TECHNICAL STANDARD OF MECHANICAL EQUIPMENT

Technical guidelines and assumptions

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1.1. DEFINITIONS AND ABBREVIATIONS

O&MM - operation and maintenance manual
STD – Standard Technical Documentation
TES - Technical Equipment Standard

1.2. GENERAL RULES

Refers to the purchase of materials and services and the design and acceptance of the mechanical engineering field.

1.3. DESCRIPTION OF THE PROCEDURE

Application of the standard in the design, manufacture, procurement, overhaul and modernisation of equipment and machinery of the mechanical engineering field.

1.4. MACHINES AND EQUIPMENT

1.4.1 PUMPS

A. Material and construction requirements

Pumps delivered to PCC Rokita should meet the following requirements:
- dimensions of connections/flanges **according to section 1.8.2 – flange connections**
- they should have a proven design without prototype solutions and components,
- the permissible noise level generated by the pumping system should not exceed 85 dB at a distance of one metre from the source,
- they should be designed for continuous operation of the working medium at a temperature not lower than the highest permissible (design) temperature and not higher than the lowest permissible (design) temperature,
- the rated duty point of the pump should be between 65% and 100% of the capacity corresponding to the maximum efficiency of the supplied impeller. In justified cases, lower values than those listed above are allowed, with the consent of PCC Rokita's technical services,
- if possible, an impeller with the largest diameter is not recommended for a given pump,
- the following condition must be met when selecting a pump: NPSHa–NPSHr≥0,5m,
- pumps operating at temperatures below 100°C should be adapted for immediate start from ambient temperature to full operating temperature. For higher operating temperatures, the supplier should provide a start-up procedure and complete monitoring systems required to protect the pump from damage due to its sudden heating
- pump and motor bearings should be metric,
- pump bearings should be adapted to grease lubrication or pressure-free oil lubrication,
- if lubricating oil is to be used at a temperature higher than 180°C, an oil cooling system should be used,
- if water cooling is required, the water-cooling system should be closed in such a way as to allow flow control,
- for all types of pumps that require a coupling, couplings with flexible inserts are required,
- coupling covers should be removable and made of non-sparking materials,
- vibration measurements should be made, and the report should be attached to the documentation provided to the Employer,
- the direction of rotation should be marked on the pump body,
- the design and corrosion protection must be matched to the operating conditions of the pump (indoor/outdoor operation)

— the electric motor must be selected in accordance with the SUT-E Technical Standard of Electrical Equipment,
— engraved nameplate made of stainless steel,
— using carbon steel for foundation anchors is not permitted.

B. Selection guidelines

The supplier of the pumping unit should ensure that the delivered devices are as unified as possible to ensure minimum operating costs and maximise the exchangeability of spare parts. To this end, the equipment and installations supplied must comply with PCC Rokita standards and norms. During design, fabrication, installation and testing the provisions of the latest editions of the following standards and regulations shall be applied:
— PN-EN ISO 17769 – Liquid pumps and installation - General terms, definitions, quantities, letter symbols and units — Part 1: Liquid pumps,
— PN-EN ISO 9906 – Rotodynamic pumps - Hydraulic performance acceptance tests,
— PN-EN ISO 21049 – Pumps - Shaft sealing systems for centrifugal and rotary pumps,
— PN-EN ISO 809+A1 – Pumps and pump units for liquids - Common safety requirements,
— PN-EN ISO 2858 – End-suction centrifugal pumps - Designation, nominal duty point and dimensions,
— PN-EN ISO 14414 – Pump system energy assessment,
— API 610 Centrifugal Pumps for Petroleum, Petrochemical and Natural Gas Industries – the need for application should be agreed upon with the Employer (if applicable) unless specified at the beginning of the process,
— API 674 Positive Displacement Pumps – Reciprocating,
— API 675 Positive Displacement Pumps – Controlled Volume,
— API 676 Positive Displacement Pumps – Rotary,
— API 681 Liquid Ring Vacuum Pumps and Compressors,
— API 682 Mechanical Seals – API 610 (the pump standard),
— API 685 Sealless Centrifugal Pumps,
— DIN ISO 1940 Mechanical vibration – Balance quality requirements for rotors in a constant (rigid) state,
— PN-EN ISO 9905 – Technical specifications for centrifugal pumps - Class I,
— PN-EN ISO 5199 – Technical specifications for centrifugal pumps - Class II,
— PN-EN ISO 9908 – Technical specifications for centrifugal pumps - Class III,
— PN-EN ISO 12483 – Liquid pumps - Pump units with frequency inverters - Guarantee and compatibility tests,
— PN-EN ISO 12162+A1 – Liquid pumps - Safety requirements - Procedure for hydrostatic testing,
— PN-EN ISO 3661 – End-suction centrifugal pumps - Baseplate and installation dimensions,
— STD – Standard Technical Documentation,
— SUT-C – Technical Equipment Standard - Control & Instrumentation,
— SUT-E – Technical Equipment Standard - Electrical engineering field,
— SUT-M – Technical Equipment Standard – Mechanical engineering field.

C. Tests and trials

PCC Rokita reserves the right to inspect the pump at the manufacturer's site before delivery – unless otherwise agreed. The following tests should be carried out at the manufacturer's site:
— pressure testing of the casing,
— parameter test with vibration measurement, according to the standard for manufacture,
— NPSH test according to the standard for manufacture, while:
  - for NPSHa – NPSHr≤1m a full NPSH test is required,
  - for 1m< NPSHa – NPSHr≤ 2m a test is required for the rated point,
  - for NPSHa – NPSHr>2m no test is required.
— noise level measurements.

D. Preferred manufacturers

Vortex (centrifugal)	Displacement (cam, gear, screw)	Displacement dosing (membrane, piston)
– Dickow Pumpen – Duchting – Friatec/Rheinhuette – Grundfos – Hermetic –Munsch – Hydro–Vacum – KSB – Tapflo – Richter – Warman – Sulzer – Lowara Vogel Series – Klaus Union – Hydro–Vacum – LFP – Powen–Wafapomp Group – SIHI – CP Pumpen – Geko–Pumpen	– Boerger – GAA–LOBEX – Tapflo – Johnson Pump – Albany – Tuthil – Allweiler – GlobalGear	– Bran Luebbe – Lewa – Afros – Kracht – Marzocchi – Tapflo – ARO – ProMinent – Versamatic

E. Required documentation

The documentation provided as part of the delivery is an integral part of the order and its lack or incompleteness will be considered as non-compliance with the requirements of the order. The documentation must be provided in accordance with the guidelines of section 1.13.2 – DOCUMENTATION.

1.4.2 CONVEYORS

A. Material and construction requirements

<u>Conveyor construction:</u>

— should provide stable positioning of the conveyor during operation,
— should provide a centrally symmetrical material inlet onto the belt in the drop area,
— anti-corrosion protection according to section 1.11. – Anticorrosion,
— easy access to conveyor components enabling possible repairs,
— security elements:
— removable cover of rotating elements,
— pull-wire safety switch for immediate shutdown
— pre-start signalling,
— engraved nameplate made of stainless steel,

<u>Belt</u>

— should be carried out in a three-core trough system or a flat arrangement (depending on the purpose of the conveyor),
— the return belt should be guided along with the return pulleys in a flat arrangement,

- minimum belt tensile strength required is 630 kN/m,
- straps with a textile core are allowed:
- polyamide (P),
- polyester (E),
- cellulose fibres (Z),
- the minimum number of tape spacers is 3,
- the tape should have as little as possible heat laminated and vulcanised joints (preferably one).

Drive units

- the drive unit should be placed stably on the conveyor frame and be a drop station,
- the drum should be driven by a gearmotor selected according to section 1.4.4 – Gearmotors,
- a drum weight optimization process is required to extend the life of the drive and idler drum bearings and to optimize drum transport to the final installation site,
- bearings should be adapted to grease lubrication without stopping or dismantling the drums (e.g. ball couplings), the bearings of the tension and idler drums shall be grease lubricated without stopping or disassembling the drum by means of ball ball-lubricators (“grease nipples").

Tensioning and returning drums

- the belt should be tensioned with a screw tensioner that will adjust the running belt,
- long conveyor can have a deflection drum and a tension roller with a counterweight.

Drive pulleys and drums

- it is required to use pulleys with dimensions according to PN-EN ISO 1537, made of HDPE, with a fixed axis with labyrinth seal,
- the drive and return drum must be made of steel, jacketed with a layer of rubber, vulcanized KARO, mounted to the structure on bearings in holders,
- the drive should be done by a gearmotor selected according to section 1.4.4 – Gearmotors,
- transmission of the drive to the conveyor drive pulleys allowed by the use of chain, this requires the use of mountable sprockets on the rollers’ shafts,
- the chain drive should be implemented in such a way that it is possible to compensate the chain tension - tensioners,
- in the case of drive pulleys, it is necessary to take into account the mounting of drive gears.

Scrapers and scoops

- it is required to use a scraper and/or scoop/brushes on the returning belt in order to clean the conveyor belt of residual material,
  the scraper and scoop’s design should be equipped with self-compensation, considering wiping of the abrasive elements – inserts.

Covers

Conveyor belt covers must be used if a conveyor is mounted on the outside or in a location where there is a possibility of contamination of the material.

B. Required documentation

The documentation provided as part of the delivery is an integral part of the order and its lack or incompleteness will be considered as non-compliance with the requirements of the order. The documentation must be provided in accordance with the guidelines of section 1.13.2 – DOCUMENTATION.

1.4.3. FANS

A. Material and construction requirements

Fans supplied to PCC Rokita should meet the following requirements:
- dimensions of connections/flanges **according to section 1.8.2 – flange connections**
- they should have a proven design without prototype solutions and components,
- the permissible noise level generated by the fan system should not exceed 85 dB at a distance of one metre from the source,
- the nominal operating point of the fan can be variable, so a control solution based on a frequency converter is recommended,
- fan and motor bearings should be metric, the bearing housings have grease nipples for grease lubrication
- for all types of fans that require a coupling, couplings with flexible inserts are required,
- coupling covers should be removable and made of non–sparking materials,
- fan impellers should be secured against unscrewing,
- For media other than air, shaft sealing (stuffing box or mechanical seal) and drainage stub with flange DN25 are required,
- engraved nameplate made of stainless steel,

B. Selection guidelines

The supplier of the fans should ensure that the delivered devices are as unified as possible to ensure minimum operating costs and maximise the exchangeability of spare parts. To this end, the equipment and installations supplied must comply with PCC Rokita standards and norms, and in particular:
- STD – Standard Technical Documentation,
- SUT-C – Technical Equipment Standard - Control & Instrumentation,
- SUT-E – Technical Equipment Standard - Electrical engineering field,

C. Work conditions

When selecting the fan including the drive, particular attention should be paid to the environment in which the fan will operate and the associated risks and the operating medium (confirmation of chemical resistance of the materials).
Unless agreed otherwise, the fan should be designed for continuous operation in the air in climatic conditions appropriate for the location of the PCC Rokita plant (temperature – 20°C/+50°C, UV radiation).

D. Suppliers

- Owent Sp. Z O.O.
- Nyborg–Mawent
- Fawent S.A.
- Hürner – Funken GmbH

- Venture Industries
- COLASIT
- DABROWENT
- Arivent Italiana
- L.E. FERRARI

E. Standards and regulations

During design, fabrication, installation and testing the provisions of the latest editions of the following standards and regulations shall be applied:
- PN-EN ISO 13351 Fans - Dimensions
- PN-EN ISO 5802 Industrial fans - Performance testing in situ
- PN ISO 14695 Industrial fans - Method of measurement of fan vibration
- API 673 Centrifugal Fans for Petroleum, Chemical, and Gas Industry Services

F. Required documentation

The documentation provided as part of the delivery is an integral part of the order and its lack or incompleteness will be considered as non-compliance with the requirements of the order. The documentation must be provided in accordance with the guidelines of section 1.13.2 – DOCUMENTATION.

1.4.4. GEARMOTORS

Gearmotors supplied to PCC Rokita:
- must be selected with at least 15% reserve power, relative to the maximum power consumed at start-up, for worst-case start-up and operating conditions,
- should have a flange mount,
- must be equipped with features that make it possible to check the oil level in the operating position (sight glass for inspection, gauge/dipstick or other such feature),
- gear units operating outdoors must be suitable for operation in atmospheric conditions (operating temperature from -20°C to +50°C) and in industrial environment,
- design solutions for electric motors according to SUT-E,
- preferred manufacturers of gearmotors: NORD, Siemens, Kacperek, SEW, ANTICO,
- engraved nameplate made of stainless steel,

The use of belt transmissions in driving devices should be limited to a minimum, and the application of this type of solution should be each time agreed upon with PCC Rokita Technical Services. If it is required to regulate the speed of the agitator, it should be realized by using frequency converters (according to the electrical standard SUT-E). The gearbox should be selected so that the drive can operate over the entire required speed range.

A. Required documentation

The documentation provided as part of the delivery is an integral part of the order and its lack or incompleteness will be considered as non-compliance with the requirements of the order. The documentation must be provided in accordance with the guidelines of section 1.13.2 – DOCUMENTATION.

1.4.5. AGITATORS

A. Material and construction requirements

Drive

For drive selection refer to section 1.4.4 Gearmotors.

Agitator

For agitators with a split impeller, it is necessary to ensure construction solutions prevent loosening and unscrewing of assembly components during normal operating conditions.
Agitators (especially high-speed ones) should be designed in such a way that, under normal operating conditions, no cavitation phenomena occur near the impeller or tank walls.

- high-speed agitators must be dynamically balanced after installation and before initial operation.
- each time selection of the proper type of agitator/agitators should be carried out with consideration of process parameters occurring inside the tank and expected results of the agitator's work.

Shaft

- hollow shafts must be built in such a way that no working fluid or other liquids can get inside them,
- split shafts should be constructed in such a way that they cannot be disconnected by themselves by unscrewing the threaded fittings,
- the selection of construction materials and the dimensioning of shafts must be carried out for the highest possible operating loads with a minimum 15% margin.
- dimensions and dimensional tolerances of the mechanical seal/agitator shaft connection for enamelled double reactor seals according to DIN 28159,
- Diameters as well as dimensions and dimensional tolerances of the connection mechanical seal/agitator shaft for double seals of mixers and reactors made of carbon steel or acid-resistant steel according to DIN 28154.

Sealing of the shaft

For non-pressure tanks:

- single mechanical seal or, for highly toxic or hazardous compounds, double mechanical seal.
- flange connections connecting the tank with a double mechanical seal for:
    a) enamelled agitators should be specified according to the standard: DIN 28137–2,
    b) agitators and reactors should be made according to the standard: DIN 28137–1,
- seal material designs in the form of cartridge seals are preferred

For pressure tanks:
Double mechanical seals with barrier fluid system:

- fluid in the double seal, in case of leakage (inward or outward) will not pose a threat to the environment and will not contaminate the liquid in the tank.
- barrier gas - used when the selection of a barrier fluid due to the working fluid is impossible (dangerous) or economically unjustified.

Lower shaft bearing

Lower shaft bearings should be used for vertical agitators with long drive shafts and for media whose properties, such as high viscosity, non-homogeneity or other properties may promote shaft vibrations.
Due to the lubrication of the lower shaft support (bearing arrangement) by the working fluid, the selection of materials for the friction elements of the bearing arrangement must be examined in each case. Do not use a lower bearing on abrasive media.

B. Standards and regulations

During design, fabrication, installation and testing the provisions of the latest editions of the following standards and regulations shall be applied:

- Machinery Directive 2006/42/EC,
- PN-EN ISO 12100 – Safety of machinery — General principles for design — Risk assessment and risk reduction,
- STD – Standard Technical Documentation,
- SUT-C – Technical Equipment Standard - Control & Instrumentation,
- SUT-E – Technical Equipment Standard - Electrical engineering field,

C. Additional requirements

Agitator drive components such as motor, gearbox, couplings, mechanical sealing, etc. operating in explosion hazardous areas must have the appropriate ATEX characteristics for the most unfavourable parameters and explosive conditions and operating parameters of the device they comprise.
In the selection of agitators, the parameters are to be determined according to the technical specifications/Datasheet No. ME03 “AGITATOR" contained in the Standard Technical Documentation (STD) valid at PCC Rokita SA.

D. Required documentation

The documentation provided as part of the delivery is an integral part of the order and its lack or incompleteness will be considered as non-compliance with the requirements of the order. The documentation must be provided in accordance with the guidelines of section 1.13.2 – DOCUMENTATION.

1.5. TANKS, PRESSURE EQUIPMENT

A. General requirements

At the design stage, it is necessary to determine whether the tank belongs to a pressure or non–pressure group and specify the category of fluid, according to the Regulation of the Minister of Development of 11 July 2016 on the requirements for pressure equipment and assemblies of pressure equipment.
The tank designer/builder should ensure that the tank does not pose a hazard during operation and is secured as much as possible in unstable conditions. The tank has to be designed in accordance with the relevant legal provisions, taking into account the possibility of increased and reduced pressures and temperatures. The constructor/designer should ensure that the delivered device is as safe as possible against leakage and damage to ensure maximum safety conditions during operation.

The designer of the tank and the installation should ensure that the device is optimally adapted to the technological requirements in compliance with all technical requirements.
While designing the tank one should take into account technological and operational aspects such as:

- manholes - with the diameter DN600, if possible. The final number of manholes should be confirmed with the Technical Service of PCC Rokita,
- the design should take into account elements for manholes suspension,
- for reactors and mixers at least one manhole. Preferred diameter DN600, it is allowed to use the diameter DN 500 without the need to obtain the approval of Technical Service of PCC Rokita,
- drain stub and a basin on the bottom floor with a drain to this stub - the "zero stub",
- additional stub pipes in case of a future connection to the system (stub pipes are blanked off at the delivery stage),
- stubs for the measuring equipment,
- ladder and service platforms for stubs, along with the safety fixtures and measuring equipment important from the point of view of the process (utility supply, utility consumption control),
- In the case of stub pipes and top-mounted equipment, a service platform with railing is required,
- engraved nameplate made of stainless steel, at least 1 mm thick, in compliance with directive 2014/68/EU,
- hot/cold insulation (in these cases the plate shall be accessible and visible),
- the temperature of the hydraulic tightness/pressure test should be assumed as a minimum of +5oC, which should be included in the design documentation,
- when selecting the material of the bolts, the possibility of corrosion occurring at the junction of two materials with different potentials should be taken into account in order to avoid galvanic corrosion.

B. Design requirements

Tanks delivered to PCC Rokita should be designed and manufactured in accordance with the following requirements:

- in accordance with the separate legal provisions to ensure minimum loss of the working medium in the event of changes in pressure or temperature,
- so as to limit the leakage of the working medium into the environment during filling or draining to a safe minimum level,
- made of material resistant to the working medium or covered with a suitable lining or protected with a protective coating,
- made of a material whose components, when in contact with the working medium, are not liable to form a dangerous reaction or to become visibly impaired, in particular by accelerated ageing and increased brittleness,
- made of a material resistant to the chemical compounds that cause destruction due to chemical corrosion. For industrial/ hydrant/refrigeration water, continuous resistance to chloride concentrations above 500 ppm,
- they should have a proven design,
- for tanks made of carbon steel, a corrosion allowance of at least 2 mm must be assumed,
- in the case of tanks made of alloy steels, each time the following formula should be used to calculate the minimum thickness, at the same time the amount of allowance should be agreed upon with PCC Rokita technical services,

  0.5 (D, mm/1,000+5) or 6 mm, where D - tank diameter,
- in such a way as to prevent the build-up of potentially dangerous electrostatic charges or be provided with a means of discharging such charges,

- the design and components ensure safe and complete emptying and enable the tank to be cleaned,
- the design and components must ensure correct venting, also during hydraulic leakage testing if required,
- the design and components must ensure proper ventilation when carrying out internal inspections or possible repairs of the inner layer,
- the design of platforms and ladders must ensure safe working conditions for the staff,
- the support structure for the associated pipelines should be primarily supported by an independent structure, or if it is not possible to support an independent structure, it is permissible to support the tank shell by means of reinforcing caps, after prior agreement with the customer,
- dimensions of connections/flanges according to **section 1.8.2 - flange connections** on stub connections to the pipes, excluding inspection manholes,
- in a manner which takes account of vibrations which may be transmitted to pipework and building structures,
- When designing a cyclic operation tank, the number of cycles must be anticipated, and each time the number of cycles must be agreed upon with the customer,
- in the case of other tanks, a life expectancy must be foreseen, each time to be agreed upon with the customer,
- ovalization must be checked according to the design guidelines used according to the design standard,
- static loads originating from the filling level of the tank must be taken into account in the design
- in accordance with the requirements set out in the separate legislation on pressure tanks:
  a) PN-EN 13445 – Unfired pressure vessels,
  b) PN–EN 13121 – GRP tanks and vessels for use above ground,
  c) PN-EN 1591–1 – Flanges and their joints - Design rules for gasketed circular flange connections,
  d) Taylor Forge Method for Flange Design,
  e) WUDT– UC – WO–O/19 - Conditions of the Office of Technical Inspection for flange connections design,
  f) WUDT– UC – Conditions of the Office of Technical Inspection
  g) PN-EN 14276- Pressure devices in refrigeration systems and heat pumps

- for tanks for storing poisonous or caustic materials in accordance with the Regulation of the Minister of Economy of 16 April 2002 on the technical conditions of technical inspection, which should be met by non-pressure and low-pressure tanks intended for storing poisonous and caustic materials
- for tanks for storing flammable liquids in accordance with the Regulation of the Minister of Economy of 18 September 2001 on the technical conditions of technical inspection to be met by non-pressure and low-pressure tanks intended for storing flammable liquids and the Regulation of the Minister of Economy of 31 March 2008 amending the regulation on conditions of technical inspection which should be met by non-pressure and low-pressure tanks intended for storing flammable liquid materials.

In addition, the requirements specified for a given group of tanks and pressure equipment, as indicated in the following subsections, must also be met.

1.5.1 NON-PRESSURE AND LOW-PRESSURE TANKS

A. Work conditions

Low-pressure tanks are tanks to store materials in which the working pressure, not taking into account hydrostatic pressure, is maintained above the atmospheric pressure but does not

exceed 0.5 bar g (50kPa), or gas with pressure up to 0,5 bar g (50kPa) is used to empty or to flush the tank.

Non-pressure tanks are used to store liquids at atmospheric pressure or overpressure varying from 0.25 kPa underpressure to 3.5 kPa overpressure, hydrostatic pressure caused by the column of the working medium is not taken into account.
In order to ensure the safe operation of the tanks, the following additional considerations must be taken into account:

- leave a free space in the tank to protect against fluid leakage or permanent deformation of the closed tank as a result of the fluid volume increase under the influence of a temperature increase,
- tank filling should not exceed 95% of the tank capacity, based on the highest operating temperature,
- fluid level in the tank should be recorded and at least two alarm thresholds should be determined: I-alarm: filling level of 80%, II-alarm: filling level above 90%,
- the tank should be equipped with a device preventing the working medium from leaking into the ground and surface and groundwater,
- safety devices should be designed and constructed in such a way that, if a leak occurs in a tank, the leak is stopped by that device and no contamination of the environment occurs,
- if underpressure can be created in the tank, the designer should perform strength calculations for the tank with respect to the expected external pressure, and should adequately strengthen the structure for underpressure higher by 1.5 kPa than specified, provided that the vacuum is not equal to 0 bar abs,
- the non-pressure and low-pressure tanks shall be fitted with at least two devices to protect the container against exceeding the permissible underpressure and overpressure, including at least one breather device according to section **1.7.3 - breather valves, and section 1.7.4 - safety valves,**
- exceeding 0.25 kPa underpressure and 3.5 kPa overpressure shall activate an alarm signal, hydrostatic pressure caused by the column of the working medium shall not be taken into account,
- in the event of Low-pressure tanks, exceeding 0.5 bar overpressure shall activate an alarm signal, hydrostatic pressure caused by the column of the working medium shall not be taken into account,
- the capacity of the breather device should take into account the maximum fluid flow rate resulting from the heating or cooling of the contents and the filling or emptying of the tank,
- the breather device should be protected against rainwater, foreign elements and should be resistant to corrosion,
- tanks for flammable and explosive media and others that require it shall be fitted with a fire fuse,
- the shut–off valve between the tank and the breather device should not be mounted,
- calculations of other loads for above-ground tanks, in particular, snow and wind loads shall be carried out according to the requirements set out in the Polish Standards.

B. Design requirements

Non-pressure and Low-pressure tanks delivered to PCC Rokita should be designed and manufactured in accordance with the following requirements:

- the thickness of full flanges (caps) should be selected in accordance with strength calculations, taking into account the anti-corrosion additive for a given material, but not less than for class PN6, while the class of flange drilling in accordance with PN10, PN16 or PN25, depending on the requirements and arrangements with Technical Service of PCC Rokita and the adopted standard on the basis of which the tank will be designed,

— in accordance with the requirements set out in the separate legislation on non-pressure and Low-pressure tanks:

a) Regulation of the Minister of Economy of 16 April 2002 on the technical conditions of technical inspection, which should be met by non-pressure and low-pressure tanks intended for storing poisonous and caustic materials
b) Regulation of the Minister of Economy of 18 September 2001 on the technical conditions of technical inspection to be met by non-pressure and low-pressure tanks intended for storing flammable liquids and the Regulation of the Minister of Economy of 31 March 2008 amending the regulation on conditions of technical inspection which should be met by non-pressure and low-pressure tanks intended for storing flammable liquid materials.
c) PN-EN 14015 – Specification for the design and manufacture of site built, vertical, cylindrical, flat-bottomed, above ground, welded, steel tanks for the storage of liquids at ambient temperature and above,
d) PN-EN 13121 – GRP tanks and vessels for use above ground,
e) PN-EN 13445 – Unfired pressure vessels
f) for plastic tanks according to WUDT-UC-UTS/01.

1.5.2 PRESSURE DEVICES

A. Work conditions

In order to ensure the safe operation of the tanks, the following considerations must be taken into account:
— leave a free space in the tank to protect against fluid leakage or permanent deformation of the closed tank as a result of the fluid volume increase under the influence of a temperature increase,
— tank filling should not exceed 95% of the tank capacity, based on the highest operating temperature,
— the level of the working medium should be recorded, and exceeding 90% of the tank capacity should trigger an alarm signal,
— the tank should be equipped with a device preventing the working medium from leaking into the ground and surface and groundwater,
— safety devices should be designed and constructed in such a way that, if a leak occurs in a tank, the leak is stopped by that device and no contamination of the environment occurs,
— if underpressure can be created in the tank, the designer should perform strength calculations for the tank with respect to the expected external pressure, and should adequately strengthen the structure for underpressure higher by 1.5 kPa than specified,
— the pressure inside the tank should be recorded,
— the pressure tank should be fitted with at least two devices to protect the container against exceeding the highest permissible working pressure, according to section **1.7.4 - safety valves,**
— the capacity of the safety device should take into account the maximum gas flow rate resulting from the heating or cooling of the contents and the filling or emptying of the tank,
— the safety device shall be installed in such a manner as to prevent the entry of rainwater and foreign bodies and to resist corrosion,
— tanks for flammable and explosive media and others that require it shall be fitted with a fire fuse,
— the shut–off valve between the tank and the safety device should not be mounted,
— calculations of loads for above-ground tanks, in particular, snow and wind loads shall be carried out according to the requirements set out in the Polish Standards.

B. Design requirements

Pressure tanks delivered to PCC Rokita should be designed and manufactured in accordance with the following requirements:

— in accordance with the requirements set out in the separate legislation on pressure tanks:

a) Regulation of the Minister of Development of 2 June 2016 on simple pressure tanks,
b) Regulation of the Minister of Transport of 20 October 2006 on the technical conditions of technical supervision in the field of design, manufacture, operation, repair, and modernisation of specialised pressure equipment,
c) Regulation of the Minister of Development of 11 July 2016 on requirements for pressure equipment and assemblies of pressure equipment, Pressure Equipment Directive 2014/68/EU,
d) Regulation of the Minister of Development of 17 December 2021 on technical conditions of technical supervision for certain pressure equipment subject to technical supervision Journal of Laws of 2022, item 68,
e) ASME DIV VII, VIII (with the approval of the Technical Director),
f) PN-EN 13121 – GRP tanks and vessels for use above ground,
g) for metal tanks according to 2014/68/EU and 2014/29/EU, together with the associated harmonised standards,
h) for plastic tanks according to WUDT-UC-UTS/01,
i) enamel coated tanks and reactors must be manufactured in accordance with DIN 28136.

C. Required documentation

The documentation provided as part of the delivery is an integral part of the order and its lack or incompleteness will be considered as non-compliance with the requirements of the order. The documentation must be provided in accordance with the guidelines of section 1.13.2 – DOCUMENTATION.

1.5.3 FILTRES and FILTERING EQUIPMENT

Filters and filtering equipment as a group of pressure equipment must additionally meet the following requirements:

— have a drain stub for complete emptying of the filter,
— have a venting stub,
— the type of filter element used should be a standard solution - generally available to the public,
— non-standard filter elements may be used provided that technical documentation of the element's attachment to the filter is provided, but this type must be agreed upon with the technical service,
— the bottom/manhole, which is used to replace the filtration elements, should be equipped with a crane applies to the diameter of filters and filtration devices up to DN1000 inclusive

1.5.4 HEAT EXCHANGERS

When selecting the exchanger, the operating parameters and the environment in which it will operate must be taken into account. If at least one of the working media of the exchanger is water, the exchanger materials in contact with the water must be resistant to chloride ion concentrations above 500 ppm.

The heat exchanger shall be provided with flange connections according to **section 1.8.2 - flange connections** on stub pipe connections.

A. Plate (heat exchangers)

- The design of the exchangers should be bolted, dismantled for easy maintenance and cleaning of the plates.
- Gaskets should be selected taking into account the exchanger operating media and design temperatures, preferred are Clip-on type gaskets. The shape of the plates and the fixing of the gaskets should allow for easy removal of the old gaskets and installation of new ones in case of service of the exchanger.
- Welded construction of the exchanger with plates permanently connected to each other, e.g. by soldering or welding is not recommended. In the case of using an exchanger whose plates are permanently joined together, it is necessary to agree and obtain approval from PCC Rokita technical services.
- For each selection of the exchanger plate thickness should be consulted with the PCC Rokita technical services
- The exchanger should be provided with flange connections for connection to the pipeline, and splash guards made of the mat. 1.4404 should be installed on these connections.
- When selecting the exchanger, a minimum thickness of 0.6 mm of the thermal plate should be assumed. Other thickness values, if not indicated by the Employer in the technical specification/ToR, shall be each time agreed upon with relevant technical services of PCC Rokita.
- The gasket material of the exchanger is to be selected for operating conditions of the working medium for temperatures at least 10°C higher than the maximum and 10°C lower than the minimum if the minimum temperature of the working medium is below 0°C. The temperatures of the media supplied to the exchanger (power source) are to be verified.
- The permissible loads should be taken in accordance with API 662, Table II.
- For plate heat exchangers, the selection is to be made in terms of pressure on the basis of the space in which the higher pressure occurs, so that the value of the highest allowable pressure PS for each space of the exchanger is to be the same, irrespective of the prevailing pressure in the space with the lower pressure. Furthermore, the differential pressure between the two spaces under operating conditions must not be less than the PS value.
- For pressure tests, the value of the differential pressure must not be less than 1.1 x the maximum allowable pressure PS (0 bar g in one space, 1.1 x PS in the other space).

B. Preferred suppliers of plate heat exchangers

- GEA–KELVION
- ALFA LAVAL
- API SCHMIDT
- TRANTER

C. Shell-and-tube (heat exchangers)

Where appropriate, it is recommended that the exchangers be of modular design - so that the tubular insert is not permanently connected to the outer shell and can be easily dismantled or repaired. Each time the exchanger type (according to TEMA) should be agreed upon with PCC Rokita technical services.
The heat exchanger shall be provided with flange connections according to **section 1.8.2 - flange connections** on pipe connections.
The permissible loads should be taken in accordance with API 660.

D. Spiral (heat exchangers)

Spiral heat exchangers are characterised by excellent heat transfer performance in many demanding industrial applications. They are suitable for viscous products and those containing solid particles that in other types of exchangers would “kill” them or make them corrode excessively.
This type of heat exchanger should be used only upon approval of PCC Rokita technical services.

E. Required documentation

The documentation provided as part of the delivery is an integral part of the order and its lack or incompleteness will be considered as non-compliance with the requirements of the order. The documentation must be provided in accordance with the guidelines of section 1.13.2 – DOCUMENTATION.

1.6. PIPELINES

A. WORK CONDITIONS

According to the Regulation of the Minister of Development of 11 July 2016 on the requirements for pressure equipment and assemblies of pressure equipment, the designer at the design stage of the technical documentation for pipelines, determines the categories based on the fluid's group membership (I - hazardous fluids, group II - fluids not listed in group I), the maximum allowable pressure PS and the nominal diameter DN.
The categories of pipelines are determined by the designer at the design stage of the technical documentation.

Pipelines should be designed in accordance with the guidelines in PN-EN 13480. In the case of pipelines in refrigeration systems, it is allowed to use standard PN-EN 14276 - Pressure devices in refrigeration systems and heat pumps. For pipelines categorised as Good Engineering Practice (GEP), the following should be adopted according to class I.

The metal and non-metal industrial pipelines are divided into classes. It is required that the newly designed pipelines be within the pipeline classes stipulated in the standard. The pipeline classes were created on the basis of existing assumptions of production plant technology suppliers, experience, and many years of practice. These classes can be assigned to most of the media present in PCC Rokita. In justified cases, it is possible to use a special class (S), which must be each time agreed upon with relevant PCC Rokita services.

Table no. 1.6.1. Classification of pipelines by material (or equivalent).

Class name	Class	Material
Carbon steel 1	CS1	P235GH
Carbon steel 2	CS2	P265GH
Carbon steel 3	CS3	P355GH, P355NL1, P355NQ, P355NH
Corrosion resistant steel 1	SS1	X 5 CrNi 18–10 (304, 1.4301)
Corrosion resistant steel 2	SS2	X 2 CrNiMo 17–12–2 (316L, 1.4404)
Corrosion resistant steel 3	SS3	X 6 CrNiMoTi 17–12–2 (316Ti, 1.4571)
Glass fibre reinforced plastic	GRP1	GRP type E / Derekane 470
Glass fibre reinforced plastic 2	GRP2	GRP type E / Derekane 411
Glass fibre reinforced plastic – lined 1	GRP3	GRP type B / PVC-U (Dekadur) or PVC-C
Glass fibre reinforced plastic – lined 2	GRP4	GRP type B / PP
Glass fibre reinforced plastic – lined 3	GRP4	GRP type B / PVDF
Plastic 1	PP	PPH
Plastic 2	PE	PE100
Special	S	Ti, Ni, PVDF, CS/PTFE, CS/enamel, CS/rubber, high temperature resistance steel, SS 324/other

B. Materials requirements

Pipelines delivered to PCC Rokita must be designed and manufactured in accordance with the following material requirements:

- made of material resistant to the working medium or covered with a suitable lining or protected with a protective coating,
- made of a material whose components, when in contact with the working medium, are not liable to form a dangerous reaction or to become visibly impaired, in particular by accelerated ageing and increased brittleness,
- made of a material resistant to the chemical compounds that cause destruction due to chemical corrosion.
- for pipelines made of carbon steel, a corrosion allowance of at least 1,5 mm must be assumed,
- for pipelines made of carbon steel in contact with dry chlorine gas or liquid chlorine, a corrosion allowance of at least 3 mm must be assumed,
- in the case of pipelines made of alloy steel, the amount of corrosion allowance must be agreed upon with PCC Rokita Technical Services each time.

Where hydraulic pressure testing is harmful or impractical during the operational phase, other tests may be carried out, including **pneumatic tests. Therefore, when designing the pipeline, the allowable pressure PS (design pressure) must be set so that it is at least 20% higher than the maximum operating pressure in the pipeline, which depends on the maximum pressure of the supply source and/or the safety pressure (safety valves, safety plates).**

For industrial, cooling and hydrant water, continuous resistance to chloride content of up to 500 ppm. In addition, the build-up of potentially dangerous electrostatic charges should be prevented or limited or equipped with a discharge system.

C. Design requirements

Pipelines delivered to PCC Rokita must be designed and manufactured in accordance with the following material requirements:

- the design and components must provide maximum access to mounted fittings and instrumentation and to detachable connections and adjustable supports/slings,
- the design and components must ensure safe and complete emptying and cleaning,
- the design and components must ensure correct venting,
- the design of platforms and ladders must ensure safe working conditions for the staff,
- the pipeline support structure must be designed in such a way that it does not exceed the permissible loads on apparatus and equipment stubs,
- (pipelines should be built) in a manner which takes account of material expansion which may be transferred to the adjacent pipeline,
- When designing a pipeline, its service life and fatigue analysis should be determined
- Two types of piping connections are permitted: flanged and welded in accordance with section **1.8.1 - connection methods,**
- the dimensions of the connections are to be matched in accordance with section 1.8.2 - flanged connections, butt joint type B1 should be made according to PN–EN 1092–1,
- the completed pipelines are to be subjected to workmanship tests and a strength and tightness test of the joints,
- have at least two engraved nameplates (at the start(s) and end(s) of the pipeline), made of Corrosion resistant steel 1.4404 (316L), min. 1 mm thick,
- hot/cold insulation (in these cases the plate shall be accessible and visible)
- determination (marking) of measuring points for life tests (e.g. wall thickness); in addition, in the case of insulated pipe, it must be possible to remove the insulation easily and quickly with access to these points (inspection windows).
- construction materials used for the pipelines shall comply with standards harmonised under Directive 2014/68/EU.
- materials should be selected in accordance with the execution stages envisaged and be appropriate to the working medium and the external environment. The selection should be carried out in such a way that the pipeline can withstand both the normal operating conditions and the transient conditions occurring during transportation, testing or pressure testing which accompanies commissioning
- the inspection documents for the piping components specified in the subject standards are to be in accordance with PN-EN 10204 type 3.1 inspection certificate(s),
- metallurgical products for pressure parts of equipment must be delivered with an acceptance certificate in accordance with the construction-technical documentation, or if this is not specified, they must be delivered with a type 3.1 inspection certificate according to PN-EN 10204:2006,
- For pipelines made of stainless steels or corrosion resistant steels, it is recommended to use thicknesses according to ASTM/ASME standards,
- when selecting the material of the bolts, the possibility of corrosion occurring at the junction of two materials with different potentials should be taken into account in order to avoid galvanic corrosion.

For all classes of piping, the nominal diameters are required to be within the range: DN15, DN25, DN32, DN50, DN80, DN100, DN150, DN200, DN250, DN300, DN350, DN400, DN500
The following table summarises the nominal and external diameters and the minimum required thicknesses of the pipelines. For design thicknesses greater than specified, assume a higher class.
Only in justified cases, it is possible to depart from this rule, which must be each time agreed upon with PCC Rokita Technical Services.

D. Steel (pipelines)

The table below contains a list of types of nominal and external diameters as well as the minimum required thickness of pipelines.

Table 1.6.2. Recommended outer diameters for the individual diameters of the range.

Nominal diameter	Outer diameter [mm]	Minimum thickness [mm] Carbon steels and stainless and corrosion-resistant steels.	
		Carbon steel (ISO)	Stainless Steel ASTM/ASME
DN 15	21.3	2.0	2.11
DN 25	33.7	2.6	2.77
DN 32	42.4	2.6	2.77
DN 50	60.3	2.9	2.77
DN 80	88.9	3.2	3.05
DN 100	114.3	3.6	3.05
DN 150	168.3	4.0	3.40
DN 200	219.1	4.5	3.76
DN 250	273.0	5.0	4.19
DN 300	323.9	5.6	4.57
DN 350	355.6	5.6	4.78
DN 400	406.4	6.3	4.78
DN 500	508.0	6.3	5.54

The assumed minimum wall thickness shall be confirmed by analytical calculations for each selected pressure class (fatigue analysis, if required) according to EN 13480-3 or other accepted design standard and additionally a stress analysis for the designed piping system shall be provided. Necessity and scope of performing stress analysis to be agreed upon with PCC Rokita Technical Services.
The applied thickness of the pipeline elements may not be less than the sum of the minimum design thickness and the assumed allowance. If the thickness is less than that indicated in Table 1.6.2, then the thicknesses indicated in this table shall be used.

E. Steel piping for liquid chlorine and dry chlorine gas (Eurochlor requirements)

The following are requirements for minimum wall thicknesses for steel pipelines in contact with liquid chlorine or dry chlorine gas.

The assumed minimum wall thickness should be confirmed by analytical calculations for each selected pressure class (fatigue analysis if required) according to PN - EN 13480-3 or according to another accepted design standard and additionally a stress analysis for the designed piping system should be presented. If the thickness is less than that indicated in Table 1.6.3, the thicknesses indicated in this table shall be used.

Table 1.6.3. Recommended wall thickness for pipelines in contact with chlorine for individual diameters of the range.

Nominal diameter	Minimum thickness [mm]
DN 25	4.5
DN 40	5.0
DN 50	5.2
DN 80	5.5
DN 100	6.0
DN 150	7.1

For pipelines with diameters greater than DN150, the minimum wall thickness must not be less than the sum of:

(a) the design minimum thickness adopted for the highest design pressure, taking into account a PS (design) pressure increased by a minimum of 20% with respect to the maximum working pressure,

(b) an accepted corrosion allowance of 3 mm.

If the sum of this thickness is less than 7 mm, a wall thickness of not less than 8 mm should be used anyway.

F. Plastic

Pipes and fittings made of GRP (glass fibre reinforced) or GRP in addition to the internal lining (PP, PVDF, PVC-C, PVC-U) must be manufactured and supplied according to standards: DIN 16965, DIN 16966, and DIN 16867.

Only epoxy vinyl ester resins Derakane 470 or Derakane 411 using the BPO curing system are permitted for use. It is required that the structural layer and the chemical resistant layer be made of the same resin. The outer layer is to be additionally UV-resistant.

If it is necessary to use a different type of resin, a written derogation must be obtained from the technical specialist. When selecting a replacement for the above-mentioned resins, the parameter HDT must be taken into account, which must be at least 15°C higher than the permissible temperature of the pipe and fittings.

Use spigots with loose flanges (LF). Depending on their diameter, the following material executions are permitted:

a) from DN15 to DN150 – loose flange - swivel plastic
b) from DN200 up – loose flange - swivel steel in zinc plating

For pipes and fittings with thermoplastic inner lining, the lining types listed below must be used, depending on the medium, chemical resistance and maximum permissible temperature:

a) PP – PPH 2222 should be adopted
b) PVC–U – should be adopted in accordance with FM DIN 7748-PVC-U or EP–076–04–28/ISO or Trovidur EN
c) PVC–C – Dekadur C should be adopted
d) PVDF – Symalit SD should be adopted

Minimum thickness of thermoplastic liners for Type B pipes and fittings

- for diameter < DN80 not less than 3.6 mm, except for PP DN25>=2.9 mm and PVDF>=3.0 mm
- for diameter < DN80 not less than 4 mm, except for PVDF>=3.0 mm

Table 1.6.4. Plastic materials.

Type B		Type E	
Diameter	**Manufacturing class**	**Diameter**	**Manufacturing class**
DN25–350	PN16	DN25–150	PN16
DN400–500	PN10	DN200–500	PN10

The permissible operating pressure for GRP pipelines is specified depending on **the operating temperature and the nominal diameter of the pipes in DIN 16 867. The type of fittings should be agreed upon with PCC Rokita Technical Services at the design stage.**

G. Enamelled piping

Enamelled steel pipelines should be manufactured in accordance with DIN 2873/2876 (dimensions and tolerances of enamelled components) and ISO 28721 (quality requirements for enamelled components). Each fitting and pipe used shall be manufactured to parameters not less than PS: –1/+10 barg, TS: –20/+200'C (even if design parameters are lower) and be marked for compliance with the Pressure Equipment Directive 2014/68/EU (PED). The thickness of the enamel layer on steel pipes shall be at least 0.8 mm to 2.2 mm. All fittings and pipelines shall include split flanges DIN 28150. Enamelled pipelines whose original material is carbon steel are required to have an external anticorrosion coating suitable for the conditions in which the pipeline is to operate.
All enamelled pipelines or supplied should be equipped with a screw or clamp for ground connection. Enamelled pipelines should be subject to the following acceptance tests, which are the responsibility of the manufacturer of the enamelled pipelines or fittings:
— acid resistance tests according to DIN EN ISO 28706-2 standards,
— base resistance tests according to DIN EN ISO 28706-4 standards,
— thermal shock resistance tests according to DIN EN ISO 13807 standards,
— boroscopic tests using a test voltage of 20 kV,
— the thickness of the enamel layer according to DIN 2873 standards,
— visual tests of the layer condition carried out before shipping the materials.

The table below is a list of standard sizes of enamelled piping.

Table 1.6.5. Recommended sizes for enamelled piping.

Range dimension	Required minimum wall thickness - mm	Applicable pipeline section lengths - mm
DN 25	3.6	100 – 3000 (every 100 mm)
DN 50	4.0	
DN 80	5.0	
DN 100	5.0	
DN 150	5.0	
DN 200	6.3	
DN 250	6.3	
DN 300	7.1	

At the design stage of enamel-lined pipelines, the condition of not exceeding equivalent stresses at any point in the pipeline should be ensured:
— 50MPa for TS temperature: <120°C
— 30MPa for TS temperature: 120°C – 200°C

H. Teflon

Pipelines delivered to PCC Rokita must be designed and manufactured in accordance with the following material requirements:

- the structural layer is a steel component designed and constructed in accordance with the requirements for steel piping
- the PTFE layer (PFA, FEP, ETFE) is a chemically resistant layer which is not responsible for the structural strength of the pipeline
- a very important element in the choice of teflon-lined pipelines is the correct selection, i.e. taking into account the permissible parameters: minimum pressure (especially when below atmospheric pressure) and maximum pressure, as well as minimum and maximum temperature, due to the limited possibilities of application
- one of the flanges is required to be a moveable (loose) flange
- for potentially explosive utilities, plastomers that have been impregnated with substances that can dissipate electrostatic charges (e.g.: PTFE–AS or PFA–AS)
- for media with a high content of hard particles it is recommended to use plastics with increased mechanical strength, good corrosion and abrasion resistance: (e.g. ETFE)
- pipeline components delivered to PCC Rokita must be pressure tested at the manufacturer's premises before shipment
- for "natural primary" lining a high-voltage (approx. 25 kV) flashover test is required, while for conductive lining an electrical discharge test is required
- each individual component of the pipeline is to be identifiable - in this context it is important that the required material certificates for the components are supplied with the delivery and that the components are marked accordingly, e.g. flange markings etc. to comply with the requirements specified in the pressure directive
- the delivered components must be sealed on all sides with solid plugs (wooden, plastic)
- the components to be supplied shall conform to ISO 9080

I. Required documentation

The documentation provided as part of the delivery is an integral part of the order and its lack or incompleteness will be considered as non-compliance with the requirements of the order. The documentation must be provided in accordance with the guidelines of section 1.13.2 – DOCUMENTATION.

1.6.1 SUPPORTS AND SUSPENSIONS

A. Design requirements

To ensure safe operation, the following considerations must be taken into account when designing and installing pipelines:

- carrying out a static calculation for the case of thermal expansion of the pipeline assuming that the pipeline is 100% filled with working medium at a given pressure, provided that the working medium is not lighter than water,
- performing a strength analysis of the designed routes, taking into account static loads (gravity, temperature, pressure), occasional loads (climatic loads: snow, wind, strength test) and dynamic loads (hydraulic impact, gas pulsation)
- performing dynamic calculations for cases and hydraulic shocks,
- fixed and adjustable supports and/or slings must be selected to ensure the possibility of self-compensation due to thermal expansion, vibrations, and hydraulic shocks,
- load calculations must take into account the conditions of external factors, in particular, snow and wind loads shall be carried out according to the requirements set out in the Polish Standards.

- the weights of the fittings to be installed must be assumed for the calculations; in the case of increased loads, the fittings and accessories must be individually supported/suspended,
- (must be) made of a material whose components are not capable of being clearly weakened, in particular by accelerating ageing, creep and an increase in brittleness,
- suspensions attached to other pipelines are not permitted
- when installing pipelines, use flat insulation spacers selected for the weather and pipeline operating conditions,
- if flat rubber spacers made of NBR are used, the rubber hardness should be 50°–70°Shore A (dimensions in the table below).
- A statement of the forces and moments resulting from the loads acting on the pipelines is to be provided, comparing them with the permissible values for the supports

Table 1.6.6. Recommended clamp sizes

Pipeline diameter DN	**Clamp**		**Rubber spacer**		
	Clamp width B [mm]	Clamp thickness s [mm]	Bolt	Thickness [mm]	Width [mm]
25 – 100	60	6	M12	5	58
150 – 200	70	8	M16		68
250 – 500	80		M20		78

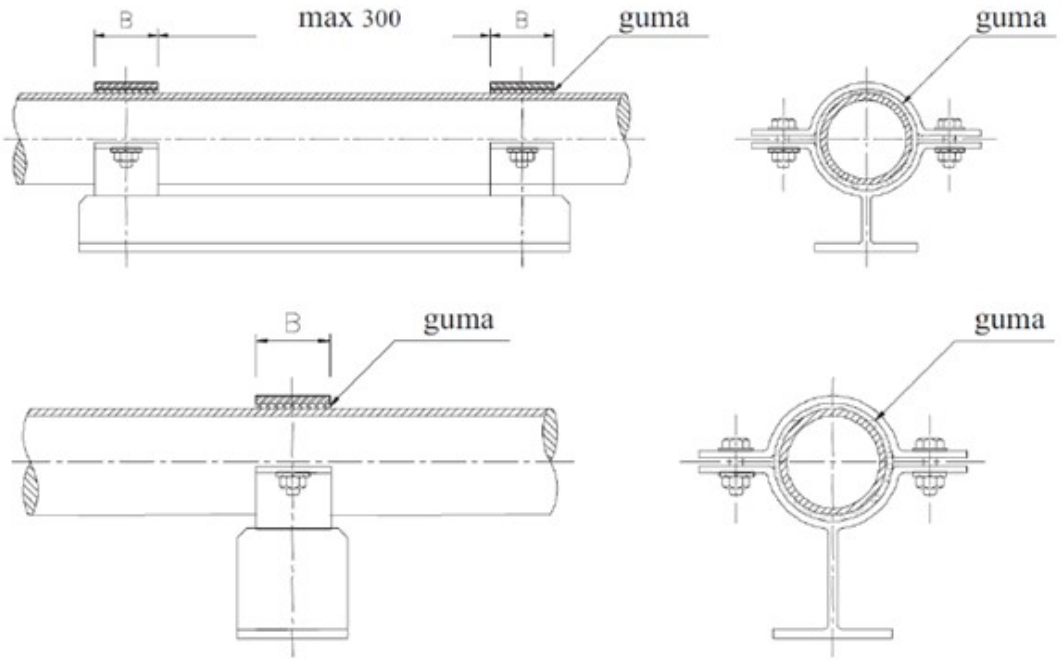

Fig. 1.6.1. Fixed support for pipelines: 1) above DN250, 2) below DN250.

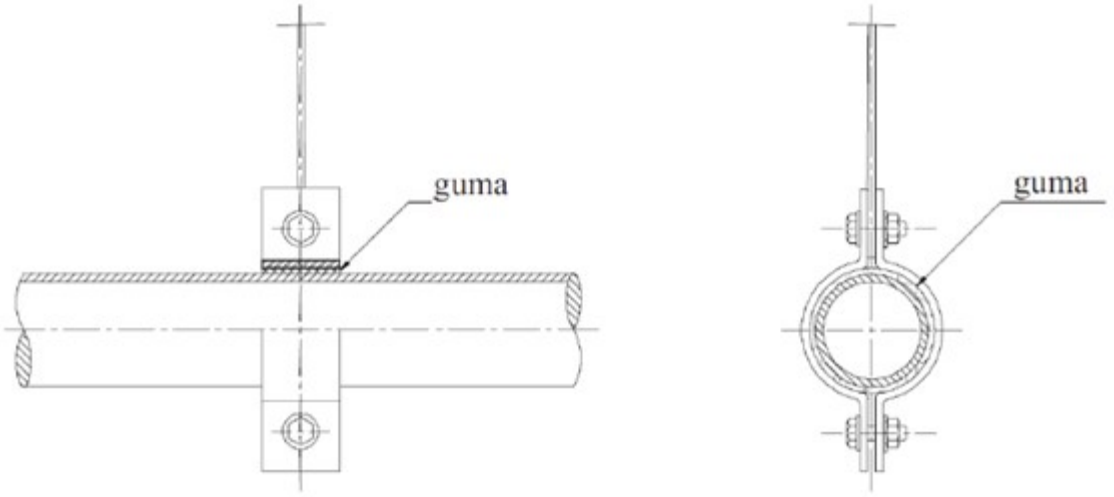

Fig. 1.6.2. Suspension for pipelines.

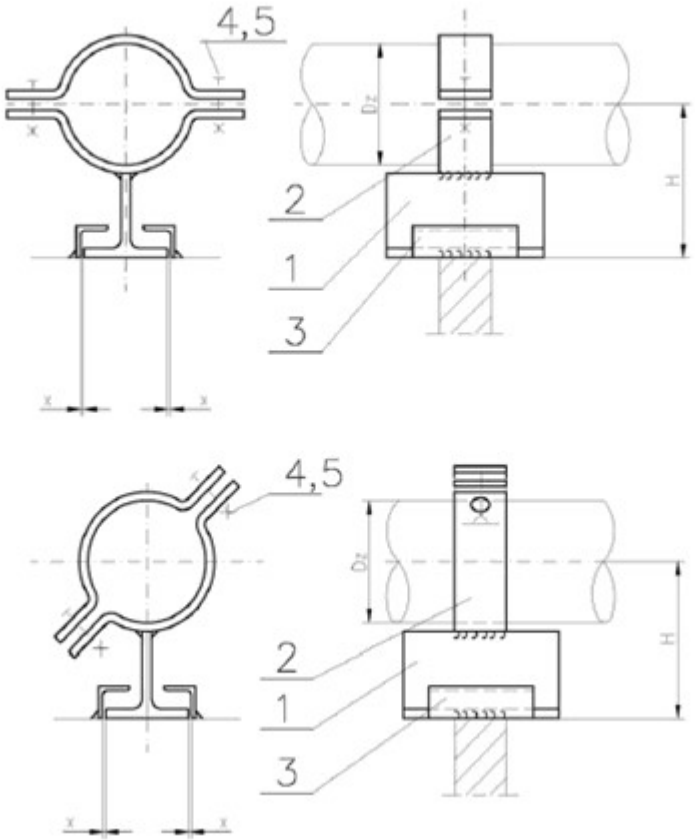

Fig. 1.6.3. T"- type sliding support: 1– T-bar; 2– clamp bent from flat bar; 3– angle bar; 4– bolt; 5– screw.

B. Required documentation

The documentation provided as part of the delivery is an integral part of the order and its lack or incompleteness will be considered as non-compliance with the requirements of the order.

The documentation must be provided in accordance with the guidelines of section 3.12. – DOCUMENTATION.

C. Standards and regulations

- PN-EN 13480 – Metallic industrial piping,
- PN-EN 14276 – Pressure devices in refrigeration systems and heat pumps
- PN-EN ISO 1127 – Stainless steel tubes - Dimensions, tolerances, and conventional masses per unit length,
- PN-ISO 4200 – Plain end steel tubes, welded and seamless - General tables of dimensions and masses per unit length.
- PN-ISO 5252 – Steel tubes.
- PN-EN ISO 6708 – Pipework components.
- PN-EN ISO 3183 – Petroleum and natural gas industries - Steel pipe for pipeline transportation systems.
- PN-EN 10210 – Hot finished steel structural hollow sections.
- PN-EN 10216 – Seamless steel tubes for pressure purposes.
- PN-EN 10217 – Welded steel tubes for pressure purposes.
- PN-EN 10219 – Cold formed welded structural hollow sections of non-alloy and fine grain steels.
- PN-EN 10220 – Seamless and welded steel tubes.
- PN-EN 10224 – Non-alloy steel tubes and fittings for the conveyance of aqueous liquids including water for human consumption.
- PN-EN 10253 – Butt-welding pipe fittings.
- PN-EN 10204 – Metal products -- Types of inspection documents
- PZB.PR.03. I02 Way of marking pipelines, chemical storage places, sampling places as well as chemical containers and storage tanks.

1.7. FITTINGS

The following parameters must be taken into account when selecting barrier fittings:
- fittings type,
- Length of construction,
- type of connection: flanged, welded or threaded
- the highest allowable pressure – PS [bar]
- the highest and lowest allowable temperature – TS [°C],
- medium,
- material,
- drive type,
- sealing type,
- existence of explosion danger zone - EX execution
- additional equipment or special execution,

Fittings shall meet the requirements of the relevant standards relating to the above issues.
The fittings shall be so selected and installed to ensure failure-free operation within the permissible parameters of the installation on which they are to be used, the material shall be subjected to an impact test at the lowest metal temperature TM, and the required value KV shall be 40 J.

A. Material and construction requirements

- the fittings must be made of materials listed in the material standards and finished and thermally treated in accordance with the provisions of the relevant standards and Directive 2014/68/EU
- the materials used for the fittings must have at least the same or greater resistance to the working fluid as the parent material of the pipelines or apparatus to which they are connected
- the materials used for the fittings must be selected on the basis of the strength characteristics of the design pressure-temperature relationship, while satisfying the condition of mechanical strength, allowing safe operation over the full range of specified design temperatures and pressures,
- the materials used for the fittings shall be impact-tested at the lowest temperature of -29°C and the required KV shall be 40 J
- **no material made of aluminium or its derivatives may be used**
- it is preferred that manual valves with diameters above DN100 are equipped with worm gear, the final selection should be discussed with PCC Rokita services,
- manual fittings must be equipped with a position indicator,
- the fittings must be made as dismantlable construction so that they can be reconditioned,
- (the fittings) should have an extended shank to allow for the installation of thermal insulation,
- For fittings to be mounted on apparatus, insulated piping, adequate stem length must be considered.

The following sequence should be followed on process installations:
- flange connections according to section **1.8.2 – flange connections,**
- welded – in accordance with safety or legal requirements and industry standards in the case of hazardous parameters and medium. In addition, welded fittings must be suitably sized for body-to-pipe weldability.
- threaded - each time it must be agreed upon with PCC Rokita technical services

1.7.1 SHUT-OFF FITTINGS

A. Globe valves

Required building length – series 1 according to PN-EN 558-1 (DIN 3202-1 series F1).
Valves with stuffing box seals must be able to adjust the pressure of the sealing packing.
Globe valves for operation with liquid or dry gaseous chlorine must be EUROCHLOR approved in accordance with GEST 17/492. Cancellation of EUROCHLOR exclusively upon approval by the Technical Manager.
Valves designed to regulate the flow must have a design suitable for this purpose (suitable construction of globe and seat).
There shall be a marking on the valves clearly indicating the open/closed position and the direction of flow should be marked permanently.

B. Ball valves

The required installation length for ball valves is:
- for diameters up to DN 50 series 1, according to PN-EN 558-1 (DIN 3202-1 series F1),
- for diameters above DN 50 series 1, according to PN-EN 558-1 (DIN 3202-1 series F1) or recommended series 14, according to PN-EN 558-1 (DIN 3202-1 series F4).

Ball valves must be dismantlable and must have full flow.
<u>It is unacceptable to use a ball valve as a flow regulator except for valves designed for this purpose.</u>

Use valves with the relieved ball for media which, while closed in the dead space of the valve, can cause a significant increase in pressure and its damage.

C. Gate valves

The required installation length for gate valves is:
- for diameters up to DN 150 series 26, according to PN-EN 558-1 (ANSI B16.10, tab.9 unit 4),
- for diameters over DN 150 series 15 according to PN-EN 558-1 (DIN 3202-1 series F5)
- series 14 according to PN-EN 558-1 (DIN 3202-1 series F4)

Gate valves with stuffing box seals must be able to adjust the pressure of the sealing packing.
Gate valves must be dismantlable and must have full flow.
Gate valves are designed to open or close the medium flow. They must not be used to throttle the flow.

D. Knife gate valves

Required installation length – series 20 according to PN-EN 558-1
Knife gate valves are preferred for cutting off loose media (e.g. granules), liquids with suspensions, sludges and sediments, where tightness and the ability to regulate / limit flow are required.
It is required to use LUG-type knife gate valves. The WAFER-type may be used only after the approval of the Technical Services of PCC.
Single direction valves must have the flow direction clearly indicated by an arrow on the body.

E. Butterfly valves

Required installation length – series 20 according to PN-EN 558-1
It is required to use LUG-type butterfly valves. The WAFER-type butterfly valve may be used only after the approval of the Technical Services of PCC. For butterfly valves for hazardous media, butterfly valves with TA-Luft certification (VDI 2440) must be used.

1.7.2 CHECK VALVES

The required installation length for check valves is:
- flanges with globe – series 1 according to PN-EN 558-1 (DIN 3202-1 series F1),
- interflange with plate – series 49 according to PN-EN 558-1 (DIN 3202-3 series F4),

Check valves connecting pipelines made of different materials (e.g. to secure the flow of a medium to a pipeline supplying nitrogen for purging) must be made of materials chemically resistant to both media in the highest parameters occurring at both ends of the valves and the direction of flow must be permanently marked. When selecting a check valve, the opening pressure of the valve must be taken into account.

1.7.3 BREATHING VALVES

Breathing valves protect tanks from rising and/or falling internal pressure. They must be selected to meet the condition of higher throughput than the utility supply, taking into account:
- temperature and atmospheric pressure changes,
- filling or emptying of the tank,
- rapid heating or cooling of the tank content,
- increase in pressure as a result of an external fire,

- inert gas supply (mainly nitrogen),
- properties of the working medium during normal operation and in an emergency,
- manufacturing of materials chemically resistant to all media in the highest parameters found in the tank,
- the flow direction should be permanently marked on the valve body.
- type, kind, and diameter of flange connection in accordance with **section 1.8.2 - flange connections**,
- breather valves for flammable/explosive media tanks should be selected with integrated flame arresters,
- for media solidifying or polymerizing at low temperatures, breather valves should be specified with (electrical) heating.

For breather valves protecting non-pressurised or low-pressure tanks, the guidelines of EN ISO 28300 should be followed.

1.7.4 SAFETY VALVES

Safety valves and plates (pressure inserts) protect equipment and apparatus against an excessive increase in internal pressure. They must be selected in order to protect the equipment against an excessive increase in pressure above the permissible pressure. When selecting a safety device, account shall be taken of:

- physical and chemical properties of the media
- changes in temperature and back pressure behind the safety valve,
- filling of the tank,
- rapid heating of the tank content,
- increase in pressure as a result of an external fire,
- inert gas supply (mainly nitrogen),
- properties of the working medium during normal operation and in an emergency,
- material design for the highest performance in the tank.

SYR membrane safety valves are not allowed.

A. Selection of overpressure protection devices

In the selection of assembly and operation of safety valves and safety plates (pressure inserts) the following should be followed: WUDT guidelines or requirements of the PN-EN ISO 4126 series of standards concerning safety devices against excessive pressure. API 520 standards and PN- EN 13136 may be used, subject to prior agreement with PCC Rokita Technical Services. Regardless of the adopted/applied standard or conditions, the requirements of the Pressure Equipment Directive 2014/68/EU must be met at the same time.
The rule of thumb is to make the line supplying the working medium to the safety valve as short as possible so that the pressure loss in this line (at maximum [flow]) does not exceed 3% of the pressure difference between the pressure at the beginning of the valve opening and the foreign counter-pressure if any. In addition, these lines should be designed to compensate for thermal elongations, and the fixing of the safety valve and lines should take into account the static and dynamic effects of the working medium.
When selecting and calculating safety devices (safety valves and pressure inserts), the expansion condition must also be taken into account. Furthermore, in the case of heat exchanger protection, the case of tube/plate breakage must be additionally considered.

B. Calculation and selection

The selection and check calculations for safety devices (safety valves, safety plates,) include:
- the place of installation and the function of the protection devices,
- calculation rules for protection devices (preferably according to WUDT or PN - EN ISO 4126, (after obtaining approval also API 510 and PN-EN 13136) - regardless of the adopted/applied standard or conditions, the requirements of the Pressure Equipment Directive 2014/68/EU must be met at the same time.
- calculation of the required protection devices capacity for the target system,
- calculation of the required diameter and cross-sectional area of the inflow channel and the maximum pressure drop at the valve inlet,
- calculation of the effect of back-pressure downstream of the protection device on the capacity of the protection system,
- Checking the capacity of the protection device with the conclusion that the capacity of the selected device is higher than the required capacity,
- data sheet with project assumptions/data sheet.

C. Design requirements

Valves supplied to PCC Rokita:
– they must be dismantlable,
– have a rating plate (factory/identification),
–must have flange connections in accordance with **section 1.8.2 - flanged connections**, threaded or welded connections are acceptable upon prior approval of PCC Rokita Technical Services.

1.7.5 SIGHT GLASSES

Required building length – sight glasses series 1 according to PN-EN 558–1 **(**DIN 3202 – 1 series F1).
The design of the sight glasses must allow for the removal and replacement of seals and lenses,
Preferred flat glass material for general purpose sight glasses - borosilicate glass.
The glass must be resistant and of a class equal to or higher than the working medium.

1.7.6 FILTRES (FITTINGS)

Required building length – series 1 according to PN-EN 558-1 (DIN 3202-1 series F1).
The filters must be dismantlable and should be quickly cleaned without removing the filter, preferably type Y. The mesh size of the filter insert and pressure drop must be agreed upon at the design stage with PCC Rokita Technical Services.
The medium flow direction should be permanently marked on the valve body.

A. Preferred fitting manufacturers

Fittings	Type	Selected suppliers
Shut-off	Ball valves	Kingdom
		Andrex
		Chemitex Zetkama

		Efar
		FLOWSERVE
		XOMOX
		PEKOS
	Cone taps	Az–Armaturen
		Xomox
	Plastic valves	GF
		Safi
		Marley
	Gate valves	Zetkama
		Arma–Pol
		EBRO
		Wakmet
		Małapanew
		Hawle
	Knife gate valves	EBRO
		Larox
Sight glasses	Sight glasses	Andrex
		Kluge
		Chemitex
		ATOMAC – FLOWSERVE
		Xomox
		Az–Armaturen
Check Valves	Flange and inter-flange	Zetkama
		EBRO
		Andrex
		Wakmet
		XOMOX
		SISTO
		ATOMAC–FLOWSERWE
Protecting	Safety valves	Armak
		Leser
		LDM
		Chemar
		ARI–Armaturen
		Richter Chemie
	Safety heads/plates	Fike
		REMBE GmbH
		Bs&B
	Breather valves	Protego
		RMG
Self-cleaning valves		OMC Envag
		ChemTech
		Eaton
Strainers	Diagonal	Andrex
		Sferaco

B. Required documentation

The documentation provided as part of the delivery is an integral part of the order and its lack or incompleteness will be considered as non-compliance with the requirements of the order. The documentation must be provided in accordance with the guidelines of section 3.13. – DOCUMENTATION.

1.7.7 COMPENSATORS

In justified cases, after obtaining the consent of the PCC Rokita Technical Services, it is allowed to use compensators.

The preferred solution is flange compensators (at least one rotary flange) in the drilling class according to PN. Weld-in compensators can be used only after additional agreement with PCC Rokita Technical Services.

Compensators provide four types of displacements
a) axial displacement (compression, extension)
b) angular displacement
c) lateral displacement
d) torsional displacement

Depending on the type of material from which the bellows is made, compensators are divided into
a) steel compensators
b) rubber compensators with reinforcement made of rubber reinforced with a synthetic or steel braid
c) Teflon compensators
d) fabric compensators made of glass fabric, which can additionally be covered with a layer of e.g. silicone or Teflon

The appropriate type and type of compensator should be selected depending on the operating parameters, taking into account in particular:
a) dimension of the diameter DN or in the case of a rectangular/square compensator, its sides A and B
b) installation length dimension [mm]
c) type of medium (chemical name, pH and other requirements affect the selection - e.g. solids, abrasiveness, etc.)
d) living material
e) flow rate
f) building direction (vertical, horizontal, diagonal)
g) working pressures
h) allowable pressure PS
i) operating temperature
j) permissible temperature TS
k) installation location and ambient temperature
l) occurrence of pressure pulsations
m) minimum number of work cycles
n) type and scope of shipments
- axial [+/- mm]

- transverse [+/- mm]
- angular [+/-°]

o) material and type of corrosion protection of the connection

If the PCC Rokita Technical Service accepts the compensator for welding, specify the size of the connection to be welded - external diameter and thickness of the pipeline)

In addition, the use of additional equipment should be considered, such as: limiters, protective hoods, fireproof covers, inner / outer protective sleeves, guide sleeves, securing rings in the case of vacuum operation.

Metal expansion joints should be made in accordance with PN-EN 14917 - Metal expansion joints for pressure applications.

1.8. CONNECTIONS

1.8.1 Connection methods

PCC Rokita uses two types of connections:
detachable flange connections:
— on metal pipelines,
— on plastic pipelines,
— when connecting devices and apparatus,
(b) inseparable:
— welded on metal pipelines,
— welded, sealed, laminated, and glued on plastic pipelines
c) other (only upon agreement with the customer):
— threaded, (drinking water)
— soldered

1.8.2 FLANGE

Acceptable types of flanges used:
— type 01 - flat flange with butt joint type B1
— type 11 - welding neck flange with butt joint type B1,
— type 05 - flat flange with butt joint type B1
— type 02 - loose flange with flat ring for welding type 32, with butt joint type B1.

Due to the operating pressures, suitably matched flanges are used: PN10, PN16, PN25 and PN40 according to the table below:

Table 1.8.1. Comparison of flange twistability in given pressure classes.

<table>
<tr><th rowspan="2">Diameter</th><th colspan="4">Flange type of working pressure</th></tr>
<tr><td>PN10</td><td>PN16</td><td>PN25</td><td>PN40</td></tr>
<tr><td>DN25</td><td colspan="4" rowspan="4">PN40</td></tr>
<tr><td>DN32</td></tr>
<tr><td>DN50</td></tr>
<tr><td>DN80</td></tr>
<tr><td>DN100</td><td rowspan="2">PN16</td><td rowspan="6">PN16</td><td colspan="2" rowspan="2">PN40</td></tr>
<tr><td>DN150</td></tr>
<tr><td>DN200</td><td rowspan="5">PN10</td><td rowspan="5">PN25</td></tr>
<tr><td>DN250</td></tr>
<tr><td>DN300</td></tr>
<tr><td>DN350</td></tr>
<tr><td>DN400</td></tr>
</table>

The surfaces of the butt joints shall be parallel to each other, and the permissible deviation from perpendicularity to the axis of the pipeline measured at the external diameter of the butt joint shall not exceed 0.01 of that diameter, but not more than 2 mm.
The fasteners (flanges, bolts, nuts, washers, gaskets, and alignment sleeves) shall comply with the technical documentation and the material standards.

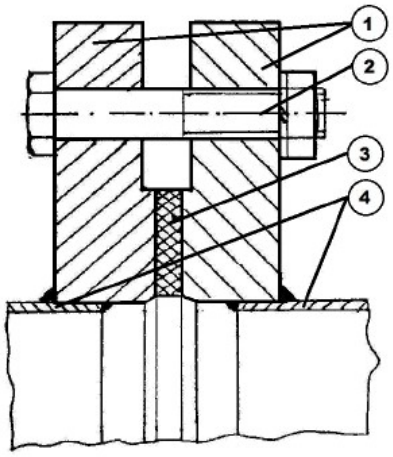

Fig. 1.8.1. Flange connection type 01 B-1: 1 – flange; 2 – screw, nut, washer; 3 – gasket; 4 – pipe.

Tightening of bolts in a flange-to-bolt joint should be carried out using a torque spanner or other methods with controlled thrust in accordance with the calculated torque for the flange joint in question.

The calculations for flanged joints on pipelines should be carried out according to WUDT-UC-WO-O/19 - Strength calculations for flange and bolt connections or according to EN 1591–1 – Design rules for gasketed circular flange connections. Regardless of the adopted/applied standard or conditions, the requirements of the Pressure Equipment Directive 2014/68/EU must be met at the same time.

For machinery and equipment, flange connection calculations are carried out according to the design rules for the machinery or equipment in question.

Flange connections for hazardous media must have splash guards made of material that is resistant to the medium and the weather. It does not apply to insulated pipelines and gas pipelines.

The size of the thread protruding beyond the nut should be between 2-3 turns.

Bolt threads must be protected against corrosion with lubricants.
In justified cases (upon prior agreement with PCC Rokita Technical Services), plastic protective caps should be used in areas particularly exposed to corrosion.

The selection of screws should take into account, among other things:

- the range and variation of temperatures in which the bolted connection will operate (applies to both low and high temperatures - embrittlement at low temperatures,
- creep at higher temperatures),
- the range and variability of pressures and temperatures (cyclicity),
- hydraulic shocks,
- loads due to thermal expansion of pipelines, apparatus, and equipment,
- other, resulting from the specifics of the connection to be designed/manufactured.

A. Materials requirements

- the screw material should be homogeneous without surface defects;
- screws should be free of grease contamination which may indicate previous use;
- mechanical and chemical properties shall comply with the relevant directives and standards, and mechanical properties Rm and Re (the yield point is particularly important),
- should provide a secure and safe connection,
- cold forged fasteners shall be delivered in the tempered or heat-treated condition;
- the materials used for screws and nuts shall be impact-tested at the lowest temperature of metal TM and the required KV shall be 40 J
- each batch of screws should be marked and supplied with a type 3.1 inspection certificate according to PN-EN 10204
- the screws supplied must be manufactured in accordance with PN-EN ISO 4014;
- screws without heads must be marked at one end in such a way that they can be identified on the certificates of origin provided,
- screws with hexagon heads and nuts shall be marked with the property class and the manufacturer's identification mark,
- the gaskets used must be resistant to the medium and have a mechanical strength higher than that calculated for the flange connection in question,
- the material is to be selected in accordance with **section 3.9.1 - Gaskets for flange connections**.

B. Testing of screw properties

Screws with hexagon heads should be tested according to PN-EN ISO 898 – 1. The number of screws used for the test should meet the requirements of PN - EN ISO 3269
- nuts should be tested according to PN-EN ISO 898 – 2 item 8. The number of nuts used for the test should meet the requirements of PN - EN ISO 3269

— impact test with a prescribed value of KV 40 J

C. Flange connections of plastic pipelines

Three types of flange connections are permitted when connecting plastic and plastic-to-steel pipelines as shown in the figure below.

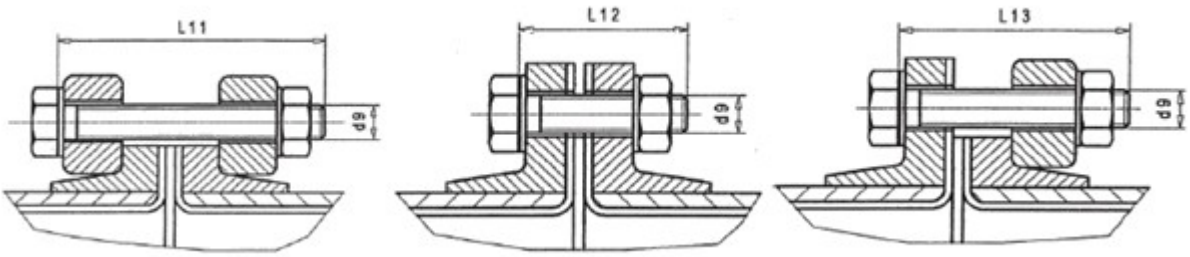

Fig. 1.8.2. Type of flange connections. Seen from the right: loose flange – fixed flange (FL–FF), fixed flange – fixed flange (FF–FF) and loose flange – loose flange (FL–FL).

In GRP flange connections the following must always be used:
— washers between the laminate and the screw nut,
— loose flanges made of GRP - for pipelines with diameters DN <200
— loose flanges made of steel - for pipelines with diameters DN ≥200

The tightening torques valid for flange connections made of GRP using flat gaskets made of elastomers with a shore hardness of approx. 60º are shown in the table below. If elastomer profile seals are used, the specified torque values can be reduced by approx. 20%. Screws should be tightened evenly "crosswise" using a torque spanner. Avoid exceeding the specified torque values.

Table 1.8.2. Recommended screw tightening torques depending on the nominal diameter of the pipeline.

Rated diameter [DN]	Screw tightening torque [Nm]
25	15
50	25
80	25
100	25
150	50
200	50
250	50
300	60
400	80
500	80

1.8.3 WELDED (connections)

Welded connections require the presentation of documentation in accordance with PN-EN 13480 and CE marking, in particular:
– Welding Procedure Specification (WPS)
– Welding Procedure Qualification Record (WPQR)
– welding work inspection log (welding progress check)
– certificates of materials used (materials and welding wires)
– reports on the quality testing of the connectors: 100% VT, 50% MT and HT, 25% RT (deviations to be agreed upon with the customer)

The standards set out below must be taken into account when designing, manufacturing, and accepting

A. Quality requirements for welding

— PN-EN ISO 3834 - Polish version - Quality requirements for fusion welding of metallic materials.
— PN-EN ISO 9001– Polish version - Quality management systems
— PN – ISO 10005 – Polish version – Quality management systems
— PN-EN 18001 – Polish version – Occupational health and safety management systems

B. Qualification of welding procedures

— PN-EN ISO 15607 – Polish version – Specification and qualification of welding procedures for metallic materials
— PN-EN ISO 15609 – Polish version – Specification and qualification of welding procedures for metallic materials — Welding procedure specification
— PN-EN ISO 15610 – Polish version – Specification and qualification of welding procedures for metallic materials
— PN-EN ISO 15611 – Polish version – Specification and qualification of welding procedures for metallic materials
— PN-EN ISO 15612 – Polish version – Specification and qualification of welding procedures for metallic materials
— PN-EN ISO 15614 – Polish version – Specification and qualification of welding procedures for metallic materials - Welding procedure test

C. Materials requirements

— PN-EN 1561 – Polish version - Founding - Grey cast iron
— PN-EN 1563 – Polish version - Founding - Spheroidal graphite cast irons
— PN-ISO 3755 – Polish version - Cast carbon steels for general engineering purposes
— PN-EN 10021 – Polish version - General technical delivery conditions for steel products
— PN-EN 10024 – Polish version - Hot rolled taper flange I sections
— PN-EN 10027 – Polish version – Designation systems for steels
— PN-EN 10028 – Polish version – Flat products made of steels for pressure purposes
— PN-EN 10034 – Polish version - Structural steel I and H sections

- PN-EN 10080 – Polish version - Steel for the reinforcement of concrete - Weldable reinforcing steel
- PN-EN 10088 – Polish version – Corrosion resistant stainless steel
- PN-EN 10149 – English version - Hot-rolled flat products made of high yield strength steels for cold forming
- PN-EN 10204 – Polish version - Metallic products
- PN-EN 10219 – Polish version – Cold formed welded structural hollow sections of non-alloy and fine grain steels
- PN-EN 10222 – Polish version – Steel forgings for pressure purposes

D. Design and execution of welded structures

- PN-EN 1090 – Polish version - Execution of steel structures and aluminium structures
- PN-EN 13480 – Polish version – Metallic industrial piping

E. Guidelines for welding metals and alloys

- EN 1011 - English version - Welding - Recommendations for welding of metallic materials

F. Non-destructive testing of welded joints

- PN-EN ISO 9712 - Polish version - Non-destructive testing - Qualification and certification of NDT personnel
- PN-EN 583 - Polish version - Non-destructive testing - Ultrasonic examination
- EN ISO 3452 - English version - Non-destructive testing - Penetrant testing
- EN ISO 5579 - English version - Non-destructive testing — Radiographic testing of metallic materials using film and X- or gamma rays
- PN-EN ISO 5817 - Welding — Fusion-welded joints in steel, nickel, titanium, and their alloys (beam welding excluded)

1.9. SEALING

1.9.1 GASKETS FOR FLANGE CONNECTIONS

When selecting/designing static sealing for a particular installation, its selection is influenced by:
- Temperature and pressure of the medium in the sealing system,
- Chemical nature of the medium,
- Mechanical load impacting the gasket,
- Type of connection used.

Rest sealing of the following materials can be used:
- Elastomers,
- Fibrous materials,
- Other materials including expanded graphite, mica (vermiculite) and PTFE,
- Metal materials.

Gasket types:
- Soft (non-metal),
- Metal - soft material,
- Metal

For GRP pipelines, the use of profiled gaskets is recommended. It is a flanged ring with a metal insert. Due to the spherical form of the rubber part, even Low-pressure applied to the flange results in good sealing.

Fig. 1.9.1 Profile gasket cross-section.

When selecting rest sealing the designer should always specify, at the documentation stage, the maximum values of the gasket material design factors σ_m, σ_r, **b,** required for the correct and safe operation of the flange-screw joint.
The selection of a particular manufacturer and type of seal should be made during the construction phase based on the maximum values of the calculated coefficients σ_m, σ_r, **b** and be agreed upon with the GTP department Technical Specialist assigned to the task.
The selection of a specific sealing type must be agreed upon with PCC Rokita Technical Services and the user of the installation. When selecting rest sealing it is required to determine the maximum values of the gasket material design factors required by the design algorithm.
Seal performance values of a given manufacturer according to standards: ASME, AD–2000 Merkblatt and WUDT–UC–WO–O/19. Preferred according to WUDT–UC–WO–O/19.

Table 1.9.1. Overview of preferred gaskets for sample media.

GASKETS TABLE	
Gasket material	**Application**
Graphite	Steam; Steam condensate; Propylene oxide; Ethylene oxide; Reaction mass - raw alkali polyether; Isocyanates; MDI; KOH; Thermal Oil; MPA; Phthalic acid anhydride; MRS; liquid sulphur; Soda lye over 60%; Oil heat carrier; Hydrochloride (T>150°C); Heating salts; Oxyalkylates
EPDM	Catholyte; Soda lye below 35%; Alphacellulose solution; Anolyte; Nitrogen; Bisulfite; Wet chlorine; Hydrochloric acid 7;5%; 15%; 30%; 32%-37% Chlorine condensates; Chlorine exhausts; Sodium hypochlorite; Air; Calcium chloride solution; Sodium sulphide; Brine (crude; pure; prepared; ultra pure; dechlorinated; acidified; used); Demi(neralized) water; Hydrogen; cooling water; acidic water; soda ash solution
FKM	Sulfuric acid; Hydrochloric acid

PTFE	Propylene oxide; Propylene; Chlorohydrin; Dichloropropane; Lime milk; Lime effluent; Polyesters; Polyurethane systems; Acrylonitrile; TDI; Orto-TDA; Phosphorus trichloride; Phosphorus oxychloride; Phosphorus; Isopropylphenol; Phenol; Roflex (products); Roflam (products); Rostabil (products); Oxygen; Oskardisperser; Disperser R; Sodium lye 30%; Sulfuric acid; Rokamina K30 K40; ABS acid;
ePTFE	Sodium lye 32% - 50%; Process condensate; Sodium hypochlorite; Chlorobenzene; Dichlorobenzene; Hydrochloric acid 32%-37%; Hydrogen chloride; Benzene
Aramid/ NBR	Ammonia; Dry chlorine and liquid chlorine in some applications (in equipment deliveries from abroad); Glycol; Hydrogen condensate; Hydrogen; Chlorobenzene; Dichlorobenzenes; nitrogen; liquid chlorine; chlorine gas dry; chlorine exhausts dry; measuring air; process air; cooling water; industrial water; rokryl, rokryl amines; styrene; sulforokanol; rokanol; glycol solution
Envelope gasket - graphite/aramid	Enamelled connections

The type of gasket should be agreed upon with PCC Rokita Technical Services

1.9.2 ROPES

When selecting/designing packing for a particular unit in the installation, consideration must be given to:
- Temperature and pressure of the medium,
- Chemical resistance of rope,
- Mechanical load impacting the packing.

Possibility to use braided packing from the following materials:
- Natural fibres yarn
- Synthetic fibre yarns,
- Aramid fibre yarns,
- Carbon fibre yarns,
- Graphite fibre yarns,
- PTFE fibre yarns,
- Yarn of PTFE multi-directional fibres (GFO)

Types of braided packing used:
- weatherproofed,
- interleaved,
- dry,
- filled,
- filled with reinforcement.

Possibility of using braided packing:
dynamic:

— pumps stuffing box,
— fittings stuffing box,
— agitators stuffing box,

static:
— sealing of manholes,
— sealing of tanks and vessels,
— sealing of flaps.

A. Standards and regulations

— PN-EN 1514 – Flanges and their joints - Dimensions of gaskets for PN-designated flanges.
— PN-EN 12560 – Flanges and their joints - Gaskets for Class-designated flanges.

1.10. LUBRICANTS

At PCC Rokita S.A., lubricants with only certain properties and uses are allowed.
The following list contains the specification of the required properties for individual groups of the most commonly used lubricants and penetrators:

1. Multi-purpose aerosol grease
— It must have very good penetration and lubricating properties,
— It should not interact with metals and their alloys, plastics, rubber, and varnished surfaces,
— It should have the ability to displace moisture from electrical and ignition systems
— It should have the ability to loosen rusted threaded connections.
— Minimum thermal resistance from -25°C to + 150°C,

2. Degreaser:
— It must not leave residue after evaporation,
— It must not be corrosive to metals,
— It cannot damage plastics,
— It must have high dielectric resistance,
— It must have a high flash point.

3. Dry spray grease
— It must be resistant to chemicals, oils, and water
— Operating temperature from -50°C to + 200°C
— It must have a short evaporation time of the liquid substance

4. Anti-slip product for drive belts and tapes
— It must have a short evaporation time of the liquid substance
— It should reduce squeaks and improve grip
— It must not have a negative effect on rubber, skin, or canvas.

5. Fastener loosening spray
— It should be characterised by high efficiency in loosening the fasteners,
— It must have very good penetration properties,
— It should be characterised by a high speed of action.

6. Anti-seize product
— high temperature >1 000°C,
— It must be able to be used in a highly aggressive chemical environment,
— Preferably in paste form.

7. Agent for cleaning and degreasing electrical equipment
— It should allow removal of oxide and sulphur layers,
— It should remove explosive deposits and soot,
— It should effectively remove resinous soiling,

- It should enable the reduction of voltage losses,
- It must not be corrosive,
- It must not be conductive.
- It must evaporate completely within several minutes. It must not leave residue after evaporation,
- The product must be neutral towards metals, plastics, rubber and paints, varnishes and electro-insulating coatings

The product must not be classified as hazardous to humans or the environment. Indicate in which packaging it is to be delivered. If these will be refill packs, the supplies must also include applicators.

1.11. ANTICORROSION

1.11.1 PAINTING SYSTEMS

The corrosion protection system should be selected according to PN-EN ISO 12944-2, while the method of protecting steel surfaces according to the corrosion category table (Table below) should be adopted for a durability period of at least 15 years in class H (high).

Table 1.11.1. Corrosivity categories (acc. to PN EN ISO 12944–2).

Corrosivity category		Examples of industry environments at PCC	
		Inside	Outside
C4	High	Chemical plant	Industrial area
C5	Very high	Areas with almost continuous condensation and heavy pollution.	Industrial area with high humidity and aggressive atmosphere.
CX	Extreme		

The colour should be selected in accordance with the PZB.PR.03.O02 Instructions for Marking Pipelines and Tanks and the table below.

Table 1.11.2. Selection of paint colours due to the medium.

Colour according to RAL		Purpose
9003	white	– degassing lines, neutralisers, tanks, and pipelines
9004	black	– high pressure nitrogen lines, tanks, and pipelines
1023	yellow	– low and medium pressure nitrogen lines, tanks, and pipelines – safety constructions, railings, balustrades, toeboards etc. – hoists and hoisting equipment
9006	grey	– steam and condensate lines, tanks, and pipelines
6017	green	– water lines (industrial, cooling), tanks and pipelines
4008	violet	– hazardous media lines (lyes, acids), tanks and pipelines
8003	brown	– oil and flammable media lines, tanks, and pipelines
3020	red	– hydrogen lines, tanks, and pipelines – fire protection installations, tanks, and pipelines
5012	sky blue	– air lines, tanks, and pipelines
5002	– blue	– devices: pumps, motors – supporting structures, flyovers, posts, etc
7035	grey	– devices: fans, compressors, conveyors, gears

1.11.2 SURFACE PREPARATION

Steel surfaces should be dry, clean and free of grease, oil, moisture, dust and other impurities in accordance with the requirements of PN-EN ISO 12944-4; PN-EN ISO 8501-1, When cleaning metallised steel, special care must be taken not to remove the layer of undamaged metal during cleaning. Surfaces should be prepared in accordance with the recommendations of the painting kit manufacturer given in the technical data sheets of the materials used.
Surfaces should be prepared in accordance with class Sa 2½ or St 3, if abrasive blasting methods cannot be used (in accordance with PN-EN ISO 8501-1),
Before cleaning (by abrasive blasting method, as well as by hand tools and mechanical tools), all thick rust layers must be removed (by peeling). Visible oil, grease and dust should also be removed.
Wastes, e.g. used abrasive, rust, old coatings, should be collected and handled in accordance with relevant national legislation and prior arrangements with the parties concerned.

1.11.3 GALVANISED FLAME

Anti-corrosion coatings made using the flame galvanising process shall be characterised by the absence of ripples, blisters, rough areas, and sharp edges. A properly executed coating is also required to maintain the continuity of the coating.
It is allowed to have "white corrosion" on galvanised surfaces (mainly zinc oxide and hydroxide), but special attention should be paid to ensure that the minimum thickness of the coating is observed. "White rust" must be removed if it is present on surfaces to which additional coatings will be applied.
Coating thickness testing shall be performed by one of the methods listed in Attachment D to PN EN ISO 1461:2011.
The surfaces to be tested shall be approximately in the centre of the product (in the case of long products, the surfaces to be tested shall not be less than 100 mm from the edge of the product). The number of reference surfaces is dependent on the size of the individual test articles in the control sample. The number of samples shall be determined in accordance with Table 1.11.

Table 1.11.3. Number of reference surfaces required for the test.

Category	Size of the significantly important area	Number of reference surfaces to be tested on the product
a	> 2 m2	≥3
b	> 100 cm2 to ≤ 2 m2	≥1
c	> 10 cm2 to ≤ 100 cm2	1
d	≤ 10 cm2	1 per each N of products

Table 1.11.4. Minimum coating thickness and mass on specimens that have not been centrifuged.

Material	Local thickness of coating (minimum value) [µm]	Local weight of coating (minimum value) [g/m2]	Average thickness of coating (minimum value) [µm]	Average weight of coating (minimum value) [g/m2]
Steel > 6 mm	70	505	85	610
Steel > 3 do ≤ 6 mm	55	395	70	505
Steel ≥ 1,5 do ≤ 3 mm	45	325	55	395
Steel < 1,5 mm	35	250	45	325
Cast iron ≥ 6 mm	70	505	80	575
Cast iron < 6 mm	60	430	70	505

Table 1.11.5. Minimum coating thickness and weight on specimens that have not been centrifuged.

Material	Local thickness of coating (minimum value) [µm]	Local weight of coating (minimum value) [g/m2]	Average thickness of coating (minimum value) [µm]	Average weight of coating (minimum value) [g/m2]
Threaded				
> 6 mm	40	285	50	360
≤ 6 mm	20	145	25	180
Other products (including casts)				
> 3 mm	45	325	55	395
≤ 3 mm	35	250	45	325

Exact guidelines for the place of measurement and the number of reference surfaces can be found in PN-EN ISO 1461:2011.
It is permissible to repair an uncoated surface, but the repaired area should not exceed 0.5% of the total surface area of the component. A single uncoated area should not exceed 10 cm2. The repair should be carried out by thermal spraying with zinc or by using paint with a gh zinc content. Coatings with zinc flakes, zinc pastes and zinc-based solders are also acceptable. Before carrying out the repair, remove all contaminants and prepare the surface to ensure proper adhesion. The thickness of the coating over the area to be repaired shall be at least 100 µm (unless agreed otherwise), the coating applied shall provide adequate cathodic protection of the product surface).

1.11.4 ZINC PLATING

The thickness of the zinc coating applied galvanically shall be 25 µm. Zinc plating is recommended for products for which the appearance of ripples or bosses is not desired (e.g. screws, nuts).

1.12. INSULATION

Thermal insulation can be divided into heat insulation and cold insulation.
Pipeline insulation is used to avoid heat loss, to prevent condensation on pipelines (water vapour condensation), and for safety reasons (direct contact with high temperature pipelines).
Properties of insulation materials to look out for when making a selection:
- thermal conductivity coefficient – λ,
- porosity – %,
- mechanical resistance,
- water absorption,
- flammability,
- water vapour diffusion coefficient – µ,

Thermal insulation should be used:
- on the entire surface of straight sections, fittings, and pipe joints,
- as far as technically feasible, over all or part of the surface of heat exchange or heat storage equipment.

Thermal insulation shall be applied, as far as technically feasible, to all or part of the surface of fittings installed on the said pipes. Thermal insulation shall not be used on the surface of safety valves, pump motors and control valve actuators.

1.12.1 HEAT INSULATION

Use mineral wool for pipelines insulation

Requirements for the heat insulation used:
- Thermal resistance: >400°C
- Volumetric density: >80kg/m3
- Thermal conductivity tolerance: +0 / –10 %
- Flammability: >B2 (acc. to DIN 4102)
- Braid mesh: hexagonal, wire >0.7mm
- Screen foil: 0.08mm aluminium foil for electrically heated pipelines.

Table No. 1.12.1 Minimum thicknesses of heat insulation depending on the pipeline diameter and operating temperature.

Nominal diameter	Media temperature ranges in °C:			
	0–100	100–200	200–300	>300
	Insulation thickness in mm			
DN15	50	50	50	50
DN20	50	50	50	50
DN25	50	50	50	50
DN32	50	50	50	50
DN40	50	50	50	50
DN50	50	50	50	50
DN80	50	50	50	70
DN100	50	50	70	70
DN150	70	70	70	70
DN200	70	70	70	70
DN250	80	80	80	80
DN300	80	80	80	100
DN400	80	80	100	100
DN500	80	100	100	100
DN600	100	100	100	100
>DN600	100	100	100	100
Tanks <1000	50	50	70	80
Tanks <1000	50	70	100	120

Table 1.12.2 The required thermal conductivity for thermal insulation, measured at a given temperature.

	100°C	150°C	200°C	250°C	300°C	350°C
W/mK (mats)	0,052–0,047	0,061–0,055	0,074–0,067	0,088–0,080	0,106–0,096	0,126–0,114
W/mK (shales)	0,048–0,044	0,057–0,051	0,068–0,061	0,081–0,073	0,097–0,087	

1.12.2 COLD INSULATION

Insulation material to be used for insulating pipelines - foamed plastics (polyurethane foam, polyethylene foam, foam based on synthetic rubber). In the case of devices for flammable media, foamed cellular glass should be used as insulating material.

Requirements for the cold insulation used:
- Water vapour diffusion coefficient: > 7000
- Thermal conductivity tolerance: +0 / –10 %
- Flammability: >B2 (acc. to DIN 4102)
- Application temperature range (medium) from – 50°C to +110°C

Table 1.12.3. Minimum thicknesses of cold insulation depend on the pipeline diameter.

Nominal diameter	Temperature range in °C			
	+30 -4	-5 -18	-19 -32	-33 -46
	Insulation thickness in [mm]			
DN15	25	40	40	50
DN25	30	35	40	45
DN32	30	35	40	45
DN50	30	35	45	50
DN80	30	40	45	55
DN100	30	40	50	60
DN150	30	45	55	65
DN200	35	45	55	65
DN250	35	45	55	70
DN300	35	45	60	70
DN400	35	45	60	70
DN500	35	50	60	75
DN600	35	50	60	75
>DN600	35	50	60	75

Table 1.12.4. The required thermal conductivity for cold insulation is measured at a given temperature. EN ISO 13787, EN12667, EN ISO 8497).

	–20°C	+/–0°C	+10°C	+20°C	+40°C	+70°C
W/mK	0.031– 0.034	0.033–0.036	0.034– 0.037	0.035– 0.038	0.037– 0.040	0.040– 0.043

1.12.3 PROTECTIVE JACKET, INSULATION INSTALLATION

A. Protective jacket

The protective jacket shall be applied evenly over the entire external surface of the insulation proper. The external surface of the protective jacket shall be smooth, without cracks, bends or indentations and shall be of a shape suitable for the cable or appliance to be insulated. Two cables located close to each other (so that their respective insulation layers are in contact) may share a common protective insulation jacket, provided that the cables can move freely relative to each other. Protective jackets, made of water and vapour impermeable material, on cables or equipment in underground ducts shall be fitted with ventilation bands or spacers, situated at the transverse overlaps of the jacket elements, to allow the insulation proper to dry out if it becomes wet.

The jacket's elements (sheets) shall be applied over the surface of the insulation proper with overlaps at both longitudinal and transverse joints of the sheets. Longitudinal and transverse overlaps of the jacket elements (sheets) should be located in such a way as to prevent penetration (leakage) of rainwater. Stainless steel self-tapping screws should be used to join adjacent sheets.

— Material: sheet metal coated with alu-zinc or stainless steel on both sides
— Coating material: Alu-zinc alloy (55%AL, 43.4%Zc, 1.5%Si)
— Coat thickness >20um

— Coat weight: >150 g/m2

Table 1.12.5. The thickness of the sheet used depends on the circumference of the insulation on the pipelines.

<400mm (<DN25)	400–1000mm (DN25–DN200)	1000–2000mm (DN200–DN600)	>2000mm (>DN600)
0.6	0.7	0.8	0.8

B. Insulation of fittings and flange connections

For thermal insulation of fittings and flange connections, it is recommended to use two-piece or multi-piece fittings (hoods). Individual fittings are to be fastened using clamps made from e.g. zinc-plated steel sheet or plastic tape, in such a way as to allow for repeated assembly and disassembly. The spindles, valve stems and gate valves shall be routed outside the fittings. Their surfaces should not be insulated. Hoods should be assembled in such a way as to allow disassembly and reassembly of the fittings or flange connections they protect.

C. Installation of insulation

The surface of pipelines, fittings and equipment should be clean and dry. It is not permitted to install thermal insulation on surfaces contaminated with media, grease, fat, etc. and on surfaces with an incompletely dry or damaged anti-corrosion coating. The materials to be used for thermal insulation should also be dry and clean and not damaged. The storage of materials at the workplace should exclude the possibility of them becoming damp or damaged. Pay attention to tools (knives and punches should be sharp and brushes should be clean).
The completed insulation must be protected with a protective jacket on an ongoing basis, i.e. on the same day that it is installed. Thermal insulation should not be installed during precipitation. If electrical heating is to be installed on the pipeline, the pipeline must be wrapped with aluminium foil after the heating cable has been laid.

— The mineral wool mats should always be firmly connected with each other. When installing multilayer insulation, successive layers should cover the joints of previous layers. The insulation should be made waterproof.
— The insulation materials (lagging, rolls, boards) should be installed "in compression", i.e. the lagging should be slightly compressed along its length. In this way, constant pressure on the glued joints is ensured. All installation work should be carried out at ambient temperature (optimum temperature is +15°C to +20°C). The ambient temperature during installation should not be below 0°C.
— The end of the insulation and the expansion joints in the protective jackets of the cables must be protected against mechanical damage and moisture. The sharp edges of the cover sheet must be made blunt/bent.
— Figures 1-6 show recommended design solutions for insulation of flange connections on vertical and horizontal pipelines, fittings, and elbows and pipelines.

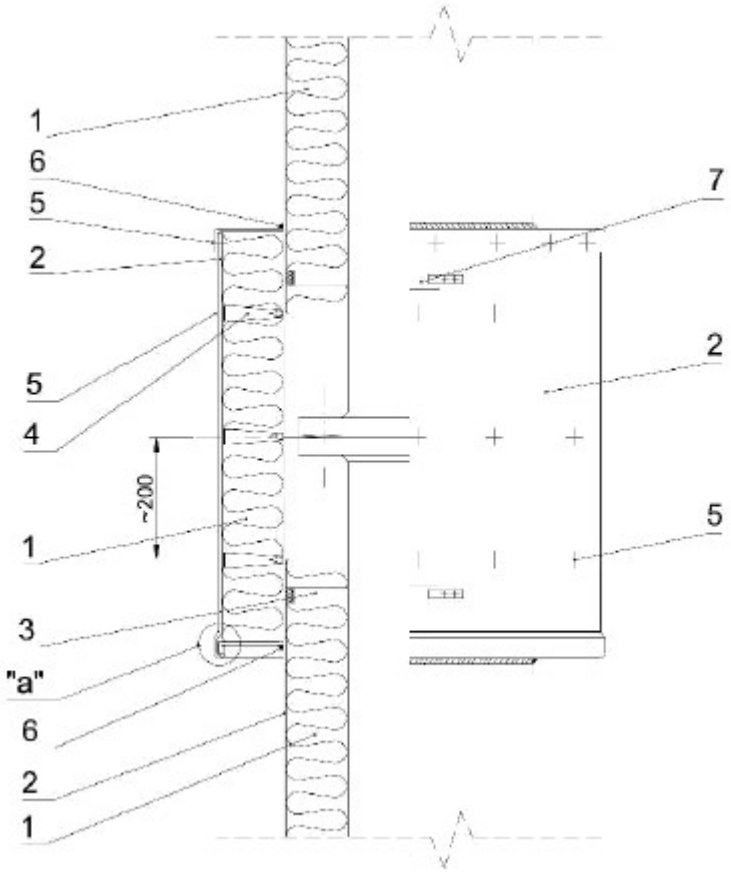

Figure 1.12.1. Insulation of flange connections on vertical pipelines. 1– Insulation mat, 2– Insulation covering jacket, 3 – Supporting structure, 4 – Elements fastening insulation,
5 – Tubular rivet with fastening core, 6 –Sealing with silicone putty, 7 – Hood lock

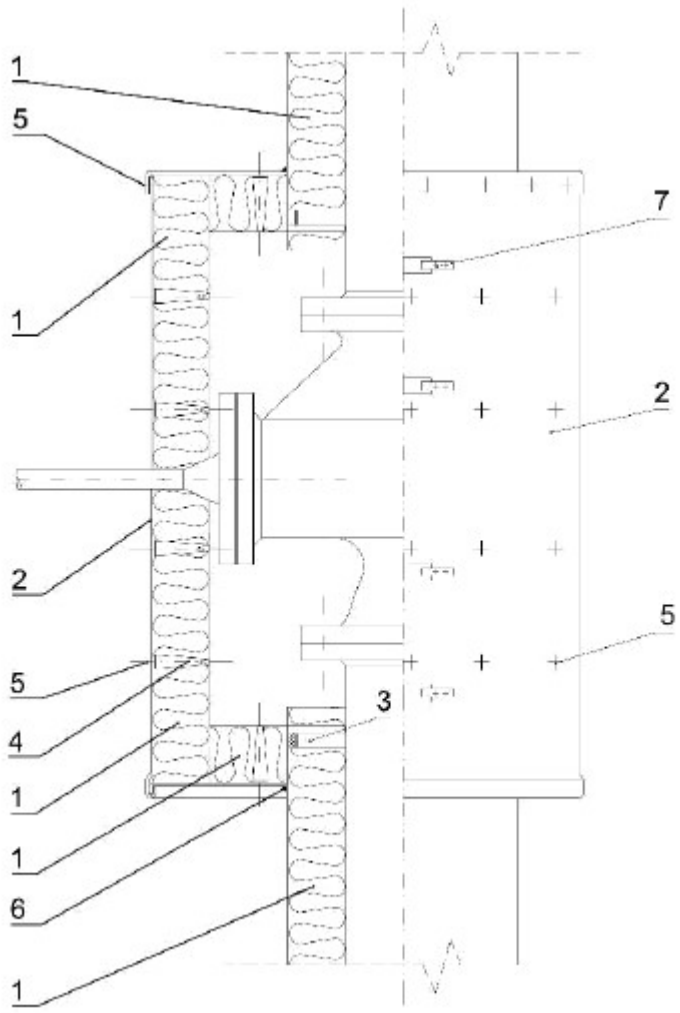

Figure 1.12.2. Insulation of a flange valve on vertical pipelines. 1– Insulation mat, 2– Insulation covering jacket, 3 – Supporting structure, 4 – Elements fastening insulation, 5 – Tubular rivet with fastening core, 6 –Sealing with silicone putty, 7 – Hood lock

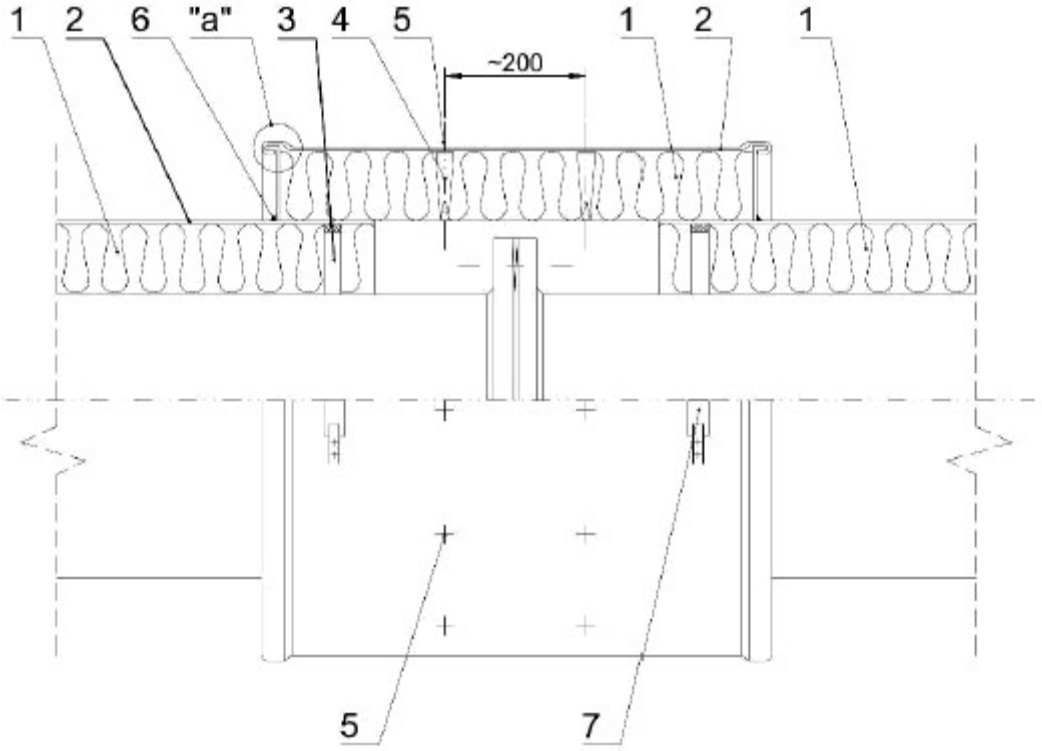

Figure 1.12.3. Insulation of flange connections on horizontal pipelines. 1– Insulation mat, 2– Insulation covering jacket, 3 – Supporting structure, 4 – Elements fastening insulation, 5 – Tubular rivet with fastening core,

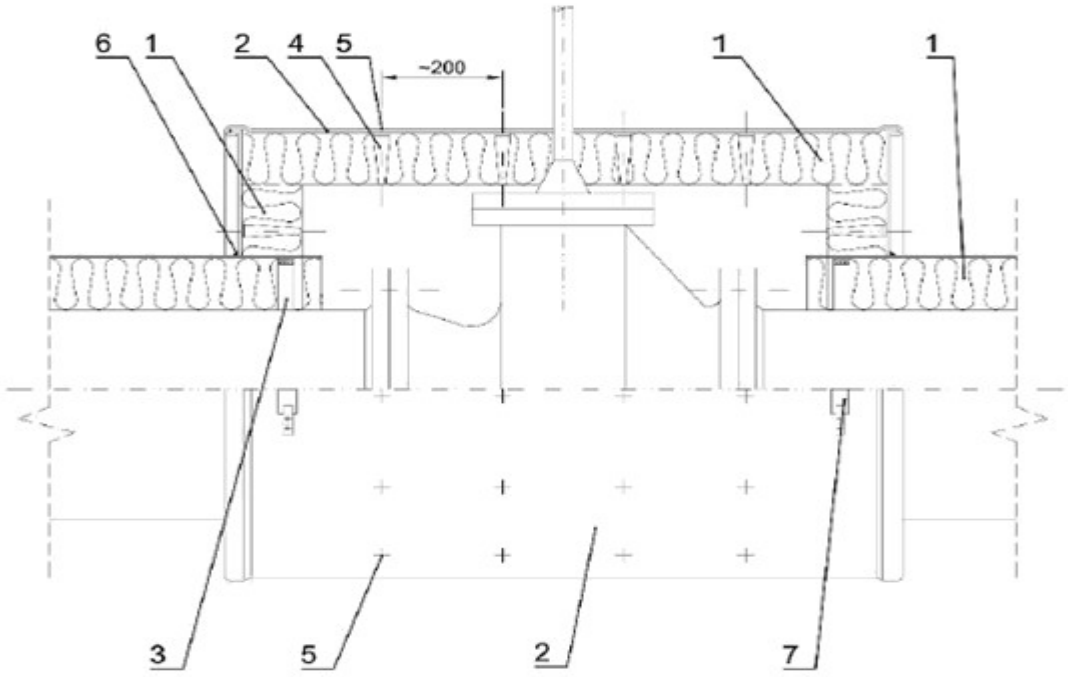

Fig. 1.12.4, Insulation of a flange valve on horizontal pipelines. 1– Insulation mat, 2– Insulation covering jacket, 3 – Supporting structure, 4 – Elements fastening insulation, 5 – Tubular rivet with fastening core, 6 – Sealing with silicone putty, 7 – Hood lock

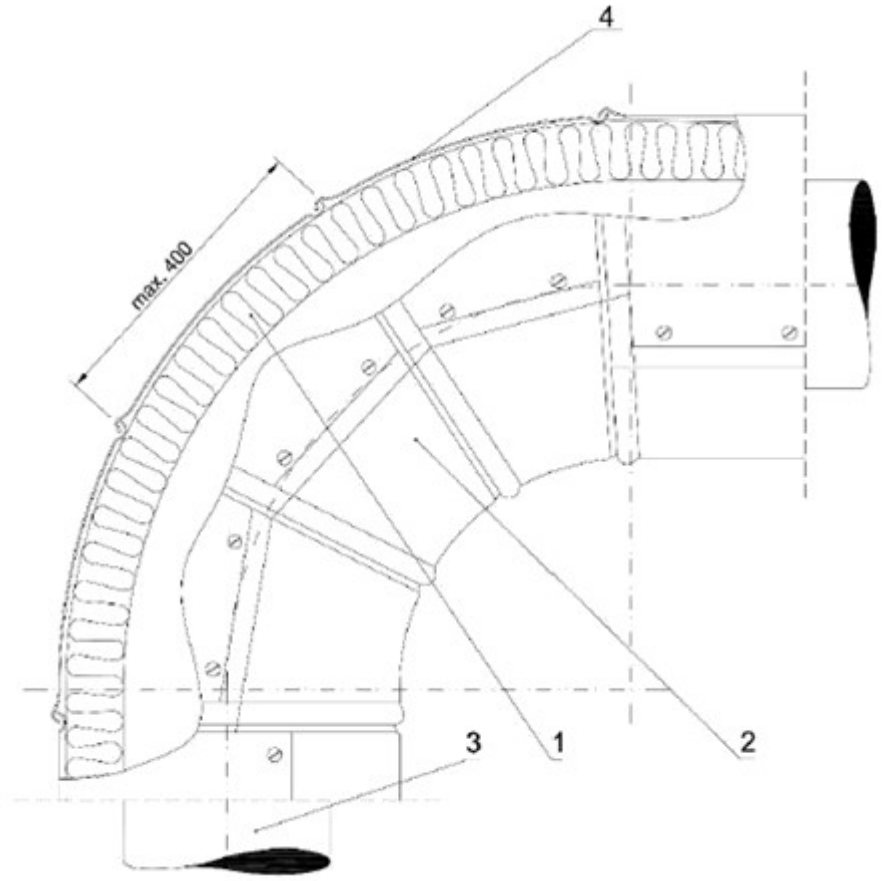

Figure 1.12.5. Elbow Insulation. 1– Insulation mat, 2 – Cover segment, 3 – Support pipeline, 4 – Insulation cover jacket

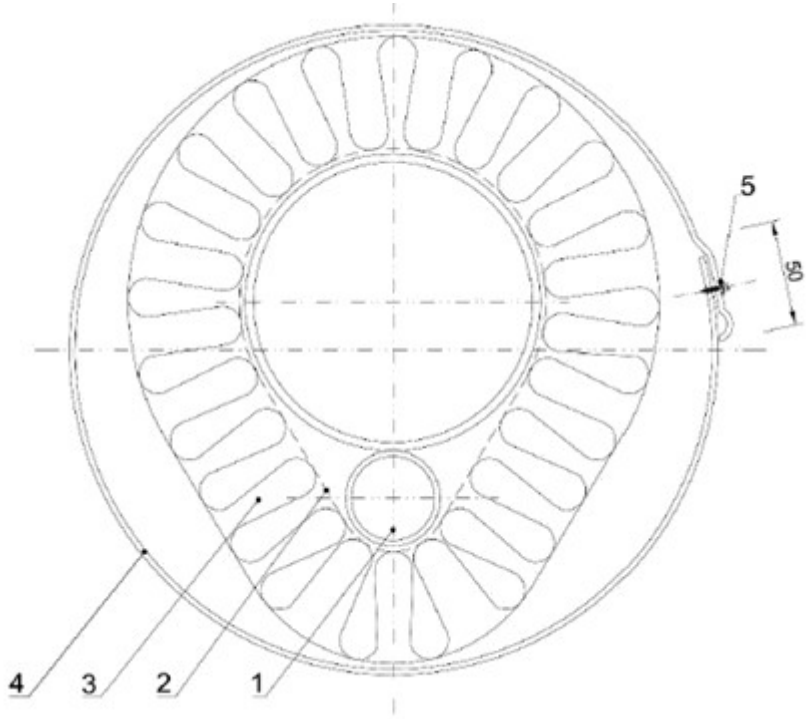

Figure 1.12.6. Insulation of pipeline with a heating cable. 1 – Heating Cable, 2– Zinc plated wire mesh, 3 - Insulation mat, 4 – Insulation cover jacket, 5 – Stainless steel self-tapping screw

D. Regulations and standards

- PN-EN ISO 1461 – Hot dip galvanized coatings on fabricated iron and steel articles
- PN-EN ISO 12944–2 – Paints and varnishes - Corrosion protection of steel structures by protective paint systems
- PN-EN ISO 8501–1 – Preparation of steel substrates before application of paints and related products

1.13. DOCUMENTATION

The documentation supplied as part of the design, execution and delivery task is an integral part of the order and its absence or incompleteness shall be treated as a failure to meet the requirements in accordance with the order or delivery.

Each piece of equipment delivered to PCC Rokita or assembled on the installation must be provided with a set of documents necessary for its safe and proper operation.

1.13.1 DESIGN DOCUMENTATION

The design documentation should be prepared legibly, in the Polish language and the metric system, and should be provided for each branch separately, in the number of 3 copies in the paper form, 2 copies in the electronic form, and should include (the design prepared according to the template - appendix to STD Mechanical Engineering Field):

- A technological scheme (simplified with the data of devices, pipelines, and fittings – technical number, DN diameters, insulation, heating, etc.),
- 3D drawings in PDF 3D format with the possibility of activating individual elements/systems,
- 3D models in CAD format with the possibility of activating individual elements/systems,

- technical description of the devices and apparatus,
- list with a specification of the devices, apparatus, pipelines, and fittings,
- technical datasheet of devices and apparatus,
- specification of materials and installation of the elements (pipes, fittings, flanges, screws, etc.),
- situational plans (including existing installation elements),
- assembly drawings of installations (with fittings and apparatus),
- isometric drawings with material specification and marking of connections, supports and suspensions,
- endurance calculations:

a) analytical calculations of the pipe wall thickness,
b) analytical calculations of the shaped elements (bows, reducers, tees, bottoms)

- calculations of the flange connections (selection of the gaskets compatible with standard PCC SUT-M),
- calculations of the weakening hole (if occurs)
- analysis of the stress distribution in the pipelines and the influence of the piping on the tanks and other equipment of the designed installation
- analysis of the impact of the newly designed installation on the existing piping,
- analysis of the effects of rotating equipment on piping (analysis of piping vibrations caused by rotating equipment)
- calculations for the selection of safety devices (safety and breather valves),
- calculations of the flange connections (selection of the gaskets compatible with standard PCC SUT-M),
- calculations of elements durability (especially elements exposed to corrosion, cracking, creep, abrasion),
- calculation and selection of thermal insulation,
- performance characteristics of power flow devices (efficiency, power, efficiency, pressure/compression, NPSH),
- analysis of the impact of new facilities and installations on existing ones.

As-built documentation shall be prepared to take into account changes and deviations from the execution documentation and confirmed by “AS-BUILT" (in red with the date of the change).
The design documentation should be delivered legible, in the Polish language and the metric system and should be provided for each branch separately, and should include:

- 3 copies in paper form,
- 2 copies in electronic form: PDF files and editable files in .dwg, .doc, .xls format,
- delivery and quality documentation - of devices, apparatus, and fittings,
- a technological scheme (simplified with the data of devices, pipelines, and fittings – technical number, DN diameters, insulation, heating, etc.) - A3 format,
- situational plans (including existing installation elements) - A3 format,
- isometric drawings with material specification and marking of connections, supports and suspensions - A3 format,
- assembly drawings of installations (with fittings and apparatus) - A4 and A3 format,
- specification of materials and installation of the elements (pipes, fittings, screws, etc.),
- calculations of the flange connections (selection of the gaskets compatible with standard PCC SUT-M),
- calculations of elements durability (especially elements exposed to corrosion, cracking, creep, abrasion),
- selection and comparison of thermal insulation and jacket thicknesses.

For devices under the control of the Office of Technical Inspection (Polish UDT), the project and report of the conformity assessment of the project according to module B have to be approved by a notified unit.

During the selection and design of surveillance devices, the possibility of failure should be reasonably foreseen, therefore the calculation methods must take into account a sufficient safety margin, which translates into:

- the permissible stresses must be limited by safety factors that eliminate the possibility of danger occurring,
- the design pressure must be higher than the maximum allowable working pressure including the hydrostatic pressure when the tank/vessel is filled with the working medium,
- if there is more than one working volume, the partition must be designed for the highest pressure,
- the design temperature must be below the lowest permissible operating temperature by at least 10°C, and at least 35°C higher than the highest operating temperature,
- the design of the surveillance device must take into account the operation in an unstable state under varying system parameters,
- the highest stress parameters must be kept within safe limits,
- The strength calculation must take into account the mechanical properties of the material used.

1.13.2 AS-BUILT DOCUMENTATION

The as-built documentation should be prepared taking into account changes and deviations in relation to the executive documentation and confirmed by the compliance of "AS BUILD" execution (red color with the date of change).
As-built documentation must be provided legibly, in Polish and in the metric system, and should be provided for each industry separately and should contain:

- 3 copies in paper form,
- 2 copies in electronic form: PDF files and editable files in .dwg, .doc, .xls format,
- delivery and quality documentation - devices, apparatus and fittings,
- technological diagram (simplified with data of devices, pipelines and fittings - technical number, DN diameters, insulation, heating -, etc.) - A3 format,
- site projections (taking into account the existing elements of the installation) - A3 format,
- isometrics with material specification and marking of connections, supports and slings - A3 format,
- assembly drawings of installations, devices and accessories (including fittings and apparatus) - format A4 and A3,
- material specification of the installation and its components (pipes, fittings, flanges, screws, etc.)
- calculation of flange connections (selection of gaskets in accordance with the PCC SUT-M standard),
- calculations of durability of elements (especially elements exposed to corrosion, cracking, creep, abrasion),
- selection and specification of the thickness of thermal insulation and protective coat.

1.13.3 DELIVERY AND QUALITY DOCUMENTATION

OF THE PUMP

The complete documentation (technical, operating and quality) with the delivery of the pump must include at least:

1. Declaration of conformity according to the Machinery Directive 2006/42/EU

2. Instruction manual in Polish (including storage, assembly, start-up, operation and maintenance manual, troubleshooting procedures)
3. Assembly drawing of the pump with complete parts list (A3 drawing format)
4. Full specification of the parts (part numbers, technical data, and other necessary data)
5. Assembly drawing of the entire pump unit (A3 drawing format)
6. Dimensions in the drawings must be stated in the metric system.
7. A technical data sheet, in which the data relating to the specific pump supplied is contained:
   a) type and serial number of the pump
   b) manufacturer's data and type of other components (engine, coupling, mechanical seal), together with the supply of technical documentation (O&MM) for these components
   c) for pumps to be frequency controlled, the energy performance curves must include several curves - at least for minimum, nominal and maximum frequency
   d) type and quantity of lubricants and frequency of replacement/lubrication
   e) scope of inspections and maintenance with a specification of parts and duration of their performance
   f) weight of the pump, motor and foundation frame,
   g) the position of the centres of gravity of all assemblies
   h) allowable forces and moments on stubs
8. Documentation of the manufacturing process as well as examinations and tests carried out - among others, certificates / approvals (including material approvals for components operating under pressure) and energy performance characteristics (H [m] / Q [m3/h]; P [kW] / Q [m^3/h]; Eta [%] / Q [m^3/h]; NPSH[m] / Q [m^3/h]) with the operating point indicated for the nominal and minimum capacity in terms of the impeller diameter used
9. Test bench vibration measurement certificate (ISO 10816)
10. With the delivery of the pump, 2 (two) copies of the documentation in hard copy and 1 (one) set of documentation in electronic version (on a labelled CD or pendrive) must be provided.

BELT CONVEYORS

The complete documentation (technical, operating and quality) with the delivery of the belt conveyor must include at least:

1. Declaration of conformity according to the Machinery Directive 2006/42/EU
2. Instruction manual in Polish (including assembly, start-up, operation and maintenance manual, troubleshooting procedures)
3. Assembly drawing with complete parts list (A3 drawing format)
4. Manufacturing drawings of the housing/conveyor frame including minimum wall thickness of the elements
5. Manufacturing drawings of drums and rollers (pulleys)
6. Detailed drawings of bunkers/loading/unloading silos
7. Working drawings of other elements that are not standardised (e.g. guards, ladders and service platforms, roller supports)
8. Full specification of parts (manufacturers' part numbers and other necessary data)
9. In the case of elements of a conveyor which additionally have a chemical-resistant/abrasive coating on the load, information about the type of coating used and its dimensions
10. Technical conditions of execution and acceptance
11. Dimensions in the drawings must be stated in the metric system.

12. A data sheet, including at least:
    a) type and serial number of the belt conveyor
    b) capacity, speed, maximum load weight
    c) details of the manufacturer and type of the other main components included in the conveyor (working element: belt/chain, geared motor, buckets, drums, safety systems, correcting rollers, scrapers) together with the supply of technical documentation (O&MM) for these components
    d) scope of inspections and overhauls with a specification of parts and duration
    e) allowable forces and moments for bolted connections
    f) type and quantity of lubricants and frequency of replacement/lubrication
13. Documentation of manufacture and testing performed – certificates/approvals (including material approvals and testing of anti-corrosion coatings)
14. With the delivery of the belt conveyor, 2 (two) copies of the documentation in hard copy and 1 (one) set of documentation in electronic version (on a labelled CD or pendrive) must be provided.

FANS

The complete documentation (technical, operating and quality) with the delivery of the fan must include at least:

1. Declaration of conformity according to the Machinery Directive 2006/42/EU
2. Instruction manual in Polish (including storage, assembly, start-up, operation and maintenance manual, troubleshooting procedures)
3. Assembly drawing of the fan with complete parts list (A3 drawing format)
4. Full specification of the parts (part numbers, technical data, and other necessary data)
5. Assembly drawing of the entire unit (A3 drawing format)
6. Dimensions in the drawings must be stated in the metric system.
7. A technical data sheet, in which the data relating to the specific fan supplied is contained:
    a) type and serial number of the fan
    b) manufacturer's data and type of other components (engine, coupling), together with the supply of technical documentation (O&MM) for these components
    c) for fans to be frequency controlled, the energy performance curves must include several curves - at least for minimum, nominal and maximum frequency
    d) type and quantity of lubricants and frequency of replacement/lubrication
    e) scope of inspections and maintenance with a specification of parts and duration of their performance
    f) weight of the fan, motor and foundation frame,
    g) the position of the centres of gravity of all assemblies
    h) allowable forces and moments on stubs
8. Documentation of the manufacturing process as well as examinations and tests carried out - among others, certificates/approvals (including material approvals for components operating under pressure) and energy performance characteristics (P [kW] / Q [m^3/h]; Eta [%] / Q [m^3/h];) with the operating point indicated for the nominal and minimum capacity in terms of the impeller diameter used
9. Test bench vibration measurement certificate (ISO 10816)

10. With the delivery of the fan, 2 (two) copies of the documentation in hard copy and 1 (one) set of documentation in electronic version (on a labelled CD or pendrive) must be provided.

GEARMOTORS

The complete documentation (technical, operating and quality) with the delivery of the gear motor must include at least:

1. Declaration of conformity according to the Machinery Directive 2006/42/EU
2. Instruction manual in Polish (including assembly, start-up, operation and maintenance manual, troubleshooting procedures)
3. Assembly drawing with complete parts list (A3 drawing format)
4. Full specification of parts (manufacturers' part numbers and other necessary data)
5. Dimensions in the drawings must be stated in the metric system.
6. A data sheet, including at least:
   a) type and serial number of the gearbox
   b) the gear ratio value, maximum and minimum speeds, permissible torque,
   c) scope of inspections and overhauls with a specification of parts and duration
   d) allowable forces and moments for bolted connections
   e) type and quantity of lubricants and frequency of replacement/lubrication
7. Documentation of manufacture and testing performed – certificates/approvals (including material approvals and testing of anti-corrosion coatings)
8. With the delivery of the gear motor, 2 (two) copies of the documentation in hard copy and 1 (one) set of documentation in electronic version (on a labelled CD or pendrive) must be provided.

AGITATORS

The complete documentation (technical, operating and quality) with the delivery of the agitator must include at least:

1. Declaration of conformity according to the Machinery Directive 2006/42/EU
2. Instruction manual in Polish (including assembly, start-up, operation and maintenance manual, troubleshooting procedures)
3. Assembly drawing with complete parts list (A3 drawing format)
4. Full specification of parts (manufacturers' part numbers and other necessary data)
5. Dimensions in the drawings must be stated in the metric system.
6. A data sheet, including at least:
   a) type and serial number of the agitator
   b) scope of inspections and overhauls with specification of parts and duration
   c) allowable forces and moments for bolted connections
   d) type and quantity of lubricants and frequency of replacement/lubrication
7. Documentation of manufacture and testing performed – certificates/approvals (including material approvals and testing of anti-corrosion coatings)
8. Agitator running test report.
9. With the delivery of the agitator, 2 (two) copies of the documentation in hard copy and 1 (one) set of documentation in electronic version (on a labelled CD or pendrive) must be provided.

PRESSURE TANKS

The complete documentation (technical, operating and quality) with the delivery of the pressure tank must include at least:

1. Declaration of conformity according to the Pressure Equipment Directive 2014/68/EU
2. Instruction manual in Polish (including storage, assembly, start-up, operation and maintenance manual)
3. Assembly drawing with full specification of the components (drawing minimum A3 format) and dimensions.
4. Structural drawing of non-standard components e.g. sieve bottom connections to roller or tubes, baffles, sight glasses, etc
5. Full specification of the parts (part numbers, technical data, and other necessary data)
6. Drawings for welded, screwed, threaded, and reamed joints
7. Specification of heat treatment, if applicable
8. Strength calculations with a compilation of data for calculations (minimum and nominal thickness, corrosion allowance, stress strength, hardness, etc.), or a list of minimum design thicknesses, corrosion allowance and those adopted/used in the device
9. Calculations of flange connections
10. Specification of permissible loads on nozzles and mounting brackets to the shell (if exist).
11. Nameplate drawing
12. Technical conditions of execution and acceptance
13. Dimensions in the drawings must be stated in the metric system.
14. Datasheet with permissible forces and moments on stubs
15. If safety devices (safety valves/safety plates or breather valves) are included in the container delivery, the selection of these devices **according to 1.7.4 SAFETY VALVES** and a report on settings and acceptance
16. If other devices or fittings are included in the delivery, technical documentation (O&MM) must be provided for these components
17. Documentation of manufacture and examinations and tests carried out:
    a) records of examinations and tests carried out (non-destructive tests, hydraulic tests, testing of anti-corrosion coatings, spark tests for chemical-resistant linings, etc.).
    b) technological sheets for manufacturing processes (WPS, bending sheets, etc.),
    c) for containers with chemical-resistant liners, a certification that the chemical-resistant liner has been manufactured and tested
    d) type 3.1 inspection certificate(s) according to PN-EN 10204
18. With the delivery of the tank, 2 (two) copies of the documentation in hard copy and 1 (one) set of documentation in electronic version (on a labelled CD or pendrive) must be provided.

NON-PRESSURE TANKS

The complete documentation (technical, operating and quality) with the delivery of the non-pressure or low-pressure tank must include at least:

1. Certificate of construction and acceptance pressure test
2. Instruction manual in Polish (including storage, assembly, start-up, operation and maintenance manual)
3. Assembly drawing with full specification of the components (drawing minimum A3 format) and dimensions.

4. Structural drawing of non-standard components e.g. sieve bottom connections to roller or tubes, baffles, sight glasses, etc....
5. Full specification of the parts (part numbers, technical data, and other necessary data)
6. Drawings for welded, screwed and threaded joints
7. Specification of heat treatment, if applicable
8. Strength calculations with a compilation of data for calculations (minimum and nominal thickness, corrosion allowance, stress strength, hardness, etc.), or a list of minimum design thicknesses, corrosion allowance and those adopted/used in the device
9. Calculations of flange connections
10. Specification of permissible loads on nozzles and mounting brackets to the shell (if exist).
11. Nameplate drawing
12. Technical conditions of execution and acceptance
13. Dimensions in the drawings must be stated in the metric system.
14. Datasheet with permissible forces and moments on stubs
15. If safety devices (safety valves/safety plates or breather valves) are included in the container delivery, the selection of these devices **according to 1.7.4 SAFETY VALVES** and a report on settings and acceptance
16. If other devices or fittings are included in the delivery, technical documentation (O&MM) must be provided for these components
17. Documentation of manufacture and of examinations and tests carried out:
    a) records of examinations and tests carried out (non-destructive tests, hydraulic tests, testing of anti-corrosion coatings, spark tests for chemical-resistant linings, etc.).
    b) technological sheets for manufacturing processes (WPS, bending sheets, etc.),
    c) for containers with chemical-resistant liners, a certification that the chemical-resistant liner has been manufactured and tested
    d) type 3.1 inspection certificate(s) according to PN-EN 10204
18. With the delivery of the tank, 2 (two) copies of the documentation in hard copy and 1 (one) set of documentation in electronic version (on a labelled CD or pendrive) must be provided.

In the case of non-pressure or low-pressure tanks which are subject to UDT, the technical documentation must also include the technical requirements specified by the technical supervision for this type of tank, along with the delivery of a Report of Construction and Acceptance Pressure Test signed by an UDT inspector.

FILTRES AND FILTERING EQUIPMENT

The complete documentation (technical, operating and quality) with the delivery of the filter/filtering equipment must include at least:

1. Declaration of conformity according to the pressure directive 2014/68/EU
2. Instruction manual in Polish (including storage, assembly, start-up, operation and maintenance manual)
3. Assembly drawing with full specification of the components (drawing minimum A3 format) and dimensions.
4. Structural drawing of non-standard components e.g. sieve bottom connections to roller or tubes, baffles, sight glasses, etc....
5. Technical data sheet, including:
    a) type and serial number
    b) pressure PS, temperature TS,

c) capacity
d) weight of the empty and full apparatus
e) allowable forces and moments on stubs
f) technical specification of the filtering elements - number/type of filtering elements used, as well as the material and degree of filtration
g) the type of gaskets used and their dimensions

6. Full specification of the parts (part numbers, technical data, and other necessary data)
7. Drawings for welded, screwed and threaded joints
8. Specification of heat treatment, if applicable
9. Strength calculations with a compilation of data for calculations (minimum and nominal thickness, corrosion allowance, stress strength, hardness, etc.), or a list of minimum design thicknesses, corrosion allowance and those adopted/used in the device
10. Specification of permissible loads on nozzles and mounting brackets to the shell (if exist).
11. Calculations of flange connections
12. Nameplate drawing
13. Technical conditions of execution and acceptance
14. Dimensions in the drawings must be stated in the metric system.
15. If safety devices (safety valves/safety plates) are included in the delivery, the selection of these devices **according to 1.7.4 SAFETY VALVES** and a report on settings and acceptance
16. If other devices or fittings are included in the delivery, technical documentation (O&MM) must be provided for these components
17. Documentation of manufacture and of examinations and tests carried out:
    a) records of examinations and tests carried out (non-destructive tests, hydraulic tests, testing of anti-corrosion coatings, spark tests for chemical-resistant linings, etc.).
    b) technological sheets for manufacturing processes (WPS, bending sheets, etc.),
    c) for filters with chemical-resistant liners, a certification that the chemical-resistant liner has been manufactured and tested
    d) type 3.1 inspection certificate(s) according to PN-EN 10204
18. With the delivery of the tank, 2 (two) copies of the documentation in hard copy and 1 (one) set of documentation in electronic version (on a labelled CD or pendrive) must be provided.

EXCHANGERS

The complete documentation (technical, operating and quality) with the delivery of the exchangers must include at least:

1. Declaration of conformity according to the pressure directive 2014/68/EU
2. Instruction manual in Polish (including storage, assembly, start-up, operation and maintenance manual)
3. Assembly drawing with full specification of the components (drawing minimum A3 format) and dimensions.
4. Structural drawing of non-standard components e.g. sieve bottom connections to roller or tubes, baffles, sight glasses, etc....
5. Technical data sheet, including:
   a. exchanger type and serial number
   b. medium type A / B
   c. pressure PS and temperature TS for space A / B
   d. capacity of space A / B
   e. heat exchange surface [m2]

f. heat output of the exchanger [kW].
g. weight of the empty and full exchanger
h. stub orientation
i. allowable forces and moments on stubs
j. specification of "thermal" panels - number of panels used, including panel material, thickness and type of seals used
k. flow diagram
l. heat exchanger selection sheet, including flow, temperature and pressure for working parameters (nominal and maximum)

6. Full specification of the parts (part numbers, technical data, and other necessary data)
7. Drawings for welded, screwed and threaded joints
8. Specification of heat treatment, if applicable
9. Strength calculations with a compilation of data for calculations (minimum and nominal thickness, corrosion allowance, stress strength, hardness, etc.), or a list of minimum design thicknesses, corrosion allowance and those adopted/used in the device
10. Specification of permissible loads on nozzles and mounting brackets to the shell (if exist).
11. In the case of plate heat exchangers, it is mandatory to indicate the coefficient A
12. Calculations of flange connections
13. Nameplate drawing
14. Technical conditions of execution and acceptance
15. Dimensions in the drawings must be stated in the metric system.
16. If safety devices (safety valves/safety plates) are included in the delivery, the selection of these devices **according to 1.7.4 SAFETY VALVES** and a report on settings and acceptance
17. If other devices or fittings are included in the delivery, technical documentation (O&MM) must be provided for these components
18. Documentation of manufacture and of examinations and tests carried out:
    a) records of examinations and tests carried out (non-destructive tests, hydraulic tests, testing of anti-corrosion coatings, spark tests for chemical-resistant linings, etc.).
    b) technological sheets for manufacturing processes (WPS, bending sheets, etc.),
    c) for exchangers with chemical-resistant liners, a certification that the chemical-resistant liner has been manufactured and tested
    d) type 3.1 inspection certificate(s) according to PN-EN 10204
19. With the delivery of the tank, 2 (two) copies of the documentation in hard copy and 1 (one) set of documentation in electronic version (on a labelled CD or pendrive) must be provided.

TECHNOLOGICAL PIPELINES

The complete documentation (technical, operating and quality) with the delivery of the technological pipeline must include at least:

1. Declaration of Conformity according to the Pressure Equipment Directive 2014/68/EU, and for pipelines exempted from the Pressure Equipment Directive pursuant to Article 4.3, a Performance Certificate must be provided
2. Instruction manual in Polish (including storage, assembly, start-up, operation and maintenance manual)
3. 3D isometric drawing with a specification of components (A3 drawing format)
4. Construction drawing for atypical pipeline components (not covered by harmonised standards under the Pressure Equipment Directive)
5. Full specification of the parts (part numbers, technical data, and other necessary data)

6. Drawings of welded, screwed, threaded and soldered joints
7. Drawings of supports and suspensions
8. Specification of heat treatment, if applicable
9. Strength calculations with a compilation of data for calculations (minimum and nominal thickness, corrosion allowance, stress strength, hardness, etc.), or a list of minimum design thicknesses, corrosion allowance and those adopted/used in the device
10. Calculations of flange connections
11. Nameplate drawing
12. Technical conditions of execution and acceptance
13. Dimensions in the drawings must be stated in the metric system.
14. If safety devices (safety valves/safety plates) are included in the delivery of the pipeline, the selection of these devices **according to 1.7.4 SAFETY VALVES** and a report on settings and acceptance
15. If other devices or fittings are included in the delivery, technical documentation (O&MM) must be provided for these components
16. Documentation of manufacture and testing performed – certificates/approvals:
    a) records of examinations and tests carried out (non-destructive tests, hydraulic tests, testing of anti-corrosion coatings, spark tests for chemical-resistant linings, etc.).
    b) technological sheets for manufacturing processes (WPS, bending sheets, etc.),
    c) for pipelines with chemical-resistant liners, a certification that the chemical-resistant liner has been manufactured and tested
    d) Type 3.1 inspection certificate according to PN-EN 10204
17. With the delivery of the pipeline, 2 (two) copies of the documentation in hard copy and 1 (one) set of documentation in electronic version (on a labelled CD or pendrive) must be provided.

STOP FITTINGS (SHUT-OFF)

The complete documentation (technical, quality) with the delivery of the stop fittings must include at least:

1. Declaration of conformity according to Pressure Equipment Directive 2014/68/EU
2. Type 3.1 inspection certificate according to PN-EN 10204
3. Leak test report according to PN-EN 12266
4. Certificate of resistance to the medium
5. Operating temperature vs. pressure diagram
6. Manufacturer's warranty and data sheet

NON-RETURN FITTINGS

The complete documentation (technical, quality) with the delivery of the non-return fittings must include at least:

1. Declaration of conformity according to Pressure Equipment Directive 2014/68/EU
2. Type 3.1 inspection certificate according to PN-EN 10204
3. Leak test report according to PN-EN 12266
4. Certification of resistance to the medium and valve opening pressure
5. Operating temperature vs. pressure diagram
6. Manufacturer's warranty and data sheet

BREATHER VALVES

The complete documentation (technical, quality) with the delivery of the breather valve must include at least:

1. Type 3.1 inspection certificate according to PN-EN 10204
2. Operating temperature vs. pressure diagram
3. Diagram of valve opening pressure vs. flow capacity
4. Manufacturer's warranty and data sheet

SAFETY VALVES

The complete documentation (technical, quality) with the delivery of the safety valve must include at least:

1. Declaration of conformity according to Pressure Equipment Directive 2014/68/EU
2. Type 3.1 inspection certificate according to PN-EN 10204
3. Certified technical data necessary to perform capacity calculations
4. Valve selection sheet
5. Certificate of resistance to the medium
6. Operating temperature vs. pressure diagram
   Manufacturer's warranty and data sheet

No.	Link	Document name
1.	Notes Link	FW.C.1503.01 Air cooler
2.	Notes Link	FW.C.1503.02 Column
3.	Notes Link	FW.C.1503.03 Agitator
4.	Notes Link	FW.C.1503.04 Static agitator
5.	Notes Link	FW.C.1503.05 Metering pump
6.	Notes Link	FW.C.1503.06 Centrifugal pump
7.	Notes Link	FW.C.1503.06 Vertical centrifugal pump
8.	Notes Link	FW.C.1503.08 Vacuum pump, liquid ring compressor
9.	Notes Link	FW.C.1503.06 Piston pump
10.	Notes Link	FW.C.1503.06 Rotary pump
11.	Notes Link	FW.C.1501.11 Reactor
12.	Notes Link	FW.C.1503.06 Centrifugal compressor
13.	Notes Link	FW.C.1503.13 Piston compressor
14.	Notes Link	FW.C.1503.14 Fan
15.	Notes Link	FW.C.1503.15 Blower fan
16.	Notes Link	FW.C.1503.16 Tailings tank
17.	Notes Link	FW.C.1503.16 Tank
18.	Notes Link	FW.C.1503.18 Ejector
19.	Notes Link	FW.C.1503.19 Filter
20.	Notes Link	FW.C.1503.19 Bag filter
21.	Notes Link	FW.C.1503.21 Silos
22.	Notes Link	FW.C.1503.22 Bucket conveyor
23.	Notes Link	FW.C.1503.23 Screw conveyor, feeder
24.	Notes Link	FW.C.1503.24 Belt conveyor, feeder
25.	Notes Link	FW.C.1503.25 Dehydrator
26.	Notes Link	FW.C.1503.26 Safety plate
27.	Notes Link	FW.C.1503.27 Flame arrester
28.	Notes Link	FW.C.1503.28 Gearbox
29.	Notes Link	FW.C.1503.29 Electric motor
30.	Notes Link	FW.C.1503.30 Shell and tube heat exchanger
31.	Notes Link	FW.C.1503.31 Heat exchanger
32.	Notes Link	FW.C.1503.32 Heat exchanger, spiral
33.	Notes Link	FW.C.1503.33 List of apparatus and equipment
34.	Notes Link	FW.C.1503.34 Overview of insulation of apparatus and technological equipment
35.	Notes Link	FW.C.1503.35 List of fittings and materials
36.	Notes Link	FW.C.1503.36 List of storage tanks
37.	Notes Link	FW.C.1503.37 List of pumping machines
38.	Notes Link	FW.C.1503.38 List of pipelines
39.	Notes Link	FW.C.1503.39 Detailed list of the pipeline components
40.	Notes Link	FW.C.1503.40 Overview of pipe insulation
41.	Notes Link	FW.C.1503.41 List of spare parts
42.	Notes Link	FW.C.1503.38 List of stubs
43.		FW.C.1503.43 Check valve

No.	Link	Document name
1.	N/A	DIRECTIVE 2014/68/EU OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 15 May 2014 on the harmonization of the laws of the Member States relating to making available on the market of pressure equipment
2.	N/A	DIRECTIVE 2014/29/EU OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 26 February 2014 on the harmonization of the laws of the Member States relating to simple pressure vessels
3.	N/A	DIRECTIVE 2006/42/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 17 May 2006 on the approximation of the laws of the Member States relating to machinery
4.	N/A	DIRECTIVE 2014/34/EU OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 26 February 2014 on the harmonization of the laws of the Member States concerning equipment and protective systems intended for use in potentially explosive atmospheres
5.	N/A	DIRECTIVE 2014/35/EU OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 26 February 2014 on the harmonization of the laws of Member States relating to electrical equipment designed for use within certain voltage limits
6.	N/A	DIRECTIVE 2014/30/EU OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 26 February 2014 on the approximation of the laws of the Member States relating to electromagnetic compatibility
7.	N/A	DIRECTIVE 2014/33/EU OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 26 February 2014 on the approximation of the laws of the Member States relating to lifts
8.	N/A	DIRECTIVE 2005/88/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 14 December 2006 on the approximation of the laws of the Member States relating to the noise emission in the environment by equipment for use outdoors
9.	N/A	DECISION 768/2008/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 9 July 2008 on a common framework for the marketing of products
10.	N/A	REGULATION (EU) 2021/821 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 20 May 2021 setting up a Union regime for the control of exports, brokering, technical assistance, transit and transfer of dual-use items
11.	N/A	REGULATION OF THE MINISTER OF DEVELOPMENT of 11 July 2016 on requirements for pressure equipment and assemblies of pressure equipment
12.	N/A	REGULATION OF THE MINISTER OF DEVELOPMENT of 2 June 2016 on simple pressure tanks

13.	N/A	REGULATION OF THE MINISTER OF ECONOMY of 31 March 2008 on the technical conditions of technical inspection, which should be met by non-pressure and low-pressure tanks intended for storing liquid flammable materials
14.	N/A	REGULATION OF THE MINISTER OF ECONOMY of 16 April 2002 on the technical conditions of technical inspection, which should be met by non-pressure and low-pressure tanks intended for storing poisonous and caustic materials
15.	N/A	REGULATION OF THE MINISTER OF TRANSPORT, CONSTRUCTION AND MARITIME ECONOMY of 7 August 2013 on the technical conditions of technical supervision with regard to design, manufacture, operation, repair, and modernisation of specialised pressure equipment
16.	N/A	REGULATION OF THE MINISTER OF TRANSPORT, CONSTRUCTION AND MARITIME ECONOMY of 24 September 2013 on conditions of technical supervision which the devices for filling and emptying transport containers should comply with
17.	N/A	REGULATION OF THE MINISTER OF ECONOMY of 13 October 2011 on essential requirements for machinery
18.	N/A	REGULATION OF THE MINISTER OF ECONOMY of 20 December 2005 on essential requirements for machinery and safety components
19.	N/A	REGULATION OF THE MINISTER OF ECONOMY of 30 October 2002 on minimum requirements for occupational safety and health as regards the use of machines by employees at work
20.	N/A	REGULATION OF THE MINISTER OF DEVELOPMENT AND TECHNOLOGY of 17 December 2021 on the technical conditions for technical supervision in the field of operation of certain pressure equipment
21.	N/A	REGULATION OF THE MINISTER OF DEVELOPMENT dated 6 June 2016 concerning requirements for protective systems and equipment for use in potentially explosive atmosphere
22.	N/A	REGULATION OF THE MINISTER OF DEVELOPMENT of 3 June 2016 on requirements for lifts and their safety components for lifts
23.	N/A	REGULATION OF THE MINISTER OF DEVELOPMENT AND TECHNOLOGY of 30 October 2018 on technical conditions for technical supervision in respect of the operation of certain materials handling equipment
24.	N/A	REGULATION OF THE MINISTER OF ECONOMY of 28 December 2001 on the technical conditions of technical supervision applicable to hoists

25.	N/A	REGULATION OF THE MINISTER OF ECONOMY of 5 August 2005 on occupational safety and health at work involving exposure to noise or mechanical vibration
26.	N/A	REGULATION OF THE MINISTER OF ECONOMY of 28 May 2007 on the essential requirements for equipment for use outdoors relating to the noise emission in the environment
27.	N/A	ACT of 22 January 2021 on technical supervision
28.	N/A	ACT of 15 April 2021 on conformity assessment and market surveillance systems
29.	N/A	ACT on 22 November 2019 on electromagnetic compatibility
30.	N/A	ACT of 31 March 2021 Energy Law
31.	N/A	WUDT/UC/2003 PRESSURE EQUIPMENT ed. I October 2003 optional technical specifications for the manufacture and modernisation of pressure equipment
32.	N/A	WUDT/ZB/2009 NON-PRESSURE AND LOW-PRESSURE TANKS ed. II November 2009 technical specifications for general requirements for manufacturing and retrofitting of non-pressure and low-pressure tanks