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TRANSMISSION
SYSTEM OPERATOR**

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**TECHNICAL JOB
SPECIFICATION**

552/2

REVISION 0

DATE 05/04/2011

HIGH PRESSURE (HP) TRANSMISSION SYSTEMS

BUTT WELDING STEEL FITTINGS DN ≥ 350

QUALITY ASSURANCE PAGE

CHANGES LOG

REVISIONS LOG

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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)

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

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

ELOT EN 10045-1
[Charpy impact test on metallic materials; part 1: test method]

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

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

1.0 SCOPE

1.1 ITEM

Butt welding fittings DN \geq 350

1.2 SERVICE

Sweet natural gas with sporadic passage of water and glycol.

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

EN 10253-2 and additionally satisfying the requirements herein.

2.3 PRESSURE RATING CALCULATIONS

Design calculations shall be in accordance with **EN 10253-2**. 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 -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).

2.4 DESIGN PROOF TEST

Not required.

2.5 MATERIALS

As per EN 10253-2.

Unless otherwise specified on DATA SHEET material grades shall be:

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

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.

2.6 CHEMICAL COMPOSITION

As per table 3, EN 10253-2.

2.7 TENSILE PROPERTIES

Longitudinal weld seams shall be tested.

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

2.8 HEAT TREATMENT

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.

2.9 TRANSVERSE GUIDED WELD BEND TESTS

Required.

2.10 IMPACT TEST

Testing with one set of 3 test specimens shall be carried out on the parent material for each lot of fittings, with lot size as defined in ELOT EN 10045-1.

The test temperature shall be -20°C or lower.

Acceptance criteria shall be :

- Mean value from the 3 specimens > 31 Joules, with the lowest single value > 24 Joules.

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 **EN 10253-2** 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 SR3 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 **EN 10253-2**.

2.12 TOLERANCES OF WELDING FITTINGS

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

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 **ELOT EN 12732**.

Hardness of the weld seam and heat affected zone shall nowhere exceed 260HV10.

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 ultrasonically scanned to **EN 10253-2**, or equivalent approved standard. Plate or welded pipe intended as starting material for tees shall be 100% continuously ultrasonically 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 ultrasonically scanned to **ELOT EN 10208-2** or equivalent approved standard.

External and accessible internal surfaces of tees and elbows either extruded over mandrel or induction bent shall be magnetic particle examined 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 **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 12732**.

However, where radiography is unfit for detection of defects, joints shall be ultrasonically examined as per **ELOT EN 12732**.

Where radiography or ultrasonic examination is unfit for detection then magnetic particle examination maybe used as per **ELOT EN 12732**.

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 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 (SR1 to SR4) 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 $> 0.96 \times$ 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.

3.3 SUPPLEMENTARY REQUIREMENTS-SR2

Tees shall be furnished with guide bars as per attachment 1 for scraper passage in accordance with Table 1 below.

The guide bars shall be welded together with two crossrails that shall be fixed to the branch wall by fillet welds. All edges that may be rubbed by scrapers shall be rounded with radius equal to one-half the bar thickness. Guide bars shall be mounted flush with the bore of the run and shall further have their ends shaped so that they follow the contour of the outlet as closely as possible. Guide bars and cross-rails shall be made of killed carbon steel.

B	Wt	h	<					R					>	
			1050	900	750	700	650	600	550	500	450	400		350
DN 50	-	-	-	-	-	-	-	-	-	-	-	-	-	-
DN 100	8	30	-	-	-	-	-	-	-	-	-	-	-	2
DN 150	8	35	-	-	-	-	.	.	2	2	2	2	2	2
DN 200	8	40	-	-	2	2	2	2	2	2	2	2	2	3
DN 250	8	50	-	2	2	2	2	2	2	2	3	3	3	3
DN 300	10	55	2	2	2	2	2	2	3	3	3	3	3	3
DN 350	10	55	3	3	3	3	3	3	3	3	3	3	3	3
DN 400	10	60	3	3	3	3	3	3	3	3	3	3	3	-
DN 450	10	65	3	3	3	3	3	3	3	3	3	3	-	-
DN 500	10	70	3	3	3	3	3	3	3	3	-	-	-	-
DN 550	15	70	3	3	3	3	3	3	3	-	-	-	-	-
DN 600	15	75	3	3	3	3	3	3	-	-	-	-	-	-
DN 650	15	80	3	3	3	3	3	-	-	-	-	-	-	-
DN 700	15	85	3	3	3	3	-	-	-	-	-	-	-	-
DN 750	15	90	4	4	4	-	-	-	-	-	-	-	-	-
DN 900	20	100	4	4	-	-	-	-	-	-	-	-	-	-
DN 1050	20	120	5	-	-	-	-	-	-	-	-	-	-	-

No. of bars

B = Nominal branch dia.(mm)
R = Nominal run diameter (mm)

wt = Guide bar wall thickness
h = Guide bar height

TABLE 1 REQUIRED NUMBER OF GUIDE BARS AND GUIDE BAR DIMENSIONS (mm).

All fillet welds shall be dye-penetrant examined and any indication shall be cause for rejection.

3.4 SUPPLEMENTARY REQUIREMENTS-SR3

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.

3.5 SUPPLEMENTARY REQUIREMENTS - SR4

Notch toughness shall be satisfied according to para 2.10 at test temperature lower than -20°C, at minimum design temperature as mentioned in Material Requisition.

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

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distortion damage during transportation and erection.

