MINISTRY OF REGIONAL DEVELOPMENT AND PUBLIC WORKS

Draft

ORDINANCE No ……………………

on the design, construction and operation of water supply systems

P A R T O N E

GENERAL REQUIREMENTS

Article 1. (1) The Ordinance sets out the technical requirements for research, design, construction and operation of new ones, as well as for reconstruction, reorganisation and/or overhaul of existing water supply systems.

(2) The elements of the water supply systems are: water abstraction facilities, water drawing facilities, pumping stations, natural water treatment plants, regulating water pressure equipment, external plumbing, water supply networks in the water supply areas (primary feeders, secondary feeders, building plumbing deviations) and general measuring means necessary for the water abstraction, purification, storage, transmission, distribution and measurement of water up to the border with the building water supply system or the internal (in situ) water supply network of the users.

(3) Water supply systems shall be designed in accordance with the general and detailed development plans in force within the meaning of the Spatial Development Act (SDA), the requirements for the construction works under Article 169(1) and (3) of the SDA and the rules and norms of this Ordinance.

(4) Water supply systems shall be constructed and put into operation either stage-by-stage or fully in accordance with the construction documents issued in accordance with the procedure laid down in the SDA and in compliance with the investment project with scope in accordance with Annex 1 and Annex 2 to this Ordinance.

Article 2. The Ordinance applies simultaneously with the normative acts and technical specifications (Bulgarian standards and Bulgarian technical approvals), which define the requirements related to the bearing capacity and stability of the building structures to operational and seismic loads, the quality of water intended for drinking and household purposes, hygiene, health, protection of the environment and water management, fire safety, health and safety at work, technical requirements for physical security, management of construction waste, the deployment and safe operation of technical conduits and facilities and the rules for the implementation and adoption of construction works (CW).

Article 3. (1) Water supply systems shall be designed with a view to the complex use and protection of water resources.

(2) In the process of pre-investment studies, a technical, financial and sanitation and hygiene assessment of existing elements of water supply systems is carried out with a view to their optimal use.

(3) When designing closely located water supply systems, the possibilities for building a common water supply system are analysed.

Article 4. (1) Water supply systems shall be categorised as follows:

1. first category – for water supply for drinking and household uses of settlements of 0, I and II category and for industrial water supply, where a reduction of up to 30 % of the water quantity supplied in the dimensioned consumption for 72 h is allowed;

2. second category – for water supply for drinking and household uses of settlements of III and IV category, agricultural sites and industrial water supply, where a reduction of up to 30 % of the water quantity supplied in the dimensioning consumption for 10 days or interruption of the water supply for 6 hours is allowed;

3. third category – for water supply for drinking and household uses of settlements of V, VI, VII and VIII category and for industrial water supply, where a reduction of up to 30 % of the water quantity supplied in the dimensioning consumption for 15 days or interruption of the water supply for 24 hours is allowed.

(2) For production or other sites with higher requirements for the continuity of drinking water supply than those for the category of the settlement from which they are supplied, independent water supply for drinking and household purposes meeting the requirements shall be designed.

(3) The categorisation of settlements in the design of water supply systems shall be determined in accordance with an order of the Minister of Regional Development and Public Works issued under the Administrative and Territorial Structure of the Republic of Bulgaria Act.

Article 5. (1) For drinking and household needs of the population, water shall be provided in compliance with the requirements of Ordinance No 9 of 2001 on the quality of water intended for drinking and household purposes (promulgated in SG, Issue 30 of 2001).

(2) Drinking water shall be provided for livestock in accordance with Ordinance No 44 of 2006 on the veterinary requirements for livestock holdings (promulgated in SG, Issue 44 of 2006)

and in accordance with the requirements for the conditions for keeping farm animals in livestock holdings.

(3) The quality of water for industrial needs shall be determined based on the manufacturing technology.

Article 6. (1) When designing water abstraction facilities from surface water sources, the water quantity required for water supply shall be ensured by provision of the minimum monthly average water quantities of the surface water source, as follows:

1. for the first category of the water supply system – 95 % provision;
2. for the second category of the water supply system – 90 % provision;
3. for the third category of the water supply system – 85 % provision.

(2) The assessment of the capacity of groundwater sources shall be carried out on the basis of the explorations carried out in accordance with Ordinance No 1 of 2007 on the exploration, use and protection of groundwater (promulgated in SG, Issue 87 of 2007).

Article 7. (1) The products envisaged by the investment project and used in the construction of water supply systems must have assessed compliance with the essential requirements laid down in the ordinances referred to in Article 7 of the Technical Requirements to Products Act (TRPA) or be accompanied by documents (test reports, quality certificates, etc.) certifying their compliance with the requirements of other regulations.

(2) The design of water supply systems provides for, and when constructing, construction products are incorporated that are intended to come into contact with drinking water, which comply with Regulation (EU) No 305/2011 of the European Parliament and of the Council laying down harmonised conditions for the marketing of construction products and repealing Council Directive 89/106/EEC (OJ L 88/5 of 04/04/2011), and Ordinance No RD-02-20-1 of 2015 on the conditions and procedure for the incorporation of construction products into the construction works in the Republic of Bulgaria (promulgated in SG, Issue 14 of 2015).

(3) The materials, from which construction products, reagents, filter fillings, disinfectants and anti-corrosion coatings for drinking and household water supply are produced, must comply with Ordinance No 9 of 2001 on the quality of water intended for drinking and household purposes.

(4) The products incorporated in water supply systems, produced and/or marketed in EU member states and Turkey, or legally produced in an European Free Trade Association (EFTA) member state, which is a party to the Agreement on the European Economic Area (EEA), can be used for the purposes of this Ordinance, if they guarantee an identical or higher safety level pursuant to the requirements defined in this Ordinance.

Article 8. The pre-investment studies and the investment design of a new water supply system or a new water abstraction facility shall be carried out in accordance with the procurement of the documentation required under Article 60 of the Water Law with a view to issuing a permit for water abstraction.

Article 9. The investment design of water supply systems in the conceptual design phase shall be developed in at least two competitive options for settlements of I and II category.

Article 10. (1) Water supply systems shall be designed, constructed and operated in such a way as to prevent water stagnation in them and reverse flow from building plumbing systems and/or in situ water supply in the connected properties.

(2) Connection of water supply systems shall be permitted only where the qualities of the water after mixing meet the requirements of Ordinance No 9 of 2001 on the quality of water intended for drinking and household purposes.

Article 11. (1) When designing water supply systems of first category in seismic areas with a seismic factor Cs > 0.15 (reference acceleration – a_{gR} > 0.15) according to the seismic hazard map of Bulgaria for a repeatability period of 475 years from 2009) water supply from at least two independent water sources shall be foreseen. Where the main water source is from groundwater in cracked rocks or karst terrains, the second source of water shall be foreseen to be from surface water.

(2) For water supply systems in seismic areas with a seismic factor Cs > 0.15 (reference acceleration – a_{gR} > 0.15), supplied by one water source with one water abstraction, double reserve for firefighting purposes shall be foreseen, as well as additional reserve for drinking purposes for not less than 8 h.

(3) Volumetric equipment of water supply systems in seismic areas with a seismic factor Cs > 0.15 (reference acceleration – a_{gR} > 0.15) shall be calculated for the joint action of seismic loads, their own weight, the weight of the water in the facility and the ground pressure.

Article 12. (1) Water supply systems shall be designed, operated and maintained in such a way as to ensure the hydraulic and technological functioning of the system and functioning in respect of the environment and structural integrity during normal operation over an economically justified service life.

(2) The design service life is assumed to be 25 years, taking into account future changes in the water supply area and serving to determine the dimensioning water quantities. The contracting authority may also determine another duration of the design service life.

(3) The warranty periods of the elements of the water supply system are determined in accordance with Ordinance No 2 of 2003 on the commissioning of construction works in the Republic of Bulgaria and minimum warranty periods for executed construction works, facilities and construction sites (promulgated, SG Issue. 72/2003).

Article 13. (1) Water supply systems are provided against acts of terrorism, vandalism and other actions aimed at destroying their integrity and polluting drinking water.

(2) Around the water abstraction facilities of water supply systems, sanitary and security zones shall be designed and constructed in accordance with the requirements of Ordinance No 3 of 2000 on the conditions and procedure for the study, design, approval and operation of sanitary and security zones around water sources and facilities for drinking and household water supply and around mineral water sources used for healing, prophylactic, drinking and hygienic needs (SG Issue 88 of 2000).

(3) For the elements of the water supply system, a security belt shall be provided in accordance with the requirements for the necessary areas for the construction of water supply sites under Ordinance No 7 of 2003 on the rules and regulations for the organisation of the different types of territories and development zones (promulgated, SG Issue. 3 of 2004).

(4) For water supply conduits and facilities outside urbanized areas, easement strips are defined in accordance with Ordinance No RD-02-20-1 of 2020 on the conditions and procedure for determining the dimensions and location of the easement strips and the special regime for the exercise of the easements of water supply and sewer conduits (networks) and facilities outside settlements and settlement formations (promulgated, SG Issue. 29 of 2020) and Ordinance No …….. on the health requirements for water sources for drinking and household water supply, mineral water sources and water supply systems.

(5) The elements of water supply systems shall be provided with the necessary system for physical protection in accordance with Ordinance No RD-02-20-6 of 2016 on the technical requirements for physical security of construction works (promulgated in SG Issue. 1 of 2017).

Article 14. (1) The scope and content of the pre-investment study, the terms of design assignment and the investment project of the water supply system shall be developed in accordance with Ordinance No 4 of 2001 on the scope and content of investment projects (SG, Issue 51 of 2001) and in compliance with Annexes 1 and 2 to this Ordinance.

(2) When developing investment projects of water supply systems or their individual elements under European and other funding programmes, the requirements of the respective programme shall also be taken into account. If there is a difference between the requirements of the respective programme and those of this Ordinance, the stricter requirements shall be complied with.

(3) The list of applicable Bulgarian standards for the design, construction and operation of water supply systems is set out in Annex 3.

PART TWO

DESIGN OF WATER SUPPLY SYSTEMS

Chapter One

WATER CONSUMPTION AND WATER SUPPLY STANDARDS. DIMENSIONING WATER QUANTITIES. WATER HEAD IN THE WATER SUPPLY NETWORK

Article 15. The water supply systems of urbanized areas (cities and settlement formations) shall be dimensioned in accordance with:

1. the drinking and household needs of the population;
2. water needs when carrying out:

(a) public service activities;

(b) production activities;

3. Fire safety rules and norms.

Article 16. (1) The number of water users is determined for the design service life based on the current development plan of the settlement or settlement formation, taking into account changes in the population (permanent residents and temporary residents) and the other users.

(2) In cases where the design service life referred to in paragraph 1 is longer than that of the current development plan of the settlement or settlement formation or there is no development plan in force, the population shall be determined for the design service life on the basis of natural population growth according to the statistical data from official sources (e.g. National Statistical Institute).

Article 17. (1) The daily average water consumption required for a specific urbanized area shall be determined on the basis of:

1. the forecasts of the existing development schemes and plans for the social, economic, engineering, technological and territorial development of the water-supplied urbanized area and of the regional and/or municipal development plans in cases where there is no general development plan in force;

2. the regional general plans for the development of water supply and sewer systems and facilities;

3. the type and number of water users in the urbanised territory, determined in accordance with Article 16;

4. the studies of the necessary water quantities for production buildings in accordance with the production technology in them, the normative acts for health and safety at work and the sanitary and hygienic requirements;

5. additional representative measurements of water consumption, which allow a statistical analysis of 24 hr. costs and taking into account the change in technical and social and economic factors during the service life, when it is provided for in the design assignment.

(2) Where there is no data under paragraph 1 and/or no detailed measurements and/or studies referred to in paragraph 1 have been carried out, the average 24 hr. water consumption (sum of daily water consumption for drinking and household needs and public service buildings) shall be assumed 150-250 l per user per day depending on the local social and climatic conditions. The costs of production and special needs shall be determined further after the studies referred to in paragraph 1(4) have been carried out and shall be added to the accepted 24 hr. water consumption per user per day.

(3) The water quantities for special sites of the Ministry of Defence and the Ministry of Interior shall be determined by the assignment for preparation of the investment project.

(4) The water supply standards for industrial and agricultural buildings are determined by the design assignment taking into account the technological requirements for water consumption for industrial and sanitary and hygienic needs.

(5) The coefficient of 24 hr. non-uniformity shall be determined after the studies referred to in paragraph 1 have been carried out. Where no current data is available and/or no detailed measurements have been carried out, it shall be within the range of 1.5 for urbanized areas with more than 10,000 inhabitants to more than 2 for urbanized areas with less than 2,000 inhabitants.

(6) The maximum hourly water quantity shall be determined as follows: from twice the average hourly water quantity (the average daily water quantity divided by 24 hours) for urbanized areas with more than 10,000 inhabitants to five times the average hourly water quantity for urbanized areas with less than 2,000 inhabitants.

(7) The maximum hourly water quantity may be changed in accordance with the studies referred to in paragraph 1(3), also taking into account the influence of concentrated water users for production and other special needs.

(8) For resorts, the coefficients of 24 hr. and hourly non-uniformity may be determined by the assignment for the development of the investment project in accordance with the studies referred to in paragraph 1.

Article 18. (1) The technical losses of water (the sum of unavoidable physical losses of water and water for technological needs) in the water supply system, depending on the elements of the system included, are accepted as follows:

1. when designing new water supply systems – up to 20 % of the daily average consumption;

2. in case of partial reconstructions, modifications and/or major repairs of existing water supply systems – for the unreconstructed, unmodified and/or unrepaired part, higher water losses can be assigned after the justification based on measurement data.

(2) Technical losses of water are added to the maximum daily and maximum hourly water consumption, without multiplying them by the coefficients of 24-h. and 1-h. non-uniformity.

Article 19. The required water quantities and duration of fire extinguishing shall be determined according to the rules and norms of fire safety.

Article 20. (1) Water pipes and their facilities from the water catchment to the drinking water treatment plants 24-hr. water quantity (also including the technical losses of water in the water supply system and the water consumption for the treatment plant"s own needs), and from the treatment plant to the water-pressure and control facility for the maximum 24-hr. water quantity (including the technical losses of water in the water supply system).

(2) The water pipes and their facilities from the water-pressure and control facility to the first branch of the water supply network shall be dimensioned for a water quantity equal to the sum of the maximum hourly consumption, the water quantity for fire extinguishing and the technical losses of water.

Article 21. The method for determining the dimensioning water quantity for a particular section of the water supply network, the transit water quantity, the road cost, the specific quantity of water and the total reduced length is in accordance with Annex 4.

Article 22. (1) The minimum pressure of the design elevation of the adjacent terrain at the critical point in the water supply network shall be:

1. in buildings with one floor above the ground – not less than 0.1 MPa;

2. in buildings with more than one floor above the ground – 0.04 MPa are added for each floor.

(2) In cases where the pressure for individual buildings is insufficient, facilities shall be designed to the building systems to increase the pressure.

Article 23. The minimum pressure in the water supply network of production buildings shall be determined in accordance with the assignment for the development of the investment project, including the technological and technical requirements, as well as with the rules and norms for fire safety.

Article 24. The maximum pressure in the water supply network of the settlements is 0.6 MPa. An exception is allowed for look-ahead carry water pipes through the urbanised territory.

Article 25. The minimum pressure for fire extinguishing needs at the design elevation of the adjacent terrain for the critical point/critical fire hydrant shall be determined in accordance with the fire safety rules and norms.

C h a p t e r T w o

REQUIREMENTS FOR THE DESIGN OF WATER ABSTRACTION FACILITIES

Section I

General provisions

Article 26. (1) Each water abstraction facility shall be provided with a means of measuring the flow and level as well as sampling for the purpose of controlling the quality of the water.

(2) When examining water intended for drinking and household water supply, the following analyses shall be carried out, depending on the water source:

1. the analysis of the water quality of surface water sources shall cover at least:

(a) an analysis of the existing database of the monitoring carried out by the water supply and sewer operator or at the point closest to the water abstraction facility from the monitoring programmes of the basin directorates in accordance with the requirements of Ordinance No 12 of 2002 on the quality requirements for surface water intended for drinking and household water supply (promulgated in SG Issue 63 of 2002) and Ordinance No N-4 of 2012 on the characterisation of surface waters (promulgated, SG Issue. 22 of 2013). Data for a minimum period of 5 years shall be analysed;

(b) where there is no archive database for some of the indicators from Ordinance No 9 of 2001 on the quality of water intended for drinking and household purposes that can be found in the water source, short-term monitoring shall be carried out. Short-term monitoring shall cover the four seasons evenly over a period of at least one year. The number of samples for each indicator shall be at least 20.

2. The analysis of the quality of water from water catching of springs used for drinking and household purposes shall cover at least:

(a) an analysis of the existing database of the monitoring carried out by the water supply and sewer operator or at the point closest to the water abstraction facility from the monitoring programmes of the basin directorates in accordance with the water quality requirements of Ordinance No 1 of 2007 on the exploration, use and protection of groundwater (promulgated in SG Issue 87 of 2007) and Ordinance No 9 of 2001 on the quality of water intended for drinking and household purposes;

(b) where there is no archive database for some of the indicators from Ordinance No 9 of 2001 on the quality of water intended for drinking and household purposes that can be found in the water source, short-term monitoring shall be carried out. Short-term monitoring shall cover the four seasons evenly over a period of at least one year. The number of samples for each of these indicators shall be at least 12.

3. the analysis of the water quality of underground water sources intended for drinking and household water supply shall cover at least:

(a) an analysis of the existing database of the monitoring carried out by the water supply and sewer operator or at the point closest to the water abstraction facility of the monitoring programmes of the basin directorates in accordance with the water quality requirements of Ordinance No 1 of 2007 on the exploration, use and protection of groundwater and Ordinance No 9 of 2001 on the quality of water intended for drinking and household purposes;

(b) where there is no archive database for some of the indicators of Ordinance No 9 of 2001 on the quality of water intended for drinking and household purposes that can be found in the water source, short-term monitoring shall be carried out. Short-term monitoring shall cover the four seasons evenly over a period of at least one year. The number of samples for each indicator shall be at least 4 times per year during the four seasons, in the event of water abstraction of two decreases (with a maximum average daily flow rate foreseen and an operational average daily flow rate foreseen) for six days.

Article 27. Constructions shall not be permitted on water abstraction facilities, except for constructions related to the operation of the water supply system.

Section II

Vertical and horizontal groundwater abstraction facilities

Article 28. (1) Groundwater abstraction facilities shall consist of:

1. underground part of a groundwater facility intended for water abstraction;

2. aboveground part of the groundwater facility intended for water abstraction.

(2) The aboveground part of the groundwater facility shall be designed in compliance with the rules and norms of this Ordinance and with the normative acts laying down the rules for the design of building structures.

(3) For groundwater abstraction facilities that fall into the flooding strips of rivers and the lands flooded at the maximum filling of the dams, design solutions for their protection against flooding shall be envisaged.

Article 29. (1) The underground parts of groundwater facilities intended for water abstraction are part of the groundwater survey and shall be designed under the conditions and in accordance with the procedure laid down in Ordinance No 1 of 2007 on the exploration, use and protection of groundwater.

(2) Shaft wells may be designed in aquifers with a depth of 6 ÷ 30 m from the ground and a thickness of the aquifer of 3 to 8 m.

(3) Shaft wells with horizontal drainage lines may be designed into water-bearing aquifers of uniform sand with a thickness of 15-20 m and with an estimated flow rate greater than 45 l/s.

(4) Horizontal drainage may be designed at an overlay depth of the lower water retainer of the aquifer of 5 to 8 m below the ground and a thickness of the aquifer of 1 to 3 m.

(5) Water abstraction galleries shall be designed under the conditions of paragraph 4 for water supply systems with a capacity exceeding 500 l/s.

(6) Pipe wells shall be designed in all cases, except in the cases referred to in the preceding paragraphs. Pipe wells may also be designed in the cases referred to in paragraph 2 where the estimated flow rate is up to 1 l/s.

(7) Facilities for local groundwater monitoring are designed, where required, in accordance with Ordinance No 1 of 2007 on the exploration, use and protection of groundwater.

Article 30. (1) In the event of water abstraction for the purpose of drinking and domestic water supply of urbanised areas, the number of replacement water abstraction facilities shall be determined according to the table. 1.

Table 1

Number of operating water abstraction facilities	Number of replacement water abstraction facilities depending on the category of the water supply system		
	first	second	third
From 1 to 4	1	1	1
From 5 to 12	2	1	-
Above 12	20 %	10 %	-

(2) The requirement referred to in paragraph 1 may not apply to water abstraction facilities extracting groundwater from deeper aquifers (the second or next from the surface groundwater body) after the first top layer.

(3) In case of water abstraction for independent water supply for agricultural or industrial purposes, the number of replacement wells shall be determined following a technical justification and depending on the parameters of the authorised use in accordance with the permit for water abstraction, but it may not be higher than that given in the table. 1.

Article 31. (1) The over-ground part of the pipe wells shall be designed as a shaft dimensioned to accommodate at least the following operating equipment:

1. pumping units;

2. means of measuring the abstracted water volumes;

3. means of measuring the water level.

(2) It is permissible, when a pipe well is equipped with a horizontal centrifugal pump, to design a separate shaft for the positioning of pump units with bottom up to 2 m below the ground surface.

(3) The over-ground part of pipe wells shall be designed in such a way as to enable access to drilling or other specialised apparatus, apparatus for the repair of the facility or its equipment, if necessary.

Article 32. (1) The over-ground part of shaft wells shall be designed at 1 m above the level of the highest surface water or not less than 0.8 m from the ground level.

(2) A watertight pavement shall be designed around the wells with a width of not less than 1.5 m and an inclination of 0.1 from the well outwards.

(3) The over-ground part of the shaft wells with horizontal drainage lines shall be designed as a bunker pumping station with a machine room for pump units and with auxiliary service and monitoring rooms.

(4) The over-ground part of the shaft well shall be designed with a ventilation chimney with a cap having a height of not less than 2 m from the surface of the terrain.

(5) In the immediate vicinity of the shaft well, a shaft shall be designed to fit the pump units and/or means of measuring the abstracted water volumes, and the water meters shall not be at a distance of more than 2 m from the mouth of the well.

Article 33. (1) Horizontal drainages and galleries shall be protected from direct ingress of surface water by appropriate sealing of the covering layers.

(2) To the horizontal water abstraction facilities, as well as in the elbows (horizontal or vertical) of the water receiving parts, inspection shafts for ventilation, monitoring and repair shall be designed.

(3) A watertight pavement with a width of 1 to 2 m and an inclination of 0.1 shall be designed around the inspection shafts.

(4) The inspection shafts shall be designed with a ventilation chimney with a hat having a height of not less than 2 m.

(5) The collection shaft for receiving the water from the horizontal drainages shall be designed with a water and dry chamber and a overflow-drainage system.

(6) At the place of discharge of the overflow-drainage system, a non-return valve shall be provided.

Section III

Spring catchments

Article 34. Spring catchments are part of the groundwater survey and shall be designed as groundwater facilities intended for water abstraction under the conditions and in accordance with the procedure laid down in Ordinance No 1 of 2007 on the exploration, use and protection of groundwater.

Article 35. (1) A collection shaft with adequate ventilation shall be designed to the spring catchments, and the catchment shall be protected by an earth embankment to preserve the temperature of the spring water.

(2) The collection shaft shall be designed with a water and dry chamber and, if necessary, a settling chamber.

(3) The water chamber shall be designed with appropriate compaction to protect the water from surface contamination, freezing and flooding with surface water, assuming that spring water will enter the water chamber by jumping from 10 to 20 cm.

(4) To discharge water from the water chamber, a water abstraction pipe shall be designed with a water abstraction strainer and a shut-off valve.

(5) To discharge excess water, as well as to remove the sediments in the water and settling chamber, a overflow-drainage system is provided.

(6) At the end of the overflow-drainage system, a non-return valve shall be provided

Article 36. In case of catching springs where the spring water contains a large amount of clay and sand particles, a settling chamber connected to the water chamber through a overflow shall be provided in the collection shaft.

Article 37. The shut-off fittings of the emptying and water abstraction pipes shall be designed in the dry chamber of the collection shaft.

Section IV

Surface water abstraction

Article 38. (1) The choice of water source and the location of water abstraction shall be determined on the basis of the analysis of the needs for drinking and household water, the results of the hydrological and hydrogeological surveys, the analysis of the qualitative indicators and the possibility of establishing a sanitary and security zone.

(2) The type and design of the water abstraction facilities shall be determined according to the category of water supply system, hydrogeological characteristics of the water source, minimum and maximum water levels and sanitary and hygienic requirements. The type and design of the water abstraction facilities shall not permit the entry of sediments, floating substances or aquatic animals.

Article 39. (1) The class of water abstraction facilities for year-round use shall be determined in accordance with the category of water supply system in accordance with Article 4.

(2) The class of water abstraction facilities for seasonal use shall be accepted as a smaller by one unit.

(3) The classification of dam walls and dams by levels of potential danger according to the assessment of the risk of casualties and the occurrence of economic, social and environmental damage shall be in accordance with the Ordinance on the conditions and procedure for carrying out the technical and safe operation of dam walls and their facilities and for monitoring their technical condition, adopted by Decree No 12 of 2020 of the Council of Ministers (published in SG Issue 12 of 2020). 9 of 2020).

Article 40. (1) Water abstraction from rivers shall be designed as shore, watercourse or drainage depending on their location in relation to the water source.

(2) The gross area of water receiving openings for shore water abstraction shall be determined when all sections of the water abstraction facility operate simultaneously (excluding replacement ones) according to the formula set out in Annex 5.

(3) Openings of reception chambers during watercourse abstraction shall be located along the course of the river.

(4) Drainage water abstraction shall be designed under the watercourse of shallow rivers and shall be dimensioned as a groundwater abstraction facility.

Article 41. Water abstraction openings shall be located at a distance as follows: at least 0.5 m from the bottom of the water body, 0.2 m below the ice cover and at least 0.3 m below the lowest wave elevation.

Article 42. (1) In the case of water abstraction from dams, the possibility of using the main sluice or the inlet of the sluice as a water abstraction facility shall be assessed.

(2) When the water abstraction facility is located in a dam wall, possibility to repair the wall without interruptint the operation of the water abstraction facility shall be provided.

Article 43. (1) Water intake towers shall be designed for water abstraction from dams or from large natural lakes.

(2) The water intake towers shall be located in bays and areas of the aquatory protected from waves or beyond the boundary of coastal currents.

(3) The water intake openings of towers shall be designed at a depth greater than three times the wave height and at a distance of at least 10 m under the edge of the dam`s overflow. The lower edge of the lowest water intake opening shall be at least 1 m above the level of dead volume, and the maximum operating water level shall be at a distance not less than 6 m from its upper edge.

Article 44. (1) Fish protection devices shall be designed to the water abstraction facilities used for fish farming as an element of the facility or as a separate facility of the water abstraction channel.

(2) The need for a fish protection device as well as its type shall be determined in accordance with the requirements of the authorities for the protection and control of fishery resources.

(3) The openings of the water abstraction facilities shall be dimensioned for an average velocity of passage of water through the inlet grid or net in accordance with the requirements for the conservation of fishery resources.

(4) The permissible velocities of water passage into water receiving openings shall be determined as follows:

1. in the case of coastal non-submerged water abstraction facilities – from 0.6 to 0.2 m/s;

2. in the case of submerged water abstraction facilities – from 0.3 to 0.1 m/s;

3. when installing flat fish protection barrier nets with holes of 3 to 4 mm in front of the water receiving openings, the velocity of the water in the openings shall be determined as follows:

a) in the case of water abstraction from rivers with a current velocity exceeding 0.4 m/s – 0.25 m/s;

b) in the case of rivers with a current velocity bellow 0.4 m/s - 0.1 m/s;

c) in the case of very severe ice drift in rivers – up to 0.06 m/s.

Article 45. Coastal water abstraction wells shall be hydraulically dimensioned at:

1. the minimum water level in the water source;

2. exclusion of one of the sections of the water abstraction facility;

3. presence of other permissible unfavourable conditions (blocking the grid, overgrowth of the water intake pipe, etc.).

Article 46. The type of grids in front of the water abstraction facilities shall be determined taking into account the particularities of the water body, the water quantity, etc.

Article 47. In the presence of conditions for overgrowth of the water receiving facilities, measures for their cleaning shall be provided.

Article 48. The dimensioning velocities of water in gravitational and siphon water pipes shall be determined according to Table 2.

Table 2

Water pipe diameter, mm	Water velocity depending on the category of water abstraction, m/s	
	First	second and third
From 300 to 500	0.7 (1)	1 – 1.5
From 500 to 800	1 (1.4)	1.5 (1.9)
Above 800	1.5	2

Article 49. Siphon water pipes in water abstraction facilities shall be designed for water supply systems of the second and third category, and with a justification – for water supply systems of the first category as well.

Article 50. Gravitational and siphon water pipes shall be laid at a distance of not less than 0.5 m below the bottom of the river, and the bottom shall be strengthened against erosion.

Section V

Artificial groundwater recharge

Article 51. (1) Groundwater is artificially recharged with surface water by means of infiltration facilities of open or closed type, with a continuous or intermittent mode of operation.

(2) Infiltration facilities shall be designed as open ones in the presence of covering low-permeability layers with a depth of up to 3 m.

(3) When constructing filtration fields, natural permeable soils with good filtration (e.g. light sandy soils) may be used or artificial fields from return filters with filterable granulometry may be designed.

(4) Impermeable superficial layers of soil shall be removed.

Article 52. The quality of water used for artificial recharge shall not create obstacles to the achievement of the quality and quantity objectives of the groundwater body laid down in the relevant river basin management plan.

Article 53. The level of groundwater below the bottom of the open infiltration facilities shall not be less than 0.5 m.

Article 54. Means to measure the quantities of water supplied to the infiltration facilities shall be designed to the facilities for artificial groundwater recharge.

Chapter Three

BASIC REQUIREMENTS FOR THE DESIGN OF WATER TREATMENT FACILITIES FOR DRINKING AND HOUSEHOLD WATER SUPPLY

Section I

General requirements

Article 55. (1) In the treatment of water for drinking and household water supply, standardised methods and technologies, as well as good engineering practices shall be applied to ensure that the quality criteria of water intended for drinking and household purposes is achieved within the meaning of Ordinance No 9 of 2001 on the quality of water intended for drinking and household purposes.

(2) When designing new plants, carrying out reconstructions (including ones related to the extension of the technological scheme with additional processes) or major repairs of existing water treatment plants for drinking and household water supply, the following requirements shall be complied with:

1. attaining the quality of treated water in accordance with the requirements of Ordinance No 9 of 2001 on the quality of water intended for drinking and household purposes;

2. ensuring the safety of personnel;

3. ensuring the necessary measures against harmful effects (noise, toxic substances, etc.);

4. achieving the required service life and ensuring the durability of building structures, taking into account future extensions and changes;

5. ensuring impermeability of equipment and systems;

6. providing precautions during operation and maintenance;

7. implementing energy-efficient measures in construction and operation;

8. reducing the amount of waste products and/or their safe recovery;

9. achieving efficiency in terms of total costs (capital and operating);

10. taking into account the conclusions and recommendations of the risk assessment of the water source and its catchment area, where a risk assessment has been drawn up within the meaning of Ordinance No 9 of 2001 on the quality of water intended for drinking and household purposes;

11. providing a technical possibility for future extension of the technological scheme with additional processes, at least including clarification and use of activated carbon, if surface water is used as a water source;

12. bypass connections shall be provided in drinking water treatment plants to exclude part or all of the treatment facilities for examination, cleaning, ongoing or major repair;

13. at the entrance and exit of drinking water treatment plants, means for measuring the flowing water quantities must be designed;

14. when designing treatment plants, backup power supply shall be envisaged as a second independent energy source.

(3) The assignment for the design of a new plant, reconstruction or overhaul of an existing drinking water treatment plant (DWTP) shall contain at least the following data and conditions:

1. data from a pre-investment study:

(a) engineering data for the designated site of DWTP (location, ownership, engineering and geological, hydrogeological and hydrological, seismic surveys, geodetic surveying, detailed development plan with specified infrastructure connections);

(b) conclusions from the analyses on water quality in the water supply network and measures to improve it;

(c) conclusions on water quality in the water source and parameters that necessitate treatment of water for drinking and household purposes;

(d) in the case of an existing drinking water treatment plant - data on the capacity, treatment efficiency and assessment of the operational status of the existing facilities;

(e) net productivity of the drinking water treatment plant at present and at the end of the design service life;

2. conclusions from the risk assessment and risk management pursuant to Ordinance No 9 of 2001 on the quality of water intended for drinking and household purposes (where such one is prepared) in relation to the catchment areas of water sources;

3. requirements for the number of options and design phases.

Article 56. (1) The water treatment technology, the type and dimensioning parameters of the treatment facilities and the dimensioning dose of reagents shall be established depending on the quality of the water in the water source, the risk assessment (where such one is prepared) of the water source and its catchment, the productivity of the treatment plant, the specific conditions and data from the technological studies and the operation of existing facilities or ones working under similar conditions.

(2) For design purposes, according to the content and nature of suspended and humus substances, water shall be categorised as follows:

1. with small turbidity – up to 50 mg/l;
2. with average turbidity – from 50 to 250 mg/l;
3. turbid – from 250 to 1,500 mg/l;
4. with high turbidity – over 1,500 mg/l;
5. slightly coloured – up to 35^{O} (according to the Platinum-Cobalt Scale);
6. medium coloured – from 35^{O} up to 120^{O} (according to the Platinum-Cobalt Scale);
7. strongly coloured – over 120^{O} (according to the Platinum-Cobalt Scale).

Article 57. The dimensioning capacity of treatment plants shall be defined as the sum of the net water quantity determined in accordance with Article 20(1) and the water quantity for technological uses.

Article 58. (1) Treatment plants shall be dimensioned for uniform operation throughout the day.

(2) For treatment plants with a capacity of up to 3 000 m^3 per day, discontinued operation mode is allowed depending on the water use regime.

(3) The number and design capacity of the treatment facilities shall be determined in such a way that, when one of them is down for maintenance or repair, continuity of operation of the drinking water treatment plant shall be ensured and the necessary treatment effect shall be achieved;

(4) The number and design capacity of operating in parallel and replacement pump units, dosing devices and other auxiliary installations shall be determined in such a way as to ensure the normal operation of the drinking water treatment plant in the event of suspension for maintenance or repair of some of them.

Article 59. (1) Process waste water shall be treated before discharge to a water body to an extent that satisfies the quality criteria of the discharge permit. In cases where the discharge of process water into sewer systems is envisaged, the requirements of Ordinance No 7 of 2000 on the conditions and procedure for discharge of production waste water into sewer systems of settlements (SG, Issue 98 of 2000) shall be complied with.

(2) Sludge from drinking water treatment plants shall be treated in accordance with good engineering practices in order to achieve the required quality according to the requirements for their utilisation provided by the project.

Section II

Reagent plant – purification chemicals.

Article 60. (1) In the case of reconstruction or overhaul of existing drinking water treatment plants, the dimensioning doses of reagents shall be determined on the basis of operational data.

(2) When designing new drinking water treatment plants, the dimensioning doses of reagents shall be determined experimentally for different periods of the year with characteristic quality indicators of water.

(3) It is permissible to determine the dimensioning dose of the reagent on the basis of operational data from other drinking and household water treatment plants using similar water sources of similar turbidity and reagents of the same chemical composition.

Article 61. (1) The method of preparation and dosing of reagent solutions shall ensure continuity of delivery at the designated points in the technological process and shall not in any way impede the operation of the drinking water treatment plant.

(2) When delivering and designing facilities for storage and preparation of reagent solutions, the manufacturer"s requirements for occupational safety and health protection shall be complied with.

(3) The number of containers for the preparation of reagent solutions shall be assumed at least two.

(4) The material and design of containers for the preparation of reagent solutions shall take into account the physical and chemical properties of the reagents, ensure their durability, operational safety, and prevent migration leading to a change in the composition and effect of reagents.

(5) The design of the containers for the preparation of solutions shall allow their emptying and cleaning and, in the case of solutions prone to the formation of sludge or suspensions, it shall be possible for them settle and be removed from the containers without impairment of the dosing process.

Article 62. A list of applicable standards with reagent requirements is set out in Annex 3.

Section III

Mixing devices. Air separators. Reaction chambers

Article 63. (1) Mixing devices shall be designed as to ensure rapid and uniform mixing of reagents with water.

(2) The type and design of mixers shall be designed so as not to permit the precipitation of suspensions and reagents.

(3) The number of mixers for mixing the coagulant with water shall be at least 2.

Article 64. Emptying and overflow pipes shall be designed in open mixers when no overflow pipe is provided in the inlet shaft of the treatment plant.

Article 65. (1) Air separators shall be designed in front of precipitators with a whirlpool chamber for flocculation, clarifiers with suspended layer or filters with upward flow of water.

(2) Air separators shall not be designed if the mixer design ensures the release of the air dissolved in the water and when the water is not enriched with air on its way to the next facility.

(3) It is permissible to design one air separator for all facilities.

(4) Air separators shall be dimensioned for a water flow rate of 0.05 m/s and water retention of not less than 1 min.

Article 66. (1) Flocculation chambers shall be designed obligatorily when water is cleared through precipitators.

(2) The type and design of the flocculation chamber shall be determined on the basis of a technical and economic analysis, taking into account field conditions, purification technology, plant capacity and design requirements.

(3) When designing flocculation chambers, the following requirements shall be met:

1. the retention time for the water in the flocculation chambers shall be from 20 to 40 minutes;

2. the velocity of water in the flocculation chambers shall not permit precipitation of the formed floccles at the bottom of the facility;

3. the removal of water from the flocculation chambers shall take place in such a way as to prevent the rupture of the already formed floccles.

(4) Flocculation chambers shall be located as close as possible to the precipitators or be incorporated into them.

Section IV

Precipitators and clarifiers

Article 67. Precipitators and clarifiers shall be hydraulically dimensioned according to their specific characteristics and the results of technological research.

Article 68. (1) The type of precipitator shall be determined on the basis of a technical and economic justification.

(2) The design of precipitator shall, to the maximum extent possible, prevent the formation of dead zones or bottom streams resulting from a change in the temperature of the incoming water.

(3) In the beginning and at the end of the precipitators, distribution devices shall be provided which shall be designed to ensure uniform movement of water throughout the cross-section of the facility and, accordingly, its uniform discharge.

(4) In each precipitator, a sludge collection zone shall be provided, with the bottom of the precipitator being shaped in such a way as to facilitate their removal.

(5) The turbidity of precipitated water may not exceed values greater than 8-12 mg/dm^3.

Article 69. When designing horizontal precipitators, after coagulation treatment of water, the following requirements shall be complied with:

1. the precipitator shall be dimensioned with experimentally determined values of the precipitation rate and the horizontal flow rate, at a preset depth of the sedimentary part;

2. In the absence of experimentally determined values or operational data on the precipitation rate and horizontal flow rate, recommended values from good engineering practices shall be used;

3. the depth of precipitator shall be taken from 3 to 5 m;

4. the precipitator shall be divided into corridors, each corridor being able to disconnect itself from operation without compromising the operation of the other corridors;

5. sludge removal shall be manual, hydraulic or mechanised. The selection shall be made with the investment project on the basis of a technical and economic justification.

Article 70. The assessment of hydraulic characteristics of the flow shall take into account the appropriateness to calculate the Reynolds (Re) and Frud (Fr) numbers (Annex 6).

1. if Re < 20,000 the flow turbulence shall be considered acceptable. If Fr > 10 - 5 the flow shall be considered stable;

2. if one of the two criteria referred to in item 1 is not satisfied, the width of the precipitator corridors should be reduced and the criteria recalculated.

Section V

Filters.

Article 71. (1) The type of filters shall be determined after experimental technological research and a technical and economic analysis, taking into account the quality of the water, the capacity of the treatment plant, the local climatic and geographical conditions, etc.

(2) The parameters used in filters dimensioning shall be determined by technological research, by analogy with similar facilities in operation or on the basis of good engineering practices.

(3) If the number of filters is up to 20, one filter in repair shall be acceptable. When the filters are more than 20, two filters in repair shall be acceptable.

Article 72. (1) Filters are loaded with pure quartz sand or other grain materials in accordance with the requirements of Bulgarian standards or Bulgarian technical approvals. Annex 3 contains information on the applicable standards for filter fillings.

(2) For slow filters, a site for sand washing in a hydraulic way shall be designed.

Article 73. (1) The area of filters shall be determined by formula (1) according to Annex 6.

(2) The number of filters shall not be less than 3. For plants with a capacity of up to 3 000 m^3 per day or with a continuous mode of operation, this number is allowed to be less than 3.

Article 74. The maximum permissible pressure losses in the filter filling shall be up to 3.5 m for pressureless filters and up to 8 m for pressure filters.

Article 75. The sand filling of fast filters is characterised by the following parameters:

1. a coefficient of heterogeneity, to be determined in accordance with Annex 6;
2. effective grain diameter, to be determined in accordance with Annex 6.

Article 76. (1) Slow filters shall be dimensioned for a filtration rate of 0.1 to 0.3 m/h.

(2) The number of filters referred to in paragraph 1 shall be not less than 2.

(3) Slow filters shall be designed with mechanical or hydraulic sand regeneration.

(4) The water layer above the filter filling is 1.5 m.

Section VI

Removal of organic matter, odour and taste of water

Article 77. (1) In the case that oxidisers are used to remove organic matter, odour or taste, sorption treatment of water by filtration through a rapid filter with granulated activated carbon shall be also envisaged.

(2) Chlorine, ozone, potassium permanganate, chlorine dioxide, hydrogen peroxide or other oxidisers authorised for use in the treatment of water for drinking and household purposes shall be used as oxidisers.

(3) In the event of short-term deterioration of the quality of the water, use of powdered activated carbon is allowed, which shall be introduced into water before the coagulation treatment or in front of the filters.

(4) If water contains easily oxidizing organic matter in small concentration, it is permissible to use oxidisers without sorption treatment of water, if the quality of treated water complies with the requirements of Ordinance No 9 of 2001 on the quality of water intended for drinking and household purposes.

Article 78. (1) The type and doses of oxidisers shall be determined according to technological requirements.

(2) Treated water shall be disinfected regardless of the use of oxidisers.

Article 79. (1) Granular carbon filters shall be applied as a final treatment facility.

(2) Water fed into the activated carbon filters shall not be allowed to contain suspended substances in quantities exceeding 1.5 mg/l.

Section VII

Water disinfection

Article 80. (1) In central water supply, water for drinking and household needs shall be necessarily disinfected.

(2) For the disinfection of drinking water, as well as for the disinfection of water supply systems and facilities for drinking and household water supply, biocidal products authorised under the terms of Regulation (EU) No 528/2012 the European Parliament and of the Council of 22 May 2012 concerning the making available on the market and use of biocidal products (OJ 2012 L 167) and/or pursuant to Act on the protection from the harmful impact of chemical substances and mixtures.

(3) For disinfection of drinking water biocidal products of product type 5 are used in accordance with Annex V, and biocidal products of product type 4 in accordance with Regulation (EU) No 528/2012 are used for the disinfection of water supply systems and facilities for drinking and household water supply. of the European Parliament and of the Council of 22 May 2012 concerning the making available on the market and use of biocidal products (OJ L 167, 2012)

(4) Information on biocidal products and their active substances is contained in the Register of Biocidal Products on the website of the Ministry of Health.

(5) Other decontamination methods may be used in addition to chemical disinfection of water.

(6) Biocidal products used in the disinfection of drinking water shall be used in accordance with the conditions laid down in the permit granted and the relevant norms of this Ordinance.

Article 81. (1) The disinfection method, concentration and contact time shall be determined in accordance with the conditions of the permit granted to the biocidal product concerned.

(2) In determining the disinfection method referred to in paragraph 1, account shall also be taken of the quality criteria of water, the possibilities for mechanisation and automation of the processes, the conditions for storage of biocidal products, the energy consumption and the impact on the environment and human health, following an appropriate technical and economic justification.

(3) The contact time referred to in paragraph 1 shall be provided in tanks, and for settlements of III to VIII category, it is permissible to use the water pipe to the first user.

Article 82. (2) Disinfection facilities shall be designed corrosion resistant.

(3) All enclosed spaces shall be provided with ventilation. The activities shall be carried out in compliance with the requirements of the Health and Safety at Work Act and its secondary regulations.

(4) Where biocidal products with active substance - active chlorine derived from chlorine are used for disinfection, the provisions of Articles 83 to 95 shall apply.

Article 83. (1) Chlorinator stations and premises where there is a risk of chlorine gas leakage shall provide for:

1. continuous measurement of chlorine in the air and generating warning light and audible signals at a measured concentration equal to or greater than 3 mg of chlorine per m^3 of air and emergency light and audible signals at a measured concentration equal to or greater than 9 mg of chlorine per metre of cubic air;

2. construction of an automated, closed ventilation and neutralisation system with 20 times exchange of the air per hour in the room with the largest volume, which is triggered by a warning or emergency signal for chlorine leak;

3. the volume of neutralisation solution to be injected into the neutralisation system (scrubber) in countercurrent to the delivered chlorine-contaminated upstream-downstream flow of air shall be sufficient to dispose of a complete container of chlorine - a barrel or cylinder, depending on the intended mode of delivery;

4. it is permissible to build open ventilation in the expenditure warehouse with continuous three-time air exchange per hour and shielded openings on an external wall with a total area of 0.02 % of the floor area (in well-sealed premises) to be used by operators when replacing containers of chlorine, in strict compliance with the safety rules. The openings shall be located 15 cm from the floor and close to the ceiling.

Article 84. The working dose of chlorine for water disinfection shall be determined on the basis of the quality and composition of water and by technological studies. For design purposes, where such preliminary studies have not been carried out, it shall be determined as follows:

1. 2 to 3 mg/l – for filtered surface water;

2. from 0.7 to 1 mg/l – for groundwater.

Article 85. (1) Chlorinator stations operating with liquefied chlorine and liquefied chlorine depots shall be located at a distance of not less than 150 m from residential and industrial buildings in or outside urbanized areas in accordance with the health protection requirements of settlements, taking into account the wind rose and providing for the disposal of accidentally released chlorine.

(2) In cases where the chlorinator station and/or chlorine depots referred to in paragraph 1 are separate sites and are located outside the territory of the treatment plant, they shall be provided with the necessary physical protection system, in accordance with Ordinance No RD-02-20-6 of 2016 on the technical requirements for physical security of construction works.

Article 86. Liquefied chlorine chlorinator stations shall be designed with:

1. apparatus room for chlorinator apparatus;

2. an entrance hall, in which cabinets with protective clothing, medicaments for first aid and fountain for drinking water are placed;

3. an expenditure store for cylinders and/or barrels;

4. a warehouse for the storage of an operational stock for 15-30 days depending on the category of the water supplied site;

5. a room for chlorometer and contact tank, where automatic adjustment of the chlorine dose is provided;

6. premises for disposal facilities for accidentally released chlorine without direct connection to the other premises in the chlorinator station.

Article 87. (1) When designing chlorinator stations, a connection shall be provided between the apparatus room for chlorinator apparatus and the expenditure store through the entrance hall.

(2) Direct connection of the apparatus room, the expenditure store and the entrance hall to the other premises in the chlorinator stations is not allowed.

(3) The chlorinator stations, located in a common building with other facilities of the treatment plant, shall be separated by a dense wall without construction openings.

Article 88. (1) It is not allowed to design chlorinator stations and chlorine warehouses in premises below the ground level.

(2) Apparatus rooms for chlorinators and analysers shall be designed with natural lighting, with windows oriented as far as possible to the north or so as to prevent direct solar heating of the chlorinator apparatus. The window area is 10 % of the floor area.

(3) The backup technological equipment of the chlorinator stations includes:

1. up to two working chlorinators – one replacement chlorinator;
2. for more than two working chlorinators – two replacement chlorinators.

Article 89. (1) Pipelines for liquefied and gaseous chlorine and chlorine water shall be designed to be chlorine resistant and with an ascending slope of 0.01 to the chlorinator apparatus.

(2) Chlorine pipelines shall be designed on consoles in the premises, and when they are outside the building – on trestles, ensuring their protection from direct solar heating.

Article 90. Chlorine pipelines shall be dimensioned for three times the maximum dimensioning amount of chlorine as follows: 2.5 m/s to 3.5 m/s for gaseous chlorine and 0.8 m/s for liquefied chlorine, at an operating pressure of not less than 1.6 MPa and at a test pressure of 2.3 MPa.

Article 91. (1) In parallel operation of two or more chlorinators, the chlorine water pipelines shall be connected by means of a tank without interruption of the flow.

(2) Pipelines shall be located in the premises in mounting channels, in the floor or on consoles to the walls, and outside the building – underground or in collectors, in which no other communications are foreseen in addition to the pipelines.

Article 92. An audible and/or light alarm system shall be provided in the premises of chlorinator stations for liquefied chlorine in case of accidentally leakage of chlorine from the facilities.

Article 93. Waste water may be discharged from the apparatus room, the expenditure store and the entrance hall of the chlorinator station only if this does not lead to environmental contamination. Otherwise, a neutralising reagent shall be used before waste water is discharged.

Article 94. Chlorinator stations operating with chlorine compounds shall be designed with the following premises:

1. a chlorinator room in which the reagent containers and dispensers are placed;
2. warehouse for chlorine compounds;
3. an entrance hall.

Article 95. The free area in the chlorinator rooms is 4 to 6 m^2, and the passageways between containers, dispensers and walls shall be designed to be more than 0.7 m wide.

Article 96. (1) Water disinfection plants other than those referred to in Articles 83 to 95 shall be designed in accordance with the manufacturer`s instructions.

Article 97. The operation of all water disinfection plants shall be fully automated, synchronising with the operation of the water pipe, pumping stations or water treatment plant.

Article 98. The ducts of the ventilation system and the disposal equipment shall be designed to be produced from corrosion resistant construction products.

Section VIII

Warehouses for reagents and filter materials. Auxiliary and service rooms

Article 99. (1) Reagent and filter material warehouses shall be dimensioned according to the transport, loading and unloading conditions, the stock required, the storage requirements and the physical and mechanical properties of the materials.

(2) Reagent warehouses shall be dimensioned for a 15-30-day stock with maximum reagent consumption.

(3) Reagent warehouses are allowed to be dimensioned for a smaller stock, but not less than 7 days after an appropriate technical and economic justification.

(4) In the case of central (basic) warehouses, it is permissible to dimension the reagent warehouses for a three-day stock.

Article 100. (1) Depending on the capacity of the treatment plant, the quality of raw water, the technology of treatment, the volume of technological control and local conditions in addition to the main technological facilities and premises, the necessary auxiliary facilities and premises, including laboratories, shall be provided, and their type and area shall be determined.

(2) The main, auxiliary and service premises in buildings shall be located in compliance with the technological and sanitary and hygienic requirements and with the fire safety rules and norms following an appropriate technical and economic justification.

(3) The auxiliary and service premises shall be provided with the necessary sanitary and hygienic rooms according to the number of staff.

C h a p t e r F o u r

BASIC REQUIREMENTS FOR THE DESIGN OF PUMPING STATIONS

Article 101. (1) The category of pumping stations shall be determined in accordance with the category of the water supply system they serve.

(2) Pumping stations are designed for operation according to three schemes:

1. open system;

2. closed system;

3. mixed system.

(3) Pumping stations shall be designed to provide the necessary dimensioning pressure and water quantity in the water supply system.

(4) When designing pumping stations, the following conditions shall be prevented and/or avoided:

1. cavitation;

2. instability due to abnormal water level fluctuations;

3. overloading resulting from an exceptional increase in energy consumption;

4. unacceptable increase of noise during operation of pumping stations beyond the limits of the maximum permissible norms.

(5) The method of deployment of the equipment in the pumping station and the mode of operation of the pumps shall be determined on a case-by-case basis.

Article 102. (1) The total head of a pump or pump group is defined as the sum of the geodetic height overcome, the total head loss, and:

1. In case of direct supply into the network - the free head at the critical point;

2. In case of free flowing into a tank - an additional head of 3 m (or any other value, if necessary) at the end of the pusher or the required free head at a high point along its path.

(2) When choosing a pump, its operating point shall be determined in accordance with the high values of the pump”s efficiency.

Article 103. (1) Each system pump unit-thrusting water pipe shall be examined for a hydraulic shock under the most unfavourable operating conditions, on the basis of which protective measures shall be taken to ensure the maximum dimensioning pressure in the water pipe below the permissible operating pressure for a given type of pipe according to Annex 7.

(2) Dimensioning of the thrusting water pipe shall be carried out with the water quantity at the operating point of the selected pump group.

(3) If a hydraulic shock is possible, equipment shall be designed to prevent or suppressing it.

Article 104. In the machine room of pumping stations, positioning of pumps operating with harmful, odour-releasing liquids and domestic or industrial waste water are not allowed.

Article 105. (1) Replacement pump units shall be provided for each group of pump units, depending on the category of water supply system and the number of operating units according to the Table 3.

Table 3

Number of operating units in one group of pumps	Number of replacement units installed in the pumping station, depending on the category of water supply system		
	first	second	third
1	1	1	1
From 2 to 6	2	1	1
From 7 to 10	2	1	-
Above 10	2	2	-

(2) For sites, for which continuous water supply is envisaged, backup power supply from a second independent energy source shall be designed.

Article 106. (1) Pumping units and other equipment in the pumping station shall be located so that there is free access for service and repair.

(2) Fittings and plumbing shall be positioned in such a way that losses of head shall be minimal and that access to the shut-off valves shall be ensured when the pumps are installed as well.

(3) In pumping stations with lifting mechanisms, an installation site shall be constructed to provide a passageway with a width of not less than 0.7 m to the pump unit fitted on it.

(4) Premises in which vertical pumps are located shall be designed in compliance with the requirements for installation, dismantling and removal of pumps and their assemblies, including by means of lifting equipment.

(5) Under unfavourable soil conditions, the installation of two pumps on one common foundation, without passageway between them is allowed, and a bypass of at least 1.0 m wide shall be provided.

Article 107. (1) For each naturally flooded pump group and regardless of the number of pumps, no less than two suction water pipes shall be designed.

(2) When one suction water supply of naturally flooded pumps is disconnected, the remaining pumps shall transfer the entire dimensioning water quantity in the case of water supply systems of the first and second category, and 70 % of the dimensioning water quantity for water supply systems of the third category.

(3) In the case of pumps that are not naturally flooded, each of them shall be designed with a self-contained suction water pipe.

(4) The suction water pipes of pumps that are not naturally flooded shall be designed with an ascending slope to the pumps of 0,005.

(5) Suction water pipes shall be designed with eccentric reduction gears.

(6) In case of naturally flooded pumps, measures shall be taken to prevent the transferring vibrations during the operation of the pump to the tank wall.

(7) In case of pumps, that are not naturally flooded, a return valve shall be provided at the beginning of the suction pipes.

Article 108. The mounting channels of water pipes shall be designed with dimensions that provide:

1. from 0.2 to 0.3 m free space under the pipe;
2. from 0.2 to 0.4 m free space above the pipe;
3. from 0.25 to 0.3 m free side space between the wall and the pipe.

Article 109. The permissible water velocities for hydraulic dimensioning of pressure and suction water pipes are according to Table 4.

Table 4

Pipe diameter, mm	Permissible water velocity in water pipes of pumping stations, m/s	
	for suction water pipes	for pressure plumbing
Up to 250	from 0.6 to 1.0	from 0.8 to 2.0
From 300 to 800	from 0.8 to 2.0	from 1.0 to 3.0
Above 800	from 1.2 to 2.0	from 1.50 to 4.0

Article 110. (1) The thrusting plumbing of each pump shall be designed with a consecutively located non-return valve and shut-off valve.

(2) A non-return valve and a shut-off valve shall be installed on the common thrusting water pipe after the means of measuring the water quantity.

(3) For the pusher outside the pumping station, support blocks shall be provided at the place of change of the direction of the water pipe. The support blocks shall be dimensioned to absorb the maximum reaction force in the event of a hydraulic shock.

Article 111. Shut-off valves shall not be installed on the suction water pipe, except in cases where pumps are naturally flooded or have a common suction water pipe.

Article 112. A means of measuring the water quantity shall be designed at the outlet of the pumping station. When the means of measuring the water quantity is located outside the pump station building, a shaft shall be provided.

Article 113. (1) Control systems in pumping stations shall be designed for manual, remote or fully automatic control in such a way as to prevent unnecessary repetition of start-up and stop operations or change of the pump speeds.

(2) A separate control panel shall be provided for each pump unit, which shall include:

1. a safety device for shutting off the engine in case of disturbances in operation;

2. measurement means and indicators for carrying out control and observations of: the water level; the flow rate and pressure; the engine speed; the voltage; the size of electric current; the reactive power factor; the concentration of gas mixtures; the working hours of units, etc.

(3) In case of a simultaneous operation of two or more pump units the control system shall provide a possibility for changes in the sequence of switching on and off.

(4) The control system shall ensure sequential activation of the operating and replacement pump units.

Article 114. (1) When designing drawing tanks, measures against water stagnation shall be provided.

(2) The input water pipe in the drawing tank shall be designed above the maximum water level.

(3) The intake holes of the suction pipes shall be positioned and formed in such a way that air is not sucked in, and that there is a sufficient distance around them.

(4) The adjusting volume of the drawing tanks shall be determined on the basis of the hourly irregularity (hourly schedule) of the incoming and pumped water quantities or on the basis of at least the 15-minute maximum performance of the pump with the highest capacity.

(5) If it is necessary to store fire-fighting and emergency volumes, they shall be determined in accordance with the requirements of the fire safety rules and norms for determining the fire-fighting volume and Article 69 for determining the emergency volume.

(6) In drawing tanks with submerged pump units, lifting equipment shall be provided to lower and hoist pump units, when their weight is over 50 kg.

Article 115. The waterproofing of pumping stations shall be designed in accordance with the requirements of Ordinance No RD-02-20-2 of 2016 on the design, implementation, control and acceptance of waterproofing systems of construction works.

Article 116. (1) When designing the machine room, its drainage shall be foreseen.

(2) Leaks from the gaskets of pumps are led to the drainage shafts.

(3) The water from the vacuum body of the self-sucking pumps shall be led into a drainage system to the drainage shafts or for reuse.

Article 117. (1) With a dynamic water level up to 9 m below the surface of the terrain, siphon drainage of water from a group of wells to one common collection well is allowed.

(2) For every 10 wells, one spare pump shall be provided in stock.

Article 118. (1) Well caps shall be located in above-ground or underground premises (bunkers), the dimensions of which shall be determined according to the number and dimensions of the pump units and other equipment, as well as the occupational health and safety requirements.

(2) The height of the premises referred to in paragraph 1 shall be determined according to the dimensions of the equipment, but it shall not be less than 2.5 m.

(3) The top part of the lining tubes of wells shall be designed at a distance of at least 0.2 m from the floor.

Article 119. The water pipes in the pumping station shall be disinfected in compliance with the disinfection requirements laid down in this Ordinance.

Chapter Five

REQUIREMENTS FOR THE DESIGN OF EXTERNAL PLUMBING, PLUMBING NETWORKS AND FACILITIES

Article 120. In the design of external water pipes, water supply networks and facilities, in addition to the requirements of the Ordinance, the requirements of BDS EN 805 "Water supply - Requirements for systems and components outside buildings" shall also be complied with.

Article 121. (1) Water pipes shall be designed to have the necessary strength and resistance at the most adverse velocities, pressures and flow rates of the water supply system.

(2) The fire-extinguishing water consumption shall be ensured at the maximum water consumption for everyday needs.

Article 122. (1) The elements of the water supply system before the pressure and control facility shall be dimensioned for the maximum daily water quantity. After the pressure and control facility, the elements of the water supply system shall be dimensioned with the maximum hourly water quantity.

(2) For checking the maximum permissible rates and determining the required pressures (respectively, the elevations of the facilities to provide these pressures), the case of operation of the

water supply network with simultaneous maximum hourly consumption and fire-extinguishing water consumption shall apply.

Article 123. (1) When determining the permissible water velocities in water pipes for their normal operation and for ensuring the necessary quality of drinking water, measures shall be taken to prevent water stagnation, deterioration of water quality indices (e.g. turbidity), as well as to prevent a hydraulic shock.

(2) In order to prevent water stagnation, it is necessary that the velocity of the daily water quantity to be greater than 0,005 m/s.

(3) In order to prevent deterioration of the quality indices of water in the network (e.g. turbidity), it is necessary that the velocity at the maximum hourly water quantity to be greater than 0.5 m/s. Lower velocities are allowed for plumbing with the minimum permissible diameter.

(4) The maximum permissible velocity in plumbing is 2 m/s, and velocities of up to 3.5 m/s shall be accepted only in individual cases and following an appropriate technical justification.

(5) In the case of pumping delivery, the diameters of the plumbing shall be determined on the basis of technical and economic dimensioning, so as to be the most advantageous in taking into account the capital expenditures and operating costs. This condition shall be provided at water velocities of 0.8 to 1.4 m/s.

Article 124. (1) Hydraulic dimensioning of plumbing is carried out according to data from the technical specifications of the designed pipes.

(2) In hydraulic dimensioning of plumbing, the formulas established in practice are used and, if a check is necessary, the Colebrook-White formula is recommended.

(3) Plumbing shall be designed for continuous operation, taking into account expected water temperature fluctuations, soil loads, surface loads, groundwater, mobile loads, pipe weight and water weight at a nominal pipe diameter greater than 1,000 mm, as well as the forces undertaken by the plumbing during installation and subsequent construction works.

(4) The value of the hydraulic roughness (k) in the calculation according to the Colebrook-White formula is determined by:

1. the design value of the roughness k_1, including the influence of pipes and pipe connections; when using k_1 local pressure losses in fittings shall be taken into account (Annex 8), or

2. the dimensioning value of the roughness k_2, including the influence of pipes, pipe connections, and fittings (Annex 8); when determining the dimensioning value of the hydraulic roughness, its increase over time shall be taken into account.

(5) Local head losses are taken into account in all plumbing elements (access fittings, fittings, measuring instruments, etc.).

Article 125. (1) When designing the plumbing, the dimensioning pressure, the maximum dimensioning pressure and the pressure for water supply system testing shall be determined, taking into account all conditions for the flow of the relevant water quantity.

(2) The water pipe elements shall be designed to withstand the dimensioning pressure, maximum dimensioning pressure and system testing pressure.

(3) For fittings, the pressures referred to in paragraph 2 shall be determined in the open and closed position to ensure their tightness and functioning in normal operation in accordance with the technical specification.

Article 126. For the protection of plumbing from hydraulic shock, as well as for its limitation, the need to design devices at appropriate places in plumbing shall be analysed.

Article 127. All elements of the water supply system shall be designed and tested in such a way as to provide water tightness for the expected service life under the operating conditions of loading.

Article 128. (1) The number of external plumbing shall be determined according to the category of the water supply system and the complex launch programme for stage-by-stage commissioning.

(2) The need for a connection between two or more parallel external water pipes shall be determined by reference to the number of independent water abstraction facilities and the number of water pipes, and connection shall be permitted only where the qualities of the water after mixing meet the requirements of Ordinance No 9 of 2001 on the quality of water intended for drinking and household purposes.

(3) In case of disconnection of an external plumbing or its section, the necessary water quantity shall be provided for the drinking and production needs of users in accordance with the category of water supply system, redundant volumes and regulating water pressure equipment.

Article 129. In case of water supply from a single external water pipe, a reservoir for storage of spare water shall be provided for the needs of users during the repair of damage depending on the category of the water supply system and in accordance with the rules and norms for fire safety.

Article 130. (1) The time period for the repair of damage in the external water pipes, as of the interruption of water supply, shall be determined in accordance with Table 5 for plumbing of the first category. For plumbing of the second and third category, the time period shall be calculated by multiplying it by coefficients as follows: 1.25 – for water pipes of the second category and 1.50 – for water pipes of the third category.

Table 5

Pipe diameter, mm	Permissible time period for interruption of water supply for the repair of damage in water pipes (h) at the depth of pipe laying of	
	up to 2 m	more than 2 m
Up to 400	8	12
From 400 to 1000	12	18
Above 1000	18	24

(2) Depending on the type of pipes, the peculiarities along the water pipe route, the conditions for laying the pipes, the availability of road, transport and technical means for the repair of damage, the time period according to Table 5 is allowed to be increased, but by not more than 20 %.

(3) If there is a need for disinfection of the water pipe after the repair of damage, the time period may be further increased by 12 h.

Article 131. A means of measuring water before the first branch of the water supply network in the water supply area shall be designed on the external plumbing.

Article 132. Water supply networks shall be designed in such a way as to ensure:

1. supply of all users with water having the required quantity and pressure;
2. continuous supply of water both in normal operation and in case of damage and repair of individual water supply sections depending on the category of the water supply system;
3. bringing water to users in the most appropriate technical and economical way;
4. possibility for satisfactory and easy maintenance.

Article 133. (1) Water supply networks shall be designed closed.

(2) Branched water supply networks shall be provided for the supply of water for production purposes, where interruption of water supply is allowed for the purpose of repairing damage.

(3) For technical or economic reasons, zones may be designated in water supply networks (Annex 9)

(4) It is permissible to design branched networks for water supply systems of the third water supply category and for dead-end streets where water supply branches cannot be connected with adjacent branches.

Article 134. (1) The minimum internal diameter of the pipes of the water supply network in urbanized areas with a population of more than 100,000 inhabitants is 95 mm, and for territories with a population of less than 100,000 inhabitants – 75 mm.

(2) In the case of water supply to a small number of users (up to 30) by means of water pipe with one-sided water supply having a length of up to 100 m and where there are no requirements for fire extinguishing, pipes with a minimum internal diameter of 50 mm are used.

Article 135. Water supply networks and facilities shall be located in urbanised areas in compliance with the requirements of Ordinance No 8 of 1999 on the rules and standards regulating the deployment of physical conduits and facilities in urbanized areas (SG, Issue 72 of 1999).

Article 136. The technological schemes of water supply networks in urbanized areas shall be designed with main plumbing branches, forming rings, extended in the direction of the general movement of the water, and with secondary plumbing branches for each street of the development plan of the settlement.

Article 137. (1) Building plumbing deviations shall be positioned as far as possible in a straight line and with the smallest length between a plumbing branch of the water supply network and the building in such a way that they are easily accessible for maintenance and repair.

(2) The building plumbing deviation includes a water intake part (water intake bracket or access fitting), pavement shut-off valve, common water meter-fitting assembly and water pipes.

(3) The diameters of building plumbing deviations according to the drinking, household and fire-fighting needs of water, the location of the common water meter-fitting assembly and the choice of water meter and device agains backflow (according to BDS EN 1717 "Protection against pollution of potable water in water installations and general requirements of devices to prevent pollution by backflow") shall be determined in accordance with the requirements for the design of building plumbing systems.

(4) The diameter of the building plumbing deviation for industrial buildings shall be determined according to the water needs in accordance with the production technology.

Article 138. (1) Water supply network and water pipes shall be equipped with shut-off valves insulating individual sections in accordance with the category of provision of the water supply system and the fire safety rules and standards.

(2) In determining the number of shut-off valves and the distance between them, the density and intensity of construction, fire safety rules and standards, the location of hospitals, schools, residential and production buildings and other concentrated users shall be taken into account.

(3) Shut-off valves must be designed on any deviation of the main plumbing branch.

(4) The necessary venting and emptying equipment shall be provided for insulated by shut-off valves sections of the water supply network and external plumbing which in the course of operation will be emptied for repair or for other reasons.

(5) Hydrants can be used for the needs of operation, such as filling, emptying, venting and flushing the pipes.

(6) In the case of external plumbing and main plumbing branches, as well as in the case of long sections of secondary plumbing branches, the distances between shut-off valves shall be determined simultaneously, subject to the requirements of paragraph 1, and they shall not exceed:

1. 5 km – for external plumbing;

2. 2 km – for main water supply branches of the network;

3. 0.5 km – for secondary plumbing branches of the network.

(7) The distances referred to in paragraph 6 may be increased after justification and subject to the requirements of paragraph 1.

Article 139. (1) In order to ensure the necessary water supply for fire-fighting needs, fire hydrants shall be provided at each junction for streets of 1st to 4th class in urbanised areas. Where the distance between two adjacent fire hydrants provided at junctions for streets of I to IV class in urbanised areas is greater than 100 m, the fire safety rules and standards regarding the maximum permissible distance between fire hydrants in the settlement shall be complied with.

(2) When designing fire hydrants on external or main plumbing branches of the deviation for installation of fire hydrants, shut-off valves shall be provided.

Article 140. In green and arable areas, the security pot of shut-off valves and underground shut-off valves, the shaft covers of facilities of water supply systems shall be installed at least 15 cm above the ground.

Article 141. (1) External water pipes shall be equipped with air vents to release air during operation and when filling the plumbing, as well as for the introduction of air during its emptying.

(2) The characteristic points for the design of air vents are as follows:

1. all high positioned points determined by the pressure line (points 2, 8 and 14 in Fig. 1 of Annex 10 and Fig. 2 of Annex 10) of the plumbing;

2. the places with a sharp change of slope of the track from ascending to descending (point 14 in Fig. 1 in Annex 10);

3. on long pressure plumbing with a constant small slope, long ascending sections, long descending sections or sections parallel to the pressure line, air vents located at a distance of 400 to 800 m from each other shall be designed.

(3) The type and size of the required air vents shall be determined according to the estimated amount of air and water supply system using the data in their technical specifications. The type of air vents according to the characteristic points for their design on water pipes are set out in Annex 10.

(4) In cases where air vents are designed in shafts, measures must be taken to prevent the penetration of external water into the water supply system.

(5) Shut-off fixtures shall be provided to the air vents.

Article 142. (1) In addition to hydrants, emptying facilities may also be designed for emptying and/or flushing water pipes.

(2) Depending on the degree of risk to pollution of drinking water, measures against backflow such as free drainage shaft, non-return valves and protection devices against backflow shall be provided for the emptying facilities, according to BDS EN 1717 "Protection against pollution of potable water in water installations and general requirements of devices to prevent pollution by backflow".

(3) The diameter of the emptying pipe shall be up to 200 mm.

(4) If necessary, precipitation and neutralisation facilities shall be provided before discharge of water from emptying and/or flushing the water pipes in the sewer system.

(5) It is not allowed to connect the emptying facility to the sewer system.

Article 143. External plumbing and main and secondary branches of the water supply network shall be designed with a slope of not less than 0,002 in the direction of the current.

Article 144. (1) Water pipes shall be designed strengthened against the loads caused by changing their direction or changing diameters.

(2) When the resulting forces cannot be absorbed by the connections of the pipes, the vertical and horizontal elbows of the water pipes shall be equipped with support blocks in accordance with the specific conditions, the acting forces and the characteristics and type of soil.

Article 145. (1) Compensators shall be provided for on:

1. water pipes whose connections cannot compensate for axial displacements caused by temperature differences of water, air or soil;
2. plumbing in tunnels, canals or on supports according to their design, with the distance between the compensators and fixed supports being determined by calculations;
3. water pipes laid in creeping and sliding lands.

(2) When designing underground laying of water pipes made of welded steel pipes and connecting by cast iron flange fittings not protected from the influence of axial tension forces, compensators or movable joints shall be provided.

(3) The distance between the compensators or fixed supports shall be calculated from data in the technical specifications of the pipes.

Article 146. (1) The material and type of pipes, fittings and fixtures for plumbing and plumbing networks shall be determined on the basis of static calculations and in accordance with sanitary and hygienic requirements, the aggressiveness of the soil, the category of the water supply system and the requirements for the quality of the water.

(2) Pipes with increased strength characteristics shall be designed if necessary:

1. when crossing railways, roads and other elements of the transport technical infrastructure;

2. at the intersections of plumbing with a sewer branch;

3. when laying water pipes in hard-to-reach places, falling terrains, mud and peat soils, in mine and karst areas.

(3) When passing under the river, the water pipe shall be protected according to the specific conditions.

Article 147. Street transit plumbing shall be designed 0.2 m lower than the level of distribution plumbing measured from the crown.

Article 148. When designing plumbing in collectors, the norms and rules for the design of collectors for engineering conduits and facilities in urbanised areas are observed.

Article 149. (1) When passing under railways, motorways and roads and streets of Class I and II, water pipes shall be designed in a siege pipe or tunnel.

(2) The inner diameter of the siege tube shall be at least:

1. for plumbing with an external diameter of up to 125 mm – 100 mm larger than the outer diameter of the plumbing;

2. for plumbing with an external diameter of 125 to 350 mm – 200 mm larger than the outer diameter of the plumbing;

3. for plumbing with an external diameter of more than 350 mm – 250 mm larger than the outer diameter of the plumbing, as determined on the basis of the provided installation spacers.

(3) In determining the clear distance referred to in paragraph 2 between the water supply and the siege pipe, the thickness of the thermal insulation, if any, and the method of installation shall be taken into account.

(4) Design of water pipes without housing under station railway tracks and industrial tracks is allowed.

(5) The smallest horizontal clear distances between the parallel technical conduits and the plumbing and the distance of the plumbing from other facilities shall be determined in compliance with the rules and norms for the deployment of technical conduits and facilities in settlements.

(6) The dimensions of passable tunnels shall take into account the possibility of laying and repairing the pipes.

(7) In one housing or tunnel it is allowed to lay several water pipes, as well as joint laying of water pipes and other technical conduits and equipment.

Article 150. (1) When passing water pipes of the first and second category with a drain siphon through rivers with a maximum water quantity exceeding 400 m^3/s, not less than two pipes shall be provided for.

(2) The dimensioning water quantity for each branch of the drain siphon shall be determined according to the category of the water supply system.

(3) The laying depth of the underwater parts of the water supply, as measured by the crown of the pipes, shall be not less than 0.5 m below the bottom of the river, taking into account the possibility of natural or artificial modification of the bottom or correction of the river.

(4) The clear distance between the individual branches of the drain siphons shall not be less than 1.5 m.

(5) On both sides of the drain siphon shafts shall be built with shut-off valves to switch the water pipes.

(6) The width of the underwater trench and the way of passage of the water pipe shall be determined according to geological surveys.

Article 151. (1) Plumbing shafts shall be designed from prefabricated reinforced concrete elements, monolithic, plastic or other suitable materials.

(2) In the presence of groundwater above the bottom of the shaft and on the walls at a height of 0.5 m above the highest level of groundwater, waterproofing shall be designed.

(3) The working height of the shafts shall not be less than 1.8 m.

(4) The height of the backfill above the roof of the water shafts shall be determined according to the vertical layout and shall be from 0.3 to 0.4 m.

(5) For stop taps with a diameter of more than 600 mm, additional holes for manipulation from the surface shall be designed in the roof of the shafts.

(6) Where necessary, access to the shafts shall be granted to the means of transport.

(7) On the walls of the shafts shall be designed steps of materials with the strength and resistance required for the intended loads.

(8) Around the entrances of the shafts, located in green areas and in unpaved terrains, there shall be a watertight pavement with an inclination outward from the entrance. The entrance of the shafts onto streets with durable pavement shall be at the level of the pavement, and the shafts shall be covered with metal lids, and if necessary – with a second thermal insulation cover. In the landscaped areas, the level of the opening or cover shall be designed at least 0.15 m above the design level of the terrain.

(9) Shafts with shut-off valves for discharge of water and for air vents shall be designed along the route of the water pipes or as outward shafts depending on the specific conditions, location and diameter of the water pipe. After technical justification, the design of shaft-free runoffs and air vents is also allowed.

(10) Plumbing shafts shall be provided against unauthorised access.

Article 152. (1) In case of increased iron and manganese content in the water, the water pipe is designed as pressure pipe from the water abstraction to the treatment plant to prevent water aeration.

(2) Construction of pressureless plumbing is also allowed, and measures are provided for removal of manganese deposits and sludges formed in the water pipe.

Article 153. (1) External plumbing and plumbing branches from the water supply networks in the water supply areas are designed underground.

(2) It is permissible to design the water pipes at the level of the terrain, above the level of the terrain (on embankment or stands), in canals and collectors, in conjunction with other underground communications after an energy efficiency assessment and after technical and economic justification.

(3) For all types of soils (except rocky, sedimentary and silts), plumbing trenches are designed on the natural, undistorted bed, in accordance with the manufacturer"s instructions when laying.

(4) In the case of rocky soils, a sand cushion with a thickness of not less than 10 cm shall be designed. It is permissible that the cushion is made of sandy clays and clay sands, compacted to a volumetric weight of 1.5 t/m^3.

(5) When determining the depth of laying of the pipes, the level of the terrain according to the level plan, the height of freezing of the soil, as well as the possibility of operation of the water pipe before the implementation of the vertical planning shall be taken into account, in case it is carried out after putting the plumbing into operation.

(6) The minimum land covering over water pipes outside urbanised areas shall be accepted as follows:

1. under lawns, flower areas and other terrain not loaded by transport, construction and other goods – 1.20 m;
2. under roads – 1.50 m;
3. less than 1.20 m or less than 1.50 m – following technical and economic justification and the provision of thermal control and other measures to ensure the safety of the pipeline.

Article 154. (1) To filling up the pipes, a material is used that:

1. has the necessary strength characteristics so that, after its compacting, the design profile of the laid plumbing does not change;
2. does not cause corrosion, damage or deterioration of the mechanical properties of the pipes, coatings and parts with which it is in contact in accordance with Annex 11;
3. is chemically resistant and does not cause harmful reactions in contact with soil or groundwater;

4. is compacted to the extent necessary;

5. does not contain organic materials, frozen soil, large stones, rock fragments, tree roots, etc.

(2) The requirements for the degree of compaction of the main backfilling and the backfilling for the area around the pipe, as well as the type of material for them, are given in the "Water supply and sewer" part of the investment project. The requirements for the compaction of the ground bed under the road surface and for the implementation of the road structure above the ground bed are given in the part of the investment project, which gives the requirements for the design and construction of the road. In cases where there is no road surface, the project "Water supply and sewer" part provides a solution for the type of backfilling and the degree of its compaction.

Article 155. (1) When designing plumbing, the necessary measures shall be taken to protect drinking water from adverse effects as a result of an aggressive environment.

(2) Where studies reveal the presence of aggressive soils, protective measures shall include:

1. the use of construction products resistant to aggressive soils and soil contaminants;

2. cathodic protection and anti-corrosion coating of steel pipes;

3. placing plastic pipes not resistant to the identified pollutants in protective pipelines;

4. provision of coatings or suitable additives for concrete pipe parts intended for лаъинг in conditions of aggressive and polluted soils.

(3) In the event that the measures referred to in paragraph 2 cannot ensure the protection of the water pipe and drinking water against the effects of an aggressive environment, another technical solution shall be provided, including the modification of the water pipe route.

(4) Corrosion protection of the outer and inner sides of steel pipes shall be designed in accordance with their technical specification, taking into account the corrosion properties of the soil and the water being carried out, water stabilisation measures and the presence of wandering currents.

Article 156. (1) When designing the plumbing, the type and volume of the non-destructive control of the pipes intended for welding shall be determined, depending on the specific conditions, the type of pipes, the operating pressure and the category of the water supply system.

(2) The volume of control referred to in paragraph 1 may not be taken to be a lower percentage than the total number of connections referred to in Table 6.

Table 6

Category of water supply system by degree of water provision	Operating pressure, MPa		
	up to 0.6	from 0.6 to 1.6	over 1.6
First	5	8	10
Second	4	6	8
Third	3	5	6

(3) All butt welded connections of underwater pressure pipes and drain siphons shall be subjected to 100 % non-destructive control at the places of welding.

(4) The connections designated for control shall be examined throughout the perimeter.

(5) The design specifies the requirements for weld samples in terms of tensile strength, bending angle, impact strength, etc. in accordance with the technical specifications of the pipes.

Article 157. (1) Each plumbing shall be subjected to a hydraulic test to demonstrate the water tightness, as well as to check the strength and performance of pipes, access fittings, joints, support blocks, reinforcements and other plumbing elements.

(2) The method and the necessary stages of testing shall be determined by the design, respecting the specified requirements of BDS EN 805:2004, together with the requirements of Annex 12, or the requirements of Annex 13. In cases where the conditions of laying and construction of the plumbing do not permit the use of these requirements, other test procedures according to the design may also be used.

(3) Test methods shall be defined in the project. The test can be performed in the following three stages:

1. preliminary test (for strength);
2. pressure drop test to determine the remaining amount of air in the water pipe;
3. basic test (for water tightness).

(4) Prior to pressure tests, where necessary, pipes (with or without connections) may be covered with the backfilling material, thereby preventing changes in the pipe laying conditions that would lead to leakage. The need for backfilling of the pipes, as well as the connections, is indicated in the project.

(5) For all plumbing, the test pressure shall be calculated on the basis of the maximum dimensioning pressure as follows:

1. when calculating a hydraulic shock:

$$STP = MDPc + 100\ kPa \qquad (1),$$

where:

STP is the test pressure, kPa;

MDPc – the value of the maximum dimensioning pressure when the hydraulic shock is calculated, kPa;

2. without hydraulic shock calculation, the smaller of the two values shall be registered:

$$STP = MDPa \times 1{,}5 \qquad (2),$$

or

$$STP = MDPa + 500\ kPa \qquad (3),$$

where MDPa is the value of the maximum dimensioning pressure at an established permissible value of the hydraulic shock, not less than 200 kPa.

Article 158. (1) The plumbing shall be tested completely or by separate sections.

(2) During the test, the sections of the water pipe shall be selected in such a way that:

1. the test pressure shall be reached at the lowest point of each test section;

2. at the highest point of each test section, a pressure at least corresponding to the maximum dimensioning pressure (MDP) shall be reached. Other test pressure values are allowed after justification by the designer.

Article 159. (1) The purpose of the preliminary test is to:

— stabilise the test sections by allowing them to have movements and deformations expected during operation;

— reaching the necessary water saturation using materials for pipes and coatings that absorb water;

— to allow pressure-dependent increase in the volume of flexible pipes prior to the main test.

(2) The duration and pressure of the preliminary test shall be determined in the design according to the plumbing material and the relevant product standards.

(3) The pre-test pressure shall be determined in accordance with Article 157(5) and Article 158(2). Other pre-test pressure values may also be specified after technical justification in the design.

Article 160. (1) The plumbing shall be tested to a pressure drop to determine the amount of air remaining in it in order to prevent false results when performing the main test.

(2) The need for the test referred to in paragraph 1 and instructions for carrying out it shall be specified in the design.

Article 161. (1) The main test of plumbing shall be carried out by one of the following methods:

1. method of loss of water;

2. method of pressure loss.

(2) The method of the main test shall be specified in the design, taking into account the laying conditions, the material and the diameter of the pipes.

Article 162. (1) New, modified or reconstructed plumbing areas shall be put into operation only after disinfection and washing.

(2) For the disinfection of the plumbing and plumbing equipment, the type of disinfectant used, the concentration and contact time, the need for neutralisation of the waste disinfection solution and the manner in which it is carried out, instructions shall be developed, which shall be included in the project.

(3) When performing disinfection, plumbing is divided into sections, where necessary.

(4) Biocidal products of product type 4 in accordance with Regulation (EU) No 528/2012 of the European Parliament and of the Council of 22 May 2012 concerning the making available on the market and use of biocidal products (OJ L 167, 2012) shall be used for the disinfection of water supply systems and facilities, which are authorised under that Regulation and/or under the Act on the Protection from the Harmful Impact of Chemical Substances and Mixtures. Information on biocidal products and their active substances is contained in the Register of Biocidal Products on the website of the Ministry of Health.

(5) The selection of a biocidal product shall take into account its harmful effects on staff and the environment, contact time, water composition and cost price.

(6) The minimum contact time shall be determined according to the conditions of the authorisation granted to the biocidal product used, the diameter and length of the disinfected section of the pipeline, the material from which the pipes are met, the conditions of application and the manufacturer`s instructions.

(7) BDS EN 805 "Water supply. Requirements for systems and components outside buildings" sets out the recommended active substances of biocidal products and neutralising reagents.

Article 163. The place and the way of discharge of the waste water from the disinfection and flushing of the water pipes shall be determined in accordance with the requirements of the regulations for environmental protection.

C h a p t e r S i x

BASIC REQUIREMENTS FOR THE DESIGN OF REGULATING WATER PRESSURE EQUIPMENT

Article 164. (1) Underground tanks, over-ground tanks and water pressure towers shall be designed to equalise the difference between water inflow and variable water consumption, to maintain the necessary pressure in the water supply system, as well as to store a reserve of water for fire-fighting needs and a designated reserve of water for use in case of emergency.

(2) The tanks referred to in paragraph 1 shall be designed in compliance with the requirements of this Ordinance and of BDS EN 1508 "Water supply. Requirements for systems and components for the storage of water."

(3) It is also permissible to use tanks prepared under factory conditions meeting the requirements of paragraph 2.

Article 165. (1) The type and location of the tank shall be determined according to its purpose, the operation mode of the water supply system, the category of water supply provision, the water quality and the forecasts of the current development plans, taking into account the topographic conditions, the hydraulic characteristics of the water supply system and the technological requirements.

(2) The tank shall be provided, where possible, in the immediate vicinity of the water supplied site to ensure greater safety, protection from accidents and reduction of pressure losses.

(3) When choosing the location of the tank, account shall be taken of the type of soil for backfilling, covering and landscaping with a view to maintaining the area around the tank.

Article 166. (1) To ensure the water tightness of the tanks, concrete with appropriate additives is used and protective watertight surface layers and/or waterproofing linings are applied.

(2) Tanks shall be designed to prevent external waters and/or other contaminants from entering through walls, roof, openings, inlets or through pipelines.

(3) Water in water chambers shall not be exposed to daylight.

(4) Inlets and ventilation equipment shall be designed in such a way that the water is protected from pollution.

(5) In order to prevent heating or cooling of water, thermal insulation is provided, the technical characteristics of which shall take into account local climatic conditions, operating requirements and reduction of condensation in water chambers.

(6) When designing water chambers, the reduction of "dead" areas shall be ensured by an appropriate chamber shape or appropriate placement of the influx and intake pipes corresponding to the capacity of the tank.

(7) Self-cleaning and water sampling devices shall be provided for each water chamber.

(8) Access holes in the tank shall be designed so that materials and devices for cleaning, control and repair can be transported through them.

Article 167. (1) The total operating volume of the pressure and control equipment is defined as the sum of the regulating volume, the fire extinguishing volume and the volume for emergency use.

(2) The regulating volume of the pressure and control equipment shall be determined according to the water supply mode and the time schedule of the consumption.

(3) Where data are not available on the water supply regime and on the percentage distribution of consumption over the day, the regulating volume shall be determined according to the category of provision of the water supply for:

1. first category water supply systems – 30 % 50 % of the maximum 24-hour water quantity;

2. second category water supply systems – 50 % 60 % of the maximum 24-hour water quantity;

3. third category water supply systems – 60 % 70 % of the maximum 24-hour water quantity;

4. reduction of the regulating volume of the water pressure towers is allowed, and the difference between the required and the accepted volume is stored in the drawing tank.

Article 168. (1) The volume of hydrophores for drinking, household and production needs shall be determined in accordance with the requirements for the design of pumping and hydrophore installation in building plumbing systems.

(2) Hydrophores cannot be used to store water for fire-fighting and emergency needs.

Article 169. (1) The volume for emergency needs shall be determined on the basis of the risk of possible accidents in the supplying water pipe, water abstraction facilities, pumping stations and control systems, as well as the adverse effects associated with those accidents.

(2) In the case of supply of water to the pressure and control unit in one supplying water pipe, the necessary volume for storage of the water shall be provided during the repair according to the category of water supply provision and the data in Table 5.

(3) The recovery time of the emergency water reserve shall be 36 to 48 h.

Article 170. (1) The volume for fire fighting needs shall be provided in cases where it is technically impossible or economically uneconomic to provide the necessary water quantities for fire extinguishing directly from the water source.

(2) The volume of the inviolable reserve for fire fighting needs and the number of fire extinguishing tanks shall be determined according to the fire safety rules and standards.

Article 171. (1) When designing pressure and regulation tanks, one or more water chambers, a rebar chamber and a security belt shall be provided.

(2) When designing tanks, account shall be taken of their future expansion.

Article 172. The elevation of the lowest water level in the pressure tanks and water pressure towers and the minimum pressure in the hydrophores shall be determined with a view to ensuring the necessary pressure in the water supply system at the maximum consumption determined in accordance with Article 121(2) for drinking and household needs and fire extinguishing.

Article 173. (1) No less than two water chambers shall be provided in the pressure tanks, and the regulating volume, the volume for fire fighting needs and the emergency volume shall be allocated proportionally.

(2) Design of a tank with a single chamber is allowed when storage of a volume for fire fighting needs is not required and the tank is used for contact between the water and the decontaminating biocidal product or when the required regulating volume is up to 50 m^3.

(3) For each water chamber, possibility to measure the water level shall be provided.

(4) The water towers are designed as single-chamber ones.

(5) In the construction of water chambers, construction products with smooth outer surfaces (without pores) are used in accordance with the requirements for contact with drinking water.

(6) A means of supplying water into or from tanks and other mobile containers shall be provided for each tank.

Article 174. (1) The exchange of water in pressure tanks with a regulating volume exceeding 100 m^3 it is provided by circulating walls.

(2) Natural or artificial ventilation is provided to ensure the air exchange in the chambers with free water level.

(3) Ventilation of water chambers shall be designed separately from the ventilation of the rebar chamber.

(4) The number and diameter of ventilation chimneys and filter devices shall be determined in such a way that the vacuum when emptying and head when filling the tanks is below the permissible values.

Article 175. The rebar chamber shall be dimensioned to accommodate all operating equipment.

Article 176. (1) Piping systems in pressure tanks and their shut-off fittings shall be designed so as to permit independent and independent use of water chambers.

(2) For each water chamber, an influx and intake pipe and an emptying and drainage-overflowing system shall be provided with appropriate fittings and means for measuring the quantity and level of water.

(3) To ensure the circulation of water in the water chambers, the influx and intake pipe are designed at different heights and opposite in plan.

(4) A strainer is provided to the intake pipe.

(5) A bypass pipe connection shall be provided between the influx and intake pipes in the pressure and control units, and measures shall be taken to protect the water supply network from increasing the pressure downstream of the tank.

Article 177. (1) The overflow pipe shall be dimensioned for a water quantity equal to the difference between the maximum hourly inflow and the minimum hourly consumption.

(2) No shut-off fittings shall be provided on the overflow pipe.

(3) When connecting the draining and overflowing system with the sewer system, separation by means of air shall be provided before the drainage system to prevent backflow of water and gases from the sewer.

(4) The height of the water level above the overflow funnel is up to 100 mm.

Article 178. (1) Design of production premises in the body of the water tower is allowed, if they are related to the servicing of the water supply system.

(2) Lightning rods are designed for the water towers.

Article 179. (1) The diameter of the pipe during the gravitational emptying of the tank or the water pressure tower is determined for an assumed time of emptying of the total volume stored in them.

(2) In cases where the gravitational emptying of the tank is impossible or technically impractical, it is necessary to provide for a way of emptying it by pumping.

Article 180. In the case of monolithic connection of the pipes passing through the bottom of the water towers, compensators shall be provided.

Article 181. When designing the tanks, access to the water chambers, the rebar chamber and the operating equipment shall be provided.

Article 182. (1) The earth covering of underground tanks is 0.4 to 0.7 m.

(2) The design of tanks without earth covering is allowed, if equivalent thermal insulation is made.

Article 183. When designing tanks, a sub-bottom or peripheral drainage system shall be provided, if necessary.

Article 184. The tanks located above the terrain shall be covered by an earth embankment above the roof plate with a thickness of 0.4 to 0.7 m, and the lateral slopes shall be determined in accordance with the angle of internal friction of the embankment.

Article 185. (1) The water pressure towers are designed with a thermal insulation housing around the water chamber.

(2) Design of water towers without thermal insulation housing is allowed depending on the volume of the water chamber and the mode of operation of the tower, the climatic conditions and the water temperature requirements.

Article 186. The methods of testing tanks shall be determined by the design in accordance with the requirements of BDS EN 1508 "Water supply. Requirements for systems and components for the storage of water".

Article 187. (1) The design of the tanks determines the way of their washing and disinfection in compliance with the requirements of BDS EN 1508 "Water supply. Requirements for systems and components for the storage of water".

(2) The tanks shall be washed with clean drinking water and the use of chemical cleaners is limited as much as possible and complies with the requirements of the regulations for environmental protection.

(3) Disinfectants and neutralising reagents specified in BDS EN 805 shall be used to disinfect the tanks.

(4) Contact time shall be at least 24 hours.

C h a p t e r S e v e n

MINIMUM REQUIREMENTS FOR ELEMENTS OF WATER SUPPLY SYSTEMS IN CASE OF ACCIDENTAL CONTAMINATION BY RADIOACTIVE SUBSTANCES, HAZARDOUS CHEMICALS AND MIXTURES AND BIOLOGICAL AGENTS

Section I.

General requirements

Article 188. (1) Technical measures for operation under normal operating conditions with the possibility of rapid transition to operation in conditions of accidental environmental pollution by radioactive substances, hazardous chemicals and mixtures and biological agents as a result of major industrial accidents, etc. shall be planned when designing new, as well as during the reconstruction of existing elements of water supply systems.

(2) When designing a new one and in reconstruction of an existing water supply system, the contracting authority shall commission a study for enterprises/facilities with low and high risk potential operating on the territory of the water supply system, classified in accordance with

Chapter Seven, Section I of the Environmental Protection Act (EPA), and/or the possible impact of such enterprises/facilities. For established enterprises/facilities, available up-to-date information is collected from the public registers of the Ministry of Environment and Water, as well as information from the National Information System for reporting under the European Pollutant Release and Transfer Register on the website of the Executive Environment Agency. As a result of the information collected, the risks of potential pollution from established enterprises/facilities with anticipated pollution parameters and values, the duration of the possible pollution and the scope of the pollution impact are determined and, if necessary, additional data are required by the relevant competent authorities in accordance with the EPA.

(3) The requirements of this Chapter shall be complied with in the design of new and in the reconstruction of existing elements of water supply systems for which territory of functioning the data referred to in paragraph 2 are available.

(4) When designing new and in reconstruction of existing elements of water supply systems for which territory of functioning there is no data under paragraph 2, only the technical measures against ingress of atmospheric water and protection against access to outdoor air, defined in particular by Articles 191 to 195, shall be complied with.

Article 189. (1) When designing water supply systems for which, in accordance with Article 188(3), technical measures are planned to switch to operation in the conditions of accidental pollution of the environment, a reduction of the water quantity by up to 30 % of the dimensional consumption of the settlement shall be allowed.

(2) Where possible, the reduced water quantity referred to in paragraph 1 shall be provided by an underground water source.

Article 190. (1) When designing new water supply systems with surface water abstraction, for which territory of functioning there is data under Article 188(2), a second independent water source with a minimum quantity of water referred to in Article 89(1) shall be investigated and provided and which source shall be underground, if possible, for preventive purposes as required by this Chapter.

(2) For the underground water source referred to in paragraph 1, the relevant requirements of the Ordinance No 1 of 2007 on the exploration, use and protection of groundwater shall be met to ensure a minimum quantity of water in accordance with the requirements of Article 189(1) with water quality in accordance with Ordinance No 9 of 2001 on the quality of water intended for drinking and household purposes.

Section II.
Water abstraction facilities

Article 191. (1) When designing new water abstraction facilities (technical shafts above underground wells) the following measures are envisaged against atmospheric water penetration and protection against ambient air access:

1. waterproofing – externally on the bottom and walls;
2. conductor tube with pressurising flange;
3. sealing of the clearance between the lining column of the well and the conductor tube;
4. obligatory sealing of all openings over the pressurising flange, including heads of bolts for securing the flange;
5. sealing gasket at the places of crossing the pipelines with the surrounding reinforced concrete walls;
6. automatic air vent;
7. floor siphon connected to a "S-shaped" water shutter with a height of 0.50 m;
8. solid metal cover tested and certified under BDS EN 124 "Gully tops and manhole tops for vehicular and pedestrian areas".
9. exhaust ventilation pipe coming out above the terrain and ending with a fine grid (mesh).

(2) In the case of reconstructions of existing water abstraction facilities (technical shafts above underground wells), only the practically applicable measures referred to in paragraph 1 to protect against access to ambient air shall be provided.

(3) The ventilation pipes of the technical shafts shall be dimensioned for the maximum flow rate of exhausted air through the automatic air vent according to the design part "Heating, ventilation and air conditioning” in compliance with the requirements of the applicable regulations and the technological assignment.

(4) In case of impossibility to protect water supply systems against ambient air access for settlements of V to VIII categories, individual local wells (if any) shall be indicated for operation under conditions of accidental pollution of the environment.

Section III.
Plumbing and equipment

Article 192. (1) When designing new ones, as well as in reconstruction of external supplying water pipes and water supply networks, they should be considered as being watertight (air tight) for the intended purpose under the working conditions of loading and protected for operation under conditions of accidental pollution of the environment.

(2) For water supply facilities, for which servicing staff is required, measures shall be provided to protect against access of polluted outdoor air to the premises by:

1. sealing doors and windows;

2. ventilation system where the air flow passes through an air purification filter (protective detoxifying absorption filter based on activated charcoal or other high-efficiency air filter) to purify the outdoor atmospheric air entering the facility;

3. appropriately sealed containers (gallons) for drinking water for the purpose of covering the water drinking needs of staff within the specified duration of the possible contamination according to the data referred to in Article 188(2).

(3) The projects parts "Architectural", "Constructive", "Electrical" and "HVAC" shall be developed in compliance with the requirements of the existing regulations for the respective parts of the project and the terms of reference.

Article 193. (1) When designing new shafts of air vents in the water supply network and pressureless distribution shafts, the following measures against atmospheric water penetration and protection against ambient air access shall be provided:

1. waterproofing – externally on the bottom and walls;

2. sealing gasket at the places of crossing the pipelines with the surrounding reinforced concrete walls;

3. floor siphon connected to a "S-shaped" water shutter with a height of 0.50m;

4. solid metal cover tested and certified under BDS EN 124 "Gully tops and manhole tops for vehicular and pedestrian areas".

5. exhaust ventilation pipe with a return valve and fine grid (mesh);

6. compensating ventilation pipe with an air purifying filter (protective detoxifying absorption filter based on activated charcoal or other high-efficiency air filter) to purify the outdoor atmospheric air entering the facility.

(2) In the case of reconstructions of existing shafts of air vents in external plumbing and pressureless distribution shafts, a compensating ventilation pipe with an air filter and practically applicable measures under paragraph 1 shall be provided for protection against ambient air access.

(3) The ventilation pipes of the shafts are dimensioned for the maximum flow rate of exhausted and compensating air according to the term of reference to the project under part "HVA" in compliance with the requirements of the applicable regulations.

(4) It is permissible that the shafts of the drainers, the shock-absorbing and the pressurised distribution shafts are not protected against access to the ambient air.

Article 194. (1) Construction openings (external and internal doors, windows, openings for overflow and emptying pipes, ventilation system, etc.) of newly designed and existing regulating water pressure equipment shall be protected against access of the ambient air for operation under conditions of accidental pollution of the environment.

(2) The sealing external and internal doors and windows against access to the ambient air are determined according to the design of part "Architecture" in compliance with the requirements of the applicable regulations and the technological assignment.

(3) The outdoor air supply ventilation system shall be dimensioned in accordance with the technological assignment with a flow rate equal to the volume of the water and rebar chambers separately and an air purification filter (protective detoxifying absorption filter based on activated charcoal or other high-efficiency air filter) is provided to purify the outdoor atmospheric air entering the facility. If necessary, suction and blow ventilation shall be designed according to the design of part "HVAC" in compliance with the applicable regulations and the technological assignment.

(4) A water shutter with a height of at least 0.5 m shall be provided for the overflow system of the regulating water pressure equipment.

Section IV.
Pumping stations

Article 195. (1) External and internal doors and windows, openings for overflow and emptying pipes, ventilation system and other construction openings of newly designed and existing pumping stations shall be designed to provide protection against ambient air access under conditions of accidental environmental pollution.

(2) The sealing external and internal doors and windows against access to the ambient air are determined according to the design of part "Architecture" in compliance with the requirements of the applicable regulations and the technological assignment.

(3) The forced blow and suction ventilation system of the pumping stations protected against access of the ambient air shall be designed according to the design of part "HVAC" with a rate of air exchange, calculated on the basis of heat release from the equipment in compliance with the requirements of the applicable regulations and of the technological assignment.

(4) Air purification filters (protective detoxifying absorption filters based on activated charcoal or other high-efficiency air filters) for purification of the outdoor atmospheric air entering the facility shall be provided at the openings for outdoor air entering the facility according to the design of part "HVAC" in compliance with the requirements of the applicable regulations and of the technological assignment.

Article 196. All pumping stations to the water supply systems designed for operation under conditions of accidental pollution of the environment shall be provided with double power supply from two independent sources of electricity, one of which may be a diesel unit according to the design of part "Electrical" in compliance with the requirements of the current regulations and of the technological assignment.

Section V
Treatment plants

Article 197. (1) Only drinking water treatment plants (DWTPs) to water supply systems with water abstraction from surface water sources and unprovided with additional independent groundwater sources with a minimum water quantity in accordance with the requirements of Article 189 of this Chapter shall be designed for operation under conditions of accidental pollution of the environment.

(3) In the technological premises of the treatment plant, for which staff is required, measures shall be provided to protect against the access of ambient air to them by:

1. sealing doors and windows;

2. ventilation system where the air flow passes through an air purification filter (protective detoxifying absorption filter based on activated charcoal or other high-efficiency air filter) to purify the outdoor atmospheric air entering the facility;

3. appropriately sealed containers (gallons) for drinking water for the purpose of covering the drinking needs of staff within the specified duration of the possible contamination according to the data referred to in Article 188(2).

(4) The sealing external and internal doors and windows for protection against access to outdoor air in the technological rooms are determined according to the design part "Architecture" in compliance with the requirements of the applicable regulations and of the technological assessment.

(5) The forced blow-suction ventilation system of the rooms (dacilities) protected against access of the ambient air shall be designed in the "HVAC" part depending on the temperature, air exchange and relative humidity of the air under the technological assignment. Outdoor air intake holes shall be designed with an air purifying filter (protective detoxifying absorption filter based on activated charcoal or other high-efficiency air filter) to purify the outdoor atmospheric air entering the facility.

(6) Process waste water shall be treated in accordance with the requirements of this Ordinance.

(7) Sludges from the drinking water treatment plant designed to operate under the conditions of accidental pollution of the environment shall be collected at predefined sites on the site in accordance with the requirements of the waste management regulations.

Article 198. (1) The technology for water treatment in the treatment plants, which will operate under the conditions of accidental environmental pollution and the requirements of Article 89, provides for:

1. increasing the doses of the reagents used, as well as the time for their contact with the treated water according to the determined non-compliance of the concentrations of accidental pollutants in accordance with the data referred to in Article 188(2) in relation to the water characteristic values in the water abstraction facilities and in accordance with the manufacturer"s instructions.
2. the possibility to include additional dosing devices for the delivery of increased quantities of reagent solutions at the influx point into purified water in accordance with paragraph 1, including chlorination plants.
3. the possibility of replacing traditional inert filtration materials with filtering materials that have better sorption properties according to the standards set out in Annex 3 to this Ordinance and good practice in this area, with a view to selectively sorbing contaminants.
4. areas for the reagents referred to in item 1 and filter materials referred to in item 3 as a reserve for the duration of operation of DWTPs in conditions of accidental pollution of the environment according to the data referred to in Article 88(2) and in addition to the designated areas of the reagent and filter materials warehouses for operation of DWTPs under normal conditions.

(2) For the operation of DWTP under conditions of accidental pollution of the environment, an increase in the consumption of electricity for the operation of additional dosing and other devices, provided by power supply from two independent sources of electricity under the design part "Electrical", is envisaged in compliance with the requirements of the current regulations and of the technological assignment.

(3) The technical measures referred to in paragraph 1 shall be determined by the investment project of the treatment plant and the instructions for the technical operation of the plant shall also include technological instructions for operation under conditions of accidental pollution of the environment.

(4) Drinking water containing residues of reagents used in accordance with paragraph 1 above the maximum permitted levels in accordance with Ordinance No 9 of 2001 shall not be allowed at the outlet of the treatment plant and at the tap of the user.

Article 199. In cases where existing DWTPs do not provide for measures to operate under the conditions of accidental pollution of the environment, the possibility of emergency connection of specialised mobile treatment plants providing the amount of treated water referred to in Article 189 shall be provided.

C h a p t e r E i g h t

SITES, FACILITIES, CONSTRUCTIONS AND INSTALLATIONS. AUTOMATION AND MANAGEMENT OF WATER SUPPLY SYSTEMS

Section I

Sites

Article 200. The sites of treatment plants and the facilities of the water supply systems shall be designed in compliance with:

1. the rules and norms for the different types of territories and development areas;

2. the requirements for the design of sanitary and security zones and hygiene requirements for health protection of the urban environment;

3. the requirements of water treatment technology (for treatment plants);

4. geological, hydrogeological conditions, etc.

Article 201. (1) The sites referred to in Article 200 shall, if possible, be constructed on:

1. uncultivated and poorly productive terrains, where available;

2. terrains with a slope ensuring the gravitational movement of treated water and the gravitational drainage of waste and surface water;

3. unfloodable terrains.

(2) The sites of the treatment plants and the facilities of the water supply systems shall be improved, illuminated and surrounded in compliance with the sanitary and hygienic requirements and the requirements for safe and healthy working conditions during operation. Auxiliary and/or service buildings shall be designed, if necessary, to individual facilities in accordance with the safety requirements.

Section II

Facilities and structures

Article 202. The facilities of the water supply systems shall be so arranged as to ensure:

1. possibility of expansion and stage-by-stage construction;
2. minimum length of technical conduits (channels, drain siphones, plumbing, air ducts, etc.);
3. access of means of transport and mechanisation for repair and servicing;
4. minimal head loss in accordance with the natural slope of the terrain.

Article 203. In order to increase the operational safety of water supply systems in seismic areas with a coefficient of seismicity Ks > 0,15 (reference acceleration – agR > 0.15), the following events are foreseen:

1. tanks are located in opposite sections of the water supply network;
2. the construction of water towers is not allowed;
3. tanks shall be located away from the water supplied site, outside the fault areas according to microseismic zoning;
4. hydrophore systems are designed for sites with water consumption up to 100 m^3/h;
5. water supply systems shall be designed with low pressure;
6. in the case of pipelines that pass through walls and foundations of buildings, the holes are made 10-20 cm larger than their diameter, and the space around them is filled with watertight elastic materials;
7. in the case of pipelines that pass through the walls of tanks and other equipment, gaskets are installed.

Article 204. Contact of the surrounding and supporting structures of the treatment plant with the walls of the built-in tanks and other facilities shall be allowed after technical and economic justification.

Article 205. The underground facilities are connected to the above ground parts and the exit of the building with open staircases secured by railings.

Article 206. In order to ensure fire safety in buildings and facilities, elements of water supply systems, the fire safety rules and standards shall be complied with.

Article 207. Chlorinator stations to treatment plants and warehouses for chlorine and other reagents representing dangerous substances shall be designed taking into account the necessary spare volumes for the automatic transfer of these substances from the damaged containers.

Article 208. Open tanks with a wall height of less than 0.70 cm above ground level shall be secured by a railing of 0.9 m high.

Article 209. The designs under the "Constructive" part are developed on the basis of a technological assignment in compliance with the requirements of the normative acts for the design of building structures in relation to the envisaged facilities.

Article 210. For the passage of the water pipes through expansion joints are provided compensators that provide the necessary elasticity of the connection.

Section III

Installations Automation and control

Article 211. The designs under part "Electrical (power supply, electrical equipment and electrical installations)" shall be developed on the basis of a technological assignment and in compliance with the requirements of the relevant regulations for electrical installations and power lines.

Article 212. Technological monitoring of water supply systems and equipment shall be provided by means and instruments for continuous and periodic monitoring.

Article 213. The systems for management of the technological processes, the degree and volume of automation are determined according to the requirements of the assignment for the development of the investment project and according to the conditions for technical operation.

Article 214. The designs under part "Heat Supply, Heating, Ventilation and Air Conditioning" shall be developed on the basis of terms of reference and in compliance with the requirements of the relevant regulations.

Part Three

CONSTRUCTION, COMMISSIONING AND TECHNICAL OPERATION OF WATER SUPPLY SYSTEMS

C h a p t e r n i n e

GENERAL PROVISIONS

Article 215. (1) Water supply systems shall be constructed and put into operation in stages or fully in accordance with the construction documents issued under the terms and procedure of the SDA and in compliance with the rules and standards of this Ordinance.

(2) Water supply systems shall be constructed in compliance with the requirements of Ordinance No 2 of 2004 on the minimum requirements for health and safety at work in the

performance of construction and installation works (promulgated in SG, Issue 37 of 2004) and the specific requirements set out in the safety and health plan.

(3) In the construction of the buildings and facilities of the water supply systems, in addition to the requirements of this Ordinance, the requirements of the normative acts, which define the rules for the implementation of construction works and the adoption of the relevant types of building structures, shall be complied with.

(4) The finishing works and insulations of the main and auxiliary buildings and facilities shall be carried out in accordance with the requirements of moisture resistance and corrosion resistance.

Article 216. (1) Before starting the construction of the elements of the water supply systems, incoming control of the construction products, devices and facilities provided for by the project, verification of the documents for attesting compliance with the basic requirements for construction works, and technical documentation shall be carried out.

(2) Construction products with technological defects, cracks and deviations from the permissible values specified in their technical specifications shall not be used.

Article 217. Upon acceptance of the completed construction works of the elements of the water supply systems, the necessary examinations and tests are carried out to verify their conformity with the issued construction papers and the rules for the implementation of the construction works, drawing up the necessary acts and protocols in accordance with Ordinance No 3 of 2003 on drawing up acts and protocols during construction (promulgated, SG, Isuue 72/2003).

Article 218. The authorisation of the use of water supply systems and the determination of the warranty periods for completed construction works, facilities and construction sites for the removal of hidden defects after their adoption and commissioning are carried out under the conditions and in accordance with Ordinance No 2 of 2003 on commissioning of construction works in the Republic of Bulgaria and minimum warranty periods for completed construction and installation works, facilities and construction sites (SG, Issue 72/2003).

Article 219. Technical acts and protocols for acceptance and commissioning shall be drawn up before a separate element of the water supply system is put into trial operation.

Article 220. The elements of the water supply systems shall be disinfected before they are put into operation.

Article 221. (1) The parameters of the elements of the water supply system, which are provided in the project, realised at the time of construction and accepted at the time of commissioning, shall be maintained by technical operation in the process of normal operation of the system.

(2) The owner of the water supply system shall designate the persons responsible for the technical operation of its individual elements.

(3) During the technical operation of the water supply system, a system of technical servicing and equipment repair shall be created and the corresponding technical documentation shall be kept.

(4) The technical operation of water supply systems complies with the requirements of Ordinance No 9 of 2004 on ensuring healthy and safe working conditions in operation and maintenance of water supply and sewerage systems (SG Issue. 93 of 2004).

C h a p t e r T e n
CONSTRUCTION, TESTING AND OPERATION OF WATER ABSTRACTION FACILITIES

Section I

Construction of groundwater abstraction facilities

Article 222. (1) The construction of the underground part of groundwater facilities intended for abstraction or artificial recharge of groundwater shall be carried out under the conditions and in accordance with the procedure laid down in Ordinance No 1 of 2007 on the exploration, use and protection of groundwater.

(2) The above-ground part(s) of the groundwater facilities referred to in paragraph 1 shall be constructed in accordance with the issued construction papers, the rules and norms of this Ordinance and the normative acts laying down the rules for the implementation of the construction and installation works of the types of building structures.

Article 223. (1) When constructing the above-ground part of pipe wells shall be provided:

1. the mouth of the pipe well shall be not less than 0.2 m high above the bottom of the shaft;

2. non-infringement of the integrity of the lining pipes and their cementation;

3. insulation to prevent the penetration of surface water into the shaft and around the mouth of the pipe well.

(2) The requirement referred to in paragraph 1(2) shall not apply when the bottom of the shaft is located below the ground. In these cases, after removing the lining pipes located above the intended height of the pipe well, waterproofing of the pipes prior to the construction of the shaft is ensured.

Article 224. When constructing the above-ground part of shaft wells and the shaft for the positioning of the instruments for measuring the abstract water volumes, the following shall be provided:

1. non-infringement of the implemented waterproofing around the concrete rings in the upper part of the well;

2. watertight pavement in accordance with the design requirements.

Article 225. When constructing horizontal drainage, the following requirements are met:

1. in order to prevent the penetration of surface water over the gravel filling of the drainage pipes, waterproofing of tamped clay with a thickness of 20-40 cm, a concrete slab with a thickness of not less than 10 cm or watertight insulation of suitable artificial material shall be constructed;

In case of danger of flooding with surface water, an earth bank over the drainage channel shall be constructed at least 0.5 m above the ground and 5 m apart from the axis of the channel to be grassed;

3. around the inspection shafts shall be constructed watertight pavement according to the design requirements;

4. ventilation shall be provided for all shafts according to the design requirements.

Article 226. The construction of the collection shaft for receiving water from spring catchments shall comply with the following requirements:

1. excavation works begin with the making of the drainage canal;

2. over and at the side of the shaft, waterproofing shall be constructed of compacted clay of 50 cm thick, which is covered with an earth embankment with a suitable slope.

Section II

Construction of surface water abstraction facilities

Article 227. (1) The underground parts of pumping stations and coastal water abstraction wells intended for the collection of water shall be carried out in open excavations, either by descending or by coffers.

(2) Depending on the hydrogeological conditions and the means of implementation defined in the project, open water leading away, artificial lowering of the level of soil water, soil freezing, pile sheathing and artificial strengthening of the soil are applied.

(3) The excavations are formed, levelled and adopted by an act of acceptance of the earth foundation. The act reflects the actual elevations of the excavation works carried out after testing the strength of the soil.

Article 228. In open water leading away, the water from the excavation is continuously pumped to complete and final construction of the underground parts of the facility.

Article 229. (1) The laying of gravitational or siphon-acting pipelines connecting the water receiver to the pumping station or to the shore well shall be determined in accordance with the design and in compliance with the requirements of Chapter Fourteen.

(2) The gravitational or siphon-acting pipelines of the water catchment facilities within the limits of their water part of the water receiver are laid by lowering the pipeline from floating or stationary supports, by free submersion or by deflection walls.

(3) The lowering and strengthening of the pipelines within their water part shall be determined in accordance with the design requirements.

Article 230. The pipeline of a water catching facility for laying in an underwater trench shall be prepared prior to its digging and shall be laid immediately after checking its fitness.

Article 231. Before starting the construction of the base of the river water receiver, the stake axes of the water receivers and the quotation of the temporary benchmarks shall be checked, and if necessary the riverbed shall be cleaned and deepened.

Article 232. (1) After construction of pavement under the water receivers, control diving inspections are carried out by measuring the width, length and transverse slope of the pavement.

(2) The permissible deviation of the constructed pavement from its design the surface is up to 30 mm.

Section III

Testing of water abstraction equipment

Article 233. (1) Testing of water abstraction facilities shall be carried out after completion of all construction works before they are connected to the water supply system.

(2) Testing shall include the pre-operational drawing of the authorised round-the-clock and maximum quantities with the equipment installed for the operation of the facilities. A report shall be drawn up for the test carried out.

Article 234. (1) Where the water abstraction facility is intended for drinking and household water supply of an urbanised area or for independent drinking and household water supply, at the end of the pre-operational drawing, samples shall be taken for chemical, microbiological and radiological analysis of the quality of the water to be supplied into the water supply system.

(2) The analysis of the samples referred to in paragraph 1 shall be carried out as follows:

1. for groundwater abstraction facilities – by microbiological, chemical and radiological indicators defined in Ordinance No 9 of 2001 on the quality of water intended for drinking and household purposes;

2. for surface water abstraction equipment – by chemical and microbiological parameters in accordance with the requirements of Ordinance No 12 of 2002 on the quality requirements for surface water intended for drinking and household water supply and radiological indicators under Ordinance No 9 of 2001 on the quality of water intended for drinking and household purposes.

(3) Analyses shall be carried out or commissioned to accredited laboratories according to BDS EN ISO/IEC 17025 "General requirements for the competence of testing and calibration laboratories" or other equivalent internationally recognised standards.

Section IV

Acceptance, commissioning and technical operation of water abstraction facilities

Article 235. (1) When accepting the water abstraction facilities, their compliance with the issued construction papers shall be checked.

(2) Water abstraction facilities are accepted only after completion of all construction works and after dismantling of temporary protective equipment.

(3) Upon acceptance the following shall be checked:

1. the order book of the construction works;

2. the statement of findings for establishing the suitability of the construction works;

3. the acts and protocols drawn up during the construction;

4. the water tightness of the walls, joints, seams and connections of all parts of the facilities located below the level of groundwater or river water;

5. tightness of piping connections;

6. degree of sealing of the dykes and embankments stages.

Article 236. The documentation for the construction and acceptance of the underground part of a groundwater facility drawn up in accordance with the requirements of Ordinance No 1 of 2007 on the exploration, use and protection of groundwater is an integral part of the construction papers issued for the water abstraction facility.

Article 237. (1) During the technical operation of the water abstraction facilities, a logbook shall be kept, recording any changes occurring in the operation process, as well as the need for ongoing or major repairs.

(2) During technical operation, periodic and/or continuous measurements of water flow and quality shall be carried out, and in case of deviations, sanitary and technical measures shall be carried out depending on the type of water source and the pollutants identified.

(3) In case of unacceptable deviations, the water abstraction facility shall be excluded from operation.

Chapter eleven

CONSTRUCTION, TESTING AND COMMISSIONING OF NATURAL WATER TREATMENT PLANTS

Article 238. The main and auxiliary facilities and pipelines, the auxiliary and service buildings on the site of the drinking water treatment plant shall be constructed in accordance with the issued construction papers, the rules and norms of this Ordinance and the normative acts laying down the rules for the implementation of the construction works of the types of building structures.

(2) Facilities and sewer collectors for the discharge of domestic or process waste water shall be constructed in accordance with the issued construction papers, the rules and norms of Ordinance No RD-02-20-8 of 2013 on the design, construction and operation of sewerage systems, as well as the normative acts laying down the rules for the implementation of construction works for the types of building structures.

Article 239. (1) Prior to the commissioning of drinking water treatment plants, hydraulic testing of the facilities shall be carried out after completion of all construction works and upon reaching the design strength of the concrete (for concrete facilities). Separate equipment, sections of pipelines, ducts, etc. shall be subjected to hydraulic testing in accordance with the requirements of the technical instructions of the commissioning project. Prior to the start of the test, the main and auxiliary facilities, pipelines and ducts constructed shall be cleaned from construction waste.

(2) Unless otherwise justified in the design, the following tests shall be carried out:

1. hydraulic testing of volumetric water-containing equipment to demonstrate water tightness in accordance with Section III of Chapter Fourteen;

2. hydraulic testing of piping and adjoining fittings to demonstrate strength and water tightness in accordance with Section IV of Chapter Thirteen;

3. hydraulic testing of pumping stations according to the order of Chapter Twelfth;

4. hydraulic testing of sewer collectors and associated facilities in accordance with the requirements of Ordinance No RD-02-20-8 of 2013 on the design, construction and operation of sewerage systems;

(3) For facilities the operation of which is connected with water of non-drinking properties, the tests referred to in paragraph 2(1) may be carried out with natural water from the nearest suitable water source.

(4) The facilities shall be backfilled after successful tests.

(5) Filtration losses shall not be allowed during the testing of tanks intended for the storage of aggressive liquids and chemical reagents.

(6) When testing open facilities, the loss of water from vapours from the exposed water surface shall be additionally accounted for.

(7) The test of the filter drainage systems for strength and water tightness shall be carried out according to the manufacturer”s requirements. The test of the filter drainage systems shall be carried out before the test referred to in paragraph 2, item 1.

(8) In the case of high levels of groundwater, measures shall be envisaged to lower them in the area of the facility or to protect against comming off by weighting.

(9) In the presence of aggressive and corrosively active groundwater, measures are envisaged to protect the steel and concrete parts of installations falling below groundwater level.

Article 240. (1) Pressure filter housings shall be tested for strength and water tightness before filling them with filtration materials.

(2) When filling the filter with water, the air from it is completely removed.

(3) The test pressure of the filter housing for strength shall be taken equal to the operating pressure increased by a factor of 1.5.

(4) The test of housing for strength is carried out successfully if leakages and destruction are not detected at the test pressure for 10 minutes.

(5) The test pressure of the pressure filter housing shall be taken equal to the operating pressure increased by 0.5 MPa. The test was performed successfully if no leakages were detected for 24 hours and the pressure did not drop by more than 0.05 MPa.

Article 241. (1) After successful testing of the filtration drainage system referred to in Article 239(7) and of the housing of the pressureless filters referred to in Article 239(2)(1) or the housing of the pressure filters referred to in Article 240, they shall be filled with filter material. After backfilling the filter material, its horizontality is checked.

(2) After the check referred to in paragraph 1 has been carried out, an intense test wash of the filter shall be carried out in accordance with the design requirements.

Article 242. (1) Upon acceptance of the natural water treatment plant, a comprehensive assessment of its implementation in accordance with the requirements of the issued construction papers and the readiness for its introduction into technical operation shall be carried out.

(2) Upon acceptance of the natural water treatment plant, the following shall be checked:

1. the order book of the construction works;

2. the statement of findings for establishing the suitability of the construction works;

3. the master plan of the site with underground technical conduits drawn;

4. the acts and protocols drawn up during the construction;

5. compliance with the issued construction papers of the facilities, buildings, equipment, pipelines, electrical, heating and ventilation installations, measuring instruments and automation;

6. the horizontality of the edges of the walls of the jet-deflecting partitions and of other parts of the facilities through which the water overflows during their operation;

7. the correct placement of the elements through which the water enters the parallel working facilities, as well as the elements for the entry of the water into the individual facilities;

8. the documents for certified conformity of all incorporated products with the essential requirements for them.

Article 243. (1) Upon acceptance of the natural water treatment plant to synchronise the operation of the treatment facilities, a 72-hour test of hydraulic conductivity shall be carried out under operating conditions, for which a protocol shall be drawn up.

(2) After a successful 72-hour test, the facilities and pipelines are disinfected with biocidal products of product type 4 pursuant to Regulation (EU) No 528/2012 of the European Parliament and of the Council of 22 May 2012 concerning the making available on the market and use of biocidal products (OJ L 167, 2012) with a concentration and contact time according to the manufacturer”s instructions, but not less than 6 h.

(3) In the case of major repairs and reconstructions of individual equipment and plumbing, unless otherwise specified in the design, washing and disinfection shall be carried out in accordance with Annex 14.

(3) The purification effect shall be demonstrated after at least 48 hours of trial operation of the treatment plant by taking samples for analysis of the quality of the treated water in the presence of a representative of the health control authorities. A protocol shall be drawn up for the results of the water analysis.

Article 244. (1) During the technical operation of the treatment plant, the necessary documented and operational system shall be organised for the control of the technical condition and for the repair and maintenance of all its parts.

(2) The status of the replacement chlorinators shall be checked periodically or a mode of operation with alternating the available chlorinators shall be applied.

C h a p t e r T w e l v e

CONSTRUCTION, TESTING AND COMMISSIONING OF PUMPING STATIONS

Article 245. Pumping stations shall be constructed in accordance with the issued construction papers, the rules and norms of the ordinance and normative acts for the rules for the implementation of the types of building structures.

Article 246. (1) When accepting the pumping station, the following shall be checked:

1. statement of findings for establishing the suitability of the construction;
2. order book of the construction;
3. master plan of the site with the underground technical conduits drawn;
4. approved investment project for individual buildings and facilities, equipment, pipelines, electricity supply, heating, ventilation and automation;
5. acts and protocols drawn up during construction works;
6. test reports for fittings and piping;
7. compliance with the design of installed pipelines, pumping units, fittings, measuring instruments and automation;
8. characteristics and parameters of installed operating and replacement pump units, measuring instruments and automation and of lifting and transport equipment for their conformity with the design;
9. compliance with the design of shock absorbers, heating, ventilation and lighting of the machine room;
10. documents certifying compliance of all incorporated products with their essential requirements.

(2) Each pump shall be tested at full load (if necessary by a test deviation connected to the pump supply side) showing the pressure and flow rate values indicated in the marking, taking into account the pressure losses in the supply pipe and the fittings between the source and the measuring device.

(3) The pipe system in pumping station buildings shall be tested in accordance with the requirements for testing and putting into service of water pipes.

(4) The pumping station shall be accepted in operation after a 72-hour test has been carried out under operating conditions, if its operation complies with the design requirements for which a report is drawn up.

Article 247. For the normal technical operation of the pumping station, a documented system for technical service and repair shall be organised.

Chapter thirteen

LAYING, INSTALLATION, TESTING, ACCEPTANCE AND COMMISSIONING OF PLUMBING

Section I

General requirements

Article 248. The pipes are laid and installed in accordance with the issued construction papers, the rules and norms of this Ordinance and the manufacturer`s instructions for laying, installation and testing of pipes.

Article 249. Pipe parts shall be transported and stored in accordance with the manufacturer`s instructions so as to avoid interactions with dangerous substances, contamination and damage.

Section II

Laying and mounting in trenches

Article 250. When performing excavation works for pipe laying, the normative requirements for distances from foundations, underground facilities and technical conduits shall be complied with and the necessary measures shall be taken against any damage to them.

Article 251. (1) When determining the dimensions of the trench for laying pipes and its shaping, as well as when determining the height of backfilling, the design requirements shall be complied with. In the case of laying water pipes in trenches, the minimum width of the trenches shall comply with the requirements of Annex 15. All deviations from the design plan shall be agreed with the designer.

(2) Before the laying of pipes, the depth, slopes, width and condition of the bottom of the trench shall be verified.

Article 252. (1) The base of the trench shall be shaped in such a way as to allow for the unhindered laying of pipes along its entire length. If necessary, indentations shall be made for the pipe connectors.

(2) When the bottom of the trench is appropriate and can serve as the base of the pipes, it shall be formed in accordance with the longitudinal profile of the pipeline and, if necessary, compacted.

(3) When the bottom of the trench is not suitable for the base of the pipes (consisting of stones, rocks, unstable or loess soils), the trench shall be excavated at greater depth depending on the material of the pipes and their external protection. Removed excess soil is replaced by suitable according to the design, which is formed in accordance with the longitudinal profile of the pipeline and compacted.

(4) Where the bases for laying pipes are unstable or loess soils, special measures shall be taken in accordance with the design and subject to the requirements of Chapter Sixteenth.

(5) In the case of laying in trenches of pipelines below groundwater level, if necessary, measures shall be taken to lower the level of groundwater (by means of additional drainage or other measures) or the pipelines shall be weighted to prevent the possibility of coming off to the surface or deformation.

(6) In the presence of sections of the water pipes and facilities below the level of corrosively active and aggressive groundwater, measures shall be taken to protect the pipelines and concrete of the facilities from the aggressive effects of groundwater.

Article 253. The pipes shall pass through the walls of the equipment in an appropriate manner so as to ensure that the equipment is watertight and to prevent unacceptable loads on the pipes or facilities.

Article 254. (1) Pipes, access fittings and fittings shall be connected in such a way that the pipeline is watertight and withstands the working loads.

(2) Support blocks shall be constructed in such a way that the pipe connection, if possible, remains free.

(3) Pipes shall be welded by qualified personnel using welding equipment and methods approved by the manufacturer of the corresponding types of pipes and access fittings.

(4) When connecting pipes, lubricants intended for contact with drinking water shall be used
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Article 255. (1) Damaged insulation coatings on pipes and access fittings shall be restored and applied in places where the coating has been damaged, according to the designer"s instructions and in accordance with the technical specification of the pipes.

(2) When pipes are plastic coated, measures shall be taken to protect them from contact with sharp stones or other solid formations in the trench, as well as to prevent prolonged thermal effects of thermal conduits and contact with dangerous substances.

Article 256. (1) Where testing of external anti-corrosion coatings is envisaged or where the water pipes are metal with an electrical insulation coating and cathodic protection is provided for them, the coating shall be tested with an electrical control equipment.

(2) The test voltage shall be determined in the design depending on the type and thickness of the coating.

(3) Any defects found shall be rectified in accordance with the requirements of the technical specification of the pipes and the reconstructed area shall be retested.

(4) A report shall be drawn up for the test results.

Article 257. (1) Damages on the inner coating or of the lining of pipes and access fittings shall be restored in accordance with the manufacturer"s instructions.

(2) The inner coating or lining of pipes and access fittings shall be executed in such a way as to meet the safety requirements of products (materials) which are in contact with water intended for drinking and household purposes.

Article 258. Plumbing shafts are built in compliance with the requirements of the design.

Article 259. When constructing plumbing under elements of the transport technical infrastructure, the necessary resistance against the collapse of the facilities shall be ensured.

Article 260. (1) Before the laying of pipelines through a water obstacle, control measurements of the depth of the bottom shall be carried out and the correlation between the actual and the design elevations on the design route of the underwater trench shall be established.

(2) In case of significant deviations between the actual and design elevations at the bottom of the water obstacle and in case of insufficient protective soil, the requirements of the project regarding the height of the protective layer shall be complied with.

Article 261. (1) Drain siphons through rivers and gullies are built during the lowest water levels.

(2) Drain siphons are loaded with additional loads connected to the pipes to prevent them from coming on the surface.

Article 262. (1) The pipes shall be covered by backfilling with layers of suitable materials: the lower part of the base, the upper part of the base, the lateral backfill and the initial backfill in accordance with Annex 11.

(2) The quality and degree of compaction of the material for backfilling the pipes shall be determined according to the design depending on the location of the pipeline (green area, roadway, industrial site, etc.).

(3) For the needs of the technical operation of the plumbing, means of tracing and marking for the purpose of tracking and/or detection shall be provided.

(4) After the main backfilling and before the final restoration of the upper surface of the excavation, in which the plumbing is laid, warning strips are placed to mark and protect the plumbing.

Section III

Trenchless laying

Article 263. Before the trenchless laying of a pipeline:

1. determine the location of the existing underground networks and facilities of the technical infrastructure along the design route of the water pipe being laid;

2. the following technical characteristics of the pipes shall be taken into account:

a) internal and external diameters;

b) length;

c) permissible operational loads;

d) the type and execution of the pipeline connections;

e) permissible curve radius or angle deviation of the pipeline connectors;

3. the necessary geological surveys shall be carried out for the type and parameters of the earth layers along the design route of the water pipe, by choosing an appropriate method for its laying and unhindered implementation.

Article 264. (1) The main and intermediate shafts for trenchless pipe laying shall be designed and constructed in such a way as to withstand static and dynamic loads during the laying process.

(2) The location of the main shafts shall take into account the places of connection with an existing plumbing and/or change of the pipeline route.

(3) The location of the intermediate shafts/openings shall take into account the places of connection with existing plumbing and/or change of route, as well as the capabilities of the chosen technology for maximum length of the penetration without an intermediate shaft.**Article 265.** (1) Methods that do not lead to loss of ground layers and deviations from the design route of the pipeline shall be provided for the trenchless laying of the pipeline.

(2) The following shall be taken into account when determining the method of trenchless laying:

1. the required accuracy of laying;
2. location of adjacent technical conduits and facilities of the technical infrastructure;
3. the outer diameter, material and strength characteristics of the pipes for laying;
4. length of laying;
5. earth conditions;
6. the presence of groundwater;
7. minimum ground cover of the pipeline.

Article 266. (1) During the construction of the pipeline, if applicable, the direction, length and depth of laying, as well as management adjustments (in manageable methods) shall be recorded and documented.

(2) The maximum recording interval for manageable horizontal drilling is 1.0 m and in the case of other methods — one record per a pipe.

Article 267. In the case where laying is guided by a laser or other optical system, it shall be mounted in such a way that it is not affected by the movements caused by the laying.

Article 268. (1) The maximum permissible deviations from the direction and depth of laying shall be determined in the project for trenchless laying according to the requirements for operation and maintenance, the slope of the pipeline, the possibilities of the laying method, the underground networks and facilities of the technical infrastructure and geological conditions.

(2) Deviations from the pipeline design route in the case of trenchless laying shall be noted during the laying process. The design permissible values shall not be exceeded.

Section IV

Testing

Article 269. (1) The plumbing shall be subjected to a hydraulic test to demonstrate the strength and water tightness after a detailed examination to establish the conformity of the plumbing performance, the connections and the reinforcements carried out with the issued construction papers.

(2) Trenchless positioned plumbing shall be tested before the main and intermediate shafts are backfilled.

(3) The tests shall be carried out before the installation of fittings (hydrants, control valves, etc.). Dead flanges are put in the places of the fittings. The shut-off valves of the water pipe shall be

open during the test. Their use in the closed position as a boundary of a section is allowed only if the nominal pressure of the shut-off valve is greater than the test pressure.

(4) Exposed sections of the water pipe must be protected from direct solar radiation by covering.

(5) In the case of plastic piping, care shall be taken to ensure that the temperature of the outer wall of the pipe does not exceed 20 °C during all test stages.

Article 270. (1) The plumbing is tested completely or section by section.

(2) During the test of the plumbing, measures shall be taken to supply and release the required water quantity without any difficulty.

Article 271. (1) Before testing the pipeline, verification of compliance with the requirements of the regulations for safety and health at work shall be carried out.

(2) Works, which are not directly related to the test of the piping, shall be prohibited in the excavations.

Article 272. (1) The dead flanges and other temporary fitting parts of the pipeline shall be strengthened before the test.

(2) It is not allowed to remove the temporarily installed supports and reinforcements at the edges of the test section before the final pressure drop after the test.

Article 273. (1) Before pressure tests, testing devices shall be checked with regard to their calibration, suitability for operation and compatibility with plumbing.

(2) Before testing, all kinds of waste and foreign objects from the water pipe must be removed.

(3) Before pressure tests, deviations shall be placed at the points of possible air collection with shut-off valves or other devices for the same purpose.

(4) The pipeline is slowly filled with water with open air exhaust devices. It is recommended that the water supply, with which the plumbing is filled, be less than 10 % of the dimensioning water quantity.

(5) The piping shall be tested at pressure with closed ventilating devices and open intermediate fittings of the test section.

(6) The design sequence shall be followed during all test stages.

(7) After the test, the pressure in the pipeline shall be reduced slowly to atmospheric pressure and the pipeline shall be emptied when air exhaust devices are opened.

(8) Drinking water shall be used when testing the pipeline, unless otherwise specified in the design.

Article 274. (1) The duration of the preliminary test shall be determined according to the design requirements.

(2) The test pressure is according to the design requirements.

(3) In the event of unacceptable changes in the condition of the bed in a part of the pipeline and/or leakage, the preliminary test shall be terminated, the pressure in the test section shall be equalised with the atmospheric pressure and the defects shall be removed.

(4) The preliminary test has been carried out successfully if there are no visible defects or signs of water permeability.

Article 275. (1) The underwater piping shall be subjected to a preliminary test in two stages:

1. on the berm of the excavation – after welding the pipes;
2. at the bottom of the trench – after checking for proper laying in the trench and before backfilling.

(2) Preliminary testing of pipelines when they pass under transport infrastructure elements shall be carried out after laying the pipeline in a housing or in a collector tunnel before filling them to the design elevation and backfilling the working and reception excavations.

Article 276. The pipeline shall be tested to a pressure drop, if required by the design.

Article 277. (1) The main test of the pipeline shall not be permitted prior to its preliminary test.

(2) The method for conducting the main pipeline test shall be determined according to the design requirements.

(3) In case that water losses exceed the specified values or defects are detected, the test section shall be checked, the defects shall be rectified and the test repeated until the losses fall below the specified values.

Article 278. In cases where the pipeline is divided into test sections and the test results of all sections are within the limit values, the whole system shall be subjected to a final test under pressure equal to the operating pressure for not less than 2 hours, unless otherwise prescribed.

Article 279. A report shall be drawn up for the test results.

Section V

Acceptance and commissioning

Article 280. When receiving a plumbing, the following shall be checked:

1. statement of findings for establishing the suitability of the construction;
2. order book of the construction;
3. acts and protocols drawn up during the construction;
4. the pipeline, compensators, shafts and all items available for inspection;

5. elevations of the longitudinal profile of the pipeline;

6. all fittings, including hydrants, for their proper functioning and compliance with the issued building papers;

7. reports of the pipeline tests carried out;

8. reports of laboratory samples;

9. document from the Geodesy, Cartography and Cadastre Agency for a geodetically surveyed and drawn conduit in the underground cadastre or a document from the municipal administration for data provided in the form and volume necessary to note the water pipe in the cadastral plan;

10. documents certifying compliance of all incorporated products with their essential requirements;

11. plumbing data (instructions for operation, maintenance and servicing of individual parts of the system, measures against freezing, corrosion, contamination or prevention of water stagnation in pipelines with low hydraulic conductivity, etc.).

Article 281. (1) New plumbing, as well as plumbing after overhaul, modification or reconstruction is washed and disinfected before commissioning.

(2) Water used for washing and disinfection should be of drinking water quality.

Article 282. (1) Disinfected plumbing or facility must be isolated from the operating parts of the plumbing system.

(2) In the case of laying of short plumbing and building deviations with DN < 80mm and with a length of not more than 100 m, it shall be permitted not to comply with the requirement under paragraph 1 to separate the water pipes unless otherwise prescribed by the designer. In these cases, water from the disinfected section into the operating water supply network is not allowed.

(3) The choice of disinfectant is made according to the required contact time and according to the qualities of the water, and in case of use of calcium hypochlorite, the hardness of the water shall be taken into account. The type of disinfectant is defined in the project. Recommended disinfectants and neutralising reagents are specified in BDS EN 805.

(4) Where there are no additional stricter requirements in the design, disinfection shall be carried out in accordance with Annex 14. In cases where chlorine-based biocidal products are used for disinfection, the percentage of active chlorine in the product, the volume of the chlorinated section of the pipeline and the accepted concentration (dose) of active chlorine shall be taken into account in the determination of the required quantity of biocidal product.

(5) The type of disinfectant and the way of disinfection of the plumbing system are determined by the project.

Article 283. (1) When flushing the water pipes, the method of flushing (without and with air), the rate and the minimum washing time shall comply with the design requirements. Where there are no detailed instructions, washing shall be carried out in accordance with Annex 14.

(2) Unless otherwise specified in the project, the flushing with drinking water of water pipes without the addition of disinfectants shall be carried out by creating a minimum flow rate in the pipes of 0.9 m/s. The volume of water to be used for washing is at least 3 times the volume of the pipe.

(3) For elements of the water supply system in operation, as well as newly built at the discretion of the designer, air can be used to increase the cleaning effect by injecting air during flushing with drinking water.

(4) When emptying the pipes into the sewer system, measures shall be taken to exclude the possibility of pre-washing products (dirty water and dirt) to be sucked back into the pipe.

Article 284. (1) The method of disinfection of the elements of the water supply system, as well as the need for neutralisation of the waste disinfection solution is determined in the project. Where there are no detailed instructions, disinfection shall be carried out in accordance with Annex 14.

(2) The following methods of disinfection are permitted:

1. static way of using drinking water with the addition of disinfectant;

2. dynamic way with drinking water and with the addition of disinfectant.

(3) When the static method with the use of drinking water and addition of disinfectant is used, the disinfectant fully fills the facility or pipe section.

(4) When the static method of disinfection of plumbing networks with the use of drinking water and addition of disinfectant is used, disinfection is carried out by delivering the disinfectant in a pipeline filled with drinking water.

Article 285. (1) Depending on the contact time of the disinfectant, the section after disinfection shall be washed so that the residual disinfectant content in the water does not exceed the required water quality values. If necessary, a corresponding neutralising reagent shall be used.

(2) After disinfection and washing, the water supply is filled with drinking water, and samples are taken for microbiological and chemical analysis.

(3) Analyses shall be carried out or commissioned to accredited laboratories according to BDS EN ISO/IEC 17025 "General requirements for the competence of testing and calibration laboratories" or other equivalent internationally recognised standards.

(4) Where the results of the analyses referred to in paragraph 2 meet the water quality requirements, the section of the pipeline shall be connected in due time to the water supply system to prevent its secondary pollution.

(5) In the case of short sections of water pipe, repair work and building deviations with diameters of less than 80 mm, no samples shall be taken for water analysis unless otherwise prescribed.

Article 286. (1) For the conducted washings and disinfections of the water pipes, statement of findings are drawn up.

(2) For the results of chemical and microbiological analyses of water, protocols shall be applied.

Article 287. (1) The place and the way of discharge of the spent water from the disinfection and washing of the water pipes shall be determined in the project and in accordance with the requirements of the normative acts for environmental protection.

(2) Where there are no detailed instructions, the discharge of the waste water from disinfection and washing shall be carried out in accordance with Annex 14.

Article 288. For the normal technical operation of the water pipe, a documented system for its technical servicing and repair shall be organised depending on the specific local conditions, the category of water supply, the loss of water, the quality of the water, the pressure and the provision of the required water quantity, the road loads, the laying conditions, the type of soil and the material from which the pipes are made.

Chapter Fourteen

CONSTRUCTION, TEST, ACCEPTANCE AND COMMISSIONING OF TANKS

Section I

Construction

Article 289. The tanks are built in accordance with the construction papers, the rules and norms of the ordinance and the normative acts for the implementation of the types of building structures.

Article 290. (1) When drainage is envisaged at the bottom of the tank, the drainage excavations are carried out simultaneously with the excavations of the foundations, the drainage being arranged immediately before the concreting of the foundations and the bottom.

(2) In the presence of groundwater in the excavation for laying the foundations and the bottom of the tank, the water level is lowered by water abstraction for 24 hours after the completion of concrete works.

(3) In the presence of aggressive and corrosively active groundwater, measures are envisaged to protect the steel and concrete parts of the tank located below the level of groundwater.

Article 291. All the slopes of the bottom to the emptying shafts and the level of the foundations are formed when the concrete is laid, before the screeds are executed.

Article 292. The walls of the tank are built before the concrete on the bottom is cured.

Article 293. When concreting the roof reinforced concrete slabs above the water and dry chambers of the tanks, slopes are provided for surface water drainage.

Article 294. In the case of structures of prefabricated elements, suitable seals are used in the implementation of the expansion joints and in the passage of pipes and canals through structural elements.

Article 295. The connection components and fittings of the pipelines are carried out watertight and accessible for installation, disassembly and servicing.

Article 296. (1) It is not allowed to concrete the pipelines in the walls of the dry chamber.

(2) Pipes and fittings, which pass through the separation wall between the water and the rebar chamber, after cleaning are concreted tightly when the concrete is laid.

Article 297. Thermal insulations shall be carried out according to the requirements of the design and the relevant technical specifications.

Article 298. (1) The pipelines of the water towers are executed by compensating connections.

(2) The water abstraction fittings of the water towers are thermally insulated.

Article 299. The metal parts of the tank are painted after cleaning and drying and after the execution of the screeds.

Article 300. (1) The tanks shall be backfilled after testing.

(2) A protective canal is built around the tanks to divert surface water.

Section II

Testing

Article 301. (1) All water-containing equipment shall be tested to water tightness after completion of all construction works and upon reaching the design strength of the concrete (in the case of reinforced concrete tanks).

(2) Prior to the test, a detailed examination of the tank"s readiness for testing (presence of structural defects and design deviations) shall be carried out for which a statement of findings shall be drawn up.

(3) Water intended for drinking and household purposes shall be used in the test to water tightness.

Article 302. (1) Each water chamber is tested to to water tightness.

(2) The test referred to in paragraph 1 shall include a water tightness test for the roof, walls and bottoms of the tank.

Article 303. (1) The method of conducting the tank roof water tightness test shall be determined in accordance with the design requirements.

(2) The test referred to in paragraph 1 has been carried out successfully if there are no visible leakages on the underside of the roof.

Article 304. (1) Before the water tightness test of the walls and bottoms of the water chambers of the tank, all process shutters shall be closed in such a way that water is not permeated through them.

(2) All fittings and openings shall be closed, and the outer surfaces of the walls shall be left open for free access and inspection.

Article 305. The water chambers of the tank are filled with water in two stages:

1. partial filling with water at a height of up to 1 m for one day to check the water tightness of the bottom;

2. filling to the design elevation.

Article 306. (1) The walls of the tank water chambers shall be tested to water tightness for at least five days after being filled with water to the design elevation.

(2) Before starting the control to determine filtration losses, it is necessary not to increase the amount of daily water decrease.

(3) The test was performed successfully, if the 24-hour water loss does not exceed 3 l/m^2 wetted surface of the walls and bottom, there is no stream of water occurs through the walls, no leaks through the joints and the base is not moistened.

(4) During the test, only darkening or slight sweating shall be allowed in separate locations of the outer walls.

Article 307. (1) The test has not been carried out successfully in the presence of splashes of water on the walls or when the soil at the base of the tank is moistened, even if water losses do not exceed the limit values. In this case, the places to be repaired are specified. After the defects have been rectified, the test shall be performed again.

(2) Reports shall be drawn up for the results of the tests carried out.

Section III

Acceptance and commissioning

Article 308. When accepting a tank, check the following:

1. order book of the construction;
2. statement of findings for establishing the suitability of the construction;
3. acts and protocols drawn up during construction works;
4. piping systems, seals, water chambers and all items available for inspection for their conformity with the construction papers;
5. all fittings for their proper functioning;
6. test reports;
7. documents certifying compliance of all incorporated products with their essential requirements.

Article 309. Before commissioning, the tank is cleaned, washed and disinfected.

Article 310. All internal surfaces of the tank shall be cleaned and all pipe systems washed thoroughly with clean drinking water with sufficient pressure.

Article 311. (1) The tank shall be disinfected with a disinfectant solution, the concentration and contact time of which are in accordance with the manufacturer"s instructions.

(2) Piping systems shall be disinfected subject to the disinfection requirements set out in Section V of Chapter Thirteen.

(3) All inner surfaces of the tank are washed with a disinfectant and then with clean drinking water, after which the tank is filled to the design water level with drinking water containing a residual disinfectant at a concentration lower than the minimum required values for water intended for drinking and household needs**.**

(4) Samples for chemical and microbiological analysis shall be taken after the expiry of time for the water storage in the tank specified by the design and manufacturer"s instructions.

(5) Analyses shall be carried out or commissioned to accredited laboratories according to BDS EN ISO/IEC 17025 "General requirements for the competence of testing and calibration laboratories" or other equivalent internationally recognised standards.

(5) The tank shall be put into service once the results of the analysis confirm that the water in the tank and in the connected plumbing meets the minimum quality requirements for water quality intended for drinking and household purposes.

Article 312. For the results of the water analyses, protocols are submitted, and for the disinfection of the tank – acts.

Article 313. For the normal technical operation of the tank, a documented maintenance and repair system shall be organised, including the necessary monitoring of water quality, periodic control of all elements, maintenance, cleaning and disinfection.

Article 314. (1) Where, in the course of technical operation, it is found that the tank is unfit for its intended purpose, measures shall be taken to carry out the necessary repair and restoration works.

(2) Before the tank is reintroduced into operation, the water chambers that have been excluded for repair and restoration work shall be cleaned and disinfected.

Chapter Fifteen

CONSTRUCTION OF WATER SUPPLY SYSTEMS IN CREEPING SOILS

Article 315. (1) Water pipes and facilities are laid on a ground base of type I in terms of creeping, as well as in non-creeping soils, in accordance with the requirements of Ordinance No 1 of 1996 on the design of flat foundations (SG, Issue 85 of 1996).

(2) The base under water pipes and facilities laid on a ground base of type II in terms of creeping is prepared in accordance with the design requirements and the requirements of Ordinance No 1 of 1996 on the design of flat foundations.

Article 316. (1) The excavation of trenches and excavations shall be permitted after completion of the arrangements to ensure the drainage of surface water.

(2) Trenches are excavated section by section with a size according to the design requirements.

Article 317. (1) Excavation works shall be stopped when a section of sudden land creeping is found until the sources of water ingress are removed and the works shall not recommence until the creeping has been stabilised.

(2) On a case-by-case basis, an act of deformation of the structure shall be drawn up.

Article 318. (1) Deepening under the connections of the pipeline is carried out after preliminary compaction of the soil.

(2) Deepening under butt welded connections shall not be allowed.

Article 319. (1) In the case of ground bases of type II in terms of creeping, no backfilling of trenches and excavations with overwatered soils or with sandy and draining soils and materials shall be allowed.

(2) Under the pipes, sand pads and other draining materials are not allowed.

Article 320. (1) Underground or semi-underground facilities of the water supply system, regardless of their size and soil conditions, shall be constructed after preliminary compaction of the soil, the creation of a protective pad or the strengthening of the creeping soil under the facilities to the design depth of the bottom of the excavation.

(2) The soil under the facilities shall be compacted, cover with a protective pad (screen) of compacted local soil or is strengthened, on an area greater than the area of the facility, by at least 1.5 m beyond its outlines.

(3) Compaction of creeping soils under the facilities is carried out on creeping soils with a volumetric density of soils of $\rho_N < 1.6$ g/cm^3 and water saturation rate of $Sr < 0,7$ and is carried out with heavy compaction or roller, with additional moistening if necessary.

(4) Substituting the creeping soil under the facilities and creating a protective pad (screen) of compacted local soil (or loess) is used for a water saturation rate of the soil – $Sr > 0.7$.

(5) The thickness of the protective pad (screen) of compacted local soil shall not be less than 60 cm below the design elevation at the bottom of the excavation for the facility, and it shall be laid and compacted in layers not thicker than 30 cm.

(6) The compaction of the soil or the protective pad at the base of the plumbing and facilities shall be controlled by determining the volumetric density of the soil skeleton in the outlines of each compacted layer, with not less than 4 samples.

(7) Not less than 90 % of the samples of the compacted soil or of each layer of the protective pad shall have a volumetric density of the skeleton not less than 98 % of the standard density specified in the laboratory.

(8) Reinforcement of the foundation by means of a cement and loess pad is carried out in accordance with the requirements of Ordinance No 1 of 1996 on the design of flat foundations.

Article 321. (1) Reinforced concrete structures are concreted without interruption.

(2) When the concreting is interrupted, the joints are processed to ensure their water tightness.

(3) In the process of concreting and processing concrete, the requirements of Ordinance No 3 of 1994 on control and acceptance of concrete and reinforced concrete structures (promulgated in SG, Issue 97 of 1994) shall be complied with.

Article 322. (1) For protection from surface water around the facilities, water protection measures and strengthening measures are carried out.

(2) For systematic monitoring of the creeping of the ground base in the case of creeping soils after construction of the facilities, lateral benchmarks (at least 4 pieces) shall be placed at a distance of twice the width of the facilities.

Article 323. In the case of creeping soils, the water towers shall be founded with full provision of the discharge of water in the event of leakage of gaskets, connections and other damage. The foundations are protected from permeation of surface water by means of wide pavements and drainage ditches. Overflow and drainage systems shall be discharged at a distance of at least 15 m from the foundations.

Article 324. After construction and testing of a type II ground base to creeping, the gaps formed between the wall of the excavation and the facility shall be filled with clay soil in layers not thicker than 40 cm, compacting them to the design volume density of the soil skeleton, but not less than 95 % of the standard density determined in the laboratory.

ADDITIONAL PROVISIONS

§ 1. For the purposes of this Regulation:

1. "Water abstraction facility" means a facility designed to capture water and supply it while preserving its natural properties to the water supply system;

2. "Drawing facility" means a facility located prior to the pumping station to equalise the flow of water and the pumped water quantity according to the accepted operation mode of the pumps;

3. "Pumping station" means a pumping facility to ensure the appropriate pressure and water quantity in the water supply system;

4. "Treatment plant" means a complex of facilities for the treatment of raw natural water with a view to ensuring the regulatory requirements for the quality of the water before it is fed into the water pipes;

5. "Pressure and control device" means a device to equalise the relatively constant flow and variable water consumption during individual hours of the day (pressure tanks, water towers and hydrophores);

6. "External water pipe" means a water pipe which transports water from the water source to the regulating water pressure facilities, the natural water treatment plant and the water supply network in the water supply area;

7. "Water supply network" means a network of water pipelines in the water-supplied territory to deliver the necessary water quantities to the properties of consumers;

8. "Main plumbing branch of a water supply network" means a water pipe with distribution functions in the water supply area, usually without direct connections to consumers;

9. "Secondary plumbing branch of a water supply network" means a plumbing connecting one or more main plumbing branches to building plumbing deviations;

10. "Building plumbing deviation" means a plumbing connecting a main or secondary plumbing branch of the water supply network to the properties of consumers;

11. "Technical losses of water in water supply systems" means the sum of the unavoidable real (physical) losses of water and the losses of water resulting from the emptying of the water supply network in the construction of new routes and sections, washing, disinfecting and repairing defects in the water supply system, not including the "technological needs of DWTP";

12. "Maximum allowable operating pressure (PMA)" means a pressure which a piping, or its component, can withstand when the system is operated, which occurs for a short period of time, as well as in the event of a hydraulic shock;

13. "Permissible operating pressure (PFA)" means a pressure which a piping element can withstand during continuous operation of the system;

14. "Permissible test pressure (PEA)" means a pressure that a newly installed piping element can withstand for a relatively short period of time to ensure the integrity and water tightness of the pipeline;

15. "Dimensioning pressure (DP)" means a pressure in the water supply system without taking into account the hydraulic shock;

16. "Maximum dimensioning pressure (MDP)" means a pressure in the water supply system, taking into account the hydraulic shock;

17. "Operating pressure (OP)" means an internal pressure that occurs at a specified time and place in the water supply system;

18. "Test pressure (sample pressure) (STP)" means a hydrostatic pressure for testing new plumbing, for checking their integrity and water tightness;

19. "Drinking water treatment plant" means a complex of facilities for the treatment of water from natural or other water sources with a view to achieving the quality indicators for drinking and household needs laid down in Ordinance No 9 of 2001 on the quality of water intended for drinking and household purposes;

20. "Technical possibility for future expansion of drinking water treatment plants" includes, as minimum requirements, the provision of sufficient head and space to include new facilities;

21. "Technological needs of DWTP" include water for the normal operation of treatment processes and water for the preparation of reagent solutions.

22. "Pressure regulator" means a fitting that lowers water pressure to a specified value;

23. "Boundary shut-off valve" means a shut-off valve which serves to separate an area from the network and is closed in normal operation of the system;

24. "Infuse pipe" means the pipe through which the water quantity enters the tank;

25. "Intake pipe" means the pipe through which water is fed from the tank to the water supply network;

26. Naturally flooded centrifugal pump" means a pump where the elevation at the water level in the drawing tank is above the elevation of the highest part of the impeller of the pump. When charged from a pressurised plumbing, this requirement is to the elevation of the pressure line of that plumbing;

27. "Pumping stations in an open system" are those that feed the water into a tank with a free water level, i.e. the head is interrupted. An example of such a scheme is a pump with a transient pressurised tank;

28. "Pumping stations in a closed system" are those that feed water into a network or other pumping station where there is no free water level, i.e. the head is not interrupted. An example of such a scheme is a pump, which supplies water directly to the water supply network;

29. "Pumping stations in a mixed system" are those that supply water both directly into a network and into a tank with a free water level. An example of such a scheme is a pump with a counter-pressure tank;

30. "Water containing facility" is a watertight water facility for pressureless storage. Such are water chambers, drawing tanks, pressure tanks, etc.;

31. "Economically justified service life" is in accordance with § 5(65) of the Additional Provisions of the SDA;

32. "Design service life" is equal to the number of years after commissioning for which the required hydraulic capacity in the design of the water supply system is determined;

33. "Backflow" means the movement of the fluid against the direction of current in the building system and/or site water supply in the connected properties;

34. "Unavoidable real (physical) loss of water" means the smallest technically achievable real (physical) losses of water in a well-maintained and managed water supply system;

35. "Device against backflow" means a device that prevents backflow and complies with BDS EN 1717 "Protection against pollution of potable water in water installations and general requirements of devices to prevent pollution by backflow";

36. "Radioactive substance" means a substance within the meaning of §1(8) of the Additional Provisions of Ordinance No 9 of 2001 on the quality of water intended for drinking and household purposes;

37. "Hazardous chemical substances and mixtures” means a concept according to § 1(6) of the Additional Provisions of the Act on the Protection from the Harmful Impact of Chemical Substances and Mixtures;

38. "Biological agents" means a concept within the meaning of § 1(1) of the Additional Provisions of Ordinance No 4 of 2002 on the protection of workers from risks related to exposure to biological agents at work, in conjunction with Directive 2000/54/EC of 2000.

39. "Accident" is a term within the meaning of § 1(2) of the Additional Provisions of the Disaster Protection Act.

40. "Conductor tube" is a protective steel tube with a sealing flange mounted externally around the lining column at the top of the well and anchored to the reinforced concrete bottom of the technical shaft.

41. "Reagents" means chemicals, including biocides, used in the treatment (purification and disinfection) of drinking water;

42. "Biocide" is referred to in Article 3(1)(a) of Regulation (EU) No 528/2012 of the European Parliament and of the Council of 22 May 2012 concerning the making available on the market and use of biocidal products.

§ 2. In the event of breaches of this Ordinance, the administrative provisions of the SPA and the Administrative Offences and Penalties Act shall apply, unless a more serious sanction is envisaged in another act.

§ 3. The Ordinance has passed the procedure for the exchange of information in the field of technical regulations under Decree No 165 of 2004 on the organisation and coordination of the exchange of information on technical regulations and rules on information society services and on the establishment and operation of a Product Contact Point (SG Issue. 64 of 2004).

TRANSITIONAL AND FINAL PROVISIONS

§ 4. The Ordinance is issued on the basis of § 18(1) of the Final Provisions of the SDA in conjunction with Article 169(1), (3) and (4) of the SDA and repeals Ordinance No 2 of 2005 on the design, construction and operation of water supply systems (promulgated in State Gazette, Issue. 34 of 2005, amended in Issue. 96 of 2010 and SG Issue 45 of 2016).

§ 5. The standards referred to in the Ordinance shall be subject to the existing versions, with the exception of harmonised standards within the meaning of Regulation (EU) No 305/2011 of the European Parliament and of the Council of 9 March 2011 laying down harmonised conditions for the marketing of construction products and repealing Council Directive 89/106/EEC, to which the version published in the Official Journal of the European Union applies.

§ 6. The Ordinance has passed the procedure for the exchange of information in the field of technical regulations under Decree No 165 of the Council of Ministers of 2004 on the organisation and coordination of the exchange of information on technical regulations and rules on information society services and on the establishment and operation of a Product Contact Point (SG Issue. 64 of 2004), which introduced Directive 98/34/EU, updated by Directive 2015/1535.

§ 7. (1) The procedures initiated for the approval of an investment project and the issuance of a building permit shall be completed in accordance with the current procedure.

(2) Proceedings under paragraph 1 shall be deemed to have been initiated from the date of submission of a written application for approval of the investment project by the competent authority.

§ 8. (1) The procedures initiated for the construction of water supply systems or parts of water supply systems shall be completed in accordance with the current procedure.

(2) Proceedings under paragraph 1 shall be deemed started as of the date of issue of the building permit for a water supply system or part of a water supply system.

§ 9. (1) The procedures for commissioning commenced shall be completed in accordance with the current procedure.

(2) Proceedings referred to in paragraph 1 shall be deemed to have been initiated with the drawing up of the statement of findings referred to in Article 176(1) of the SDA for transmission by the builder to the contracting authority of the executed and completed construction.

§ 10. The Ordinance shall enter into force four months after its publication in the State Gazette, with the exception of Annex 13 to Article 157(2), which shall enter into force on 1 July 2025.

Annex 1

to Article 1(4) and Article 14(1)

Minimum requirements for the scope of pre-investment studies and investment projects for water supply networks and facilities

I. The phases of elaboration of investment projects for the water supply system and its elements shall be determined by the contracting authority in compliance with the regulatory requirements and the contractual conditions for construction.

II. The minimum scope of pre-investment studies shall include:

1. data on the existing situation and design requirements for the development of the territory covered by the water supply system (development, cadastral, plot and/or grade line plans);
2. data on possible water sources – according to the requirements of the existing normative and administrative acts;
3. geological and hydrogeological data on the territory covered by the water supply system;
4. demographic data on the settlements included in the water supply system at the time of design and forecast data at the end of the design service life;
5. data on industrial, utility and agricultural enterprises on the territory of the water supply system at the time of design and forecast data at the end of the design service life;
6. data about the potential of territories with specific and preventive planning protection (if such exists) in connection with nature preservation regimes and cultural and historic heritage sites;
7. other data (circumstances) required by the type and specific nature of the local conditions;
8. forecasts of master plans for the development of water supply and sewerage systems;
9. data on the existing water supply system;
10. data on the existing sewerage system (sewer network and WWTP);
11. the need for replacement, reconstruction or new construction of the water supply system and its elements;
12. analysis of the results of an assessment of the catchment/recharge area in the points of water abstraction for drinking and household water supply, as required by Ordinance No 9 of 2001.

III. Clarification of the investment intention includes:

1. clarification of the territorial scope of the investment intention;

2. consideration of possible alternative solutions for the water supply system;

3. clarification of the need for preparation/amendment to the detailed development plan;

4. setting an indicative value of alternative solutions;

5. determining the responsibilities of the participants in the investment process;

6. risk assessment for the realisation of the investment intention;

7. justification of the social relevance and effectiveness of the investment initiative, including improvement of public works, hygiene and environmental conditions, jobs creation and provision of public services;

8. drawings: plot plan on an appropriate scale indicating the territorial scope of the investment intention and the main elements of alternative solutions for the water supply system.

IV. The minimum volume of the design of the water supply system and its components shall include:

1. an explanatory note containing the information (data from pre-investment studies); the explanatory note explains the proposed design solutions and their compliance with the requirements of Article 169 of the SDA; the technological solutions shall consider at least two comparable versions of the water supply system and, if justified, the project shall be developed in a single version;

2. hydraulic calculations of the water supply system and its components according to the requirements of the design assignment; in case of dimensioning of a completed water supply network, if the locations of the fire hydrants are not specified, it is permissible to set the water consumption per fire in the area as concentrated consumption at one point;

3. phases of construction, if required by the design assignment;

4. the quantitative and value calculations based on summarized indicators and generalized values as per options, which clearly reflect the construction phases;

5. technical and economic comparison of options and a proposal to select an option for the next design phase;

6. drawings:

- a situation plan of the water supply system on an appropriate scale with a designated location of the site covered by the project;
- Situation in M 1:2000(1000) – a plan with a preliminary solution;
- Situation in M 1:2000 (1000) – plan with measurement data;
- Situation in a suitable scale with clear indication of the construction phases;
- longitudinal profiles in M 1:2000 of the main branches;
- a horizontal and vertical section of the equipment on an appropriate scale;

- transverse profiles of plumbing at characteristic points with existing and design underground infrastructure drawn.

V. The minimum scope of the technical design for the water supply system and its components includes:

1. part "Water supply" of the technical design is prepared in separate sections for water supply and/or building systems.
2. in the case of industrial sites, part "Water supply” shall be prepared in the sections for networks and installations referred to in item 1 and, depending on the specific needs, shall be further elaborated:
- water balance, types of water flow cycles, networks and facilities;
- design solutions of purification facilities;
- projects of water catchments, corrections of rivers, bank-protection facilities and other hydrotechnical facilities necessary for the operation of the site.
3. the drawings of the external, including site water supply networks, shall include:
- a plot plan on an appropriate scale with characteristic data from the vertical planning, on which the routes of existing and designed water supply networks with designated lengths, slopes, pipe elevations, location of facilities, water quantities and pressures are drawn;
- longitudinal profiles in M 1:500 for lengths and in M 1:50 for the heights of external plumbing branches with designated dimensioning data, the locations of the access fittings shafts, all deviations with slope number and pipe diameter, the intersections with other underground communications, the level of existing terrain and the category of earthwork;
- horizontal and vertical sections with pipe nets and elevations on the existing terrain drawn;
- installation plan for external plumbing networks with numbers of main intersections, assembly diagrams of the assemblies with markings of connections and fittings by type and number, number of branches with lengths, type, location, pipe diameter, conditional operating pressure, etc.;
- details of facilities at the discretion of the designer and details of the non-standard elements.
4. the drawings of external plumbing shall include data on dimensioning water quantities and rates, slopes, pressures, elevations of the excavation, bottom pipe, existing and design terrain, distances between elbows, detailed points of terrain, facilities and fittings, horizontal and vertical distances to intersections with other underground ducts and facilities, the lengths of the sections and the type of pipes and fittings.
5. the explanatory note of the water supply part of the technical design shall contain:
- output data and the general requirements of the design assignment;

- data on the water supply, geological and hydrological characteristics of the area (if necessary), including the specific requirements for installations in relation to the characteristics of the site (loess soils, frosts, earthquakes, landslides, etc.);

6. the calculations to the water supply part of the technical design include:

- hydraulic calculations, including hydraulic shock, and dimensioning tables for water supply networks and equipment;
- calculation tables and graphs;
- calculations of the structures of construction facilities to water supply networks, where these are not applied to the structural part of the technical design;
- specifications of all facilities related to network design solutions, data on their technical parameters and a specification of the necessary basic materials and devices, where not reflected in the drawings;
- quantitative accounts by sub-site for water supply networks and facilities.

7. where required by the design assignment (design contract), a bill of quantities of the construction works shall be applied to the water supply part of the technical design.

VI. The minimum volume of the detailed design for the water supply system and its components shall include:

1. when a technical design has been elaborated with the water supply part of the detailed design, the design solutions of the part of the technical design shall be specified and detailed;
2. where no technical design has been elaborated as a previous design phase, the water supply part of the detailed design shall be drawn up with the contents of the water supply part of the technical design, supplemented and specified by the content in accordance with the requirements of this Annex;
3. the drawings of the water supply part of the detailed design for the external, including site water supply networks, complement the drawings of the water supply part of the technical design with:

- details of non-standard network elements and of the places where they intersect with other networks;
- further elaboration of details for installation, reflecting any changes in the networks as compared to the technical design;
- machine and design drawings for complex assemblies and facility elements (treatment plants, pumping stations, hydrophores, etc.), if necessary;
- details of facilities to the water supply networks or their non-standard elements – at the discretion of the designer.

4. the explanatory note shall be drawn up with the contents of the explanatory note of the technical design part, including in addition the description of the most significant problems, which are further clarified and solved in the working design phase and are relevant for the implementation of the construction works in relation to:

- the connection to the water source;
- the installation of the equipment to the networks;
- the technical data of the network;
- the specific technological requirements for the laying, connection and testing of networks or their individual equipment and components.

5. the calculations for the part water supply of the detailed design are with the content of the part water supply of the technical design.

6. Instructions for installation and operation of water supply systems and their elements shall be drawn up after assignment of a detailed design.

Annex 2

to Article 1(4) and Article 14(1)

Minimum requirements for the scope and content of the pre-investment studies of “Drinking water treatment plant” part and the scope and content of the “Technological” part of the investment project for the drinking water treatment plant

I. Minimum scope and content of the pre-investment studies in the studies part for drinking water treatment plants

1. Water quality analysis at the water source

1.1. analysis of existing water sources used for drinking and household water supply

For all water sources, the following shall be carried out:

- the water volumes allowed for water abstraction and the volumes actually abstracted for drinking and household needs shall be analysed for a minimum period of 5 years;

- information is collected on the presence of sanitary and security zones and the state of the enclosures and informative signs;

- analysis of the results of the assessment of the catchment/recharge area of the water abstraction points for drinking and household water supply, as required by Ordinance No 9 of 2001;

Alternative water sources shall be analysed similarly according to quantitative and qualitative indicators, if their use is foreseen for the design service life of the pre-investment study.

1.2. The collection of the database for analysis of the water source is in accordance with Article 26(2) of this Ordinance. The database collected is analysed.

2. In the presence of existing drinking water treatment plants (DWTPs), an analysis of the design and current capacity of the treatment plant as well as of the current operational status is carried out.

2.1. analysis of the design capacity of the DWTP

Summarised information is required that shall include:

(a) design flow rate and quality parameters that require water treatment. Design data for the main treatment facilities;

(b) technological scheme of the project under which the DWTP was built;

(c) information on modernisation of the technological scheme with new processes and reconstruction of individual facilities over the years;

(d) information on technological waste water and sludge;

2.2. analysis of the current capacity of the DWTP and of the current operating condition

It is necessary to analyse an operational database for a period of at least 5 years, containing:

(a) data on the sum of incoming water quantities at the inlet of DWTP. The database shall make it possible to assess the dynamics of changes in water quantities at the inlet;

(b) data on the quality of raw water at the inlet of DWTP and on the quality of treated water at the outlet of PSTP. The database must allow assessment of the treatment effect in the light of the requirements of Ordinance No 9 of 2001 on the quality of water intended for drinking and household purposes;

(c) data on the structural condition and machinery of the individual technological facilities; assessment of the effectiveness of individual technological processes;

(d) data on reagents used – type and annual amounts, specific consumption per cubic of treated water;

(e) data on the annual electricity consumption and specific consumption per cubic of treated water; electricity consumption for specific processes (e.g. for flushing filters);

(f) consumption of process water – on an annual basis, including a percentage in relation to the incoming water quantity; a specific consumption for flushing of one filter;

(g) side processes – process water and sludge treatment. Degree of treatment of process waste water and receiver of treated water. Annual volume of sludge and ways of recovery;

(h) information on the management of the water treatment process – type, locations and frequency of monitoring of technological processes, automation, SCADA.

3. Analysis of water disinfection in the distribution water supply network

The analysis shall include:

(a) the number, location and type of water disinfection facilities;

(b) the operational condition of water disinfection facilities;

(c) information on the management of the water disinfection process in the network – e.g. process automation, SCADA.

4. Analysis of drinking water quality at the end user

Analysis of the database from the monitoring of drinking water quality within the meaning of Ordinance No 9 of 2001 on the quality of water intended for drinking and household purposes is required for a minimum period of 5 years.

The analysis shall identify indicators with deviation from drinking water quality requirements, extent and frequency of deviation. The places/areas in which there are frequent deviations from an indicator shall be registered.

5. Conclusions from the analysis of the existing situation

5.1. The analysis of water sources must lead to clear conclusions on:

(a) trends for changes in available water volumes and sufficiency of water volumes for the purposes of drinking and household water supply at the time of analysis, as well as within the design lifetime of the pre-investment study;

(b) quality indicators which do not comply with the requirements of Ordinance No 9 of 2001 on the quality of water intended for drinking and household purposes, including their characteristic values and trends of change;

(c) the impact of climate change shall be assessed for all water sources, if not included in the risk assessment. The impact of climate change is based on studies, including climate models for climate change in the given region;

(d) the degree of construction and the state of the sanitary and security zones around the water sources.

6.2 The analysis of the drinking water quality at the end user should lead to clear conclusions on:

(a) degree of compliance of the drinking water quality at the end user with the requirements of Ordinance No 9 of 2001 on the quality of water intended for drinking and household purposes;

(b) the need for water treatment according to certain indicators;

(c) the need to replace certain sections of the water supply network where, as a result of worn out pipes, frequent deviations are observed by characteristic parameters (e.g. due to corroded pipes – excess iron concentrations, chromaticity);

6.3 The analysis of existing drinking water treatment plants should lead to clear conclusions on:

(a) the current hydraulic capacity and the required hydraulic capacity for the design lifetime of the pre-investment study. The latter is established in the framework of analyses of the water supply system (Annex 1);

(b) the effectiveness of technological scheme at present and whether it will be able to meet future drinking water quality requirements in relation to the conclusions reached on the quality of the water source in item 1 and the current regulatory requirements for drinking water quality (e.g. Directive 2020/2184);

(c) the efficiency of the use of reagent, process waters and electricity consumption. The conclusions should allow for a comparison of the results. It is advisable to derive numerical parameters, e.g. consumption per unit of purified water per unit of time;

(d) the need to introduce new facilities/technological processes and/or reconstruction of existing facilities in order to achieve compliance with the normative requirements for drinking water quality;

(e) the need to increase the control/monitoring of the purification process by specifying the monitoring places and parameters.

7. Definition of the purposes of the investment intention

Investment objectives are defined on the basis of the conclusions of the existing situation analysis. The objectives are usually related to compliance with regulatory requirements for drinking water quality in a given water supply system or specific settlement. The investment objective may also be aimed at increasing the efficiency of a particular purification process, including energy efficiency.

The investment objective must always be consistent with the requirements and eligible financing measures of the respective financing organisation.

8. Analysis of possible strategic and technological solutions to achieve the investment intention

The analysis shall include:

7.1 Analysis of various strategic decisions

The analysis of the different strategic solutions should normally be developed at the level of the water supply system. Strategic solutions for improving the quality of drinking water or the efficiency of purification processes are an integral part of the strategic analyses at the level of the water supply system.

The analysis of the different strategic solutions may include, but are not limited to, consideration of the following options: construction of an independent DWTP for one or several settlements or establishing an alternative water source or linking a settlement to another water supply system with appropriate water quality.

In cases where the investment objective is related to the reconstruction of a specific facility and/or, for example, the construction of a water disinfection facility in the network, an analysis of the different strategic solutions is not necessary.

The choice of the most appropriate strategic solution shall be made on the basis of a multi-criteria analysis, including consolidated technical, economic, social and environmental criteria.

8.2 Detailed (technological) analysis

Within the framework of the chosen strategic solution, several technological variant solutions are being developed.

Where, on the basis of the strategic option analysis, the construction of a drinking water treatment plant is chosen as the most appropriate solution, the detailed option analysis may include, but is not limited to: selection of a site for the drinking water treatment plant, comparison of different technological options (schemes) for water treatment, including with a view to reducing energy costs, reagent costs or technological losses of water.

Where, on the basis of the strategic option analysis, an alternative water source is chosen as the most appropriate solution, the detailed option analysis may include, but is not limited to: selection of the most suitable water abstraction place, choice of type of water abstraction facility, configuration of water abstraction wells in case of underground water sources.

Where, on the basis of the strategic option analysis, the connection of a settlement to another water supply system is chosen as the most appropriate solution, detailed option analysis may include, but is not limited to: choosing a route of the connecting main pipeline, changing the configuration of the water supply system, selecting the material of the pipes.

The level of detail of the detailed variant solutions considered should allow a realistic assessment of the investment and operating costs according to aggregate indices. In this regard, when considering variants of a drinking water treatment plant, the minimum requirements shall include, but are not limited to:

Text part: A detailed description of the technological scheme, dimensioning of the main facilities and associated equipment, the need to change the status of terrains (e.g. for a treatment plant site) and complementary engineering infrastructure (e.g. roads, sewage, electricity supply) and related investment costs.

Graphic part: Technological scheme, master plan and hydraulic profile along the water path

The choice of the most appropriate technological solution is based on a comparison of the present value of the investment and operating costs.

When individual facilities are reconstructed of a drinking water treatment plant, the operating costs shall not be limited to those of the reconstructed facilities, but shall cover the operating costs of the entire drinking water treatment plant.

9. Presentation of the investment intention

The chosen option shall be presented in detail. Information shall be given on the additional project works to be carried out.

II. Minimum requirements for the scope and content of investment projects for DWTPs, part "Technological"

1. Conceptual design, part "Technological"

The "Technological" part of the conceptual design of DWTPs contains the following components:

(a) an explanatory note describing the quality of the water source, the drinking water quality requirements, the technologies and processes considered (including for the treatment of process waste water) and the reagents to be used;

(b) technological and hydraulic measurement of the basic facilities and technological measurement of the buildings;

(c) specification of the main machinery and technological equipment;

(d) specification of the instruments for monitoring the water quantities and water quality within the individual technological processes and at the output of the DWTP;

(e) specification of the laboratory equipment;

(f) estimated data on reagent consumption, daily and annual electricity consumption, as well as specific reagent and electricity consumption per unit of volume of treated water;

(g) estimated data on the consumption of technological water and the place of discharge;

(h) bill of quantities based on consolidated indices;

(i) estimated values of the operating costs and price of 1 m^3 treated water;

(k) drawings on an appropriate scale:

- technological diagram;
- a building plan for the territory of the DWTP and a plot plan for the elements of the technical infrastructure;
- longitudinal profile along the water path;
- drawings of basic facilities.

(l) design assignments for all project parts including minimum technological requirements for them (in case no previous phase has been prepared).

2. Detailed design, part "Technological"

The minimum scope of the "Technological" part of the detailed design contains the following components:

(a) an explanatory note detailing the technologies and processes considered;

(b) technological calculations and measurements which give more specific details to those set out in the conceptual project;

(c) specification of the reagents to be used in the treatment technology;

(d) specification of the main machinery and technological equipment with details of its technical parameters, with attached passport data;

(e) specification of the essential materials and products required;

(f) specification of the main electricity consumers with calculated operating hours and expected total annual electricity consumption; energy balance;

(g) specification of the main measuring instruments and apparatus;

(h) specification of the main pipe connections with a description in terms of length, diameter and material;

(i) instructions for the commissioning and technical operations of the individual technological phases, facilities and technical conduits;

(j) basic drawings on an appropriate scale:

- detailed technological diagram clearly showing all the monitoring and measuring devices showing specific features;
- development plan for the territory of the DWTP and a plot plan for the elements of the technical infrastructure with designated all facilities and connections between them, including the point of discharge of the process waste water into the receiver, roads, buildings, green areas, etc.;
- hydraulic profile along the water flow;
- hydraulic profile along the process waste water path;
- plans, horizontal and vertical sections of all buildings and facilities with designation of pipe nets and fittings, with corresponding elevations, as well as elevations of the existing terrain;
- details of the facilities and details of non-standard elements;
- other drawings and diagrams – on an appropriate scale, where necessary depending on the specificity of the technology;
- cross sections at typical points clearly showing the subterranean infrastructure;
- in the case of buildings and facilities – detailed schematics, cross-sections, façades – to M 1:100 or M.1:200.

Annex 3

to Article 14(3), Article 62, Article 72(1) and Article 198(1)(3)

List of applicable Bulgarian standards for the design, construction and operation of water supply systems

1. BDS EN 805 "Water supply. Requirements for systems and components outside buildings".
2. BDS EN 1508 "Water supply. Requirements for systems and components for the storage of water";
3. BDS EN 545 "Ductile iron pipes, fittings, accessories and their joints for water pipelines. Requirements and test methods";
4. BDS EN 10220 "Seamless and welded steel tubes. Dimensions and masses per unit length";
5. BDS EN 1074-1 "Valves for water supply. Fitness for purpose requirements and appropriate verification tests. Part 1: General requirements."
6. BDS EN 1074-2 "Valves for water supply. Fitness for purpose requirements and appropriate verification tests. Part 2: Isolating valves";
7. BDS EN 1074-3 "Valves for water supply. Fitness for purpose requirements and appropriate verification tests. Part 3: Check valves";
8. BDS EN 1074-4 "Valves for water supply. Fitness for purpose requirements and appropriate verification tests. Part 4: Air valves";
9. BDS EN 1074-5 "Valves for water supply. Fitness for purpose requirements and appropriate verification tests. Part 5: Control valves";
10. BDS EN 1074-6 "Valves for water supply. Fitness for purpose requirements and appropriate verification tests. Part 6: Hydrants";
11. BDS EN 12201-1 "Plastics piping systems for water supply, and for drainage and sewerage under pressure. Polyethylene (PE). Part 1: General provisions National Annex (NA)";
12. BDS EN 12201-2 "Plastics piping systems for water supply, and for drainage and sewerage under pressure. Polyethylene (PE). Part 2: Pipes. National Annex (NA)";
13. BDS EN 12201-3 "Plastics piping systems for water supply, and for drainage and sewerage under pressure. Polyethylene (PE). Part 3: Fittings. National Annex (NA)";
14. BDS EN 12201-4 "Plastics piping systems for water supply, and for drainage and sewerage under pressure. Polyethylene (PE). Part 4: Valves";

15. BDS EN 12201-5 "Plastics piping systems for water supply, and for drainage and sewerage under pressure. Polyethylene (PE). Part 5: Fitness for purpose of the system";

16. BDS EN 12729 "Devices to prevent pollution by backflow of potable water. Controllable backflow preventer with reduced pressure zone. Family B. Type A";

17. BDS EN 13076 "Devices to prevent pollution by backflow of potable water. Unrestricted air gap. Family A, Type A";

18. BDS EN 13077 "Devices to prevent pollution by backflow of potable water. Air gap with non-circular overflow (unrestricted). Family A. Type B";

19. BDS EN 13078 "Devices to prevent pollution by backflow of potable water. Air gap with submerged feed incorporating air inlet plus overflow. Family A. Type C";

20. BDS EN 13079 "Devices to prevent pollution by backflow of potable water. Air gap with injector. Family A. Type D";

21. BDS EN 13959 "Anti-pollution check valves - DN 6 to DN 250 inclusive family E, type A, B, C and D";

22. BDS EN 14451 "Devices to prevent pollution by backflow of potable water. In-line anti-vacuum valves DN 10 to DN 50 inclusive. Family D. Type A";

23. BDS EN 14452 "Devices to prevent pollution by backflow of potable water. Pipe interrupter with atmospheric vent and moving element DN 10 to DN 20. Family D. Type B";

24. BDS EN 14453 "Devices to prevent pollution by backflow of potable water. Pipe interrupter with permanent atmospheric vent DN 10 to DN 20. Family D. Type C";

25. BDS EN 14454 "Devices to prevent pollution by backflow of potable water. Hose union backflow preventer DN 15 to DN 32. Family H. Type A";

26. BDS EN 14455 "Devices to prevent pollution by backflow of potable water. Presssurised air inlet valves DN 15 to DN 50. Family L, Type A and Type B";

27. BDS EN 12889 "Trenchless construction and testing of drains and sewers";

28. BDS 1295-1 "Structural design of buried pipelines under various conditions of loading. Part 1: General requirements."

29. BDS EN 1514-1 "Flanges and their joints. Dimensions of gaskets for PN-designated flanges. Part 1: Non-metallic flat gaskets with or without inserts";

30. BDS EN 736-1 "Valves". Terminology Part 1: Definition of types of valves".

31. BDS EN 736-2 "Valves". Terminology Part 2: Definition of components of valves";

32. BDS EN 736-3 "Valves. Terminology Part 3: Definition of terms."

33. BDS EN 12904 "Products used for treatment of water intended for human consumption. Silica sand and silica gravel";

34. BDS EN 12911 "Products used for treatment of water intended for human consumption. Manganese greensand";

35. BDS EN 16421 "Influence of materials on water for human consumption. Enhancement of microbial growth";

36. BDS EN 12873-1 "Influence of materials on water intended for human consumption. Influence due to migration. Part 1: Test method for factory-made products made from or incorporating organic or glassy (porcelain/vitreous enamel) materials";

37. BDS EN 12873-2 "Influence of materials on water intended for human consumption. Influence due to migration. Part 2: Test method for non-metallic and noncementitious site-applied materials";

38. BDS EN 12873-3 "Influence of materials on water intended for human consumption. Influence due to migration. Part 3: Test method for ion exchange and adsorbent resins";

39. BDS EN 12873-4 "Influence of materials on water intended for human consumption. Influence due to migration. Part 4: Test method for water treatment membranes."

40. BDS EN 13052-1 "Influence of materials on water intended for human consumption. Organic materials. Determination of colour and turbidity of water in piping systems. Part 1: Test method";

41. BDS EN 13101 "Steps for underground man entry chambers. Requirements, marking, testing and evaluation of conformity."

42. BDS EN 1420 "Influence of organic materials on water intended for human consumption. Determination of odour and flavour assessment of water in piping systems";

43. BDS EN 15975-1 "Security of drinking water supply. Guidelines for risk and crisis management. Part 1: Crisis management";

44. BDS EN 15975-2 "Security of drinking water supply. Guidelines for risk and crisis management. Part 2: Risk management";

45. BDS EN ISO 17769-1 "Liquid pumps and installation. General terms, definitions, quantities, letter symbols and units. Part 1: Liquid pumps";

46. BDS EN ISO 17769-2 "Liquid pumps and installation. General terms, definitions, quantities, letter symbols and units. Part 2: Pumping system";

47. BDS EN 14396 "Fixed ladders for manholes";

48. BDS EN 14718 "Influence of organic materials on water intended for human consumption. Determination of the chlorine demand. Test method";

49. BDS EN 14944-1 "Influence of cementitious products on water intended for human consumption. Test methods. Part 1: Influence of factory made cementitious products on organoleptic parameters";

50. BDS EN 14944-3 "Influence of cementitious products on water intended for human consumption. Test methods. Part 3: Migration of substances from factory-made cementititous products";

51. BDS EN 15664-1 "Influence of metallic materials on water intended for human consumption. Dynamic rig test for assessment of metal release. Part 1: Design and operation";

52. BDS EN 15664-2 "Influence of metallic materials on water intended for human consumption. Dynamic rig test for assessment of metal release. Part 2: Test waters";

53. BDS EN 16056 "Influence of metallic materials on water intended for human consumption. Method to evaluate the passive behaviour of stainless steels and other passive alloys";

54. BDS EN 16057 "Influence of metallic materials on water intended for human consumption. Determination of residual surface lead (Pb). Extraction method";

55. BDS EN 16058 "Influence of metallic materials on water intended for human consumption. Dynamic rig test for assessment of surface coatings with nickel layers. Long-term test method";

56. BDS EN 16421 "Influence of materials on water for human consumption. Enhancement of microbial growth";

57. BDS EN ISO 8795 "Plastics piping systems for the transport of water intended for human consumption. Migration assessment. Determination of migration values of plastics pipes and fittings and their joints (ISO 8795:2001)";

58. BDS ISO 4064-1 Measurement of water flow in closed conduits. Meters for cold potable water. Part 1: Specifications;

59. BDS EN 1017 "Chemicals used for treatment of water intended for human consumption. Half-burnt dolomite";

60. BDS EN 12902 "Products used for treatment of water intended for human consumption. Inorganic supporting and filtering materials. Methods of test";

61. BDS EN 12904 "Products used for treatment of water intended for human consumption. Silica sand and silica gravel";

62. BDS EN 12905 "Products used for treatment of water intended for human consumption. Expanded aluminosilicate";

63. BDS EN 12907 "Products used for treatment of water intended for human consumption. Pyrolyzed coal material";

64. BDS EN 12915-1 "Products used for the treatment of water intended for human consumption. Granular activated carbon. Part 1: Virgin granular activated carbon";

65. BDS EN 12915-2 "Products used for the treatment of water intended for human consumption. Granular activated carbon. Part 2: Reactivated granular activated carbon";

66. BDS EN 13753 "Products used for treatment of water intended for human consumption. Granular activated alumina";

67. BDS EN 13754 "Products used for treatment of water intended for human consumption. Bentonite";

68. BDS EN 14456 "Products used for treatment of water intended for human consumption. Bone charcoal";

69. BDS EN 1017 "Chemicals used for treatment of water intended for human consumption. Half-burnt dolomite";

70. BDS EN 12902 "Products used for treatment of water intended for human consumption. Inorganic supporting and filtering materials. Methods of test.";

71. BDS EN 12906 "Products used for treatment of water intended for human consumption. Pumice.";

72. BDS EN 12910 "Products used for treatment of water intended for human consumption. Garnet";

73. BDS EN 12912 Products used for treatment of water intended for human consumption. Barite;

74. BDS EN 12913 Products used for treatment of water intended for human consumption. Powdered diatomaceous earth;

75. BDS EN 12914 Products used for treatment of water intended for human consumption. Powdered perlite;

76. BDS EN 15795 "Products used for treatment of water intended for human consumption. Natural unexpanded aluminosilicates".

Notes:

1. This list is for informational purposes only. It was created to support the participants in investment design and construction for the current and applicable standards for the design, construction and operation of water supply systems.

2. The standards referred to in this Annex may be subject to revision. Accordingly, use of the most recent versions is recommended.

3. The list of standards has been drawn up at the date of approval of the Ordinance and must be considered as provisional, especially with regard to the products and devices intended for use in water supply systems.

Annex 4
to Article 21

Determination of the dimensioning water quantity for a particular section of the water supply network

1. The dimensional water quantity Q (l/s) for a particular section of the water supply is determined by the formula:

$$Q\ Q_т + αQ_п + \sum Q_k \qquad (1),$$

where:

Q_t is the transit water quantity through the dimensioned section, l/s;

Q_P — the travel consumption of the dimensioned section, l/s;

α – coefficient to be determined according to ratio:

$\frac{Q_n}{Q_m + Q_n}$; take α = 0.5;

$\sum Q_k$ — the total maximum hourly water quantity to meet the needs of concentrated consumers, l/s.

2. The transit water quantity Q_t shall be determined by the formula:

$$Q_т = q_o \sum L_R \qquad (2),$$

where:

q_o is the specific water quantity, l/s;

$\sum L_R$ — the reduced length of the dimensioned section, m.

3. Travel consumption Q_P shall be determined by the formula:

$$Q_п = q_o L_R \qquad (3),$$

where L_R is the reduced length of the dimensioned section, m.

4. The specific water quantity q_o shall be determined by the formula:

$$q_o = \frac{Q_{максч}}{\sum L_R} \qquad (4),$$

where Q_{Maxh} is the maximum hourly consumption of the settlement, reduced by the maximum hourly consumption of the concentrated users.

5. The reduced length L_R (m) of the water supply network shall be determined by the formula:

$$L_R = K \,.\, L = 5$$

where:

K is a coefficient to be assumed as:

- in the case of two-side built-up streets – 1.0;
- in the case of one-side built-up streets – 0.5;
- in the case of transit sections, 0;
- in areas with a population density greater than the average for the settlement – from 1.0 to 2.0;

L – the actual length of the water supply network, m.

Annex 5

to Article 40(2)

Determination of the gross area of the water intake holes

Gross area of water intake holes F_{pcs} (m^2) shall be determined by the formula:

$$F_{pcs} = 1{,}25 \frac{k \,.\, Q_{op}}{V},$$

where:

V is the water velocity in the water intake holes relative to the clear section, m/s;

Q_{dim} — the dimensioning quantity of water per section, m/s;

1,25 – a coefficient taking into account the blocking of the holes;

k – a coefficient taking into account the narrowing of the apertures of the grids or meshes, which shall be taken as follows:

- for grids – k = $\frac{a + б}{a}$;

- for nets – k = $\left(\frac{a + б}{a}\right)^2$,

where:

a is the clear distance between the bars, cm;

b – the thickness of the bars, cm.

Annex 6

to Article 70(1), Article 73(1) and Article 75(1) and (2)

Determination of filter area and equivalent grain diameter

1. The area of filters F_F (m^2) shall be determined by the formula:

$$F_ф = \frac{Q}{v_\phi} \qquad (1),$$

where:

Q is the dimensioning performance of the station, m^3/h;

V_F — filtration rate, m/h.

2. Effective grain diameter

$$D_{Ef} = D_{10} \qquad (2)$$

where:

D_{Ef} is the diameter of the sieve holes through which 10 % of the mass of the test sample passes during the sieve analysis of the filter filling.

3. The heterogeneity coefficient K of the filter filling shall be determined by the formula:

$$K = \frac{D_{60}}{D_{10}} \qquad (3),$$

where:

D_{60} and D_{10} are the diameters of the sieves through which 60 % and 10 % (of the mass) of the test sample pass respectively in the sieve analysis of the filling.

4. Check for Reynolds number (Re) and Frud number (Fr) when dimensioning horizontal settling basin

$$\Re = \frac{V\,h\,.\,R}{v} < 20000 \qquad (4)$$

$$R = \frac{A_{V\,h}}{P} \qquad (5)$$

$$Fr = \frac{(V\,h)^2}{g\,.\,R} > 10^{-5} \qquad (6)$$

where:

Re – Reynolds number, dimensionless value;

Vh – average velocity of water in the settling basin corridors, m/s;

R – hydraulic radius of one corridor of the settling basin, m

A_{Vh} — cross-sectional area of one corridor of the settling basin, m^2

P – the wetted perimeter of the cross section of one corridor of the settling basin, m

ν – kinematic viscosity of water, m^2/s

Fr – Frud number, dimensionless value;

g – gravitational acceleration, 9.81 m/s^2

Annex 7

to Article 103(1)

Hydraulic shock in pressure plumbing

1. A hydraulic shock can occur with a sudden change in water velocity in gravitational or thrusting pressure plumbing. It occurs when closing and opening stop fixtures, starting and stopping pumps or stopping the power supply. The change in pressure at a given point in the pipeline at the occurrence of a hydraulic shock is shown in Figure. 1.

2. The characteristics of the hydraulic shock wave are shown in Fig. 2.

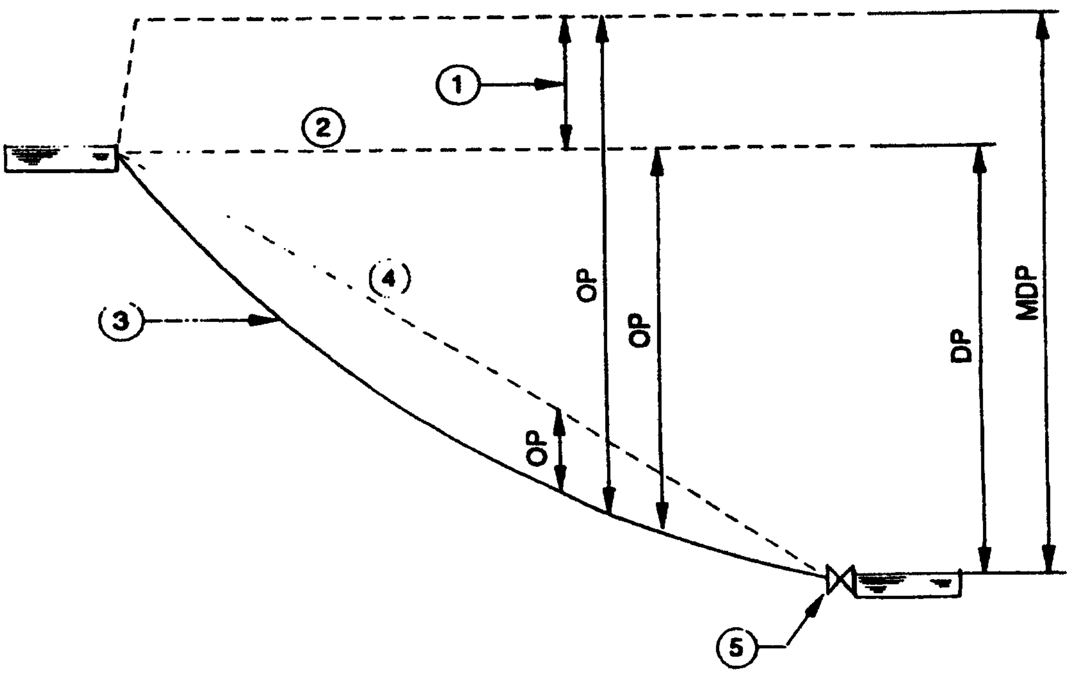


Figure 1.

Hydraulic shock in a typical pressure plumbing:

1 – increased pressure in case of hydraulic shock; 2 – hydrostatic pressure line; 3 – longitudinal profile of pipelines; 4 – piezometric line; 5 – shut-off fittings

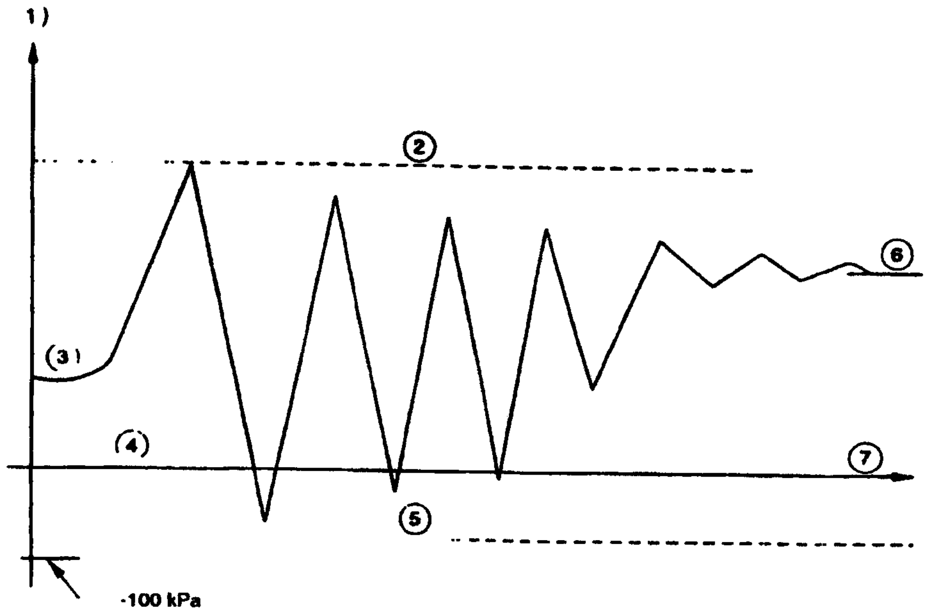


Figure 2.

Hydraulic shock wave characteristics:

1 – pressure; 2 – maximum dimensioning pressure MDP; 3 – initial operating pressure OP; 4 – atmospheric pressure; 5 – pressure at saturated vapours; 6 – new operating pressure OP; 7 – time

Annex 8
to Article 124(4)(1) and (2)

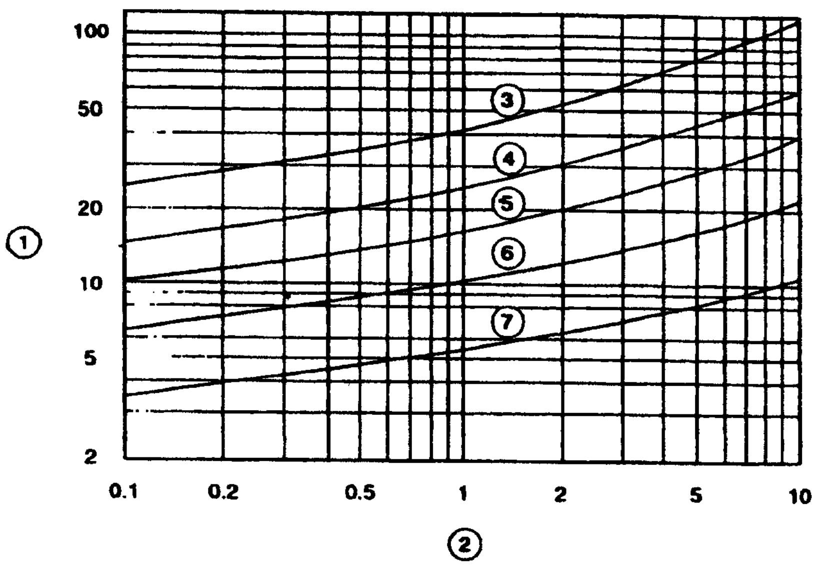
Value of hydraulic roughness k

1. In determining the design value of roughness k_1 the pressure losses that occur in the access fittings and fittings are reported in two ways:

1.1. the first method uses experimental results that show that the pressure losses are approximately proportional to the square of the water velocity, i.e. there are different types of local resistance coefficients for different access fittings and fittings;

1.2. in the second way, a "equivalent length" is used, i.e. a straight section of pipeline with the same pressure losses as in the access fittings and fittings.

2. The dimensioning value of hydraulic roughness k_2 is within the range of 0.1 x 10^{-3} m and 0.4 x 10^{-3} m for external plumbing, up to 0.4 x 10^{-3} m for main plumbing branches, and 1.0 x 10^{-3} m for secondary plumbing branches. The specific value of the dimensioning hydraulic roughness k_2 is determined according to the type and internal coating of pipes and hydraulic conditions that may affect the quality of the water, as well as the type and number of fittings, access fittings and connections according to the figure.



Relation between the dimensioning value of the roughness k_2 and pressure losses at different internal diameters D (for water supply section with a length of 100 m, water velocity of 1.5 m/s and water temperature of 10 ˚C): 1 – pressure losses, kPa; 2 – roughness, m x 10^{-3}; 3. D = 100 mm; 4. D = 150 mm; 5. D = 200 mm; 6. D = 300 mm; 7. D = 800 mm

Annex 9

to Article 133(3)

Examples of zoning of plumbing networks

The diagrams given in this annex are indicative, with the specified type of feeder being randomly selected (pressure tank or pumping station).

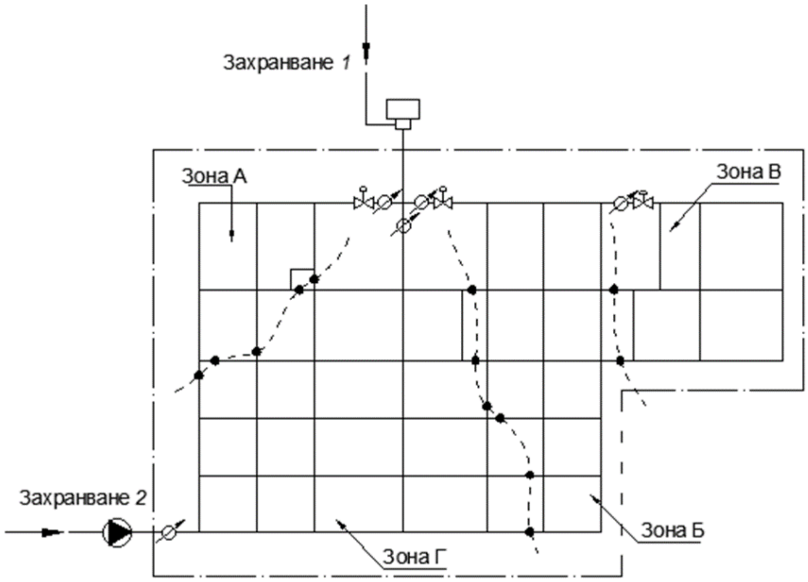


Figure 1 Water supply network, which is divided into zones by boundary stop taps (areas A, B and C have one power supply and zone D has two power supplies)

Захранване	water supply
ЗонаБ	Zone B

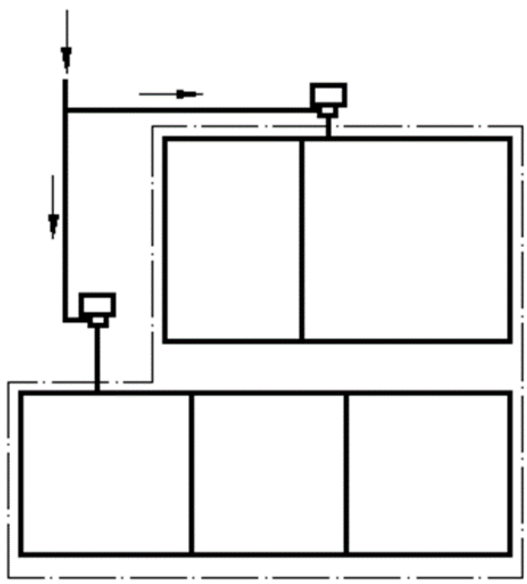


Figure 2 Water supply system divided into two zones, each of which has independent water supply

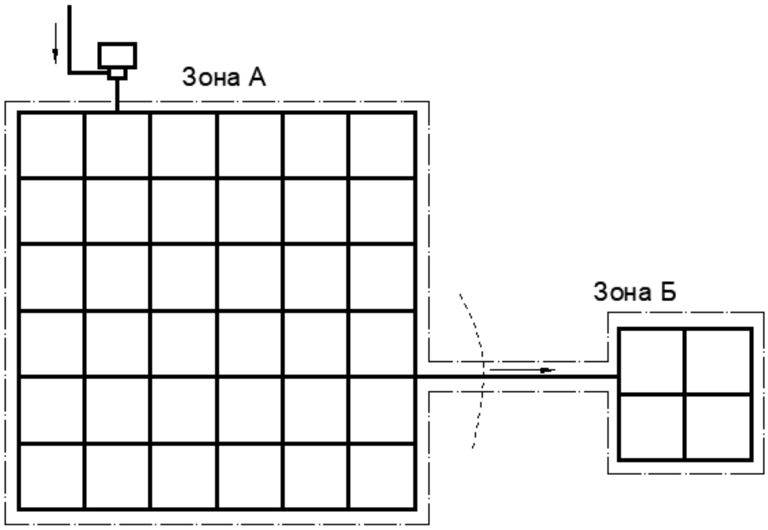
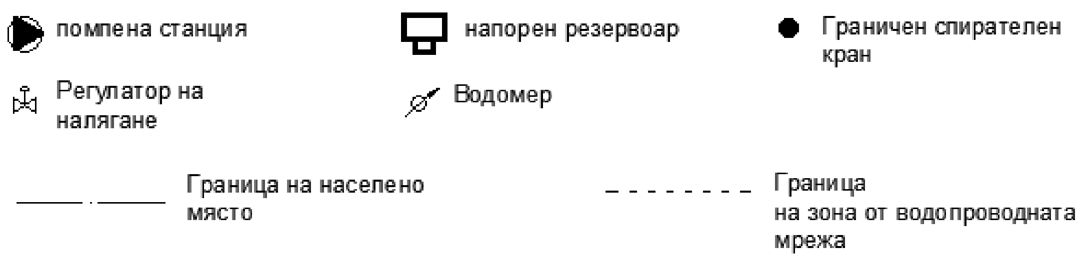


Figure 3 Zoning of the water supply network of a settlement with a separate urbanized area (e.g. remote residential complex)

ЗонаБ	Zone B

Diagram designations:



помена станция	pumping station
напорен резервоар	pressure tank
Граничен спирателен кран	boundary stop tap
Регулатор на налягане	pressure regulator
Водомер	water meter
Граница на населено място	settlement boundary
Граница на зона от водопроводната мрежа	boundary of a zone of the water supply network

Annex 10

to Article 141(2)(1) and (2) and (3)

Example of air vents positioning

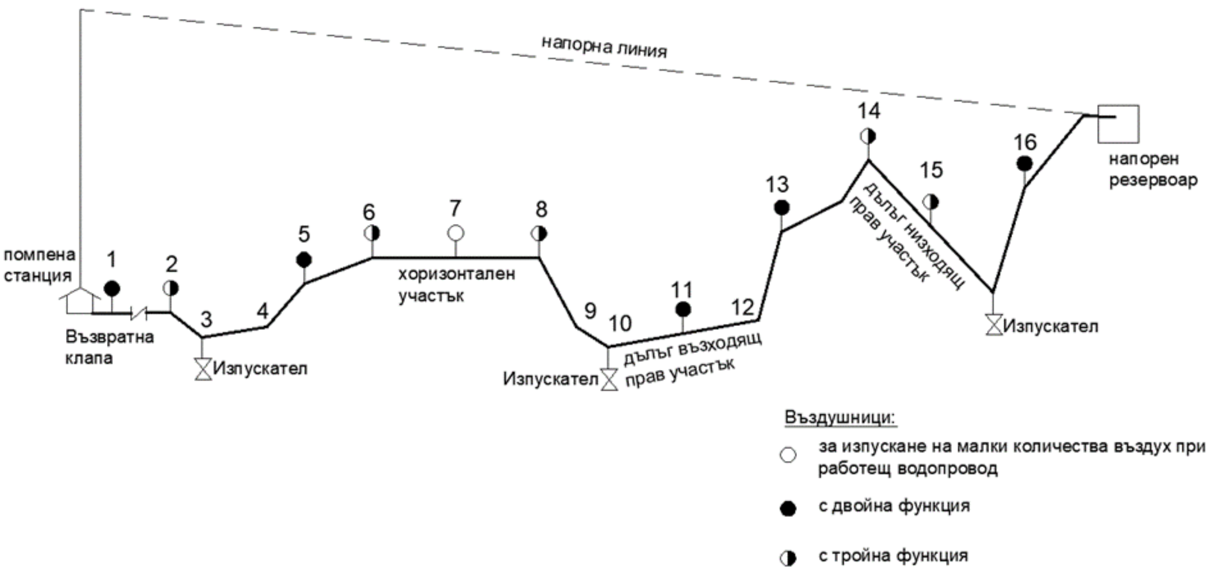


Figure 1 Example positioning of different types of air vents in thrusting plumbing after a pump

помпена станция	pumping station
Възвратна клапа	Non-return valve
Изпускател	Discharger
хоризонтален участък	horizontal section
Дълъг възходяш прав участък	Long ascending straight section
напорен резервоар	pressure tank
Въздушници	Air vents
за изпускане на малки количества въздух при работещ водопровод	for the release of small amounts of air in an operating plumbing
с двойна функция	with double function
с тройна функция	with triple function

Characteristic points and type of air vents in them

Point No	**Description of the location**	**Type of air vent**
1.	after the pump	with double function

2.	increasing downward slope	with triple function
3.	low point	no air vent is required
4.	increasing ascending slope	no air vent is required
5.	decreasing ascending slope	with dual or triple function
6.	start of horizontal section (small inclination section)	with triple function
7.	horizontal section (small inclination section)	with dual or triple function
8.	end of horizontal section (small inclination section)	with triple function
9.	decreasing downward slope	no air vent is required
10.	low point	no air vent is required
11.	long ascending slope	with dual or triple function
12.	increasing ascending slope	no air vent is required
13.	decreasing ascending slope	with dual or triple function
14.	high point	with triple function
15.	long downward slope	with dual or triple function
16.	decreasing ascending slope	with dual or triple function

Note: The following types of air vents are designed for external plumbing:

1. with double function, which supply and release large amounts of air when filling and emptying the plumbing;

2. with triple function (combined), which supply and release large amounts of air when filling and emptying the water pipes, as well as releasing small amounts of air in case of operating water pipes;

3. others, for example, with a single function or with a device designed to reduce hydraulic shock.

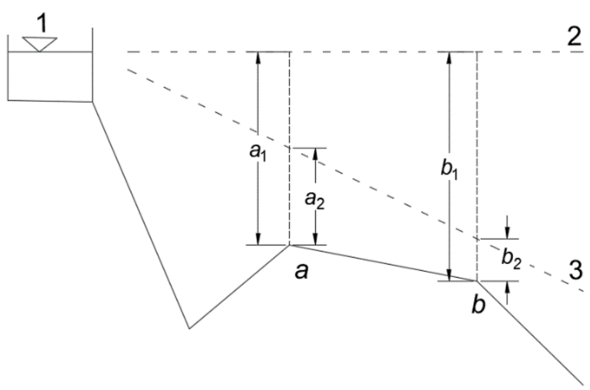


Figure 2 Example diagram with two high points

Key:

1. water level
2. line of hydrostatic head (hydrostatic line)
3. line of hydrodynamic head (hydrodynamic line)

a and *b* — high points, respectively *a* with regard to altitude and *B* relative to the hydrodynamic line

a_1 and b_1 – hydrostatic head

a_1 и b_1 – hydrodynamic head

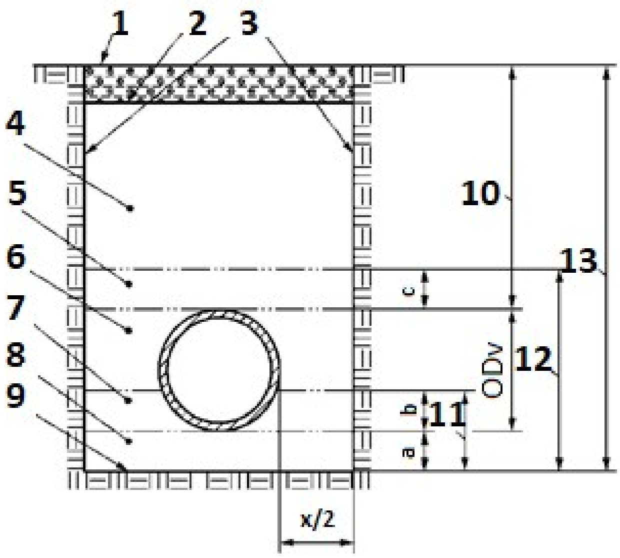
Annex 11

to Article 154(1)(2) and Article 262(1)

Backfilling of trenches for plumbing

1. Design and elements of the trench

An example design and elements of a trench for plumbing is shown in the following figure.



1	surface	9	bottom of the trench
2	ground bed of the road surface (where applicable)	10	cover height
3	walls of the trench	11	height of the base
4	main backfilling	12	height of the area around the pipe
5	initial backfilling	13	depth of the trench
6	side backfilling	a	thickness of the lower part of the base
7	upper part of the base	b	thickness of the upper part of the base
8	lower part of the base	c	thickness of the original backfilling
		ODv is the vertical projection of the outer diameter	

Example design and elements of a trench

2. Backfilling materials for the area around the pipe

The materials to be used for the backfilling must be determined by the design. Materials from the groups referred to in points 3, 4 and 6 may be used.

3. Re-use of soil from the excavation

The re-use of the soil from the excavation for backfilling can be carried out when it is foreseen by the design. The soil from the trench shall not contain materials that may adversely affect the pipe (e.g. too large particles, tree roots, waste, organic materials, frozen materials, snow and ice) and clay lumps larger than 75 mm.

4. Materials delivered

The materials delivered are referred to in points (a), (b) and (c). They may include recycled materials and their use must take into account the environmental consequences.

(a) Grain materials

Grain materials may be:

- fractionated (one-size) grain material;
- unfractionated grain material (material with different granulometric composition);
- sand;
- any additional materials;
- crushed materials.

(b) Materials with binders

Materials with binders may include:

— soil with cement;

— stabilised soil (e.g. with cement, calcium carbonate);

— lightweight concrete;

— concrete with reduced cement and/or sand content and free of coarse additional material (for pavement or concrete base);

— unreinforced concrete;

— reinforced concrete;

— self-sealing materials for filling.

(c) Other materials

Materials which can be compacted, other than those described in letters (a) and (b), may be used for the area around the pipe when they are not expected to adversely affect the pipe. The project must take into account the environmental impact of these materials.

5. Maximum particle sizes in the area around the pipe

Table 1 gives the maximum particle sizes in the area around the pipe for certain pipe types. In the case of re-use of soil from the excavation, soil clods of a size greater than twice the size indicated in the table to that Annex shall not be allowed. Frozen material as well as residues (e.g.

asphalt concrete pieces, bottles and timber) are not allowed.

For pipes with wall structure and materials not listed in the table, e.g. multilayer polyethylene pipes and pipes of polyethylene PE 100 RC, the requirements of product standards or, where such standards are not available, the manufacturer”s technical specifications shall be complied with.

Table

Material of pipes		**Insulation coating**	**Size of round particles**	**Particle size of crushed material**
Pipes of spheroidal-graphite cast iron		Zinc/bitum	0 – 32 mm Single grains up to 63 mm	0 – 16 mm Single grains up to 32 mm
Pipes of steel and spheroidal-graphite cast iron		Cement solution	0 – 63 mm Single grains up to 100 mm	0 – 63 mm Single grains up to 100 mm
PVC-U pipes, PE 80 and PE 100	≤ DN 200		0 – 22 mm	0 – 11 mm
	>DN 200 ≤ DN 600		0 – 40 mm	
PE-Xa			0 – 63 mm	0 – 63 mm
Fibreglass pipes	DN ≤ 400		0 – 16 mm Single grains with 16 mm	
	DN > 400		0-32 mm Single grains with 32 mm	
Note: In case of technical specification of the manufacturer of pipes and access fittings, with indications regarding the type and size of the backfilling particles in the area around the pipe, which differ from the values in the table, the requirements of the manufacturer shall be complied with.				

6. Materials for main backfilling

The materials used for main backfilling shall comply with the requirements of the design. Most of the materials defined in paragraph 2 can be used as a main backfilling. Some materials, such as fractionated round grain material, may not be suitable for all conditions.

The maximum size of the rock material of the excavated soil (or the materials referred to in point 4), which is used for the main backfilling, shall be 75 mm or equal to the thickness of the original backfilling, or half the thickness of the compacted layer, with the lowest value taken into account. The maximum size may be further limited depending on the area of application (e.g.

roads), soil conditions, the presence of groundwater and the material of the pipe. For rock areas, special conditions can be defined.

Annex 12

to Article 157(2)

Test of plumbing according to BDS EN 805:2004 "Water supply. Requirements for systems and components outside buildings" (BDS EN 805:2004)

1. General provisions

The purpose of this application is to assist the participants in investment design and construction by clarifying some of the requirements of BDS EN 805:2004 regarding pressure testing of water pipes. BDS EN 805:2004 should be used to fully comply with the requirements for pressure test of plumbing.

The pressure test of plumbing generally goes through preparatory activities and three stages (Fig. 1, as follows:

- preliminary test:
- pressure drop test to determine the remaining amount of air in the water pipe;
- main test.

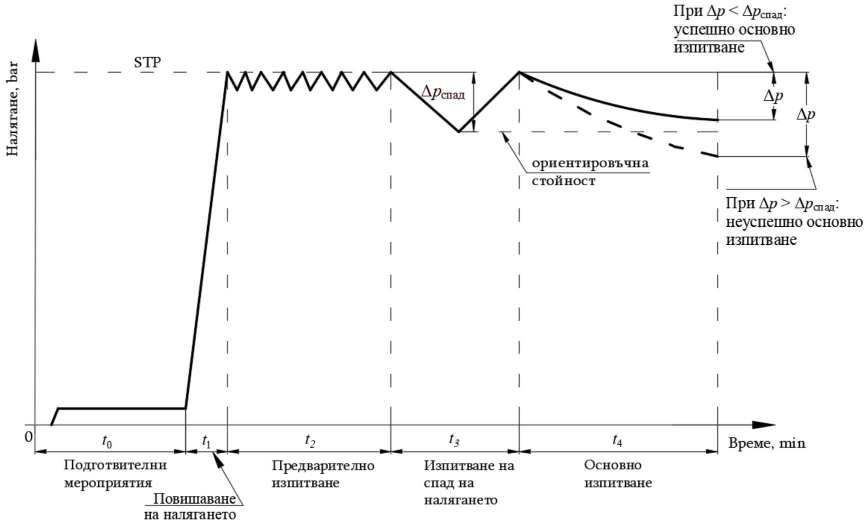


Figure 1 – Test stages for pressure loss method

ПрИ Δр < Δрспад: успешно основно изпитване	At Δp & Δpsd: successful main test
Ориентировъчна стойност	Indicative value
При Δр > Δрспад: неуспешно основно изпитване	At Δp > Δpsd: failed main test
Подготвителни мероприятия	preparatory events
11овишаване на налягането	Pressure rise
Предварително изпитване	Preliminary test:
Изпитване на спад на налягането	Pressure drop test

Основно изпитване	Main test
Време, min	Time, min

2. Preparatory activities

The necessary preparatory activities for the purpose of carrying out the test shall be determined by the designer. They depend on local conditions, temperature, type of material and pipe diameter, length, longitudinal profile of the plumbing and other factors.

Prior to pressure tests, where necessary, pipes (with or without connections) may be covered with the backfilling material, thus preventing bed changes that would lead to leakage. The need for backfilling of pipes, as well as of the connections, is indicated in the project.

3. Preliminary test:

The duration and pressure of the preliminary test shall be determined in the design according to the material of the pipes, in accordance with the relevant product standard and/or manufacturer"s instructions. If unacceptable changes in the trench condition of any part of the plumbing and/or leaks are observed, the pressure must be reduced to atmospheric pressure and the defects must be rectified.

4. Pressure drop test to determine the remaining amount of air in the water supply

The presence of air in the test section of the water supply leads to false results in the main test, giving the impression of fictitious leaks as well as conditions of concealment of leaks. Pressure drop test to determine the remaining amount of air in the water supply is at the discretion of the designer and depends on the local conditions (length, diameter, longitudinal profile of the plumbing, etc.).

The test for the presence of air in the test water supply shall be carried out in the following order:

(a) after completion of the preliminary test, a volume of water shall be discharged and measured until a pressure drop Δp is reached with a value according to item 5.2;

(b) The discharged volume of water ΔV which corresponds to the pressure drop $\Delta p$is compared with permissible water losses $\Delta V_{max.}$ For the calculation of the maximum permissible water losses V_{max}, formula 1 shall be used;

$$\Delta V_{max} = 1,5.V.\Delta p.\left(\frac{1}{E_w} + \frac{D}{e.E_R}\right) \quad (1),$$

where:

V_{max} are the permissible water losses, l;

V - volume of test section, l;

Δp — the measured pressure losses according to item 5.2, kPa;

E_w – water elasticity module, kPa;

D — inner tube diameter, m;

e — wall thickness of the pipe, m;

E_R — elasticity module of the pipe wall in the direction of the periphery, kPa;

1.5 – coefficient of permissible air content prior to the main pressure test.

(c) When the inequality $\Delta V < \Delta V_{max}$ is fulfilled, it means that the amount of retained air will not interfere with the accuracy of the test and one may proceed to the next stage. If this condition is not met, air bleeding shall be carried out, including by mechanical methods, and the test shall be repeated until the condition is fulfilled.

5. Main test

The main test shall not start until the preliminary test and the pressure drop test (air presence check) are carried out when prescribed in the design.

When performing the main test, particular care shall be taken to ensure that conditions of large temperature changes are not present during the test.

Two main test methods are applied:

– method of water loss;

– method of pressure loss.

For pipes with visco-elastic behaviour, an alternative test method may be prescribed according to BDS EN 805.

5.1. Main test using the water loss method

Two equivalent methods may be used to measure water losses: measuring the drained volume of water or measuring the pumped volume (5.1.1 and 5.1.2). The choice of method is determined in the project.

Measured water losses ΔV at the end of the main test using the methods of 5.1.1 or 5.1.2 shall not exceed the value calculated according to the following formula (formula 2):

$$\Delta V_{max} = 1,2.V.\Delta p.\left(\frac{1}{E_w} + \frac{D}{e.E_R}\right) \quad (2),$$

where:

ΔV_{max} are the permissible water losses, l;

V — volume of the tested section, l;

Δp — the measured pressure losses, according to item 5.2, kPa;

E_w – water elasticity module, kPa;

D — inner tube diameter, m;

e — pipe wall thickness, m;

E_R — elasticity module of the pipe wall in the direction of the periphery, kPa;

1.2 – coefficient of permissible deviation (e.g. for air content) during the main pressure test.

5.1.1. Measurement of the drained volume of water

The determination of water losses by means of the drained volume is carried out in the following order:

- The pressure is gradually increased until the test pressure (STP) is reached.
- STP is maintained, if necessary by pumping, for a period of time t_1 not less than one hour (Fig. 2);
- The pump shall be switched off to prevent further water entering the test section for a period of time t_2 equal to one hour or a longer period, if determined by the designer (Fig. 2);
- At the end of the test time, the pressure losses Δp are measured and after that STP is restored again by pumping;
- Through draining, the volume of water ΔV is determined through which the value of the pressure losses Δp obtained at the end of the main test is reached again.

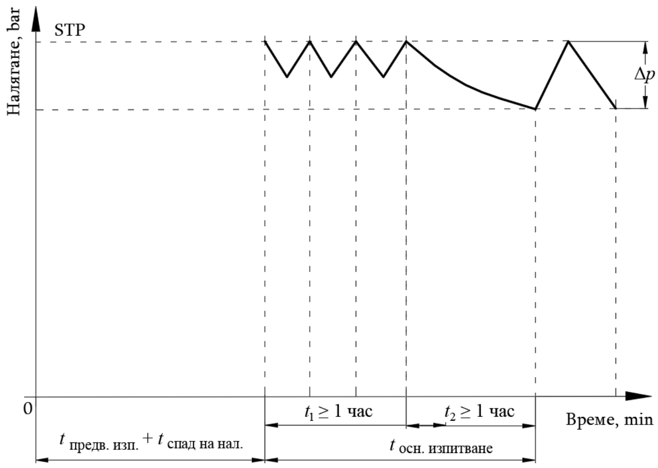


Figure 2 – Test process using the water loss method by measuring the drained volume

час	hour
Време, min	Time, min
$t_{предв.\ изп}.+ t_{спад\ на\ нал}$	$t_{prel.\ test}.+ t_{drop\ of\ pres}$
$t_{осн.\ изпитване}$	$t_{main\ test}$

5.1.2. Measurement of the pumped volume of water

The determination of water losses by the pumped volume is carried out in the following order:

- The pressure shall be gradually increased until the STP test pressure is reached;
- STP pressure is maintained by pumping during the time period t_1 not less than one hour or a longer period if determined by the designer (Fig. 3);

- With an appropriate measuring instrument, the water volume ΔV *is* measured which is pumped to maintain STP.

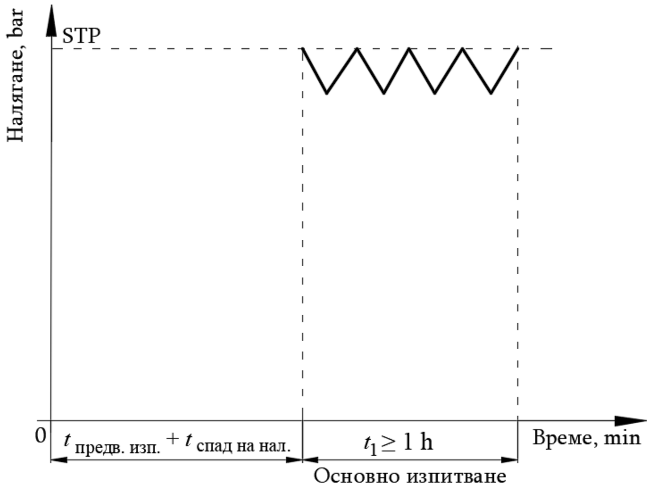


Figure 3 – Diagram of the test process using the water loss method by measuring the pumped volume of water

час	hour
Време, min	Time, min
$t_{\text{предв. изп}}$.+ $t_{\text{спад на нал}}$	$t_{\text{prel. test}}$.+ $t_{\text{drop of pres}}$
Основно изпитване	Main test

5.2. Main test by the method of pressure loss

The main test using the method of determining pressure losses shall be carried out in the following sequence (Fig. 1):

- The pressure in the test plumbing section shall be gradually increased to the test pressure (STP);
- After a period of 1 hour or more, if specified in the design, pressure losses shall be recorded;
- Analysis of the change in pressure losses Δp is made and they should show a decreasing trend and shall not exceed the following values at the end of the first hour:
  - 20 kPa for cast iron pipes with or without cement screed, steel pipes with or without cement screed, reinforced concrete cylindrical tubes, plastic tubes;
  - 40 kPa for fibre-cement pipes and non-cylindrical concrete pipes. For fibre-cement pipes, when the design determines that there are conditions for excess absorption, the permissible pressure losses may be increased from 40 to 60 kPa.

Annex 13

to Article 157(2)

Test of plumbing

The test procedures described in this Annex shall be applied when they are specified in the design.

I. General requirements

Each pipeline constructed shall be subjected to a pressure test with water to ensure the integrity of the pipes, joints, access fittings and other elements (such as support blocks).

The test procedure and pass/fail criteria shall be specified in the design. Where this Annex is used, the procedure shall be selected in accordance with point II (for non-viscoelastic materials such as metal, concrete or glass reinforced plastic) or III (for viscoelastic materials such as PE and PVC) of the Annex.

Before choosing a procedure in accordance with point II or III, the designer must check whether any atypical aspects or features not covered by points II or III must be taken into account.

Test media other than drinking water (plus disinfectants, where necessary) shall not be used in the test of plumbing. The reasons are as follows:

- a gaseous test medium under pressure (air, nitrogen, etc.) entails serious hazards to the safety of persons and objects in the vicinity of the test sections;
- pumps used to create pressure may cause deposits in the test section that adversely affect water quality after commissioning.

1. Safety

(a) Protective clothing and equipment

Before starting testing activities, a check shall be made that appropriate safety equipment is used and that the personnel have the necessary protective clothing.

(b) Excavation works

All excavations must remain properly fortified for the time of installation of the plumbing until the completion of the restoration of the terrain. During the pressure test, no activities, that are not related to the pressure test, shall be permitted in the trenches of the plumbing.

2. Filling and testing

For the purpose of testing, the water pipes shall be filled from the lowest possible point slowly with drinking water, while all means of air discharge are open and the piping is adequately ventilated to avoid the presence of pressurized air and to ensure energy saving.

Where necessary, a disinfectant is added.

Before the pressure test, a check shall be carried out to ensure that the test equipment is calibrated, in good working condition and properly installed to the pipeline. The pressure tests shall be carried out with all ventilating devices in the closed position and opened shut-off valves.

At all stages of the test and when planning the test cycle, the freezing conditions at night or excessive heat during the day shall be taken into account and any change in activities shall be controlled to avoid any danger to personnel. All personnel shall be clearly informed of the intensity of the load on the temporary access fittings and supports and of the consequences, if damage occurs.

3. Pressure test

3.1 Preparation

(a) Backfilling and strengthening

Before the pressure test, the pipes shall, where appropriate, be covered (e.g. with a backfilling material) so as to avoid changes in soil conditions which may be critical to the integrity of the pipeline and to minimise the effect of temperature changes. In places where the connections remain uncovered, a check for their tightness and integrity can be carried out. However, too much difference in temperatures can occur, which is why backfilling can be carried out, respectively, of the connections. Permanent supports or reinforcements shall be designed so as to withstand the stress of the test pressure. The concrete support blocks shall have gathered the appropriate strength before the start of the test. Before testing, it shall be ensured that the plugs or other temporary dead flanges are appropriately strengthened and the load is distributed according to the strength of the support base. Until the pressure in the pipeline is reduced to the atmospheric pressure, no temporary supports or reinforcements shall be removed at the edges of the test section.

(b) Choosing the test section and filling it for testing

The piping shall be tested as a whole or, where necessary, divided into several test sections.

The test sections should not exceed 3 km or have too large volumes as this may cause unmanageable problems during the test (e.g. detection of leakages, provision of the required amount of water for the test and its discharge).

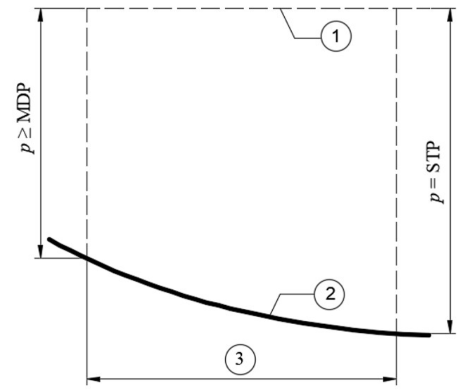
The test sections shall be selected in such a way that:

— the system test pressure (STP) shall be achieved and not exceeded at the lowest point of each test section as shown in Fig. 1;

— at the highest point of each test section a pressure, that is at least equal to the maximum dimensioning pressure (MDP), shall be reached according to Fig. 1, unless otherwise stated in the project;

— the required amount of water for testing can be provided and taken away without difficulty;

— the influences of differences in temperature shall be minimised where the pipe and connections are exposed.



1 Hydrostatic line of the test section

2 Pipeline

3 Test section

Figure 1 – Maximum difference between MDP and STP

Before filling and testing, all impurities and foreign substances shall be removed from the inside of the pipeline. The test section is filled with water. Drinking water shall be used for water supply pressure testing unless otherwise specified in the design.

The air must be removed as fully as possible from the pipeline. Filling shall be carried out slowly and, if possible, from the lowest point of the pipeline in such a way as to prevent the creation of vacuum and allow the air to escape through appropriately dimensioned ventilation means.

3.2 Test pressure

For all piping, the system test pressure (STP) shall be calculated according to the maximum design pressure (MDP) according to the following formulae.

— when calculating hydraulic shock

$$STP = MDPc + 100\ kPa$$

— without hydraulic shock calculation

$$\left.\begin{array}{l} STP = MDPa \times 1{,}5 \\ \text{или} \\ STP = MDPa + 500\ kPa \end{array}\right\}$$ the smaller of the two values shall be used

where,

MDP is denoted as MDPa when there is a fixed permissible value of hydraulic shock;

MDP is defined as MDPc when the hydraulic shock is calculated

For all piping, the test shall be carried out at a system test pressure (STP) in accordance with the requirements of Table 1, ensuring that the maximum test pressure does not exceed 1,5 × PFA in any of the lowest piping elements or in the test section.

Table 1

Pressure conditions for determining elements

elements		**system**
PFA	≥	DP
PMA	≥	MDP
PEA	≥	STP

PFA is the permissible operating pressure of an element, which represents the maximum hydrostatic pressure that the element can withstand in continuous operation;

PMA is the permissible maximum operating pressure of an element, which is the maximum pressure that occurs from time to time, including hydraulic shock, which the element can withstand when operating;

PEA is the permissible test pressure for the test section, which is the maximum hydrostatic pressure that a newly installed element can withstand for a relatively short period of time to ensure the integrity and tightness of the pipeline;

DP is the dimensioning pressure that represents the maximum operating pressure of the system or section given in the design, without taking into account hydraulic shock

The established permissible value of the hydraulic shock pressure included in MDPa shall not be less than 200 kPa.

The calculation of a hydraulic shock shall be carried out using appropriate methods and using the relevant general formulas in accordance with the specific design conditions and on the basis of the most unfavourable operating conditions.

3.3 Place for installation of test equipment

Under normal circumstances, the installation site of the test equipment shall be the lowest point on the test section.

If it is not possible to install the test equipment at the lowest point of the test section, the pressure for the pressure test shall be the system test pressure calculated for the lowest point of the test section reduced by the difference in height.

3.4 Operating pressure test with visual inspection

In special cases, with the consent of the relevant water supply and sewer operator (e.g. piping of small lengths, building plumbing deviations or sections made of pipes in rolls without connections between the two ends of the section), a visual inspection may be carried out for the water pipes to be tested and the system test pressure to be the operating pressure of the pipeline. Note also item I, 4.7 for cases of exceptions.

4. Test procedure

4.1. General requirements

Different applicable test procedures can be applied to all types of pipes and materials. The test procedure is defined with the design and is carried out in three stages:

1. preliminary testing;
2. pressure drop test (in I, 4.3 alternatives are indicated);
3. main pressure test.

4.2 Preliminary test

The preliminary test is intended to:

— stabilise the part of the pipeline to be tested, allowing for the majority of time-dependent displacements;

— achieve appropriate water saturation when water-absorbing materials are used;

— allow pressure-dependent volume increase in flexible tubes to occur before the main test.

The piping shall be appropriately divided into test sections fully filled with water and bled. The pressure shall be raised at the highest point at least to the maximum dimensioning pressure (MDP), unless otherwise specified in the design, and to STP at the lowest point (item I, 3.1(b). The pressure maintained through pumping at the inlet of the pipeline shall not exceed STP.

In the event that unacceptable changes in the position of any part of the pipeline and/or leakage occur, the pressure in the pipeline shall be reduced to atmospheric pressure and the malfunctions shall be rectified.

The duration and pressure of the preliminary test depend on the materials of the pipeline and are defined in the design, taking into account the relevant product standards.

4.3. Pressure drop test

Air in the test section of the pipeline may erroneously show a leak or, in some cases, conceal a small leak, therefore the presence of air will reduce the accuracy of the main pressure test. Excessive amount of air in the pipeline may also present a safety risk during the pressure test. Therefore, a pressure drop test should be carried out to determine whether there is too much air amount.

The pressure drop test makes it possible to assess the remaining volume of air in the test section. Thrusting a plug pushing the air may be a means of assisting the removal of air prior to the pressure test.

The criteria for the successful/failed pressure drop test shall be defined in the design.

The design may not specify the performance of the pressure drop test when the required air removal can be carried out in another way, e.g. where the test section has:

- sufficient slopes ($\geq$ 2 mm/m),
- air vents at all high points,
- there are no elements that can cause air bags retention.

4.4 Main pressure test

(a) General requirements

The main pressure test shall not start until the preliminary test and the pressure drop test have been successfully completed.

It is necessary to take into account the effect of temperature differences during the pressure test.

There are two main test methods:

- method of pressure loss;
- method of water loss.

(b) Method of pressure loss

Pressure Loss Δp and their increase is an indicator of leaks and water tightness.

The duration of the test for pressure losses shall be 1 hour or more, unless otherwise specified in the design. During the main pressure test, pressure losses Δp shall show a decreasing trend and shall not exceed the following values at the end of the first hour:

— 20 kPa for spheroidal-graphite cast iron pipes with or without cement mortar coating, steel pipes with or without cement mortar coating, steel cylindrical concrete pipes, plastic pipes;

— 40 kPa for non-cylindrical concrete pipes.

(c) Method of water loss

Two equivalent methods may be used to measure water losses:

- measurement of the volume of drained water:
- measurement of pumped water volume:

The designer must specify which method to use.

4.5 Lowering the pressure

The pressure in the pipelines shall be reduced slowly, and all means of ventilation shall be opened when emptying, in order to avoid creating a vacuum and breaking the pipeline.

4.6 Assessment of the test

In the event that pressure losses or water losses exceed the specified limits or failures are detected, the pipeline shall be checked and/or repaired. The test shall be repeated as long as the losses comply with the specified limits.

4.7 Final system test

Where the length of the pipeline is divided into two or more pressure test sections and all sections have been successfully tested, the whole system shall be subjected to the operating pressure for at least 2 hours. Any additional element included after the pressure test of adjacent sections shall be visually inspected for leakages and changes in the route and elevations of the pipeline (note also I, 3.4).

4.8 Recording of test results

A complete record of test details shall be drawn up and kept.

II. Testing of non-viscoelastic pipelines (hard material pipes) (metal, concrete, fibreglass (GRP))

1. General provisions

For pipelines made of metal (cast iron or steel) with any kind of internal coating (e.g. cement mortar coating), it should be taken into account that pipeline joints with muffles, clamped muffles, flange connections and welded connections have different behaviours during the pressure test procedure (e.g. displacement and anchoring). Note that differences in interior coating, joints or other characteristics should also be taken into account for other non-viscoelastic (e.g. concrete or fibre reinforced GRP pipelines).

Figure 2 presents the block diagram of the pressure test procedure.

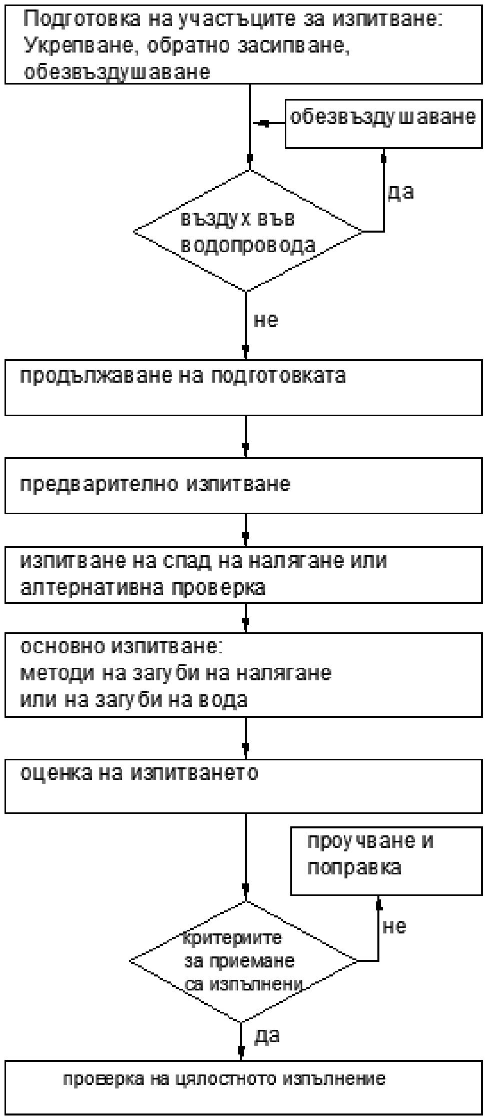


Figure 2 – Block diagram of the pressure test procedure

Подготовка на участъците за изпитване: Укрепване, обратно засипване, обезвъздушаване	Preparation of test sections: Strengthening, backfilling, ventilating
обезвъзду шаване	ventilating
Да	Yes
не	no
въздух във водопровода	air in the plumbing
продължаване на подготовката	continuation of the preparation
предварително изпитване	preliminary test
изпитване на спад на налягане или алтернативна проверка	pressure drop test or alternative inspection
основно изпитване: методи на загуби на налягане или на загуби на вода	main test: methods of loss of pressure or loss of water
оцета на изпитването	test assessment
проучване и поправка	study and corrections
критериите за приемане са изпълнен	acceptance criteria fulfilled

проверка на цялостното изпълнение	verification of overall performance

2 Safety

(a) with regard to staff, the following shall be taken into account:

- at all stages of the test, the planned procedure and any possible modification thereof shall be carried out in such a way as to avoid any danger to personnel;
- all personnel must be clearly informed of the intensity of loading on temporary facilities and of the consequences in case of damage;
- where disinfectants are used, all personnel must be clearly informed of the appropriate handling of them;
- before starting any pressure test procedure, a check shall be made for the availability of appropriate protective equipment and that the personnel are in possession of the correct protective clothing.

(b) in connection with the construction of pipelines and all related activities, the following shall be taken into account:

- permanent supports or reinforcements are designed to withstand the pressure of the test pressure;
- the concrete support blocks shall be allowed to gain appropriate strength before starting the test;
- plugs or other temporary dead flanges shall be properly fixed, the load being distributed according to the strength of the support base. Gate valves, fire hydrants, hydraulic shock protection devices or safety valves are not allowed to be used as dead flanges;
- any temporary supports or reinforcements at the ends of the test section shall not be removed until the pressure in the test section has been reduced to the atmospheric pressure;
- after completion of the construction and until the backfilling, all excavations should remain properly secured. Any activity not related to pressure tests shall not be carried out in tubular trenches during such tests;
- during the application of pressure, the trench and the space around it shall be protected by providing a safe distance. Only competent personnel may enter the protected area where it is necessary to carry out certain duties;
- before carrying out a pressure test, a test equipment shall be checked with a view to verifying whether it is calibrated, in good working order and correctly fitted to the test section.

(c) the following shall be taken into account during the test:

- the air from the test section shall be discharged as much as possible. Filling shall be carried out slowly and, if possible, from the lowest point of the test section in such a way as to prevent back suction and in such a way that air exits through suitably dimensioned air vents.

- the test section shall be filled slowly with water until all the air vents are open and the test section is suitably ventilated;
- the water used for testing shall be discharged appropriately without flooding or adversely affecting the construction site.

3 Preparing the test section

3.1 General provisions

The length of the test sections shall be determined taking into account the following:

- local conditions (e.g. in terms of access);
- availability of suitable water for the test;
- number of fitting parts and accessories (e.g. valves, hydrants, etc.);
- the difference in height between the different parts of the test section;
- the presence of lockable connections.

The test sections shall be selected in such a way that:

- the length of the test section normally does not exceed 1,500 m;
- the system test pressure STP can be generated for the specified time;
- the system test pressure STP shall be achieved at the lowest point of each test section;
- at the highest point (by altitude) of each test section, at least the maximum dimensioning pressure (MDP) shall be achieved (Fig. 1 for example of the pressure profile).
- the required amount of water for the test can be provided and removed without difficulty
- the influence of temperature changes is minimised, especially when the pipe and connections are exposed to weather conditions that may cause freezing or excessive heating.

In the case of partial locking of access fittings with pipes to provide self-reinforcing, the locked sections may be tested together with the unlocked sections. In the case of a fully locked section, the possibility of longitudinal deformation of the pressure line shall be provided. The ends of these sections are not plugged.

Before the test, all deposits and foreign materials shall be removed from the test section.

3.2. Strengthening (fixing) and plugging

Separation of test sections shall be achieved by using deaf flanges or equivalent plugging methods.

The hydraulic loads exerted on the ends of the test sections shall be assessed. The reinforcements are placed where necessary so as to absorb the loads in the crosswise placed wooden beams in the excavation or in the pile reinforcement.

Before the test, all connections for the change of direction and/or cross-section in the test section, such as elbows, tees, cones (reduction gears) and dead flanges, shall be tightened (or strengthened) appropriately by means of support blocks or clamping (self-locking) joints.

Instead of dead flanges, other elements such as gate valves, fire hydrants, hydraulic shock protection devices or safety valves should not be used. If, for practical reasons, shut-off valves are used as closing devices, their nominal pressure (PN or PFA) shall not be lower than the system test pressure STP.

The compressive force on the plug of a pipeline (such as dead flanges) increases with the square of the diameter. Table 2 gives examples of compressive forces generated by a pressure of 1 bar in a plugged pipeline (calculation of the following values by example: for DN 150 and 10 bar, the compressive force will be 2270 daN;

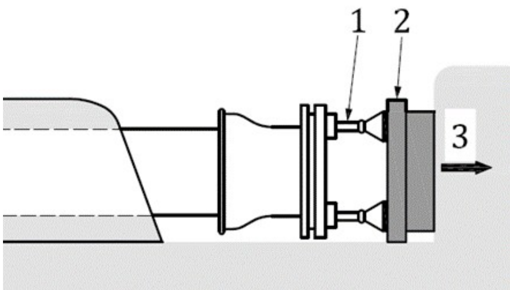
$F = P.\pi.D^2$ where P is the pressure and D is the outer diameter).

Table 2

Examples of compressive forces generated by a pressure of 1 bar in a plugged pipeline

DN	*F* (1 bar) daN	DN	*F* (1 bar) daN	DN	*F* (1 bar) daN	DN	*F* (1 bar) daN	DN	*F* (1 bar) daN
60	47	250	590	600	3 167	1 200	12 370	2 200	41 115
80	75	300	835	700	4 278	1 400	16 787	2 400	48 891
100	109	350	1 122	800	5 568	1 500	19 236	2 600	57 340
125	163	400	1 445	900	7 014	1 600	21 851		
150	227	450	1 809	1 000	8 626	1 800	27 612		
200	387	500	2 223	1 100	10 405	2 000	34 045		

Screw jacks can be used to compensate for possible sinking. Figure 3



1 screw jack

2 pressed support

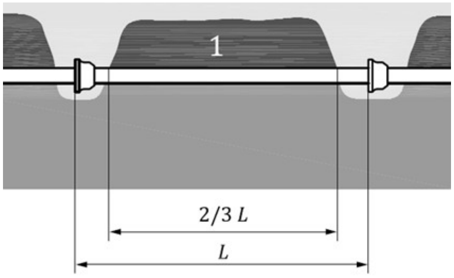
3 compressive force

Figure 3 – Example of strengthening with a jack

3.3 Partial backfilling

The test sections are usually partially backfilled, leaving the pipe connections accessible for inspection. Only if too much temperature deviation can occur, backfilling of the connections or other covering is foreseen.

Sufficient fill material shall be laid to protect the test section from moving (Fig. 4). In particular, before testing, the parts of the test section with locking connections that obtain their stability from their interaction with the soil shall be backfilled.



1 backfilling

L standardised pipe length.

Figure 4 – Partial backfilling before test

3.4 Filling with water and ventilating

The test section is fully filled with water and ventilated. The pressure shall be increased to the operating pressure OP without exceeding the system test pressure STP. The ends of the test section are plugged, usually with dead flanges fitted with ventilation valves.

Pumped water may contain air, which after a period of time will separate. If ventilated, the volume previously occupied by the air can be replaced by water and thus the pressure may decrease. The kinetics of dissolving air in water is a function of many parameters, in particular:

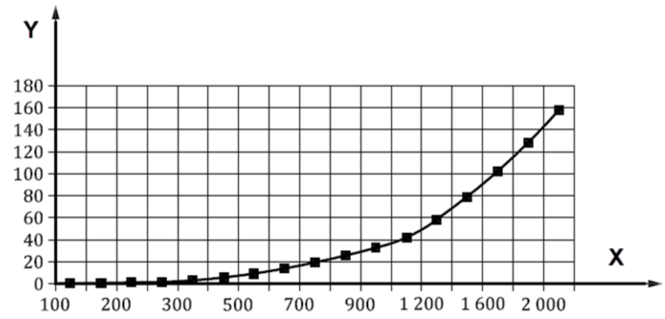
- the initial level of saturation of the pumped water;
- water temperature (the amount of dissolved air decreases with an increase in temperature);
- water pressure (the amount of dissolved air decreases with a decrease in pressure);
- the location of the air pockets;
- the dimensions of the separation surface between air and water.

The test section shall be filled slowly with open air vents at the lowest point so that no back suction occurs and the air can escape through the air vents. Too fast filling can cause retention of air bags.

The full check of the air valve shall be carried out by checking that each automatic air valve and each manual air valve does not release any more air.

In the case of variable inclination without ventilation at all high points, thrusting by means of a plug pushing the air can be applied, especially when even higher filling speeds cannot sufficiently remove the air.

Figure 5 shows typical water quantities when filling.



X DN of the pipe

Y water quantity when filling in litres/second

Figure 5 – Typical water quantities when filling

Ingestion of water from the inner coating of cement solution takes time, depending on the humidity of the air before filling, the temperature, the thickness of the coating and its structure.

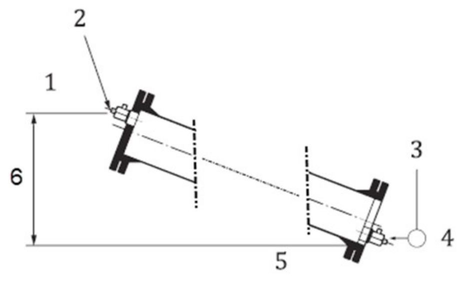
After filling and before starting the preliminary test, an operating pressure OP shall be maintained in the test section for as long as is necessary for stabilisation in relation to possible piping movement and water absorption (may be 24 hours or even longer).

All exposed connections, access fittings, reinforcements and plugs are visually inspected. Any defects detected at that time shall be repaired, where necessary, after emptying the test section.

4. Pressure test procedure

4.1 General requirements

Test pressure is the system test pressure calculated at the lowest point of the test section. If possible, a calibrated pressure measuring instrument with appropriate range and accuracy shall be installed at the lowest point of the test section (Figure 6).



1 higher end

2 air vent

3 test pump and pressure measuring instrument

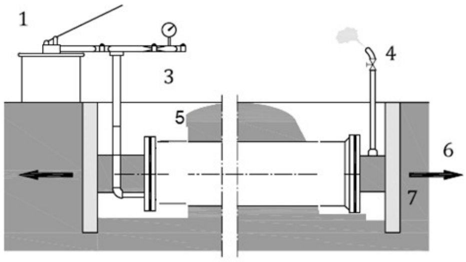
4 applied pressure (STP)

5 lower end

6 height difference between upper and lower ends

Figure 6 – Filling and applicable pressure

Typical pressure test elements are shown in Figure 7.



1 test pump

2 pressure gauge

3 connection to the pump

4 air vent

5 backfilling

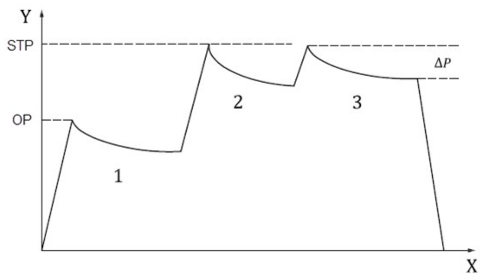
6 axial force

7 strengthening system

Figure 7 – Pressure test elements

After preparation for testing, in accordance with II(3), the test shall be carried out in two or three additional steps (see Figure 8) as follows:

- preliminary test
- pressure drop test, if not omitted by the designer in accordance with I 4.3:
- main test (pressure loss or water loss test).



X time (hours)

Y pressure (bar)

1 preparation (up to 24 hours or more)

2 preliminary test (1 hour or more)

3 main test (1 hour or more)

Figure 8 – Steps in the test procedure, including preparation, with aalterative check instead of a pressure drop test

4.2 Preliminary test

When the visual inspection, in accordance with II 3.4, is successful in order to further stabilise the test section, the pressure shall be gradually increased until the system test pressure (STP) is reached. The duration of the preliminary test and the need for re-pumping to maintain the pressure depends mainly on further water absorption as in II, 3.4.

The system test pressure (STP) shall be calculated from the maximum design pressure (MDP) as follows:

- calculation of hydraulic shock: STP=MDPc+100 kPa
- without hydraulic shock calculation, the smaller of the two values shall be reported.

STP = MDPa+500 kPa

STP = MDPa x 1,5

where,

MDP is denoted as MDPa when there is a specified value assumed for hydraulic shock;

MDP is defined as MDPc when the hydraulic shock is calculated

The test pressure shall not exceed the maximum test pressure (PEA) of any element (pipes, access fittings, flanges, valves and other components), nor the operating pressure of any closing device. The test pressure at the highest point of the test section shall be not less than the maximum design pressure (MDP) at this point.

Changes in temperature may affect the pressure inside the test section. This effect is minimised by ensuring that the initial and final temperature of the pipe wall at each step of the test procedure is approximately the same, which is most important for the main pressure test.

A pressure drop test shall be performed to determine whether there is too much air unless it is omitted in the design and an alternative check is carried out.

4.3 Pressure drop test

After successful completion of the preliminary test, all air vents of the test section shall be closed and all shut-off valves in the test section shall remain open from now on.

The pressure in the test section shall be increased to the system test pressure STP by venting the test equipment.

The volume of water ΔV is removed from the test section and is measured. The resulting pressure drop Δp is also measured.

The water volume removed ΔV is compared with permissible water losses ΔV_{max}corresponding to the measured pressure drop Δp. The pressure drop test is successful when $\Delta V \leq \Delta V_{max}$.

Permissible water losses V_{max} are calculated according to Formula 1:

$$\Delta V_{max} = 1,5 \cdot V \cdot \Delta p \cdot \left(\frac{1}{E_w} + \frac{D}{e \cdot E_R} \right) \quad (1)$$

where,

V_{max} are the permissible water losses, l;

V is the volume of the test section in l calculated with the inner diameter of pipe D, l;

Δp is the measured pressure drop, kPa;

E_W is the volume module of water, kPa;

D is the inner diameter of the pipe, without taking into account the inner coating of cement solution, $D = ID$, m;

e is the thickness of the pipe wall, m;

E_R is the module of elasticity of the pipe wall in the direction of the periphery, kPa;

1.5 is the coefficient of the permissible unavoidable air content.

4.4 Main pressure test

4.4.1 General requirements

After successful completion of the preliminary test and the pressure drop test, the pressure shall be gradually increased until the system test pressure (STP) is reached.

Stabilisation processes can continue, causing pressure changes without necessarily implying leakage. These processes may be mainly due to:

— increase of the volume of the test section due to longitudinal or lateral movements of the joints;

— presence of non-removed air in the test section;

— dissolution in water of the air still present in the test section;

— temperature fluctuations.

The main pressure test will be carried out in accordance with the design requirement (by the pressure loss test method or the water loss test method according to this paragraph).

4.4.2 Pressure loss test

Once the system test pressure (STP) has been reached, the duration of the pressure loss test shall be 1 hour. Pressure losses shall be reported directly. Pressure losses Δp shall show a decreasing trend and shall not exceed 20 kPa after 1 hour while the pipeline is under pressure.

4.4.3. Water loss test

An additional choice shall be made in accordance with the designer"s decision:

(a) measurement of the volume of drained water:

• After reaching the system test pressure (STP), the STP shall be maintained, if necessary, by pumping for a period of not less than one hour.

• The pump is switched off and no more water is allowed to enter the test section for 1 hour.

• After 1 hour, the reduced pressure is measured, STP is restored by pumping, and then water losses are measured by draining water until the previous reduced pressure is reached again after 1 hour.

(b) Measuring the volume of pumped water:

• After reaching the system test pressure (STP), the STP shall be maintained, if necessary, by pumping for a period of 1 hour.

• Measurement is done of the amount of water required for pumping to maintain STP.

If the test section is watertight, the measured water losses will not exceed the value calculated using Formula 2:

$$\Delta V_{max} = 1{,}2\ V.\ \Delta P\ [1/E_W + D/e.\ E_R) \qquad (2)$$

where:

ΔV_{max} are the permissible loss of water in litres;

V is the volume of the test section in litres calculated with the inner diameter of the tube D;

ΔP are the permissible pressure losses in kPa as follows:

E_W is the volume module of water in kPa;

D is the inner diameter of the tube in m, without taking into account the coating of cement solution, $D = ID$;

e is the thickness of the pipe wall in m;

E_R is the module of elasticity of the pipe wall in the peripheral direction in kPa;

1.2 is a factor that takes into account the permissible unavoidable air content.

5. Completion of the test

To reduce the pressure to the atmospheric in the test sections, as well as to evaluate/record the test results and visually check the connections between the test sections and the existing supply system (see I, paragraphs 4.5, 4.6, 4.7 and 4.8)

III. Test of viscoelastic pipelines (PE, PVC-U, PVC-O)

1. General requirements

Each pipeline constructed shall be tested by means of water under pressure to ensure the integrity of pipes, joints, fittings and other elements such as support blocks.

No test liquid other than drinking water (plus disinfectants, where necessary) shall be used.

2. Safety

(a) with regard to staff, the following shall be taken into account:

- at all stages of testing, the planned procedure and any possible modification thereof shall be carried out in such a way as to prevent a hazard to personnel;
- all personnel shall be clearly informed of the intensity of the loading of temporary facilities and reinforcements, as well as of the consequences of a failure;

- where disinfectants are used, all staff shall be clearly informed of how they shall be handled.

- before starting any pressure test procedure, a check shall be made for the availability of suitable protective equipment and that the personnel are in possession of suitable protective clothing.

(b) in connection with the construction of pipelines and all related activities, the following shall be taken into account:

— permanent supports or reinforcements shall be so designed as to withstand the stress of the test pressure.

— The concrete support blocks shall be allowed to develop appropriate strength before the test begins.

— Plugs or other temporary plugging fittings shall be suitably fixed, the load being distributed according to the strength of the support base. Shut-off valves, fire hydrants, hydraulic shock protection devices or safety valves shall not be used as dead flanges.

— Any temporary supports or reinforcements at the ends of the test section shall not be removed until the pressure in the test section has been reduced to the atmospheric pressure;

— After completion of the construction and until the backfilling, all excavations should remain properly secured. Any activity not related to pressure tests shall not be carried out in the plumbing trenches during such tests.

—During the application of pressure, the trenches and the space around it shall be protected by providing a safe distance. Only competent personnel may enter the protected area when it is necessary to carry out certain duties.

— Before carrying out a pressure test, a check of the test equipment shall be carried out with regard to whether it is calibrated and in good working order and correctly fitted to the test section.

(c) the following matters shall be taken into account during the test:

- The air from the test section shall be discharged as fully as possible. Filling shall be carried out slowly and, if possible, from the lowest point of the test section in such a way as to prevent back suction and so that the air exits through suitably dimensioned ventilating devices.

- The test section shall be filled slowly with water while all the air vents are open and the test section is suitably ventilated;

- The water used for testing shall be discharged appropriately without flooding or adversely affecting the construction site.

3 Preparing the test section

3.1 General requirements

The length of the test sections shall be determined taking into account the following:

- local conditions (e.g. in terms of access);
- availability of appropriate water;
- number of fittings and components (e.g. valves, hydrants, etc.);
- difference in heights between different parts of the test section;
- presence of fortified (restricted in movements) connections.

The test sections shall be selected in such a way that:

- MDP and 0.7 x PFA are not exceeded at any point in the test section during filling:
- where MDP or 0.7 x PFA are exceeded during filling, this shall be considered as part of the pressure increase during the preliminary test within the time limits according to II 4.2 and as pressure according to II 4.3;
- where MDP is exceeded during filling, this indicates that MDP can also be exceeded during the later phase of operation of the pipeline. In this case, the design should be reviewed (in particular the location of pressure regulators);
- the normal length of the test section shall not exceed 1,500 m;
- the system test pressure STP can be generated for the specified time;
- the system test pressure STP shall be achieved at the lowest point of each test section;
- at the highest point (by altitude) of each test section, at least the maximum dimensioning pressure (MDP) shall be achieved (see Fig. 1 for example of the pressure profile);
- the water required for the test can be provided and removed without difficulty;
- the influence of temperature changes is minimised, especially when the pipe and connections are exposed to weather conditions that are cause for freezing or excessive heating.

Before the test, all dirt and foreign materials shall be removed from the test section.

3.2. Strengthening (fixing) and plugging

Separation of test sections shall be achieved by using deaf flanges or equivalent plugging methods.

The hydraulic loads exerted on the ends of the test sections shall be assessed. The reinforcements are placed where necessary so as to absorb the loads in the crosswise placed wooden beams in the excavation or in the pile reinforcement.

Before the test, all connections for the change of direction and/or cross-section in the test section, such as elbows, tees, cones (reduction gears) and dead flanges, shall be tightened (or strengthened) appropriately by means of support blocks or locking (self-locking) joints.

Instead of dead flanges, other elements such as stop cocks, fire hydrants, hydraulic shock protection devices or safety valves should not be used. If, for practical reasons, stop taps are used as closing devices, their nominal pressure shall not be lower than the system test pressure STP. When assessing the total permissible leaks for the test section, due account shall be taken of the permissible leakage(s) from this element(s).

3.3. Partial backfilling

The test sections are usually partially backfilled, leaving the pipe connections accessible for inspection. Only if too much temperature deviation can occur, backfilling of the connections or other covering is foreseen.

Sufficient backfilling material shall be laid to prevent the test section from moving. In particular, before testing, the parts of the test section with locked connections that obtain their stability from their interaction with the soil shall be backfilled.

3.4 Filling with water and ventilating

The test section is fully filled with water and ventilated. The pressure is increased to the operating pressure OP (see also the limitations in III 3.1). The ends of the test section are plugged, usually with dead flanges fitted with air vents.

Pumped water may contain air, which after a period of time will separate. If ventilated, the volume previously occupied by the air can be replaced by water and thus the pressure may decrease. The kinetics of dissolving air in water is a function of many parameters, in particular:

— the initial level of saturation of the pumped water;

— the water temperature (the amount of dissolved air decreases with an increase in temperature);

—water pressure (the amount of dissolved air decreases with a decrease in pressure);

— the location of the air pockets;

— the dimensions of the separation surface between air and water.

The test section shall be filled slowly, with open air vents, from the lowest point, so that no back suction occurs and the air can escape through the air vents. Too fast filling can cause retention of air bags.

The full inspection of the air vent is carried out by checking that each automatic air vent and each manual air vent does not release any more air.

In the case of variable inclination without ventilation at all high points, thrusting by means of a plug pushing the air can be applied, especially when even higher filling speeds cannot sufficiently remove the air.

3.5 Reduction of temperature and pressure

During the entire test period, the test section shall be protected from temperature increase in order to prevent the temperature of the outer wall of the pipe to exceed 20 °C. This can be estimated by checking the external temperature, taking into account the temperature of the fluid (cooling or heating effect). It will take time to balance the temperature in the wall of the pipe. Where temperatures above 20 °C cannot be prevented, a reduction factor shall be applied in accordance with Table 3.

Table 3

Pressure reduction factor at temperatures above 20 °C

	Pressure reduction factor	
temperature	**material**	
T [°C]	**PE**	**PVC-U, PVC-O**
20	1.000	1.000
21	0.987	1.000
22	0.974	1.000
23	0.961	1.000
24	0.948	1.000
25	0.935	0.980
26	0.922	0.960
27	0.909	0.940
28	0.896	0.896
29	0.883	0.896
30	0.870	0.870
31	0.857	0.857
32	0.844	0.844
33	0.831	0.831
34	0.818	0.818
35	0.805	0.805
36	0.792	0.792
37	0.779	0.779
38	0.766	0.766
39	0.753	0.753
40	0.740	0.740
Based on the pressure reduction factor for: PE 1.3 %/°C, between 20 °C and 40 °C, PVC-U or PVC-O 2.0 %/°C, between 25 °C and 40 °C		

4. Pressure test procedures

4.1 General requirements

The test pressure is the system test pressure calculated for the lowest point of the test section. If possible, a calibrated pressure measuring instrument with appropriate range and accuracy shall be installed at the lowest point of the test section.

The test shall be carried out in three steps:

- preliminary test:
- pressure drop test (generally, there are no conditions for omitting the pressure drop test);
- main pressure test.

One of the following test methods shall be followed.

- The shrinkage method is the typical PE test method and can alternatively be used for PVC-U and PVC-O. The shrinkage method uses the viscoelastic property of the pipe material and provides reliable results for the tightness in a short time. (III, item 5).
- The ordinary method is the typical test method for PVC-U and PVC-O and can alternatively be used for PE. (III, item 6).

4.2 Choice of the test method

Figure 9 gives an overview of the selection process.

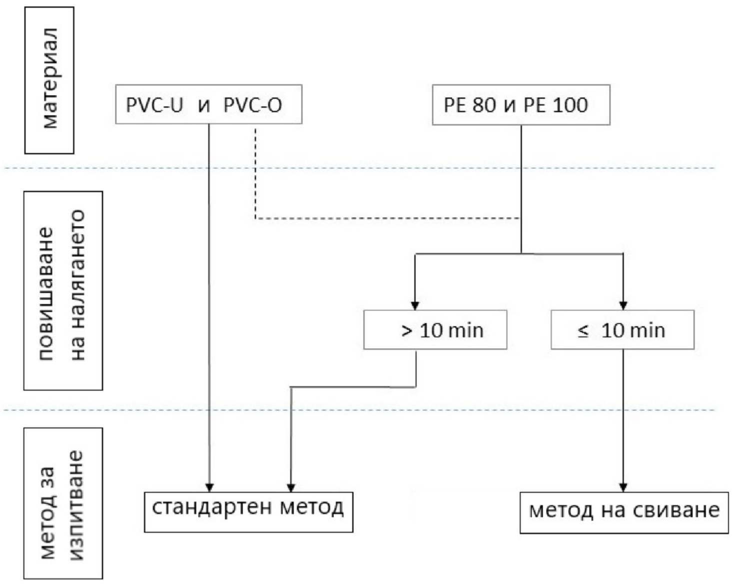


Figure 9 – Choice of the test method

метод за изпитване	test method
Повишаване на налягането	Increase in pressure
материал	material
стандартен метод	standard method
метод на свиване	shrinkage method

The application of the shrinkage method is based on the assumption that STP can be achieved within 10 minutes of exceeding MDP at the lowest point of the test section.

4.3 Test pressure for viscoelastic pipes:

The system test pressure (STP) shall be calculated from the maximum design pressure (MDP) in accordance with I 3.2:

STP = 1.5 × MDP or

STP = MDP + 5 bar (the smaller of both values is recorded)

Due to the behaviour of highly elastic materials absorbing energy from hydraulic shocks, for viscoelastic pipes meeting European product standards (EN 12201, EN 17176, EN ISO 1452), no addition of a value of hydraulic shock pressure is foreseen. MDP can therefore be considered to be identical to DP.

To start the shrinkage effect of the pipe, a minimum test pressure for the shrinkage method shall be applied as follows: 0.7 × PFA (i.e. 0.7 × PN). Examples are shown in Table 4.

Example calculations for minimum test pressures are shown below:

Designed pipe system PN 10 – MDP = 10 bar System test pressure → STP = 1.5 x MDP = 15 bar Installed pipe: PE 100 / SDR 7.4 / PN25. To start shrinking, the minimum test pressure for a pipe PE 100 / SDR 7.4 / PN25 (where PFA = PN) is 0,7 x PFA = 17.5 bar. The test pressure of 15 bar for the PN 10 pipe system is lower than the minimum test pressure of 17.5 bar. → The shrinkage method is not applicable	Designed pipe system PN 16 – MDP = 16 bar System test pressure → STP = MDP + 5 = 21 bar Installed pipe: PE 100 / SDR 11 / PN16. To start shrinking, the minimum test pressure for a pipe PE 100 / SDR 11 / PN16 (where PFA = PN) is 0.7 x PFA = 11.2 bar The system test pressure of 21 bar for PN 16 pipe system is higher than the minimum test pressure of 11.2 bar. → The shrinkage method is applicable

Table 4 gives STP values for MDP for typical PN and SDR.

Table 4

STP values based on MDP

Maximum design pressure MDP	System test pressure [a] STP at ≤ 20 °C		Classification of pipes by pressure	Standard dimension ratio SDR (d_n/e_n)		
MDP	STP [b]	Minimum test pressure[c]	PN	SDR		
[bar]	[bar]	[bar]		P E 100	PV C-O	PV C-U
0	0	4.2	PN6			
1	1.5					
2	3.0					
3	4.5					
4	6					
5	7.5					
6	(9)[d]			26	N/	41
7	10.5	5.6	PN8			
8	(12)[d]			21	N/	33
9	(13,5)	7	PN10			
10	(15)[d]			17	65	26
11	16	8.7 5	PN12.5			
12	17			13	57	21
13	18	11. 2	PN16			
14	19					
15	20					
16	21			11	45.	17
17	22	14	PN20			
18	23					
19	24					
20	25			9	37	13.
21	26	17. 5	PN25			
22	27					
23	28					
24	29					
25	30			7.	29	11

[a] the maximum test pressure shall be determined by the lowest positioned element, which may not be a viscoelastic pipe.

[b] STP is calculated as a lower value than (MDP + 5 bar) or (MDP x 1.5)

[c] A calculated test pressure of at least 0.7 x PFA (where PFA = PN) allows a shrinkage method to be applied (see item 5), otherwise the standard method (see item 6) is applied.

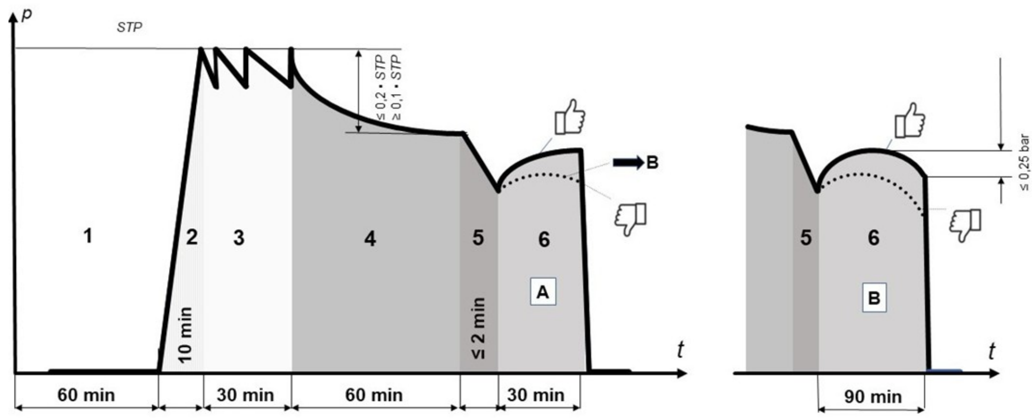
[d] STP for the shrinkage method only when the pipe manufacturer confirms the test parameters. Alternatively, a pipe with a higher PN can be selected.

5 Test procedure using the shrinkage method

5.1 General requirements

Figure 10 shows the pressure curve and the duration of the different test stages:

- preliminary test;
- pressure drop test;
- main pressure test.



Preliminary test (III, item 5.2)

1 preparation

2 increase of pressure

3 phase of pressure maintenance

4 rest phase (0.1 STP ≤ pressure loss ≤ 0.2 STP)

Pressure drop test (III, item 5.3)

5 pressure drop (Δ)*p* in bar; values shown in the table)

Main pressure test (III, item 5.4)

6 main pressure test (Scenario A, if successful after 30 minutes; Scenario B in case of doubt after 30 minutes, Scenario B lasts a total of 90 minutes)

Figure 10 – Pressure test diagram using the shrinkage method

5.2 Preliminary test

The preliminary test is intended for the following:

— thermal stabilisation of the test section so that the temperature in the pipe wall does not change during the main pressure test;

— increase the pressure to STP;

— checking for air in the test section.

In addition, the preliminary test shall be used to allow the pressure-dependent increase in the volume of flexible pipes to occur before the main test and, as far as possible, thus to eliminate distortions in the test result. When necessary, purge is carried out to remove excess air. If there are unacceptable changes in the position of any part of the test section and/or leakages, the pressure in the test section shall be reduced to the atmospheric pressure and the defects shall be rectified.

5.2.1. The preliminary test is performed in the following four steps (Fig. 10):

(a) Preparation (rest): after filling, the tap at the highest point is opened for 1 hour. During this time no air enters the pipeline.

(b) Accumulation of pressure: Close the tap and raise the pressure at the highest point to at least the maximum design pressure (MDP) without exceeding the system test pressure (STP) at the lowest point. STP is reached within 10 minutes. To reach STP in no more than 10 minutes, the maximum volume of the pipe section is usually 30 m^3. Larger pumps can be selected for larger volumes.

(c) Pressure maintenance: the STP pressure is maintained by continuous pumping for a period of 30 minutes.

(d) Rest for 1 hour: Pumping is stopped and pressure losses in the test section are measured. During this time, the test section under pressure undergoes viscoelastic deformation.

5.2.2. During the rest phase:

- A loss of pressure above 20 % is a sign of leakage (unless the test section has been exposed to an unacceptable increase in temperature.)
- A loss of pressure below 10 % is a sign of too much air in the test section.

In both cases, the preliminary test including the one-hour rest period shall be repeated after the test section has been brought to the rest conditions described above.

5.3. Pressure drop test

The pressure drop test is an integral part of the main pressure test.

The pressure drop test shall be used to determine whether the remaining air content in the test section is too high. Too high air content may adversely affect the test results.

The pressure drop test shall be performed immediately after the successful completion of the preliminary test rest phase (without recovery of STP) as follows:

- Volume of water ΔV is removed to achieve a pressure drop Δp within a maximum of 2 minutes and the volume ΔV is measured. Table A.6 gives target values for Δp for different types of PE and PVC materials. ΔV is compared with permissible water losses ΔV_{max} calculated according to Formula 3 or Formula 4.
- The permissible water losses shall be calculated using the following Formula 3:

$$\Delta V_{max} = 0{,}1 \cdot f \cdot \frac{\pi \cdot ID^2}{4} \cdot L \cdot \Delta p \cdot \left(\frac{1}{Ew} + \frac{ID}{ER \cdot s} \right) \qquad (3)$$

where,

ΔV_{max} are the permissible water losses, in l;

V is the volume of the test section, in l;

Δp — the actual (measured) pressure drop that may slightly deviate from its target value as set out in Table 5, in bar;

E_W — the volume module of water, in kPa;

ID — the inner diameter of the pipe, in mm;

E_R — the module of elasticity of the pipe wall in the peripheral direction, in kPa;

f — 1.05 for thermoplastic pipes, the compensation factor for unavoidable air inclusions;

s — the calculated wall thickness of the pipe, taking into account average value plus tolerance, in mm; where $s = s_n + (0.1 \times s_n + 0.2) \times 0.5$

L — the length of the test section, in m.

or

$$\Delta V_{max} = V_c . L , \qquad (4)$$

where,

ΔV_{max} are permissible water loss, in litres;

L — the length of the test section, in m;

V_c — the calculated water volume due to the plastic pipe expansion according to Table 6. For other pipe sizes V_{max} is calculated using Formula 3.

Ventilation of the test section shall be sufficient where:

$\Delta V \leq \Delta V_{max}$

where,

ΔV_{max} are the permissible water losses, l

ΔV is the volume of drained water, l

Table 5

Pressure drop Δp

Pipe material	E-Module E_R in N/mm^2 [a]	Series of pipes SDR	Pipe series S	Pressure drop (target values) Δp in barb
PE 80	850	11	5	2.2
PE	1100	17	8	2.0
PE	1100	11	5	3.2
PE100/RC	1100	7.4	3.2	5.2
PVC-U	2600	21	10	3.8
PVC-U	2600	13.5	6.25	5.9
PVC-O	3500	57	28	2.0
PVC-O	3500	45.8	22.4	2.6
PVC-O	3500	37	18	3.2
PVC-O	3500	29	14	4.0

a typical values for 2h modules of elasticity

b These pressure drop values are not calculated but are based on experience in practice

Table 6

Calculated water volume V_c (ml/m)

OD	**PE80**	**PE100/RC**		**PVC-U**		**PVC-O**	**PVC-O**	**PVC-O**	**PVC-O**
SDR[a, b]	11	17	11	21	13.5	57	45.8	37	29
63	4.97	5.78	4.93	7.19	6.19	-	-	6.58	8.22
75	7.34	8.36	7.28	10.15	8.81	-	9.04	11.13	11.90
90	10.45	11.92	10.36	14.78	12.79	11.46	13.63	16.77	17.38
110	15.70	18.12	15.55	21.96	19.13	19.43	21.39	26.17	26.03
125	20.20	23.63	19.94	28.57	24.83	27.26	29.09	34.18	33.90
140	25.70	29.86	25.47	36.05	31.26	34.33	38.68	43.26	42.80
160	33.25	38.77	32.97	46.86	40.82	45.02	50.70	57.51	55.89
180	42.19	49.45	41.83	59.96	51.66	57.16	64.35	72.17	70.73
200	52.17	60.75	51.74	73.69	63.78	70.75	79.63	90.29	87.32
225	66.05	76.70	65.48	93.40	81.23	89.78	101.01	114.26	111.74
250	82.10	96.18	81.39	116.65	100.03	111.06	124.93	141.05	137.33
280	102.79	120.39	101.90	145.49	125.85	139.59	156.99	177.95	173.16
315	130.45	152.23	129.31	185.48	159.39	176.99	199.02	224.48	219.44
355	165.86	192.17	164.41	235.87	203.36	225.17	253.15	285.66	278.27

400	210.54	245.69	208.71	298.56	257.51	286.30	321.82	364.68	355.04

[a] Ratio of the nominal outer diameter of the pipe to the nominal wall thickness

[b] For the calculation of SDRs not specified, take into account the nominal outer diameter of the pipe d and the wall thickness of the pipe s, taking into account the average value plus tolerance; where

$s = s_n + (s_n \cdot 0.1 + 0.2) \times 0,5$ with s_n as nominal wall thickness of the pipe

5.4 Main pressure test

The pressure reduction during the pressure drop test (step 5, see Figure 10) results in an immediate shrinkage of the test section with a slight increase in pressure (step 6). As shown in Figure 10, the pressure stabilises after about 30 minutes.

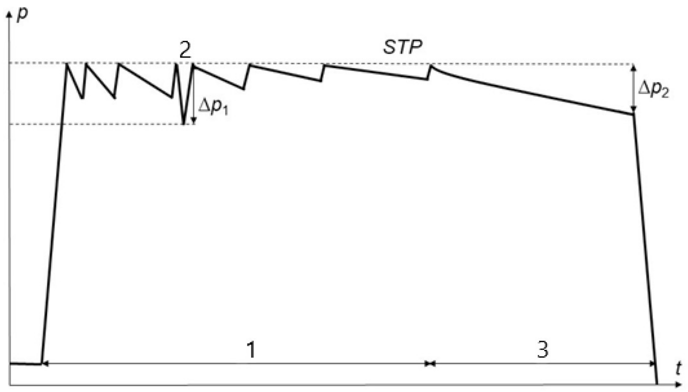
The test section is considered to be under pressure if, during the shrinkage time, the pressure line shows an increasing to constant trend (Figure 10, Scenario A).

In case of doubt, the duration of the test may be extended to 90 minutes (Figure 10, Scenario B). The main pressure test is successful, if the pressure drop does not exceed 0.25 bar, measured from the maximum value after the increase during shrinkage.

6 Test procedure using the standard method

6.1 General provisions

Figure 11 and Figure 12 show the pressure curve and the duration of the steps in the standard method (with or without pressure reduction in accordance with Table 7).

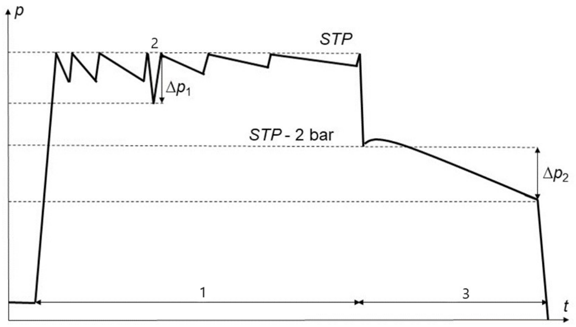


1 Preliminary test

2 Pressure drop test (air bleeding control)

3 Main pressure test

Figure 11 – Pressure test diagram using the standard method



1 Preliminary test

2 Pressure drop test (air bleeding control)

3 Main pressure test

Figure 12 – Pressure test diagram using the standard pressure reduction method

6.2 Preliminary test

The preliminary test and the pressure drop test, as an integral part of the preliminary test, shall aim at:

— thermal stabilisation of part of the test section so that the temperature of the pipe wall does not change during the main pressure test;

— increase the pressure to the system test pressure (STP) at the lowest point of the test section;

— checking for air in the test section.

Where necessary, a plug pushing the air is applied to remove excess air. In the event that obvious unacceptable changes in the position of any part of the test section and/or leaks occur, the test section shall be decompressed and the malfunctions rectified. The following four steps are implemented:

— Accumulation of pressure: Close the tap and raise the pressure at the highest point as fast as possible to at least the maximum design pressure (MDP) without exceeding the system test pressure (STP) at the lowest point.

— Pressure maintenance: the STP pressure shall be maintained by continuous pumping for a period of 1 hour before the pressure drop test is performed.

— Pressure drop test according to A.24.6.3.

— Further pressure maintenance (according to Table A.8 minus 1 hour): the STP pressure is maintained by continuous pumping until the start of the main pressure test.

6.3 Pressure drop test

The pressure drop test is an integral part of the preliminary test to determine whether the air content of the test section is too high.

The pressure drop test conducted 1 hour after the start of the preliminary test makes it possible to estimate the remaining air volume in the test section, since a large amount of air in the test section will result in incorrect data. Thrusting a plug pushing the air may be a means of assisting the removal of air prior to the pressure test.

The pressure drop test shall be performed as follows:

Remove water with volume ΔV to achieve approximately 1 bar pressure drop and measure the volume ΔV and the actual pressure drop Δp_1 (which does not have to be exactly 1 bar, but for example 0.9 bar or 1.1 bar). Compare ΔV with permissible water losses ΔV_{max} calculated according to Formulas 4 or 5.

$$\Delta V_{max} = 0.1 \cdot f \cdot \frac{\pi \cdot ID^2}{4} \cdot L \cdot \Delta p \cdot \left(\frac{1}{Ew} + \frac{ID}{ER \cdot s} \right) \tag{4}$$

where:

ΔV_{max} are permissible water loss, in litres;

V is the volume of the test section, in litres;

Δp_1 is the actual (measured) pressure drop, in bar;

E_W is the volume module of water in kPa;

ID is the inner diameter of the pipe, in mm;

E_R is the module of elasticity of the pipe wall in the peripheral direction, in kPa;

f is a compensation factor for unavoidable air inclusions; f = 1.05 for thermoplastic pipelines;

s is the calculated wall thickness of the pipe, taking into account the average value plus tolerance, in mm; where $s = s_n + (0.1 \times s_n + 0.2) \times 0.5$

L is the length of the test section, in m.

The ventilation of the test section shall be sufficient when:

$\Delta V \leq \Delta V_{max}$

where:

ΔV_{max} are the permissible water losses, in l;

ΔV is the volume of drained water, in l.

6.4 Main pressure test

After successful preliminary test, including the pressure drop test, the pressure maintenance shall be stopped (see Figure 11). For PE/PN 16 only, the pressure shall be reduced by 2 bar (STP – 2 bar; see Figure 12; as a result of the test pressure lowering by 2 bar, elastic shrinkage of the plastic pipe is obtained, but not as much as in the shrinkage method.). The main pressure test is successful when pressure losses Δp_2 after pressure maintenance is stopped (and pressure reduction by 2 bar for PE/PN 16) shall not exceed the maximum pressure loss Δp_{max}according to Table 7 after the time according to Table 7.

Table 7

Indicative values for a normal procedure test

Pipe material	Pressure classification PN	DN/OD	Preliminary test pressure/maintenance time		Main test (no pumping)		
			STP bar**)	Time h	Pressure at the beginning	Pressure losses Δp_{max} bar**)	time h
PVC-U	10/16	≤ 150	13/21	12	13/21	≤ 0.2	3
PVC-U	10/16	> 150 ≤ 400	13/21	12	13/21	≤ 0.2	6
PVC-O	12.5	≤ 150	16.25	12	16.25	≤ 0.2	1.5
PVC-O	12.5	> 150 ≤ 400	16.25	12	16.25	≤ 0.2	1.5
PVC-O	12.5	> 400	16.25	12	16.25	≤ 0.2	1.5
PVC-O	16	≤ 150	21	12	21	≤ 0.2	1.5
PVC-O	16	> 150 ≤ 400	21	12	21	≤ 0.2	1.5
PVC-O	16	> 400	21	12	21	≤ 0.2	1.5
PVC-O	20	≤ 150	25	12	25	≤ 0.2	1.5
PVC-O	20	> 150 ≤ 400	25	12	25	≤ 0.2	1.5
PVC-O	20	> 400	25	12	25	≤ 0.2	1.5
PVC-O	25	≤ 150	30	12	30	≤ 0.2	1.5
PVC-O	25	> 150 ≤ 400	30	12	30	≤ 0.2	1.5

PVC-O	25	> 400	30	12	30	≤ 0.2	1.5
PE80, PE100/RC	10/16	≤ 150	12/21	12	12/19	≤ 0.3	3
PE80, PE100/RC	10/16	> 150 ≤ 400	12/21	12	12/19	≤ 0.6	6
PE80, PE100/RC	10/16	> 400	12/21	12	12/19	≤ 1.2	12

7. Completion of the test

For reducing the pressure in test sections, assessment/recording of test results and visual inspection of the joints between the test sections and the existing supply system, the requirements of I 4.5, 4.6 and 4.8 shall be met.

Annex 14

to Article 243(3), Article 282(4), Article 283(1), Article 284(1) and Article 287(2)

Disinfection of facilities and elements of water supply systems

1. General provisions

The facilities, elements of the water supply system, facilities of drinking water treatment plants, water abstraction facilities, drawing and pressure tanks, pumping stations, water supply networks, etc. shall be disinfected in the following cases:

- Preventive, before commissioning;
- After periodic washing;
- After repair and emergency work;
- In cases of contamination, where there are conditions for the development of disease-causing micro-organisms, as well as the creation of an epidemiological situation.

It is recommended that the disinfection of the inner surfaces (bottom and walls) of equipment and tanks with large volumes and passable pipelines (with large diameters) should be carried out by applying a layer of solution by spraying. Disinfection is carried out after mechanical cleaning and washing.

Facilities with smaller volumes are disinfected by traditional volumetric methods by filling them with a disinfectant solution.

After the construction of a new or replacement of an existing water pipe, as well as the building plumbing deviations connected to it, must be washed and disinfected.

The following methods of washing and disinfection are permissible:

- washing with drinking water without the addition of a disinfectant, with or without air supply;
- static way of using drinking water with the addition of a disinfectant;
- dynamic way with drinking water and the addition of a disinfectant.

The water used for washing and disinfection must be capable of being supplied and discharged with the permission of the water supply system operator and the relevant basin directorate on the territory of which the site is located in compliance with the requirements related to the protection of the environment.

2. Preparation for disinfection

2.1. Selection of disinfectant

The type of disinfectant and the way of disinfection of the plumbing system are determined in the project.

Where chlorine-based biocidal products are used for disinfection:

For the determination of the required quantity of biocidal product, the percentage of active chlorine in the product, the volume of the chlorinated section of the pipeline and the accepted concentration (dose) of active chlorine shall be taken into account in accordance with the following formula:

$$T = \frac{0{,}082.D^2.l.K}{A}$$

where:

T – the required mass of the commercial product containing chlorine, taking into account 5 % for losses, kg;

D and l – respectively, the diameter and length of the pipeline, m;

K – accepted concentration (dose) of active chlorine, mg/l;

A – the percentage of the active substance (chlorine) in the commercial product, %.

The minimum contact time shall be determined by the designer, taking into account the conditions of the permit issued, the type and size of the facility, and for the plumbing, the diameter, length, material and conditions of application of the pipeline section to be disinfected shall be taken into account.

2.2. Dosing equipment for biocidal products for disinfection

Facilities and devices suitable for contact with drinking water and safe operation are used for disinfection.

The following may be used as dosing devices for biocidal products for disinfection:

- ejectors (Fig.1);
- dispenser pumps (Fig.2)

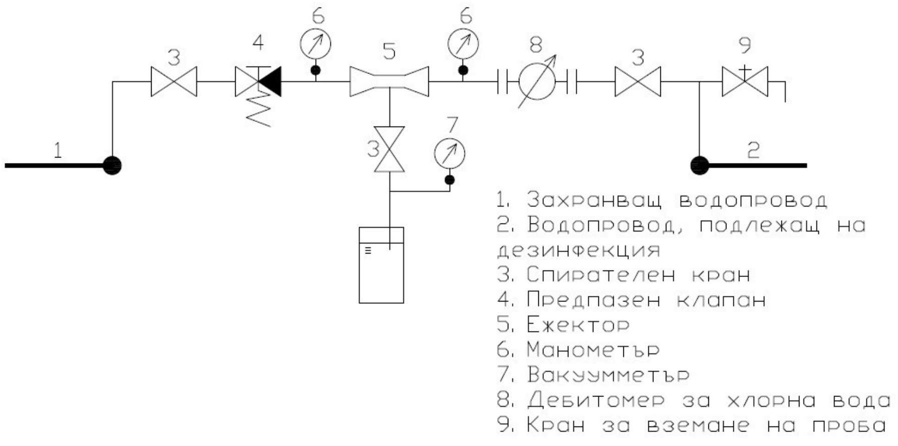


Figure 1. Installation for disinfection with ejector

ЗАХРАНВАЩ ВОДОПРОВОД	SUPPLYING WATER PIPE
ВОДОПРОВОД, ПОДЛЕЖАЩ НА ДЕЗИНФЕКЦИЯ	PLUMBING SUBJECT TO DISINFECTION
СПИРАТЕЛЕН И СРАН	STOP TAP

ПРЕДПАЗЕН КЛАПАН	SAFETY VALVE:
ЕЖЕКТОР	EJECTOR
МАНОМЕТЪР	PRESSURE GAUGE
ВАКУУММЕТЪР	VACUUM METER
ДЕВИТОМЕР ЗА ХЛОРНА ВОДА	FLOW METER FOR CHLORINATED WATER
КРОН ЗА ВЗЕМАНЕ НА ПРОБА	VALVE FOR SAMPLING

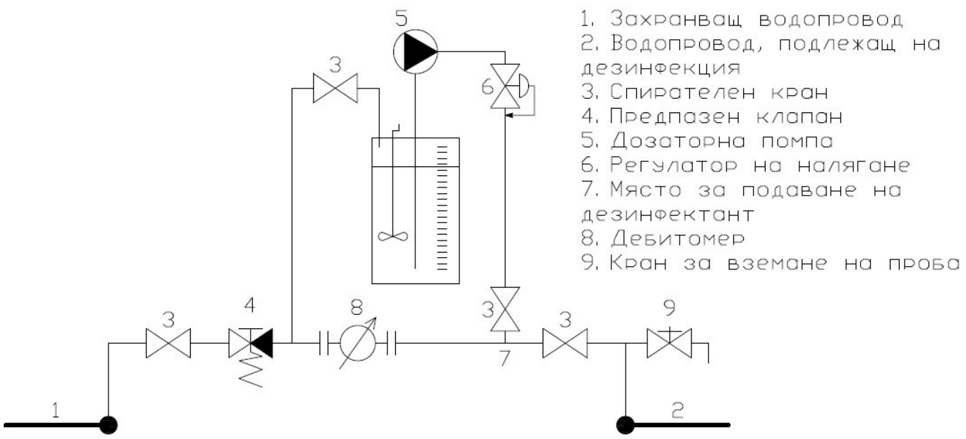


Figure 2. Disinfection instalation with a dispenser pump

ЗАХРАНВАЩ ВОДОПРОВОД	SUPPLYING WATER PIPE
ВОДОПРОВОД, ПОДЛЕЖАЩ НА ДЕЗИНФЕКЦИЯ	PLUMBING SUBJECT TO DISINFECTION
СПИРАТЕЛЕН И СРАН	STOP TAP
ПРЕДПАЗЕН КЛАПАН	SAFETY VALVE:
ДОЗАТОРНА ПОМПА	DISPENSER PUMP
РЕГУЛАТОР НА НАЛЯГАНЕ	PRESSURE REGULATOR
МЯСТО ЗА ПОДАВАНЕ НА ДЕЗИНФЕКТАНТ	PLACE FOR DELIVERING DISINFECTANT
ДЕВИТОМЕР	FLOW METER
КРОН ЗА ВЗЕМАНЕ НА ПРОБА	VALVE FOR SAMPLING

2.3. Isolation of the facility and/or plumbing to be disinfected

The disinfected plumbing and/or facility must be isolated from the operating parts of the water supply system.

Unless otherwise prescribed by the designer, it is permissible in special cases not to separate water pipes, such as in cases of laying of short water pipes and building deviations with DN < 80mm and with a length not exceeding 100 m. In such cases, water from the disinfected section shall not be allowed to enter into the existing supply system.

3. Pre-washing before disinfection

The purpose of pre-washing before disinfection is to remove larger deposits (construction waste, corrosion products, etc.) that can be a source of contamination.

3.1. Washing with drinking water

When flushing the plumbing, the velocity and minimum duration of confluences shall comply with the design requirements.

Unless otherwise specified in the project, the drinking water flushing of water pipes without the addition of disinfectants shall be carried out by creating a minimum flow rate in the pipes of 0.9 m/s.

The volume of water to be used for washing is at least 3 times the volume of the pipe.

The sloping pipes should be washed from top to bottom. On the other hand, filling with disinfectant should be carried out from the bottom upwards.

When emptying the water pipes into the sewer system, measures shall be taken to exclude the possibility of pre-washing products (dirty water and dirt) being sucked back into the pipe.

3.2. Hydropneumatic flushing

For elements of the water supply system in operation, as well as for newly built at the discretion of the designer, means may be used to increase the cleaning effect by introducing air during flushing with drinking water.

When flushing with additional introduction of air from a compressor, may be used the installation shown in Fig. 3

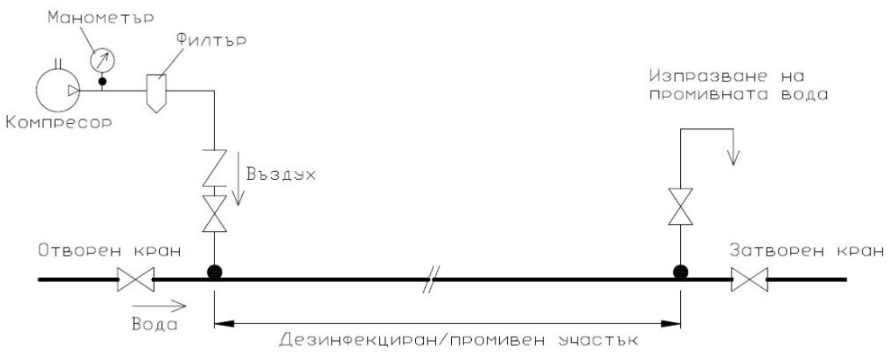


Figure 3. Hydropneumatic flushing installation

МОНОМЕТЪР	PRESSURE GAUGE
ФИЛТЪР	FILTER
КОМПРЕСОР	COMPRESSOR;
ВЪЗДУХ	AIR
ОТВОРЕН КРАН	OPEN VALVE
ВОДА	WATER,
ИЗПРАЗВАНЕ НА ПРОМИВНАТА ВОДА	EMPTYING OF THE FLUSHING WATER
ЗАТВОРЕН КРАН	CLOSED VALVE
ДЕЗИНФЕКЦИРАН/ПРОМИВЕН УЧАСТЪК	DISINFECTED/WASHED SECTION

In the case of hydropneumatic flushing, the amount of compressed air supplied shall be at least 50 % of the flow rate of the supplied water. The air shall be introduced into the pipeline under pressure exceeding the internal pressure of the pipeline by 0.05-0.15 Mpa. The recommended velocity of the air-and-water mixture in the pipelines is 2.0 to 3.0 m/s.

4. Disinfection:

The disinfection method, type of disinfectant used, concentration and contact time shall be determined in accordance with the conditions of the permit granted. The need for neutralisation of the waste disinfectant solution is determined in the project. The disinfection of water supply networks and facilities shall be carried out in accordance with Article 162.

Disinfectant filling should be carried out from the bottom upwards.

4.1. Static method of disinfection using drinking water and adding a disinfectant

In the static method, the disinfectant solution fully fills the facility or pipe section. Biocidal products with the recommended maximum permissible concentration as per BDS EN 805 shall be used for its preparation. The technological diagram shown in Figure may be used for the delivery of the disinfectant solution. 4

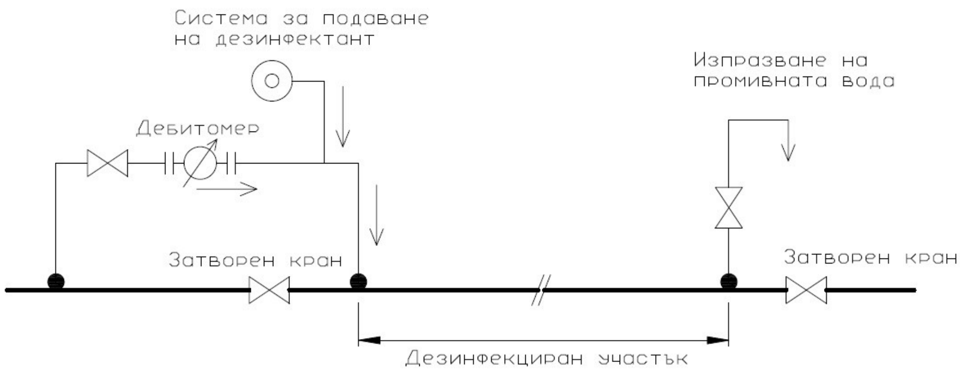


Figure 4. Installation for disinfection of a pipe section using the water and the pressure of the water supply network

СИСТЕМА ЗА ПОДАВАНЕ НА ДЕЗИНФЕКТАНТ	SYSTEM FOR DELIVERING DISINFECTANT
ДЕВИТОМЕР	FLOW METER
ЗАТВОРЕН КРАН	CLOSED VALVE
ИЗПРАЗВАНЕ НА ПРОМИВНАТА ВОДА	EMPTYING OF THE FLUSHING WATER
ДЕЗИНФЕКЦИРАН УЧАСТЪК	DISINFECTED SECTION

The contact time depends on the concentration of the disinfectant solution, but in this method it can not be less than 12 hours.

4.2. Dynamic method of disinfection using drinking water and the addition of a disinfectant (snail method)

Disinfection is carried out by supplying the disinfection solution in a water pipe filled with drinking water. For this purpose, specialised equipment shall be used that is intended for contact with drinking water and equipped with a spraying disinfectant solution device which moves slowly along the length of the pipe section. The quantity, concentration and speed of movement of the supplying disinfectant solution device shall be determined in the design.

4.3. Disinfection during the repair of a water supply section in operation

When repairing a water supply section in operation, clean or disinfected parts must be used. Water from the excavation should not be allowed into the pipe. After completion of the repair, the plumbing section shall be disinfected by recommending the use of biocidal products with maximum permissible concentrations according to BDS EN 805 and a contact time of at least 1 hour.

After the repair, a thorough washing must be carried out (see item 3.1) until the quality of drinking water under Ordinance No 9 of 2001 on the quality of water intended for drinking and household purposes is reached.

4.4. Disinfection of filters, precipitators, mixers and other small volume equipment

Disinfection of the facilities of drinking water treatment plants shall be carried out in accordance with Article 243(2).

Unless otherwise specified in the design, the disinfection of individual filters after filling them with filter filling, precipitators, mixers and low-volume pressure tanks may be carried out by filling them with a disinfectant solution with a concentration of 75-100 mg/l of active chlorine. After contact for not less than 5-6 hours, the chlorine solution is drained through the emptying system of the facility, after which complete washing is carried out until the drinking water quality with 0.3-0.4 mg/l residual chlorine is reached.

4.5. Disinfection of tanks and other high volume equipment

Disinfection of drinking water treatment plants shall be carried out in accordance with Article 243(2).

Unless otherwise specified in the design, a method by spraying walls that are in contact with drinking water with a solution containing chlorine biocidal products with an active chlorine concentration of 200-250 mg/l is allowed for disinfection of individual high volume facilities. The recommended dose of the solution is 0.3 to 0.5 litres per 1 m^2 from the inner surface of the facility. The recommended time for contact of the layer of disinfectant solution on the walls of the facility is between 1 and 2 hours. Then disinfected surfaces should be washed with clean drinking water, removing the products of disinfection. The work should be carried out using special clothes, rubber boots and gas masks before entering the facility.

5. Washing after disinfection

Washing after disinfection shall be carried out similarly to that given in item 3.1.

6. Water sampling

Samples for microbiological and chemical analyses shall be representative of the relevant element of the water supply system.

In the case of pipelines, once the washing after disinfection has been completed, the samples shall be taken as follows:

- at the end of the pipe section;
- in the case of branching of the pipeline – at the ends of the branched water sections;
- in the case of long plumbing – at the end and at intervals of a given distance of the section.

In the case of drinking water tanks, it is recommended to take samples from a depth of about 1 m.

Sampling shall determine the concentration of the disinfectant, which shall not exceed that prescribed in the applicable regulations for the relevant element of the water supply system.

7. Microbiological examination

The locations and intervals at which samples are to be taken shall be determined in the project.

The samples taken shall be examined in the light of microbiological security requirements.

If the results of the microbiological analysis of the samples comply with the requirements of Ordinance No 9 of 2001 on the quality of water intended for drinking and household purposes, disinfection is considered successful.

If the test results do not meet the requirements of Ordinance No 9 of 2001, a new disinfection and/or washing must be carried out until microbiological safety is achieved.

In the case of repair works of short water supply sections and building plumbing deviations with DN<80mm, if nothing else is prescribed, microbiological examination is not required. For plumbing with internal cement coating, the pH value shall not exceed 9.5.

Where the results of the microbiological analyses meet the water quality requirements, the section of the pipeline or facility shall be connected in due time to the water supply system to prevent its secondary contamination.

8. Draining the products from washing and disinfection

After the disinfection has been completed, washing and disinfection products must be drained without harming the environment. If necessary, a neutralising reagent shall be used (see BDS EN 805).

8.1. Discharge of spent water from washing and disinfection

Possible ways to discharge water containing products from the washing or disinfection process are as follows:

- discharge into the settlement sewer network;
- direct discharge into a receiving water body;
- infiltration in the soil.

Discharge into the settlement sewer network is permitted subject to the requirements of Ordinance No 7 of 2000 on the conditions and procedure for discharge of industrial waste water into the sewerage systems of settlements and authorisation by the water and sewerage operator.

The release of water containing products from washing and disinfection into surface and groundwater bodies by infiltration may be carried out in accordance with the provisions of the WA.

8.2. Neutralisation of washing and disinfection products

In cases where direct discharge under item 8.1 cannot be allowed, it is necessary to use chemical neutralisation of waste products from washing and disinfection to make them environmentally safe. The recommended neutralising reagents are given in BDS EN 805.

For chlorine containing disinfectants, it is recommended to use a 10 % sodium thiosulfate solution. For practical application, the addition of approximately 3.5 g of technical ($Na_2S_2O_3$ 5 H_2O) or 2.2 g anhydrous sodium thiosulfate ($Na_2S_2O_3$) per gram of chlorine is required. Sodium thiosulfate is harmless to aquatic organisms. However, oxygen consumption in water caused by excess sodium thiosulfate should be taken into account.

Sodium thiosulfate can also be used to eliminate excess potassium permanganate and hydrogen peroxide. It is necessary to monitor its complete mixing with water containing waste products from disinfection.

Other ways of neutralising disinfection products may also be mentioned in the project.

Dechlorination can also be carried out in special reaction chambers such as tanks, construction pits, shafts, etc., where the necessary time to reach dischargeable concentrations of the spent disinfection solution is provided.

Hydrogen peroxide is also suitable for dechlorination and the procedure is the same. Approximately 1 g of H_2O_2 is necessary to reduce 1 g of chlorine. A 5 to 10 % solution is used that quickly degrades in the receiving water.

Chlorine can also be rendered harmless with activated charcoal. In this case, portable filters with activated charcoal fillings with a volume between 1 and 2 m^3 are recommended. To remove the retained products, filters need to be washed back.

9. Documenting the disinfection and washing process

The data from the conduct of disinfection and the results of the examination shall be documented and attached to the construction papers. For the conducted washings and disinfections of the water pipes, statement of findings are drawn up. For the results of chemical and microbiological analyses of water, protocols shall be applied.

Annex 15

to Article 251(1)

Determination of the width of the trench in the case of trench laying of plumbing

The width of the trench depends on the type and diameter of the pipe, the type of backfilling material and the compacting method. It shall be defined in the investment project in such a way as to ensure the necessary working space during construction, taking into account the specific conditions in the design and specifics of the construction (deep of the excavation, geological conditions and the need to strengthen the excavation and/or compaction of the area around and above the pipe, the mechanisation for making the excavations, etc.). Very narrow trenches do not provide good installation conditions, and wide trenches make construction more expensive.

When determining the width of the trench, the necessary safety measures in accordance with the occupational health and safety regulations shall be provided.

The trench width shall be not less than the values defined in Table 1 and Table 2.

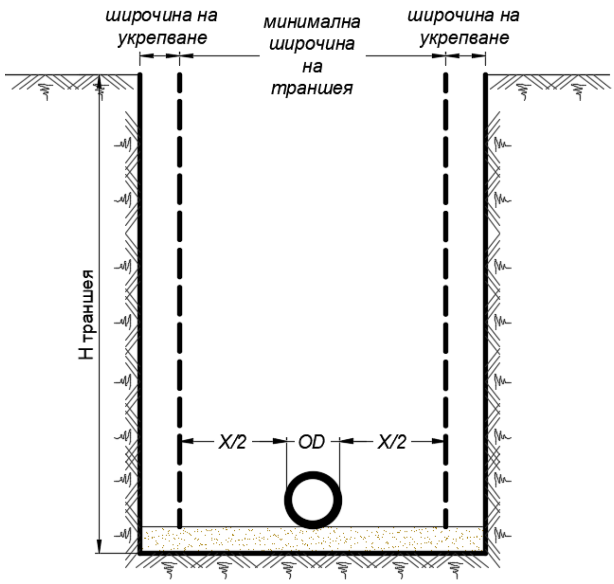


Figure 1 Strengthened trench

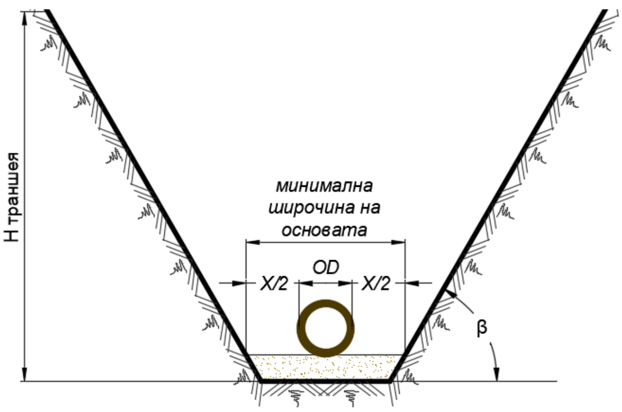


Figure 2 Unstrengthened trench

широчина на укрепване	width of strengthening
Минимална широчина на траншея	Minimum trench width
широчина на укрепване	width of strengthening
Минимална широчина на основата	Minimum width of the base
Н траншея	N trench

Table 1

<table>
<tr><th rowspan="2">External diameter OD, mm</th><th rowspan="2">Minimum trench width in the case of strengthened trenches (OD + X), m</th><th colspan="2">Minimum width of the base in the case of unstrengthened trenches (OD + X)), m</th></tr>
<tr><th>angle of repose of the trench wall in relation to the horizon ß > 60º</th><th>angle of repose of the trench wall in relation to the horizon ß > 60º</th></tr>
<tr><td>OD≤ 225</td><td>OD + 0.40</td><td colspan="2">OD + 0.40</td></tr>
<tr><td>225. OD ≤350</td><td>OD + 0.50</td><td>OD + 0.50</td><td>OD + 0.40</td></tr>
<tr><td>> 350 OD < 700</td><td>OD + 0.70</td><td>OD + 0.70</td><td>OD + 0.40</td></tr>
<tr><td>≥ 700 OD ≤ 1200</td><td>OD + 0.85</td><td>OD + 0.85</td><td>OD + 0.40</td></tr>
<tr><td>> 1200</td><td>OD + 1.00</td><td>OD + 1.00</td><td>OD + 0.40</td></tr>
<tr><td colspan="4">Notes:
In the values OD + X, X / 2 is equal to the minimum working space between the pipe and the wall of the strengthening means or trench wall (in case no strengthening is foreseen).

ß is the angle of the unstrengthened trench wall measured in relation to the horizontal.</td></tr>
</table>

Table 2

<table>
<tr><th>Trench depth – H $_{trench}$ (m)</th><th>Minimum trench width m</th></tr>
<tr><td>1.00</td><td>there is no requirement for the trench width</td></tr>
<tr><td>≥ 1.00 ≤ 1.75</td><td>0.80</td></tr>
<tr><td>> 1.75 ≤ 4.00</td><td>0.90</td></tr>
<tr><td>> 4.00</td><td>1.00</td></tr>
<tr><td colspan="2">Note:
In the values of minimum trench width, the minimum working space between the pipe and the strengthening wall or trench wall (if strengthening is not foreseen) is indicated.</td></tr>
</table>

Notes:

1. A minimum trench width, in relation to the requirements of Tables 1 and 2, shall be accepted when mechanised compacting of the backfilling is not required.
2. A larger trench width, in relation to the the requirements of Tables 1 and 2, shall be determined in the case of use of construction equipment requiring space for: compacting and testing equipment; systems for strengthening the trenches; simultaneous installation of connected pipes and

support of adjacent pipes. The working space should be sufficient to carry out all types of construction and installation work without restrictions. For pipes laid in in strengthened trenches or in unstrengthened trenches requiring compaction of backfilling by machinery, the working space X/2 shall be at least 0.30 m for pipes with an external diameter of up to 600 mm and for pipes with a diameter equal to or greater than 600 mm, 0.50 m.

3. Reduction of the trench width according to the requirements of Tables 1 and 2 is allowed under the following circumstances:

- when staff access to the trench or between the pipeline and the wall of the trench is not required, for example for automated laying techniques;
- in the case of heavy construction site conditions;

When two or more pipes are laid in one trench, the horizontal clear distance for work between pipes must be 0.40 m for pipes ≤ OD 700 mm and 0.50 m for pipes > 700 mm.