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**TECHNICAL JOB  
SPECIFICATION**

**499/7**

**REVISION 0**

**DATE 05/04/2011**

# **HIGH PRESSURE (HP) TRANSMISSION SYSTEMS**

## **CONCRETE WORKS**

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**CHANGES LOG**

**REVISIONS LOG**

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### REFERENCE DOCUMENTS

- ELOT EN 1991  
[Eurocode 1: Actions on structures]
- ELOT EN 1992  
[Eurocode 2 - Design of concrete structures]
- ELOT EN 1993-5  
[Eurocode 3: Design of steel structures - Part 5: Piling]
- ELOT EN 1994  
[Eurocode 4: Design of composite steel and concrete structures]
- ELOT EN 1996  
[Eurocode 6: Design of masonry structures]
- ELOT EN 1997  
[Eurocode 7: Geotechnical design]
- EAK-2003 ΦΕΚ 781B/18.06.2003  
«Τροποποίηση και συμπλήρωση Ελληνικού Αντισεισμικού Κανονισμού  
ΕΑΚ 2000»  
[Hellenic Seismic Code]
- EΚΤΣ ΦΕΚ 315B/ 1997, και τροποποίηση αυτού ΦΕΚ 537B/ 22.06.2001  
«Ελληνικός Κανονισμός Τεχνολογίας Σκυροδέματος»  
[Hellenic Concrete Technology Regulation]
- EΚΤΧ-ΦΕΚ 381B/ 2000  
«Ελληνικός Κανονισμός Τεχνολογίας Χαλύβων Οπλισμού Σκυροδέματος»  
[Hellenic Reinforcement Technology Regulation]
- EΚΩΣ – 2000 ΦΕΚ 1329B  
«Ελληνικός Κανονισμός Οπλισμένου Σκυροδέματος»  
[Hellenic Reinforced Concrete Code]

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## 1.0 SCOPE

This specification covers the materials for and the construction of concrete works for the natural gas pipelines.

The requirements of the following, shall be fulfilled: This specification

- ΕΚΩΣ - 2000 ΦΕΚ 1329B
- ΕΚΤΧ - ΦΕΚ 381B 2000
- ΕΚΤΣ - ΦΕΚ 315B 1997
- ΕΑΚ-2003 - ΦΕΚ 781B/18.06.2003
- ELOT EN 1991 (Eurocode 1)
- ELOT EN 1992 (Eurocode 2)
- ELOT EN 1994 (Eurocode 4)
- ELOT EN 1996 (Eurocode 6)
- ELOT EN 1997 (Eurocode 7)
- ELOT EN 1993-5 (Eurocode 3 - Part 5).

## 2.0 MATERIALS

### 2.1 CEMENT

Ordinary or quick-setting Portland cement shall be used, according to the Hellenic Concrete Technology Regulation requirements.

### 2.2 AGGREGATES

Aggregates shall fulfill the requirements of the Hellenic Concrete Technology Regulation.

Maximum particle size shall be 32 mm. For concrete which will be situated above ground in the completed structure and which may be exposed to frost, hard- stone aggregates (granite chippings or similar) shall be used.

For concrete below ground the combined content of chalk and porous flint with a dimension greater than 4 mm, shall not exceed 5% by weight.

### 2.3 WATER

Potable water shall be used.

### 2.4 ADDITIVES

Apart from the normally applied air-entraining agents and plasticizers, additives may only be used by agreement of the Owner Representative.

### 2.5 STEEL REINFORCEMENT

Steel reinforcing bars shall be grade S500s (previous St IV) according to the Hellenic Reinforced Concrete Code and the Hellenic Reinforcement Technology Regulation.

All symbols shall be in accordance with the Hellenic Reinforced Concrete Code.

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Other qualities of reinforcing steel bars shall not be used without the approval of the Owner Representative.

All binding wire shall be annealed.

## **2.6 FORMWORK**

Form types will be as indicated on the drawings.

All concrete (concrete for blinding excluded) shall be cast in formwork unless otherwise indicated.

Burrs and discontinuities larger than 1 mm in boards are not allowed. No honeycombing or holes exceeding 5 mm may occur.

## **2.7 CONCRETE QUALITY**

All concrete shall be ready-mixed (with the exception of lean concrete for blinding).

A record of all control data and essential production and finishing data shall be made by the contractor and shall be handed over to the Owner Representative.

### **2.7.1 Concrete for Blinding**

Concrete for blinding shall be grade C12/15 according to the Hellenic Reinforced Concrete Code and the Hellenic Concrete Technology Regulation.

### **2.7.2 Concrete for Reinforced and Mass Concrete Structures**

Concrete for reinforced and mass concrete structures and concrete for concrete piles shall be grade C20/25 minimum in accordance with the Hellenic Concrete Technology Regulation.

Maximum characteristic water - cement ratio shall be 0.6.

Strengths indicated on the drawings have precedence over strengths indicated in the Specifications.

Air entrainment shall be 4-6%.

Concrete shall be vibrated according to the Hellenic Concrete Technology Regulation.

Cement content shall be minimum 275 Kg/m<sup>3</sup> and total content of cement and filler minimum 375 Kg/m<sup>3</sup>.

## **2.8 CEMENT MORTAR**

Cement mortar shall be mixed in proportion 1:3 (cement: sand) by weight.

## **3.0 CONSTRUCTION**

### **3.1 AGGREGATES**

Quality control of the factory-made concrete shall be based upon results from the factory's running quality control tests.

This control shall be prepared and carried out in accordance with the principles mentioned in the Hellenic Concrete Technology Regulation and the factory shall be subject to quality control of an approved control organization.

Delivery notes with the data of the concrete delivered shall be handed over to the Owner Representative.

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### **3.2 REINFORCEMENT**

Contractor shall prepare bending schedules showing all cutting and bending lengths. The Owner Representative may ask for copies of the bending schedules to be given.

Locations of joints in running reinforcement are not normally indicated on the drawings.

Reinforcement work for any section shall be totally completed before casting of that section is started.

Steel reinforcement through small holes and recesses shall be cut-out and steel replacement of the correct lap length shall be installed beside the hole.

Casting work may not be started before the reinforcement has been approved by the Owner Representative.

### **3.3 FORMS**

Forms shall be according to the Hellenic Concrete Technology Regulation.

Formwork and framework shall be rigid so that the quality requirements for geometry and appearance can be fulfilled.

Where form clamps are used in visible surfaces, they shall be placed in a regular pattern approved in advance by the Owner Representative.

Immediately before casting, the form shall be rinsed.

All wooden surfaces of forms shall be watered thoroughly before casting. Oiling of forms may be used providing that the form oil does not cause discolouration.

Minimum concrete cover of the reinforcing bars shall be according to the Hellenic Concrete Technology Regulation and the Hellenic Reinforced Concrete Code, but not less than :

30 mm for indoor structures and

40 mm for outdoor structures.

### **3.4 CONCRETING**

Before casting, the reinforcement and formwork shall be approved by the Owner Representative.

Concrete shall be cast before setting begins. During casting it must be ensured that segregation does not take place as the concrete falls into the form.

Concrete shall be cast in layers not exceeding 0.3- 0.4 m in thickness and shall be compacted by vibration.

The concrete shall be vibrated until it can be clearly seen to be thoroughly vibrated.

The vibrator head shall be inserted at a sufficient number of places to ensure that every part of the concrete is thoroughly vibrated. When the vibrator rod is pulled from the concrete, this shall be done slowly so that no cavities are formed where the rod has been.

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Concrete may not be moved sideways due to vibrator's action. The vibrator shall be kept in good condition, and a reserve one shall be kept available so that a vibrator which fails during casting can be replaced immediately.

When casting horizontal surfaces, a beam vibrator can be used. Construction joints other than those indicated on the drawings are subject to approval by the Owner Representative.

Concrete treatment at severe weather conditions shall be as per the Greek Concrete Technology Regulation **EKTΣ- ΦΕΚ 315B 1997**.

Concreting is recommended to be avoided at temperatures greater than 36°C or less than 4°C unless special measures would be taken. Concreting in ambient temperature below -15°C is strictly forbidden.

### **3.5 CURING**

Concrete shall be maintained in a moist condition for specific period of time, according to the Hellenic Concrete Technology Regulation.

### **3.6 RECESSES**

Recesses shown on the drawings shall be made and after installation of items to be cast-in, the concreting shall be performed.

### **3.7 SURFACE TREATMENT**

The concrete surface shall be smoothed to a flat and even surface, free of cavities, burrs, sharp edges, holes and slurry accumulations. Tolerance on level is  $\pm 8$  mm and tolerance on surface irregularity is max. 10 mm, measured with 3 m boring rod.

## **4.0 PILE FOUNDATIONS**

### **4.1 MATERIALS**

Concrete for piles shall be grade C20/25 minimum in accordance with the Hellenic Concrete Technology Regulation with a water-cement ratio lower than 0.6.

Pile reinforcing bars shall be grade S500s (previous St IV).

### **4.2 DESIGN**

Pile design and pile reinforcement shall be according to **EΚΩΣ-2000 – ΦΕΚ 1329B, ELOT EN 1992 (Eurocode 2) and ELOT EN 1993-5 (Eurocode 3- Part 5)**.

### **4.3 CONSTRUCTION**

Driving of piles shall be carried out in accordance with **ELOT EN 1993-5 (Eurocode 3- Part 5)**. For all driven piles the progress of pile-driving shall be registered in a daily record.

The driving resistance shall be recorded as a number of blows per 0.20 m of penetration.

Documentation for efficiency factor on the actual pile driver shall be presented to the Owner Representative.

The cropping and disposal of pile ends shall be included in the contract. Pile concrete shall extend minimum 50 mm up into the structure and reinforcement rods shall extend minimum 0.5 m up into the structure.



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**5.0 ENCASING WITH CONCRETE**

Where the Contractor needs to use a concrete encasing of the pipe instead of concrete saddles, the thickness of the concrete shall be calculated in each case.

Minimum reinforcement material shall be two reinforcing meshes T92 (4.2 mm diameter bars placed every 150mm) of grade S500s.

Between the concrete and the pipe, one layer of 15mm minimum thickness roofing felt

or rockshield mat shall be placed.

The system used will be subject to approval by Owner.

**6.0 CONCRETE SADDLES**

Saddles are to be in agreement with Owner Standard drawing or to be of self-fixing type.

The saddles to be used will be subject to Owner approval.