SRI LANKA STANDARD 449:1978 UDC 621.643.2:628.24:696.1:666.73

## SPECIFICATION FOR GLAZED EARTHENWARE PIPES

BUREAU OF CEYLON STANDARDS

# SRI LANKA STANDARD SPECIFICATION FOR GLAZED EARTHENWARE PIPES

SLS 449:1978

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BUREAU OF CEYLON STANDARDS 53, Dharmapala Mawatha, Colombo 3, Sri Lanka.

## SRI LANKA STANDARD SPECIFICATION FOR GLAZED EARTHENWARE PIPES

#### FOREWORD

This Sri Lanka Standard was prepared by the Drafting Committee of the Bureau on Earthenware Pipes under the authority of the Civil Engineering Divisional Committee of the Bureau of Ceylon Standards. It was approved for adoption and publication by the Council of the Bureau on 1978-12-01.

Rational metric and inch sizes of pipes (which are not equivalent to one another and therefore not interchangeable) are specified in this standard. Both sets of sizes are to be considered as 'standard' until such time the inch set is withdrawn after the industry changes over completely to the metric system. All other standard values given herein are in metric units. Equivalent imperial values appearing in parenthesis are only for guidance.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis shall be rounded off in accordance with CS 102\*. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

\*CS 102 Presentation of numerical values.

In preparing this standard the assistance derived from the publications of the Australian Standards Institution, the British Standards Institution, the New Zealand Standards Institution and the South African Bureau of Standards is gratefully acknowledged.

#### 1 SCOPE

This standard specifies the requirements for the following clay pipes and fittings, with or without sockets, suitable for drains and sewers.

Pipes : Straight pipes

Fittings (Figures 3 to 18)

- a) Taper pipes, concentric and eccentric (level invert)
- b) Bends
- c) Taper bends
- d) Junctions
- e) Channels, straight and taper, half-section
- f) Channel bends, half-section
- g) Channel junctions, half-section
- h) Interceptors
- j) Saddle junctions

## 2 MATERIALS AND MANUFACTURE

The clay and any glaze used in the manufacture of pipes and fittings shall be such that the finished goods have the following characteristics:

- a) Adequate structural strength (8)
- b) High resistance to chemical attack (11)
- c) Permanently low water permeability (9)
- d) High resistance to abrasion.

Pipes and fittings shall be glazed. The glazing may be on the interior only or on both the interior and exterior but need not be on the jointing surface of the socket or spigot. The finished products shall be sound and free from cracks, chips, local distortions and surface imperfections subject to the limitation specified in 12. The glaze shall be:

- ceramic glaze, including that known as glass
   (vitreous) enamel, consisting of suitable glazing
   material applied prior to firing, and/or
- salt glaze, obtained by the action of common salt, compounds of sodium borax, boric acid or a combination of these during the firing process.

#### **3 DIMENSIONS AND TOLERANCES**

#### 3.1 Barrels

3.1.1 The internal diameter of a pipe or fitting shall not deviate from the nominal bore beyond the limits of minimum and maximum internal diameters given in Table 1.

3.1.2 The difference between the measured least thickness (not measured in a groove) and the greatest thickness shall not exceed 3 mm (0.1 in).

3.1.3 The spigots of pipes and fittings having grooved or roughened sockets may be grooved circumferentially or roughened and the depth of such grooves or roughening shall not be more than 2 mm (0.08 in).

#### 3.2 Sockets

Sockets when present shall be one of two types, either:

Type 1 : For use with manufacturer's special or flexible joints or

Type 2 : Grooved or roughened, for use with customers' selected jointing materials.

NOTE - Spigots and sockets of Type 1 not having other jointing material attached may be used with customers' selected jointing materials.

## 3.2.1 Type 1

The design of sockets of Type 1 and the tolerance for both spigot and socket dimensions depend on the joint selected. The test pressure and the angular and axial straight movements which the joint will tolerate under that pressure without loss of watertightness, shall be stated by the manufacturer. The requirements for the thickness of the socket are the same as those for the barrel except for special provisions required for the joint.

### 3.2.2 Type 2

The interior of the sockets of Type 2 (see Fig. 1) shall be conical having a minimum taper of 1 in 50; thus the diameter of a socket 50 mm (2.0 in) deep will be at least 2 mm (0.08 in) greater at the outer end than at the inner end.

The depth of sockets and the excess width of the shoulder (C) of such a socket of any individual pipe or fitting over the mean thickness of the barrel shall be not less than the figures given in Table 2. The mean thickness (A) of any individual barrel shall be ascertained by adding the measured least thickness (not in a groove) to the greatest thickness and dividing the sum by two. The socket may be grooved circumferentially or roughened

Nominal bore	Limits of internal diameter			
	Minimum mm	Maximum mm		
75	73	80		
	98	105		
100	122	132		
125*				
150	147	158		
175*	173	183		
200*	196	210		
200		235		
225	222	235		
250*	246	313		
300	296			
		391		
375	371	467		
450	447	547		
525	520			
	596	623		
600	596	705		
675	736	788		
750	/30			
	812	864		
825	889	940		
900	005			
in	in	in		
111	3 13/16	4 1/8		
4	5 13/16	_6 1/4		
<b>6</b>	8 13/16	9 3/8		
9	0 15/10			
	11 13/16	12 1/2		
12	14 13/16	15 5/8		
-15	17 13/16	18 3/4		
18				
	20 13/16	22		
21	23 11/16	25 1/8		
24	26 11/16	28 1/4		
27				
30	29 11/16	31 1/2		
30	35 11/16	37 1/2		
σε		- ( · · · · · · · · · · · · · · · · · ·		

## TABLE 1 - Dimensions of barrels

\*Non-preferred sizes.

Nominal bore	Minimum internal depth of socket (B)	Minimum excess shoulder measurement (C - A)
mm	<b>mn</b>	mm
75	50	8
100	50	10
125*	55	10
	35	10
150	55	10
175*	55	10
200*	65-	13
100	85-	. 15
225	65	13
250*	70	15
300	70	15
300		15
375	75	15
450	75	15
525	80	20
52.5	80	20
600	90	20
675	90	20
750	90	20
750	50	20
825	90	25
900	90	25
,000	50	23
in	in	in
4	2	3/8
6	2 1/4	7/16
° I		4710
9	2 1/2	1/2
12	2 3/4	5/8
**	2 3/ 7	570
15	3	5/8
18	- 3	5/8
21	3 1/4	3/4
	5 4/7	
24	3 1/2	3/4
27	3 1/2	3/4
30	3 1/2	3/4
- 36	3 1/2	1
- 50	J 1/2	â.
	1	

X

## TABLE 2 - Dimensions of sockets type 2

(See Fig. 1)

\*Non-preferred sizes.

inside and the depth of such grooves or roughening shall not be more than 3 mm (0.1 in). The requirements for the thickness of the socket are the same as those for the barrel.

## 4 LENGTH OF STRAIGHT PIPES AND CHANNELS

4.1 The lengths of straight pipes and half-section channels exclusive of the internal depth of the socket shall normally be as given in 4.1.1 or 4.1.2.

4.1.1 Metric units: 0.60 m, 0.75 m, 0.90 m, 1.20 m and 1.50 m with a tolerance of  $\pm$  20 mm per metre length of pipe.

4.1.2 Imperial units: 2 ft,  $2\frac{1}{2}$  ft, 3 ft, 4 ft, and 5 ft with a tolerance of  $\pm \frac{1}{4}$  in per foot length of pipe.

4.1.3 Pipes of lengths other than the above may be deemed to comply with this specification provided that such other lengths have been agreed by the purchaser.

## 5 PERMISSIBLE DEVIATION FROM STRAIGHTNESS

When tested in accordance with Appendix A the permissible deviation from straightness of the barrel of a pipe of any diameter shall not exceed, that specified in Column 3 of the table given under Fig. A1.

#### 6 DIMENSIONS OF FITTINGS

The thickness of fittings shall be not less than the thickness of the pipes with which they will be used.

The dimensions of fittings given in Figures 3 to 18 and the related tables shall be regarded as indicative only and accurate compliance is not required.

Sockets, when present shall be either Type 1 or Type 2 (see 3.2). The figures show sockets of Type 2 only. The form of Type 1 sockets depend on the type of joint.

Taper pipes and half-section taper channels may be ordered in normal combination of diameters, including reverse tapers. The other dimensions shall be within the limits given in Tables 1 and 2 and in 4.

7 DEFINITIONS OF RIGHT AND LEFT-HAND CHANNEL FITTINGS

A right-hand channel fitting is such that, when viewed against the direction of flow, the arm of a junction or the socket of a bend etc. projects to the right (Fig. 2). A left hand channel fitting is such that when viewed as above the arm or socket projects to the left.

8 MINIMUM TEST LOAD (SAFE WORKING LOAD)

When tested in accordance with Appendix B, the pipe tested shall withstand the intensity of loading appropriate to its size and class specified in Table 3, and this strength shall be called the safe working load.

The strength of sizes other than those given in Table 3 shall be ascertained by purchaser from supplier.

#### 9 BARREL IMPERMEABILITY TEST

The barrels of the pipes and fittings when subjected to an impermeability test over the whole length of pipe or fitting shall be free from leakage when an internal hydraulic pressure of 70 k) a (10.2  $lbf/in^2$ ) is applied for 1 minute. Care shall be taken to ensure that all air is expelled from pipes and fittings before the test is commenced.

# TABLE 3 - Minimum test load(Safe working load)

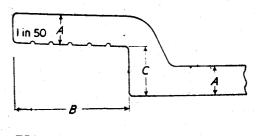
Nominal bore	Load per metre of inside length
Tom	kN/m
100	20
150	20
225	20
300	22
Nominal bore	Load per foot of inside
Nominal bore	Load per foot of inside length
Nominal bore mm	
mm	length lbf/ft
	length lbf/ft 1 350
mm 4	length lbf/ft

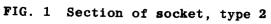
### **10 HYDRAULIC PROOF TEST**

When subjected to a hydraulic test, straight pipes and fittings except channel fittings shall without leakage withstand internal pressure as follows:

Straight pipes 140 kPa (20.3 lbf/in<sup>2</sup>) Fittings, except channel fittings 70 kPa (10.2 lbf/in<sup>2</sup>)

The pressure shall be applied at a rate not exceeding 70 kPa (10.2  $lbf/in^2$ ) in five seconds, and full pressure shall be maintained for at least five seconds. Care shall be taken to ensure that all air is expelled before the test is commenced.





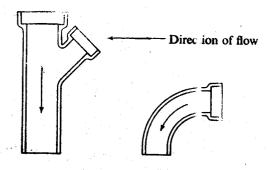


FIG. 2 Right hand filtings

## 11 ACID AND ALKALI RESISTANCE TESTS

When tested in accordance with Appendix C the loss in mass of any specimen after being immersed for 48 hours in a 1.0 N solution of hydrochloric or nitric or sulphuric or acetic acid or of sodium hydroxide (caustic soda) shall not exceed 0.25 per cent of dry mass.

## 12 WORKMANSHIP AND FINISH

#### 12.1 Cracks

All pipes and fittings shall be free from fractures and large or deep cracks.

A small number of visible cracks up to 25 mm (1.0 in) long shall not be considered as defects provided they do not interfere with the functions of the pipe or fittings.

#### 12.2 Chips and local distortions

An area on the spigot and socket of all rubber ring jointed pipes and fittings shall be free from chips within a distance equal to the cord diameter of the joint ring on both sides of the centre of the nominal assembled ring seat.

Chips and local distortions which otherwise do not prevent a good joint being made shall not be considered as defects provided they do not impair the structural strength of the pipes or fittings.

### 12.3 Other surface imperfections

External and internal surface imperfections, of the barrel such as extrusion lines, pimples, blisters, chips and other handling abrasions, shall be accepted provided they are of not more than 3 mm (0.1 in) departure from the normal surface.

#### 13 SAMPLING

13.1 lot: In any consignment, all the pipes (or fittings) of the same size and type manufactured essentially under similar conditions shall be grouped together to constitute a lot.

#### 13.2 Pipes

From the lot take at random the number of pipes shown in Column 2 of Table 4 relative to the lot size shown in Column 1.

If, after inspection and test of the sample taken as above, the number of defectives found lies between the relevant acceptance number and rejection number given in Columns 4 and 5 of Table 4, take at random from the lot a second sample of the size shown in Column 3 relative to the lot size shown in Column 1. If the number of defectives found in the first sample is greater than or equal to the corresponding rejection number the lot shall be rejected without taking a second sample.

#### 13.3 Fittings

From the lot take at random five fittings.

14 COMPLIANCE

## 14.1 Pipes

The lot shall be deemed to comply with the specification if after inspection and test of the samples taken in accordance with 13.1,

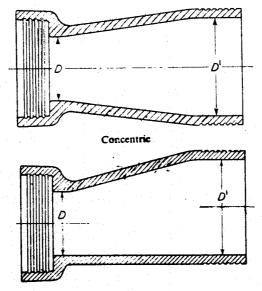
- a) the number of defectives found in the first sample does not exceed the relevant acceptance number given in Column 4 of Table 4 or,
- b) where a second sample is taken, no defective is found in the second sample.

## TABLE 4 - Sample sizes for pipes

Lot size	Sizes of lst sample	Sizes of 2nd sample	Acceptance number	Rejection number
Up to 500	5	7	0	2
501 to 1500	8	10	0	2
1501 to 5000	12	15	1	3

## 14.2 Fittings

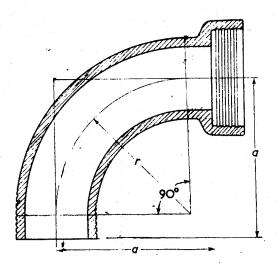
The lot shall be deemed to comply with the specification if after inspection and test of the sample taken in accordance with 13.1 not more than one defective is found.



Level invert (eccentric).

FIG. 3 Taper pipes

BENDS



(millimetre dimensions)

Nominal bore	Sho	rt	Medi	um	Loi	1g
	r	a	<u> </u>	<b>a</b>	r	<u>a</u>
75 100 * 125 and 150 * 175, *200 and 225 * 250 and 300	90 90 150 -	140 140 190 - -	150 150 190 215 255	190 190 230 265 305	215 230 - -	- 255 265 -

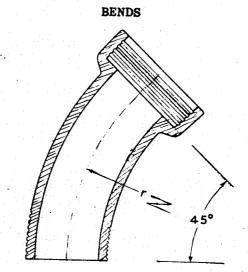
\* Non-preferred sizes

(inch dimensions)

Nominal bore	Shor	t	Medium	n	Long	
	ŕ	8	r	а	r	a
4	3 1/2	5 1/2	6	7 1/2	8 1/2	10
6	6	7 1/2	7 1/2	9	9	10.1/2
9 `	1 <b>-</b> 1	-	8 1/2	10 1/2	-	- 1
12	-	-	10	12	-	-
•	1 <u>.</u>	L athen no			<u></u>	ano

In altition to the above, bends of other nominal bores given in Table 1 are available.

FIG.	4	One	quarter	bends
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(millimetre dimensions)

Nominal bore	Short	Medium	Long	
·	r	. r	r	
75	255	380	-	
100	255	380	510	
* 125 and 150	380	455	535	
*175, *200 and				
225		535	-	
250 and 300		610	-	
	1.			

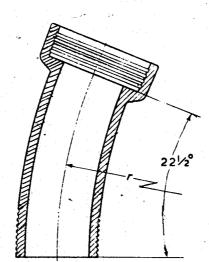
\* Non-preferred sizes

(inch dimensions)

Nominal bore	Short	Medium	Long
	r	r	r
. 4	10	15	20
6	15	18	21
9	-	21	-
12	-	24	
	The second second	1	

In addition to the above, bence of other Nomina bores given in Table 1 are available.

## FIG. 5 One eighth bends



(millimetre dimensions)

Nominal bore	r	
75	760	
100	760	
*125 and 150	915	
*175, *200 and 225	1065	
*250 and 300	1220	

(inch dimensions)

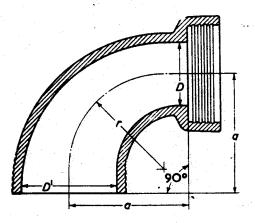
111	Nominal bore	r	
	4	30	
	6	36	
	9	42	
	12	48	

In addition to the above, bends of other nominal bores given in Table 1 are available.

## FIG. 6 One sixteenth bends

BENDS

## TAPER BENDS



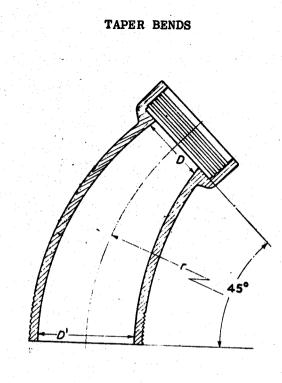
(millimetre dimensions)

Nominal	bore		
D	D	r	a
75	100	150	190
100	150	150	190
150	225	190	2 30

(inch dimensions)

NO	inal	DOFE		
/	D'	D	r	
	4	6	6	7 1/2
	6	9	7 1/2	9

FIG. 7 One-quarter taper bends



(millimetre dimensions)

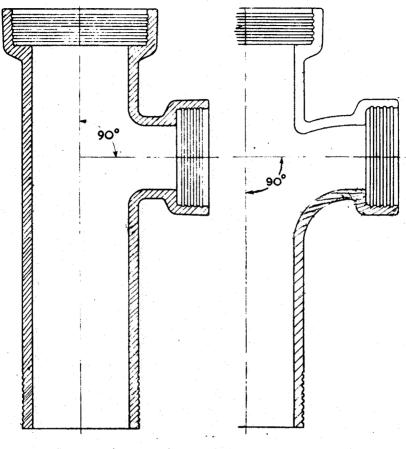
Nominal	bore	· · · · ·	
D	D <sup>1</sup>	r	
100	150	380	
150	<sup>1</sup> 225	455	

(inch dimensions)

 minal bo		
D	D1	r
4	6 9	15 18

FIG. 8 One-eighth taper bends

JUNCTIONS



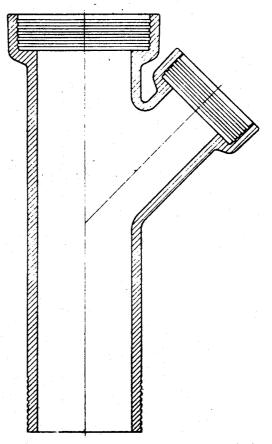
## (1) Square type

(2) Curved square type

The barrels of junctions may be of the nominal bores shown in Table 1, but the nominal bore of the branch may not exceed that of the barrel. In the case of junctions with branch at an acute angle, branches up to an including 225 mm or 9 in nominal bore form an angle of approximately  $55^{\circ}$  to  $60^{\circ}$  the barrel, according to size.

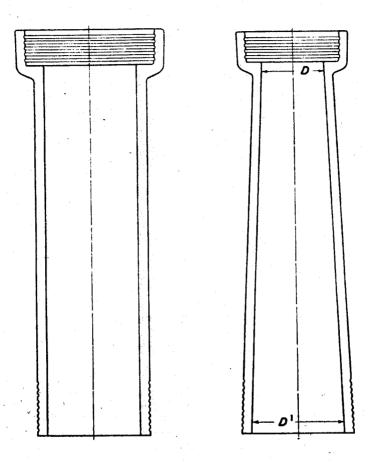
# FIG. 9 Junction with branch at an angle of approximately 90<sup>0</sup>

## JUNCTIONS



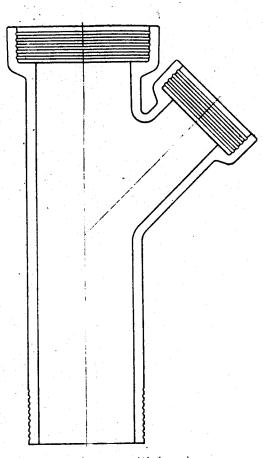
The barrels of junctions may be of the nominal bores shown in Table 1, but the nominal bore of the branch may not exceed that of the barrel. In the case of junctions with branch at an acute angle, branches up to an including 225 mm or 9 in nominal bore form an angle of approximately 55° to 60° the barrel, according to size.

FIG. 10 Junction with branch in an acute angle



See 4 for lengths and 6 for dimensions

FIG. 11 Half section FIG. 12 Half section straight channels taper channels



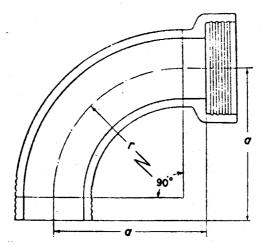
CHANNEL JUNCTIONS

- a) Square or curved square with branch at an angle of approximately 90° having contours as shown in Fig. 9.
- b) Oblique with branch at an acute angle as shown.

The main channel and branches of junctions may be any one of the nominal bores shown in Table 1, but the nominal bore of the branch may not exceed that of the main channel. In the case of oblique junctions, branches up to an including 225 mm or 9 in nominal bore form an angle of approximately  $55^{\circ}$ to  $60^{\circ}$  to the main channel, according to aize.

FIG.

13 Half-section channel junctions



(millimetre dimensions)

Nominal	Short		Med	lium	Long		
bore	r	8	r	a	r	a	
75	90	140	150	190	-	-	
100	90	140	150	190	215	255	
*125 and 150	150	190	190	230	230	265	
*175,*200 and 225	-	-	215	265	-		
*250 and 300	-	-	255	305	-	-	

\*Non-preferred sizes

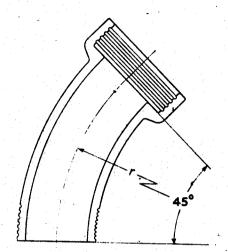
(inch dimensions)

Short		Medi	um	Long	
'n	a	r	8	r	8
3 1/2	5 1/2	6	7 1/2	8 1/2	10
6	7 1/2	7 1/2	. • <b>9</b>	9 .	10 1/2
-	-	8 1/2	10 1/2	-	-
	-	10	12		-
	'r 3 1/2	<b>'r a</b> 3 1/2 5 1/2	'r     a     r       3 1/2     5 1/2     6       6     7 1/2     7 1/2       -     -     8 1/2	'r a r a   3 1/2 5 1/2 6 7 1/2   6 7 1/2 7 1/2 9   - - 8 1/2 10 1/2	'r a r a r   3 1/2 5 1/2 6 7 1/2 8 1/2   6 7 1/2 7 1/2 9 9   - - 8 1/2 10 1/2 -

In addition to the above, bends of other nominal bores given in Table 1 are available.

FIG. 14 Half-section one-quarter channel bends

#### CHANNEL BENDS



#### (millimetre dimensions)

Nominal bore	Short	Medium	Long	
	r	. <b>r</b>	r	
75	255	380	_	
100	255	380	510	
*125 and 150	380	455	535	
*175,*200 and 225		535		
*250 and 300	-	610	-	

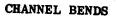
\*Non-preferred sizes

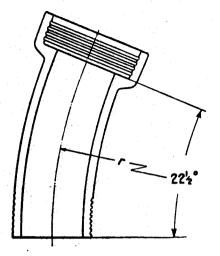
(inch dimonsions)

Nominal bore	Short	Medium	Long
	r	r	r
4	10	15	20
6	15	18	21
9	· · · · ·	21	-
12	-	24	-
The addition to the too	1		and the second sec

In addition to the above, bends of other nominal bore given in Table 1 are available.

FIG. 13 Half-section one-eighth channel bends





(millimetre dimensions)

Nominal	Г		
bore			
75	760		
100	760		
*125 and 150	915		
*175, *200, and 225	1065		
*250 and 300	1220		

\* Non-preferred sizes

(inch dimensions)

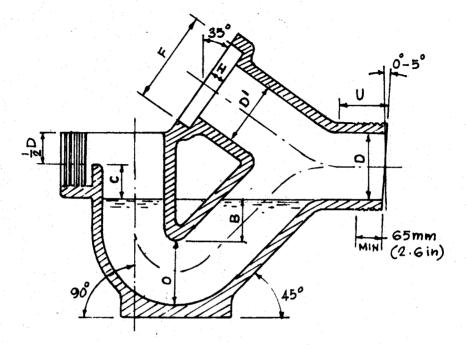
Nominal bore	r
4	• 30
6	36
9	42
12	48
· · · · · · · · · · · · · · · · · · ·	

In addition to the above, bends of other nominal bores given in Table 1 are available.

FIG.

#### 16 Half-section one-sixteenth channel bends

## INTERCEPTORS



(millimetre dimensions)

	D nom	D <sup>1</sup> nom	H min	O min	U min	B min	C min	F min	
	100	100	25	90	90	57	38	146	
L	150	100	25	140	90	57	50	146	

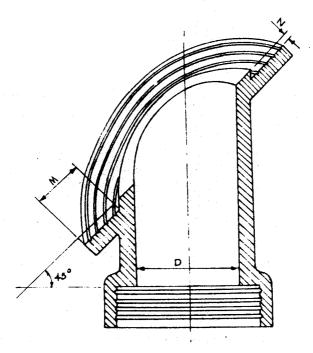
(inch dimensions)

D nom	D <sup>1</sup> nom	H min	O min	U min	B min	C min	F min
4	4	1	3 1/2	3 1/2	2 1/2	1 1/2	5 3/4
6	4	1	5 1/2	3 1/2	2 1/4	2	5 3/4

a) Supplied with plug stopperb) Interceptors may be with or without the foot

17 Interceptors (Channel type) FIG.

## SADDLE JUNCTIONS



(millimetre dimensions)

	D nom	Saddle to fit pipe of nominal bore		M min	N
	100	100 and 150		50	19 + 6
	100	200, ,250 and			-
ł		300	1	70	22 + 6
_	150	150 to 300		70	$22 \pm 6$

(inch dimensions)

D	Saddle to fit pipe of niminal bore	M	N	
4	4 and 6	2	3/4 + 3/4	
4	9 and 12	2 3/4	7/8 + 1/4	
6	6 to 12	2 3/4	7/8 + 1/4	

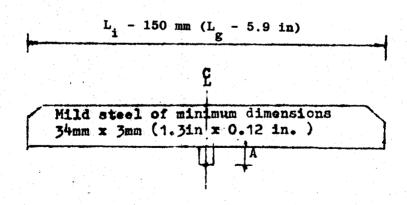
## FIG. 18 45° Saddle Junctions

#### APPENDIX A

#### STRAIGHTNESS TEST

Deviations from straightness of a pipe barrel shall be tested on any concave side of the barrel of the pipe, using a gauge in the form shown in Fig. A<sub>1</sub>. It shall be 150 mm (5.9 in) shorter than the effective length 'L' of the pipe in order to allow for clearance at the shoulder of the socket and at any jointing material at the spigot end. The projection A of the gauge shall be rigidly affixed on the centre line of the gauge and be in accordance with the table below. The cross section at the end of the projection shall be round or square not less than 4 mm (0.16 in) nor more than 10 mm (0.4 in).

If the gauge when applied is in contact with the surface of the pipe at both ends, then the deviation from straightness is excessive.



Inside length of pipe L <sub>i</sub>		Projection* A	
-(1)	(2)	(3)	(4)
m	ft	mm	in
0.60	2	5	(0.20
0.75	2 1/2	6	(0.2)
0.90	3	7	(0.3)
1.20	4	. 8	(0.3)
1.50	5	10	(0.4)

\* This dimension is equal to the permissible deviation from straightness (see 5).

FIG. A1 Deviation from straightness gauge

#### APPENDIX B

## MINIMUM TEST LOAD (TWO-EDGE BEARING METHOD)

#### **B.1** APPARATUS

#### **B.1.1** Testing Machine

The testing machine shall be arranged so that the distribution of the test load along the length of the barrel of the pipe will not be appreciably affected by the deformation or yielding of any part of the machine during the application of the load.

## B.1.2 Bearing Block

The load shall be applied to the pipe via two hard unyielding diametrically opposed bearing blocks (See Fig. B<sub>1</sub>). The bearing blocks shall present two flat parallel surfaces to the pipe being tested. These bearing surfaces shall be 150 mm (5.9 in) the wide: of length not less than the length of the pipe

tested excluding the socket; and shall be faced with rubber packing, not less than 12 mm (0.5 in) thick or more than 25 mm (1.0 in) thick and of hardness between 50 and 55 IRHD\*.

#### **B.2 CALCULATION OF TEST LOAD**

If the full pipe length is subjected to the crushing strength test, the total test load shall be obtained by multiplying the effective length of the pipe by the appropriate test load per metre (or per foot) as set out in Table 3.

Alternatively the pipe specimens may be cut into one-metre (or one-foot) lengths and each length of each pipe shall be required to carry, without cracking, the appropriate test load given in Table 3.

#### **B.3 PROCEDURE**

The load shall be applied across the centre line of the pipe in a manner that will ensure a uniform distribution of the load throughout the test length. The centre of the applied load shall be collinear with the mid point of the test length.

#### **B.4 APPLICATION OF LOAD**

The load shall be applied at a continuous rate in the range 50 N/s to 180 N/s (1 [bf/s to 40 lbf/s) until the specified test load is reached. The test load shall be maintained on the pipe for not less than the time required to observe and record the load, and to examine the pipe, but shall be not less than 30 seconds.

\* See SLS 297 Methods of testing vulcanized rubber Part 4 Determination of wardness

#### APPENDIX C

## ACID AND ALKALI RESISTANCE TESTS

C.1 A specimen shall be prepared, consisting of a freshly broken piece of pipe upon which glaze need not, be present, about  $7 \times 10^4 \text{ mm}^3$  (4 in<sup>3</sup>) in volume, free from cracks or shattered edges. It shall be thoroughly cleaned and dried at a temperature of not less than 150°C until no further loss of mass can be noted and then immersed in 500 ml of required test solution for a period of 48 hours at a temperature of 15  $\pm$  5°C.

The 1.0 N acid solutions may be prepared by diluting the following volumes of concentrated acids with water to produce 1 litre of solution:

Hydrochloric acid (sp. gr. 1.18) 88.9 ml; Nitric acid (sp. gr. 1.42) 65 ml:

Sulphuric acid (sp. gr. 1.84) 28.5 ml; Glacial acetic acid (sp. gr. 1.05) 56.7 ml.

The 1.0 N solution of sodium hydroxide may be taken as containing 40 g of sodium hydroxide per litre.

The weighing apparatus used shall be accurate to within 0.01 g when loaded with 200 g.

On removal from the solution the specimen shall be carefully and thoroughly washed with hot distilled water and afterwards boiled in 500 ml of distilled water for half an hour and further boiled in a further 500 ml of distilled water for another half an hour. The specimen shall be dried at a temperature of not less than 150°C until no further loss of mass can be noted and the percentage of acid or alkali soluble matter shall be calculated as follows:

## Loss as percentage of dry mass =

## (original dry mass - final dry mass) x 100

originial dry mass

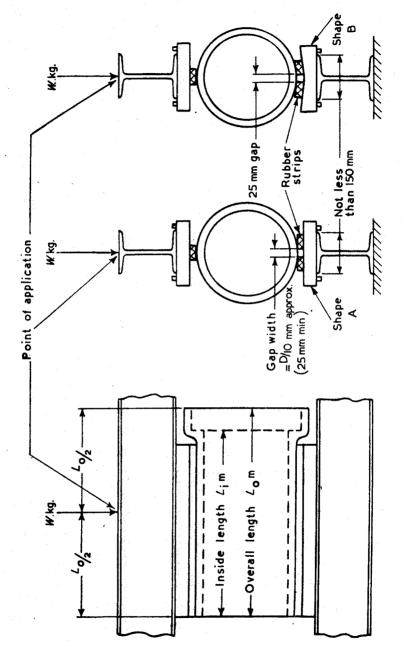


FIG. B1 Crushing test

D1 1 D

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