| δesfa | Hellenic Gas Transmission System Operator S.A. 357-359 Messogion Av., GR 152 31 Halandri Tel.: 213 088 4000 Fax: 210 674 9504 Email: desfa@desfa.gr | | TECHNICAL SPECIFICATION |
|----------------------|---|--------|----------------------------|
| Doc No: DSF-SPC-PIP- | -038 | Rev. 1 | Page 1 of 13 |



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Table of Contents

| 1 | SCOPE | 4 |
|---|------------------------------|------|
| 2 | REFERENCES | 4 |
| 3 | GENERAL REQUIREMENTS | 6 |
| 4 | SUPPLEMENTARY REQUIREMENTS | . 12 |
| 5 | INSPECTION AND CERTIFICATION | . 13 |
| 6 | SHIPMENT | . 13 |



1 SCOPE

1.1 GENERAL

This Specification covers the minimum requirements for the design, fabrication and supply of Insulating Couplings. Main purpose of insulating couplings installation is the electrical isolation between upstream and downstream sections. Insulating Couplings will service natural gas and liquid oil products.

1.2 ADDITIONAL INFORMATION

Additional information may be given in the project's requirements, basic design documents and drawings, and should be read in conjunction with this Technical Specification.

Any conflict between requirements of this Technical Specification, basic design documents and drawings, Standards, Material Requisition and Datasheet shall be referred to Owner for clarification before proceeding with fabrication of the subject part.

2 **REFERENCES**

Items/equipment to be supplied under this Specification shall comply with the requirements of the latest edition of the Codes, Standards, Specifications and Practices as applicable, except if specifically, modified hereafter:

2.1 REFERENCE DOCUMENTS

| • | Technical Specification DSF-SPC-QAC-005 | [Shop Inspection of Equipment and | | |
|---|---|------------------------------------|--|--|
| | | Materials for NGT Project] | | |
| • | Technical Specification DSF-SPC-QAC-006 | [Inspection and Test Instructions] | | |

2.2 REFERENCE CODES AND STANDARDS

 2014/68/EU [Pressure Equipment Directive (PED) of the European Parliament and of the Council of 15 May 2014 on the harmonization of the laws of the Member States relating to the



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| Doc No: DSF-SPC-PIP-038 | Rev. 1 | Page 5 of 13 |
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| • | EN 10045-1 method] | [Charpy impact test on metallic materials; part 1: test |
|---|-----------------------|--|
| • | EN 583-1 | [Non-destructive testing - Ultrasonic examination - Part 1: |
| | | General principles] |
| • | EN 1290 | [Non-destructive testing of welds - Magnetic particle testing of |
| | | welds] |
| • | EN ISO 3183 | [Petroleum and natural gas industries. Steel pipe for pipeline transportation systems] |
| • | EN 1514 series | [Flanges and their joints - Dimensions of gaskets for PN – |
| | | designated flanges] |
| • | EN 1515-3 | [Flanges and their joints – Bolting – Part 3: Classification of bolt materials for steel flanges, class designated] |
| • | EN 1759-1 | [Flanges and their joint – Circular flanges for pipes, valves, fittings and accessories, class designated – Part 1: Steel flanges, NPS ½ to 24"] |
| • | EN 12732 | [Gas supply systems - Welding steel pipework - Functional Requirements] |
| • | EN 1591-1 | [Flanges and their joints - Design rules for gasketed circular flange connections - Part 1: Calculation method] |
| • | EN 1594 | [Gas supply systems - Pipelines for maximum operating pressure over 16 bar - Functional requirements] |

Important Note:

For the referred Specifications, Codes and Standards, the last valid version is applicable. The paragraphs of the above-mentioned Standards are referring at the last valid version.

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|------------------------|---|--------|----------------------------|
| Doc No: DSF-SPC-PIP-03 | 38 | Rev. 1 | Page 6 of 13 |

3 GENERAL REQUIREMENTS

3.1 **TYPE**

Insulating Couplings shall be monoblock type with pipe stubs.

3.2 DESIGN AND OPERATING DATA

Refer to project's requirements, basic design documents and drawings.

3.2.1 COUPLING ELEMENTS DESIGN PRESSURE

Coupling elements design pressure is equal to pipeline's design pressure, unless Supplementary Requirement SR3 is specified on project's requirements and basic design documents.

3.2.2 WELDING ENDS (STUBS) DESIGN PRESSURE

Welding Ends design pressure is equal to pipeline's design pressure.

3.3 DESIGN CALCULATIONS

As per project's requirements, basic design documents and drawings

3.3.1 DESIGN CODE

In accordance with EN 1591-1.

Minimum thickness, exclusive of corrosion allowance, shall not be less than 5 mm for carbon and low-alloy steel pressure parts or the abutting pipe thickness whichever is bigger.



3.3.2 BENDING MOMENT

No bending moment maybe taken into account, unless Supplementary Requirement SR3 is specified on the project's requirements and basic design documents.

3.3.3 CORROSION AND PRODUCTION ALLOWANCE

Corrosion allowance shall be specified as per project's requirements and basic design documents.

Production allowance value should be added to calculated wall thickness.

3.4 CONSTRUCTION

3.4.1 JOINTS

Bolted or threaded joints are not permitted. The design of welds joining stubs and coupling element shall permit radiographic examination of the welds.

3.4.2 SEALS

One or two independent seals refer to basic design documents.

Each seal shall be made from continuously mounded precision O-rings in a dielectric material.

3.4.3 EMERGENCY SEAL

Not required unless Supplementary Requirement SR1 is specified. Refer to basic design documents.

3.4.4 BORE

Not less than 96% of abutting pipe's inside diameter, unless Supplementary Requirement SR2 is specified. Refer to basic design documents.

3.4.5 LENGHT

Stub length shall be sufficient for application of internal coating in accordance with paragraph 3.10 (total length of coated area).



3.4.6 WELDING ENDS

Shall match the abutting ends within a tolerance of +1.6 mm. Refer to basic design documents for abutting pipe dimensions.

Beveling shall be as specified in EN ISO 3183.

3.5 MATERIALS

According to ELOT EN ISO 3183 grades L245 through L485.

3.5.1 IMPACT TESTS

On all pressure retaining components EN 10045-1 impact tests at a temperature lower than -20°C shall be performed on each material used, consisting of three test specimens from the same heat as the actual delivery.

3.5.2 WELDING ENDS (STUBS)

Seamless or welded carbon steel pipe as per EN ISO 3183 grades L245 through L485 inclusive or equivalent.

Grades L360 through to L485 can only be used on stubs of DN 750 or larger.

3.5.3 COUPLING RINGS, SHELL, ETC.

Forgings, rolled plates or tubular products shall be used.

3.5.4 SEALS AND DIELECTRIC

Shall be inert to gas, methanol and glycol. Elastic properties shall ensure a sustained pre-compression of sealing element.

3.6 FABRICATION

3.6.1 PLATE FORMING

Plate forming shall comply to EN ISO 3183. In case that subsequent heat treatment is required, it shall be normalizing.



3.6.2 WELDING

Welding shall comply to EN 12732. Hardness of the weld seam and heat affected zone may nowhere exceed 300 HV 10.

3.6.3 REPAIR BY WELDING

No permission in base materials.

3.6.4 GRINDING

Surface defects may be removed by grinding, providing the minimum calculated wall thickness is maintained.

3.6.5 POST HEAT TREATMENT

As per EN 12732 and EN ISO 3183.

Any heat treatment operations performed by fabricator and intended to enhance mechanical properties, shall obtain Owner approval.

When normalized and tempered materials are specified, the tempering shall be performed prior to any welding unless specifically otherwise authorized in writing by Owner.

The tempering temperature shall be 100°C higher than that required for PWHT, unless otherwise specified.

Final closure welds around dielectric components may be exempted.

3.7 NON-DESTRUCTIVE EXAMINATION

3.7.1 PLATES AND WELDED PIPES

All items shall be ultrasonically scanned to EN 583-1.

3.7.2 FORGINS

All forgings shall be magnetic particle examined as per EN 1290 over entire surface. On machined surfaces no linear indications are acceptable.

3.7.3 WELDS

All joints shall be NDT inspected RT or UT, as applicable, in acceptance with EN 12732.



3.7.4 WELDING ENDS

All welding ends shall be ultrasonically examined to a minimum distance of 50 mm from and including the bevel. Any indication shall be cause for rejection.

3.8 HYDROSTATIC PRESSURE

3.8.1 TEST PRESSURE

Each insulating coupling shall be hydrostatically pressure tested for at least five minutes and a minimum test pressure 1,5 x design pressure as per para. 8.5.2, EN 1594.

Temperature of water shall never be less than 4°C and insulation coupling Fabricator shall take all necessary precautions avoid brittle fracture of equipment during the hydrotest.

Axial forces occurring during testing shall not be constrained.

3.8.2 PRESSURE CYCLES

Initially each coupling shall be subjected to three (3) pressure cycles between 10% and 85% of Test Pressure.

3.8.3 ACCEPTABILITY STANDARD

With the full test pressure applied for a minimum of 30 minutes, no signs of leakage or permanent deformation shall be observed.

3.9 ELECTRICAL TESTS

3.9.1 COUPLING CONDITION

Couplings with one seal shall have these tests applied after hydrostatic testing and the application of the internal coating.

Couplings with two seals shall have these tests applied both before and after hydrostatic testing and the application of the internal coating.

Couplings shall be in a fully dried condition.



3.9.2 STRENGTH TEST

5000 V AC., 50 Hz shall be applied for a period of not less than one minute during which no puncture of coating or formation of sparks may occur, and the leak current differential shall not exceed 2 mA.

The leak current differential between the two tests performed on couplings with two seals shall not exceed 10% of the current of the first test.

3.9.3 RESISTANCE TEST

500 V DC. with a measured electrical resistance greater than 0.1 Mohm.

3.10 SURFACE TREATMENT (COATINGS)

Unless specified on the basic design documents, coatings shall be to coupling manufacturer's recommendation with the following requirements:

3.10.1 EXTERNAL

Insulating coating capable of resisting preheating to 150°C at the welding end. Coating to be cut back 150 mm from welding end.

Coating to be subject to a holiday test of not less than 5 kV + 5 kV per mm of coating thickness, unless stated otherwise on basic design documents and is free of holidays.

3.10.2 INTERNAL

Abrasion resistant coating of a minimum length of 1 x Nominal diameter or 300 mm whichever is the largest.

Coating to be subject to a holiday test of not less than 5 kV, unless stated otherwise on basic design documents, and is free of holidays.

3.11 MARKING

Each coupling shall be marked with:

- Manufacturer's mark.
- Coupling's serial number.
- Material grade of stubs.
- Outside diameter of pipe to which the coupling shall be attached.



- Inspection stamp.

Markings shall be dye stamped in a place outside the coating and covered with a clear soluble varnish.

The Owner Contract Number shall be paint stenciled.

4 SUPPLEMENTARY REQUIREMENTS

4.1 GENERAL

The following Supplementary Requirements shall not apply, unless specifically requested on basic design documents.

Further requirements, if specifically mentioned on basic design documents, shall be valid. Material Requisition shall specify the applicability (as requested) of PED 2014/68/EU. In case of conflict between such requirements and the requirements contained herein, the former shall prevail.

4.1.1 SUPPLEMENTARY REQUIREMENTS – SR1

Coupling shall be prepared for installation of a tight emergency seal. Installation shall be possible with coupling under pressure.

4.1.2 SUPPLEMENTARY REQUIREMENTS – SR2

Coupling shall permit passage of scrapers. The bore shall not be less than 0.96 x inside diameter of abutting pipe.

4.1.3 SUPPLEMENTARY REQUIREMENTS – SR3

Coupling elements design pressure shall include an allowance for predictable well defined bending moments (M) with a value as specified on the Data Sheet.

This revised design pressure shall be determined thus:

(Coupling Element Design Pressure) = (Pipeline Design Pressure) + $\frac{16 \cdot M}{3.1416 \cdot G^3}$

where:

G = Diameter at location of the effective gasket load reaction.

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|-------------------------|---|--------|----------------------------|
| Doc No: DSF-SPC-PIP-038 | | Rev. 1 | Page 13 of 13 |
| | | | |

M = Bending moment at the insulating coupling position induced due to seismic forces, soil displacement / settlements, etc, according to the stress analysis of the pipeline system.

4.1.4 SUPPLEMENTARY REQUIREMENTS – SR4

For installations with Hydrogen Service requirements the pipes used for the manufacturing of the insulating joints must cover all the relevant requirements (Option A or B acc. To ASME B.31.12) as described in the project Data Sheets. All non metallic materials (e.g. Sealing O rings) shall also be suitable for use with hydrogen.

5 INSPECTION AND CERTIFICATION

Inspection will be performed by an Independent Accredited Inspection Body.

Inspection requirements are defined in the following documents:

- a. Material requisition and Datasheet.
- **b.** DESFA Tech. Spec. No. DSF-SPC-QAC-005 "Shop inspection of equipment and materials for NGT project" and DSF-SPC-QAC-006 "Inspection and Test Instructions".
- c. Relevant project specifications.
- d. Inspection clauses of applicable codes.

6 SHIPMENT

One-piece equipment shall be completely equipped with all internal/ external attachments before shipment, unless otherwise specified.

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

All exposed machined surfaces shall be coated with rust preventive. Welding ends shall be protected with plastic covers.