



RP 43-1

ONSHORE TRANSMISSION PIPELINES TO BS 8010

June 1992

Copyright © The British Petroleum Company p.l.c.

All rights reserved. The information contained in this document is subject to the terms and conditions of the agreement or contract under which the document was supplied to the recipient's organisation. None of the information contained in this document shall be disclosed outside the recipient's own organisation without the prior written permission of Manager, Standards, BP International Limited, unless the terms of such agreement or contract expressly allow.

BP GROUP RECOMMENDED PRACTICES AND SPECIFICATIONS FOR ENGINEERING											
Doc. No. RP 43-1		Issue Date June 1992	Latest Amendment Date								
Document Title ONSHORE TRANSMISSION PIPELINES TO BS 8010 (Replaces BP Engineering CP 43)											
APPLICABILITY		International									
Regional Applicability:		All Businesses									
SCOPE AND PURPOSE This Recommended Practice is a supplement to BS 8010 Pipelines, Part 2 Pipelines on land: design, construction and installation, Section 2.8, Pipelines in steel for oil, gas and associated products. Although this Recommended Practice is supplemental to a British Standard, the concepts used in the British Standard have international applicability.											
AMENDMENTS <table border="0" style="width: 100%;"> <tr> <td style="width: 10%;">Amd</td> <td style="width: 20%;">Date</td> <td style="width: 20%;">Page(s)</td> <td style="width: 50%;">Description</td> </tr> <tr> <td colspan="4"> </td> </tr> </table>				Amd	Date	Page(s)	Description				
Amd	Date	Page(s)	Description								
CUSTODIAN (See Quarterly Status List for Contact) Pipelines, BPE											
Issued by:- Engineering Practices Group, BP International Limited, Research & Engineering Centre Chertsey Road, Sunbury-on-Thames, Middlesex, TW16 7LN, UNITED KINGDOM Tel: +44 1932 76 4067 Fax: +44 1932 76 4077 Telex: 296041											

CONTENTS

Section	Page
FOREWORD	iii
1. GENERAL.....	1
1.1 Scope	1
1.8 Quality Management.....	1
2. DESIGN.....	2
2.1 Safety Considerations	2
2.6 Design Considerations	2
2.7 Design Conditions	3
2.8 Design Criteria.....	4
2.9 Pressure, Thermal and Other Stress Criteria	9
3. MATERIALS	9
3.1 General Requirements, Materials and Dimensional Standards	9
3.3 Pipe	10
4. CORROSION PROTECTION	12
4.2 External Corrosion	12
4.3 Internal Corrosion.....	12
5. TERMINALS AND INTERMEDIATE STATIONS	13
5.3 Hazardous Area Classification	13
5.5 Vibration Resonance and Noise	13
5.8 Safety Systems.....	13
6. CONSTRUCTION	13
6.1 General.....	13
6.4 Setting Out and Surveying for Bends	14
6.5 Handling and Storage of Pipe.....	15
6.6 Pipe Stringing, Field Bending and Swabbing	15
6.7 Pipe Inspection	15
6.8 Welding.....	16
6.9 Joint Wrapping and Trench Excavation.....	16
6.11 Lowering.....	18
6.12 Backfilling and Reinstatement	18
6.13 Coating Survey Following Construction.....	19
6.14 Crossings.....	19
6.15 Cleaning and Gauging.....	20
7. QUALITY ASSURANCE/QUALITY CONTROL	20
7.1 General.....	20
7.6 Records and Document Control.....	20



8. PRESSURE TESTING	20
8.1 General.....	20
8.2 Safety Precautions	21
8.4 Test Pressure	21
8.5 Test Procedures.....	22
8.7 High Level Testing	22
8.9 Repairs to Test Failures	22
9. COMMISSIONING	22
9.4 Commissioning	22
APPENDIX A.....	24
DEFINITIONS AND ABBREVIATIONS	24
APPENDIX B.....	25
LIST OF REFERENCED DOCUMENTS.....	25
APPENDIX C.....	27
PIGGING SYSTEMS	27
C1 SCOPE.....	27
C2 SYSTEM DESIGN	27
C3 OPERATION	32
C4 MAINTENANCE.....	33
FIGURE 1	34
EXTENT OF PIPELINE SYSTEMS	34



FOREWORD

Introduction to BP Group Recommended Practices and Specifications for Engineering.

The Introductory volume contains a series of documents that provide an introduction to the BP Group Recommended Practices and Specifications for Engineering (RPSEs). In particular, the 'General Foreword' sets out the philosophy of the RPSEs. Other documents in the Introductory volume provide general guidance on using the RPSEs and background information to Engineering Standards in BP. There are also recommendations for specific definitions and requirements.

Value of this Recommended Practice

It clarifies certain of the [BS 8010](#) requirements and lists those additional BP requirements not fully detailed in [BS 8010](#).

Application

This Recommended Practice is a transparent supplement to [BS 8010](#) Pipelines, Part 2, Pipelines on land: design, construction and installation, Section 2.8, Pipelines in steel for oil, gas and associated products. The titles and numbering of the text of this BP Group Recommended Practice follow those of the BS. All text is cross referenced and qualified, modifies or adds to the requirements of the BS.

Text in *italics* is Commentary. Commentary provides background information which supports the requirements of the Recommended Practice, and may discuss alternative options.

This document may refer to certain local, national or international regulations but the responsibility to ensure compliance with legislation and any other statutory requirements lies with the user. The user should adapt or supplement this document to ensure compliance for the specific application.

Principal changes from Previous Edition

Now supplemental to [BS 8010](#) rather than IP 6.

Feedback and Further Information

Users are invited to feed back any comments and to detail experiences in the application of BP RPSEs, to assist in the process of their continuous improvement.

For feedback and further information, please contact Standards Group, BP Engineering or the Custodian. See Quarterly Status List for contacts.



1. GENERAL

1.1 Scope

This Recommended Practice specifies BP general requirements for the design, construction and testing of onshore pipelines and associated installations used for the transmission of crude oil, petroleum liquid products, natural gas and gaseous products.

This Recommended Practice shall be used as a supplement to [BS 8010](#), British Standard Code of Practice for Pipelines, Part 2, Pipelines on Land: Design, construction and installation, Section 2.8, Pipelines in steel for oil and gas.

All requirements of [BS 8010](#), Part 2, Section 2.8 shall apply unless otherwise specified in this Recommended Practice.

This Recommended Practice is based on an external code which sets out good pipeline practices and is based on the requirements to satisfy UK legislation. Where in other countries another code of practice forms the basis of design, reference should be made to this Recommended Practice for areas not covered by that code of practice.

(Additional to [BS 8010](#) para 1.1)

Figure 1 illustrates further interpretation of the extent of pipeline systems to which BS 8010, Part 2, Section 2.8 may apply for sections of pipe between process plant, storage areas, etc. within or between refineries, chemical plant or similar facilities.

When assessing if a section of pipe is to be considered a pipeline for the application of this Recommended Practice, consideration is to be given to the categorization of substances, classification of location and proximity to areas of unrestricted public access. This also applies for pipes within boundary fences of large installations between widely spaced separate process areas.

It should be noted that the UK Health and Safety Executive consider the pipeline boundaries to include the pig trap and the first valve on all branch lines off the pipeline system.

The appropriate regulatory bodies should be consulted whilst establishing pipeline and plant demarcations.

1.8 Quality Management

The design, construction and testing of pipelines shall be undertaken in accordance with the requirements of this Recommended Practice. Quality Assurance shall be provided by the planned and systematic implementation of the actions required to secure the standards defined



within. Implementation will be in accordance with an international or national quality standard such as [BS 9001](#).

(Additional to [BS 8010](#) para 1.8)

2. DESIGN

2.1 Safety Considerations

2.1.1 General

Discussions should be held with the intended operating group and appropriate regulatory body to establish the in-service inspection requirements to allow suitable provision to be accommodated in the design.

2.6 Design Considerations

Above ground crossings should be avoided as they can be more easily subjected to vandalism or terrorist attack.

2.6.1 Road Crossings

Where the open trenching method is employed it is sometimes desirable, especially in the vicinity of other services, to give warning of the presence of the pipeline by placing a concrete slab over it, suitably identified. Where concrete is placed around or above the pipeline it should be separated from it by a 100 mm layer of fine grained material as protection for the pipe coating.

2.6.3 River and Estuary Crossings

Where conditions permit, pipelines at water crossings can be installed by one of the following methods:-

- (i) pulling the pipeline in a preploughed trench and burying by dumping;*
- (ii) pulling the pipeline and subsequent burial using a post burial plough;*
- (iii) pulling the pipeline simultaneously with a plough pulling head to trench, install and bury in one operation.*
- (iv) horizontal directional drilling.*

2.6.6 Sleeved Crossings

Crossings should preferably be designed without the use of casing sleeves, as the sleeves screen the carrier pipe from cathodic protection currents. If a casing sleeve is provided it is necessary to ensure that the annular space between the casing sleeve and the carrier pipe is kept in such a condition that corrosion of the carrier pipe cannot occur. This requires the ends of the carrier pipe to be sealed to prevent the ingress of soil or ground water. Internal corrosion protection of the carrier pipe would therefore be unnecessary.



Condensation can occur in the annulus and cause corrosion. A sampling point to test for moisture should be considered.

If the annulus cannot be effectively sealed, then venting and drainage connections should be provided and the crossing designed at a slope, with the vent pipe connected to the top of the casing sleeve at the upper end and the drain connected to the bottom of the sleeve at the lower end.

Corrosion protection of the outer surface of the carrier pipe is required.

2.6.12 Location of Section Isolating Valves

In vulnerable water areas, valves located below ground should be surrounded by suitable granular material to allow minor leaks to be readily identified. In certain locations it may be considered advisable to install valves which are below ground in impervious pits provided with a locked cover. The design of such pits should make provision for some means of ventilation.

2.7 Design Conditions

2.7.2 Internal Design Pressure

Flowlines directly connected to oil or gas wellheads shall be designed to accommodate the maximum wellhead pressure anticipated to occur during the life of the field.

As an added safeguard against failure of protective devices the maximum calculated pressure due to operating and surge pressures shall not exceed the hydrostatic test pressure, as specified for the pipeline field test.

(Additional to [BS 8010](#) para 2.7.2)

Flowlines directly connected to oil or gas well heads shall be designed to accommodate the maximum closed-in well head pressure anticipated.

When the product from a number of flowlines is co-mingled at a central collection facility for transportation by a single common pipeline to a processing unit and when the normal operating pressure range is well below the maximum closed-in well head pressure (see BP Group [RP 44-1](#)), a lower design pressure may be used if adequate reliability is assured for the well head safety equipment and any down stream overpressure safety devices.

2.7.4 Temperature Considerations

2.7.4.1 Design Temperature

Frost heave shall be considered on pipelines operating at temperatures below 0°C.

(Additional to [BS 8010](#) para 2.7.4.1)



2.7.5 *Dynamic Effects*

2.7.5.1 *Shock Effects*

Additional shock effects may be experienced due to the following:-

- (i) *Passage of pigs or spheres through a pipeline.*
- (ii) *Slugging transients in multiphase or depressurising flow.*

2.7.6 **Weight Effects**

2.7.6.2 **Live Loads**

In water logged or marshy ground, or in ground subject to flooding, consideration should be given to preventing flotation.

(Additional to [BS 8010](#) para 2.7.6.2)

2.7.7 **Thermal Expansion and Contraction Loads**

No allowance is necessary for completely buried pipelines carrying fluids at ambient temperatures.

(Additional to [BS 8010](#) para 2.7.7)

2.8 Design Criteria

2.8.2 **Pressure-Temperature Ratings**

2.8.2.5 **Over Pressure Protection**

Over pressure protection systems shall conform to BP Group [RP 44-1](#).

(Additional to [BS 8010](#) para 2.8.2.5)

2.8.3 **Pressure Design of Pipeline Components**

2.8.3.3 **Flanges**

Flanges shall be welding neck type and be designed and manufactured in accordance with BP Group [GS 142-4](#).

Flanges exceeding or departing from standard dimensions may be used providing that they are designed with reference to BP Group [GS 146-2](#).
(Substitution for [BS 8010](#) para 2.8.3.3)

A swivel ring flange may be used to enable easier alignment in difficult situations.



Well head flanges and those on all well site fitments up to and including the safety shut-off valve shall be designed and manufactured in accordance with [API 6A](#).

For electrical insulation purposes, adapted flanges with insulating washers and sleeves may be used. Alternatively, special proprietary insulation joints may be fitted.

(Additional to [BS 8010](#) para 2.8.3.3)

Note that when selecting and specifying flange standards, although dimensional compatibility exists between certain flanges in the varying standards, material specifications and pressure-temperature ratings do not always correspond.

Generally monolithic insulating joints are preferred to insulating flanges in which insulating washers and sleeves are used. The selection and design of monolithic couplings should take into consideration externally applied loadings and the full range of operating conditions.

2.8.3.4 Bolting

Bolting shall be designed and manufactured in accordance with BP Group [GS 142-9](#).

(Substitution for [BS 8010](#) para 2.8.3.4)

Extra access should be allowed for longer studbolts that may be required where hydraulic bolt tensioners are to be used.

Special nuts with drilled faces may be required where hydraulic bolt tensioners are to be used.

2.8.3.5 Non Metallic Components and Gaskets

Gaskets and joining for use with bolted flanges shall be designed and manufactured in accordance with BP Group [GS 142-7](#).

(Substitution for [BS 8010](#) para 2.8.3.5)

For oil service of class 900 and above, and gas service of class 600 and above, ring joint flanges shall be used.

(Additional to [BS 8010](#) para 2.8.3.5)



2.8.3.6 Fittings

Pipeline fittings shall be designed and manufactured in accordance with BP Group [GS 142-5](#).

(Substitution for [BS 8010](#) para 2.8.3.6)

Forged fittings should be used wherever practicable.

All welded connections in fabricated fittings should be reinforced as necessary, to ensure that the fitting has strength at least equal to the main pipe to which it is to be joined.

(Additional to [BS 8010](#) para 2.8.3.6)

2.8.3.7 Branch Connections

For branches of 25% or less of the main diameter, but not exceeding NPS 6 (DN 150), proprietary reinforced branch connections ('weldolets') may be installed as an alternative to tees. For branches not exceeding NPS 12 (DN 300) and also 25% or less of the main diameter, proprietary reinforced branch connections ('sweepolet') may be used.

Full consideration shall be given to possible sectional distortion when fully welding out weldolets on thin wall pipe.

Extruded headers designed to the relevant code shall be acceptable. Site fabrication shall not be acceptable.

Proprietary tees having oversized bodies and perforated or slotted internal liners corresponding with the pipe run should generally be used for branch connections in pipelines where spheres will be used.

The use of vents, drains and other similar connections to the pipeline should be avoided wherever possible.

(Additional to [BS 8010](#) para 2.8.3.7)

2.8.3.9 Closures

End closures for pig traps shall be designed and manufactured in accordance with BP Group [GS 143-1](#).

Flat, ellipsoidal, spherical and conical closure heads should be designed in accordance with BP Group [GS 146-2](#).



(Substitution for [BS 8010](#) para 2.8.3.9)

See Appendix C for Commentary.

2.8.4 Valves

For pipelines to be pigged or sphered, full-bore valves shall be used. For pipelines which will not be pigged, and for manifolds and associated piping, reduced bore valves may be used.

Flanges integral with the valve shall comply with the design of the mating pipeline flanges.

The requirements for handling the fabricated valve assembly shall be considered in selecting the wall thickness of valve pup or transition piece.

Pup or transition pieces shall be welded to the valve by the valve manufacturer.

Check valves should be avoided in pipelines that are to be pigged. Where there is a requirement for check valves, the design shall be such that the valve will pass pipeline pigs without hindrance or damage.

Valves shall be either pipeline gate valves or ball valves.

Valves with PTFE or similar trim should not be specified for duties in which particulate matter (e.g. sand or scale) is present.

Pipeline valves shall be maintainable and have a minimum number of bolted body joints. Top entry valves with welded ends are preferred

Where provision for removal of valves is required, the ends shall be flanged or have proprietary connectors. The piping design shall include provision for the spreading of flanges for the removal of valves.

Gate and ball valves should have block and bleed connections to allow the integrity of seals and stem packing to be checked.

Double disc gate or ball valves may be considered for vent and drain duty and should be designed in accordance with [API Spec 6D](#) and [API RP 6F](#). They should be threaded or flanged at the outlet to permit plugging when not in use.

(Additional to [BS 8010](#) para 2.8.4)

In the selection of valves the following points should be taken into consideration:-



- (i) *When a valve is required to be fitted with an actuator, the acceptable effective operating time may influence the choice between a gate or ball valve.*
- (ii) *For small-bore hand operated valves, top entry ball valves are more easily operable.*
- (iii) *Large-bore gate or through-conduit valves which protrude above the ground may present more maintenance and operating difficulties than ball valves. Ball valves may also offer advantages where space is limited.*
- (iv) *Specific attention should be given to ball and stem packing properties, or the possible need for renewal, when handling products with scouring properties.*
- (v) *Valve stations for land pipelines should be protected by security fences and sited for ease of access compatible with security. Valves should also be lockable.*

In certain circumstances, valves may be installed below ground in impervious pits; the access to the pit should be lockable.
- (vi) *Mainline valves, other than ball valves, should be designed to enable both seats to seal, thereby allowing venting of the body to check valve integrity and offer 'double block and bleed' facility.*

2.8.5 Pig Traps

Pig traps shall be designed and manufactured in accordance with BP Group [GS 143-1](#).

(Substitution for [BS 8010](#) para 2.8.5)

Requirements for the design of the pigging system are given in Appendix C of this document.

(Additional to [BS 8010](#) para 2.8.5)

Guidance on the design of pig traps is given in Appendix C.

2.8.6 Slug Catchers

2.8.6.1 Vessel Type Slug Catchers

The design of vessel type slug catchers shall be in accordance with BP Group [GS 146-2](#).

(Substitution for [BS 8010](#) 2.8.5)



2.9 Pressure, Thermal and Other Stress Criteria

2.9.2 Hoop Stress

The design thickness is the minimum wall thickness of the pipe based on pressure containment and excludes manufacturing and corrosion allowances.

(Additional to [BS 8010](#) para 2.9.2)

2.9.3 Expansion and Flexibility

2.9.3.3 Nominal wall thickness (including any corrosion allowance) shall be used to calculate the pipe stiffness for use in expansion and flexibility calculations.

The stress checks shall be performed for both the nominal wall thickness and for the nominal wall thickness minus the corrosion allowance. These two conditions are taken to represent the pipe in its as-built condition and in its corroded condition.

(Additional to [BS 8010](#) para 2.9.3.3)

3. MATERIALS

3.1 General Requirements, Materials and Dimensional Standards

Materials in contact with the fluid in sour service shall be in accordance with BP Group [GS 136-1](#).

(Additional to [BS 8010](#) para 3.1)

Material properties are to be selected for the full range of temperatures that the material will experience during its design life and the effects of corrosion and erosion. Due regard should also be given to the effect of low temperature caused by depressurising a gas pipeline. It should be noted that the design basis for the upstream and downstream connecting facilities may require the capability for rapid depressurisation of the plant pipework and pressurised equipment up to the pipeline ESD valves.

Where pipeline materials and welding procedures are to be suitable for resisting cracking in the presence of H₂S and free water, reference is to be made to the latest version of BP Group [GS 136-1](#).

Where free water is present in a pipeline, the possibility of internal corrosion due to dissolved CO₂ must be considered. Corrosion can be controlled by the use of suitable pipeline materials (including the use of extra wall thickness) or by the use of corrosion inhibitors if conditions are suitable for their application. Internal coatings or internal cladding with metallic or organic materials may also be considered.



The use of protective treatments containing zinc is prohibited for the internal protection of pipelines and any ancillary equipment used for the transport of aviation fuels. The use of copper, copper alloys, or cadmium plated materials should be avoided wherever possible. In the case of ancillary equipment for the injection of AL-38 corrosion inhibitor, (which is an additive used in certain aviation fuels), the use of copper, copper alloys, aluminium alloys containing more than 4% copper, zinc or zinc alloys is prohibited.

3.3 Pipe

3.3.1 Specifications

Pipe shall conform to the requirements of BP Group [GS 142-1](#), [142-2](#) or [142-3](#) on as appropriate.

(Substitution for [BS 8010](#) para 3.3.1)



TABLE 4**MATERIAL SPECIFICATION**

Title	Number
Pipe:	
Submerged Arc Welded Pipe to API 5L	BP Group GS 142-1
Seamless Pipe to API 5L	BP Group GS 142-2
Electric Resistance Welded Pipe To API 5L	BP Group GS 142-3
Materials for Sour Service to NACE Std MR0175-90	BP Group GS 136-1
Fittings, flanges and gaskets:	
Pipe Line Flanges	BP Group GS 142-4
Pipe Line Fittings	BP Group GS 142-5
Gaskets and Jointing	BP Group GS 142-7
Bolting:	
Bolting for Flanged Joints (Unified Inch Series)	BP Group GS 142-9
Structural materials and pressure vessels:	
Pig Launchers and Receivers	BP Group GS 143-1
Unfired Pressure Vessels	BP Group GS 146-2

(Additional to [BS 8010](#) table 4)

4. CORROSION PROTECTION

4.2 External Corrosion

4.2.2 External Coatings for Buried Pipelines

Buried pipelines shall be externally protected in accordance with BP Group [GS 106-3](#).

(Substitution for [BS 8010](#) 4.2.2 2nd para, 1st sentence)

Thermal insulation applied to a pipeline may not provide adequate protection against external corrosion. Where necessary, a protective coating suitable for the temperature duty should be applied to the pipe prior to the application of the insulation.

4.2.3 External Coatings for Above Ground Pipelines

Above ground pipelines shall be externally protected in accordance with BP Group [GS 106-2](#).

(Substitution for [BS 8010](#) para 4.2.3)

4.3 Internal Corrosion

4.3.1 General

When designing for corrosive duty consideration should be given to one or more of the following measures to overcome excessive internal corrosion of the pipe wall:

- (i) *Corrosion inhibition by continuous or batch treatment.*
- (ii) *Internal coatings.*
- (iii) *Internal corrosion allowance.*
- (iv) *Internal cladding with corrosion resistant alloy or organic liner.*
- (v) *Solid corrosion resistant alloy.*

Under certain conditions, microbially induced corrosion may occur, e.g. in pipelines transporting water or crudes containing water. There may be a requirement to monitor sulphate reducing bacteria (SRB) and their effect on pipeline corrosion. Injection of biocide may be required where SRB are active in causing corrosion.

Consideration may be given to the application of a thin film of epoxy primer (50-75 microns) immediately after blast cleaning to prevent corrosion during the period up to commissioning.

For guidance on corrosion monitoring, reference may be made to BP Group [RP 6-1](#)



5. TERMINALS AND INTERMEDIATE STATIONS

5.3 Hazardous Area Classification

Hazardous area classification shall be in accordance with BP Group [RP 44-6](#).

(Additional to [BS 8010](#) para 5.3)

5.5 Vibration Resonance and Noise

The evaluation of noise from a site shall be in accordance with BP Group [RP 14-1](#).

(Additional to [BS 8010](#) para 5.5)

5.8 Safety Systems

5.8.2 Pressure Control and Pressure Relief

Overpressure protection systems shall conform to the requirements of BP Group [RP 44-1](#)

Where a standby pump is installed in a series arrangement, the design shall include means to ensure that the spare pump cannot be started when all other pumps are running.

(Additional to [BS 8010](#) para 5.8.2)

5.8.5 Emergency Shutdown Facilities

Emergency shutdown facilities shall conform to the requirements of BP Group [RP 30-2](#).

(Additional to [BS 8010](#) para 5.8.5)

6. CONSTRUCTION

6.1 General

The right of ingress to and egress from the right-of-way should normally be limited to points where such right-of-way intersects public roads.

Particular attention should be given to the problems of containing farm pests and diseases. This will not only involve special fencing but also vehicle washing, etc.



6.4

Setting Out and Surveying for Bends

(i) Temporary Gates

Before entering upon any property, a suitable temporary gate in each fence crossed by the pipeline right-of-way should be installed, except where special restrictions require that fences should not be disturbed. No permanent fence should be cut without first securing and tying off between the limits of the gap so that no permanent damage shall result.

Openings should be of sufficient width to allow passage of construction equipment and material, but should not exceed the width of the right-of-way specified. The gates should be kept securely closed at all times except during passage of personnel and equipment.

If special conditions require, the contractor may either tunnel under the fence without disturbing it, or take an entire section down and rebuild it after construction operations are completed.

(ii) Temporary Fencing

During construction of the pipeline and before any work has commenced, the right-of-way should normally be fenced off. Stockproof fencing should meet the alternative requirements for cattle, horses, sheep or pigs. Accredited herds may require double fencing. Where land is cultivated, the owner or occupier may accept posts and rope for delineation.

Access through the right-of-way for the public and occupiers must be provided as required by local conditions and regulations.

(iii) Clearing

All trees, brush, hedges, fences, debris and loose rocks must be cleared from the right-of-way and properly disposed of before grading.

(iv) Grading

Grading and clearing of the right-of-way should be performed in such a manner as to reduce interference with existing natural drainage. Where terracing or diversion dams have been cut, the ground should be completely restored to its original state as soon as lowering and backfilling is completed. All grading should be finished to maintain the original drainage or water flow conditions as nearly as practicable, and should conform to regulations of the government, or local or other authorities having legal jurisdiction. Grading should be performed so that the ditching operation can be carried on to provide a suitable ditch for the laying of the pipe to conform to the requirements and specifications for ditching. Where necessary, temporary bridges should be constructed.

(v) Top Soil and Turf

All top soil should be excavated for the width of the trench and should be kept separate. For the width of the trench, all true turf should be cut, rolled and stacked for subsequent replacement.



In some cases it will be necessary to remove top soil completely from the working width.

Top soil should be replaced in the original position after completion of pipelaying operations.

6.5 Handling and Storage of Pipe

Pipe shall not be allowed to drop or strike objects which will damage it, but shall be lifted or lowered from one level to another by suitable equipment. Wide canvas slings or special lifting hooks equipped with cradles to fit the curvature of the pipe should be used.

In the handling or storage of pipe, suitable equipment and procedures shall be used to prevent distortion, flattening, denting, scoring, corrosion or other damage. Pipe stacking height, supporting blocks and bearers shall be selected to prevent damage to the external pipe coatings.

For high ambient temperatures, special protection should be provided to prevent softening of bituminous type coatings resulting in damage when handling. For very low ambient temperatures, special protection should be provided to avoid embrittlement and cracking of bituminous type coatings.

(Additional to [BS 8010](#) para 6.5)

6.6 Pipe Stringing, Field Bending and Swabbing

During field bending of pipe, a straight length of at least 2 diameters should be left at each end and the bend should not include a circumferential butt weld.

When bending coated pipe, cracking or disbonding of bituminous coatings may be caused unless the pipe and coating are sufficiently pre-warmed. After bending, the pipe coatings shall be inspected for damage.

(Additional to [BS 8010](#) para 6.6)

6.7 Pipe Inspection

All dents which exceed a maximum depth of 6 mm in pipe up to 300 mm nominal diameter and dents which exceed 2% of the nominal diameter for pipes larger than 300 mm should be removed by cutting out the damaged portion of pipe as a cylinder. Insert patching and pounding out of the dent shall not be permitted

(Additional to [BS 8010](#) para 6.7)



For guidance on assessment of defects, refer to [ANSI/ASME B31.4](#). However, minimum pipe wall thickness rather than nominal wall thickness should be used in the relevant equations.

6.8 Welding

6.8.1 General

Welding and the qualification of welding procedures and welding operators shall be performed in accordance with BP Group [GS 118-10](#).

Where statutory regulations require that the pipeline is welded in accordance with [API Std 1104](#), BP Group [GS 118-9](#) shall be used.

Fabricated pipework, not forming part of the pipeline, shall be welded in accordance with of BP Group [GS 118-5](#) or [118-6](#), depending on the material compositions involved.

Due consideration shall be given to the avoidance of preferential weld corrosion in the selection of weld metal.

(Substitution for [BS 8010](#) para 6.8.1)

6.8.3 Welding Inspection

Welding inspection shall be performed in accordance with the appropriate BP Group Specification as identified in the specifications referenced in section 6.8.1 of this Recommended Practice.

(Additional to [BS 8010](#) para 6.8.3)

6.9 Joint Wrapping and Trench Excavation

The trench depth shall be over excavated by a minimum of 100 mm.

The minimum separation between the outer surfaces of the pipeline coatings in a multi pipeline trench should be 400 mm.

If closer spacings are to be used, consideration should be given to the provision of adequate access between the pipelines for manual back-filling, inspection and repair activities.

(Additional to [BS 8010](#) para 6.9)



(i) Location

The ditch must be dug on the line as staked out. The delineated area should include all excavation, whether by ditching machine, power shovel, hand blasting, or other method necessary to prepare the ditch for the pipe.

(ii) Minimum Ditch Dimensions

The ditch should be finished to provide the specified cover over the pipe. The minimum width of the trench is normally 300 mm greater than the nominal pipeline diameter.

The ditch may be dug to such additional depth and width as will ensure the finished ditch meets the specified dimensions. The depth of the ditch should be measured from the average level of the original ground or the grade whichever is lower, on the two sides of the ditch. The width stated should be measured at the bottom of the ditch.

(iii) Depth of Burial

Special consideration should be given to areas with deep drains.

(iv) Hand Ditching

In cases where valuable growing timber is encountered in the right-of-way and in locations where the use of ditching equipment may result in unnecessary damage or injury to the property crossed by the right-of-way, the ditch should be excavated by hand.

(v) Blasting

When blasting is necessary to grade the right-of-way, it must be effected in accordance with the requirements of local authorities. Occupants of nearby buildings, stores, houses, or places of business must be notified in sufficient time to protect any livestock nearby before the work is done. Inspectors must be present during blasting. Where necessary, shots should be blanketed to prevent damage to nearby structures, telephone, telegraph and power lines.

(vi) Drainage Improvements

Where pipelines are laid in agricultural land which has drainage problems, consideration should be given to landowners who have plans to improve drainage at a later date by excavating new drainage ditches. These are not infrequently more than 1 m deep, and in such circumstances greater depths of cover will be needed.

(vii) Land Drains

Where drain tiles are encountered, the ditch should be dug so that the pipeline may be laid over or under such tiles with a minimum clearance of 100 mm. When a drain tile is damaged, cut or removed, it should be temporarily repaired immediately in such a manner that the tile can function properly. At the time such a tile is damaged, the location must be clearly marked. These markers must be kept in place and should not be

removed, except by the tile repair crew after the tiles have been permanently repaired and the repairs have been inspected and approved by the landowner or his agent, and the inspector.

Consideration should be given to using white plastic mesh or suitable markers laid over pipelines in areas potentially liable to third party excavation.

6.11 Lowering

Slings should be made of canvas or equally non abrasive material and of adequate width to prevent damage to external pipe coatings.

(Additional to [BS 8010](#) para 6.11)

6.12 Backfilling and Reinstatement

Backfilling operations should closely follow lowering of the pipe.

The trench shall be backfilled around and over the pipe with granular material, or readily compactable material free from tree roots, vegetable matter, building rubbish, frozen soil and clay lumps greater than 75 mm or stones greater than 12 mm in size. The material shall be compacted in even thickness layers on both sides of the pipe and to 300 mm above the crown of the pipe. When sand is used extensively for back fill, stabilising barriers, drainage, or both, should be provided where necessary to prevent wash out on steep sections.

The remainder of the trench shall be backfilled with selected excavated material free from boulders, large stones, scrap metal, electrode stubs or other materials capable of damaging the coating or pipeline.

Any surplus material removed from the site shall be subsoil and not top soil.

The replaced soil should be compacted by rolling with the tracks of mechanical equipment or by tamping. A slight crown should be left over the trench to allow for settlement.

(Additional to [BS 8010](#) para 6.12)

(i) Protection of the Pipe

As an alternative to sand padding or selected backfill, an improved 'Rockshield' may be used. Rockshield 4.8 mm thick and securely fastened around the pipe is considered adequate. Consideration should be given to cathodic protection shielding in the selection of 'Rockshield'.

(ii) *Backfilling*

All backfills should be crowned to a height of not less than 200 mm and not more than 300 mm above the adjacent ground surface, except through irrigated farm land. Through such farm land, all excavated material should be returned to the ditch. The finished backfill should be sufficiently level to permit normal irrigation, even if harrowing, discing or hand raking is required to accomplish this. Where the use of borrowed material is necessary to crown the backfill to the required height, the manner and method of acquiring this must be approved. All terraces, and sides of drainage or irrigation canals, and all roads and highways that are cut should be backfilled in 150 mm layers and each layer thoroughly tamped by hand or machine to provide a good bond between the undisturbed sides of the ditch and the new backfill material.

When backfilling on hillsides or sloping ground, furrows or terraces should be provided across the pipeline ditch to direct the flow of water onto the natural drainage courses and away from the pipeline ditch. In no case should surface drainage be diverted into channels other than the ones they followed before the line was laid.

All backfilling across the drainage ditches, irrigation ditches, terraces, railroads, public highways, private drives, trails, roads or streams should be done in a manner satisfactory to any private, governmental or local authority having jurisdiction. Road crossings should be backfilled immediately after the pipeline has been laid in order that bridging may be removed.

Manual backfilling should be used where mechanical equipment would damage buildings or structures.

6.13 *Coating Survey Following Construction*

Following repair to coatings found to be damaged on the coating survey, all visual inspection and holiday testing should be repeated including a repeat coating survey (e.g. Pearson survey) of the section repaired.

6.14 Crossings

The pipeline should be laid below all existing services. A minimum clearance of 300 mm should be provided, with a concrete slab installed between the pipeline and other services, extending 1 metre on either side of the pipeline.

In those instances where it is required for the pipeline to be laid above existing services, this shall be taken as a special case with the crossing design developed in consultation with the operator of the crossed services. A minimum clearance of 300 mm should be provided between the top of the existing service and the pipeline.

A concrete slab shall be installed between the pipeline and other services extending 1 metre on either side of the pipeline.



(Additional to [BS 8010](#) para 6.14)

For ditch crossings, ensure that the 'true clean bottom of the ditch' has been identified.

6.15 Cleaning and Gauging

A gauging pig should be propelled through the pipeline by the water being used to fill and test the pipeline. The use of air to propel the gauging pig is prohibited. However, air may be used to propel swabbing pigs when dewatering pipelines for the transportation of gases.

The pipeline shall be gauged with an aluminium gauging plate of diameter not less than 95% of the minimum internal diameter of the pipeline.

(Additional to [BS 8010](#) para 6.15)

7. QUALITY ASSURANCE/QUALITY CONTROL

7.1 General

The application of quality assurance techniques to the design, construction and testing of pipelines shall be in accordance with [ISO 9001](#).

(Additional to [BS 8010](#) para 7.1)

7.6 Records and Document Control

7.6.6 Retention of Documents and Records

All procurement/construction certification and NDT records shall be prepared for retention for the life of the pipeline.

(Additional to [BS 8010](#) para 7.6.6)

8. PRESSURE TESTING

8.1 General

8.1.1 General

The subdivision of a pipeline into sections for testing purposes will depend upon a number of factors which may include:



- (i) Whether or not the pipeline has been designed as a number of sections.
- (ii) The location of adequate supplies of suitable water and water disposal.
- (iii) Elevation differences along the route.
- (iv) The relative density of the fluid to be conveyed by the pipeline.
- (v) The possibility of a future change of use from oil to gas / or vice versa.
- (vi) The possibility of the future installation of additional pumping or compressor stations.

The test pressure as calculated, is applied at the highest point in the test section. The lower elevations will therefore be subjected to a higher test pressure.

If main line valves are to be used to divide a pipeline into sections care must be taken to ensure that the differential pressure across the valve does not exceed the maximum pressure specified for the valve seats.

The valve body should be capable of withstanding the test pressure. If the valves cannot be included in the test, then temporary closures should be fitted to the pipeline, and then removed on the completion of the test.

Some valve designs may require the valve to be partially open during hydrostatic testing to allow access of test water into internal spaces. In these instances care should be taken to ensure that the valve is fully opened before pigging is performed.

8.2 Safety Precautions

8.2.3 Use of Temporary Pig Traps

All vents should remain open whilst opening the launcher or receiver.

Pipeline pressure should be reduced to atmospheric pressure and trap vents opened before cutting or otherwise disconnecting the temporary trap from the pipeline.

(Additional to [BS 8010](#) para 8.2.3)

8.4 Test Pressure

8.4.1 Hydrostatic Test Pressure

Test pressures producing membrane stresses of 95% of the specified minimum yield stress are quite usual.



8.5 Test Procedures

8.5.1 Hydrostatic Testing

Should the test programme require that the test water is to be resident in the pipeline for extended periods then consideration should be given to water treatment by the addition of biocides, oxygen scavenger, etc. to reduce potential internal corrosion.

8.5.1.2 Line Filling

All pressure limiting devices, relief valves, pressure regulators and controls should be removed and the connections blanked off before hydrostatic testing.

(Additional to [BS 8010](#) para 8.5.1.2)

8.5.1.3 Air Content

The quantity of air in the pipeline during hydrostatic testing should not be more than 0.2% of the total fill volume of the pipeline section under test.

(Additional to [BS 8010](#) para 8.5.1.3)

8.7 High Level Testing

Publication IGE/TD/1 of the Institution of Gas Engineers gives details of high level testing as applied to gas pipelines in the UK.

8.9 Repairs to Test Failures

Weld repairs shall be undertaken in accordance with BP Group [GS 118-10](#) when the repair is to be to [BS 4515](#) and BP Group [GS 118-9](#) when the repair is to be to [API Std. 1104](#).

(Substitution for [BS 8010](#) 1st para 8.9)

9. COMMISSIONING

9.4 Commissioning

9.4.1 Commissioning of Category B Substance Pipelines

If it is necessary to displace air in the pipeline by the category B substance to be conveyed, care shall be taken to prevent the possibility of compression-ignition.

(Additional to [BS 8010](#) para 9.4.1)



9.4.3

Commissioning of Category D Substance Pipelines

Displacement of test water with high pressure hydrocarbon gas or well fluid (including oils) can result in the formation of solid hydrates blocking the line.



DEFINITIONS AND ABBREVIATIONS**Definitions**

Standardised definitions may be found in the BP Group RPSEs Introductory volume.

Abbreviations

ANSI	American National Standards Institute
API	American Petroleum Institute
BS	British Standard
DN	Nominal diameter
ESD	Emergency shutdown
IP	Institute of Petroleum
NDT	Non destructive testing
NPS	Nominal pipe size



LIST OF REFERENCED DOCUMENTS

This is a list of documents which are not already listed in [BS 8010](#), Part 2, Section 2.8. A reference invokes the latest published issue or amendment unless stated otherwise.

Referenced standards may be replaced by equivalent standards that are internationally or otherwise recognised provided that it can be shown to the satisfaction of the purchaser's professional engineer that they meet or exceed the requirements of the referenced standards.

ISO 9001	Quality systems - Model for quality assurance in design/development, production, installation and servicing
BS 8010	Code of Practice for Pipelines, Part 2 Pipelines on Land: Design, construction and installation, Section 2.8, Pipelines in steel for oil and gas
BP Group RP 6-1	<i>Guide to Corrosion Monitoring</i> (was BP RP 50)
BP Group RP 14-1	Noise Control (was BP CP 2)
BP Group RP 44-1	Overpressure protection systems (was BP CP 14)
BP Group RP 44-6	Area classification to IP 15 (was BP CP 39)
BP Group RP 30-2	Protective instrumentation systems (was BP CP 48)
BP Group GS 106-2	Painting of metal surfaces (was BP Std 141)
BP Group GS 106-3	External coatings for steel transmission pipelines (was BP Std 144)
BP Group GS 118-5	Carbon and carbon manganese steel pipework (was BP Std 167 Part 1)
BP Group GS 118-6	Alloy steel pipework (was BP Std 167 Part 2)
BP Group GS 118-9	Welding of transmission pipelines to API 1104



	(was BP Std 192 Part 2)
BP Group GS 118-10	Welding of transmission pipelines to BS 4515:1984 (was BP Std 192 Part 1)
BP Group GS 136-1	Materials for sour service to NACE Std MR0175-90 (was BP Std 153)
BP Group GS 143-1	Pig launchers and receivers (was BP Std 159)
BP Group GS 142-1	Submerged arc welded pipe to API 5L (was BP Std 166 Part 1)
BP Group GS 142-2	Seamless pipe to API 5L (was BP Std 166 Part 2)
BP Group GS 142-3	Electric resistance welded pipe to API 5L (was BP Std 166 Part 3)
BP Group GS 142-4	Pipeline flanges (was BP Std 166 Part 5)
BP Group GS 142-5	Pipeline fittings (was BP Std 166 Part 6)
BP Group GS 142-7	Gaskets and jointing (was BP Std 173)
BP Group GS 142-9	Bolting for flanged joints (was BP Std 175)
BP Group GS 146-1	Vessels to BS 5500:1989 (was BP Std 194 Part 1)



PIGGING SYSTEMS**C1 SCOPE**

This Appendix provides requirements for the design of permanent pigging systems for onshore applications.

C2 SYSTEM DESIGN**C2.1 General**

Pig traps that are permanently installed in a pipeline system shall be designed for the maximum operating conditions and the test pressure of the system. Since they have to be opened whilst the pipeline is in service, they should always be installed in conjunction with a main block valve, and be provided with suitably valved connections to allow for the necessary operational activities.

Receivers shall be sized to accommodate initial pipeline debris during final system hydrostatic testing and commissioning and also wax removal by pig runs during operation. For gas lines, receivers shall also have provision for disposing of water-methanol slugs, rust and mill scale from brush pig runs and any residue from inhibitor slugs.

Pig traps are considered to be part of the pipeline and should therefore be designed to take the pipeline hydrostatic test and operating pressures.

Consideration may be given to the case for a temporary receiver to catch initial debris to avoid damage to ESD valves and isolation valve seals.

C2.2 Vessel Design Code

Pig traps shall be designed in accordance with BP Group [GS 143-1](#).

C2.3 Valves

In the selection of isolation valves to be used in a pig trap system, consideration should be given to the following:-

- (a) There may be a need for bubble-tight shut off when the trap is open.
- (b) Some operational situations may call for double block and bleed facilities.



- (c) Particularly at the end of a pig run, the pipe is likely to be contaminated with scale and other hard debris which is liable to cause seat damage.
- (d) It is essential that pigs and spheres should pass without obstruction. Care should be taken to ensure that the port design is full-sized and smoothly contoured. Attention is drawn to any internal bypass passages which may cause loss of driving force.
- (e) Actuator operation, including ESD may be essential.
- (f) In some applications, size and weight are an important consideration.

The choice of single or double isolating valves between the pigging facilities and the pipeline should take into consideration an evaluation of the likelihood and the consequences of an unplanned shutdown for valve maintenance. The frequency at which pigging is needed is also an important factor.

If the temporary loss of availability can be tolerated, a single valve may be acceptable. Local operational practices shall be taken into account and the possibility of obtaining double block and bleed facilities in a single valve should not be overlooked.

Where double isolation valves are installed on a pig trap, and where local safe practice requirements allow, the outer valve shall be permanently open and only used during pigging operations if the other, normally operating valve is damaged. A vent between the two valves will allow double block and bleed for safe access to the trap during maintenance.

An additional factor which could influence the choice of single or double isolating valves would be the need to blow down completely the contents of the pipeline

Where a pig trap is transportable, double valve isolation should be provided.

C2.4

End Closures

End closures on traps shall be provided with a safety device so that the doors cannot be inadvertently opened while there is internal pressure in the trap. On smaller flowlines where the trap is only intended for occasional use, the end closure may be replaced by a blind flange.



C2.5 Interlocks

A valve interlock system shall be provided to ensure that the pig launching and receiving operations are undertaken in the correct sequence and that the valves are not operated when the door is open.

It is recommended that interlocks are limited to the isolating valve, mainline valve, bypass valve, vent and drain valve(s) and closure door.

Care shall be taken to ensure that the selected equipment is robust and reliable.

Where pig traps are designed and constructed for remote operation, the design should incorporate a means of preventing remote operation while the trap is in an unsafe condition.

C2.6 Pig Indicators

Where an intrusive pig indicator is selected it shall be of a trigger or plunger type. The design should allow for particulate matter that may be present in the pipeline, particularly in gas pipelines.

It is recommended that, for reliability and confirmation of signal, two indicators are installed at the chosen position. Indication at the pig trap and at the adjacent pipeline is recommended.

During installation and initial set up of intrusive type indicators, care shall be taken to ensure the correct protrusion into the pipeline bore.

The distance between pig indicator and mainline valve shall be selected to ensure that the pig has cleared the valve on activation of the pig signal.

C2.7 Vents and Drains

Consideration shall be given to provision of double vents and drains to allow more controlled venting, better drainage and to reduce the risk of blockage. One vent should be located near to the end closure and one close to the nearest mainline isolation valve to prevent differential pressure occurring across a pig or sphere lodged in the neck of the pig trap.

The discharge of any vent or drain should be sited so as to minimise any hazard due to the toxic or flammable nature of the released material.

C2.8 Intelligence Pig Capability

The design of the trap and layout of the pigging facilities should take into account the likelihood that on-line inspection will be required during the life of the pipeline. Dimensions should be based on handling the longest intelligence pigs in current use.

When operational pigging is not required, suitable pipework arrangements may be made to allow use of temporary pig traps for intelligence pigging.

C2.9 Pressure Indicator

A pressure indicator, capable of measuring the full pressure range to be expected during operation and test, shall be positioned adjacent to, and visible from, the closure.

Consideration shall be given to providing a second pressure indicator close to the mainline isolation valve to check that venting has been successfully carried out and that a pressure differential does not exist across a pig which may be lodged in the neck of the trap.

For high pressure systems, where a full range gauge may have inadequate accuracy or definition close to zero, consideration should be given to the installation of an additional, suitably rated, low range gauge.

In some cases an additional pressure switch to interlock with the door mechanism should be provided.

C2.10 Thermal Relief

Thermal relief is not normally installed on a pig trap unless it is required by the local regulations or particular design criteria.

As pig traps are designed to the same operational requirements as the pipeline of which they form a part, over pressure due to operational loads is not a risk and will not require pressure relief devices.

The requirement for thermal relief should be assessed on a case-by-case basis. Because relief valves are a potential source of failure, they should only be fitted when there is a creditable risk of overpressure.

In general, solar radiation does not present a problem provided that the pig trap is located in a freely ventilated area or an area shaded from direct sunlight. When assessing the risks of solar radiation, the nature and temperature of the fluid transported in the pipeline should be considered. The risk of over pressure due to heat from external fire sources in the vicinity of the pig trap should be considered. When a pig trap cannot be located away from the potential fire or heat sources, then the fitting of a relief valve should be considered.

C2.11 Site Location and Surrounding Area

Where possible, the closure end of the trap should point away from process plant, tankage, buildings, etc.

Adequate area shall be provided around the pigging equipment and pipework to allow safe access for operational, inspection and maintenance activities.

Adequate ventilation (natural or otherwise) shall be provided to displace all gases and vapours that may be emitted during the pigging operations.

Handling equipment and craneage shall be provided for the safe handling of the anticipated range of pig types. Pigs and spheres for the larger diameter lines may require permanent mechanical handling equipment. The design of this equipment should be based on a technical and economic assessment of the frequency and type of pigging operations.

A pig/sphere storage area is to be provided in the vicinity of the pig trap offering the appropriate environmental protection. The frequency of supply should be considered when sizing the storage area.

Consideration should be given to the safe disposal of all substances from the pig trap following a pigging operation, including scale, debris and wax.

C2.12 Operational Standby

The end closure door shall be kept closed during standby.

The intended condition of the pig trap during those periods when pigging operations are not being conducted may impose design requirements. There are a number of safe standby approaches adopted by pipeline operators, the selection being dependent upon the fluid being transported and operator experience. Typical approaches include the following:-

- (i) *Pig trap is left full of water and depressurised.*
- (ii) *For a multi-product pipeline the normal flow is routed through the pig trap to avoid contamination of product batches. In this way the pig trap is self purging.*
- (iii) *Pig trap left open to a blowdown drum with an automatic discharge operated by level switch.*
- (iv) *Pig trap is left pressurised with an inert gas.*

C2.13 Purging

When appropriate, particularly when toxic materials are involved, provision should be made to purge the trap before opening.

C2.14 Small Bore Connections

Vent, drain and purge connection shall have double isolation.

Consideration shall be given to using non-return valves on vents and drains where downstream pipework or equipment is connected to other process areas to prevent backflow of hydrocarbon or other hazardous fluids.

(Additional to [BS 8010](#))

C3 OPERATION

C3.1 Operating Procedures

Detailed operating procedures should be developed for all anticipated pigging operations.

All pigging operations should be conducted by a minimum of two authorised personnel who are fully familiar with the operating procedures. These authorised personnel shall be fully familiar with the design and function of the end closure mechanism and be capable of identifying deficiency in the mechanism due to wear or component failure.

C3.2 Notification

Formal notification should be given of all pending pigging operations describing type of operation, pig type, number and anticipated time of arrival of the pig at the downstream facility.

C3.3 Vents

No attempt should be made to open a pig trap until the internal pressure in the pig trap has been reduced to atmospheric conditions.

Vents should be designed to remain open whilst opening the pig trap, provided the vents are direct to atmosphere. In a closed vent system, the vent valve should be closed before opening the door.

C3.4 Purging

Where appropriate, particularly when toxic materials are involved, provision should be made to purge the trap before opening. In certain circumstances, the use of personal protective equipment should be considered.

If the substance collected by the pigging operation contains pyrophoric materials or similar then the pig trap should be flushed with water before opening.



After each pigging operation, closure seals should be inspected, and if necessary, replaced before sealing the pig trap.

C3.5 *Intelligent Pigging*

When preparing to use an intelligence pig, detailed operating procedures should be developed for all necessary cleaning, gauging and inspection operations.

The pipeline to be inspected should be gauged and cleaned in accordance with the requirements of the intelligence pig operator to ensure a safe and effective inspection operation.

Contingency plans for the necessary action in case the pig becomes stuck should be developed. In appropriate cases, these should include provision of standby equipment for emergency intervention.

C4 *MAINTENANCE*

C4.1 *Inspection*

The pig trap and associated facilities should be regularly inspected and the condition reported.

Certified records should be kept of all inspections performed.

Particular attention should be given to inspection of the end closure mechanism.

C4.2 *Maintenance*

The pig trap and associated facilities should be included in a planned maintenance system co-ordinated with the regular inspection programme.

A maintenance manual should be held on site, containing sections on design, implementation and execution of the maintenance function. Reference material included in the maintenance manual should include equipment lists, manufacturers' drawings and literature and a list of spares.

The maintenance documentation should also include work scheduling of individual items of equipment and historical records.

Inspection (visual and NDT) and maintenance of external screw thread type end closures are of particular concern because of their vulnerability to abuse, wear and tear, environmental deterioration and design complexity.



