



BSI Standards Publication

Heating systems in buildings — Installation and commissioning of water based heating and cooling systems

National foreword

This British Standard is the UK implementation of EN 14336:2025. It supersedes BS EN 14336:2004, which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee RHE/24, Heating systems and water based cooling systems in buildings.

A list of organizations represented on this committee can be obtained on request to its committee manager.

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Heating systems in buildings - Installation and commissioning of water based heating and cooling systems

Systèmes de chauffage dans les bâtiments - Installation
et commissionnement des systèmes de chauffage à eau

Heizungsanlagen in Gebäuden - Installation und
Abnahme der Warmwasser-Heizungsanlagen

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European foreword

This document (EN 14336:2025) has been prepared by Technical Committee CEN/TC 228 “Heating systems and water-based cooling systems in buildings”, the secretariat of which is held by DIN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by December 2025, and conflicting national standards shall be withdrawn at the latest by December 2025.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN shall not be held responsible for identifying any or all such patent rights.

This document supersedes EN 14336:2004.

In comparison with the previous edition EN 14336:2004, the following technical modifications have been made:

- new technologies are covered;
- inclusion of new test procedures;
- editorial organization to facilitate the use of this document within a comprehensive commissioning process.

Any feedback and questions on this document should be directed to the users’ national standards body. A complete listing of these bodies can be found on the CEN website.

According to the CEN-CENELEC Internal Regulations, the national standards organisations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Republic of North Macedonia, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Türkiye and the United Kingdom.

Introduction

The subjects covered by CEN/TC 228 are the following:

- design of water-based heating and cooling systems;
- installation of heating systems;
- commissioning of heating systems;
- instructions for operation, maintenance and use of heating systems;
- methods for calculation of the design heat loss and heat loads;
- methods for calculation of the energy performance of heating systems.

Heating systems also include the effect of attached systems such as hot water production systems.

All these standards are systems standards, i.e. they are based on requirements addressed to the system as a whole and not dealing with requirements to the products within the system.

Where possible, reference is made to other European or International Standards, such as product standards. However, use of products complying with relevant product standards is no guarantee of compliance with the system requirements.

The requirements are mainly expressed as functional requirements, i.e. requirements dealing with the function of the system and not specifying shape, material, dimensions or the like.

The guidelines describe ways to meet the requirements, but other ways to fulfil the functional requirements might be used if fulfilment can be proved.

Heating systems differ among the member countries due to climate, traditions and national regulations. In some cases, requirements are given as classes so national or individual needs may be accommodated.

In cases where the standards contradict with national regulations, the latter should be followed.

Figure 1 illustrates the basic sequence of the installation and commissioning process.

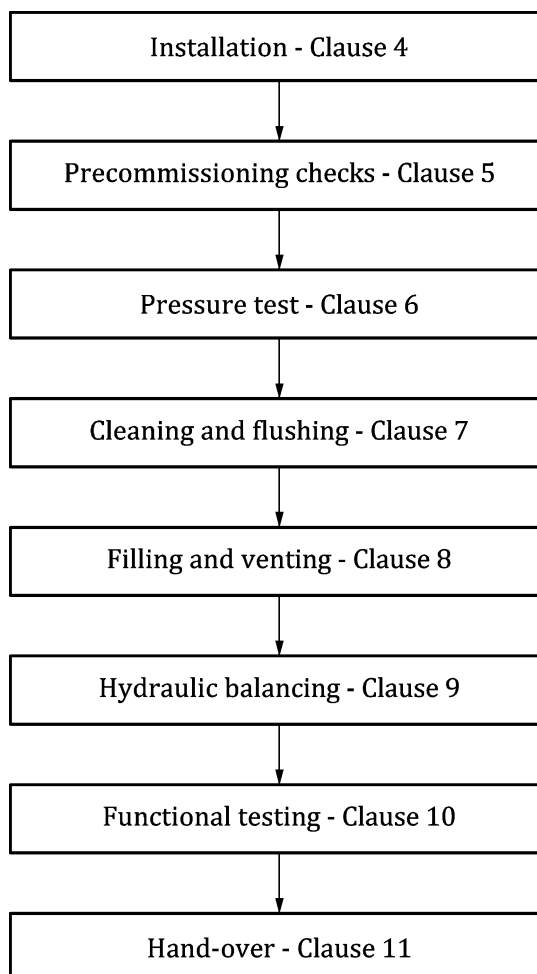


Figure 1 — Installation and commissioning process

1 Scope

This document specifies the requirements for the installation and commissioning of water-based heating, water-based cooling, and heating of domestic hot water (DHW) systems in buildings with a maximum operating temperature of 105 °C.

This document is applicable to the commissioning of systems as a whole, in cases of new systems, renovations and replacement of equipment.

This document does not apply to superheated water systems or steam systems and it does not apply to the specific commissioning requirements for individual components (e.g. how to set fuel/air ratio on a burner). Also, it does not apply to the installation or commissioning of attached systems (e.g. air conditioning, domestic hot water distribution, ventilation systems).

This document specifies only technical requirements but it does not specify any commercial or contractual arrangements between parties.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 12170, *Heating systems in buildings — Procedure for the preparation of documents for operation, maintenance and use — Heating systems requiring a trained operator*

EN 12171, *Heating systems in buildings — Procedure for the preparation of documents for operation, maintenance and use — Heating systems not requiring a trained operator*

EN 61082-1, *Preparation of documents used in electrotechnology — Part 1: Rules (IEC 61082-1)*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <https://www.electropedia.org/>

3.1 installer

party performing the installation process

3.2 client

party for whom the installation process is performed

Note 1 to entry: In some contexts, the client may be represented by a professional during the installation and commissioning process.

3.3 commissioning

advancement of an installation from the stage when the mechanical and electrical installation work is complete to a confirmed operation-ready state according to specified requirements

Note 1 to entry: The word “commissioning” is used here to identify the activities of checking, testing and setting to work the installed systems prior to hand-over. This is only a part of the comprehensive “commissioning process” as defined in Ashrae 202 standard.

3.4

hydraulic balancing

process of adjusting flow rates throughout the system to obtain the required flow rates under design conditions

3.5

contaminant

undesired substance or particle which is present inside a water-based system

Note 1 to entry: Example of contaminants are welding scale, slag, cuttings, metal oxide particles, cutting oil residues, dirt.

3.6

flushing

washing out of a piping system to remove contaminants

3.7

mechanical cleaning

process of pipe cleaning and removal of dirt and debris by forcing a device called a pig or scraper through the pipeline

3.8

heat distribution system

configuration of interconnected components for the transport of heat from the heat generation system to the heat emission system or any attached system

3.9

heat emission system

configuration of interconnected components for the dispersal of heat to a heated space

3.10

heat generation system

configuration of interconnected components/appliances for the supply of heat to the heat distribution system

3.11

cooling generation system

configuration of interconnected components/appliances for the extraction of heat from the cooling distribution system

3.12

maintenance

combination of all technical, administrative and managing actions necessary to retain an item in, or restore it to, a state in which it can perform an intended function

[SOURCE: EN 12170 and EN 12171]

3.13

maximum operating pressure

maximum pressure at which the system, or parts of the system, is designed to operate

3.14

maximum operating temperature

maximum temperature at which the system, or parts of the system, is designed to operate

3.15

P&ID

pipng and instrumentation diagram

3.16

OM&U

operation, maintenance and use

[SOURCE: EN 12170 and EN 12171]

3.17

operation

those actions necessary to make available the services, which the system has been designed to provide

[SOURCE: EN 12170 and EN 12171]

3.18

setting to work

process of setting a static system into operation

3.19

use

action of receiving the services, which the system has been designed to provide

[SOURCE: EN 12170 and EN 12171]

3.20

shop drawing

drawing or diagram prepared to be used during on-site installation activities

3.21

pressure test

combination of tightness and load test

3.22

tightness test

test performed to ensure that there are no leaks in a hydraulic system

Note 1 to entry: Tightness test is normally performed at lower pressure than load test.

3.23

load test

test performed to ensure that the system can withstand the designed fluid pressure and that it has the required strength reliability under operating conditions

4 Installation

4.1 Preparation for the installation

4.1.1 Documentation

The installation activities can begin only after the design has been approved for execution and the following documentation and/or information has been prepared and handed over for installation:

- a) equipment and component specifications;
- b) design specification including:
 - functional diagrams;
 - installation layout;
 - installation details;
 - materials to be used or not used (avoided);
 - design flow rates and all other information needed for testing and balancing (hydraulic balancing);
 - specification of filling water;

NOTE Additional information can be found in EN 12828, EN 17671 and applicable regulations.

Some documents may be available later in the installation process.

- c) a coordinated **time schedule** of the work, specifying priorities and relationship between installation items, where appropriate (e.g. any timing to be respected between installation works);
- d) a list of critical materials / equipment to be checked and / or approved upon delivery (see 4.2 – incoming goods);
- e) an agreed procedure or instructions to handle changes;
- f) a list of test and control activities to be performed during the installation and commissioning process, which include:
 - anticipated tests to be performed during the installation process (e.g. any pressure testing of concealed pipes before covering them);
 - required pre-commissioning checks;
 - required documented actions, installation site inspections, verifications and testing, such as pressure test, cleaning, filling, balancing, etc.

Concerning item f), the client and the installer(s) shall agree the required reports to be provided during the installation process.

Additional information and an example of a list according to item f) are given in informative Annex A.

The completed test reports and forms for the listed test and control activities shall be annexed to the OM&U instructions.

4.1.2 Site preparation

It shall be ensured that:

- the site is available and accessible for installation;
- handling facilities are provided;
- storage facilities are provided;
- appropriate services/utilities (e.g. water, electricity, gas) are available;
- contractual obligations about site organization are met.

4.2 Inventory and inspection of incoming goods

Delivered materials shall be checked to ensure, that:

- quantities and descriptions correspond to the design specification;
- equipment and components are undamaged.

All accompanying documentation shall be archived and kept available for the installation activities and for inclusion in the OM&U instructions.

The inspection of incoming materials that have been identified as critical to achieve the design objectives shall be documented.

4.3 Handling of materials

Any manufacturer's instructions on how to handle materials shall be followed.

Suitable handling equipment shall be used where necessary.

Penetration/accumulation of dirt and damage of exposed parts shall be avoided.

Attention shall be given to safety requirements.

4.4 Storage of materials

Storage of components shall be carried out according to the manufacturers' specifications with particular attention to safety requirements and climatic conditions.

Protection of stored materials shall consider at least:

- sunlight (high temperatures and UV light);
- high temperatures;
- humidity, rain and other atmospheric agents;
- low temperatures and icing;
- animals (e.g. insects, rodents);
- penetration/accumulation of dirt and damage of exposed parts;
- hygiene;
- mechanical stresses due to inappropriate storage.

Special provisions shall be given if the installation process shall be residue free (see 4.5.1 and 7.1).

EXAMPLE Keeping caps on pipes and any other mean of avoiding component contamination.

4.5 Installation of components

4.5.1 General

Manufacturers' instructions for the installation of components shall be available and followed.

The components shall be installed in accordance with the design specifications.

Proper accessories and tools for positioning, assembling and installation shall be available.

Before installation, every component shall be internally clean, visually checked and suitable for use.

The components shall be installed in a way that allows further (subsequent) installation work and operations such as insulation. All serviceable components shall be installed in such a way that they can be serviced, repaired or replaced.

EXAMPLE manoeuvring space and access to replace fan-coil filters

Components shall be placed, fixed and supported in such a way that they are steady and no harmful deformations occur and so that thermal expansion is possible. Supports and bracings shall consider seismic actions, if required by local regulation.

Clean working procedures (such as avoiding producing and/or leaving swarf and debris in the components and pipes) shall be adopted if it is planned to avoid cleaning at the end of the mechanical installation. The installation of filters is recommended in this case (residual risk, check regularly).

The installer shall notify the client of any obvious evidence of possible design mistakes or installation difficulties and agree a solution.

NOTE The task of the installer is to carry out a plausibility check of the documentation but not to check calculations or to revise the design documentation.

4.5.2 Heat generation

4.5.2.1 General

The structure upon which the heat supply (generator) is supported and its immediate surroundings shall be in accordance with the design specifications.

Clearances between the heat generator and adjacent materials, e.g. for safety, cleaning and maintenance, shall be at least in accordance with the heat generator manufacturer's instructions.

Points of attention shall be:

- a) protection of combustible material and fire protection;
- b) any installation room of the heat generator shall be built and equipped according to the applicable legal and safety regulations;
- c) heat generator mounting, positioning and connection, in order to limit noise transmission from the appliance;
- d) avoiding stress transmission (connection of piping).

4.5.2.2 Combustion generator

Point of attention shall be:

- a) combustion air supply and flue gas evacuation;
- b) airing and ventilation openings;
- c) fuel supply.

4.5.2.3 Heat pumps

Point of attention shall be:

- a) noise and distance to the property limit for heat pumps with outdoor unit;
- b) air ducts for indoor mounted, air source heat pumps.

4.5.2.4 Solar collectors

Point of attention shall be:

- a) access to the roof;
- b) shadings;
- c) hangers and supports on the roof shall not compromise the roof waterproofing;
- d) insulation material for collector pipes shall withstand high temperatures within steam range and be weatherproof where necessary;
- e) using suitable materials for glycol mixture;
- f) weight of the system (for natural circulation with store on the roof).

4.5.2.5 Heat exchangers

Point of attention shall be:

- a) right connection and flow direction;
- b) room for disassembling and cleaning (shell and tube);
- c) avoiding mechanical stresses from connections.

4.5.3 Heat distribution – piping and pumps

Measures shall be taken to prevent moisture, fire, smoke, noise and infestants where pipes pass through a structure.

When pipes cross the building envelope or a separation between ventilation zones, air tightness shall be maintained.

When crossing fire rated structures, applicable regulations and technical standards shall be followed.

The components shall be installed in a way that allows insulation according to the design.

In cases where joints and components are inaccessible, they shall be maintenance free and have an appropriate life expectancy.

Point of attention shall be:

EXAMPLE provisions to allow thermal expansion of pipes (supports with fixed points and moving points)

- a) provisions to avoid transmission of stresses to equipment (flexible joints);
- b) provisions to fill, flush and drain the systems, vents and drains along pipes, including slope;
- c) orientation of devices according to manufacturer instructions (e.g. control valves, pumps, meters);
- d) positioning of sensors;
- e) straight pipe runs before and after sensitive devices, e.g. heat meter, flow rate sensors;
- f) provisions to measure pressure and/or temperature and/or flow rates during commissioning;
- g) positioning of cold water pipes with respect to potentially hot lines.

NOTE Legionella growth is increased significantly at temperatures above 25 °C.

The pressure test (and any other relevant test concerning them) shall be carried out prior to the covering of permanent joints and components.

4.5.4 Heat emission

Heat emitters shall be installed so as to allow venting.

Positioning shall consider maintenance (e.g. filter replacement for fan-coils).

Points of attention shall be:

- a) hydraulic isolation (providing a means to shut off e.g. for maintenance purpose);
- b) draining provisions, both of technical water and condensate (for cooling emitters);
- c) flushing provisions;
- d) dielectric isolation to prevent corrosion;
- e) positioning of surface mounted emitters in respect of attaining the rated heat output (e.g. under niches or obstructions);
- f) positioning of humidity sensors for embedded cooling emitters.

For embedded heating and cooling surfaces, the installation shall comply with EN 1264-4 „*Water based surface embedded heating and cooling systems — Part 4: Installation*”.

4.5.5 Control and monitoring

Controls and water sampling points shall be accessible for their use, setting and servicing.

Meters and sensors shall be accessible for reading and servicing.

The following factors shall be considered when installing water temperature sensors, which may be either surface type sensors or insertion type sensors:

- stratification effects when mixing hot and cold water;
- time lag issues with automatic control;

- location on the upper side of pipes and surface contact for the surface type sensor;
- location in elbows or on the upper side of pipes and positioning in the water stream of the sensitive part for the insertion type sensor;
- insulation from the environment.

For wireless connections, emitters, receivers and boosters (repeaters) shall be positioned according to the design specification and manufacturer instruction to ensure the link.

4.5.6 Thermal insulation

Supports, suspensions, girders and fixpoints passing through the thermal insulation shall be installed so as to limit heat losses.

Cooling circuits shall be fully insulated to avoid condensation.

The insulation material of cooling circuits shall be closed cells type.

4.6 Site inspections during the installation work

Site inspections can be arranged by installer and client.

Site inspections during the installation work are intended to verify that:

- the installation is proceeding according to design specifications and time schedule;
- the installation is proceeding according to the requirements set out in 4.2 to 4.5.

Any defects found during the on-site inspection shall be reported to the installer for rectification.

Further information on site inspections and a sample inspection report with provisions for follow-up of rectification are given in Annex B.

4.7 Changes during the installation process

Any deviation from the design specification, including layout, shall be notified to the client, evaluated by the installer and by the responsible of the design and authorized by the client.

Consequences regarding:

- energy performance;
- functionality and service level;
- maintenance;
- interference with other installation and commissioning work;
- repetition of any previous testing;
- compliance with regulatory requirement

shall be considered when evaluating a change.

5 Pre-functional checks

5.1 Objective

The purpose of the pre-commissioning checks is to guarantee that the mechanical and electrical installation of the system is correct and completed and it is therefore possible and safe to proceed with cleaning, pressure testing, filling, balancing and setting to operation.

The pre-commissioning checks include:

- a general check of the entire system;
- individual checks for equipment and major components;
- electrical checks.

Pre-functional test may be documented. Examples of suitable forms are given in Annex C.

5.2 General check

It shall be verified that the installation is in accordance with the design specification. The reference shall be:

- functional diagrams (P&ID check);
- layout drawings.

5.3 Equipment and component check

Each equipment or major component shall be verified in order to ensure that:

- it has not been damaged during installation (especially surface mounted heating and cooling emitters);
- it is adequately supported and levelled;
- the installation complies with design specifications and manufacturer instructions such as:
 - functional diagrams, e.g. isolation valves are installed, check valves in the right direction;
 - layout specifications, e.g. position, elevation, orientation, free straight runs after and before, levelling, free space for maintenance;
 - electrical actuators are paired with the correct service areas and temperature sensors and controls;
 - any wireless connection is stable;
- painting (protective coating) is finished;
- insulation is complete and thickness is correct, except where insulation shall be completed after pressure testing;
- labels are in place;
- equipment and component documentation has been collected and archived;

- power and other utilities are available for testing.

Insulation, protective coatings and labels may be completed later during the commissioning process. They have to be checked for completion before hand-over.

Insulation is to be completed after pressure testing and labelling is to be applied after the insulation is completed.

For embedded emitters, ensure that the applicable initial heating up protocol (e.g. according to Annex B of EN 1264-4:2021) has been followed before the final floor covering is installed.

Additional information on pre-commissioning checks and sample pre-commissioning checklists for equipment and major components are given in Annex C.

5.4 Electrical checks

Check that power is available and that it is safe to operate electrical components.

Live electrical checks and commissioning activities can be performed with a provisional power connection.

Information on electrical checks is given in Annex C.

6 Pressure test

6.1 General

In order to ensure their tightness and their capacity to withstand the design maximum pressure, new and renovated water-based heating and cooling systems shall be subjected to a **pressure test** upon completion and before functional testing.

A **pressure test** according to this document consists of:

- a **tightness test** to ensure water tightness of the system;
- a **load test** to ensure the capacity of the system to withstand the design maximum pressure (strength reliability).

The test can be performed by:

- either a hydraulic test, using water or another liquid (see 6.2);
- or a pneumatic test, using air or an inert gas (see 6.3).

When deciding whether a pressure test is to be carried out with water or air/inert gas, the following factors shall be considered:

- residual liquid after a hydraulic test is a hygienic and corrosion hazard in the event of anticipated longer periods of non-operation before handing-over and operation;
- closed water-based heating, and cooling circuits cannot be tested with water during periods of frost unless dedicated provisions are taken;
- a pneumatic test requires additional safety measures as compressed gases can be dangerous;
- with a pneumatic test, the pressure is uniform in the whole system whilst the pressure depends on the elevation in the case of a hydraulic pressure test.

The tightness test and the load test need not necessarily be performed with the same medium.

The tightness test and the load test can be combined in a single testing session.

The tightness test and the load test can be performed by sections. Each tested section shall be clearly identified in a dedicated report.

Installation parts that are to be embedded in building structures or permanently concealed behind walls or ceilings shall be pressure tested when still visible and accessible.

For new systems, the pressure test shall be performed before insulation is applied.

Prior to performing the pressure test, all openings and connections to the testing section are to be sealed. To achieve this, the end of each test section and all line openings are to be sealed with appropriate plugs suitable for the required pressure, caps, blanks or blind flanges. Closed valves at the end of a test section are not considered as tight seal. All valves within the test section shall be fully opened.

A manometer with an appropriate display range and resolution is to be used for the pressure test. The manometer is to be positioned at the lowest possible point of the system. The contract or the design specification may require a calibrated instrument.

To avoid false results due to temperature changes, the test shall be performed after thermal equilibrium is reached between the test medium temperature and the surrounding temperature.

NOTE 1 The thermal time constant of a non-insulated pipe ranges from 15 min for DN 15 to 90 min for DN 80.

The client is to be notified of the pressure test in advance, so that he or his representative have the opportunity to attend the execution of the test.

If a pressure test fails, the leakage shall be identified and repaired and the test successfully repeated.

The pressure test shall be documented by means of a test report which shall include at least the following information:

- identification of the system;
- identification of the tested section;
- date of the test;
- test medium;
- initial test pressure;
- time from filling to start of pressure test to allow temperature equilibrium;
- test duration (time span with the system under test pressure);
- pressure drop during test duration or final pressure;
- tightness confirmation (pass/fail);
- identification and signature of the person responsible for the test.

NOTE 2 See 4.1.1 and Annex A for the agreed required documentation.

The pressure test reports shall cover the entire system.

Closed water circuits may only be balanced and commissioned after the pressure test has been successfully passed and documented.

See Annex D for additional information and a sample pressure test report form.

6.2 Hydraulic test

Tightness and load test can be performed with water.

The system shall be filled from the bottom to the top and vented.

While filling the system with water, it shall constantly be checked whether leaks are present by monitoring the system for escaping air or signs of escaping water. The same procedure has to be performed throughout the entire testing period.

In the case of plastic pipes, it is to be noted that they expand when they are pressurized due to their mechanical properties. This shall be considered when applying the test pressure. Reference is made to the respective manufacturer's specifications.

For DHW-systems, hygienic aspects additionally apply. In these cases, EN 806 and national regulations require pneumatic pressure testing as the only possible testing method.

EXAMPLE VDI 6023 Part 1 require pneumatic testing of domestic hot water piping.

Additional information and a suggested report form are given in Annex D.

6.3 Pneumatic test

Tightness and load tests can be performed with air or inert gas.

This method is particularly recommended if long intervals between the load test and hand-over and operation are to be expected.

The air used for the tightness and load tests shall be oil-free, since there is an increased risk of corrosion if oil is present and the presence of oil in valves and components can damage incorporated plastic and sealing materials. An oil-free compressor shall be used to generate the compressed air. Inert gas can also be used instead of compressed air.

Prior to pneumatic testing, a person shall be appointed responsible for:

- executing the process throughout the duration of the test;
- monitoring the compression unit;
- checking whether the system has been completely depressurised after the test is complete.

For the load test, during pressurization and equilibration time, there shall be no unauthorised persons in the close proximity of the circuit sections being tested.

The supply of compressed gas shall be controlled outside the test zone if possible.

The supply connection of the compressed gas to the tested section shall include:

- a shut-off valve;
- a pressure reduction valve;
- a manometer;
- a safety valve;
- a relief valve

as shown in Figure 2, to prevent the test pressure from being exceeded.