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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 performing elements.

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.

DCS – Distributed Control System

PLC – Programmable Control Logic

ESD – Emergency Shutdown System (interlocks system)

SOV – Solenoid valve

ZSL – Limit switch, indicating closed position of valve

ZSH – Limit switch, indicating open position of valve

Trim – valve sub-assemblies contacting with process fluid and influencing relationship of valve throughput vs. degree of its opening: seat, plug, stem.

APC – Advanced Process Control

5 Description

All characteristic features of measurement type, range of application and limitations, relate to solutions most frequently used in industrial practice. In each case, and particularly in relation to instrument application conditions, detailed adjustment with manufacturer or vendor shall decide. One shall also follow requirements of specific plant licensor, if they are more stringent than requirements of this specification, or are conditioning guarantee; this applies in particular to selection of valve body and closing element materials.

The valves constitute part of pipeline and subject to requirements of Directive 97/23/EC (PED), Pressure Equipment.

5.1 Selection criteria

Control and ON-OFF valves are the most expensive element of regulation of control loop. Proper valve selection has decisive influence on control quality, reliability of whole plant, operation safety and energy losses caused by throttling element. Considering co-operation of valves with APC system, high quality of operation shall be ensured for the valve itself, as well as for its control elements

5.1.1 General requirements

Valve process connections shall be according to ASME B 16.5.

The valves must be fabricated according to Directive 97/23/EC (PED), Pressure Equipment.

Pressure class of process connection: at least class 600 lbs for DN ½" up to 1-1/2" valves. For remaining sizes, the class shall conform to that of pipeline. Flange connections are preferred; use of wafer type design requires GLSA approval.
Caution: On selection of body material different than that of pipeline class, required pressure class of valve may be higher than class arising from pipeline class. The vendor is obliged to check if body and flange material, as well as their pressure class are adequate for design pressure and design temperature given in detail specification.

Packing of stuffing box shall be appropriately chosen to process fluid temperature. The packing cannot deteriorate dynamic properties of the valve, however it must ensure limitation of emissions to environment to the highest possible degree.

Stem guiding must protect the valve and stem and trim against vibrations, considering process parameters of process fluid.

One shall pursue to mount all valves with actuator stem in vertical position, and for angle valves this conditions is stringently required. Each deviation in this regard requires GLSA approval.

Metal trim is preferred. Soft seals are allowed in case when high tightness is required (class V and VI according to ASME-FCI-7-2), fluid temperature does not exceed 200ºC, pressure drop on valve is low, and solid matter contaminations are not present.

The valves must be delivered complete, assembled with accessories specified in detail specification (actuator, positioner, air filter-regulator, solenoid valve, position limit switches, etc.). Connections inside the assembly shall be done with use of stainless steel tubes (AISI304 or AISI316 as minimum) and compression tube fittings. Tubes of at least 8 mm outside diameter shall be used. Pressure regulator connection shall be ¼" NPT (F).

If additional structural components are used, which reduce cavitation or noise, then vendor shall deliver them assembled with valve in a single unit.

The actuators shall be selected for instrument air pressure from 0.4 up to 0.7 MPa.

In case of valves intended for continuous control, their opening degree at maximum flow shall not exceed 90%.

The valve along with its instrumentation must require just minimum maintenance.

In all cases, at least following data have to be stamped on valve flange: size, pressure class, body and flange material. Additional requirements concerning marking shall be according to specification GLSA 3030.

The following data shall be given in valve specification: failsafe position i.e. valve position at supply air failure that fulfils fail-safe position required by process conditions.

Detail specification of the valve must contain process data and design requirements of the valve.

5.1.1.1 Process data

- Type of process fluid and its physical properties, including fluid phase (gas, liquid, sludge, multi-phase)
- Density (specific gravity, molecular mass, etc.)
- Vapour pressure
- Viscosity
- Critical pressure and critical temperature
- Degree of superheating (for steam) or vapour content on the valve – % of evaporation
- Special corrosive agents, resulting from contamination (H_2S, chlorine, etc.)
- Solid matter contents (e.g. dust from catalyst)
- Minimum, normal and maximum medium flow, as well for start-up and emergency cases
- Pressures at valve inlet and outlet for each case of flow
- Temperature of process fluid for each case of flow
- Minimum, normal and maximum pressure drop on valve, also pressure drop for closed valve
- Shut-off class
- Pressure and temperature of process fluid in emergency conditions
- Maximum allowable noise level: noise level shall not exceed 85 dB(A).
- Special requirements of environment protection
- Explosion classification in area of valve installation.

5.1.1.2 Constructional data

Caution: final design data shall be given by valve vendor. In case of significant deviations from base specification, the vendor specification must be approved by GLSA.

- Body type (globe, angle, butterfly, etc.)
- Body material
- End connections: size, pressure class, facing
- Type and characteristics of trim (equal-percentage, linear, etc.)
- Plug operation in case of instrument air failure (closes, opens, last position)
- Plug operation in case of control signal absence

- Size of trim (full bore, reduced)
- Materials of trim components (plug, seat, stem, stem guide)
- Flow action on plug (to open, to close)
- Type and size of actuator
- Material of stuffing box packing
- Type of explosion protection
- Accessories (positioner, position signalling, handwheel, etc.)
- Special requirements e.g. flameproof design.

5.1.2 Material selection

Minimum requirements, both for the body and trim (plug, seat, stem, stem guide) are determined by pipeline material classes. Minimum requirement for plug, seat and stem is AISI 316 stainless steel. It is necessary, however, to pay special attention to requirements of the plant licensor for specific valve in each case.

While selecting material, one shall take into account resistance to corrosion, and in case of plug, seat and stem, abrasion resistance as well. Stelliting or other method of plug and seat hardening shall be used for following conditions: pressure drop on valve 700 kPa and higher, process temperature 315ºC and higher, cavitation or flashing conditions, when fluid contains solids.

Stuffing box packing must be appropriately selected to process temperature. In case of toxic media, special, low-emission packing shall be used, for example of bellow type or with spring compression that automatically compensates changes resulting from material ageing and temperature changes. Structure and seal material of stem must guarantee longevity of stuffing box, put minimum requirements related to maintenance and create minimum friction, so that control properties of the valve are not impaired. Seal materials must be asbestos-free.

The vendor shall provide material certificate 3.1 according to PN-EN 10204 for valve body.

5.1.3 Valve size selection

Selection of valve (valve size, that is closely connected with valve type) must be based on calculations executed with use of specialized software. On base design, or quotation stage, the calculations are executed by engineering company. Final calculations are executed by vendor of the valves, on the grounds of a software that is taking into account constructional data of offered valve. Calculating program shall be based on equations given in ANSI/ISA S75.01 or PN-EN 60534-2 standard.

Calculating software used by vendor shall provide at least the following data:

- Valve size: Cv (Kv), nominal size of the valve
- Opening degree for minimum, normal and maximum flow. Maximum noise level.
- Noise level for minimum, normal and maximum flow.
- Presence of cavitation, flashing, chocked flow.
- Type and size of actuator, with consideration given to pressure drop on closed valve
- Time of opening from 0% to 100% and from 100% to 0% for ON-OFF type valves. For valves operating in continuous control loops, time of steering from 0% to 75% of opening degree.
- Fluid linear velocity on valve outlet.

It is also desirable to give performance curve of installed valve, based on specified cases – for minimum, normal and maximum flow.

5.1.4 Operating speed

Control valves

Stroking time for closing and opening shall not exceed the values given in the following table.

Valve size [inch]	Maximum stroking time [seconds]
½ - 2	6
3	9
4	12
6	15
8	18
10	30
12 and more	36

ON-OFF valves

The vendor shall assure stroking times for closing and opening, according to detail specification. Quoted stroking time is measured starting from the moment of signal sending to solenoid valve up to moment when valve reaches required position, confirmed by limit switch. Each valve shall be furnished with proximity limit switches of NAMUR type.

In order to keep required stroking times, the vendor must choose adequate accessories – an actuator, positioner and additional equipment, if required, e.g. booster, quick exhaust valve, etc.

5.1.5 Flow characteristics

Inherent flow characteristic for the gives valve flow – opening degree relationship at constant pressure drop on the valve.

There is wide variety of valve characteristics currently, particularly for special designs. Their basic characteristics and rough selection principles are as follows:

Level control systems

Pressure drop on valve	**Recommended valve characteristics**
Constant pressure drop (dP)	Linear
dP decreases with flow increase, dP at maximum flow >20% of dP at minimum flow	Linear
dP decreases with flow increase, dP at maximum flow <20% of dP at minimum flow	Equal-percentage
dP decreases with flow increase, dP at maximum flow <200% of dP at minimum flow	Linear
dP decreases with flow increase, dP at maximum flow > 200% of dP at minimum flow	Quick-opening

Flow control systems

Flow measurement signal to regulator	Location of control valve in relation to flow measurement point	Recommended valve characteristics	
		Broad range of flow set value changes	Narrow range of flow changes, but large dP change with flow increasing
Flow proportional	In series	Linear	Equal-percentage
	On bypass 1)	Linear	Equal-percentage
Square root type	In series	Linear	Equal-percentage
	On bypass 1)	Equal-percentage	Equal-percentage
1) Closing of valve increases flow			

Pressure control systems: Equal-percentage

Temperature control systems: Equal-percentage

In practice, a characteristic of flow through valve installed in process is of importance, and calculating program shall give its approximation. Such characteristics shall be the base for valve characteristics selection.

Note: The relationship of valve opening degree against control signal can be modified by positioner, which enables better selection of control characteristics also in cases, when flow characteristics of valve type selected on the grounds of other criteria is not of desired type.

5.1.6 Flashing and cavitation

Liquid evaporation downstream the valve, in place of maximum contraction – vena contracta, means significant increase of volumetric flow, which can even lead to supersonic velocities. Gas bubbles collapsing in effect of partial recovery of pressure, leads in turn to cavitation. Both these phenomena are danger both for valve itself and for plant, and generate high-level noise.

In order to eliminate those phenomena, or limit their negative impact on valve and plant, it is necessary to follow:

- proper selection of valve type
- proper valve size selection
- adequate selection of trim design, e.g. multi-stage trim, cage seat with cylindrical plug and suitable arrangement of openings.
- application of external elements taking over part of pressure drop.

In each case the valve vendor shall propose the best problem solution in consultation with engineering company and GLSA.

5.1.7 Noise level

Noise limiting constitutes significant element of valve selection. This is achieved mainly through restricting of phenomena described in previous paragraph, and with methods contained therein.

The valve vendor shall propose solution to the problem. Maximum noise level cannot exceed 85 dB(A).

Additional noise reduction, if required, is accomplished by acoustic insulation of valve and pipeline.

5.1.8 Valve type selection

The following table presents preliminary selection only. More accurate characteristics of various valves are given in further paragraphs. Final selection of valve type shall be done in close co-operation of purchaser and vendor, taking into account all selection criteria.

	Globe	Ball	Butterfly	Diaphragm
Basic operation mode	**Continuous control**	**ON-OFF**	**Continuous control**	**ON-OFF**
Possible other operation mode	**ON-OFF**	Continuous control, with V-port ball	**ON-OFF** (with eccentric plug movement)	Continuous control
Closing method	Plug moves perpendicular to seat	Radial seals fitted to ball plug	Rotary closing element pressed to radial seal	Diaphragm pressed to seat. Contact with seat only when valve is closed
Characteristics of regulation	Full possibility of characteristics selection	Ball V-port, usually equal-percentage	Usually linear for opening up to 70%	Control only up to 60% of opening range
Cavitation protection	Very good	Limited	No	No
High tightness class	Possible	Possible	Possible	Limited
Main applications	Continuous control When tight shut-off is required	Sludge	For low pressure drops	Abrasive, corrosive media. On water treatment plants

5.2 Globe valves with linear stem motion

Versatile application type, but mainly for continuous control. This type of valve can be of design adapted both for cryogenic applications, and for process high temperature. Also available in three-way version.

Sizes from ½" up to 16" and Cv from fractional values up to 2500 approx.

Pressure classes up to 2500 lbs.

Rangeability up to 50:1. The vendor shall state actual rangeability of offered valve.

Application of single-seat valves with contoured plug is preferred. Valves with plug designs in form of perforated cylinder shall not be used for contaminated process fluids.

Application of double-seat valve requires GLSA approval. In case of high pressure drops, the pressure balanced plug shall be used in single-seat valves.

If process temperature drops below –17ºC, then extended stuffing box shall be used. For temperatures exceeding 300ºC, extended or finned stuffing box shall be used. The vendor shall propose final selection on the grounds of design data and operation data of offered valve.

Stem guiding. Top guiding is allowed for diameters up to 3", for diameters above 3" top-bottom and cage type guiding shall be used. Stem guiding must preclude plug rotation.

For very high pressure drops, angle valves, and/or valves with multi-stage trim shall be used. Angle valve shall be installed with outlet directed vertically downwards.

Use of diaphragm type actuators is preferred. Application of piston type actuators, single- or double acting is allowed for large diameter valves, when this is required in a view of necessary operating speed, or because of high pressure drop on closed valve.

5.3 Rotary globe valves (e.g. Masoneilan make Camflex)

They are to be used particularly in applications where flashing on valve outlet exists. Sizes from 1" up to 16" and Cv up to 2200 approx. (flow to open), or 3600 (flow to close).

Pressure classes up to 600 lbs.

Use of flange type valves is preferred. Wafer type valves may be used only in special applications.

Rangeability 100:1. The vendor shall state actual rangeability of offered valve.

Strong and rigid stem guiding shall be used, which prevents stem bending.

Actuator: according to manufacturer standard.

5.4 Ball valves

Sizes from ½" up to 20", Cv up to approx. 10000 (depending on pressure class).

Pressure classes up to 600 lbs. Higher-pressure classes are available in special designs.

Rangeability 100:1 up to 500:1 for V-port type valves. The vendor shall state actual rangeability of offered valve.

The ball valves shall not be used for highly corrosive media, and in applications where cavitation is possible.

Use of flange type valves is preferred. Wafer type valves may be used only in special applications.

In ON-OFF type applications, full bore valves shall be used. V-port designs shall be used for continuous control applications.

Application of ball valves is not recommended for high pressure drops.

Buffer tanks for instrument air shall be used for valves of critical importance.

The vendor shall propose trim seal adequately to process temperature and shut-off class required. Application of soft seals is allowed for temperatures lower than 200ºC.

5.5 Butterfly

Sizes from 2" up to 60", Cv up to 100000 approximately.

Pressure classes for valves with centric rotary motion of plug, up to 600 lbs.

Rangeability up to 75:1. The vendor shall state actual rangeability of offered valve.

Use of butterfly valves with centric rotary plug motion and soft trim seal, is allowed only in low-pressure applications.

In high-pressure application, butterfly valves with eccentric, or double-eccentric plug motion shall be used, which ensure better tightness also for metal-metal trim seal.

Use of valves with two flanges is preferred. Wafer valves may be used only in special applications.

In cases, where for wafer valves the disk protrudes outside the body contour when the valve is open, the vendor must provide adequate pipe insert that enables ease dismantling of valve with this insert.

5.6 Diaphragm valves

Used mainly for sludge-related applications and at low process pressure. Their characteristics are close to quick-opening one, continuous regulation shall be avoided.

Sizes from 1" up to 12". Working pressures of medium up to 1 MPa for small diameters and up to 350 kPa for 6" and larger diameters. Medium temperature up to 100ºC.

Rangeability 10:1. The vendor shall state actual rangeability of offered valve.

This type is not suitable for high process pressures and temperatures.

Quick wear.

5.7 Steam desuperheaters

Note: Installation of steam desuperheater in pipeline requires straight section, approximately 10D downstream the desuperheater. Manufacturer of specific desuperheater shall determine recommended length of this section

Basic selection criteria for desuperheater type:

- temperature difference of steam obtained after cooling, and saturated steam temperature at pressure downstream the desuperheater
- steam pipeline diameter
- required rangeability

Basic types of employed desuperheaters and recommended range of their application:

- The type with several water injection nozzles inserted to pipeline centre. Only such designs are allowed to use, where flow control of injected water is accomplished by means of stem motion that changes number of active injection nozzles. Erection of desuperheater requires only single connecting nozzle on steam pipeline. Use of this desuperheater type is preferred in GLSA. Rangeability: 10:1 (linear characteristics) up to 25:1 (equal-percentage characteristics).

  Pressure drop: high
  Minimum steam superheating after cooling: 8ºC.

- The type with injection nozzles in single or double Venturi tube. In this case, an insert with this Venturi tube shall be installed in steam pipeline.
  Rangeability: 10:1 (double venturi)
  Pressure drop: moderate
  Minimum steam superheating after cooling: 5ºC.

- The type using additional atomization steam.
  Rangeability: 50:1

Pressure drop: negligible
Minimum steam superheating after cooling: <5ºC.

5.8 Pressure regulators (no auxiliary energy)

These are mainly of globe valve type.

Application:

- In process, where low control quality is sufficient, as well as in locations where instrument air is not available, for pressure control downstream a valve or upstream a valve (PCV) and fluid flow (FCV) or temperature (TCV).
- TCV valves shall be used on auxiliary systems, e.g. for oil temperature control at compressors. The vendor of auxiliary system shall select the valve.
- For tank blanketing. Two-valve units shall be used, providing two-stage control of pressure.
- For auxiliary media, e.g. air purging where separation of measuring instrument from process medium is required, flushing of process connections.

Design:

- Globe valve with diaphragm type actuator
- Internal connection of control signal is preferred.
- The diaphragm shall be resistant to medium influence.

5.9 Special valves

Valves of special design are used in cases when standard design valve cannot be matched, or when this is advantageous from assembly or economic point of view.

Three-way distributing or mixing valves with rotary plug. They shall be used in applications where simultaneous closure of both ways is not allowed, and high shut-off tightness is not required. Pressure class up to 900 lbs.

Globe valves for boiler systems, where control of small flows at high pressure drops during boiler drum filling, and control of large flows during normal operation is required. These are globe valves with linear stem movement, but with double plugs enabling full control range coverage. Utilisation of such valve allows avoiding application of two valves operating in parallel.

The valves used in industrial boiler burner systems must fulfil special requirements concerning shut-off tightness and operating speed. The valves must have certificate of authorized body, e.g. Central Laboratory of Technical Inspection (CLDT), and must fulfil requirements determined by SIL level.

Valves with bell type plug. This is a new design that offers exceptional rangeability, reaching even 10000:1! Pressure class 300RF, nominal diameters up to 8". Their application requires references from vendor and GLSA acceptance.

5.10 Actuators and accessories

5.10.1 Actuators

Actuators are indispensable equipment for all remotely controlled valves. They are also used for driving of flaps in air ducts, metering pumps stroke setting, etc.

Basic requirements:

- Providing of force or torque high enough for reliable valve closing or opening; the actuator must have at least 25% force (torque) reserve, also for pressure difference at fully closed valve.
- The actuator must provide safe position of valve (or other executing element) in case of supply failure, determined in detail specification (FC, FO, FL)
- The actuator must provide closing / opening time, or stroking time that is specified in detail specification. Basic requirements regarding operating speed are given in paragraph 4.1.4.

Pneumatic diaphragm actuators with return spring are preferred for control valves. Multi-spring actuators are preferred.

Pneumatic piston actuators shall be used in case of large valves, where dimensions of diaphragm actuators would be too big, when high operating speeds are required, as well as in cases where such preference arises from valve design (e.g. in case of ball valves).

For control of furnace flaps pneumatic piston actuators shall be used, equipped with position transducer.

Electro-hydraulic actuators shall only be used in cases, when very high forces and very high operating speeds (stroking time < 1 sec.) are required. Application of these actuators is allowed when this is a standard solution in package delivery, e.g. in compressor control system.

Electric actuators for valves and other executing equipment for continuous control. Requirements:

- 4 – 20 mA control signal
- Limit switches for closed and open position
- Overload circuit breaker
- Failure alarm
- Position transducer with 4 – 20 mA output signal (if required by detail specification)
- Single supply – for motor and control system
- Explosion protection: flameproof enclosure – Ex d
  Protection class: IP65 as a minimum.

Electric actuators for ON-OFF type valves are described in standard 4220 (electric standard).

5.10.2 Positioners

Application of electro-pneumatic (E/P) intrinsically safe positioners is preferred. Pneumatic actuators associated with I/P, I/H converter can only be used in case of harsh operating conditions (high vibration level, high temperature) and for special valves, shall vendor of the valve or machine (e.g. turbo-compressor) determines such requirements.

Input signal: 4-20 mA, intrinsically safe

Protection class: at least IP 65.

Electric connection: M20x1.5

For valves classified as *critical* the positioners with advanced diagnostic shall be adopted, while for valves classified as *important* the positioners with basic diagnostic shall be used.

Valves category classification: critical, important, residual, shall be made base on GLSA Instruction No 2A and connected to them attachment No1.

5.10.3 Solenoid valves

Supply: 24V=. The valve must be suitable to continuous operation when energised.

Explosion protection: flameproof enclosure – Ex d.

Protection class: at least IP65

Electrical connection: M20x1.5

Vendor of the main valve shall select solenoid valve size. The valve must be installed and pneumatically connected with valve control system, delivery complete with main valve.

In case of self-contained application, the valve must be equipped with assembly elements specified in detail specification.

5.10.4 Position indicating devices and transducers

Limit switches shall be used according to requirements of regulations for ESD/SIS systems, or according to process requirements.

Intrinsically safe proximity sensors shall be used, suitable for direct connection to input cards of DCS or PLC systems. Requirements regarding signal must be described in detail specification.

In case when several signalling devices are used on single valve, all of them must be connected to common junction box. Electric connection to the box: M20x1.5. Protection class: at least IP65.

Position transducers are to be used only for precise control in open loop, when feedback from controlled process parameters does not exist. Two-wire transducer with 4-20 mA signal shall be used. Electric connection: M20x1.5. Protection class: at least IP65.

All equipment elements that require cable connections shall be delivered with M20x1.5 cable glands, matched to cable diameter.

5.10.5 Filter-regulator

Valve shall be equipped with filter-regulator in each case of pneumatic type actuator applied. The filter-regulator size shall be selected by vendor on a base of actuator type selected and stroking time required.

Connection size: ¼" NPT (F)

5.10.6 Other

Lock-up valve shall be used in case, where executing element has to keep last position on air supply failure. Design and connections: according to valve vendor standard.

Quick exhaust valve shall be used in case of very short closing / opening times for large valves. Design and connections: according to valve vendor standard.

Booster shall be used, when positioner itself cannot ensure quick enough action of large valve actuator. Design and connections: according to valve vendor standard.

6 Relevant documents

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

7 Standards and regulations

Design, execution and assembly shall comply with the latest edition of below listed standards and regulations.

Only specific, valve – related standards are listed here. The remaining standards relating to P & I are given in specification GLSA 3010 – Instrumentation general requirements.

ANSI/ISA S75.01	Flow Equations for Sizing Control Valves.
ANSI/ISA S75.02	Control Valves Capacity Test Procedure.
ANSI/ISA S75.03	Face-to-Face Dimensions for Integral Flanged Globe-Style Control Valve Bodies (ANSI Classes 125, 150, 250, 300, and 600).
ANSI/ISA S75.04	Face-to-Face Dimensions for Flangeless Control Valve (ANSI Classes 150, 300, and 600).
ANSI/ISA S75.12	Face-to-Face Dimensions for Socket Weld-End and Srewed-End Globe-Style Control Valve (ANSI Classes 150, 300, 600, 900, 1500 and 2500).
ANSI/ISA S75.15	Face-to-Face Dimensions for Buttweld-End Globe-Style Control Valve (ANSI Classes 150, 300, 600, 900, 1500 and 2500).
ANSI/ISA S75.16	Face-to-Face Dimensions for Flanged Globe Style Control Valve Bodies (ANSI classes 900, 1500, & 2500).
ANSI/ISA S75.22	Face-to-Centerline Dimensions for Flanged Globe-Style Angle Control Valve Bodies (ANSI Classes 150, 300, and 600).
ANSI/FCI 70.2	Control Valve Seat Leakage
API 941	Steels for Hydrogen Service at Elevated Temperatures and Pressures in Petroleum Refineries and Petrochemical Plants
NACE MR0103	Materials Resistant to Sulfide Stress Cracking in Corrosive Petroleum Refining Environments
PN-EN 161	Automatyczne zawory odcinające do palników i urządzeń gazowych.
PN-EN ISO 23553-1	Urządzenia kontrolne i zabezpieczające palników olejowych. Wymagania szczegółowe. Część 1: Urządzenia odcinające palników olejowych
PN-EN 61508-1	Bezpieczeństwo funkcjonalne elektrycznych/elektronicznych/programowalnych elektronicznych systemów związanych z bezpieczeństwem. Część 1: Wymagania ogólne
PN-EN 61508-2	Bezpieczeństwo funkcjonalne elektrycznych/elektronicznych/programowalnych elektronicznych systemów związanych z bezpieczeństwem. Część 2: Wymagania dotyczące elektrycznych/elektronicznych/programowalnych elektronicznych systemów związanych z bezpieczeństwem (oryg.)
PN-EN 61508-3	Bezpieczeństwo funkcjonalne elektrycznych/elektronicznych/programowalnych elektronicznych systemów związanych z bezpieczeństwem. Część 3: Wymagania dotyczące oprogramowania (oryg.)
PN-EN 61508-4	Bezpieczeństwo funkcjonalne elektrycznych/elektronicznych/programowalnych elektronicznych systemów związanych z bezpieczeństwem. Część 4: Definicje i skrótowce (oryg.)
PN-EN 61508-5	Bezpieczeństwo funkcjonalne elektrycznych/elektronicznych/programowalnych elektronicznych systemów związanych z bezpieczeństwem. Część 5: Przykłady metod określania poziomów nienaruszalności bezpieczeństwa (oryg.)

PN-EN 61508-6	Bezpieczeństwo funkcjonalne elektrycznych/elektronicznych/programowalnych elektronicznych systemów związanych z bezpieczeństwem. Część 6: Wytyczne do stosowania IEC 61508-2 i IEC 61508-3 (oryg.)
PN-EN 61508-7	Bezpieczeństwo funkcjonalne elektrycznych/elektronicznych/programowalnych elektronicznych systemów związanych z bezpieczeństwem. Część 7: Przegląd technik i miar (oryg.)

European Union Directives

94/9/EC	Equipment explosive atmospheres (ATEX).
97/23/EC	Pressure equipment (PED)

8 Enclosures

- Enclosure N° 1, Documents requirements.
- Enclosure N° 2, GLSA Organisation instruction No 2A with Appendix No: A.

9 Record of changes

No.	Date	Description	Introduced by
1		This specification entirely replaces the former LOTOS Group S.A. standard No. PR 07 350 with the same title.	M. Domaniewski
2	30-11-2013 (rev. 1)	Review, update, standardize and changes to the Standard within scope of order No. OK/990/2012	Editorial board coordinated by T.Wróbel
-	31-08-2015	Page layout corrections, no contents changes.	T. Wróbel

Grupa LOTOS S.A.	**ENCLOSURE No:1**	Spec. N° 3450
	Documents requirements	

	WITH BID	WITH DELIVERY	NOTES
MANUFACTURER'S DATA SHEET	Yes	Yes	
LIST OF DEVIATIONS TO INQUIRY SPECIFICATIONS	Yes		
LIST OF SPARES RECOMMENDED FOR 2 YEARS OPERATION WITH ITEMIZED PRICES	Yes		
LIST OF SPARES RECOMMENDED FOR COMMISSIONING AND PROVISIONAL ACCEPTANCE TEST	Yes		
TEST CERTIFICATES		Yes	If specified
MATERAIL CERTIFICATES ACCORDING TO EN-10204 3.1		Yes	If specified
CERTIFICATES ISSUED BY OFFCIAL ORGANIZATIONS FOR EQUIP. TO BE UTILIZED IN HAZARDOUS AREAS	Yes	Yes	If applicable
CERTIFICATES ISSUED BY OFFICIAL ORGANIZATIONS FOR EQUIPMENT TO BE UTILIZED FOR CUSTODY TRANSFER			
OUTLINE AND DIMENSIONAL DWGS, ELECTRICAL ARRANGEMENT	Yes	Yes	
ELECTRICAL DIAGRAMS		Yes	
INSTALLATION, OPERATION AND MAINTENANCE INSTRUCTION MANUALS		Yes	
DOCUMENTS IN ELECTRONIC VERSION ON CD		Yes	
INSPECTION BOOK		Yes	If specified
FABRICATION QUALITY CONTROL PLAN		Yes	If specified
DECLARATION OF CONFORMITY WITH EU DIRECTIVES		Yes	
MANUFACTURING CERTIFICATES		Yes	If specified
CALIBRATION CERTIFICATE		Yes	If specified
HYDROSTATIC TEST REPORT		Yes	If applicable

1 Introduction

The purpose of this instruction is an objective classification of all automatic valves operating on LOTOS Group's installations considering their importance for maintaining the continuity and parameters of production and auxiliary processes. The classification of a device for a specific criticality group (due to the degree of its criticality) will have a crucial influence on the selection and application of an adequate, optimum maintenance strategy for that device, and in particular on the following:

- the speed of the maintenance services' reaction to a notified failure (procedures considering the significance of the device)
- providing spare parts for the device
- the range of the device operating parameters monitoring
- the frequency of the diagnostic controls of the device by appropriate services
- the scope and frequency of inspections of the device.

1.1 Classification of automatic valves in LOTOS Group

Each valve used in LOTOS Group shall be classified for one of the following three groups, depending on it significance:

- critical valves
- important valves
- other valves

The classification of valves is based on fixed criteria and a conversion algorithm.

1.2 Definitions

A critical valve – a device whose failure may bring about life or property hazard, environmental pollution, a complete stoppage of the plant or a reduction in the volume of the plant's production.

An important valve – a device whose failure and the time required for the repair may result in a significant reduction in the volume of production of the installation where it is installed and/or a decline in the installation's process parameters.

Other valve – a device whose failure and the time required for the repair does not result in a decline in the process parameters and/or a reduction in the volume of the installation's production.

Control valves list – a breakdown of all automatic valves with a steplessly adjustable opening, used in LOTOS Group. The breakdown is by the production installation and the process number. It presents the basic technical data and the evaluation criteria with the final definition of the degree of criticality.

On-off valves list – a breakdown of all automatic valves with an open/close adjustment, used in LOTOS Group. The breakdown is by the production installation and the process number. It presents the basic technical data and the evaluation criteria with the final definition of the degree of criticality.

The degree of criticality of an automatic valve – the designation of the valve importance: "CRITICAL", "IMPORTANT" or "OTHER" according to the criteria conversion algorithms.

2 The rules of generating the automatic valves list

2.1 The definition of automatic valve classification criteria

An automatic valve is assigned to one of the groups on the basis of five criteria defining the degree of criticality. Each criterion is described by three properties. For a given valve, each criterion may be described by one property only. The criteria that determine the degree of criticality are:

A – the safety criterion – we distinguish the following types of valves:
- very dangerous
- dangerous
- safe

B – the criterion of significance from the plant's point of view – valves of:
- fundamental significance
- great significance
- small significance

C – the criterion of significance from the point of view of the installation – valves that are:
- very important
- significant
- other

D – the criterion of failure probability – valve with a relatively:
- high failure probability
- medium failure probability
- low failure probability

E – repair criterion – valves requiring repair actions that are:
- very complex
- of average complexity
- simple

A detailed description of the criteria and the methods for assigning the properties to them are presented in Appendix A – "A description of an automatic valve evaluation criteria".

2.2 The criticality matrix of an automatic valve

In order to value the criteria for specific valves and to calculate the degree of criticality a matrix has been prepared that pictures the classification into the criteria and the values assigned to them.

For each criterion a weight has been arbitrarily defined, reflecting the criterion significance from the plant's point of view. The weight has been described numerically - by values $0 < X_{1–5} \leq 1$.

For each of the properties arranged in the three columns of the matrix numerical values $Y_{1–5}$ – respectively 1, 3, 5 have been assigned.

The number 5 corresponds to the properties of the greatest significance; the number 1 corresponds to the properties of the least significance.

The criticality matrix for the devices is presented below.

DEVICE CRITICALITY MATRIX

	Criterion	**Weight**	**Scoring**		
			5	3	1
A	Safety	X1	very dangerous	dangerous	safe
B	Device significance for the plant	X2	fundamental significance	great significance	small significance
C	Device significance for the installation	X3	very important	significant	other
D	Failure probability	X4	high	medium	low
E	Device repair	X5	very complex	of average complexity	simple

The following weights have been adopted for automatic valves:

X1 = 1; X2 = 1; X3 = 1; X4 = ¾; X5 = ½.

2.4 The method for determining the degree of criticality of an automatic valve

The degree of criticality of an automatic valve K is determined according to the following algorithm:

$$K = X_1*Y_1 + X_2*Y_2 + X_3*Y_3 + X_4*Y_4 + X_5*Y_5$$

where:
X_{1-5} – weights assigned respectively to specific criteria 1 – 5
Y_{1-5} – values assigned respectively to each criterion 1 – 5.

If $K \geq A$ then the valve belongs to the group CRITICAL.
If $A > K \geq B$ then the valve belongs to the group IMPORTANT.
If $K < B$ then the valve belongs to the group OTHER.

The following coefficients have been adopted for automatic valves:
A = 14.25
B = 10.75

2.5 The stages of development of the critical devices list

2.5.1 The first stage of the development of the critical devices list is the preparation of a breakdown of devices used in LOTOS Group, which are to be classified.

2.5.2 Then for each device in the breakdown we determine the values of all five criteria defined for determining the degree of criticality of the device.

2.5.3 The criteria evaluation process for each device is conducted by a team consisting of the device user and a specialist from the infrastructure office. A service representative may be added to this team.

2.5.4 The criterion of the device significance from the plant's point of view is approved by the production director or a person appointed by him (criterion – B).

2.5.5 "The control valves list" and the "On-off valves list" are used for entering the values of individual criteria. The lists are shown in appendix 2. Individual criteria can be assigned the numbers 1, 2 or 5 according to the device criticality matrix (point 2.3).

2.5.6 On the basis of the assigned values and the weight coefficients, the degree of criticality is calculated for each device according to the algorithm (point 2.4).

2.5.7 Depending on the calculated value of the degree of criticality (K), individual devices will be qualified for one of the three groups: critical, important or other devices (point 2.4).

Automatic valves qualified for a specific criticality group are subject to the appropriate maintenance strategy which is presented in the "Instructions for dealing with automatic valves" – appendix 3.

2.6 List of appendixes

Appendix A: Description of automatic valve evaluation criteria

1.1 Safety criterion – A

The safety criterion defines the potential impact of the device failure on hazard to life and health, property and the environment.

In order to determine the values for the safety criterion one of the three values assigned to this criterion shall be selected, which best corresponds to the device in question.

Very dangerous **5 points**	Dangerous **3 points**	Safe **1 point**
This category encompasses devices whose failure: 1. causes a serious life or health hazard by: - contact with a caustic, toxic medium - fire as a consequence of the failure - explosion as a consequence of the failure; 2. causes material losses connected with: - the fire of a part of, the whole, or several installations - explosion - damage to other equipment caused by the interruption of the process such as an abrupt rise in temperature or pressure as a result of the failure; 3. may cause environmental pollution going beyond LOTOS Group's area: - serious soil contamination, river and groundwater pollution - atmospheric pollution necessitating the evacuation of employees or local people.	This category encompasses devices whose failure: 1. may indirectly cause a serious life or health hazard by: - outflow of a pressurised medium - outflow of a hot medium (steam, boiler water, other) - a leak of a medium as an indirect cause of other leaks (unsealing) of dangerous liquids, ignition, explosion 2. causes a property damage or destruction hazard 3. may cause local environmental pollution within LOTOS Group's premises: - local soil pollution - local atmospheric pollution	This category encompasses devices whose failure does not cause: 1. life or health hazard 2. a property damage or destruction hazard 3. natural environment contamination, e.g. a leak of safe media: water, steam, nitrogen, biodegraded media.

1.2 The criterion of significance from the plant's point of view – B

The criterion of the device significance from the plant's point of view describes the impact of the device failure considering the following:

a. operating consequences for the plant – stoppage of the plant, a deterioration of the process or quality parameters on installations functioning together with the installation on which the classified device is installed
b. economic consequences – reduction in the profitability of the plant's production
c. commercial consequences – resulting from failure to meet contract conditions.

In order to determine the value for the "device – plant" criterion one of the three values assigned to this criterion shall be selected, the one that best suits the device under consideration. A description of the values of the a/m criterion is shown in the table below.

A device of fundamental significance from the plant's point of view **5 points**	A device of great significance from the plant's point of view **3 points**	A device of small significance from the plant's point of view **1 point**
A device whose failure may cause: - the necessity to shut down the whole plant - a group of basic installations - economic loss irreparable within a year	A device whose failure may cause: - a transient interruption of the process continuity on several basic installations - a necessity to change the process parameters of a group of basic installations	A device whose failure may cause, at worst: - local process problems, without influencing the whole process of the plant - losses that can be undone within a short time horizon.

1.3 The criterion of significance from the point of view of an installation - C

The criterion of the device significance from the point of view of the installation describes the impact of the device failure considering the following:

a. operating consequences for the plant or auxiliary processes – process or quality parameters deterioration on the installation on which the device is installed
b. economic consequences – reduced efficiency of the operation of the installation
c. stoppage of auxiliary processes.

In order to determine the value for the a/m criterion one of the three values assigned to this criterion shall be selected, the one that best suits the device under consideration. A description of the values of the a/m criterion is shown in the table below.

A very important device **5 points**	A significant device **3 points**	Other device **1 point**
A device whose failure results in the stoppage of a part of or the whole installation or a group of installations till the device is repaired. It is assumed that a very important device performs a basic role in the process and that it does not have a process bypass.	A device whose failure results in: - a transient interruption of the process continuity - a change in the course of the process - a change in the process parameters It is assumed that a significant device performs a basic role in the process but that it has a functional process bypass which can perform a similar function or a parallel process system which can take over the operation.	Devices whose temporary stoppage does not cause an interruption of the process continuity and/or change in the process parameters are classified as other devices.

1.4 The criterion of failure probability – D

The criterion of failure probability describes the possibility of occurrence of the device failure considering the average time between successive repairs (the MTBF indicator).

To determine the value of the "failure probability" criterion for the given device we must select the nearest degree of probability corresponding to the occurrence of a failure of the given device, based on statistical data and experience.

A description of the values of the a/m criterion is presented in the table below:

A device with high failure probability **5 points**	A device with medium failure probability **3 points**	A device with low failure probability **1 point**
As such we classify devices for which the probability of service intervention is estimated to be one or more times per quarter (due to the design, place of installation or operating conditions).	As such we classify devices for which the probability of service intervention is estimated to be one or more times per year but not more frequently than once per quarter (due to the design, place of installation or operating conditions).	As such we classify devices for which the probability of service intervention is estimated to be not more frequent than once per year (due to its design, place of installation or operating conditions).

1.5 The repair criterion – E

The device repair criterion describes repair actions undertaken after a failure considering:
a. the degree of complexity of the repair: the required time of the repair, possibility of doing the repair by the plant's own means, necessity to make agreements with the manufacturer
b. the cost of the device
c. availability of spare parts.

In order to determine the value for the "device repair" criterion one of the three values assigned to this criterion shall be selected the one that best suits the device under consideration.

A description of the values of the a/m criterion is shown in the table below.

A very complex repair **5 points**	A medium complex repair **3 points**	A simple repair **1 point**
1. The time of the repair can exceed 1 shift. 2. The repair requires the participation of / consultation with the device manufacturer or the authorised service from outside LOTOS Group. 3. The cost of the device exceeds PLN 50,000. 4. Replacement parts are available from suppliers to special order (service etc). Delivery takes more than 14 days.	1. The time of the repair is not longer than 1 shift. 2. The repair requires analyses, decisions, consultations with technical departments (diagnostics, process etc). 3. The cost of the device is within PLN 20 – 50 thousand. 4. Replacement parts are available from suppliers to order. Delivery within 14 days.	1. The time of the repair is not longer than 4 hours. 2. The repair is done by workshop workers (foreman's team) without the need for extensive consultation with technical departments (diagnostics, process etc). 3. The cost of the device does not exceed PLN 20,000. 4. Replacement parts are available from many suppliers "from the shelf". Delivery within 48 hours.

Note:

A unit repair task is assumed with the maximum required service crew for the device under consideration.