TECHNICAL SPECIFICATION

PIPELINE ISOLATING JOINTS
(AMENDMENTS/SUPPLEMENTS TO MSS SP-75)

DEP 31.40.21.31-Gen.

April 1993

DESIGN AND ENGINEERING PRACTICE

USED BY

COMPANIES OF THE ROYAL DUTCH/SHELL GROUP

PREFACE

DEP (Design and Engineering Practice) publications reflect the views, at the time of publication, of:

Shell International Oil Products B.V. (SIOP)
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Shell International Exploration and Production B.V. (SIEP)
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Shell International Chemicals B.V. (SIC)

The Hague, The Netherlands,

and other Service Companies.

They are based on the experience acquired during their involvement with the design, construction, operation and maintenance of processing units and facilities, and they are supplemented with the experience of Group Operating companies. Where appropriate they are based on, or reference is made to, national and international standards and codes of practice.

The objective is to set the recommended standard for good design and engineering practice applied by Group companies operating an oil refinery, gas handling installation, chemical plant, oil and gas production facility, or any other such facility, and thereby to achieve maximum technical and economic benefit from standardization.

The information set forth in these publications is provided to users for their consideration and decision to implement. This is of particular importance where DEPs may not cover every requirement or diversity of condition at each locality. The system of DEPs is expected to be sufficiently flexible to allow individual operating companies to adapt the information set forth in DEPs to their own environment and requirements.

When Contractors or Manufacturers/Suppliers use DEPs they shall be solely responsible for the quality of work and the attainment of the required design and engineering standards. In particular, for those requirements not specifically covered, the Principal will expect them to follow those design and engineering practices which will achieve the same level of integrity as reflected in the DEPs. If in doubt, the Contractor or Manufacturer/Supplier shall, without detracting from his own responsibility, consult the Principal or its technical advisor.

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1) Operating companies having a Service Agreement with SIOP, SIEP, SIC or other Service Company. The use of DEPs by these Operating companies is subject in all respects to the terms and conditions of the relevant Service Agreement.

2) Other parties who are authorized to use DEPs subject to appropriate contractual arrangements.

3) Contractors/subcontractors and Manufacturers/Suppliers under a contract with users referred to under 1) or 2) which requires that tenders for projects, materials supplied or - generally - work performed on behalf of the said users comply with the relevant standards.

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All administrative queries should be directed to the DEP Administrator in SIOP.

NOTE: In addition to DEP publications there are Standard Specifications and Draft DEPs for Development (DDDs). DDDs generally introduce new procedures or techniques that will probably need updating as further experience develops during their use. The above requirements for distribution and use of DEPs are also applicable to Standard Specifications and DDDs. Standard Specifications and DDDs will gradually be replaced by DEPs.

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APPENDICES

1. INTRODUCTION

1.1 SCOPE

This is a new DEP which gives minimum technical requirements for the design, fabrication and inspection of monolithic isolating joints, for electrical isolation of pipelines from plants and/or other pipelines.

This DEP amends and supplements MSS SP-75, 1988 Edition and provides the requirements for isolating joint components not covered by MSS SP-75.

1.2 DISTRIBUTION, INTENDED USE AND REGULATORY CONSIDERATIONS

Unless otherwise authorised by SIPM, the distribution of this DEP is confined to companies forming part of the Royal Dutch/Shell Group or managed by a Group company, and to Contractors and Manufacturers/Suppliers nominated by them (i.e. the distribution code is "F", as defined in DEP 00.00.05.05-Gen.).

This DEP is intended for use by Functions in the Group that are involved in the design, material procurement, construction and operation of pipelines.

If national and/or local regulations exist in which some of the requirements may be more stringent that this DEP, the Contractor shall determine by careful scrutiny which of the requirements are the more stringent and which combination of requirements will be acceptable as regards safety, environmental, economic and legal aspects. In all cases, the Contractor shall inform the Principal of any deviation from the requirements of this DEP which is considered to be necessary in order to comply with national and/or local regulations. The Principal may then negotiate with the Authorities concerned with the object of obtaining agreement to follow this DEP as closely as possible.

1.3 DEFINITIONS

1.3.1 General definitions

The **Contractor** is the party which carries out all or part of the design, engineering, procurement, installation, and commissioning or management of a project or operation of a facility. The Principal may undertake all or part of the duties of the Contractor.

The **Manufacturer/Supplier** is the party which manufactures or supplies equipment and services to perform the duties specified by the Contractor.

The **Principal** is the party which initiates the project and ultimately pays for its design and construction. The Principal will generally specify the technical requirements. The Principal may also include an agent or consultant authorised to act for, and on behalf of, the Principal.

The word **Shall** indicates a requirement.

The word **Should** indicates a recommendation.

1.3.2 Specific definitions

Data sheet - the data/requisition sheet DEP 31.40.21.93-Gen., to be used by the Principal and completed by the Contractor.

1.4 CROSS-REFERENCES

Where cross-references to other parts of this DEP are made, the referenced section number is shown in brackets. Other documents referenced by this DEP are listed in (6).

1.5 ACTION ITEMS

The data sheet shall be fully completed by the Principal, or the Contractor as appropriate.

2. ISOLATING JOINT FUNCTIONAL REQUIREMENTS

2.1 GENERAL

The purpose of isolating joints is to provide electrical isolation between sections of pipelines to prevent detrimental electrochemical interaction between the sections. Isolating joints are used also to ensure effective current distribution for cathodic protection systems.

The isolating joint is intended to be installed above ground or above water. It is intended to be girth welded between two pipeline sections.

Single isolating joints shall not be used when the transported fluid is an electrolyte or contains an electrolyte (e.g. salty water) with the following properties: the resistivity of the electrolyte is below 100 ohm.cm and the electrolyte occupies more than 5 percent of the pipeline cross-section. For these conditions, an isolating spool section shall be used instead, refer to DEP 30.10.73.31-Gen.

The design of the isolating joint shall be compatible with the design code adopted for the pipeline in which it is installed, as stated in the data sheet.

NOTE: ANSI/ASME B31.4 and B31.8 are commonly adopted pipeline codes. In some situations, e.g. within plant fences, the pipeline sections connected to the isolating joint may be designed to a plant piping code, e.g. ANSI/ASME B31.3.

The isolating joint shall be suitable for pigging operations.

2.2 JOINT COMPONENTS

The joint shall consist of the following components (Figure 1):

- Two spools, internally coated, each consisting of a pipe segment with a bevelled end for welding to the pipeline, and a flanged end for encapsulation into insulating and filler material. Slip-on flanges shall not be used. The material used for the pipe segments shall be compatible with the pipeline material, as provided in the data sheet.
- A retaining casing for strength connection of the two spools.
- Insulating and filler materials for electrical isolation between the two spools.
- One set of ring seals for pipeline internal pressure containment. When specified by the Principal (in the data sheet), there shall be a second set of ring seals.

  NOTE: A double sealing arrangement should be specified for design pressures in excess of 50 bar (ga), or when the transported fluid is classified by the Principal as toxic.

- Two terminal connecting lugs on the outer surface of each spool. Each lug shall be suitable for a M10 bolted connection. One set of lugs is intended for electrical measurements. The other set is intended for a surge diverter installation (by the Principal). The distance between the lugs intended for the surge diverter shall not exceed 300 mm. The lugs shall be welded on doubler plates on the spools.

2.3 DIMENSIONAL REQUIREMENTS

The internal diameter of the joint shall not deviate by more than ±2% from the nominal internal diameter of the pipeline.

The overall length of the joint shall be as indicated in the data sheet.

The derivation of the joint length shall be in accordance with the following:

- The overall length of the joint shall be at least one metre.
- When the fluid contains an electrolyte the overall length of the joint shall be at least one metre, or four times the nominal diameter of the pipeline, whichever is the greater.

NOTE: In the context of isolating joints, the electrolyte either has a resistivity higher than 100 ohm.cm, or it occupies less than 5 percent of the pipeline cross-section, see (2.1).

For pipelines with a wall thickness exceeding 25 mm, the Manufacturer/Supplier shall confirm that the length of the joint is suitable for post weld heat treatment of the field welds,

i.e. the heat generated by the treatment is not detrimental to the isolating and filler materials and the internal coating. If this is not the case, the length of the joint shall be increased accordingly.

2.4 LOADING REQUIREMENTS

The isolating joint shall be able to resist the design pressure and the design temperature, in combination with the possible external loadings stated in the data sheet.

NOTE: Isolating joints, because of their fabrication method, should not be exposed to undue loads. They should be installed in straight runs of pipe (i.e. away from bends), and supported on each side of the retaining casing. This will minimise stresses due to bending and torsion. Axial stresses due to thermal expansion should be prevented by installing the joint in an unrestrained section of the pipeline.

3. AMENDMENTS TO MSS SP-75, 1988 EDITION

The design, material selection, fabrication and testing of the isolating joint shall be in accordance with MSS SP-75, 1988 Edition, with the following amendments. Paragraph numbers in this section coincide with the respective paragraphs in MSS SP-75.

NOTE: In the context of this DEP, the word "fitting" means the isolating joint.

1. SCOPE

1.4 Add to this clause:

Wrought materials other than those covered by this standard, which may be used in the fabrication of the fitting, shall comply with DEP 30.10.02.11-Gen. In addition, the tensile, hardness and notch toughness properties, and the properties for sour service conditions (when specified), shall be in accordance with the requirements of this standard for all materials.

NOTE: The preferred specifications are API Spec 5L, ASTM A106 and A333 for pipes; ASTM A105 and A234 for forgings; ASTM A515 for plates.

2. PRESSURE RATING

2.2 Add to this clause:

The values of S, t and D are those of the pipeline.

2.5 Add to this clause:

The fitting shall be designed following the methodology described in ASME VIII Division 1 Appendix 2 or equivalent, using the design pressure, design temperature and design factor of the pipeline, and the anticipated external loads acting on the fitting.

5. HYDROSTATIC TESTING

Delete this clause and replace with:

Each fitting shall be hydrostatically tested at the pressure P specified in Clause 2.2, with the fitting in an unrestrained condition. The pressure shall be held for four hours. There shall be no leakage or loss in pressure during the test.

9. HEAT TREATMENT

9.1 Add to this clause:

When the fitting consists of several components assembled together by welding, without further cold or hot forming, the individual components may be heat treated separately, i.e. prior to assembly.

9.1.1 Delete this clause and replace with:

Welds made to assemble individual components shall be post weld heat treated if the wall thickness exceeds 25 mm.

Fittings, or their individual components, shall be heat treated in accordance with Clause 9.1.2, 9.1.3 or 9.1.4.

13. TOLERANCES OF WELDING FITTINGS

13.3 Add to this clause:

For a distance of 100 mm from the welding ends, the internal diameter shall not deviate by more than ± 1.5 mm from the nominal internal diameter of the pipeline.

14. MANUFACTURE

14.4.1 Delete this clause and replace with:

All welds shall be made by welders/welding operators qualified in accordance with ASME IX. Welding procedures shall be qualified in accordance with ASME IX.

16. INSPECTION

16.2 Add to this clause:

An Inspection certificate shall be provided by the manufacturer in accordance with the following:

- ISO 10474 Type 5.1.B for chemical analysis, mechanical properties, notch toughness properties, hardness properties, heat treatment, non-destructive examination.
- ISO 10474 Type 5.1.C for other tests, e.g. dimensional checks, pressure test (when specified), functional checks.

17. MARKING

17.1 Add to this clause:

When sour service conditions are specified, the fitting shall be stamped "NACE MR0175".

18. SUPPLEMENTARY REQUIREMENTS

SR-5 Delete and replace with:

The base material and welds shall have a maximum hardness of 325 HV10.

When sour service conditions are specified, the base material and welds shall have a maximum hardness as specified in NACE MR0175.

Base metal hardness readings shall be made as per ASTM E92 on each heat lot of fittings at 5 random locations.

As part of the welding procedure qualification tests, a hardness traverse shall be carried out across welds and heat affected zones at a distance of 2 mm from the external surface of the welds. Three hardness impressions shall be made in the weld while hardness impressions shall be made at 1 mm intervals in the heat affected zone, beginning at the fusion line.

SR-6 Add to this clause:

In addition, the actual yield to tensile strength ratio shall not exceed 0.85.

SR-7 Delete and replace with:

The notch toughness properties shall be determined in accordance with section 11.1 of this standard.

From each heat of steel, 3 transverse specimens shall be taken from the base material.
As part of the welding procedure qualification tests, three sets of three transverse specimens shall be taken from welds at the following locations: weld center, fusion line, and fusion line +2 mm.

The minimum notch toughness properties shall be in accordance with Standard Specification L-2-2/3. For flanged components in the fitting, the thickness used for determining the test temperature shall be either the thickness of the flange divided by 4 or the thickness at the weld preparation, whichever is greater.

SR-9 Add to this clause:

The welding ends of each fitting shall be 100% ultrasonically tested over a distance of 25 mm from each end from both the internal and external surfaces.

The acceptance criteria for ultrasonic inspection shall be in accordance with ASME VIII Division 1, Appendix 12.

SR-11 Delete and replace with:

The carbon equivalent defined in 7.3 shall not exceed 0.43%. The carbon content shall not exceed 0.23%, or 0.25% for forgings.

When sour service conditions are specified, the materials shall comply in addition with the requirements of NACE Standard MR0175, and shall be proven to be resistant to hydrogen induced cracking in accordance with MESC Spec. 74/125.

4. SUPPLEMENTARY REQUIREMENTS TO MSS SP-75

The following supplementary requirements listed in Section 18 of MSS SP-75 shall apply: SR-2, SR-4, SR-5, SR-6, SR-7, SR-9, SR-10, SR-11, SR-12 and SR-13.

5. COMPONENTS NOT COVERED BY MSS SP-75

5.1 RING SEALS

Elastomeric materials for ring seals shall resist explosive decompression, and shall be suitable for long-term exposure to the transported fluid at the design pressure and temperature conditions. The cross-section of the seals shall not exceed 7 mm diameter for design pressures of 150 bar and above.

NOTE: Compatibility of ring seal materials with the transported fluid may be checked with DEP 30.10.02.13-Gen. Polybutadiene acrylonitrile (NBR) and vinylidene fluoride-hexafluoropropylene are commonly used materials.

5.2 ISOLATING AND FILLER MATERIALS

The isolating materials and filler materials shall be suitable for the long-term exposure to the transported fluid at the design pressure and temperature conditions.

NOTE: Compatibility with the transported fluid may be checked with DEP 30.10.02.13-Gen. Fabric reinforced phenolics for isolating materials, and epoxies or silicones for filler materials are commonly used.

5.3 COATING

The isolating joint shall be coated internally to prevent electrical bridging of the two spools through the transported fluid. The joint shall be coated externally. The internal and external coatings shall terminate 50 mm from the joint ends.

All surfaces to be coated shall be blast cleaned to ISO 8501-1 grade 2 ½. The internal and external coatings shall consist of an amine cured epoxy, to a dry film thickness of 300 microns applied in two coats. The application shall be in strict accordance with the coating supplier's specification.

NOTE: Epoxy internal coatings may not be suitable for some chemical products, refer to DEP 30.10.02.13-Gen. When other coatings need to be specified, advice from a material specialist should be taken. Metallic pigmented coatings shall not be used.

Following the hydrostatic pressure test (3) and electrical checks (5.4), the coatings shall be subject to holiday detection using a wet sponge tester set at 60 volts. The acceptance level shall be zero pinholes.

5.4 ELECTRICAL CHECKS

Electrical checks, to be done after the hydrostatic pressure test, shall be carried out in the following sequence:

- A voltage of 1500 V (ac) at 50 Hz shall be applied across the joint for 5 minutes. There shall be no breakdown, flash-over and reduction in electrical resistance during this period.
- A voltage of 1000 V (dc) shall be applied across the joint in a dried condition. The resistance shall be at least 1 mega-ohm.

5.5 TRANSPORTATION

The isolating joint shall be protected against damage in transit. The bevelled ends of the joint shall be protected by plastic covers and care shall be taken to prevent damage to the external and internal coatings.

5.6 DOCUMENTATION

In addition to the Certified Material Test Reports (3. Clause 16), the Manufacturer/Supplier shall provide a user manual detailing the requirements for installation and inspection in service.

6. REFERENCES

In this DEP, reference is made to the following publications:

NOTE: Unless specifically designated by date, the latest edition of each publication shall be used, together with any amendments/supplements/revisions thereto.

SHELL STANDARDS

Index to DEP Publications and Standard Specifications	DEP 00.00.05.05-Gen.
Metallic Materials - Selected Standards	DEP 30.10.02.11-Gen.
Non-Metallic Materials Selection and Application	DEP 30.10.02.13-Gen.
Design of Cathodic Protection Systems for Onshore Buried Pipelines	DEP 30.10.73.31-Gen.
Line Pipe for Use in Oil and Gas Operations under non-Sour Conditions	L-2-2/3
Hydrogen Induced Cracking Sensitivity Test	MESC Spec. 74/125

AMERICAN STANDARDS

Specification for Line Pipe	API Spec 5L

Issued by:
American Petroleum Institute
Publications and Distribution Section
1220 L Street Northwest
Washington DC. 20005
USA.

Boiler and Pressure Vessel Code Section VIII, Pressure Vessels,1992 Edition	ASME VIII
Boiler and Pressure Vessel Code Section IX, Qualification Standard for Welding and Brazing Procedures, Welders, Brazers, and Welding and Brazing Operators	ASME IX
Chemical Plant and Petroleum Refinery Piping	ANSI/ASME B31.3
Liquid Transportation Systems for Hydrocarbons, Liquid Petroleum Gas, Anhydrous Ammonia, and Alcohols	ANSI/ASME B31.4
Gas Transmission and Distribution Systems	ANSI/ASME B31.8

Issued by:
The American Society of Mechanical Engineers
345 East 47th Street
New York NY 10017
USA.

Standard Specification for Forgings, Carbon Steel, for Piping Components	ASTM A105/A105M
Standard Specification for Seamless Carbon Steel Pipe for High-Temperature Service	ASTM A106
Standard Specification for Piping Fittings of Wrought	ASTM A234/A234M

Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures	
Standard Specification for Seamless and Welded Steel Pipe for Low-Temperature Service	ASTM A333/A333M
Standard Specification for Pressure Vessel Plates, Carbon Steel, for Intermediate- and Higher-Temperature Service	ASTM A515/A515M
Standard Test Method for Vickers Hardness of Metallic Materials	ASTM E92

Issued by:
American Society for Testing and Materials
1916 Race Street
Philadelphia Pa 19103-1187
USA.

Specification for High Test Wrought Butt Welding Fittings, 1988 Edition	MSS SP-75

Issued by:
Manufacturers Standardisation Society
of the Valves and Fittings Industry
127 Park Street N.E
Vienna Virginia 22180
USA,

Standard Recommended Practice Sulphide Stress Cracking Resistant - Metallic Materials for Oil Field Equipment	NACE MR0175

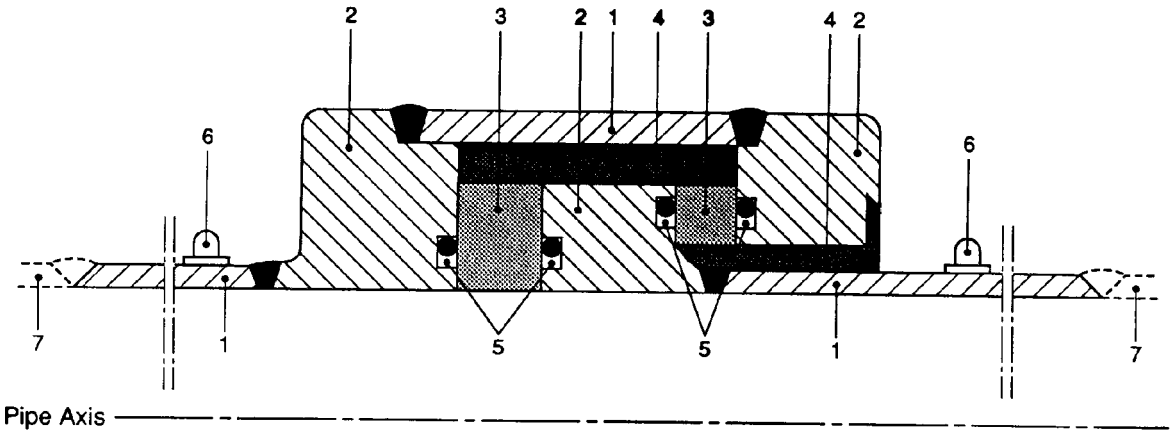
Issued by:
National Association of Corrosion Engineers
P.O. Box 218340
Houston Texas
USA.

INTERNATIONAL STANDARDS

Preparation of Steel Substrates before Application of Paints and Related Products Visual Assessment of Surface Cleanliness, Part 1; rust grades and preparation grades of uncoated steel substrates and of steel substrates after overall removal of previous coating	ISO 8501-1
Steel and steel products inspection documents	ISO 10474

Issued by:
International Organisation for Standardisation
1, Rue de Varembé
Case postale 56
CH-1211 Genève 20
Switzerland.

FIGURE 1 TYPICAL ISOLATING JOINT



1: Linepipe
2: Forgings
3: Insulating Material
4: Dielectric Filler
5: Ring seals
6: Connecting Lugs
7: Pipeline

APPENDIX 1 SPECIMEN COPY OF BLANK DATA SHEET

A specimen copy of the data/requisition sheet DEP 31.40.21.93-Gen. is shown below. The latest revision of this sheet shall be used and can be found in the Requisitioning binder (DEP 30.10.01.10-Gen.).

APPENDIX 1 - SPECIMEN COPY OF BLANK DATA SHEET

A specimen copy of the data/requisition sheet DEP 31.40.21.93-Gen. is shown below. The latest revision of this sheet shall be used and can be found in the Requisitioning binder (DEP 30.10.01.10-Gen.).

	Data/requisition sheet for **Pipeline Isolating Joints**		Project Name:			
			Project Number:		Order/Enquiry No.:	
			QUANTITY REQUIRED:			
1	Section (Note 1)	ITEM	SELECTION			
2	2.1	Pipeline Design Code	ANSI B31.4		ANSI B31.8	Other:
3	3 (2.5)	Pipeline Design Factor				
4	2.3	Pipeline Outside Diameter	mm			
5		Pipeline Wall Thickness	mm			
6	2.2	Pipeline Material	Specification:		Type/Grade:	
7	3 (2.3)	Pipeline Design Pressure	bar (ga)			
8		Pipeline Design Temperature	Minimum	°C		
9			Maximum	°C		
10	2.1/5.1/5.2	Transported Fluid				
11	2.3	Isolating Joint Length	mm			
12	3 (1.4/17.1/18SR5/18SR11)	Sour Service	Yes		No	
13	2.2	Toxic Service	Yes		No	
14	2.2	Double Seal Required (Note 2)	Yes		No	
15	2.4 3 (2.5)	External Forces and Moments	Axial force	N		
16			Bending moment	N.m		
17			Torsion	N.m		
18			In shaded boxes		use a 'Check Mark' to indicate selection	
19			ADDITIONAL DATA			
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40			INFORMATION TO BE SUBMITTED WITH THE TENDER			
41			This completed data/requisition sheet DEP 31.40.21.93-Gen. (i.e. all data fields not already completed by the Principal).			
42						
43						
44						
45						
46						
47			NOTES		DESCRIPTION OF REVISIONS	
48			General: Isolating joints shall comply with DEP 31.40.21.31-Gen.			
49			Note 1: Refers to section numbers of DEP 31.40.21.31-Gen.			
50			Note 2: A double sealing arrangement should be specified if the design pressure is greater than 50 bar (ga) or if the transported fluid has been classed as toxic.			
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56			Made by / Date	EQUIPMENT	Rev letter	
			Checked by / Date	PLANT	Date	
			Appr. by / Date	CONSIGNEE	Sign	
			Eng. by Principal		Sheet No. 1 of 1	
					Equipm. No	
					Req. No	

DEP 31.40.21.93-Gen., dated 04/93.