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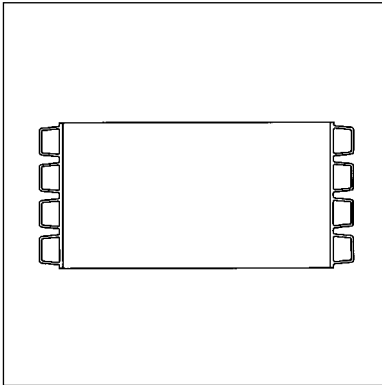
**Roads and Bridges
Agrément Certificate
No 96/R092**

Designated by Government
to issue
European Technical
Approvals

POLYTWIN TWINWALL HIGHWAY DRAINAGE SYSTEM

Canalisations et raccords
Leitungsrohre und Anschlußteile

Product



- THIS CERTIFICATE RELATES TO THE POLYTWIN PVC-U TWINWALL FILTER AND CARRIER HIGHWAY DRAINAGE SYSTEM.
- The system is for use in highway drainage for the collection and disposal of surface and sub-surface water in accordance with the Department of Transport (DOT) requirements and the conditions set out in the Design Data and Installation parts of the accompanying Detail Sheets.

Department of Transport Requirements

1 Requirements

1.1 The general requirements for drains are contained in the DOT's Manual of Contract Documents for Highway Works (MCHW) Volume 1 *Specification for Highway Works*.

1.2 Further information and guidance is given in MCHW, Volume 2 *Notes for Guidance on the specification for Highway Works*, and Volume 3 *Highway Construction Details* (Drawing Numbers F1 and F2).

1.3 Additional site requirements may be included on particular contracts.

Conditions of Certification

2 Conditions

2.1 Where reference is made in this Certificate to any Act of Parliament, Regulation made thereunder, Statutory Instrument, Code of Practice, British Standard, manufacturer's instruction or similar publication, it shall be construed as reference to such publication in the form in which it is in force at the date of this Certificate.

2.2 The quality of materials and the method of manufacture have been examined and found satisfactory by the BBA and must be maintained to this standard during the period of validity of this Certificate. This Certificate will remain valid for an unlimited period provided:

- (a) the specification of the product is unchanged; and
- (b) the manufacturer continues to have the product checked by the BBA.

2.3 This Certificate will apply only to the product that is installed, used and maintained as set out in this Certificate.

2.4 In granting this Certificate, the BBA makes no representation as to:

- (a) the presence or absence of patent or similar rights subsisting in the product; and
- (b) the legal right of Polypipe plc to market, install or maintain the product; and
- (c) the nature of individual installations of the product, including methods and workmanship.

2.5 It should be noted that any recommendations relating to the safe use of this product which are contained or referred to in this Certificate are the minimum standards required to be met when the product is used. They do not purport in any way to restate the requirements of the Health & Safety at Work etc Act 1974, or of any other statutory or Common Law duties of care, or of any duty of care which exist at the date of this Certificate or in the future; nor is conformity with such recommendations to be taken as satisfying the requirements of the 1974 Act or of any present or future statutory or Common Law duties of care. In granting this Certificate, the BBA does not accept responsibility to any person or body for any loss or damage, including personal injury, arising as a direct or indirect result of the use of this product.



In the opinion of the British Board of Agrément, the Polytwin Twinwall Highway Drainage System is fit for its intended use provided it is installed, used and maintained as set out in this Certificate. Certificate No 96/R092 is accordingly awarded to Polypipe plc.

On behalf of the British Board of Agrément

Date of issue: 19th February 1996

Director

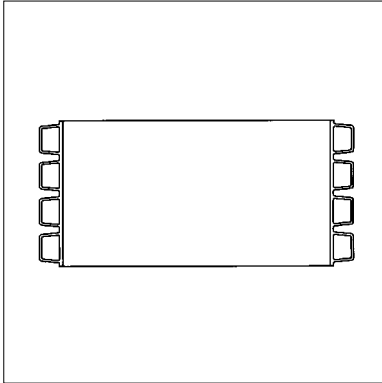


Polypipe plc

**POLYTWIN 150 mm, 225 mm AND 300 mm
TWINWALL PIPES WITH PLAIN AND
INTEGRAL SOCKET ENDS**

**Roads and Bridges
Certificate No 96/R092
DETAIL SHEET 1**

Product



• THIS DETAIL SHEET RELATES TO POLYTWIN 150 mm, 225 mm AND 300 mm PVC-U TWINWALL FILTER AND CARRIER PIPES.

• The pipes with plain and integral socket ends are for use in highway drainage for the collection and disposal of surface and sub-surface water.

This Detail Sheet must be read in conjunction with the Front Sheets, which give the Conditions of Certification and the product's position regarding the Department of Transport's (DOT) requirements.

Technical Specification

1 Description

1.1 Polytwin twinwall pipes with plain or spigot ends and integral sockets are manufactured in golden brown PVC-U by a twin extrusion process. Two PVC-U pipes are extruded simultaneously, one inside the other, and heat welded together in one continuous process. The outer wall is corrugated and the inner wall is smooth finished.

1.2 The socket/spigot pipe is available in lengths of 6 m. Details and dimensions are given in Table 1 and Figures 1 and 2.

1.3 The integral socket end of the pipes is designed to connect with the plain or spigot pipe end. Details and dimensions are given in Table 2 and Figure 2.

Figure 1 Details of Twinwall pipe (plain end)

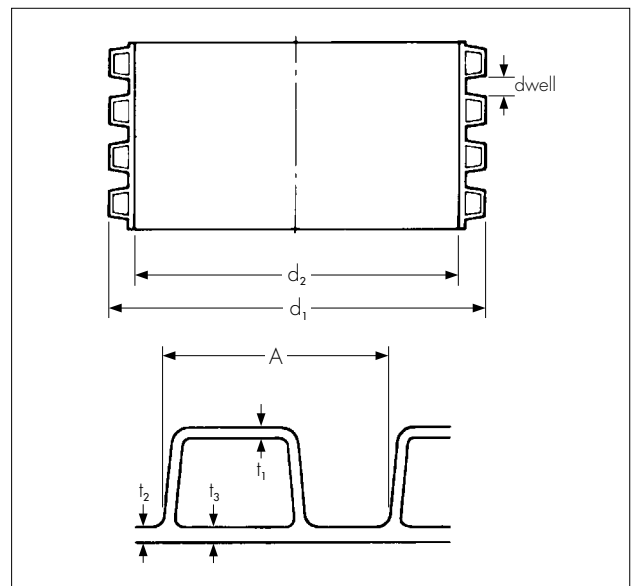


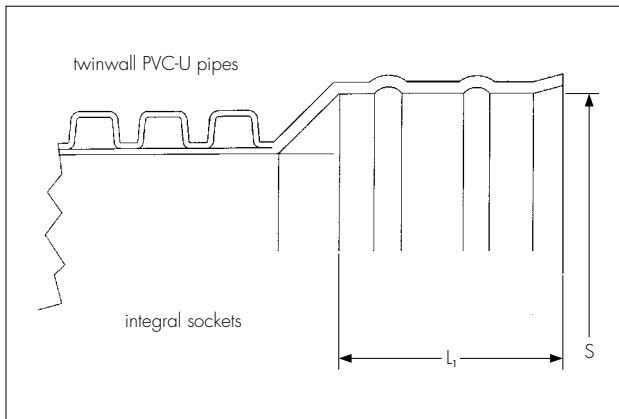
Table 1 Pipe dimensions

Nominal pipe pipe diameter (mm)	External dia. d (mm)	Nominal internal dia. d ₂ (mm)	A nominal (mm)	t ₁ min (mm)	t ₂ min (mm)	t ₃ min (mm)	Nominal length (m)	Nominal weight (kgm ⁻¹)
150	159.5-160.5	146	14.5	0.65	1.3	0.65	6	1.4
225	249.3-250.7	229	20.2	1.05	1.9	1.05	6	3.5
300	329.1-330.9	301	25.2	1.10	2.3	1.10	6	5.75

Table 2 Integral socket dimensions

Nominal pipe diameter	Internal dia. S (mm) (max)	Nominal socket depth (L ₁) (mm)	Nominal seal height (h) (mm)
150	161.1	70	16
225	251.85	90	13
300	332.5	110	15

Figure 2 Twinwall PVC-U pipes



1.4 Elastomeric seals manufactured to BS 2494 : 1990 are available for all pipe sizes, details are given in Table 2 and Figure 3. The seals must be fitted in accordance with the installation instructions to ensure a watertight joint (see sections 5.2 and 12.3).

1.5 Pipes can be supplied either slotted or unslotted. The slotted pipe has three slots to each dwell (between corrugations), equally spaced around the circumference. The slots are also offset by 60° for alternative dwells along the pipe length (see Table 3, Figure 1 and Figure 4).

Table 3 Slotted pipe details

Nominal pipe	No of slots per dwell	No of slots per metre	Nominal slot length	Nominal slot width	Permeable area (mm ² m ⁻¹)
			(mm)	(mm)	
150	3	210	32	1	6700
225	3	150	50	1	7500
300	3	120	70	1	8400

Figure 3 Seals

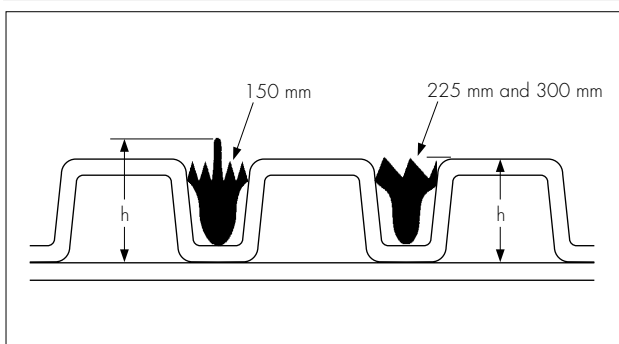
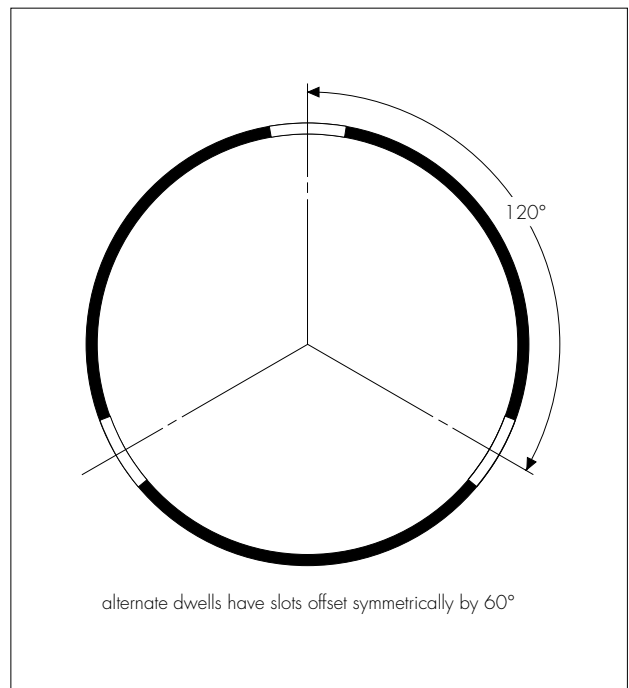


Figure 4 Details of slots



1.6 Continuous quality control is exercised during the manufacture of the pipes, checks include:

- dimensional accuracy
- impact resistance
- short-term stiffness
- visual checks.

1.7 A label bearing the BBA identification mark incorporating the number of this Certificate is attached to each pack of pipes or, alternatively, the BBA logo and Certificate number is printed or embossed on each pipe.

2 Delivery and site handling

2.1 Handling, storage and transportation should be in accordance with BS 5955 : Part 6 : 1980.

2.2 When long-term storage is envisaged, Polytwinn twinwall pipes must be protected from direct sunlight. If protection cannot be provided, consideration must be given to the effects of daily exposure to direct sunlight:

Up to 3 months — negligible UV degradation but possible extreme surface temperatures of up to 80°C may cause some localised distortion.

3 to 12 months — may have a significant effect on the impact resistance and physical properties.

Over 12 months — damage will occur unless protection provided.

2.3 Pipes are generally delivered in prepacked bundles and should be retained in their packaging until installation.

lightness in weight are a significant advantage in handling and installation.

3 General

Polytwin 150 mm, 225 mm and 300 mm Twinwall Pipes with Plain and Integral Socket Ends, when installed in accordance with the recommendations given in this Certificate, are suitable for use in highways for the collection and disposal of surface and sub-surface water.

4 Strength

4.1 The predicted 50-year ultimate pipe stiffness of the pipes exceeds the minimum requirement of the Highway Specifications. For design purposes the 50-year value should be taken as 1.4 kNm^{-2} .

4.2 The pipes can be used as an alternative to the plastics pipes for surface water drains listed in Table 5/1 of the MCHW, Volume 1, and for safe bedding depth purposes may be assumed to have a standard dimension ratio (SDR) equivalent of not greater than 41.

4.3 The pipes have adequate resistance to impact loads to which they may be subjected during installation and in service.

5 Performance of joints

5.1 Joints on filter pipes made from integral socketed pipe without the rubber seals are not watertight or partly watertight as defined in the MCHW, Volume 1, clauses 504.3 and 504.4.

5.2 Correctly made, the joints constructed from integral socketed pipe with rubber seals remain watertight when subjected to deflection and distortion, and comply with the MCHW, Volume 1, clause 504.3 (see section 13).

6 Water infiltration

The slot area for the pipes exceeds the DOT's minimum requirement of 1000 mm^2 per metre length.

7 Flow characteristics

7.1 The pipes will have normal flow characteristics associated with PVC-U pipes.

7.2 Full-bore velocities are given in Table 4. The values are based on the Colebrook-White equation. An appropriate value of roughness coefficient should be selected when designing the drainage system.

8 Practicability of installation

The pipes are installed easily using traditional drain-laying techniques (see section 11). The lengths in which the pipes are available and their

9 Maintenance

9.1 The degree of ingress of silt into the drains will be similar to that for perforated pipes to BS 4962 : 1989 installed in the same manner and conditions.

9.2 Access to the system for cleaning should be provided by conventional methods.

9.3 The system can be rodded easily using flexible drain rods. In common with other standard plastic drainage systems, toothed root cutters and rods with metal ferrules, as used with some mechanical clearing systems, could damage the pipes and couplings and should not be used.

10 Durability

In the opinion of the BBA, when used in the context of this Detail Sheet, the material from which the pipes are manufactured will not significantly deteriorate and the anticipated life of the system will be in excess of 50 years.

Installation

11 General

Polytwin 150 mm, 225 mm and 300 mm Twinwall Pipes with Plain and Integral Socket Ends must be installed in accordance with the Department of Transport Requirements and Clauses 503 and 505 of MCHW, Volume 1.

12 Procedures

12.1 For typical laying, trench and backfilling specification details reference should be made to Figure 5 and the MCHW, Volume 3, Drawing No F1 (Type T and S) and F2 (Type G, H and I).

12.2 Pipes are cut easily using conventional hand tools, and should be cut square between the corrugations.

12.3 For a watertight joint, the seal is located between the first and second corrugation, for the 150 mm, 225 mm and 300 mm pipe sizes. The seal should then be coated with Polypipe lubricant.

12.4 Both the plain end of the pipe and integral socket should be cleaned, the pipe plain end offered to the socket and pushed fully home either by hand, or using a lever if necessary.

12.5 Pipe and integral sockets must be protected against damage from site construction traffic.

12.6 Care should be taken during backfill to maintain the line and level of the pipeline. If necessary, the pipe should be restrained to prevent uplift.

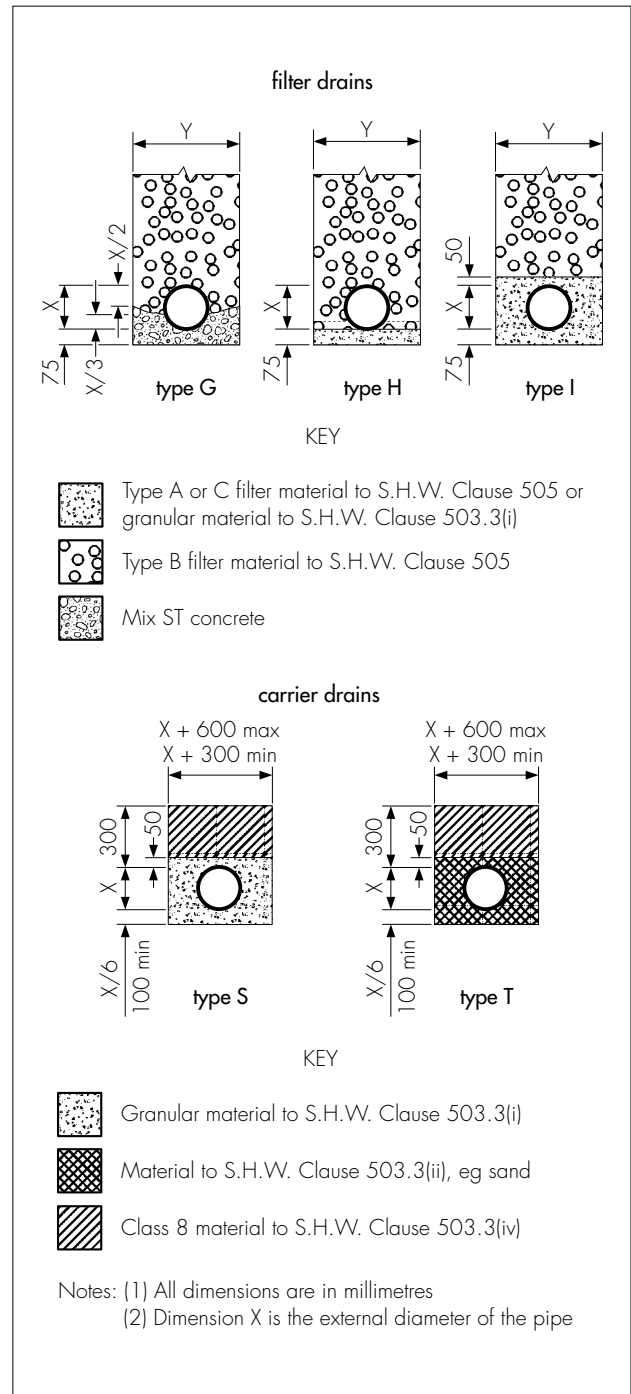
Table 4 Full-bore discharges and velocities

Pipe internal diameter = 146 mm								
Gradient	Roughness R (mm)							
	0.06		0.60		1.50		5.00	
	Velocity (ms ⁻¹)	Flow (ls ⁻¹)	Velocity (ms ⁻¹)	Flow (l ⁻¹)	Velocity (ms ⁻¹)	Flow (ls ⁻¹)	Velocity (ms ⁻¹)	Flow (ls ⁻¹)
1.0	13.24	221.67	9.99	167.17	8.65	144.77	6.88	115.21
10.0	4.10	68.66	3.15	52.69	2.73	45.71	2.17	36.41
20.0	2.87	48.02	2.22	37.19	1.93	32.29	1.54	25.74
30.0	2.32	38.90	1.81	30.32	1.57	26.35	1.25	21.01
40.0	2.00	33.48	1.57	26.23	1.36	22.81	1.09	18.19
50.0	1.78	29.78	1.40	23.43	1.22	20.39	0.97	16.27
60.0	1.62	27.06	1.28	21.37	1.11	18.60	0.89	14.85
70.0	1.49	24.95	1.18	19.77	1.03	17.22	0.82	13.74
80.0	1.39	23.25	1.10	18.48	0.96	16.10	0.77	12.85
90.0	1.31	21.85	1.04	17.41	0.91	15.17	0.72	12.12
100.0	1.23	20.66	0.99	16.50	0.86	14.39	0.69	11.49
120.0	1.12	18.76	0.90	15.04	0.78	13.13	0.63	10.49
140.0	1.03	17.28	0.83	13.91	0.73	12.14	0.58	9.71
160.0	0.96	16.09	0.78	13.00	0.68	11.35	0.54	9.08
180.0	0.90	15.11	0.73	12.24	0.64	10.70	0.51	8.56
200.0	0.85	14.28	0.69	11.60	0.61	10.15	0.48	8.12
250.0	0.76	12.67	0.62	10.35	0.54	9.06	0.43	7.26
300.0	0.69	11.48	0.56	9.43	0.49	8.27	0.40	6.62
400.0	0.59	9.83	0.49	8.14	0.43	7.15	0.34	5.73
500.0	0.52	8.70	0.43	7.26	0.38	6.38	0.31	5.12
600.0	0.47	7.88	0.39	6.61	0.35	5.82	0.28	4.67
700.0	0.43	7.24	0.36	6.10	0.32	5.38	0.26	4.33
800.0	0.40	6.73	0.34	5.70	0.30	5.03	0.24	4.04
900.0	0.38	6.31	0.32	5.36	0.28	4.73	0.23	3.81
1000.0	0.36	5.96	0.30	5.07	0.27	4.49	0.22	3.61

Pipe internal diameter = 229 mm								
1.0	17.45	718.58	13.34	549.36	11.66	480.26	9.45	389.13
10.0	5.43	223.58	4.21	173.30	3.68	151.70	2.99	123.00
20.0	3.80	156.70	2.97	122.37	2.60	107.20	2.11	86.95
30.0	3.09	127.13	2.42	99.80	2.12	87.48	1.72	70.98
40.0	2.66	109.53	2.10	86.35	1.84	75.73	1.49	61.46
50.0	2.37	97.54	1.87	77.17	1.64	67.71	1.33	54.97
60.0	2.15	88.71	1.71	70.40	1.50	61.79	1.22	50.17
70.0	1.99	81.85	1.58	65.13	1.39	57.18	1.13	46.44
80.0	1.85	76.33	1.48	60.89	1.30	53.48	1.05	43.44
90.0	1.74	71.76	1.39	57.37	1.22	50.40	0.99	40.95
100.0	1.65	67.90	1.32	54.40	1.16	47.80	0.94	38.85
120.0	1.50	61.69	1.20	49.61	1.06	43.62	0.86	35.45
140.0	1.38	56.87	1.11	45.89	0.98	40.36	0.80	32.82
160.0	1.29	53.00	1.04	42.89	0.92	37.74	0.75	30.69
180.0	1.21	49.80	0.98	40.40	0.86	35.57	0.70	28.94
200.0	1.14	47.09	0.93	38.30	0.82	33.73	0.67	27.45
250.0	1.02	41.82	0.83	34.20	0.73	30.15	0.60	24.54
300.0	0.92	37.95	0.76	31.17	0.67	27.50	0.54	22.40
400.0	0.79	32.53	0.65	26.92	0.58	23.78	0.47	19.39
500.0	0.70	28.86	0.58	24.02	0.52	21.25	0.42	17.33
600.0	0.64	26.16	0.53	21.88	0.47	19.38	0.38	15.82
700.0	0.58	24.07	0.49	20.22	0.44	17.92	0.36	14.64
800.0	0.54	22.39	0.46	18.88	0.41	16.75	0.33	13.69
900.0	0.51	21.00	0.43	17.77	0.38	15.78	0.31	12.90
1000.0	0.48	19.84	0.41	16.84	0.36	14.96	0.30	12.23

Pipe internal diameter = 301 mm								
1.0	20.60	1465.85	15.87	1129.37	13.95	992.39	11.41	811.85
10.0	6.42	457.11	5.01	356.41	4.41	313.53	3.61	256.64
20.0	4.51	320.74	3.54	251.71	3.11	221.57	2.55	181.44
30.0	3.66	260.42	2.89	205.33	2.54	180.83	2.08	148.12
40.0	3.16	224.51	2.50	177.68	2.20	156.55	1.80	128.26
50.0	2.81	200.04	2.23	158.81	1.97	139.98	1.61	114.70
60.0	2.56	182.00	2.04	144.89	1.80	127.74	1.47	104.70
70.0	2.36	167.99	1.88	134.06	1.66	118.24	1.36	96.92
80.0	2.20	156.71	1.76	125.34	1.55	110.57	1.27	90.65
90.0	2.07	147.37	1.66	118.11	1.46	104.23	1.20	85.46
100.0	1.96	139.49	1.57	112.00	1.39	98.86	1.14	81.07
120.0	1.78	126.80	1.44	102.15	1.27	90.21	1.04	73.99
140.0	1.64	116.95	1.33	94.50	1.17	83.48	0.96	68.50
160.0	1.53	109.02	1.24	88.33	1.10	78.06	0.90	64.06
180.0	1.44	102.47	1.17	83.23	1.03	73.58	0.85	60.39
200.0	1.36	96.93	1.11	78.91	0.98	69.78	0.81	57.29
250.0	1.21	86.15	0.99	70.47	0.88	62.37	0.72	51.23
300.0	1.10	78.21	0.90	64.25	0.80	56.90	0.66	46.75
400.0	0.94	67.12	0.78	55.51	0.69	49.22	0.57	40.47
500.0	0.84	59.58	0.70	49.55	0.62	43.98	0.51	36.18
600.0	0.76	54.04	0.63	45.15	0.56	40.11	0.46	33.02
700.0	0.70	49.75	0.59	41.74	0.52	37.11	0.43	30.56
800.0	0.65	46.30	0.55	38.98	0.49	34.69	0.40	28.58
900.0	0.61	43.05	0.52	36.70	0.46	32.68	0.38	26.94
1000.0	0.58	41.05	0.49	34.77	0.44	30.98	0.36	25.55

Figure 5 Trench and bedding details



Technical Investigations

The following is a summary of the technical investigations carried out on Polytwinn 150 mm, 225 mm and 300 mm Twinwall Pipes with Plain and Integral Socket Ends.

13 Tests

13.1 The following tests were carried out to determine the stiffness characteristics of the pipe:

- initial pipe stiffness (STIS 5 mins) to BS 4962, Appendix B
- ultimate pipe stiffness (STES 50 years) to BS 4962, Appendix B.

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13.2 Tests were carried out on the pipe to determine:

impact strength at 0°C to BS 4962 : 1989, Appendix E, with modified striker of 1.0 kg mass and 50 mm diameter
resistance to penetration of simulated sharp aggregate to BBA Pipe Penetration Test, reference S1/102
Vicat softening point to BS 2782 : Part 1.

13.3 Tests were carried out on jointed pipe to establish:

watertightness of joints to 0.5 bar positive pressure and 0.5 bar negative pressure when subjected to 10% diameter distortion and also when subjected to 3° angular deflection
seepage rates of joints in accordance with MCHW, Volume 1, Clause 509.7
drop strength to BS 5481 : 1977(1989), Appendix D
insertion force (ease of jointing)
resistance to rodding.

13.4 Tests were carried out to establish the dimensional accuracy of the pipe, socket and ring seal.

14 Other investigations

14.1 An assessment was made in relation to the effect of the production tolerances on the performance of the products.

14.2 An evaluation of existing data was made to assess chemical resistance and durability.

14.3 Calculations were carried out to determine: flow capacity
slot area.

14.4 An assessment was made of the ease and practicability of installation.

14.5 The manufacturing process was examined, including the methods adopted for quality control, and details were obtained of the quality and composition of the materials used.

Bibliography

BS 2782 *Methods of testing plastics*
Part 1 *Thermal properties*

BS 4962 : 1989 *Specification for plastics pipe and fittings for use as subsoil field drains*

BS 5481 : 1977(1989) *Specification for unplasticized PVC pipe and fittings for gravity sewers*

BS 5955 *Plastics pipework (thermoplastics materials)*
Part 6 : 1980 *Code of practice for the installation of unplasticized PVC pipework for gravity drains and sewers*



On behalf of the British Board of Agrément

Date of issue: 19th February 1996

Director

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