

1. General informations

1. **Pressure testing** – is a process consisting on checking the tightness and quality of the tested network - e.g. a pipeline. Depending on various factors, pressure tests can be classified as follows:
 - a. **due to the location of the installation:**
 - internal (fire protection systems)
 - external (water supply)
 - b. **due to the type of test substance:**
 - water tests (hydraulic)
 - gas tests (with inert gas or air)
 - c. **due to the scope of performance:**
 - overall tests
 - section tests

The pressure test should be performed before covering the furrows and channels, before painting the system components and before making thermal insulation. The pressure test should be performed on the entire pipeline, and if it is impossible, e.g. due to design or construction reasons - it should be tested in sections.

2. **Pressure test**, regardless of the type of pipes (materials) used, consists of three basic stages and is carried out in a specific sequence:

- 1) **initial test** - consists to filling up the tested installation with a chosen medium (e.g. water or gas) in order to check the system completeness and detect significant leaks. Tested section **must be cleaned by rinsing, blowing through or pushing forward by a solid projectile or plug (so-called pigging)**. Immediately after cleaning the installation should be filled up by water, bear in mind that appropriate corrosion inhibitor is needed if the test results of water used to filling and topping up the installation and used installation's materials require to introduce them into installation. Filling should be started (if possible) at the lowest point of the pipeline. The duration of the preliminary test depends on the materials of the pipeline and should be defined by the designer, taking into account the relevant product standards.
- 2) **pressure drop test** - for the time specified by the system designer, the specified pressure of the test liquid should be maintained (10 bar for water tests), if during this time no leaks occur or if they remain within a certain standard, you can proceed to the main pressure test. However, if the pressure of the test liquid drops significantly and leakage points are revealed - the system should be drained, the leaks should be eliminated and the pressure drop test should be performed again.
- 3) **the main pressure test** - performed after the successful completion of **stage 2)**, consists in increasing the pressure of the test liquid and observing the entire tested installation for a specified time (**for the installation tested with water, the pressure is 15 bar and the observation time 2 hours**). If no leaks or pressure are visible after 2 hours does not drop on the test manometer - the test is positive, otherwise drain the system, repair any leaks and perform the main pressure test again.

THE REMOVAL OF LEAKAGE OR REPAIRS ON PRESSURE INSTALLATIONS IS FORBIDDEN!

Remember!

In the preparation stage and carrying out related work with pressure testing, all workers involved must be equipped with the following set of personal protective equipment:

- a) a protective helmet with a fastened chin strap,
- b) full work clothes,
- c) S3 class safety shoes,
- d) a warning vest,

other PPE provided for use during work depending on the risks identified at the time of planning the work and developing the Safe Work Instruction (IBWR).



When testing the pressure, use a calibrated disc pressure gauge (minimum disc diameter 150 mm) with a range 50% greater than the test pressure and 0.1 bar graduation for the test pressure up to 10 bar, 0.2 bar for the pressure above 10 bar. This pressure gauge should be mounted on the tested installation before performing the preliminary test.

When carrying out pressure tests with water, its physical conditions should be taken into account and the process of thermal "shrinkage" of the pipeline should be taken into account, as these factors have a significant impact on the values and fluctuations of measurement pressures and the interpretation of test readings.

2. Principles of work organization

1. Tests on installations managed and operated by LG ESWA technical departments:

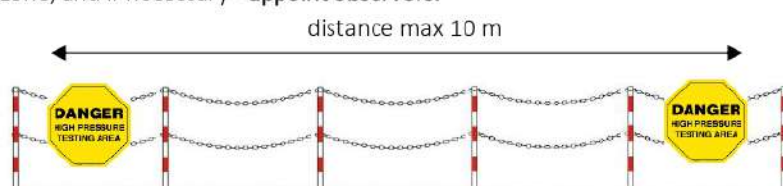
- a) The contractor is authorized to perform pressure tests only and only on the basis of work permits (general and sector permits). Detailed conditions for the issuing of work permits at LG ESWA are described in **Procedure 10.1**.
- b) performing pressure tests within the existing installations or their components must be preceded by appropriate arrangements between the technical departments of the plant and the Contractor, and after the implementation of the necessary safeguards.
- c) the owner of the installation (e.g. Area Responsible) is a person without consent and knowledge whose work cannot start.
- d) The contractor carries out a pressure test strictly in accordance with installation design recommendations and having regard to the arrangements with the technical departments of LG ESWA.
- e) supervision over the course of the pressure test is obligatory both for the Contractor (Work Supervisor) and the owner of the installation (Area responsible).

2. Tests within newly built installations, not commissioned for use by LG ESWA:

- a) The contractor is authorized to perform pressure tests only on the basis of the issued work permits (general and sector permits), detailed conditions for issuing work permits in LG ESWA are described in Procedure 10.1. The prerequisite for issuing the Contractor's permit is the development and presentation of the Instructions for Safe Performance of Works (IBWR) for the opinion of the Health and Safety Department of LG ESWA. The instructions should be read by all employees involved in the work, while they confirm that they have read the instructions with their own signature.
- b) performing pressure tests within newly built installations or their components must be preceded by the performance of appropriate safeguards described in IBWR, the implementation of which is the responsibility of the contractor (team leader).
- c) if the resulting installation or its element will be connected to the existing installations and operating on the premises of LG ESWA - making arrangements between the Contractor and the relevant technical departments of the plant is obligatory. The contractor also uses security and other activities indicated on the basis of arrangements.
- d) representative of the LG ESWA technical department, agreed by the Contractor of the test, is obliged to supervise its course. It is allowed to participate in the process also by means of a video recording or other form ensuring insight into the operating parameters of the installation, including the achievement of the required pressure by the installation.

3. Preparation of the work area for the pressure test includes:

- a) **ensuring constant supervision over the course of works** - the Works Supervisor of the team that will carry out the pressure test is obliged to exercise continuous, uninterrupted supervision at the place of work **until its completion**.
- b) **fencing of the danger zone** - the work zone covered by the pressure test must be strictly protected against access by third parties. The contractor is obliged to use appropriate means (barriers, chains, etc.) and mark the zone with appropriate pictograms in each direction of the zone, and if necessary - **appoint observers**.



Remember!

In cases justified by the possibility of the tested installation freezing or causing excessive corrosion, it is allowed to perform a tightness test with oil-free compressed air.

The value of the pressure of testing the tightness of the installation with compressed air should not exceed 3 bar.

The compressor, used for air tightness testing, should be equipped with a safety valve that will open when the leakage test pressure is exceeded by no more than 10%.

When testing the tightness of the installation with compressed air, particular attention should be paid to the resulting dangers with the risk of an accident caused by the possibility of ejection of an element of the installation by the compressed air (e.g. not to be used as caps for push-in plugs made of plastic).

If leakage in the installation is revealed during testing, it can be located acoustically or with the use of a foaming solution.

When taking pressure gauge readings at the beginning and at the end of the test, and for a period of at least half an hour before reading the reading, the ambient temperature should be the same (the temperature difference should not exceed ± 3 °C) and there should be no solar radiation.

- c) **elimination of hazardous factors - the Contractor is obliged to:**
- remove any debris from the area (waste, unnecessary materials):
 - remove the live power cables (cables, extension cords) and devices connected to the voltage (platforms, heaters, switching stations, etc.),
 - switch off the voltage in neighboring electrical installations, which cannot be removed and may be exposed to flooding with water etc. in agreement and with the consent of the owner of the installation or the Area Responsible.
 - adequately secure the necessary devices against flooding, e.g. slow-moving platforms or other devices and tools that will be necessary during the work (especially control panels and power supply elements for these devices).
 - make sure the piping is properly supported or suspended from the structure. The flow of the medium in the pipeline, and in particular the liquid, causes the installation to vibrate naturally, which may cause parts of the installation to loosen, and consequently lead to unsealing.
 - provide an appropriate amount and type of portable extinguishing agents if, as a result of leakage, it is necessary to perform fire-hazardous work.
- d) **providing materials for the possible neutralization of the test substance** with which the test will be carried out - in order to maintain control over a possible leak (containers, cleaning cloth, sorbent, etc.). The Contractor is also obliged to organize a safe place for the discharge of the test substance from the installation to be tested - if a leak occurs and it becomes necessary to repair the leaky section or element of the installation.
- e) **determining the signal to start, suspend and end the test** - the Contractor, in consultation with a representative of the LG ESWA technical department or with the Area responsible in which the test will be performed and his employees, determines the signal to which the test substance will be applied to the tested installation, signal for which to interrupt the administration and at the end of the test. It is recommended to transmit the signal by radio - using walkie-talkies. The Works Supervisor of the Contractor's team is obliged to check the efficiency of communication means and communication between individual employees before starting the test.
4. **After the pressure test has been carried out, the Contractor shall draw up a test report** specifying:
- a. data of the Performer of the test,
 - b. sample location (building, level, area, line number, etc.),
 - c. date, time and duration of the test,
 - d. test pressure at which the tightness of the installation was tested,
 - e. applied test substances, including equipment and measuring devices,
 - f. determining whether the test was carried out and completed with a **positive result**, or with a **negative result**.
 - g. date and signature of the Head of the team performing the test,
 - h. date and signature of the Area Responsible or representative of the technical department, **then the test is considered completed**.

The data in the test report must refer to the actual state - i.e. to a section or the whole of the tested installation. It is not allowed to test one section and translate the test result over the entire installation!

Remember!

If possible, tests should be carried out in the evening and at night.

If the test is carried out over a large area - fencing and marking of the danger zone should be provided in all places where the tested installation runs. The contractor is obliged to provide an appropriate number of observers if the fence is not feasible.

All observers must have radio communication with the test team in order to immediately alert about the danger if a leak is detected. Observers obliged are kept at a safe distance from the tested installation i.e. at least 5 meters.

Installations that have become unsealed need to be carried out after their repairs re-pressure test. It is unacceptable to repair the installation and its subsequent operation without checking the performance parameters and security.

Performing another pressure test as part of an unsealed installation requires notification and approval of the Responsible for the area and a representative of the LG ESWA technical department.

Issuance of the test report by the Contractor and statement, that the test was completed with a positive result, inconsistent with the actual state, will result in incurring costs as a result of breakdowns or accidents involving the tested inoperative installation.

3. Proceeding in emergency situations

1. **At the stage of planning and preparing for the test**, the Contractor is obliged to identify hazards in the workplace, assess the risk of their occurrence and apply appropriate measures to eliminate or minimize this risk. Proper planning, preparation of a work execution methodology, risk assessment for the task and training of the employees involved is mandatory.
2. **The equipment, devices and tools** to be used by the Test Contractor must be in a proper technical condition, meet the requirements for general provisions and have appropriate certifications, if any are required (UDT, conformity assessment, operator's qualifications and others). The Contractor is responsible for the technical condition and compliance with legal requirements in relation to the machines, tools and devices used. For any damage caused as a result of damaged work The Contractor bears full responsibility for the work with inadequate equipment.
3. **Emergency situations that may arise during the test may be related to many factors, including :**

- a. **unsealing or explosion of the tested installation or its components** - if the installation was unsealed during the test - the Contractor is obliged to immediately stop the activities and notify the Ordering Party, the Responsible for the area or a representative of the LG ESWA technical department and the LG ESWA Safety Team.

If, as a result of leakage or explosion of system components, the employees involved in the test or third parties suffered injuries, the Contractor is obliged to immediately provide them with first aid and notify the plant emergency services. The contractor is then obliged to prepare a report on such an event and present it to the Health and Safety Department of LG ESWA immediately.

If the leakage does not endanger the safety of employees or third parties - the Contractor, through his own efforts and means, arranges the repair of the tested installation, and is obliged to empty the installation of the test substance. Repairs are made only on the non-pressurized installation.

- b. **leakage of operating fluids from the machines used to perform the test** - in this situation, the Contractor temporarily protects the damaged machine and operating fluids released from it as a result of a failure - with the use of sorbent and cleaning cloth. If necessary, the Contractor is obliged to notify the Company Fire Department. A machine that has failed (e.g. a mobile platform) must be removed from the work area and subjected to professional service - for which the Contractor is responsible.
- c. **fall from height** - if the employee fell during the test from a height and hung in the safety harness - The contractor is obliged is to follow **standard 9.2 Evacuation of a worker after a fall from a height** and notify the Employer, Area Responsible or representative of LG ESWA technical department and LG ESWA Safety and Health department.

The Contractor is obliged to train the employees involved in the test in providing first aid after a fall from a height and in other situations!

Remember!

The Ordering Party of works consisting in the performance of pressure tests is obliged to provide the Contractor with the necessary information on the safe organization of the work. The Contractor is obliged to take into account the instructions provided by the Ordering Party, the Area Responsible and the representative of the LG ESWA technical department and to adapt the work methodology to the requirements.

The Contractor is forbidden to use damaged equipment, equipment not intended for specific activities or other than its own.

The Works Supervisor of the pressure test team is obliged to periodically check the communication between individual observers - if the test is carried out in a large area.

If the Contractor is not able to neutralize the operating fluids (oil, hydraulic fluids) with his own efforts and in the event of their leakage from used machines and devices - he is obliged to immediately notify the Company Fire Brigade.

Each of the employees working at height must be familiar with the content of the company standards relating to this category of work and other work performed on the premises of the plant.

- d. **fainting / loss of consciousness by an employee** - Contractor, obligated it is possible to evacuate the injured employee from the work zone as soon as possible, provide first aid and notify the company's ambulance service, the employee should not be left unattended until his arrival.
- e. **cuts, wounds** - the contractor provides employees at the workplace with a first aid kit, employees are obliged to help each other in the event of such situations, if necessary, the company ambulance service should be called.
- f. **electric shock** - if the worker remains conscious as a result of electric shock from the installation / power tools and has lost contact with the power source, he should be evacuated from the workplace and the company emergency services should be called, if he remains unconscious due to electric shock and it is suspected that he has not lost contact with a power source (e.g. a cut cable) - disconnect the power source from the power supply as soon as possible, start rescue actions and call the company's ambulance service as soon as possible.
- g. **fire** - if during the test, for various reasons, there is a fire or fire in the area of work (short circuit of the installation, battery fire in the mobile platform, etc.). The Contractor is obliged to immediately take an extinguishing action using his own handheld extinguishing agents and at the same time notify the Company Fire Brigade. The Contractor shall also notify the Ordering Party, the Area Responsible (or representative of the LG ESWA technical department) and the Safety and Health Department of LG ESWA about the incident, immediately.

The Contractor is obliged to provide an appropriate amount and type of own portable extinguishing agents necessary for the safe performance of the task. The Contractor is responsible for the technical condition, periodic inspections of the equipment and training of employees in its use.

The storage and warehousing of flammable materials in places not intended for this is prohibited. The contractor who, by his actions, causes a fire in the test area or to a fire, shall be fully responsible for any damage resulting from it.

If there is a need for temporary storage of flammable materials in the work area - e.g. fuel - the Contractor is obliged to agree the conditions of storage of such materials with the Responsible for the area or a representative of the LG ESWA technical department and take the necessary actions to ensure adequate fire protection of such materials.

- h. **evacuation** - a situation caused by the activation of a fire alarm in an area or building in connection with the detection of a threat. If, during the pressure test in the work area, a fire alarm is triggered - the Contractor is obliged to suspend the test, secure the equipment and devices (disconnect from the power supply, place it in a safe place, suspend the administration of the test substance, etc.) and follow the messages transmitted by the means of communication and follow the evacuation routes to the nearest exit, then to the assembly point for evacuation.

The Contractor is obliged to check the personnel condition of his team after leaving the building or area where the evacuation took place!

Remember!

In the event of any emergency, the Contractor is obliged to notify about this fact of the Ordering Party, Area Responsible or representative of the LG ESWA technical department and the LG ESWA OHS Department and, if necessary, call the in-house emergency services.

If an incident occurs during the performance of works - a potentially accidental event; events resulting in the need for first aid or an accident at work - the contractor is obliged to immediately notify the Safety and Health Department of LG ESWA about this fact and prepare the necessary reports related to the event.

As a result of an emergency or incident, the Contractor's works in the area may not be continued in the relationship with blocking a work permit or its closure by the Ordering Party or a representative of the Health and Safety Department of LG ESWA.



The required handheld firefighting equipment and the Contractor's equipment are:

- a) a fire extinguisher of at least 6 kg ABC type,
- b) a fire blanket,
- c) a first aid kit.

This equipment should be checked prior to commencement of work and supplemented if necessary.

4. Good and bad practice during pressure testing



Adequate fencing and marking the danger zone, in which pressure tests will be performed.

A label with instructions in 4 languages (Polish, English, Korean, Ukrainian) is protected against adverse weather conditions, e.g. flooding.

Separating dangerous zones with white and red tapes is forbidden.

The use of inefficient or damaged compressors during pressure tests (broken pressure gauges, broken safety valve, no UDT certification, damaged high pressure pipes or oil leaks, etc.) is unacceptable.

A Contractor who uses damaged equipment or equipment that threatens the safety of its employees or third parties will lose the ability to perform work due to the immediate blocking of the work permit.



Marking the sampled installation in such a way that it is not possible to effectively inform other employees or third parties.

If the tested installation is present at a height, e.g. on a suspended ceiling - the area below the ceiling should be secured, etc. or the observers should be involved in securing the area. **Performing pressure tests without marking and fencing the danger zone is unacceptable.**



The pressure gauges used to measure the test pressure must be in a proper technical condition, meet the requirements of the relevant standards, and have valid calibration certificates and be selected depending on the test pressure.

The pressure gauges should be secured against damage.



Remember!

The Performer of the test is responsible for organizing a sufficient amount of material resources to separate the danger zone.

It is not allowed to perform other work unrelated to the test in the test area.

For access control to the area, in which the test is carried out, the Contractor is responsible. He is obliged to properly train his observers and employees in this regard.



The observer securing the pressure test zone must necessarily have:

- a red warning vest with the word OBSERVER,
- a red safety helmet with a chinstrap,
- signaling devices - a whistle or a megaphone and a red indicator,
- efficient means of communication (walkie-talkies with a spare power kit),
- first aid kit.

For arranging the equipment and equipping observers the test Contractor is responsible - for checking them, the Contractor's Work Supervisor.