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# WATER INDUSTRY SPECIFICATION

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UK Water Industry

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## SPECIFICATION FOR MECHANICAL AND COMPRESSION FITTINGS MADE PRINCIPALLY FROM THERMOPLASTICS FOR POLYETHYLENE PRESSURE PIPES WITH OR WITHOUT AN ALUMINIUM BARRIER LAYER OF NOMINAL SIZE $\leq 63$

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### FOREWORD

This specification defines the properties required of mechanical and compression fittings in the size range 20 mm to 63 mm for use with polyethylene pressure pipes manufactured to BS EN 12201-2 or polyethylene pressure pipes with an aluminium barrier layer manufactured to BS 8588.

The test methods included in Issue 1 of this specification were based on ISO standards. Where appropriate, direct reference has been made to these ISO test methods which have been adopted as BS EN ISO standards. The resistance to pull-out test has been aligned with IGN 4-01-02: 2017.

This specification was approved by the UK Water Industry's Standards Board following development by the Water Industry and the British Plastics Federation (BPF) Pipes Group.

Throughout this specification, fittings are designated by a size related to the metric nominal outside diameters of the pipe with which the fitting is to be used.

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

This specification may call for the use of procedures that may be injurious to health and safety if adequate precautions are not taken. It refers only to technical suitability and does not absolve the user from legal obligations relating to health and safety at any stage.

Compliance with this specification does not of itself confer immunity from legal obligations nor does the specification purport to include all the necessary provisions of a contract. Users of this specification are responsible for its correct application.

Reference to a European Standard, British Standard, Water Industry Specification or any other specification applies equally to any equivalent specification.

Information contained in this specification is given in good faith. Neither Water UK nor BPF Pipes Group can accept any responsibility for actions taken by others as a result.

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## **1. SCOPE**

This specification stipulates the requirements for end-load resistant, mechanical and compression fittings, made principally of thermoplastics. They are for use in cold potable water services for sizes 20 mm to 63 mm for pressures up to 12.5 bar at 20°C.

These fittings are designed for use with pipe manufactured to EN 12201-2 or BS 8588.

## **2. MATERIALS**

2.1 The fitting shall be made principally from a thermoplastics or materials which do not suffer from corrosion from potable water (pH range 6 - 8.5) or low resistivity soils (<200 ohm.cm).

2.2 Any elastomeric sealing ring used in the construction of the fitting shall conform to BS EN 681-1 Type WA.

## **3. DESIGN AND CONSTRUCTION**

3.1 The wall thickness of compression fittings shall be such as to enable the fittings to meet all the requirements of this specification.

3.2 The fittings shall be free from internal flash or other irregularities which might restrict the free flow of fluid and shall be so designed that the resistance to the flow of the fluid through the fittings is minimised.

3.3 Union nuts shall have suitable means for tightening.

3.4 Provision for gripping the body shall be made on all fittings with screwed ends.

3.5 Compression fittings shall be supplied with a means for ensuring the correct position of the pipe within the fitting. This requirement does not apply to components designed as repair couplings.

3.6 The external and internal threads of the ends of transition fittings other than for compression ends, shall be threaded with one of the appropriate forms of threads in accordance with BS EN 1254-2. The use of tapered threads in accordance with clause 5.4 of BS 21: 1985 is also permitted.

NOTE: Manufacturers should provide clear jointing instructions including any maximum permitted torque.

3.7 Flanged joints shall be constructed such that they may be attached to flanges designated PN16 whose dimensions are shown in the relevant part of BS EN 1092.

## **4. DESIGNATION OF SIZE OF FITTING**

The size of fitting shall be designated by the nominal metric outside diameter of the pipe with which the fitting is to be used.

## **5. EFFECT OF MATERIALS ON WATER QUALITY**

All chemicals and construction products used by water undertakers, from the source of the water, up to the point of delivery to the consumer's pipework shall be introduced in accordance with the requirements of the Water Supply (Water Quality) Regulations 2016, the Water Supply (Water Quality) Regulations 2016 in Wales, The Water Supply (Water Quality) Regulations (Northern Ireland) 2017 or The Public Water Supplies (Scotland) Regulations 2014.

NOTE 1: Materials complying with these Regulations are listed on the Approved list published by the Drinking Water Inspectorate See <http://dwi.defra.gov.uk/drinking-water-products/approved-products/soslistcurrent.pdf>

NOTE 2: Water fittings installed in premises which receive a water supply from a water undertaker should comply with the requirements of The Water Supply (Water Fittings) Regulations in England Wales, Northern Ireland and in Scotland The Water Supply (Water Fittings) (Scotland) Byelaws. WRAS Product or Material Approvals, administered by the Water Regulations Advisory Scheme, provide one method to demonstrate fittings are of an appropriate quality and standard, see [www.wras.co.uk](http://www.wras.co.uk).

## **6. TYPE TEST REQUIREMENTS**

### **6.1 General**

Fittings shall meet the requirements of this section before compliance with this specification can be claimed. If there is a change in materials or dimensions, then the manufacturer shall ensure that the conditions of this specification are still satisfied.

Unless otherwise specified, the test samples shall be taken from a production batch which complies with all the other requirements of this specification.

Unless otherwise specified, fittings and test assemblies shall be conditioned for not less than 24 hours at (20 ± 2)°C.

Details and results for each type test relevant to each material composition and manufacturing process shall be made available to the purchaser or his representative on request.

## 6.2 Sampling for type testing

Three fittings of nominal size 63, or the largest size of the manufacturer's range complying with this specification, shall be tested to the requirements of 6.3.1.

Three fittings of all sizes of the manufacturer's range shall be tested to the requirements of 6.3.2 and 6.3.3 and one fitting for each size and type of the manufacturer's range complying with this specification shall be tested to the requirements of 6.4 to 6.9.

## 6.3 Pressure tests at 20°C

### 6.3.1 Pressure test at 5,000 hours

When assembled in accordance with BS EN ISO 1167-4, the test assembly shall be subjected to the internal water pressure test method described in BS EN ISO 1167-1. The assembly shall withstand an appropriate pressure as specified in Table 1 for a minimum of 5000 hours without leakage at any time during the test.

**Table 1 - Test pressures for 5,000 hour test**

Nominal size	Test pressure minimum (bar)
20	23
25	18
32	18
50	18
63	18

### 6.3.2 Pressure test at 165 hours

After preparation to BS EN ISO 1167-4, the test assembly shall be tested in accordance with the method described in BS EN ISO 1167-1. The assembly shall withstand an appropriate internal

water pressure as specified in Table 1 for a minimum of 165 hours without leakage at any time during the test.

**Table 2 - Test pressure for 165 hours test**

Nominal size	Test pressure minimum (bar)
20	25
25	20
32	20
50	20
63	20

### 6.3.3 Pressure test at 1 hour

After preparation to BS EN ISO 1167-4, the test assembly shall be tested in accordance with the method described in BS EN ISO 1167-1. The assembly shall withstand an appropriate internal water pressure as specified in Table 1 for a minimum of 1 hour without leakage at any time during the test.

**Table 3 - Test pressure for 1 hour test**

Nominal size	Test pressure minimum (bar)
20	28
25	23
32	23
50	23
63	23

## 6.4 Internal pressure resistance when subjected to bending stresses

When assembled in accordance with BS EN ISO 3503, a test assembly shall be subjected to a leaktightness test described in BS EN ISO 3458. The assembly with a maximum bend radius of 20 x nominal outside diameter, shall withstand an internal pressure as specified in Table 3 for a minimum of 1 hour without leakage at any time during the test.

## 6.5 External pressure resistance

When tested in accordance with the method given in BS EN ISO 3459, a test assembly shall withstand an external pressure of 0.1 bar above atmospheric pressure for 1 hour followed by a pressure of 0.8 bar above atmospheric pressure for a further 1 hour

without leakage at any time during the 2 hours test duration.

**6.6 Resistance to pull-out of a test assembly**

When tested in accordance with BS EN ISO 3501, a test assembly shall be subjected to the appropriate force given in Table 4. After removal, examine the test piece for pull-out from the compression ring and/or fracture/tearing of the pipe. If appropriate, the cap nut shall be removed to permit examination.

**Table 4 - Test forces for test under constant load**

Nominal pipe size	20	25	32	50	63
Test force (kN)	1.6	2.4	4.0	10.0	15.0

**6.7 Resistance to freezing**

When assembled in accordance with BS EN ISO 1167-4, the test assembly shall be filled with water and left in a freezer at a temperature below -15°C for 24 hours.

The test assembly shall be removed from the freezer and conditioned for a period of not less than 24 hours at a temperature of (20 ± 2)°C. One test assembly shall then be tested to, and meet, the requirement of 6.3.3 and one to that of 6.6.

**6.8 Impact resistance at 0°C**

When tested by the method described in Appendix A, the fitting shall neither crack nor break.

If the fitting does not crack or break, it shall then be conditioned for a period of not less than 24 hours at a temperature of (20 ± 2)°C. One test assembly shall be tested to, and meet, the requirement of 6.3.3 and one to that of 6.6.

**6.9 Resistance to external bending - male and female adaptors**

When tested by the method described in Appendix B and applying the forces specified in Table 5 for 1 hour, the fitting shall neither crack nor break. For evidence of cracking, the test piece shall be viewed under an optical microscope at 40 x magnification.

**Table 5 - Applied bending moment for external bending test**

Nominal size	Applied bending moment - minimum (Nm)
20	80
25	110
32	150
50	250
63	300

**7. QUALITY CONTROL TEST REQUIREMENTS**

**7.1 Sampling frequency**

Production quality control activities shall be carried out in accordance with an appropriate sampling plan drawn from BS 6001-1.

The manufacturer shall not knowingly supply a defective unit in any batch.

**7.2 Voids and defects**

None of the fitting samples evaluated shall show blisters, excessive delamination or cracking, or signs of weld line splitting.

For fittings moulded by conventional techniques, care shall be taken in examining the area around the point of injection, where no cracks or delamination shall penetrate to a depth greater than 20% of the wall thickness. For fittings moulded by end-gating techniques, e.g. ring or diaphragm methods, any cracks or delamination in the wall of the fitting adjacent to the injection area shall be parallel to the axis and shall not penetrate to a depth of more than 20% of the socket length.

The assessment of the depth of penetration of cracks or delamination shall be carried out by sectioning the specimen at the point of injection and measuring the depth to which these defects penetrate the wall thickness of the fitting.

NOTE: Non-destructive test methods may be used as an alternative if approved under a quality assurance scheme.

### 7.3 Pressure test at 1 hour

Fittings shall be tested to, and meet, the requirements of 6.3.3.

### 7.4 Resistance to pull-out of a test assembly

Fittings shall be tested to, and meet, the requirements of 6.6.

### 7.5 Resistance to external bending - male and female adaptors

Fittings shall be tested to, and meet, the requirements of 6.9.

## 8. MARKING AND INSTRUCTIONS FOR USE

Fittings manufactured to this specification shall be clearly and legibly marked. No method of marking shall prejudice the performance of a fitting.

The marking shall give the following information:

- (a) Manufacturer's identification;
- (b) Batch identification code;
- (c) Material designation (e.g. PE80 / SDR 11);
- (d) Nominal size.

The following additional information shall be provided and may be printed on a label attached to the fitting or an individual bag.

- (e) Reference to this Water Industry Specification i.e. WIS 4-32-11;

- (b) Pressure rating in bar.

The manufacturer shall provide clear assembly instructions.

## 9. REFERENCES

BS 21	Specification for pipe threads for tubes and fittings where pressure-tight joints are made on the threads (metric dimensions).
BS 6001-1	Sampling procedures for inspection by attributes: Part 1 sampling schemes indexed by acceptable quality level (AQL) for lot-by-lot inspection.

BS 8588	Polyethylene pressure pipe with an aluminium barrier layer and associated fittings for potable water supply in contaminated land. Size 20 mm to 630 mm
BS EN 681-1	Elastomeric seals - Materials requirements for pipe joint seals used in water and drainage applications. Part 1: Vulcanised rubber.
BS EN 1092	Flanges and their joints. Circular flanges for pipes, valves, fittings and accessories, PN designated. (Parts 1 to 4
BS EN 1254-2	Copper and copper alloys - Plumbing fittings. Part 2: Fittings with compression ends for use with copper tubes.
BS EN 12201-2	Plastics piping systems for water supply, and for drainage and sewerage under pressure. Polyethylene (PE). Pipes
BS EN ISO 1167-1	Thermoplastics pipes, fittings and assemblies for the conveyance of fluids. Determination of the resistance to internal pressure. General method
BS EN ISO 1167-4	Thermoplastics pipes, fittings and assemblies for the conveyance of fluids. Determination of the resistance to internal pressure. Preparation of assemblies
BS EN ISO 3458	Plastics piping systems. Mechanical joints between fittings and pressure pipes. Test method for leaktightness under internal pressure.
BS EN ISO 3459	Plastics piping systems - Mechanical joints between fittings and pressure pipes. Test method for leaktightness under negative pressure.
BS EN ISO 3501	Plastics piping systems. Mechanical joints between fittings and pressure pipes. Test method for resistance to pull-out under constant longitudinal force.
BS EN ISO 3503	Plastics piping systems - Mechanical joints between fittings and pressure pipes - Test method for leaktightness under internal pressure of assemblies subjected to bending.
IGN 4-01-02	The determination of end-loads for the performance testing of pipeline fittings.

## APPENDIX A - IMPACT RESISTANCE AT 0°C

For each test, 10 test specimens shall be evaluated. The test specimens shall be pre-conditioned at  $(0 \pm 2)^{\circ}\text{C}$  for 3 hours prior to testing. The tests shall be conducted within 30 sec. of removal from the conditioning chamber/bath.

Each test specimen shall be dropped from a height of  $(2 \pm 0.05)$  m in random positions, onto a flat concrete floor.

Visually examine the test specimens for breaks or cracks. Condition them for 24 hours at  $(20 \pm 2)^{\circ}\text{C}$ . One test specimen selected at random shall then be tested to, and meet, the requirement of 6.3.3 and one to that of 6.5.

## APPENDIX B - RESISTANCE TO EXTERNAL BENDING

Male and female adaptors shall be screwed into metal support plates, so arranged to allow the fitting to be loaded with a constant force. A typical assembly is illustrated in Figure 1.

The fittings shall be screwed hand tight into the supports and a bending moment applied to the fitting via a circular metal bar. The bar shall have a diameter equal to the nominal size of the fitting.

The test force for the appropriate size of fitting as given in Table 5 shall then be applied and the bending moment imposed for 1 hour. At the end of this period, the pressure is released and the fittings removed for inspection.

The fittings shall be examined under an optical microscope at 40 x magnification.

Figure 1 - Typical apparatus for external bending

