Grupa LOTOS S.A.	**TECHNICAL SPECIFICIATION**	Spec. N^{o}
	Gas detectors	3520

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1 Subject of specification

This specification used in conjunction with other technical specifications of LOTOS Group S.A., establishes minimal requirements regarding designing and execution of gas detection systems for toxic and explosive gases.

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.

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 with GLSA
- Data Sheets approved by GLSA
- This specification
- Other Specifications
- Drawings and other documents
- Standards

4 Definitions and designations

GLSA – Grupa Lotos S. A.

System of dangerous gases detection (explosive and toxic) is used for protection of people, equipment and environment protection purposes.

Gas detector – an instrument performing measurement of dangerous gases concentration (e.g. H_2S, lack of oxygen, hydrocarbons), where electrical signal constitutes output signal from sensor.

NDS – the highest allowable concentration, above which concentration of gases reaches level that is dangerous for people.

Detector of explosive gases – a sensor converting concentration of explosive gases to electrical signal.

DGW (LEL) Low Explosive Limit – such level of explosive gases concentration, above which the gas and air mixture can explode.

FAT- factory acceptance test

5 Description

5.1 Functions realized by the system

- Detection of combustible gases concentration (e.g. hydrocarbons and hydrogen)
- Detection of toxic gases (e.g. hydrogen sulphide) and dangerous gases (lack of oxygen) concentration
- Visualisation and activation of signalling system in DCS on the plant, as well as in fire centre

5.2 Types of sensors allowed for application

- Catalytic sensor

  Catalytic sensor operates on basis of resistance change measurement on resistor, on which catalyst has been sprinkled. Catalytic combustion on sprinkled catalyst results in resistance change in one of bridge limbs. Connection of sensor with card is accomplished by means of three-conductor cable.
- IR based sensors
- Electrochemical sensors

5.3 Ranges and settings

Below are given proposed measuring ranges and alarm settings. They can be changed in case when hazard analysis would order more stringent approach.

- H_2S sensors

  Range: 0 – 50 ppm H2S

  Setting: the first threshold – 5 ppm the second threshold – 10 ppm
- HC sensors

  Range: 0 – 100% LEL

  Setting: the first threshold – 10% LEL the second threshold – 40% LEL

5.4 Location of sensors in explosion hazard zones

Location of sensors in explosion hazard zones 1 and 2 is foreseen; sensors of flameproof design are preferred. Were applicable, plant can be divided to autonomous sectors with individual signalisation panels (horn and beacons). In that case gas detected in one sector activate alarm only in this sector.

In cases where gas detector can directly cause emergency shout down of plant, it is recommended to locate more than one detector at each point and use 2 of 3 vote logic.

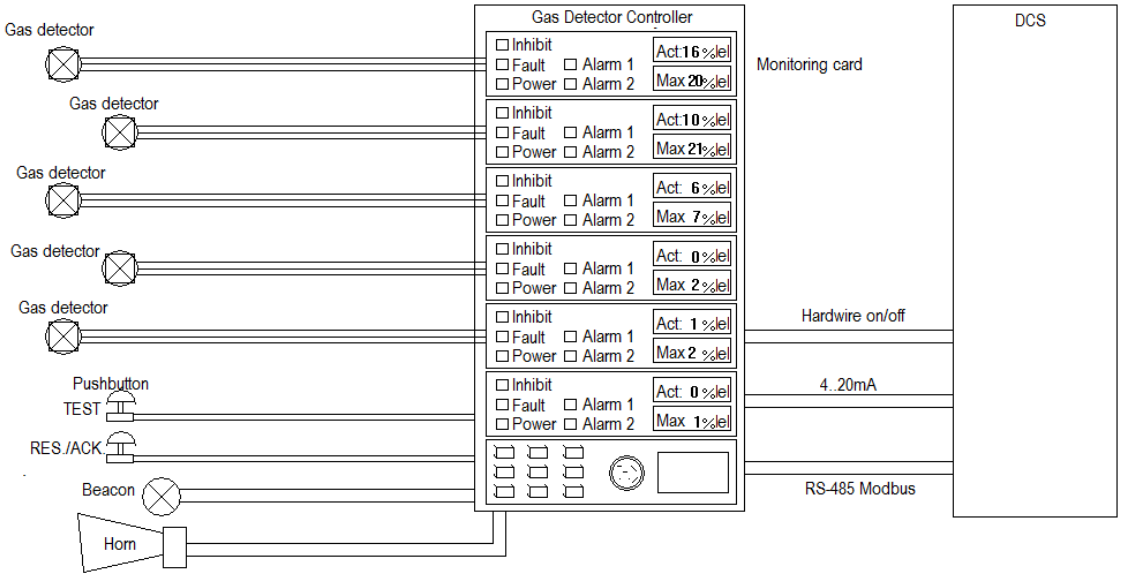
5.5 Configuration of system

The following configurations of gas detection systems are allowed:

- System based on individual monitoring cards

Each sensor shall be individually connected to monitoring card. Monitoring cards shall be installed in 19" rack (GDC – Gas Detector Controller). The rack with monitoring cards, engineering card and input/output interface cards shall be located in cabinet, which shall be installed in TIR room. It is recommended to use all elements produced by gas detector manufacturer.

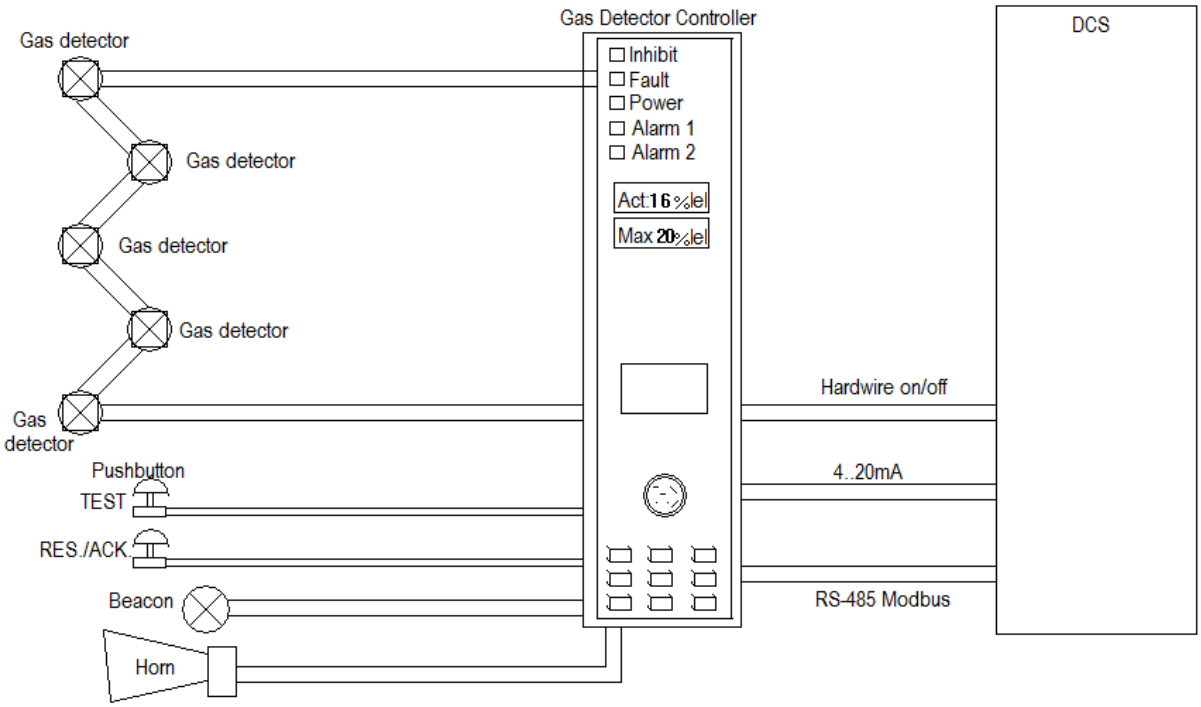
It is forbidden to directly connect gas detector to PLC/DCS or its remote analogue or digital input. Therefore PLC controller cannot be consider as GDC. Communication between gas sensor and monitoring cards can be done by means of analogue or digital signal. Communication between GDC and DCS must be hardwire (minimum common digital signals) and digital (e.g. MODBUS) or analogue (e.g. 4....20mA).



- Ring type system based on intelligent sensors

  Ring type system is based on intelligent sensors operating in full loop. Central unit is located in TIR. Computer operating as central unit of detection system must be of industrial design, according to standard N° 3620.

Direct connections of sensors to DCS are not allowed.



5.6 System tasks

The system task is to trigger alarm on plants and to transmit adequate signal to distributed control system, in order to illustrate occurrence place of dangerous gases allowable concentration exceeding.

The system must be able to generate the following signals:

- individual signal of first alarm threshold concentration exceeding,
- individual signal of second alarm threshold concentration exceeding,
- common signal of gas detectors' defect,
- common signal, information that one of gas detectors is inhibited,
- common signal of system failure.

Furthermore system must transmit do DCS gas concentrations and alarms from each of gas detectors via digital communication or other. Hardwire must be used to transmit six common alarms: first threshold alarm for toxic and explosive gas, second threshold alarm for toxic and explosive gas, system or detector failure and inhibit.
System must be able to receive signals:

- beacon TEST (push button at gas panel located on plant)
- Reset /Acknowledge (push button at gas panel located on plant)
- Reset form DCS
- Acknowledge from DCS

For purposes of warning signalisation on a plant, the system has to generate the following binary signals:

- 1 DPDT individual signal of first alarm threshold concentration exceeding
- 1 DPDT individual signal of second alarm threshold concentration exceeding
- 1 DPDT common signal of system failure

Output signals from relay card shall be as follows: closed relay contact for normal parameters, open relay contact when the parameter is exceeded.

Signalling on a plant must be executed with use of light (beacon) and acoustic (horn) measures of adequate loudness, according to the following directions:

- Signalling with yellow blinking light on exceeding of the first H2S concentration threshold and present till concentration gets below first threshold and system is reset.
- Signalling with yellow blinking light on exceeding of the second H2S concentration threshold
- Signalling with red blinking light on exceeding of the first HC concentration threshold and present till concentration gets below first threshold and system is reset.
- Signalling with red blinking light on exceeding of the second HC concentration threshold
- Acoustic signalling (with pneumatic hooter/horn) on each exceeding of the first or second threshold of H2S or HC concentration.
- Cancellation of audible signal with pushbutton located next to each signalling panel. Pressing of this pushbutton results in 15 minutes delay of repeated hooter activation.
- Light signalling is active until moment, when H2S or/and HC concentration exceeding conditions disappear. Alarm cancel pushbutton is located in control room and on gas panel at plant
- Lamp test pushbutton shall be installed on each signalling panel.
- At control room, on separate visualisation screen one separate synoptic shall be foreseen. Synoptic must contain plant layout with all gas detectors that colour changes when there is an alarm or failure, and next to each sensor current indication shall be placed. In the one of the corners separate part for common signals shall be located. Six common alarms (first and second alarm form toxic and combustible gases detectors, system/gas detector failure, inhibit) and pushbuttons (acknowledge and reset) shall be located.

5.7 Gas detectors of explosive gases in Loading Systems

In gas detection system controlling the safety operation of Loading Systems, beside general principles being in force, one shall use loading shut down in the following logic:

- Exciding of first alarm threshold cause stopping of wagon puller.
- Exciding of second alarm threshold cause loading shut down.
- Exciding of first and second threshold alarm result in light and sound signalling.

5.8 FAT-Factory Acceptance Test

Representative of LOTOS Group S.A. shall participate in Factory Acceptance Test (FAT), which shall include at least:

- Verification of system conformity to technical specification
- Functional test of system for inputs and outputs, while if the system contains up to 16 sensors, then execution of test with all 16 sensors connected is required; if it contains more than 16

sensors, 50% of them shall be connected. Functional test consist in feeding of zero gas and range gas, tripping of all alarm thresholds, and simulation of alarms resulting from system defects.

- Simulation of supply failure and system restart.
- The supplier shall notify LOTOS Group S.A. about acceptance tests date 30 days in advance before planned acceptance date.
- Errors discovered during acceptance tests shall be rectified when tests are still going on, if possible.
- The supplier shall correct errors on drawings and in documentation within maximum 30 days after FAT completion.

5.9 Final test on plant (SAT) and guarantee

After system start-up, the Supplier shall verify correctness of its operation and provide document that will confirm on-site calibration of each gas detector. On site and with GLSA representative presence functional test of system must be perform – gas will be applied to randomly chosen sensor to obtain first and second alarm and to observe activation of beacons and horns that will be cancelled on-site on local panel. Next, different gas detector will be used and cancelation (acknowledge and reset) will be done from DCS. If any discrepancies to standard are found, test must be repeated from the beginning after correction of problem.

Shall any discrepancies are found between workmanship and documentation or art of engineering, the Supplier shall submit report that can constitute basis for corrections' execution by contractor. In case of acceptance of changes that have been done by contractor, Supplier of the system shall introduce them into documentation. Finally the Supplier shall guarantee three-year proper operation of the system starting from date of its commissioning.

6 Relevant documents

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

7 Norms and standards

Designing, execution and erection shall comply with the latest editions of below listed norms and standards.

Only norms that are specifically connected with gas detection systems are listed here. The other norms concerning Control and Automatics are quoted in specification GLSA 3010 – Instrumentation general requirements.

8 Enclosures

- Enclosure No 1, Requirements regarding documentation

9 Record of changes

No.	Date	Description	Introduced by
1	05.05.2011	This specification entirely replaces the former LOTOS Group S.A. standard No. PR 50 019 with the same title.	P. Skoneczny M. Domaniewski
2	30-11-2013 (rev. 2)	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

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Grupa LOTOS S.A	**ENCLOSURE No. 1**	Spec. N^{o}
	Requirements regarding documentation	3520

	WITH OFFER	ON DELIVERY	NOTES
TECHNICAL SPECIFICATION OF MANUFACTURER	Yes	Yes	
LIST OF DEVIATIONS FROM TENDER QUERY SPECIFICATION	Yes		
LIST OF SPARE PARTS ALONG WITH PRICES, RECOMMENDED FOR 2-YEAR OPERATION	Yes		
LIST OF SPARE PARTS FOR PRE-COMMISSIONING AND COMMISSIONING PERIOD	Yes		
CERTIFICATES OF TESTS		Yes	if specified
MATERIAL CERTIFICATES ACCORDING TO EN-10204 3.1		Yes	if specified
CERTIFICATES OF CONFORMITY FOR EQUIPMENT INTENDED FOR OPERATION IN EXPLOSION HAZARD ZONE	Yes	Yes	if applies
CERTIFICATES ISSUED BY APPROPRIATE BODY FOR EQUIPMENT SERVING SETTLEMENT MEASUREMENTS		Yes	if applies
DIMENSIONAL DRAWINGS	Yes	Yes	
ELECTRICAL WIRING DIAGRAMS		Yes	
ASSEMBLY, OPERATION AND MAINTENANCE INSTRUCTIONS		Yes	
ELECTRONIC VERSION ON CD CARRIER		Yes	
INSPECTION BOOK		Yes	if specified
PRODUCTION QUALITY PLAN		Yes	if specified
DECLARATION OF CONFORMITY TO EUROPEAN UNION DIRECTIVE (CE MARK) ISSUED BY MANUFACTURER		Yes	
CERTIFICATES OF MANUFACTURER		Yes	if specified
CALIBRATION SHEETS		Yes	if specified
HYDROSTATIC TEST REPORT		Yes	if applies