



Technical Requisition For:
API 681 Pumps & Compressors

Client: NIS AD, Novi Sad, Serbia

Project Number: U211

**Project Name: Replacement Of Rotary Equipment And Installations In Pancevo Oil
Refinery**

Location: Pancevo Oil Refinery

Item Summary

[illegible]

List of Attachments

| DOCUMENT NUMBER | DESCRIPTION TITLE | REVISION |
|--|--|----------|
| 1. TECHNICAL REQUISITION | | 01 |
| 2. DATASHEETS | | |
| 2.1. U211-MR-0040 | DS - Suction Of A Mixture Of Hydrocarbons And Air From The Connected Vapour System | 01 |
| 2.2. U211-MR-0041 | DS - Pump For Regeneration Of The Activated Carbon Bed (Desorption Phase) In Vapor Recovery Unit | 01 |
| 3. SUPPLIER DOCUMENT REQUIREMENTS (SDR) | | |
| 3.1. U211-SDR-0007 | SDR – Mechanical | 00 |
| 3.2. U211-SDR-0008 | SDR – Electrical | 00 |
| 3.3. U211-SDR-0009 | SDR – Instrumentation | 00 |
| 4. SPECIFICATIONS | | |
| 4.1. U211-EL-SP-0008 | ES for Low Voltage Cage Induction Motor | 00 |
| 4.2. U211-IC-SP-0006 | Instrumentation requirements | 00 |
| 4.3. U211-PR-DS-0003 | Site and Utility Data Sheet | 00 |
| 5. MISCELLANEOUS | | |
| 5.1. U211-TR-0010 | Tech. Excl. & Deviations Summary (TEDS) | 00 |
| 5.2. U211-TR-0011 | TEDS (Instructions for Completion) | 00 |

Document Title: Technical Requisition for API 681 Pumps & Compressor

Revision: 01

Issue Date: 08-Aug-2024

WBD Contract No: U211

| | | | | | |
|--------------------------------|------------|-------------|-------------------|----------------|-----------------|
| | | | | | |
| | | | | | |
| | | | | | |
| Revised as per Client comments | 01 | 08-Aug-2024 | MG | MR | GŠ |
| Issued for Review | 00 | 18-Jul-2024 | MG | MR | GŠ |
| Revision descriptions | Rev | Date | Originator | Checker | Approver |

| | | |
|--|--------------|------|
| Document Title: | Document No. | Rev: |
| Technical Requisition for API 681 Pumps & Compressor | U211-TR-0008 | 01 |

VACUUM PUMPS and COMPRESSOR (API 681)

INDEX

| SECTION | PAGE |
|---|------------------------------|
| 1. <u>GENERAL</u> | 6 |
| 2. <u>SCOPE OF SUPPLY</u> | 7 |
| 2.1 BY VENDOR | 7 |
| 2.2 BY OTHERS | 7 |
| 3. <u>VENDOR'S OBLIGATIONS / RESPONSIBILITIES</u> | 8 |
| 4. <u>CODES, SPECIFICATIONS AND STANDARDS</u> | 9 |
| 5. <u>AUTHORITY APPROVALS</u> | 10 |
| 6. <u>ENGINEERING REQUIREMENTS</u> | 11 |
| 6.1 <u>GENERAL</u> | 11 |
| 6.2 <u>REFERENCES</u> | 12 |
| 6.3 <u>PUMP/ COMPRESSOR</u> | 16 |
| 6.4 <u>PUMP SHAFT SEALS & SEALING SYSTEMS</u> | 17 |
| 6.5 <u>EQUIPMENT CONDITION MONITORING</u> | 18 |
| 6.6 <u>PIPING & NOZZLES</u> | 19 |
| 6.7 <u>STATIC EQUIPMENT</u> | 20 |
| 6.8 <u>MATERIALS & MATERIAL INSPECTION</u> | 20 |
| 6.9 <u>ELECTRIC MOTORS</u> | 22 |
| 6.10 <u>INSTRUMENTATION</u> | ERROR! BOOKMARK NOT DEFINED. |
| 6.11 <u>CIVIL</u> | 22 |
| 7. <u>NAMEPLATES & ROTATIONAL ARROWS</u> | 23 |
| 8. <u>SPARE PARTS</u> | 24 |
| 9. <u>SURFACE PREPARATION AND PAINTING</u> | 24 |
| 10. <u>NOISE LEVEL</u> | 24 |
| 11. <u>INSPECTION AND TESTING</u> | 24 |
| 12. <u>WARRANTY PERIOD</u> | 25 |
| 13. <u>VENDOR'S SERVICES</u> | ERROR! BOOKMARK NOT DEFINED. |
| 14. <u>PREPARATION FOR SHIPMENT</u> | 25 |

| | | |
|--|--------------|------|
| Document Title: | Document No. | Rev: |
| Technical Requisition for API 681 Pumps & Compressor | U211-TR-0008 | 01 |

1. GENERAL

- 1.1 This **Technical Requisition** is issued to cover minimum requirements for material purchase, design, manufacturing, inspection, testing, shipment and documentation of compressor / vacuum pump units including drivers and auxiliaries.
- 1.2 The equipment shall be in strict accordance with this Technical Requisition and all other documents, codes and standards referred to in the Technical Requisition and its attachments (as listed in the Technical Requisition index). Any **exception to the Technical Requisition** documents and referred codes and standards shall be clearly advised to Client (in writing).
- 1.3 **Order of precedence** to be used in realization of this job is as follows:
 - 1st. Rules and regulations of Serbia,
 - 2nd. Technical Requisition for Vacuum Pumps / Compressors (this document) and all documents named in "List of Attachments" within this document.
 - 3rd. Serbian or International technical standards.
 - 4th. Vendor's specifications, documents and information.

Any conflict generated within this document and documents named in List of Attachments shall be referred to Client in writing for clarification and resolution.
- 1.4 Compliance with the Technical Requisition does not relieve Vendor from responsibility to deliver **equipment** of proper design, suitable for specified conditions. Any conflict between the Technical Requisition requirements and Vendor's opinion shall be clearly advised to Client (in writing).

Additionally Vendor is responsible for:

- All co-ordination with sub-suppliers and collection of all details, drawings, data and all calculations to achieve optimum design and for submission of all documents requested.
- Engineering, performance and guarantee of the complete scope of supply of purchased materials.

In principal all contacts with sub-suppliers shall be via the Vendor.

| | | |
|---|---------------------|-------------|
| Document Title: | Document No. | Rev: |
| Technical Requisition for API 681 Pumps & Compressor | U211-TR-0008 | 01 |

1.5 Following **terms** are used in this text:

Vendor: company selected for equipment delivery
 Sub-supplier: company which provide particular equipment (e.g. pump, compressor E-motor...) to Vendor
 WBD: project Contractor (Client's agent for design services)
 Client/Purchaser: company assigning the project and operating the plant (NIS Petroleum Industry of Serbia)

2. SCOPE OF SUPPLY

2.1 BY VENDOR

- Design, manufacturing and supply of equipment and material including relevant documents, inspections, testing etc. shall be, as a minimum, in accordance with this Technical Requisition and Pump/Compressor Data sheets included in the Technical Requisition.
- Services:**
 Vendor's representative site supervision during equipment installation – minimum SAT/COMMISSIONING and assistance during start-up (assistance during the process of putting Compressors/Vacuum pumps into operation)
 - During shutdown approximately 4 consecutive weeks (6 days per week; 12 hours per day), is required (if longer/lesser duration needed for supervision services, payments will be per daily rate all in accordance with the Agreement).
 - During regular plant operation (outside shutdown period) approximately 4 consecutive weeks (5 days per week; 8 hours per day).
- Consumables:**
 Vendor will provide all lubricants for pre-commissioning, commissioning and start-up including one year of operation after successful start-up
- Spare parts:**
 Spare parts for pre-commissioning, commissioning and start-up shall be included in the supply.
- Special tools:**
 Special tools required for installation/maintenance (if applicable), shall be included in the supply.

2.2 BY OTHERS

Excluded from Vendor's scope is:

- Concrete foundation and grouting material.
- Off-skid Process piping (including on/off valves, instruments,...).
- Wiring (cables) to electrical consumers and to instruments out off compressor / pump skid
- Cable glands.

| | | |
|---|---------------------|-------------|
| Document Title: | Document No. | Rev: |
| Technical Requisition for API 681 Pumps & Compressor | U211-TR-0008 | 01 |

- Local control station for E-motor (start/stop buttons).
- Equipment installation to the foundation and grouting (however it has to be done under Vendor supervision).
- First fill fluids (to be defined by Vendor, but supplied by others)

3. VENDOR'S OBLIGATIONS / RESPONSIBILITIES

- 3.1 Vendor shall assume full and overall responsibility for the complete scope of supply.
- 3.2 Vendor shall be solely responsible for providing complete and operable API 681 pumps/ compressors in full accordance with applicable industry codes and standards, Serbian regulations, and Purchaser's technical requirements.
- 3.3 Vendor's proposal shall be based on equipment that complies strictly with the requirements of tender documentation, and in conjunction with the technical requirements and listed attached documents.. Any proposed exceptions shall be recorded within the TEDS" document and accompanied by a description of the proposed substitution.
- 3.4 Proven, reliable, energy-efficient equipment is required.
- 3.5 Vendor may offer alternative designs that improve energy efficiency without reducing equipment reliability.
- 3.6 Proposed design features having less than two years' operating experience shall be specifically listed and details of construction shall be provided for Purchaser's review and written acceptance.
- 3.7 Vendor is fully responsible for the complete design, performance, implementation of quality assurance procedures and inspection of materials and components, manufacturing, testing and certification of the complete unit in full compliance with the requirements of this Technical Requisition and applicable Codes, Standards and Regulations.
- 3.8 Vendor shall obtain and co-ordinate all sub-supplier equipment activities as required to provide fully functional unit in accordance with the documents and requirements referenced herein (all requirements as listed in this Technical Requisition and its referenced documents shall be also imposed on his sub-suppliers).
- 3.9 In principle all contacts and correspondence between Purchaser and sub-suppliers will take place via the Vendor, if any.
- 3.10 Vendor shall ensure compliance with Serbian code and authority regulations . This includes delivery of all documents required to satisfy the code, the regulations and

| | | |
|---|---------------------|-------------|
| Document Title: | Document No. | Rev: |
| Technical Requisition for API 681 Pumps & Compressor | U211-TR-0008 | 01 |

authorities. Status of authority approval shall be forwarded to Purchaser on a monthly basis..

- 3.11 Bidder shall indicate any deviation from tender documentation requirements and Technical Requisition as integral part within it's bidd. Requirements specified in the Technical Requisition shall be considered as minimum.
- 3.12 It is Vendor's responsibility to design, manufacture and deliver equipment in line with requirements of this Technical Requisition. Applicable exceptions, if any, to be listed in TEDS form attached.
- 3.13 For any technical concession request after order, Vendor is obliged to send to Client vendor concession request for approval. Technical concession request must include all cost and schedule impacts, material availability or delivery issues, if any. Insufficient information may result in rejection. The Vendor Concession Request requires Purchaser's verdict and signature prior to start of the related activities. Any cost consequences related to approved concession request will be at Vendor's cost.
- 3.14 Any increased cost due to changes in the design or fabrication to meet the requirements of this Technical Requisition which are not caused by Purchaser and define through approved technical concession request by Purchaser are at Vendor's cost. If changes are caused by Purchaser cost will be at Purchaser. It will be regulated through change request.
- 3.15 Vendor shall perform all NDE examinations and testing using properly qualified personnel or subcontractors In order to fulfill requirements from Serbian legislation.
- 3.16 Vendor is responsible for all coordination with sub-suppliers and collection of all details, drawings, data and all calculations to achieve optimum design and on time submission of all documents requested in the Technical Requisition.
- 3.17 Purchaser's review of Vendor's documents does not relieve the Vendor of his responsibilities to deliver equipment, documents and services conforming to this Technical Requisition.
- 3.18 Any inspection performed by Purchaser in no way relieves Vendor of his responsibility for equipment to meet the requirements of the Technical Requisition and Serbian legislation.
- 3.19 Vendor is obliged to submit all documents defined in SDR (for all disciplines) within MDB package for Client approval. Documents must be approved by Client prior shipment of equipment.
- 3.20 Final documentation (MDB) shall be submitted by Vendor in 1 (one) hard copy and 1 (one) electronic copy in English language (with exception of IOM manual with should be included in MDB in both: Serbian and English version, as defined in SDR). Electronic copy have to be "searchable" in the most extent (excluding scanned material certificates and similar documents). Binding and printing requirements will be provided by Client.

4. **CODES, SPECIFICATIONS AND STANDARDS**

- 4.1 Unless otherwise specified, the latest edition of the specifications, codes and standards as specified in this Technical Requisition and/or its attachments shall be adhered to for the design and material requirements. As such, these documents form part of the

| | | |
|--|--------------|------|
| Document Title: | Document No. | Rev: |
| Technical Requisition for API 681 Pumps & Compressor | U211-TR-0008 | 01 |

Technical Requisition. It shall be Vendor's responsibility to acquire all required codes and standards.

- 4.2 The following listing shall not be considered as complete in case a reference is made in the below mentioned codes, specifications and standards to other relevant codes, specifications and standards these shall also be considered as applicable.

- Project specifications as per Technical Requisition List of Attachments.
- Serbian, international codes and standards referred to in Technical Requisition; latest edition unless specified otherwise.

4.3 Order of Precedence

The order of precedence shall be the latest revision of the following:

1. Serbian regulations, standards and codes.
2. Technical Requisition including all documents listed in Attachments
3. International codes and standards

Any conflict generated within the Technical Requisition not solved by the order of precedence shall be referred to Purchaser in writing for clarification and resolution.

5. AUTHORITY APPROVALS

- 5.1 Serbian **authority approvals** (certificates) shall be arranged and delivered by Vendor. This includes submittal of all required documents, assessment of design, arrangement of inspection and tests and obtaining certificates of conformance.

Serbian authority regulations that have to be adhered:

a) For pressure equipment:

- "PRAVILNIK O OPREMI POD PRITISKOM" (Sl. glasnik RS, br. 114/2021) - Serbian Rulebook for pressure equipment

b) For non-pressure equipment Vendor is obliged to address to the Ministry of Economy in Republic of Serbia for approval of foreign conformity documents

c) For electrical equipment placed in hazardous area:

- "PRAVILNIK O OPREMI I ZAŠTITNIM SISTEMIMA NAMENJENIM ZA UPOTREBU U POTENCIALNO EKSPLOZIVNIM ATMOSFERAMA" (Sl. glasnik RS, br. 10/2017 i 21/2020) - Serbian rulebook on equipment and protective systems intended for use in potentially explosive atmospheres

d) For machinery:

- "PRAVILNIK O BEZBEDNOSTI MAŠINA" (Sl.Glasnik RS. br. 58/2016 i 21/2020) - Serbian rulebook on machinery safety

In accordance Serbian legislation and standards shall nameplate also bear Serbian mark of conformity "3A".

5.2 "CE" MARKING

Equipment, materials and components which are "CE" certified, shall bear "CE" marking (if applicable) and shall be compliant to applicable EC or EU Directives, such as, but not limited to:

Vendor shall supply all authority documents required by EU legislative:

| | | |
|--|--------------|------|
| Document Title: | Document No. | Rev: |
| Technical Requisition for API 681 Pumps & Compressor | U211-TR-0008 | 01 |

- Declaration of Conformity is required for complete equipment and also for particular equipment parts (components). Mandatory codes and specifications shall be specified in the declaration.
- Certificates of Conformity issued by Notified Body according to EU directives (if applicable).

Each piece of equipment (including instruments) shall be clearly identified by a nameplate, permanently attached to the equipment.

Vendor shall supply all authority documents required by EU legislative:

EC Declaration of Conformity in accordance with all relevant EU directives (especially e.g. for electrical equipment: LVD 2006/95/EC (73/23/EEC), EMC 2004/108/EC (89/336/EEC), ATEX 94/9/EEC etc.).

EC Declaration of Conformity is required also for particular equipment parts (components).

All equipment, material and components included in the delivery shall be “CE” certified and shall have “CE” marking (if applicable).

EC Certificate of Conformity issued by Notified Body, according to EU directives (e.g. ATEX 94/9/EEC, etc.).

All “CE” certified equipment shall be recertified in Serbia for approval of foreign conformity documents.

- 5.3 Vendor shall include all authority documentation, approval documentation, certification, etc, in the manufacturing data books.

6. ENGINEERING REQUIREMENTS

6.1 GENERAL

- 6.1.1 Requirements for pumps / compressors are based on API Standard 681, latest edition.
- 6.1.2 Requirements of this specification are supplementary to API 681, forming a single set of specification requirements for pumps / compressors.
- 6.1.3 Requirements in the API standard which are not ammended by or mentioned in this specification remain applicable.
- 6.1.4 Technical Requisition including all documents listed in Attachment shall be applied for this project.
- 6.1.5 “SI” units shall be used (except of “bar” required for pressure).
- 6.1.6 Equipment shall be designed for **four (4) years of uninterrupted service** (scheduled plant overhaul interval is 4 years) under conditions specified herein.
- 6.1.7 Unless otherwise stated in Data Sheets, outdoor, **unsheltered installation** is considered. Vendor shall design proper winterization measures (e.g. scope of electrical tracing and insulation – supplementary material will supplied and installed by Client). See “Site & Utility Data-Sheet” U211-PR-DS-0003 for climatic conditions and design conditions.

| | | |
|---|---------------------|-------------|
| Document Title: | Document No. | Rev: |
| Technical Requisition for API 681 Pumps & Compressor | U211-TR-0008 | 01 |

- 6.1.8 Equipment shall be **delivered pre-assembled** to the maximum possible level. All components (include auxiliaries or seal flush plan), after assembly, must be within the boundaries of the baseplate. Oversized junction boxes may overhang the perimeter of the baseplate.
- 6.1.9 Vendor may offer **alternative design** if thus obtaining improvement over the specified equipment at the same or better cost with better operation or maintenance conditions and without decrease in quality. Alternatives require Client's approval.
- 6.1.10 Vendor shall review equipment design with regard to discover and eliminate any **safety hazards** and to assure comfortable operability and maintainability (good equipment **ergonomics**).
- 6.1.11 Vendor shall within offer submit information regarding location of maintenance facilities applicable for the Client Site (closest to the Site). During equipment guarantee period Vendor's maintenance representative shall response on Client's request till 48 hours after the request (equipment failure announcement) and solve the failure till 10 calendar days after the request (equipment failure announcement).
- 6.1.12 **Experience**
All equipment and its elements shall be of a proven design / size and shall be well within Vendor's actual experience.
- 6.1.13 **Laws and Regulations / Authority Requirements**
Serbian laws, standards and regulations must be followed. Serbian standards are harmonized with EU standards. If EU certification is done Serbian recertification is required.
Vendor is responsible to obtain all required certificates and approvals.
- 6.1.14 Vendor can use his standard equipment manufacturers (his standard Vendor List), if not specified otherwise within this Technical Requisition.

6.2 REFERENCES

| | |
|----------------------|--|
| Directive 2014/34/EU | Equipment and Protective Systems Intended for Use in Potentially Explosive Atmospheres (ATEX) – mandatory from 20-Apr-2016 |
| Directive 2014/68/EC | Pressure Equipment Directive |
| Directive 2006/95/EC | Low Voltage Electrical Equipment Directive |
| Directive 2014/30/EC | Electromagnetic compatibility (EMC) |
| Directive 2006/42/EC | Machinery Directive |
| API 681 | Liquid Ring Vacuum Pumps and Compressors for Petroleum, Chemical, and Gas Industry Services |
| IEC 60079 | Electrical Apparatus for Explosive Gas Atmospheres |

| Document Title: | Document No. | Rev: |
|--|--------------|------|
| Technical Requisition for API 681 Pumps & Compressor | U211-TR-0008 | 01 |

| | |
|------------------|--|
| IEC 60529 | Degrees of Protection Provided by Enclosures (IP Code) |
| IEC 60034 | Rotating electrical machines |
| | Rotating electrical machines - Part 2: Methods for determining losses and efficiency of rotating electrical machines |
| IEC 60034-2 | IEEE Recommended Practice and Requirements for Harmonic Control in Electric Power Systems |
| | Adjustable speed electrical power drive systems |
| IEEE Std 519 | Amendment 1 - Adjustable speed electrical power drive systems |
| IEC61800 1-5 | - Part 5-1: Safety requirements - Electrical, thermal and energy |
| | Adjustable speed electrical power drive systems |
| IEC61800-5 1 | Adjustable speed electrical power drive systems - Part 5-1: |
| 1:2007/AMD1:2016 | Safety requirements - Electrical, thermal and energy |
| IEC 60146 | Semiconductor converters - General requirements and line commutated converters |
| IEC 61508 | Functional safety of electrical/electronic/programmable electronic safety-related systems |
| IEC 61511 | Functional safety – Safety instrumented systems for the process industry sector |
| EN 62337 | Commissioning of Electrical, Instrumentation and Control Systems in the Process Industry – Specific Phases and Milestones |
| EN 62381 | Automation Systems in the Process Industry – Factory Acceptance Test (FAT), Site Acceptance Test (SAT) and Site Integration Test (SIT) |
| EN 62382 | Control Systems in the Process Industry – Electrical and Instrumentation Loop Check |
| EN 13445 | Unfired pressure vessels |
| EN 13480 | Metallic industrial piping |

| Document Title: | Document No. | Rev: |
|---|---------------------|-----------|
| Technical Requisition for API 681 Pumps & Compressor | U211-TR-0008 | 01 |

| | |
|--------------|--|
| IEC 60502 | Power cables with extruded insulation and their accessories for rated voltages from 1 kV |
| IEC 60445 | Basic and safety principles for man-machine interface, marking and identification – Identification of equipment terminals, conductor terminations and conductors |
| IEC 61439 | Low-voltage Switchgear and Control Gear Assemblies |
| IEC 60085 | Electrical insulation – Thermal evaluation and designation |
| IEC 60027-1 | Letter symbols to be used in electrotechnology |
| IEC 60204-1 | Electrical equipment of industrial machines |
| IEC 60617-DB | Graphical symbols for diagrams |
| IEC 61082 | Preparation of documents used in electrotechnology |
| IEC 61346 | Industrial systems, installations and equipment and industrial products - Structuring principles and reference designations |
| IEC 60073 | Basic and Safety Principles for Man-Machine Interface, Marking and Identification - Coding Principles for Indicators and Actuators |
| IEC 60079-14 | Explosive atmospheres Gas & Dust - Part 14: Electrical installations design, selection and erection |
| IEC 60204 | Safety of machinery – Electrical equipment of machines |
| IEC 60227 | Polyvinyl Chloride Insulated Cables of Rated Voltages up to and Including 450/750 V |
| IEC 60287 | Electrical Cables – Calculation of the Current Rating |
| IEC 60332 | Tests on electric and optical fibre cables under fire conditions |
| IEC 60364 | Electrical Installations of Buildings |
| IEC 60668 | Dimensions of Panel Areas and Cutouts for Panel and Rack-mounted Industrial Process Measurement and Control Instruments |
| IEC 62305 | Protection of Structures against Lightning |
| IEC 60072 | Dimensions and Output Series for Rotating Electrical Machines |
| IEC 60331 | Tests for Electric Cables under Fire Conditions – Circuit Integrity |
| ISA S5.1 | Instrumentation Symbols and Identification |
| ISA S5.2 | Binary Logic Diagrams for Process Operations |
| ISA S5.3 | Graphic Symbols for Distributed/Shared Display |

| | | |
|---|---------------------|-------------|
| Document Title: | Document No. | Rev: |
| Technical Requisition for API 681 Pumps & Compressor | U211-TR-0008 | 01 |

| | |
|-------------------|---|
| | Instrumentation, Logic and Computer Systems |
| ISA S5.5 | Graphic Symbols for Process Displays |
| EN 10204:2004 | Metallic products - Types of inspection documents |
| EN 13463 –1: 2009 | Non-electrical equipment for potentially explosive atmosphere |
| EN 13463 – 5:2011 | Non-electrical equip. for potent. ex atm. Protection by constr. Safety |
| IEC 61000 | Electromagn. Compatib. for Industrial Process Meas. and Control |
| IEC 61131 | Programmable Controllers |
| IEC 61784 | Industrial Communication Networks - Profiles |
| IEC 62443 | Industrial Automation and Control System Security |
| ISO 20816-1 | Mechanical vibration — Measurement and evaluation of machine vibration |
| ISO 7919-3 | Mechanical vibration — Evaluation of machine vibration by measurements on rotating shafts — Part 3: Coupled industrial machines |
| ISO 281 | Rolling Bearings - Dynamic Load Ratings and Rating Life |
| API 670 | Machinery Protection Systems |
| API 671 | Special-Purpose Couplings for Petroleum, Chemical, and Gas industry services |
| ASME B16.5 | Pipe Flanges and Flanged Fittings |
| ASME B16.10 | Face to Face and End-to-End Dimensions of Valves |
| ASME B16.34 | Valves – Flanged, Threaded and Welding End |
| ASME B31.3 | Process Piping |
| ASME B46.1 | Surface Texture (Surface Roughness, Waviness and Lay) |
| ASME B1.20.1 | Pipe Threads, General Purpose (Inch) |
| API 614 | Lubrication, Shaft Sealing, and Control-oil Systems and auxiliaries for Petroleum, Chemical and Gas Industry Services |
| API 541 | Form wound squirrel cage induction motors – 345 kW (500HP) and larger |

| | | |
|---|---------------------|-------------|
| Document Title: | Document No. | Rev: |
| Technical Requisition for API 681 Pumps & Compressor | U211-TR-0008 | 01 |

| | |
|---------|--|
| API 547 | General purpose Form-wound Squirrel cage induction motors-185 kW through 2240 kW |
| API 682 | Shaft Sealing System for Centrifugal and Rotary Pump |
| API 686 | Recommended Practice for Machinery Installation and Installation |

6.3 PUMP/ COMPRESSOR

6.3.1 **API 681** (last edition) and corresponding documentation listed in attachment are applicable for this project.

6.3.2 All wetted cavities (including stuffing box,...) shall be capable of venting and draining. Casing drain nozzle will be supported with a bracket (if applicable).

6.3.3 Non-sparking, all-metal (metal flexible element – set of membranes), non-lubricated shaft coupling with a spacer shall be used.

Coupling data-sheet (including dimensions) shall be delivered.

Coupling guards shall be of non-sparking design, adequately rigid and supported to prevent contact with rotating parts.

Couplings and guards between drivers and pumps/compressors shall be supplied and mounted by Vendor

6.3.4 Belt drives can only be used for equipment and require Client approval.

If V-belts and tooth belts are provided they shall be oil resistant conforming to BS 903 part A16 and antistatic in accordance with either BS 3790, ISO 1813 or API 1B.

6.3.5 **Base-plate** shall be equipped with E-motor alignment jack-screws allowing its longitudinal and transverse adjustment. Alignment screw brackets shall be of sufficient rigidity to avoid their deformation during shaft alignment.

Base-plate levelling screws shall be preferably of “jacking bolt” type.

Base-plates shall be equipped with a drip pan or rim and drain nozzle - to collect possible leakage.

Vendor shall provide stainless-steel shims (min. overall thickness of 3 mm, max. 5 shims in a bundle) under E-Motor feet (and gearbox, if applied) to allow E-Motor (gearbox) shaft height adjustment.

Machined pads under equipment feet will be enlarged in such way that they will allow placing of spirit level (at both horizontal directions – for base-plate levelling).

Base-plates shall be equipped with a stainless steel earthing bolt.

6.3.6 It is assumed that all pumps/compressors in services with operating temperature less than 150°C are suitable for instantaneous start-up from ambient to full operating temperature. For higher operating temperatures (or if a/m assumption is wrong), Vendor shall provide suitable start-up procedure (as part of the operating manual) and any recommended monitoring equipment (e.g. skin temperature probes) to ensure that the pump/compressor (including shaft seals) does not incur damage due to rapid heat-up.

| | | |
|--|--------------|------|
| Document Title: | Document No. | Rev: |
| Technical Requisition for API 681 Pumps & Compressor | U211-TR-0008 | 01 |

- 6.3.7 Vendor shall design proper equipment & auxiliary piping heating / tracing in case that the fluid handled can solidify at ambient temperature. Procedure, how to keep the stand-by pump/compressor in “ready for start-up” mode shall be confirmed by Client and clearly described in Vendor’s equipment operating manual. This is applicable namely for following items:

Pour point [°C] of pumped liquids:

GA-XXX + XX °C

- 6.3.8 All **special tools** (custom made) required for installation / maintenance shall be included in the equipment delivery, if applicable.
- 6.3.9 All **of the pump/compressor equipment**, motor, vessels and accessories shall be delivered on a single skid. Vendor shall provide information on the skid general arrangements, with dimensions and static and dynamic loads transferred on to foundations.

6.4 PUMP/COMPRESSOR SHAFT SEALS & SEALING SYSTEMS

- 6.4.1 Pumps/compressors shall be supplied with mechanical seals and sealing systems in accordance with the requirements identified in the datasheets **API 682** (last edition) is applicable for this Project.
- 6.4.2 Shaft seal and seal system pre-selection (based on process information and designers’ assumptions) has been indicated in "Pump/Compressor Data Sheets". In case that the pre-selection seems to be incorrect, then the pump/compressor manufacturer (together with the seal manufacturer) shall propose a new seal or seal system selection (as an option) for designer/Client's approval. Vendor is responsible for the final seal and seal system selection.
- 6.4.3 Normally, the following manufacturers may be considered for shaft seal delivery:
- John Crane
 - EagleBurgmann

Alternatively, Vendor can propose his own sealing system from other manufacturer with sufficient proof that it is of same quality and reliability as the above given manufacturers.

- 6.4.4 Unless otherwise specified, the mechanical seal and seal system shall be designed to withstand:
- Under static conditions (pump standstill – typically the stand-by pump/compressor):
Pump/compressor design pressure at the pump/compressor design temperature (see “Pump/Compressor Data-sheet” – min. required design) = “design” values required by the process (not the pump/compressor manufacturer).
 - Under dynamic conditions (pump/compressor running):
maximum applicable seal chamber pressure (based on the maximum suction pressure) at the pump/compressor design temperature (see “Pump/Compressor Data-sheet” – min. required design).

| | | |
|--|--------------|------|
| Document Title: | Document No. | Rev: |
| Technical Requisition for API 681 Pumps & Compressor | U211-TR-0008 | 01 |

In case that this rule cannot be applied, Vendor shall clearly inform Client about the proposed seal / seal system maximum allowable pressure. Then Client would have to install a pressure relieve valve upstream the pump/compressor suction to protect seal / seal system against over-pressurizing in case of accidental suction isolating valve closing during pump/compressor pre-heating.

- 6.4.5 Applicable seal **API plans** and scope of seal system accessories required are in accordance with API 682 and details provided in Data Sheets.

Seal system will be located within equipment base-plate.

API-plan 53 reservoir / accumulator **gas filling** connection shall be preferably (in order to unify it within the Plant) 5/8" UNF with a protective cup.

1 (one) **gas filling kit** for all API-plans 53 reservoirs / accumulators shall be delivered by Vendor as an "special tool".

Barrier fluid filling connection shall be provided with quick coupling connector Swagelok 1/2" QC8-D8 DESO (stem) with a protective cup.

Air cooled seal systems (53, 23: finned pipes) are preferred (if pump/compressor itself does not require cooling water).

- 6.4.6 Barrier fluid pre-selection has been indicated in "Data-Sheets". In case that the pre-selection seems to be incorrect, then the Manufacturer shall propose a new barrier fluid selection for Client approval.
- 6.4.7 Free connections on the barrier fluid vessel shall be blinded or plugged. Plugs shall be of the same material as the vessel (not "plastic").
- 6.4.8 If possible (dimensionally), the seal end-plate shall be provided with quench-IN / vent and quench-OUT / drain connections (API plan 61). Pumps/compressor shall be shipped with the quench-IN connection plugged. Plugs shall be of the same material as the seal end-plate. Quench-OUT / drain connection shall be plugged for vertical in-line pumps, for horizontal pumps shall be provided with a drain pipe terminated at the base-plate drip pan/rim.
- 6.4.9 Stuffing box pressure shall be indicated in "Pump/compressor Data Sheet" (and at seal drawing) at least for items with dual seals, pumps at vacuum service and pumps with external flush system. Stuffing box of such pumps shall be provided with a plugged opening (provision for future pressure gauge installation). Plugs shall be of the same material as the seal chamber / end-plate.
- 6.4.10 Positive pressure in the stuffing box shall be assured during operation if a vacuum is specified at the pump/compressor suction.

6.5 EQUIPMENT CONDITION MONITORING

- 6.5.1 Unless, there is a continuous vibration monitoring foreseen, each pump/compressor bearing housing shall have flat (machined) surfaces (diameter of min. 25 mm) suitable for placing of portable vibration probe (magnetic) at locations according to ISO 10816.

The same philosophy is applicable for E-motors (location of probe according to IEC 60034-14).

| | | |
|--|--------------|------|
| Document Title: | Document No. | Rev: |
| Technical Requisition for API 681 Pumps & Compressor | U211-TR-0008 | 01 |

6.6 PIPING & NOZZLES

6.6.1 **Process piping** including on/off valves (inlet + outlet), inlet strainer s and in-line instruments shall be delivered by Client.

6.6.2 Suction and discharge piping orientation is indicated in equipment Data sheet, however in cases where the requested orientation appears to be non-standard for a particular type of equipment, and the Vendor is unable to make the modification at reasonable cost, the Vendor can propose a standard connection arrangement, while specifying the reason in TEDS.

6.6.3 Vendor shall design, deliver, assemble and clean-out all auxiliary piping (including all appurtenances) within the confines of base-frame.

If possible, piping inlets / outlets shall be manifolded and piped to terminal connections (single per service) at the front edge of equipment base-plate with minimum preferred size of 3/4" (DN20).

6.6.4 All **piping** shall be according to EN 13480.

Piping and nozzles with sizes smaller than 1/2 " (DN15) and with non-standard sizes 1.1/4" (DN32), 2.1/2" (DN65), 3.1/2" (DN90), 5" (DN125), 7" (DN175), 9" (DN225) and 22" (DN550) shall be avoided.

6.6.5 Seamless stainless steel tubing may be used for lines 2" and smaller. Swagelok is currently the only acceptable supplier of compression-type fittings for tubing (other manufacturers require Client acceptance).

6.6.6 All customer's piping connections shall be flanged. Nozzles and pipe **flanges** shall be according to ASME B16.5, raised face, smooth finish. Welding-neck flanges will be applied (if applicable).

6.6.7 Spiral wound **gaskets** (SS 316 + graphite) according to ASME B16.20 shall be applied for all flanges with rating up-to 300# (up to 600# only for services: Cooling Water, Steam, Condensate and Boiler feed water). Ring joint with metal oval ring according to ASME B16.20 shall be applied for all other flanges with rating 600# and higher. The use of asbestos is prohibited.

6.6.8 **Bolts and nuts** shall be imperial.

6.6.9 **Socket-welded joints** (fittings, pipe bushings) may be used for sizes 1/2" – 1.1/2" (DN 15 - 40) and rating up-to 600# and only for non-hydrogen service. Pipe fittings shall be according to ASME B16.9, small pipe fittings for threaded and socket weld connections according to ASME B16.11.

6.6.10 **Threaded connections** should be avoided. If necessary, they may be applied only for non-hazardous services (air, water,...) and only up to size 2". Other application requires Client approval. Threaded connection shall be NPT according to ASME B1.20.1.

If threaded connection cannot be avoided then screw-to-flange adaptor shall be applied at joints requiring assembly for maintenance and at Customer's connections.

6.6.11 **Valves** shall be of a heavy-duty design (bolted bonnet and gland type) flanged or butt welded. Ball valves (not the segmented with "tie rods" type) may be applied for auxiliary piping only with Client's approval. Valves shall be according to ASME B16.34, F to F dimensions of valves according to ASME B16.10.

| | | |
|--|--------------|------|
| Document Title: | Document No. | Rev: |
| Technical Requisition for API 681 Pumps & Compressor | U211-TR-0008 | 01 |

- 6.6.12 **Vents / drains** shall be equipped with an on/off valve and piping preferably routed to the drip pan/rim (if the fluid is not hazardous or does not solidify at ambient temp.). If termination at drip pan/rim is not possible then vents / drains will have a pipe oriented downwards (or sideward) allowing venting / draining into a bucket (up-wards orientated nozzles are not acceptable - "spraying" of personnel needs to be avoided). Piping open end will be blinded (cup, plug or blind flange).

Vent / drain piping in hazardous service will have customer nozzle (flange) terminated at the edge of skid (to be connected to a Plant flare or liquid disposal system).

- 6.6.13 Sight-glass with a moving element (e.g. "turbine" element or balls) and throttling valve (for manual capacity adjustment) shall be installed at each cooling water outlet branch (for each cooled equipment part).

Thermal expansion relieve valve shall be installed at each cooling water loop, which may be accidentally isolated by on/off valves (while equipment is in operation) and if equipment damage could be the consequence.

- 6.6.14 All piping and valves shall be pressure tested and certified accordingly. Minimum test pressure of 1-1/2 times the adjusted cold pressure rating of the valves, fittings, expansion joints, or other limiting elements is considered. Gaskets applied for system hydro-tests and operational tests shall be the same type specified for service.

- 6.6.15 Piping and valves shall be inspected (non-destructive testing) and certified (material certificates) in the same way as an equipment - see separate chapter.

- 6.6.16 If Vendor has specific requirements for cleaning (e.g. chemical cleaning, sand-blasting and flushing with rust preventive agent, N2 purging etc.) of process piping (up-stream the equipment = supplied by Client) after its installation then recommended treatment procedure shall be clarified by Vendor (it shall be part of equipment installation instructions).

6.7 STATIC EQUIPMENT

- 6.7.1 Serbian authority regulations that have to be adhered:

- "PRAVILNIK O OPREMI POD PRITISKOM" (Sl. glasnik RS, br. 114/2021) - Serbian Rulebook for pressure equipment

For non-pressure equipment Vendor is obliged to address to the Ministry of Economy in Republic of Serbia for approval of foreign conformity documents

Serbian regulations are harmonized with Requirements of "Pressure Equipment Directive" PED 97/23/EC

Vendor shall provide equipment classification according to PED and this classification will be submitted to Client for review (draft of "Declaration of Conformity") prior to equipment manufacturing (or sub-contracting). Corresponding level of "authority / notified body" involvement will be applied during equipment design / manufacturing / inspection and testing.

- 6.7.2 Static equipment should be fabricated, welded and tested in accordance with EN13445.

- 6.7.3 Minimum design metal temperature shall be -28 °C (minus).

| | | |
|--|--------------|------|
| Document Title: | Document No. | Rev: |
| Technical Requisition for API 681 Pumps & Compressor | U211-TR-0008 | 01 |

6.7.4 All documents according to appropriate attached SDR form shall be supplied. All documents shall be marked with valid Technical Requisition Number, Client Document Code and signed by responsible person. All revisions/changes shall be marked clearly.

6.7.5 If equipment requires insulation then it will have insulation clips (if needed).

6.8 MATERIALS & MATERIAL INSPECTION

6.8.1 Unless otherwise specified by Client, construction material shall be selected by manufacturer based on attached "Data Sheets"

6.8.2 Vendor shall indicate the material code (Serbian) and the actual grade of material he is supplying in the equipment "Data-Sheet". ASTM, AISI or ASME equivalent designation shall be always added.

6.8.3 Following requirements should be understood as minimal for material certificates:

- Material certificates 3.1B according to EN 10204 shall be submitted at least for pressure-containing parts (including piping) in contact with the fluid handled if being in a service belonging to inspection category B / C (see below), for parts operating in a corrosive atmosphere and for materials not covered by recognized international standards (e.g. APIs).
- Material certificates at least 3.1A in accordance with EN 10204 shall be submitted for pressure-containing parts in a service belonging to inspection category A as well as for non-pressurized parts in contact with the fluid handled and for all auxiliary equipment and piping in non-hazardous service (e.g. lube-oil system, cooling water piping, nitrogen system, air supply...).

6.8.4 Equipment and piping (in both process and auxiliary service) material shall be inspected (non-destructive testing) and certified as follows:

All welds and critical areas of castings shall be inspected in accordance with the requirements of the relevant inspection category (if not given otherwise by relevant standards or mutual agreement). The minimum inspection requirements for given inspection category are following:

Category A: Visual inspection.

Category A is applicable only for non-hazardous services (flammable fluid is not understood as "hazardous") within the following process design pressure and temperature range:

0 to 25 bar(g) and -28 °C to +150 °C.

Category B: Visual inspection and magnetic particle or liquid penetrant inspection (all welds including auxiliary piping and critical areas of castings).

Category B is applicable for non-hazardous services (flammable fluid is not understood as "hazardous") within the following process design pressure and temperature range:

25 to 90 bar(g) or -28 °C to -50 °C or +150 °C to +400 °C

Category C: Requirements of inspection category B together with radiographic or ultrasonic inspection.

| | | |
|--|--------------|------|
| Document Title: | Document No. | Rev: |
| Technical Requisition for API 681 Pumps & Compressor | U211-TR-0008 | 01 |

Category C is applicable for all **hazardous services** (e.g. fluid handled is indicated as toxic, poisonous, self-igniting, carcinogenic, liquids with vapor pressure above 5 bara) or non-hazardous services within the following process design pressure and temperature range:

above 90 bar(g) or above +400 °C or below –50 °C.

Ultrasonic inspection shall be executed when radiographic inspection is not feasible. Dye penetrant inspection shall be provided when magnetic particle inspection is not feasible.

6.8.5 The inspection acceptance limits (evaluation criteria) for non-destructive testing (including the visual one) shall be advised prior the inspection.

6.9 ELECTRIC MOTORS

6.9.1 Requirements of following “Engineering Specification” shall be followed:

- U211-EL-SP-0008 ES for LV Motors

E-motor Subsuppliers shall be subject of Client approval.

Electrical equipment protection level shall be appropriate to the hazardous area classification of the package installation.

Nevertheless the supplier have to adopt sizing and technical characteristic of the cables.

6.9.2 **Explosion protection**

Electrical equipment for installation in zone 2 hazardous area shall be suitable also for installation in Zone 1. Motors for use in zone 1 and zone 2 hazardous area shall be flameproof with an increased safety terminal box, in accordance with IEC 60079. Ex motors in increased safety (e) or non-sparking (n) execution are not acceptable.

6.9.3 Application of “maintenance-free” **bearings** (greased for the whole lifetime) is preferred against bearings with greasing nipples - if applicable.

6.9.4 **Earthing**

The equipment installed on base-frames shall be bonded. The base frames shall be equipped with a stainless steel earthing lugs at two point located diagonally opposite. The minimum conductor size for bonding shall be 16mm². The equipment which will be installed separately from base frames e.g. excitation panels shall be equipped with earthing lug.

6.10 CIVIL

6.10.1 Equipment is intended for installation on concrete **foundation**. The cement & sand based grouting (non-shrinking) is intended to fill-up entirely the base-plate. Vendor shall notify Client (as soon as possible) if such equipment installation would not meet his recommendation.

6.10.2 **Anchor** bolts (for grouting to “pockets”) shall be delivered by Client. Vendor shall specify type of anchor bolts and size of pockets (in general arrangement drawing).

| | | |
|---|---------------------|-------------|
| Document Title: | Document No. | Rev: |
| Technical Requisition for API 681 Pumps & Compressor | U211-TR-0008 | 01 |

7. Nameplates & Rotational Arrows

A nameplate shall be securely attached at a visible location on the compressor/pump frame, and on any major piece of auxiliary equipment.

Rotation arrows shall be cast in or attached to each major item of rotating equipment at a readily visible location in accordance with API 681 par 2.10.2.

Nameplates and rotation arrows (if attached) shall be of austenitic stainless steel or nickel-copper (UNS N04400 alloy). Attachment pins shall be of the same material. Welding is not permitted.

The following data, as a minimum, shall be clearly stamped or engraved on the frame. Units used on the nameplates shall correspond to those used on the datasheets:

- Project tag number;
- year of manufacture;
- Vendor's name;
- serial number;
- model number;
- Rated capacity;
- Rated power;
- Maximum allowable working pressure;
- Minimum and maximum allowable working temperature;
- Rated speed;
- Hydrostatic test pressure

The following data, as a minimum, shall be clearly stamped on the nameplate of any major piece of auxiliary equipment:

- Project tag number, if any;
- year of manufacture;
- Vendor's name;
- serial number;
- model;
- Certification marking („3A“/CE)

Nameplates shall be positioned to be clear of equipment surface or insulation by 40mm and in such a way that they can be easily read, wherever possible from grade, adjacent to a man-way or from an access platform.

| | | |
|--|--------------|------|
| Document Title: | Document No. | Rev: |
| Technical Requisition for API 681 Pumps & Compressor | U211-TR-0008 | 01 |

Any additional information required by the Vendor or by the Client shall be defined during the detail engineering phase.

The Vendor shall reference the Project equipment and instrumentation tag numbers in its technical documentation. The Client will provide the tag numbers during the detail engineering phase.

8. SPARE PARTS

- 8.1.1 Spare parts recommended by Vendor for equipment commissioning and plant start-up (i.e. first 2-3 months of equipment operation) shall be included in equipment delivery. Client assumes, that set of gaskets and O-rings (required for equipment disassembly / assembly) and one spare mechanical seal is satisfactory for this purpose.

9. SURFACE PREPARATION AND PAINTING

Painting and coating of equipment shall comply with Datasheet. Vendor's standard painting system may be proposed as an alternative, but shall be subject to Client's review and approval.

Vendor's standard **painting** procedure is acceptable (if suitable for given industrial chemical plant environmental area-class C5-I – very high (industrial)), however top coating colour shall be in accordance with enclosed Specification for Surface Preparation and Painting (RAL 6029 "mint green" for Compressors, pumps, electromotors, etc.).

10. NOISE LEVEL

- 10.1.1 Every attempt shall be made to minimize noise. If the allowable noise limits can not be met, Vendor shall propose sound attenuation measures in order to reduce noise to minimum applicable level.
- 10.1.2 "Low Noise" E-motor (= with noise optimised air cooling system) will be applied as first noise reduction measure in case that noise limit could be jeopardized.

11. INSPECTION AND TESTING

- 11.1.1 Inspection test plan (ITP) for fabrication and Vendor requirements for installation shall be prepared by Vendor following requirements within this procurement package, Serbian law and approved by Client before start of fabrication.
- 11.1.2 Acceptance of shop tests does not constitute a waiver of requirements to meet field performance under specified operations conditions, nor does inspection relieve the Vendor of his responsibilities.
- 11.1.3 Refer to the Pump/ Compressor data sheets and Technical Requisition to determine the complete scope of inspection, testing and Purchaser participation therein.
- 11.1.4 The Purchaser's and the Vendor's representatives, as applicable, shall indicate compliance in accordance with the inspector's checklist by initialing, dating, and submitting the completed checklist to the Purchaser prior to shipment.
- 11.1.5 Unless specified otherwise by the Client or legislative requirements, nondestructive examination (NDE) of materials shall be in accordance with PED.

| | | |
|--|--------------|------|
| Document Title: | Document No. | Rev: |
| Technical Requisition for API 681 Pumps & Compressor | U211-TR-0008 | 01 |

- 11.1.6 Mechanical Run test procedure, Performace test procedure and FAT procedure shall be subject to client approval.

12. WARRANTY PERIOD

- 12.1.1 The warranty period for the Goods lasts for a period of 3 years (36 months) from putting the Goods into operation, but not more than 4 years (48 months) as of the date of delivery of the Goods.

13. PREPARATION FOR SHIPMENT

- 13.1.1 Vendor's standard **painting** procedure is acceptable (if suitable for given industrial chemical plant environmental area-class C5 for long lasting period), however top coating colour according to plant standard ("mint "green RAL 6029 for all surfaces up to max. 120 °C including E-motor and base-plate; RAL 9006 "white aluminium" for hot surfaces) is required.

- 13.1.2 Equipment **preparation** (conservation,..) shall allow outdoor installation at Site (on the foundation; protected only by a plastic foil) for at least 6 months period of Plant erection till the equipment first start-up (see "Site & Utility Data Sheet" for climatic conditions).

In case that preservation renewal / prolongation would be required by Vendor then appropriate procedure including time schedule shall be included in Instructions for Storage. Vendor shall also specify if his supervision is required.

Equipment shall be prepared (protected, conserved ...) for oversea transportation.

- 13.1.3 As a minimum, the Vendor shall:

- prepare the supply for shipment and deliver to nominated delivery point i.e. Pancevo Oil refinery, Spoljnostarcevaccka 199A, 26000 Pancevo, Republic of Serbia on DAP Incoterms 2020
- furnish internal and external shipping braces required to prevent damage or movement during transportation;
- preservation must be done for oversea transport
- furnish all the crates with relevant Packing List and Shipping Documentation;
- provide shipping, installation, operation and maintenance weights and centre of gravity;

- 13.1.4 The Vendor shall provide Storage and Maintenance Procedures for Client's review and approval, which shall include, as a minimum, the following subjects:

- weather protection;
- equipment storage maintenance;
- periodical inspection;
- periodical maintenance;
- notice required for equipment usage;
- corrosion protection and application of temporary coatings;
- storage conditions including temperature range and humidity.

| | | |
|--|--------------|------|
| Document Title: | Document No. | Rev: |
| Technical Requisition for API 681 Pumps & Compressor | U211-TR-0008 | 01 |

Storage and Maintenance Procedures should also take in to account filling equipment with nitrogen or adequate alternative for prolonged storage, preservation and transportation.

- 13.1.5 Interior surfaces shall be thoroughly dried and preserved with suitable **rust preventative**. Type of conservation and suitable solvent shall be indicated on a tag attached on the device. Preferred type of conservation is such one, which does not require removal prior to operation.
- 13.1.6 All customer's **connections** shall be identified, according to markings on the general arrangement drawing, with waterproof and weatherproof labels fastened with stainless-steel wire.
- 13.1.7 All **openings** shall be blinded with suitable covers (fastened in such way that the cover can not be removed without a tool.) and sealed against water and dust. Flanged connections shall be provided preferably with a bolted wooden (or aluminium) cover.
- 13.1.8 All **valves** will be checked for operability (= hand wheels turn easily after equipment painting) and all will be at "closed" position.
- 13.1.9 If any **loose equipment** / accessories is to be delivered, it shall have a label with corresponding item № (to make clear to what equipment it belongs). It should be boxed separately.