smoke sensors
1.3 Heat sensors
1.4 Multi-sensors

C. ADDRESSABLE UNITS
1. The manufacturer shall be capable of offering two-state addressable versions of the following units, taking only one address from the loop:
1.1 Ionisation smoke detectors

1.2 Photoelectric smoke detectors
1.3 Heat detectors
1.4 Photoelectric beam smoke detectors
1.5 Ultra-violet flame detectors
1.6 Conventional detector interface module
1.7 Addressable sounder modules
1.8 Addressable relay interface modules
1.9 Addressable switch monitoring modules
1.10 Short circuit isolator modules (no address required)
1.11 Loop powered sounders
1.12 Manual call points for indoor use
1.13 Manual call points for outdoor use
1.14 Multiple inputs/outputs
1.15 Radio interfaces to detectors and call points

D. CONVENTIONAL UNITS
1. Then manufacturer shall have available the following types of conventional automatic detectors, manual call points and ancillary units for connection to the system via suitable interfaces:
1.1 Ionisation smoke detectors
1.2 Photoelectric smoke detectors
1.3 Photoelectric beam smoke detectors
1.4 Ultra-violet flame detectors
1.5 Heat detectors
1.6 Manual call points for indoor use
1.7 Manual call points for outdoor use
1.8 Remote indicator units
1.9 Sounders
2. Analogue Addressable and addressable detectors and modules must be able to transmit to the FACP an address to be used in the system configuration.
3. It must be possible to connect and mix automatic detectors, addressable manual call points and addressable modules within the same zone sub-division of an addressable loop.
4. All equipment connected to the system addressable loop, either directly or via interfaces, shall be proofed against electrical noise, high frequency pulses and electromagnetic influences from other equipment.
5. The manufacturer shall have available suitable equipment to test and remove or exchange all three main types of automatic point-type detectors when installed.

E. IONISATION SMOKE DETECTORS
1. The ionisation smoke detectors shall be capable of detecting visible and invisible combustion gases emanating from fires, using a dual ionisation chamber in which the air is ionised by a single radioactive source.
2. The radioactive source used shall be AM 241 of one microcurie or less.
3. The ionisation smoke detectors shall be designed to have high resistance to contamination and corrosion and shall include RFI screening to minimise the effect of radiated and conducted electrical interference.
4. The ionisation smoke detectors shall be suitable for operation in air speeds of up to 10m/s and shall incorporate screens to minimise the effects of small insects.
5. The manufacturer shall have available the following versions of the ionization smoke detector to meet different applications:
5.1 Analogue addressable
5.2 Conventional
6. The ionisation smoke detector shall incorporate LED’s, clearly visible from the outside, to provide indication of alarm actuation.
7. In locations where the detector is not readily visible, remote indicator units shall be provided.

F. PHOTOELECTRIC SMOKE DETECTORS
1. The photoelectric smoke detectors shall be capable of detecting visible combustion gases emanating from fires and shall employ the forward light-scatter principle.

2. The point-type photoelectric smoke detectors shall be equally sensitive to a wide range of combustible materials.

G. DUCT SMOKE DETECTORS
1. The manufacturer shall produce standard equipment for the installation of smoke detectors in air ducts. This equipment shall be designed to accommodate the manufacturer's standard smoke detectors and bases:
1.1 Analogue addressable,
1.2 Addressable and conventional.

H. HEAT DETECTORS
1. The heat detectors shall be capable of detecting rapid rise in temperature and/or fixed absolute temperatures.
2. The heat detectors shall employ two heat-sensing elements with different thermal characteristics to provide a rate of rise dependent response.
3. The heat detectors shall include RFI screening to minimize the effect of radiated and conducted electrical interference.
4. The manufacturer shall have available the following versions of heat detectors to meet different applications:
4.1 Analogue addressable – grade 1, 2 or 3.
4.2 Two state addressable – grade 1
4.3 Two state addressable – grade 2
4.4 Conventional – grade 1
4.5 Conventional – grade 2
4.6 Conventional – range 1
4.7 Conventional – static 60ºC
4.8 Conventional – static 90ºC

5. The heat detectors shall incorporate LED's, clearly visible from the outside, to provide an indication of alarm actuation.
6. In locations where the detector is not readily visible, remote indicator units shall be provided.

I. DETECTOR BASE:
1. All detector base shall fit into a common standard type base. Every base shall have a built-in option allowing mechanical locking of the detector head to prevent unauthorized removal or tampering.
2. Detector insertion and removal shall be by simple push-twist movement through the use of an extended tool by one person at the floor level with the detector mounting height up to 7 meter even with the mechanical locking device activated.
3. The base shall be equipped with screw-less terminals capable of securely retaining wires up to 1.5 sq.mm. The base shall be suitable for use for both Class A & Class B wiring.
4. The standard base shall consist of a sealing plate to prevent dirt, dust, condensation or water from the conduit reaching the terminals or detector contact points.
5. The standard base shall be supplied with a removable base cover to protect the contact area during installation stage and to allow checking and commissioning of the individual loops before insertion of the detectors. The dust cover shall be removable by an extended tool up to 7 meters from the floor level.
6. Special base assemblies with sounders from the same manufacturer shall have minimum of 75dBA output

J. DEVICE MONITORING MODULE
1. The device monitoring module shall permit the use of conventional detecting devices including sprinkler flow switches and supervisory switches on the addressable system. The module can be mounted together in the fire alarm cabinet or be in the standard outlet boxes located near the device being monitored.

K. CONTROL MODULE
1. Interfaces a controlled device to the addressable system, This enables the fire alarm panel to direct an instruction

2.7 FIRE ALARM NOTIFICATION APPLIANCE

A. SPEAKER- STROBES
   1. Fire lights shall be a xenon-strobe type or equivalent. It shall be low-voltage (24VDC).
      1.1 The maximum pulse duration shall be 2/10ths of one second (0.2 second with a maximum duty cycle of 40%). A pulse duration is defined as the time interval between initial and final points of 10% of maximum signal.
      1.2 The intensity shall be minimum of 75 candela.
      1.3 The flash rate shall be minimum of 1Hz and a maximum of 3Hz.
   2. The color shall be clear or nominal white (i.e. unfiltered or clear filtered white light).
   3. Electric, utilizing solid state electronic technology operating on a nominal 24 VDC, with a nominal rating of 82 dBA at 3m.

B. ANNUNCIATOR PANEL- BACK LIT GRAPHIC TYPE
   1. Graphic annunciator showing the site plan, and access way shall be provided and installed in FCC room and every Elevator lobby in each floor.
   2. Indicating Lamps
   3. Provide supervised light emitting diodes (LED’s) for indication.

2.8 SPECIAL DETECTION SYSTEM AND DEVICES

A. Where specified, special detection system, addressable and non-addressable type, such as beam detectors, linear detector, aspirating smoke detection system, gas detector, etc. shall be used. The detection system shall be of a type approved by Bureau of Fire Department/Authorities having Jurisdiction and shall be suitable for a particular application, environmental condition and hazard. The Contractor shall submit detailed equipment catalogue, description, technical data and test certificate for approval. The Contractor shall submit information proving the suitability of the special detection system and devices for a particular application and hazard for approval.

B. Where detection system is required in open-air/outdoor applications, the Contractor shall use and submit suitable detection system approved by Bureau of Fire Department/Authorities Having Jurisdiction for approval. Special detection system shall also be used where necessary to avoid unwanted alarm.

PART 3 – EXECUTION

3.1 GENERAL

A. All equipment shall be installed and connected in accordance with the manufacturer's recommendations. Following the required specifications indicated here.

B. Wiring shall be color coded, and in accordance with the manufacturer's recommendations and Fire Department requirements. Install wiring in an independent, dedicated metallic raceway system.

C. Connections to devices installed in accessible tile ceilings shall be in flexible conduit.

D. Device back boxes shall be securely attached to framing members.

E. Provide wireways above and/or below equipment cabinets to accommodate large concentrations of wiring. Conductors within equipment cabinets shall be carefully formed and harnessed.

F. Connect equipment to emergency power system.

G. Furnish a fire alarm speaker and a firefighter's plug in jack for each elevator. Coordinate installation with elevator equipment supplier.

H. FCIP and smoke control sequence wiring shall be dedicated and independent from other systems.

I. Provide a 25 mm empty conduit from the FACP to the nearest telecom terminal backboard.

J. Speaker circuits on individual floor are to be wired in alternate pattern e.g. 'a'-'b'-'a'- 'b'-'a'.

3.2 TESTING AND COMMISSIONING

A. Provide the service of a competent factory-trained engineer or technical authorized by the manufacturer of the fire detection and alarm system equipment to technically supervise and participate during all of the adjustments and tests for the system. Make all adjustments and tests in the presence of the Project Manager.

B. When the system has been completed, and prior to the final inspection, furnish testing equipment and perform the following tests in the presence of the Engineer and the Local authority having jurisdiction.
   1. Check installation, supervision and operation to ascertain that they will function as specified.
   2. When any defects are detected, make repairs or install replacement components, and repeat the test.

C. At the final inspection, a factory-trained representative of the manufacturer of the major equipment shall perform the required test. In addition, the representative shall demonstrate that the systems function properly in every respect. The demonstration shall be made in the presence of the Owner's Representative, Project Manager, Consultant and the local authority having jurisdiction.

3.3 ADDRESSABLE FIRE ALARM TESTING

The correctness of cabling with continuity as per the approved shop drawings. System design & configuration check, Access Control & P.A System integration test

A. PHOTOELECTRIC SMOKE DETECTOR
   1. The testing shall be carried out for each loop / zone, initially one detector in a zone and subsequently 2 or more are disassociated detectors in each zone with time lapse between the detectors to test for Alarm Priority, Alarm Queuing and Call Logging.
   2. An identified detector will be subjected to smoke aspiration from burning paper/cigarette puffs, rubber and other materials which give dense smoke held at 0.3 M distance from the detector. The FACP should indicate increased analogue output for that address and after the programmed delay time, a fire alarm signal shall be indicated. This delay shall be utilized for alarm verification.
   3. The same test shall be carried out for two detectors in the same Loop but in different rooms. The FACP shall indicate Pre Alarm higher analogue levels for both detectors in its display with separate identification for both fires. One of the detectors in question be subjected to higher and longer levels of smoke aspiration. The FACP should give priority alarm for this address. The printout shall indicate individual addresses of the detectors with achieved analogue values and the time of event. This test shall be carried out for different Loops as well as for 2 Loops simultaneously. One detector of each type will be disconnected and subjected to slow dust build - up by means as desired by the Bidder and again connected in the circuit. The FACP shall indicate the changed ambient levels and automatically adjust the analogue values for the same. These Detectors shall then be replaced by new Detectors of identical type and the FACP shall then be programmed accordingly and checked. The Bidder will take custody of the removed detectors without additional cost to the project.

B. MANUAL PULL STATION
   1. Manual Pull Station in each area is opened & tested for its alarm. Every manual call point will be actuated in every zone in all locations to check for the alarm response. One half of the testing shall be made on a stand by battery power.

C. LOOP
   1. Any part of the Loop shall be short circuited. The FACP shall indicate the communication failure of all the devices connected in the short circuited segment. After

the short circuit is corrected, the Fault Isolator shall return to its normal status automatically, this being reflected in the FACP. The Loop shall then be in normal operation again. Any part of the Loop shall be de wired and tested as given above.

END OF SECTION 284600