Grupa LOTOS S.A.	**TECHNICAL SPECIFICATION**	Spec. N° 4170
	Low Voltage Auxiliary Switchgears	

Contents

1 Subject of specification 3
2 Scope of validity 3
2.1 Deviations 3
2.2 Exclusions 3
3 Hierarchy of Documents 3
4 Definitions and designations 3
4.1 Designations 4
5 Descriptions 4
5.1 Ambient conditions 4
5.2 Electrical network parameters 4
5.2.1 Medium voltage 15kV (LOTOS Railway, North Marine and 4
5.3 Basic design requirements 5
5.3.1 Documentation 5
5.3.2 General requirements 5
5.3.3 Technical requirements 6
5.4 Design requirements 7
5.4.1 Electrical parameters 7
5.4.2 Operating conditions 7
5.4.3 Enclosure 7
5.4.4 Basic design requirements 7
5.4.5 Automatics of the switchgear 8
5.4.6 Busbar system 9
5.4.7 Cable compartment 9
5.4.8 Equipment compartment 11

This document is the property of LOTOS Group SA.. Coping and giving it to other are forbidden without express written authority by LOTOS Group SA

5.4.9 Wiring 11
5.4.10 Terminals 12
5.5 Feeding of switchgears 12
5.6 Outgoing feeders 13
5.7 Switchgear (switching instruments) 13
5.7.1 Circuit breakers/disconnectors 13
5.7.2 Control and signalling instruments 13
5.8 Measuring instruments 14
5.8.1 Current transformers 14
5.8.2 Measuring instruments 14
5.8.3 Arrangement of circuits 15
5.9 Links to CSNiM 15
5.10 Marking 15
5.11 Painting 15
5.12 Scope of delivery 15
5.12.1 Reserve outgoing feeders 16
5.12.2 Tools and spare parts 16
5.13 Quality control 16
5.13.1 Inspection 16
5.13.2 Factory tests 16
5.13.3 Acceptance 18
5.14 Guarantee requirements 18
5.15 Deliveries 18
6 Relevant documents 18
7 Codes and standards 19
8 Record of changes 20

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 Low Voltage Auxiliary Switchgears (with rated voltage up to 1kV).

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 deviations from this specification and relevant specifications, standards and documents, including the bidder's proposals indicating a more economic and/or technically better design or solution, shall be submitted in writing for checking and approval by LOTOS Group S.A. No deviation or modification shall be permitted unless confirmed in writing by LOTOS Group 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 concerning low voltage switchgear room. Such requirements are covered in civil specification – 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/ SUPPLIER/CONTRACTOR

4.1 Designations

GL SA – LOTOS Group Inc.

LV – low voltage

AC -- alternate current

DC – direct current

NO – normally open

NC – normally closed

SZR – Auto Transfer Switching system

DOL – Direct online Motor Start-up

CSNiM – Central Monitoring and Supervision System

KiA – Control and Automatics (Instrument)

EMC – Electromagnetic Compatibility

Shall – Indicate a mandatory requirement

5 Descriptions

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
▪ Work conditions	refinery, sea coast

5.2 Electrical network parameters

▪ 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 tolerance	400V, 400V, TN-S, TN-C/S with +/-10% allowable

- 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

5.3 Basic design requirements

5.3.1 Documentation

The bidder (supplier) shall submit for approval the following documents:

- List of documents
- Catalogues
- Dimensional drawings
- Data sheets filled by supplier
- Schematic diagram of the switchgear
- General arrangement
- Front view
- Equipment of cubicle (layout of equipment)
- Layout of control-signalization equipment
- Assembly diagrams
- List of equipment
- Spare parts list
- Certificates
- EMC declarations
- Declaration of conformity
- Erection and operating instruction

5.3.2 General requirements

Reliability, smooth operation and easy handling are required for all equipment applied. Typical equipment shall be used. Application of prototype equipment, not registered and not admitted for production is forbidden.

Spare parts shall be attainable through 10 years minimum.

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

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

The supplier shall deliver thermal balance emitted by equipment, on assumption that all equipment is working at full load.

The switchgears must fulfil requirements of EMC directive, which means that it shall properly operate in defined electromagnetic environment, while not introducing additional electromagnetic interferences.

5.3.3 Technical requirements

The auxiliary Low Voltage switchgears installed in electrical substations shall be fabricated as indoor use, free-standing or wall type, in metal enclosure.

A typical switchgear shall be delivered, fabricated according to applicable standards and regulations, and having certificate of type test and declaration of conformity.

Equipment and instruments predestined for operation inside a building located outside of explosion hazard areas shall be used.

Cubicles of the switchgears shall be adapted to assembling on a mounting frame. The frame shall be included in the switchgear scope of supply.

The switchgear shall feed consumers and drives of adequately grouped, interdependent process plants. In the individual switchgear, consumers of specified process plant shall be grouped by areas in such way, so that consumers of specific group would be easily switched off manually or remotely.

5.4 Design requirements

5.4.1 Electrical parameters

Insulation rated voltage	**Ui = 1000V**
Operating rated voltage	**Ue= 690V**
Rated short circuit current	**depends on the switchboard connection place - requires adjusting with GL each time**
Auxiliary voltage	**24V DC, 110V DC, 220V DC or 230V AC**
Supply system	**TN-C-S or TN-S** (depending on solution for substation)
Outgoing cubicles	**TN-S** (Circuit breakers, fuse switch disconnectors in 4-pole version)
Busbar system	**5- bus arrangement**

Auxiliary voltage selection must be finally agreed with GL SA.

5.4.2 Operating conditions

The switchgears shall be installed in electrical station building, in the room intended for LV switchgears location. Temperature in switchgears' room shall not exceed +5ºC ÷ +40ºC.

5.4.3 Enclosure

The switchgears shall be fabricated as indoor, free-standing or wall type, in metal housing. Required protection class IP30.

Metal enclosure of the switchgear shall be adapted to earthing in two points as minimum.

Design of all switchgear units must preclude penetration of rodents to their interior. Enclosure door must be equipped with gaskets against rodents / insects.

5.4.4 Basic design requirements

Switchgear construction shall be adapted to possible extension of the switchgears by adding new cubicles. Solutions of cubicles shall permit for adding new ones later on, without need for any cutting, welding or existing structure changing.

Each cubicle shall have metallic external guards, excluding floor which constitutes integral part of the enclosure, as well as door locked with standard key lock. The cubicles shall be fully separated one from another. Electric arc protection barriers shall be applied between cubicles.

Functional compartments in a cubicle shall be separated one from another with internal partition walls.

Cubicles of the switchgears shall be composed of the following functional compartments:

- Busbar compartment (main busbars, distribution busbars and auxiliary circuits busbars)
- Equipment compartment
- Cable compartment
- Control compartment (for feeding and tie cubicles)

Opening of both busbar compartment and cable compartment shall be possible only with use of adequate tools.

Compartments of the switchgears cubicles shall be easily accessible from front side, and easy exchangeable. Compartment door shall be fastened to cubicle structure by means of hinges.

Opening angle of door shall not exceed 120°. Opening of door cannot cause damage or actuation of equipment mounted on them.

Modules shall be separated one from another with horizontal particle plates made of metal or isolation plastic.

All partition walls shall minimize spreading of electric short circuits effects, formed inside the switchgear, outside of the place of their generation.

Structure of switchgear cubicles shall be made of galvanized elements. The other components shall be made of sheet steel plate coated with epoxy resins. Painting method will be set during detailed technical planning stage.

The individual cubicles shall be made as:

- stationary or withrawable incoming feeders,
- outgoing feeders, withdrawable (for motor drives), or stationary (for other consumers)

Earthing busbar, with cross-section fulfilling requirements of all valid regulations, shall be laid inside along all switchgear panels.

Main busbars shall be divided into sections, corresponding to transport division length. In place of the switchgear installation, individual sections of busbars shall be joined with copper band or by bolting, according to supplier standard. Joining of busbars shall proceed without need for their relocation.

Easy access to equipment mounted inside the switchgear cubicles shall be provided. All indicators shall be visible.

All cubicles of the switchgear shall have sufficient ventilation provided, by means of air grates.

Between partition walls of adjacent cubicles, small clearance shall be foreseen in order to prevent mutual thermal influence. It is necessary to ensure carrying away of heat generated by equipment mounted inside the cubicle. The switchgear shall be built in such a way, that at maximum ambient temperature rise additional ventilation would not be required.

Each outgoing cubicle shall have reserve outgoing feeders, according to schematic diagram of the switchgear, approved by GL SA. It is assumed that number of reserve circuits and space for additional outgoing feeders shall amount to minimum of 20%.

Switchgear shall be equipped in pocket for documentation. All equipment shall be unequivocally marked, according to technical documentation.

The supplier shall provide detailed data concerning installation of the switchgear, along with data regarding assembly frame.

On switchgear front shall be drawn switchgear one-line diagram with description of power sources on main incomer cubicles, incomer feeder diagrams, tie diagrams, and main and distribution busbars.

5.4.5 Automatics of the switchgear

Lighting switchgears – ROE, as well as external electric heating switchgears – RPHT, and AC switchgear RPZ shall be provided with Auto Transfer Switching System – SZR.

The task of SZR system is to minimize effects of partial failure of the switchgear supply.
SZR automatics system shall be each time agreed with GL SA

5.4.6 Busbar system

Low voltage auxiliary switchgears shall be equipped with:

- five-bus system of main busbars (L1, L2, L3 busbars mounted in upper part of the switchgear cubicles. Earthing and neutral busbars shall be led horizontally, along lower part of cubicles).
- framing system of auxiliary circuits.

Main busbars shall be separated from framing auxiliary circuits.

Thermal and dynamical criteria for busbars selection shall ensure withstanding by them maximum short circuit current on incoming feeder side.

The busbars shall be such selected thermally and dynamically, so as to withstand maximum short circuit current on incoming feeder side.

Busbar cross-sections must be such selected, that their load capacity is greater, or at least equal to 120% of nominal current of incoming feeder, however required load capacity must be each time finally agreed with GL SA

Allowable temperature rise of busbars shall not exceed of 40ºC for maximum load conditions.

While making selection of number and location of buses fastening, as well as method of their coupling, the following requirements shall be taken into account:

- dynamical forces present in failure conditions
- resonance phenomenon
- insulating gaps

Size of the buses shall be constant along whole switchgear. It is not allowed to reduce size of busbars in any place.

The buses shall be marked with L1, L2, L3 symbols from left to right side, and from top to bottom.

Layout of busbar system, i.e. the buses, connections of individual bus sections and fixed contacts for withdrawable buses' elements, shall be made of electrolytic copper. Connections between fixed contacts and cable terminals, such as in case of measuring current transformers, shall be made with copper buses.

Flexible connections shall be used in case of necessity for compensation of expansion, spreading and short-circuits or vibration transfer on connections or busbar system prevention, which can be harmful to the system.

Earthing bus shall be installed on the whole length of switchgear unit.

The following elements shall be connected to earthing bus:

- metal parts of housings
- cable screens or metal shields (if required)
- secondary windings of current transformers.

Earthing bus shall be connected in minimum of two places to external earthing system.

5.4.7 Cable compartment

Cable compartment shall be made in such a way, so that supply and control cables would be easily connected to adequate terminals of each outgoing feeder.

Earthing terminals, intended for earthing of cable screens or armour, shall be made in cable compartment.

All elements that can be live, shall be guarded. Cable compartment shall be adapted for safe routing and connecting of cables without additional safety measures use, in case when the switchgear is live.

All cable glands and other insulation materials necessary for making of connections constitute part of the switchgear, and shall correspond to the number and type of cables used. The cables shall enter from switchgear bottom side through cable entrances fitted with rubber bushings.

Adequate structures for fastening of cables shall be made in cable compartment. Cables shall be fixed reliable by special screwed cable holders. It is not allowed to fix cables to construction by cable binders. It is required that cables shall be also fixed (to cable structures by screwed cable holders) in cable cellar. Fixing cables in switchgear cable compartment only is prohibited because it allows for free hanging down of cables in cable cellar.

5.4.8 Equipment compartment

Cubicles with withdrawable, movable or fixed modules shall be such dimensioned, that connection of those modules to common busbar system would be possible (height, width, main busbars, etc., shall fit each other).

Main current circuits of control instruments, relays, fuses, overcurrent breaker switches, shall be isolated from auxiliary circuits.

5.4.9 Wiring

Main current circuits:
Copper conductor in PVC jacket – cross area 2.5 mm^2 as minimum

Control circuits:
Copper conductor in PVC jacket – cross area 1.5 mm^2 as minimum.

Wiring shall be made in accordance to relewant legislation and standards. Details for wiring execution shall fulfil requirements included in 4400 “Cables and routes” standard..

It is prohibited to connect two conductors to one terminal..

The conductors can be of cord type, single- or multi-wire. Multi-wire conductors shall be used for flexible connections of equipment mounted on cubicle door. Such conductors shall be protected against mechanical damages by means of flexible protective tubes.

Each conductor end shall be equipped with connector, enabling connecting it to terminal strip, and with terminal enabling connecting it to specific equipment. For multi-wire conductors sleeve-type cable terminals shall be used.

For single-wire conductors, yellow and green colours are not allowed, in order to avoid mistakes with yellow- green PE conductor.

All conductors shall be marked next to their connection place using address method. Terminals of equipment and instruments shall also be marked, which would enable to avoid improper connections with terminals strips. Potential method is prohibited.

Conductors to heaters of motors’ windings, as well as to other equipment that can heat up to high temperature, shall have insulation with increased thermal resistance.

Conductors to telemetry instruments shall be screened. The screen shall be earthed on single end only.

The following colours of insulation shall be used:

AC current circuits:	**black for phase, ends and terminals (L1, L2, L3)**
AC neutral conductor:	**light-blue**
AC control circuits:	**black, with numbering of ends**
DC circuits:	**grey, with numbering of ends**
PE protective bus:	**yellow / green**

All internal circuit conductors in each cubicle and all conductors coming from external circuits shall be marked by address method. Other marking method for internal wiring is not allowed.

It is required that all conductors shall be in one piece – making connections on one conductor by any kind of junction elements is prohibited.

Terminals shall be marked in accordance to 6120 "Process identification system" standard, section "Electric equipment identification system" and agreed with GL SA.

5.4.10 Terminals

All incoming and outgoing feeders shall be equipped with separate terminals.

All terminals shall be selected for cables and conductors cross-sections listed on switchgear schematic diagram, acknowledged by GL SA

All terminal strips and all terminals shall be unequivocally labelled.

Connecting terminals shall be grouped in the following way:

- Separately for current and voltage measuring transformers
- Separately for auxiliary circuits
- Separately for control circuits
- Separately for SIL circuits

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

Only single conductor can be led onto single terminal. Interconnections shall be executed by means of bridges. It is prohibited to connect two conductors to one terminal.

Control circuits connected to SIL system shall have separate connection terminals strips

10% of reserve terminals shall be foreseen for each terminal strip.

All terminals and terminal strips shall be of the same type. Wherever bolting of conductor can cause its damage, latch type terminals shall be used.

Terminal strips shall be made for all internal and external control, measuring, protection and supply circuits.

Terminal strips shall be arranged in cable compartment in such manner, that enough space would be provided, necessary for execution of connections, conductors and cables change-over and tags placement.

5.5 Feeding of switchgears

Low voltage auxiliary switchgears – for lighting (ROE) and electric heating (RPHT) and AC auxiliary switchgear (RPZ), shall be fed from two independent sources through Auto Transfer Switching system.

The following feding systems are required:

- Switchgear RPZ type – supplied by two independent cable feeders. Two-section switchgear, working in operating reserve, with open section tie in basic configuration
- Switchgear ROE type – supplied by two independent cable feeders. Two-section switchgear, working in operating reserve, with open section tie in basic configuration
- Switchgear RPHT type – supplied by two independent cable feeders. Two-section switchgear, working in operating reserve, with open section tie in basic configuration

Incoming feeders for AC auxiliary switchgears shall be provided with automatic air circuit breakers, fixed type with electric drive, or molded case type circuit breakers. It is allowed to use molded case breakers plug-in type For DC switchgears fuse disconnectors are allowed

Rated parameters of installed devices shall be matched to expected maximum power demand of the switchgear load.

Main circuit breakers shall be selected for short circuit parameters determined in section "Design requirements" of this specification.

Protective instruments shall be installed in incoming feeders and shall perform selectivity of actuation with protective instruments in medium voltage switchgear or other source, from which the auxiliary switchgear shall be fed.

5.6 Outgoing feeders

Outgoing feeders shall be fixed type equipped in fuse disconnector with fuse sizes adequate to power of supplied consumers.

5.7 Switchgear (switching instruments)

5.7.1 Circuit breakers/disconnectors

Each three-phase outgoing feeder shall be equipped with fuse switch disconnector in four-pole version, providing feed disconnection possibility, and performing function of short circuit and overcurrent protection or in molded case circuit breaker (fuse disconnector preferred).

Each single-phase outgoing feeder shall be protected with fuse switch disconnector in two-pole version, providing feed disconnection possibility, and performing function of short circuit and overcurrent protection. Each disconnector shall be adapted to work in "OFF-ON-OFF" cycle, starting from "ON" position.

Each circuit breaker shall be provided with indicator of mechanical spring engagement and disengagement, as well as indicator of mechanical switching on and off.

Short-circuit disconnectors with electric drive shall be equipped with adequate short circuit and overcurrent trips,

After emergency switch off, actuated by short circuit, overload or temperature protections, switching on the circuit breaker again can take place only after intentional, manual resetting of the circuit breaker or protection.

5.7.2 Control and signalling instruments

Control, protection and signalling instruments shall be unequivocally marked, according to technical documentation.

Auxiliary voltage (refer to section "Design requirements") serves as control voltage for incoming and outgoing feeders.

Signalling lamps

LED or neon type signalling lamps shall be used. All installed lamps shall be of uniform type, with glass fittings.

Signalling circuits shall have their own protections.

Colours of lamps shall be selected according to valid regulations and norms.

Danger shall be signalled with use of red colour.

Switchgears shall have system to lamp controlling made as button or switch "TEST LAMPEK" mounted on switchgear front panel

Control and signalling

Control circuits shall be protected with two-pole overcurrent circuit-breakers. Characteristics of these circuit-breakers shall be such selected, that selectivity of protections is ensured.

Overcurrent circuit-breakers shall be manually switched on and off, and they shall be equipped with auxiliary contacts, enabling monitoring of these circuit-breakers (obligatory required for RPHT switchgear type).

For auxiliary voltage for control and signalization refer to section "Design requirements"..

Auxiliary relays

Auxiliary relays shall be used in order to:

- contact multiplying
- time delay control
- supervision of control circuits
- separate signals transmitted to DCS.

5.8 Measuring instruments

5.8.1 Current transformers

Current transformers, of 1A secondary current at rated primary current shall be used in case of necessity.

Secondary windings shall be unequivocally marked.

Measuring transformers shall be selected according to requirements of measuring instruments applied.

Dynamical and thermal resistance of current transformers shall correspond to short circuit parameters of individual system elements.

The current transformers shall proper operate at load equal to 1.2 x rated current.

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

Each motor outgoing feeder for motor of rated power **>30kW** shall be provided with current transformer and ammeter.

5.8.2 Measuring instruments

The instruments supplied directly with 400V voltage and maximum current load of contacts 10A shall be used, excluding measuring transformers (unless otherwise settled).

Application of digital instruments (including network parameter analyzers) is allowed after adjusting it in advance with GL SA.

Position indicators

Positions indicators shall be installed in all feeder cubicles, in order to unequivocal representation of circuit-breaker state in case of lack of possibility of direct observation from breaker front panel.

The indicators shall represent the following circuit-breakers states:

- „SWITCHED ON"
- „SWITCHED OFF"
- „EMERGENCY SWITCH-OFF".

5.8.3 Arrangement of circuits

Control, protection, monitoring and signalling circuits, present in the switchgear, shall be executed according to closed circuit principle, i.e. control circuits of each outgoing feeder are independent from control circuits of the other feeders.

Above-mentioned circuits shall be single-phase fed.

5.9 Links to CSNiM

1. Incoming feeder

- Signalling of SZR actuation and voltage presence for main feeders .

5.10 Marking

The main and auxiliary buses, as well as cable terminals, must be marked.

Nameplates shall be permanent placed on the front of cubicle. If rear access to switchgear equipment is foreseen, then necessary nameplates shall be places on switchgear back as well.

All inscriptions shall be made in Polish language.

Each device shall be described with use of permanent nameplates, according to control diagram and assembly diagram.

Spare outgoing feeders shall be labelled, along with specification of their maximum rated current or maximum rated power.

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

All internal circuit conductors in each cubicle and all conductors coming from external circuits shall be marked by address method. Other marking method for internal wiring is not allowed.

Contents of the nameplates should be agreed with GL SA

5.11 Painting

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

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

Final RAL colour should be adjusted with GL SA.

5.12 Scope of delivery

The delivery shall include the following items:

- LV switchgear shall be built according to this specification and documents relevant to it.
- Documentation of the Supplier shall include diagrams, installation requirements, adequate certificates, declaration of conformity and other required as per current legislation.
- Fine accessories, fuse-links, connectors, nuts, auxiliary materials, etc.
- Spare parts necessary for starting-up and commissioning.
- Spare parts for 2-year operation period.
- Adequate packaging and transport to installation site.
- Supervision on erection, tests, start-up and commissioning.

5.12.1 Reserve outgoing feeders

The Supplier shall provide 20% of reserve outgoing feeders.

It is required for outgoing feeders to contain each type, occurring in the switchgear.

5.12.2 Tools and spare parts

The Bidder shall deliver:

- tools
- spare parts

necessary for start-up and maintenance of the switchgear.

Furthermore, the Bidder shall submit list of spare parts for 2-year operation. This list, and price list of specified spare parts, shall be submitted to GL SA prior to receiving order on the switchgear delivery.

5.13 Quality control

The quality control shall be carried out according to requirements of valid ISO 9001 standards and regulations. The manufacturer procedures shall be applied as a minimum.

5.13.1 Inspection

Inspection of the switchgear 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 of all requirements of this specification.

5.13.2 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, minimum 8 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 firms.

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

- Standard tests according to PN-EN 60439. All circuit breakers and all cassettes in outgoing cubicles 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
- Original, unequivocal representation for protecting relays, and for ±10% of random chosen thermal relays.

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

5.13.3 Acceptance

Acceptance of the switchgears 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.

5.14 Guarantee requirements

Main requirements regarding the guarantee are contained in purchase documentation. The guarantee shall include all equipment and instruments installed in cubicles of the switchgear, until end of their operation period.

5.15 Deliveries

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

Cubicles of the switchgears 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.

6 Relevant documents

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

7 Codes and standards

Low voltage auxiliary switchgears shall be fabricated according to below listed Polish Standards

- PN-EN, PN-IEC and European equivalents of IEC/CENELEC standards.
- PN-IEC 60050-151 International eletrotechnical vocabulary. Part 151: Electrical and magnetic devices.
- PN-IEC 60050-441 International eletrotechnical vocabulary. Part 441: Switchgear, controlgear and fuses.
- PN-EN 60073 Basic and safety principles for man-machine interface, marking and identification. Coding principles for indicators and actuators.
- 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 60439 Low-voltage switchgears and controlgears. (all parts)
- PN-EN 60669 Switches for household and similar fixed electrical installations (all parts)
- PN-EN 60947 Low- voltage switchgear and controlgear (all parts)
- PN-EN 61095 Electromechanical Contactors for household and similar purposes.
- PN-EN 60243-1 Methods of test for electric strength of solid insulating materials. Part 1. Tests at power frequencies
- PN-EN 50274 Low-voltage switchgear and controlgear assemblies. Protection against electric shock. Protection against unintentional direct contact with hazardous live parts
- PN-EN 60529 Degree of protection provided by enclosures (IP code)

Low voltage auxiliary switchgears built according to other norms and standards shall be submitted to GL SA for approval.

Technical documentation for auxiliary Low Voltage switchgears each time shall be submitted to GL SA for acceptance.

8 Record of changes

No.	Date	Description	Introduced by
0		This specification entirely replaces the former LOTOS Group S.A. standard No. PR 07 427 with the same title.	J. Bućko
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