



**HELLENIC GAS
TRANSMISSION
SYSTEM OPERATOR**

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**TECHNICAL JOB
SPECIFICATION**

A-3

REVISION 1

DATE 23/09/2011

**LIQUEFIED NATURAL GAS PLANTS
SPECIFICATION FOR LOW TEMPERATURE
TESTING OF PRESTRESSING STRAND**

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CHANGES LOG

REVISIONS LOG

Rev. No	Rev. Date	REASON FOR CHANGE	Made By	Approved By
1	23-09-2011	DESFA Comments	PQ DPT	VG
0	03-06-2011	FIRST ISSUE	PQ DPT	VG

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REFERENCE DOCUMENTS

ELOT EN 14620-3

[Design and manufacture of site built, vertical, cylindrical, flat-bottomed steel tanks for the storage of refrigerated, liquefied gases with operating temperature 0°C and -165°C – Part 3: Concrete Components]

ELOT EN ISO 15630-3

[Steel for the reinforcement and prestressing of concrete - Test methods - Part 3: Prestressing steel]

prEN 10138-1

[Prestressing steels - Part 1: General requirements]

prEN 10138-3

[Prestressing steels- Part3: Strand]

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1. GENERAL

1.1 This specification defines the low temperature testing of pre-stressing strand required to be performed by CONTRACTOR. These testing requirements are additional to the requirements covering pre-stressing strand in accordance with prEN 10138-3 "Prestressing steels- Part3: Strand", or other equivalent accepted standards for the use of materials at normal temperatures. All wires used for the pre-stressing of the construction of the storage tanks shall fulfill the following requirements which must be used in Qualification Testing prior to use in the works and later for Routine Control Testing during construction.

2. QUALIFICATION TESTING

1 2.1 Method of Testing

2.1.1 Testing shall be in accordance with the requirement of ELOT EN ISO 15630-3 "Steel for the reinforcement and prestressing of concrete - Test methods - Part 3: Prestressing steel" and prEN 10138-1 "Prestressing steels - Part 1: General requirements".

2.2 Specimens

2.2.1 Only un-notched specimens are required.

2.3 Criteria

2.3.1 Individual specimens shall have a minimum 2% elongation before fracture, on a gauge length of 100 mm.

2.3.2 Elongation is to be measured on a stress / strain diagram after eliminating effects of slipping of anchorages and other testing errors.

2.3.3 Ultimate tensile strength shall be determined for information purposes only.

1 2.4 Testing – Additional Requirements

Further to the requirements of prEN 10138-1 and prEN 10138-2 about testing and sampling the following requirements shall be valid.

2.4.1 **Specimens:**

Length of specimen shall be sufficient to permit adequate testing with a gauge length of 100 mm.

2.4.2 **Temperature Condition:**

- (a) Central portion of specimen: Stored Product Temperature ($\pm 2^{\circ}\text{C}$).
Stored Product Temperature shall mean -170°C for LNG service.
- (b) Outer portions of specimen (adjacent to anchorage devices): 5°C colder than the central portion.
- (c) During testing up to yield point: maximum increase in temperature 15°C .

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2.4.3 Accuracy of measuring devices:

- (a) Temperature : $\pm 1^{\circ}\text{C}$
- (b) Load : $\pm 0.1\%$
- (c) Elongation : $\pm 0.1\%$

1 2.4.4 Speed of testing:

- (a) Rate of application of load up to yield point: Not greater than 690 N/mm^2 per minute.
- (b) Rate of extension of specimen beyond yield point: Not greater than $12,7 \text{ mm/mm}$ per minute.

2.4.5 Record of properties:

- (a) Stress / strain diagram until fracture.
- (b) Determination of yield strength, ultimate strength, elongation after break.
- (c) Temperature distribution along the wire.

2.5 Sampling

2.5.1 Samples per batch – 15 samples per batch shall be selected each with a length sufficient to have:

- (a) One third for tensile testing.
- (b) Two thirds in reserve.

2.5.2 Number of batches: One per grade, per origin and per diameter to be used in the project selected from a minimum of 2 heats and 25 tone minimum per heat.

One batch shall mean one lot of bars with the same diameter, the same grade and the same origin (but not necessarily from the same heat).

2.5.3 Number of tensile tests per batch – 15 No.

1 2.5.4 Method of sampling:

- (a) Randomly within a whole batch.
- (b) With the agreement of OWNER.

3. ROUTINE CONTROL TESTING

3.1 The same requirements as outlined in paragraphs 2.1 to 2.4 for Qualification Testing shall apply for Routine Control Testing.

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1 3.2 Sampling

3.2.1 Number of samples and tensile tests per shipment:

- (a) Under 500 tones: 5 with the same length as in paragraph 2.5.1
- (b) Over 500 tones: 5 for every 500 tones or part thereof in the same shipment.

One shipment shall mean one lot of strands with the same diameter and the same grade delivered and accepted at the same time.

3.2.2 Method of sampling:

- (a) Randomly within a whole batch.
- (b) With the agreement of OWNER.