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TECHNICAL SPECIFICATION

HIGH PRESSURE (HP) TRANSMISSION SYSTEMS

INSTALLATION IN MUDDY BOTTOM AREAS

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REFERENCES DOCUMENTS

Job Spec. DSF-SPC-CIV-002
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ELOT EN 1594

[Gas supply systems - Pipelines for maximum operating pressure over 16 bar - Functional requirements]

ELOT EN 1997

[Eurocode 7: Geotechnical design]

BS 6031
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Requirements Set out by Authorities during Construction Phase

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]

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Εγκύκλιος 27/2012 Αρ. πρωτ. ΔΙΠΑΔ/οικ./369/15.10.2012) Ένταξη στα συμβατικά τεύχη (ΕΣΥ) των δημοπρατούμενων έργων, άρθρου σχετικού με τα «απαιτούμενα μέτρα ασφάλειας και υγείας στο εργοτάξιο»

1. SCOPE

Unless otherwise specified in the detailed design documents of the contract, this specification covers the requirements for the earthworks (trenching, backfilling) connected with the replacement of muddy bottom for the installation of the pipeline in areas where the trench bottom is classified as "muddy".

The "muddy bottom" areas shall either specified in the geotechnical investigations performed prior to construction commencement, or discovered during excavation of trenching.

2. GENERAL

As areas, where replacement of muddy bottom is required for the stable installation of the pipeline, are the areas where the geotechnical investigations have shown that the soil at the elevation where the pipeline is laid, consists of:

- Debris-rubbish
- Turf
- Organic deposits
- Clay of very high plasticity (vw ≤1.3 t/m3)

The main requirement for the installation of the pipeline through areas classified above is the construction of stable bottom profile in order to prevent the pipeline of being subject to settlements due to bottom rupture and provide suitable granular backfilling material in order to eliminate the up lift acting forces.

3. CONSTRUCTION

3.1 GENERAL

Depending on the elevation of the water table at areas where muddy bottom exists, two construction methods shall be applied. One method will be applied at the areas with high water table (above the level of pipeline installation) and another at the areas with low level water table, i.e. level of water table below the pipeline foundation level considering all weather conditions and seasons.

Prior to commencement of works at muddy bottom areas, Contractor shall submit to the Supervising Engineer for approval a construction plan specifying the work procedure.

The construction plan shall state the principles of construction in relation to a corresponding time schedule, the slope inclinations of excavation, embankment within the muddy bottom area, the water level during replacement, estimated surface loads and the approved by the Authorities locations for disposition of excavated material.

3.2 CONSTRUCTION SITE PREPARATION - ACCESS ROADS

Requirements specified in applicable construction specifications for preparation of site and excavation works are applicable.

The areas for access roads and soil depot shall be located by Contractor and shall be subjected to relevant Authorities and Owner's Representative approval. The width of access road shall be 4.0 m.

It is Contractor's responsibility to construct the ROW (Right Of Way) properly in order to ensure the safe movement of all construction equipment and the safe transportation of the materials.

On road areas the Contractor shall strip the top soil to a depth of 0.25 m. The top soil can be stored along the road, in a strip of land with a maximum width of 2.0 m.

On soil depot areas the Contractor shall strip the top soil to a depth of 0.25 m. Stripped top soil shall be stored within the soil depot area and in a way which rules out the possibility of any mixing of top soil with excavated muddy bottom.

Contractor shall improve the ROW surface with suitable material, where required.

3.3 EXCAVATION AND DISPOSAL OF MUDDY MATERIAL

All muddy material shall be excavated from the trench and shall be removed for disposal.

The bottom of the trench shall be over-excavated of at least 60 cm below the foundation level of the pipeline (below the bottom of pipe). The clearance between the trench walls and the pipe shall be min. 0.60 meters from either side.

Excavation of the trench shall be carried out in a sequence corresponding to the supply of the required quantities for backfilling.

Mud or any other material fallen into the trench after excavation shall be removed out and the trench cross section specified above shall be maintained. The excavation material shall not be used again for backfilling and will be driven away for disposal under Contractor's responsibility and cost.

During all excavation the Contractor shall make a continuous surveying and sounding of the excavation covering a grid of 10m x 10m or smaller. The measurements shall clearly establish the levels and extent of the excavated bottom profile. The Owner Representative will check the measurements and must be allowed time to do so before sand / gravel filling is made. Where this requirement is not fulfilled, the Contractor shall perform cased checkborings at his own expense and to the necessary depth, supervised by the Owner Representative.

The results of the surveying shall be shown on as-built cross sections which, on a daily basis, shall be presented to the Owner Representative. These cross sections will form a prerequisite for approval of the earth works by the Owner Representative.

In case that Contractor receives a permit from the respective authorities and/or landowner to spread over the ROW the excavated material after completion of backfilling, the mud shall be temporarily stored provided that mixing with topsoil will be avoided. Otherwise the excavated material shall be driven away by Contractor and shall be disposed at areas where relevant permit exists.

It is Contractor's responsibility to obtain all necessary licenses from the authorities for the transportation and disposal of muddy material.

The Contractor shall ensure that weight restrictions on roads are not exceeded. If these restrictions are exceeded, the Contractor is responsible for compensating or restoring any damage caused to these roads immediately.

3.4 FILLING IN AREAS WITH HIGH WATER TABLE

The areas, where the level of the water is permanently or periodically above the foundation level of the pipeline, are defined by the term "areas with high water table".

Where the project's time schedule allows, it is preferable to construct the pipeline during seasons with lower level of the water table.

Unless otherwise specified in the construction plan or the special design, dewatering shall be performed during excavation so that the water elevation to be approximately 1 meter above the trench bottom. Complete dewatering of the trench should be avoided in order to ensure the stability of the trench bottom.

Following completion of trenching and provided that the Supervisor has inspected the cross section of the trench and approval has been granted, the subsequent activities shall commence.

All filling material (bedding and backfilling) shall be wrapped within a geotextile filter cloth (non-woven) type POLYFELT TS 500 or equivalent.

After completion of trench excavation, the geotextile filter sheets shall be placed over the trench providing an overlapping of 0.50 meters to the direction of the trench. The width of sheets must be properly measured in order to completely encase the bedding and backfilling material allowing also an overlapping of 0.50 meters.

The over-excavated space between the pipe bottom level and the trench bottom level shall be filled with granular material forming thus the bedding layer for the pipeline. After completion of the bedding the trench shall be dewatered and the bedding shall be properly compacted.

Granular material should be used for both bedding and backfilling material to reduce settlement and maintain stability.

The pipeline shall be lowered immediately while the trench shall be free of water.

Prior to lowering in, the pipeline shall be wrapped with rock shield sheets, in order to avoid any damages to the coating.

Immediately after lowering in, backfilling of the trench with granular material
shall be performed up to a height of 20 cm below the final surface elevation. The filling material shall be lightly compacted.

After completion of backfilling with granular material, the geotextile filter shall be properly wrapped on the top.

The clearance between the top of granular filling and ROW surface shall be backfilled with excavated material.

Sand / gravel should fulfill the following requirements :

a. Passing 0.125 mm sieve : max. 20%

b. Coefficient of uniformity : more than 2.0

In addition sand / gravel should not contain any large amount of lumps which are not broken to pieces when placed under water.

In the zone of future pipeline trench, the sand / gravel shall not contain stones larger than 64 mm.

When field materials which, if suitably processed, would produce sand / gravel in strict compliance to the requirements described above, is not readily available at / or near the work area, an alternative material may be used that shall be obtained from nearby quarries after the approval of the Owner's Representative.

This alternative material shall fully conform to the requirements described in the Greek Standard Technical Specification (ΠΤΠ) Ο-150 titled "Construction of Roadway Sub-bases Using Aggregates of Graded Type Ο-150", as sand / gravel having the following gradation curve B.

Sieve No.	Passing in % of Weight
50mm	100
40mm	70-100
25mm	55-85
20mm	50 - 80
No. 4	30-60
No. 10	20-50
No. 40	10-30
No. 200	5-15

3.5 FILLING IN AREAS WITH LOW WATER TABLE

The areas, where the level of the water table is permanently of periodically below the foundation level of the pipeline, are defined by the term "area with low water table".

The filling material shall conform to the requirements set out in above para 3.4. Geotextile filter shall not be used in areas with low water table.
Soil improvement underneath the pipeline should reach proper thickness, depending on the soil. The sand / gravel for bedding shall be placed in layers not exceeding 20 cm. Each layer shall be properly compacted by means of a suitable compactor.
The pipe prior to lowering in shall be wrapped with rock shield in order to avoid damages to the coating.

After lowering in of the pipe, backfilling shall be performed with sand / gravel granular material up to a height of 20 cm below the final ROW surface elevation. Backfilling shall be performed in layers of 30 cm. Each layer shall be compacted by means of suitable compactor. The clearance between the top of granular filling and the ROW final surface shall be backfilled with excavated material.
The filling with unspecified material for the last 20 cm up to ROW surface elevation shall preferably be carried out with the original excavated material. Any other material shall be approved by the Owner Representative before use.

3.6 REINSTATEMENT

Reinstatement of ROW and access roads shall be performed in accordance with relevant **Job Specification DSF-SPC-CIV-014.**

The maximum deviation of the reinstatement levels from the original level, cannot exceed +0.25m or -0.0m.

4. SPECIAL CONSTRUCTION

In case that the pipeline route will be located along a quite extended muddy area (with soil consistency as per definition of para 2.0 above) or areas with extreme geotechnical conditions (i.e. hydraulic bottom ruptures, artesian phenomenon) the actual site data shall be examined on the spot and special construction measures shall be defined.

These measures will be subjected to Owner Representative’s approval and the additional cost shall be defined according to the contractual terms.

5. AS BUILT DOCUMENTATION

Areas where muddy bottom was encountered shall be specified on the as built drawings.