Grupa LOTOS S.A.	**TECHNICAL SPECIFICATION**	Spec. N° 4220
	Electric actuators for Motor Operated Valves (MOV)	

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 4
4.1 Definitions 4
5 Description 4
5.1 General requirements 4
5.2 Ambient conditions 4
5.3 Supply of electric actuators 5
5.4 Scope of delivery 5
5.5 Technical requirements 7
5.5.1 Types of actuators used with motor operated valves 7
5.5.2 General requirements 7
5.5.3 Assembly conditions for electrical actuators of valves 7
5.5.4 Electrical motor of actuator 7
5.5.5 Anti-condensation heater, drain and vent valve 8
5.5.6 Handwheel 8
5.5.7 Gate valve position indicator 9
5.5.8 Limit switches and/or torque switches 9
5.5.9 Enclosure 9
5.5.10 Cable connection and internal wiring 10
5.5.11 Explosion protection 10

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5.5.12 Data plate 10
5.5.13 Externally controlled electrical actuators 11
5.5.14 Electrical actuators with integrated control 11
5.5.15 Fire protection 13
5.6 Quality control 14
5.7 Shipment 14
5.8 Tests and trials on site 14
5.8.1 Commissioning 15
5.9 Guarantee requirements 15
6 Relevant documents 15
7 Codes and standards 15
8 Enclosures 15
9 Record of changes 16

1 Subject of specification

This specification used in conjunction with other technical specifications of LOTOS Group S.A., establishes minimal requirements regarding designing and manufacture of electric actuators for motor operated valves (MOV).

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

Technical requirements in scope of designing and delivery of electric actuator remote control device were described in specification of Control and Automatics branch.GL SA specifications:

- 3710 Data transmission systems
- 3640 DCS-PLC control systems
- 3630 Control panels

Technical requirements in scope of designing and delivery of (gate) valves that shall be driven with electric actuators, are described in specification of mechanical branch, N^{o} GL 2510 „Cut-off fittings"

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 Definitions

GL SA – LOTOS Group Inc.

MOV – motor operated valve

DOL – Direct online Motor Start-up

KiA – Control and Automatics (Instrument)

EMC – Electromagnetic Compatibility

Shall – Indicate a mandatory requirement

5 Description

5.1 General requirements

- This specification establishes minimum requirements regarding designing, documentation, materials, production, inspection, identification tests, deliveries and assembly for electric actuators of motor operated valves (MOVs).
- All elements necessary to ensure safe and required by conditions operation, are to be taken into consideration, even if omitted in this specification.
- Supplier of actuator is responsible for entirety of designing, selection of actuator elements, wiring inside the actuator, matching of electric actuator with consideration given to valve type, as well as valve operating conditions.
- 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%

5.2 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

5.3 Supply of electric actuators

- Supply voltage 400V ±10%, 3L+PE
- Supply voltage for anti-condensation heater 230 V, TN-S
- Frequency 50 Hz +4% / -6%
- DC auxiliary voltage, control and signalling 24V DC ±5 %

Temporary voltage drops of order up to 20% shall not influence proper and uninterruptible operation of equipment.

The Bidder shall select and deliver appropriate cable bushing, enabling introduction of cables to electric actuator. Selection of cable bushing shall be accomplished on the grounds of data regarding types and cross sections of cables being connected to the actuator, obtained from LOTOS GROUP or from its appointed representative. Application of more than one reduction is impermissible. All glands and reductions for devices working in explosion hazard zone shall be certified for operation in Zone 1.

5.4 Scope of delivery

The Bidder of electric actuator for gate valve is responsible for selection of all actuator sub-assemblies, assurance of adequate properties of each part, assurance of safe continuous operation of actuator without direct supervision in above-specified operating conditions.

Boundaries of delivery are presented in Annexes N° 1 and 2, refer to p. 6.1 and 6.2 of the specification, depending on type of ordered actuator.

List of documentation that shall be delivered to GL S.A:

- List of documents
- Dimensional drawings of electric actuators
- Data sheet of electric actuators, containing at least:
  - process engineering number
  - factory number
  - rated voltage
  - rated output
  - rated speed
  - rated current and starting current at rated voltage
  - current at blocked rotor for rated voltage
  - efficiency and power factor for 50%, 75% and 100% of full load
  - temperature rise in rated conditions
  - maximum torque of actuator
  - explosion-proof parameters (Ex data, Ex certificate number, CE number, …)
- Schematic diagrams of electric actuators
- Assembly diagrams of electric actuators' terminal strips
- Installation, operating and maintenance instruction of electric actuators
- List of spare parts necessary for start-up period during commissioning
- List of spare parts necessary for 2-year operation period
- EC type examination certificate, EC declaration of Conformity,
- Declaration of product conformity to type described in type testing certificate EC, issued by manufacturer or his authorized representative
- Manufacturer's declaration of conformity to electromagnetic compatibility (EMC),
- Manufacturer's declaration of product fabrication conformity to norms
- Others required by the requirements of specification 1020-Classification of Explosion Hazard Zones

5.5 Technical requirements

5.5.1 Types of actuators used with motor operated valves

Motor operated valves are used for:

- Separation of plant part from media, in situations endangering fire safety. Their task is to minimise possibility of inflammable or toxic liquids leakage from process equipment in case of fire.
- Execution of linking operations according to requirements of engineering process

Depending on destination of electrically controlled valve, two design types of actuators are foreseen:

- Valve actuators with external control – without own automatics system
- Valve actuators with integrated control – with own automatics system, integrated reversal starter, contactors' unit and system of limit switches.

Drive type is each time determined by LOTOS GROUP

5.5.2 General requirements

All electrical actuators of valves shall feature long operation life and high reliability.

Each electrical valve actuator shall provide torque sufficient to open valve that is closed, or to close valve at pressure inside the valve equal to 125% of maximum operating pressure allowable for that valve.

The actuator shall be designed in a manner ensuring closing of valve according to differential pressure specified. Power output safety margin of motor able to close or open the valve, shall be adequate to provide sufficient switching torque for maximum torque of the valve and at 10% supply voltage drop below rated voltage value.

The Bidder of actuator shall quote in offer required time for valve opening or closing. Maximum allowable time for closing or opening the valve, shall not exceed 30 seconds in case of fire cut-offs.

5.5.3 Assembly conditions for electrical actuators of valves

Electrical actuators of valves shall be foreseen for outdoor operation without additional protection against weather conditions. Direct sunlight shall not influence proper operation of electric actuator and valve. The bidder shall provide and deliver additional protective measures required.

Horizontally assembly position for actuator is preferred. It is necessary to avoid such assembly position, for which in case of gearbox sealing damage, sensible elements of actuator (such as motor, control elements, contactors, contacts) would be flooded by gear oil.

5.5.4 Electrical motor of actuator

Actuator motor shall be fully functional and operative at rated torque and environmental conditions given in p. 4.2, as well as for operating conditions specified in data sheet for gate valve.

Design of applied motor shall be adapted to:

- Three (3) open – close operations following in sequence, or 15 minutes of continuous operation at full load (depending on which requires shorter time)
- Six (6) current surges following successively one after another, at blocked rotor of motor

- Operation at overload

The motor shall be 3-phase, induction, squirrel-cage, adapted for direct-on-line start-up (DOL), with sealed, initially greased, long-life ball bearings, and whole unit closed in sealed enclosure of protection degree at least IP54.

Insulation of electrical motor shall be produced in F class, at allowable temperature rise as for B class.

Windings of stator shall be copper, fully insulated; star configuration is preferred, with non-earthed neutral point.

Aluminium design of stator is impermissible.

The rotor shall be statically and dynamically balanced. Balancing of rotor with use of lead or other labile material is impermissible. Balancing by means of mechanically fastened weights is preferred.

Design of electrical actuator shall ensure, that even in case of limit switches failure, rotor of motor shall be stopped which shall not entail damage of the actuator or valve served by it.

5.5.5 Anti-condensation heater, drain and vent valve

Each electrical actuator of valve shall be designed for outdoor operation, in environmental conditions specified according to p. 4.2. The actuator shall be equipped with anti-condensation heater, drain valve and vent valve. Drain/vent valve shall be located in lowest point of actuator enclosure, for arbitrary angle of actuator assembly position.

In case of actuators described in p. 4.5.13, anti-condensation heater shall be supplied with independent circuit from 0.4kV switchgear in electrical substation. Separate cable gland shall be provided for anti-condensation heater supply cable.

In case of actuators described in p. 4.5.14, feeding circuit of anti-condensation heater shall be led out inside the actuator enclosure. Additional cable gland is needless in this case.

5.5.6 Handwheel

Each electrical actuator shall be provided with handwheel. Adjusting handwheel must be automatically disconnected from the actuator in the moment of applying voltage on actuator motor. Coupling of the handwheel shall operate in such a manner, so that closing or opening of gate valve by means of handwheel is always possible, and shall enable hand operation by means of handwheel also in case of freezing or seizing of electrical drive. Required time of valve opening or closing with use of handwheel for fire cut-offs, shall not be longer than 1 min. The Supplier shall take into account rated data of gate valve, cross section of pipe being connected and torque required for changing of valve state, in order to meet condition of maximum opening/closing time of the valve. Adjusting handwheel shall be provided with interlock, accomplished by means of padlock fastening. The handwheel must ensure possibility for removing it from the actuator. Rotation of adjusting handwheel in clockwise direction shall result in closing of the valve, while counter clockwise rotation shall result in opening of the valve.

Damage of electrical actuator of valve shall not influence possibility of manual operation by means of adjusting handwheel.

5.5.7 Gate valve position indicator

Electrical actuator shall be equipped with position indicator, informing about gate valve operating condition: open, closed, and intermediate position between open and closed positions. Position indicator shall be mounted ergonomically, so that identification of valve position would be easy possible while standing next to it. All signals informing about valve operating condition (open, closed, intermediate position between open and closed), shall be accessible for remote control devices.

5.5.8 Limit switches and/or torque switches

Each electrical actuator shall be provided with limit switches and/or torque switches, for representation of following valve positions:

- Closed
- Open

while the following shall be foreseen:

- Two contacts „closed" for „Closed" valve position
- Two contacts „closed" for „Open" valve position

Limit switches and/or installed inside the actuator, shall enable possibility for easy adjustment, without need to use of any additional, special tools, nor need to opening of enclosure and disassembly of limit switches unit from internal part of the enclosure. Repeatability of settings shall be contained within ±5% range of set point as a minimum.

Contacts shall be designed in such a way, so that easy change of function from „normally open" to „normally closed" and inversely, would be possible by means of wiring reconnection.

Preferred type of valve position sensor (open/closed), is limit switch of microswitch type.

5.5.9 Enclosure

All component elements of actuator, and connections between them shall be located in common, uniform enclosure, protecting them against mechanical damage and adverse environment influence. Enclosure of the actuator shall be waterproof, of protection degree at least 65 according to PN-EN 60529, and simultaneously shall have waterproof and dustproof seal between enclosure and junction box with cable glands, in which the other electrical elements of the actuator are contained. The additional seals between junction box and enclosure shall protect against penetration of water and dust to actuator interior, when on period of cable connecting the junction box remains open. The actuator shall be designed and produced in such a way, so that all settings and calibrations necessary during start-up would be possible to perform without need to opening of main enclosure of actuator control device, especially tit concern acutators which working in explosion hazardous ares and for this case there is no exceptions for this rule. The enclosure shall provide sufficient protection for period of short-term storage of the device, without need to apply voltage.

Toothed gear of the actuator shall be tightly sealed in enclosure filled with gear oil. It shall be able to operate at arbitrary angle.

All accessible metal parts of the actuator shall be effectively earthed. The actuator shall be provided with earthing terminal, located on external part of metallic enclosure. Nuts, washers, etc., shall be delivered together with the actuator.

5.5.10 Cable connection and internal wiring

All cables shall be introduced to the actuator from bottom side, if possible. Cable entrance on actuator enclosure side is also acceptable. Introducing of cables from top side of outdoor installed actuator is impermissible. The Bidder shall deliver a set of adequate cable glands together with the actuator.

Each unused opening in electrical actuator shall be sealed by means of replaceable, certified protective hole plug. The hole plug shall be explosion-proof design for explosions zones.

Each power and control conductor of the actuator shall be marked on both its ends. Terminals for connection of conductors shall be grouped in common place, and shall form uniform terminal strip. All conductors of power, control and signalling circuits of actuator shall be connected to terminal strips by means of screwed type terminals.

It is prohibited to connect two conductors to one terminal. Junction box shall be equipped with threaded openings prepared for installation of adequate cable bushings, in number corresponding to number of external cables being connected.
For the MOV inlet power and control cable is only allowed single reduction.
If is necessary to use thicker cables than MOV factory solution, intermediate junction boxes are required.

A data plate, durably fastened inside junction box cover, shall contain the following information:

- Serial number
- Supply voltage
- Number of wiring diagram
- Drawing of terminal strip.

5.5.11 Explosion protection

Enclosure of actuator shall be of explosion-proof design and shall have certificate confirming fabrication of the equipment according to ATEX directive 94/9/EC in force. Testing of the product and issuing of certificate shall be done by notify body .

Active parts of equipment operating in hazardous areas shall be protected by enclosure in the implementation of Ex d flameproof.
Connection boxes, intermediate junction boxes ,terminals, shall be Ex e .increase safety type.

Required types of Ex construction : Ⓔx II 2G Ex de II... lub Ⓔx II 2G Ex d II...

For the selection of the actuators for the hazardous areas, "Classification of explosion hazard zones. Selection of Ex equipment " shall be used, the specification 1020.

Copies of the EC type examination certificate and EC declaration of Conformity shall be delivered with MOV devices

5.5.12 Data plate

The actuator shall be marked by means of durable plate, made according to valid regulations.

The data plate shall be made of stainless steel and fastened to non-removable part of frame by means of stainless steel bolts.

The data plate shall contain the following information:

- Identification number of gate valve
- Name of manufacturer
- Model / Serial number of actuator
- Insulation class
- EC type examination certificate, EC declaration of Conformity and others as per specification 1020 requirements
- Rated speed of actuator
- Rated output
- Rated voltage
- Rated, starting and maximum current
- Rated operation time at full load
- Wiring diagram

Note: The motor shall be independently equipped with its own data plate, presenting as a minimum: rated voltage, rated output and frequency.

5.5.13 Externally controlled electrical actuators

Each electrical valve actuator with external control (not being equipped with own control system), shall be composed of the following parts: electrical motors, set of limit / torque switches according to p. 4.5.8, thermal protection of motor, anti-condensation heater. All power and control conductors shall be led out on standard terminals installed.

External control box can be delivered together with the electrical actuator for gate valves as an option – this shall be each time agreed with LOTOS GROUP The control box shall consist of:

- „Open", „Close" and „Stop" pushbuttons
- Operating mode selector switch: local/remote, with possibility for interlock placement in form of padlock, in one out of three positions: local control, OFF position (voltage disconnection from the actuator) and remote control (possibility of „Stop" active local disconnector switch use still exists)

Design of control box shall be insensitive to shocks, and suitable for humid and corrosive atmosphere, according to ambient conditions presented in p. 4.2.

5.5.14 Electrical actuators with integrated control

Each electrical actuator with integrated control shall consist of the following parts: electrical motor, integrated reversal starter, built-in local control device, set of limit / torque switches according to p. 5.5.8, anti-condensation heater, and shall feature possibility for connection of remote signalling and control devices through existing standard terminals installed.

Operation control and protecting devices (reversal starter, transformer of secondary circuits voltage, fuses, electronic control systems, etc.) shall be mounted in single, common enclosure of electric actuator.

Local control switches shall be located on enclosure of electrical actuator.

Devices of local control shall feature:

- „Open", „Close" and „Stop" change-over switches
- Operating mode selector switch: local/remote, with possibility for interlock placement in form of padlock, in one out of three positions: local control, OFF position (voltage disconnection from the actuator) and remote control (possibility of „Stop" active local disconnector switch use exists)

Electrical actuator with own control system shall have the following protections:

- Disconnection of voltage from motor in case of rotor blockage on attempt to put in motion seized gate valve
- Thermal protection against excessive overheating of motor (realised by means of thermal circuit-breakers or thermistors embedded directly in winding of motor)
- Overload protection against torque exceeding during closing and opening operations
- Motor protection against incomplete phase operation, in case of incomplete phase supply
- Control of operation direction
- Protection against operation direction change
- Internal monitoring of control systems
- Monitoring of control signals

As an option for electrical valve actuators, furnishing of actuator with IN/OUT card is foreseen, enabling control through control bus. The following transmission protocols are preferred:

- Modbus
- Profibus
- Dedicated protocols of supplier

Purposefulness of application of actuators controlled by means of control bus, and type of used bus shall be each time agreed with LOTOS GROUP

Actuators with integrated control system can be provided with servo-motor giving possibility for continuous control of valve position with use of external 4 ÷ 20 mA, or digital control signal. Details concerning such solution shall be each time adjusted with LOTOS GROUP

5.5.15 Fire protection

Fire MOV actuators have to withstand hydrocarbon fires set to PN-EN 1363-2, by a defined period of time (see 1180 standard “Firefighting”.)

Protection against fire shall have a form of:

- Fire protection coating

The first of possible methods consist in use of fire protection coating covering actuator, and also local control box (if exists). Covering of actuator with protective coating shall be done by actuator supplier, after completion of valve tests. Fire protection compound shall has certificate .

During spreading of fire protection coating, particular attention shall be paid on elements, which may require opening or removing during assembly or maintenance, as for example bolts, covers of junction boxes for cable connections, etc. Spreading of fire protection coating shall proceed in such a way, so that disassembling of above-mentioned elements would not influence its durability.

- Fire protection box

The second possible protection is use of fire protection box, in which the actuator shall be contained. The box shall be made of steel, and its external surface covered with fire protection coating.

Temperature endurance of external enclosure (fire protection box) or fire protection coating, shall be at least 1000°C for minimum period of 0.5 h.

Valve design shall ensure fire resistance as stated above.

Note: Purposefulness and selection of fire protection shall be each time agreed with LOTOS GROUP

5.6 Quality control

Quality control shall be executed according to requirements included in order. Quality control according to standard procedures of manufacturer shall be executed as a minimum.

Authorised representative of LOTOS Group S.A shall have right to verify design, materials and quality of actuator fabrication.

Supplier shall submit to LOTOS GROUP schedule and scope of electric actuators tests for review minimum 8 week in advance before start

The actuators shall be fully assembled, wired and tested by manufacturer in his works. Each measuring and testing instrument shall have valid official certification, issued by independent testing body. Not later than 10 days after completion of tests, the Bidder shall send LOTOS GROUP a report containing results of testing. Acceptance of delivery can proceed after submitting of positive test results being satisfactory for LOTOS GROUP, complete documentation and fulfilling of all requirements included in order.

The Bidder shall guarantee that electrical actuators shall meet requirements contained in the specification until the end of their utilisation period.

Each actuator shall subject to testing for correct operation. Verification and evidence of the following parameters is required:

- Starting torque
- Current at maximum torque
- Actuator speed
- Maximum torque

Each actuator with motor drive shall subject to functional test for proper operation of limit switches, torque switches, interlocks and indicators of valve position. The test shall be done with the actuator mounted on the valve that shall be operated with maximum pressure differential specified in its data sheet.

5.7 Shipment

Marking of shipment shall comply with requirements contained in order.

Cable entrance places shall be sealed with hole plugs of the same IP degree of protection, as electrical actuator IP degree of protection.

Electrical actuators shall be packaged in such a manner, that one-year protection against damage from penetration of humidity, improper handling during shipment and outdoor warehousing would be ensured.

Rotors of motors shall be protected by means of blocking fastening at works for transport period, and such, that damage of bearings would be precluded. The blocking shall be adequately marked, so that it would be easily noticed and removed during installation / start-up.

5.8 Tests and trials on site

Electrical actuators shall be tested on site according to directions of assembly and operating instruction.

5.8.1 Commissioning

Actuators commissioning by Buyer can be done after:

- conducting all test with positive results being satisfactory for Buyer
- Buyer approval for all documents listed in purchase documentation

5.9 Guarantee requirements

Major guarantee requirements are listed in purchase documentation. Guarantee shall cover all devices and instruments and ensure keeping specified parameters to end of their lifetime.

6 Relevant documents

- 1020 standard "Classification of Explosion Hazard Area"
- Other Technical Specifications, shown on delivered List of Technical Specifications for GL S.A

7 Codes and standards

Electrical acutators shall be made in accordance with listed below Polish codes PN-EN, PN-IEC and European equivalent IEC/CENELEC codes.

- PN-IEC 60034 Rotating electrical machines (all parts)
- PN-EN 60079 Electrical apparatus for potentially explosive atmospheres
- PN-EN 60529 Degrees of protection provided by enclosures (IP Code)
- PN-EN 60947 Low voltage switchgear and controlgear
- PN-EN 60079-0 Explosive atmospheres – Part 0: Equipment –General requirements
- PN-EN 60079-1 Explosive atmospheres – Part 1: Equipment Protection by Flameproof Enclosures "d"
- PN-EN 60079-7 Explosive atmospheres – Part 7: Equipment Protection by increased safety 'e"
- PN-EN 60079-11 Explosive atmospheres – Part 11: Equipment Protection by intrinsic safety".
- PN-EN 1363-2 Fire resistance tests. Alternative and additional procedures
- ATEX 94/9/EC Directive

MOVs made in accordance to other codes and standards must be submitted to GL SA for acceptance.

8 Enclosures

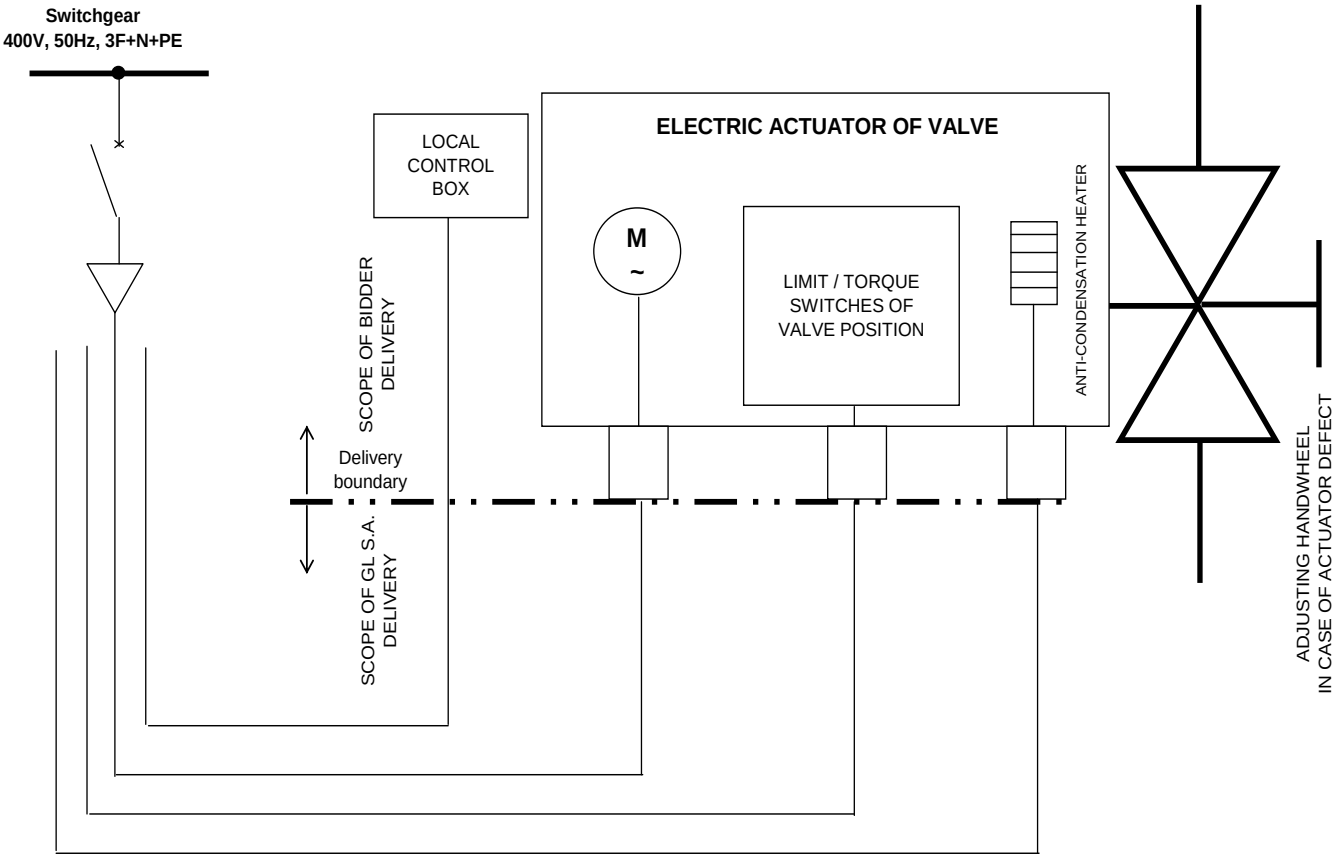
- Enclosure No. 1, Scope of deliveries for externally controlled electric actuator of gate valves
- Enclosure No.2, Scope of deliveries for integrated electric actuator of gate valves

9 Record of changes

No.	Date	Description	Introduced by
1.	28.04.2011	Review of content standards, a change resulting from the implementation of the proposals P10 +.	J. Bućko Z. Alama M. Rompa
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 content changes.	T. Wróbel

Note:

Technical and purchase requirements for valves only are described in mechanical specification 2510 "Shut-off fittings"



Grupa LOTOS S.A	**ENCLOSURE No. 2**	Spec. N^{o}
	Scope of deliveries for remotely controlled electric actuator of gate valves	4220

Note:

Technical and purchase requirements for valves only are described in mechanical specification 2510 "Shut-off fittings"

