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HIGH PRESSURE (HP) TRANSMISSION SYSTEMS

TRENCH AND BACKFILLING FOR PIPELINES LAID BY OR UNDER ROAD SURFACES

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CHANGES LOG

REVISIONS LOG

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REFERENCE DOCUMENTS

Job Spec. No. 499/2
[Trenching and Excavation]

Job Spec. No. 499/4
[Backfilling]

Job Spec. No. 499/5
[Reinstatement] Drawing

Standard No. STD-4-41-15

ΒΜ5/30058/1983

Standard Technical Specification ΠΤΠ Ο-150
Standard Technical Specification ΠΤΠ Α-201
Standard Technical Specification ΠΤΠ Α-203
Standard Technical Specification ΠΤΠ Α-265

ΥΑ ΒΜΠ/30058/1983 (ΦΕΚ 121/Β/23-3-1983)
«Έγκριση πρότυπης προδιαγραφής σημάνσεως εκτελούμενων έργων σε οδούς εντός κατοικημένων περιοχών»
[Technical standard for safety measures to be taken for works in urban areas]

Π.Δ. 1073/1981 (ΦΕΚ 260/Α/16.9.1981)
«Μέτρα ασφαλείας κατά την εκτέλεση εργασιών σε εργοτάξια οικοδομών και πάσης φύσεως έργων αρμοδιότητας Πολιτικού Μηχανικού»
[Presidential Decree for Greek Regulations in Safety]

1.0 SCOPE

This specification specifies earthworks and asphalt works required at areas where the pipeline is laid under or adjacent road surfaces.

2.0 GENERAL

The following paragraphs specify all relative works applied to all types of soil, in order to obtain the typical sections specified by **Job Specification No. 499/2** and the **Std Dwg No. STD-4-41-15.**

The above specification and drawing should not contradict one another, but in case they do, the most stringent requirements prevail.

Trenching is with regards, but is not limited to the following works:

- Cut and demolish the existing pavement (concrete or asphalt) in case of existing roads.
- Excavation of the trench.
- Dewatering and pumping, if required.
- Support underground installations if any - underpin structures that are without support because of the excavations.
- Leveling the bottom and sides of the trench.

Excavations are usually done with excavating machines or occasionally by hand, if there is a risk of damaging other installations or creating public nuisance.

Asphalt cutting must be done with special tool, i.e. asphalt saw-cutter.

3.0 EXCAVATION

3.1 SETTING OUT

Setting out should commenced before excavating the road or pavement.

A strip of 1,50m width is cleared after removing debris, and the trench edges are marked on the ground by means of paint, string etc.

Contractor shall check along the route for any obstacles, which may not be indicated on construction drawings.

3.2 MONITORING HOLES

Monitoring holes must be provided before the excavation works are commenced, in order to identify any underground installations (pipes, sewers, electric ducts etc). The exact number and position of monitoring holes will be proposed by Contractor, and approved by the Supervisor according to local conditions.

This approval does not relieve Contractor of his obligation and responsibility to identify accurately existing underground installations along the pipeline routing.

3.3 SURFACE CUTTING

It is with regards cutting of all types of surface i.e. asphalt or cement slabs, pavement, concrete lining etc, and their subbases. Every material that could possibly be reused should be cleared and transported to appropriate place.

Discarded material shall be removed by Contractor to locations designated by the relevant Authorities.

Cutting works must be done carefully, using a proper asphalt-cutting machine in order to obtain a neat and orderly layout of excavation.

Walkway slabs should be removed in individual pieces. The temporary placing of the excavated surface materials must be done properly without causing:

- Damages in urban areas.
- Obstructions during the pipe transportation and installation.
- Problems to pedestrians and traffic.
- Danger to personnel.
- Problems to surplus material removal.
- Damage to reusable slabs.

In case that there is no place on site for placing excavation materials that will be reused, Contractor will transport them to an appropriate place and then transport them back to site, at his own expense.

3.4 SAFETY MEASURES

Safety measures are very important for the acceptable execution of works. These measures consist of, but are not limited to:

- Marking of the working area according to law **Π.Δ. 1073/1981 (ΦΕΚ 260/Α/16.9.1981)** – "Safety measures for civil engineering works", **ΥΑ ΒΜΠ/30058/1983 (ΦΕΚ 121/Β/23-3-1983)** – "Technical standard for safety measures to be taken for works in urban areas".
- apply any possible means to ensure safe move of people and vehicles i.e.:
    1. Protective barriers, fences and signals for pedestrians
    2. Traffic signs for vehicles
    3. Traffic lights and reflective signs
    4. Deviation of roads
    5. Safety barriers, signals, traffic arrangement study
    6. Illumination

3.5 EXCAVATIONS

Trenches and excavations of any shape must be undertaken according to relevant standards and specifications, following the rules of good engineering practice. Sides and bottom leveling shall be performed for any type of soil, even if water is accumulating. Isolated boulders may be removed manually.

Uprooting and removal of plants shall be done only as appropriately, and relevant permits shall be obtained, if required, from the Forestall Authorities.

At areas where machinery cannot be used, works shall be done manually, regardless of the amount of work required.

Use of explosives shall be avoided, except at rare cases where Contractor shall get special permit issued by the relevant Authorities. Such permit is issued after submission of relevant report by Contractor, which shall indicate measures to be taken for safety of the public and adjacent structures. The permit is copied for

information to the local police station, who shall also be informed about intended safety measures to be taken.

Contractor shall inform the Supervisor beforehand about the type of pneumatic drill point and the safe distance (for vibrations) of the plant to be used, according to Manufacturer's specifications.

3.6 DEWATERING

If water is accumulating in the trench, it must be drained or pumped to a location approved by the relevant Authorities or the landowner.

If special permission is required, Contractor is responsible for obtaining it. Any problem relating to water existence, which may appear at any time before the delivery of works, shall be resolved by Contractor at his own expense.

3.7 SUPPORTING OF EXISTING INSTALLATIONS

It is necessary to support properly and protect every pipe, duct or other installation, which may be revealed during excavation works.

Contractor is responsible to restore, at his own expense, any damage caused to underground installations. Supporting works shall be performed in a way approved by the owner of the revealed installations, who must be informed by Contractor in time about the incident.

3.8 UNDERPINNING OF DISTURBED STRUCTURES

Sides and bottom of the trench shall be well formed, in order to facilitate lowering and placement of the pipeline and personnel moving adequately in the trench. If there is a risk of slope failure, for any reason, the trench sides shall be supported by a timber and/or steel structure. Without such support, Supervisor shall not allow workers to get into the trench, especially when the soil is non-cohesive.

The retaining system shall not hinder progress of works, or create difficulties in inspecting any part of the works.

Contractor is responsible for removal of the retaining structure when is not necessary. The removal of the retaining shall be technically acceptable, and all the necessary safety measures shall be taken. In case of underpinning, (buildings, basements, underground installations), Contractor is responsible for executing all these works in such a way that the safe execution of pipeline installation and the integrity of all adjacent structures are assured.

Where necessary, or requested by Supervisor, Contractor is obliged to submit full design calculations for the retaining structures.

3.9 INCREASE OF DESIGN DEPTH OF TRENCH

Depth of the trench shall be increased in the following cases:

a) At areas where future excavation, or heavy loads are expected (erection of buildings, deep foundations, etc) and may cause damages to the pipe.

b) Where there are trees with very deep roots, which may damage the pipe insulation.

c) At areas where above loads are exceeding the allowable bearing load of the pipe.

d) At areas where the pipe crosses under roads, railways and depth increase is required by the relevant Authorities, specifications or the detailed engineering.

e) At crossings with rivers or canals.

f) At areas with steep ground slopes, where the pipeline should follow the ground contours as far as possible.

g) At areas where the pipe clashes with other underground installations.

h) At areas where the bottom consists of alluvial deposits or muddy strata.

3.10 REDUCTION OF DESIGN DEPTH OF TRENCH

When there is an extensive underground installation, the pipe may not be possible to be placed below the 1200mm minimum depth. This is acceptable provided that protective measures shall be taken by Contractor, at his own expense, ie:

- Protective saddles (concrete or P.V.C).
- Protective concrete slabs.
- Concrete coating of pipe.

All the above structures shall be according to relevant sizing calculations, which will be submitted to Supervisor for approval.

The above protective measures may also be used in other in the cases, i.e.:

- Heavy imposed above ground loads
- Railway crossings
- Major Road crossings
- River, canal or stream crossings
- Hazardous underground installations
- Protection required from roots of trees, bushes, etc.

4.0 BEDDING

4.1 PREPARATION OF THE PIPE-BEDDING

Every sharp object which may damage the pipe during its lowering or its installation shall be removed. If the bottom is not at lower level than the appropriate design depth due to over-excavation, it shall be filled again with sand up to the required design level.

4.2 BEDDING MATERIAL

Bedding layer shall be 200mm thick, made of sand, free of organic or other substances. This bedding layer shall be extended up to the side slopes of the road.

The pipe is lowered, after checking and approval of the thickness of the sand layer by Supervisor.

5.0 PADDING AND MARKING

5.1 PADDING

The padding layer consists of the same material as the bedding one and it is placed according to relevant drawings.

It shall surround the pipe and cover it all over and shall form an above the top of pipe layer 200mm thick.

Sieving of material on site is not allowed.

Also use of sand with salt residues is not allowed, to avoid corrosive action on the pipe.

5.2 WARNING MESH

Yellow plastic mesh is placed on top of the padding, for pipe detection purposes. It has the following characteristics:

- Width 60 ± 1 cm
- Weight/m 140 ± 10 gr
- of HDPE
- Colour yellow, stability 7-8 on blue scale.
- Texture Net-like, except a central area strip which is 7 ± 1cm wide. On that shall be printed : ΔΕΣΦΑ ΑΓΩΓΟΣ St (X) ΥΠΟ ΠΙΕΣΗ
- Mesh form Either side of the central strip, shall have 7-8 eyes, size 4x4cm.
- Packing sheets of 200-300m length.

6.0 BACKFILLING

6.1 GENERAL

The trench is backfilled after the pipe installation, the padding and the placement of the yellow plastic mesh have taken place.

Backfilling material shall consist of appropriate excavated material or crushed aggregate according to **ΠΤΠ Ο-150** or **ΠΤΠ Ο-155**, and it shall be adequately compacted. Surplus material shall be removed.

The backfilling works should not later than 24 hours after the excavation is executed, unless the Authorities responsible for traffic etc. otherwise order (for additional information, see also **Job Specification No. 499/4**).

6.2 BACKFILLING COMPACTION

There are two categories of backfilling compaction, according to the size of imposed ground loads:

a) For footways, rural roads or other secondary roads and fire break zones, backfilling material consists of appropriate excavated soil, which is laid and compacted in 250mm thick layers. Compaction shall be performed by vibrator and soaking in parallel, until refusal.

b) For major roads, asphalt roads, pavements, concrete surfaces, road shoulders, backfilling material consists of crushed aggregate to **ΠΤΠ Ο-150**, which is laid and compacted in 200mm thick layers. Compaction shall be performed by vibrator and soaking in parallel, until the material density is equal to 90% of the maximum achieved in laboratory conditions, to modified method of AASHO T-180 D, for the first layers above the pipe and 95% for the subbase and base pavements
Contractor is responsible for handling backfilling materials in such a way, so that no obstacle nor danger is created neither for the pedestrians nor for the traffic.

All work shall be performed according to the law and the regulations of local Authorities.

6.3 BACKFILLING OF THE UPPER PART OF THE TRENCH

If the top surface of the trench is longitudinally sloped and there is risk of water erosion, backfilling of the upper part of the trench, shall be performed as follows:

a) For rocky ground, the upper part aggregate (to **ΠΤΠ Ο-150**), shall be stabilized by added cement.

The mixture proportions are: 100kg dry cement mixed with $1m^3$ of crushed aggregate. The final mixture is spread in two layers 15cm each. Then, vibrator and soaking are used until refusal. The top surface shall be smoothed out, so that it facilitates surface water flow.

b) For less rocky ground, mass concrete C12/15 (10cm thick layer) shall be used, instead of aggregate and cement.

c) For soft soil conditions, crushed aggregate size shall be 10-15cm, laid in a 30cm thick layer.

6.4 TEMPORARY REINSTATEMENT OF ROADS

Temporary reinstatement, if required, is performed with excavated material free of stones bigger than 30mm. This is placed on the top of the second backfilling layer, up to 50mm above the asphalt level. Its purpose is to facilitate traffic flow until proper final reinstatement of the road surface is provided.

6.5 REMOVAL OF SURPLUS EXCAVATION MATERIAL

This shall be performed by Contractor regularly and in parallel with backfilling works, unless Supervisor instructs otherwise. If traffic or other conditions reduce the available storage space, more than the surplus material may have to be removed. In this case, backfilling material shall be transported from a borrow-pit. Excavated material shall be removed and transported to sites approved by the Authorities and the trench surrounding area shall be delivered clean and tidy.

7.0 REINSTATEMENT OF EXISTING WORKS

7.1 GENERAL

Reinstatement of existing works shall be done all along the length of the excavated trench, within the deadlines set by Supervisor and according to the approved Time Schedule of works. In every case Contractor shall assure full reinstatement to the previous condition, unless he is instructed by Supervision otherwise.

Contractor shall always follow technical rules and regulations, and he shall satisfy requirements of all Authorities, State Law or Police instructions.

Contractor has the responsibility for full reinstatement of road surfaces and pavements, against Owner, third parties and Authorities. Contractor shall take care, so that the final surface has the same level, shape and shall function as the adjacent one, which has not been disturbed during the excavation (for additional information see also **Job Specification No. 499/5**).

7.2 USE OF CONCRETE

Mass or reinforced concrete may be used for reinstatement of walkways and

concrete surfaces of roads. Thickness and necessary reinforcement shall be defined by appropriate calculations, which will be submitted for Supervision approval.

7.3 USE OF CEMENT MORTARS, LIME MORTARS, TILES ETC

Before apply mortars, either for formation of final surfaces or as adhesives, special attention shall be paid to the preparation of the interface. This shall be cleaned, roughened out and wetted, before placing the mortar.

Excessive use of water, fine aggregates, or incorrect mixing proportion shall be avoided during mortar preparation, in order to eliminate possible cracks, excessive wear and disconnection of materials. It is important that mortars are kept wet for a minimum period of seven (7) days after their use. For lime mortars, recommended composition is 1 part lime / 4 parts sand, and 350 kg of cement added per cubic meter of mixture. Two centimeters thick mortar layer should be used, while joints should be filled with cement mortar of composition 1 part cement / 2 parts sand.

7.4 REINSTATEMENT OF ASPHALT ROAD SURFACES

Sequence of works is as follows:

a) Removal of the asphalt pieces over areas where the subbase has cracked and disturbed. Asphalt pieces are removed manually or with machinery in such a way, that the scar layout consists of straight lines parallel or perpendicular to the trench axis.

b) Filling up with aggregate to **ΠΤΠ Ο-150** and **ΠΤΠ Ο-155** for the upper 200mm and compaction with soaking in parallel, by vibrator, up to the point when the density is at least the same as of the adjacent material of the road.

c) Top surface of the compacted aggregate is cleared from any loose material and covered with emulsion type ΚΕ-S of **ΠΤΠ Α203,** or emulsions ΜΕ-Ο or ΜΕ-1 of **ΠΤΠ Α201,** according to instructions by the Supervisor.

d) The required layers of asphalt grout to **ΠΤΠ Α265** are laid, each 50mm thick in order to reinstate the total thickness of existing asphalt road. Between these layers, adhesive layer type ΚΕ-1 of **ΠΤΠ Α203** is applied. The appropriate temperature for laying asphalt grout is 120-130°C. Asphalt grout laying is not allowed if weather conditions are cold or windy (to be judged by Supervisor), or if the temperature is below 10°C. Asphalt grout laying shall be performed by experienced crew and compaction will be done using appropriate plant vibrators and rollers.

e) Road surface is cleaned (with brooms, pressure water) of any residues of material and then it shall be open to traffic.

Following Owner's Representative instruction for reinstatement of major roads and fast completion of works (to avoid accidents etc), Bitumix binder may be used and Contractor will be reimbursed with the difference in price of the new binder.

7.5 REINSTATEMENT OF OTHER SURFACES

> Earth roads with gravel shall be reinstated with one layer of a total thickness of 150mm of crushed aggregates according to **ΠΤΠ Ο-150** compacted to obtain density equal to 95% of the maximum achieved in laboratory conditions to modified method of AASHO T-180D.

> Shoulders of concrete or asphalt materials shall be reinstated to be of the same materials as the existing ones. In case of earth roads shoulders shall be of 150mm crushed aggregated according to ΠΤΠ Ο- 150.