The standard in chapters 1 – 6 is binding for all departments of ORLEN Unipetrol RPA s.r.o. which use the piping systems or carry out (ensure) their maintenance, repair.
The standard in chapters 7, 8, 9 is binding for all departments of ORLEN Unipetrol RPA s.r.o. for capital construction and installation of new piping.

Furthermore, the standard is binding for all departments of ORLEN Unipetrol RPA s.r.o. which are responsible for register, inspection, testing and acceptance of piping systems and for the external companies (suppliers) performing maintenance activities for ORLEN Unipetrol RPA s.r.o. The standard does not apply to subsidiaries of ORLEN Unipetrol RPA s.r.o. or Litvínov and Kralupy refinery units.

The departments of the company are obliged to present the standard to all external organizations ensuring the activities concerning piping systems for them (maintenance, capital construction).

The standard applies for all piping systems classified in group 4 pursuant to N 11 985.

Table of contents

1 General provisions

1.1 Terms, definitions and abbreviations

User	- Head of a production plant or a department to whom the tangible fixed assets was intrusted to use. The person is responsible for its effective utilization and completeness
Maintainer	- Defined person responsible for technical status of individual groups of the tangible fixed assets including maintenance and repairs
Operator	- Director of a section or a plant entrusted with overall responsibility for the tangible capital assets
Company	- ORLEN UNIPETROL RPA, s.r.o.
DHM	- long term tangible assets
OFÚ	- UNIPETROL SERVICES, s.r.o., Financial accounting dept.
OFŘ	- UNIPETROL SERVICES, s.r.o., Financial management dept.
PMI	- Positive material identification; analytic method carried out by mobile emission spectrometers intended for verification of chemical composition of the metallic materials as specified by the standard
Inspector	- Defined employee responsible for technical integrity of equipment in the entrusted section (as per asset register).
VT	- Production teams

NCR	- non-conformance register (defects and backlogs)
WPS	- welding procedure specification
WPQR	- welding procedure qualification report
PED	- Directive of the European Parliament and the Council on pressure equipment 2014/68/EU
PWHT	- Post welding heat treatment
PKZ (ITP)	- Inspection and test plan
STS	- Technical service section
SEP	- Standard engineering practice

1.2 The piping system consists not only from the pipeline itself including valves, compensations (U-band), measuring diaphragms and insulation, but also accessories, e.g. heat tracing piping, condensate separator, walkways for valves or measurement devices as well as bonding and the auxiliary structures (lining of U compensators and floor supports) serving for fixing and operation of the piping systems. Condensate headers, precipitators (separators) and distributors are part of the pipeline only if these do not represent independent pressure vessels pursuant to section 2 part. b) Decree No. 18/1979 Coll.

1.3 The standard concerns all independent piping systems classified in group 4, pursuant to the standard N 11 985.

1.4 For high pressure pipeline with operating overpressure of 10 MPa and more with DN exceeding DN 10, the principles stipulated in part 2.3 herein apply, this point shall not be applied for piping systems operated in the petrochemical plants (monomers and polyolefins).“

1.5 The standard does not apply to:

1.5.1 pipeline or its parts with nominal inside diameter smaller than DN 25 up to PN 64 including, and pipeline or its parts with PN 100 and more with nominal inside diameter smaller than DN 10,

1.5.2 piping systems conveying solid substances using the air (pellets, bulk material, etc.) that open into pressureless (air vented) silos and tanks, or conveying ecologically non-hazardous, non-flammable and non-explosive materials. The respective head of the maintenance department in cooperation with the head of the plant (or an employee authorized by the head of the plant) decide on classification of the piping system into this category.

1.5.3 underground piping systems.

1.6 Validity of the standard for individual types of piping systems is explained in detail in individual paragraphs.

1.7 Financial accounting dept. - OFÚ keeps records of the long term tangible assets that show which departments are the users and maintainers of individual long term tangible asset. These lists are sent to the users and maintainers once per two years.

1.8 Battery limits at the piping system between individual users are set in the Handling rules of the piping system, which is prepared by the Head of the plant or by an authorized employee in compliance with the Directive 845. These handling rules must be approved by the Heads of both

affected plants. In case of disagreement, the Unit director (or directors of the affected units in case it's a limit point between two different units).

1.8.1 For the maintenance purposes the battery limit between the supplier and the consumers overlaps with the limit between individual users. Energy pipeline battery limit is determined by the Directive 348.

1.8.2 In case the piping system is used and maintained by more users, the limit between individual users is also determined by a written agreement between these users.

1.8.3 Limits for maintainers are determined by the scope of inventory number as per the pipe card of the respective system in compliance with register of the financial accounting dept. and does not have to always correspond with operational limits defined by the Handling rules of the piping system.

2 Classification, register and marking of piping systems

2.1 Basic classification

Piping systems that this standard applies to are classified in four 4 as follows:

- **group I**: selected most important systems from the group of equipment 4 as per N 11 985
- **group II**: selected important piping systems from the group of equipment 4 as per N 11 985
- **group III**: other less important piping systems from the group of equipment 4 as per N 11 985
- **group IV**: other unimportant piping systems from the group of equipment 4 as per N 11 985

Piping system groups I and II contain piping systems with hazardous fluids (gases, gases dissolved under pressure, steams, liquids and their mixtures) and pipeline with potential hazard to health of people, property or to environment in case of potential failure. Hazardous fluids are pursuant to CEN/TR 13 480-7:2002 (taken over by ČSN 13 0020:2005 in the Czech Republic) classified in the Fluid group 1 and are defined as fluids that are explosive, extremely flammable, highly flammable, flammable (when the highest permitted temperature is above the ignition point) extremely toxic, toxic or oxidative.

Piping system groups I and II also contain the following:
- Piping systems classified as gas equipment as per Decree ČÚBP and ČBÚ No. 21/1979 Coll. and standard N 11 004
- Piping systems of water vapour/steam, water and condensates with temperature of 110 °C and higher and with operating pressure of 4,5MPa and higher.

Piping system groups III and IV contain piping systems with products and parameters that do not fit into system groups I and II.

Classification of piping systems into groups is done by the respective members of the production team, employees of the inspection department or maintenance department.

2.2 Register

Piping systems are unambiguously identified by a technical place code in PM SAP and by inventory number of tangible fixed assets.

One piping system or its part under one inventory number of tangible fixed assets may be registered only for one type of product, defined by a technical regulation, operating rules or by design documentation.
Newly registered piping systems that are repeated (are part of equipment mounted to lines or rows) the register is implemented for each piping system with individual inventory number.

2.2.1 Each piping system of group I –IV must have a unified "Piping system card" prepared and maintained by the respective maintainers in cooperation with the users and inspectors. The cards are being prepared in the course of the investment erection stages.

2.2.2 We recommend pre-prints of the cards be prepared in three colours for the lucidity purposes, in particular in scope of the new investment projects:

- Red colour : for group I
- Blue colour : for group II
- White colour : for groups III and IV

Piping system cards must be properly kept and archived both in electronic and written form (digitalization– scan, etc.). – applies for newly handed over investment projects

The cards are part of the passports of the respective piping systems. The maintainer records inspections and repairs of the piping systems into the cards or passports.

2.2.3 Columns "Piping system cards" for cycles of external inspections, NDT checks and pressure leak tests are filled as per determination of the respective maintainer and inspector (see art. 4.3:4.5:4.6).

2.2.4 Records in PM SAP

2.2.4.1 Records of piping systems and their parts in PM SAP is ensured through information record of the technical place, that contains the following basic descriptive data:

- Technical place code
- Name
- Classification class
- Inventory number of tangible fixed asset
- Piping system group as per 2.1.
- Cost center of the respective production plant
- Maintainer code
- Inspector code
- Operating parameters (the highest admissible pressure, the highest admissible temperature, operating fluid)
- Technical parameters (material, nominal inner diameter, nominal pressure, their length)
- Documentation (isometry, BOM, section of a pipe bridge, line list, PI&D numbers, laying drawings, number of the safety valve)

Piping systems are recorded in the PM SAP based upon demonstrable request (written or e-mail) from the respective user or maintainer, that must contain the abovementioned data.

Changes in the information record of the piping system in PM SAP are only upon demonstrable request of:

- the respective operator – in case of liquidation
- the respective maintainer or inspector – in case of inspection plan modification,

The demonstrable request shall contain the following data:

- Code of technical place of the piping system
- Piping system name
- Date of requested change (removal)
- New values of changed data
- Documentation in case it was modified or changed
-

The requests are delivered to the Maintenance support department that administers database of piping systems in PM SAP and ensures modifications of their information records.

All employees involved (user, maintainer and inspector) must be informed about execution of the changes vial electronic mail.

2.2.4.2 Part of the records in PM SAP consists of inspection activity plans for piping systems.

Administration of these plans is ensured by the reliability and documentation department.
This activity includes:

- Implementation (deactivation) of inspection activity plans
- Interchanging the plans

Implementation of the plan is only possible upon demonstrable request of the respective maintainer, or inspector as per defined responsibilities/accountabilities, which must contain the following data:

- code of technical place of the piping system
- name
- inspection activity designation (strategy)
- inspection activity period
- term of last execution of the inspection activity
- date of requested execution of a change (implementation, deactivation)

The requests are delivered to the Maintenance support department.
The user, the maintainer and the inspector are informed about execution of the changes in the inspection plans vial electronic mail..

2.2.4.3 Records and check of piping system inspection is ensured by individual maintainers and inspectors using the database in PM SAP. The database of monitored piping systems is updated based upon original protocols on executed inspections of pipeline, liquidation protocols, enlistment of new piping systems into the set and other changes in basic data of pipeline inventory numbers (change of maintainer, change of account, change of building, change of name, change of type and cycle of inspection).

2.2.4.4 Individual maintainers and inspectors are obliged to inspect the updated sets of piping systems regularly in PM SAP module in scope of their competence in order to meet the defined deadlines of piping inspections of all kinds..

2.2.4.5 Complex records and check of piping system inspections is ensured in close cooperation with the Financial Accounting department (OFÚ) that forwards the information on implementation of new piping systems, liquidations and other changes in basic data of piping systems (change of maintainer, user, building or name) to the departments involved (operator, maintainer and inspector).

2.3 Designation/marking of piping systems and its segments

2.3.1 What concerns piping systems with operating overpressure 10 MPa up to 32,5 MPa with flange joints pursuant to N 16, N 18, designation(marking) will be performed for high pressure segments from material grade 15 (N) and of the following segments from material grade 12 (S) and grade 17:

- all high pressure closing valves and back pressure valves
- connecting bend of the DN 70 coolers
- prolonged base bend
- thermowells
- all safety relief valves
- cooler Y-branches
- special adapting pieces (forged or welded) as per determination of the maintainer
- high pressure cooler tubes

2.3.1.1 Designation/marking of these segments is ensured by the maintainer.

2.3.1.2 After designation with a register number each high pressure segment has to pass the dimension inspection. The maintainer receives a written report on the results of the inspection that contains data pursuant to N 16, N 18.

2.3.1.3 High pressure segments newly designated with a register number are fitted with a registration card issued by an authorized employee of the maintainer where the results of the inspection report, date and place of installation are recorded. High pressure segments of basic DN 6 are an exception, where instead of the piping system, the installation is recorded by the position where the segment is installed (e.g. valve group of chamber No.7). During next inspection the authorized employee makes a record of operating hour number. Register card index of high pressure parts and book of assigned register numbers for individual groups of high pressure segments is established by the respective maintainer.

2.3.1.4 High pressure segments made of material grade 15 (N) of German origin (from 1939 – 1945) are marked with register numbers in agreement with the register cards. Numbering system and register cards were taken over.
High pressure segments made of material grade 15 (N) (manufactured after 1945) are marked with numbers with SZ index and there are respective register cards established. High pressure segments in ammonia plant will be numbered with AS designation before each register number (e.g. AS 55451) in order to distinguish them from the same numeral series of Česká rafinérská, a.s.

2.3.1.5 Measurements of selected high pressure parts made of material grade 15 (N) and specifically determined segments of grade 12 (S) is performed during repairs, or for segments classified in I and II groups, during planned inspections and revisions. The selected high-pressure segments are defined based on visual inspection carried out by the inspector in cooperation with the maintenance engineer. Scope of high pressure segments that are measured is defined by the repair breakdown. Results of the measurement are part of the written report (form No. 066/007-36/65-3771), results of which together with date and place of installation are recorded in the register cards.

2.3.1.6 High pressure segments not registered yet, embedded in existing equipment, are marked with a number of position as per respective drawing documentation prior to disassembly. Immediately after the disassembly, the register number is embossed onto the segment and a register card is issued. The place of current installation is registered in the register card. After inspection of dimension the result of inspection report is recorded in the register card.
If the segment is found satisfactory, the date and place of installation is recorded in the card.

Scope of disassembled segments during repairs is defined by the repair breakdown.

2.3.1.7 Selected high pressure segments that are administered by the maintainer and are not built-in are marked with a register number in case they are prepared by the maintainer for installation. After marking, the segment is handed over for inspection. Other manipulation is similar to the one stated in art. 2.3.1.2 a 2.3.1.3, or in art. 2.3.1.6 herein. Spare piping segments, prepared for the case of quick replacement, must be marked in a similar way.

2.3.1.8.New high pressure segments, stocked out from the warehouses are marked with a register number and the register card for them is issued with date and place of installation. The respective maintainer asks for certificates from the technical inspection department(quality management dept.) of the contractor as per the numbers embossed on the segments by the manufacturer

2.3.1.9 Equipment after erection will be handed over with non-registered high pressure parts. The executing company shall hand over only certificates to the high pressure segments which must contain designation of test, heat number, register number, etc. During disassembly of any part for any reason, it is proceed in the same way as when disassembling the selected high pressure segments from the existing equipment, as stipulated in art. 2.3.1.6.

2.3.2 Groups of numbers for high pressure segments for individual maintainers of the production equipment are as follows:

Compression and	
• distribution of gases	0 - 9 999 **x)**
• Ammonia plant	AS 10 000 - 69 999

x) *Department of Compression and distribution of gases maintains numbering as per existing way in scope of the given group and numbering of valves continues from 2 000 to 9 999.*

At other production plants the numbering of individual segments always starts with initial number of the group intended for the respective production plant. Existing number of valves are kept until termination. Other high pressure segments of determined groups are numbered continuously with register numbers regardless of the inside diameter.

3 Passports and drawing documentation

3.1 Passports

Passports of piping systems are maintained by the maintainer or by subordinate employees.
Passports of piping systems are maintained either in written of electronic form.

3.1.1 Passports of pipe group I-IV
Apart for documents specified in the passport content pursuant to standard N 11 985 “Standard for passports of production equipment” the following annexes to the passports are determined for the piping systems of group I - IV:

- piping system card
- repair report (quality part)
  inspection protocols
- wall thickness inspection protocols
- accident protocols

- the passport contains partial drawings with identification of the repair scope
- complete drawing documentation in the AS BUILT documentation scope is archived and administered in DMS SAP in compliance with S 350
- Technological procedures or protocols on execution of surface protection (if prepared) containing the kind, type and thickness of coating materials, date of surface protection execution and the warranty provided.

Scope and number of other annexes are defined by the maintainer and the inspector with respect to the type of piping system.

3.1.2 Documentation of new high pressure segments
When replacing the selected high pressure segments manufactured pursuant to company standards N 16, N 18, we proceed in accordance with art. 2.3.1.6 herein.

3.2 Drawing documentation

Drawing documentation must be filed for all piping systems, which is prescribed by general regulations and ČSN standards valid in the time of equipment manufacture. Administration of this documentation is defined by Directive 350.

4 Checks, inspections, revisions and tests

In order to ensure safe and reliable operation of the piping systems it is necessary to check their status regularly. In order to do so, the given checks, inspections, revisions and tests are performed.

Based upon performed inspections and measurements the maintainer (based upon proposal of the inspector) plans replacement of the piping systems 3 to 5 years in advance.

List of determined inspections, checks, revisions and tests:

- Inspections performed by the user – chapter 4.1
- Operating revisions – chapter 4.2
- External inspections carried out by maintenance engineers – chapter 4.3.1
- „B“ inspections - external inspections carried out by the maintainer – chapter 4.3.2 – register in the PM SAP system
- Internal local inspections – chapter 4.4
- Pipe segment wall thickness inspection – chapter 4.5 – register in the PM SAP system
- Pressure leak tests - periodical – chapter 4.6.1 – register in the PM SAP system
- Pressure strength tests after repairs – chapter 4.6.2
- Pressure leak tests after completed repairs– chapter 4.6.3

4.1 Inspections performed by the user

4.1.1 Inspection of the equipment represents visual assessment whether the status of operated equipment complies with requirements of the occupational safety and safety of technical equipment as well as with requirements of fire protection.

4.1.2 Inspections are carried out by an authorized employee of the user who demonstrably masters operational regulations, safety and emergency regulation for operating the inspected equipment, related safety regulations, Fire rules and alarm regulations together with emergency plan of the respective production plant (or the emergency plan of the company) and who has been trained to operate the equipment.

4.1.3 4.1.3 Inspections are carried out on piping systems of all groups minimum once per three months during operation of the equipment.
4.1.4 Piping systems of group I located on pipe bridges with exception of those that are technologically and territorially part of the respective production plant, are inspected, among others, once per month.

4.1.5 The following, in particular, is visually inspected:

- Tightness of piping systems, surface of pipes (status of surface protection) bends, Y-branches, transitions, and flange joints (conductive bonding)
- Fixing the piping systems (supports, hangers)
- Vibrations, impacts
- Heat tracing function and draining system function
- Removal of inflammable objects
- Marking the piping systems pursuant to ČSN 13 0072, N 13 700 and designation of closing valves

4.1.6 Except for inspections, the operating staff is obliged to test function of valves by turning the stem by a certain number of turns, if possible during operation, to execute regular cleaning and valve stem preservation. Procedures and terms are defined by the head of the plant or an employee authorized by this head of the plant.

4.1.7 The authorized employee makes a record into the second section „annex – check sheet“, that shall contain:

- First name and surname of the employee who performed the inspection
- Date of inspection
- Scope of inspection with unambiguous designation of the pipeline as per operating practice
- Detected defects
- Signature of the employee who performed the inspection

List of piping system is a part of the inspection documentation.

4.1.8 Removal of detected defects is ensured by the employee authorized to perform the inspection either himself or in cooperation with the maintainer, or he informs his superior about them. Removal of defects is also recorded into the second section „annex – check sheet“.

4.1.9 Execution of the gas equipment inspections is determined by Section 3, Decree of ČÚBP No. 85/1978 Coll. Inspections are performed by an authorized employee of the user who must possess a certificate on professional competence to operate the gas equipment based upon testing by the inspection/revision engineer. Provisions stipulated in art. 4.4.1, 4.1.2, 4.1.5,4.1.7 and 4.1.8 apply for performance of gas equipment inspection. Inspections of gas equipment (piping systems) are performed at least once per year under operation. The authorized employee shall record the inspections into the second section of the annex to the check sheet „Table No. 1: Protocol on executed inspection + Table No. 2: Protocol on defects and their removal“.

4.2 Operating revisions

Operating inspections of gas piping systems are performed by the inspection engineer pursuant to N 11 004.
Gas equipment revision report shall be submitted to the user, maintainer and the inspector.

4.3 External inspections ensured by the maintainer

4.3.1 External inspections performed by maintenance engineers or by the maintenance engineers in cooperation with the external company (applies for the department of bridges).
The inspections are performed for all piping systems of group I - IV.

4.3.1.1 In particular, the following items are visually inspected:

- External appearance, overall status of the pipeline system, insulation and surface protection condition
- Pipeline system, flange joints and valve packing tightness
- Mounting of the pipeline system (supports, suspensions, hinges), compensator pipe deformation

4.3.1.2 Inspection cycle must not exceed 1 month. For the piping systems important from the production point of view or for those with higher occurrence of defects, the cycle of these inspections may be defined as adequately shorter by the maintainer. Also the scope and content of the inspections has to be adjusted accordingly and with respect to importance of the system.

4.3.1.3 Inspections are carried out in scope of regular site tours through individual sections by responsible maintenance engineers or maintenance engineers in cooperation with the external company **(applies for the department of bridges)**. Removal of potential findings having impact on safe operation of piping systems resulting from the inspections is organized by the maintenance engineers by issuing separate reports and subsequent orders implemented in the planning process. Scope of the repair is always consulted and approved by the respective inspector. The respective scheduler of the production team decides on the term of execution as per the assigned priorities.

4.3.1.4 In case of substantial findings or findings with a large volume of activities and assumption of significant financial load, the authorized employee shall inform its superior manager about these findings without any delay.

4.3.2 External inspection executed by the maintainer or by an employee authorized by the maintainer - “B” inspections

These are performed for the piping systems of all groups. These inspections serve predominantly as a base for repair planning, their purpose is visual ascertainment of current technical status of the piping system including the accessories.

4.3.2.1 Coating inspection pursuant to N 10 051 is carried out directly by the maintainer, or by ordering the material and NDT testing department.

4.3.2.2 Pipe segment wall thickness checking is not part of the inspection. However what concerns piping systems of I and II groups and other piping systems, where the measurement was decided, an employee performing the inspection must evaluate results of the wall thickness in the previous cycle and to adopt a standpoint to the situation.

4.3.2.3 An employee performing the inspection must assess even external corrosive attacks and potential attenuation in inadmissible places of the piping system (place of supports, suspensions, etc.) in relation to the corrosivity of environment, surface temperature and manner of piping system protection. Another part of the inspection in also visual inspection of piping system, flange joints and valve packing tightness.

4.3.2.4 If necessary, the maintainer or the authorized person performing the inspection invites also employees of different expert departments as consultant partners.

4.3.2.5 The cycle of inspections is determined by the maintainer and it is recorded into the piping system card. The cycle of inspection for piping systems of I and II groups may not exceed 3 year period, what concerns III and IV groups it may not exceed the 5 year period.

4.3.2.6 Results of the check/inspection is recorded by the maintainer into the prescribed protocol and a copy is sent to the respective representative of the production team and the designated inspector. Based upon the protocol, the maintainer administers the inspection in the PM SAP system.

4.3.2.7 The inspector utilizes the results of the check/inspection for planning the scope of inspections/checks within other inspections as per art. 4.4 4.5 and 4.6 including determination of the scope for wall thickness of the assessed piping system.

4.3.2.8 In case of uncertainty what concerns the piping system condition as a result of the findings ascertained during activities as per the art. 4.3, it is necessary to supplement these activities with NDT tests (UT, RT, etc.).

4.4 Internal local inspections

These are carried out for piping systems of I - IV groups. Internal local inspection is carried out during replacement of the valves or parts of the piping.

4.4.1 In case the maintenance engineer finds out in the course of the visual inspection that the selected segments reached their ultimate wear, he/she informs the respective inspector and they jointly determine the scope of checks of next segments taking into account the knowledge of current condition of wear, or the inspection of the whole technological node. The segments, reaching the ultimate level of wear where repeated use does not guarantee safe operation in the next repair cycle, are replaced. The repair itself is carried out in compliance with article 4.3.1.3.

4.5 Pipe segment and piping wall thickness inspection

Wall thickness is checked mainly what concerns systems of I and II groups. The inspector in cooperation with the maintainer, who ensures the course of activities based upon requirements of the inspector, decide upon the inspection. What concerns piping systems in groups III and IV, the wall thickness inspection is not commonly performed.

4.5.1 Inspections are carried out on permanently selected segments with assumed maximum wear. Selection of scope of measurement, number of measuring points or ratio of inspected surface is determined according to corrosivity and assumed forms of corrosion. When determining measuring points, it is necessary to individually assess individual pipe branches according to corrosivity and to determine places with expected maximum attack.

Factors, that must be taken into account include:

a) whether the equipment works in gaseous or liquid phase
b) fluid character
c) place with maximum temperature
d) place with maximum pressure
e) place with maximum flow velocity (potential material erosion)
f) places with non-laminar flow
g) places where the medium can be entrapped

h) places where the medium concentrates (bleed-off, bottom parts, bending, non-insulated necks/bellmouth)
i) vicinity of feed, places with potential priming
j) places with vibrations, sudden changes of temperature
k) external influences

Initial determination of measuring points cannot be considered as final, but it may be optimized based upon assessment of ascertained data.

4.5.2 In order to determine cycles of inspection, the inspector together with the maintainer may use cooperation of the Head of the material and NDT testing department. Frequency of measurement is determined according to the corrosivity and assumed corrosion forms, ascertained corrosive losses and according to existing experience with the given piping system. The maximum interval between the inspections and between acceptance of the pipeline after erection and first inspection is 5 years. Results of the inspection are recorded by the Inspector into a prescribed protocol, copy of which is sent to a respective representative of VT and to a defined maintainer. Based on the protocol, the Inspector administers the inspection in the PM SAP system.
In case the piping is included in the corrosion loop system, the inspection cycle is fixed based upon calculation of the fluid criticality. This calculation takes into account technical, safety and economic parameters of the piping. Based upon the calculation, the piping systems are put into intervals for inspection: ½ year, 1 year, 2 years, 4 years and 5 years. The interval is determined by the Material and NDT dept. and may only be changed upon new determination of the fluid criticality. The corrosion engineers shall add data to the application software of corrosion loops.

4.5.3 Measuring the pipe and pipe segment wall thickness is carried out by an expert department (e.g. Material and NDT dept. or departments performing the maintenance, etc.). The person submitting the request for measurement is obliged to provide specification of the request specifying the technical place, designation of the system, DN and PN, number of bldg. and number of inspected segments, temperature, operating fluids and piping system material.

4.5.4 The expert department (Material and NDT dept.) performing the measurement also determines the measurement method. In case the measurement is performed using the ultrasonic method, the maintainer will ensure cleaning of measuring points of the pipe segments down to the metal surface. In case of assumed repeated measurement the measuring point is permanently marked as per methodology of ORLEN UNI RPA based upon assignment of the inspector in cooperation with the maintenance engineer with respect to requirements of the corrosion loop project. Recommended dimension and shape of the measuring point shall be determined by an expert department carrying out the NDT activities. Exact location of the measuring point on the segment is in competence of the inspector in cooperation with the maintenance engineer. It is necessary to take into account, that the measuring cross-section of the pipe has more cleaned and measured points around its circumference in order to simplify assessment of the pipeline status.

4.5.5 Results of the inspections are recorded in the protocol by the expert department which performed the measurement, the protocol including assessment is handed over to the inspector and the maintainer, a copy is filed in its documents as well. The protocol states for each measured point its wall thickness, it states minimum wall thickness pursuant to company standards or alignment charts for minimum wall thickness or the manufacturing documentation, whether each segment is suitable for next operation or not.

4.5.6 When ascertaining extraordinary cases of wall thickness attenuation, the expert department who performed the measurement is obliged to inform the responsible inspector, user, maintainer or the superior departments.
Furthermore, proceed in accordance with S 846 – solution of NDT test results.

4.5.7 Based upon the requirement of the investor, the maintainer is obliged to prepare the order for repair incl. all respective spare parts and to submit it to the production team for approval and planning of the whole action.

4.6 Pressure leak tests - periodical, pressure strength tests after repairs

They are carried out for piping systems of all groups. Procedure of such pressure tests is defined in N 11 062 and N 11 063.

4.6.1 Pressure leak tests - periodical

4.6.1.1 The cycle of the pressure leak test is defined by the inspector in cooperation with the maintainer or a representative of a production team with respect to knowledge of current status of piping system wear. Periodical pressure leak tests are carried out for piping systems of group I and II and the length of the cycle is max. 5 years.

4.6.1.2 Leak tests may be performed using water or other suitable liquid (inert gas, operating fluid). Value of the testing pressure is determined jointly by the members of the production team, inspection department and maintenance department, its value should not be lower than 0,9 multiple of the max. operating pressure, the value of the pressure may be lower in exceptional cases. The testing pressure remains in the piping system for the whole period of tightness testing/verification.

4.6.1.3 Results of the periodic pressure leak tests are evaluated by the inspector/revision engineer based upon a procedure determined by them.

4.6.1.4 In case of a pressure drop of the check pressure gauge or leakage, the test is unsatisfactory and needs to be repeated and ensured that the piping system is inspected again. During repeated testing the suspicious places of insulated pipeline must be stripped.

4.6.1.5 The user is obliged to cooperate with the inspector or maintainer when performing the periodical pressure leak tests. The user, together with the inspector, is responsible for compliance with the determined terms.

4.6.1.6 Results of the leak pressure tests are recorded by the inspector to the prescribed protocol, a copy is sent to the respective representative of the production team and the designated maintainer. Based upon the protocol, the inspector administers the given inspection/check in the PM SAP system.

4.6.2 Pressure strength tests after repairs

4.6.2.1 When repairing the piping requiring with welding, it is necessary to perform a strength pressure test of the piping system or its part. In exceptional cases, this test may be replaced by 100% NDT weld check (radiation, ultrasonic or other tests, see the product standard) and by a leak test, however this type of test must be agreed in advance. Testing pressure for the pressure leak test must be higher or equal to the operating pressure, which is generally fulfilled by the 0,9 multiple of the max. operating pressure.

The strength pressure test and tightness after repair may be performed by different methods upon agreement with the expert department, e.g. using the special procedure combining calculation methods with material testing and diagnostic methods (e.g. steam piping to SC).

4.6.2.2 The piping system that was shut down for a period exceeding 6 months or it was not put back to operation latest by 6 months after performance of the test, must not be put back into operation without approval of the determined committee containing the production team, Inspection department and Maintenance department (the committee is convened by the production team).

Conclusion of the committee may require execution of:

- Pressure leak test,
- Activities pursuant to art. 4.1, 4.3.2 ad 4.5 hereof,
- For pipeline included in the designated gas equipment, execution of an extraordinary "Operational revision of piping system of the designated gas equipment (VPZ) " under operation of the respective piping system.
- Strength pressure test for industrial piping systems (defined by TPG 70301- e.g. natural gas)

It is in responsibility of the user who shall ensure the performance in cooperation with the inspector and the maintainer

This provision does not apply for piping systems erection of which is ensured by a respective expert department of the investment section in scope of implementation of the investment action.

4.6.2.3. Strength pressure test of piping systems that are categorized by Decree No. 21/1979 Coll. as reserved gas equipment, are taken over by an inspection engineer for gas equipment of the contractor . He issues a protocol after a successful test, which is handed over to the user, inspector or the maintainer, who are responsible for filing the protocol into the piping system card or insert it into the electronic piping card.

4.6.2.4 Strength pressure test of other piping systems are performed by a professionally qualified person who issues and undersigns a protocol/report on the tests, which is handed over to the user, inspector or the maintainer, who are responsible for filing the protocol into the piping system card or insert it into the electronic piping card.

4.6.2.5 The user is obliged to cooperate with the inspector, contractor and the maintainer when performing the strength pressure test after repair.

4.6.3 Pressure leak tests are carried out to verify tightness of piping systems before commissioning (e.g. after turn-around) and after completed repairs when individual parts of the systems were disassembled and in cases when leakage in dismountable joints cannot be excluded after long term operation. (e.g. during frequent and fast changes in medium temperature).

4.6.3.1 Scope of the pressure leak test after repair is defined and ensured by the user and verification of equipment tightness is ensured by the contractor.

4.6.3.2 Pressure leak tests of piping systems that are categorized by Decree No. 21/1979 Coll. as reserved gas equipment, are taken over by an inspection engineer for gas equipment of the contractor. He issues a protocol after a successful test, which is handed over to the user, inspector or the maintainer, who are responsible for filing the protocol into the piping system card or insert it into the electronic piping card.

4.6.3.3 Pressure leak tests of other piping systems are performed by a professionally qualified person who issues and undersigns a protocol/report on the tests, which is handed over to the user, inspector or the maintainer, who are responsible for filing the protocol into the piping system card or insert it into the electronic piping card.

4.6.3.4 The user is obliged to cooperate with the inspector, contractor and the maintainer when performing the pressure leak test after repair.

4.7 Dimensional inspection of high pressure segments

4.7.1 Dimension inspection is performed and results are assessed pursuant to standards N 16, N 18.

4.7.2 When performing the dimension inspection of high pressure segment, the parts that are connected to the assembled ones are inspected as well.

4.7.3 Dimension inspection is performed by the quality department of the supplier (technical inspection dept.) where the inspection was ordered. The department issues a written report on the performed inspection that is then handed over to the maintainer.

4.7.4 In case the dimension inspection shows, that the high pressure segments reached ultimate wear, the maintainer shall perform an assessment whether these segments may be used for lower pressure level or whether they are intended for disabling. Segments usable for the lower pressure level are distinguished from the segments for operating overpressure of 32,5 MPa by prescribed marking that is performed by the supplier from whom the inspection was ordered.

4.7.5 The supplier from whom the inspection was ordered issues a report of rejects for the unsatisfactory segments to be disabled.

4.7.6 Unsatisfactory segments without utilization for lower pressure levels will be wasted by destroying the thread ends.

4.7.7 High pressure valves may not be used for any lower pressure level after reaching the ultimate wear for operating overpressure 32,5 MPa.

4.7.8 For piping systems of lower pressure levels and their inspections, which were assembled from segments excluded from usage for operating overpressure of 32,5 MPa, the same principles as for systems with operating overpressure 32,5 MPa shall apply.

4.8 Inspections during assembly of high pressure equipment

4.8.1 Inspections of assembly of high pressure equipment are carried out by an authorized employee of the maintainer during repairs and after the repairs before handing the equipment over for operation.

4.8.2 Authorized employees are entitled to have any segment, that has no register number,, replaced upon previous notification of the maintainer. Replacement needs to be carried out in compliance with the repair breakdown that determines which segments are to be disassembled.

4.8.3 Inspection of high pressure equipment assembly is carried out so that the register cards of the segments liable to individual register would contain record of the assembly location. Based upon

this list, it is possible to determine the operating time and place of high-pressure segment implementation from the cards.

4.8.4 What concerns high pressure piping systems of material grade 12 (S), for which high pressure segments manufactured pursuant to N 16, N 18 were used for their assembly and where it was demonstrably verified that amount of wall thickness loss enables performance of internal inspection and wall thickness inspections in cycles longer than 3 years, it is possible to give up register and monitoring pursuant to art. 2.3 and such a piping systems may be registered pursuant to art. 2.1 and 2.2 hereof.

4.9 Documentation of check, inspection and test results

4.9.1 The person responsible (maintainer or inspector) shall prepare protocols on inspections and tests according to art. 4.3. and 4.6. These protocols are unified for the whole company and issued in form of a printed form.

4.9.2 The protocols and their results are documents for issuance of maintainer´s order for execution of the repair or replacement of the piping system.

4.9.3 The respective maintainer files the original copy of the protocol regarding any type of inspection/check in the respective passport of the piping system.

5 Acceptance from operation to repair and from repair back to operation

5.1 Execution of inspection and acceptance

Execution of all types of repair must be checked. When repairing piping systems of I and II groups, special attention must be paid to all the activities.

5.1.1 Handing over the piping systems for repair is carried out by issuing the " Work permit on equipment" to the department executing the repair pursuant to Directive 465.

Acceptance of the piping systems after repair is performed by an authorized representative of the user by closing the "Work permit on equipment". Acceptance takes place with presence of the representatives of the contractor, user and maintainer.

5.1.2 Ordering and organization of the repairs is solved within the ordering system PM SAP and in compliance with N 11 200. The maintainer shall consult the repair procedure and the scope of requested technical documentation with the respective inspector, in particular what concerns requested documents certifying the repair.

All welding works must be carried out pursuant to valid and applicable standards. Inspection and execution by the company must be in compliance with a valid product standard (e.g. ČSN EN 13 480).

5.1.3 Documents on repair and inspection are filed to the piping system passport by the maintainer.

5.1.4 Inspections of newly executed surface protections or their repairs are performed only by the Material and NDT dept. within the meaning of Directive 317.

5.1.5 When inspecting the piping systems of all groups, the provision of articles in chapter 5.1. remain binding.

6 Operation of piping systems

6.1 Changes in operation of piping systems

6.1.1 In case there are any deviations from the technological mode during operation, that could have significant influence on the condition, safety and life time of the pipeline, the user is obliged to notify in writing the respective maintainer immediately and ask for the standpoint of the Material and NDT department.

6.1.2 In case the user only intends to do such changes, he is obliged to follow Directive 843.

6.1.3 Upon request of the user, the respective department executing maintenance of the user´s equipment is obliged to make a standpoint to the limit of essential deviations that do not have to correspond with limits determined by the technological regulation.

6.2 The user is obliged to ensure regular inspection of corrosion and erosion and continually ensure effective removal of the extensive corrosion and erosion sources.

7 Manufacture, reconstruction of piping

It is carried out in accordance with Government Decree 219/2016 Coll. (2014/68 / EU) -PED and harmonized standards ČSN EN 13 480, ČSN EN 15 001 a ČSN EN 1775.

The manufacturer / supplier / contractor (hereinafter referred to as the supplier) prepares the design, calculation of the piping solely at his own risk, on the basis of input data from the customer. Where possible, the supplier shall take into account the requirements for detailed material specifications and required product properties from the customer and his comments. However, these detailed customer specifications are not binding and shall not relieve the manufacturer of responsibility for the correct design of the final product. If it is not possible to use detailed specifications and customer comments during production, this must be stated during the inspection at the design stage.

Before commencing the works, the Supplier must submit the inspection and test plan for approval to the designated ORLEN Unipetrol RPA representative.

7.1. As part of the Client´s inspection, ORLEN Unipetrol RPA requires the possibility of continuous inspection and submission of documentation to prove the quality of production in the form of a random production and assembly inspection at the following individual stages:

a) AT THE STAGE OF DESIGN - pre-manufacture activity

b) AT THE STAGE OF MANUFACTURE– inspections during production at the manufacturing plant

c) AT THE STAGE OF ASSEMBLY– inspection during assembly at the destination in Chempark

d) AT THE STAGE OF FINAL APPROVAL – check of Inspection and Test Plan, final tests and documentation of individual devices

e) AT THE STAGE OF PRESSURE EQUIPMENT SET TEST

7.2. ORLEN Unipetrol RPA may request confirmation by its signature in the approval stamp, printed on the title page, or in the inspection and testing plan designated by the ORLEN Unipetrol RPA representative, when approving the relevant documentation.

7.3. Detected non-compliances will be recorded in the form of an NCR report and shall be continuously removed by the supplier.

7.4. In the event of a gross violation of approved procedures, non-removal of NCR, the designated representative of the customer is entitled to suspend manufacturing / assembly at the expense of the supplier until removal.

7.5. The STS department or the authorized representative of ORLEN Unipetrol RPA shall gradually confirm the fulfilment of the individual stages a-e, by a separate record, where the individual NCRs are also specified. It is assumed that without confirming the fulfilment of the requirements of the previous stage, it is not possible to carry out further activities of the next stage.

7.6. Internal inspections by the customer do not release the supplier from liability for the completeness of the final product and have no impact on any complaint proceedings. Failure to apply certain points of inspection and comments on the supply of designated tech. equipment by the customer and STS, does not release the supplier from the obligation of the manufacturer and the requirements of regulations to meet them.

7.7. Connections to other pressure equipment must meet the requirements of N 11 005.

7.8. If the piping is a designated gas equipment, the requirements of N 11 004 must be met at the same time.

7.9. The contractor can divide the entire piping set into sub-sets and subsequently divide the documentation in this way. However, this must be covered by a summary report, which ensures that the individual sub-sets are linked so that the overall set is complete, this means complete regarding testing the individual sub-sets as well as completing the overall documentation for the individual elements.

7.10. If pressure and safety equipment is part of the piping installation, it must be clear from the documentation supplied whether it has a safety, regulatory or informative function. If it has a safety function, it must be clear in which SIL category it has been evaluated. The tests will be performed in accordance with N 11 017.

7.11. The success of proving the inspection presupposes the fulfilment of these inspection points in particular (proposal for inspection points in the contractor's PKZ – see tab. 1.a – 1.e).

Table 1.a. Design stage in particular

	Title	Y/N
1	Checking all technical parameters specified in the contract	
2	Checking project documentation and welding procedures	
3	Audit at a selected supplier - verification of qualifications and quality assurance procedures	
4	Approval of the inspection and test plan of manufacture and assembly (PKZ)	
5	Checking the manufacture and assembly plan and schedule	
6	Checking requirements for surface treatment, paints and coatings, conservation and insulation	

7	Technological process diagram (PFD), machine-technological diagram (PID)	
8	Definition of individual elements included in the set and precise delimitation of the set by marking on the machine-technological scheme (PID)	

Table 1.b. Manufacture stage in particular

	Title	**Y/N**
1	Participation in the tests required by the inspection and test plan	
2	Checking the scope of non-destructive tests	
3	Checking the certificates of the materials used	
4	Notch toughness tests of materials and testing welding plates	
5	Physical verification of the material of pressure parts and verification of all certificates and transmission of marks	
6	Checking compliance with the qualification of welders for approved welding procedures	
7	Inspection of the production process of pipes and necks, grooving of welds	
8	Verification that the connected extension and accessories agree with the approved drawings - before installation	
9	Partial pressure test of prefabricated parts - if applicable	
10	Checking X-rays and verifying the results of NDT tests	
11	Checking the correctness of the seal used	
12	Checking the correctness of the fasteners used	
13	Final visual and dimensional inspection according to the approved documentation	
14	Checking the final production documentation	
15	Checking the condition of surface preparation for coatings	
16	Paint inspection, including measurement of thickness and quality of work	
17	Transport readiness check	
18	Checking the certificates of the materials used	
19	Participation in the final assessment by the Notified Body - if applicable	
20	Draft of operating and maintenance instructions in the Czech language	

Table 1.c. Assembly stage in particular

	Title	**Y/N**
1	Before assembling the piping in position, the supplier's technician will perform a visual inspection of the piping in the presence of a designated ORLEN Unipetrol RPA representative in order to determine the condition of the piping since the last inspection, transport, and handling.	
2	Record of the cleanliness of the installed equipment before the beginning of the assembly	
3	Participation in the tests required by the inspection and test plan	
4	Checking the scope of non-destructive tests of connection welds	
5	Checking the certificates of the materials used	
6	Qualification sheets of welding and NDT personnel	
7	Checking compliance of the qualification of welders for approved welding procedures	
8	Inspection and participation in working tests of welders	
9	Studying X-rays and verifying the results of NDT tests	
10	Checking the correctness of the seal used	
11	Checking the correctness of the fasteners used	
12	Qualifications for the installation of flange connections TALUFT / ČSN EN 1591-4	

13	Participation in pressure tests	
14	Machine-technological scheme (PID)	
15	Pressure equipment (valves, gate valves, flaps)	
16	Safety equipment (safety valves, rupture discs, reducers/limiters, flow meters)	
17	Welding diagram (pipe axonometry with XYZ / AS build isometry marking)	
18	Inspection of the slope of the pipeline, if it is not possible to perform the inspection of the slope of the piping according to the drawing documentation, then the manufacturer / assembly organization will perform the inspection during assembly and prepare a record / protocol on the inspection	
19	Checking the flow direction, setting the valve throughput, functionality and accessibility of the valve control panel and non-return valve control, etc.	
20	Checking the assembly documentation	
21	Checking the condition of surface preparation for coatings	
22	Paint inspection, including measurement of thickness and quality of work	
23	Participation in the final assessment by the Notified Body	
24	Design of the set and necessary documents for the assessment of the pressure equipment set	
25	Inspection of marking in line with N 13 700	

Table 1.d. Stage of final approval of individual products in particular

	Title	**Y/N**
1	Verification of all production tests and inspections of individual pressure equipment	
2	Photocopies of production labels of individual pressure equipment	
3	Documentation in accordance with the Annex to the PED I.3.3.a 3.4. 2014/68 / EU (Decree 219/2016 Coll.)	
4	EU Declaration of conformity according to 2014/68 / EU of individual pressure equipment	
5	EU Certificate of the Authorized Persons / Notified Body of Individual Pressure Equipment	
6	Inspection report of the Authorized persons (contractual annex to the delivery) of individual pressure equipment	
7	Instructions for operation and maintenance in the Czech language of individual pressure equipment	
8	Evaluation of residual risks according to the Labour Code and the European Directive (89/391 / EEC) of individual pressure equipment	

able 1.e. Stage of final commissioning of pressure equipment sets and functional units in particular

All the necessary documents for the assessment of the set must be delivered before commencing the self-assessment at the place of installation and approved by the Authorized person.

In majority of cases, the piping is not commissioned as an individual part, but as a part of a pressure equipment sets which create a functional units. In such a case, the inspection of the sets in compliance with the N 11005 shall apply, in particular:

	Title	**Y/N**
1	Definition of individual elements included in the set according to PED and precise delimitation of the set by marking on the machine-technological scheme (PID).	
2	The supplier of the set defines the safety equipment including actuators installed in the TZ set. It includes a reference to the processed risk analysis, including proposed other equipment protections (indicators, warning devices), which allow automatic or manual intervention, which keeps the equipment within the allowable limits and which are tested according to N 11 017.	
3	Celkové posouzení sestavy TZ proti překročení nejvyšších dovolených mezí potvrzenou AO. Pokud je potrubí součástí sestavy tlakového zařízení Overall assessment of the TZ assembly against exceeding the maximum permissible limits confirmed by the authorized person, in case the piping is a part of the pressure equipment set	
4	The approval of the sets takes place in partial sub-sets according to the process paths of the fluids by	

	the pressure device.	
5	Upon assembly and connection of the piping, the contractor´s OTK engineer, with participation of the inspection engineer OI, shall carry out the leak test that will be a part of the hand-over documentation of the new piping.	

8 Required documentation for new piping

The piping documentation will take the form of quality components and will be limited according to individual piping routes. Each file shall contain.

Table 2. Piping documentation

	Title	**Y/N**
1	Approved design parameters and documentation by the representative of ORLEN Unipetrol RPA (before the start of manufacturing).	
2	Documentation in accordance with the Annex to the PED Directive I.3.3.a 3.4. 2014/68 / EU (NV 219/2016 Coll.) Accompanying documentation for metal industrial pipes (ČSN EN 13 480) in accordance with Government Decree No. 378/2001 Coll. Section 2 letter e) must contain a set of design documentation, production documentation and operating instructions. See detailed specifications in Table 9.1.	
3	EU Declaration of Conformity according to 2014/68 / EU for individual specified products and sets	
4	EU Certificate of the Authorized Person	
5	Inspection report of the Authorized Person (contractual annex to the delivery)	
6	Evaluation of residual risks according to the Labour Code and the European Directive (89/391 / EEC)	

Table 2.1. The piping documentation shall contain the following:

	Title	**Y/N**
1	List (Content) of documentation	
2	Documents specified in point tab. 8.1. d.	
3	Strength calculation of pressure parts (confirmed by AO for cat. II + III). The strength calculation will clearly specify the minimum allowable wall strength of individual components of the device (pipes, arched bottoms, necks, etc.), including taking into account any cyclic stress.	
4	The scope and composition of the "pipe class" document must be approved by a representative of ORLEN Unipetrol RPA. Each pipe class must contain, among other things, a corrosion allowance and a min. pipe wall thickness for each diameter.	
5	Detailed drawing documentation, confirmed by AO on each approved drawing. In addition to the set of drawings and individual details, it will also contain isometrics and specifications of individual pipe parts.	
6	List of certificates of basic and additional materials, individual certificates of materials and certificates of individual components of the piping set	
7	A. Sub-sets and all details of necks, reinforced collars, counter-flanges, or blinding flanges	
8	B. Laying (supports, hinges, etc.), brackets	
9	C. Pedestals, sliding plates	
10	D. Determination of places for the first NDT thickness measurement - initial states	
11	E. Location of earthing flags	
12	F. Location of insulation clips, if applied	
13	G. Identification marks of welders on individual welds of the device	
14	Copies of the validated Inspection and Test Plan (ITP) from all parties involved	
15	Calculation of tightening torques of individual flange connections	
16	BOM (including basic) containing specifications of fasteners for flanged joints	

17	List of spare parts	
18	Photocopy of the factory label mounted on the product, filed in the accompanying technical documentation.	
19	Electrical data (e.g., pipe heat tracing)	
20	Welding inspection certificate	
21	Record of welds	
22	WPQR list - individual WPQRs	
23	List of WPS and individual WPSs	
24	List of welders and their certificates confirmed by the employer	
25	Technological procedure of weld repairs - defect reports	
26	Procedures to ensure identifiability of materials	
27	NDT plan	
28	NDT maps	
29	List of NDT employees	
30	NDT personnel certificate	
31	List of NDT reports	
32	NDT test reports	
33	List of PWHT staff and their certification	
34	List of PWHT reports	
35	PWHT reports	
36	Final and evident (pressure) test report	
37	Report on final acceptance and inspection after pressure test	
38	Leak test reports or proof of exemption (non - execution or alternative method of execution of LT)	
39	Pipe cleanliness report	
40	Dimensional inspection report	
41	Surface treatment report - external, internal	
42	Quality management certificate in the field of MANUFACTURE OF PRESSURE EQUIPMENT, e.g., according to ČSN EN ISO 9001	
43	Welding process certificate according to ČSN EN ISO 3834	
44	Control boards test results	
45	Initial inspection of earthing, connection of pipes, vessels, etc.	
46	Documents certifying assessment of compliance in scope of the pressure equipment set	

9 Tightening production conditions

9.1 General

9.1.1. Piping classified in category 0 must be designed, manufactured and inspected and tested in accordance with ČSN EN 13 480 and the documentation specified for category I must be documented.

9.1.2. Piping with a working pressure ≤ 0.5 bar must be designed and manufactured in accordance with ČSN EN 13 480, Production, inspection and testing and documentation is carried out in accordance with piping of pipeline category 0.

9.1.3. All special materials will be supplied with favourable material properties in the upper 50%, which are required according to EN standards.

9.1.4. Do not mark the identification marks of welders on the equipment, but on the welding diagrams - axonometry.

9.1.5. Marking on the surface of pipes can only be applied with markers that do not contain chlorides, sulphites or do not cause corrosion - special markers.

9.2 Documentation

9.2.1. Piping of category 0 and I shall have material certificates 3.1, piping of category II and III will always be documented with certifications 3.1 issued by authorized (PED) material primary manufacturer. What concerns deliveries from the secondary manufacturer (trader, modifier, seller) the material must be delivered with certificate 3.2 pursuant to ČSN EN 10 204.

9.2.2. The following documentation will be supplied to the installed valves and fittings:

Declaration of conformity, inspection and adjustment report, catalogue sheet, installation instructions for the valves and fittings (operating instructions), construction inspection after installation, and a leak test after installation will be provided.

9.2.3. Table 9.4-1 - Final documentation, standards EN 13480-5 footnotes are deleted. All fields marked with an X are considered mandatory. The drawings referred to under number 3 must be fully included in the final documentation.

9.3 Construction

9.3.1. The number of joint welds will be as low as possible, based on a suitable construction design, selection of sufficiently long pipes and semi-finished products, etc.

9.3.2. Screw neck joints and joints with welded necks are not permitted.

9.3.3. Holes crossing longitudinal and circumferential welds are not permitted.

9.3.4. The supplier/contractors must prevent additional welds on the pipes.

9.3.5. All pressure parts must allow complete drainage and drying.

9.3.6. The use of segmental arches requires the written consent of STS OI ORLEN Unipetrol RPA and a detailed drawing and strength calculation with a specified minimum permissible wall thickness must be provided.

9.3.7. The written consent of STS OI ORLEN Unipetrol RPA is required for the use of flat bottoms.

9.3.8. The selection of arched bottoms for horizontally laid piping must be made so that the wall thickness does not have to be adjusted by an external bevelling (see Fig. 7.1.2-1 in EN 13 480-3).

9.3.9. For necks with a reinforcing collar, NDT tests must be documented before welding the reinforcing collar. The ventilation hole will always be located in the middle of the upper axis.

9.3.10. The structural end of flat profiles welded to the piping must be performed by continuous welding with the prescribed radius to eliminate the notching effect. The weld can be terminated by "dripping" with the TIG method without subsequent grinding.

9.4 Cyclic stress

9.4.1. If the piping is stressed cyclically, the expected number of stress cycles and the amplitude of the tension fluctuation spectrum will be agreed by the representatives of STS OI ORLEN Unipetrol RPA. Welded joints with low notch effect will be preferably used (see Table 10.3.2-4 in EN 13 480-3).

9.4.2. When designing for cyclic stress, the value of η must be limited to a maximum of 2.35 for non-circular pipes and bends (see Table 10.3.2-5 in EN 13 480-3).

9.4.3. When designing structural parts, the preferential use of welded joints with notch effect of class K1 must be taken into account (see Table 10.3.2-4 in EN 13 480-3).

9.5 Bends

9.5.1. Non-circularities must be reduced by 50% in comparison to the stated values (see permissible values in EN 13480-4 Fig. 7.4.1-1 - permissible non-circularity).

9.5.2. Bending - a check of the corrugation on the inner side of the bend will be documented by a report of 100% visual inspection, stray waves on the inner side of the bend are allowed – of maximum height 1 mm. (see EN 13480-4 part 7.4.3).

9.5.3. Bending - sharp bruises from the pulley are not allowed. A plane must not be formed during the repair. The minimum wall thickness must not be exceeded.

9.6 Welding

9.6.1 General

9.6.1.1. The welding process may be carried out only by a company that has a certified system of quality management for welding – ISO 9001, ČSN EN ISO 3834-2, et al. As per the type and group of weldments.

9.6.1.2. The contractor is obliged to secure the respective certification at all its sub-contractors. The sub-contractors are approved/denied by the customer (Client).

9.6.1.3. The welders must be tested and certified pursuant to ČSN EN ISO 9606-1 (among others as per the excess (filler) material FM 1-6), ČSN EN ISO 9606-2 through 4 as per the basic material and the welding operators pursuant to ČSN EN ISO 14 732. Welder qualification for pressure equipment is required in compliance with PED.

9.6.1.4. The qualification certificate for pressure equipment must be fitted with certification of a notified body certifying its presence at testing of the welder (notified body stamp) and with a protocol that the test was in compliance with 2014/68/EU.

9.6.1.5. The welder certificate shall not be accepted without certification of the employer certifying experience of the welder with welding in accordance with the given certificate in the last half-year.

9.6.1.6. The contractor must determine a qualified welding supervisor for the construction site (IWE, EWE pursuant to ČSN EN ISO 14 731) and ensure permanent welding supervision during the whole production and assembly process on site.

9.6.1.7. The contractor shall provide the investor with a list of welders (welding operators) and their qualifications. This list will be updated in case of any change – rejection of a welder or enlisting of a new one, or change in their qualification. Each change shall be announced to the investor against the investor´s authorization. The list shall be maintained updated at all times.

9.6.1.8. The contractor is obliged to ensure sufficient number of qualified engineers of the welding supervision as well as their permanent presence on welding sites.

9.6.1.9. The contractor shall prepare a list of all welding supervision engineers. The list shall be maintained updated at all times as well as the list of welders.

9.6.1.10. Sources of welding and other el. appliances used by the contractor must have a valid periodical revision for el. appliances. All equipment used in the welding process, including auxiliary activities, must be calibrated, verified and validated pursuant to ČSN EN ISO 17 662.

9.6.1.11. The construction documentation shall contain the welding plan – list of numbers, types and dimensions of welds (basic and excess (filler) materials, heat treatment ...) with assigned respective WPS and designation of welds and WPS in the drawings (isometric views).

9.6.1.12. The construction documentation shall contain the welding logbook with the records of all relevant information regarding execution of welds and regular inspections of the welding supervisor engineers.

9.6.1.13. Welding activities may be carried out only in accordance with the WPS prepared pursuant to valid and applicable WPQR (ČSN EN ISO 15 614-1 through 14). WPQR in compliance with PED is required for the pressure equipment. The contractor shall prepare a list of all WPS and WPQR intended for the construction and submit this list together with these WPS to the investor for approval. Any change in the prepared WPS, or addition of a new WPS to the list must be discussed and approved by the investor.

9.6.1.14. Repairs of welds must be described by a technological procedure for easier cases or by a separate WPS in other cases. These repair technological procedures shall be derived from the WPS to which they relate and shall be included in the WPS list. Updating shall be subject to the same procedures as for proper WPS.

9.6.1.15. WPS for the executed weld shall be placed visibly on every welding site.

9.6.1.16. Distribution of excess (filler) material to the welders will be managed in a stabilized manned as described in the welding plan. Method for handling (drying in an oven and transporting in heat quiver) and recollection of the excess (filler) material after the works are interrupted shall also be described.s

9.6.1.17. The weld may be executed only on the surface that is fully cleaned in the distance min. 50 mm from the weld area, internally and externally what concerns the tubes/pipes.

9.6.1.18. Bevel of the weld area will be finished with a blunting of 1,5-2 mm with respect to WPS and ČSN EN ISO 9692.

9.6.1.19. There will be a gap of 2-4 mm, in the weld root, as per the thickness of the excess (filler) material with respect to the WPS and ČSN EN ISO 9692.

9.6.1.20. What concerns welds with preheating; stitching may be executed only on the preheated basic material. The stitch may remain in the weld only if it is stated in the WPS. If not, MT or PT test check must be performed after the stitch is grinded.

9.6.1.21. Bridges may be prepared only from the material identical to the basic material of the weld. In case the bridge is attached outside the weld, the surface of the basic material must be smoothened by grinding with follow-up PT or MT check after the bridge is removed.

9.6.1.22. Each welder must be equipped with equipment for measurement of weld surface temperature, both during preheating and when measuring the interpass temperature.

9.6.1.23. Temperature of preheating must be maintained for the whole period of root welding. Then the interval between the temperature of preheating and the interpass shall apply. Temperature measurement must be carried out in compliance with ČSN EN ISO 13 916.

9.6.1.24. All materials must be documented with certificates of inspection pursuant to ČSN EN 10 204. With test certificates for excess material 2.2 or with inspection certificates 3.1 or 3.2, where requested, what concerns basic materials with inspection certificates 3.1, or 3.2, where requested.

9.6.1.25. Non-destructive testing (NDT) must comply with the client´s assignment and with the Inspection and test plan (PKZ, ITP), approved by the client. NDT is always carried out by a certified organizations with calibrated apparatuses.

9.6.1.26. All welds must be min. the double-fillet (double-pass) welds, except for use of single-fillet (single-pass) automated welds. In such a case, it is necessary to provide the client with WPS and WPQR for approval.

9.6.1.27. For heterogeneous joints, we request to determine execution of WPQR of heterogeneous joints not in material groups, but directly for individual basic or excess (filler) material.

9.6.1.28. Welding in positions PG, PJ pursuant to ČSN EN ISO 6947 are inadmissible, including auxiliary structures. Welding in position PK pursuant to ČSN EN ISO 6947 is allowed only for automated and semi-automated welding and upon approval of the client´s welding supervision.

9.6.1.29. The contractor shall submit regulations to ensure identification and transfer of material designation, weld joint designation, welder designation, NDT staff designation and heat treatment designation to the client for approval.

9.6.1.30. Prior to commencement of manufacture, the contractor shall submit forms of the following documents for approval:

- Welding plan,
- Instructions for pre-heating before welding,
- Instructions for post weld heat treatment

9.6.1.31. The following documents shall be submitted by the contractor after executed welding works:

- Protocol on hardness measurement (it shall contain range of permissible values and assessment),
- Protocol on heat treatment with attached signature and stamp of the contractor´s welding supervision engineer,
- Welding work logbook,
- Weld record sheet for the given drawing or isometry must contain the following basic identification data (weld number, dimension – diameter and thickness, identification of welder, date of welding, NDT checks (numbers of protocol of VT (visual testing), MT/PT, RT/UT), number of heat treatment protocols, numbers of protocols on hardness test, basic material characteristics, heat numbers of basic materials).
- Individual NDT test protocols

9.6.2 Welder qualifications

9.6.2.1. Prior to commencement of works on pressure equipment, the welder (welding operator) shall carry out the skill test. The client´s technical supervisor shall be notified in writing of this test well in advance in compliance with the contract and the test shall be carried out with the presence of the welding supervisor engineer of the contractor, or even the client´s technical supervisor. The client is entitled to check execution and assessment of the tests. Results of the skill tests shall be documentable in written form and shall contain assessment of the results of RT+ PT/MT+VT.

9.6.2.2. Execution, material and dimensions of the test welds, scope and criteria for assessment of the skill tests shall be defined by the welding supervisor engineer of the contractor and submitted for approval to the client. It is necessary to observe the nature of the delivery (e.g. material, dimensions, NDT assessment), WPS and principles of ČSN EN ISO 9606-1 through 4 (ČSN EN ISO 14 732). Minimum scope of NDT tests consists of VT and RT (UT) what concerns butt welds, and VT + fracture test what concerns fillet welds. In case of welding of materials requiring preheating and post weld heat treatment, it is necessary to carry out the MT (PT) test.

9.6.2.3. In case of welding of materials requiring preheating and post weld heat treatment, it is necessary to perform only preheating and after-heating during the work test, post weld heat treatment is not required.

9.6.2.4. The welders must carry out the skill test with materials of such a group that qualifies the max. scope of real welds executed by the welder, while the principles contained in ČSN EN ISO 9606-1 through 4 (ČSN EN ISO 14 732) apply for the scope of qualification for the basic material .

9.6.2.5. When welding the martensitic creep-resisting steel, it is necessary to carry out the skill test with this material. When welding heterogeneous joints, the combination of materials must comply with the real joints.

9.6.2.6. Material shall be provided by the contractor and costs for the skill tests shall be included in the price for Work.

9.6.3 Oxy-acetylene flame welding

9.6.3.1. Oxy-acetylene flame welding is not permitted. It may be permitted only in exceptional cases and on already operated equipment by the OI ORLEN Unipetrol RPA.

9.6.4 Minimum adjacent weld distances

9.6.4.1. Design measures have to take into account that compliance with the values determined in the standard EN 12 952-5:2011 part 8.1.7 Minimum adjacent weld distance, Table 8.1-1 Distance between branches and main weld joints, is ensured.

9.6.4.2. It is not allowed for the weld joints to cross the circumferential welds and for the holes to be done in the circumferential welds.

9.6.4.3. Transition of the weld surface into the basic material of welded parts (fillet weld) to the main parts pressure stressed will not be located within the distance shorter than 40 mm from the main weld joints (circumferential weld).

9.6.5 Butt welds distance

9.6.5.1. If it is necessary to insert a pipe, then the minimum distance between two butt welds for pipes with the outer diameter smaller or equal to 250 mm must be at least double the outer diameter of the pipe, however no less than 200 mm. In case the outer diameter of the pipe is larger than 250 mm, the distance between the butt welds must not be shorter than 500 mm. Exceptions are permitted only upon approval of the OI ORLEN Unipetrol RPA.

9.6.5.2. In case the post weld heat treatment is required, this heat treatment must be executed pursuant to EN 12952-5:2011, art. 8.11.4.

9.6.6 Joints of heterogeneous materials

9.6.6.1. Heterogeneous welds must be of such a construction design that the place of heterogeneous weld is sufficiently accessible for operations of potential future repairs.

9.6.6.2. Butt welds of heterogeneous materials (austenitic/ferritic) on construction parts under load are not allowed, with the exception of weld joints of pipes to measurement devices from austenitic steels.

9.6.6.3. If possible, do not execute heterogeneous (austenitic-ferritic) weld joints between parts under load and between the parts to be connected.

9.6.7 Excess (filler) materials for welding

9.6.7.1. Only such welding materials that have been verified by the material data sheets may be used.

9.6.7.2. Drying of coated electrodes (does not apply to VacPac) is carried out in ovens with temperature control and registration of the heating cycle course as per recommendations of the excess (filler) material manufacturer and internal procedures of the contractor for storage, handling, identification and use, as well as the welding procedure WPS. Dried electrodes must be placed in the oven, small ovens or quivers at temperature of approx. 80°C until they are used. This equipment must be at disposal for every welder for the whole period of welding work execution.

9.6.7.3. Identifiability of excess (filler) materials and their protection against damage and contamination must be secured for the whole period starting from storage until its utilization during the welding.

9.6.8 Repair by welding

9.6.8.1. Each inacceptable imperfection/defect of the weld must be removed and recorded in the welding documentation.

9.6.8.2. Complete removal of the imperfection/defect must be checked by a NTD method before the repair by welding is initiated.

9.6.8.3. In case the imperfection/defect is removed by welding, it must be carried out as per valid and applicable WPS by a welder possessing required qualifications and afterwards inspected by a prescribed NDT method as the original weld.

9.6.8.4. In case the repairs are executed only by mechanical removal (grinding the undercut, etc.) precautions must be taken to prevent attenuation of the wall thickness below the prescribed value of the welded segment/part.

9.6.8.5. Max. two repairs of welds on pipe at the same place are allowed, the weld must be completely removed after second unsuccessful repair including the TOO and replaced with a new intermediate piece.

9.6.8.6. Repairs by welding may be executed only in case the following conditions are met:
- pipes up to DN 80 mm – total length of repaired weld approx. 50 % of the weld circumference,
- pipe exceeding DN 80 mm – total length of repaired weld approx. 30 % of the weld circumference.

9.6.8.7. In case the scope of repair is larger, it is necessary to remove the weld and replace it with a new one, or to insert an intermediate piece length of which is determined by the design engineer. Other solution of weld repairs must be discussed with the client.

9.6.9 Heat treatment

9.6.9.1. Post weld heat treatment (PWHT) must be executed as per written procedure with all the substantial data on the process.

9.6.9.2. Number and arrangement of thermo-couples must comply with the requirements specified in ČSN EN ISO 17 663 ad EN 12 952-5:2011; figure 10.4-3 – Minimum width of heated stripe in case of local heat treatment.

9.6.9.3. Preheating of martensitic creep-resisting steel is possible only using the el. appliance with automatic control and recording the course of preheating.

9.6.9.4. Preheating the pipeline with P-B burner is allowed only up to DN 100.

9.6.9.5. Local heat treatment or heat treatment of martensitic creep-resisting steel with P-B burners is prohibited. This prohibition applies also to all other flame burners.

9.6.9.6. When applying the post weld heat treatment, the annealing furnace parameters and numbers and arrangement of measurement thermos-couples will be determined apart from the temperature and PWHT duration. Furthermore, the shape, number and arrangement of the supports for the annealed component will be defined as well.

9.6.9.7. When applying the post weld heat treatment, complete cover of the weld by a heating mat for PWHT shall be determined.

9.6.9.8. During the annealing process, the calculation of the limit cumulative heat transfer will be determined for special steels to verify possible degradation of material properties.

9.6.9.9. In case next heat treatment is applied to the quality in oven in the course of pipe manufacturing (after forming), it is necessary to provide a protocol in microstructure test jointly with their pictures magnified 200x and then 500 – 800x. The protocol shall contain the identification data (material identification, heat number and pipe number) as well as positions of the part in the drawing. At the same time, the protocol or record of the heat treatment will be submitted (the whole history of heat treatment must be documented).

9.6.9.10. Number of thermo-couples for measurement of temperature during heat treatment for boilers :

- Ø ≤ 76,1 mm: 1 thermo-couple (for horizontal position of pipe axis , the thermo-couple is located in the position 12 o´clock),
- Ø 76,1 – 114,3 mm: 2 thermocouples (for horizontal position of pipe axis , the thermo-couple is located in the position 6 and 12 o´clock, for vertical position of pipe axis, the thermo-couples are located every 180°),
- Ø > 114,3 mm: 4 thermocouples (for horizontal position of pipe axis , the thermo-couple is located in the position 3, 6, 9 and 12 o´clock, for vertical position of pipe axis, the thermo-couples are located every 90°).

9.6.9.11. The number of thermos-couples for measurement of temperature during heat treatment for other equipment shall comply with the ČSN EN ISO 17 663.

9.6.9.12. The thermo-couples must be removed after performing the PWHT and the surface cleaned after their welding, and in case of temporary welds also inspected by a VT or PT/MT method.

9.7 NDT tests and dimensional checks

9.7.1. General requirements for NDT

9.7.1.1. This part applies to the performance of inspection and testing as part of the manufacture, assembly of pressure and non-pressure equipment, their parts and welded structures.

9.7.1.2. According to the internal document ORLEN Unipetrol RPA S 338 - Initial inspection of metallic materials and products from them by non-destructive methods - it is necessary to ensure the required obligations of the supplier and make the object of inspection available in any stage of production, assembly for the material testing and NDT department.

9.7.1.3. NDT testing must be performed in the course of whole manufacturing and assembly processes.

9.7.1.4. A group of welds is a number of welds welded by one welder or operator according to a specific welding procedure. The group must also be taken from each individual device and piping system of the same isometric or axonometric drawing.

9.7.1.5. Butt welded pipe joints must be tested around the entire circumference.

9.7.1.6. Fillet weld joints for extruded outlets, reinforcing plates, branches and similar construction elements must be tested all around their circumference.

9.7.1.7. If the tested welds show unacceptable defects, these non-compliant welds must be recorded in the NDT test report without exception.

9.7.1.8. It is not permissible to create a system with separate reports for weld joints with acceptable and inacceptable defects.

9.7.1.9. Only markers that do not contain chlorides, sulphites or do not cause corrosion will be used for marking the surface - special markers

9.7.1.10. Devices and equipment used for NDT testing and measurement must be calibrated. Calibration must be ensured continuously throughout the project.

9.7.2. Requirements for NDT staff

9.7.2.1. Non-destructive testing of pressure equipment must be performed by personnel trained and inspected in accordance with ČSN EN ISO 9712 including testing of non-detachable joints of pressure equipment and pressure sets of categories III and IV according to the provisions of Directive 2014/68 / EU (in accordance with PED).

9.7.2.2. For non-destructive testing methods for which permanent recording of indications is not performed, the testing personnel must be qualified at least according to level 2 in accordance with EN ISO 9712 a and must be eligible to test non-detachable welded joints of pressure equipment and pressure sets of categories III and IV according to the provisions of Directive 2014/68/EU.

9.7.2.3. VT (visual testing) inspections before and during welding can be also performed by the members of the welding supervision with EWS/IWS, EWT/IWT, EWE/IWE qualifications.

9.7.2.4. Procedures for individual non-destructive tests must be approved by STS ORLEN Unipetrol RPA.

9.7.3. Detection of surface defects

During visual testing (VT), magnetic testing (MT) and penetrant testing (PT), adjacent areas of the welded joint must be tested and documented, on both sides up to a distance of 25 mm from the weld axis. If defects are found outside this area, such as spray - 602, or contact with an electrode - 601, these must be removed and the surfaces subjected to a suitable testing technique. Testing of these areas must also be documented. Use preferably the magnetic testing (MT) method for ferromagnetic materials (e.g. with ferric structure).

9.7.3.1. *Visual testing - VT*

9.7.3.1.1. Implementing regulation: ČSN EN ISO 17 637.

9.7.3.1.2. Evaluation: ČSN EN ISO 5817 Quality level B.

9.7.3.1.3. After welding, the VT inspection is always performed before the other prescribed NDT inspections.

9.7.3.1.4. 100 % VT inspection of welds must be performed in several stages:

- before welding - inspection of weld surfaces, sets, etc.,
- during welding - implementation of individual layers, their cleaning, etc.,
- after welding - inspection of surface defects, cleaning of the weld, etc.,
- surface inspection after repairs - any defects arising after the repair.

9.7.3.1.5. Visual testing must be documented and all relevant information related to the test activity must be provided. The general statement "All welds on the XY component have been subjected to a 100% visual testing" is prohibited.

9.7.3.1.6.
10.7.3.1.1. Reports on performed VT inspections must be submitted for inspection to the representative of ORLEN Unipetrol RPA within the individual inspections according to the Inspection and Test Plan, including confirmed verification of removal of the detected defects.

9.7.3.2. *Penetrant testing – PT*

9.7.3.2.1. Implementing regulation: ČSN EN ISO 3452-1.

9.7.3.2.2. Evaluation: ČSN EN ISO 23 277.

9.7.3.2.3. Admissibility criteria: ČSN EN ISO 23277 Admissibility level 2. Upon consultation with the NDT department, the inspector of OI STS ORLEN Unipetrol RPA can determine the admissibility level 1 for the critical places.

9.7.3.2.4. Discuss any potential change to the testing specification with the ORLEN Unipetrol RPA Material and NDT Department.

9.7.3.3. ***Magnetic (powder) testing – MT***

9.7.3.3.1. Implementing regulation: ČSN EN ISO 17 638.

9.7.3.3.2. Evaluation: ČSN EN ISO 23 278.

9.7.3.3.3. Admissibility criteria: ČSN EN ISO 23 278 Admissibility level 2. Upon consultation with the NDT department, the inspector of OI STS ORLEN Unipetrol RPA can determine the admissibility level 1 for the critical places.

9.7.3.3.4. Discuss any potential change to the testing specification with the ORLEN Unipetrol RPA Material and NDT Department.

9.7.4. Detection of volume defects

9.7.4.1. ***Radiographic testing – RT***

9.7.4.1.1. Implementing regulation: ČSN EN ISO 17 636-1.

9.7.4.1.2. Radiographic technology: ČSN EN ISO 17 636-1 – Class B: More sensitive technology.

9.7.4.1.3. Evaluation: ČSN EN ISO 10 675-1.

9.7.4.1.4. Admissibility criteria: ČSN EN ISO 10 675-1 Admissibility level 2. The inspector of OI STS ORLEN Unipetrol RPA can determine the admissibility level 1 for the critical places.

9.7.4.1.5. The possibilities offered in the standard ČSN EN ISO 17 636-1 to move the equipment to the test conditions set for Class A must be approved by the OI STS ORLEN Unipetrol RPA department. Class B is required by default.

9.7.4.1.6. Deviations from the Class B test conditions may only be made with the written consent of ORLEN Unipetrol RPA. Any changes to the test specification shall be discussed with the Material Testing and NDT Department.

9.7.4.1.7. If the device is subjected to RT testing, the starting point of laying the images and the direction of their placement for retrospective identification must be indelibly marked on it.

9.7.4.1.8. What concerns weld joints of closing and control valves that are associated with frequent manipulation of the operator during the operation of the equipment (drainage, sludge removal, deaeration, sampling, etc.) the NDT test must be carried out with min. scope of 5 % RT, in particular for weld of armatures from the side of the pressure part.

9.7.4.2. ***Ultrasonic testing – UT***

9.7.4.2.1. Implementing regulation: ČSN EN ISO 17 640.

9.7.4.2.2. Testing technique and class: ČSN EN ISO 17 640 - at least B. Any changes in the test specification shall be discussed with the material testing and NDT department.

9.7.4.2.3. Evaluation: ČSN EN ISO 11 666.

9.7.4.2.4. Admissibility criteria: ČSN EN ISO 11 666 Admissibility level 2.

9.7.5. Pressure equipment – general

9.7.5.1. For steam piping elbows, an impression of the structure is required in the sense of Article 7.2.4 of ČSN EN 13 480-5. in stage 0 according to VGB - TW 507. The structure is verified at 1 place located on the drawn side of the bend (at the point of creeping measurement). The structure is further verified for martensitic 9% Cr steels.

9.7.5.2. If the weld is not accessible for verification of the weld joint integrity when executing the pressure test, 100 % NDT testing (VT, MT/PT, UT/RT) must be carried out during manufacture / assembly. These welds must be marked separately in the welding documentation.

9.7.5.3. When determining the ranges and degrees of admissibility of NDT testing of pressure equipment, it is necessary to increase the ranges according to the internal standard N 15 010 chapters 3.

9.7.5.4. For piping systems operated in the creeping area, the UT inspection must be documented by the manufacturer for testing for longitudinal and transverse defects as per respective product standard - TC2.

9.7.5.5. For piping systems operated in the creeping area, critical points will be identified by the contractor and approved by STS OI ORLEN Unipetrol RPA. The contractor will perform testing of the material structure (imprint - replica) at these places.

9.7.5.6. For piping systems operated in the creeping area, critical points will be identified by the contractor and approved by STS OI ORLEN Unipetrol RPA. The contractor will install the mandrels for creeping measurement at these places according to OEG 13 1011. A reference zero measurement of the initial states will be performed at the places of installation of the mandrels.

9.7.5.7. For piping systems operated in the creeping area, NDT inspections on welded joints will be performed in the range of 100 % VT, 100 % MT/PT, 100 % RT/UT including inspection of the root.

9.7.5.8. he spectrographic test (PMI) will be performed on all alloyed main production material.

9.7.5.9. The values given in brackets apply to the test range of NDT as per ČSN EN 13 480-5 tab. 8.2-1 and at the same time, the scope of NDT testing must not be lower that the scope specified in N 15 010.

- The NDT test range for piping of pipeline category 0 as per PED (SEP) and piping with working pressure ≤ 0.5 bar will be in the range:
  - all welds 100 % VT
  - circumferential welds 5 % MT/PT and RT/UT

- The NDT test range for piping of pipeline category I as per PED will be at least in the range:
  - all welds 100 % VT
  - circumferential welds 10 % MT/PT and 10 % RT/UT

- The NDT test range for piping of pipeline category II and III as per PED will be at least in the range:
  - all welds 100 % VT
  - circumferential welds 50 % MT/PT and RT/UT pursuant to ČSN EN 13 480-5 and N 15 010 (always the higher value)

9.7.5.10. Visual inspections of welds will comply with the requirements of ČSN EN 17 637 and will be performed by a qualified worker according to ČSN EN ISO 9712 - VT / VT2dw and will be declared by NDT report, which will be clearly divided for individual pipeline branches.

9.7.5.11. Checking the geometry of welds: Permitted offset of external surfaces (double-sided) of welded pipes for pipes with wall thickness ≤ 3.6 mm is 0.6 mm maximum, for pipes with wall thickness > 3.6 mm is 1 mm maximum.

9.7.5.12. In the case of a larger offset found on the outer surface, an assessment shall be made by measuring the diameter of the pipe and the wall thickness of the pipe and then calculating the offset of the inner surfaces. If, even in this case, a larger offset is found than is allowed, an RT check will be performed, which must prove the absence of root defects.

9.7.5.13. Bending radius tolerance R is allowed ± 4 mm for pipes ≤ Ø 57 mm and ± 6 mm for pipes > Ø 57 mm.

9.7.6. Other welded structures

9.7.6.1. Complete abandonment of non-destructive testing of welded joints is not permitted.
9.7.6.2. All weld joints of supports, feet and hinges created in scope of the assembly must be subjected to 100% VT and 10 % PT/MT inspection.

9.7.6.3. For stressed welds, a minimum test range of 5% for volume defects is specified and any exceptions must be approved by the Material and NDT dept.

9.7.7. Hardness test

9.7.7.1. After all heat treatment processes, the manufacturer must ensure that the welds and material have the properties specified in the technical delivery regulations of ČSN EN 10 216-1 through 5 (strength, yield strength). These properties shall be documented by the manufacturer by performing the hardness test after the heat treatment.

9.7.7.2. The measurement must be documented in such a way as to ensure traceability to the relevant weld

9.7.7.3. What concerns special steels, both the lower and upper hardness limits shall be determined.

9.7.7.4. Weld joint harness measurement is performed for the basic material in the heat affected zone of the weld (both sides of the weld) and in the weld (filler) metal.

a) For diameters smaller than DN 100 incl., in 1 place on the circumference
b) For diameters exceeding DN 100 in 3 places distributed every 120° of the circumference.

9.7.7.5. If the measured hardness is unsatisfactory, it is necessary to perform a new control measurement in the entire prescribed range (it is appropriate to also use another measurement method). If the unsatisfactory measurement result is confirmed, corrective measures (new TZ, etc.) shall be proposed. The proposed measure must be approved by the Material and NDT dept. of ORLEN Unipetrol RPA.

9.7.7.6. Position of measuring points of formed pipe parts

Hot bending with normalization or finishing	Hot bending without normalization or finishing	Tightened pipes (reduction)	Cold bending
1 measuring point on the unshaped arm	1 measuring point on the unshaped arm	1 measuring point on unshaped areas	1 measuring point on the unshaped arm
1 measuring point in the neutral zone in the bending area	1 measuring point in the tension zone of bending	1 measuring point in the area of the strongest deformation	1 measuring point in the tension zone of bending
	1 measuring point in the pressure zone of bending		
Note: for bends where measuring points for creeping will be installed in the production			
measurements must be made in 3 sections after approx. ½ of the bend and 4x every 90° circum.	xxx	xxx	xxx

9.7.7.7. Permissible hardness values and test range

Material ZM	Basic material	Weld metal	Heat affected zone
16Mo3 (1.5415)	140 – 190 HV	max 260 HV	max 320 HV
13CrMo 4-5 (1.7335)	135 – 185 HV	max 270 HV	max 320 HV
10CrMo 9-10 (1.7380)	140 – 190 HV	max 280 HV	max 320 HV
15CrMoV510 (1.7745)	160 – 215 HV	max 280 HV	max 320 HV
X20CrMoV12-1 (1.4922)	215 – 265 HV	max. 300 HV	max 350 HV
X10CrMoVNb9-1 (1.4903, P91)	190 – 260 HV	max 300 HV	max 320 HV

X11CrMoWVNb9-1-1 (1.4905, E911)	200 – 260 HV	max 300 HV	max 320 HV
15NiCuMoNb5 (1.6368, WB 36)	190 – 240 HV	max 300 HV	max 330 HV
X10CrWMoVNb9-2 (1.4901, P92)	190 – 260 HV	max 300 HV	max 320 HV
15 128.5 (14MoV6-3, 1.7715) pipes of thickness up to 36 mm	140 – 197 HB	max 290 HV	max 340 HV
15 128.9 – thickness above 12 mm diameter 70 to 377 mm	163 – 223 HB	max 290 HV	max 340 HV
15 128.5(14MoV6-3, 1.7715) metal sheets	135 – 183 HB	max 290 HV	max 340 HV
15 128.5 (14MoV6-3, 1.7715) - forgings	141 – 223 HB	max 290 HV	max 340 HV

9.7.7.8. For cold-formed parts such as bends, the highest value of the base material +60 HV applies. The highest value of the base material +80 HV applies to hot-formed components such as bends.

9.8 Pressure tests

9.8.1. With regard to the redistribution of internal stress and the favourable effects of the pressure test on the overall condition and life span of the piping, all pipelines will be hydraulically pressurized in accordance with PED and ČSN EN 13 480 to at least 1.43 times of PS. An exception for each separate pipeline branch can be granted by the STS OI ORLEN Unipetrol RPA inspector. Based on his/her consent, it is possible to use another method of pressure testing, which is allowed by the respective company standard.

9.8.2. Pneumatic pressure tests are performed exceptionally under clearly defined safety conditions with the consent of the inspector STS OI ORLEN Unipetrol RPA.

9.8.3. The conditions for the safe performance of this test as well as for subsequent periodic inspections will be determined for the prescribed pneumatic pressure test.

9.8.4. The supplier may include the piping in the joint pressure test program only if the piping has the same PT test pressure value defined on the basis of the PS.

9.8.5. During the pressure test, the machine-technological scheme (PID) of the pressure circuit must be documented, from which the exact delimitation of the pressurized circuit will be evident with the recording of the layout of blind elements, valves - pressure limits. If there are double valves included, the first one must be in the open position.

9.8.6. After the pressure test and removal of the blanking plugs and installation of all equipment on the final design condition, the contractor, in cooperation with the operation of ORLEN Unipetrol RPA, will ensure a leak test usually with inert gas according to individual pressure levels. Required pressure for leak test = PS for individual pipelines and pressure levels. An exception for each separate pipeline branch may be granted by the OI STS ORLEN Unipetrol RPA inspector. Based on

his/her consent, it is possible to use another method of verifying the tightness, or reducing the pressure to verify the tightness, which is allowed by the Czech legislation.

10 Related standards and regulations

• ČSN 13 0020 (CEN/TR 13480-7)	Metallic industrial piping - Part 7: Guidance on the use of conformity assessment procedures
• ČSN 13 0072	Piping. Marking of pipes according to the operating fluid
• ČSN 13 3060-4	Industrial valves. Technical regulations - Part 4: Documentation of valves
• ČSN 38 6405	Gas equipment. Principles of operation.
• ČSN EN 1591-4	Flanges and their joints. Part 4, Qualification of personnel competency in the assembly of the bolted connections of critical service pressurized systems
• ČSN EN 1775	Gas supply - Gas pipework for buildings - Maximum operating pressure less than or equal to 5 bar - Functional recommendations
• ČSN EN 10 204	Metallic products – Types of inspection documents
• ČSN EN 10 216	Seamless steel pipes for pressure purposes – Technical delivery terms – Part 1 - 5
• ČSN EN 12 952-5	Water-tube boilers and auxiliaries - Part5: Design and construction of the boiler
• ČSN EN 13 480	Metal industrial piping - parts 1 to 6
• ČSN EN 15 001-1	Gas supply. Gas pipelines with an operating pressure higher than 0.5 bar for industrial use and gas pipelines with an operating pressure higher than 5 bar for industrial and non-industrial use - Part 1: Detailed functional requirements for design, materials, construction, inspection and testing
• ČSN EN 15 001-2	Gas supply. Gas pipelines with an operating pressure higher than 0.5 bar for industrial use and gas pipelines with an operating pressure higher than 5 bar for industrial and non-industrial use - Part 2: Detailed functional requirements for commissioning, operation and maintenance
• ČSN EN ISO 3452-1	Non-destructive testing – Penetrant method PT - Part 1: General principles
• ČSN EN ISO 3834	Requirements for quality during fusion welding of metallic materials – Part 1 - 5
• ČSN EN ISO 5817	Welding – Weld joins of steel, nickel, titanium and their alloys by fusion welding (except for electron beam welding and laser welding) – quality levels
• ČSN EN ISO 6947	Welding and related processes – welding positions
• ČSN EN ISO 9001	QMS - requirements
• ČSN EN ISO 9606	Welder testing – Fusion welding - Part 1 - 5
• ČSN EN ISO 9692	Welding and related processes – recommendations for preparation of weld joints - Part 1 - 4
• ČSN EN ISO 9712	Non-destructive testing – qualification and certification of NDT workers
• ČSN EN ISO 10 675-1	Non-destructive testing of welds – Admissibility criteria for radiographic testing - Part 1: Steel, nickel, titanium and their alloys
• ČSN EN ISO 11 666	Non-destructive testing of welds – ultrasonic testing – Levels of admissibility
• ČSN EN ISO 13 916	Welding – Directive for measurement of preheating temperature, interpass temperature and heating temperature

- ČSN EN ISO 14 731 Welding supervision – Tasks and responsibilities
- ČSN EN ISO 14 732 Welding staff – Tests of welding operators and setters of mechanical or automatic welding of metallic materials
- ČSN EN ISO 15 614 Determination and qualification of welding procedures for metallic materials – Welding procedure test- Part 1 - 14
- ČSN EN ISO 17 636-1 Non-destructive testing of welds - RT - Part 1: X-ray and gamma radiation methods
- ČSN EN ISO 17 637 Non-destructive testing of welds – Visual testing of fusion welds
- ČSN EN ISO 17 638 Non-destructive testing of welds – Magnetic (powder) testing
- ČSN EN ISO 17 640 Non-destructive testing of welds – Ultrasonic testing – methods, test classes and evaluation
- ČSN EN ISO 17 662 Welding - Calibration, verification and validation of welding equipment
- ČSN EN ISO 17 663 Welding – requirement for quality of heat treatment associated with welding and related processes
- ČSN EN ISO 23 277 Non-destructive testing of welds – Penetrant testing- Levels of admissibility
- ČSN EN ISO 23 278 Non-destructive testing of welds – Magnetic (powder) testing - Levels of admissibility

- N 10 051 Surface protection of metal structures and equipment
- N 11 004 Operating rules of gas equipment
- N 11 005 Operating rules of pressure equipment
- N 11 017 Performance of Loop checks
- N 11 062 Pressure tests (hydraulic)
- N 11 063 Pressure tests (pneumatic)
- N 11 200 Acceptance from operation to repair and from repair to operation
- N 11 985 Standard for keeping passports of production equipment
- N 13 700 Marking of pipes according to flowing fluid
- N 15 010 Admissible classification grades of welds and range of weld inspections using RT or UT method
- N16 standards N16 company standards
- N18 standards N18 company standards

- Directive 317 Principles of anticorrosion protection for machinery and technological equipment
- Directive 338 Input inspection of metallic materials and products from them by non-destructive methods
- Directive 348 Energy management
- Directive 350 Technical drawing documentation
- Directive 465 Permitting work
- Directive 843 Changes in technological process and production equipment
- Directive 845 Handling regulations
- Directive 846 Solutions for NDT testing results
- Metrological Order
- Labour Code

- Decree of ČÚBP and ČBÚ No. 85/1978 Coll. on inspections, revisions and tests of gas equipment.
- Decree of ČÚBP and ČBÚ No. 18/1979 Coll., designating dedicated pressure equipment and laying down certain conditions to ensure its safety
- Decree of ČÚBP and ČBÚ No. 21/1979 Coll., designating dedicated gas installations and laying down certain conditions to ensure their safety

- Decree of ČÚBP and ČBÚ No. 554/1990 Coll., amending and supplementing the Decree of the Czech Office for Occupational Safety and the Czech Mining Authority No. 21/1979 Coll., which determines the reserved gas facilities and sets certain conditions to ensure their safety
- Government Regulation No. 219/2016 Coll., laying down technical requirements for pressure device assessment when launched on market (This decree stipulated technical requirements for pressure equipment)
- Government Regulation No. 378/2001 Coll., laying down detailed requirements for safe operation and use of machines, technical equipment, apparatuses and tools
- Directive of the European Parliament and of the Council EU 2014/68/EU on the approximation of the laws of the Member States concerning pressure equipment
- Directive of the European Parliament and of the Council 89/391/EHS

11 Annexes

Annex No.1 – 1.page of the piping system card

Annex No.2 – 2. page of the piping system card – the record may be solved by a registry in the PM SAP

Záznam vnějších prohlídek C, vnitřních prohlídek a tlakových zkoušek

list 2/4

Datum prohlídky	Číslo protokolu	Hlavní zjištěné závady	Datum odstranění závad	Návrh příští opravy	
				druh	datum

Annex No.3 – 3. page of the piping system card – the record may be solved by a registry in the PM SAP

list 3/4

Záznam oprav

Druh opravy	Číslo objednávky	Rozsah opravy	Datum ukončení opravy

Annex No.4 – 4. page of the piping system card – the record may be solved by a registry in the PM SAP

list 4/4

Záznam kontrol tloušťky stěny

Datum kontroly	
Číslo protokolu	
Hlavní zjištěné závady	
Datum odstranění závad	

SEZNAM POTRUBNÍCH ROZVODŮ SKUPINY : _____

Závod :

Výrobna :

Název potrubního rozvodu	Provozní přetlak [Mpa]	Inventární číslo	Číslo stavby (mostu)		Číslo výkresu	Rok dosažení směrné životnosti	Poznámka
			staré	nové			

Annex No. 6 – 1.page of the equipment inspection (test) protocol

Protokol o prohlídce (zkoušce) zařízení skupiny - _____

Číslo protokolu :	Technické místo - kód :	
	Číslo investičního majetku :	Podčíslo :
Název zařízení - název technického místa :		
Závod :	Výrobna :	Stavba :
Druh prohlídky (zkoušky) :		Datum :
Zjištěný stav :		

Annex No. 6 – 2. page of the equipment inspection (test) protocol

Strana 2/2

Navržená opatření :
Poznámky :
Jména a podpisy komise Předseda : Členové :

Check sheet

Periodical checks

1. section: to be filled by an authorized employee of the production team of the plant (user)

2. section: Table 1 is filled by an authorized employee of the production team of the plant (user) with unambiguous designation of piping as per operating habits (seq. number, pipe branch number, limits /to, fluid). The inspecting person (user) adds date and signature.
Table 2 is filled by the inspecting employee as per detected defects and their removal.

3. section: **The maintenance engineer or inspector (maintainer) must submit a list of pipe branches to the given check sheet as per the asset register, which serves the authorized employee of the production team of the plant for filling the Table 1 with unambiguous designation of piping as per the operational habits.**

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1. SECTION:

Check sheet No.:	number

Check sheet of aboveground piping systems for:
Description of checked piping

Checks is performed regularly:	Description of the number of checks (dates)

Operating checks of the aboveground piping systems of all groups are performed by the operators of the technological equipment.

The following, in particular, is visually inspected:

- Tightness of piping systems, surface of pipes (status of surface protection) bends, Y-branches,
- transitions, and flange joints (conductive bonding)
- Fixing the piping systems (supports, hangers)
- Vibrations, impacts
- Heat tracing function and draining system function
- Removal of inflammable objects
- Marking the piping systems pursuant to ČSN 13 0072, N 13 700 and designation of closing valves

Apart from the checks, the operating staffs are also obliged to test functionality of the valves by turning the stem by a certain number of turns, if possible during operation, to execute regular cleaning and valve stem preservation. Procedures and terms are defined by the head of the plant or these data are included in the operating regulation.

The authorized employee makes a record into the second section, that shall contain:

- First name and surname of the employee who performed the inspection
- Date of inspection
- Scope of inspection with unambiguous designation of the pipeline as per operating practice
- Detected defects
- Removed
- Signature of the employee performing the check

Removal of detected defects is ensured by the employee authorized to perform the inspection either himself or in cooperation with the maintainer, or he informs his superior about them. Removal of defects is also recorded into the second section.

2. SECTION:

Table 1: Protocol on execution of check

SEQ. NO.	NUMBER OF PIPE BRANCH AS PER OPERATING HABITS	DESCRIPTION OF PIPE BRANCH	LIMIT FROM	LIMIT TO	FLUID	DATE AND SIGNATURE

Table 2: Protocol on defects and their removal

DEFECTS	REMOVED

Shift: ……

The check sheet was revised by: ……..