DOC NUMBER: **569-DB07-AIC-110-004**	CLIENT NUMBER: **PRD-AIC-TSP-010**
CLIENT: **TAKEDA/BAXALTA**	
PROJECT **BURITI EPCMV PROJECT**	

FIRE ALARM SYSTEM

DESIGN BASIS

REV	DATE	DESCRIPTION	EXEC	CHECK	APPROV.
2	18JAN2022	ISSUE FOR CONSTRUCTION CONSIDERING COMMENTS	MAV	MAF	RSP
1	25NOV2021	ISSUE FOR CONSTRUCTION CONSIDERING COMMENTS	MAV	MAF	RSP
0	29SEP2021	ISSUE FOR CONSTRUCTION	MAV	MAF	RSP
E	17SEP2021	90% DD ISSUE	MAV	MAF	RSP
D	31MAR2021	30% DD ISSUE	MAV	MAF	RSP
C	16OCT2020	FINAL BD ISSUE	MAV	MAF	MSS
B	28AUG2020	90% BD ISSUE	MAV	MAF	MSS
A	09JUL2020	50% BD ISSUE	MAV	MAF	MSS

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1. REVISION HISTORY

Rev.	Reason for change
A	50% BD ISSUE
B	90% BD ISSUE
C	FINAL BD ISSUE
D	• Included DOC NUMBER and rename CLIENT NUMBER (Former PRD-AIC-TS-010). • General review in index numbering because of the new table 1 (revision history) • New numbers of drawings and documents in items 6.4 • Inclusion of the Building 7F and W.W.T in item 3 (Scope) • Added item 7.3, As requested by Takeda/Baxalta, all rooms must have a smoke detector in the fire alarm system
E	• Updated item 4. • Updated item 6.3. • Updated items 7.2.1, 7.3.1.2, 7.3.2.2, 7.4.2.1 and 7.4.2.2. • Added items 7.4.12 and 7.4.13.
0	• Updated to Issue for Construction
1	• Updated 3.1 • Updated item 7.3.3f
2	• Updated items 3.3, 7.3.2.3 • Added items 10, 11, 12 and 13.

2. PROJECT DESCRIPTION

2.1 Takeda has re-negotiated a licensing and tech transfer agreement (LTTA) with the Brazilian state- owned company Hemobrás (HB) to transfer the technology of Takeda's recombinant FVIII (rFVIII) product ADVATE from Takeda to Hemobrás. Hemobrás is planning to construct a vertically integrated facility for manufacturing of rFVIII at the Hemobrás owned site at Goiana, Pernambuco (PE), Brazil (Project Buriti).

2.2 The scope of Project Buriti is to design, build and qualify a new vertically integrated rFVIII Manufacturing facility, and includes implementation of all needed support buildings and Systems (Warehouse, QC Lab, Administration, Cafeteria and Utilities) on an existing brownfield site. It is expected that the new facility is completely self-contained and the existing Goiana site provides only basic utility supply (city water, gas, power) and logistics (access road, site security). The project also must account for operation's waste management (specifically process waste). The site's capacity layout for ADVATE manufacturing shall be based on three 2500L chemostat bioreactors, even though only equipment for a two bioreactor operation should be implemented at first.

2.3 In order to guarantee an optimal integration with current facility operations, a complete functional telecommunications systems connection between the new building and the existing buildings will be designed.

3. SCOPE.

3.1 This document is a technical guideline to design Fire Alarm systems considered for the Buriti Project – Buildings: B07A - Drug Product, B07B - Drug Substance, B07C-Boilers, B07F – Generator Building and Wastewater Treatment Plant.

3.2 This document has the minimum engineering requirements to be considered to integrate a complete and functional Fire Alarm systems to the Site's system.

3.3 Compatibility with already existing systems at Goiana site is required.

4. ACRONYMS.

AM	Fire Alarm Manual Pull Station
EMG	Emergency Generator
FACP	Fire Alarm Control Panel
FBAT	Fire Alarm Battery Cabinet
FCM	Intelligent, addressable control module
FMM	Fire Alarm Monitoring Module
FRM	Fire Alarm Relay Module
FS	Flow Switch
IAV	Fire Alarm Audible Speaker and Visual Alarm
IM	Fire Alarm Isolation Module - Clean Utilities
IV	Fire Alarm Visual Alarm
ISO	Intelligent addressable isolator module
IV	Fire Alarm Visual Alarm
NCA	Network Control Annunciator
SC	Smoke Detector – CRAC type
SD	Duct Smoke Detector
SG	Smoke Detector – Gas type
SH	Smoke Detector – Heat type
SI	Smoke Detector – Ionization type
SP	Smoke Detector – Photoelectric type
ST	Smoke Detector – Thermal type
TS	Tamper Switch
WWT	Wastewater Treatment Plant

5. REGULATIONS AND STANDARDS.

5.1 Systems design, equipment, materials and procedures, considered in this project, have to fulfill the next regulations and standards:

Implementation of Alarm and Fire Detection Systems (Execução de Sistemas de Alarme e Detecção de Incêndio)	NBR 17240
Automatic Smoke Detector for Fire Alarm Systems (Detectores Automáticos de Fumaça para Proteção Contra Incêndio)	NBR 11836
Código de Segurança contra Incêndio e Pânico para o estado de Pernambuco	COSCIP
Low Voltage Electrical Installations (Instalações Elétricas de Baixa Tensão)	NBR 5410
Regulatory Standards of the Brazilian Labor Department (Normas Regulamentadoras do Ministério do Trabalho)	NR
American Society of Heating, Refrigerating and Air Conditioning Engineers	ASHRAE
National Fire Protection Association	NFPA
Electronic Industries Association	EIA
Institute of Electrical and Electronics Engineers	IEEE
National Electrical Code	NEC
International Standards Organization	ISO

6. PROJECT DELIVERABLES.

6.1 Drawings and documents for conceptual design, that follow Hemobrás's requirements and standards.

6.2 Drawings will be issued in AutoCAD and Documents will be issued in Microsoft Office.

6.3 Reference drawings:

7A-I-0-7-02	Riser Diagram	Drug Product	Fire Alarm
7B-I-0-7-02	Riser Diagram	Drug Substance	Fire Alarm
7A-I-1-3-13	Ground floor	Drug Product	Fire Alarm
7B-I-1-3-13	Ground floor	Drug Substance	Fire Alarm
7A-I-2-3-23	First floor	Drug Product	Fire Alarm
7B-I-2-3-23	First floor	Drug Substance	Fire Alarm
7A-I-0-3-03	Walkable ceiling	Drug Product	Fire Alarm
7B-I-0-3-03	Walkable ceiling	Drug Substance	Fire Alarm
7A-I-3-3-33	Second floor	Drug Product	Fire Alarm
7B-I-3-3-33	Second floor	Drug Substance	Fire Alarm
7C-I-1-3-13	Ground floor	Boiler	Fire Alarm
7F-I-1-3-13	Ground floor	EMGs	Fire Alarm

6.4 Reference documents:

PRD-AIC-TSP-010 - Fire Alarm System Design Basis

PRD-AIC-LIS-024 – Fire Alarm System Equipment & Devices Schedule

PRD-AIC-LIS-042 - Bill of materials – Fire Alarm

7. ENGINEERING INFORMATION.

7.1 General definitions

7.1.1 The project shall fully comply with ABNT standards, and in the absence or omission thereof, the internationally recognized standards mentioned above shall be observed.

7.1.2 The installation of the entire Fire Alarm System must be in strict accordance with the standards of the Fire Department and local approvals of the state of Pernambuco (PE).

7.1.3 As requested by Takeda/Baxalta, all rooms must have a smoke detector (SP) in the fire alarm system.

7.1.4 All electronic equipment must meet the requirements of regulations on radio frequency electromagnetic interference.

7.2 Subject Areas Covered

7.2.1 The new Fire Alarm System shall be installed in the following buildings described below belonging to the Buriti project,

BUILDING TAG	DESCRIPTION
B07A	DRUG PRODUCT (FDP)
B07B	SUBSTANCE PRODUCT (BDS)
B07C	BOILERS
B07F	EMERGENCY GENERATORS
WWT	WASTEWATER TREATMENT PLANT

7.3 Fire Alarm System

7.3.1 General Specifications

7.3.1.1 In general, the Fire Alarm System is a safety measure that aims to ensure that, in the event of a fire in a building, its occurrence is reported early, contributing to the early stages of fight.

7.3.1.2 The system aims to monitor the environments through sensors and pull stations, interconnected to their respective detection and alarm Control Panel (FACP). An Ethernet network shall be provided between the FACP panel and the BMS to allow

data traffic between them. In the occurrence of any event detection, the system will generate visual and audible alarms locally, in the environments and in the FACP, being this alarm also visualized in a graphic overview screen of the BMS Operator Station to be installed in the BMS Control room of the B07B, in order to detail the information about the activated alarm.

7.3.1.3 The field devices are formed by addressable smoke detectors, temperature and thermo-velocimetric sensors, according to the particularities of each environment, in addition to pull stations and notification-appliances installed in the various areas and buildings. Smoke detectors will be installed in the HVAC system's return ducts and will be interconnected with both the Fire Alarm System and the HVAC system's Control Panels, so that these detectors are unique and common to both systems (HVAC and FA system).

7.3.1.4 The Fire Alarm System of the buildings belonging to the Buriti Project shall consist of autonomous and independent FACP, interconnected in a ring type network, having their operation, status, alarms and events monitored through graphic screens dedicated to the Fire Alarm System. This system will consist of a Main Fire Station located in the Administrative Building that will monitor the other FACP/NCA of the site and will be responsible for communicating with the Fire Fight Brigade in case of an accident.

7.3.1.5 All FACP and NCA shall be addressable, and microprocessor based, 24 VDC, large number of points, multiple access levels, alarm mute capability, LCD display, digital alarm transmitter communicator, minimum 24 hour battery backup. Have functions to monitor, supervise, activate, and deactivate devices and units. It must have supervision, fault and alarm signaling capability. The signaling shall be specific and shall indicate the address, the zone and other descriptive measures that allow the operator to respond in the most efficient way to the event.

7.3.1.6 The FACP shall have loop electronic circuit board to accommodate the addressable devices. Each loop shall have a capacity of up to 125 addressable devices. The FACP shall be expandable to add loop electronic circuit board for future expansions. Loop circuits shall be Class A type (with loop return to the control panel) in a ring to prevent a single break from disconnecting the FACP. The loop circuit shall have analog information capability to analyze detector conditions and sensitivity levels. Some exceptions may be applied, but with Takeda's due approval.

7.3.1.7 The FACP must be capable of powering the system's notification-appliances and control/command modules. For larger loops, the inclusion of remote power supplies for powering the notification-appliances and modules distributed in the buildings must be analyzed.

7.3.2 Fire Alarm System Network

7.3.2.1 The network that will interconnect all the FACP and NCA must be own and independent of the data network (converged network) of the other buildings belonging to the site. See Appendix 13.1.

7.3.2.2 As a project premise will be adopted that B07A (Drug product building will have a dedicated FACP. The auxiliary buildings (Boilers – B07C, Generators – B07F) will

not have a FACP or NCA, but the concept of using pull stations and notification-appliances should be maintained, being these detection devices, powered and connected to the FACP of building B07A. The FACP will control all the detection and alarm components of the neighboring building.

7.3.2.3 The WWT building may have a SCL loop connected to the FACP, so that it is possible to interconnect the WWT smoke detectors. Also, a NCA annunciator will be provided at the WWT building.

7.3.2.4 The wiring and cabling of the fire alarm system shall be independent of any other system, i.e. it shall be installed in exclusive conduits; they shall be identified by red paint. The wiring and cabling of the fire alarm system shall consist of power circuits for the fire alarm panels, as well as exclusive system sources, detection, signaling and alarm circuits (loops), monitoring and control circuits, intercommunication circuits between the fire alarm panels and other communication circuits with other systems.

7.3.2.5 The physical distribution of the fire supervision and alarm signal cables that interconnect the B07A´s FACP and the Main Center (Guardhouse) shall run via underground (buried) by optical fiber. The buried routes can be installed in the same existent concrete duct bank of the communications system for example, but in different conduits.

7.3.3 Basic System Requirements

a) To comply in particular with the specifications of NBR 17240, in its latest edition, in particular regarding the number of detection points, application of sensors, pull stations and notification-appliances, as well as their distribution throughout the environments, including walkable ceilings, technical areas and other locations where applicable.

b) All system components must be weatherproof or protected for operation in the environment. Control modules and other similar electronic components shall not be installed in outdoor areas if they are not for outdoor installations or are not approved to operate outdoors. Transient surge suppressor (line isolator modules) must be installed in the circuits immediately after their entry into buildings from outside.

c) All components must be UL listed.

d) Install in all places where applicable, rigid and flexible conduits, dedicated for the Fire Alarm system, to interconnect the field devices to the FACP.

e) The Fire Alarm System to be implemented at Hemobrás shall use semi-heavy-duty rigid conduits, in hot dip galvanized steel, seamless and with removed burrs and thickness in compliance with ABNT-5597, with gauge of at least ¾" and NPT thread. In the derivations of conduits to the points where the sensors are fixed, they must be made by means of flexible conduit with metal core, "seal tube" type and octagonal boxes for fixing the detectors on the slabs and linings (where necessary).

f) The Fire Alarm System design should have its own conduit, panels, junction boxes, cables and multicables, and no resources should be shared with the instrumentation of other systems. Entire infrastructure of the Fire Alarm

System must have proper identification as mentioned in the corresponding standard.

g) The detection stations shall be supplied with critical (emergency) load feeders via UPS.

h) The Fire Alarm system shall control the unlocking of the turnstiles of the access control system automatically to preserve the physical integrity of people.

i) The action of a sensor (pull station or smoke detector) must cause an alarm to alert people and action of the Fire fight brigade in the actions necessary for the event, in addition to acting on the interlock of elevators, access control system, act on smoke exhausts and others to be detailed in the project, through specific modules of the system. The interface modules for these actions must be installed, interconnected, and activated according to the standards.

j) Improving the feature of robustness of the loop, it should not have splices, derivations, or connectors in the middle of the circuit. Terminal blocks or terminal panels should be used. Such terminations shall be clearly identified and easily accessible. These locations shall be clearly identified in design and installation drawings and diagrams.

k) The cables for the loops shall be halogen-free and the shielding and diameter shall be as determined by the system manufacturer. Circuit colors should be Red (+) and Black (-).

l) The design must include the use of line insulator modules. These modules limit the number of elements that can become inoperative, they also shorten the maintenance time by determining the location of short or open circuit in the loop. These modules should therefore be clearly identified and easily accessible. The indicator LED should be visible (not inside a junction box). The flashing LED indicates normal operation and the continuous LED indicates failure. One isolating module should be installed at the beginning of the loop and another at the end of each loop. Other isolator modules shall be installed every 20 elements of the loop and no more than 40 elements. Line isolator modules shall be installed when the detection loops change floor or building.

m) The Fire Alarm system shall have signal and power circuits for all components. Additional panels for the detection elements shall be provided to facilitate the number and load of alarm elements in the building. Additional panels shall be clearly identified and easily accessible. The locations of additional signs shall be clearly identified in both floor plans and diagrams. The load shall be calculated in such a way that it does not exceed 80% of that provided for each circuit and the voltage drop does not exceed 14%. The additional panels shall have battery backup for a minimum of 8 hours (in stand-by). The notification circuit must be in accordance with NBR 17240 Class A with red (+) and black (-) cables with a minimum diameter of 1.5 mm² and insulation in accordance with the Brazilian standard.

7.4 Basic Composition of Equipment

7.4.1 The Fire Alarm and Detection System shall consist of at least the following equipment:

7.4.2 Fire Alarm Control Panel (FACP)

7.4.2.1 The BMS system of the B07 will be connected to the FACP of B07A building and to Hemobrás' dedicated network system, allowing alarms to be made available on the NCA at Hemobrás Guardhouse. The system will consist of a main panel (FCAP) for receiving data that will be able to identify all individual building alarms (e.g., VG's activation, firefighting system monitoring, detector trigger or pull station, etc.). The main panel (FACP) will send the alarm signal to the firefighting brigade room to initiate the prompt response of the brigade group. This center will also serve as a "24-hour center" for the two-way communications system throughout the site area. The main unit will also have the ability to record all events (alarms, faults, mute alarms, etc.) but will not have the ability to mute the alarms in the buildings or test each individual system in the buildings.

7.4.2.2 All FACP and NCA panels will communicate through a proprietary network through a fiber optic ring that will have distinct paths, called main path and redundant path.

7.4.2.3 The OWS shall have a power source via battery and via UPS, printer and workstation (microcomputer) for viewing the exclusive graphic screens of the detection and alarm system.

7.4.2.4 The room where the Firefighting Brigade will be located shall also have a workstation to visualize the graphic screens.

7.4.2.5 The local FACP in building B07A shall have a lockable front access door, liquid crystal display incorporated into the doors to monitor the system, and key to turn the system on/off. Connections, instruments, and controls shall allow only front access.

7.4.2.6 Individual circuits shall be provided to receive and analyze signals from each device, and circuits for continuous supervision and control of the entire facility. Fire alarm and fault alarm indication shall be provided by individual and separate circuits.

7.4.2.7 They shall be micro-processed with addressable system (large number of points), 24VDC operation, multiple levels of access, silent alarm capabilities, LCD display, integral digital alarm communication transmitter, minimum 24 hour battery backup. Functions must monitor, supervise, activate, and deactivate devices and units. The local panel shall be able to transmit and supervise problems and alarm signals. The signals shall be specific indicating the address, zone and other descriptive measure such that the device can operate most efficiently. An Ethernet interface should also be provided to connect to the site's supervision and building control network.

7.4.2.8 The local panel (**FBAT**) should be able to provide power for the notification-appliances. Remote power supplies for the audiovisual beacons should also be provided to distribute the load of the installation. Audible announcement will be made by voice communicators (when installed in the building) and siren tones. The audio visual alarm shall be synchronized.

7.4.3 Network Control Annunciator (NCA)

7.4.3.1 They should be micro-processed with addressable system, 24VDC operation, multiple access levels, silent alarm capabilities, 80 character LCD display (minimum)

and display all alarm and fault conditions. The signals shall be specific to the address, zone, and other descriptive measure such that the device can operate most efficiently. An Ethernet interface should also be provided to connect to the site's supervisory and building control network.

7.4.4 Pull Stations (AM)

7.4.4.1 All pull stations shall be addressable. They shall be of the double action and polycarbonate type. The case shall be red in accordance with standards. The pull station should have a protective cover because it is considered that its installation is in public places where false alarms may occur due to improper actuation. The protective cover should be made of transparent plastic with UV protection. The typical operation is to lower the lever of the activated device and sound the alarm through the local audiovisual signal. The actuator should be installed at a height between 1.20m and 1.60m from the floor and the nameplates should be in Portuguese language.

7.4.4.2 The pull stations should preferably be located near the exits, common areas and escape routes. The maximum distance between them should be 30 meters as required by standard. Pull stations should also be installed next to the fire house cabinets.

7.4.5 Horn/Strobes (IAV)

7.4.5.1 These Notification-appliances have high frequency, power (sound pressure) and dispersion (long range) audible and/or visual alarms and must be activated by the FACP when fire accidents occur. The audiovisual warning devices shall emit visual indication flash signals (with adjustable intensity) and shall be installed above the pull stations. The visual warning devices shall emit flash-type visual indication signals (with adjustable intensity) and shall be installed on the walls or ceilings of rooms and corridors.

7.4.5.2 Audio-visual warning devices shall provide an audible alarm with a power (sound pressure) of at least 15 dBA above the normal sound pressure of the rooms. This value shall be verified by the bidder in all environments of the buildings.

7.4.6 Strobes (IV)

7.4.6.1 Strobe lights must be synchronized and pulsed. The candela rating will be 15/75 CD. Strobe lights are normally installed to guide the occupants out of the building. In addition, it is recommended to add stroboscopic lights in places with a large number of doors (corridors) changing rooms, or places with a high concentration of noise where the operator/employee uses an ear muffler so that visual signaling is more effective than sound signaling.

7.4.7 Smoke detectors

7.4.7.1 Smoke and/or thermo-velocimetric detectors shall be addressable; they shall be of the "intelligent" type with a sensitivity that can be adjusted via a local FACP.

7.4.7.2 Sensitivity shall be adjustable based on dirt accumulation and ambient conditions and local position. Power and alarm LEDs shall be located at the base of the detector

indicating normal and alarm operation (flashing and continuous). The element shall consist of the detector and base. The base must contain the electronic module for communication with the FACP.

7.4.7.3 The detectors must be resistant to possible normal temperature changes, humidity and corrosion, and mechanical vibration. It must have the manufacturer's identification, type, temperature (in degrees Celsius), range and/or parameters for operation, and year of manufacture conveniently printed on its body.

7.4.7.4 The connection between the detector and the base should be by specific terminals. The detector base or detector supervision unit shall be protected and packed and shall be made of white plastic.

7.4.7.5 Additionally, the manufacturer shall officially inform the fixed trigger temperature of the temperature detectors, the gradient and fixed operating temperature of the thermo-velocimetric detectors, and the intensity of the radioactive source of each smoke detector, when provided with ionization chambers.

7.4.7.6 For the Buriti Project, smoke and/or thermo-velocimetric detectors shall be used, basically the following types of sensors:

- Optical Smoke Sensors (Detectors), **SP**. These sensors have their operation based on the photoelectric effect (optical), which may use elements with obscuration technology, light reflection, or other optical technology. They are suitable for environments where smoke is the main indication of a fire principle. (Example: Meeting Rooms, Telecommunication Rooms and Corridors).
- Thermo-velocimetric Sensors, **ST**; These sensors have two parameters for detection, one resulting from the speed of temperature increase in a period of time and the other referring to the fixed temperature gradient. As for the first parameter, the detector must activate the alarm when in a predefined time the temperature increase is higher than the pre-set temperature, and as for the second parameter regardless of the time the temperature exceeds the pre-set limit. They are suitable for environments where the instantaneous temperature increase is the main indication of the fire principle. (Example: electrical rooms, and technical rooms).
- High sensitivity optical smoke detector (**SD**) suitable for use in HVAC ducts shall be used to protect sensitive, non-tolerant smoke areas and equipment where local air conditioners are used, in compliance with NFPA 76 (Very Early Warning Fire Protection) section 8.5.3.1.2.3. It shall be analog, addressable, UL listed as compatible with the FACP in whose loop it will be interconnected. It shall consist of an enclosure, an optical spot laser detector, designed to detect smoke produced by various types of combustible materials. The FACP shall obtain the analog reading from each detector each time it communicates and compare the reading with the pre-programmed setting, alarming if such setting is exceeded.
- Bean smoke detector. It should be designed for the protection of open areas, with high and/or inclined ceiling; where occasional smoke detectors are difficult to install, maintain and operate. The linear detector shall be intelligent and addressable, UL listed as compatible with the fire

alarm and detection panel, in whose loop it will be interconnected. It must use self-reflecting infrared light barrier technology, consisting of an infrared light transmitter/receiver unit, or a reflecting mirror. The assembly shall constantly measure the intensity of reflected infra-red light. The FACP should, when communicating, obtain the analog reading from each detector, and compare the reading with the pre-programmed or corrected setting, alarming if this setting is exceeded. Different levels of sensitivity will be allowed, some of them being of the "self-adjustment" type. When a "self-adjustment" is selected, the detector should automatically adapt its operation to obtain the optimum sensitivity for that particular working environment. It must integrate short-circuit isolators into its electronics. Optionally, the detector may have a sensitivity test system, composed of a filter, internal to the optical system of the detector, and fixed to the shaft of a servomotor, which will move the filter in the direction of the ultra-red light beam, thus testing its sensitivity. This optional system will allow the user to perform the necessary maintenance tests required by standards, such as NFPA 72, without having to physically access the detector. This test can be performed through the front display of the fire panel or with the use of an optional remote test station. The servomotor should be powered by external 24 Vdc, not the SLC detection loop.

7.4.8 Gas Detector (SG)

7.4.8.1 Gas Detectors are occasional, classified by the type of gas to be identified (LPG, natural, or hydrogen). Their location also depends on the type of gas monitored, depending on the density of the same. Sensors must use infrared and NDIR electrocatalytic technologies.

7.4.9 Intelligent Addressable Control Module (FCM)

7.4.9.1 The Control Modules are addressable devices that, in case of fire, must be controlled by the FACP, in order to allow the activation or deactivation of equipment, such as audible and audio-visual indicators and the unlocking of the turnstiles at the accesses to the building.

7.4.10 Intelligent Addressable Monitor Module (FMM)

7.4.10.1 The Monitor Modules are addressable devices controlled by the FACP, which have the function of monitoring the physical state of the equipment, such as flow switch for example.

7.4.11 Isolator Module (ISO)

7.4.11.1 The Isolator modules are devices which must isolate the devices (detectors, monitoring and control modules) from the loop in which they are installed, so that in the event of rupture, damage, short circuit or overload of the overall system network, this "isolated" loop is protected from the others, thus maintaining the integrity of the circuit.

7.4.12 Flow switch (FS)

7.4.12.1 A flow switch is typically mounted on the side of a pipe where water flow is expected to be detected in the event of a sprinkler head activation. When water moves past the flow switch in the pipe the pressure of the water moves an integrated paddle (a component of the flow switch) in the direction of water flow. This movement activates a switch that triggers an alarm signal at a fire detection and alarm system.

7.4.13 Tamper switch

7.4.13.1 A tamper switch is a mechanical and electrical device connected to a fire protection valve that signals a warning if the valve partially or fully closes. The tamper switch sends the signal to a fire control panel which creates a record of the incident.

7.4.14 Conductors

7.4.14.1 The conductors must have suitable gauges for each case, according to the current and allowable voltage drop, and flameproof insulation compatible with the voltage to which they will be subjected. They will meet, as a prerequisite, NBR NM 280 (IEC 60228) - insulated cable conductors; NBR 17240. All conductors must be properly identified.

7.4.14.2 These conductors should preferably be rigid/flexible copper conductors for circuits and have non-propellent insulation, resistant to temperature above or equal to 70°C. Single wires and cables shall have a minimum insulation voltage of 600V and a minimum cross-section of 1.50mm² for the detection loops. For power supply cables and sirens, the conductors will have a minimum insulation voltage of 300V and a minimum cross-section of 2.50mm². Remember that for the sizing of the electrical conductors, the maximum voltage drops allowed for detection circuits is 5% and for alarm and command circuits is 10%.

7.4.14.3 As a characteristic of the cables, the ohmic resistance of the cable shielding cannot exceed 50 ohms between the central and the furthest point of the system.

7.4.14.4 They should have different colors to identify the polarity of the circuit, preferably red (+) and black (-) in the case of "loops" and white (+) and black (-) in the case of feeder circuits.

7.4.14.5 Distance between system cables and conductors and the power supply cables (127 Vac) should be at least 500mm.

7.4.14.6 The communication network between the detection and FACP shall be by means of 62.5 microns multi-mode fiber optics, these cables shall be housed in dedicated conduits that shall be installed on the technical floor of building B07A in order to provide interconnection between the network of the FACPs in each building.

7.4.14.7 There are different types of cables (conductors) in a fire detection installation that must meet the installation standards and technical specifications.

7.4.14.8 Among the main types are distinguished:

a) Signal cables for addressable sensors.

b) Cables for siren power.

c) Cables for power supply.

d) Cables for communication.

7.4.15 Junction boxes

7.4.15.1 The arrangement and spacing of the various bridge and junction boxes of the system should be carefully planned to facilitate the pulling services of the cables as well as the future maintenance services of the system.

7.4.15.2 All boxes must be carefully installed, with perfect level and plumbing, in the exact position determined in design and, when installed in masonry elements, must face the final covering.

7.4.15.3 The junction boxes used internally will be in steel plate no. 14, finished with internal and external antioxidant paint, with lid fixed by means of screws. These boxes will be obligatorily used in the places of subdivision of conduits and for the housing of the command and monitoring modules of the system.

7.4.15.4 The exposed passage boxes used externally will be weatherproof with high mechanical and corrosion resistance, without external paint, and will be manufactured in cast aluminum alloy, with threaded inlets and screwed cover and with rubber sealing gasket to inhibit water and gas entry.

7.4.15.5 The junction boxes used in the external area will be in masonry, according to the dimensions indicated in the project plan.

8. VOICE EVACUATION AND EMERGENCY TELEPHONE SYSTEM

8.1 The emergency communication system helps to inform, through voice messages, the need to evacuate the building after the confirmation of a fire. Digitally pre-recorded messages should notify occupants of the building of fire conditions or other emergencies involving the protection of lives. The Emergency Communication System shall consist of Emergency Telephones and a Sound System consisting of a Voice Command Center, microphones, amplifiers, loudspeakers and horns for automatic message announcements and live announcements.

8.2 Bi-directional communication via emergency phones (hot-line) should be available at selected locations in all buildings connected with the central station in the Guardhouse Building's Security Room. Basically, they shall be installed in one or two locations on the ground floor, in the corridors, near the stairways, elevators and next to the fire alarm panel. These stations can be fixed devices, housed in rooms with key and break-away system. The activation and the call to the central are made by removing the phone from the hook or plugging the handset into the connector, without having to dial any numbers. Conventional signals such as call tone and busy should be provided for user guidance. This system must be fully integrated to the Audio Command Center, allowing its operation through a single location and linking voice commands through the speakers from the phones. This part of the system must be integrated with the Fire Alarm system.

8.3 The sound signal must be transmitted by the central station in standard 70 Vrms and must have the necessary power to attend the speakers distributed in the buildings and specific places of the site.

8.4 The wiring and sound cabling shall be installed in infrastructure separate from any other system and in exclusive conduit. The emergency communication system shall be run entirely via metal cable.

9. MAINTENANCE REQUIREMENTS

9.1 Maintenance of the equipment and devices mentioned in the above topics will be an important procedure to increase their useful life. Planning the right time for maintenance can reduce the cost and avoid equipment downtime.

9.2 The Fire Alarm System should be able to receive any type of maintenance that needs to be done, so that parts can be replaced in a modular way and quickly, requiring a team previously trained, with training in electronics and specific training for this type of service and product.

9.3 The system should also be easy to connect to measuring and testing devices to check and indicate defects instantly. All devices to be used must contain technical manuals easily found on the Databook and/or web site of the manufacturer.

10. TRAINING

10.1 Training courses for the personnel must be included, so they can achieve the correct and safe operation and management of the system.

10.2 The courses shall include didactic materials and the required reference manuals in Portuguese.

10.3 Courses for Operators, for Operation Engineers and for Maintenance Engineers must be implemented.

10.4 The courses shall cover the following areas:

a) Operation.
b) Maintenance.
c) Configuration.
d) Administration.

10.5 Contend and duration of the courses must be sent to the client for approval.

10.6 Place will be designated by the client, 10 persons per course must be at least considered.

11. VENDOR SERVICES

11.1 Vendor system shall present a proposal including installation, configuration, programming, testing, commissioning, repair and service to the entire system, and must also include training services for operation and maintenance personnel.

11.2 Any detail omitted in this document does not relieve the vendor of his obligation to provide a complete system operating satisfactorily.

11.3 The contractor is responsible to complete pending work.

12. TESTING

12.1 Vendor will be sent for approval, the protocols of acceptance tests. These protocols must be sent to Takeda/Hemobrás at least one month prior to the scheduled start date of the respective tests.

12.2 Protocols not previously approved by Takeda/Hemobrás will not be accepted.

12.3 Each type of test shall be described, indicating the purpose and method to perform the test and to record the results obtained.

12.4 Is the requirement for the supplier to provide all testing documentation AND perform the tests for commissioning and SAT.

12.5 Material, documentation, and equipment to be used in each test shall be described.

12.6 Takeda/Hemobrás may reserve the rights to witness and participate in the tests and request special tests.

12.7 Testing to the following equipment's must be done:

a) Hardware (FACP, NCA, detectors, sensors, et all)
b) Software
c) Communications.
d) Configurations/Settings.

12.8 The tests to be considered are:

a) Acceptance test on site (SAT).

12.9 Tests of entire equipment and materials may only be scheduled when assembly, connection, identification, etc. are completed.

12.10 Acceptance tests should consider the following:

a) Must be done with the system fully connected.
b) All cards and devices must be tested individually.
c) All inputs, outputs and control circuits must be individually and completely tested.
d) All software modules must be checked.
e) All communication channels must be checked.
f) The logic configured in base of cause and effect matrix must be tested.
g) All infrastructure must be certified (FO cables, UTP cables, connectors)

12.11 System will be received by the client once is fully tested and its operation is validated.

13. APPENDIX

13.1 Fire Alarm Hemobrás topology.

Fire Alarm
Hemobrás topology

TOPOLOGIA ANEL SISTEMA FIRE ALARM