



Hellenic Gas Transmission System Operator

**HELLENIC GAS  
TRANSMISSION  
SYSTEM OPERATOR**

357-359, MESSOGION AVE.,  
15231 ATHENS, GREECE  
Tel.: 210 6501258  
Fax : 210 6501551

**TECHNICAL JOB  
SPECIFICATION**

**550/1**

**REVISION 0**

**DATE 29/06/2011**

**LNG PLANT**

**BUTT WELDING STEEL FITTINGS**

**(CRYOGENIC SERVICES INCLUDED)**

**QUALITY ASSURANCE PAGE**

**CHANGES LOG**

**REVISIONS LOG**

Rev. No	Rev. Date	REASON FOR CHANGE	Made By	Approved By
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**REFERENCE DOCUMENTS**

EU Directive 97/23/EC “of the European Parliament and of the Council of 29 May 1997 on the approximation of the laws of the Member States concerning pressure equipment” (PED)

DESFA Job Spec. No. 970/2  
[Shop Inspection of Equipment and Materials for NGT Project]

ELOT EN 1160  
[Installations and equipment for liquefied natural gas —General characteristics of liquefied natural gas]

ELOT EN 10208-2  
[Steel pipes for pipelines for combustible fluids - Technical delivery conditions - Part 2: Pipes of requirements class B]

ELOT EN ISO 148-1 supersedes ELOT EN 10045-1  
[Metallic materials - Charpy pendulum impact test - Part 1: Test method]

ELOT EN 12732  
[Gas supply systems - Welding steel pipework - Functional requirements]

ELOT EN 10253-2  
[Butt welding pipe fittings – Part 2: Wrought carbon and ferritic alloy steel with specific inspection requirements]

ELOT EN 10253-4  
[Butt welding pipe fittings – Part 4: Wrought austenitic and austenitic-ferritic (duplex) stainless steels with specific inspection requirements]

**1.0 SCOPE**

**1.1 ITEM**

Butt welding fittings

**1.2 SERVICE**

Process and Utility piping at LNG installation.

**1.3 ADDITIONAL INFORMATION**

Additional information may be given in the DATA SHEET and Material Requisition and these documents should be read in conjunction with this material specification.

Fitting Vendor shall be responsible to design, fabricate and supply fittings in accordance with the requirements of applicable documents.

In no event, however, dimension, thicknesses, etc., are to be less than those required by standards.

Any conflict between requirements of this specification and drawings, DATA SHEET and Material Requisition supplementary design data, or Codes, shall be referred to Owner, for clarification, before proceeding with fabrication of affected part.

**2.0 GENERAL REQUIREMENTS**

**2.1 UNITS**

Metric for all units.

**2.2 SPECIFICATION**

**ELOT EN 10253-2** for carbon and ferritic alloy steels and **ELOT EN 10253-4** for cryogenic materials that can be used in contact with LNG according to **ELOT EN 1160**. Additional requirements mentioned in this specification shall also be satisfied.

**2.3 PRESSURE RATING CALCULATIONS**

Design calculations shall be according to **ELOT EN 10253-2** and **ELOT EN 10253-4**

Refer to DATA SHEET for details of design pressure, design factor, corrosion allowance and abutting pipe dimensions and material specifications.

Elbows and return bends shall have minimum wall thicknesses as per Annex A **ELOT EN 10253-2** and as follows:

- along outside arc never less than  $t$ ; where  $t$  is the wall thickness required for straight pipe of same material and outside diameter as the elbow when calculated by Barlow's formula using the maximum allowable stress value defined above.
- along inside arc never less than  $1.25 \times t$  for 1 1/2 D elbows and  $1.10 \times t$  for 3 D elbows.

Corrosion and production allowances shall be added to the calculated wall thickness (including elbows).

In any case all fittings shall be able to withstand the same internal pressure as the abutting pipe. Cryogenic fittings shall be type B as this is defined in **ELOT EN 10253-4**.

#### **2.4 DESIGN PROOF TEST**

Not required.

#### **2.5 MATERIALS**

As per **ELOT EN 10253-2**.

Unless otherwise specified on DATA SHEET material grades shall be:

For  $DN \leq 450$  grade shall be P355.

For  $500 \leq DN \leq 900$  grade shall be L415NB.

For  $DN = 1050$  shall be L450 QB.

Steels requiring preheating for field welding to temperatures higher than 100°C are not acceptable.

As per **ELOT EN 10253-4** for fittings to be used in cryogenic service. A list of materials that can be used in contact with LNG is given in Appendix B of **ELOT EN 1160**.

Colour coding shall be in accordance with DESFA specification **900/3**.

Positive material identification shall be (P.M.I) shall be performed according to DESFA specification **930/1**.

#### **2.6 CHEMICAL COMPOSITION**

As per table 3, **ELOT EN 10253-2** and **ELOT EN 10253-4**

#### **2.7 TENSILE PROPERTIES**

Longitudinal weld seams shall be tested.

For induction bend or extruded elbows all specimens shall be obtained from the bend section.

#### **2.8 HEAT TREATMENT**

Carbon and ferritic steel fittings shall be delivered in the normalized condition.

Quenching shall only be permitted with induction bent elbows provided this is

followed by a suitable tempering treatment. On completion of all welding works, fittings shall be stress relieved.

Cryogenic fittings shall be delivered with a solution annealing/quenching heat treatment.

## **2.9 TRANSVERSE GUIDED WELD BEND TESTS**

Required.

## **2.10 IMPACT TEST**

Impact testing shall be carried out on the parent material for each lot of fittings, with lot size as defined in **ELOT EN ISO 148-1**. The test temperature shall be the minimum design temperature or lower.

-Acceptance criteria shall be:

- Mean value from the 3 specimens > 31 Joules, with the lowest single value > 24 Joules for carbon and alloy ferritic steels.
- Mean value from the 3 specimens >60 Joules for materials intended for cryogenic service (-196°C)

For subsize specimens, the acceptability levels shall be reduced proportionally with the reduction in cross-sectional area below the notch.

## **2.11 FITTING DIMENSIONS**

### **2.11.1 REDUCING TEES**

Reducing tees with combinations of run size and outlet size not included in **ELOT EN 10253-2** and **ELOT EN 10253-4** shall have a Center-to-End length of the run equal to that specified for a straight tee with the same run size as the reducing tee.

### **2.11.2 REDUCERS**

Reducers shaped as conical shells shall have an End-to-End length sufficiently long to permit the half-apex angle of the cone to be 20° or less.

### **2.11.3 ELBOWS**

Unless supplementary requirement SR2 is specified elbows produced by induction bending or by extrusion over mandrel may have straight tangential ends with length of not more than one diameter.

### **2.11.4 WELDING ENDS**

The inside diameter at welding ends shall equal the inside diameter of the abutting pipe. Refer to DATA SHEET. Subject to tolerances specified in **ELOT EN 10253-2** and **ELOT EN 10253-4**

## **2.12 TOLERANCES OF WELDING FITTINGS**

The tolerance on inside diameter at ends in accordance with **ELOT EN 10253-2** and **ELOT EN 10253-4**.

2.13 **MANUFACTURE**

2.13.1 COLD-FORMING TEES, ELBOWS

Cold-forming (except rolling of plates) is not permitted. Tees' outlets shall be produced by extrusion or forging.

Elbows shall be produced either by induction bending of seamless or longitudinally welded pipe, by extrusion over mandrel of seamless pipe, or by welding together of two identical, hot-formed shells.

Caps shall be seamless.

2.13.2 WELDING

Welding qualifications and procedures shall be in accordance with **EN ISO 15614-1**.

Hardness of the weld seam and heat affected zone shall not exceed 260HV10 for carbon and alloy ferritic steels. Hardness requirements are not applicable for fittings intended for cryogenic use.

Repair by welding in parent material is not permitted.

2.14 **NON DESTRUCTIVE EXAMINATION**

2.14.1 STARTING MATERIALS

Plates and welded pipe shall be ultrasonic tested. Plate or welded pipe intended as starting material for tees shall be 100% continuously ultrasonic scanned for laminations and other discontinuities over surfaces to be extruded. Recording of any discontinuity condition shall render plate or pipe as rejected.

Seamless pipe shall be ultrasonic tested through its entire length to verify internal soundness.

External and accessible internal surfaces of tees and elbows either extruded over mandrel or induction bent shall be examined with a surface crack detection method as follows:

2.14.2 TEES, ELBOWS

Over entire extruded area.

In four bands, each 100 mm wide and extending from one end to the other parallel with elbow's axis.

The bands shall be placed along outside, inside, top and bottom of the elbow.

For forgings method and acceptance standards shall be as **ELOT EN 10253-2**, however, linear indications are unacceptable.

2.14.3 WELDS

All joints shall be radiographed and found acceptable in accordance with **ELOT EN 1473**.

However, where radiography is unfit for detection of defects, joints shall be



ultrasonically examined.

Where radiography or ultrasonic examination is unfit for detection then magnetic particle examination may be used.

**2.14.4** WELDING ENDS

All welding ends shall be examined for laminations or other discontinuities to a minimum distance of 50 mm from and including the bevel with a non-destructive method capable of detecting discontinuities extending into the bevel and having a transverse dimension exceeding 6 mm. Any such discontinuity shall be unacceptable.

**2.15** **MARKING**

Additionally to the marking specified in **ELOT EN 10253-2** each fitting shall be marked with an item number and the Third Party Inspector's or Notified Body stamp if the fittings are following under the **EU Directive 97/23/EC**.

Full traceability shall be ensured between test reports and item numbers.

The purchase order identification shall be the Client Supply Order Number. This number shall be die stamped.

**2.16** **SURFACE TREATMENT**

**2.16.1** INTERNAL

Untreated free of dirt-grease oil, etc.

**2.16.2** EXTERNAL

Soluble rust-preventive varnish.

**3.0** **SUPPLEMENTARY REQUIREMENTS**

**3.1** GENERAL

The following Supplementary Requirements shall not apply unless specifically requested on the applicable Data Sheet.

Further requirements, if specifically mentioned in the Material Requisition or on the DATA SHEET, shall be valid. In case of conflict between such requirements and the requirements contained herein, the former shall prevail.

**3.2** **SUPPLEMENTARY REQUIREMENTS - SR1**

Tees run pipe or elbows, as may be the case, shall have a bore throughout the body > 0.96 x inside diameter of abutting pipe. The bore shall be proved on each item by passing a gauging plate or sphere with diameter as required above. The tolerance on plate/sphere diameter shall be + 1 mm.

**3.4** **SUPPLEMENTARY REQUIREMENTS-SR2**

The curvature of the elbows shall continue right to the weld ends, i.e. elbows shall not have tangential ends or transition zones in which mechanical properties (e.g. hardness) may be influenced by the on setting or termination of bending operation.

#### **4.0 TECHNICAL DOCUMENTATION**

##### **4.1 QUANTITY**

Four copies of each, inclusive of original, for all documents and certificates. Four copies of each, inclusive of one reproducible, for all drawings.  
Also electronic files of all Documents and Certificates must be submitted by Contractor to the Owner.

##### **4.2 DOCUMENT REQUIREMENTS**

###### **4.2.1 WITH TENDER**

Statement regarding starting materials, with reference to Material Standards.

Statement regarding manufacturing process for each type of fitting (forming process and subsequent heat treatment).

###### **4.2.2 AFTER AWARD OF CONTRACT (BEFORE PRODUCTION)**

Dimensional drawings of each item inclusive of material list giving material grades and certification levels of starting materials etc.

Guide bar arrangements shall be shown in detail for tees ordered with SR2.

Design calculations for each item.

Statement of Standard proposed for ultrasonic scanning of starting materials.

Statement of method and a procedure summary for non destructive examination of welding ends.

Vendor's Detailed Test and Inspection plan.

The plan should additionally show the control points at which the Independent Accredited Inspector's witnessing/ approval is required, as per section 5 herein.

###### **4.2.3 ON DELIVERY**

Fitting certification package.

#### **5.0 INSPECTION AND CERTIFICATION**

Inspection will be performed by a Third Party Accredited Inspection Body to be appointed by OWNER.

Inspection requirements are defined in the following documents.

- a. Material requisition
- b. Job Spec. No. 970/2**
- c. Relevant project specifications
- d. Inspection clauses of Applicable Codes

Inspection procedures to be followed as detailed in Owner document "Inspection and Test instructions".

#### **6.0 SHIPMENT**

Where necessary, fittings shall be supported by temporary stiffeners to avoid distortion damage during transportation and erection.