NZS 7601:1978

Superseding NZS 1338

Specification for POLYETHYLENE PIPE (TYPE 3) FOR COLD WATER SERVICES

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Declared on 25 August 1978 by the Standards Council to be a standard specification pursuant to the provisions of section 23 of the Standards Act 1965.

First published August 1978
Reprinted June 1988

The following SANZ references relate to this standard:

Project No. P 1021
Draft for comment No. DZ 7601
Printing code: 300 — 1988/2006/26525

AMENDMENTS

No.	*Date of issue*	*Description*	*Entered by, and date*

John Milne Ltd., Wellington

NEW ZEALAND STANDARD

Specification for POLYETHYLENE PIPE (TYPE 3) FOR COLD WATER SERVICES

Superseding NZS 1338

STANDARDS ASSOCIATION OF NEW ZEALAND
6th Floor, Wellington Trade Centre, 181-187 Victoria Street, Wellington
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AUGUST 1978

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CONTENTS PAGE

COMMITTEE REPRESENTATION

This standard was prepared under the supervision of the Plastics Industry Sectional Committee (76/–) for the Standards Council, established under the Standards Act 1965. The committee consisted of representatives of the following:

Department of Education
*Department of Health
Department of Labour
*Department of Scientific and Industrial Research
*Ministry of Works and Development
New Zealand Institution of Engineers
*New Zealand Society of Master Plumbers
*Plastics Institute of New Zealand

The Polythene Pipe for Cold Water Services Committee (76/7) was responsible for the preparation of this standard, and consisted of representatives from the following organizations in addition to those marked with an asterisk (*) above:

Municipal Association of New Zealand
New Zealand Wholesale Plumbers Merchants Guild

RELATED DOCUMENTS

Reference is made in this standard to the following documents:

		Clause reference herein
MP 3801 : 1972	*A guide to the adoption of the model building bylaw (NZS 1900) by local authorities using the standard adoption and annual updating procedures.*	2.1.1
BS 21 : 1973	*Pipe threads for tubes and fittings where pressure-tight joints are made on the threads*	3.1
BS 143 and 1256 : 1968	*Malleable cast iron and cast copper alloy screwed pipe fittings for steam, air, water, gas and oil.*	3.1
BS 572 : 1960	*Interchangeable conical ground glass joints*	B2.1
BS 1792 : 1960	*One-mark volumetric flasks*	B2.1
BS 2782	*Methods of testing plastics*	4.1.1, 4.1.3, 4.2, E.1.1
BS 3412 : 1976	*Polyethylene materials for moulding and extrusion.*	4.1.3

RELATED LEGISLATION

The Electrical Wiring Regulations 1976	F2.1

ACKNOWLEDGEMENT

In the preparation of this standard assistance has been derived from publications of the British Standards Institution and of the Standards Association of Australia. This assistance is gratefully acknowledged.

FOREWORD

This standard is an updated and metric revision of NZS 1338 : 1963, *Polythene pipe (Type 425) for cold water services*, and is intended to meet the requirements for makers and users of polyethylene pipe (Type 3) for cold water services.

The former imperial units have been "soft" metricated in this document. It was considered that other changes or "hard" metrication would not be in the best interests of users, causing increased costs, and creating other difficulties in relation to the manufacture of fittings. The opportunity has been taken to update and revise the composition, packing and marking clauses.

The type designation (3) indicates the recommended maximum working stress for the material, in megapascals, at 20 °C when in pipe form. This stress has been used as the basis for calculating the minimum wall thicknesses. A specification for polyethylene pipe (Type 5) for cold water services is provided in NZS 7602.

The "Notes on the use of polyethylene pipe (Type 3) for cold water services" in Appendix F of this standard are intended to assist users in assessing the suitability of polyethylene pipe for particular purposes and to ensure its proper use.

Throughout this standard the name "polyethylene" is used. It should be noted that this name is equivalent to the name "polythene".

(Blank)

NEW ZEALAND STANDARD

Specification for
POLYETHYLENE PIPE (TYPE 3)
FOR COLD WATER SERVICES

1 SCOPE

1.1 This standard sets out the requirements for black polyethylene pipe of Type 3 for use in cold water services, and in flush, overflow, warning and waste-pipe applications. The type designation refers to the maximum working stress of the material at 20 °C, in megapascals, when in pipe form.

2 INTERPRETATION

2.1 *General*

2.1.1 Where any other standard named in this standard has been declared or endorsed in terms of the Standards Act 1965, then –

(a) Reference to the named standard shall be taken to include any current amendments declared or endorsed in terms of the Standards Act 1965; *or*

(b) Reference to the named standard shall be read as reference to any standard currently declared or endorsed in terms of the Standards Act 1965 as superseding the named standard, including any current amendments to the superseding standard declared or endorsed in terms of the Standards Act 1965.

NOTE – The date at which amendments or superseding standards are regarded as "current" is a matter of law depending upon the particular method by which this standard becomes legally enforceable in the case concerned. In general, if this is by contract the relevant date is the date on which the contract is created, but if it is by Act, regulation, or bylaw then the relevant date is that on which the Act, regulation, or bylaw is promulgated; for bylaws, promulgation includes updating by the procedure set out in MP 3801*.

3 CLASSIFICATION

3.1 Polyethylene pipe shall be classified by wall thickness as follows:

(a) *Thin wall pipe.* Suitable for connection by means other than screw threading.

(b) *Thick wall pipe.* Suitable for screw threading to BS 21*, for use with fittings complying with BS 143* and BS 1256* and also suitable for connection by other means.

See list of related documents.

4 COMPOSITION

4.1 Extrusion compound

4.1.1 The compound shall be manufactured from a mixture of the following:

(a) Polyethylene with a density not greater than 930 kg/m^3 at 20 °C.

(b) Carbon black in such amount that, when the compound is tested by Method 405A of BS 2782*, the carbon black content shall be 2.5 ± 0.5 percent. The carbon black shall comply with the following requirements:

Density: 1500 to 2000 kg/m^3
Maximum volatile matter: 9.0 percent by mass.
Average particle size: 0.010 to 0.025 μm.
Toluene extract: Not more than 0.10 percent by mass when determined by the method described in Appendix A.

(c) Antioxidant in such amount that, when the compound is tested by Method 405B or 434D of BS 2782*, or by the method described in Appendix B, the antioxidant content shall be not more than 0.30 percent nor less than 0.02 percent by mass. The antioxidant used shall be one or more of the following:

(1) *N, N'*-di-2-naphthyl-*p*-phenylenediamine, with a melting range of 228 to 235 °C (*see* Method 405B of BS 2782*).

(2) 4,4'-thiodi-(6-*tert*butyl-*m*-cresol) (*see* Method 434D of BS 2782*).

(3) di-[2-hydroxy-5-methyl-3-(1-methylcyclohexyl) phenyl] methane (*see* Method 434D of BS 2782*).

(4) 2,6-di-*tert*butyl-*p*-cresol (*see* Method 434D of BS 2782*).

(5) 1,1,3-tri-(5-*tert*butyl-4-hydroxy-2-methylphenyl) butane (*see* Method 434D of BS 2782*).

(6) Octadecyl 3-(3,5-di-*tert*butyl-4-hydroxyphenyl) propionate (*see* Method 434D of BS 2782*).

(7) Pentaerythritol tetra-3-(3,5-di-*tert*butyl-4-hydroxyphenyl) propionate (*see* Method 434D of BS 2782*).

(8) 1,1-di-(3-*tert*butyl-4-hydroxy-6-methylphenyl)butane (see Appendix B).

4.1.2 The addition of the manufacturer's own rework materials, produced during the manufacture and works testing of pipe complying with this standard, is permissible. No other rework material shall be used.

4.1.3 The compound, when tested by Method 105C of BS 2782*, shall have a melt flow index not exceeding 2.6.

NOTE – Extrusion compound conforming to Class W of BS 3412*, satisfies the requirements of this standard in respect of carbon black content and average particle size of the carbon black and content of permitted antioxidants.

4.2 *Pipe material.* The extruded pipe shall contain 2.5 ± 0.5 percent by mass of carbon black when tested by Method 405A of BS 2782*. The carbon black and antioxidant shall be evenly dispersed in the pipe material. The carbon black dispersion shall be satisfactory when tested by the microtome technique described in Method 510A of BS 2782*. Figures 1 to 6 illustrate satisfactory dispersion and figures 7 to 12 illustrate unsatisfactory dispersion.

5 FREEDOM FROM DEFECTS

5.1 The internal and external surfaces of the pipe shall be smooth, clean, and reasonably free from grooves and other defects.

6 LENGTHS

6.1 Pipes shall be supplied in random lengths, or in coils of 30 m, 50 m, 75 m, 100 m, 150 m, 200 m, or as agreed between manufacturer and purchaser. Tolerance on coil length shall be – 0 + 1 percent.

7 DIMENSIONS AND WORKING PRESSURES

7.1 The pipe shall conform to the outside diameters and wall thicknesses given in tables 1 and 2.

7.2 The working pressures that may be continuously applied to pipe at temperatures not exceeding 20 °C are shown in tables 1 and 2. Manufacturers' data should be consulted for working temperatures above 20 °C.

Table 1 DIMENSIONS AND WORKING PRESSURES OF THIN WALL PIPE

Nominal bore	*Outside diameter*		*Wall thickness*		*Working pressure*	
	Min.	*Max.*	*Min.*	*Max.*		
mm	*mm*	*mm*	*mm*	*mm*	*MPa*	*mH_2O*
15	16.9	17.3	2.3	2.6	0.9	90
20	24.9	25.4	3.1	3.5	0.8	80
25	31.2	31.8	3.1	3.5	0.65	65
32	37.5	38.1	3.1	3.5	0.5	50
40	43.8	44.5	3.1	3.5	0.45	45
50	56.5	57.2	3.1	3.5	0.35	35

Table 2 DIMENSIONS AND WORKING PRESSURES OF THICK WALL PIPE

Nominal bore	*Outside diameter*		*Wall thickness*		*Working pressure*	
	Min.	*Max.*	*Min.*	*Max.*		
mm	*mm*	*mm*	*mm*	*mm*	*MPa*	*mH_2O*
15	21.1	21.5	4.3	4.8	1.5	150
20	26.5	27.0	4.3	4.8	1.0	100
25	33.3	33.8	4.3	4.8	0.85	85
32	42.0	42.6	5.0	5.6	0.8	80
40	47.9	48.6	5.3	5.9	0.7	70

*See list of related documents.

8 PACKING

8.1 If the pipe is to be coiled, it shall be done at a temperature of less than 30 °C. The internal diameter of the coil shall not be less than 24 times the mean outside diameter of the pipe with a minimum of 0.4 m.

9 HYDROSTATIC TEST (BATCH TEST)

9.1 For the purpose of testing, the pipe shall be divided into batches of continuous production of each size of pipe from each machine. A sample of pipe, having a length 10 times the nominal bore of the pipe but not less than 250 mm, shall be cut from each batch or once in each eight hours of continuous production, whichever is less. The sample taken from the batch shall be representative of the whole batch.

9.2 The sample shall be tested according to the method described in Appendix C, and shall withstand for a period of not less than 1 hour the test pressure given in tables 3 and 4 without showing signs of leakage or weeping.

9.3 Should a sample fail to meet the requirements of clause 9.2 further tests on three additional samples from the same batch shall be carried out in a similar manner. If these further three samples pass the test, the batch shall be deemed to comply with this standard, but if one or more of the samples also fails, the batch shall be deemed not to comply with this standard.

10 HEAT REVERSION TEST

10.1 Three representative samples of pipe shall be taken from each extrusion run, at intervals not exceeding 8 h, and shall be tested by the method described in Appendix D. No sample shall alter in length by more than 3 percent.

10.2 Should any sample fail to meet the requirements of clause 10.1, a further six samples shall be selected at random from the batch and tested in a similar manner. If these further six samples pass the test, the batch shall be deemed to comply with this standard but if one or more of the samples also fails, the batch shall be deemed not to comply with this standard.

11 TENSILE TEST (TYPE TEST)

11.1 A tensile test shall be carried out on a sample of pipe in accordance with the method described in Appendix E at intervals not exceeding four weeks, and at every change in composition of the extrusion compound. The pipe shall have a tensile strength of not less than 10.98 MPa and an elongation at break of not less than 350 percent.

NOTE – This test may be omitted subject to a certificate of compliance with the above requirements being provided by the manufacturer of the raw material.

Table 3

MINIMUM TEST PRESSURES FOR THIN WALL PIPE

Nominal bore	*Minimum test pressure*
mm	*MPa*
15	2.4
20	2.2
25	1.6
32	1.4
40	1.2
50	0.9

Table 4

MINIMUM TEST PRESSURES FOR THICK WALL PIPE

Nominal bore	*Minimum test pressure*
mm	*MPa*
15	4.0
20	2.7
25	2.3
32	2.2
40	1.9

12 MARKING

12.1 All pipes shall be indelibly marked at intervals not greater than 2 m with the following:

(a) The number of this standard, that is, NZS 7601.

(b) The name, trademark, or other means of identification of the manufacturer.

(c) The nominal bore and the working pressure as given in tables 1 or 2.

12.2 The marking shall be impressed longitudinally in the following colours:

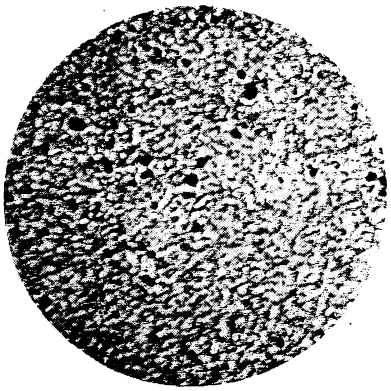
Thin wall – white
Thick wall – yellow

NOTE – The Standard Certification Mark Scheme

Shown here is the certification mark of the Standards Association of New Zealand. This mark may be used only by those manufacturers licensed by the Standards Association and must be accompanied by the number of the relevant New Zealand standard and the number of the authorizing licence. The presence of this mark on or in relation to a product is an assurance that the goods are manufactured under a system of supervision, control and testing (including periodical inspection of the manufacturer's works by SANZ) designed to ensure compliance with the standard.

For further particulars, apply to the Director.

NZS 7601
Licence No. .....



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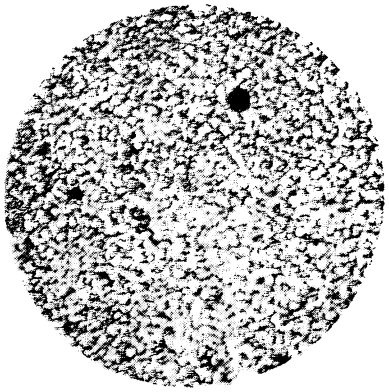

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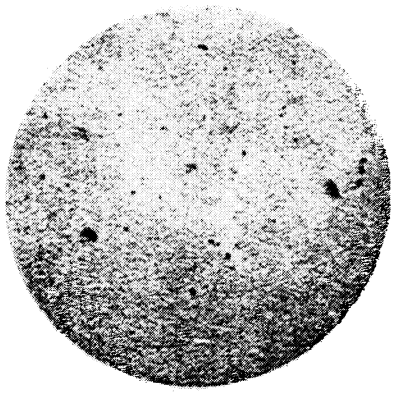

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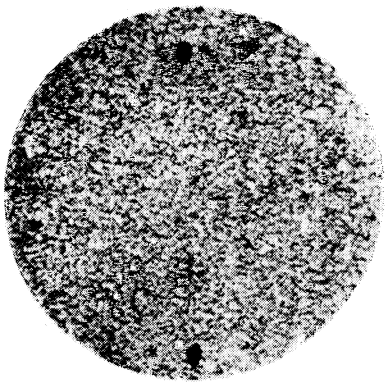

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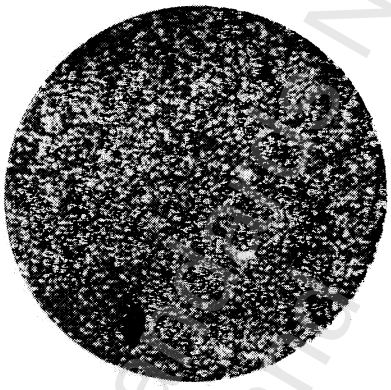

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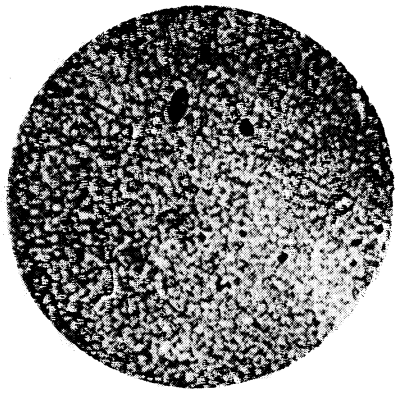

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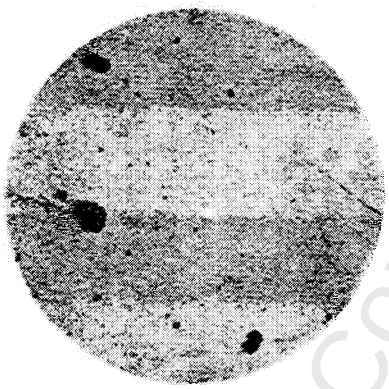
Figures 1 to 6 SATISFACTORY DISPERSION OF CARBON BLACK



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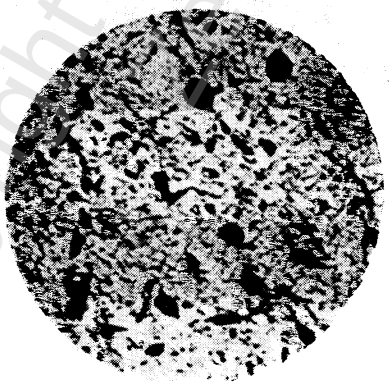

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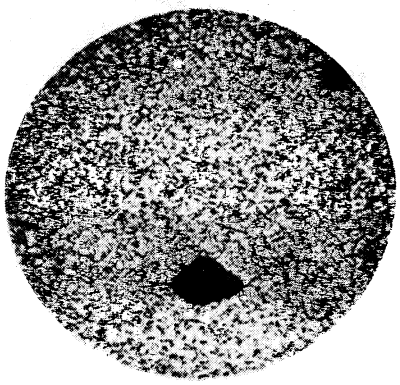

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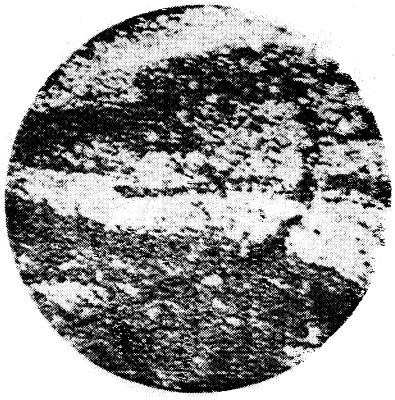

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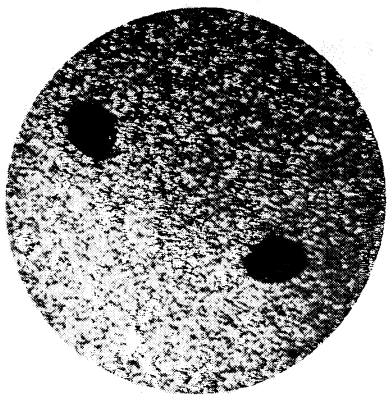

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Figures 7 to 12 UNSATISFACTORY DISPERSION OF CARBON BLACK

APPENDIX A

METHOD FOR THE DETERMINATION OF TOLUENE EXTRACT OF CARBON BLACK

A1 APPARATUS

A1.1 The following apparatus is required for the toluene extraction of carbon black.

(a) *Extraction thimbles,* double thickness, fat extracted.

(b) *Soxhlet apparatus.*

(c) *Shallow weighing dish,* 50 ml capacity, of borosilicate glass.

A2 REAGENT

A2.1 The reagent used shall be sulphur-free toluene of a recognized analytical reagent quality.

A3 PROCEDURE

A3.1 Weigh to 1 mg 5 to 8 g of pelletized carbon black or 2 to 5 g of compressed fluffy black and place in a paper extraction thimble. Measure 50 to 60 ml of toluene into the Soxhlet flask. Insert the thimble into the Soxhlet extractor. Assemble the Soxhlet apparatus and extract for 22 h. Evaporate successive small portions of the extract solution (filtered if necessary) nearly to dryness in the previously cleaned, dried and tared 50 ml shallow glass weighing dish. Rinse the extraction flask with toluene and add the washings to the weighing dish. Evaporate the combined extracts on a hotplate to a volume of approximately 5 to 10 ml, and finally dry to constant weight the dish and contents in an oven at 115 °C. Cool in a desiccator to room temperature and weigh to 1 mg.

A4 CALCULATION

A4.1 Toluene extract percent $= \dfrac{\text{mass of extract}}{\text{mass of sample}} \times 100$

APPENDIX B

METHOD FOR THE DETERMINATION OF 1,1-di-(3-*tert*butyl-4-hydroxy-6-methylphenyl) butane

B1 SUMMARY

B1.1 The quantitative estimation of small amounts of 1,1-di-(3-*tert*butyl-4-hydroxy-6-methylphenyl) butane in polyethylene compounds is made by means of an ultraviolet spectrophotometric method. In this method the antioxidant is extracted from the sample with boiling chloroform; the amount of antioxidant present in this solution is determined by measuring the ultraviolet absorption at a wavelength of 244 nm.

B2 APPARATUS

B2.1 The following apparatus is required:

(a) *Ultraviolet spectrophotometer.*

(b) *One-mark volumetric flasks,* 100 ml capacity, made to BS 1792*.

(c) *A matched pair of fused quartz cells,* with 10 mm path length.

(d) *Electric hotplate.*

(e) *Reflux condenser,* with 24/29 (B24) ground glass joint to BS 572*

(f) *Extraction flasks,* with 24/29 (B24) ground glass joint to BS 572*.

(g) *Filter funnel.*

(h) *Filter paper,* 150 mm diameter†.

B3 REAGENT

B3.1 The reagent used shall be chloroform of a recognized analytical reagent quality.

B4 PROCEDURE

B4.1 Preparation of sample solution:

B4.1.1 *Range 0.02 to 0.1 percent.* Weigh to 1 mg approximately 5.0 g of the sample into a 150 ml extraction flask and add 60 ml of chloroform by means of a pipette. Add a few anti-bumping granules. To the neck of the flask fit a condenser and then boil the contents of the flask gently on a hotplate for 45 min. Wash down the condenser and the neck of the flask with about 15 ml of chloroform, stopper the flask, and leave to cool in a bath of running water for 15 min. Filter the solution through a 150 mm paper, and wash the flask and the polymer on the filter with chloroform until the volume of the filtrate collected in a volumetric flask is 100 ml. Shake well. At the same time carry out a blank on the chloroform used, submitting the solvent to the same heating and filtration as described for the sample.

B4.1.2 *Range 0.1 to 0.6 percent.* The procedure here is exactly the same as described in B4.1 except that only 1.0 g of sample is used.

B4.2 *Spectrophotometry.* Measure the ultraviolet absorption of the sample extract over the wavelength range 220 to 310 nm in a 10 mm cell against the chloroform blank in the comparison cell. To avoid evaporation of the solvent use stoppered or covered cells. Calculate the absorbance at a wavelength of 244 nm using the base line method with a base line drawn from the absorbance at 220 nm tangentially.

B4.3 *Calibration graph.* Prepare the calibration graphs relating to the concentration of 1,1-di-(3-*tert*butyl-4-hydroxy-6-methylphenyl) butane in chloroform to absorbance at 244 nm by the following method:

> To a series of 100 ml volumetric flasks add 0, 1, 2, 3, 4, 5 ml and 6 ml of a standard 1.0 g/ℓ solution of 1,1-di-(3-*tert*butyl-4-hydroxy-6-methylphenyl) butane in chloroform and dilute each to 100 ml with chloroform. Measure the absorbance of each solution in the range 255 to 320 nm in 10 mm cells against chloroform in the comparison cell. Calculate the absorbance at 286 nm by the base line method as described in clause B4.2 and plot a graph of absorbance at 286 nm against milligrammes of 1,1-di-(3-*tert*butyl-4-hydroxy-6-methylphenyl) butane per 100 ml of chloroform solvent. This graph applies to the range 0 to 6 mg of 1,1-di-(3-*tert*butyl-4-hydroxy-6-methylphenyl) butane per 100 ml of chloroform solvent.

See list of related documents.

† Whatman No. 542 papers are suitable.

B5 RESULTS

B5.1 Read off the concentration of 1,1-di-(3-*tert*butyl-4-hydroxy-6-methylphenyl) butane in the chloroform extract from the appropriate calibration graph. Hence calculate the amount of 1,1-di-(3-*tert*butyl-4-hydroxy-6-methylphenyl) butane in the original sample and quote the results as a percentage.

B6 ACCURACY

B6.1 This method should give results, at the 0.3 percent level of antioxidant, accurate to ± 10 percent of the mean value.

APPENDIX C

HYDROSTATIC TEST

C1 CONDITIONING OF TEST SAMPLE

C1.1 Condition the test sample in air or water at 20 ± 2 °C for 30 min immediately prior to testing. Conditioning in water may be carried out with the sample connected to the test apparatus.

C2 TEST PROCEDURE

C2.1 If the conditioning has been carried out in air, connect the sample to the test apparatus and fill with water, ensuring that all air is released from the sample. If the conditioning has been carried out in water, connect the sample to the test apparatus if it is not already connected, and ensure that any remaining air is released from the sample.

C2.2 Apply the test pressure at a uniform rate without shock or pulsation. Maintain the test pressure within 2 percent of the value required and the test temperature at 20 ± 2 °C for the time specified in section 9. Suitable end connections for the sample are shown in fig. 13.

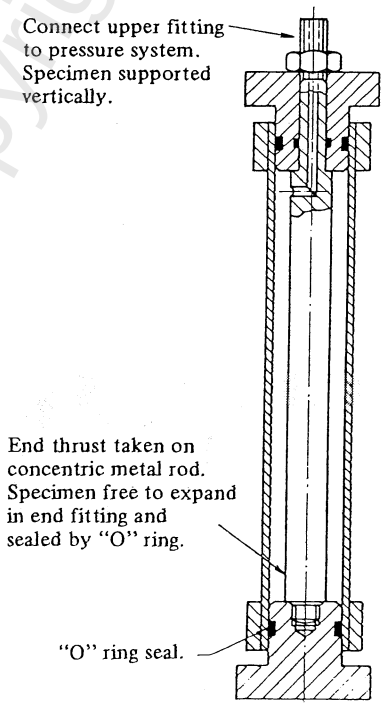

Fig. 13 SUITABLE END CONNECTIONS FOR HYDROSTATIC TEST

APPENDIX D

HEAT REVERSION TEST

D1 PROCEDURE

D1.1 Measure the length at 20 °C of a sample of pipe approximately 150 mm long. Immerse the pipe for 30 ± 2 min in a bath containing boiling water, ethylene glycol or an oil free from aromatic hydrocarbons at a temperature of 100 ± 2 °C. Remove the pipe from the bath and allow it to cool. Measure the length of the pipe when it has cooled to 20 °C.

APPENDIX E

TENSILE TEST

E1 PROCEDURE

E1.1 Cut two longitudinal test specimens from points 180° apart on the circumference of the pipe, to conform with the profile of the dumb-bell shown in fig. 301.9 of BS 2782*. On each test specimen mark two reference lines 25 mm apart, perpendicular to the long axis, placing the lines symmetrically on the waisted part of the specimen. Condition and test the two specimens in accordance with Method 301F of BS 2782*, except for setting the rate of traverse at 460 ± 75 mm per minute, and for reporting the test results of each specimen separately.

APPENDIX F

NOTES ON THE USE OF POLYETHYLENE PIPE (TYPE 3) FOR COLD WATER SERVICES

F1 GENERAL

F1.1 The following notes have been prepared for guidance in the reasonable and practical use of polyethylene pipe (Type 3) for cold water service. Users can obtain further information and advice from the manufacturers, and before installing polyethylene pipe for cold water supplies, should approach the Controlling Local Authority regarding local conditions and regulations.

F2 PROPERTIES

F2.1 *Essential characteristics.* Polyethylene is not liable to attack from any potable water or from soils which are corrosive to metals. Because of the slight permeability of polyethylene to gases, including coal gas, particular care should be taken when siting polyethylene pipe. It is flexible, elastic and heat insulating; this facilitates laying and installation, and minimizes the danger of frost damage. It is an electrical insulator and therefore cannot be used for earthing electrical installations.

NOTE – Metallic water pipes may be part of the earthing arrangements of electrical installations in compliance with the Electrical Wiring Regulations 1976. Whenever existing metallic pipe systems are repaired or replaced using pipes or joints of electrically insulating material, additional work may be needed to maintain the electrical continuity of the earthing system. The pipe installer must ensure that this aspect is checked by a registered electrician or Electrical Supply Authority Inspector.

See list of related documents.

F2.2 *Effect of heat.* The mechanical properties of polyethylene are adversely affected by a rise in temperature. Polyethylene pipes should therefore not be used for hot water services, and should not be fixed in contact with hot surfaces, nor where they will be exposed to direct sunlight.

F2.3 *Coefficient of thermal expansion.* The coefficient of thermal expansion is such that an increase in length of 1.5 mm/m for a 10 °C rise in temperature is likely to be experienced.

F2.4 *Effect of ultraviolet.* The black pigment retards the degradation of polyethylene by ultraviolet in sunlight and inhibits organic growth within the pipe. It is advisable that where the pipe is intended for long-term or permanent use it is trenched in, thus giving further protection from ultraviolet degradation.

F3 JOINTING

F3.1 Suitable compression fittings are available to suit the sizes of pipe listed in table 1 and table 2. Care should be taken in the selection of appropriate fittings.

F4 BENDING

F4.1 Cold bends can be made when the bend radius is greater than 12 times the outside diameter of the pipe. Hot bending is carried out for tighter radius bends, where the pipe is supported internally by using dry sand or a suitably sized bending spring. The heat may be applied using boiling water, or glycerine at a temperature of 100 °C, or by the careful application of a blowlamp. The pipe should be held in the shape required until cold.

F5 FIXING

F5.1 *General.* The pipe is supplied in coils or straight lengths, and the latter should be used for surface installations where neat appearance is of particular importance. Where pipe is cut from a coil, fixing should be arranged so that the curvature of the pipe is corrected by contact with the surface to which it is fixed. Such pipe should not be straightened by applying tension. Standard pipe clips and the like may be used for supporting the pipe and these should be tightened firmly but not too tightly so that they do not bite into the pipe. In view of the high coefficient of thermal expansion of polyethylene, provision for expansion and contraction may be necessary in long runs of pipe. The general practice of avoiding proximity between cold water pipes and hot pipes or hot surfaces should be followed. Where stopcocks or heavy fittings are used, care must be taken to anchor securely the end of the pipe to prevent twisting or other distortion of the pipe.

F5.2 *Horizontal runs.* Present knowledge indicates that, failing continuous support, clips and the like should be used at approximately the distances set out in table 5.

Table 5 DISTANCE BETWEEN SUPPORTS

Nominal bore	*Distance between supports*
mm	*mm*
15	750
20	750
25	750
32	900
40	900
50	1200

F5.3 *Vertical runs.* The clips or other supports should be fixed at not more than twice the distances for horizontal runs.