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SPECIFICATION FOR UNDERGROUND STOP VALVES, INCLUDING SPHERICAL VALVES, FOR POTABLE WATER SERVICES FOR NOMINAL SIZES UP TO AND INCLUDING 63 AND NOMINAL PRESSURES OF 10 BAR MINIMUM AND MADE PRINCIPALLY OF METAL OR THERMOPLASTICS

FOREWORD

This specification has been prepared by WRc plc under the direction of the Water Services Association/Foundation for Water Research Sewers and Water Mains Committee in consultation with the Water Industry and principal product suppliers associations to define the performance requirements for underground stop valves including spherical valves for potable water services and made principally of metal or a thermoplastics material.

These valves are for use with copper pipes to BS 2871: Part 1 or polyethylene pipes to BS 6572*, WIS No 4-32-02* or BS 6730.

Attention is drawn to the WAA/WRc Manual for MDPE pipe systems for water supply which has been prepared to offer guidance to the UK Water Industry on the practical design, installation and operation of PE water pipeline systems as well as to the following Water Industry Specifications and British Standards:

BS 864 Parts 2 and 5
WIS No 4-32-04
WIS No 4-32-06
WIS No 4-32-07§
WIS No 4-32-08

* BS 6572 is equivalent to WIS No 4-32-02 and is now regarded as the lead specification.
§ In course of preparation.

To claim compliance with this specification, the manufacturer shall operate a quality assurance system relating to the manufacture and quality of these fittings to this specification in compliance with BS 5750: Part 2 (EN 29002) which ensures that products claimed to comply with this specification consistently meet the required level of quality. Enquiries regarding the availability of NACCB or equivalent accredited third party certification should be addressed to an appropriate third party certification body or to WRc.

This specification includes a requirement for the determination of head loss. No test levels are, however, specified. Users will give preference to low headloss values. At the next revision of this specification, it is intended to specify maximum head loss requirements.

It is not intended that this specification should be restrictive in relation either to design or materials. Providing satisfactory data are submitted to the Sewers and Water Mains Committee, this specification can be amended accordingly.

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 calls 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.

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Reference to a 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 but neither the Foundation for Water Research/WSA nor WRc can accept any responsibility for actions taken as a result.

CONTENTS

1. SCOPE

1.1 This specification stipulates the quality assurance, water quality, performance, quality control and marking requirements for underground plug cocks for cold potable water services to BS 2580 as well as underground stop valves for water services to BS 5433. It also stipulates the performance and quality control requirements for screw down valves and plug valves made principally of a thermoplastics material as well as for spherical valves made principally of metal or a thermoplastics material.

1.2 The thermoplastics materials for the manufacture of the bodies of these valves covered by this specification are:

Acrylonitrile/butadiene/styrene	- ABS
Polyethylene	- PE
Polypropylene	- PP
Unplasticised polyvinyl chloride	- PVC

1.3 These stop valves are for use for cold potable water services (underground) with copper pipes to BS 2871: Part 1, up to and including nominal size 54, or polyethylene pipes to BS 6572 or WIS No 4-32-02, up to and including nominal size 63, and shall be capable of operating continuously at a pressure of at least 10 bar at temperatures up to 25°C.

NOTE The titles of the publications referred to in this document are listed under clause 10 - References.

2. QUALITY ASSURANCE

Manufacturers shall operate a quality system relating to this specification in compliance with BS 5750: Part 2 (EN 29002).

3. DEFINITIONS

For the purposes of this Water Industry Specification the following definitions apply:

Plug valve (see Fig 1)

A form of shut-off device comprising a body having a tapered seating into which is fitted a plug which can be turned to move its port relative to the body ports to control the flow of water.

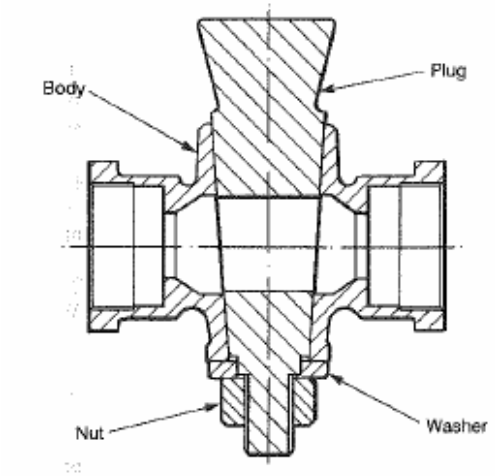

Figure 1 Typical plug valve to BS 2580

Screw down stop valve (see Fig 2)

Any valve in which a disc carrying a renewable non-metallic washer is lifted from and lowered onto the body seat by a spindle whose axis is perpendicular to the face of the body seat and having suitable means of connection for insertion in a pipeline.

Spherical valve (see Fig 3)

A form of shut-off device, having a ball which can be turned to move its port or ports relative to the body seatports to control the flow of liquid.

Stop valve

A stop valve may be a plug valve, a screw down stop valve or a spherical valve. The use of the word valve, herein, shall be taken to mean an underground stop valve.

Nominal size of valve

The nominal size of a valve is the nominal size of the pipe to which the valve is designed to be connected.

4. MATERIALS

4.1 Screw down, plug or spherical valves made principally of metal shall conform to clause 9 of BS 5433: 1976 or clause 4 of BS 2580: 1979, and shall also meet the requirements of clause 6.1.1.

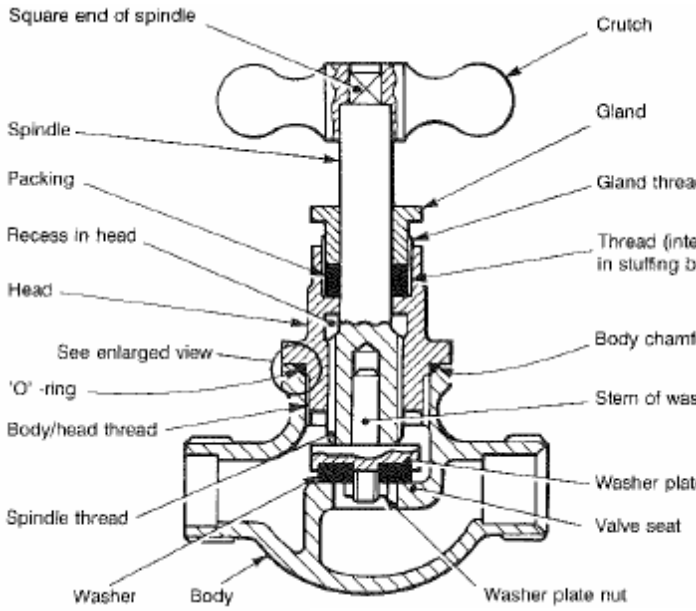

Figure 2 – Typical screw-down

4.2 Screw down, plug or spherical valves made principally of a thermoplastics material shall conform to one of the following:

(a)	ABS	- clause 3 of BS 5392: Part 1: 1976;
(b)	PE	- clauses 2, 3.1 and 3.2 of WIS No 4-32-04: Issue 2;
(c)	PP	- clauses 2.1, 2.2.1.1, 2.2.2 and 2.2.3 BS 4991: 1974;
(d)	PVC	- clause 5 of WIS No 4-31-07: Issue 1

Plastics stop valves shall also meet the requirements of clause 6.1.2.

4.3 Elastomeric joint rings shall be made from materials complying with Type W of BS 2494: 1990.

5. DESIGN AND CONSTRUCTION

5.1 Every stop valve shall:

(a) not pass water, under a pressure equivalent to 1.5 times its rated working pressure, when closed;

(b) be watertight under a pressure equivalent to 1.5 times its rated working pressure when open;

(c) in the case of a screw down valve, be so designed or adapted that its seat washer can be readily renewed;

(d) not incorporate a loose washer plate;

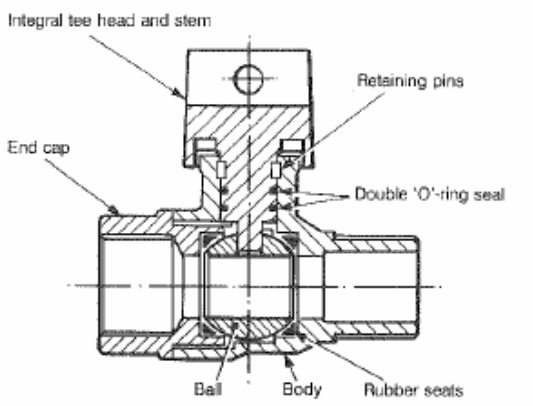

Figure 3 – Typical spherical valve

(e) be capable of operating continuously at a pressure of not less than 10 bar at 25℃;

(f) in the case of copper alloy valves be immune or resistant to dezincification;

(g) for designs using O-ring spindle seals, a minimum of 2 seals and a non-rising spindle shall be used;

(h) valves shall not be self opening under service conditions and shall not require an opening torque of more than 10Nm when tested under pressure.

5.2 Long-term material performance of plastics valves shall be demonstrated by providing data based on the requirements of ISO/DTR 9080.

6. PERFORMANCE REQUIREMENTS

The requirements in this section shall be met before compliance with this specification can be claimed. If there is a change in process technique or the introduction of a new or modified material, then it will be necessary to ensure that the conditions of the specification are still satisfied after the introduction of such changes.

Type tests shall be repeated periodically.

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

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

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6.1 Effect on water quality

6.1.1 Metallic components

When used under the conditions for which they are designed, materials in contact with or likely to come into contact with potable water shall not constitute a toxic hazard, shall not support microbial growth and shall not give rise to unpleasant taste or odours, cloudiness or discolouration.

NOTE Details of applicable test methods are available from the Water Byelaws Advisory Scheme, 660 Ajax Avenue, Slough.

6.1.2 Non-metallic materials

Non-metallic materials (in manufactured form) shall be tested to and meet the requirements of BS 6920: Part 1.

NOTE Products for installation and use in the United Kingdom which are verified and listed under the UK Water Fittings Byelaws Scheme are deemed to satisfy the requirements of this Clause. (Water Byelaws Advisory Service, 660 Ajax Avenue, Slough SL1 4BG).

In addition, pending the determination of suitable means of characterising the toxicity of leachates for materials in contact with potable water, materials (in manufactured form) shall be approved by the Department of Environment Committee on Chemicals and Materials of Construction for use in Public Water Supply and Swimming Pools as being free from adverse health effects.

NOTE A list of approved chemicals and materials is available from the Technical Secretary of the above committee at DoE, Water Division, Romney House, 43 Marsham Street, London SW1P 3PY.

6.2 Determination of head loss against size

The pressure differential (head loss) across the valve at velocities of 0.5 and 1.25m/sec. shall be determined by the method described in Appendix A and shall be recorded.

6.3 External pressure resistance

The valve shall be tested in accordance with the method described in ISO 3459 at a test gauge pressure of 0.1 bar for 1 hour. The pressure shall then be raised to 0.8 bar for a further period of 1 hour. During the test, there shall be no signs of leakage.

6.4 Pressure test at 20℃

When tested in accordance with Appendix B, a valve in the closed position shall withstand a pressure of 1.5 times its rated working pressure for 15 minutes. The valve shall then be fully opened and the pressure maintained at 1.5 times the rated working pressure of the valve for a further period of 15 minutes.

During the test, there shall be no evidence of leakage.

6.5 Torque test

The valve shall be held rigidly in a clamp. The clamp shall not impede the free movement of the spindle of the valve.

With the valve in the fully open position, a torque shall be applied of not less than 10Nm in an anticlockwise direction. The valve shall then be fully closed and a torque of not less than 10Nm shall be applied in a clockwise direction.

During the test, the valve shall not break or unscrew.

6.6 1000-hour pressure test at 20℃ for valves with plastics bodies

When tested in accordance with ISO 1167, at a temperature of 20 ±2℃, valves, with appropriate pipes and test caps connected at each end, shall withstand, in the open position, the test pressures given in Table 1 for 1000 hours without failure or leakage.

Table 1 - Test pressure for long term pressure testing of plastics valves

Material of valve body	Test pressure (bar)
ABS	1.56 x PN*
Polyethylene	1.5 x PN*
Polypropylene	1.56 x PN*
PVC-U	2.0 x PN*

* PN is the rated working pressure of the valve (in bar)

6.7 Flattening test for valves with plastics bodies

Valves with plastic bodies shall be tested to and meet the requirements of ISO/DIS 9853.

7. QUALITY CONTROL REQUIREMENTS

7.1 Pressure test for metallic valves

Before leaving the factory, all metallic valves shall be tested in the assembled condition both in the fully opened and the fully closed condition.

In both cases, the test shall consist of either a hydraulic test at not less than 1.5 x PN*, or a pneumatic test at not less than 0.5 X PN* while the stop valve is completely immersed in water. The pressure shall be maintained for 60 seconds and 5 seconds respectively. During the tests, the valve shall not leak.

In the case of dispute, the following procedure shall be followed to establish whether a valve leaks or not. After the test specimen has attained the test pressure, the test specimen shall be isolated from the pressure source for a period of 5 mins. During that period, the pressure drop shall not exceed 2% of the test pressure.

7.2 Pressure test for plastics valves

Before leaving the factory, all plastics valves shall be tested in the assembled condition both in the fully opened and the fully closed condition.

In both cases, the test shall consist of either a hydraulic test at not less than 1.5 X PN*, or a pneumatic test at not less than 0.5 x PN* while the stop valve is completely immersed under water. The pressure shall be maintained for 60 seconds and 5 seconds respectively. During the tests, the valve shall not leak.

In the case of dispute, the following procedure shall be followed to establish whether a valve leaks or not. After the test specimen has attained the test pressure, the test specimen shall be isolated from the pressure source for a period of 5 mins. During that period, the pressure drop shall not exceed 2% of the test pressure.

7.3 Hot oven test for plastics valves

After testing in accordance with the method specified in ISO 580 under the test conditions specified in Table 2, the test specimen shall be allowed to cool and examined. There shall be no cracks, bubbles or blisters. In the area of the injection sprue, deterioration is permitted up to 20% of the wall thickness of the fitting at that point.

Table 2 - Test conditions for trot oven test for plastics valves

Material	Temperature (℃)	Min. Time (h)
ABS	150 ±2	0.5
Polyethylene	150 ±2	1.0
Polypropylene	150 ±2	0.5
PVC-U	150 ±2	1.0

7.4 Appearance of metallic valves

All materials used shall satisfy the recommendations of BSI PD 6484. The surface of any protective coating and/or plating shall be continuous and free from visible defects.

7.5 Appearance of plastics valves

All materials used shall have a smooth surface appropriate to the manufacturing process used. There shall be no visible area of scorching due to overheating during manufacture.

8. TEST CONDITIONS

During type testing or in any case of dispute, specimens shall be conditioned prior to testing at 23℃, unless otherwise specified, for not less than 24 hours. For hydrostatic tests involving liquid immersion, the specimens shall be conditioned in the liquid at the test temperature for not less than 24 hours.

9. MARKING

Valves manufactured to this specification shall be clearly and permanently marked. No method of marking shall prejudice the performance of a fitting when tested to the requirements of this specification. Permanently marked is defined as acid etching, embossing, rolling-in, stamping, indenting, soldering or welding on a plate.

The marking shall give the following information:

(a) Manufacturer's identification;

(b) Reference to this Water Industry Specification, i.e. WIS No 4-23-04. (The use of this mark is a claim by the manufacturer that the product has been manufactured in accordance with the requirements of this Specification and the claim is his sole responsibility);
(c) The nominal size and pressure rating at 20℃ in bar;

(d) The direction of flow. The direction of flow need not be marked on valves which can be installed in either direction;

(e) A third party certification mark (if permissible).

(f) For plastics valves, identification of the material from which the valve body has been made as follows:

Acrylonitrile/butadiene/styrene	- ABS
Polyethylene	- PE
Polypropylene	- PP
Unplasticised polyvinyl chloride	- PVC

(g) For metallic valves resistant to dezincification, the CR mark;

In addition, the following information shall be marked on the packaging in which the valves are supplied:

(h) Batch identification.

10. REFERENCES

INTERNATIONAL STANDARDS

ISO 580	Moulded fittings in unplasticised polyvinyl chloride (PVC) for use under pressure - oven test.
ISO 1167	Plastic pipes for the transport of fluids - Determination of the resistance to internal pressure.
ISO 3459	Polyethylene (PE) pressure pipes - joints assembled with mechanical fittings - Internal under-pressure test method and requirement.
ISO/DTR 9080	Thermoplastics pipes - extrapolation method.
ISO/DIS 9853	Injection moulded PVC fittings for pressure pipe systems - Flattening test.

European Standards

EN 29002	Quality systems - Model for quality assurance in production and installation.

British Standards

BS 864	Capillary and compression tube fittings of copper and copper alloy. Part 2 Specification for capillary and compression fittings for copper tubes. Part 5 Compression fittings for polyethylene pipes with outside diameters to BS 5556.
BS 2494	Specification for elastomeric joint rings for pipework and pipelines.
BS 2580	Underground plug cocks for cold water services.
BS 2871	Specification for copper and copper alloys. Tubes. Part 1 Copper tubes for water, gas and sanitation.
BS 4991	Specification for propylene co-polymer pressure pipe.
BS 5392	Specification for acrylonitrile/ butadiene/ styrene (ABS) fittings for use with ABS pressure pipe. Part 1 Fittings for use with pipe for industrial uses.
BS 5433	Specification for underground stop valves for water services.
BS 5728	Measurement of flow of cold potable water in closed conduits. Part 3 Methods for determining principal characteristics of single meters (including test equipment).
BS 5750	Quality systems. Part 2 Specification for production and installation.
BS 6572	Specification for blue polyethylene pipes up to nominal size 63 for below ground use for potable water.

BS 6730	Specification for black polyethylene pipes up to nominal size 63 for above ground use for cold potable water.
BS 6920	Suitability of non-metallic products for use in contact with water intended for human consumption with regard to their effect on the quality of water. Part 1 Specification.
PD 6484	Commentary on corrosion at bimetallic contacts and its alleviation.

Water Industry Specifications

No. 4-31-07	Specification for unplasticised PVC pressure fittings and assemblies for cold potable water (underground use).
No. 4-32-02	Specification for polyethylene pressure pipe for cold potable water (underground use).
No. 4-32-04	Specification for polyethylene fusion joints and fittings for use with cold potable water pressure pipes.
No. 4-32-06	Specification for polyethylene electrofusion couplers and fittings for cold potable water supply for nominal sizes up to and including 180.
No. 4-32-07§	Specification for electrofusion control boxes.
No. 4-32-08	Specification for site fusion jointing of MDPE pipe and fittings.

WAA/WRc Manual for MDPE pipe systems for water supply.

§ In course of preparation.

APPENDIX A - TEST METHOD FOR THE DETERMINATION OF HEAD LOSS AGAINST SIZE PROCEDURE

A.1 PROCEDURE

A.1.1 The test shall be conducted in accordance with the procedure described in BS 5728: Part 3 using suitably accredited equipment.

A.1.2 Measure the static differential pressure (ΔP1) at the flow rates specified in Table 3 along a straight section of pipe of a size and quality for which the fitting is designed.

A.1.3 Install the fitting to be tested in the test rig and repeat the measurement (ΔP2) at the same flow rates. The actual head loss (ΔP) due to the fitting is given by:

DP = DP2 – DP1

A.2 TEST REPORT

The report shall include the following information:

(a) Full identification of the sample under test;

(b) The recorded head losses (AP) at velocities of 0.5 and 1.25 m/s;

(c) The date of the test;

(d) Observations and test conditions.

APPENDIX B - PRESSURE TEST AT 20℃

B.1 TEST SPECIMEN

A valve with copper pipes to BS 2871: Part 1 or polyethylene pipes to BS 6572 or WIS No. 4-32-02 as appropriate connected to each end.

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B.2 PROCEDURES

The pipe on the inlet side of the valve shall be connected to equipment that permits the application of a controlled internal hydrostatic pressure to the test specimen to an accuracy of ±2%'

With the valve in the closed position, the test specimen shall be filled with water and all air vented. It shall then be maintained at a temperature of 20 ±2℃ and a pressure of 1.5 times the rated working pressure for 15 mins. The pressure shall, then be released.

For valves which can operate in either direction, the free pipe end of the test specimen is then connected to the pressure equipment and the procedure described above repeated. At the conclusion of this test, the pressure is released and the free end of pipe plugged or capped. With the valve fully opened, the test specimen shall be filled with water, vented of all air and the pressure raised and maintained at 1.5 times the rated working pressure of the valve for 15 mins. The test temperature shall be maintained at 20 ± 2℃.

Leakage of the valve can be determined by isolating the valve from the pressure source after the test specimen has attained the test pressure. The drop in pressure over a five minute period shall not exceed 2% of the test pressure.

B.3 REPORT

The report shall include the following:

(a) Reference to this Water Industry Specification;

(b) Full identification of the test specimen;

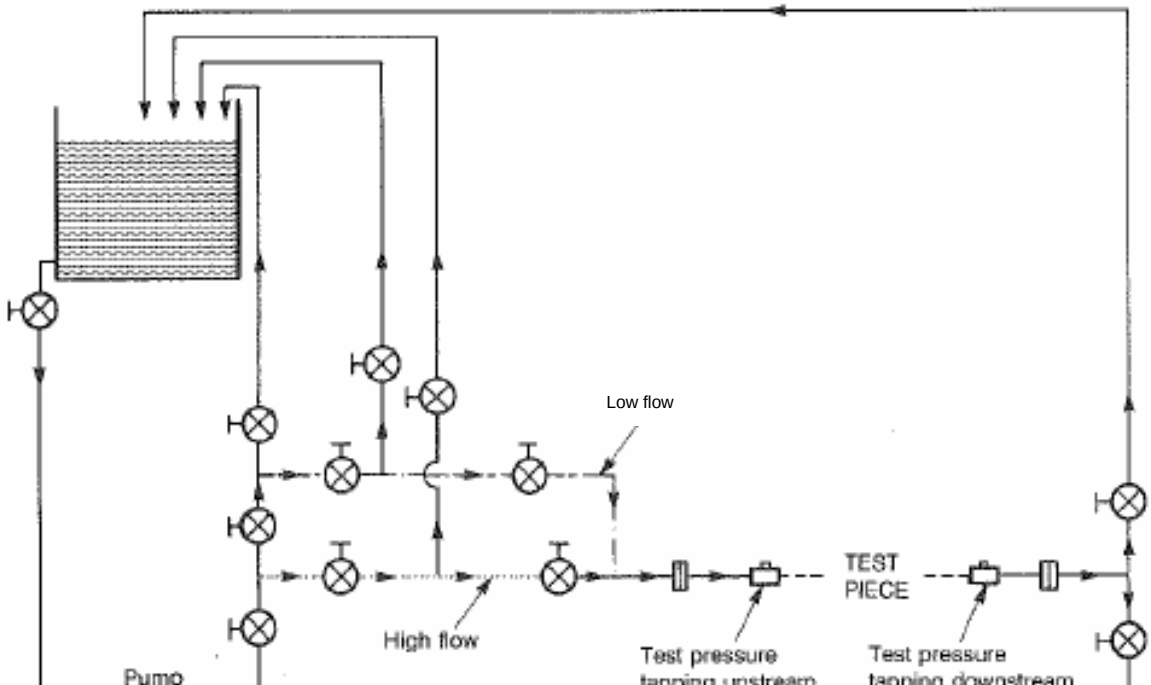
(c) Pressures applied and the corresponding times;

(d) Whether the test specimen leaked or not;

(e) The date of the test.

Table 3 – Flow rate (L/min) at velocities of 0.5m/s and 1.25m/s

Copper pipes to BS 2871: Part 1			PE pipes to BS 6572		
	Flow rate L/min			Flow rate L/min	
DN	0.5 m/s	1.25 m/s	DN	0.5 m/s	1.25 m/s
12	2.8	7.0	-	-	-
15	4.4	11.0	20	5.8	14.5
18	6.4	15.8	-	-	-
22	9.6	24.0	25	10.0	25.0
28	16.2	40.5	32	16.3	40.7
35	25.0	62.5	-		-
42	40.0	100.0	50	40.0	100.0
54	59.9	149.8	63	63.2	158.0



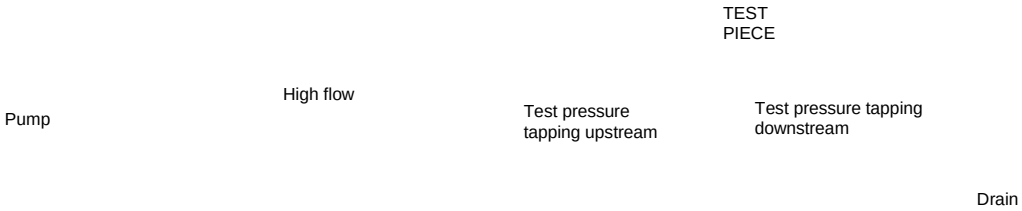


Figure 4 – Typical test rig for the determination of head loss against size