British Standard

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BS 8010-2.5:
1989

Code of practice for

Pipelines —

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

Section 2.5 Glass reinforced thermosetting plastics

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Committees responsible for this British Standard

The preparation of this British Standard was entrusted by the Plastics Standards Policy Committee (PLM/-) to Technical Committee PLM/9, upon which the following bodies were represented:

British Gas plc
British Plastics Federation
British Plumbing Fittings Manufacturers' Association
British Valve and Actuator Manufacturers' Association
Department of the Environment (Construction Industries Directorate)
Department of the Environment (Property Services Agency)
Department of Transport
Electricity Supply Industry in England and Wales
Engineering Equipment and Materials Users Association
Health and Safety Executive
Institution of Civil Engineers
Institution of Gas Engineers
Institution of Production Engineers
Institution of Water and Environmental Management (IWEM)
National Association of Plumbing, Heating and Mechanical Services Contractors
Plastics and Rubber Institute
Plastics Land Drainage Manufacturers' Association
Royal Institute of Public Health and Hygiene
Water Authorities Association
Water Companies Association
Water Research Centre

The following bodies were also represented in the drafting of the standard, through subcommittees and panels:

Association of Consulting Engineers
British Board of Agrément
Federation of Civil Engineering Contractors
Institution of Mechanical Engineers
Pipeline Industries Guild

This British Standard, having been prepared under the direction of the Plastics Standards Policy Committee, was published under the authority of the Board of BSI and comes into effect on 31 August 1989

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Contents

Foreword

This Section of BS 8010 has been prepared under the direction of the Plastics Standards Policy Committee in support of publication under the direction of the Civil Engineering and Building Structures Standards Policy Committee of BS 8010 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.*

Part 1 (which supersedes CP 2010-1:1966) contains 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 is to be divided into several Sections which are to be published as separate documents as follows:

— *Section 2.1: Ductile iron*[1];

— *Section 2.2: Steel (for water and associated products)*;

— *Section 2.3: Asbestos cement*[1];

— *Section 2.4: Prestressed concrete pressure pipelines*[1];

— *Section 2.5: Glass reinforced thermosetting plastics*;

— *Section 2.6: Thermoplastics*;

— *Section 2.7: Precast concrete*[1];

— *Section 2.8: Steel (for oil, gas and associated products).*

Each Section will contain information relevant to 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, with Sections related to the conveyed material.

This Section 2.5 does not supersede any part of CP 2010. It deals with pressure and non-pressure pipelines constructed using glass reinforced thermosetting plastics and in particular is based on pipes and fittings that comply with BS 5480-1 and BS 5480-2, as applicable.

For supporting information not incorporated in published standards, reference is made to a bibliography provided as Appendix C.

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.

[1] Published.

Attention is drawn to the principal Acts of Parliament enabling pipelines to be constructed and regulating procedures, given in Appendix A of BS 8010-1.

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 to iv, pages 1 to 22, 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.

Subsection 1. General

1 Scope

This Section of BS 8010 gives design considerations and recommendations for construction and installation of pressure or non-pressure pipelines incorporating glass reinforced thermosetting plastics pipes and fittings complying with BS 5480-1 and BS 5480-2 as applicable. It should be read in conjunction with BS 8010-1.

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

Descriptions of types of joints are given in Appendix A and general requirements for non-metallic materials likely to come into contact with potable water are given in Appendix B.

NOTE 1 A list of documents recommended for further reading for additional information and guidance is given in Appendix C.

NOTE 2 A format for a typical summary for pipeline records and maintenance arrangements is given in Appendix D.

NOTE 3 The titles of the publications referred to in this Section are listed on the inside back cover.

2 Definitions

NOTE The meanings of terms associated with trenching are illustrated in Figure 1.

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

2.1
glass reinforced thermosetting plastics (GRP) pipe

a pipe conforming to BS 5480 and produced from thermosetting resins reinforced with glass fibres and possibly containing inert filler and aggregate

2.2
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

2.3
flexible joint

a connection that is designed to permit angular deflections or axial movement, or a combination of both, in service, without impairing the efficiency of the joint

NOTE See Appendix A.

2.4
rigid joint

a connection that is designed not to permit angular deflection or axial movement in service

NOTE See Appendix A.

2.5
self-anchoring joint

a connection that is designed to prevent separation under the axial thrust induced by internal pressure, temperature fluctuations or ground movement whilst still permitting angular deflection and/or axial movement without impairing the efficiency of the joint

NOTE See Appendix A.

2.6
site test procedure

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

2.7
stringing

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

2.8
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

2.9
working pressure

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

2.10
works hydrostatic test pressure

the internal hydrostatic pressure applied to pipes at the manufacturer's works

3 Applications

The pipelines covered by this Section of BS 8010 are generally suitable for conveying water, sewage, trade waste, slurries, sludges, brine and some chemicals. When used for the conveyance of sewage, reference should be made to BS 8005-0, BS 8005-1, BS 8005-2 and BS 8005-4. GRP pipes and fittings are particularly suitable for pipelines in locations where corrosive environments exist either internally or externally.

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 GRP pipelines, including pipelines within towns, cities, water catchments and industrial areas. Particular attention is called to the need to prevent damage or leakage arising from one or more of the following factors:

a) corrosive soil condition;

b) internal corrosion/erosion;

c) mechanical equipment used during construction or on other works;

d) ground settlement, movement or erosion;

e) any abnormal circumstances, e.g. adjacent trenching.

4.2 Measures to prevent damage may include one or more of the following:

a) use of a particular resin type and/or an external barrier layer if necessary;

b) use of a particular resin type and/or an internal liner, if necessary, and limitation of flow velocity to reduce erosion;

c) providing increased cover or a concrete cover as a protection against external mechanical damage or erosion;

d) for subsidence, additional flexible joints, anchored joints, rafts or piling;

e) 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;

f) providing protection from frost for pipelines above ground or in ducts.

5 Inspection

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

Particular emphasis is laid on the inspection for possible damage to pipes, fittings and joints before installation and for the correct bedding of the pipeline, jointing, anchoring and testing. Any sub-standard materials or workmanship should be rectified or, where necessary, rejected.

Subsection 2. Materials

6 General

A variety of resin systems and reinforcement structures may be used to make GRP pipes and fittings that comply with the requirements of BS 5480-1 and/or BS 5480-2. Different combinations will have differing properties which may make them particularly suitable for specific fields of usage referred to in clause **3** (e.g. because they are capable of deflecting to a greater extent before their long term performance is significantly impaired, or because of better resistance to cyclic stress or aggressive environments), and may be preferred accordingly.

7 Pipes

GRP pipes should comply with BS 5480-1 and BS 5480-2 as applicable.

NOTE These standards specify diameters, lengths, classification, tolerances and basic performance requirements.

8 Fittings

GRP fittings and relevant aspects of fittings made from other materials should comply with BS 5480-1 and BS 5480-2 as applicable.

9 Valves

9.1 Materials

All material used in valves should be compatible with the products which are to be conveyed in the pipeline. For use with potable water, see the requirements given in Appendix B.

9.2 Control valves

Valves should comply with the requirements of one of the following British Standard specifications:

a) BS 5150, Cast iron wedge and double disk gate valves for general purposes;

b) BS 5152, Cast iron globe and globe stop and check valves for general purposes;

c) BS 5153, Cast iron check valves for general purposes;

d) BS 5155, Specification for butterfly valves;

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

Valves outside the range of sizes, or differing in type or otherwise not complying with the specifications listed 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 the tests recommended in this Section of BS 8010.

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. On new installations consideration should be given to standardizing the direction of closure as clockwise.

9.3 Air valves

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

10 Flanges

Flanges may be made from a variety of materials including GRP or steel, but it is essential that those used are compatible with the use of the pipeline. Flanges should be compatible with flanges as specified in BS 4504. Flanges complying with other standards may be used for particular purposes.

Unless otherwise specified by the purchaser, PN 16 flanges are usually supplied and are therefore suitable for working pressures up to and including 16 bar, particularly for water industry applications.

The use of high tensile bolts of smaller diameter than the corresponding mild steel (MS) bolts to facilitate manufacture and installation of larger diameter flanges is permitted. BS 4772 gives details of the bolt hole diameters for such flanges. Such flanges will be marked accordingly. Where high tensile bolts are used with flanges holed for mild steel bolts, special washers should be used in accordance with the pipe manufacturer’s recommendations.

11 Bolts, nuts and washers

Mild steel bolts and nuts should comply with the requirements of BS 4190 and high tensile steel bolts and nuts should comply with BS 3692 to minimum grade 8/8. Washers should comply with BS 4320. Where the pipeline is in a corrosive environment, the bolts, nuts and washers may require special coatings or other protection or to be made from suitable alloy materials.

12 Gaskets

12.1 General

Gaskets should comply with the applicable requirements of BS 2494.

Those sections of gaskets which are likely to come in contact with potable water and gasket lubricants should be incapable of permitting bacterial growth and should comply with the requirements for the effect of materials on water quality (see Appendix B). Maximum temperature limitations apply to the use of both natural and synthetic rubbers. This will vary with the type of material used and the design of joints and the manufacturer's advice should be sought. The manufacturer's advice should be sought if the likely temperature is below 0 °C or above 40 °C. Gaskets should be protected from unnecessary exposure to the effects of ultraviolet radiation, light and ozone.

12.2 Flange gaskets

The dimensions of gaskets cut from flat sheet for flanges should conform to BS 4865. Moulded gaskets designed to suit a range of pressure ratings may be used.

NOTE Gaskets used with flexible joints are commonly referred to as joint rings.

Subsection 3. Design

13 Pipeline design

The necessary hydraulic, economic and structural assessments should be made in accordance with recognized practice (see Appendix C). For hydraulic design, for example, recourse may be had to publications prepared by the Hydraulic Research Station (Hydraulic Research Ltd). For structural design, the recommendations of BS 7159 or of Guidelines published by the Water Research Centre (WRc Engineering Ltd) may be applicable.

The factors taken into account should include those identified in clauses **14** to **20** inclusive, as applicable.

14 Pipe design

NOTE This clause is basically concerned with design and testing in respect of internal pressure. The pipe design may also be influenced by other factors which are the subject of other clauses, e.g. clause **15**.

14.1 Works hydrostatic test pressure

Details of the applicable test are given in appendix G of BS 5480-2:1982.

NOTE Fittings in accordance with BS 5480 are required to be equal to or superior in performance to pipe of the same classification and should be designed accordingly. For practical reasons however, the fittings when fabricated are only subjected to a pneumatic leaktightness test at a relatively low pressure (100 mbar gauge). If more stringent pressure testing of fittings prior to installation is considered necessary, arrangements should be agreed with the manufacturer accordingly.

14.2 Working pressure

The pressure ratings of GRP pipes are classified in BS 5480-1 by the maximum sustained working gauge pressure for nominal service temperatures up to 30 °C (see **15.3**).

14.3 Surge pressures

The maximum surge pressure should be calculated (see note). It is important that the total pressure within the pipeline including normal operating surges does not exceed the rated pressure of the pipeline.

Where surges in excess of the rated pressure could occur occasionally, the manufacturer's guidance as to a suitable class of pipe should be sought.

If the number of pressure cycles in the lifetime of the pipeline may exceed 10^5, the manufacturer's advice should be sought.

NOTE The minimum pressure induced by surge may be a negative gauge pressure: see however **15.5**.

14.4 Site test pressure

The maximum site test pressure for GRP pipes and fittings for pressure applications should be up to (1.5 times the working pressure) or (working pressure plus 5 bar), whichever is the lower. If a full hydrostatic test is required for non-pressure pipelines, the site test pressure should not exceed 1.5 bar.

15 Service and environmental considerations

15.1 General

The design may be subject to limitations according to the service and environmental conditions in which the pipeline operates. The relevant conditions may include one or more of the factors identified in **15.2** to **15.6** inclusive.

15.2 Nature of fluid conveyed

Where the fluid conveyed is other than clean water or non-septic domestic sewage, the manufacturer should be supplied with details of the fluid, giving full chemical and physical properties, and his advice be sought.

15.3 Temperature

GRP pipes can be suitable for use within the temperature range – 10 °C to + 70 °C.

Where the temperature of the pipe or the fluid conveyed is likely to exceed 30 °C, the manufacturer should be supplied with full details, including maximum and minimum temperatures, the time at each of these temperatures and the frequency of any cyclic temperatures, and his advice sought. For temperature limitations applicable to gaskets see **12.1**.

Where substantial variations in pipeline temperature may occur, provision should be made for thermal movement. Flexible joints can accommodate thermal movement but special installations such as bridge crossings, where the movement may be localized, may require the inclusion of a special expansion joint. Where pipelines are subject to substantial temperature variations, the effect of fluid expansion on the internal pressure during shutdown should be taken into account and pressure relieving devices should be installed if required.

15.4 Thermal insulation

Pipelines carrying water with a depth of cover of at least 0.9 m are not normally subject to freezing in the UK. Where this depth of cover cannot be achieved, adequate thermal insulation should be provided and maintained (see CP 3009) or the system be designed so that there is always a flow through the pipeline.

15.5 Vacuum and external fluid pressure

For non-pressure pipelines, the installed pipeline should be capable of taking the maximum external water pressure. Pressure pipelines should be capable of withstanding the combined effects of the maximum external water pressure and a complete internal vacuum.

The method of analysis and use of stiffening rings given in section 6 of BS 7159:1989 may be applicable, otherwise, in both cases, full details should be submitted to the manufacturer and his advice sought.

15.6 External loading

When correctly installed, GRP pipes have sufficient strength for all normal conditions when operating at pressures up to their rated pressures.

It is necessary to consider the combined effect of internal and external loads and it is essential that calculations are made in accordance with a recognized approach for computing the behaviour of the pipes. Design recommendations given in BS 7159 may be applicable, otherwise attention is drawn to the literature listed in Appendix C.

The factors taken into account should include the following:

a) type of installation (e.g. trench, embankment on pipes);

b) depth of burial;

c) type of traffic loading;

d) any additional surcharges;

e) native soil type;

f) height of water table;

g) maximum and minimum working pressure;

h) magnitude and frequency of any surge;

i) minimum and maximum operating temperatures.

16 Pipes on supports

16.1 General

For pipelines or sections thereof carried on supports, whether above ground or buried in ground having inadequate load bearing capacity, the spacing of the supports depends upon the type of joint and the load imposed on the pipeline. Account should be taken of the variation in length of pipes permitted in BS 5480-1. In all cases, the beam strength and the effect of load concentration at the supports should be checked.

Adequate anchorage of the pipe to the support should be provided.

16.2 Pipes on piers above ground

GRP pipes can be installed on piers above ground. However, the manufacturer's advice should be sought on the support details, spacing and anchorage. The manufacturer should also be consulted because the design of the pipe may need to be modified to suit these installation conditions.

16.3 Pipes on piers below ground

Extremely high loads can be imposed on the pipeline when laid on piers below ground. The manufacturer's advice should be sought.

17 Access to pipeline

The design should take full account of the pipeline route and layout and ensure that adequate access is available to all parts of the pipeline. In large diameter pipes, internal access should be provided at intervals for inspection, maintenance and the removal of obstructions, giving consideration to the need to provide a safe working environment at all times. Where the use of swabbing equipment is contemplated, provision for insertion and extraction should be made at suitable locations.

18 Protective devices

18.1 General

Protective devices, such as relief valves, surge chambers, pressure limiting stations and automatic shutdown equipment, should be provided, where necessary, to ensure that the internal pressure at any point in the pipeline system does not exceed the site hydrostatic test pressure (see **14.4**) of the pipes used. This is particularly important where any pipeline is connected to another pipeline which is designed for a higher operating pressure. Where surge is likely to occur, see **14.3**.

18.2 In-line valves

Valves should be placed in the pipeline at intervals so that sections of the pipeline can be isolated and emptied if necessary within a reasonable time and without too great a loss of material. At special crossings of major roads, water courses, and railways or other such major points or in extremely hazardous locations, valves to isolate the section concerned should be fitted, having due regard to the material being transported through the pipeline. Consideration should be given to providing locking arrangements for valves, particularly if butterfly valves are used. Where butterfly valves are proposed and swabbing is to be carried out, special facilities should be provided. Valves should be placed in positions which allow easy access and minimize interference with the use of the land.

18.3 Air valves

Air release valves should be provided on liquid pipelines for the release and admission of air during filling and emptying of sections of the pipeline between isolating valves and to bleed off air released from solution during operation of the pipeline.

The type of air valve chosen (small single orifice, large single orifice, double orifice or kinetic) should be selected after consideration of the duty and location of the valve. Air valves should be located at all topographic high points and high points on the pipeline with respect to the hydraulic gradient and should also be located at intervals along any sections where the gradient of the pipeline is parallel to or less than the the hydraulic gradient. On long sections of pipeline of even gradient, air valves should be positioned at intervals of approximately 0.5 km, depending on the diameter of the main and the air valve chosen. Air valves may also be required where the gradient of the pipeline changes.

The chamber housing an air valve should be designed to be free draining and free from risk of flooding or possible back siphonage.

18.4 Drainage valves and washouts

Drainage valves should be provided for emptying sections of the pipeline between isolating valves and for flushing out the pipeline while in service. Drainage valves on water pipelines should discharge to a watercourse or ditch through a washout pipe, although in urban areas it may be necessary to construct a discharge chamber from which water is pumped to the surface water drainage system. The relevent water or drainage authority should be consulted with respect to the allowable size and location of washout discharge.

NOTE The gradient between air release and between drainage valves should not normally be less than 1 : 250, although in special cases a minimum gradient of 1 : 400 may be used.

19 Joints

19.1 General

GRP pipes are usually supplied with socket and spigot, loose collar or flanged ends.

The gasket and pipe joint surfaces should be in accordance with the manufacturer's specified dimensions and tolerances. The gasket should be of such size and shape that when jointed in accordance with the manufacturer's instructions it should provide a positive seal within the manufacturer's range of maximum joint deflection and spigot withdrawal, under all combinations of joint and gasket dimensional tolerances, and in the conditions likely to occur along the pipeline including, where applicable, those below atmospheric pressure.

NOTE Joints incorporating rubber seals are often of proprietary design and are not standardized.

19.2 Flexible joints

Flexible joints are either of the push-in form (see Appendix A, types 1 and 2), or a mechanical form (see Appendix A, types 3 and 4). Type 1 is used on standard socket and spigot pipes. Type 2 is used on plain-ended pipes. The slip-on couplings, types 3 and 4 may also be used with plain-ended pipes. Flanged adapters, type 5, may be used if required. Where joints other than those supplied by the manufacturer are used, the manufacturer's advice should be sought regarding their suitability.

Such joints offer little or no resistance against spigot withdrawal due to internal pressure and it is therefore essential that they are anchored at changes of direction and/or blank ends (see **24.4**).

19.3 Flanged joints

Flanged joints may be fabricated in GRP or consist of a stub flange in GRP with a metal backing flange (see Appendix A, type 6).

19.4 Joint selection

Pipelines should be designed with sufficient flexibility, or provided with sufficient restraint, to prevent thermal movement from causing excessive stresses in the pipe, excessive bending or unusual loads at joints, or undesirable forces at or adjacent to points of connection to equipment or supporting structures, or at anchors, valves and branches. Account should also be taken of the effects of ground movement. These considerations influence the type of joint to be used.

20 External and internal corrosion resistance

20.1 Pipes

GRP pipes are resistant to most environments. However where unusual conditions are anticipated, such as industrial tips, a detailed investigation should be carried out and the manufacturer's advice sought. Similarly, where fluids other than potable water or non-septic sewage are conveyed, full details of the fluid should be provided and the manufacturer's advice sought.

20.2 Joints

Where steel is used for bolts, nuts and washers, slip-on couplings or anchorage devices, protection from corrosion should be provided. Where GRP is used for its corrosion resistance, the manufacturers should be consulted regarding the choice of suitable gaskets.

Subsection 4. Construction

NOTE Reference should be made to BS 8010-1 for procedures to be followed before any work is commenced. It gives procedures and recommendations for work on land which are common to all types of pipeline.

21 Transport, handling and storage

21.1 General

Pipes should be loaded and handled with care in accordance with the manufacturer's recommendations and not dropped. Incorrect handling can result in damage to the pipe surfaces and, in severe cases, to the structural pipe wall. Impact on the outside of the pipe can cause star cracking in the bore. Particular attention should be paid to the following to prevent damage to pipes or joint components:

a) secure loads on lorry or wagon;

b) suitable handling equipment correctly used;

c) correct stacking methods;

d) proper storage of joint components.

21.2 Transport

All pipes should be secured to prevent movement during transit. The means of securing should be designed to prevent damage to pipe and joint. Vehicles should have purposely designed supports separating the layers and the arrangement of the supports should be subject to the manufacturer's approval.

21.3 Off-loading mechanically

Pipe masses, types of stacking, outreach required and site conditions are important factors to take into account when determining the suitability of lifting equipment. The machine should retain the load safely in the event of power failure. Off-loading should be carried out smoothly and without snatch.

Where cranes are used for off-loading single pipes, fabric slings or purpose-designed lifting beams should always be used. Hooks, chains and wire ropes should not, under any circumstances, be used. Where pipes are off-loaded using forklifts, forks and uprights should be suitably padded to prevent damage to the pipes and joints. Where pipes are supplied nested, the unloading should be carried out in accordance with the manufacturer's recommendations.

21.4 Off-loading manually

Where lifting gear is not available, and the mass of the pipe permits (normally DN 300 max.), individual pipes may be off-loaded by rolling them down a ramp formed of timber skids, extending from the vehicle's side to the ground. During this operation, suitable steadying rope should be used to prevent the pipes from rolling down at excessive speeds and striking other pipes or objects.

21.5 Stacking

The arrangement and height of stacks is limited by the type and design of pipe. It is essential that the manufacturer's advice be sought as to the correct procedures to be adopted. The stacking area should provide a firm foundation with a suitable approach road for vehicles. Stacks should be arranged so as to provide safe vehicular and pedestrian access. During stacking and removal operations, safe access to the top of the stack is essential. All pipes, whether stacked or arranged as a single layer, should be secured against movement arising from, for example, wind or vandalism.

21.6 Stringing

Pipes involved in stringing should be wedged or pinned to prevent movement.

NOTE See also BS 8010-1.

22 Trenching

NOTE See BS 8010-1 for general considerations regarding trenching.

22.1 General

See Figure 1 for illustration of the terminology used for the purposes of this Section of BS 8010. Because GRP pipes are flexible conduits which in the buried condition normally rely on the pipe-soil structure interaction for their load bearing capacity, it is important that the pipes are bedded and surrounded in a material which is capable of transmitting lateral thrusts from the pipe to the native soil forming the trench wall and that the native soil does not become over-stressed.

For this reason it is essential that the soil conditions that relate to the trench construction and the pipe installation are established prior to finalizing the design of the pipeline. Where this information has not been previously ascertained to the satisfaction of the designer, a soils assessment and, where necessary, a site investigation should be undertaken. This investigation should determine the classification and density of the native soil and groundwater levels along the length of the pipeline and should indicate the proper backfill and compaction procedures to be followed for various classes of pipe during installation. It should also confirm the suitability of the native soil as a pipe bedding and pipe zone backfill material and establish areas of unsuitable material where the importation of selected bedding and pipe zone backfill material may be required.

Soils with medium to high plasticity are not normally suitable for use as bedding and pipe zone backfill.

The purpose of an installation procedure is to ensure that assumptions made during design are achieved in the field. Where changes are noted during installation which contravene the original design assumptions, guidance should be sought from the designer.

22.2 Trench width

The width of the trench should be determined at the design stage, taking into consideration the type of native soil and backfill and the compaction procedures to be adopted. Where mechanical compaction is required, the width of the trench is typically [outside diameter + 600 mm] although this may be reduced for small diameter pipes (e.g. DN 300 or less) and should be increased where heavy compaction equipment is used.

Occasionally it may be necessary to use a wide trench, e.g. (3 × DN) or more, to limit the stresses on the native soil. For this reason it is essential that the designed trench width is adhered to. The manufacturer's advice may be sought on suitable trench widths.

22.3 Trench bedding

The trench should be over-excavated to at least 100 mm to provide a bedding under the pipe (see Figure 1). The surface of the compacted bed should be continuous, smooth and free of stones larger than those permitted in the contract specification for the pipe zone backfill material, so as to provide a uniform support to the pipe. The bed should be provided with joint holes to ensure that the pipe rests on the barrel and not on the joint.

23 Pipe inspection, repair and cutting

23.1 Inspection

Prior to installation each pipe and joint should be visually inspected for signs of damage such as star cracking in the bore, grooving or scuffing and especially for damage to joint surfaces.

23.2 Repairs

Before any repairs are carried out, the manufacturer's advice regarding the feasibility and procedures to be adopted should be sought. The recommendations given in BS 7159 may be applicable.

23.3 Cutting

GRP pipes can be cut with a power-driven, abrasive-wheel cutting machine. The abrasive disc manufacturer's advice should be sought regarding the most suitable disc to use.

NOTE When using such equipment the operative is required to wear suitable eye protection and should wear a mask and gloves.

23.4 End preparation of cut pipes for jointing

Burrs and sharp edges should be removed by filing or grinding and, where required, a chamfer should be provided. The cut end should then be sealed. The manufacturer's advice regarding the dimensions of the chamfer and sealing of the ends should be adhered to.

24 Laying, jointing and anchoring

24.1 Laying

Pipes should at all times be handled with care in accordance with the manufacturer's recommendations. Pipes should be lowered into the trench using equipment suitable for the weight and size of pipes. The positioning of the sling to ensure a proper balance should be checked when the pipe is just clear of the ground. Where lifting equipment is not available, small diameter pipes (normally 300 DN max.) may be lowered by hand using suitable ropes.

All persons should vacate the section of the trench into which the pipe is being lowered.

All construction debris should be cleared from the inside of the pipe before or just after a joint is made. This can be done by passing a pull-through along the pipes, or by hand, depending on the diameter of the pipe. When laying is not in progress, a temporary end closure should be securely fitted to the open end of the pipeline. This can make the pipe buoyant in the event of the trench becoming flooded and any movement of the pipes should be prevented either by partial re-filling of the trench or by temporary strutting.

24.2 Jointing

Jointing procedures will vary according to the type of joint being used.

Basic requirements for all types of joint are as follows:

a) cleanliness of all parts, particularly joint surfaces;

b) correct location of components;

c) centralization of the spigot within the socket;

d) strict compliance with manufacturer's jointing instructions.

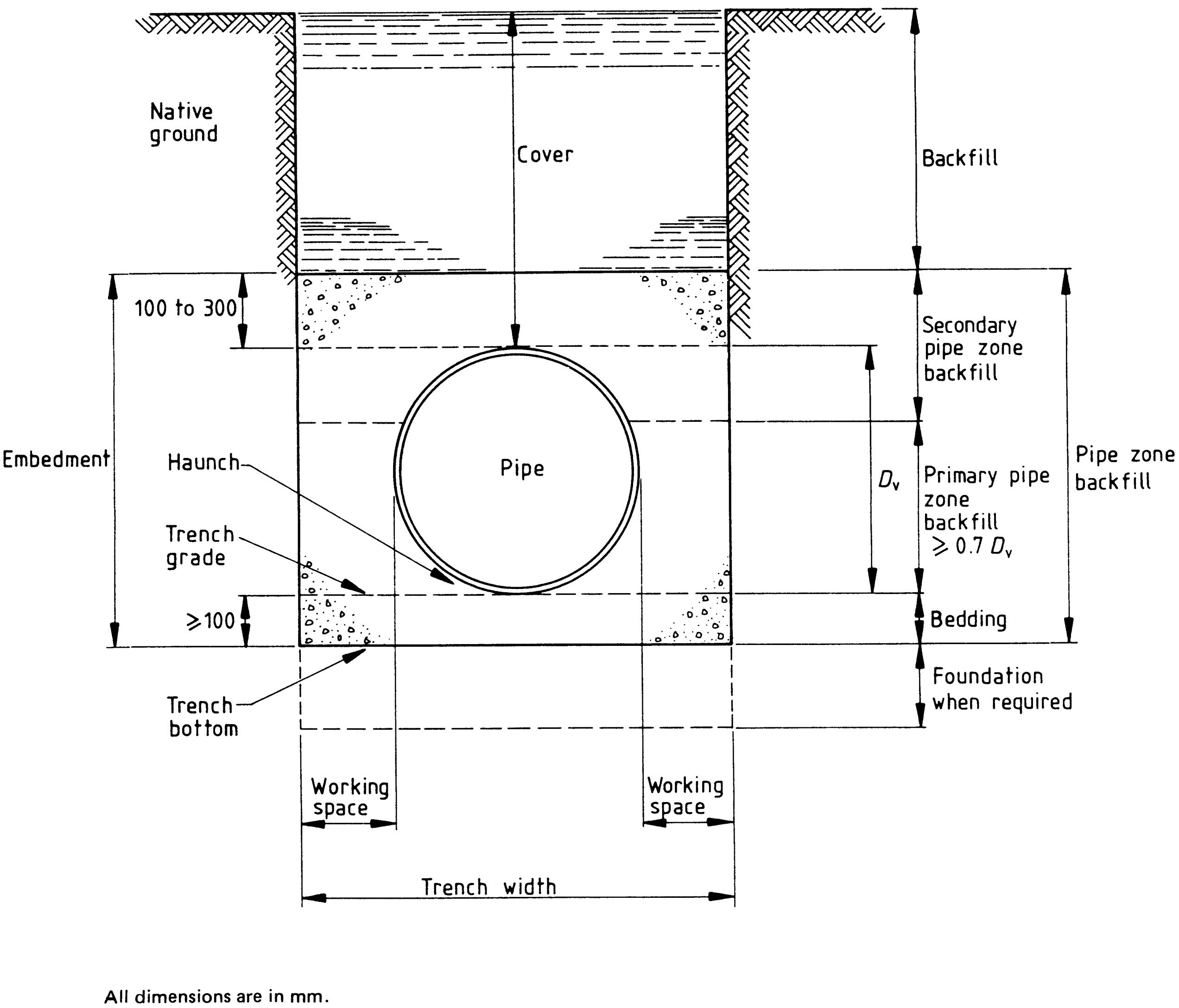


Figure 1 — Trench terminology

The jointing surfaces should be cleaned for at least the insertion depth. Gaskets should be wiped clean and inspected for damage. Where lifting gear has been used to place the pipe in the trench, it should be used to support the pipe and assist in centralizing the spigot in the socket. Where the pipeline is suspected to be subject to movement due to ground settlement or temperature variation, a gap should be left between the end of the spigot and the bottom of the socket to allow for tolerable changes of direction and/or length.

24.3 Jointing pipes laid on gradients

If pipes are laid down on steep gradients where the soil/pipe friction is low, care should be taken to ensure that no excessive spigot entry or withdrawal occurs. As soon as the joint assembly has been made, the pipe should be held in place and the trench backfilled over the barrel of the pipe.

Unless the gradient is 1 in 2 or steeper, anchorages are not normally necessary. Where anchorages are necessary the manufacturer should be informed because this may affect the design of the pipe.

24.4 Anchors and thrust blocks

Pipelines should be securely anchored at blank ends, tees, bends, tapers and valves to resist thrust arising from internal pressure. Anchors and thrust blocks should be designed to withstand the forces resulting from the internal pressure when the pipeline is under site test, taking into account the safe bearing pressure of the surrounding soil. Consideration should also be given to forces in the pipeline when empty and precautions taken against possible flotation. Where possible, concrete anchor blocks should be of such a shape as to leave the joint clear.

Where fittings are manufactured in GRP, they should be completely encased in concrete. The dimensions and details of the concrete encasement should be such that it is capable of withstanding any internal pressure and external loads applied to the pipe. This may require the use of reinforced concrete. Provision should also be made to resist thrust.

For recommendations regarding GRP pipes encased in concrete, see **24.5**.

24.5 Building into structures

Where GRP pipes enter manholes or pass through solid structures, anchor blocks or valve chambers, or have a concrete surround, it is essential to provide flexibility to the pipeline on either side of the structure. This should be effected by introducing two flexible joints to the pipeline on each side of the structure such that the first joint is no more than one pipe diameter or 600 mm, whichever is the greater, from the structure and the second is approximately 1.5 diameters from the first. Care should also be taken to ensure thorough compaction of the bedding material beneath the pipe immediately outside the structure, particularly where over-excavation of the trench has occurred. In some circumstances, it may be considered desirable to backfill this over-excavation with lean mix concrete to the underside of the pipe bedding material.

Where the pipe passes into the manhole, structure, or concrete surround, the external surface of the pipe should be surrounded with 6 mm to 10 mm thickness of a flexible material, such as chloroprene rubber, for a minimum distance of 100 mm from the point of entry into the structure. This precaution helps the pipe to absorb the stresses resulting from pipe deflections outside the structure.

Where watertightness between the pipe and structure is a requirement, pipes can be supplied with puddle flanges laminated onto the pipe. Puddle flanges should not be used to anchor the pipes against thrust unless specifically designed so to do. The external surface of the pipe can also be treated to improve its bond with the concrete either by painting with a suitable epoxy or other resin and blending with sand to give a roughened surface prior to incorporation in the works, or by using bonding mortars, or a combination of these techniques. The pipe manufacturer’s advice should be sought when determining suitable resins.

25 Backfilling

Reference should be made to BS 8010-1 for general considerations regarding backfilling, clean-up and reinstatement. Wherever possible, in order to minimize misalignment of the bed with resulting shear across the joint, pipes should not have backfill material placed until the succeeding pipe is laid and jointed. If joints are to be individually inspected during subsequent hydrostatic testing, the trench should be backfilled and compacted over the barrel of each pipe leaving the joints exposed, or other such measures should be taken to prevent movement of the pipes during the testing processes. Removal of any dewatering facilities should be scheduled in the light of the prevailing conditions so as to avoid any disturbance of the pipe by flotation before installation is complete.

It is essential that the conditions of the material surrounding the pipes are as detailed in the design.

Bedding and the pipe zone materials should be compacted across the full width of the trench and not disturbed by the withdrawal of trench temporary support. Care should be taken to fill and compact any voids left by the temporary support system. Special attention should be given to the compaction of the backfill material under the haunches of the pipe.

Where a change in direction is being made by utilizing the lateral deflection available from flexible joints, the trench should be cut to give sufficient room for the joint to be made with the pipes in line, the pipe being deflected after the joint has been made. Deflection of any as-laid joint should not exceed the maximum deflection recommended by the manufacturer to allow for subsequent movement.

Where high water tables are encountered, precautions should be taken to prevent flotation when the pipeline is empty. Such precautions should not induce localized stress in the pipes.

Where excavated material is to be used for the backfill, it should be selected to exclude organic material, frozen soil, large stones, rocks, tree roots or similar large objects and should conform to the design requirements.

Where the native ground is fine grained, such as clay, silt or sand, or if the installation is below the water table, the bedding and pipe zone backfill material (see Figure 1) selected should be such that fines will not migrate from the adjacent soil of the trench bottom or walls. Conversely, the possibility of migration of fines from the pipe bedding and pipe zone backfill into the native soil should be minimized by the specification of material with a suitable grading. In some instances the specification of a filter fabric may be an appropriate solution. Any migration or movement of soil particles from one area to another may result in the loss of the necessary support for the pipe and settlement.

In the process of backfilling the trench, pipes should be protected from falling rocks and direct impact from compaction equipment.

Heavy mechanical compactors should not be used within 300 mm of the pipe crown.

Subsection 5. Cleaning, testing and commissioning

26 Cleaning

Before a pipeline can be considered ready for service it should be cleaned internally as thoroughly as possible to ensure that no foreign matter remains inside the pipe. The first stages of the cleaning operation are referred to in **24.1** and **24.2**, i.e. cleaning individual pipes during laying and jointing. Pigs of suitable design, e.g. polyurethane swabs, may be used providing that the pipeline has been constructed to allow the passage of such pigs. Where the pipeline is to be tested with water, the filling and emptying of the pipeline may to some extent cleanse the line.

27 Testing

27.1 General

All pipelines should be tested before being brought into service. This should include testing for geometrical conditions, i.e. deflection of the overall position of the pipe and/or deformation of its cross-sectional dimensions in excess of the applicable design limits, and for leaktightness. For the latter purpose, the type of test will depend upon the fluid which the pipeline will eventually convey and may comprise a hydrostatic test or a pneumatic test, or both. The hydrostatic test is safer to carry out and can be made more stringent as regards the strength of a completed pipeline and it should be used wherever practicable. With the exception of testing non-pressure mains at very low pressures (100 mm water gauge), pneumatic testing is to be avoided if possible, because of the hazards inherent in containing large volumes of compressed air. However, there may be occasions when hydrostatic testing is not possible and air is the only medium available for applying a test pressure.

27.2 Hydrostatic testing

27.2.1 *General.* The completed pipeline may be tested either in one length or in sections; the length of section should be decided by considering the following factors:

a) availability of suitable water;

b) the number of joints to be inspected; and

c) the difference in elevation between one part of the pipeline and another.

Where joints are left uncovered until after testing, each pipe should be prevented from moving (see clause **25**).

27.2.2 *Initial procedure.* It is prudent to begin testing any particular pipeline in comparatively short lengths, preferably as the pipeline is laid, and to increase the length of test section progressively as experience is gained until lengths of about 1.5 km or more are tested in one section, subject to consideration of the length of trench which it is permissible to leave open in particular circumstances.

Each test section should be properly sealed off, preferably with special stop ends designed for the safe introduction and disposal of the test water and release of air, and secured by adequate anchors. The thrust on the stop ends should be calculated on the external spigot diameter and the anchors designed to resist it. It is often economical to provide a concrete anchor block which has subsequently to be demolished rather than risk movement of the stop ends during testing. Hydraulic jacks should be inserted between temporary anchors and stop ends if required in order to take up any horizontal movement of the temporary anchors. All permanent anchors (see **24.4**) should be in position and, if made of concrete, should have developed adequate strength before testing begins. The section under test should be filled with clean disinfected water, taking care that all air is displaced through vents at high points and at special stop ends or by using a pig or a sphere.

After filling, the pipeline should be maintained at test pressure for a period (see note) in order to achieve conditions as stable as possible for testing.

If pressure measurements are not made at the lowest point of the section, an allowance should be made for the static head between the lowest point and the point of measurement to ensure that the maximum pressure is not exceeded at the lowest point.

NOTE The length of this period will depend upon many factors such as movement of the pipeline under pressure, the quantity of air trapped and the degree of any re-rounding by the internal pressure.

27.2.3 ***Test procedure***

NOTE The following procedure is suitable for pipelines carrying water: more stringent requirements may be necessary for pipelines carrying other fluids.

Site test pressures should be in accordance with **14.4**.

The pressure in the pipeline should be raised steadily until the site test pressure is reached in the lowest part of the section. This pressure should be maintained, by pumping if necessary, for a period of not less than 1 h. The pump should then be disconnected and no further water permitted to enter the pipeline for a period of 1 h. At the end of this period the reduced pressure in the pipeline should be measured, the original test pressure restored by pumping and the loss measured by drawing off water from the pipeline until the pressure has fallen to match the reduced pressure previously noted.

The acceptable loss should be clearly specified and the test should be repeated until this is achieved. The generally accepted loss for non-absorbent pipelines such as GRP is 0.02 L/mm of nominal bore per kilometre of pipeline per 24 h per bar[2)] of pressure applied head (calculated as the average head applied to the section under test). The loss should be plotted graphically against time to show when volume changes due to such factors as re-rounding are substantially complete.

27.2.4 *Fault detection*. If the test result is not satisfactory, the fault should be found and rectified.

Methods employed for finding leaks include the following:

a) visual inspection of pipeline, especially if each joint is not covered by the backfill;

b) aural inspection using a stethoscope or listening stick in contact with the pipeline;

c) use of electronic listening devices, including leak noise correlators which detect and amplify the sound of any escaping fluid;

d) use of a bar probe to detect signs of water in the vicinity of joints, if backfilled;

e) introduction of a gas compound into the test water and use of a gas detection device to detect the presence of any gas that has escaped through the leak.

Where there is difficulty in locating a fault, the section under test should be subdivided and each part tested separately.

NOTE A pneumatic test with an air pressure not exceeding 2 bar (gauge) may be used to detect leaks in pipelines laid in waterlogged ground.

Pneumatic testing could in the event of excessive pressurization give rise to serious explosions. During testing it is important that all persons not engaged in the test operations be kept away from the section of the pipeline under test.

Whenever pneumatic testing is carried out the operation should be supervised by a suitably trained engineer.

27.2.5 *Final testing*. After all sections have been jointed together on completion of section testing, a test on the complete pipeline should be carried out. This test should be carried out in a manner similar to that described in **27.2.1** to **27.2.4**, as applicable. During the test, all work which has not been subject to sectional tests should be inspected.

27.2.6 *Disposal of water*. It is important to ensure that proper arrangements are made for the disposal of water from the pipeline after completion of hydrostatic testing and that all consents which may be required from land owners and occupiers, and from river drainage and water authorities have been obtained.

NOTE With some liquids, notably oil and oil products, it may be necessary to provide temporary interceptors to prevent any oil being discharged with the water. In some cases, e.g. heavily chlorinated water, treatment may be necessary before final disposal.

28 Commissioning

28.1 General

Pipelines intended to convey liquids are usually tested hydrostatically. Unless the test water is of an acceptable quality for the purpose of the pipeline, commissioning consists of displacing the test water from the line by the liquid to be conveyed. Where the pipeline is to carry potable water it should be sterilized as described in **28.2**.

Visible dirt and debris should have been removed either manually or by the use of cleaning pigs before testing (see **24.1** and clause **26**). Filling and emptying the pipeline with test water may also help cleanse the line.

Where air release and drainage valves have been installed, the test water may be drained and the pipeline refilled with the liquid to be conveyed.

All temporary connections used during the testing and commissioning should be closed off and securely blanked before the pipeline is brought into use. All blanks should be sterilized where appropriate.

[2)] 1 bar = 10^5 N/m^2 = 10^5 Pa.

28.2 Sterilization

If the pipeline is to carry potable water, where feasible it should be thoroughly flushed with clean water. It should then be disinfected by contact for 24 hours with water containing at least 20 mg/L of free chlorine, emptied and filled with potable water. The chlorinated water should receive treatment to dilute the chlorine to an acceptable level before discharging to a sewer or watercourse. After a further 24 h, samples for bacteriological examination should be taken at a number of points along the pipeline and at all extremities.

The pipeline should not be brought into service until the water at each sampling point, having stood in the pipeline for 24 h, has maintained a satisfactory potable standard.

28.3 Records

The recommendations given in BS 8010-1 concerning record plans should be adopted and should include arrangements for maintenance of the plans to enable compliance with the corresponding recommendations given in Part 1 concerning abandonment. A format for a typical summary to detail commissioning arrangements is given in Appendix D.

Subsection 6. Abandonment

29 Disused pipelines

The recommendations given in BS 8010-1 concerning abandonment should be adopted.

Appendix A Types of joint

A.0 Introduction

Joints are generally of a type using elastomeric sealing rings as a medium. The most commonly used types of joint are described in **A.1** to **A.6** and Figure 2 to Figure 7. The manufacturer's recommended maximum joint deflections are intended to provide for changes in gradient and level, slow curves, the adjustment of angle at bends and any subsequent movement. Deflections at installation should make adequate allowance for any subsequent movement.

A.1 Type 1. Integral socket and spigot joint

An integral socket and spigot joint is a push-in joint incorporating a specially formed socket and spigot. The seal is effected by means of an elastomeric gasket located on the spigot or in the socket before jointing. Entry of the spigot into the socket compresses the gasket and completes the joint, for example as shown in Figure 2. Little effort is required to complete assembly of small diameter pipes; tackle to joint all sizes of pipe is usually supplied by the manufacturer.

The manufacturer's advice regarding deflection and withdrawals should be sought.

A.2 Type 2. Loose collar joint

A loose collar joint is a simple push-in joint consisting of a full-width elastomeric profile, usually of an EPDM rubber[3)], overwrapped with GRP. The elastomeric profile is bonded to the GRP wrapping and pipes are normally delivered with the joint already jointed onto one end of the pipe, for example as shown in Figure 3. The joint can be used at any point along the length of a cut pipe without special profiling of the pipe end. The manufacturer's advice regarding deflection and withdrawals should be sought.

A.3 Type 3. Slip-on coupling

A slip-on coupling is designed for use with plain-ended pipes. It consists of a sleeve, at the ends of which are wedge-shaped elastomeric gaskets and flanges held together by bolts, for example as shown in Figure 4(a). Tightening of the bolts compresses the gaskets between the sleeve and pipe to seal the joint.

Special slip-on couplings to connect pipes of different diameters or materials are available. A typical stepped coupling is shown in Figure 4(b), but several designs are available and advice should be sought from the manufacturer regarding applicability, deflection and withdrawal.

A.4 Type 4. Band coupling

A band coupling is designed for use with plain-ended pipes. It consists of a metallic band encasing a shaped elastomeric profile, for example as shown in Figure 5. The elastomeric profile is compressed by tightening up circumferential bolts positioned at one point on the circumference. The manufacturer's advice regarding applicability, deflection and withdrawal should be sought.

A.5 Type 5. Flange adapters

A flange adapter is designed to connect flanged pipe or any flanged fitting to plain-ended pipe. It consists of a flange and sleeve piece, a wedge-shaped elastomeric gasket and a loose gland fastened to the main body by bolts. Tightening of the bolts compresses the gasket between the sleeve and pipe to seal the joint, for example as shown in Figure 6. The flange joint is made using standard jointing procedures for flanged pipework. The adapter usually includes steel components which should be suitably protected.

Several designs are available and manufacturers' advice regarding deflection and withdrawal should be sought. They do not provide the rigidity or anchorage of a standard flange joint and should be supported and/or anchored accordingly.

A.6 Type 6. Flange joints

Flanged joints are made by one of the following techniques:

a) integral forming, for example as shown in Figure 7(a);

b) attaching a preformed GRP flange, for example as shown in Figure 7(b);

c) forming a stub flange with metallic backing flange, for example as shown in Figure 7(c).

The seal is usually effected by means of a flat elastomeric gasket compressed between the flanges by means of bolts which also serve to connect the pipes rigidly. Gaskets of other materials, both metallic and/or non-metallic, are available for special applications. It is essential that flanged joints are tightened to a predetermined torque using clean bolts lubricated on all mating surfaces to ensure that the design load is obtained. Advice on recommended torques can be obtained from manufacturers.

[3)] Classification in accordance with BS 3502-3.

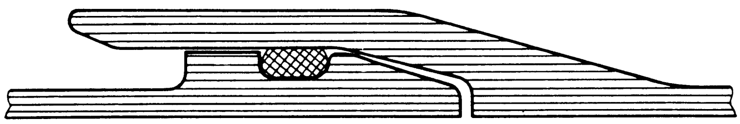


Figure 2 — Typical integral socket and spigot joint

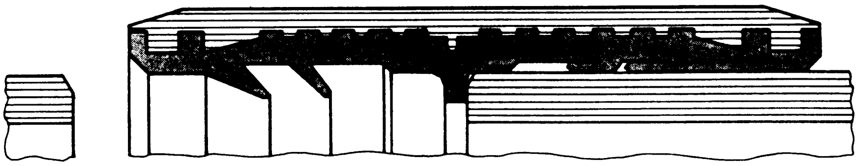


Figure 3 — Typical loose coller joint

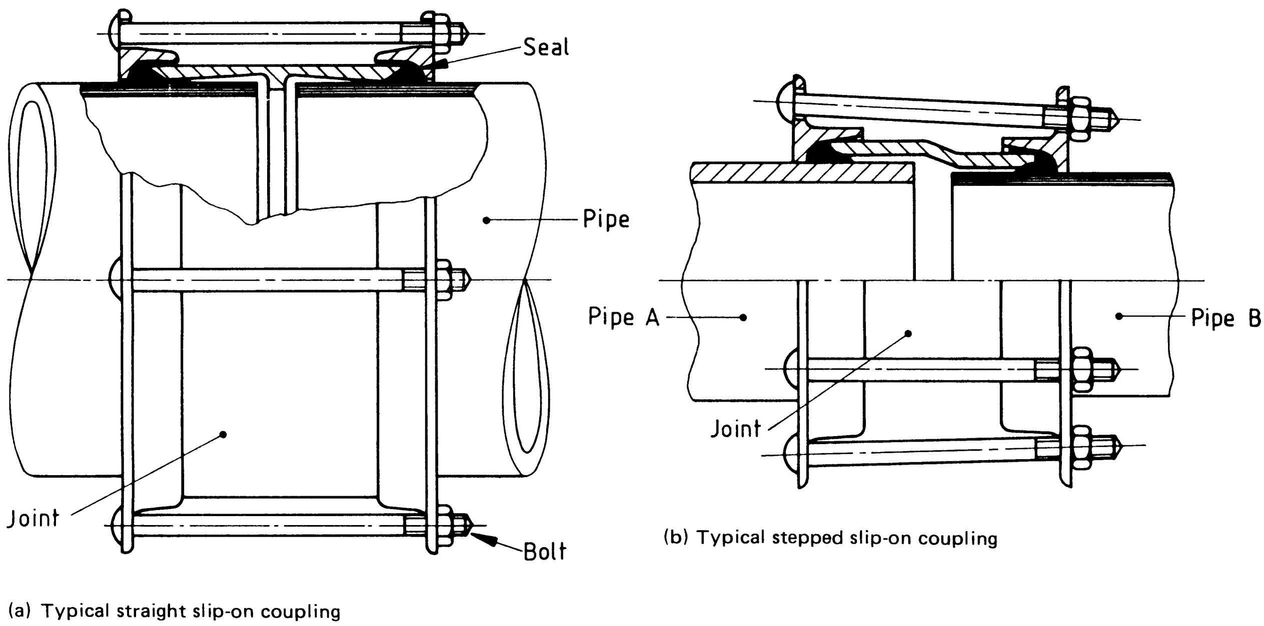


Figure 4 — Typical slip-on coupling

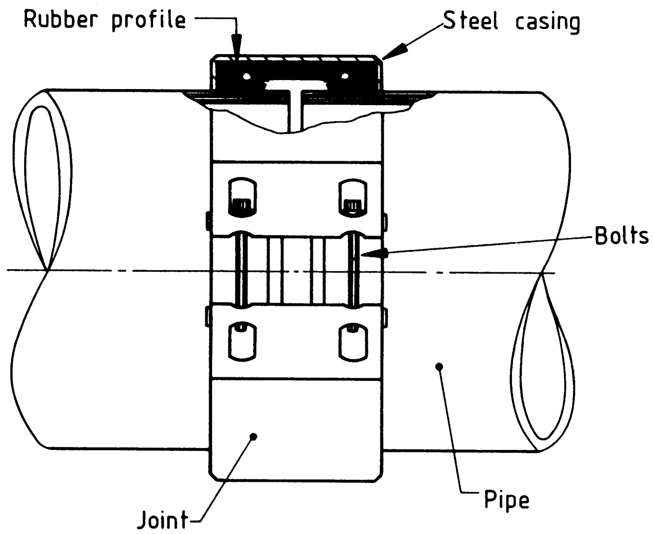


Figure 5 — Typical band coupling

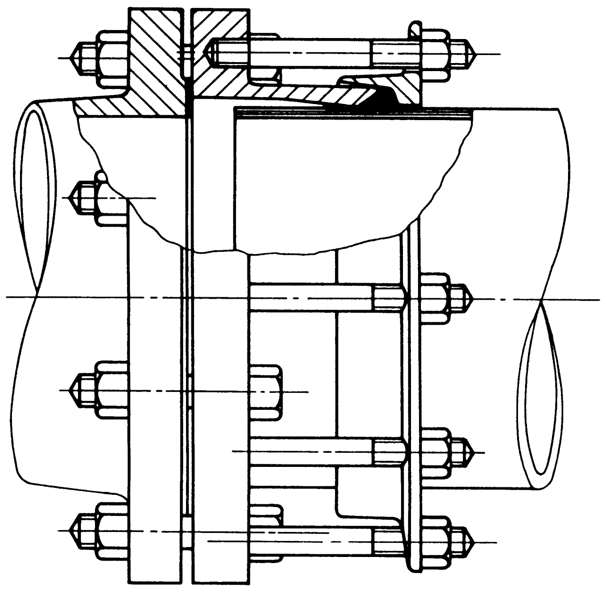
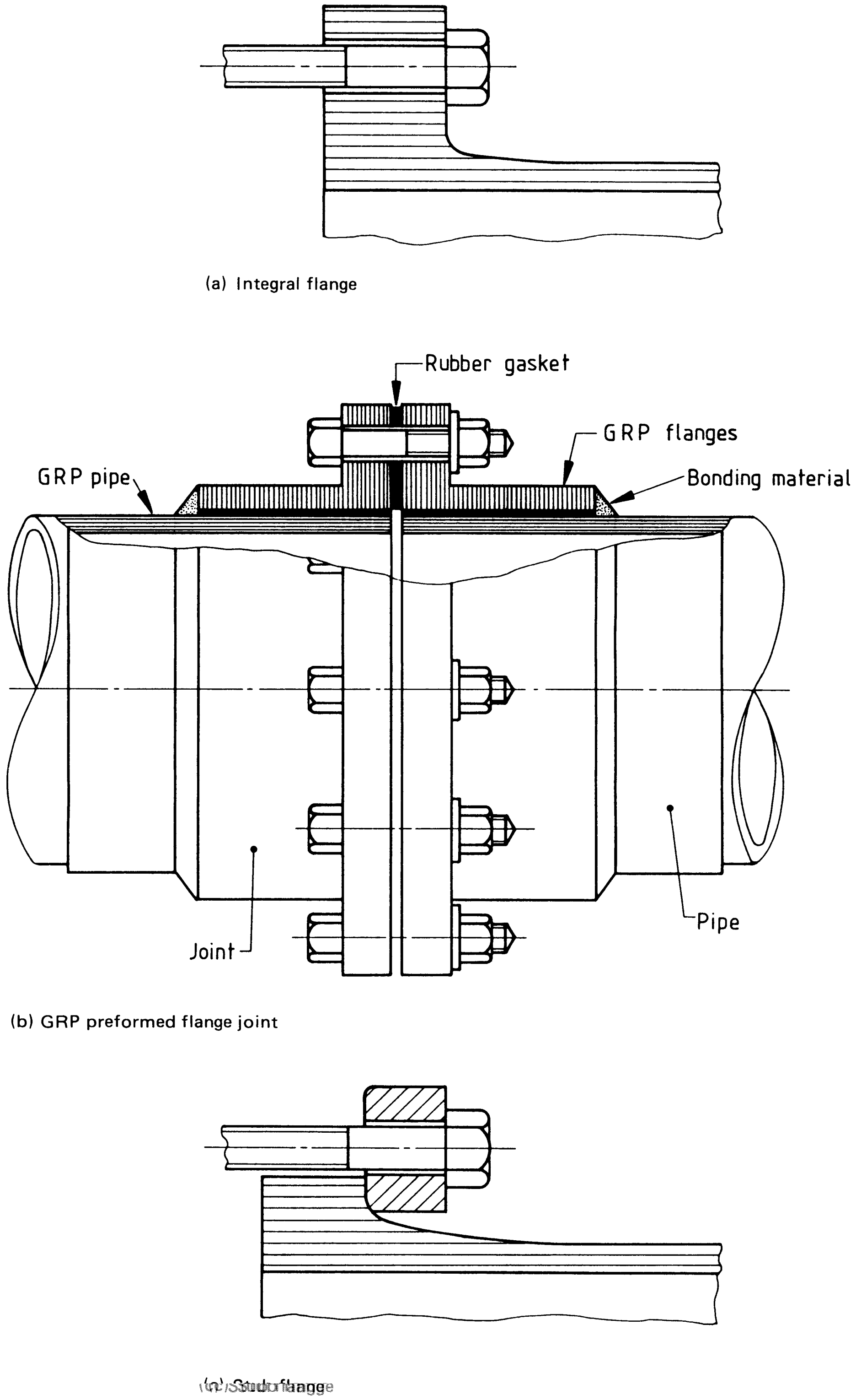


Figure 6 — Typical flange adapter



(a) Integral flange

(b) GRP preformed flange joint

(c) Stub flange

Figure 7 — Typical examples of various flanges

Appendix B Effect of non-metallic materials on water quality

When used under the conditions for which they are designed, it is essential that non-metallic materials in contact with or likely to come into contact with potable water are required to comply with the requirements of BS 6920-1.

Appendix C Bibliography of further reading

These documents are listed for information and guidance. The list should not be assumed to be complete or exclusive. Where there are differences the advice of this Section of BS 8010 should be followed or an engineer's decision taken. In addition, in respect of components to be used in a pipeline, the manufacturer's literature should be included.

AMERICAN SOCIETY OF CIVIL ENGINEERS. Buried fiberglass pipe performance and installation requirements and design calculations in international standardization. *Proceedings of international conference "Advances in underground pipeline engineering" University of Wisconsin, Madison, USA, August 27–29, 1985.*

ANSI/AWWA C 950-81 — Standard for Glass Fibre Reinforced Thermosetting Resin Pressure Pipe.

ASTM D 2992-87 — Obtaining Hydrostatic Design Basis for Reinforced Thermosetting Resin Pipe and Fittings.

ASTM D 3839-79 Underground Installation of Flexible Reinforced Thermosetting Resin Pipe and Reinforced Plastics Mortar Pipe.

BAILEY, R.J., SCHLEGEL, D.L. and LAUGHLIN, B.E. Developing concensus design approach for fibreglass-reinforced thermosetting pipe. *Proceedings of 39th Conference Reinforced Plastics/Composites Institute, USA, January 16-19, 1984 (Session 15-6).*

BISHOP, R.R. and LANG, D. Design and performance of buried fiberglass pipes — A new perspective. *Proceedings of the Pipeline Division Session, ASCE National Convention, 1984.*

COLE, B.S. and TIMBLIN, L.O. Strain calculations for FRP pressure pipe. *Proceedings of the Pipeline Division Session, ASCE International Conference, New Orleans, March 30 – April 1, 1981.*

DEPARTMENT OF HEALTH AND SOCIAL SECURITY. The Bacteriological Examination of Water Supplies. *DHSS Report 71.*

HYDRAULICS RESEARCH LTD. Charts for the hydraulic design of channels and pipes. HMSO. Fifth edition, 1983.

HYDRAULICS RESEARCH LTD. Tables for the hydraulic design of pipes and sewers — Metric edition. HMSO. 1982.

IRVINE, D.J. and SMITH, R.J.H. Trenching practice. *CIRIA Report 97. 1982.*

NATIONAL WATER COUNCIL. Water supply hygiene. *Occasional Technical Paper No. 2.*

REID, I.W. GRP Sanitary sewer pipes — Integral corrosion-resistant lining. *CIRIA Report 112. 1982.*

WATER RESEARCH CENTRE AND WATER AUTHORITIES ASSOCIATION. Civil engineering specification for the water industry. Second edition 1984.

WASTE WATER TECHNOLOGICAL ASSOCIATION e.B (ATV). Guidelines for static calculations of waste water pipes and pipelines. *ATV Worksheet A127. December 1984.*

WRc ENGINEERING LTD. Guidelines to the water industry for the design and installation of glass fibre reinforced plastics pipes. *WRc External report 31E. 1981.*

WRc ENGINEERING LTD. Pipe Materials Selection Manual — Water Mains — UK edition. WRc/Water Authorities Association, January 1988.

YOUNG, O.C. and O'REILLY, M.P. TRRL, DEPARTMENT OF TRANSPORT. A guide to design loadings for buried rigid pipes. HMSO 1983[4].

[4] This document for guidance on vehicular loading only.

Appendix D Typical summary of pipeline records and of any special arrangements for its maintenance

Date of summary . . . .

We . . . .

submit the following summary of the testing and other records of the pipeline constructed by us to your contract

no.. . . . .

Glass reinforced thermosetting plastics units

1) Have been sampled and tested in accordance with BS 5480 (Copy of manufacturing certificates attached).

2) Pipes and other units have been laid with strength classes, joints and other manufacturing details in accordance with the contract specification and drawing nos. . . . .

Trench, tunnel and bedding details

Have been constructed in accordance with the contract specification and drawing nos. . . . .

Pipeline straightness (line and level)

Have been checked for compliance with the contract specification and drawing nos. . . . . by the following methods:

Pipeline watertightness initial tests

Method used . . . .

Infiltration rate achieved . . . .

Exfiltration rate achieved . . . .

Pipeline watertightness final tests

Method used . . . .

Infiltration rate achieved . . . .

Exfiltration rate achieved . . . .

Backfilling, cleaning-up and reinstating Has been carried out in accordance with BS 8010 : Part 1 and Section 2.5 as applicable

(Copies of certificates agreed with occupiers attached)

Special arrangements for pipeline maintenance

Arrangements have been made with landowners (see section five of BS 8010 : Part 1 : 1989) as follows:

Signed . . . . (Contractor)

Date . . . .

Publications referred to

BS 2494, *Specification for elastomeric joint rings for pipework and pipelines.*

BS 3502, *Schedule of common names and abbreviations for plastics and rubbers.*

BS 3502-3, *Rubbers and latices.*

BS 3692, *Specification for ISO metric precision hexagon bolts, screws and nuts. Metric units.*

BS 4190, *Specification for ISO metric black hexagon bolts, screws and nuts.*

BS 4320, *Specification for metal washers for general engineering purposes — Metric series.*

BS 4504, *Specification for flanges and bolting for pipes, valves and fittings. Metric series.*

BS 4772, *Specification for ductile iron pipes and fittings.*

BS 4865, *Specification for dimensions of gaskets for pipe flanges to BS 4504.*

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

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

BS 5153, *Specification for cast iron check valves for general purposes.*

BS 5155, *Specification for butterfly valves.*

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

BS 5480, *Specification for glass fibre reinforced plastics (GRP) pipes and fittings for use for water supply or sewerage.*

BS 5480-1, *Dimensions, materials and classification.*

BS 5480-2, *Design and performance requirements.*

BS 6920, *Suitability of non-metallic products for use in contact with water intended for human consumption with regard to their effect on the quality of the water.*

BS 6920-1, *Specification.*

BS 7159, *Code of practice for design and construction of glass reinforced plastics (GRP) piping systems for individual plants or sites.*

BS 8005, *Sewerage.*

BS 8005-0, *Introduction and guide to data sources and documentation.*

BS 8005-1, *Guide to new sewerage construction.*

BS 8005-2, *Guide to pumping stations and pumping mains.*

BS 8005-4, *Guide to design and construction of outfalls.*

BS 8010, *Code of practice for pipelines.*

BS 8010-1, *Pipelines on land: General.*

CP 2010, *Code of practice for pipelines*[5].

CP 3009, *Thermally insulated underground piping systems.*

[5] Referred to in the foreword only.

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