

## DETAIL DESIGN STAGE II

### SPECIFICATION OF ESSENTIAL ORDER CONDITIONS - TECHNICAL PART OF A FILTER PRESS WITH PERIPHERAL EQUIPMENT pos. E1.1101d,e, E1.1102d,e, E1.1111d,e, E1.1130a,b, E1.1140a,b

**PROJ. NO.** 130008  
**DOC. NO.** E2E1\_1101U07101REWA

**INVESTOR:**

SODA POLSKA CIECH S.A.  
88-101 INOWROCŁAW, UL. FABRYCZNA 4

**INVESTMENT:**

INTENSIFICATION OF SODA ASH PRODUCTION BY 200,000 TONS/YEAR AT  
SODA POLSKA CIECH IN INOWROCŁAW

**FACILITY:**

**FACILITY NO. E1.12 UTILIZATION - FILTRATION**

Position	Title and full name	Authorization no.	Date	Signature
Designed by	inż. Rafał Sobieraj	n/a	06.2014	
Main Designer	mgr inż. Paweł Czapla	n/a	06.2014	
Reviser				
Project Manager	mgr inż. Cezary Gąsiorowski	n/a	06.2014	

**Warsaw, June 2014**

**INTENSIFICATION OF SODA ASH PRODUCTION BY 200,000 TONS/YEAR AT SODA POLSKA CIECH IN INOWROCŁAW****E1.1101D,E; E1.1102D,E; E1.1111D,E; E1.1130A,B; E1.1140A,B – THE FILTER PRESS WITH PERIPHERAL EQUIPMENT****PROJECT CONTENT**

Pos.	Name	Document No.
1.	Specification of essential order conditions - technical part Filter press with peripheral equipment, pos. E1.1101d,e, E1.1102d,e, E1.1111d,e, E1.1130a,b, E1.1140a,b	E2E1_1101U07101REW0_ENA
2.	Technical specification Filter press with peripheral equipment, pos. E1.1101d,e, E1.1102d,e, E1.1111d,e, E1.1130a,b, E1.1140a,b	E2E1_1101U07101REW0_ENA
3.	Equipment layout	E2E1_1101U07301REW0
4.	Projection of the level +5.10 m	E2E1_12B05012REW0
5.	Projection of the level +8.40 m	E2E1_12B05013REW0
6.	Guidelines concerning delivery of the final documentation	E1E2_00U07002REW0
7.	Guidelines concerning anticorrosion protection	E1E2_00U07003REWC

**TABLE OF ARRANGEMENTS AMONG DEPARTMENTS**

	DESIGNERS	
DEPARTMENT	NAME	DATE / SIGNATURE
TECHNOLOGICAL	n/a	
APPARATUS AND DEVICES	n/a	
TUBULATION	n/a	
MEASUREMENTS AND AUTOMATICS	Marek Bartkiewicz	
ELECTRICAL	Sławomir Woźniak	
WATER-SUPPLY-AND-SEWAGE	n/a	
HVAC	n/a	
CONSTRUCTIONAL-BUILDING	Joanna Oleńska	
ARCHITECTURAL	n/a	
ANTICORROSION PROTECTION AND PAINTING	Urszula Lipska	

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## 1. INTRODUCTION

This elaboration includes the full filtration system, i.e.: the filter press E1.1101d,e; the sludge pumps supplying the presses E1.1111d,e; the belt conveyor under the press E1.1102d,e; the air compressor e1.1130a,b; and another necessary devices composing the filtration system.

A Supplier of the filtration system should submit their offer for delivery of devices for the complete filtration system.

The devices will be mounted at the facility E1.12 – UTILIZATION- FILTRATION at SODA POLSKA CIECH SA, Inowrocław ul. Fabryczna 4, 88-101 Inowrocław.

Location of the main devices is shown on the drawing E2E1\_1101U07301 enclosed to the request for proposal. Preferably, dimensions of filter presses and conveyors should be adapted to the assumed net of pillars, ceiling joists and holes in the plate of reinforced concrete supporting structure, that is shown on the enclosed drawings. Drawing numbers:

- level +5.10 m: E2E1\_12B05012
- level +8.40 m: E2E1\_12B05013

The document specifies requirements for delivery of complete devices together with motors, plates, clamping screws, anchor bolts, etc.

The Supplier (of devices with equipment required in the inquiry) is required to have an experience as regards design and production of such a type of devices.

The Supplier bears full responsibility for the design, performance, assembly and acceptance tests according to assumptions of PROCHEM S.A.

The delivery includes technical documentation of the devices.

The delivered system must be up to assumptions contained in this document. Violations are acceptable in some detailed solutions.

The proposed violations must be supported by the manufacturer's experience and owned standard solutions; they must conform the wide-conceived good engineer's practice.

The violations made by the Supplier must be approved by PROCHEM S.A.

The document shall be considered together with the technical specification E2E1\_1101U07101REW0\_EN.

## 2. GENERAL TECHNICAL REQUIREMENTS

### 2.1. General requirements

- The offered devices must conform the enclosed assumptions as regards the structural solutions, technological parameters, materials used and welding technology.
- Hermetic pumps - performance according to the supplier standard is acceptable.
- Untight pumps should comply with requirements as for pumps of chemical type, i.e. PN-EN ISO 5199.
- Use materials under PN-EN.
- Tanks specified as a pressure equipment should be designed, carried out and tested according to PN-EN 13445 (calculations acc. to AD2000 are allowed) and they should conform Directive 97/23/EC (PED) of 29 May 1997 and, in particular, the Economy Minister's Order of 21 December 2005 on fundamental requirements for the pressure equipment and the pressure equipment assemblies (Law Gazette of 2005, No. 263 Pos. 220).

- Apparatus ferrule flanges acc. to PN-EN 1092-1 -acc. to detailed guidelines of PROCHEM S.A. This applies to a flange type, requirements for a pad. PROCHEM S.A. requirements for screws, nuts and gaskets will be specified similarly.
- After the contract is concluded, the Supplier shall specify permissible forces and moments acting on ferrules.
- Equipment to be used in the explosion hazard zone must conform ATEX Directive 94/9/EC.
- Use SI Units in the design; this conforms international requirements of IEC and ISO requirements. This applies to all drawings and texts in each documentation. Units for each value must be the same in the drawings and in the enclosed texts (documents).
- The apparatus design must provide continuous operation of all its assemblies while keeping the nominal technological parameters within the weather, operation and maintenance conditions specified in the offer.
- The materials, the individual apparatus structure and the equipment structure must comply with the following criteria:
  - the foreseen corrosion must not exceed this specified in the project
  - permanent deformation, ageing process and fatigue are not allowed within the planned service life and the designed operating conditions.
- The equipment and its components used must be proven in permanent operation and in the same operating conditions.
- Use of pilot and prototype devices and equipment is prohibited.
- The individual devices will be released for production on the basis of the documentation accepted by PROCHEM S.A.
- Each device must have the Declaration of Conformity with Directives and CE marking.
- Each device to be used in the explosion hazard zone must conform ATEX Directive 94/9/EC.

## 2.2. Requirements for Suppliers

These requirements together with relevant documents, data sheets and/or drawings set forth the minimum range of requirements for: design, performance, supervision, assembly of apparatus and acceptance tests.

Divergences as regards the requirements must be explained and agreed in a protocol of differences.

The Tenderer is required to list standards in their offer that will be used for the design, material selection, performance, welding technology and acceptance tests.

## 2.3. Standards and regulations

The equipment must be designed, manufactured, tested and certified according to the latest version of appropriate standards, regulations and lists (in the area concerned).

- Machinery Directive 2006/42/EC
- Directive on machinery for pesticide application 2009/127/EC
- Lifts Directive 95/16/EC
- Gas Appliances Directive 2009/142/EC
- Pressure Equipment Directive (PED) 97/23/EC
- Simple Pressure Vessels Directive 2009/105/EC
- Electromagnetic Compatibility (EMC) Directive 2004/108/EC
- Low Voltage Directive (LVD) 2006/95/EC

- Directive on Equipment and Protective Systems Intended for use in Potentially Explosive Atmospheres (ATEX) 94/9/EC
- Noise emission by outdoor machinery Directive 2000/14/EC
- Non-electrical equipment for use in potentially explosive atmospheres - Part 1: Basic method and requirements of PN-EN 13463-1

No.	Branch	Standard / Directive
1.	Zone classification	PN-EN 60079-10, PN-EN 1127-1
2.	Electrical	PN-EN, PN-IEC, ATEX 94/9/CE, (EMC) IEC 61000-6
3.	Pressure equipment	PED 97/23/EC, 2009/105/EC, EN 13445, AD-Merkblätter
4.	Equipment material	PED 97/23/EC, PN-EN, EN,
5.	Storage tanks, silos	PN-EN, EN
6.	Turbomachines	2009/127/EC, DIN-EN, EN
7.	Piping	PED 97/23/EC, EN 13480/1-5, EN 288,
8.	Piping materials	EN 13480/1-5,
9.	Tooling	PN-EN, PN-IEC, IEC, ATEX 94/9/EC, (EMC) IEC 61000-6, EN 298, EN 161
10.	Noise	2000/14/EC
11.	Pressure safety valves (PSV)	PED 97/23/EC

### 2.3.1. Standards of the ORDERER

It has been agreed with the ORDERER that standards of PROCHEM S.A. would be used within some range of design and production.

### 2.3.2. Standards of the MANUFACTURER

If the Manufacturer's standards are to be used, they must be approved by PROCHEM S.A.

## 2.4. Document priority order

Whenever the documents include conflicting technical requirements, these requirements must be used in the following order:

- European-domestic laws and regulations
- Obligatory criteria and standards of PROCHEM S.A.
- Standards and another regulations

In general, the most exacting regulations must be used.

## 2.5. Documentation

### 2.5.1. Documentation for acceptance

Within two weeks, after signature of the contract at the latest, the Supplier is obliged to transfer so called acceptance documentation, i.e. the assembly drawing allowing to check the design conformity with the annex of the contract.

### 2.5.2. Assumptions for design intended for use of branches of PROCHEM S.A..

Within two weeks after the documentation acceptance by PROCHEM S.A. at the latest, the Supplier is obliged to transfer the final assumptions for branches of PROCHEM S.A. to be used for the executive design needs.

### 2.5.3. Final documentation

The Supplier is obliged to carry out the documentation in Polish language according to detailed



requirements.

- Drawings – Auto Cad 2008,
- Text documents - Microsoft Word 2003.

2.5.4. Registration-acceptance documentation to notify the apparatus to UDT, TDT, do the operating supervision (if the device is subject to acceptance by UDT, TDT). The Investor carries out this documentation in-house.

### 3. DESIGN PRINCIPLES

#### 3.1. Fundamentals

The offered filter presses with peripheral equipment must be up to this request for proposal, the requirements and standards contained in it and the enclosed annexes.

#### 3.2. Climatic data

##### 3.2.1. Basic climatic data

- Maximum air temperature: + 35°C
- Minimum air temperature: – 20°C
- Mean air temperature within a year: +8°C
- Relative air humidity: 50%.

##### 3.2.2. Detailed guidelines

- Adaptation to winter conditions -25°C.

Adaptation to winter conditions is based on temperature -25°C. This temperature shall be considered when specifying requirements for the steam heating protecting against freezing and solidification and protecting buildings in winter conditions. If temperature is 0°C or lower, the frost protection is necessary.

- Design principles for outdoor devices: -29°C +30°C
- Design principles for the electrical equipment and materials: indoor and outdoor min/max temperature: -25 °C/+40 °C
- Snowfall

Standard snow load according to PN EN 1991-1:3:2005 (for the outdoor tanks)

- Wind

Wind load according to PN-77/B-02011, 1st wind zone

Designed wind velocity 20 m/s

Designed wind pressure 250 Pa

**Note:**

**For the outdoor apparatus, the condition concerning the temperature design principles, i.e. - 29°C +30°C, must be met.**

##### 3.2.3. Apparatus location

The devices are located at the utilization and filtration facility E1.12 in a room without any ventilation or heating systems, in the ambient temperature.

### 4. SCOPE OF THE OFFER AND DELIVERY

The scope of delivery specified in this elaboration is as follows:

1. Complete devices with equipment detailed in the technical specification E2E1\_1101U07201REWA:
  - Filter press, pos. E1.1101d,e (2 pcs), up to the technical specification E2E1\_11017201REWA
  - Belt conveyors, pos. E1.1102d,e (2 pcs), up to the technical specification E2E1\_11017201REWA
  - Sludge pumps, pos. E1.1111d,e (2 pcs), up to the technical specification E2E1\_11017201REWA
  - Air compressor, pos. E1.1130a,b (2 pcs), up to the technical specification E2E1\_11017201REWA
  - Compressed air tank, pos. E1.1140a,b (2 pcs), up to the technical specification E2E1\_11017201REWA
2. Assembly of apparatus and devices - optional

**The remaining data are contained in the technical specification for the filter press with peripheral equipment, pos. E1.1101d,e, E1.1102d,e, E1.1111d,e, E1.1130a,b, E1.1140a,b, enclosed to this request for proposal: E2E1\_1101U07201REWA. The layout of the main devices is shown in the enclosed drawing no. E2E1\_1101U07301.**

#### **4.1. Remaining requirements**

1. Delivery of the devices according to the selection sheets provided
2. Service platforms, stairs and ladders (if required - see the assembly drawings from PROCHEM S.A.),
3. Gaskets, counterflanges, screws, nuts, washers for flange connections
4. Supports, anchor bolts, clamping screws and another assembly components.
5. Equipment operation guarantee acc. to the manufacturer's standards and regulations in force.
6. The apparatus must be protected against corrosion according to guidelines provided by PROCHEM S.A.
7. Transportation to the building site
8. The acceptance test (the final hydrostatic test) with acceptance by a notified body for pressure vessel (including also components necessary to carry out the hydraulic test, i.e. stoppers, screws, nuts, gaskets),
9. Insulation holders - made according to standards of PROCHEM S.A.
10. Supervision of the assembly and start-up of the individual devices.
11. Instruction as to operation
12. Each device should have a rating plate acc. to the ORDERER's requirements, acc. to the enclosed sample. If a warning plate is required, it should be provided by the Supplier. The plate material should be resistant to weather conditions (acid resistant steel is recommended)
13. The Tenderer should specify agents to be led to the devices (electrical energy, water) and their demand.

**Note:**

**Do not manufacture any devices until the final solution acceptance is obtained from the Orderer.**

#### **4.2. Tenderer / Supplier responsibility**

- The Supplier is entirely responsible for failure-free operation of devices or nodes designed by them within the whole guarantee period. The basic regulations, the local regulations and their specification may not be quoted in case of failure.
- Comments placed by PROCHEM S.A. on the Supplier's documentation do not release the Supplier from their responsibility for carrying out the project in compliance with the assumptions.
- The Tenderer is responsible for the correct specification of the device at the offer stage. Possible enlargement of the device by the Contractor after conclusion of the contract will not be subject to price negotiations unless it occurs due to the fault of the Orderer.
- After conclusion of the contract, the Supplier shall transfer the confirmation of proposed clamping screws spacing and their diameter to PROCHEM S.A. and, at the same time, they shall specify the maximum value of the force occurring in the screw.
- All delivery components mentioned in clause 4 must be delivered with the devices.
- The delivery components should be protected for transport and also for outdoor storage in the autumn-winter period.

#### **4.3. Guarantees**

The Tenderer is obliged to guarantee that the delivered devices with equipment are free from errors and defects in the area of:

- materials used including their mechanical properties, welding properties, impact resistance, ageing and anticorrosive properties in reference to:
  - design,
  - workmanship and product quality control,
  - welding technology and acceptance procedure,
  - assembly at the destination,
- observance of relevant specifications, regulations and standards,
- the apparatus complies with design and operational requirements, and it meets requirements contained in the request for proposal;
- on the base of the assumptions, the Supplier guarantees the equipment performance, height of lift, compression, correct selection of the equipment types, power and rpm of motors.

#### **4.4. Emissions**

Not applicable

#### **4.5. Noise**

In compliance with the regulation in force.

The Tenderer must specify parameters concerning noise produced during the equipment operation.

### **5. SPARE PARTS**

#### **5.1. Spare parts for commissioning and guarantee period**

The Supplier is required to:

- deliver spare parts, oils, greases and another materials proposed for commissioning and spare parts for the mechanical guarantee period,

#### **5.2. Spare parts for service life:**

The Supplier is required to provide:

- a list of parts subject to periodical replacement within the service life of the mechanical devices.

## 6. BRANCH REQUIREMENTS

### 6.1. General

According to climate conditions at the plant location, the values contained in the technical part of specification of essential order conditions should be used for the design.

All equipment components susceptible to corrosion should be delivered as rust-proofed due to their exposure to weather during transport and operation. Rustproofing should be carried out in compliance with technology specified by PROCHEM S.A. or equivalent one developed by the manufacturer.

Maximum diameter, length and weight limits for the shipment components should be agreed upon between the Supplier and the ORDERER. Where the equipment components are to meet more stringent requirements due to the design parameters and/or operating conditions, the Supplier shall prepare the separate specifications and calculations for the design, material selection, production and testing agreed with PROCHEM S.A.

All electrical devices installed in the explosion hazard areas must have ATEX certificate.

During transport, the device must be protected against:

- deformation,
- mechanical damages, the rust-proof coat damage.

The devices must be stored at the building site at the same conditions as during transport and, in addition, the following is required:

- protection against loss of stability (falling over),
- protection against moisture and precipitation.

The components must be marked properly.

The storage area should be separated and fenced.

The device assembly is required to be carried out on the basis of the assembly guidelines specified in the technical documentation of the pump. The assembly and commissioning require supervision by the Supplier. The equipment running in compliance with its technical documentation.

The facility and its auxiliary equipment should be standardized as much as possible. The technical documentation for the facility must conform as many requirements defined in standards PN-EN or other at least equivalent ones as possible. SI units must be used in the whole design.

Performance and workmanship must be in compliance with the Directive 98/37/EC of the European Parliament and of the Council of 22 June 1998 on the approximation of the laws of the Member States relating to machinery.

### 6.2. Technical requirements

☐ According to climate conditions at the plant location, the values contained in the Design Principles, clause 3.2 of this request for proposal, should be used for the design.

☐ In case of vertical vessels with total height exceeding 12 m, the pressure, the wind load and the deadweight load as well as these loads combination shall be taken into account in the design. In case of vertical vessels with total height 12 m or lower, the combination of the wind load, the pressure and the weight shall be considered only for devices for which height/diameter ratio is 10:1 or higher.

☐ The equipment shall be delivered as a whole including internal components (incl shelves, distributors, collectors, packing, etc. for columns). In case of the equipment delivered in parts and requiring welding at the building site, the Supplier of the devices shall deliver also necessary welding electrodes or wires, the welding technology as well as control plates to evaluate welders' qualifications.

☐ Internal devices for each module shall be delivered together with all auxiliary elements

necessary for assembly such as special gaskets, shims, etc. All elements such as bracket for platforms and ladders, piping or insulation supports should be welded to the apparatus shell at the manufacturer's plant.

- ☐ Maximum diameters and lengths, weight limits concerning transport or the apparatus performance in workshop should be agreed upon between the Contractor and the ORDERER.
- ☐ Protection against increase of apparatus pressure is foreseen on piping (unless otherwise stated in the enquiry sheet).
- ☐ The equipment should be protected during transport and within one year of outdoor storage.
- ☐ Apparatus should be equipped with necessary transport handles allowing to set the apparatus in the designated area of the system.
- ☐ Flange pasking types acc. to Technical Data Sheet for the apparatus.
- ☐ All equipment components susceptible to corrosion should be delivered as rust-proofed due to their exposure to weather during transport and operation. Rustproofing should be carried out in compliance with technology specified by PROCHEM S.A.
- ☐ The device assembly shall be carried out in compliance with the assembly technology developed by the apparatus manufacturer and it must meet requirements of Polish Standards. The device must be easily available in order to control its operation, repair and clean it or replace its subassemblies.
- ☐ Maximum diameter, length and weight limits for the shipment components should be agreed upon between the Supplier and the ORDERER. Where the equipment components are to meet more stringent requirements due to the design parameters and/or operating conditions, the Supplier shall prepare the separate specifications and calculations for the design, material selection, production and testing agreed with PROCHEM S.A.
- ☐ Maximum diameter, length and weight limits for the shipment components should be agreed upon between the Supplier and the ORDERER.
- ☐ The devices with off-gauge dimensions must be divided accordingly into transport units. The Supplier of apparatus shall divide it into transport units. The division must be agreed upon between the Supplier and the ORDERER.

During transport, the elements must be protected against:

- deformation,
- mechanical damages, the rust-proof coat damage.
- moisture and precipitation.

The components must be marked properly.

- ☐ Assembly of the apparatus to be united at the building site must be carried out on the basis of the assembly technology developed.

The assembly arrangement project should contain:

- organization of construction works
- technology of the works
- regulations on industrial safety in force
- adopted welding technology
- ☐ The facility and its auxiliary equipment should be standardized as much as possible.

The technical documentation for the facility must conform requirements defined in standards PN-EN or other or at least equivalent ones. SI units must be used in the whole design.

### 6.3. Requirements for mechanical devices

The mechanical devices must be designed and manufactured in compliance with the requirements

detailed in the request for proposal and the Directive 2006/42/EC of the European Parliament and of the Council of 17 May 2006.

The manufacturer of the device should enclose the EC declaration of conformity in compliance with the attachment II of the Directive 2006/42/EC.

Each device should have CE marking in compliance with the attachment III of the Directive 2006/42/EC.

The fundamental requirements as regards health protection and safety should be in compliance with the attachment I of the Directive 2006/42/EC.

The devices should be designed and manufactured in compliance with requirements of all directives involved in this device group.

Each device should be delivered with its rating plate containing the following data:

- Name of the manufacturer
- Name of the orderer
- Technological device no.
- Device type
- Serial number
- Year of production
- Performance
- Power
- Product quality control mark after acceptance.

Preferably, the rating plate should be made of acid resistant steel.

The plate design should be agreed upon with PROCHEM S.A.

The above data should be engraved. Character height = 3.5mm

The rating plate bracket should be welded to the device structure with continuous fillet weld.

The plate shall be riveted to the bracket.

Carry out CE marking acc. to the directive in force.

Welding must be carried out acc. to the approved welding technology and the welders must have suitable qualifications.

The mechanical devices should be delivered with the final paint coat.

The devices that, due to transport or installation reasons, cannot be delivered as fully assembled must be assembled from the units at the destination. Assembly units to be assembled finally should have as big dimensions as possible. Their documentation must be transferred to the ORDERER.

Motor drives should be properly selected. Controlled change of speed systems may be used depending on economical and process considerations. If use of frequency converters is necessary, the inverters of ACS series from ABB, with PROFIBUS DP communication, are required according to the ORDERER's recommendations.

The statements on all packet elements conformity with relevant Directives (machinery, electrical, etc.) must be provided.

#### **6.4. General requirements for rotating machines**

The pumps must be designed and manufactured in compliance with the requirements detailed in the request for proposal and the Directive 2006/42/EC of the European Parliament and of the Council of 17 May 2006.

The manufacturer of the pumps should enclose the EC declaration of conformity in compliance with the attachment II of the Directive 2006/42/EC.

The pumps should have CE marking in compliance with the attachment III of the Directive 2006/42/EC.

The fundamental requirements as regards health protection and safety should be in compliance with the attachment I of the Directive 2006/42/EC.

The devices should be designed and manufactured in compliance with requirements of all directives involved in this device group or the device.

The machines should be equipped with all elements necessary to meet requirements of regulations on safety and protection against accidents.

Normally, the machines should be delivered with motors; the special drives may be an exception. The automatic system of variable speed control should be specified depending on technological and economical conditions.

Permissible noise level at the distance of 1 metre from its source: 80dB(A). The Supplier should specify the noise level for the given rotating machine.

It is necessary to standardize machines, their auxiliary equipment and production procedures.

All pressure vessels connected to pumps and having the product  $P \times V > 0.005 \text{ MPa m}^3$  (P- design pressure, V- vessel capacity) as well as their additional equipment should be designed and manufactured according to the pressure regulations in force - PED Directive and UDT requirements.

## 6.5. Centrifugal pumps

The chemical pumps should meet requirements of PN-EN ISO 5199.

The hermetic pumps - according to the Supplier's standards.

The apparatus flanges - requirements, see clause 2.1

The pump construction solution should be proven and adapted to the required function. All pump dimensions should be in compliance with ISO (the metric system). Pumps and motors should be suitable for continuous outdoor operation and without shielding.

Each pump should be delivered as the pre-assembled unit to be mounted on common foundation plate: the pump, the mechanical seal with the cutting fluid system (if any), the motor with coupling and shield. The clamping screws with nuts and shims should be delivered for each pump.

All single-stage and two-stage pumps operating at temperature lower than 150°C and multi-stage pumps operating at temperature lower than 95°C should be suitable to immediate start from the ambient temperature up to full working temperature. For higher working temperatures, the manufacturer should specify the start-up procedure and provide suitable measuring equipment (temp. measurement) to avoid any damage as a result of fast pump heating, together with the mechanical seal.

The pumps starting automatically (if required) and their motors should be designed for start-up with the full load and with open valves.

The working point of the pump should be between 70% and 110% of the highest efficiency point on the capacity curve.

In case of low flows at high elevation heads, select the single-stage pumps with high rotational speed.

For the single-stage pumps, the ratio of the choked pump pressure to the working pressure should be 1.1-1.3.

For the selected pump, the following condition should be met:  $NPSH_r < NPSH_{av} - 0.5m$ .

The bearings lubricated with oil are preferred (this applies to the hermetic pumps).

The bearing housing should be rigid and not sparking to protect the personnel. The coupling load factor taking into account the working conditions should be equal to 1.4 as minimum.

In case of pressure lubrication used, the pump manufacturer shall provide the oil system consisting of the oil tank, the oil pump, filters, piping as well as the control and measuring apparatus.

Unless otherwise specified, the tests listed below should be carried out at the seller's factory:

- hydrostatic pressure test for the body
- certified performance test with vibration analysis according to the standard PN-EN ISO 5199 for chemical pumps (of power above 30 kW)
- certified test NPSH
- noise level test
- certified disassembly and inspection after tests

For  $NPSH_{av} - NPSH_r < 1$  m, the complete test NPSH carried out in compliance with the relevant standard is required.

For  $1 \text{ m} < NPSH_{av} - NPSH_r < 2$  m NPSH, the test at the design point is required.

For  $NPSH_{av} - NPSH_r > 2$  m, the test NPSH is not required.

The manufacturer should provide certificates for all test carried out and certificates for materials for all pressure elements, shafts, shielding sleeves for shafts and rings wearing due to friction.

The manufacturer should provide the following certificates and reports:

- material certificates (as below)
- certificates for devices with Ex protection in compliance with Atex100a
- heat treatment report
- nondestructive testing report
- report of dynamic balancing of rotors (if any)
- pressure test reports
- functional test reports
- NPSH test report (if any)
- noise testing report (if any)

The guidelines should be also applied to pumps of Canned type.

The material certificates should be prepared according to requirements of PN-EN 10204 type 2.2

During transport, the elements must be protected against:

- deformation,
- mechanical damages, the rust-proof coat damage.
- moisture and precipitation.

The components must be marked properly.

## 6.6. Detailed requirements for rotating machines

### 6.6.1. Climatic data

The climatic data are given in clause 3.2.

### 6.6.2. Protection of apparatus and devices

Protection against increase of device pressure is to be provided on piping.



### 6.6.3. Protection with painting

Carry out the protection with painting according to clause 6.7.

### 6.6.4. Requirements concerning forces on pump ferrules

The permissible forces on the pump ferrules, see clause 2.1.

### 6.6.5. Requirements concerning the documentation packet to be delivered by the Supplier.

The packet should contain the following documents according to standards:

#### DOCUMENTATION REQUIRED FOR PUMPS:

1. Drawings with general layout with main dimensions.
2. Required foundation and clamping screws.
3. Erection drawings.
4. Maximum permissible load on ferrules.
5. The Orderer's pump data sheets filled in by the Supplier.
6. The Orderer's motor data sheets filled in by the Supplier.
7. Typical pump curves with working points marked.
8. Certified drawings with dimensions.
9. Part list.
10. Sectional views with part code numbers marked.
11. Mounting, operation and maintenance instructions.
12. Certified reports for tests required by the specification.
13. Material certificates required by the specification.
14. Certified pump performance curves.

#### THE CERTIFIED DIMENSIONED DRAWINGS OF THE COMPLETE UNIT SHOULD CONTAIN:

- overall dimensions of the pump, the coupling, the drive and the foundation plate;
- the layout, intended use and dimensions of all main and auxiliary ferrules - position and bores for clamping screws;
- weight of the pump, the coupling, the drive, the foundation plate and the total unit weight;
- centre of gravity specified for the pump, the coupling and the drive;
- permissible flange load;
- moment of inertia for all rotating parts;
- dimensions to be used for location of assemblies on the foundation plate;
- tolerance for the foundation plate levelling on the foundation;
- thermal displacement of ferrules for pumps operating at temperatures above 200°C.

#### THE SECTIONAL VIEWS SHOULD CONTAIN:

- each part number shown in the drawing;
- each part name without abbreviations;
- number of parts in each device;
- each part code number;
- material;
- permissible axial clearance of the rotor;
- clearances between new rotors (the wearing rotor ring) and the wearing housing rings (if any) and limiting clearances that require part replacement.

#### IN ADDITION, SECTIONAL VIEWS CONCERNING MULTI-STAGE PUMPS SHOULD CONTAIN:

- clearances between rotors and interstage guides with tolerance for new pumps and for repair;
- guide (diffuser) channel width;
- clearances for new interstage seals and labyrinth seals (if any) and limiting clearances that require part replacement.
- assembly details concerning diffuser assembly in piping and drums (sleeves) (if any);

- assembly details to be used for assembly of the interstage seal and labyrinth seals (if any);
- assembly details to be used for assembly of the pump supports on the base frame;
- overall dimensions and fit for thrust and radial bearings.

INSTALLATION DRAWINGS OF MULTI-STAGE ROTORS SHOULD CONTAIN THE FOLLOWING DATA:

- axial distance with tolerance on the active side of the stopper ring of the bearing;
  - to each impeller;
  - to the centre of each radial bearing including operational width of the slide bearing;
  - to each interstage seal;
  - to the compensating device on the high pressure side;
- vibration pickup locations and measuring points of shaft vibrations;
- fits for co-acting parts;
- all necessary dimensions to check the rotor wear;
- rotor run-out measurement and permissible rotor run-out;
- actual dimensions and all thread types;
- data for assembly of the stopper ring of the bearing and in particular:
  - fit between the stopper ring of the bearing and the shaft, tolerances for the shaft shape and location;
  - torques to tighten up the nuts;
  - nut thread size;
  - surface roughness;
- data for the lightener assembly, in particular its length, inside and outside diameters with tolerances, and permissible run-out;
- dimensions of a new labyrinth seal and dimensions for repair or replacement.
- dimensions of the shaft to be connected with the coupling;
- all data concerning balance for:
  - shaft with permissible residual balance;
  - complete rotor with permissible residual unbalance;
- surfaces and procedures concerning unbalance correction of the shaft and the complete rotor;
- sequence of rotor assembly and supercritical speed of rotation;
- weight of the shaft, the elements shrink fit on the shaft (if any) and the complete rotor;
- shrink fit (if any);
- mutual axial fit (with tolerances) of datum surfaces of the shaft and the housing;
- list of all materials and parts.

INSTALLATION DRAWINGS OF THRUST BEARING SHOULD CONTAIN:

- overall dimensions;
- fit;
- list of connections, their brief description and intended use;
- list of materials and parts.

INSTALLATION DRAWINGS OF RADIAL BEARING SHOULD CONTAIN:

- overall dimensions,
- fit between the shaft and the bearings, and between the supports and the socket in the body,
- list of connections, their brief description and intended use,
- list of materials and parts.

SHAFT PACKING DRAWINGS SHOULD CONTAIN:

- overall dimensions with tolerances;
- assembly dimensions with fit (especially diameters);
- requirements for the shaft and the packing cover;
- list of all connections, their location and intended use;
- list of materials and parts.

**COUPLING INSTALLATION DRAWINGS SHOULD CONTAIN:**

- overall dimensions and, in particular, attachment dimensions with tolerances;
- permissible misalignment;
- diameter tolerances for new hubs and limiting tolerances that require part replacement;
- hubs and shafts fit;
- tapers and interferences for hubs with conical holes;
- shrink fit and heating temperature for hubs in shrink fit connections (if any);
- list of materials and parts.

**DIAGRAM AND LAYOUT OF THE WIRING SYSTEM AND TOOLING SHOULD CONTAIN:**

- position of each instrument and device;
- list of elements;
- all technical data necessary to identify the individual elements;
- list of connections;
- limiting values for vibration amplitude, temperature, pressures that result in shutdown or alarm signals;
- location of all elements in the pump unit.

**DIAGRAM AND LAYOUT OF THE AUXILIARY PIPING SHOULD CONTAIN:**

- size, rating and location of the connection and pipes;
- size, rating and location of the service connections for the Investor's needs;
- list of materials.

**DIAGRAM AND LAYOUT OF THE LUBRICATING OIL SYSTEM SHOULD CONTAIN:**

- position of each element;
- data required to identify all elements of the pressure lubricating system;
- mesh aperture size, filtration ratio and permissible pressure drop for each oil filter;
- capacity of the oil tank or the oil well;
- delivery of the oil pump and discharge pressure;
- oil flow rate in each point;
- list of connections with dimensions, ratings and location of all connections.

**DRAWINGS OF AUXILIARY EQUIPMENT SHOULD CONTAIN IN PARTICULAR:**

- types, values, weight, overall dimensions and connection dimensions for the equipment mentioned below: eg. pumps, filters, pressure vessels, etc.
- sectional views of the mentioned equipment;
- list of materials;
- list of spare parts.

**DATA OBTAINED FROM VIBRATION ANALYSIS SHOULD BE SHOWN AS FOLLOWS:**

- for the single-stage pumps: measurements within three axes at each bearing;
- for big multistage pumps: analysis of radial and torsion vibration in compliance with the standard.

AS-BUILT CLEARANCES should be specified in the final measuring protocol and the actual fit and clearances for the following parts should be included:

- the shaft, the shaft sleeve, the complete rotor, the impeller, the wearing rings, all sleeve bearings;
- break (crack) in the balancing device seal for the multistage pumps.

Material certificates should contain:

- physical and chemical data concerning materials used in all pressure parts, impellers, shafts, shaft sleeves, wearing rings.

Please find enclosed (attachment no. 3) the table of contents of the foreseen final documentation to be provided by the contractor.

**6.7. Materials**

The materials used during production must be suitable for loads occurring during the device operation. The material selection criteria are as follows:

- design temperature
- chemical composition and characteristics of the working medium
- minimum and maximum permissible ambient temperature
- mechanical and technological properties, eg. impact resistance, weldability

Surfaces of apparatus made of acid resistant steel must be clean and free from organic fouling (greases, oils, paints) and metallic impurities - in particular, from iron or carbon steel remainders and discolouration resulting from welding. Surface degreasing, cleaning, etching and passivation are required.

For devices made of austenitic steels, the data certifying resistance to intercrystalline corrosion must be provided.

Sheets of austenitic steels should be ordered as pickled and supersaturated.

Welding additives should be used depending on parts to be welded. The strength values and resistance to corrosion of these materials must not be lower than these values for the basic material.

The materials should be certified in compliance with PN-EN/10204 type 2.2.

## **6.8. Performance and acceptance**

The devices should be delivered with their rating plates made acc. to the Supplier's standard. The plates must be resistant to the working environment.

The serial number should be cast-in or incuse on the equipment body. Sense of rotation should be also marked on the pump body with an arrow cast-in or incuse.

Equipment welding must be carried out acc. to the approved welding technology and the welders must have suitable qualifications.

Range of non-destructive weld testing using X-rays or the ultrasonic method must meet requirements of EN regulations or equivalent. The non-destructive testing of welds should be carried out after the last heat treatment or forming acc. to EN.

Results of the non-destructive testing of welds should be classified acc. to the above standards.

The results of welds testing must be shown in as-built documentation of the equipment.

The tanks that, due to transport or installation reasons, cannot be delivered as fully assembled must be assembled from the units at the destination. Assembly units to be assembled finally should have as big dimensions as possible.

Their documentation must be transferred to PROCHEM S.A.

All assembly units must have transport handles.

The apparatus manufacturer must specify requirements for clamping screws (if not included in the delivery).

The mechanical devices should be delivered with the final paint coat.

All technological ferrules must be available easily through suitably designed communications path (platforms, ladders) - the range must be agreed upon with PROCHEM S.A.

The statements on all packet elements conformity with relevant Directives (machinery, pressure, etc.) must be provided.

## **6.9. Requirements of the branch 'Measurements and Automatics'**

The requirements (if any) are shown in the drawing or in the questionnaire.

## 6.10. Requirements of the 'Electrical' branch

The devices included in the specification will be mounted beyond any explosion hazard zone. If use of frequency converters is necessary, the inverters of ACS series from ABB, with PROFIBUS DP communication, are required according to the ORDERER's recommendations. The inverter shall be taken into account in the delivery.

### **EARTHING:**

The device housing shall be connected to the earthing system. Earth conductors should be connected directly to the device and not to the foundation or screws in the base. To this end, the device shall be factory equipped with the earth terminals as its integral part. Each device shall be equipped with at least two earth terminals located at easily available areas to be used for connection of the earth conductors.

All devices delivered with counterflanges or covers must have jumpers to bridge the connections. To this end, place spring washers under heads of two opposite screws and under two opposite nuts.

## **I DEVICES WITH ELECTRIC MOTORS (NORMAL WORKING CONDITIONS)**

### **MOTORS:**

Use induction squirrel-cage motors adapted to direct start-up, with windings with insulation of temperature class F.

The motors of power up to 160 kW shall be powered from the three-phase AC mains 400 V (3L+PE).

The motors of power above 160 kW shall be powered from the three-phase AC mains 6000 V (3L+PE).

The motors should be carried out with protection level IP55 (IP54 for the filter press).

The junction box shall be made of cast iron, cast steel or steel sheet minimum 3 mm thick, with a terminal inside to connect PE conductor.

Cable glands at the junction boxes should be adapted to the feeder cable diameter. The final rated power of the motor shall be specified by the Supplier. On the basis of this information, the electrical system designer shall select the feeder cable and communicate the cable diameter to the device manufacturer to install the proper glands.

The motors should have an additional terminal (clamp) do be connected with the earthing system.

The motors of rated power 10 kW and higher should be equipped with sensors to control the windings temperature. PTC sensors with leads to the junction box terminals shall be used. A cable of PTC sensors shall be led from the motor box through the separate cable gland.

## **II. I DEVICES WITH ELECTRIC MOTORS POWERED THROUGH INVERTERS (NORMAL WORKING CONDITIONS)**

### **MOTORS:**

Use induction squirrel-cage motors adapted to direct start-up, with windings with insulation of temperature class F.

The motors shall be powered from the three-phase AC mains 400 V (3L+PE) - for drives of power ≤ 160kW or 6 kV - for drives of power > 160 kW.

The motors should be carried out with protection level IP55 (IP54 for the filter press).

The motors shall work with frequency converters (inverters). Consequently, they should be adapted for frequency control of rpm. They must have construction ensuring heat removal or an additional motor with a fan forcing the air circulation. The parameters confirming the motor adaptation for cooperation with a frequency converter should be given in the technical documentation.

According to the ORDERER's recommendations, use of the frequency converters of ACS series from ABB, with PROFIBUS DP communication, is required. The inverter shall be taken into account in the delivery.

The junction box shall be made of cast iron, cast steel or steel sheet minimum 3 mm thick, with a terminal inside to connect PE conductor.

Cable glands at the junction boxes should be adapted to the feeder cable diameter. The final rated power of the motor shall be specified by the Supplier. On the basis of this information, the electrical system designer shall select the feeder cable and communicate the cable diameter to the device manufacturer to install the proper glands.

The motors should have an additional terminal (clamp) do be connected with the earthing system.

The motors should be equipped with sensors to control the windings temperature. PTC sensors with leads to the junction box terminals shall be used. A cable of PTC sensors shall be led from the motor box through the separate cable gland.

#### **6.11. Requirements concerning anticorrosion protection**

The guidelines for anticorrosion protection - acc. to the document no. E1E2\_00U7003REWC.