Grupa LOTOS S.A.	**TECHNICAL SPECIFICATION**	Spec. N^{o}
	UPS Supply System for lighting installations	4810

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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 design and manufacture of UPS Supply Systems.

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.

The Contractor is independently responsible for selection of equipment and materials to be purchased on the basis of technical design particularly in relation to instruments and equipment made in explosion – proof execution.

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

The scope of this specification does not include:

- requirements regarding UPS for DCS system purposes
- requirements regarding UPS room.

Such requirements are covered in the following specifications:

- control and automatics branch – standard N° 3130: „UPS supplied voltage distribution systems”
- civil branch – standard N° 5200 „Buildings”

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 GL SA
- Data Sheets approved by GL SA
- This Specification
- Other Specifications

- Drawings and other documents
- Standards

4 Definitions and designations

CONTRACTOR: GL SA; LOTOS Group Inc./ BUYER

SUPPLIER: BIDDER / VENDOR

4.1 Designations

GL SA – Grupa LOTOS S.A.

SN – medium voltage

DC – direct current

IT – electrical network with isolated neutral point

SZR – Auto Transfer Switching system

PPZ – Scheduled Supply Switching-over

DOL – Direct online Motor Start-up

CSNiM – Central Monitoring and Supervision System

KiA – Control Systems and Instrumentation

EMC – Electromagnetic Compatibility

Shall – Indicate a mandatory requirement.

5 Description

5.1 Ambient conditions

- Atmosphere: marine, aggressive industrial, chemical and dusty
- Ambient temperature (max/min): +36°C/-25 °C
- Relative humidity (max/min): 90%/70%
- Elevation above sea level: 1m
- Wind speed: 26 m/s
- Snow falls: 290mm
- Work conditions: refinery, sea coast

5.2 Power network parameters

▪ High voltage	110000V, 3-phase, earthed neutral point of transformer
▪ Medium voltage	15kV (LOTOS Railway, North Marine and 6000V,Przejazdowo Water Supply Point), 3-phase, IT (isolated network)10.5kV (GPZ3), 3-phase, IT (isolated network)6kV (GPZ1, GPZ2), 3-phase, IT (isolated network)
▪ Frequency	50Hz with +4%/-6% allowable tolerance
▪ Low voltage	400V, TN-C/S with +/-10% allowable tolerance
▪ Low voltage (lighting, heating)	230V, TN-S
▪ Low voltage (emergency lighting)	110V DC
▪ Alternate current control voltage	230V, 1-phase
▪ Direct current control voltage	24V DC,110V DC. 220V DC (for GPZ1,S7 and S9)

5.3 Basic design requirements

5.3.1 Documentation

The Bidder (supplier) shall submit to GL the following documents:

- List of documents
- Catalogues
- Data sheets filled by supplier
- Schematic diagram of the UPS
- Dimensional drawings
  - General arrangement of cabinets
  - Front view
- Drawings of cabinets equipment (arrangement of devices)
- Layout drawings of control and signalling instruments, and terminal strips
- Assembly diagrams
- List of equipment
- Spare parts list
- Tests schedule
- Certificates
- EMC Declarations
- Declaration of conformity
- Assembly Instruction, Operating Manual in polish language, dedicated for supplied UPS

5.3.2 General requirements

For all used devices, reliability, smooth operation and easy handling are required. Typical equipment shall be used. Application of prototype equipment, not registered and not approved for production, is forbidden.

Spare parts shallshall be accessible through minimum 10 years.

It is required that service response time for delivered equipment, determined as time elapsing from the moment of notice until service arrival, cannot be longer than 4 (four) hours.

Rated data for equipment shallshall correspond to rated data of the equipment for continuous operation, at specified (previously given) working conditions.

Nominal working conditions of equipment shallshall fulfil requirements for at least nominal voltage and nominal current ranges, for all applications and for voltage tolerance ±10%.

All UPS devices shall be equipped with a manual by-pass circuit for switching power supply load directly to the network. The UPS shall be designed in such way that after the load switches will be possible to replace of UPS and repair by external Service.shallThe UPS must fulfil requirements of EMC directive, which means that it shall properly operate in defined electromagnetic environment, while not introducing additional electromagnetic interferences.

5.4 Design requirements

5.4.1 Electric parameters of UPS/option for emergency lighting feeding on the office buildings/

Rated power	According to data sheet
Rated input voltage	**400V ±10%, 50Hz +4%/ -6%, (3L+N+PE)**
Rated input voltage for by-pass	**400V ±10%, 50Hz +4% / -6%, (3L+N+PE)**
Rated output voltage	**230V ±10%, 50Hz ±5%, (1L+N+PE)**
Autonomous operation time	**120min.**
Normal mode of operation:	„On-line" (double conversion)

The other requirements according to data sheet.

5.4.2 Working conditions

The UPS shall be installed in electric station building, in the room destined for uninterruptible supply equipment, and direct current equipment. Temperature in this room shall not exceed **+22°C**. (Guidelines for UPS room are included in civil branch specification – standard N° 5200 „Buildings").

5.4.3 Basic technical requirements

The UPS unit shall consist of the following elements:

- semi-conductor rectifier for inverter supplying and charging / recharging of battery pack
- serviceless lead-acid battery pack
- sransistorised inverter with sinusoidal output
- static by-pass (static switch)

- manual service by-pass supplied from mains. in case of two UPS working parallel separating transformer is required.,
- multifunction panel with operating unit, digital measurements of state and the UPS self-diagnostic module, as well as alarm signalling (for example, information about UPS operation faults)
- inputs and outputs protected against overvoltages by means of overvoltage limiters, selected to working conditions of the UPS, and equipment supplied by it.

5.4.4 Basic constructional requirements

The frame shall be included in the UPS scope of supply.

Each cabinet shall be adapted for possible UPS extension by adding new cabinets. Solutions of the cabinets shall enable adding new ones on later stage, without need for cutting, welding and structure changing.

The UPS cabinets shall be separated one from another.

Each cabinet shall feature metal external housing (made of rigid steel sheet), composed of two sidewalls, rear wall, roof (excluding floor, as integral part of enclosure), as well as door locked with standard key lock.

Earthing bus, led inside the cabinets, shall have sufficient cross-section area, and shall be equipped with connectors enabling coupling it to external earthing system.

The devices installed inside the cabinets shall be visible and easily accessible.

All UPS cabinets shall have adequate ventilation, provided by means of ventilation grates located in lower part of door, and in roof.

A small clearance shall be foreseen between partition walls of neighbouring cabinets, in order to avoid their mutual thermal impact. It is necessary to provide carrying away of heat generated by equipment installed in the cabinet.

All devices shall be unequivocally marked, according to control diagrams.

The supplier shall provide detailed data concerning UPS mounting, along with data regarding mounting frame.

Cabinet door shall be equipped with gaskets against rodents / insects.

On the upper or lower part of the cabinets, dismountable carrying handles shall be installed. Upper frame shall be strong enough to withstand all stresses occurring during transport.

5.4.5 Cable compartment

The cable compartment shall be made in such a way, that supply and control cables can be easily connected to adequate terminals of each outgoing.

Earthing terminals, intended for earthing of cable screens or armours, shall be mounted in cable compartment.

All elements that can be live, shall be shielded. Cable compartment shall be adapted to safe routing and connecting of cables, without need for use of additional precautions in case when switchgear is live.

All cable glands and other insulation materials necessary for completion of connections, are part of the UPS, and shall correspond to the number and type of used cables. The cables shall be entered from UPS bottom side, through cable entrances furnished with rubber bushings.

Adequate facilities shall be provided in cable compartment for fastening of cables.

5.4.6 UPS compartment

All necessary protection methods, precluding access to apparatuses installed inside the housing shall be applied. All permanent insulated contacts shall be shielded.

Power electronics of the UPS shall be placed in metal case, ensuring electromagnetic compatibility (EMC).

Control elements, relays, fuses, overcurrent circuit breakers, shall have main current circuits separated from auxiliary circuits.

In order to provide proper protection against electric shock and protection against static electricity, all UPS compartments shall be furnished with earthing terminals. The terminals shall be connected to earthing bus, which in turn shall be connected through earthing terminal to main earthing system. Earthing terminals shall be accessible without need for using any additional tools.

All specified spare elements shall be completed and delivered along with UPS delivery.

5.4.7 Wiring

Main power circuits and also control circuit shall be made:

Copper conductor in PVC jacket –according to vendor standard.

The wiring shall be made with care, according to manufacturer documentation, valid regulations, standards and long-term code of practice, and in such way, so as to any possible failures would be easy to locate and eliminate.

Only single conductor can be connected to single terminal.

The conductor shall be multi-wire type. The conductors used for flexible connections (e.g. for apparatuses mounted on the cabinet door), shall be protected against mechanical damage by means of flexible protective conduits.

Each conductor end shall be furnished with connector enabling connection to terminal block, as well as with terminal enabling connection to specific equipment. For multi-wire conductors, sleeve type cable terminals shall be used.

Green and yellow colours for cable jackets cannot be used, in order to avoid mistake for yellow-green PE conductor.

All conductors shall be marked adjacent to connection place. Terminals of equipment and apparatuses shall be marked as well, which will enable to avoid incorrect connections to terminal strips.

Connections to external monitoring systems (DCS, PLC) shall be made with use of measuring cables, according to requirements of GL 3120 specification. Possible connections made by means of fibre optics, shall be each time agreed with GL.

The following colour scheme for insulation jackets shall be used:

The method of conductors' marking must correspond to requirements of specification GL 6120 – "Process Identification System", chapter entitled "Identification and marking system for electric instruments and equipment"

All cables must be described by an address. There may be another way of describing the wires.

All cables shall have tag name with use addressable method. It is not allowed to use different method to labelling circuits.

5.4.8 Terminals

All supply and outgoing feeders shall be furnished with separate terminals.

Short-circuiting switches shall be used for main circuits, so that switching off of individual cable does not result in switching off the remaining ones.

All terminals shall be adequately selected to used cables.

All terminal strips, as well as all terminals shall be unequivocally labelled.

Connecting terminals shall be grouped in the following way:

- Separately for measuring transformers
- Separately for direct current DC
- Separately for control circuits.

Individual groups of terminals shall be separated one from another by means of insulating barriers.

Only single conductor can be connected to single terminal. Interconnections shall be made in form of bridges.

Measuring terminals and short-circuiting terminals shall be made for voltage and current transformers.

All terminals and terminal strips shall be of the same type. Terminals shall be used for external and internal control circuits, measurement circuits and protection circuits.

The terminal strips shall be provided for all internal and external control, measuring, protecting and supply circuits.

The terminal strips shall be arranged in cable compartment in a way that ensures adequate space, necessary for execution of connections, switching over of conductors and cables, and placing of tags.

5.5 Supply

The UPS shall be equipped with two supply circuits:

- Main supply
- By-pass supply

For details refer to block diagram of typical UPS – Annex N° 1.

5.6 The rectifier

Direct current part of the rectifier shall be equipped with:

- current intensity limiter, matched to the battery pack characteristics,
- output protected against overloads,
- non-earthed output.

Selection of the rectifier output parameters shall ensure:

- quick battery charging, from partial discharge state up to 96% of its rated capacity during 10 hours period, at full UPS load and with power factor varying from 0.7 for inductive load, up to equal 1.0.

The rectifier shall feature soft start-up characteristics curve, in order to avoid strong current surge.

The rectifier should have hand and auto mode hand for compensation ambient temperature impact on battery charging current.

The rectifier shall feature regulation function and voltage fluctuation compensation on direct current side. Voltage fluctuations shall not exceed allowed range of ±1%.

5.7 Battery pack

Bi-sectional battery pack shall be provided for each UPS unit.

For details refer to:

- typical UPS block diagram – Annex N° 1
- battery pack data sheet.

The battery shall be composed of serviceless cells.

The battery size shall be such selected, so as to UPS output parameters are reached at minimum temperature of +5°C.

Allowable number of full discharge cycles during its guaranteed life period, shall be equal to 250 minimum, The battery pack shall be automatically recharged during normal UPS load.

The battery pack shall be connected to bus-bar and designed for 120 min of back-up operation time

/ option for emergency lighting feeding /

Use batteries of the expected life span of 10 years minimum design.

5.8 The inverter

The inverter shall be suitable for operation in range of output parameters specified in data sheet, both during continuous supply from the rectifier with battery connected, and during temporary supply from battery pack while rectifier failure.

The inverter shall be automatically disconnected from direct current supply, when allowable minimum voltage level on input is reached, or when allowable tolerance ranges are exceeded both for voltage, and for frequency on output. In such case UPS supply shall proceed through by-pass. Switching over of supply shall proceed uninterruptedly.

The inverter shall enable UPS operation with battery pack disconnected.

The inverter shall be adapted for the following overloads:

- 105% for continuous operation
- 125% for 10 min.
- 150% for 1min.

5.9 Intercircuit change-over switch (static switch)

Internal electronic by-pass shall be capable for switching the main power UPS to direct power supply from the main power supply.

5.10 Control panel

All functions necessary for UPS control and monitoring shall be accomplished by means of control and monitoring panel. The panel shall be equipped with LCD display, LED lighting diodes, control pushbuttons and a keypad, enabling convenient interface between the UPS and its user.

Mode of operation, as well as basic UPS functions monitoring, shall be accomplished by means of LED indicators. The LCD display shall serve for operating, UPS power supply operation monitoring, as well as alarm information displaying.

5.11 Control, protecting and signalling devices

Each UPS unit shall be equipped with control unit, performing functions listed in point 4.10.

5.11.1 Protection of outgoings

All outgoings shall be protected with double-pole over-current circuit breakers. Selected protections shall guarantee selectivity operation of overload and short-circuit protections.

Use of residual-current device should be agreed with the GL SA.

5.11.2 Auxiliary relays

The auxiliary relays shall be used in order to:

- auxiliary contacts multiplication
- obtain time delays in control
- voltage condition monitoring in control circuits,

if required.

5.11.3 Current transformers

When necessary, current transformers shall be used with 1A secondary current, at rated primary current.

Secondary windings shall be appropriately connected to terminal strip and unequivocally marked.

The current transformers shall be selected according to requirements of measuring instruments used.

Dynamic and thermal strength of current transformers shall correspond to short-circuit parameters of individual system elements.

The current transformers shall work uninterruptedly at load equal to 1.2 x rated current.

- Current transformers shall be of class 0.5 (for ammeters)
- Measuring current transformers shall be of class 1 (for measuring instruments excluding ammeters)
- Current transformers for protecting devices shall be of class 3.

5.11.4 Auxiliary – service equipment

Below listed instrumentation shall be installed in UPS unit as a minimum outfit:

- charge mode selection switch for rectifier

- device enabling rectifier current limit setting
- device enabling inverter output voltage setting
- device enabling inverter output frequency setting
- device enabling inverter synchronisation range setting
- select switch for intercircuit change-over switch

Below listed auxiliary equipment shall be installed as the minimum outfit:

- Manual switches: rectifier on/off; battery on/off; main supply on intercircuit change-over switch on/off; service by-pass switch
- Measuring instruments: a device (module) for output current measurement, a device (module) for inverter output voltage measurement, a device (module) for inverter output frequency measurement; device (module) specifies the degree charge/discharge batteries.
- Indicators / alarms: All alarms and control signals shall be multiplied through potential-free contacts for remote indication in DCS

5.12 Connections to DCS

Main connections to DCS system are presented on the external wiring diagram – Annex N° 2.

Signal to control room shall be transmitted through hard-wired connections. Cable connection to superior system (DCS) shall be executed according to specification N° 3110 – "Cable and pneumatic routes"

The following signals shall be sent from each UPS unit to central control room:

- battery operation
- supply from mains
- failure
- battery voltage level

Preferred method of signals sending to DCS is use of communication link (Modbus, RTU and Profibus, DP).
In case when connection of UPS to superior system (DCS) is made by means of fibre optic, scope of supply shall be agreed with GL SA.

5.13 Marking

Main and auxiliary bus-bars must be marked.

Labelling, dismountable plates shall be placed on cabinet face. If rear access to UPS unit is foreseen, than necessary labelling plates shall be placed on cabinet back as well.

All inscriptions shall be prepared in Polish language.

Each equipment shall be labelled with use of permanent labelling plates, according to control diagram and assembly diagram.

Colour scheme for indicating lamps and control pushbuttons shall comply with standards' requirements.

All cables and conductors shall be labelled according to assembly diagram.

The content of labelling plates shall be agreed with GL SA.

5.14 Painting

Factory painting standards for determined, harsh ambient conditions, shall be employed.

Minimum thickness of paint layer shall be greater than 60 micrometers.

Final colour is to be RAL1015 .

5.15 Scope of delivery

The delivery shall meet the following criteria:

- The UPS shall be built according to this Specification and documents relevant to it.
- Documentation of Supplier shall include calculations, diagrams, installation requirements, certificates of tests and trials, adequate certificates.
- fine accessories, fuses, connectors, nuts, auxiliary materials, etc.
- spare parts necessary for start-up and commissioning.
- spare parts for 2-year operation period.
- adequate packaging and transportation to installation site.

5.15.1 Tools and spare parts

The Bidder shall deliver:

- tools
- spare parts

necessary for UPS start-up and commissioning.

Furthermore, the bidder shall submit list of spare parts for 2-year operation. The list, and price quotation for specified spare parts shall be submitted to GL prior to receiving order on UPS delivery.

The Bidder shall deliver 0.5l of paint used for the UPS painting.

5.16 Quality control

The quality control shall be performed according to requirements of valid ISO 9001 standards and regulations. Procedures of manufacturer shall be employed as a minimum.

5.16.1 Inspection

Inspection of the UPS shall be carried out in presence of Buyer, or representatives assigned by him.

The Buyer acceptance does not release the supplier from liability for keeping to purchase terms, delivery of required documents and fulfilling all requirements of this specification.

5.16.2 Factory tests

The supplier shall carry out all required tests according to factory procedures, this specification, relevant data sheets and adequate domestic and international regulations.

Filled certificate of completed tests shall be issued after their positive completion.

The supplier shall submit to GL SA for revision schedule of factory tests and activities, resulting from procedures regarding these tests, 4 weeks in advance of their beginning date.

The supplier is responsible for delivery of copies for current operating conditions of tests, confirmed with certificate of completed tests.

All measuring equipment and instruments shall have up-to-date certificates, issued by independent organizations..

Below listed tests shall be carried out for each field, and confirmed with a certificate:

- standard tests according to PN-EN 60439. All vacuum breaker switches and other equipment in outgoing fields shall be inspected visually and functionally, with consideration given to overloads.
- tests of dielectric strength, described in detail in PN-EN 60439 standard
- insulation resistance measurement by means of insulation resistance 1000V meter
- graduation and polarity check for all current and voltage transformers at original, unequivocal representation
- detailed simulation test for selectivity of protections

The supplier shall specify number and type of tests, which have to be carried out for working UPS unit.

5.16.3 Acceptance

Acceptance of the UPS by Buyer can proceed after:

- Carrying out of all tests by supplier, with test results being satisfactory for Buyer
- Approving by Buyer of all documents listed in purchase documentation.
- Training by the supplier designated by purchaser workers for UPS operating rules on the basis of the delivered in Polish language operation manuals

5.17 Guarantee requirements

Main requirements regarding the guarantee are contained in purchase documentation. The guarantee shall include all equipment and instruments installed in UPS cabinets, through whole period of their use.

5.18 Deliveries

The UPS shall be delivered to GL according to requirements contained in purchase documentation.

UPS cabinets shall be packaged in boxes.

All devices shall be protected for period of transport. Particular attention shall be paid on protections of measuring instruments and protecting devices.

The equipment shall be protected against moisture penetration and improper handling during transportation and storage. The supplier shall analyse necessity for anti-condensation heaters installation.

Not connected terminals of cables and conductors shall be protected by means of thermo-shrinkable tips, in order to protect them against current leakage caused by humidity.

6 Relevant documents

- Other Technical Specifications, shown on delivered List of Technical Specifications for GL S.A

7 Codes and standards

The UPS shall be fabricated according to below listed Polish Standards PN-EN, PN-IEC and European equivalents of IEC/CENELEC standards.

PN-EN 60146	Semiconductor converters.
PN-EN 60073	Basic and safety principles for man-machine interface, marking and identification. Coding principles for indicators and actuators.
PN-EN 60896-11	Lead-acid stationary batteries.Part11: General requirements and testing methods.
PN-EN 60439 (all parts)	Low-voltage switchgears and controlgears.
PN-EN 60445	Basic and safety principles for man-machine interface, marking and identification. Identification of equipment terminals and of terminations of certain designated conductors, as well as general principles of alphanumerical system.
PN-EN 60947 (all parts)	Low-voltage switchgear and controlgear.
PN-EN 60529	Degrees of protection provided by enclosures (IP Code)
PN-EN 50091-2	Uninterruptible power systems (UPS). Part 2. EMC requirements

UPS system implemented by other norms and standards must be submitted for approval GLSA.

Shall any discrepancies arise between requirements of individual documents, then the following hierarchy of importance is to be observed:

- Polish regulations and GL requirements in force
- This specification
- Data sheets
- Other specifications
- Drawings and other documents
- Norms

8 Attachments

- Attachment N° 1 - Typical diagram of UPS

- Attachment N° 2 – Diagram of UPS connections
- Attachment N° 3 – Diagram of measurement for UPS.

9 Record of changes

No.	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 content changes.	T. Wróbel