TECHNICAL SPECIFICATION

PIG TRAP END CLOSURES
(AMENDMENTS/SUPPLEMENTS TO MSS SP-75)

DEP 31.40.21.32-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)
and
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 pig trap end closures made of carbon steel, to be fitted on pig trap systems designed in accordance with DEP 31.40.10.13-Gen.

The purpose of the end closure is to allow the insertion and removal of pigs into and from a pig trap.

This DEP amends and supplements MSS SP-75, 1988 Edition and provides the requirements for end closure 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 described 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 user 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, construction, 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 31.40.21.94-Gen., to be used by the Principal and completed by the Contractor. A specimen copy for information is included in Appendix 1. The actual form can be found in the requisitioning binder, DEP 30.10.01.10-Gen.

Major barrel – enlarged pipe section of a pig trap used for loading or retrieval of pigs.

Pig – a device which can be propelled through a pipeline by fluid flow and normally used for cleaning, batching, inspection or other activities.

Pig trap – an ancillary item of pipeline equipment, with associated pipework and valves, for

introducing a pig into a pipeline or removing a pig from a pipeline.

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. END CLOSURE FUNCTIONAL REQUIREMENTS

2.1 GENERAL

The end closure shall conform to the general requirements of ASME VIII Division 1 Section UG-35 (b) (Quick Actuating Closures). Attention is drawn to the requirement for a fail-safe design of the opening mechanism; specifically, the failure of any part of the opening mechanism shall leave the closure closed rather than open.

The design of the end closure shall be compatible with the design code adopted for the adjoining Pig Trap, as stated in the data sheet.

NOTE: ANSI/ASME B31.4 and B31.8 are widely adopted pipeline codes, and are also commonly used for pig traps. In some situations, the pig trap may be designed to a plant piping code, e.g. ANSI/ASME B31.3.

The end closure is intended to be girth welded to the end of the major barrel of a pig trap. The position of the closure (horizontal or vertical) shall be as indicated in the data sheet.

The end closure shall be of the quick acting type, lever or handwheel operated, and hinged or supported from above by a carrier as indicated in the data sheet. The quick acting design should allow opening and closing by one man in a period of approximately one minute, without the use of additional devices.

The design of the end closure shall be suitable for permanent location in an open environment.

NOTE: When the opening of the end closure is in the vertical plane, e.g. on vertical pig traps, the end closure should be equipped with a counterweight or a hydraulic opening system. There should be a locking device to hold open the door while personnel are loading or unloading pigs.

NOTE: Closures 18" and larger are generally handwheel operated.

2.2 CLOSURE COMPONENTS

The end closure shall consist of the following components:

- A removable door, which provides full bore access when open, and terminates and seals the bore when closed.
- A welding end hub, for joining to the major barrel of a pig trap. The material used for the welding end hub shall be compatible with the major barrel material, as provided in the data sheet.
- A closure handling device, suitable to lift, hinge or swing the door. When the handling device is attached to the closure, it shall be attached to the welding end hub, not to the major barrel of the pig trap.
- Ring seals for pressure containment. The activation of the seals shall be such that the fluid within the pig trap is contained at any pressure between 1 bar (abs) and the pig trap design pressure.
- Two safety devices to prevent inadvertent opening of the closure before the pig trap is depressurised (2.3).

End closures with exposed screw expanders or captive ratchet braces should not be used, because of the high maintenance requirements and the non fail-safe aspects of some opening mechanism designs.

2.3 SAFETY DEVICES

The end closure shall have the following safety devices:

- A pressure locking device to prevent opening of the door when the pig trap is pressurised.
- A safety bleeder that when released will alert the operator to a possible hazard unless pressure in the pig trap is relieved completely. Opening of the door shall not be possible unless the bleeder is released. Engaging the bleeder shall only be possible when the closure is closed. The bleeder shall be designed such that there is no risk of blockage.

The devices shall be constructed and located so that they cannot readily be rendered inoperative. The devices shall be easily accessible for inspection.

3. AMENDMENTS TO MSS SP-75, 1988 EDITION

The design, material selection, fabrication and testing of the end closure 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 end closure.

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 major barrel.

2.5 Add to this clause:

The fitting shall be designed following the methodology described in ASME VIII Division 2 Appendix 4 or equivalent, using the design pressure, design temperature and design factor of the major barrel for strength analysis, and the anticipated number of pressure cycles for cyclic loading analysis.

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 major barrel.

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 in accordance with NACE MR0175.

Base metal hardness readings shall be made in accordance with 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 and the following:

From each heat of steel, three 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 width of 25 mm 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. ITEMS 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 in diameter for design pressures of 150 bar and above.

NOTE: Compatibility of ring seal material 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 BOLTING

The selection of bolting material shall be in accordance with DEP 30.10.02.11-Gen. Bolts and nuts shall be fluorocarbon coated.

NOTE: The preferred materials for standard applications are ASTM A193/A193M grade B7 and ASTM A194/A194M grade 2H for non sour service conditions, and ASTM A193/A193M grade B7M and ASTM A194/A194M grade 2HM for sour service conditions. For special applications, e.g. low temperature, other materials may apply.

5.3 COATING

After blast cleaning to ISO 8501-1 grade 2 ½, the end closure shall be externally coated with an amine cured epoxy, to a dry film thickness of 300 microns, applied in two coats. The coating shall terminate 50 mm from the bevelled end of the closure hub. The application shall be in strict accordance with the coating supplier's specification.

5.4 TRANSPORTATION

The closure shall be protected against damage and corrosion during transport and storage. The bevelled end of the closure hub shall be protected by a plastic cover.

5.5 DOCUMENTATION

In addition to the Certified Material Test Report (3. Clause 16), the Manufacturer/Supplier shall provide a user manual, detailing the requirements for the installation, operation, and maintenance of the end closure. A list of recommended spare parts shall be included.

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 Pipeline Pig Trap Systems	DEP 31.40.10.13-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, 1992 Edition	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 Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for High-	ASTM A193/A193M

Temperature Service

Standard Specification for Carbon and Alloy Steel Nuts for Bolts for High-Pressure and High-Temperature Service	ASTM A194/A194M
Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures	ASTM A234/A234M
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
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.

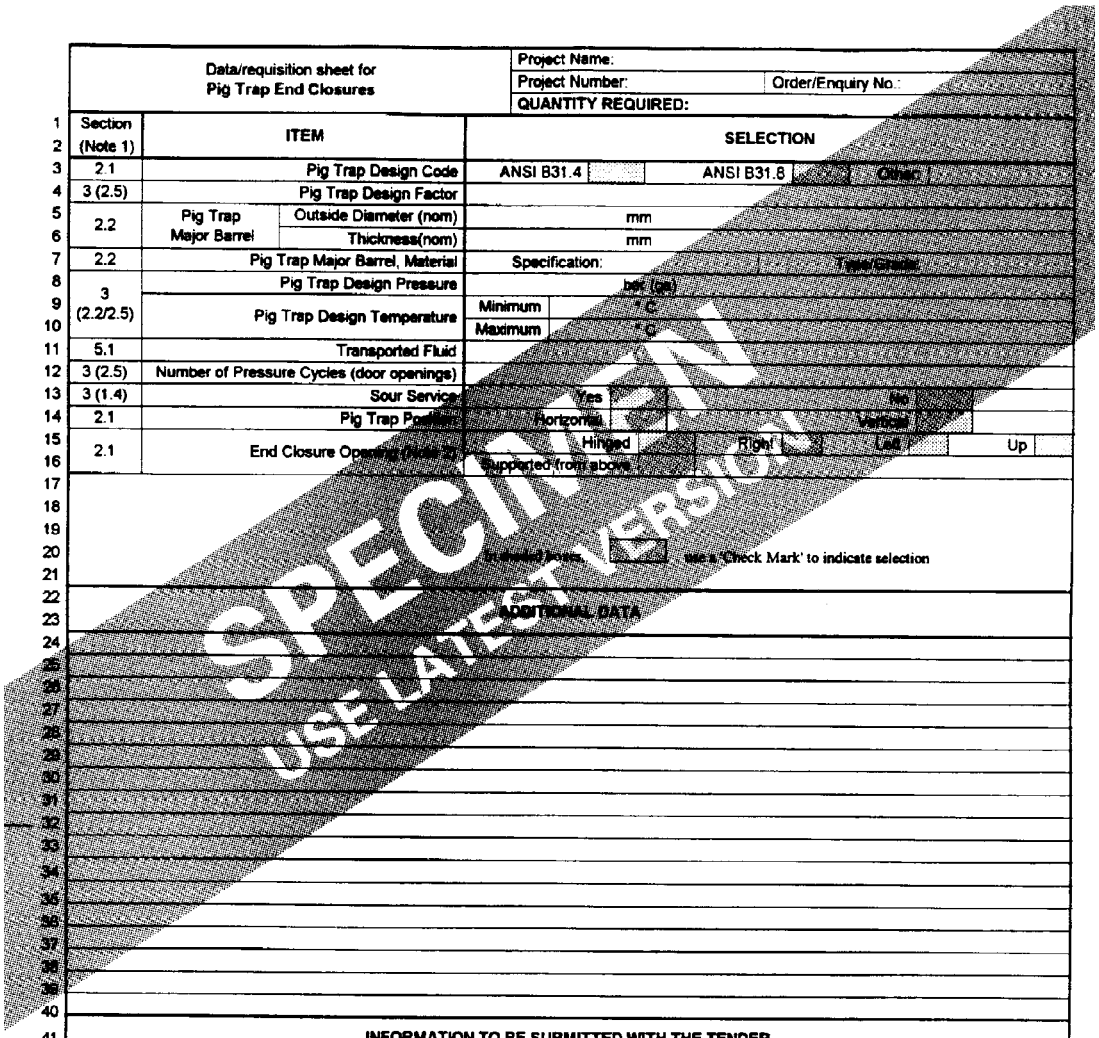
INTERNATIONAL STANDARDS

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 coatings	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.

APPENDIX 1 SPECIMEN COPY OF BLANK DATA SHEET

A specimen copy of the data/requisition sheet DEP 31.40.21.94-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 Pig Trap End Closures			Project Name:			
				Project Number:	Order/Enquiry No.:		
				QUANTITY REQUIRED:			
Section (Note 1)	ITEM			SELECTION			
2.1	Pig Trap Design Code			ANSI B31.4		ANSI B31.8	Other:
3 (2.5)	Pig Trap Design Factor						
2.2	Pig Trap Major Barrel	Outside Diameter (nom)		mm			
		Thickness(nom)		mm			
2.2	Pig Trap Major Barrel, Material			Specification:		Type/Grade:	
3 (2.2/2.5)	Pig Trap Design Pressure			bar (ga)			
	Pig Trap Design Temperature			Minimum	°C		
				Maximum	°C		
5.1	Transported Fluid						
3 (2.5)	Number of Pressure Cycles (door openings)						
3 (1.4)	Sour Service			Yes		No	
2.1	Pig Trap Position			Horizontal		Vertical	
2.1	End Closure Opening Direction			Hinged	Right	Left	Up
				Supported from above			
	In shaded boxes, use a 'Check Mark' to indicate selection						
	ADDITIONAL DATA						
	INFORMATION TO BE SUBMITTED WITH THE TENDER						
	This completed data/requisition sheet DEP 31.40.21.94-Gen. (i.e. all data fields not already completed by the Principal).						
	NOTES					DESCRIPTION OF REVISIONS	
	General: End Closures shall comply with DEP 31.40.21.32-Gen.						
	Note 1: Refers to section numbers of DEP 31.40.21.32-Gen.						
	Note 2: For hinged closures, the Principal shall indicate the required opening orientation (right/left/up)						

Made by	Date	EQUIPMENT	Rev letter		
Checked by	Date	PLANT	Date		
Appr. by	Date	CONSIGNEE	Sign		
			Sheet No 1 of 1		
Eng. by Principal			Equipm. No		
			Req. No		

DEP 31.40.21.94-Gen., dated 04/93.