

Code of practice for

Pipelines —

Part 2: Pipelines on land: design,
construction and installation —

Section 2.4 Prestressed concrete
pressure pipelines

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- British Compressed Gases Association
- British Gas plc
- British Plastics Federation
- British Precast Concrete Federation Ltd.
- Concrete Pipe Association
- Country Landowners' Association
- County Surveyors' Society
- Department of Energy (Petroleum Engineering Division)
- Ductile Iron Producers' Association
- Electricity Supply Industry in England and Wales
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- Federation of Civil Engineering Contractors
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- National Farmers' Union
- Pipeline Industries Guild
- Royal Institution of Chartered Surveyors
- Society of British Gas Industries
- UK Offshore Operators' Association Ltd.
- Water Authorities Association
- Water Companies Association
- Water Research Centre

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Foreword

This Section of BS 8010 has been prepared under the direction of the Civil Engineering and Building Structures Standards Committee. The standard is being published in four Parts to form a complete revision of all five Parts of CP 2010 as follows:

- *Part 1: Pipelines on land: general;*
- *Part 2: Pipelines on land: design, construction and installation;*
- *Part 3: Pipelines subsea: design, construction and installation;*
- *Part 4: Pipelines on land and subsea: operation and maintenance.*

The new Part 1 (which will supersede CP 2010-1:1966) is intended to contain general information which is relevant to a variety of pipelines and a variety of transported materials. It deals with those aspects of pipeline development that affect the owner and occupier of land through which the pipeline passes.

Part 2 will be divided into several Sections which will be published as separate documents as follows:

- *Section 2.1: Ductile iron;*
- *Section 2.2: Steel (for water and associated products);*
- *Section 2.3: Asbestos cement;*
- *Section 2.4: Prestressed concrete pressure pipelines;*
- *Section 2.5: Glass reinforced thermosetting plastic;*
- *Section 2.6: Thermoplastics;*
- *Section 2.7: Precast concrete;*
- *Section 2.8: Steel (for oil, gas and associated products).*

Each Section will contain information on the design, construction and installation of a pipeline in the particular material. These Sections will supersede Parts 2, 3, 4, and 5 of CP 2010.

Part 3 will include information relevant to the design, installation and commissioning of subsea pipelines in steel and other materials.

Part 4 will contain advice on the operation and maintenance of pipelines and will probably be in Sections related to the conveyed material.

This Section 2.4 supersedes CP 2010-5:1974 which is withdrawn. It deals with pressure pipelines constructed both in cylinder and in non-cylinder prestressed concrete pipes, using pipes and fittings that comply with BS 4625.

It has been assumed in the drafting of this British Standard that the execution of its provisions is entrusted to appropriately qualified and experienced people.

Attention is drawn to the principal Acts of Parliament enabling pipelines to be constructed and regulating procedures, given in Appendix A of BS 8010-1¹⁾

A British Standard does not purport to include all the necessary provisions of a contract. Users of British Standards are responsible for their correct application.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 16, an inside back cover and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

¹⁾ In preparation.

Subsection 1. General

1 Scope

This Section of BS 8010 gives design considerations and construction and installation recommendations for pressure pipelines incorporating prestressed concrete pipes complying with BS 4625 and should be read in conjunction with BS 8010-1²⁾.

This British Standard code of practice is not intended to replace or duplicate hydraulic, mechanical or structural design manuals.

NOTE 1 The numbers in square brackets in the text of this Section refer to the numbered references in Appendix B.

NOTE 2 The titles of the publications referred to in this standard are listed on the inside back cover.

2 Definitions

For the purposes of this Section of BS 8010 the following definitions apply.

2.1

pipeline

a line of pipes, of any length, without frequent branches. It does not include piping systems such as process plant piping within refineries, factories or treatment plant

2.2

prestressed concrete cylinder pipe

a welded sheet steel cylinder with steel socket and spigot rings welded to its ends, lined with concrete suitably compacted and circumferentially prestressed to withstand internal pressure and external design loads and subsequently coated with cement mortar to protect the steel cylinder and prestressing wires

2.3

prestressed concrete non-cylinder pipe

a suitably compacted concrete core longitudinally prestressed with pretensioned high tensile steel wire embedded in the concrete, circumferentially prestressed to withstand internal pressure and external design loads and subsequently coated with cement mortar to protect the circumferential prestressing wire

2.4

working pressure

the maximum sustained internal pressure excluding surge to which each portion of the pipeline may be subjected when installed

2.5

works hydrostatic proof test pressure

the internal hydrostatic pressure to be applied to every pipe at the manufacturer's works

2.6

site test pressure

the pressure to be applied to the pipeline, or sections thereof, after laying, to test its strength and watertightness

2.7

surge pressure

the maximum and minimum pressure produced by a change in velocity of a moving stream of liquid. It is at its maximum when there is a sudden stoppage such as would be caused by suddenly closing a valve or stopping a pump

2.8

stringing

the placing of pipes in line on the ground ready for laying

3 Application

The pipelines covered by this Section of BS 8010 are composed of rigid pipes with flexible joints suitable for conveying water, slurries and sludges, sewage, trade wastes and brine under pressure. Prestressed concrete pipes are manufactured to specific lengths and to suit individual requirements but cannot be cut to length on site. Special manufacture is required for closure units. Closures are effected by using closure units which include closure pipes made to the correct length for each situation. Alternatively, for cylinder type pipes only, sized and lined steel closure pipe can be supplied for cutting on site.

When used for the conveyance of sewage, reference should be made to CP 2005³⁾.

The actual service and environmental conditions should be considered in determining whether the pipe is suitable. Service conditions include working pressure, maximum and minimum operating temperatures, the extent of chemical and physical reaction between the material carried and the pipe and joint material, and the toxicity of the material carried. Environmental factors relate to the route of the pipeline and include the amount of open country or built up areas along the route, the nature of the soil, the presence of areas liable to subsidence, the existence of exposed aquifers and any other conditions which might affect the pipeline.

²⁾ In preparation.

³⁾ In course of revision and will be published as BS 8005.

When used under the conditions for which they are designed, materials in contact with or likely to come into contact with potable water should not constitute a toxic hazard, should not support microbial growth and should not give rise to unpleasant taste or odour, cloudiness or discoloration of the water (see Appendix A).

4 Safety

4.1 The recommendations of this Section of BS 8010 are considered to be adequate for public safety under conditions usually encountered in prestressed concrete pipelines.

Particular attention is called to the need to prevent damage or leakage arising from:

- a) excessive settlement, movement or erosion;
- b) applied external loads;
- c) mechanical equipment used during construction or on other works;
- d) aggressive soil conditions.

4.2 Measures to prevent damage may include:

- a) proper bedding and adequate anchoring to prevent settlement or movement;
- b) increased earth cover or concrete protection against external damage or erosion;
- c) indicating the presence of the pipeline with additional markers particularly in congested areas or areas where future development is known to be planned, and adequate marking at river and water course crossings;
- d) additional protection as recommended in **17.1**.

5 Inspection

The safety of a properly designed pipeline depends more on the standards and quality of inspection applied at all stages than on any other single feature.

Inspection starts at the factory where pipes and components are manufactured and should continue through all stages of construction. Clauses concerning the rights of inspection are given in BS 4625. Any sub-standard materials should be rejected and any faulty workmanship rectified before any further work is done.

Particular emphasis should be given to:

- a) inspection for possible damage to the pipe and any protective coating before installation;
- b) inspection of trench dimensions;
- c) inspection of the bedding of the pipeline;
- d) inspection of jointing;
- e) inspection of anchoring;
- f) testing.

Subsection 2. Materials

6 Pipes

Prestressed concrete pressure pipes should comply with BS 4625 which specifies two types namely, cylinder and non-cylinder (see 2.2 and 2.3).

7 Fittings and closure units

7.1 Fittings

Fittings for use with prestressed concrete pressure pipes should comply with BS 534 or BS 4625. Fittings may be fabricated by welding steel tube or plate or be formed from a prestressed concrete pressure pipe by including additional steel plate or tube where required.

7.2 Closure units

Closure units alone or with pipes of non-standard length are required to close gaps between adjacent sections of pipeline. These should be ordered specially to the length required.

8 Valves

8.1 Materials

All material used in valves should be compatible with the products which are to be conveyed in the pipeline. Valve bodies should be of ductile iron wherever possible.

8.2 Control valves

Valves should comply with an appropriate British Standard specification, the principal ones being:

BS 5150, *Cast iron wedge and double disk gate valves for general purposes.*

BS 5152, *Cast iron globe and globe stop and check valves for general purposes.*

BS 5153, *Cast iron check valves for general purposes.*

BS 5155, *Cast iron and carbon steel butterfly valves for general purposes.*

BS 5163, *Predominantly key-operated cast iron gate valves for waterworks purposes.*

It is recommended that the direction of rotation needed to close the valve be clockwise.

A clear indication should be given on all valves of the direction of rotation needed to close the valve. The direction of rotation should be the same for any one pipeline installation.

8.3 Air valves

Automatic air valves are available in a number of forms, the most common are single orifice, double orifice and kinetic.

Reference should be made to the manufacturer's recommendations.

9 Flanges

Flanges, where used, should comply with BS 4504-1 for steel or BS 4772 for ductile iron.

NOTE Some existing installations may have flanges complying with BS 10, but BS 10 is obsolescent and will eventually be withdrawn. There is no interchangeability between flanges complying with the requirements of BS 10 and flanges complying with the requirements of BS 4504-1.

10 Bolts, nuts and washers

Low carbon steel bolts and nuts should comply with BS 4190 and high tensile steel bolts and nuts should comply with BS 3692, minimum grade 8.8. Washers should comply with BS 4320.

11 Gaskets and joint rings

11.1 General

Elastomeric gaskets and joint rings should comply with BS 4865 and BS 2494 respectively but other materials may be used if they have been proved fit for the purpose.

The section of gaskets and joint rings which is likely to come in contact with potable water, and lubricating materials, should be incapable of permitting bacterial growth and should comply with the requirements for the effect of materials on water quality (see Appendix A).

Maximum temperature limitations apply to the use of both natural and synthetic elastomers. This will vary with the type of material used and the design of joints. The manufacturer's advice should be sought if the maximum temperature is likely to exceed 50 °C for mechanical joints or 60 °C for push-in joints.

Gaskets and joint rings should be protected from unnecessary exposure to the effects of ultraviolet radiation, light and ozone.

11.2 Flange gaskets

The dimensions of gaskets for flanges designated PN 10, PN 16, PN 25 and PN 40 should comply with BS 4865-1.

12 Materials not complying with British Standards

Fittings, valves and other products outside the range of sizes or differing in type or otherwise not complying with the recommended British Standards may be used, provided that they have at least equal strength and tightness and are capable of withstanding the test requirements of the appropriate specifications and tests recommended in this Section of BS 8010. Particular attention should be given to Appendix A.