

**TENDER SPECIFICATIONS "Rehabilitation of Stejaru HPP. Rehabilitation of the Pressure knot"****VOLUME 3 TECHNICAL REQUIREMENTS****PART 3 TENDER SPECIFICATIONS****Section 3.2. TENDER SPECIFICATIONS. BASIC WORKS. PRESSURE KNOT****Chapter 3.2.A Butterfly valve chamber. Electrical-mechanical equipment.****3.2.A.1. Butterfly valve installation****TABLE OF CONTENTS**

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1. OBJECT OF THE TENDER SPECIFICATIONS

1.1. These Specifications refer to the delivery, assembly and commissioning of the **technical unit "Butterfly valve installation"**, fully equipped, including the hydraulic drive installations and the electrical control and automation installations for the equipment of the pressure knot of Stejaru hydro power plant.

1.2. The Specifications include, without limitation to:

- the conditions for the design, manufacture, packaging, transport, assembly and commissioning of the Technical Unit;
- the quality conditions that the supply must meet;
- the controls, tests and trials to be performed for the acceptance of the Technical Unit;
- the standards, norms and technical prescriptions that the Contractor must comply with

1.3. It is specified that the Tender Specifications only specify the essential requirements for the supply. The Contractor is responsible for establishing the constructive solutions, for choosing the materials and for carrying out the resistance calculations according to the operating conditions of each component of the technical unit. It is also the responsibility of the Contractor to establish the methods and volume of checks, tests and trials of the equipment according to the technical prescriptions, standards, norms and Romanian and international norms in force so that, after installation and commissioning of the objective, they constitute a complete assembly, in perfect working order.

1.4. In order to fully and correctly meet all the requirements related to the equipment that is the subject of these Specifications, the Contractor shall consult and comply with the provisions of :

PART 1 GENERAL INFORMATION ON STEJARU HYDROPOWER PLANT

PART 2 GENERAL TECHNICAL CONDITIONS

PART 3 TENDER SPECIFICATIONS.

If there are inconsistencies, the data presented in these Tender Specifications shall prevail. For the electrical part of the supply, the provisions contained in the specialized tender specifications shall be observed.

2. VOLUME AND LIMITS OF SUPPLY

2.2. Composition of the technical unit

2.2.1. The 2 (two) Technical Units "**Butterfly valve installation**", included in the Contract for the rehabilitation of the pressure knot related to Stejaru HPP, have the following composition:

Butterfly valve installation	U10 (left line)	U11 (right line)
- working butterfly valve DN4200 (downstream)	1 pc.	1 pc.
- DN4200 safety butterfly valve (upstream)	1 pc.	1 pc.
- DN4200 connection section, provided with emptying system	1 pc.	1 pc.
- mounting compensator (located upstream)	1 pc.	1 pc.
- hydraulic drive system (pressure oil unit, actuators, hydraulic drive circuit consisting of pipes and fittings, etc.)	1 assembly.	1 assembly.
- ladders and metal access platforms	1 assembly.	1 assembly.
- AMCs (measuring and control equipment) necessary for controlled actuation and protection of butterfly valves	1 assembly.	1 assembly.
- Embedded parts	1 assembly.	1 assembly.
- by-pass installation (for regulating the filling and insulation flow), made of stainless steel pipe, fittings (isolation valves and control valves, flanges, fasteners, etc.)	1 assembly.	
- AMCs for penstock filling maneuvers with controlled flow through the by-pass installation	1 assembly.	
- Dewatering system	1 assembly.	
- AMCs for the dewatering system (float level transducers, oil sensor in water, downstream water outlet control valve, etc.)	1 assembly.	
- Penstock ventilation system	1 assembly.	
- mandatory spare parts, according to Chap.12	1 set	
- SDVs (including device for hydraulic pressure test, mounting/dismounting devices, adjustment, etc.)	1 set	

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- oil and lubricants, the entire quantity required for both butterfly valve installations	1 set
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The composition of the Technical Unit "**Butterfly valve installation**", presented above, is the minimum necessary to carry out the rehabilitation works of Stejaru HPP. Based on its own experience, the Tenderer may propose to the Beneficiary the completion of the supply with other elements it deems necessary so that it meets the safety and performance conditions required in the Tender Specifications and at the same time, so there are no points of discontinuity between the butterfly valve installation and the other equipment at the pressure knot and in the plant to which it is functionally or constructively connected.

2.1.2. The Technical Units "**Butterfly valve installation**", defined above, are completed and complete the Technical Units defined in the Tender Specifications "3.2.A.3 - Electrical installations for the supply and distribution of alternating current and automation":

2.2. Limits of the supply

2.2.1. The Contractor must analyze the component of the technical unit in correlation with the other existing equipment in the pressure knot and power plant, to which it is functionally and/or constructively connected, to make the necessary additions and to inform the Beneficiary about the occurrence of any discrepancies or discontinuities between them. The exact composition of the technical unit shall be defined when contracting, but not less than it is presented in *point 2.1*.

2.2.2. The Contractor shall deliver to the Beneficiary a technical unit in perfect working order, equipped with all the accessories necessary for automatic operation, with remote control and supervision, executed according to state of the art technologies and able to meet the safety and performance conditions required in these Tender Specifications.

2.2.3. The "Butterfly valve installation" technical unit is limited **upstream**, at the entrance to the butterfly valve chamber, to the wall upstream of the connection flanges with the branches of the symmetrical distributor, located downstream of the surge chamber and **downstream** of the wall downstream of the connection with the M1 anchorages belonging to the penstock.

The Contractor shall ensure all mechanical, hydraulic and electrical connections of the butterfly valve installation with the adduction and with the penstock, with the ventilation installation of the penstock, with the protection installations of the penstock, with the electrical control and automation installation of the butterfly valves and with the electrical control and automation installation of the plant, so that the functional unit of the assembly is achieved.

2.3.4. The Contractor has the obligation to make its own measurements on site in order to know, the level elevations and the real length between the connection limits of the supply with the headrace and with the ends of the penstock sections, so that there are no discontinuity points between the supply and the rest of the hydraulic circuit.

2.3 Activities of the Contractor

2.3.1. The Contractor is responsible for all the categories of works specified in Volume 3 of the documentation for the rehabilitation of the pressure knot related to Stejaru HPP, namely: Part 2 – "General technical conditions", of which we mention:

- design;
- Manufacturing
- testing in factory (FAT);
- transport on site;
- dismantling the existing butterfly valve installation (left wire, respectively right wire), including the related installations;
- decommissioning of the leaked oil collection installation;
- all construction works for:
 - refurbishment/modification, as appropriate, of the foundations related to the Technical Unit "Butterfly valve installation", namely: butterfly valves, HPU, dewatering pumps;
 - waterproofing of the H channel related to the dewatering installation;
- mounting the components of the new butterfly valve installation;
- connection of the existing compressed air installation to the new HPUs;
- dry and water tests, commissioning.

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2.3.2. The Contractor is also responsible for drawing up the technical documentation according to the provisions of Part 2 – "General technical conditions", with the specification that for the butterfly valve installation the technical documentation shall also include the following:

- diagrams and functional diagrams for the drive installation;
- the list and characteristics of the measuring and control devices provided for the integration of the butterfly valve installation in SCADA, including the diagrams of their location;
- the specification of the oil and other necessary lubricants, indicating the quantity and quality for each assortment.

2.3.3. The contractor has the obligation to make its own measurements on site to establish the actual condition, dimensions and exact positioning of the gaps and embedded parts. The Contractor shall provide in its supply correspondence with the gaps, the existing embedded parts and the existing construction.

3. THE CURRENT SITUATION

3.1. Constructive-functional description

3.1.1. Butterfly valve installation

The butterfly valve chamber from the pressure knot consists of four DN 4200 butterfly valves.

The valve has a vertical axis and is made of housing and lens. The housing is welded and consists of two parts with horizontal division plane. The sealing in the division plane, between the two parts, is carried out by a special rubber gasket. The 2 (two) actuating actuators of each butterfly valve are fixed to the upper housing by a special system.

The lens is made of cast steel and consists of three parts which are assembled by studs. It is connected with the 2 (two) vertical spindles of the valve by means of screws and pins.

The lens is driven by the 2 (two) actuators of the valve, actuators that work in opposition. The transmission of movement from the servo motors to the lens is carried out by means of a roller lever mounted on the upper spindle. The steering of the spindles is ensured by 2 (two) bearings with bronze bushings.

For each butterfly valve installation (composed of safety valve and working valve), **the hydraulic drive system** consists of 4 (four) servomotors, in which pistons with sealing segments are mounted. The actuator cylinders are assembled on two half-housings, which in turn are assembled and fixed to the upper housing of the butterfly valve. The valve is closed or opened by means of the lever which is fixed to the lens spindle.

Note:

The downstream butterfly valve related to the left wire was dismantled, in its place there is a DN4200 pipe section.

b. The mounting compensator is the connecting piece between the butterfly valve and the upstream section of the headrace. Between the two valves on a wire there is a pipe section with flanges that facilitates their installation and disassembly.

On each wire, downstream of the working valve, there is a ventilation/de-airing valve integrated in the ventilation system of the penstock (see the specifications 3.2).

The thickness of the steel sheet of the pipe upstream of the butterfly valve is 15 mm.

c. The by-pass installation serves the butterfly valves from the pressure knot and has the role of allowing the filling of the penstock, balancing the pressures between the upstream area and the downstream area of the valves and emptying the supply after the exhaustion of the emptying possibilities by turbine. It will also allow the evacuation downstream of the butterfly valve chamber of the infiltrated flows in the main headrace during the periods when it is necessary to empty the headrace for inspections, interventions and maintenance operations.

DN500 by-pass installation includes:

- a manually operated safety valve, mounted on the upstream circuit, with an insulating role
- two service valves with hydraulic drive, mounted downstream of the working butterfly valve, on each penstock
- a manually operated exhaust valve, mounted on the downstream circuit, with an isolation role.

d. The pressure oil unit (HPU) ensures the amount of pressure oil required for the safe operation of the valves.

The butterfly valve chamber at the Pressure knot consists of two Pressure Oil Units.

Each of the two valves installed on a line is served by a HPU, consisting of :

- **right line HPU (existing):**

- oil tank:

- total volume:

14 m³

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- normal oil volume: 11 m³
- Air-oil accumulator:
 - total volume: 10 m³
 - normal oil volume: 2 m³
 - rated pressure: 20 bar
- electric pumps:
 - number of electric pumps: 2 pcs.
 - flow rate: 4.0 l/s
 - rated pressure: 20 bar
 - engine power: 12 kW
- **left line HPU (rehabilitated):**
 - oil tank:
 - total volume: 2.2 m³
 - Air-oil accumulator:
 - number of air-oil accumulators: 2 pcs.
 - total volume: 4 m³
 - normal oil volume: 0.7 m³
 - normal air volume: 3.3 m³
 - rated pressure: 63 bar
 - test pressure: 90 bar
 - number of electric pumps: 2 pcs.
 - pump type: with gears
 - flow rate: 100 l/min
 - rated pressure: 63 bar
 - rated power of electric motor: 15 kW
 - supply voltage: 400 Vac, 50 Hz
 - rated power of the oil heating system: 1.4 kW

3.1.2. Oil collection installation

The oil leaks from the valve actuators on a wire are collected and transported to an intermediate oil collection tank, specific to each wire. It is provided with a float and an electric pump. When the oil level in the tank rises, the float starts the pump which takes over the oil and sends it to the oil tank of the corresponding HPU.

If the pump does not work or the float is blocked, the oil drains from the tank through an overflow pipe into a joint tank at a lower level. From here the oil is taken over by two electric pumps (one working and one spare) and pumped into the oil tank of the HPU butterfly valves installed on the left line. The pumps are controlled automatically by a float.

3.1.3. Dewatering system

The collection of water losses is carried out in an "H" -shaped basin under the butterfly valves, perpendicular to the axis of the penstock, with a depth of 1.80 m from the elevation of 449.29 mASL. Water evacuation is carried out gravitationally, downstream through a pipe with Ø150 mm, in the existing gutter, between the penstock, from M1 to M2.

3.1.4. Compressed air installation (existing)

In order to achieve and monitor the air pressure in the accumulators of the pressure oil group related to the right wire, a ECN 70 water-cooled electric compressor is installed in the butterfly valve chamber; PN 30 bar; Q = 70 m³/h having P = 20 kW / 380 V. During the rehabilitation works, a high pressure compressor with a nominal pressure of 63 bar and a flow rate of 1100 l/min, rated power 18.5 kW, voltage 380 Vac, 50 Hz, 1540 rpm was installed in the butterfly valve chamber. The manufacturer of the 63 bar electric compressor is JAB, SC1101/80 product code.

3.1.5. Penstock ventilation system

The installation consists of:

- ventilation circuit Ø1000 - 2 branches;
- Ø1000- 2 assembly ventilation valves, provided with heating system; mounted on the penstock, downstream of the working butterfly valves.

The two ventilation circuits (right wire and left wire) are connected to an embedded (common) evacuation route downstream of the butterfly valve chamber.

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The installation was carried out (dismantled, revised, refurbished, mounted and protected against corrosion).

To be executed for the Penstock Ventilation Installation:

- left line: mounting of protective shield of suction cups heating resistors.
- right line: assembly of transducers and integration in automation
mounting of covers to heating resistors and integration of resistors in automation.

4. LOCATION AND FUNCTIONAL ROLE

The butterfly valves are mounted at the pressure knot, on the turbine headrace circuit in the plant.

The role of the butterfly valves is to close the water intake in the turbines both in normal situations and in cases of damage such as: blocking the wicket gate open, load discharges or breaking the pipe section between the working butterfly valve and the wicket gate. The downstream valve acts as a working body and the upstream one acts as a revision body, being operated in case of failure of the working valve or for its revisions.

5. TECHNICAL CHARACTERISTICS REQUIRED

5.1. Butterfly valves

- Valve type: bi-plane lens, vertical axis
- Installation site: Stejaru HPP butterfly valve chamber
- Number of butterfly valves: 4 pcs.
- Rated diameter: 4,200 mm
- Maximum static pressure: approx. 61 mwc
- Maximum dynamic pressure: 80 mwc
- Rated flow:
 - Left line: 94 m³/s
 - right line: 94 m³/s
- Maximum failure flow: approx. 287m³/s (The Contractor shall draw up its own calculation regarding the emergency flow rate)
- Elevation of the penstock shaft at the connection point with the valve installation supply: 452.50 mASL
- Type of drive: hydraulic, pressurized oil
- Actuation time:
 - closing: 20 ÷ 40 sec.
 - opening: 36 ÷ 40 sec.

5.2. By-pass installation

The by-pass installation shall ensure:

- insulation of the installation from the headrace
- balancing the pressures on both sides of each butterfly valve in the installation (both working and safety);
- controlled filling of penstocks;
- drainage of infiltrations.

The number of valves shall be chosen by the Contractor in order to meet the functional requirements of the butterfly valve installation.

Valve	Number	Location	Role
- safety valve	1	- upstream	- insulation from headrace
- service valve	4 *	- near each penstock, downstream of the working butterfly valve	- adjustment, controls the filling flow of the penstock
- drain valve	1	- downstream	- insulation in order to fill the penstock; - Infiltration evacuation.

- Type of valves
 - isolation valves: flap
 - control valves: plunger/cone/lemon type

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*Rehabilitation of the Pressure knot.*

- Mounting type in the installation	with flanges
- Rated diameter:	500 mm**
- Rated pressure:	1.0 MPa
- Elevation of the by-pass pipe shaft	447.99 mASL
- Type of valve actuation	
- isolation valves:	manual and electromechanical
- control valves:	manual and electromechanical/hydraulic
- Valve material:	
- Body:	steel
- splinter (threaded rod) and shutter organsteel	stainless steel
- Opening/closing time	maximum 1 minute

The service valves will be remotely operated.

Note:

* The number of control valves shall be chosen by the Contractor's Designer in the Basic Design (BD) phase.

** The diameter of the control valves for filling the DN4200 connection section of the butterfly valve installation shall be chosen by the Contractor's Designer in the Basic Design (BD) phase.

5.3. Electrical power supply system

The electrical power supplies of the elements of the Technical Unit are in accordance with Tender Specifications 3.2.A 3. The installed powers of the newly provided pumps and compressors motors will not exceed the existing values

6. OPERATING CONDITIONS**6.1. Environmental conditions**

The specific environmental, climatic and seismic conditions in which the butterfly valves operate are presented in detail in Volume 3, Part 1 - "General information on Stejaru hydropower plant" within this paper. The pressure supply system is presented in Volume 3, Part 1 - "General information on Stejaru hydropower plant". The ambient temperature in the butterfly valve chamber is -25/+30 °C.

6.2. Butterfly valves

6.2.1. The position of the butterfly valves in normal operation shall be "open".

6.2.2. The working butterfly valve and the safety butterfly valve shall be kept in the "open" position with oil pressure created by the related HPU.

6.2.3. The work butterfly valve shall be closed:

- normally in balanced water
- in special situations in the current.

6.2.4. The safety butterfly valve shall be closed:

- normally in balanced water
- in case of refusal to close the working valve ##\$_09\$##under current

6.2.5. After revisions or repairs, when the downstream circuit is drained, the balancing of the pressures will be done by handling the valves within the by-pass installation.

6.2.6. The emergency closing of the spare butterfly valve will be ensured when the voltage disappears at the control elements of the drive system.

6.2.7. Periodically, the electric pumps of the pressure oil unit will be automatically switched from working in standby mode so that the number of operating hours is approximately equal.

6.2.8. For the handling of the equipment and related installations during the installation, the refurbished 25 tf – 9 m overhead crane or the temporary lifting installations of the Contractor's works may be used. Information on the gauges of the component parts (butterfly valve) and their masses can be found in the original drawing RS-12-11 (Butterfly valve Ø4200).

6.2.9. Control of their butterfly valves (see related Tender Specification 3.2.A.3)

a. The closing command of the working valve will be:

- manually: locally or remotely (from the local automation cabinet of the left/right railway, from the power plant, from the control room).
- automatic, in the following situations:
 - to the butterfly valve's own defects
 - minimum pressure in the driving system

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- o upon the disappearance of direct current
 - o butterfly valve closing time exceeded (at manual control)
 - Butterfly valve chamber enclosure flooding.
 - breaking of the penstock (dangerous speed), noticed by the protection system
 - for damages in the power plant:
 - a massive flooding M2
 - a flooding of the spherical valve enclosure
 - o packaging of hydro units operating on left/right railway
 - o flooding of plant dewatering (draft tube level)
 - b. The closing command of the safety butterfly valve shall be:
 - manually: locally or remotely (from the local automation cabinet of the left/right railway, from the power plant, from the control room).
 - automatic, in the following situations:
 - to the butterfly valve's own defects
 - o minimum pressure in the driving system
 - o upon the disappearance of direct current
 - o butterfly valve closing time exceeded
 - work butterfly valve failure
 - Butterfly valve chamber enclosure flooding.
 - breaking of the penstock (dangerous speed), noticed by the protection system
 - c. The opening command of both valves will be automatic and manual, local and remote.
- The opening command is conditioned by:
- the "closed" position of the butterfly valve;
 - pumping group able to operate
 - water pressure, upstream and downstream of it, equalized.

6.3. By-pass installation

6.3.1. The position of the valves in normal operation will be "closed".

6.3.2. The control of these valves will be local (electric and manual) and remote.

6.3.3. The upstream (safety) and downstream (exhaust) valves will operate between the fully closed or fully open positions.

6.3.4. The adjustment valves will be provided with the possibility of adjusting and controlling the filling flow of the penstock downstream of the butterfly valves.

6.3.5. The control for opening and closing the control valves on the by-pass circuits of the working butterfly valves will be manual, local.

Note:

The conditions regarding the operation of the electrical equipment related to the technical unit are presented in TS 3.2.A 3.

7. DESIGN CONDITIONS

In addition to the conditions set out in Volume 3, Part 2 "General technical conditions", the design of the technical unit object of these specifications will also take into account the following specific conditions:

7.1. General conditions

7.1.1. The design of the new DN 4200 butterfly valves and of the related installations shall be made in strict accordance with the existing landmarks with which they will be in constructive and functional connection so that the spherical valve assembly constitutes a complete assembly, in perfect working condition.

7.1.2. When designing the valves and their accessories, the installation quotas imposed by the existing concrete construction shall be considered.

7.1.3. The supply will be designed from subassemblies:

- gabarit adapted for access to the mounting site through the gaps provided in the existing construction.
- so that the heaviest landmark does not exceed the load of the existing overhead crane in the butterfly valve chamber from the pressure knot.

7.1.4. In accordance with Chap. 3.1 "Classification of designs" in Part 2 "General technical conditions", the Contractor shall draw up and deliver the following technical documentation:

- Basic design;

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- Detail design;
- The final As-built documentation.

It is specified that within the action of replacing the DN4200 butterfly valves, no changes of the existing condition on the part of constructions involving new works of any kind are allowed, which may diminish or lead to a decrease in the performance of the equipment, their behavior in operation, the safety or quality of the works provided in the initial project.

Upon contracting, the volume of calculations to be presented in the calculation summaries within the technical documentation shall be agreed. The Designer **of the Butterfly Valve Installation** shall draw up and submit calculation summaries in which he shall submit the following calculations:

- calculation of torque:
 - when opening in balanced mode
 - at closing, in normal water current ($Q=94 \text{ m}^3/\text{s}$);
 - at emergency closing (breakage of the penstock);
- the torque at closing and opening shall be defined in all cases from total opening to total closing and separately: in dynamic mode and friction moment (the result shall be summarized in tables and curved graphs shall be drawn up);
- calculation of the connection between the spindle and the drive/servomotor mechanism;
- calculation of bearings, in all load cases;
- FEA analysis for the butterfly valve (valve body, lens, spindles, etc.), in all loading cases;
- dynamic flow analysis (CFD) and load loss analysis at the installed flow ($94 \text{ m}^3/\text{s}$);
- checking the water hammer at the closing sequence at the installed flow ($94 \text{ m}^3/\text{s}$) and at the fault flow.

6.2. Calculation conditions

7.2.1. The sizing of the butterfly valve installation shall be made taking into account the most unfavorable conditions that may occur in operation, using the specific safety coefficients currently applied for such equipment. When establishing the coefficients, the dynamic stresses that may occur in the operation of the valve (shocks due to the water hammer, oscillations of the water level in the surge chamber, vibrations, etc.) shall also be taken into account. These coefficients shall be explicitly presented in the calculation method summary sheet of the installation.

7.2.2. The valve body and the shutter shall be checked to withstand the hydraulic forces that appear in the "open", "closed" position and in any intermediate position.

7.2.3. When designing the supply, the most unfavorable stresses that may occur during its manufacture, transport, assembly and operation will be taken into account.

These values are given from the initial basic design of the development and not from the technical book of the equipment.

7.2. 4. The hydraulic drive system will be designed to ensure:

- oil flows and pressures at the values required by the valve driving system;
- the presence of oil, with the required pressure, on the piston of the valve actuators during the entire period of remaining in its "open" position
- carrying out the safe closing of the valve disc, without shocks, pulls or vibrations, both in the case of normal closing and in the case of emergency closing.

The emergency shutdown will be calculated at the maximum possible flow and pressure.

7.2.5. When the oil pressure drops in the drive and control system of the working butterfly valve, the FVC fault signal is issued to the power plant.

7.2.6. The technical characteristics of the accumulators of the pressure oil units shall be established so that the "oil reserve" in the accumulator, at minimum pressure, ensures the emergency closing of the working and spare butterfly valves, without starting the electric pump.

7.2.7. The selection of the characteristics of the GUP electric pumps will be made so that a single electric pump from the unit, to ensure the necessary oil flow for the long-term maintenance of both valves on a wire, in an "open" position, the second electric pump being for backup.

7.2. 8. The diameters of the pipes, the connecting parts between the pipes and the hydraulic components, as well as the routes of the circuits will be established so that the pressure losses are minimal.

7.2. 9. The shape and dimensions of the by-pass circuit will be determined so as to avoid cavitation and vibrations during its operation (if another solution is chosen for equalizing the upstream-downstream pressure of butterfly valves and for evacuating the infiltrations from the headrace).

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7.2.10. The Contractor shall take into account that a compressed air installation is provided within the Butterfly Valve Chamber equipped with a compressor with a nominal pressure of 63 bar and a flow rate of 1100 l/min. The HPU's of the Technical Unit shall operate at a nominal pressure of maximum 63 bar. If the Contractor chooses another working pressure, it shall also replace the existing compressed air installation with one adapted to the new needs.

7.3. Constructive conditions

7.3.1. The installation will be designed for the unit operation without permanent personnel, with remote management and supervision.

Therefore, valve position tracking devices, measuring and control equipment and devices (direction valves, valves, manometers, flow indicators etc.) will be designed to allow local and remote monitoring and control of the entire installation, so that it is able to meet all the automatic operating modes and the safety conditions specified in these Specifications.

7.3.2. All the forces acting on the valves will be transmitted to the concrete foundations through the embedded parts and will not be higher than those from the initial project.

7.3.3. For the periods when maintenance works are carried out, a mechanical locking system of the butterfly valve lens shall be provided in both the "closed" and "open" positions, dimensioned to withstand the stress produced by an accidental opening/closing command of the butterfly valve. Optical signaling of this position on the control panel will be provided.

7.3.4. Provision will be made for the emergency automatic shutdown when the oil pressure drops in the control system.

7.3.5. The actuation system will be provided with at least the following protections: at overload, at overpressure, at the increase of the oil level in the tank above the allowed level, at the wrong maneuvers of the valves, when exceeding the closing time, etc.

7.3.6. The sections of the oil and water pipes will be dimensioned so as to ensure the correct operation of the valve actuation and control installations. The route of the pipes, the location of the purges, vents and drains will be established in such a way as to allow the correct circulation, with minimum fluid losses as well as the total emptying of the circuits.

7.3.7. Butterfly valves and related installations shall be designed so that in operation, the average noise LAeq expressed in dB measured at 1 m distance for the butterfly valve enclosure shall be a maximum of 60 dB.

7.3.8. Operation of the valve in normal regime must not lead to dangerous vibrations.

7.3.9. The parts of the technical unit "Butterfly valve installation" will be designed so that they do not require special manufacturing technologies, they can be easily maintained by the personnel with the appropriate training, without exceptional qualification. The entire butterfly valve installation will be made in such a way as to ensure the revision and repair activity with a minimum of dismantling / mounting operations and with a minimum of technical personnel. The constructive design of the equipment will allow the easy replacement of the parts with fast wear.

7.3.10. The subassemblies related to the supply will be designed to allow the assembly and dismantling operations to be carried out in the shortest possible time and without affecting the neighboring equipment or the construction part. The constructive design of the spherical valve will allow easy replacement of fast-wearing parts.

7.3.11. The bearings of the butterfly valves shall be provided with self-lubricating bushings (DEVA type).

7.3.12. The inlets of the measuring and control devices of the DN 4200 butterfly valve installation shall be located in easily accessible places. The dimensions of the dials of the measuring and control devices and their orientation shall be such that it is possible for the operating personnel to easily read their indications.

7.3.13. The sealing between the lens and the valve housing will be designed and executed so that, in operation, the leakage flow in the "closed" position of the valve will be in accordance with ISO 5208, class E.

7.3.14. The valve body will be made of subassemblies / half-housings with division planes, in welded or cast construction, and the access to the assembly site and the load of the overhead crane in the butterfly valve chamber will be taken into account.

7.3.15. The DN4200 connection section shall be provided with a drainage system. The water drained following the emptying of the connection section shall be directed to the gutter existing between the 2 (two) penstocks.

7.3.16. All butterfly valves subassemblies shall be designed to be operated with the overhead crane of the plant or other independent local installations, included in the supply. The solutions adopted for gripping the

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parts in the hook of the lifting installations will not produce their deformations and will not present risk of accidents.

7.3.17. For personnel access to the subassemblies/parts of the installation that require supervision and maintenance during operation, the supply shall include platforms, railings, stairs, etc.

7.3.18. The degree of protection for motors shall be IP54 and for measuring and control devices shall be IP66.

8. CONDITIONS OF EXECUTION

In addition to the provisions of Volume 3, Part 2 - "General technical conditions", the execution of this technical unit will comply with the following specific conditions:

8.1. All the component parts of the spherical valve installation will be executed in accordance with the execution drawings that will be approved by the Beneficiary, strictly observing the geometry, quotas, tolerances, quality of the surfaces, technical conditions, internal and international norms and standards in force.

8.2. The components of the Technical Unit shall be made in such a way as to ensure a high reliability in operation of the assembly.

8.3. All parts shall be made in such a way that, during operation, their permanent deformations, the loosening of the joints or the increase of the clearances do not occur, regardless of the stresses that may occur.

8.4. The homologous parts of the valve installation, including the spare parts, must be interchangeable without additional adjustments or machining.

8.5. Steel with high yield strength and high tensile strength shall be used for the execution of the main parts. The safety coefficient against the yield strength will be at least 3 for the valve housing and at least 2 for the connecting parts.

8.6. The metal surfaces of the butterfly valve installation on which the seals of the moving bodies are based shall be plated with stainless steel.

8.7. Water losses at the main seal, in the "closed" position of the DN 4200 butterfly valve, will be in accordance with ISO 5208, class E.

8.8. The pipes, fittings and fasteners in the water and air circuits related to the butterfly valve installation shall be made of stainless steel. The pipe joints will preferably be flanged.

8.9. The oil circuits in the valve actuator system (pipes, fittings, assembly elements, etc.) will be made of stainless steel.

8.10. The part of the valve installation made of corrosive materials will be protected against corrosion. The recipe for the application of protection will be chosen so as to withstand for at least 5 years, under the working conditions specified in these Tender Specifications.

8.11. On the occasion of the rehabilitation of the by-pass installation, the apparent part of the DN500 pipe shall also be replaced with a pipe made of stainless steel. The connection between the embedded pipe and the new stainless-steel pipe shall be made by local breakages in the concrete inlet/outlet areas, deep enough to allow the connection of the new stainless steel pipe to the existing (embedded) steel pipe.

8.12. The whole supply will have an aesthetically pleasing presentation. The pipe routes will be arranged so as to ensure the unity of the design. The finishing of visible exterior surfaces will be ensured accordingly.

9. ASSEMBLY CONDITIONS

The provisions of the "General technical conditions" plus the following specific requirements shall be observed:

9.1. The mounting of the DN4200 butterfly valve installation shall be done by the Contractor (or by a subcontractor thereof, approved by the Beneficiary) based on the mounting design approved by the Beneficiary.

9.2. The mounting will be carried out after evaluating the condition of the concrete foundation and the existing reinforcement and their possible repair/correction. The embedded parts used until the moment of rehabilitation for fixing the valve supports, actuators and water and oil circuits will be reused only if, after carrying out the checks, it is found that they provide the necessary guarantee.

9.3. The information from the drawings included in this documentation, the drawings of the gaps and embedded parts that were the basis for the execution of the construction part (made available by the Beneficiary) and the measurements that the Contractor has the task to carry out on site, will be used.

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9.4. Checks and tests on the installation of the butterfly valves shall be carried out on the site, in order to detect and correct any errors.

9.5. All stages of assembly will be accepted by committees made up of representatives of the Contractor (or its subcontractor who carried out the installation) and those of the Beneficiary. It will not be allowed to proceed to the next stage of mounting until the correctness of the previous stage is confirmed.

9.6. Any change of design endorsed and approved by the Beneficiary or change of the written documents agreed upon along the way is prohibited without the approval of the Beneficiary.

9.7. The mounting of the technical unit will be done in compliance with the assembly and commissioning instructions executed by the Contractor and approved by the Beneficiary.

9.8. During and at the end of assembly, at least the following tests and verifications will be performed:

- checking of the correct fixation on the foundations or supports of the equipment and pipes;
- control of the flatness of the sealing surfaces;
- checking the mounting clearances and alignments according to the passport prepared by the Contractor;
- checking the correct functioning of all safety devices within the technical unit;
- checking the connection of the butterfly valve with the penstock and with the connection pipe of the supply;
- pressure test of the driving system;
- oil circuit sealing test;
- the sealing test of the shutter in the "closed" position, for each valve;
- the kinematic test of each butterfly valve;
- checking the quality of the anti-corrosion protection for components made of corrodible materials;

Desirable: The butterfly valves on each wire (left and right respectively) shall be delivered and mounted within the same time frame/ on the same headrace stop.

10. GUARANTEES

In addition to the guarantees specified in Volume 3, Part 2 "General technical conditions", for the installation of the butterfly valves, the Contractor shall also guarantee the following:

10.1. Correct operation of the butterfly valves under the conditions defined in Chap. 5.

10.2. Operating parameters of the drive system: flows, pressures, temperatures, degree of oil filtration.

10.3. The closing and opening times of the butterfly valves, specified in the Tender.

10.4. Water leaks at the "spindles", in operation and stationary, will be zero.

10.5. Water losses at the main seal, in the "closed" position of the DN 4200 butterfly valve, will be in accordance with ISO 5208, class E.

10.6. Lack of oil leaks outside the plant at the end of the guarantee period.

10.7. Vibration limits and sound level in operation.

11. ACCEPTANCE CONDITIONS

The provisions of Volume 3, Part 2 "General technical conditions" regarding the acceptance stages shall be observed. In addition, the following specific conditions shall be taken into account:

11.1. Factory checks and tests

11.1.1. The specification for the factory control of the butterfly valve installation will be agreed between the Contractor and the Beneficiary at the conclusion of the Contract and will specify: the decisive phases, the parts to be controlled, the controlled area, the type of control, the quality class, etc.

11.1.2. The following checks, tests and trials shall be performed in the presence of the Beneficiary's authorized representative:

- defecting device control with penetrating liquids, X-rays or ultrasounds, as the case may be, of all welds and castings in compliance with the conditions of CCH 70-3
- control of shapes, dimensions and tolerances, carried out after each specified phase
- tests of the mechanical characteristics of the materials
- corrosion protection control.

11.1.3. The valve and all its annexes will be assembled by testing in the factory in order to verify the correctness of their execution.

11.1.4. The following tests must be performed in the presence of the Beneficiary's authorized representative:

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- hydraulic pressure test of the valve and of the parts of the installation that will operate with water or oil under pressure
- the kinematic test of the butterfly valve together with the actuating actuators;
- functional tests of the entire supply
- the FAT test is performed at each of the butterfly valves; at the FAT, the level of losses by sealing is also checked.

11.1.5. Prior to the dispatch from the factory of the equipment nominated in the specification regarding the control in the factory, the Contractor will send to the Beneficiary, for approval, a report with the checks and tests to which they have been subjected and the results obtained (regardless of whether or not the Beneficiary has witnessed the performance of the respective checks and tests).

11.1.6. The Contractor shall request from the subcontractors the mechanical and chemical characteristics of the materials used, the list of tests and trials performed and shall make available to the Beneficiary all the necessary data for checking the conformity of its supply with the requirements of the Specifications.

11.2. Reception at the end of the works

For the reception at the end of the works related to the installation of the butterfly valve, all the necessary tests and checks will be made to confirm the fulfillment of the requirements of the specifications, including:

- checking the important elevations and the correctness of the installation of the valve installation according to the installation documentation approved by the Beneficiary;
- hydraulic pressure test of the hydraulic drive system circuits;
- testing the operation of the butterfly valves without water, with the verification of the mounting clearances;
- the kinematic test of the butterfly valve with servo motor.

11.3. Commissioning acceptance

For the acceptance of the commissioning of the valve installation, all the necessary tests and verifications will be made to confirm that the requirements of the specifications have been complied with, among which:

- test of the water operation of the butterfly valves:
 - the values of the oil and water pressure shall be checked and recorded,
 - closing and opening time of the butterfly valves,
 - water losses downstream of the valves immediately after their closure.
- the valve closing test at the maximum flow rate installed in the plant (on each penstock)
- the automatic operation of the working butterfly valves and the integration of their operation in the automatic operating program of the units in the plant
- correct, local and remote signaling of the valve position, of the water pressure on the main circuit, of the oil pressure in the drive system and of the oil level in the tank
- recording of the elapsed time between two pump cycles to restore pressure in the GUP and the pumping time
- sealing tests, on land and in load with the by-pass installation.
- checking the quality of the anti-corrosion protection for components made of corrodible materials.

On this occasion it shall be verified that:

- throughout the opening and closing stroke, the valve shutter and actuators move smoothly, without stiffness, shocks and without abnormal noises or vibrations
- closing – opening times and water leaks due to leaks are within the guaranteed values
- the working valve closes automatically when simulating a difference between the flow measured by the transducers of the protection installation when the pipe breaks
- there are oil leaks in the installation.

The acceptance of the commissioning of the installation will be admitted if the results of the abovementioned checks confirm the correct execution of the works.

11.4. Final acceptance

The final acceptance for the Technical Units that were the object of the rehabilitation contract is organized by the Beneficiary at the end of the guarantee period, according to the legal provisions.

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**12. PENALTIES AND CONDITIONS FOR REJECTION**

The provisions of Volume 3, Part 2 "General technical conditions" shall be observed.

13. LIST OF MANDATORY SPARE PARTS

For the entire technical unit "**BUTTERFLY VALVE INSTALLATION**" at least the following mandatory spare parts will be delivered:

No.	Spare part name	Quantity
1.	Electric pump pressure oil unit	1 pc.
2.	Butterfly valve actuator sealing system	1 set (to equip a valve)
3.	Butterfly valve lens spindle sealing system	1 set (to equip a valve)



OBJECTIVE: Stejaru HPP

OBJECT: Pressure knot

DATA SHEET FT no. 3.2.A.1
BUTTERFLY VALVE INSTALLATION

No.	Technical requirements imposed by the Tender Specifications	Compliance of the technical proposal with the technical specifications required by the Tender Specifications	Manufacturer
0	1	2	3
1.	Technical and functional parameters:		
	1.1 Butterfly valves - Butterfly valve type: with biplane lens - Mounting position: vertical shaft - Number of butterfly valves: 4 pcs. - Nominal diameter: 4,200 mm - Maximum static pressure: approx. 61 mwc - Maximum dynamic pressure: 80 mwc - Rate discharge - left line 94 m³/s - right line 94 m³/s - Maximum failure flow: approx. 287 m³/s <i>(The Contractor shall draw up its own calculation regarding the emergency flow)</i> - Penstock shaft elevation at the connection point with the butterfly valve installation supply: 452.50 masl - Drive type: hydraulic, with oil under pressure - Drive time: - closing 20 ÷ 40 sec. - opening 36 ÷ 40 sec. 1.2 Mounting compensator - Nominal diameter: 4,200 mm - Maximum static pressure: approx. 61 mwc - Maximum dynamic pressure: 80 mwc - Maximum axial compensation: ... mm 1.3 Connecting section - Nominal diameter: 4,200 mm - Maximum static pressure: approx. 61 mwc - Maximum dynamic pressure: 80 mwc 1.4 Driving servomotors - Number of actuators related to a butterfly valve: ... pcs. - Hydraulic cylinder diameter: ... mm - Rod diameter: ... mm - Working stroke: ... mm - Working pressure: ... mm - Rated pressure: ... mm 1.5 Hydraulic driving system, composed of: 1.5.1 Pressure oil unit (HPU) - Number of HPUs: 2 pcs. - Number of electric pumps for one HPU: 2 pcs. (work + reserve) - Oil tank volume: ... m³ - Air-oil accumulator volume: ... m³		

TS Butterfly valves chamber.	Update series:	Volume	Part	Section	Chapter	Page
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	- Working pressure: max. 63 bar - Type of drive oil: ... - Oil purity class: ... - HPU provided with: - optical level indicator: Yes - level transducer: Yes - vent filter: Yes - anti-condensation filter: Yes - oil heating system: Yes - oil revitalization system: Yes - hand pump: Yes - circuits for filling/emptying: Yes		
	1.5.2 Hydraulic circuit - Hydraulic piping material acc. to SR EN 10297-2: stainless steel - Reinforcement type: ball - Reinforcement material: stainless steel		
2.	Performance specifications and safe operation conditions:		
	- Quality requirements according to ISO 9001 - Environmental management system certification according to ISO 14001		
3.	Conditions regarding compliance with relevant standards:		
	The standards issued and published by ISO, CEI, DIN, ASTM, API, BS will be observed.		
4.	Guarantee and post-guarantee conditions:		
	According to the "GTC" and these Tender Specifications		
5.	Other technical conditions:		
	- water losses by sealing the valve lenses in the "closed" position, measured immediately after closing, shall be in accordance with ISO 5208, class E 5.2. No oil leaks in the hydraulic drive system at the end of the guarantee period.		

Designer,
S.P.E.E.H. HIDROELECTRICA S.A.

Tenderer,
...



OBJECTIVE: Stejaru HPP

OBJECT: Pressure knot

DATA SHEET FT no. 3.2.A.2
by-pass installation;

No.	Technical requirements imposed by the Tender Specifications	Compliance of the technical proposal with the technical specifications required by the Tender Specifications	Manufacturer
0	1	2	3
1.	Technical and functional parameters:		
	- valve type: - isolation valves: flap - control valves: plunger/conical/lemon type - mounting type in the installation: with flanges - number: - safety valve: 1 pc. - service valve: 4 pcs.* - drain valve: 1 pc. - location: - safety valve: upstream - service valve: near each penstock, downstream of the working butterfly valve - drain valve: downstream - functional role: - safety valve: isolation from headrace - service valve: regulating, flow control filling of penstock - drain valve: - insulation in order to fill the penstock; drainage of infiltrations. - nominal diameter: DN500** - rated pressure PN10 - by-pass pipe shaft elevation: 447.99 mdM - Type of valve actuation - isolation valves: manual and electromechanical - control valves: manual and electromechanical/hydraulic - valve material: - body: steel - splinter (threaded rod) and shutter made of stainless steel		
2.	Performance specifications and safe operation conditions:		
	- quality requirements according to ISO 9001 - Environmental management system certification according to ISO 14001		
3.	Conditions regarding compliance with relevant standards:		
	The standards issued and published by ISO, CEI, DIN, ASTM, API, BS will be observed.		
4.	Guarantee and post-guarantee conditions:		

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	According to the "GTC" and these Tender Specifications		
5.	Other technical conditions:		
	Water leaks due to leaks of the by-pass installation: null Opening/closing time maximum 1 minute The service valves will be remotely operated.		

Note:

* The number of control valves shall be chosen by the Contractor's Designer in the Basic Design (BD) phase.

** The diameter of the control valves for filling the DN4200 connection section of the butterfly valve installation shall be chosen by the Contractor's Designer in the Basic Design (BD) phase.

Designer,
S.P.E.E.H. HIDROELECTRICA S.A.

Tenderer,
...

TS Butterfly valves chamber. Electromechanical equipment	Update series:	Volume	Part	Section	Chapter	Page
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