

6. SPECIFICATIONS FOR PIPES, FITTINGS AND SPECIALS

- **GENERAL**
- **UPVC PIPES, FITTINGS AND SPECIALS**
- **DI PIPES, FITTINGS, SPECIALS AND ACCESSORIES**
- **MECHANICAL COUPLINGS, REPAIR CLAMPS AND FLANGE ADAPTORS**

SPECIFICATIONS FOR PIPES, FITTINGS AND SPECIALS

GENERAL

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GENERAL

1 Ambient Conditions

All items of materials and equipment shall be in every respect suitable for storage, installation, use and operation in the conditions of temperature and humidity appertaining in Sri Lanka.

The annual average temperature is 30 °C while the relative humidity varies generally from 70% during the day to 90% at night.

The temperature of potable water to be conveyed in the pipelines will be about 30° C.

2 Suitability for Potable Water

Pipes and pipeline components, including their protective coatings and joint materials, that will or may come into contact with potable water shall not constitute a toxic hazard; shall not support microbial growth; shall not cause taste or odour, cloudiness or discolouration of the water.

3 Definitions

The definitions given in the relevant standards which are referred to in the specification shall apply for the terms used in this specification.

4 Inspection and Testing

During manufacture and before dispatch from the place of manufacture the Supplier shall allow inspection of all pipes, fittings, and specials, etc., by an inspector appointed by the Engineer. The inspection will include attendance at all pressure, performance and material tests, execution of dimensional checks, inspection of the workmanship and standard of manufacture with scrutiny of evidence of the materials used in the fabrication of the items.

The Contractor shall arrange for such testing as may be required to be carried out at the place of manufacture according to this Specification. If there are no facilities at the place of manufacture for making the prescribed tests the Supplier shall bear the cost of carrying out the tests elsewhere at no extra cost.

The Contractor shall supply, furnish and prepare the necessary test pieces and samples and shall supply and provide all test rigs, equipment, appliances, labour and any other facilities required for inspection and testing.

The Engineer and his inspector shall be allowed full access to all areas at the place of manufacture or elsewhere, where testing, furnishing or preparation of materials for the performance and testing of work under this Specification is taking place.

The Contractor shall furnish the Engineer with reasonable facilities and space (without charge) for the inspection, testing and obtaining of such information as he desires respecting the character of materials in use and progress and manner of the work.

The Contractor shall supply to the Engineer a certificate stating that the supply items have been subjected to the tests herein and that they conform to all aspects of this Specification.

5 Marking of Pipes, Fittings and Specials

PVC Pipes & Fittings

Each pipe shall be legibly and indelibly marked with the following;

- a) the manufacturer's name and identification marks
- b) the dates of manufacture

Each fittings shall have the manufacturer's name or identification mark embossed or engraved on it. Each bend shall have the angle in degrees embossed or engraved on it.

DI Fittings

If supplier intend to provide DI pipe fittings in place of PVC fittings, all markings described below shall be legible and durable unless otherwise specified. All pipes & fittings shall be mark with the information specified in EN 12842:2000.

The mark of the manufacturer shall be embossed on all pipes and fittings. Other markings shall be cast on, cold stamped or painted with an indelible paint.

In addition to what is specified above, all pipes, specials and fittings shall be legibly and indelibly marked with information given in the following table ;

Item	Diameter (mm)	Details required	Lettering Heights of Details (mm)
Pipe Lengths (at intervals not more than 3m)	Above 350	"NWSDB"; Pipes standard (SLS or other); Class type; Nominal dia.	50
	150 to 350 (both inclusive)	as above	25
	50 to 150	as above	10

Item	Diameter (mm)	Details required	Lettering Heights of Details (mm)
Fittings and Specials	below 50	as above (except "NWSDB")	05
		"NWSDB"	10
	Above 350	"NWSDB"; Pipe standard; Class type; Nominal dia	25
	150 to 350 (both inclusive)	as above (except "NWSDB")	10
		"NWSDB"	25
	50 to 150	as above	10
Manhole Covers	below 50	as above (except "NWSDB")	05
		"NWSDB"	10
	All sizes	"NWSDB" Standard; Class type; Size	50
Surface Boxes	All sizes	As for manhole covers	20

The Contractor shall label and clearly mark all pipes, fittings, crates and boxes in indelible paint as specified in the notes forming a part of this Specification.

In addition, all fittings shall be marked with the corresponding item number in the Bill of Quantities or the number specified by the Engineer.

6 Protection During Delivery

The Supplier shall provide protection, to the approval of the Engineer, for the ends of all pipes and fittings shall be covered with plastic end caps prior to the pipes and fittings leaving the place of manufacture and shall maintain such protection until the items reach their destination in order to guard effectively against damage during transit and storage and the ingress of foreign matter inside the pipes and fittings.

All fittings shall be securely packed in crates and boxes to prevent damage during delivery. The cost of packing shall be deemed to be included in the Contract Rates and crates will not be returned.

Each box and package therein shall be clearly labeled stating the number, size and description of the contents.

All details of the proposed method of providing such protection shall be submitted at the time of tendering.

The cost of providing protection to the ends of pipes and fittings shall be included in the unit prices tendered in the Bills of quantities.

7 Storing, Handling and Hauling of Pipes, Fittings and Accessories

The storage of pipes and fittings shall be in accordance with the manufacturer's recommendation but the pipe stacking shall not exceed four tiers height unless otherwise approved by the Engineer. In case of outdoor storage, the pipes shall be kept fully covered by a net which protects pipes from sun light as well as allow to pass water through the net to avoid stagnation of water or any other approved sheeting in order to protect from direct sunlight and avoid stagnation of water on the sheeting.

The fittings shall be stored indoors with packing intact. Solvent cement shall be stored in a dark cool place (away from fire) with containers tightly closed.

The Engineer will reject any pipes, fittings & specials which have been damaged. The Contractor shall comply with the following requirements:

- a) Pipes, fittings & specials shall not be dropped, or allowed to land on sharp or other objects which will cause bends, or dents, or damage to the coating.
- b) When lifting pipes and fittings special lifting hooks with curved saddles to fit the curvature of the pipes or fitting shall be used. Alternative types of lifting hooks, clamps, or slings may be used subject to the Engineer's approval.
- c) Suitable pillow shall be used to protect pipes and fittings under securing chains or other lashings and **no unsupported over hangings of more than 1 m will be allowed**, when pipes are being transported. When transporting, only 4 tiers high stacking in the lorry will be allowed.
- d) uPVC pipes and fittings shall be protected from direct sunlight and shall not be shipped as deck cargo.

8 Packing and Protection

All items shall be adequately crated or packaged to withstand damage and deterioration due to shipping, handling and storage. Protection shall be provided to prevent ingress of foreign matter. The methods of protection and shipping shall be to the approval of the Engineer.

Bolts of the same length and size (and their accompanying nuts and washers) shall be packed together in boxes not exceeding 100 kg. gross weight.

Joint rings and gaskets shall be packed in boxes and separate packages shall be provided for each size and description of ring or gasket.

All fittings shall be packed in open sided crates.

The Contractor shall supply at his own cost all necessary materials and equipment for making good, where approved by the Engineer, any damage to pipes and fittings suffered during delivery.

9 Manufacturer's Certificate

The Contractor shall provide certificates stating that each item supplied has been subjected to the tests laid down herein and confirms in all respects to this Specification or such other Specification which has been submitted to and approved by the Engineer.

10 Quality and Workmanship

All pipes, fittings & accessories shall be manufactured in compliance with the ISO 9001:2008 Quality Management System requirements. Quality Management System Certificate shall be from an organization accredited to issue such certification and the manufacturer shall have this certificate valid during the supply and delivery of the materials. This certificate shall clearly indicate the location of the place of manufacture of goods.

11 Final Acceptance at site

All pipes, fittings & accessories shall conform to the specification at site. Engineer shall carryout necessary inspections at site prior to final acceptance.

SPECIFICATIONS FOR uPVC PIPES, FITTINGS AND SPECIALS
uPVC PIPES AND FITTINGS

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uPVC PIPES AND FITTINGS

1 uPVC Pipes

Socket and Spigot uPVC pipes shall be of the type specified, comply with Sri Lanka Standards 147 : 1993 together with additional clauses set out in this Specification. The pipes shall bear the SLS marking as well as markings as per clause 5 under General section of this Specification herein and shall be supplied in lengths not exceeding 6 meters.

2 uPVC Fittings

uPVC fittings shall be injection moulded except for bends and repair sockets which shall either be injection moulded or formed from pipe complying with SLS 147 : 1993 and shall be compatible with the uPVC pipes offered. Solvent welded fittings, shall comply with SLS 659 Part 1 : 1993 and/or BSEN 1452-1 : 2000 together with additional clauses set out in this Specification. In case of mechanical jointed fittings, the fittings shall comply with BSEN 1452-3 : 2000 as providing better quality of materials and workmanship than specified above, together with additional clauses set out herein.

The fittings and specials, if imported shall be accepted subject to the temperature correction in accordance with Table 1 below, which requires higher class fittings than that specified for supply, and shall be from manufacturers having Quality Management System Certificate ISO 9001:2008.

Table 1 : Temperature Correction

<i>Type of Fittings Specified in BOQ</i>	<i>Type/Class of Fittings to be Supplied, as per EN 1452:1999 if imported</i>
Type 600	Class C (9.0 bar)
Type 1000	Class D (12.0 bar)

Note: The SLS 147 has classified the uPVC pipes according to the maximum working pressure at 29°C while *BSEN 1452:2000* classifies uPVC pipes by maximum sustained working pressure at 20°C. Hence, imported fittings which comply with *BSEN 1452:2000*, shall be supplied in conformity with the above table 1 for temperature correction.

Detailed drawings of all fittings and specials shall be submitted by the Contractor to the Engineer for his approval prior to the commencement of manufacture.

The Contractor shall be responsible for the compatibility of fittings with the uPVC pipes offered; and satisfy the hydrostatic pressure requirements as set out in clause 7 of *EN 1452-2:1999*.

3 Manufacture of uPVC Pipes

The Contractor shall furnish copies of certificates of quality control tests carried out during manufacture of the pipes and fittings in accordance with section 8.4 of SLS 147 and shall if required by the Engineer undertake such additional tests as he considers necessary.

The Contractor shall, when required, disclose to the Engineer particulars of all toxic substances present as the result of tests carried out by the methods described in section 7.2 of SLS 147.

4 Jointing of uPVC Pipes and Joint Rings, Sealing Rings and Gaskets

uPVC pipes of diameters 63 mm and above shall be jointed by means of mechanical joints with joint rings, in accordance with EN 1452 part 2 : 1999 (with latest amendments) Solvent cement joints are only acceptable for pipes of lesser diameters.

All rubber joint rings, rubber sealing rings, rubber gaskets requiring for jointing uPVC socket and spigot pipes and specials and flanged pipes and specials shall conform to EN 681-1 (Potable Water Application) in Table 3. The Solvent cement shall comply with SLS 935 : 1991.

The joint rings, sealing ring and gasket material shall be EPDM/SBR. The hardness Range of the material for joint rings & sealing rings shall be 50-60 IRHD and the hardness range of the material for gaskets shall be 70-80 IRHD. All gaskets shall be of the inside bolt circle type.

Lubricant proposed for jointing mechanical joints of uPVC pipe shall not impart any taste, affect the quality of the water or be conducive to the growth of organisms.

The Contractor shall provide certificates to the effect that rubber joint rings, rubber sealing rings, rubber gaskets provided under this Contract have been designed and manufactured considering the following aspects so as not to render leaky joints at pressures not less than 15 bars when in use.

- i. cross sectional dimensions
- ii. peripheral length
- iii. smooth surface finish without any blemishes, depressions, protrusions etc
- iv. gaskets shall be moulded type without any joints.

The Contractor shall provide written instructions on the method of forming the chamfer on cut end of pipe for jointing.

5. Flanges, Nuts and Bolts and Washers

uPVC flanges of pipeline fittings shall comply with BS 4504:Part 3 : Section 3.1 : 1989 and BS EN 1092 : Part 2 : 1997 for PN10 or PN 16 nominal pressure rating, whichever is stated in the Bill of Quantities.

The flanges shall be of raised faced type.

All nuts, washers and bolts to be supplied with flanges shall be of high tensile steel complying with BS 4395 parts 1 and 2 : 1969.

The screw threads in all pipes and fittings shall comply with ISO metric screw threads.

The bolt lengths shall be sufficient to ensure that nuts are full threaded when tightened in their final position with two threads showing. Washers shall be provided under the head of the bolt and under the nut.

6. Sampling and Testing

The number of samples to be tested for mechanical characteristics of uPVC pipes shall be selected at random in proportion to the total number of pipes and specials of each diameter in the delivery as follows:

For deliveries of lots of 50 to 150	-	2%
For deliveries of lots of 151 to 250	-	1%
For deliveries of lots of over 250	-	0.5%

The Contractor shall, if required, undertake a reasonable number of tests on pipes or specials where the delivery is less than 50 in number.

Contractor, on the request of the Engineer, shall arrange the manufacturer to test samples from the production line in the presence of the Engineer or a nominated agency and ensure that the pipes and fittings produced are in conformity with the standards specified in SLS 147 : 1993 and EN 1452:part 3:1999.

Hydrostatic test certificates in respect of pipes and fittings manufactured in accordance with, or to a standard not inferior to SLS 147 : 1993 and EN 1452: part 1 ,2 & 3:1999 shall be supplied for pipe and fittings separately.

The Engineer shall have free access at all reasonable times to those parts of the works engaged on the manufacture and testing of pipes and fittings. If there are no

facilities at the works the Contractor shall make arrangements for the prescribed test to be carried out elsewhere without any extra charge to the Purchaser.

7 Acceptance or Rejection of Consignments

Any pipe or fitting which fails to satisfy the requirements of the Specification shall be rejected.

However the pipe or fitting which fails to satisfy any of the tests specified in the relative clauses of this specification the test in question shall be repeated on two further samples. Such samples shall be selected from the same pipes lot or from a second selection by agreement between the Contractor and the Engineer and should either of these further samples fail any of the tests, the pipes or fittings represented shall be deemed not to comply with these tests in which the samples failed and the whole lot of such pipes or fittings so represented shall be rejected.

One set of "Go/No Go" gauges shall be provided for checking the circularity of each size of uPVC pipes and specials on arrival at their destination.

8. Saddle Straps

Straps shall be of uPVC in moulded type for uPVC pipes and be of the bolted type. The bolts and nuts shall be of stainless steel conforming to BS EN ISO 3506-1 : 2009 and BS EN ISO 3506-2 : 2009.

Straps for tapping 20 and 25 mm shall be drilled and tapped to the ISO metric pipe thread.

All straps shall be proof against leakage after tapping. Full details of the straps should be given in Schedule of Particulars.

The "O" ring material shall be of EPDM / SBR and shall conform to EN 681-1 or ISO 4633 : 2002

9. uPVC Couplings

uPVC couplings shall be injection moulded, slip over or similar type, suitable for working pressure of 12 bars, unless otherwise specified.

Joint rings shall be of material EPDM conforming to EN 681-1 : 1996 or ISO 4633 : 2002 SBR.

10. Ductile Iron Fittings for uPVC Piping

1. Scope

This section covers the requirements for the supply of Ductile Iron Fittings for uPVC or PE Piping Systems.

2. Reference Standards

BSEN 12842 : 2000 : Ductile Iron Fittings for uPVC or PE Piping Systems.

3. Definition

The definitions given in relevant standards which are referred to in the specifications shall apply for the terms used in this specification.

4. Dimensions of Fittings

Standardized sizes

Standardized sizes of fittings, corresponding to the nominal outside diameter d_n of the pipes to which they have to be connected, are as follows: 40,50,63,75,90,110, 125, 140, 160, 180, 200, 225, 250,280,315,355, 400, 450, 500, 560, 630, 710.

4.1. Minimum wall thickness

The minimum wall thickness of the ductile iron, at any point, shall be as given in Table 1.

Table 1 – Minimum wall thickness

d_n	Minimum Wall Thickness mm
$d_n \leq 225$	4.0
$225 < d_n \leq 315$	5.0
$315 < d_n \leq 710$	6.0

4.2. Dimensions of Sockets

The Minimum internal diameter of sockets and the minimum depth of engagement of sockets shall comply with the values given in Tables 5 and 6 of BSEN 12842 : 2000.

5. Leak Tightness of Joints

5.1 Leak tightness of joints shall be in accordance with the Table 3 of EN 12842 : 2000.

Table 3 - Summary of test conditions.

Test	Test requirements	Test conditions uPVC Pipes	Test conditions PE Pipes.
Internal hydrostatic Pressure	<ul style="list-style-type: none"> - test pressure 1.5 x PFA + 5 bar - test duration : 2h 	<ul style="list-style-type: none"> - joint of maximum annulus, aligned withdrawn and subjected to shear load - temperature between 15°C and 25° C 	<ul style="list-style-type: none"> -joint of maximum annulus, aligned and withdrawn - temperature between 15°C and 25° C
		<ul style="list-style-type: none"> - joint of maximum annulus, deflected - temperature between 15°C and 25° C 	<ul style="list-style-type: none"> - joint of maximum annulus, deflected -temperature between 15°C and 25° C
Negative internal pressure	<ul style="list-style-type: none"> - test pressure : 0.8 bar - test duration : 2h 	<ul style="list-style-type: none"> - joint of maximum annulus, aligned, withdrawn, and subjected to shear load - temperature between 15°C and 25° C 	<ul style="list-style-type: none"> - joint of maximum annulus, -temperature between 15°C and 25° C
		<ul style="list-style-type: none"> - joint of maximum annulus, deflected - temperature between 15°C and 25° C 	<ul style="list-style-type: none"> - joint of maximum annulus, deflected - temperature between 15°C and 25° C
Cyclic internal hydraulic pressure :	<ul style="list-style-type: none"> - test pressure : between 0.5 PFA and PFA - test period : 24 000 cycles 	<ul style="list-style-type: none"> - joint of maximum annulus, aligned, withdrawn and subjected to shear load - temperature between 15°C and 25° C 	<ul style="list-style-type: none"> - joint of maximum annulus, aligned and withdrawn -temperature between 15°C and 25° C

PFA = Allowable Operating Pressure of the joint declares by the manufacture.

5.2 Hydrostatic Pressure Test

When the hydrostatic pressure test is carried out, it shall be with the following minimum test pressure :

- dn 40 to dn 630 : 16 bar
- dn 710 : 10 bar

The internal : hydrostatic pressure shall be raised steadily, until it reaches the test pressure which shall be maintained for a sufficient time to allow visual inspection. The total duration of the pressure cycle shall be not less than 15s , including 10 s at test pressure.

6. Hardness

The Brinal Hardness, shall not exceed 250 HB

7. Tensile Properties

Ductile iron fittings shall have a minimum tensile strength of 420 MPa and a minimum elongation after fracture of 5%. The tensile strength shall be tested in accordance with 6.1 of BSEN 12842 : 2000.

8. Joint Rings & Gaskets

Rubber rings and gasket materials shall comply with the requirements of EN 681-1:1996 for the type WA .

**SPECIFICATIONS FOR DI PIPES, FITTINGS, SPECIALS, ACCESSORIES,
MANHOLE COVERS AND SURFACE BOXES.**

DUCTILE IRON PIPES AND FITTINGS

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DUCTILE IRON PIPES AND FITTINGS

1 Scope

In case of the manufacturer does not provide DI pipe fittings for uPVC pipe lines in accordance with EN 12842 : 2000 and he intends to provide DI pipe fittings conform to EN 545 or ISO 2531, this specification is applicable.

This section covers the requirement for the supply of Ductile Iron pipes and fittings.

2 Reference Standards

The following standards are referred to;

ISO 2531 : 1998	Ductile iron pipes, fittings and accessories for pressure pipe lines
BS EN 545 : 2006	Ductile Iron pipes, fittings, accessories and their joints for water pipelines. Requirements and test methods.
BSEN 681 -1 : 1996	Elastomeric seals- material requirement for pipe joint seals used in water and drainage application. (Vulcanized rubber)
BSEN 1092-1 ;2007	Flanges and their joints. Circular flanges for pipes, valves, fittings and accessories , PN Designated, steel flanges.
BSEN 14399 : Part 2: 2005	Specification for high strength structural bolting assemblies for pre- loading. Suitability test for Pre-loading.
BS 1514: Part 1:1997	Dimensions of non-metallic Flanges and their joints. Dimensions of gaskets for PN designated flanges. Non metallic flat gasket with or without inserts gaskets for pressures up to 64 bar.
ISO 9001 : 2000	Quality Management System Requirement
ISO 4179 : 2005	Ductile iron pipes for pressure and non pressure pipelines Centrifugal cement mortar lining.
ISO 6600 : 1980	Ductile iron pipes centrifugal cement mortar lining (composition controls for freshly applied mortar).
ANSI A214	Cement Mortar lining for cast iron and Ductile iron pipes and fittings for water.
ISO 8179 : 2004:Part 1	Metallic Zinc with finishing layer.
ISO 8179:1995: Part 2	Zinc rich paint with finishing layer

BS 6076:1996	Polymeric film for use as a protective sleeving for buried iron pipes and fittings (for site and factory application)
ISO 8180:2006	Ductile Iron pipes – polyethylene sleeving for site application.

The year of publication of the standards referred to in the following clauses shall be the year as given above.

3 Definitions

The definitions given in the relevant standards which are referred to in the specification, shall apply for the terms used in this specification.

4 Classes of Pipes & fittings and Pressure Ratings

Ductile iron pipes and fittings shall be in accordance with ISO 2531 : 1998 or with BS EN 545:2006. The standard class designation of pipes and fittings shall be as follows unless otherwise stated.

- Socket and Spigot Pipes	K 9
- Pipes with Integral Flanges	K 12
- Pipes with factory welded flanges	K 9
- Pipes with screwed flanges	K 9 or K 10
- Fittings except tees	K 12
- Tees	K 14
- Flanges	PN 16

The allowable operating pressures shall comply with Annex A of BS EN 545 : 2006 or ISO 2531 : 1998 unless otherwise stated.

5 Dimensions of Pipes and Fittings

Dimensions of standard pipes and fittings shall be to ISO 2531 or BS EN 545 : 2006 unless otherwise shown on the Drawings or required for special purposes. Where pipes or fittings are required in dimensions other than those specified in ISO 2531:1998 or BS EN 545:2006, they shall be of the same classes as listed above and shall be designed for the works proof test pressures specified in Table 10 of ISO 2531 or Table 13 of BS EN 545 : 2006 for the relevant nominal diameter.

Manufacturer's product catalogue, showing dimensions, mass and other details of all standard fittings shall be submitted to the Engineer for his approval prior to manufacture.

Manufacturer's detailed drawings of all special fittings shall be submitted to the Engineer for his approval prior to manufacture.

Standard pipe lengths shall comply with Table 3 and 4 of BS EN 545 : 2006 for socket and spigot and flanged pipes respectively or Table 2 & 3 of ISO 2531 : 1998 or their latest revision for socket and spigot pipes, unless otherwise stated.

6 Method of Manufacture of Pipes and Fittings

All straight pipes shall be spun or centrifugally cast and fittings and joint components shall be cast in sand moulds. Prior approval of the Engineer shall be required for any alternative casting methods.

At all stages of manufacture, rigid control shall be exercised and the pipes and fittings shall be sound and free from surface or other defects.

Foundries shall comply with the requirements of ISO 9001:2008 Quality Management Systems.

Manufacturing process of Pipes and Fittings shall comply with the ISO 9001:2008 quality management system requirements and such quality management system possessed by the manufacturer should be from an organisation accredited to issue such certification. Documentary evidence regarding accreditation together with the scope of certification should be provided. Certificate shall clearly indicate the name and address of the location of factory.

The Bidder shall also submit full details of the manufacturing process he intends to use with his tender. Such details shall include but not be confined to ;

- (1) Casting and heat treatment processes.
- (2) Cleaning process and preparation of surface of iron before application of coating and lining.
- (3) Specification of all lining and coating materials, their thickness and application procedures.
- (4) Ductile Iron Pipes and Fittings shall be from the same manufacturer.

7 Coating and Lining

All ductile iron pipes and fittings shall be protected internally and externally against corrosion. The external protection shall comprise a coating of metallic zinc or zinc rich paint complying with ISO 8179 : Part 1 : 2004 and ISO 8179 Part II followed by two coats of bituminous based black paint complying with BS 3416 : 1991 Type II or an approved coat of epoxy. The internal protection shall be a cement-mortar lining complying with specified thickness in Table 8 of BSEN 545 : 2006 or relevant Table in ISO 4179 : 2005 or ISO 6600 : 1980.

All such coatings and linings shall be applied under factory conditions, in complying with BS EN 545 : 2006 or ISO 4179 : 2005/ ISO 6600 : 1980.

8 Socket and Spigot Joints

Standard pipes and fittings for pipelines of ductile iron shall be supplied with push-in socket and spigot joints similar to joint Type A.1 illustrated in BSEN 14161: 2003 .

9. Joint Rings and Lubricants

The physical properties of elastomeric joint rings shall comply with Table 2 of BSEN 681-1 : 1996 or ISO 4633 : 2002. The joint rings shall also comply with the relevant provisions in BSEN 681-1 :1996 or ISO 4633 : 2002 for effects on water quality and resistance to microbiological deterioration.

The material of joint rings shall be of EPDM/SBR and shall be dual hardness punching type with 76-84 IRHD at the heel of the ring and 46-55 IRHD at the bulb of the ring.

Joint rings shall be supplied by the pipe manufacturer.

Each joint ring shall be marked clearly and durably in accordance with the following information in a manner that does not interfere with the sealing function of the ring, in complying with clause 10 of BSEN 681-1 :1996 or ISO 4633 : 2002.

- a) The nominal size
- b) Manufacturer's identification
- c) The number of the BS or BS EN or EN with seal type designation.
- d) Abbreviation for the elastomer

Joint Lubricants for sliding joints have no deleterious effects on either the joint rings or pipes, and be unaffected by the liquid to be conveyed. Lubricants shall not impart to water taste, colour or any effect known to be injurious to health and shall be resistant to bacterial growth.

10 Flanged Joints for Pipes and Pipeline Fittings

Flanges for pipes and pipeline fittings shall unless otherwise stated comply with BS EN 1092 – 1: 2007. Flanges shall be of PN 16 nominal pressure rating and shall be raised faced, unless otherwise stated.

Note: Flanges in accordance with BS EN 545 and ISO 2531 are dimensionally compatible with BSEN 1092-Part 1:2007

Flanged joints shall be complete with all nuts, bolts, gaskets and two washers per bolt.

The flanges of all pipes and fittings shall be integrally cast. The flanges of flanged pipes shall either be integrally cast or screwed or factory welded unless otherwise stated. 'Factory welded' means that the flanges are welded to the pipes at the point of manufacture under factory conditions with inspection agency certification.

The Contractor shall be responsible for checking and ensuring that mating flanges are compatible in all cases, including where connections are required to pipe work associated with pumping plant and inlet/outlet pipe work at service reservoirs or other structures.

11 Gaskets for Flanged Joints

Gaskets for flanged pipe joints shall be of the inside bolt circle type and the dimensions shall comply with BSEN 1514 – Part 1 : 1997.

The physical properties of gaskets shall comply with Table 2 of BSEN 681-1:1996 or ISO 4633 : 2002.

The Gaskets shall also comply with the relevant provisions in BSEN 681-1 :1996 or ISO 4633 : 2002 for effects on water quality and resistance to microbiological deterioration.

The Gasket material shall be EPDM/SBR and shall be of average hardness of 76-84.

The Gaskets shall be supplied by the manufacturer and shall suit for PN 16 flanges unless otherwise stated.

Each gasket shall be marked clearly and durably in accordance with the following information in a manner that does not interfere with the sealing function of the gasket, in complying with clause 10 of BSEN 681-1 :1996 or ISO 4633 : 2002.

- (a) The nominal size
- (b) Manufacturer' s identification
- (c) The number of the BS or BS EN with seal type designation.

(d) Abbreviation for the elastomer

12 Nuts, Bolts and Washers

The nuts, bolts and washers for flanged joints shall be of high tensile steel and shall comply with BSEN 14399 – Part II – 2005 .

The bolting shall comply with the relevant provisions of BSEN 1092- 1: 2007 .

The Bolt lengths shall be sufficient to ensure that nuts are full threaded when tightened in their final position with two threads showing.

Two washers per each bolt shall be supplied for providing under the head of the bolt and under the nut.

13 Polyethylene Sleeving for DI pipes & Fittings

Where specified Tubular polyethylene protective sleeving for buried DI pipes & fittings shall comply with the relevant provisions of BS 6076 : 1996 and shall be in accordance with ISO 8180 : 2006.

The polyethylene sleeving shall be coloured blue.

14 Tolerances

Tolerances on wall thickness weights and lengths shall be in accordance with BS EN 545 and/or ISO 2531, and the specific references for compliance are as follows.

	BS EN 545 : 2006	ISO 2531 : 1998
Wall thickness	Table 8	Table 1
Weights	-	Table 3
Lengths	Table 6	Table 4 & 5

The tolerances on flange thickness and flange diameter shall be in accordance with BS EN 1092-1 : 2007.

15 Tensile properties of pipes and fittings

The tensile properties and testing methods shall be in accordance with BS EN 545 or ISO 2531 and the specific references for compliance are as follows:

	BS EN 545:2006	ISO 2531 : 1998
Tensile Properties	Table 7	Table 6

Test methods	Clause 6.3	Clause 4.3.1 Clause 6.3
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16 Hardness of Pipes and Fittings

The Hardness of pipes and fittings shall not exceed the following superficial values, when tested in accordance with brinell hardness tests complying with clause 6.4 of BS EN 545 : 2006 or clause 4.3.2. of ISO 2531 : 1998.

	Superficial Hardness
Pipes	230 HB
Fittings & accessories	250 HB

17 Works Leak Tightness Test for Pipes and Fittings

All pipes and fittings shall comply with works leak tightness requirements of BS EN 545 : 2006 and ISO 2531 : 1998 and the specific references for compliance are as follows:

	BS EN 545 : 2006	ISO 2531 : 1998
Method of testing	Clause 6.5.2 and Clause 6.5.3	Clause 6.5.2 and 6.5.3
Minimum work test pressures	Table 14	Table 10

**SPECIFICATIONS FOR DI PIPES, FITTINGS, SPECIALS, ACCESSORIES,
MANHOLE COVERS AND SURFACE BOXES.**

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MECHANICAL COUPLINGS, REPAIR CLAMPS AND FLANGE ADAPTORS

All mechanical couplings, repair clamps and flange adaptors shall comply with ISO 9001:2008 quality Management system requirement . Quality Management system certificate should be from an organisation accredited to issue such certificate. Documentary evidence regarding accreditation together with the scope of certification should be provided. This certificate shall indicate the location of the factory.

Mechanical couplings and repair clamps shall comply with WIS 4-21-02 or equivalent and shall be PN 16 pressure rated unless otherwise stated.

All these fittings shall be protected against corrossions by the application of Polymeric anti-corrosion coatings in accordance with WIS 4-52-01 Class B. (both internal and external) with the coating thickness of not less than 250 microns. Engineer's approval shall be obtained for any other type of coating, prior to order.

The mechanical couplings and repair clamps shall be designed for a safe allowable angular deflection of 6° without leakage while it shall be 3° for flange adaptors.

All fastners of couplings, clamps and adaptors shall be electroplated to BSEN 12329 : 2000 grade Zn 10 or equivalent followed by a suitable primer and then with Polymeric anti-corrosion coatings in accordance with WIS 4-52-01 Class B.to a thickness of 60 – 120 microns.

Gaskets and rubber rings shall be of EPDM/SBR and the physical properties shall comply with table 2 of BSEN 681-1:1996 or ISO 4633 : 2002. Gaskets shall be of the inside bolt circle type and the dimensions shall comply with BSEN 1514 - :Part 1 : 1997. The hardness range for Gaskets is 76-84 IRHD.

Prior to the commencement of the manufacture the Contractor shall submit to the Engineer, for approval, detailed drawings of all mechanical couplings repair clamps and flange adaptors.

