

Unipetrol RPA, s.r.o.	Pressure leak and strength tests (hydraulic)	N 11 062
Technical Services, tech.superv.dep.		

The standard is binding for all departments of the company and external organizations which perform pressure leak and strength tests (hydraulic).

The departments are obliged to present the standard to all external organizations performing hydraulic pressure leak and strength tests for them as well as to all organizations the standard is also binding for. Does not apply to the Litvínov and Kralupy Refinery unit.

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1. General provisions

1.1. Scope of validity

- 1.1.1. The standard is valid for performing hydraulic tests of steam boilers, pressure vessels, individual components of the pipeline, pipeline sections, valves, machinery equipment components.
- 1.1.2. Machinery equipment components are understood as working cylinders of compressors, pressure pump or turbine casings, etc.
- 1.2. This standard does not apply to testing of new equipment delivered by external suppliers in scope of an investment construction. The standard does not apply to pressure equipment intended for compliance assessment pursuant to the Act No. 22/1997 Coll. and Government regulation No. 26/2003 Coll. prior to launching to the market.

1.3 Strength and tightness of the pipeline is tested by a test pursuant to ČSN 13480-5. Strength and tightness of steam boilers is tested using the leak and pressure tests pursuant to ČSN 07 0710 art. 115-123 (tightness), art. 124-126 (strength). Strength and tightness of pressure vessels is tested pursuant to ČSN 69 0012, art. 107-115 (tightness), art. 117-121 (strength).

1.4 Terms, definitions and abbreviations

Operator – UNIPETROL RPA, s.r.o. represented by its Executive in compliance with the articles of the company. The executive is authorized to ensure the obligation to duly manage all means entrusted by the employer and to guard and protect assets against any damage, loss, destruction or misuse, no act contrary to legitimate interest of the employer and to ensure adoption of timely and effective measures to protect its assets. In order to adhere to

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related obligations, he/she determines the user and maintainer through controlling, organizational and technical standards.

User – Head of organization unit (e.g. Director of the section, plant, or head of department, production unit or subsection) to whom the asset was entrusted for use by the operator. The user is responsible for adherence to conditions for safe and reliable operation in compliance with instructions and regulations intended for its use, operation and service.

Maintainer – head of the maintenance department, LDS system, site administrator department or otherwise authorized employee, who is responsible for technical status of determined individual tangible asset groups including maintenance, repairs, revisions/inspections and tests.

Contractor – authorized legal or physical entity owning authorization for certain activities (e.g. assembly or repairs of equipment)

OTD TS – technical supervision department, technical service section

OKJ (OTK) – quality inspection department, works technical staff

TIČR – Technical Inspection of the Czech Republic

Inspection technician – an employee of OTD (technical supervision department) authorized to perform inspections and tests of pressure and gas equipment having certificate and professional competence for these activities

TNS – stable pressure vessels

PK – steam boilers

Notified body – a legal entity determined for activities when assessing compliance of the product with technical requirements

OOPP - personal protective equipment, protective equipment that must protect the employees from hazards, must not endanger the health and prevent from execution of works.

2. Principles for performing the tests

2.1 Persons in charge of the works during testing have to be older than 21 years and have least three-year practice in the given field.

2.2 Workers, who perform technical supervision and expert inspection of the tested equipment or component during the tests and assess the results of the testing, have to have a respective qualification for the type of steam boilers and pressure vessels – relevant

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authorization pursuant to Decree No. 18/1979 Coll. § 7, par. 1 for pipeline sections categorized pursuant to Decree No. 21/1979 Coll., § 4 for reserved gas equipment, have to have respective qualification pursuant to § 11 of the Decree No. 85/1978 Coll. (inspection technician), what concerns other equipment pursuant to respective regulations.

2.3. Scope of competences and responsibilities during the tests is determined in table No. 1

2.4 In the cases listed in N 11 063, ČSN 69 0012 and ČSN EN 13480 -5 the hydraulic pressure tests may be replaced by pneumatic ones. In such a case, when the testing liquid is changed, it is necessary to adjust working procedures and securing of the work place using appropriate measures.

3. Securing the work place during the tests

3.1 During the test no unauthorized persons are allowed in the testing area, mainly during tests of large pipeline of reserved gas equipment (e.g. external aboveground pipe network)

3.2 During tests of pressure equipment that is hard to reach, the appropriate scaffolding fitted with safe retreat routes must be erected to ensure safe work of all persons involved.

3.3 During the test the work place must be tidied to ensure safe access to tested equipment and to enable is proper inspection. The tested equipment should be placed in such a way to enable inspection from all sides. Concurrent testing (with liquid) of several pipelines places on the same bearing structure is allowed only under condition that the bearing structure is designed for this load. Bearing capacity of the construction is determined by the affected departments in scope of permit procedure.

3.4 Special attention must be paid to the equipment with fitted glass parts (e.g. gauge glass, glass inspection hole, equipment for measurement and instrumentation, etc.) both during air vent and the inspection after pressurizing.

3.5 All bolt joints between the source of pressure and the tested equipment, thread for manometers and the manometers themselves are subject to regular inspection. If vast wear is detected, it is necessary to exclude respective components immediately, invalidate and replace them with new ones.

3.6 It is not allowed to perform pressure test on open spaces during rain without any shelter.

3.7 During pressure test using the liquid under temperature lower than the solidification temperature of the testing liquid, freezing of the liquid in the tested equipment must be prevented and secured its reliable discharge. What concerns vessels located outside covered and heated spaces, it is forbidden to perform pressure tests, if the average daily temperature drops below +5 °C.

3.8 Strength of pipeline, connecting the source of pressure with the tested equipment, has to comply with respective testing pressure and has to be tested in advance by a pressure test using the cold liquid. The performing assembly organisation is fully responsible for using the tested connecting pipeline.

4. Scope of external inspection

4.1 The scope of external inspection when performing the strength and leak tests of the pipeline is determined by the inspection technician. When assessing the scope of external inspection, it is necessary to consider the working liquid, working pressure and temperature,

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total technical status of the pipeline and possibility of external corrosion influence under the insulation and influence of internal corrosion (erosion) on attenuation of the wall thickness.

4.2 In case there are unplanned deviations from the technological mode during operation that could influence status and life time of the equipment, the user is obliged to notify the maintainer immediately in writing.

4.3 Furthermore he is obliged to advise of any extraordinary circumstances that could influence the external corrosion and that were ascertained in the course of operation during equipment supervision.

4.4 It is necessary to take into account, that pressure strength test, or the pressure leak test proves reliability and safety of the pipeline for next working cycle.

4.5 When determining scope of external inspection, it is necessary to focus on all flange joints including connecting branches on de-insulated pipeline, welds, expansion bends, inbuilt valves and height break of the pipeline as well as pipe laying points.

4.6 In case of pipeline repair, when the pipeline is welded, the pressure strength and leak tests are performed on such a pipeline accompanied by external inspection of the repaired section before paint works (insulating).

4.7 What concerns high capacity units, it is necessary to opt for a different procedure. These cases mainly use experience gained in operation and maintenance of the pipeline, furthermore taking into account working parameters, type of media and results of diagnostic methods.

4.8 it is recommended, however, in the period of one cycle of the pressure test to disassemble insulation gradually section by section (technically selected) to revise influence of the environment on external surface of the pipeline, while it is necessary to consider the working parameters as well as to influence of environment and gained experience with operation and maintenance. If need be, the paint under insulation is renewed.

4.9 It is recommended to remove insulation of vessels and pipeline for minus temperature only during extensive works as overhauls, reconstructions or during repairs of the insulation itself. At the same time, it is recommended to execute waterproof removable insulation under the insulation on several places of the same equipment to check influence of external corrosion.

4.10 In case the results of inspection of un-insulated parts of the pipeline is without any defects, however the inspection manometer shows decrease, it is necessary to consider the test as unsatisfactory and to repeat the test again.

5. Work procedure during tests

5.1. Prior to the test, the pressurized part is divided from other equipment and from external atmosphere by sufficiently designed blinds (pursuant to N 13 719) and from the source of pressure by two check valves with semi-relief.

5.2. Tested equipment or components should be in such a position or adjusted in a way to enable perfect air vent of the tested space and its filling with testing liquid. Pressure is measured in the highest point of the pressure equipment.

5.3. Filling

5.3.1 Tested equipment or components are filled with the testing liquid (usually water at temperature max. 50 °C) or with any other appropriate liquid (e.g. kerosene) until the testing

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liquid freely escapes from the closable overflow adapter (from several adapters in case of component with complicated shape) located at the highest point of the filled space.

Approximately after ten minutes the tested equipment or components are filled with water. Then the check valve on the overflow adapter is closed.

5.3.2 Prior to filling the insulated pressure vessel with water for the purpose of leak or strength test, it is necessary to fit the highest point of the vessel with sufficiently long overflow pipe to prevent leakage of water under insulation.

5.3.3 In unavoidable and justified case, it is acceptable to use even operating liquid for the test under condition of securing the work place against potential consequences of the spill of the respective liquid. Procedures for these cases are determined by the maintainer upon agreement with the head of the plant.

6. Pressure leak test

6.1 Pressurizing

When pressurizing equipment or components made of grey cast iron it is not allowed to use engine actuated pumps. In other cases, the pressurizing using the engine actuated pumps is permitted only in case the velocity of pressure increase is steady and does not exceed 0,5 MPa per minute what concerns pressure assemblies with operating pressure up to 5 MPa and 0,1 MPa of testing pressure per minute what concerns pressure assemblies with operating pressure exceeding 5MPa and in case the vessel , or machinery equipment (working cylinder of the compressor, pressure pump or turbine casings, etc.) fitted with pressure-relief valve set for the highest permitted pressure. Access to the equipment is allowed only after min 1 minute after shutting down the pump. Increasing the pressure by additional pressurizing during the inspection is forbidden. When performing the leak tests of steam boilers provisions of ČSN 07 0710 (art. 115 – 123) have to be adhered to, and provisions of ČSN 69 0012 (art. 107-115) what concerns pressure vessels.

6.2 Inspection during water pressure leak test

After pressurizing to the highest permitted pressure a thorough inspection of external surface of the tested equipment or component is performed with concurrent taps of a hammer weighting 0,5 kg. Light taps are targeted to the weld joint and to places on both sides of the weld. When performing the leak tests of steam boilers provisions of ČSN 07 0710 (art. 115 – 123) have to be adhered to, and provisions of ČSN 69 0012 (art. 107-115) what concerns pressure vessels.

6.3 Testing liquid must not penetrate at the inspected weld joints and there is moisture occurring on the welds. Result of the test is satisfactory, if there is no leakage in the weld or flange joints, packing, etc. or if there is no deformation of any part of the pipeline, vessels or pressure parts of the boilers.

6.4 What concerns high pressure pipeline and their parts made of elements pursuant to N 16, N 20, N 21 and N 22 and of material class 15, hammer taps are not recommended.

6.5 Leakage removal

6.5.1 In case of any leakage, it is necessary to relief the pressure and to remove the leakage. In case the original equipment was heat treated after the welding, it is necessary to ask for preparation of a technological procedure of the repair from the welding technologist of the department/company execution the works.

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6.5.2 Removal of leaks using the folding is forbidden. After the pipeline is repaired, new pressure leak test is performed. The pressure leak test is satisfactory if there are no leaks in the joints. After welding repair the pressure strength test has to be performed for boilers and pressure vessels.

7. Pressure strength test

7.1 Pressurizing to testing pressure

7.1.1 In case of a pressure strength test after successful pressure leak test, it is possible to increase the pressure to the value of the testing pressure only in presence of a technical supervisory body pursuant to art. 2.2 and 2.3 and upon his/her command. The testing pressure is maintained during such a test for the period determined by the respective ČSN standards, however at least for the period necessary for performance of the inspection.

7.1.2 Inspection during pressure strength test: When the period the tested equipment or a component has to be under the testing pressure expires, the technical supervisory body shall carry out inspection of the external surface. It is forbidden to tap the pressure equipment with a hammer when it is under testing pressure. If any leaks or deformations are ascertained during the inspection, the tested equipment or components does not pass the test.

7.1.3 When performing the pressure strength tests of steam boilers provisions of ČSN 07 0710 (art. 124-126) have to be adhered to, and provisions of ČSN 69 0012 (art. 117-120)) what concerns stable pressure vessels and provisions of ČSN EN 13480-5 (130020) what concerns pipeline as well.

8. Protective equipment and work aids

8.1 Personal protective equipment

All employees participating in the test must use the personal protective equipment in compliance with the standard and extra personal protective equipment in accordance with risk assessment in UNIPETROL RPS, s.r.o.

8.2 Work aids

During hydraulic pressure test the following aids are used:

- Pressure pump
- 2manometers, one of them as checking manometer with denominated degree of accuracy
- Thermometer
- Pulse pipeline for manometers
- Blinds
- Mirror
- Inspection el. lamp, or portable el. lamp 24 V
- Hammer weighting 0,5 kg.

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Tab 1

Type of equipment	Pressure test	Person in charge of the test	Technical supervision, inspection, evaluation	Czech Standards
Steam boiler stable	Strength test	Authorized representative of contractor or user	Authorized inspection technician OTD TS	ČSN 07 0624 ČSN 07 0710
Steam boiler stable	Leak test	Authorized representative of contractor or user	Authorized inspection technician OTD TS	ČSN 07 0710
Pressure vessels stable	Strength test	Authorized representative of contractor or user	Authorized inspection technician OTD TS	ČSN 69 0010-7-1 ČSN 69 0012 ČSN EN 13 445-5
Pressure vessels stable	Leak test	Authorized representative of contractor or user	Authorized inspection technician OTD TS	ČSN 69 0012
Transportable pressure equipment for transport of hazardous items	Strength test is scope of tests	Authorized representative of contractor or user	Notified body	Governmental Decree No.208/2011 Coll.
Pipeline segments, machinery equipment components	Strength test	Authorized representative of contractor or user	Inspector of OTK or authorized inspection technician OTD TS	ČSN EN 13480-5 (13 0020) ČSN EN 378-2+A1 (14 0647)
Pipeline segments, machinery equipment components	Leak test	Authorized representative of contractor or user	Inspector of OTK or authorized inspection technician OTD TS	ČSN EN 13480-5 (13 0020) ČSN EN 378-2+A1 (14 0647)
Pipeline sections	Strength test	Authorized representative of contractor or user	Inspector of OTK or authorized inspection technician OTD TS	ČSN EN 13480-5 (13 0020) ČSN 38 6462

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Pipeline sections	Leak test	Authorized representative of contractor or user	Inspector of OTK or authorized inspection technician OTD TS	ČSN EN 13480-5 (13 0020) ČSN 38 6462
Valves	Strength test	Authorized representative of contractor (e.g. foreman of valve shops or valve tester with min 3 year practice) or the user	Inspector of OTK ,if not systemized then the shift leader, pressure relief valves it is worker of OKJ (OTK) with respective qualification (TIČR certificate)	ČSN 13 3060 part 2
Valves	Leak test	Authorized representative of contractor (e.g. foreman of valve shops or valve tester with min 3 year practice) or the user	Inspector of OTK ,if not systemized then the shift leader, pressure relief valves it is worker of OKJ (OTK) with respective qualification (TIČR certificate)	ČSN 13 3060 part 2

9. List of quoted and related standards and documents

Quoted

ČSN 07 0624 Assembly of boilers and boiler equipment

ČSN 07 0710 Operation, service and maintenance of steam and hot water boilers

ČSN 38 6462 Gas supply – LPG – pressure station, distribution and usage

ČSN 13 3060-2 Valves. Industrial valves. Technical regulations. Valve inspection

ČSN EN 13 445-5 5 Unfired pressure vessels - part 5: Inspection and testing

ČSN EN 378-2+A1 (14 0647) Cooling equipment and heat pumps – Safety and environmental requirements - part 2: Construction, manufacture, testing, denomination and documentation

ČSN 69 0012 Stable pressure vessels. Operating requirements

ČSN 69 0010-7-1 Stable pressure vessels. Technical rules. Testing and documentation. part 7-1 – Construction and first pressure test

ČSN EN 13480-5 (13 0020) Metal industrial pipeline – part 5: Inspection and testing

N 11 063 Pressure strength and leak tests (PNEUMATIC)

N 13 719 Blinds for pipeline

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Governmental Decree No.26/2003 Coll. on technical requirements for pressure equipment
 Governmental Decree No.208/2011 Coll. on technical requirements for transportable pressure equipment

Act No. 22/1997 Sb. on technical requirements for products and amendment of some acts

Related

ČSN EN 1440+A1 (07 8440) Equipment and accessories for LPG – Periodic inspection of refilling bottles for LPG transport

ČSN EN 1439 (07 8441) Equipment and accessories for LPG – Procedure for inspection of LPG bottles before filling, in the course of filling and after filling

ČSN EN 378-1+A1 (14 0647) Cooling equipment and heat pumps – Safety and environmental requirements - part 1: Basic requirements, definitions, classification and criteria for selection

ČSN 07 8305 Metal pressure vessels for gas transport. Technical rules

ČSN 65 0204 Long distance pipeline for flammable liquid

ČSN 65 0208 Long distance pipeline for flammable liquefied hydrocarbon gases

ČSN 75 5911 Pressure tests of water and irrigation pipeline

N 11 004 Operating rules for gas equipment

N 11 005 Operating rules for pressure equipment

Directive S 520: Long-term and low-value assets. Register, administration and deletion

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