SPECIFICATION FOR

- **COUPLINGS**
- **FLANGE ADAPTORS**
- **COUPLINGS & FLANGE ADAPTORS FOR PE AND PVC CONNECTIONS**
- **STEPPED COUPLINGS**
- **DISMANTLING JOINTS**

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Contents

Reference Standards

The following standards are referred to in this specification.

ISO 9001:2008/2015	Quality Management Systems Requirements
WIS 4-21-02	Specification for mechanical couplings and repair clamps for iron pipes for the conveyance of cold potable water (underground use) for the size range 40 to 1600mm/1.5 to 48" inclusive
ASTM F 1476	Standard Specification for Performance of Gasketed Mechanical Couplings for Use in Piping Applications
ASTM A 536	Standard Specification for Ductile Iron Castings
WIS 4-52-01 Class B	Specification for Polymeric Anti – Corrosion (Barrier) Coatings
EN 681-1:1996	Elastomeric seals - Material requirements for pipe joint seals used in water and drainage applications
ISO 4633:2002	Rubber seals- Joint rings for water supply drainage and sewerage pipe lines – specification for materials.
ISO 898-1:2009	Mechanical properties of fasteners made of carbon steel and alloy steel. Bolts, screws and studs with specified property classes, Coarse thread and fine pitch thread
BS 4190:2001 Grade 4	ISO metric black hexagon bolts, screws and nuts - Specification
BS 1449:Part 2:1983	Steel plate, sheet and strip. Specification for stainless and heat-resisting steel plate, sheet and strip
WIS 4-52-03	Specification for Anti – Corrosion Coatings on Threaded Fasteners
BS 6001:Part 1:1999	Sampling procedures for inspection by attributes. Sampling schemes indexed by acceptance quality limit (AQL) for lot-by-lot inspection
EN 10025-2:2004	Technical delivery conditions for non-alloy structural steels
EN 1563:1997	Founding - Spheroidal graphite cast irons
EN 12844:1999	Zinc and zinc alloys, Castings - Specifications
ISO 3506-1:2009	Mechanical properties of corrosion-resistant stainless steel fasteners -- Part 1: Bolts, screws and studs

1 Specification for Couplings

1.1 Large Diameter Couplings (diameter above 350 mm)

1.1.1 Scope

This specification covers large diameter couplings for pipelines.

1.1.2 General Requirements

All large diameter couplings shall be manufactured in a factory which comply with ISO 9001:2008/2015 Quality Management System requirement and shall be certified by an accredited agency which is a member of International Accreditation Forum (IAF) and have been authorized to issue a certification in their scope. The Documentary Evidence for accreditation together with the scope of certification shall be provided.

1.1.3 Marking

The markings shall be casted in to metal components marking shall include the following information.

i. Manufacturer's identification
ii. Date of Manufacture
iii. Standard to which it conform
iv. Nominal size
v. Maximum working pressure
vi. Flange to flange dimension and overall adjustment length
vii. Torque recommendation for long-term

1.1.4 Design

1.1.4.1 All fittings, and their components, shall be fit for the purpose for which they are to be used, and effect a completely leak-free seal under all specified working conditions.

1.1.4.2 All fittings referred to in this specification shall comply with the requirements of the ANSI/AWWA C219 Standard for "Bolted, Sleeve-Type Couplings For Plain-Ended Pipe". This shall include the requirement for cold expansion of centre sleeves and end rings after welding. It shall also exclude the use of circumferential welding of the End Ring or Compression Flange.

1.1.5 Technical Requirements

1.1.5.1 General

i) Large diameter coupling shall comply with WIS 4-21-02 and ASTM F 1476 and shall be of PN 16 pressure rating unless otherwise stated. The test pressure shall be 24 bars (350 psi) and working pressure of 16 bars (232 psi).

ii) Maximum allowable expansion/contraction of couplings shall be 10 mm.

iii) All water contact materials shall have the approval for the use in potable water piping system.

iv) The Center Sleeve /End rings shall be of steel confirming to BS EN 10025-2:2004 Grade S275 JR.

v) The overall length of the large diameter Couplings shall be 348mm for OD range of 351mm to 727mm.

1.1.5.2 Materials and their relevant standards

- Sleeve
  Rolled Steel to BS EN 10025-2:2004 Grade S275
- End Ring
  Rolled Steel to BS EN 10025-2:2004 Grade S275
- Gasket
  EPDM Grade "E" to BS En 681-1:1996 Type WA
- Bolt, Nuts & Washers
  Bolts – Steel to BS EN ISO 898-1:2009 Property Class 4.8
  Nuts – Steel to BS EN 4190:2001 Grade 4
  Washer – Stainless Steel to BS 1449:Part 2:1983 Grade 304 S15
- Coating
  Sleeve & End ring – Rilsan Nylon 11 to WIS 4-52-01 Part 1
  Bolts & Nuts – Sheraplex to WIS 4-52-03

1.1.5.3 Material in contact with water

All materials in contact with the fluid in the pipe shall be listed in the current Water Research Centre (WRC) 'List of materials approved for use in contact with portable water'. All materials shall comply with the latest editions of any relevant codes of practice or standard.

1.1.5.4 Coatings

All internal and external parts of coupling shall be protected against corrosion by the application of polymeric anti corrosion coating complies with WIS 4-52-01 Class B.

The minimum coating thickness at edges shall be 150 microns and at the surfaces 250 microns.

1.1.5.5 Gaskets & Rubber Rings

Gaskets & rubber rings shall be of EPDM. The physical properties shall comply with EN 681-1 or ISO 4633:2002. The preferable hardness range for gaskets is 70-84 IRHD.

All elastomeric gaskets shall be suitable for contact with portable water.

Manufacturers shall identify from which compound gaskets are fabricated and shall mark the gasket by colour flash, or other visual means, the grade of gasket, the standard applicable and adequate size information to ensure correct gaskets are used.

1.1.5.6 Nuts & Bolts

Nuts & Bolts shall be of stainless steel and shall be coated with an anti-seizing material to prevent galling during tightening.

Bolts/studs : steel shall comply to ISO 898-1:2009 property class 4.8.

Nuts : Steel shall comply to BS 4190:2001 Grade 4.

Washers : Stainless Steel shall comply to BS 1449: Part 2: 1983 Grade 304 S15.

Nuts & Bolts shall be sheraplex coated to WIS 4-52-03.

All Fasteners shall be of stainless steel comply to EN 3506:2009 and nuts coated with anti-galling compound.

Design life expectancy of couplings/ flange adaptors shall be 50 years.

Adequate washers of an approved material shall be provided to avoid damage to coatings.

1.1.5.7 Performance

1.1.5.7.1 Angular Deflection

All fittings shall be capable of allowing angular deflection of the pipes about their axes within the centre sleeve, without leakage and distortion of any metallic component of the fitting. The amount is a function of diameter as detailed below:

Upto DN450 nominal bore	$\pm 6^0$
DN450 to DN600 nominal bore	$\pm 5^0$
DN600 to DN750 nominal bore	$\pm 4^0$
DN750 to DN1200 nominal bore	$\pm 3^0$
DN1200 to DN1800 nominal bore	$\pm 2^0$
Over DN1800 nominal bore	$\pm 1^0$

1.1.5.7.2 Expansion/Contraction

All fittings shall be capable of accommodating the total of 10mm expansion or contraction due to longitudinal pipe movement without leakage.

1.1.5.8 Sampling & Testing

1.1.5.8.1 Production quality testing shall be carried out to comply with the sampling plan of BS 6001-Part 1:1999.

1.1.5.8.2 Following type tests shall be carried out by the manufacturer and test reports shall be submitted.

i. Short term internal hydrostatic pressure test
ii. Short term negative pressure test
iii. Bolt load relaxation test
iv. Leak-tightness test under angular deflection
v. Resistance to differential pressure movement test
vi. Resistance to shear test
vii. Leak tightness test under axial draw

1.1.5.8.3 Quality control tests for the following characteristics shall be carried out by the Manufacturer and test reports shall be submitted.

i. Short term internal hydrostatic pressure
ii. Short term negative pressure

1.1.5.8.3 (i) Short term internal hydrostatic pressure test

The pipe/fittings assembly shall be connected to a suitable device capable of applying and maintaining the relevant internal hydrostatic pressure as specified in table 2 of this specification, and held at a constant temperature. Each jointed assembly shall withstand the applied pressure for a minimum of one hour at ambient temperature without signs of leakage.

1.1.5.8.3 (ii) Short term negative pressure test

The pipe/fitting assembly shall be connected to a suitable device capable of applying and maintaining the relevant negative pressure as specified in Table 2 of this specification and held at a constant temperature. Each jointed assembly shall withstand the applied pressure for a minimum of one hour at ambient temperature. Fittings shall be tested with the test pipes withdrawn to the manufacturer's maximum recommended gap which shall be declared before the test is commenced.

Table 2 – Test Pressure

Size Ranges	Test pressure	
	Short-term Hydrostatic Pressure at 1 hour (bar)	**Short-term Negative pressure (bar)**
DN 40-600	PN x 1.5	0.8 (0.2*)
DN > 600	PN + 3	
* Absolute pressure (i.e below atmospheric)		

1.2 Small Diameter Couplings (OD< 350 mm)

1.2.1 Scope

This specification covers small diameter couplings for DI/CI piping systems.

1.2.2 General Requirements

All small diameter couplings shall be manufactured in a factory which comply with ISO 9001:2008/2015 Quality Management System requirement and shall be certified by an accredited agency which is a member of International Accreditation Forum (IAF) and have been authorized to issue a certification in their scope. The Documentary Evidence for accreditation together with the scope of certification shall be provided.

1.2.3 Marking

The markings shall be casted into metal components. Marking shall include the following information.

i. Manufacturer's identification
ii. Date of Manufacture
iii. Standard to which it conform
iv. Nominal size
v. Maximum working pressure
vi. Flange to flange dimension and overall adjustment length
vii. Torque recommendation for long-term

1.2.4 Technical Requirements

1.2.4.1

i) Small diameter coupling shall comply with WIS 4-21-02 and ASTM F 1476 and shall be of PN 16 pressure rating unless otherwise stated. The test pressure shall be 24 bars (350 psi) and working pressure of 16 bars (232 psi).

ii) Maximum allowable expansion/contraction of couplings shall be 10 mm while 5 mm.

iii) All water contact materials shall have the approval for the use in potable water piping system.

iv) The Center Sleeve /End rings shall be of ductile iron confirming to EN 1563:1997. Flange adaptor body shall be ductile iron confirming to EN 1563:1997

v) Gripper ring shall be of zinc alloy conform to EN 12844:1999 designation ZP3.

vi) Intermediate ring up to and including 160 mm shall be of ductile iron confirm to EN 1563:1997

vii) Intermediate ring from 180 mm and above shall be of Aluminium Alloy 6063 condition T6.

viii) The overall length of the small diameter Couplings shall be accordance with the following table.

Nominal Size (mm)	Size Range (mm)	Overall Length (mm)
Standard Sleeve Coupling		
DN 40-150	47.9-184.0	190
DN 175-300	189.0-349.0	230
Long Sleeve Coupling		
DN 50-200	57.0-244.0	285
DN 225-300	243.0-349.0	350

1.2.4.2 Materials and their relevant standards

- End Ring and Adaptor Body/Centre Sleeve
  Ductile Iron to BS EN 1563:1993 Symbol EN GJS-450-10
- Gasket
  EPDM compound Grade E to BS EN 681-1:1996, Type WA, WC
- Tee Bolts/ Bolts
  Steel to BS EN ISO 898-1:2009 Property Class 4.8
- Bolt Torque/ Spanner
  Bolt torque 55-65Nm, Spanner size A/F 19mm
- Nuts
  Steel to BS EN 4190:2001 Grade 4
- Washers
  Stainless Steel to BS 1449:Part 2:1983 Grade 304S15 Standard

1.2.4.3 Material in contact with water

All materials in contact with the fluid in the pipe shall be listed in the current Water Research Centre (WRC) 'List of materials approved for use in contact with portable water'. All materials shall comply with the latest editions of any relevant codes of practice or standard.

1.2.4.4 Coatings

Centre Sleeve, end ring, body and intermediate ring shall be coated with Rilsan Nylon II. Griper shall be of Cataphoretic coating, nuts, bolts shall be of Sherplex coated in conformity with WIS 4-52-03.

1.2.4.5 Gaskets & Rubber Rings

Gaskets & rubber rings shall be of EPDM. The physical properties shall comply with EN 681-1:1996 or ISO 4633:2002. The preferable hardness range for gaskets is 76-84 IRHD.

All elastomeric gaskets shall be suitable for contact with portable water.

Manufacturers shall identify from which compound gaskets are fabricated and shall mark the gasket by colour flash, or other visual means, the grade of gasket, the standard applicable and adequate size information to ensure correct gaskets are used.

1.2.4.6 Nuts & Bolts

Bolts shall confirm to ISO 898-1:2009 property class 8.8. If the bolts are with stainless steel, it shall confirm to ISO 3506-1:2009 Grade A4 property class 70.

Nuts shall confirm to EN 20898-2:1994 property class 8. If the nuts are with stainless steel, it shall confirm to EN ISO 3506-1:2009 Grade A4 property class 70.

Washers shall confirm to BS 1449:Part II 1983 Grade 304 S15.

Design life expectancy of couplings/ flange adaptors shall be 50 years. Adequate washers of an approved material shall be provided to avoid damage to coatings.

1.2.4.7 Performance

1.2.4.7.1 Angular Deflection

All fittings shall be capable of allowing angular deflection of the pipes about their axes within the centre sleeve, without leakage and distortion of any metallic component of the fitting. The amount is a function of diameter as detailed below:

Upto DN450 nominal bore	$\pm 6^0$
DN450 to DN600 nominal bore	$\pm 5^0$
DN600 to DN750 nominal bore	$\pm 4^0$
DN750 to DN1200 nominal bore	$\pm 3^0$
DN1200 to DN1800 nominal bore	$\pm 2^0$
Over DN1800 nominal bore	$\pm 1^0$

1.2.4.7.2 Expansion/Contraction

All fittings shall be capable of accommodating the total of 10mm expansion or contraction due to longitudinal pipe movement without leakage.

1.2.4.8 Sampling & Testing

1.2.4.8.1 Production quality testing shall be carried out to comply with the sampling plan of BS 6001-Part 1:1999.

1.2.4.8.2 Following type tests shall be carried out by the manufacturer and test reports shall be submitted.

i. Short term internal hydrostatic pressure test
ii. Short term negative pressure test
iii. Bolt load relaxation test
iv. Leak-tightness test under angular deflection
v. Resistance to differential pressure movement test
vi. Resistance to shear test
vii. Leak tightness test under axial draw

1.2.4.8.3 Quality control tests for the following characteristics shall be carried out by the Manufacturer and test reports shall be submitted.

i. Short term internal hydrostatic pressure
ii. Short term negative pressure

1.2.4.8.3 (i) Short term internal hydrostatic pressure test

The pipe/fittings assembly shall be connected to a suitable device capable of applying and maintaining the relevant internal hydrostatic pressure as specified in table 3 of this specification, and held at a constant temperature. Each jointed assembly shall withstand the applied pressure for a minimum of one hour at ambient temperature without signs of leakage.

1.2.4.8.3 (ii) Short term negative pressure test

The pipe/fitting assembly shall be connected to a suitable device capable of applying and maintaining the relevant negative pressure as specified in Table 3 of this specification and held at a constant temperature. Each jointed assembly shall withstand the applied pressure for a minimum of one hour at ambient temperature. Fittings shall be tested with the test pipes withdrawn to the manufacturer's maximum recommended gap, which shall be declared before the test is commenced.

Table 3 – Test Pressure

Size Ranges	Test pressure	
	Short-term Hydrostatic Pressure at 1 hour (bar)	**Short-term Negative pressure (bar)**
DN 40-600	PN x 1.5	0.8 (0.2*)
DN > 600	PN + 3	
* Absolute pressure (i.e below atmospheric)		

2 Flange Adaptors

2.1 Large Diameter Flange Adaptors (OD> 350 mm)

2.1.1 Scope

This specification covers large diameter flange adaptors for DI piping systems.

2.1.2 General Requirements

All flange adaptors shall be manufactured in a factory which comply with ISO 9001:2008/2015 Quality Management System requirement and shall be certified by an accredited agency which is a member of International Accreditation Forum (IAF) and have been authorized to issue a certification in their scope. The Documentary Evidence for accreditation together with the scope of certification shall be provided.

2.1.3 Marking

The markings shall be casted into metal components. marking shall include the following information.

i. Manufacturer's identification
ii. Date of Manufacture
iii. Standard to which it conform
iv. Nominal size
v. Maximum working pressure
vi. Flange to flange dimension and overall adjustment length
vii. Torque recommendation for long-term

2.1.4 Design

2.1.4.1 All fittings, and their components, shall be fit for the purpose for which they are to be used, and effect a completely leak-free seal under all specified working conditions.

2.1.4.2 All fittings referred to in this specification shall comply with the requirements of the ANSI/AWWA C219 Standard for "Bolted, Sleeve-Type Couplings For Plain-Ended Pipe". This shall include the requirement for cold expansion of centre sleeves and end rings after welding. It shall also exclude the use of circumferential welding of the End Ring or Compression Flange.

2.1.5 Technical Requirements

2.1.5.1 Flange Adaptors shall meet following minimum technical requirements:

i) Flange adaptors shall comply with WIS 4-21-02 and ASTM F 1476 and shall be of PN 16 pressure rating unless otherwise stated. The test pressure shall be 24 bars (350 psi) and working pressure of 16 bars (232 psi).

ii) Maximum allowable expansion/contraction of flanged adaptors shall be 5 mm.

iii) All water contact materials shall have the approval for the use in portable water piping system.

iv) The Center Sleeve and End rings shall be of steel confirming to EN 10025-2:2004 Grade S275 JR.

v) The minimum overall length of the large diameter Flange Adaptors shall be accordance with the following table.

Nominal Diameter (mm)	PN rating	Minimum Length (mm)
350-400	PN10/16	148
450-800	PN10/16	153
900-1000	PN10/16	169
1000-1600	PN10/16	182
350-600	PN25	155
700-800	PN25	169
900-1600	PN25	182

2.1.5.2 Materials and their relevant standards

- Flange/End Ring
  Steel to BS EN 10025-2:2004 Grade S275
- Bolt, Studs Nuts & Washers
  Bolts/studs – Steel to BS EN ISO 898-1:2009 Property Class 4.8
  Nuts – Steel to BS EN 4190:2001 Grade 4
  Washer – Stainless Steel to BS 1449:Part 2:1983 Grade 304 S15
- Coating
  Body, Flange & End ring – Rilsan Nylon 11 to WIS 4-52-01 Part 1
  Bolts & Nuts – Sheraplex coated to WIS 4-52-03
- Gasket
  LO2/LO3/YF2/YF3 – Rubber 80 IRDH moulded compound to BS EN 681-1:1996 Type WA, WC, WG
  A2E/A2H/XSXG - Rubber 70 IRDH moulded compound to BS EN 681-1:1996 Type WA, WC, WG

2.1.5.3 Material in contact with water

All materials in contact with the fluid in the pipe shall be listed in the current Water Research Centre (WRC) 'List of materials approved for use in contact with portable water'. All materials shall comply with the latest editions of any relevant codes of practice or standard.

2.1.5.4 Coatings

All internal and external parts of coupling shall be protected against corrosion by the application of polymeric anti-corrosion coating complies with WIS 4-52-01 Class B.

The minimum coating thickness at edges shall be 150 microns and at the surfaces 250 microns.

2.1.5.5 Gaskets & Rubber Rings

Gaskets & rubber rings shall be of EPDM. The physical properties shall comply with EN 681-1 or ISO 4633:2002. The preferable hardness range for gaskets is 70-84 IRHD.

All elastomeric gaskets shall be suitable for contact with portable water.

Manufacturers shall identify from which compound gaskets are fabricated and shall mark the gasket by colour flash, or other visual means, the grade of gasket, the standard applicable and adequate size information to ensure correct gaskets are used.

2.1.5.6 Nuts & Bolts

Nuts & Bolts shall be of stainless steel and shall be coated with an anti-seizing material to prevent galling during tightening.

Bolts/studs : steel shall comply to BS EN ISO 898-1:2009 property class 4.8.

Nuts : Steel shall comply to BS 4190:2001 Grade 4.

Washers : Stainless Steel shall comply to BS 1449: Part 2: 1983 Grade 304 S15.

Nuts & Bolts shall be sheraplex coated to WIS 4-52-03.

All Fasteners shall be of stainless steel and nuts coated with anti-galling compound.

Design life expectancy of couplings/ flange adaptors shall be 50 years.

Adequate washers of an approved material shall be provided to avoid damage to coatings.

2.1.5.7 Performance

2.1.5.7.1 Angular Deflection

All fittings shall be capable of allowing angular deflection of the pipes about their axes within the centre sleeve, without leakage and distortion of any metallic component of the fitting. The amount is a function of diameter as detailed below:

Upto DN450 nominal bore	$\pm 3^0$
DN450 to DN600 nominal bore	$\pm 2.5^0$
DN600 to DN750 nominal bore	$\pm 2^0$
DN750 to DN1200 nominal bore	$\pm 1.5^0$
DN1200 to DN1800 nominal bore	$\pm 1^0$
Over DN1800 nominal bore	$\pm 0.5^0$

2.1.5.7.2 Expansion/Contraction

All fittings shall be capable of accommodating the total of 5mm expansion or contraction due to longitudinal pipe movement without leakage.

2.1.5.8 Sampling & Testing

2.1.5.8.1 Production quality testing shall be carried out to comply with the sampling plan of BS 6001-Part 1:1999.

2.1.5.8.2 Following type tests shall be carried out by the manufacturer and test reports shall be submitted.

i. Short term internal hydrostatic pressure test
ii. Short term negative pressure test
iii. Bolt load relaxation test
iv. Leak-tightness test under angular deflection
v. Resistance to differential pressure movement test
vi. Resistance to shear test
vii. Leak tightness test under axial draw

2.1.5.8.3 Quality control tests for the following characteristics shall be carried out by the Manufacturer and test reports shall be submitted.

i. Short term internal hydrostatic pressure
ii. Short term negative pressure

2.1.5.8.3 (i) Short term internal hydrostatic pressure test

The pipe/fittings assembly shall be connected to a suitable device capable of applying and maintaining the relevant internal hydrostatic pressure as specified in table 4 of this specification, and held at a constant temperature. Each jointed assembly shall withstand the applied pressure for a minimum of one hour at ambient temperature without signs of leakage.

2.1.5.8.3 (ii) Short term negative pressure test

The pipe/fitting assembly shall be connected to a suitable device capable of applying and maintaining the relevant negative pressure as specified in Table 4 of this specification and held at a constant temperature. Each jointed assembly shall withstand the applied pressure for a minimum of one hour at ambient temperature. Fittings shall be tested with the test pipes withdrawn to the manufacturer's maximum recommended gap.

Table 4 – Test Pressure

Size Ranges	Test pressure	
	Short-term Hydrostatic Pressure at 1 hour (bar)	**Short-term Negative pressure (bar)**
DN 40-600	PN x 1.5	0.8 (0.2*)
DN > 600	PN + 3	
* Absolute pressure (i.e below atmospheric)		

2.2 Small Diameter Flange Adaptors (OD< 350 mm)

2.2.1 Scope

This specification covers small diameter flange adaptors for DI/CI piping systems.

2.2.2 General Requirements

All small diameter flange adaptors shall be manufactured in a factory which comply with ISO 9001:2008/2015 Quality Management System requirement and shall be certified by an accredited agency which is a member of International Accreditation Forum (IAF) and have been authorized to issue a certification in their scope. The Documentary Evidence for accreditation together with the scope of certification shall be provided.

2.2.3 Marking

The markings shall be casted in to metal components, marking shall include the following information.

i. Manufacturer's identification
ii. Date of Manufacture
iii. Standard to which it conform
iv. Nominal size
v. Maximum working pressure
vi. Flange to flange dimension and overall adjustment length
vii. Torque recommendation for long-term

2.2.4 Design

2.2.4.1 All fittings, and their components, shall be fit for the purpose for which they are to be used, and effect a completely leak-free seal under all specified working conditions.

2.2.4.2 All fittings referred to in this specification shall comply with the requirements of the ANSI/AWWA C219 Standard for "Bolted, Sleeve-Type Couplings For Plain-Ended Pipe". This shall include the requirement for cold expansion of centre sleeves and end rings after welding. It shall also exclude the use of circumferential welding of the End Ring or Compression Flange.

2.2.5 Technical Requirements

2.2.5.1

i) Small diameter flange adaptors shall comply with WIS 4-21-02 and ASTM F 1476 and shall be of PN 16 pressure rating unless otherwise stated. The test pressure shall be 24 bars (350 psi) and working pressure of 16 bars (232 psi).

ii) Maximum allowable expansion/contraction of flanged adaptors shall be 5 mm.

iii) All water contact materials shall have the approval for the use in portable water piping system.

iv). The Center Sleeve /End rings shall be of ductile iron confirming to EN 1563:1997. Flange adaptor body shall be ductile iron conforming to EN 1563:1997

v) Gripper ring shall be of zinc alloy conform to BSEN 12844:1999 designation ZP3.

vi) Intermediate ring up to and including 160 mm shall be of ductile iron conform to BSEN 1563:1997

vii) Intermediate ring from 180 mm and above shall be of Aluminium Alloy 6063 condition T6.

viii) The overall length of the small diameter Flange Adaptors shall be accordance with the following table.

Size Range (mm)	Overall Length (mm)
57-107	124
107-184	134
189-212	133
218-244	134
243-269	144
266-295	146
315-349	155

2.2.5.2 Materials and their relevant standards

- End Ring and Adaptor Body/Centre Sleeve
  Ductile Iron to BS EN 1563:1993 Symbol EN GJS-450-10
- Gasket
  EPDM compound Grade E to BS EN 681-1:1996, Type WA, WC
- Tee Bolts/ Bolts
  Steel to BS EN ISO 898-1:2009 Property Class 4.8
- Bolt Torque/ Spanner
  Bolt torque 55-65Nm, Spanner size A/F 19mm
- Nuts
  Steel to BS EN 4190:2001 Grade 4
- Washers
  Stainless Steel to BS 1449:Part 2:1983 Grade 304S15 Standard

2.2.5.2 Material in contact with water

All materials in contact with the fluid in the pipe shall be listed in the current Water Research Centre (WRC) 'List of materials approved for use in contact with portable water'. All materials shall comply with the latest editions of any relevant codes of practice or standard.

2.2.5.3 Coatings

Centre Sleeve, end ring, body and intermediate ring shall be coated with Rilsan Nylon II. Griper shall be of Cataphoretic coating, nuts, bolts shall be of Sherplex coated in conformity with WIS 4-52-03.

2.2.5.4 Gaskets & Rubber Rings

Gaskets & rubber rings shall be of EPDM. The physical properties shall comply with EN 681-1:1996 or ISO 4633:2002. The preferable hardness range for gaskets is 70-84 IRHD.

All elastomeric gaskets shall be suitable for contact with portable water.

Manufacturers shall identify from which compound gaskets are fabricated and shall mark the gasket by colour flash, or other visual means, the grade of gasket, the standard applicable and adequate size information to ensure correct gaskets are used.

2.2.5.5 Nuts & Bolts

Bolts shall conform to BSEN ISO 898-1:2009 property class 8.8. If the bolts are with stainless steel, it shall conform to EN ISO 3506-1:2009 Grade A4 property class 70.

Nuts shall conform to BSEN 20898-2:1994 property class 8. If the nuts are with stainless steel, it shall conform to BSEN ISO 3506-1:2009 Grade A4 property class 70.

Washers shall conform to BS 1449: Part II 1983 Grade 304 S15.

Design life expectancy of couplings/ flange adaptors shall be 50 years.

Adequate washers of an approved material shall be provided to avoid damage to coatings.

2.2.5.6 Performance

2.2.5.6.1 Angular Deflection

All fittings shall be capable of allowing angular deflection of the pipes about their axes within the centre sleeve, without leakage and distortion of any metallic component of the fitting. The angular deflection is $\pm 3^{0}$

2.2.5.6.2 Expansion/Contraction

All fittings shall be capable of accommodating the total of 5mm expansion or contraction due to longitudinal pipe movement without leakage.

2.2.5.7 Sampling & Testing

2.2.5.7.1 Production quality testing shall be carried out to comply with the sampling plan of BS 6001:Part 1.

2.2.5.7.2 Following type tests shall be carried out by the manufacturer and test reports shall be submitted.

i. Short term internal hydrostatic pressure test
ii. Short term negative pressure test
iii. Bolt load relaxation test
iv. Leak-tightness test under angular deflection
v. Resistance to differential pressure movement test
vi. Resistance to shear test
vii. Leak tightness test under axial draw

2.2.5.7.3 Quality control tests for the following characteristics shall be carried out by the Manufacturer and test reports shall be submitted.

i. Short term internal hydrostatic pressure
ii. Short term negative pressure

2.2.5.7.3 (i) Short term internal hydrostatic pressure test

The pipe/fittings assembly shall be connected to a suitable device capable of applying and maintaining the relevant internal hydrostatic pressure as specified in table 5 of this specification, and held at a constant temperature. Each jointed assembly shall withstand the applied pressure for a minimum of one hour at ambient temperature without signs of leakage.

2.2.5.7.3 (ii) Short term negative pressure test

The pipe/fitting assembly shall be connected to a suitable device capable of applying and maintaining the relevant negative pressure as specified in Table 5 of this specification and held at a constant temperature. Each jointed assembly shall withstand the applied pressure for a minimum of one hour at ambient temperature. Fittings shall be tested with the test pipes withdrawn to the manufacturer's maximum recommended gap.

Table 5 – Test Pressure

Size Ranges	Test pressure	
	Short-term Hydrostatic Pressure at 1 hour (bar)	**Short-term Negative pressure (bar)**
DN 40-600	PN x 1.5	0.8 (0.2*)
DN > 600	PN + 3	
* Absolute pressure (i.e below atmospheric)		

3. Couplings & Flange Adaptors for PE and PVC Connections

3.1 Large Diameter Couplings & Flange Adaptors (OD> 350 mm)

3.1.1 Scope

This specification covers couplings and flange adaptors for PE & PVC piping systems.

3.1.2 General Requirements

All couplings/flange adaptors shall meet the performance requirements of WIS 4-24-1 and shall conform to ISO 14236:2000. All couplings and flange adaptors shall be manufactured in a factory which comply with ISO 9001:2008/2015 Quality Management System requirement and shall be certified by an accredited agency which is a member of International Accreditation Forum (IAF) and have been authorized to issue a certification in their scope. The Documentary Evidence for accreditation together with the scope of certification shall be provided.

3.1.3 Marking

The markings shall be casted in to metal components marking shall include the following information.

i. Manufacturer's identification
ii. Date of Manufacture
iii. Standard to which it conform
iv. Nominal size
v. Maximum working pressure
vi. Flange to flange dimension and overall adjustment length
vii. Torque recommendation for long-term

3.1.4 Design

3.1.4.1 All fittings, and their components, shall be fit for the purpose for which they are to be used, and effect a completely leak-free seal under all specified working conditions.

3.1.4.2 All fittings referred to in this specification shall comply with the requirements of the ANSI/AWWA C219 Standard for "Bolted, Sleeve-Type Couplings For Plain-Ended Pipe". This shall include the requirement for cold expansion of centre sleeves and end rings after welding. It shall also exclude the use of circumferential welding of the End Ring or Compression Flange.

3.1.5 Technical Requirements

3.1.5.1 i) Flange adaptors & couplings shall comply with WIS 4-24-01 and ISO 14236:2000 and shall be of PN 16 pressure rating unless otherwise stated. The test pressure shall be 24 bars (350 psi) and working pressure of 16 bars (232 psi).

ii) All water contact materials shall have the approval for the use in portable water piping system.

iii) The body of the flange adaptors/couplings shall be of SG Iron to EN 1563:1997 (dia. 280 mm and below) and Ductile Iron confirming to EN 1563:1997.

iv) Design life expectancy shall be 50 years.

v) The length from the Flange to the Clamp Band of the large diameter Flange Adaptors shall be accordance with the following table.

Size Range (mm)	Flange Diameter (mm)	Length from Flange to Clamp Band (mm)
315	405	170
355	460/520	138
400-450	580	134
455	640	134
500	580	175
500	640/715	134
560	640	235
560	715	180
630	840	220
710	910	310
800	910/1025	270

3.1.5.2 Materials and their relevant standards

- Flange Adaptor Body
  Mild Steel to BS EN 10025:2004: Grade S275
- Clamp Band
  Mild Steel to BS EN 10025:2004: Grade S275

- Gaskets
  70 IRHD EPDM to BS EN 681-1:1996: Type WA.
- Coatings
  Flange adaptor body and clamp bands are coated in Rilsan Nylon 11 (Black), WRAS listed.
  Bolt and nuts and washers are zinc plated followed by Grey Flurene 177.

3.1.5.3 Material in contact with water

All materials in contact with the fluid in the pipe shall be listed in the current Water Research Centre (WRC) 'List of materials approved for use in contact with portable water'. All materials shall comply with the latest editions of any relevant codes of practice or standard.

3.1.5.4 Coatings

All parts of coupling shall be protected against corrosion by the application of Resilient Nylon coating complies with WIS 4-52-01

3.1.5.5 Gaskets & Rubber Rings

Gaskets & rubber rings shall be of EPDM. The physical properties shall comply with EN 681-1:1996 or ISO 4633:2002. The preferable hardness range for gaskets is 70-84 IRHD.

All elastomeric gaskets shall be suitable for contact with portable water.

Manufacturers shall identify from which compound gaskets are fabricated and shall mark the gasket by colour flash, or other visual means, the grade of gasket, the standard applicable and adequate size information to ensure correct gaskets are used.

3.1.5.6 Nuts & Bolts

Nuts & Bolts shall be of stainless steel and shall be coated with an anti-seizing material to prevent galling during tightening.

Bolts/studs : steel shall comply to ISO 898-1:2009 property class 4.8.

Nuts : Steel shall comply to BS 4190:2001 Grade 4.

Washers : Stainless Steel shall comply to BS 1449: Part 2: 1983 Grade 304 S15.

Nuts & Bolts shall be sheraplex coated to WIS 4-52-03.

All Fasteners shall be of stainless steel and nuts coated with anti-galling compound.

Adequate washers of an approved material shall be provided to avoid damage to coatings.

3.1.5.7 Performance

3.1.5.7.1 Angular Deflection

All fittings shall be capable of allowing angular deflection of the pipes about their axes within the centre sleeve, without leakage and distortion of any metallic component of the fitting. The amount is a function of diameter as detailed below:

	Couplings	Flange Adaptors
Upto DN450 nominal bore	$\pm 6^0$	$\pm 3^0$
DN450 to DN600 nominal bore	$\pm 5^0$	$\pm 2.5^0$
DN600 to DN750 nominal bore	$\pm 4^0$	$\pm 2^0$
DN750 to DN1200 nominal bore	$\pm 3^0$	$\pm 1.5^0$
DN1200 to DN1800 nominal bore	$\pm 2^0$	$\pm 1^0$
Over DN1800 nominal bore	$\pm 1^0$	$\pm 0.5^0$

3.1.5.7.2 Expansion/Contraction

All fittings shall be capable of accommodating the total of 10 mm expansion or contraction for couplings and 5mm expansion or contraction for flange adaptors due to longitudinal pipe movement without leakage.

3.1.5.7.3 The couplings and flange adaptors shall be suitable for use on pipes of PE100 material with SDR11, 17 or 21 without the need for a support liner for the pipe and uPVC pipes with SDR13.6 and PN16.

3.1.5.8 Sampling & Testing

3.1.5.8.1 Production quality testing shall be carried out to comply with the sampling plan of BS 6001-Part 1:1999.

3.1.5.8.2 Following type tests shall be carried out by the manufacturer and test reports shall be submitted.

i. Short term internal hydrostatic pressure test
ii. Short term negative pressure test
iii. Bolt load relaxation test
iv. Leak-tightness test under angular deflection
v. Resistance to differential pressure movement test
vi. Resistance to shear test
vii. Leak tightness test under axial draw

3.1.5.8.3 Quality control tests for the following characteristics shall be carried out by the Manufacturer and test reports shall be submitted.

i. Short term internal hydrostatic pressure
ii. Short term negative pressure

3.1.5.8.4 (i) Short term internal hydrostatic pressure test

The pipe/fittings assembly shall be connected to a suitable device capable of applying and maintaining the relevant internal hydrostatic pressure as specified in table 6 of this specification, and held at a constant temperature. Each jointed assembly shall withstand the applied pressure for a minimum of one hour at ambient temperature without signs of leakage.

3.1.5.8.4 (ii) Short term negative pressure test

The pipe/fitting assembly shall be connected to a suitable device capable of applying and maintaining the relevant negative pressure as specified in Table 6 of this specification and held at a constant temperature. Each jointed assembly shall withstand the applied pressure for a minimum of one hour at ambient temperature. Fittings shall be tested with the test pipes withdrawn to the manufacturer's maximum recommended gap.

Table 6 – Test Pressure

Size Ranges	Test pressure	
	Short-term Hydrostatic Pressure at 1 hour (bar)	Short-term Negative pressure (bar)
DN 40-600	PN x 1.5	0.8 (0.2*)
DN > 600	PN + 3	
* Absolute pressure (i.e below atmospheric)		

3.2 Small Diameter Couplings & Flange Adaptors (OD< 350 mm)

3.2.1 Scope

This specification covers small diameter flange adaptors for DI piping systems.

3.2.2 General Requirements

All small diameter flange adaptors shall be manufactured in a factory which comply with ISO 9001:2008/2015 Quality Management System requirement and shall be certified by an accredited agency who is a member of International Accreditation Forum (IAF) and have been authorized to issue a certification in their scope. The Documentary Evidence for accreditation together with the scope of certification shall be provided.

3.2.3 Marking

The markings shall be casted in to metal components marking shall include the following information.

i. Manufacturer's identification
ii. Date of Manufacture
iii. Standard to which it conform
iv. Nominal size
v. Maximum working pressure
vi. Flange to flange dimension and overall adjustment length
vii. Torque recommendation for long-term

3.2.4 Design

3.2.4.1 All fittings, and their components, shall be fit for the purpose for which they are to be used, and effect a completely leak-free seal under all specified working conditions.

3.2.4.2 All fittings referred to in this specification shall comply with the requirements of the ANSI/AWWA C219 Standard for "Bolted, Sleeve-Type Couplings For Plain-Ended Pipe". This shall include the requirement for cold expansion of centre sleeves and end rings after welding. It shall also exclude the use of circumferential welding of the End Ring or Compression Flange.

3.2.5 Technical Requirements

3.2.5.1

i) Small diameter flange adaptors shall comply with WIS 4-21-02 and ASTM F 1476 and shall be of PN 16 pressure rating unless otherwise stated. The test pressure shall be 24 bars (350 psi) and working pressure of 16 bars (350 psi).

ii) Maximum allowable expansion/contraction of couplings shall be 10 mm while 5 mm for flanged adaptors.

iii) All water contact materials shall have the approval for the use in portable water piping system.

iv). The Center Sleeve /End rings shall be of ductile iron conforming to BS EN 1563:1997. Flange adaptor body shall be ductile iron conforming to BS EN 1563:1997

v) Gripper ring shall be of zinc alloy conform to BSEN 12844:1999 designation ZP3.

vi) Intermediate ring up to and including 160 mm shall be of ductile iron conform to BSEN 1563:1997

vii) Intermediate ring from 180 mm and above shall be of Aluminium Alloy 6063 condition T6.

viii) The maximum length of the small diameter Couplings shall be accordance with the following table.

Pipe OD (mm)	Maximum Length (mm)
63-160	257
180-200	382
225-315	395

ix) The maximum length of the small diameter Flange Adaptors shall be accordance with the following table.

Pipe OD (mm)	Maximum Length (mm)
63-160	144
180-200	195
225	205
250	208
315	209

3.2.5.2 Materials and their relevant standards

- Centre Sleeve, End Ring and Adaptor Body
  Ductile Iron to BS EN 1563:1993 Symbol EN GJS-450-10
- Gripper Ring
  Zinc alloy to BS EN 12844:1999 Designation ZP3
- Intermediate Ring
  Upto and including 160mm: Ductile Iron to BS EN 1563:1993 Symbol EN GJS-450-10
  180mm and over Aluminium alloy 6063 condition T6
- Bolts
  BS EN ISO 898-1:2009 Property class 8.8

Stainless Steel BS EN ISO3506-1:2009 Grade A4 Property Class 70

- Nuts (M97)
  Steel to BS EN 20898-2:1994 Property Class 8
  Stainless Steel BS EN ISO3506-2:2009 Grade A4 Property Class 70
- Washers (M42)
  BS 1449:Part 2:1983 Grade 304S15
- Gasket (EPDM)
  BS EN 681-1:1996, Type WA/ BS 6920 hardness to 70 IRHD
- Coatings
  Centre Sleeve, end ring, flange adaptor body and intermediate ring: Rilsan Nylon 11
  Gripper: Cataphoretic coating
  Bolts, nuts: Sheraplex to WIS-4-52-03

3.2.5.3 Material

All materials in contact with the fluid in the pipe shall be listed in the current Water Research Centre (WRC) 'List of materials approved for use in contact with portable water'. All materials shall comply with the latest editions of any relevant codes of practice or standard.

3.2.5.4 Coatings

Centre Sleeve, end ring, body and intermediate ring shall be coated with Rilsan Nylon II. Griper shall be of Cataphoretic coating, nuts, bolts shall be of Sherplex coated in conformity with WIS 4-52-03.

3.2.5.5 Gaskets & Rubber Rings

Gaskets & rubber rings shall be of EPDM. The physical properties shall comply with EN 681-1:1996 or ISO 4633:2002. The preferable hardness range for gaskets is 76-84 IRHD.

All elastomeric gaskets shall be suitable for contact with portable water.

Manufacturers shall identify from which compound gaskets are fabricated and shall mark the gasket by colour flash, or other visual means, the grade of gasket, the standard applicable and adequate size information to ensure correct gaskets are used.

3.2.5.6 Nuts & Bolts

Bolts shall conform to ISO 898-1:2009 property class 8.8. If the bolts are with stainless steel, it shall conform to ISO 3506-1:2009 Grade A4 property class 70.

Nuts shall conform to EN 20898-2:1994 property class 8. If the nuts are with stainless steel, it shall conform to ISO 3506-1:2009 Grade A4 property class 70.

Washers shall conform to BS 1449:Part II 1983 Grade 304 S15.

Design life expectancy of couplings/ flange adaptors shall be 50 years.

Adequate washers of an approved material shall be provided to avoid damage to coatings.

3.2.5.7 Performance

3.2.5.7.1 Angular Deflection

All fittings shall be capable of allowing angular deflection of the pipes about their axes within the centre sleeve, without leakage and distortion of any metallic component of the fitting. The amount is a function of diameter as detailed below:

	Couplings	Flange Adaptors
Upto DN450 nominal bore	$\pm 6^0$	$\pm 3^0$
DN450 to DN600 nominal bore	$\pm 5^0$	$\pm 2.5^0$
DN600 to DN750 nominal bore	$\pm 4^0$	$\pm 2^0$
DN750 to DN1200 nominal bore	$\pm 3^0$	$\pm 1.5^0$
DN1200 to DN1800 nominal bore	$\pm 2^0$	$\pm 1^0$
Over DN1800 nominal bore	$\pm 1^0$	$\pm 0.5^0$

3.2.5.7.2 Expansion/Contraction

All fittings shall be capable of accommodating the total of 10 mm expansion or contraction for couplings and 5mm expansion or contraction for flange adaptors due to longitudinal pipe movement without leakage.

3.2.5.7.3 The couplings and flange adaptors shall be suitable for use on pipes of PE100 material with SDR11, 17 or 21 without the need for a support liner for the pipe and uPVC pipes with SDR13.6 and PN16.

3.2.5.8 Sampling & Testing

3.2.5.8.1 Production quality testing shall be carried out to comply with the sampling plan of BS 6001-Part 1:1999.

3.2.5.8.2 Following type tests shall be carried out by the manufacturer and test reports shall be submitted.

i. Short term internal hydrostatic pressure test
ii. Short term negative pressure test
iii. Bolt load relaxation test
iv. Leak-tightness test under angular deflection
v. Resistance to differential pressure movement test
vi. Resistance to shear test
vii. Leak tightness test under axial draw

3.2.5.8.3 Quality control tests for the following characteristics shall be carried out by the Manufacturer and test reports shall be submitted.

i. Short term internal hydrostatic pressure
ii. Short term negative pressure

3.2.5.8.3 (i) Short term internal hydrostatic pressure test

The pipe/fittings assembly shall be connected to a suitable device capable of applying and maintaining the relevant internal hydrostatic pressure as specified in table 7 of this specification, and held at a constant temperature. Each jointed assembly shall withstand the applied pressure for a minimum of one hour at ambient temperature without signs of leakage.

3.2.5.8.3 (ii) Short term negative pressure test

The pipe/fitting assembly shall be connected to a suitable device capable of applying and maintaining the relevant negative pressure as specified in Table 7 of this specification and held at a constant temperature. Each jointed assembly shall withstand the applied pressure for a minimum of one hour at ambient temperature. Fittings shall be tested with the test pipes withdrawn to the manufacturer's maximum recommended gap.

Table 7 – Test Pressure

Size Ranges	Test pressure	
	Short-term Hydrostatic Pressure at 1 hour (bar)	**Short-term Negative pressure (bar)**
DN 40-600	PN x 1.5	0.8 (0.2*)
DN > 600	PN + 3	
* Absolute pressure (i.e below atmospheric)		

4 Stepped Couplings

4.1 Scope

This specification covers stepped couplings for DI/CI piping systems.

4.2 General Requirements

All stepped couplings shall be manufactured in a factory which comply with ISO 9001:2008/2015 Quality Management System requirement and shall be certified by an accredited agency which is a member of International Accreditation Forum (IAF) and have been authorized to issue a certification in their scope. The Documentary evidence for accreditation together with the scope of certification shall be provided.

4.3 Marking

The markings shall be casted into metal components marking shall include the following information.

i. Manufacturer's identification
ii. Date of Manufacture
iii. Standard to which it conform
iv. Nominal size
v. Maximum working pressure
vi. Flange to flange dimension and overall adjustment length
vii. Torque recommendation for long-term seal

4.4 Design

4.4.1 All fittings, and their components, shall be fit for the purpose for which they are to be used, and effect a completely leak-free seal under all specified working conditions.

4.4.2 All fittings referred to in this specification shall comply with the requirements of the ANSI/AWWA C219 Standard for "Bolted, Sleeve-Type Couplings For Plain-Ended Pipe". This shall include the requirement for cold expansion of centre sleeves and end rings after welding. It shall also exclude the use of circumferential welding of the End Ring or Compression Flange.

4.5 Technical Requirements

4.5.1 General

i) Stepped coupling shall comply with WIS 4-21-02 and ASTM F 1476 and shall be of PN 16 pressure rating unless otherwise stated. The test pressure shall be 24 bars (350 psi) and working pressure of 16 bars (232 psi).

ii) Maximum allowable expansion/contraction of couplings shall be 10 mm.

iii) All water contact materials shall have the approval for the use in potable water piping system.

iv) The housing shall be confirming to ASTM A-536.

vi) The overall length of the Stepped Coupling shall be accordance with the following table.

Size Range (mm)		Overall length (mm)
Small End	Large End	
Small Diameter Stepped Coupling		
57-107	63-132	210
107-158	132-184	220
158-269	189-295	230
Large Diameter Expanded Sleeve Stepped Coupling		
374.5-750	394.3-758	348

4.5.2 Materials and their relevant standards

For Small Diameter Stepped Coupling

- End Ring and Adaptor Body/Centre Sleeve
  Ductile Iron to BS EN 1563:1993 Symbol EN GJS-450-10
- Gasket
  EPDM compound Grade E to BS EN 681-1:1996, Type WA, WC
- Tee Bolts/ Bolts
  Steel to BS EN ISO 898-1:2009 Property Class 4.8
- Bolt Torque/ Spanner
  Bolt torque 55-65Nm, Spanner size A/F 19mm
- Nuts
  Steel to BS EN 4190:2001 Grade 4
- Washers
  Stainless Steel to BS 1449:Part 2:1983 Grade 304S15 Standard

For Large Diameter Expanded Sleeve Stepped Coupling

- Make Up Ring Sleeve
  Mild Steel to BS EN 10025-2:2004 Grade S275
  Rolled Steel to BS EN 10025-2:2004 Grade S275
- End Ring
  Rolled Steel to BS EN 10025-2:2004 Grade S275
- Gasket

EPDM compound Grade E to BS EN 681-1:1996, Type WA

- Bolts, Nuts & Washers
  Bolts- Steel to BS EN ISO 898-1:2009 Property Class 4.8
  Nuts- Steel to BS EN 4190:2001 Grade 4
  Washer- Stainless Steel to BS 1449:Part 2:1983 Grade 304S15 Standard
- Coating
  Sleeve & End Ring –Rilsan Nylon 11 to WIS 4-52-01 Part 1
  Bolts & Nuts – Sheraplex to WIS 4-52-03

4.5.3 Material in contact with water

All materials in contact with the fluid in the pipe shall be listed in the current Water Research Centre (WRC) 'List of materials approved for use in contact with portable water'. All materials shall comply with the latest editions of any relevant codes of practice or standard.

4.5.4 Coatings

All internal and external parts of coupling shall be protected against corrosion by the application of polymeric anti corrosion coating complies with WIS 4-52-01 Class B.

The minimum coating thickness at edges shall be 150 microns and at the surfaces 250 microns.

4.5.5 Gaskets & Rubber Rings

Gaskets & rubber rings shall be of EPDM. The physical properties shall comply with EN 681-1 or ISO 4633:2002. The preferable hardness range for gaskets is 70-84 IRHD.

All elastomeric gaskets shall be suitable for contact with portable water.

Manufacturers shall identify from which compound gaskets are fabricated and shall mark the gasket by colour flash, or other visual means, the grade of gasket, the standard applicable and adequate size information to ensure correct gaskets are used.

4.5.6 Nuts & Bolts

Nuts & Bolts shall be of steel and shall be coated with an anti-seizing material to prevent galling during tightening.

Bolts/studs: steel shall comply to BS EN ISO 898-1:2009 property class 4.8.

Nuts: Steel shall comply to BS 4190:2001 Grade 4.

Washers: Stainless Steel shall comply to BS 1449: Part 2: 1983 Grade 304 S15.

Nuts & Bolts shall be sheraplex coated to WIS 4-52-03.

All Fasteners shall be of stainless steel comply to BS EN 3506:2009 and nuts coated with anti-galling compound.

Design life expectancy of couplings/ flange adaptors shall be 50 years.

Adequate washers of an approved material shall be provided to avoid damage to coatings.

4.5.7 Performance

4.5.7.1 Angular Deflection

All fittings shall be capable of allowing angular deflection of the pipes about their axes within the centre sleeve, without leakage and distortion of any metallic component of the fitting. The amount is a function of diameter as detailed below:

Upto DN450 nominal bore	$\pm 6^0$
DN450 to DN600 nominal bore	$\pm 5^0$
DN600 to DN750 nominal bore	$\pm 4^0$
DN750 to DN1200 nominal bore	$\pm 3^0$
DN1200 to DN1800 nominal bore	$\pm 2^0$
Over DN1800 nominal bore	$\pm 1^0$

4.5.7.2 Expansion/Contraction

All fittings shall be capable of accommodating the total of 10mm expansion or contraction due to longitudinal pipe movement without leakage.

4.5.8 Sampling & Testing

4.5.8.1 Production quality testing shall be carried out to comply with the sampling plan of BS 6001- Part 1:1999.

4.5.8.2 Following type tests shall be carried out by the manufacturer and Test reports shall be submitted.

i. Short term internal hydrostatic pressure test
ii. Short term negative pressure test
iii. Bolt load relaxation test
iv. Leak-tightness test under angular deflection
v. Resistance to differential pressure movement test
vi. Resistance to shear test
vii. Leak tightness test under axial draw

4.5.8.3 Quality control tests for the following characteristics shall be carried out by the Manufacturer and test reports shall be submitted.

i. Short term internal hydrostatic pressure
ii. Short term negative pressure

4.5.8.3 (i) Short term internal hydrostatic pressure test

The pipe/fittings assembly shall be connected to a suitable device capable of applying and maintaining the relevant internal hydrostatic pressure as specified in Table 1 of this specification, and held at a constant temperature. Each jointed assembly shall withstand the applied pressure for a minimum of one hour at ambient temperature without signs of leakage.

4.5.8.3 (ii) Short term negative pressure test

The pipe/fitting assembly shall be connected to a suitable device capable of applying and maintaining the relevant negative pressure as specified in Table 1 of this specification and held at a constant temperature. Each jointed assembly shall withstand the applied pressure for a minimum of one hour at ambient temperature. Fittings shall be tested with the test pipes withdrawn to the manufacturer's maximum recommended gap, which shall be declared before the test is commenced.

Table 1 – Test Pressure

Size Ranges	Test pressure	
	Short-term Hydrostatic Pressure at 1 hour (bar)	**Short-term Negative pressure (bar)**
DN 40-600	PN x 1.5	0.8 (0.2*)
DN > 600	PN + 3	
* Absolute pressure (i.e below atmospheric)		

5 Dismantling Joint

5.1 Scope

This specification covers Dismantling Joints for DI/CI piping systems.

5.2 General Requirements

All Dismantling Joints shall be manufactured in a factory which comply with ISO 9001:2008/2015 Quality Management System requirement and shall be certified by an accredited agency which is a member of International Accreditation Forum (IAF) and have been authorized to issue a certification in their scope. The Documentary Evidence for accreditation together with the scope of certification shall be provided.

5.3 Marking

The markings shall be casted in to metal components marking shall include the following information.

i. Manufacturer's identification
ii. Date of Manufacture
iii. Standard to which it conform
iv. Nominal size
v. Maximum working pressure
vi. Flange to flange dimension and overall adjustment length
vii. Torque recommendation for long-term

5.4 Design

5.4.1 All fittings, and their components, shall be fit for the purpose for which they are to be used, and effect a completely leak-free seal under all specified working conditions.

5.4.2 All fittings referred to in this specification shall comply with the requirements of the ANSI/AWWA C219 Standard for "Bolted, Sleeve-Type Couplings For Plain-Ended Pipe". This shall include the requirement for cold expansion of centre sleeves and end rings after welding. It shall also exclude the use of circumferential welding of the End Ring or Compression Flange.

5.4.3 For applications where a full flange face is required, e.g. wafer style valves, both flanges of the Dismantling Joint shall provide a full flange sealing area.

5.5 Technical Requirements

5. 5.1 General

i) Dismantling Joints shall comply with WIS 4-21-02 and ASTM F 1476 and shall be of PN 16 pressure rating unless otherwise stated. The test pressure shall be 24 bars (350 psi) and working pressure of 16 bars (232 psi).

ii) All water contact materials shall have the approval for the use in portable water piping system.

iii). The Body shall be of Ductile Iron conforming to EN 1563:2011 symbol EN-GJS-450-10 (Diameter 40-300 mm) for Cast Flange Adaptors or Rolled Steel conforming to EN 10025:2004 Grade S275 for Fabricated Flange Adaptors.

iv) End Rings or Sleeves shall be of Ductile Iron conforming to EN 1563:2011 symbol EN-GJS-450-10 (Diameter 40-300 mm) for Cast Flange Adaptors or Rolled Steel conforming to EN 10025:2004 Grade S275 or Grade S355 (Depending on section) for Fabricated Flange Adaptors.

v) Flange shall be of Rolled Steel conforming to EN 10025:2004 Grade S275 and spigot shall be of Steel Tube conforming to BS 10216-1:2013 Grade P265TR1 or Rolled Steel conforming to EN 10025:2004 Grade S275.

vi) A Dismantling Joint is essentially a double-flange pipe of adjustable length that permits removal of flanged components from a pipeline. In the assemble length that permits removal of flanged components from a pipe line. In the assembled condition, pipework pressure forces are transferred across the Dismantling Joint by means of a set of tie bars, which replace some or all, of the main flange connecting bolts.

vii) The Flange Adaptor component of the Dismantling Joint shall be manufactured to comply with American Water Works Association Standard AWWA C219.

viii) The minimum length of the dismantling joint shall be accordance with the following table.

Nominal Diameter (mm)	Minimum Length (mm)
40 (PN 10,16,25,40)	167
50-80 (PN 10,16,25,40)	175
100-300 (PN 10,16)	175
100-300 (PN 25,40)	174
350-400 (PN 10)	270
450-800 (PN 10)	275
900-1100 (PN 10)	277
1200-1800 (PN 10)	290
2000-2200 (PN 10)	390
2400 (PN 10)	412
350-400 (PN 16)	270
450-800 (PN 16)	275
900-1000 (PN 16)	277
1100-1800 (PN 16)	290
2000-2400 (PN 16)	412
350-900 (PN 25)	277
1000-1200 (PN 25)	290
1400-1800 (PN 25)	412

5.5.2 Materials and their relevant standards

- Flange Drilling
  BS EN 1092-1, ISO 7005
- Cast Flange Adaptor
  Body – Ductile Iron to BS EN 1563:1997:Symbol EN-GJS-450-10
  End Rings – Ductile Iron to BS EN 1563:1997: Symbol EN-GJS-450-10
- Fabricated Adaptor
  Body – Rolled Steel to BS EN 10025-2:2004 Grade S275
  End Rings – Rolled Steel to BS EN 10025-2:2004 Grade S275
- Flanges Spigot
  Flange – Steel to BS EN 10025-2:2004 Grade S275
  Spigot – Upto and including 165.1mm – Steel to BS EN 10025:2004 Over 165.1mm Steel to BS10216-1:2002
- Gasket
  BS EN 681-1:1996 Type WA

- Tie Rods
  H.T Steel BS4882 Grade MB7 or B7 Yield 725N/mm^2
  M48- 2" Stainless Steel to BS EN 3506-1:2009 Grade A2/A4 Property Class 70 (450 N/mm^2)
  M52 and 21/4" and above Stainless Steel to BS EN 3506-1:2009 Grade A2/A4 Property Class 50 (210 N/mm^2)
- Bolt, Nuts & Washers
  Bolts – Steel to BS EN ISO 898-1:2009 Property Class 4.8
  Nuts – Steel to BS EN 4190:2001 Grade 4
  Washer – Stainless Steel to BS 1449:Part 2:1983 Grade 304 S15
- Coating
  Centre Sleeve– Rilsan Nylon 11
  End ring – Rilsan Nylon 11
  FA Studs & Nuts – Sheraplex to WIS 4-52-03
  Tie Rods – Zn3 coated

5.5.3 Material in contact with water

All materials in contact with the fluid in the pipe shall be listed in the current Water Research Centre (WRC) 'List of materials approved for use in contact with portable water'. All materials shall comply with the latest editions of any relevant codes of practice or standard.

5.5.4 Coatings

All internal and external parts of Dismantling Joint shall be protected against corrosion by the application of polymeric anti-corrosion coating complies with WIS 4-52-01 Class B.

All Flange Adaptors, Flange Spigot and End Rings shall be coated by Rilsan Nylon 11 and all tie rods and nuts shall be protected with Zn3 Zinc coating.

The minimum coating thickness at edges shall be 150 microns and at the surfaces 250 microns.

5.5.5 Gaskets & Rubber Rings

Gaskets & rubber rings shall be of EPDM. The physical properties shall comply with EN 681-1:1996 or ISO 4633:2002. The preferable hardness range for gaskets is preferably 76-84 IRHD.

All elastomeric gaskets shall be suitable for contact with portable water.

Manufacturers shall identify from which compound gaskets are fabricated and shall mark the gasket by colour flash, or other visual

means, the grade of gasket, the standard applicable and adequate size information to ensure correct gaskets are used.

5.5.6 Nuts & Bolts

Nuts & Bolts shall be of steel and shall be coated with an anti-seizing material to prevent galling during tightening.

Bolts/ Studs: steel shall comply with BS EN ISO 8898-1:2009 property class 4.8.

Nuts: Steel shall comply with BS 4190:2001 Grade 4.

Washers: shall conform to BS 1449:Part II 1983 Grade 304 S15.

Adequate washers of an approved material shall be provided to avoid damage to coatings.

Studs, Nuts & Bolts shall be sheraplex coated to WIS 4-52-03.

All Tie rods shall be of Steel comply with BS EN 10269:2013 name 42CrMo4 (Formerly MB7) and steel nuts comply with BS EN 898-2:2012 property class 8.0 or Stainless Steel comply with BS EN 3506-1:2009 Grade A2/A4 Property class 70 and Stainless Steel Nuts comply with BS EN 3506-2:2009 Grade A2/A4 Property Class 80.

5.5.7 Performance

5.5.7.1 Angular Deflection

All fittings shall be capable of allowing angular deflection of the pipes about their axes within the centre sleeve, without leakage and distortion of any metallic component of the fitting. The amount is a function of diameter as detailed below:

	Couplings	Flange Adaptors
Upto DN450 nominal bore	$\pm 6^0$	$\pm 3^0$
DN450 to DN600 nominal bore	$\pm 5^0$	$\pm 2.5^0$
DN600 to DN750 nominal bore	$\pm 4^0$	$\pm 2^0$
DN750 to DN1200 nominal bore	$\pm 3^0$	$\pm 1.5^0$
DN1200 to DN1800 nominal bore	$\pm 2^0$	$\pm 1^0$
Over DN1800 nominal bore	$\pm 1^0$	$\pm 0.5^0$

5.5.7.2 Expansion/Contraction

All fittings shall be capable of accommodating the total of 10 mm expansion or contraction for couplings and 5mm expansion or contraction for flange adaptors due to longitudinal pipe movement without leakage.

5.5.7.3 Sampling & Testing

5.5.7.3.1 Production quality testing shall be carried out to comply with the sampling plan of BS 6001-Part 1:1999.

5.5.7.3.2 Following type tests shall be carried out by the manufacturer and test reports shall be submitted.

i. Short term internal hydrostatic pressure test
ii. Short term negative pressure test
iii. Bolt load relaxation test
iv. Leak-tightness test under angular deflection
v. Resistance to differential pressure movement test
vi. Resistance to shear test
vii. Leak tightness test under axial draw

5.5.7.3.3 Quality control tests for the following characteristics shall be carried out by the Manufacturer and test reports shall be submitted.

i. Short term internal hydrostatic pressure
ii. Short term negative pressure

5.5.7.3.4 (i) Short term internal hydrostatic pressure test

The pipe/fittings assembly shall be connected to a suitable device capable of applying and maintaining the relevant internal hydrostatic pressure as specified in table 8 of this specification, and held at a constant temperature. Each jointed assembly shall withstand the applied pressure for a minimum of one hour at ambient temperature without signs of leakage.

5.5.7.3.5 (ii) Short term negative pressure test

The pipe/fitting assembly shall be connected to a suitable device capable of applying and maintaining the relevant negative pressure as specified in Table 8 of this specification and held at a constant temperature. Each jointed assembly shall withstand the applied pressure for a minimum of one hour at ambient temperature. Fittings

shall be tested with the test pipes withdrawn to the manufacturer's maximum recommended gap.

Table 8 – Test Pressure

Size Ranges	Test pressure	
	Short-term Hydrostatic Pressure at 1 hour (bar)	**Short-term Negative pressure (bar)**
DN 40-600	PN x 1.5	0.8 (0.2*)
DN > 600	PN + 3	
* Absolute pressure (i.e below atmospheric)		