ANNEX 1 – TECHNICAL SPECIFICATIONS

General Provisions:

- The purpose of the Technical Specifications Annex is the formulation of the specific technical terms according to which and in combination with the documents and drawings approved by the Project Owner, the project in question will be executed.
- All works will be carried out in compliance with the generally accepted rules of Science and Technology and based on what is specifically mentioned in the Technical Specifications Annex.
- During the execution of the works, all official Greek regulations (e.g. Reinforced Concrete Works Regulation, Anti-Seismic Regulation, Concrete Technology Regulation, Ministry of Industry, PPC, Safety Provisions on Construction Sites, etc.) and the relevant applicable provisions as well as the ELOT standards apply. The "European standards", as defined in para. 2 of article 11 of Presidential Decree 23/94.
- Apart from the Greek standards (and draft standards) of ELOT and the "European standards", the international ISO, the German DIN and the British BS, the French AFNOR and the American ASTM and AWWA are characterized as "acceptable" standards. If the date of publication of the standards is not indicated, the most recent version of the standards in force is implied.
- Whenever it is stated that a work or material will be manufactured in accordance with a certain standard, (GTS) or other specification, it is understood (unless otherwise specified in these Technical Specifications) that it is mandatory to carry out all the corresponding tests specified, even if they are mentioned as optional in this standard or these specifications.
- The works will generally be carried out on the basis of the approved plans or any amendments or additions made or approved by the Contracting and Supervising Authorities.
- The works will generally be carried out in accordance with the safety rules and relevant provisions (including police provisions) applicable to their execution.
- Amendment of the Decree under items D22/oik. 1989/12-3-2020 (B' 1437) of the decision of the Minister of Infrastructure and Transport, on the subject: "Approval of seventy (70) Greek Technical Specifications, with mandatory application to all public works and studies". Adaptation to no. C10/2019 agreement of the Single Independent Public Procurement Authority.
- Amendment of the decision D22/4193/22-11-2019 (Β΄ 4607) of the Minister of Infrastructure and Transport on the subject: "Approval of seventy (70) Greek Technical Specifications (GTS), with mandatory application to all Public Works and Studies". Adaptation to the Decree no. C10/2019 Consent of the Single Independent Public Procurement Authority.
- According to the decision no. Cfi. 367126/22-11-2022 (Government Gazette 6366/B'/15-12-22) decision of the Minister of Infrastructure and Transport on the subject: "Approval of one hundred and fifty-four (154) Greek Technical Specifications (GTS), with mandatory application to all Public Works and Studies", issued under the authority of par. 8, of article 54 of Law 4412/2016

- According to the decision no. Cfi. 244140/9-8-2023 (Government Gazette 5115/B'/17-8-23) decision of the Minister of Infrastructure & Transport, eighty (80) revised Greek Technical Specifications (GTS) of mandatory application in all Public Works and Studies were approved.
- According to no. Cfi. 70969/7-3-2024 (B' 1890) decision of the Minister of Infrastructure and Transport, the first revision of seventy-nine (79) and the second revision of eighteen (18) Greek Technical Specifications (GTS) was approved, with mandatory application to all Public Works and Studies.
- Where the Supplementary Technical Specifications refer to the suspended ETFs, the respective GTSs are applied.

TECHNICAL SPECIFICATION 1 – DIGGING OF TRENCHES INSIDE OR OUTSIDE A RESIDENTIAL AREA

1. Subject

This Technical Specification refers to works required for the excavation of the water supply trenches.

2. Applicable Specifications

- For excavations, the GTS 08-01-03-01 applies
- For construction site signs, GTS 05-04-06- 00 applies
- For the paving of excavation products, the GTS 02-05-00-00 is applicable
- For concrete demolitions, the GTS applies 15-02-01-01
- For pumping, the GTS 08-10-01-00 applies
- For the reconstruction of the pavement, the GTS 08-06-08-03 has been applied
- For the reconstruction of curbs, the GTS 05-02-01-00 and 08-06-08-04
- For the reconstruction of cobblestones, the GTS 03-07-03-00 applies
- For concrete, the GTS 01-01-01-00 to 01-01-07-00 applies

3. Operations included on the excavation of the trenches

- Excavations in any kind of terrain
- Construction site signs
- Hazard Warning Lights
- Temporary trench bridges to facilitate pedestrian traffic
- Loading and unloading of drip and transport of excavated products
- Paving of excavation products
- Demolition of concrete pavement up to 15 cm thick.
- Dismantling of pavements and curbs, paving, cobblestones, stamped floors.
- Pole Backing
- Restoration of pavements and spilled curbs of cobblestones, cobblestones with the same (reusable) materials.
- Cutting with an asphalt cutter and dismantling of the existing asphalt or concrete road surface

- Restoration of road surfaces where it is cobblestones or cobblestones with the same (reusable) materials.

TECHNICAL SPECIFICATION 2 – DEMOLITION AND RESTORATION OF ROAD SURFACES

1. Subject

This Technical Specification describes the method of creating sections, cutting, demolishing and restoring the road surfaces on asphalt and/or cobbled roads where trenches are excavated for the installation of sewerage network pipelines.

2. Demolition of the Road Surface

Before the start of the excavations, the contractor is obliged to request a permit to cut the road surface from the relative authorities. The cost for the issuance of the permit is borne by the contractor. The delay in granting the permit due to the relative authorities' delays will have as result the approval of the extension of the deadline for the execution of the project. Cutting permits will be requested even in the case of cutting soil or unformed road surfaces.

Before the excavation is carried out, the boundaries of the excavation will be outlined on the road surface with a hammer.

The demolition of the road surface will be carried out by the contractor either by hand or by mechanical means. The demolition of the road surface will be limited to the dimensions provided for by the plans. No compensation is awarded to the contractor for excavation beyond the foreseen dimensions.

The dismantling work includes the disposal of waste or reused materials, in places near the trench and at such a distance as not to disturb the movement of vehicles or pedestrians so that they can be reused or loaded for transport.

3. Restoration of the Road Surface

Before the reconstruction of the asphalt road, careful paving and compression (stamping) must have been done in order to avoid possible subsidence.

The contractor bears the relevant responsibility for the subsidence and must take all necessary measures at its own expense until the final receipt of the project. In the event that subsidence of the road surface occurs, the contractor is obliged to pay for the removal and reconstruction of the corresponding section.

The compression will be done with an impact air hammer at the end of which a disc with a diameter of 10 to 20 cm will be placed. This applies to heights over 70 cm. above the upper surface of the pipe placed inside the trench. For greater depths will be done by hand so that there is no risk of damage to the pipes.

In this regard, the specification of trench excavation applies to the responsibility of the contractor for the protection of pipelines. If the Surveying Authority deems it necessary, it can order the overfilling of the road roller with synchronous wetting of the material backfills.

When sufficient condensation is achieved after continuous passages of the road roller, the excess backfill materials are removed so that it is possible to construct the road surface to the required thickness.

The reconstruction of the intersected road surfaces will be done so that there is no difference between the remaining old and restored road surfaces and in completely rectangular sections.
The reconstructed asphalt pavements should have a thickness of 40 cm. and be constructed from the following works:

- Construction of a road pavement base layer with aggregated quarry materials, 0.15 m thick, with the transfer of the crude material to the site of the works, according to the Standard Technical Specification O-155.
- Layer of C 16/20 concrete with a thickness of 0.10 m reinforced with T131 structural mesh.
- Asphalt pre-coating with an asphalt solution of type ME-O is otherwise defined as in the Standard Technical Specification AS-11 and A-201.
- Asphalt base layer with bitumen mixture, prepared by heat, in a permanent installation, otherwise 50 mm thick, as defined in Standard Technical Specification A-260.
- Traffic asphalt layer with asphalt concrete mixture manufactured in a permanent installation, otherwise 50 mm thick, as defined in Standard Technical Specification A-265.

The work for the reconstruction of 1 m^2 of asphalt road includes the works for the compression and cleaning of the road surface, the mixing of the asphalt mixture, the transfer to the project site, the paving and condensation of the road surface. Also included are the works for the construction of all kinds of bases and subbases included in the works for the filling of the trench with crushed material and will be carried out according to the Standard Technical Specification 0155 in a layer of 15 cm thickness. The cost for the excavation of the layers of aggregates for the final configuration of the road surface (when there is an overfill) is also included.

TECHNICAL SPECIFICATION 3 – EXCAVATION BACKFILLS WITH EXCAVATION PRODUCTS OR LOANED

The backfills will be carried out a) With the products of excavations without or with rudimentary condensation (crushing, wetting, etc.) with simple excretion carried out by mechanical means with or without manual assistance, including paving to smooth the final surface b) with appropriate materials of excavation products or loaned. The backfill materials must be laid in horizontal layers with a maximum thickness of 0.25m over the entire surface and with a minimum concentration of 95% (modified PROCTOR test).
Trench backfills are carried out after the installation of the corresponding pipelines between two shafts, the control of the bottom level of the pipeline and the shafts and the connection of the pipeline to the shafts on either side. Backfilling will not take place until the waits for the private drains have been constructed and accurately depicted horizontally and in altitude.

In the first phase, the protective backfill of the pipeline is constructed, which includes the filling up to a thickness of 0.30 m above the ridge or from the upper side by embedding the pipeline with sand. This backfill will be made of sieved materials with a hole diameter of no more than 1 cm. according to the specification "Sand pipe formwork"

Then, after the completion of the above protective layer, the condition of the pipeline will be checked by the Supervisor and then the contractor will proceed to the additional backfilling of the trench. This backfill will be done with selected excavation products as mentioned above.

The use of a vibrating or road roller is not allowed until a backfill of 0.90 m above the pipeline has been ensured.
Backfills are allowed based on the geometric volume of the filled trench according to the plans of the study after the removal of the volumes of all kinds of structures (pipelines, shafts, technical works, etc.).

In addition to the transport, from any distance by mechanical means or by hand and on a single wheel where there is no access area for the machinery, the supply, the required loading and unloading, the dropping of the means of transport, any required temporary deposits, the secretion, the layering, the lateral transport, the pounding or the use of vibrating agents, but not harmful to the safety of technical works of media or other special condensers, the on-site wetting with water as well as the required tests to verify the degree of condensation, are included.

TECHNICAL SPECIFICATION 4 – TRENCH BACKFILLING

1. Subject

This specification refers to the backfilling of underground network trenches

a) with granular materials (sand formwork)
b) with embankments above the pipeline zone

2. Applicable Specifications

The GTS 08-01-03-02 is applicable

TECHNICAL SPECIFICATION 5 – WOODEN FORMWORKS

1. Subject

Study and construction of scaffolding and formwork of wood or iron types

a) Flat surfaces
b) Curved surfaces
c) Minor Constructions

2. Applicable Specifications

The GTSs 01-03-00-00 and 01-04-00-00 apply

3. Tasks that are Specified in this Article

a) The work includes:
b) The study of scaffolding and formwork, the relevant static calculations and the drawings of details.

c) The supply of all necessary materials and components.
d) The use of machinery and devices.
e) Any transport and access, even in hard-to-reach places, dismantling, cleaning, proper preparation, application with facilitative material, collection from the construction site, etc.
f) The inspection of formworks.

TECHNICAL SPECIFICATION 6 – CONCRETE

1. Subject

The construction of outdoor / surface or underground parts of the project from unreinforced or reinforced concrete of various categories.

2 Applicable Specifications

The following GTS's are applied:

a) 01-01-10-00
b) 01-01-02-00
c) 01-01-03-00
d) 01-01-04-00
e) 01-01-05-00
f) 01-01-07-00

It is clarified that where the height from the ground is mentioned, the level of the ground is understood as it was formed by order of the Service before the construction of the concrete.
Also, the volume occupied by pipes placed on the body of the pedestal or retaining walls for their drainage and protection will not be removed.

3. Tasks that are Included in this Article

1. The categories of concrete specified in this article cover indicatively and not restrictively the following works:

1.1. Unreinforced concrete C12/15 (pavements, leveling layers)

a) It is used for the construction of unreinforced elements of dormitory structures, leveling layers of foundations, etc.
b) Access plates, curbs, kennels, solid formwork, lined trenches, shaft bottom formation to ensure smooth flow, formation of wear layer inside culverts, bed lining, slope formation and bridge waterproofing
c) Trenches, curbs, kennels, curbs, etc., which are manufactured using special construction machinery (e.g. rolling metal type or similar).
d) Walls (foundations and superstructures) that do not belong to the category of "thin-walled" cross-sections.

1.2. Unreinforced or reinforced concrete C16/20

It is used for construction of:

a) The covers, the bottom and the walls of shafts of all kinds of pipelines, rectangular trenches and other small structures.
b) Thin-walled reinforced walls (foundations and superstructure) of any height.
c) Cladding of the pile face.

1.3. Reinforced concrete C20/25
It is used for the manufacture of shields and headrests.

2. All of the above tasks include:

- The supply of the required materials of any nature and their transport over any distance (aggregates of any grade and maximum grain, water, cement of any type and strength and in any required quantity, any required additional liquefiers and stabilizers, suitable additives in the case of the use of ready-mixed concrete so that the concrete remains in working condition as well as any other additives of concrete mass).
- The execution of all required construction works (formwork, scaffolding, guardrails, sliding superstructure beams, sliding or climbing pedestal formwork, stretchers and other devices for building in a cantilever, prefabrication, transportation and placement of the prefabricated elements in the project).
- The mixing of concrete, its transportation to the construction site, its layering, condensation and maintenance.
- The preparation of a concrete composition study and the preparation of test mixtures prior to the start of concrete production.
- The sampling and testing in accordance with the specifications of this article.
- Type A surface finishes for surfaces in contact with formwork.
- The correction of any imperfections.
- The formation of PA-type plastic concrete finishes (by grinding) for surfaces that are not in contact with formwork.
- The construction of a new service access to the project or the configuration of any existing access (both for simple concrete works and for other works).
- The transportation and placement of the prefabricated elements of the project with machinery or their construction directly in their final position.
- The acquisition and use of the required mechanical equipment for the skillful and timely completion of the works.
- The workmanship and materials of cylindrical or other shaped inserts for the construction of special cross-sections (e.g. slabs with gaps) of diameter or cross-section according to the study, from suitable material that does not adversely affect the concrete approved by the Service and with appropriate strength and quality in general, so that there is no deformation by moisture, any kind of static and dynamic loads, etc., up to complete coagulation of the concrete, with any necessary reinforcement of the bodies with bulkheads, with the placement of these bodies according to the study and with the total loss that will be considered to remain permanently integrated into the concrete or removed in accordance with the approved studies and other tender conditions.
- The work and materials for the installation of unreinforced drainage pipes, pedestals and retaining walls as specified in the study of each project.

- The work and materials of expanded polystyrene or other material that may be used for the formation of joints.

It is noted that in the event that the concrete compliance criteria or other criteria that will have been set in the terms of the auction are not met, then the subsequent sampling, tests, studies, test loads, etc. are burden for the Contractor. In case of non-compliance with the criteria of the specifications, after the additional checks, the Contractor is obliged to reconstruct the section or the construction in accordance with the contract, while at the same time the Managing Authority, at its absolute discretion, may request the penalty clauses threatened by the contract or the Contractor's deduction from any delay that may arise (relevant paragraph 13.7 of the Code of Civil Procedure '97).
Acceptance protocols for concrete projects are normally made after the 28-day-old tests have been carried out on and if it is found that the concrete compliance criteria are met. In the event that other concrete compliance criteria have been set, compliance checks with the additional criteria must have been carried out and if it has been found that these criteria are also met, only then will the relevant payments be made.
If not all the compliance criteria are met, then the relevant payments remain pending until the issuance of the acceptance decisions of the construction.
If requested by the Contractor, it is also possible to make payments for concrete projects before the 28 days, provided that a concrete quality control test is taken at a younger age. These tests will be maintained normally as well as the 28-day tests, will be manufactured in equal numbers and from the same mixture as the conventional quality control tests of 28 days and will be tested in sadness no earlier than 7 days. In order to use the 7-day tests, it must have been restored by the composition study of the development relationship of the concrete strength with strength tests at least 7 days and 28 days.
The results of the compression tests over more than 7 days will be compared to the results of this strength development relationship of the composition study to determine whether the compression strength compliance criterion is met in principle and to make earlier payments. In any case, however, the criterion for compressive strength compliance will always remain the compressive strength test of conventional 28-day-old specimens normally maintained.

TECHNICAL SPECIFICATION 7 – CONCRETE ADMIXTURES (ADDITIVES)

1. Subject

This Technical Specification refers to the use of additives in concrete structures.
The use of additives is provided for reinforced concrete located below the surface of the ground or at the final backfill level in wells, pumping stations or wherever else ordered by the Contracting and Supervising Authorities.

2. Material Type

The type of material and the way and proportion of mixing the material with the concrete will be determined by the Supervising Authority. The material will be produced by a recognized factory and will be proven to be widely used. The supplier's instructions on the method and the impurity

ratio will be followed in the case of conventional projects, while in serious projects a special study will be prepared by a special laboratory. In any case, the effect of the additive on the properties of the concrete will be investigated and materials that have an adverse effect on creep and coagulation contraction will be excluded. The material must not contain bitumen or tar, sulphates or other substances that may cause corrosion of the reinforcement and reduce the strength of the concrete.

The following will be applied:

- Concrete hardening accelerators, according to ELOT EN 934-2
- Concrete mass sealants (water permeability reduction admixtures) according to ELOT EN 934-2
- Frost protection admixtures (ventilators), according to ELOT EN 934-2

The costs for the supply, transportation, loading and unloading, mixing work and any charges for testing, testing and certificate, as well as any other costs for the complete and skillful execution of the work, are included.

TECHNICAL SPECIFICATION 8 – IRON REINFORCEMENT

1. Subject

The supply, cutting and installation of iron-reinforced concrete of various diameters and steel grades.

2. Applicable Specifications

The GTS 01-02-01-00 is applicable

3. Tasks Included in this Article

- The supply of iron reinforcement on site of the projects, even in hard-to-reach places.
- The cutting, processing and diligent and skillful placement of the work in any position of the works (superstructure, foundations, piles of any type) with/or without the presence of water.
- The connection of the rods in a solid way at all crossings and not alternately with wire No. 5, or of greater thickness depending on the diameter and position of the reinforcement, or with electro-welding in the case of injected piles.
- The supply and installation of mooring wire as well as joint wrenches and other types of approved joints.
- The supply and installation of the necessary spacer supports (cavillians) that may be required.
- The drafting and submission to the Supervising Authority for approval of the relevant documents and construction plans for reinforcement, as well as all the required reinforcement tables.

4. Tables of Concrete Reinforcement

The measurement will be done in kg.
If detailed tables of reinforcement do not exist in the technical study, the contractor is obliged to draw up and submit to the Supervising Authority for inspection and approval relevant tables before the start of construction. The tables will have been drawn up on the basis of the design plans and will include in detail the dimensions, diameters, positions and lengths of coverage, weights per mm and per diameter - according to the official weight tables of the German regulations - the lengths of the iron bars, the partial and total weights of the provided reinforcements, etc. The placement of reinforcements in the project will be checked and received before the start of the paving. The drawn up lists, after the acceptance of the steel reinforcement, will be signed by the contractor and the Supervising Authority. The above considered tables of the steel reinforcements with their respective weights, constitute the measurement of the reinforcements. All the costs of the relevant works specified herein and in particular in paragraph 3 thereof are included for the completion of the project.

TECHNICAL SPECIFICATION 9 – ANCHORING BODIES

1. Subject

This technical specification refers to the construction of the required anchoring bodies of the piping network at the locations where due to the alignment of the pipeline route or due to the interference of a special equipment or contraction section, an escaping force is created to the pipes, forcing them outside the joints or to deviate from the theoretical drawing line.
It also refers to Type B anchoring bodies that are placed on a pipeline slope greater than 20% for its anchoring.
The anchoring bodies must ensure the complete stability of the piping network for the maximum operating pressure and with adequate safety margins.
Anchoring bodies shall be constructed in all the positions provided for in this approved study or in corresponding positions (in cases of modifications) where their construction proves to be necessary.
During the construction of anchoring bodies, care must be taken not to cover the joints with concrete in order to allow for tightness testing.

2. Tasks to be Performed

The works that will be carried out and the corresponding technical specifications that apply to the construction and inspection are as follows:

- Excavation of earth by hand according to the proposed dimensions and formation of the bed and the lateral surfaces to form an external formwork.
- Formwork of microstructures at the points where the anchoring body is not adjacent to the excavation side.
- Unreinforced concrete C12/15.

All the details and dimensions of the above works are specified in the relevant design plans and are carried out in accordance with the instructions of the Supervising Authority. The Authority will determine the positions and the type of anchoring bodies (Type A or Type B) to be used.

All the anchoring bodies and the works referred to in paragraph 2 of this specification, the transportation of the materials to the installation site as well as any other work that is not explicitly stated but is necessary for the satisfactory execution of the project is included to the total offer.

TECHNICAL SPECIFICATION 10 – HIGH DENSITY POLYETHYLENE (HDPE) PRESSURE PIPE AND PE FITTINGS

1. Generally

The specification refers to high-density polyethylene pipes (HDPE) and Accessories
a. for pipes made of third generation raw material for pressures of 10 ATM, 12.5 ATM, 16 ATM, 20 ATM, 25 ATM and 32 ATM.
b. for pipes made of second generation raw material for pressures of 6 ATM, 10 ATM, 12.5 ATM and 16 ATM.

MRS refers to the maximum regional pressure that a PE pipe is guaranteed to withstand when operating at nominal pressure (PN) for 50 years at 20°C. Therefore, for the following pipes, the following results are:

POLYETHYLENE TYPE	MRS (MBa)	PRESSURE (MPQ)
PE 100 (3rd generation)	10,0	8,0
PE 80 (2nd generation)	8,0	6,3

For the marking tape placed in the trench for the protection and marking of the pipeline, the GTS 08-06-08-01 is applied.

2. International Standards

High-quality polyethylene pipes and fittings are manufactured according to the following standards:

PrEN 12201	Part 1	General for Polyethylene
	Part 2	Polyethylene Pipes

ISO/DTR
ISO/DIS
ELTO 181-183

3. Raw Material

3.1. Raw Material Properties

The production of the pipes will generally follow the specifications ISO/DIS 4427 and ISO 4065. Especially the raw material will have the following characteristics:

	Control Specification	Units	MRS8	MRS10
Mechanical properties				
MRS	ISO DTR 9080		8	10
Density ISO 1183D/ISO 1872-28	ASTM D 792	Kg/m3	949	960
Flow index (load 5 kg)	ISO 1133 DIN 53735 ASTM D1238	g/10 min	0,85	0,45
Elasticity measure (50 mm/min, 23o C)	ISO 527	MPa	650	1400
Tensile strength (50 mm/min, 23o C DIN)	DIN 53455 ISO 6259 ISO 527	MPa	28	38
Leakage Voltage (50 mm/min, 23o C DIN)	DIN 53455	Mpa	20	25
Elongation at breakage (50 mm/min, 23o C DIN)	DIN 53455 DIN 16934 ISO 527 ISO 6259	%	>600	>600
Resistance to Fault Development from Environmental Stress (ESCR)	Bell Telephone Test F50	H	>1000	>1000
Physical properties				
Vicat Point (1 kg)	DIN 53460	^{o}C	121	127
Thermal conductivity	DIN 52612	W/m K	0,38	0,38
Special heat	Calorimetric	Kj/Kg K	3,4	1,9
Coefficient of linear expansion	ASTM D 696	K-1	1.3×10^{-4}	1.3×10^{-4}
Breaking Temperature	ASTM D 746	^{o}C	<-100	<-100
Electrical properties				
Dielectric Constants	DIN 53483	2,6	2,6	2,6
Dielectric Strength	DIN 53481	KV/cm		$2,2 \times 10^{2}$

Special resistance	DIN 53482	Ω cm	$=10^{17}$	$=10^{17}$
Surface resistance	DIN 53482	Ω	$=10^{14}$	$=10^{14}$

3.2. Raw Material Certificate

Upon signing the contract and before the assignment of the construction of the pipes, the contractor will deliver to the Supervisor of the project, the Managing Authority, an original certificate as well as its official translation into Greek, of the manufacturer of the raw material in which its composition, its nominal density, the Melt flow index, the tensile strength at the leakage limit, the tensile strength and the corresponding elongations, as well as the s-pressure.

An original certificate of suitability of the material for potable water from a valid Organization will also be presented, as well as an official translation into Greek.

The Project Supervising Authority shall, within five working days from the submission, give written acceptance or documented rejection of the raw material that will be used for the construction of the pipes.

4. Tubes/Pipes

4.1. Pipe Characteristics

The pipes will be BLUE in color and will be manufactured in terms of dimensions according to ISO/DIS 4427 and ISO 4065. The tests will be carried out in accordance with ISO/DIS 4437/1994.

4.2. Pipe Tests

All the tests provided for by ISO/DIS 4437/1994 will be carried out on the produced pipes, as described below. The Project Supervising Service will monitor the production of the pipes and laboratory tests either with its own staff or by assigning this work to a suitable partner.
The contractor must notify the Supervising Authority of the project in writing of the date of commencement of production of the pipes, at least ten (10) days in advance.

4.2.1. Dimensional and Samples

- The ends, the incisions of which must be perpendicular to the pipe, will be examined.
- All the produced quantity of tubes will be visually controlled in the light. The pipes must be free of bubbles, gaps or irregularities. Their color should be uniform along the entire length. Also, the surface of the pipes should be smooth internally and externally without grooves and recesses or recesses.
- The dimensions and permissible tolerances, provided for by ISO/DIS 4427 and ISO 4065, will be checked in the manner specified in the ISO/DIS 4427 and ISO 4065 (fig.1) Such checks (macroscopic and dimensional checks) will be carried out whenever there is an indication or suspicion of deviation. The result of each inspection will be recorded on a special form and will be signed by the production manager and the representative of the Supervisor of the

Managing Authority, if present. Produced pipes that deviate from those provided for in ISO/DIS 4427 and ISO 4065 will be discarded.

The ovality of the tubes will also be checked with the following restrictions:
1. For coiled tubes Max D =1.06 Dor
2. For straight pipes Max D =1.02 Dor
where Dor = nominal diameter.

4.2.2. Strength tests

For the strength test of the pipes, the tests provided by ISO/DIS 4427 and ISO 4065 will be carried out, i.e. resistance test to internal pressure and change control during heat treatment, as well as sample tests in tensile to breakage, as described below.

In the event of failure of any of the above tests, the entire quantity of pipes of the same diameter as the one or those whose test failed will be rejected.

The samples, which will undergo the two checks provided for by ISO/DIS 4437/1994, will have previously undergone squeeze-off and re-rounding, as described below in paragraph 3.2.3.

These tests will be performed once for each diameter and each production machine.

In cases where we have a stop and restart of a machine, the checks will be repeated for the produced pipe of the specific machine.

In case the production of the pipe in a machine continues beyond 70 hours, the checks will be repeated upon completion of every 170 hours of continuous production.

In the event that a deviation is found between consecutive tensile tests (described below), these tests are repeated for the specific machine and diameter where the deviation was detected.

4.2.3. Squeeze – off Test

The pipes to be supplied must be suitable for the application of the squeeze-off technique. The test will follow the following procedures:

Device

The machine, which will be used, will be in accordance with international standards and will definitely ensure the clamping in the center of the essay.

Sample

The sample shall have a minimum free length of eight (8) times the outer diameter of the tube.

Procedure

The pipe will be placed in a room with a temperature of +0 to 5oC, for a minimum period of ten (10) hours. Over a period of 10 minutes and while the sample will be at a temperature of +0 to 5oC, it will be tightened in the center of the sample with the special squeeze-off machine. The sample will remain in this state for 60 min, then it will be restored to its original state with the help of a special re-rounder tool for 30 min. The sample will then be tested according to DIN 8075 according to paragraph 4.2.2.

4.2.4. Tensile to Fracture Test

This test aims to confirm the homogeneity of the production and will be repeated every time 24 hours of production have been completed:

The number of speciments of each test will be:
1. 3 For Φ32 Pipe
2. 5 for larger diameters

The dimensions of the samples will be in accordance with the table below:

Φ Tube	Length (mm)	Width (mm)	Φ Hole
32	160		
63	160	20	10
90	160	20	10
110	160	20	10
125	160	30	15
160	160	30	15
225	160	30	15

The samples will be cut so that there is a normal distribution of their position around the circumference of the tube.
Before the test, they will remain 1 hour in a bath at 18-22oC and the test will be done immediately after the bath. The speed during the test will be 25 mm/sec.

The fracture tendency and elongation at breakage will be measured. An evaluation will then be carried out to determine whether there is a significant deviation from the data of the specimens, which were cut, together with the assays that underwent DIN 8075 strength tests in order to determine whether or not it is necessary to repeat these tests (resistance to internal pressure - change after heat treatment).
The size of the deviation that is considered significant will be agreed between the representatives of the Supervising Authority and the contractor.

4.2.5. MFI Measurement
Once for each production machine and for each new start of the machine, the MFI of the produced pipe will be measured. The MFI 190/5 of the pipes must not have a deviation of more than 0.2 gr/10 min from the corresponding MFI 190/5 of the raw material.

4.2.6. The Contractor must have ensured for the Supervisor's auditors of the Managing Authority free access to the production and storage areas of the pipes and facilitation for the performance of the measurements and tests, as mentioned below.

4.2.7. Roughness Measurement
The roughness test on the inner surface will be carried out every 4 hours on each production machine, at each new start of the machine and additionally when deemed necessary after macroscopic control during production.

The roughness should not be greater than 0.05 mm and will be measured perpendicular to the longitudinal axis of the pipeline.
In case of a deviation of more than 50% upwards, i.e. if the roughness is found to be greater than 0.075 mm. The quantity produced after the last correct measurement will be discarded.

5. Testing Laboratory

All the above tests will be carried out in a laboratory of common acceptance in the presence of the representatives of the Supervising Authority of the project. The costs of the tests are borne by the contractor and will be incorporated into the total project offer. The results of the inspections will be submitted to the Project Supervising Authority in accordance with DIN 50049. In addition to the certificates, which will be issued and will cover all the audits mentioned and will be carried out in the Supervisor of the project Managing Authority, all the measurements that will be recorded during the audits will also be given.
In the event of a deviation between the terms of this Technical Specification and those of the DIN Specification, the terms that provide for stricter controls and provide a higher degree of safety shall apply.

6. Pipe Lengths

The lengths of the straight pipes will be 6 to 12 m for straight pipes, and 50 to 100 m for roll pipes. Especially for the roll, the length can be longer.

7. Tube Packing

The pipes during transport, installation and storage will be covered with male LDPE plugs and will be packaged (1 m x 1 m x length) in such a way that they can be stored vertically. In case the pipes are in rolls, then the inner diameter will be equal to the nominal diameter by 20 times.

8. Pipe marking

The pipes will have two (2) rows of white color markings printed in opposite diameter and per meter of pipe length, which will have the following form:

WATER PIPE HDPE/Φ63 x 5.8 RN 10 XXXX = YYYYY

where:
HDPE: high-density polyethylene
Φ63 x 5.8: outer diameter x wall thickness
PN 10: nominal pressure
XXXXX: manufacturer name
YYY: production time on one side and serial number of tube length on the anti-diameter side.

Polyethylene Parts

The components that will be used will be made of black or blue polyethylene (PE), will be suitable for a welding system with electric couplings and will be cooperative with a pipe that will be made based on the Technical Specification for the manufacture of PE (HD) pipes.

The dimensions, wall thickness and tolerances of the fittings will be such as to ensure the interoperability with the pipes, the good quality of the weld as well as the maintenance of strength after welding.
The offers will clearly indicate the type, the manufacturer, the dimensions and tolerances of the parts and reference will be made to the catalogues attached to the offer.

Parts upon delivery will be accompanied by test and inspection certificates covering the following:
1. Nominal Raw Material Density
2. Nominal density of material taken from a ready-made part
3. Raw Material Flow Index Measurement
4. Raw Material Composition
5. Resistance to internal pressure (170-hour test)
6. Changes after heat treatment
7. Measuring dimensions and tolerances

All components will be embossed with their type, the manufacturer and DIN ISO.
All of the above certificates will be derived from tests carried out on trials of the specific production batch of the components to be used by the contractor.

The Supervising Authority for all the above audits reserves the right to repeat the audits in a laboratory of its choice. A certificate of resistance to internal pressure (10,000 hours) will also be issued, which will come from samples of the same design and production process as those that will be delivered to the Supervising Authority.
Tenders will indicate the specifications of which the specific components meet the requirements, even if these specifications are in the preliminary draft phase and will be attached to the tender.
The Project Supervising Authority reserves the right to carry out a random check of the components at the supplier's premises or in a commonly accepted laboratory. Especially for saddles, only those that surround the pipeline completely are accepted.

PE Pipes Welding Process
Welding Job Description
Autogenous welding and testing must be carried out in accordance with DIN 19533, DVS 2207 & 2203 and DVGW GW 330 as well as DIN 16933.
The polyethylene components before the welding process should not be exposed to sunlight and their temperature should not exceed 35oC.

In general, in order to result in a good welding, the contractor must pay attention to the following points:

- The surface temperature of the pipeline and the components should be between 0oC and 35oC and only then should we make PE by PE welds.
- The cutting at the ends of the pipeline should always be perpendicular to its longitudinal axis and have a bevel of 5° outwards.
- Clean the surfaces to be welded with a dry and clean cloth.

- Carefully scrape the entire surface of the pipeline, on which the components will be welded to a length slightly longer than the length of the electric coupling.
- For connecting a supply saddle or a repair saddle, the length of the pipeline that we scrape is a little longer than the width of the saddle, usually by 150 mm.
- A scraping tool and not a knife must always be used. Scraping is done with parallel movements towards the axis of the pipeline and always without interruption.
- First check the inside of the fittings to be clean and clean the scratched surface of the pipeline, using an evaporative solvent (trichloroethylene) and clean paper.
- We install a clamp capable of aligning the ends of the conductor during welding and keeping the conductor with the electric coupling free of stress during welding (melting) and the cooling period.
- We must ensure that the pipes and components are not moved during cooling. Depending on the manufacturer, the cooling time of the electric coupling ranges from 10 minutes for Φ20 mm to 30 minutes for Φ225 mm. Saddles generally require 15 minutes.
- During the welding time, a relevant form is completed by the head of the workshop and signed by the Supervising Authority and the supervising engineer.
- For the special parts, the welding elements will be automatically recorded through the welding device and will be the following:

1. Project code
2. Part Code
3. Craftsman's code
4. Work Date
5. Working time
6. Welding Serial Number
7. Conductor diameter
8. Component type
9. Ambient Temperature
10. Welding time
11. Recording in the machine's memory of any welding interruption

The Contracting and Supervising Authorities reserve the right to modify the requested data during the execution of the project. The above data should be downloaded by connecting the welding device to a P.C. computer and render the stored information supported by the required software.

Weld and Test Inspection

Drinking water distribution networks from PE pipelines are designed to operate at pressures of up to 10 bar. Therefore, all checks and tests must be carried out in relation to the 10 bar.

In order to get a good result from the test, we need to take into account the large coefficient of thermal expansion, and it is necessary to note that during the tightness tests, the temperature should not change significantly.

Strength test

The strength test is performed at 1.5 x PN (where PN is the nominal strength of the tube) and lasts two (2) hours. The test result is checked by pressure gauges and if the absolute pressure drop is less than 10 mbar, then the test is considered satisfactory.

Tightness test

After the pressure test and if the result is satisfactory, the pressure drops between 3 bar and 5 bar, for at least 48 hours. The test result is again checked by pressure gauges.

Audit Certificate

For each part of the network, which will be tested, an inspection certificate will be drawn up, which will show whether the test had satisfactory results or not. If not, the leaks are searched for and repaired, re-checked and so on until the result is completely satisfactory.

During the test, no pressure drop is allowed and will be checked by a recording pressure gauge. The certificate will be signed by the contractor and the supervising engineer and delivered to the Supervising Authority.

PROCEDURE FOR THE INSTALLATION OF MAIN AND DRAINAGE POLYETHYLENE PIPES IN THE DITCH

MAIN PIPELINES

Route Selection

The route of the main pipelines is planned, taking into account the control for the detection of pipes and cables of other Organizations, their drawings, surface research, test sections where there is a need and the possibility of bending the PE pipe when it is lowered into the ditch at the points of change of its route when a curve is not used. In this case, the minimum bending radius will be 30 times the outer diameter of the PE pipeline for an ambient temperature of 20oC.

Table of permissible bending of PE pipes

D (	Φ63	Φ90	Φ110	Φ160	Φ200	Φ250	Φ315	Φ>400
R (m)	1,90	2,70	3,30	3,75	6,00	7,50	9,45	Curve used

When we cannot, due to obstacles, use the curvature given by the TABLE, then we use a curve component. Also, the radius (m) increases when the temperature drops below 20oC.

Trench features

The installation of the pipeline in the trench is done in accordance with ISO 9969, AS TM D 2412-77, EN 1046 and the GAUBE method for the calculation of the deformation that a plastic pipe suffers as well as its resistance to rupture.

The width and depth of the trench is shown in the corresponding drawing. The walls of the ditch must be vertical and always free of any material and object capable of destroying or even marking the pipeline, the same applies to the floor of the ditch. Because the combination of the type and quality of the material to be used is a factor for the good support of the pipeline, the material to

be used, the material to be used for the substrate (pad) and the initial backfill, must be stable and synthetic.
The substrate should provide uniform support under the pipe and good alignment to avoid siphoning. The thickness of the substrate must be 0.10 m for all cases.

Ditch Restoration Quality
The substrate must be compressed before the installation of the pipeline and its thickness must never be less than 0.10 m after compression.
The initial backfill is compressed into two (2) layers. The first layer of compression is from 3/4 of the pipeline and below, while the second layer is from 3/4 of the pipeline and above and up to 0.20 or 0.30 m.

The final backfill is done in layers of 0.30 m and with parallel wetting of the backfill materials, where necessary.
The final backfill is completed up to the level of -0.05 mm from the asphalt and its material is 3A, while on the pavement the final backfill is up to the level of -0.18 mm from the upper surface of the pavement with 3A.

In each initial or final backfill layer, the material is condensed with a vibrator moving with compressed air, the distance between the vibrations can be 40 cm. and the number of compressions depends on the depth of the trench.
Finally, the procedure for the installation of the PE Main Pipeline is also completed with the Technical Specifications of each project.

DRAINAGE PIPELINES
Route Selection
The route of the PE drainage pipeline is always planned perpendicular to the Main Pipeline, taking into account:
1. Surface research to identify other leads
2. The fact that the use of PE pipes is not allowed inside buildings

Trench Dimensions
The excavation dimensions of the trench must be in accordance with the corresponding drawings.

Installation Depth
The excavation depth follows the depth of the main pipeline (upper part) and has a slope of 0.5 % -e.g. for 10 m road and 5 cm. difference to the main pipeline. If, for any reason, the upper part of the drainage pipeline has a depth of less than 50 cm. then the pipeline must be placed inside a protective conductor (furo) made of PVC. The diameter of the protective conductor should be 1.5 Dαγ.

PROCEDURE FOR THE INSTALLATION OF PIPES AND COMPONENTS IN THE TRENCH

MAIN PIPELINES

The process of laying pipes is carried out after the suitability check of the trench.

Straight pipes are inspected and cleaned internally before being installed in the trench. When lowering the pipes into the trench, we close their ends so that materials do not penetrate from the trench and then they are aligned in relation to the rest of the pipes and the welding process is followed.

The buns are transported by trailer, near the trench or placed in a fixed frame for their unwinding or transported on trucks. The pipeline must be protected during transport.
A special head is placed at the free end of the pipeline that allows it to be easily moved and pulled into the trench and excludes any penetration of foreign material into the pipeline.

The pipeline must be driven by rollers - special rollers - inside the trench:

1. changes in his address and
2. when it crosses or is surrounded by an obstacle in such a way that the outer surface of the pipeline is not injured

Installation of PE Pipelines in Common Trenches
In cases where a trench has to do with many users (other types of networks) e.g. pedestrian streets, the installation of PE pipelines requires special actions in order to keep the pipeline stable until the final backfill.
Due to its exposure to light and the existence of high temperatures, consequently increasing the coefficient of linear expansion, the pipeline can be moved and destroyed by adjacent networks of other organisms, which is why the backfill of the pipeline immediately after installation is the best stabilization. If this solution cannot be achieved, it is necessary to partially overlap the conductor to stabilize it.

Drainage Pipes and Saddles
Before the installation of the PE supplies in the trench, the floor of the trench must be checked in accordance with the provisions of the respective drawings.
The side walls of the trench must be free of any object capable of causing damage to the PE pipeline.

When installing the drainage pipes inside the trench, the ends of the pipeline must have plugs, so that materials do not penetrate from the trench.
The selection of the point of installation of the supply saddle on the Main Pipeline is made taking into account the following limitation:

The mounting point must be at least three (3) times the outer diameter of the main line from other components:
1. Electric Couplings
2. Repair saddles
3. Harness saddles
4. Points that have been squeezed-off in the past

5. Valves and other special parts.

POLYETHYLENE CONDUCTOR PROTECTIVE MEASURES (PE)

Generally
In addition to the installation of the blue warning tape along the pipeline and at a height of 20 cm. above that, the contractor is obliged to take additional precautionary measures for the PE pipelines.
At intersections or in the parallel route of the PE pipelines with the pipelines of other Public Utility Organizations, when safety distances between Networks cannot be maintained, the contactor is obliged to take additional precautionary measures for the PE pipelines.

Safety Distances
The minimum distance of pipelines from buildings (for residential or other human activities) is found by the type:

A = 1.5 x W x F x D
where
A: the minimum distance (m)
P: the drawing pressure (bar)
F: the design factor (0.3)
D: the nominal diameter of the pipe in m
In any case, the A must be at least 1 meter. Distances from other pipelines and utilities.

High Voltage Installations
The minimum distance of the pipeline from high-voltage installations, cables, lines, etc. is determined by the relevant Public Authorities and Organizations, in accordance with the regulations applicable to our country.

Low Voltage Installations
The minimum distance between the pipeline and the low-voltage installations of cables, lines, etc. must be for parallel travel and for intersections of at least 0.5 m unless special protection measures are taken.

Intersections with other pipelines
The distance from the drains should be as long as possible, but in no case should it be less than 0.3 m.

Also, the distance from the other pipelines must not be less than 0.2 m unless special protective measures are taken.

Parallel routing with other pipelines
From sewerage pipes at least 0.5 m. From other pipes at least 0.30 m, unless special protective measures are taken.

Special Security Measures

Protection can be achieved by placing the PE conductor inside a protective conductor. The protective conductor can be made of steel, cast iron, PVC or other material and must withstand mechanical stresses, due to overlapping loads, and will be installed according to the instructions of the supervisor.

The diameter of the protective conductor should be 1.5 times the outer diameter of the PE conductor.

In cases where the protective conductor is used for thermal protection (near heat sources) it is necessary that the PE conductor is centered inside the protective conductor.

Protective rings are placed at the entrance and exit of the ducts from the protective conductor to prevent abrasion of the PE pipe. Also, when the protective conductor consists of old parts, in the case of an already existing fouro cast iron, then we check the inside of the fouro with a pilot pass.

The offer should include the supply and installation of a marking network over the sand formwork of the pipeline.

TECHNICAL SPECIFICATION 11 – TIGHTNESS TESTS

1. General for Watertightness Tests

a) The Technical Specification of the tests refers to the imposition of hydrostatic pressure on the pipelines a) which will be installed in sections as the works progress, and finally over the entire extent of the networks to check their satisfactory construction and especially for the welding and other connection works that will be carried out on the construction site or in the ditches. b) that have already been installed and require their operation after a period of time.

b) In the case where we have a network under construction, all tests will be performed on ready-made sections of the network pipelines before backfilling. These sections for the main tests will be up to 500 meters long and will be determined each time by the Supervising Authority.

c) In case the network has already been constructed and needs to be tested at tightness pressure in order to work, it will be tested on sections that can be isolated using already installed valves. These sections cannot exceed 1500 m. In case we have a larger section, an isolation valve will be installed at the intermediate point and always after a suggestion from the Supervising Authority.

d) The tests will be carried out both for the strength and tightness of the pipes as well as for the joints, valves, anchors, welds and all structures for the configuration of the networks. The procedure of the tests will be determined by the Supervising Authority in its detail.

e) The tests consist of the following stages:
   - From the pre-trial
   - From the main test
   - From the general test to the whole network

The pressure test is defined as 1.5 times greater than the nominal operating pressure of the conductors. For general tests, the pressure is defined as the nominal pressure for the worst position of the networks.

2. Standard Equipment for the Tests

a) The contractor must have the necessary equipment and equipment to carry out the tests. The equipment should definitely include the following:
   - Water press for applying pressure
   - Various stoppers of steel or cast iron, or of other materials, which shall be temporarily applied by means of fasteners or in any other way to the ends of the section of the pipeline to be tested. Some of the caps will have sockets for the temporary attachment of the pressure device, pressure gauges and other required accessories.
   - At least two stretchers for internal inspection of the pipeline before testing.
   - At least two precision pressure gauges for measuring and monitoring the pressure.
   - Various suitable electric lamps.
   - Materials for temporary pipeline retainers.
   - Pumps for removing water that cannot be drained by natural flow.
   - Various auxiliary tools and materials.

b) The contractor will also provide suitable and experienced personnel for the tests.

c) The water pressure will have sufficient capacity to supply water with pressure that will be able to operate without any leakage up to a pressure of at least 20 atm. and will be equipped with a safety valve to prevent pressure from being exceeded.

d) Floors, where required, shall have ventilation orifices with a watertight switch. They will also have a water intake outlet of Φ 80 mm. or F 100 mm (i.e. 3'' or 4'') with a valve, to which a hose can be attached for the water pipes that will fill the tested part of the pipeline. Depending on local conditions, it must also be possible to completely or partially discharge the pipeline from the same orifice after the test has been completed. The intake orifices that will carry the caps for connecting the pressure gauges will be located in a position that allows easy monitoring of the readings, regardless of whether the water press is equipped with its own pressure gauge. The nozzle for adjusting the pressure hose of the water press will definitely have a watertight switch.

e) The pressure gauges that will be used will be of significant size and will bear clearly written indications for a field of operation up to a maximum of 25 to 30 atm. so that the test pressure applied is not far from the middle of the pressure gauge reading range. Before using the pressure gauges, they will be checked for their good operation.

f) The pumps shall be suitable for pumping wastewater with sufficient power to be sucked from the discharge site or concentration sites anywhere within the ditch and depressed into a temporary pipe at the nearest drainage location.

g) For the transport of the water, a tanker vehicle and suitable pipes (tires, canvases, etc.) will be available from the contractor

3. Preliminary work

a) Before filling the pipeline with water, measures will be taken to stabilize and exclude any movement or deformation of the pipeline due to the forces developed by the increase in

hydraulic pressure. For this reason, the pipes of the pipeline will be partially filled with sand or common earth according to the plans, after providing that all connections (welding, connections, lugs, etc.) to remain free until the end of the test. Care will also be taken for the temporary retaining of the pipeline in curves or other sections. Fixings and permanent retainers will be performed after successful testing.

b) As a second stage of the preliminary works, the external inspection of the section that will be tested by a suitable contractor's crew and the final cleaning of the walls from any sticky mud as well as the removal of any foreign bodies that will be present in the pipeline are mentioned. Cleaning will be carried out with appropriate cloths and soft brooms.

c) After equipping the plugs at the ends of the pipeline, i.e. the installation of pressure gauges, temporary water intake, etc. The pipeline will begin to be filled with water.

d) When filling the pipe with water, no air pockets should remain in it. The filling speed of the pipes expressed in corresponding flow rate (lt/s) should exceed the following values.

D (mm)	100	150	200	250	300	400	500	600	700	800	900
Q (l/s)	0.3	0.7	1.5	2	3	6	9	14	15	25	32

e) Filling with water is done from the lower level to the upper level by pump. This makes it possible to remove all air during filling. The vents will remain with the switches open until all air has been extracted from each branch of the part being tested.

In the case of the already installed pipe line, the following works will be carried out:

- Replacement of existing valves with similar ones so that each tested section can be sealed
- Excavation for the installation of an additional valve if required to isolate the tested sections.
- Excavation for the installation of the necessary test materials such as air extraction, pressure gauge and for the configuration of the water inlet supply for testing and the pressure point of the pipeline.

4. Pre-test and Test

a) After filling the pipeline with water, the final ventilation and the control of the proper operation of any existing automatic ventilation devices will be attempted.

b) At the start of operation of the water press, it supplies the pipeline with small amounts of water, while periodically the necessary additional ventilation is provided. The operation of the water press continues until pressure is applied at the value of 10 atm. and kept for at least two hours. Then the pressure will be increased to the maximum value, as given in the corresponding paragraph of this specification, and it will also be maintained for at least two hours.

c) Throughout the duration of the test, i.e. from the beginning of the washing of the pipeline with water until the increase of the pressure to its maximum value, the section to be tested on all connections and retainers will be checked, and reinforcement should be applied if they show signs of receding tendency.

d) Any leakage of water from the connections of the pipeline is unacceptable and entails the immediate interruption of the test, the evacuation of the pipeline, if necessary, the

restoration of the defect in accordance with the instructions of the Supervising Authority and the attribution of all relevant costs to the contractor and the resumption of the test or tests until their complete success.

e) It is noted that the duration of the main test will not be less than half an hour for every 100 meters of pipeline.

f) After the end of the main test, which will have been perfectly successful, the maximum static pressure inside the pipes must be maintained until the backfill is completed at a height of at least 20 cm above the upper surface of the pipes, so that any damage that could occur during the backfill work is evident from the indication of the pressure gauges.

5. General and Final tests

a) After the construction of a significant section of piping (such a section refers to the gap between two long wells), an additional test must be carried out throughout the network with an application of at least two hours equal to the maximum static pressure. This checks the connections between the separately tested segments. The connecting positions of these sections will remain unfilled until the completion of this additional test.

b) In the case of general testing of sections between shafts in replacement of certain caps, shaft valves shall be used where possible.

c) Other general tests as well as final tests may be carried out for sections larger than those corresponding between wells, i.e. for sections that include networks in a certain number of wells.

6. Test Protocol

a) The whole procedure of each test with the details of the pipeline section being tested, the successive actions and the specific observations during the test are recorded at the site of the works with precise timing in a triple-copy test book, which is profiled by the representative of the contractor and the Supervision Authority with the model DIN 19801.

b) Defects found in the tests are immediately corrected by the contractor without additional compensation. Also, the supervising engineer may request the change of gasket or connection, if there is still a loss in the joints of the conductors after rotation, tightening, etc. his.

c) The supervising engineer shall determine the date of the new test of the pipe section in case it is not possible to repair the defects or deficiencies during the test.

d) The relevant entries in the test book constitute elements for the preparation of a "test protocol" after they have been approved by the head of the Supervision Authority that directs the project.

e) In the case of installed pipes, if the test is classified as a failure, the tested section is isolated into smaller sections by placing an isolation valve at an intermediate point and the two new sections of the pipe line are tested again. All of the above will be done after the submission of a test program by the Contractor and approval by the supervising engineer.

f) The Contractor is obliged to provide all the devices and supplies referred to in the corresponding paragraph of this specification, including any other material and work required for the proper execution of the tests, without additional remuneration.

The contractor is obliged to transport the required water from any distance.

TECHNICAL SPECIFICATION 12 – SPECIAL PIECES OF DUCTILE CAST IRON

1. Subject

This technical specification refers to the supply, installation and connection of spheroidal graphite cast iron (DUCTILE IRON) parts of GGG40 quality according to DIN 1693.

2. Construction Material Description

Spheroidal graphite cast iron shall be of class 400-15 and its mechanical properties shall correspond to those of table 1 of the International Specification ISO 1083 and table 2 according to DIN 1693, in specimens cast in separate types but from the same cast metal as the parts are cast, namely:

- Minimum tensile strength : 400 N/mm2
- Minimum elongation % : 15
- Hardness (informational) : 130 - 180 Brinell

- 2.1. Number of Samples

For each type of test, samples are taken as follows:

Batch	No. Of Samples
1-100	3
101-200	4
201-400	5
401-800	7
801-1500	10

Tensile Test

The test results must not be lower than the minimum permissible value of 400 N/mm2
Test dimensions: According to ISO 1083, Figure 5

Minimum elongation

For category 400-15 the results of the measurements must not be less than 15%. The measurement is made on the tensile test before and after the test.

Repeat Test

If a sample fails one type of test, then the test is repeated in two other samples. If one of the two sample fails, then the lot is discarded.
The results of the tests may be ignored, in case of insufficient results that are not due to the quality of the metal itself but are due to any of the following reasons:

- Incorrect placement of the sample or faulty operation of the test machine.
- Defective casting or turning of the sample.
- Breaking of the tensile test beyond the measuring point.
- Casting defects in the essay, evident after breakage.

In such cases, a new sample is taken, and the results replace those of the defective sample.

3. Supply and Installation of Ductile Iron Parts

All cast iron items in the supply will end in STANDARD type lugs or simple ends of suitable outer thickness according to DIN.
Each piece will bear a) the manufacturer's mark, b) the nominal diameter and c) its class.
The required test pressure for all items must be greater than forty (40) ATMs.
The installation of the cast iron special pieces will be carried out simultaneously with the installation of the network pipes and in the locations provided for by the approved study. This is followed by the connection of the special pieces according to the plans of the approved study.

The offer shall include the construction or supply of all malleable cast iron parts needed and their transportation on site, for the completion of the project.

TECHNICAL SPECIFICATION 13 – CAST IRON SPECIAL PARTS

1. Subject

This Technical Specification refers to the supply, installation and connection of cast iron special parts.

2. Supply of Cast Iron Parts

All cast iron items of the supply will end in STANDARD type lugs or in simple ends of a suitable outer thickness pipe. The weight of the per pc. (except for the connectors) is set in the commission table. The test pressure required for all items must not be less than twenty (20) ATMs for diameters over 300 mm. All cast iron materials are subject to the corresponding German DIN regulations.
Each piece will bear the manufacturer's mark, its nominal diameter and its class.
Grey cast iron (which is used for cast iron water supply materials) must be an alloy of excellent quality raw cast iron (turtle) at least 60% and good quality secondary cast iron (machinery, etc.) up to 40%. Any other impurity of inferior materials is excluded, so that the alloy is durable, compact and homogeneous.

Cast iron must be of quality class GG-14 according to the German standard 1961 grey cast iron and for thicknesses of 8-15 mm. In other words, it must have a tensile strength of 16 mm and a flexion of 30 mm with an arrow at the time of fracture of at least 4 mm. Based on the definitions of this German standard DIN 1961 in conjunction with DIN 50108 "Cast iron gray test, cast iron sampling, tensile test, DIN 50110 Cast iron gray test, bending test" and DIN 50351 "Hardness test", the samples will be taken and tested.
The special cast iron parts will be freed from the matrices with all the necessary precautions to avoid defects, curvatures and contractions harmful to good quality. The special cast iron parts will be perfectly strong and free from any defects.

Hydraulic tests must be carried out according to the following table.

Type of cast material	Nominal diameters	Pressure tests Kgr/cm2
Special Pieces	Up to 0300 inclusive	25
	Above 0300 and up to 0600	20

To carry out the hydraulic test, the special parts must be kept under pressure for 30 seconds. They can be struck moderately with a 700 kg hammer and must withstand the pressure test without any indication of leakage, defecation or other defect of any kind.
Wherever conditions allow, hydraulic testing should be done before asphalting.

Special parts must be internally or externally coated with insulating material, unless otherwise specified. Bituminous plaster or insulating material must be hardened quickly with good adhesion and exfoliated. The inner coating must not contain any components that are soluble in water or elements that may cause any taste or odor in it after proper washing of the pipe.
In general, cast iron special pieces will be measured by weight (kg) as long as their dimensions are not larger than those approved, and a weighing protocol will be drawn up. If the dimensions of the special pieces are larger than those indicated in the drawings or in the other documents of the study, then they are either rejected by the Service or accepted on the condition that they are paid only for the weight that corresponds to the normal and approved dimensions of the pieces. However, it is possible for certain cast iron special pieces to be measured by pieces based on the order table and their price to be at the conventional prices of the Invoice.

3. Installation of Cast Iron Parts

The installation of the cast iron special pieces will be carried out simultaneously with the installation of the network pipes and in the locations provided for by the approved study.
The provision of all the necessary for the complete and skillful execution of the works, machinery and means of transport, facilities, supplies, materials and labor, is obligation of the contractor and is included in his total offer.

The contractor's offer includes full compensation for the complete and skillful execution of the works, tests, machinery and means of transport, installations, supplies and materials and labour

TECHNICAL SPECIFICATION 14 – SPECIAL STEEL PIECES

1. Subject

This Technical Specification refers to the supply, transportation, installation and connection of special steel parts (T-shaped, biflanges, contractions, etc.).
The current International Standards are the same as the specifications of steel pipes. The quantity of steel is ST 37-2 according to DIN 17100 or GRADE B according to ASTM-A 283.

2. Supply - Transportation

The special steel pieces shall come from foreign or domestic factories, certifying their origin either by the mark of the factory on them or by the certification of the factory of origin which was first brought upon receipt.
The suppliers of the above special parts must indicate, under penalty of unacceptability of their offer, the quality and strength of the produced steel as well as the specifications of the production procedure.
The special pieces must be produced and delivered in accordance with the applicable international regulations for special pieces of water supply projects.
The cast iron pieces will be flanged or not, depending on the needs of the study and according to the node list. The flanges incorporated in the special parts must meet the following conditions:

- The flanges are intended for use in a drinking water network for installation in the ground or in concrete wells.
- The flanges will have necks for welding with steel pipes. Its production will comply with the German standard DIN 2632, 2633, 2634 for operating pressures of 10, 16 and 25 BAR respectively.
- The material will be RST37-2 according to DIN 17100 or better. Especially for flanges PN 25 according to DIN 2634 the material will be at least C22 according to DIN 17100. The machining will be done in accordance with the DIN 2519 standard, i.e. The parts shall be forged, pressed or welded and the machining and tolerances shall be in accordance with paragraphs 4.2 and 4.3 of Standard 2519.
- The flanges will have a type C overhang according to DIN 2526. With each gasket, the corresponding rubber ring, that will ensure the tightness of the connection, will be delivered. The material of the rubber ring shall be at least NITRILE RUBBER GRADE T according to BS 2494 or equivalent and shall be suitable for the intended operating pressure.
- Each flange will have mandatory indications for the nominal diameter DN, the outer diameter of the pipe, the nominal pressure PN, the manufacturer's mark, the material and the DIN number on the basis of which it has been manufactured.

The factory inspection of special steel parts is carried out by the supervision at the manufacturer's premises. The manufacturer should provide all the information to verify whether the special parts have been manufactured in accordance with the terms of the specification.
In the special sections, before the construction of the insulation protection, the welds will be checked visually or with an ultrasonic device or even if the welds are initially deemed unsuitable, the supervisor may request an X-ray (radiography) check. The nominal pressure of the steel piece shall be equal to the nominal pressure of the point of the pipeline being embedded.
During the tightness and strength tests, the special parts must withstand the test pressures prescribed by the relevant technical specifications without any leakage or sweating.
After checking the welds of the special steel piece, the protective external and internal insulation will be done.
The external insulation of the special pieces will be done by wrapping tapes in multiple layers (bandages) with special care.
For the smooth winding of the tapes, the gaps will be filled with mastic and before any work, the piping at the joint will be thoroughly cleaned from dirt, dust, moisture, lubricating oxidation

residues and welding residues by rubbing with a wire brush and the external joints will be painted with PRIMER. The application will be done with a brush or roller. The primer will be allowed to dry for 5 to 30 minutes (depending on prevailing conditions) before any tape winding is done. The tape for the outer winding shall be of three layers of asymmetrical thickness with the following (or other equivalent or better) construction.
a. First layer of butyl of a thickness greater than or equal to 0.06 mm.

b. An intermediate layer of polyethylene film of a thickness greater than or equal to
0.27 mm
c. Outer layer of vinyl with a thickness greater than or equal to 0.06 mm. Thus, the total thickness of the film will be greater than or equal to 0.80 mm.

Internal protection includes, after cleaning the internal surfaces of the welds, painting with epoxy resins as mentioned above to protect the inner surface of the pipes. The paint with a thickness of at least 200 μm must overlap the existing coating on both sides so as to restore the continuity of the paint without any defect.
The contractor should provide a manufacturers certificate of suitability of the internal protection for use in drinking water.
The results of the above test for the tightness and durability as well as for the generally good condition of the special parts and their protective coating will be certified during the drafting of the receipt protocol by the competent Committee.

3. Installation

The installation of the steel special pieces will be carried out at the same time as the installation of the pipe line of the network and in the positions provided for by the approved study.
The approach, the lowering to any depth, the placement of the special parts for connection is included in the total offer.

4. Connection

- The connection of the special steel parts will be carried out following the directions that are provided in the approved study, i.e. directly by welding or neck flanges.
- The connection of the special steel pieces with the corresponding steel pipes is done by electro welding. For welding, the AWWA C206 standard generally applies.
- The connection of the flanges will be done with steel bolts in heat. Their helicotomies will be according to the international system and the head and nuts will be hexagonal.

Their shape and dimensions will correspond to the latest version of the German DIN 601 standard. The nuts will meet the requirements of the German Standard DIN 555. The steel will be 4D quality according to DIN 267.
All screws and nuts will be anodized on all visible surfaces. The method of accreditation and their inspection and acceptance will be done in accordance with the terms of the American Standard ASTM/A 165-71, as it is currently in force.
The sealing of the connection will be achieved through a gasket consisting of a 3 mm thick rubber ring for the flanges with a diameter of Φ60-Φ300.

The material of the rubber ring shall be at least NITRILE RUBBBER GRADE T according to BS 2494 or equivalent and shall be suitable for the intended operating pressure.
The inner diameter of these flanges shall be 10 mm greater than the inner diameter of the flange and the outer diameter shall be adjacent to the screws.

The connection of the flange will be done as follows:

- The pieces are aligned and placed so that the holes of the flanges are located exactly opposite to each other and a small gap is left for the insertion of the rubber ring.
- The ring and then the bolts are inserted. The ring is centered. The screws are placed and gradually tightened by successively screwing the diametrically opposed bolts.
- Similarly, the external protective insulation of the connections of the flanges when placed on the ground shall be done in the following manner or other equivalent:
  - After thoroughly cleaning the pipe and flanges around the connection from moisture, dirt or foreign materials, fill the gap of the flanges with plastic material that has a rough surface.
  - Then we wrap all the connection with three-layer tape according to DIN 30675 part I.
  - Then the whole construction is wrapped with special protective plastic paper.
- The special piece should be thoroughly examined by the Supervisor before the connection. If the external protection has been damaged either during transport, during disembarkation or at any other point of the contract, the contractor will be subject to the cost of restoration using mastic and coating tape.

Full compensation for the supply of the manufactured straight steel special pieces and steel flanges and their transportation to the project, their installation and connection is included in the total offer.

TECHNICAL SPECIFICATION 15 – CAST IRON WRENCH SHAFTS

1. Subject

This Technical Specification refers to the way in which the valve shafts will be constructed, measured and paid, according to the design plans.
The valve will be adjusted from ground level using a suitable control wrench and the use of valve control components.
Handling components include the handle shaft, control wrench, wrench adjustment part, manhole and extension tube. All components are cast iron and must meet the corresponding specifications. The valve cover should be based on prefabricated concrete supports according to the drawings. Also, the valve should be based on a concrete support made on site.

2. Works to be Performed - Technical Specifications that Apply

The works that will be carried out and the corresponding Technical Specifications that apply to the construction and the tests are the following:
A. Excavations: Technical Specification 1
B. Concrete C 16/20: Technical Specification 6

C. Special Parts (Cast Iron - HDPE): Technical Specification -12-13-14

All the details and dimensions of the above works are specified in the relevant plans of the study and will be carried out in accordance with the instructions of the Managing Authority.

The offer includes a full compensation of the contractor for the construction of a complete valve shaft and includes all the works referred to in paragraph 2 of this Specification, the transfer of the materials to the installation site as well as any other work that is not explicitly stated but is necessary for the satisfactory execution of the project. Additional excavations and additional backfills for the satisfactory execution of the project are also included in the total offer.

TECHNICAL SPECIFICATION 16 – FLANGED VALVES WITH RUBBER SEALING

1. Subject

This specification refers to the supply of valves with a diameter of 50 mm to 200 mm for network equipment. Their ends will be shaped into lugs so that their connection to the duct on both sides will be made with special pieces with lugs.

2. Applicable Specifications

The GTS 08-06-07-02 applies.

3. Technical Characteristics

3.1. The valves will be manufactured according to the ISO 5996-1984 (E) standard, category A with elastic clogging. (Symbolization GATE VALVE ISO 5996 45 DN ISO PN NA1).
3.2. The body and cover of the valves shall be made of cast iron gray of at least type GG 20 according to DIN 1691-85 or GRADE 250 according to ISO DR 185-81 for PN 10. Grey cast iron valve bodies and covers must have a smooth surface without scales, bumps, sand cavities, and any other foundry defects or failures. It is forbidden to fill the above cavities with other materials. There will be no external coating of the valves unless first cleaning and rust removal is asured. The body and cover of the valves shall be coated externally and internally with epoxy paint of a minimum thickness of 150 μm or another equivalent form of protection which must be suitable for drinking water. The manufacturer is obliged to deliver a certificate of suitability of the paint for drinking water. The color will be brown for PN 10. The connection of the body and cover shall be made with flanges and screws made of steel of at least ST 8.8 according to DIN 912. Between the body and cover gaskets there will be an elastic gasket made of at least NITRILE RUBBER GRADE T according to BS 2494 or equivalent material.
3.3. The valves will be of non-raised piston rod. The piston rod will be made of stainless steel with a minimum chromium content of 13.0% or equivalent material. The valve will close when the rod rotates clockwise. The sealing of the piston rod will be achieved with O-RINGS of high corrosion resistance and suitable for sealing at temperatures up to 60oC or other equivalent sealing method.
3.4. The latch shall be made of cast iron at least GG-25 according to DIN 1691-85 for PN 10 while for PN 16 and greater it shall be made of DUCTILE IRON of at least GGG 40 according to DIN 1693

or 400-15 according to ISO 1083-76, shall be indivisible and shall be coated with a high-strength synthetic rubber, at least NITRILE RUBBER GRADE T according to BS 2494 or equivalent, suitable for drinking water, in order to achieve elastic sealing (RESILIENT SEATING).
3.5. The length of the valves will be in accordance with ISO 5752 standard, series 15 (long) or with Tables 2 and 3 of ISO 5996-1984 (E) or with DIN 3202 F5 series or with NFE 29305 series 15.
3.6. The valve body shall have dimensional flanges at both ends in accordance with paragraph 5 of ISO 7005-1/2 and ISO 2531 or DIN 2501/28604 to 28607 or NFE 29-203 and NFE 29-205
3.7. The valve body will have mandatory indications in accordance with ISO 5209 for the nominal diameter (DNA and size), the nominal pressure (PN and pressure), the indication for the material of the body and the manufacturer's mark or name and production number of the valve. The production number may be written on an additional suitable metal plate firmly fixed to the body of the valve.
3.8. The valves shall have at the upper end of the rod a square head of 50x50 mm, of a useful length of at least 50 mm, adapted and fixed with a safety screw at the end of the rod. This square head is mounted to allow the valve to be operated with the existing valve control keys.
3.9. The valves, when open, must completely free a cross-section corresponding to their nominal diameter and have an internally suitable configuration, free of notches, etc. at the bottom to prevent possible depositing of bearings (e.g. gravel) that will make the tightness problematic when closing the valve.
3.10. The valves will be of suitable construction so that in case of possible repair, the main part of the valve will not be disconnected from the piping and the replacement of the upper part, latch, rod, etc. will be allowed.

4. Tests

4.1. Tests carried out on each valve

4.1.1. Inspection - Operation control according to the requested data 2.7. Specifically:

- Keeping order data.
- Checking the type (throttle, latch), form and equipment (e.g. the closing method, the existence of accessories)
- Check for clear indication of manufacturer data and valve informations (nominal diameter and pressure)
- Protective layer surveying internally and externally (with the naked eye)
- Operation control (open-close) and closing direction

4.1.2 Strength and Tightness Test

A1. Shell Strength Test

Each valve will be tested under hydraulic pressure in accordance with the requirements of ISO 5208/1982 or DIN 3230 series 3 and NFE 29311. The test pressure of the valve body shall be 1.5 times greater than the maximum allowable operating pressure for all sizes.
The test will be done with the valve in the open or partially open position with the shell emptied of air.
The pressure must be kept constant throughout the 2 min period without adding water. The valve must first be cleaned and dried.

A2. Shell tightness test will become the same as the previous one or even merge into one.

B. Seat tightness test, i.e. closed valve
The valves will be tested in accordance with the ISO 5208/1982 par. 4.3 for tightness test (SEAT TEST), at a pressure of 1.10 times the PN. No visible leakage should occur during the test time (RATE 3).

Initially, the valve will be filled with water in the open position, it will close, remove the water and the valve will dry on one side. The pressure will rise to the reported pressure and will remain constant for 2 minutes without the addition of water, while at the same time the waterproofing will be monitored. During the 2 minutes, no drops or sweating should be observed from the dry side nor a drop in pressure. The test is repeated on the other side.

4.2. Sampling tests

- Testing the force required to handle the valves under pressure.
- The resistance test of the isolation stem will be performed at a water pressure of 1.5 times PN with the valve closed. For one minute, the water pressure from the closed stem will be maintained at the reported pressure. No deformation of the stem should be observed.
- Material quality controls: chemical analysis of all materials in the manufacture of the valve, tensile testing, perforation hardness test.
- Checking the bolts and nuts.
- Checking the surface of the lugs (dimensions, bolt holes, streaks).
- The number of the samples will be determined by the Supervising Authority.

4.3. Inspection of Valve Construction Material
The quality of grey cast iron (GG25 according to DIN) or spheroidal graphite cast iron (GGG40 according to DIN) or cast steel (CSC according to DIN) will first be ensured by the submission of a test certificate from a recognised testing institute.
If the valves are manufactured in Greece, the contractor is obliged to give at least fifteen (15) days' written notice to the supervisor in order to attend the casting days. Failure to notify will result in the discarding of the parts to be cast. Appropriate samples will be taken during casting.
The sampling and configuration as well as the tests will be carried out in accordance with the provisions of DIN 50110 for grey cast iron (test length 650 mm and test diameter 30 mm). For each type of test, at least two samples should be taken.

<u>5. Transportation and Delivery</u>
1. After testing, each valve will be dried and ready for loading
2. The latch will be in a slightly open position when loading
3. If deemed necessary due to adverse transport conditions, the supplier will be obliged to place the valves in wooden boxes and cover the edges on each vane with wood, chipboard, plastic or other material to protect the trays and seal rings.

The offer includes full compensation for the supply of the two-key flanged rubber valves, transport and connection, including all necessary micromaterials.

TECHNICAL SPECIFICATION 17 – BUTTERFLY VALVES

1. Subject

This Technical Specification refers to the supply, transport and installation of flanged butterfly valves made of malleable cast iron. The valves should meet the following requirements and be in line with the plans and other contractual elements.

2. General Requirements

The valves will be manufactured in accordance with DIN 3354 PART2 and EN 593. will have ISO 9001 quality certificate and written certification from the factory's testing department.
The body and disc of the valves will be made of malleable cast iron (DUCTILE IRON) of GGG40 quality according to DIN 1693 and ISO 1083-91 standardization and after casting they should have a smooth surface without scales. bulges, cavities, and any other foundry defects or failures. It is forbidden to fill the above cavities with other materials.
The valve bodies will have been sandblasted and then painted externally with 2 layers of high-strength anti-corrosion paint. epoxy paint, with a thickness of at least 300 μm RAL 5005 of all layers. Internally, the total thickness of the paint will be at least 300 μm RAL 5005.
The body ring will be made of 1.4021 stainless steel.
The sealing ring of the disc will be made of EPDM elastomer and of such shape and construction as to carry out the sealing in both directions of flow.
The disc will be of double eccentricity and will have a malleable cast iron retaining ring coated with epoxy paint, for the installation of the sealing ring with stainless steel screws according to AISI 3O4-A2.
The axis will be made of ASl 420 stainless steel.
For a cross-section of the valve over 800mm, the replacement of the sealing ring will be carried out without the extraction of the valve from the network but with the insertion of the technician into the pipeline.
The valves will be manufactured and drilled according to DIN 2501 or ISO 7005 PN 10/16/25.
The body of the valves will be embossed with the nominal diameter, the nominal operating pressure, the construction material and the serial number of the factory. On the body of the valves there will be a label which will indicate the nominal diameter, the nominal operating pressure, the direction of water flow, the date of production of each valve, the production number and the manufacturer's logo.

Pressure Test Standard: ISO 5208
1. Body 1.5 x PN
2. Body Ring 1.1 x PN
3. Flange 1.1 x PN

Factory Pressure Test Standard - EN 1074
Butterfly Type Valve Parts Manufacturing Standard
• Flange-to-Flange Dimension - EN 558

• Valve gaskets - EN 1092-2 and ISO 7005
• Connection flange connecting reducer and electric motor - ISO 5210
• Reducer Body Connection Flange - ISO 5211
• Reducer resistance to water - EN 60529
• Operating Torque - EN 12570

3. Valve Handling

The valves will have a reduction mechanism that will operate through a hand crank and will ensure that the valve is operated by one person.

4. Costs included in the Installation of Valves

In particular, the following expenses are included, but are not limited to:

- The on-site transfer of the project valves
- The on-site supply of all the micromaterials required for the installation
- Loading and unloading and lost time
- Their installation and connection
- The use of any kind of equipment
- All kinds of tests and checks

TECHNICAL SPECIFICATION 18 – STEEL FITTINGS

1. Subject

This specification refers to special fittings of various diameters and pressure of 10 ATMs which will be installed for the dismantling of devices.

2. Technical Characteristics

- The disassembly pieces consist of two concentric sections that slide into each other and allow the length to be fluctuated by at least) 25 mm.
- Tubular sections and flanges should be made of ST 37 steel according to DIN 17100. It will be protected by coating internally and externally with epoxy paint of a minimum thickness of 150 μm or by any other form of protection suitable for drinking water.
- The sealing will be done with a special sealing ring.
- The bolts and nuts will be made of galvanized steel.
- The connection gaskets will have dimensions in accordance with DIN 2501/28604 to 28607 for an operating pressure of 10 ATM.

The offer shall include full compensation for the supply of the dismantling parts, transport and connections, including all necessary micromaterials.

TECHNICAL SPECIFICATION 19 – ABOVE-GROUND FIRE NOZZLE (WATER INTAKE) Φ80

1. Subject

This Technical Specification refers to the supply and installation of fire nozzles and connection to the water supply network.

2. Procurement - Technical Characteristics

The fire water intakes will be manufactured in accordance with the German DIN 3222 regulations, operating pressure, 10 atmospheres, with a total height of about 1.80 meters, resulting in an internal diameter of 80 mm. with two water intakes with a diameter of 52 mm. (2") at a distance of 273 mm. from the upper part and third 75 mm. (3") lower, all at a distance of 358 mm. from the upper end and will have a built-in valve to cut off the water supply to the three intakes, which will close clockwise with a 30X30 mm movable nut. The water intake will be accompanied by a required cast iron specially based curve of 2 flanges Φ 80 and 90o.

Pressures

a. Nominal pressure: 10 atm.
b. Hydraulic test pressure: 16 atm.
c. Maximum operating pressure: 10 atm.

Materials

The body of the fire receiver, the head, the latch and the seal of the valve and a special piece, will be made of cast iron. The watertight seats on the latch and the valve socket will be made of brass. The latch will be indivisible with converging seats. Fire taking weight approx. 170 kg.
The lugs will have a completely flat surface and will be manufactured in accordance with the German DIN 2532 regulations.
The cast iron parts of the fire extinguishers will have bituminous coating internally and externally.

3. Connection to the Network

For safety reasons, the use of an additional flanged valve with a diameter of 80 mm and 10 ATMs after the based curve is foreseen. The valve is connected to the network by T-shaped one flange tap. The valve has all the necessary cast iron parts for its adjustment with a control wrench.

4. Installation and connection

The instalation of the fire hydrants will take place in the fire construction locations provided by the plans. The connection to the pipeline will be carried out as shown in the drawings.

5. Works to be Carried out - Technical Specifications to be Applied

The works that will be carried out and the corresponding Technical Specifications that apply to the construction and control are the following:

- Concrete C 16/20 in line with Technical Specification 6
- Special cast iron parts in line with Technical Specification 13 and Technical Specification 14
- Valve Φ80 flanged pressure 10 atm in line with Technical Specification 16
- Anchoring body in line with Technical Specification 9

All the details and dimensions of the above works are specified in the relevant plans of the study and will be carried out in accordance with the instructions of the Supervising Authority.

The offer includes full compensation for the on-site supply of the fire shots of the special cast iron parts (bearing curve, tau etc.) of the valve, the connection and testing work, the fire reception and the supply of the connection micromaterials.
The offer includes the on-site value of the necessary materials and the work for the construction of the fire hydrant bearing, the safety valve and the valve cover, as well as any work that is not explicitly mentioned but is necessary for the satisfactory execution of the project.

TECHNICAL SPECIFICATION 20 – GIBAULT CAST IRON CONNECTORS

1. Subject

This Technical Specification refers to the supply and installation of GIBAULT cast iron connectors, which will be used for various connections in the network.
The contractor will supply, transport, on-site, mount, connect and test the GIBAULT connectors, in accordance with the terms below.

2. Description - Materials - Applicable Specifications

2.1. GIBAULT Special Cast Iron Parts & Connectors

2.1.1. Description

The GIBAULT connectors will be of a nominal operating pressure of 10 atm. GIBAULT connectors are used to connect special parts to the network pipes as well as in the event that plastic pipes or asbestos-cement pipes cannot be connected with their own connectors.

2.1.2. Material Quality

The cast iron parts of the GIBAULT connectors will be made of cast iron of at least GG20 quality according to the International Standard ISO 185 in conjunction with the DIN 28,500 standard. The tensile strength will correspond to the provisions of Table 1 of the ISO 185 specification in specimens casted in separate types but from the same cast metal as the parts are casted, namely:
Minimal tensile strength: 250N/mm2
Hardness: Up to 210 BRINNEL

Their interior and exterior surfaces will be coated in accordance with the above DIN 28,500 standard

2.1.4 Quality of finished parts

GIBAULT connectors will come out of the matrix with all the necessary precautions to avoid defects (curvatures and contractions) harmful to their quality. They will have the required strength and their surface will not show defects. The fracture section will be gray, fine-grained, dense and uniform. The material during casting must completely fill the molds so that its surface is free of defects. It is forbidden to fill any subsequent cavities that will appear with foreign matter.

In the event of any dispute, cast iron parts are considered acceptable as long as their hardness in the centre of their thickness does not exceed 215 BRINELL.
All external surfaces of the pieces will be cleaned with sandblasting before painting.

3. Tests

3.1. Generally

For the cast iron parts of GIBAULT connectors, the breaking strength during the internal hydraulic pressure resistance tests is defined as equal to the corresponding breaking strength of the special cast iron parts according to the DIN 28,600 standard.

4. Screws and Nuts

For screws and nuts, the following applies:
i) The screws that will be used will be hexagonal head with hexagonal nuts without gaskets; the shape and dimensions of the DIN 601 standard. The nuts will meet the requirements German standard DIN 555. The steel will be 4D quality according to DIN 26
ii) All screws and nuts will be anodized on all visible surfaces. The method of incarceration, the control and the acceptance will be according the terms of the American standard ASTM/A 165-71, that is currently in force, with the following clarifications:
- The minimum thickness of the coating is defined as 30 microns.
- The epicadmiation check will be done on a random basis. The order will be divided into groups of one thousand similar pieces. Groups of a smaller number of pieces are also considered in one group. Five samples are taken from each group, in which the thickness tests are carried out according to ASTM/A 165-7; all samples are successfully tested, the group is considered acceptable. If more than one sample fails, five pieces are resampled by the same group, which are tested. If one or more samples fail, five pieces are resampled.
Samples of this second test fail the team is rejected.

TECHNICAL SPECIFICATION 21 – STEEL NECK FLANGES WITH SCREWS, NUTS & SEALING GASKETS

1. Subject

This Technical Specification refers to steel neck flanges with screws, nuts and sealing gaskets.

2. Technical Characteristics

2.1. Flange Technical Specifications:

2.1.1. The flanges are intended for use in a drinking water network and for nominal diameters up to DN 300 for installation in the ground.
2.1.2. The flanges will have a neck for welding with steel pipes. Their construction will comply with the German standards DIN 2632, 2633, 2634, 2635 for operating pressures of 10, 16, 25 and 40 BAR respectively.
2.1.3. The material will be RST37-2 according to DIN 17100 or better. Especially for flanges PN 25 according to DIN 2634 the material will be at least C22 according to DIN 17100. The machining will be done in accordance with the DIN 2519 standard, i.e. the pieces shall be forged, pressed

and the machining and tolerances shall be in accordance with paragraphs 4.2 and 4.3 of the 2519 standard.
2.1.4. The flanges will have a protrusion (patura) type C according to DIN. With each gasket, the corresponding rubber ring will be delivered to ensure the tightness of the connection. The material of the rubber ring shall be at least NITRILE RUBBER GRADE T according to BS 2494 and shall be suitable for the intended operating pressure.
2.1.5. Each flange will have mandatory indications for the nominal diameter DN, the outer diameter of the pipe, the nominal pressure PN, the manufacturer's mark, the material and the DIN number on the basis of which it has been manufactured.
2.1.6. The neck flanges will be accompanied by the galvanized connection screws of the quality 8.8 quality flange according to ISO 4017 or DIN 933 with full threaded screws, the corresponding nuts and washers as well as the sealing gaskets made of GRADE T rubber according to BS 2494/1986 or equivalent.
2.1.7. The screws, screws and washers will be delivered mounted (screwed).

2.2. Technical Specifications of Sealing Gaskets:
Sealing gaskets are intended for connections between steel water pipes. Sealing gaskets should follow the following technical specifications:
2.2.1. Be suitable for connection between steel or cast iron flanges.
2.2.2. The construction material must be NBR (Nitrile rubber) and be specially manufactured for applications in drinking water, in accordance with KTW and DIN guidelines.
2.2.3. The operating temperature range of the gasket material ranges from -25 to +70 C.
2.2.4. To have integrated linen layers.
2.2.5. The dimensions of the gaskets, as well as the profile of the elastomer, must ensure perfect sealing of the joint, minimizing the requirement to tighten the connection screws, compensating for the imperfections and irregularities of the surfaces of the connected gaskets and avoiding pressure drops in the pipes (due to poor fitting of the gaskets on the joints).
2.2.6. Gaskets should flexibly respond to any connection angles between the connected conductors and ensure a long connection life.

2.3. Acceptance testing:
2.3.1. The test and inspection of the flanges will be carried out by the Supervising Authority who will have free access to the parts of the manufacturing plant that are related to the manufacture of the flanges being tested. The contractor is obliged to provide without any charge all the information required for the inspector to verify whether the flanges are manufactured in accordance with the terms of the Technical Specification.
2.3.2. The production plans will be checked in terms of configuration, suitability of the materials used, intended treatments and tolerances.
2.3.3. The tests and inspections will be carried out both at the contractor's factory and at the premises of the entity or at the place of installation if this is deemed necessary.
2.3.4. The qualitative receipt will be made by a committee that will draw up a receipt protocol.

The offer shall include the on-site supply of steel neck flanges, the on-site value of the necessary materials, the work for the connection of the neck flanges, as well as any work that is not explicitly stated but is necessary for the satisfactory execution of the project.

TECHNICAL SPECIFICATION 22 – UNDERGROUND PIPELINE MARKING NETWORK (MESH)

1. Subject

This Technical Specification refers to the supply, on-site transport and installation of the signage network.

2. Element

2.1. Technical Characteristics:

- Width: 30+ - 1 CM
- Weight/sq.m: 95 GR
- Texture: Lattice with a continuous belt in the center 7 ± 1 CM, where WATER SUPPLY NETWORK PIPELINE will be indicated. The letters must be printed and legible at a height of ± 4 CM.
- Color: Blue, as provided for water pipes with color stability 7-8 of the blue scale.
- Packaging: In sheets of 200 - 300 tr. M.
- Material: made of polychlorovinyl (PVC) or polyethylene (PE) or polypropylene (PP)
- Network Format: on both sides of the central zone with the highlighting, it will bear 7-8 cells, bronchi.
- Type: According to the standards used in the respective Organizations of France and England.

2.2. Tests

The supplier must carry out the following tests

Measuring Tensile Strength and Elongation at the Breaking Point

This test is carried out in accordance with the instructions of the French Specification of the Plastic Materials Standards Office No. BNMP 21038/5 - latest version or equivalent.

The test results should be as follows:

- Tensile strength: R> 17,64 Pa
- Elongation at the breaking point: A>125%

Asepsis Test

The asepsis test must be performed in accordance with the instructions of the French standard NF X 41-514 or equivalent.

Color Stability Test

A sample 100 to 150 mm long and 30 mm wide is immersed in a 20% solution of ammonium sulfur

- Temperature: 15 to 20oC

- Duration of immersion: 15 days

Color stability will be evaluated by comparing the assay with a random sample. The comparison should be made by placing the sample and the essay on a white background, with sunlight, but without direct exposure to the sun.

The test is considered satisfactory if the color of the assay remains unchanged.

2.3. Packaging

The protective mesh is packaged and delivered in 100 mm coils.

The offer shall include full compensation for the provision of all the necessary for the complete and skillful execution of the works, machinery and means of transport of supplies and materials.