Contents

1 Subject of specification 3
2 Scope of validity 3
2.1 Deviations 3
2.2 Exclusions 3
2.3 Basic terms 3
2.4 Designations 4
2.5 Ambient conditions 4
2.6 Electrical supply data 4
3 Hierarchy of documents 4
4 Description 5
4.1 Basic requirements 5
4.2 System requirements 6
4.3 Fire alarm control panel (CSP) 7
4.4 Monitoring lines 7
4.5 Elements of monitoring lines 8
4.6 Arrangement principles for manual call points 11
4.7 Organization of alarming 11
4.8 Control and monitoring of fire equipment 11
4.9 Certification of equipment 13
4.10 System cabling 13
4.11 Organisational matters 14
4.12 Equipment used in zones classified as explosion hazardous 14
4.13 Electrical supply 14
4.14 Painting 14
4.15 Marking 15
4.16 Services 15
4.17 Cables, wires, accessories 15

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4.18 Documentation 15
5 Relevant documents 17
6 Norms and standards 17
6.1 Building Law 17
6.2 Fire protection 17
6.3 Certification and approvals 17
6.4 Standards 18
7 Enclosures 18
8 Record of changes 19

1 Subject of specification

This specification used in conjunction with standard technical specifications of LOTOS Group S.A., establishes minimal requirements regarding designing and execution of fire detection and alarming system.

2 Scope of validity

This specification shall be used when preparing both quotations and purchase orders concerning planned LOTOS Group S.A. new investments and modernizations.

It shall also be a base for preparation of other detailed specifications and quotations relevant for package units or other equipment deliveries.

2.1 Deviations

Any deviation from this specification and the relevant specifications, standards and related documents including proposals, which the bidder claims to be economically and / or technically superior solutions, must be submitted in writing for review and approval by Grupa LOTOS SA. Non-approved exceptions are not acceptable by Grupa Lotos S.A.

The supplier must report in writing any ambiguity in this or any other specifications of Grupa LOTOS SA or non-compliance with the referred documents / standards and obtain a written explanation from Grupa Lotos SA.

2.2 Exclusions

This specification does not include:

- Requirements for low voltage supply system
- Requirements regarding parameters of cables
- Requirements regarding routing and laying of cables.

Above-mentioned exclusions constitute subject matter of separate specifications, listed in p. 4.

2.3 Basic terms

Addressable system - a system in which signals from each detector and/ or call point are individually identified at the control panel of fire signalling.

Analogue system – the system in which detectors generate signals corresponding to value of registered phenomenon. This signals are subsequently processed in control equipment, which decides about activation of fire alarm.

Fire zone – a space separated in such a way, so that during specified time fire would not transfer on outside or to inside of separated space.

Automatic extinguishing system – the system bounded permanently with object, containing own reserve of extinguishing medium, furnished with system for storage and feeding of extinguishing medium, started automatically or manually.

Sound system for emergency purposes – a set of devices enabling public addressing of warning signals and voice messages for safety purposes of persons present in specific building, transmitted automatically after reception of signal from fire signalling system, and also by operator.

2.4 Designations

GLSA – Grupa Lotos S. A.

SAP–fire alarm system

CSP –fire alarm control panel

SUG –fire extinguishing system

CSG –fire extinguishing control panel

DSO –sound system for emergency purposes

CSO –smoke removal control panel

BMS –building management system

CNBOP – Research and Development Centre of Fire Protection, 05-420 Józefów k/Otwocka, ul. Nadwiślańska 213

2.5 Ambient conditions

- Ambient temperature (max/min) $+36^{o}C/-25^{o}C$
- Average monthly humidity (min/max) 70%/90%
- Elevation above sea level 1m
- Wind speed 26 m/s
- Snowfall 290 mm
- Atmosphere typical for refinery Grupa Lotos S. A. (marine, aggressive industrial, chemical and dusty)

2.6 Electrical supply data

Electrical supply source available on site:

Frequency	50 Hz
Low voltage	230 VAC TN-S

3 Hierarchy of documents

In case of conflicts existing between this specification and other documents, the following order of precedence shall govern:

- The current Polish legislation
- Terms of purchase order / contract and other requirements agreed in writing GLSA
- Data Sheets approved by GLSA
- This specification
- Other Specifications
- Drawings and other documents
- Standards

4 Description

4.1 Basic requirements

4.1.1 Purpose of the system

The task of SAP system used in GLSA objects is early detection of fire and alarm rising, in order to:

- provide safety of employees by ensuring quick and safe leaving of endangered object
- minimise devastation and damages of object and its equipment, as well as material losses connected with them, by shortening of time elapsing from moment of fire detection until starting of effective rescue action led by personnel responsible for fire-safety

4.1.2 Fire alarm control panel

Fire alarm control panel shall be located, if possible, in room where permanent operating staff is present. It shall be connected to factory network of fire alarming, in which one of control panels located in building of unit responsible for fire safety, called by convention collective/superior control panel, is connected to visualisation server by means of communication link. This interface shall provide access to all information coming from component elements of the system. Control panel shall also ensure connection of interfaces for cooperation with alarming systems (e.g. access control system), DSO and BMS. The control panel shall be equipped with ports of addressable monitoring loops. All ports of control panel (signal ports, control ports) shall be formed on distribution frame or cable box indicated by GLSA branch specialist. CSP shall also monitor automatic extinguishing systems during normal operation of objects.

Network of fire control panels shall operate in loop topology, using separated fibre optics for purposes of transmission. In each object monitoring considerable number of rooms, process instruments, etc., separate CSP shall be foreseen that shall be designed in such a way, so that 50% of reserve capacity would be provided for further extension.

Integrated visualisation system includes all elements of factory fire alarming network (control panels, sensors, call points, etc.). The system archives all fire related information and enables their visualisation on dedicated monitors and signalling-mimic board in alarming point of unit responsible for fire safety. External operating field equipped with printer is located in alarming point.

4.1.3 Addressable system

SAP shall be designed as addressable, analogue system. The following elements shall be included in the system:

- CSP together with control and communication cards, external operating field with printer, battery bank for 72 h of system operation (deviations are allowable after obtaining of written GLSA approval), and display
- proprietary, CNBOP certified control cards placed in CSP, for fire extinguishing system control purposes
- analogue smoke detectors with double-sided short-circuit isolators; for detectors located in invisible places (inter-ceiling space, under technical floors, in ventilation ducts, etc.) indicators of actuation shall be foreseen, located in a manner that unequivocally signals detector activation (on underslung ceiling, on wall above technical floor, etc.)
- analogue smoke detectors in wind shields in cumulative ventilation ducts

- in rooms where possibility for smoke detectors installation does not exist, temperature sensors, flame detectors, linear temperature sensors, linear smoke detectors shall be installed
- manual call points with double-sided short-circuit isolators along communication paths, as well as in front of staircases and evacuation routes entrances; CSP shall monitor call points installed in open area (on posts) in distance up to 6000 m from CSP, using telephone cables of conductor size 0.5 mm
- door and fire flaps holders, ensuring closing of door constituting fire-screen bulkheads released on period of fire
- feeders for fire flaps along with metallic boxes with relays together with distribution strips for controlling of fire flaps and equipment controlled during fire
- input/output modules in enclosures, located on monitored lines. In case of controlling or monitoring of objects located in hardly accessible places, the modules shall be installed next to CSP
- external visual and acoustic signalling devices (fed by monitored lines)

4.1.4 Architecture

Configuration of fire alarming system according to existing state, and after planned modernization, is presented in Annexes 1 and 2.

4.2 System requirements

4.2.1 General

Offered system shall be designed in such a way, so that effects of failure of the system itself or equipment cooperating with the system would be minimised. The supplier shall present all information necessary for system reliability assessment in configuration proposed by him. Identification and localization of failures in the system shall be automated to the highest possible extent. Furthermore, sending of alarms to external equipment must be possible. All methods of control, operating and maintenance procedures, shall be designed in a manner enabling their easy realization.

Proposed system shall be designed in such a way, so that reserve of spare parts being kept would be minimised. As much, as reserve configuration exists, replacement of system modules shall be possible without interrupting the system operation.

4.2.2 Objects that require SAP application

Project shall take into consideration application of SAP in the following objects:

- Office buildings, including in particular:
  - special rooms, as archive rooms, reading rooms, offices
  - rooms with electrical equipment, such as copiers, servers
  - communication paths
- Technical buildings, such as warehouses and workshops falling under hazard of fire
- Electrical stations (all rooms and cable rooms)
- Control rooms (all rooms and cable rooms)
- Assigned process engineering equipment and pipelines

Final scope of SAP shall be adjusted according to principles given in p. 3.18.
Fire detectors selection methodology is described in GLSA 3811 specification.

4.3 Fire alarm control panel (CSP)

4.3.1 Construction of CSP control panel

Fire detection and alarming system shall be based on main control panel and sub-panels of microprocessor type with redundancy of mainboard, loop cards and microprocessor, as well as network. All fire alarming control panels shall operate within network, with all hazardous condition signals accessible on the control panel assigned as superior one.

Design of control panels shall be of modular type, including base modules that are present in each hardware configuration (mainboard with CPU and data bus, modules of indicators and operating unit, memory modules, power supply). The system shall ensure possibility for flexible furnishing of control panel with input/output cards. The above-mentioned cards shall be installed by means of multicontact connectors. Replacement of the cards shall be possible without need to disconnect of external cabling. The control panel shall be additionally equipped with the following functions:

- Recognition function, enabling verification of spurious alarms
- Arbitrarily programmable coincidences between detectors and between groups
- Arbitrarily programmable logical links and interrelations for fire control equipment and fire flaps
- Possibility of integration with alarming systems (e.g. access control system), DSO and building management systems (BMS)
- Possibility for connection to superior computer system along with full range of its functions (delivering of event messages, execution of commands)
- Installing of sub-assemblies in control panel by means of extension card application
- Possibility for installation in 19” enclosures (racks)

Each SAP control panel shall be furnished with operating panel, informing about system condition by means of short, comprehensible text messages displayed on screen and if necessary, serial recording printer with back-up supply and memory of events, as well as filter for event messages.

4.4 Monitoring lines

Loop-type monitoring lines shall be applied in the system. Addressable elements (detectors, call points, input/output modules) shall be grouped on monitoring line, so as to single damage of the line cannot bring about:

- elimination of more than 32 automatic detectors (deviation is permitted only after obtaining written agreement with proper services of GLSA)
- elimination of more that 10 manual fire call points
- failure of detectors shall not influence operation of manual fire call points
- MPC on the production installation shall be connected to supervision line via control module so that every MCP is connected to one dedicated module.

Furthermore, the following elements require separation by means of short-circuit isolators:

- groups of elements or single elements on monitoring line, which belong to different monitoring zones, that is zones for which separate signalling is foreseen on fire control panel, including fire division zones,
- groups of elements or single elements on monitoring line, which activation shall bring about actuation of specific fire equipment by means of suitable program execution,
- control elements on loops

The system shall provide possibility for assigning unequivocal, unique addresses for each element on monitoring line. The system shall ensure bilateral communication between control panel and each element (address) on monitoring line. Full utilisation of possibilities provided by analogue detectors, such as: early warning, pre-alarm signalling, individual tuning of alarm parameters for each detector (sensitivity, alarm verification time) shall be ensured.

Each element controlled within SAP shall also have programmed „Fail-safe" position, i.e. the position that it shall take up in case of bilateral communication loss by module serving it.

4.5 Elements of monitoring lines

4.5.1 Photo Optical Smoke Detector

Photo optical smoke detectors shall operate basing on principle of measurement of radiation dispersed by smoke molecules in measuring chamber, which is lightproof for external light.

Smoke detectors shall feature at least the following properties:

- Software algorithm for evaluation of smoke characteristics
- Alarm filter for reduction of spurious alarms
- Automatic adjusting of alarm threshold level for compensation of environmental influences changes
- Recognition of detector pollution
- Adjustable sensitivity level
- Pre-alarm processing
- LED alarm indication 360° visible
- Parallel indicator of activation can be connected
- Component failure causes fault signal
- Individual detector switch-off possibility
- Integrated short circuit isolator
- Approved acc. to EN54.

Photo optical smoke detectors shall be used in the following rooms: control rooms, electrical operation rooms, fanhouses, MCC rooms, instrument equipment rooms, computer rooms, rooms in office and technical buildings listed in p. 3.2.2, as well as inter-ceiling and interfloor spaces in those rooms.

4.5.2 Heat detector

Heat detectors shall detect environment temperature raise. Transgression of some established temperature threshold and transgression of set rate of temperature rise in time, shall result in heat detector activation.
Heat detector shall have at least the following properties:

- Software algorithm for evaluation of fire development characteristics;
- 3 maximum temperature settings acc. to EN54;
- Reacts to quick environment temperature rise as well as to transgression of set maximum temperature;
- Pre-alarm processing;
- LED alarm indication 360° visible;
- Parallel indicator of actuation can be connected;
- Component failure causes fault signal;
- Individual detector switch-off possibility;
- Integrated short circuit isolator;
- Approved acc. to EN54

Heat detectors shall be used in rooms of high dust level and particularly in room of emergency diesel generators, warehouses, workshops, and over equipment that can cause hazard by uncontrolled temperature rise.

4.5.3 Flame Detectors

Flame detectors shall be selected considering type of substance that can constitute fire hazard. They shall use analysis of electromagnetic radiation spectrum for this purpose and early detection of the hazard. They shall feature high sensitivity and resistance to spurious alarms. The flame detectors shall be installed on side line and connected to monitoring line by means of input/output module.

Flame detectors, suitable for specific application, can be used for monitoring of product and raw material tanks, pipelines, process engineering equipment, filling terminals, in compressor stations.

4.5.4 Linear heat detector

Linear heat detector shall be in form of a heat-sensitive cable with the steel braid and fixed with dedicated fixing clips.

Temperature rise in surroundings of detector above set value shall result in decrease of insulation resistance between pair of conductors. Change in insulation resistance shall cause activation of alarm signal. Insulation resistance shall automatically return to initial value after withdrawal of temperature rise cause. For purposes of continuity monitoring, the detector shall contain additional pair of conductors, independent from pair of conductors serving temperature control.

Linear heat detectors can be used for monitoring of tanks, pipelines, cable ducts, process engineering equipment.

4.5.5 Linear smoke detector

Operation of linear smoke detector shall be based on intensity analysis of infrared beam between transmitter and receiver. The detector shall recognize change of radiation beam intensity, and after

processing it, activate proper output informing either about necessity of the detector maintenance, or of fire alarm. The detector shall be equipped with embedded microprocessor for this purpose. Additionally the detector shall have:

- automatic compensation in case of fouling
- signalling of beam continuity breakage, lasting longer than specified time (e.g. 30 sec.)
- adjustable selectivity level in order to adapt detector operation to specific environmental conditions
- indicators of operating state on receiver enclosure, informing about stand-by, damage and alarm state

Linear smoke detector shall be installed on side line and connected to monitoring line by means of input/output module.

The detector can be used for monitoring of zones in high buildings, where access to ceilings is difficult, in vast warehouse premises, etc.

4.5.6 Manual call points

One shall use devices of direct manual operation with accuracy to specific fire zone. Alarm shall be activated by breaking of glass pane and use of pushbutton (or only breaking of glass pane in case of explosion-proof devices). Carrying out of operating tests shall be possible by means of test key use.

Call point for outdoor installation shall be of waterproof design and degree of protection at least IP66, installed under guard of red colour, dedicated to buildings, or to posts on production plants.

For installation details see specification 3020.

4.5.7 Input/output modules

Advisable attribute of the system is also possibility of installation input/output modules on monitoring lines, in order to provide high flexibility of the system.

In range of input/output modules, the following can be used:

- Side line modules used for purpose of implementation of standard direct current detectors in loop technology or monitoring of explosion hazard areas,
- Monitored inputs modules used for signalling and monitoring of contacts in door, fire flaps, extinguishing systems, sprinklers check-back signals, etc.
- Monitored output modules, used for controlling of monitored consumers supplied with external voltage (e.g. sounders)
- Control input/output modules for the integration of flame detectors into fire detection loop technology.

Input/output modules shall be always separated with short-circuit isolators from other elements operating in monitoring line. In case of high current consumption, the modules shall be supplied from external power supply, certified by CNBOP. Inputs and outputs of these modules shall be galvanically separated from monitoring loop circuits, and monitored by control panel.

4.5.8 Optical and acoustic signalling devices

Signalling devices shall announce hazard both with audible and visual signal in form of red flashing lamp. Signalling device shall enable adjustment of tone type and intensity.

4.6 Arrangement principles for manual call points

Manual call points shall be arranged along evacuation routes from building and process plants in such a way, so that the person who reveals hazards would be able to activate fire alarm during leaving of building or plant. Arrangement of manual call points shall also take into consideration their usage by persons on duty, performing reconnaissance in place from which signal of fire detection has been sent by automatic detector, in order to confirm fire hazard.

Each call point located in open area (most frequently mounted on post) shall be individually addressed on CSP that monitors it (configuration of call points group working on the same address is impermissible). Arrangement of call points on process plants shall be consistent with used technology, and agreed with production services and at the same time secured with metal protections.

In particular, principle of locating manual call points in the following places is adopted:

- at all exits from building and process plants,
- in front of staircase entrances (outdoor, if possible)
- close to smoke-proof / fireproof door (if exist),
- in long communication paths, every 40 m,
- in main technical rooms, such as control rooms, ventilation engine rooms, electrical switchgear rooms and other important technical rooms.

4.7 Organization of alarming

The following issues shall be taken into consideration in designed system:

- selection of detectors types with consideration given to environmental conditions in installation place
- application of detectors with analogue signal, and fouling compensation
- provision of system capacities for software implementation of two-detector and two-group dependence procedures

All alarm on GLSA area are alarms of II level. Deviations from above-mentioned rule shall be agreed in writing with proper services of GLSA

4.7.1 Automatic notification of personnel responsible for fire-safety (factory fire brigade)

Alarm control panels shall be equipped with module for actuation of devices transmitting alarms to alarm console of fire brigade. Alarm signals being sent shall be represented on visualisation station as well as on mimic diagram in alarm point of personnel responsible for fire-safety (fire brigade).

4.8 Control and monitoring of fire equipment

4.8.1 Requirements for control

Control from SAP control panel shall be wholly automatic, but enabling execution of tests by manual simulation of fire hazard in individual fire zones and smoke zones. It is required that all electrical drives of fire flaps shall be tested according to directions of manufacturer, and not more seldom than once a year, unless otherwise recommended by manufacturer.

Switching on of equipment falling under control shall be implemented in such a way, so that in consequence of serious failures in cable network, power supplies, etc., fire equipment would reach Fail-Safe fire condition, e.g.: smokeproof door – closed, evacuation door subject to access control – deblocked, fire flaps in living ventilation systems – safe position depending on function fulfilled by them.

Furthermore, in case of fire emerging the system shall provide:

- automatic control of aerating door,
- switching off of living ventilation,
- closing of fire flaps on borders of fire zones and divisions,
- control of fire door by means of holders operated from control panels on fire zones borders,
- lift control (positioning at ground level and opening doors)
- interfaces with safety systems (e.g. unlocking of doors, swing gates, tripod turnstiles)
- interfaces with building automation system (e.g. unlocking of independently controlled automatic entrance doors)
- control of photo optical signalling devices

4.8.2 Software of SAP system

System software must enable, among others, implementation of the following cause and effect relationships:

- switching off of ventilation system on equipment, on which smoke was detected by duct detector,
- cutting off of ventilation system serving fire separated room, in which smoke was detected by detector located in the room,
- stopping of ventilation system in case of smoke detection in individual zones (fire or smoke zones)
- starting of fire ventilation, aerating and removing smoke separately for individual smoke removal zones, related to smoke removal function along with smoke removing function together with adequate actuation of fire flaps,
- closing of smokeproof door and fire gates in zone, where fire has emerged,
- functional separation (separation of monitoring zones), in a meaning of control separation from monitoring lines of detectors installed above suspended ceiling,
- starting notification of personnel responsible for fire-safety (fire brigade) ,
- starting of optical signalling devices

Beside control functions necessary for realisation of fire scenario, the system shall collect signals on operating condition of fire extinguishing elements, such as fire flaps, gates and doors, and then transmit this information to main control panels in building of personnel responsible for fire-safety.

Fire alarm control panel shall store up to 50000 events.

4.8.3 Monitoring

1. Sprinklers
   a) monitoring of controlling and alarming valves – signal about activation of sprinkler device in specific fire zone (fire signal),
   b) monitoring of main pump operation states,
   c) monitoring of gate valves state (closing of valves – failure state)
   d) monitoring of water level in sprinklers' tank (min. and max.)
   e) monitoring of ambient temperature in hydrant room (temperature drop below 5 ºC – failure state).
2. Fire water supply system
   a) monitoring of hydrophore unit (actuation of hydrophore unit, fire signal)
   b) monitoring of water level in hydrants' tank (min. and max.)
   c) monitoring of ambient temperature in hydrants' room (temperature drop below 5ºC – failure state)
   d) monitoring of valves (normally open) on water discharge from hydrophore tank (closing of valves – failure state)
3. Fire doors, fire gates and smoke flaps
   a) monitoring of fire gates state on fire zones' borders (open, closed)
   b) monitoring of fire flaps and smoke flaps position state
4. Outgoing feeders in electrical switchgears for feeding of ventilation system, sprinklers and hydrophore, as well as selected electrical switchgears
   a) monitoring of supply continuity

4.9 Certification of equipment

All elements of SAP system, including cables and wires for internal use, applied for protection of object, shall have valid certificates approving for usage in fire protection issued by CNBOP, taking into account requirements of fire resistance PH.

4.10 System cabling

SAP cable lines and routes shall be designed according to principles adopted for explosion hazard zones – details are included in standards 3720 and 3730. External cables shall take into account environmental and climatic conditions, and possibly fire resistance. In case of laying cable routes outside the buildings, adequate fibre optic cables of reinforced construction, signalling and power cables with additional armour made of steel tape, shall be used.

Adequate cable culverts shall be used for routing of cables under roads. Cables for intrinsically safe elements shall be selected in blue colour, and routed possibly in trays / ducts constituting routes of intrinsically safe instrumentation cables.

Particular attention is paid on routing method of cabling with fire resistance min. PH90. Such cabling shall be routed in cable racks and trays of fire resistance equal to or greater than that of cabling being laid. Routing of cabling outside of discussed trays must meet requirements as to fastening method. Fastening of cabling to base shall be accomplished by means of steel clamping rings, holders, studs, or with utilisation of other system, having adequate approval.

4.11 Organisational matters

4.11.1 Technical acceptance

Technical acceptance shall be done according to requirements of Polish Standards. Independently of that, Supplier together with representative of GLSA shall check proper functioning of every element of monitoring line by its activation or e.g. performing of smoke test.

4.11.2 Fire tests

Fire tests are mandatory and are the only reliable method for verification of fire alarming system sensitivity, and enable final verification of detectors location method. They simultaneously constitute confirmation of properly implemented fire scenario. Considering high risk level of fire tests, one shall exercise extreme caution and carefulness during their execution. Places, in which they are to be executed, shall be established in agreement with designer and expert for fire protections, at least two places for each fire zone.

4.11.3 Fire scenario

Detailed fire scenario shall be presented on realisation design stage.

4.12 Equipment used in zones classified as explosion hazardous

All equipment of fire detection and signalling system, located in explosion hazard zones must be manufactured and tested according to norms for equipment of explosion-proof design. Proper production of specific equipment shall be confirmed with certificate issued by authorized testing bodies. Explosion protection shall fulfil requirements specified by LOTOS Group S.A. in relevant documents, determining explosion hazard zone, equipment group and temperature classes.

4.13 Electrical supply

GLSA shall provide separated supply circuits for signalling control panels of fire detection and alarming system, adapted to power demand specified by Supplier.

The Supplier must ensure all equipment necessary for generation of supply voltages of other values, necessary in fire detection and alarming system for internal purposes.

Unless otherwise stated, supply and its distribution system for the installation need not to be redundant. It is necessary to foresee output signal signalling electrical supply failure, and power distribution system failure.

Emergency supply from battery bank shall ensure monitoring for 72 hours, and following it alarming with full actuation of fire equipment for 30 minutes (deviation is permitted only after obtaining written approval of GLSA). Control panel power supply shall ensure charging of battery bank up to 80% of rated capacity during 24 hours; full charging shall be completed before 72 hours shall elapse. Depending on its size, power supply can be located in control panel or in separate enclosure.

The Supplier shall ensure adequate overvoltage protection of SAP system. This protection shall guarantee safety of alarm control panel, as well as of equipment connected to the control panel in case of pulse electromagnetic discharge.

4.14 Painting

Painting of equipment installed outdoors shall be done according to requirements valid for industrial, chemical and marine atmosphere.

The following SAP equipment shall have enclosures painted in red colour (RAL3001):

- SAP Control panel and sub- control panel enclosures
- Manual call points
- Enclosures of call points
- Acoustic and visual signalling devices
- SAP installation cables (excluding intrinsically safe circuits)

4.15 Marking

All SAP equipment shall be marked with producers' name and brand mark of Supplier, in order to ensure integrity of complete system. Each equipment shall be additionally equipped with label, indicating (specific) number of equipment according to documentation, and equipment numbering procedure contained in specification no 6120

Description of outdoor equipment shall be imprinted by stamping on data plates. Data plates shall be made of stainless steel, non-corrosive alloy or rigid plastic, and durably fastened to non-removable part of equipment. The Supplier shall submit to LOTOS Group S.A. proposal of label for approval, prior to production commencement.

4.16 Services

The services, which Supplier is obliged to provide:

- detail design
- system programming
- factory acceptance test and inspection
- packaging and shipment
- erection on site
- functional tests and connections to other systems
- training of GLSA personnel in scope of service, maintenance and operation
- maintenance during guarantee period

Supplier of SAP system shall possess certificate of authorized representative of selected manufacturer of equipment.

4.17 Cables, wires, accessories

All cables, wires, prongs, accessories and mechanical protection devices shall be included in scope of Supplier delivery. System cabling shall include all required connectors to equipment delivered by Supplier. All cables and terminal strips shall be marked with use of marking system conforming to GLSA procedure.

All equipment destined for outdoor operation shall be equipped with cable glands. The Supplier shall make selection of cable glands adhering strictly to nominal diameter of cables, specified by their producer.

4.18 Documentation

Sets of documentation that shall be delivered together with the system by Supplier for acceptance and system take-over purposes:

1. Technical description, including:
   - Description of existing state
   - Projected protection range
   - Functional description of system operation
   - Description of fire signalling system
   - Calculations of monitoring lines, main and reserve supply
   - Description of external equipment control
   - Description of overvoltage protection method for external monitoring lines
   - List of fire zones along with location, numbering and types of linear elements
   - List of executing elements links to fire zones
   - Recommendations regarding system maintenance and inspections
2. List of documents
   - List of certificates for approval of elements used in design to use for fire protection, issued by CNBOP
   - List of certificates for approval of elements used in design to use in explosion hazard zones
   - List of documentations, norms and relevant documents
3. Equipment list
4. Cable list
5. Drawings
   - Statement of graphical symbols used in design
   - Block diagram of installation along with accompanying equipment
   - Projections of floors with layout of elements and cabling system inside buildings
   - Field equipment layouts (based on geodetic plans) with routing of signalling and power supply cables for outdoor process area
   - Block and route diagrams of fire signalling control panel supply
   - Block and route diagrams of fire signalling control panel connection to superior control panel
   - Additional detailed drawings, e.g. method of detectors' installation under false floor spaces, method of detectors' installation on suspension strands, wiring diagram of the system connection to executing equipment
6. As-built documentation, including revised diagrams, reflecting changes introduced to equipment and wiring system
7. Start-up checklist
8. Acceptance report

Fire report, specifying fire zones and evacuation routes, as well as adjustments between branches made with fire protection expert, shall constitute base for design of fire detection and alarming system. Approval issued by fire protection expert shall be prepared on first drawing of routes and elements' arrangement.

The documentation shall conform to standard PN-EN 54 Fire alarming systems. Design, erection, acceptance, operation and maintenance of the system.

Designer shall have valid certificate, authorising to production of fire alarming system designs, issued by CNBOP, as well as certificate of authorized representative of approved equipment manufacturer.

5 Relevant documents

Any "Technical Specification" issued by GRUPA LOTOS S.A. listed in Contract Files.

6 Norms and standards

It is in each case understood that quoted standards, regulations, directives and orders are of their latest editions, along with amendments, annexes and supplements in force.

6.1 Building Law

The Law of 07 July 1994 – Building law. Uniform text Journal of Laws 2010.243.1623. as amended.

Minister of Infrastructure order of 12.04.2002 on technical conditions that buildings and their location shall adhere to. JoL. 2002.75.690 as amended.

6.2 Fire protection

The Law of 24.08.1991 on fire protection (JoL 1991.81.351. Unified text JoL 2009.178.1380 as amended.

Minister of Internal Affairs and Administration order of 07.06.2010, on fire protection of buildings, other building objects and areas. JoL 2010.109.719.

Minister of Internal Affairs and Administration order of 16.07.2009, on adjusting of building project in regards of fire protection. 2009.119.998.

6.3 Certification and approvals

The Law of 30 August 2002 on conformity assessment system (JoL 2002.166.1360); Unified text JoL 2010.138.935.

Minister of Economy order of 21 August 2007, on basic requirements for electrical equipment (JoL N° 2007.155.1089).

The Law of 13 April 2007 on electromagnetic compatibility JoL (2007.82.556).

Minister of Economy order of 22 December 2005, on basic requirements for protecting devices and systems, destined for use in explosion hazard areas (JoL N° 2005.263.2203).

Council of Minister order of 15 April 2004, on conditions and mode of accomplishing conformity assessment for telecommunication end instruments destined for connecting to public network terminals and radio equipment with basic requirements, and method of marking them (JoL No 2004.73.659).

The Law of 16 April 2004 o building products (JoL 2004.92.881).

Minister of Economy order of 21. November.2005, on technical conditions that bases and station of liquid fuels, long-reaching pipelines for transportation of petroleum and petroleum products, and their location, shall adhere to (JoL 2005.243.2063).

6.4 Standards

PN-EN 54-1	Fire detection and fire alarm systems. Introduction
PN-EN 54-2	Fire alarm systems Part 2: Control and indicating equipment.
PN-EN 54-3	Fire alarm systems Part 3: Fire alarm systems. Sounders
PN-EN 54-4	Fire alarm systems Part 4: Power supply systems (Amendment A1)
PN-EN 54-5	Fire alarm systems Part 5: Heat detectors. Point detectors.
PN-EN 54-7	Fire alarm systems Part 7: Smoke detectors. Point detectors using scattered light, transmitted light or ionization.
PN-EN 54-10	Fire alarm systems Part 10: Flame detectors. Point detectors.
PN-EN 54-11	Fire alarm systems Part 11: Manual call points.
PN-EN 54-12	Fire alarm systems Part 12: Smoke detectors. Line detectors using an optical light beam
PN-EN 54-13	Fire alarm systems Part 13: Compatibility assessment of system components
PN-EN 54-16	Fire detection and fire alarm systems. Voice alarm control and indicating equipment
PN-EN 54-17	Fire detection and fire alarm systems. Short-circuit isolators
PN-EN 54-18	Fire detection and fire alarm systems. Input/output devices
PN-EN 54-20	Fire detection and fire alarm systems. Aspirating smoke detectors
PN-EN 54-21	Fire detection and fire alarm systems. Alarm transmission and fault warning routing equipment
PN-EN 54-23	Fire detection and fire alarm systems. Fire alarm devices. Visual alarm devices
PN-EN 54-24	Fire detection and fire alarm systems. Components of voice alarm systems. Loudspeakers
PN-EN 54-25	Fire detection and fire alarm systems. Components using radio links
PN-ISO 6790	Equipment for fire protection and fire fighting. Graphical symbols for fire protection plans. Specification.

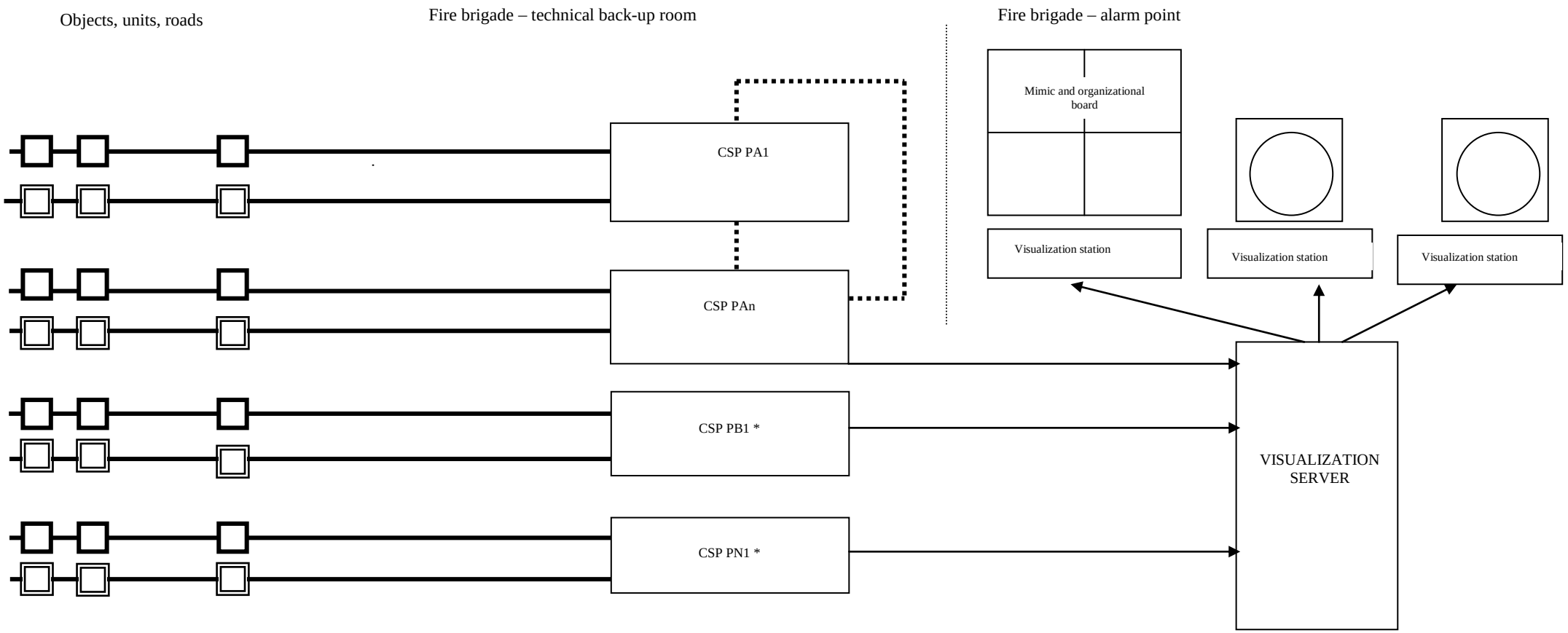
7 Enclosures

- Enclosure No 1, Fire alarm system of LOTOS Group S.A.

8 Record of changes

Lp.	Date	Description	Introduced by
1	30-11-2013 (rev. 1)	Review, update, standardize and changes to the Standard within scope of order No. OK/990/2012	Editorial board coordinated by T.Wróbel
-	31-08-2015	Page layout corrections, no contents changes.	T. Wróbel

Grupa LOTOS S.A.	**ENCLOSURE No.1**	Spec. no: 3810
	Fire alarm system of Grupa LOTOS S.A.	



Arch. No.	Area	Sub-area	Doc. No.	Rev. No.	Issue Date	Page	Pages
19320	**90**	**00**	**PR 99007**	**0**	**06.03.06**	**1**	**2**

Legend for Enclosure N° 1



System line element (existing detectors)



System line element (replaces existing addressable pushbuttons)

* CSP can be located in alarm point