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SPECIFICATION FOR
GALVANIZED STEEL PIPES AND SOCKETS

(First Revision)

SRI LANKA STANDARDS INSTITUTION

Sri Lanka Standard
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SLS 829 : 2009
(Incorporated AMD No 1 and Corrigendum 1)

Gr. 10

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Sri Lanka Standard
SPECIFICATION FOR GALVANIZED STEEL PIPES AND SOCKETS
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FOREWORD

This standard was approved by the Sectoral Committee on Materials, Mechanical Systems and Manufacturing Engineering and authorized for adoption and publication as a Sri Lanka Standard by the Council of the Sri Lanka Standards Institution on 2009.09.29.

This is the first revision of **SLS 829 : 1988** Galvanized steel pipes and fittings. In this revision, the requirements for manufacture, dimensions and tolerances, mechanical properties and the title have been revised.

All values given in this specification are in SI units.

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 an analysis, shall be rounded off in accordance with **SLS 102**. The number of significant figures to be retained in the rounded off value shall be the same as that of the specified value in this standard.

In the preparation of this standard, valuable assistance derived from the following publications of the International Organization for Standardization, British Standards Institution and Bureau of Indian Standards is gratefully acknowledged.

ISO 65 : 1981	Carbon steel tubes suitable for screwing in accordance with ISO 7-1
BS EN 10255 : 2004	Non-alloy steel tubes suitable for welding and threading-Technical delivery conditions
IS 3601: 2006	Steel tubes for mechanical and general engineering purposes-Specification

1 SCOPE

This standard specifies dimensional, physical and mechanical properties, galvanizing requirements and testing requirements for light, medium and heavy duty threaded or plain ended galvanized steel pipes and sockets for non-pressure general engineering applications.

NOTE : *Steel pipes given in Appendix **C** shall not be used for load bearing structural purposes.*

2 REFERENCES

ISO 7-1 Pipe threads where pressure-tight joints are made on the threads
Part 1 : Designation, dimensions and tolerances
ISO 2178 Non-magnetic coatings on magnetic substrates-Measurement of coating thickness - Magnetic method
ISO 8492 Metallic materials - Tube - Flattening test
SLS 102 Presentation of numerical values
SLS 121 Methods of testing mass, thickness and uniformity of coating on hot-dipped galvanized articles
SLS 428 Random sampling methods
SLS 482 Code of practice for hot-dip galvanizing of iron and steel
SLS 978 Metallic materials – Tensile testing at ambient temperature
SLS 990 Metallic materials - Tube (in full section) - Bend test

3 DEFINITIONS

For the purpose of this standard the following definitions shall apply:

3.1 nominal size (DN) : A numerical designation of size which is common to all components in a piping system other than components designated by outside diameters or thread size. It is a convenient round number for reference purposes and is only loosely related to manufacturing dimensions.
NOTE : *The nominal size is designated by the letters DN, followed by a number*.

3.2 pipes : A long hollow open-ended tube of circular cross section.

3.3 length of threaded and socketed pipe

3.3.1 *exact length* : The length of pipe exclusive of the socket.

3.3.2 *length, other than the exact length* : The overall length when one socket has been fitted.

3.4 socket: Straight screwed coupling utilized in jointing two pipes together (Table **3**)

4 DESIGNATION

4.1 Pipes

Pipes shall be designated by the nominal size (DN) and thickness series (L, M, H and L_1) as given in Table **1**, Table **2** and Table **11** and the letter G indicating that the item is galvanized.
Example : DN 20 MG

4.2 Sockets

Sockets shall be designated by the nominal size (DN) of the pipe for which they are intended, the word ”socket”, length in mm within brackets and the letter G indicating that the item is galvanized.
Example : DN 50 Socket (60) G

5 REQUIREMENTS

5.1 Material

5.1.1 *Chemical composition*

The ladle analysis of the steel for pipes and sockets shall be as follows:

Constituent	**Per cent**
Carbon	0.20 Max
Manganese	1.40 Max
Phosphorous	0.04 Max
Sulphur	0.04 Max

5.1.2 *Product Analysis*

If so agreed between the purchaser and the manufacturer, the product analysis may be carried out. Maximum permissible variations in the case of product analysis over the maximum limits specified in 5.1.1 shall be as follows:

Constituent	**Per cent**
Carbon	0.02 Max
Manganese	0.04 Max
Phosphorous	0.005 Max
Sulphur	0.005 Max

Note: *In case of welded tubes, product analysis shall not be applicable to rimming steel.*

5.2 Manufacture

5.2.1 *Manufacture of the steel*

The steel making process is at the discretion of the manufacturer. The steel shall be fully killed.

5.2.2 *Manufacture of the pipes and sockets*

Pipes and sockets shall be manufactured by seamless or welded process.

5.2.3 *Galvanizing process*

Galvanizing shall be performed on the finished black pipes/sockets. The process for galvanizing shall be either hot-dipped or electro galvanizing.

5.2.3.1 Hot dipped galvanizing

Hot dipped galvanizing shall be carried out on pipes and sockets in accordance with **SLS 482**. Galvanizing shall be carried out before threading.

The minimum mass of zinc coating shall be 400 g/m^2(56 μm) for all thickness series except L_1, for which minimum coating shall be 360 g/m^2(50 μm) and the coating shall be tested in accordance with **8.7**.

5.2.3.2 Electro galvanizing

The minimum coating thickness of electro galvanizing shall be 58 g/m^2(8 μm). The electro galvanizing can result in the thread being covered in uneven particles of zinc; these particles may be removed with a thread die or brush. Thickness of the zinc coating shall be determined by the magnetic method in accordance with **8.7.1**.

5.3 Finish on pipes and sockets

5.3.1 Small imperfections which do not affect on the minimum thickness or which can be dressed out such that the thickness after dressing remains within the tolerance limit shall be acceptable. Surface imperfections shall not be peened.

5.3.2 Threads shall comply with the requirements of **ISO 7-1** and shall have a protective coating.

5.3.3 The ends shall be cut cleanly and nominally square with the axis of the pipe and shall be free from excessive burrs.

5.3.4 The pipes shall not include welds used for joining lengths of strip during manufacture.

5.3.5 The zinc coating shall be uniform, adherent, smooth, reasonably bright, continuous and free from such imperfections as flux, ash and dross inclusions, bare and black spots, pimples, lumpiness and runs, rust stains, bulky white deposits and blisters. (See Clause **6** of **SLS 482**.) Pipes and sockets shall be galvanized covering both internal and external surfaces.

5.3.6 The external weld bead of electric welded pipes/sockets shall be trimmed to an essentially flush condition, where applicable.

5.3.7 The height of the internal weld seam of welded pipes/sockets shall not exceed 60 per cent of the specified wall thickness, where applicable.

5.4 Dimensions and tolerances

5.4.1 *Dimensions of steel pipes and sockets*

The dimensions and mass per meter length of the black pipes shall be as given in Table **1**, Table **2** and Table **11**.

The nominal dimensions of the black steel sockets shall be as given in Table **3.**

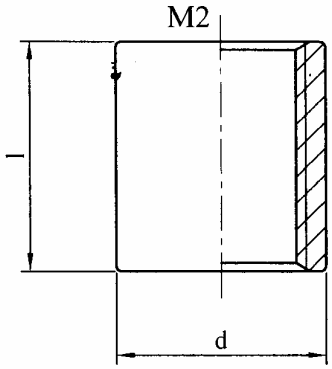
TABLE 1 - Dimensions and mass per meter length of light (L) series steel black pipes

Nominal size (DN) (1)	Thread size designation (2)	Outside diameter mm		Wall thickness mm (5)	Mass per meter length kg/m (6)
		Max (3)	Min (4)		
6	1/8	10.1	9.7	1.8	0.360
8	1/4	13.6	13.2	1.8	0.515
10	3/8	17.1	16.7	1.8	0.670
15	1/2	21.4	21.0	2.0	0.947
20	3/4	26.9	26.4	2.3	1.38
25	1	33.8	33.2	2.6	1.98
32	1 1/4	42.5	41.9	2.6	2.54
40	1 1/2	48.4	47.8	2.9	3.23
50	2	60.2	59.6	2.9	4.08
65	2 1/2	76.0	75.2	3.2	5.71
80	3	88.7	87.9	3.2	6.72
100	4	113.9	113.0	3.6	9.75

TABLE 2- Dimensions and mass per meter length of medium (M) and heavy (H) series steel black pipes

Nominal size (DN) mm (1)	Thread size designation (2)	Outside diameter, mm		Medium series (M)		Heavy series (H)	
		Max (3)	Min (4)	Wall thickness mm (5)	Mass per meter length kg/m (6)	Wall thickness mm (7)	Mass per meter length kg/m (8)
6	1/8	10.6	9.8	2.0	0.404	2.6	0.487
8	1/4	14.0	13.2	2.3	0.641	2.9	0.765
10	3/8	17.5	16.7	2.3	0.839	2.9	1.02
15	1/2	21.8	21.0	2.6	1.21	3.2	1.44
20	3/4	27.3	26.5	2.6	1.56	3.2	1.87
25	1	34.2	33.3	3.2	2.41	4.0	2.93
32	1 1/4	42.9	42.0	3.2	3.10	4.0	3.79
40	1 1/2	48.8	47.9	3.2	3.56	4.0	4.37
50	2	60.8	59.7	3.6	5.03	4.5	6.19
65	2 1/2	76.6	75.3	3.6	6.42	4.5	7.93
80	3	89.5	88.0	4.0	8.36	5.0	10.3
100	4	115.0	113.1	4.5	12.2	5.4	14.5
125	5	140.8	138.5	5.0	16.6	5.4	17.9
150	6	166.5	163.9	5.0	19.8	5.4	21.3

TABLE 3- Dimensions of steel sockets M2



Nominal size, DN (1)	Thread designation (2)	d, Min mm (3)	l , Min mm (4)
6	1/8	14	17
8	1/4	18.5	25
10	3/8	21.3	26
15	1/2	26.4	34
20	3/4	31.8	36
25	1	39.5	43
32	1 1/4	48.3	48
40	1 1/2	54.5	48
50	2	66.3	56
65	2 1/2	82	65
80	3	95	71
100	4	122	83
125	5	147	92
150	6	174	92

5.4.2 *Tolerances for pipes*

The tolerances on the outside diameter, thickness, mass and length shall be as follows:

a) Outside diameter as given in Table **1**, Table **2** and Table **11**.

b) For welded pipes the tolerance on wall thickness

For M and H pipes: ± 10 per cent
For L and L_1 pipes: -8 per cent with the plus tolerance limited by the mass tolerance

For seamless pipes, the tolerance on wall thickness is ± 12.5 per cent.

c) For welded pipes the mass tolerance

For M and H pipes : ± 10 per cent for each pipe
± 7.5 per cent per load of 10 tons or more
For L_1 and L pipes : +10 per cent and -8 per cent for each pipe
± 5 per cent per load of 10 tons or more

For seamless pipes, the maximum tolerance does not apply if the actual weight of a bundle does not exceed the theoretical weight calculated from the mass per meter length (see Table **1**, Table **2** or Table **11** as appropriate) by more than 7.5 per cent.

d) Tolerance on length

The pipes shall be supplied in the standard length, either 5.5 m or 5.8 m, or an alternative type of length given in Table **4** as specified by the purchaser at the time of enquiry and order.

TABLE 4 - Type of length and tolerance

Type of length **(1)**	**Length (L)** **m** **(2)**	**Tolerance** **(Welded and seamless)** **(3)**
Standard	5.5 or 5.8	+150 mm - 50 mm
Random	$4 \leq L \leq 16$ with a range of 2 m per order item	Up to 10 per cent of pipes supplied may be below the minimum length ordered, but not shorter than 75 per cent of the minimum range length
Exact	$L \leq 6$	+10 mm - 0 mm
	$6 < L \leq 12$	+15 mm - 0 mm
	$L > 12$	+ by agreement - 0 mm

5.4.3 *Tolerances for sockets*

For Table **3**, dimensions are nominal and subjected to manufacturing tolerances.

The tolerances on the overall length of the sockets are given in Table **5**.

TABLE 5 – Tolerance on length

Dimensions in mm

Dimension	**Up to and including 25**	**Over 25 to 40**	**Over 40 to 65**	**Over 65 to 75**	**Over 75 to 100**
Tolerance	+1.5 - 0	+3.0 - 0	+ 4.5 - 0	+ 6.0 - 0	+ 8.0 - 0

5.4.4 *Straightness of pipes*

For pipes with a specified nominal size equal or greater than DN 25, the deviation from straightness over any pipe length *l*, where *l* is the manufacturer's delivered length, shall not exceed 0.002 *l*.

NOTE : *It is not possible to specify a straightness requirement for less than DN 25, due to bending during processing and subsequent handling, however they should be reasonably straight.*

5.5 Mechanical properties

When tested in accordance with **8.3**, the mechanical properties shall be as follows:

TABLE 6- Mechanical properties

Item **(1)**	**Tensile strength R_m, Min. N/mm^2** **(2)**	**Upper yield strength R_{eH}, Min. N/mm^2** **(3)**	**Elongation after fracture on gauge length, A $5.65\sqrt{S_o}$, Min.** **(4)**
Pipes	320	195	20
Sockets	320	-	20

6 MARKING

6.1 Galvanized pipes shall be clearly and indelibly marked with the manufacturer's name or trade mark, designation (see Clause **4**) and batch no.

Marking shall appear at least once within a 1 m length from one end of each pipe.

Galvanized sockets shall be clearly and indelibly marked with the DN number and batch no. Additionally manufacturer's name or trade mark and designation may also be marked.

6.2 For the purpose of identification, the pipes shall be marked with the appropriate colour as follows:

Light (L_1) steel pipes	-	Brown
Light (L) steel pipes	-	Yellow
Medium (M) steel pipes	-	Blue
Heavy (H) steel pipes	-	Red

Pipes shall have two colour bands one at each end. However, pipes of length less than 4 m may be marked with only one colour band at one end. These bands shall be approximately 50 mm wide.

NOTE : *Attention is drawn to certification facilities offered by Sri Lanka Standards Institution see inside back cover of this specification*.

7 PACKING

The threaded ends of pipes and sockets shall be adequately protected in transit by using plastic caps or by any other suitable means.

8 METHODS OF TEST

8.1 Visual inspection

Pipes/sockets shall be inspected for the requirements in **5.3.**

8.2 Leak tightness test

8.2.1 *Pipes*

Pipes (Except for the pipes given in Appendix **C**) shall be hydraulically tested to a pressure of 5 MPa. In the case of welded pipes, the test pressure shall be reduced if necessary to that the stress in the pipe does not exceed 40 per cent of the minimum tensile strength of the material. The pressure shall be maintained for at least 5 seconds for proof and inspection.

Alternatively an eddy current test as given in Appendix **B** or any other non destructive test which gives equivalent assurance of leak tightness may be used.

8.2.2 *Sockets*

Sockets shall be hydraulically tested by the application of an internal hydraulic pressure of 5 MPa, and fittings shall show no signs of leakage during the test.

Alternatively any other non-destructive test which gives equivalent assurance of leak tightness may be used.

8.3 Tensile test

A test piece prepared from pipe/socket shall be tested for tensile test in accordance with **SLS 978**. The following requirements shall apply.

The tensile strength R_m, the upper yield stress R_{eH} or 0.2% proof stress $R_{p0.2}$, and percentage elongation after fracture A shall be determined and the results obtained shall comply with the requirements given in **5.5**. The percentage elongation shall be reported with reference to a gauge length of $L_o = 5.65\sqrt{S_o}$ (where S_o= original cross-sectional area of the specimen). If other gauge lengths are used, the corresponding percentage elongation on $5.65\sqrt{S_o}$ shall be obtained with reference to **SLS 978.** In cases of dispute, a gauge length of $5.65\sqrt{S_o}$ shall be used.

8.4 Bend test (for pipes up to and including DN 50)

When tested in accordance with **SLS 990**, the finished pipes shall withstand the test without showing any signs of fracture or failure at the weld or anywhere else in the pipe.

The pipe shall be bent cold through 90^o round a former having a radius at the bottom of the groove equal to eight times the outside diameter of the pipe.

8.5 Flattening test (for pipes above DN 50)

When the pipes are tested in accordance with **ISO 8492**, the following requirements shall apply.

a) For seamless pipes without showing either cracks or flaws until the distance between the platens, measured under load, is not greater than 60 per cent of the original outside diameter of the pipe.
b) For welded pipes without showing either cracks or flaws until the distance between the platens, measured under load, is not greater than 75 per cent of the original outside diameter of the pipe. Further, no cracks or flaws in the metal elsewhere than in the weld shall occur until the distance between the platens is less than 60 per cent of the original outside diameter. The weld shall be placed on a plane passing though the axis at 90^o to the direction of flattening.

NOTE: *Slight premature cracking at the edges would not be deemed to affect compliance with this standard.*

8.6 Free bore test (for hot-dip zinc coated pipes of DN 8 to DN 25 only).

Hot-dip zinc coated pipes shall have a free bore to enable a rod 230 mm in length and of diameter given in Table **7** to be passed through without any interference.

TABLE 7 - Rod diameters

Nominal size (DN)	Diameter of rod mm
8	4.4
10	7.1
15	9.5
20	14.5
25	20.6

8.7 Galvanized coating tests

8.7.1 *Mass of coating*

The mass of coating shall be determined in accordance with **SLS 121.**

The test piece prepared from each pipe/socket shall be 100 mm long and where the length of socket is not long enough to prepare the test specimen a suitable length shall be allowed.

The thickness of coating can be calculated using the following equation.

$$S = \frac{M}{7.2}$$

Where, S is the thickness of coating in μm
M is the mass of coating in g/m^2

NOTE: *The zinc coating thickness can be determined by the magnetic method of measurement according to* ***ISO 2178.***

8.7.2 *Uniformity of coating (for hot dipped galvanized pipes and sockets)*

The uniformity of coating shall be determined in accordance with **SLS 121.**

The test piece prepared from each pipe/socket shall 150 mm long and where the length of sockets is not long enough to prepare the test specimen a suitable length shall allowed. The test piece shall withstand following number of dips without showing any copper deposit on the surface after cleaning with running water.

For 360 g/m^2 of coating thickness - 05 number of one minute (60 seconds) dips
For 400 g/m^2 of coating thickness - 05 number of one minute dips (60 seconds) and 01 number of half minute (30 seconds)dip

8.7.3 *Adhesion of coating (for pipes)*

When tested in accordance with (a) or (b) the coating shall show no evidence of flaking on the significant surface. In addition, the coating shall show no evidence of cracking the significant surface when subjected to the bend test.

a) For the pipes outside diameter up to and including DN 50, the adhesion of coating shall be tested in accordance with **8.4**.
b) For the pipes outside diameter above DN 50, the adhesion of coating shall be tested in accordance with **ISO 8492.** The degree of flattening for the pipes is given in Table **8**.

TABLE 8– Degree of flattening for the pipes

Out side diameter (d) mm	**Distance between platen % of outside diameter**
$d \leq 21.3$	85
$21.3 < d \leq 48.3$	80
$48.3 < d \leq 76.1$	75
$76.1 < d \leq 114.3$	70
$114.3 < d$	65

APPENDIX A
COMPLIANCE OF A LOT

The sampling scheme given in this Appendix should be applied where compliance of a lot to the requirements of this standard is to be assessed based on statistical sampling and inspection.

Where compliance with this standard is to be assured based on manufacturer's control systems coupled with type testing and check tests or any other procedure, appropriate scheme of sampling and inspection should be adopted.

A.1 ROUTINE INSPECTION

A.1.1 Batch

All pipes/sockets of the same type and dimensions, manufactured, under the same conditions shall constitute a batch.

A.1.2 Each batch of pipes/sockets shall be subjected to routine inspection by the manufacturer in accordance with this standard.

A.1.3 Routine inspection shall be done in accordance with **A.1.3.1** and **A.1.3.2.**

A.1.3.1 One pipe/socket shall be selected from every 500 pipes/sockets or part thereof a batch and shall be tested as given in **8.6** and **8.7** as appropriate. The batch shall be deemed to comply with this standard in respect of these tests if the samples satisfy the test requirements. Any of the samples fail to comply with the test requirements; two further samples shall be selected from the same batch and tested. The batch shall be deemed to comply with this standard in respect of **8.6** and **8.7** (as appropriate) if the additional samples satisfy the test requirements.

A.1.3.2 Each pipe/socket of the batch accepted as in **A.1.3.1** shall be tested as given in **8.1** and **8.2.** Only those complying with these tests shall be accepted.

A.2 LOT INSPECTION

A.2.1 Lot

All pipes/sockets of same type, dimensions, belonging to one batch of manufacture and submitted for inspection at one time shall constitute a lot.

A.2.2 Scale of sampling

A.2.2.1 Samples shall be tested from each lot for ascertaining the conformity of the lot for the requirements of this standard.

A.2.2.2 The number of samples to be selected from the lot shall be in accordance with column (1) and column (2) or column (4) of Table **9** as appropriate.

TABLE 9 -Scale of sampling

Lot size	For pipes		For sockets			Acceptance number
	Number of pipes to be selected	Size of the sub sample	Number of sockets to be selected	Size of the sub sample	Size of the sub sample	
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Up to 150	3	3	9	3	3	0
151 to 300	5	5	15	5	5	0
301 to 500	8	5	15	5	8	0
501 to 1000	13	5	15	5	13	1
1001 to 5000	20	8	24	8	20	2
5001 and above	32	8	32	8	32	3

A.2.2.3 The pipes/sockets shall be selected at random. In order to ensure randomness of selection random number tables as given in **SLS 428** shall be used.

A.2.3 Number of tests

A.2.3.1 Each pipe/socket selected as in **A.2.2.2** shall be inspected for relevant marking and packing requirements given in **6** and **7**.

A.2.3.2(a) Each pipe selected as in **A.2.2.2** shall be inspected for the requirements given in **8.1.**

A.2.3.2(b) A sub sample of sockets of size as given in column (6) of Table **9** shall be drawn from the sample selected as in **A.2.2.2** and inspected for the requirements given in **8.1**.

A.2.3.3 Each pipe selected as in **A.2.2.2** and each socket in the sub sample selected as in **A.2.3.2(b)** shall be examined for dimensional requirements given in **5.4** and Appendix **C** as appropriate.

A.2.3.4 Each pipe/socket examines as in **A.2.3.3** shall be tested in accordance with **8.2.**

A.2.3.5 A sub-sample of pipes of size as given in column (3) of Table **9** shall be drawn from the sample selected as **A.2.2.2** and each item in the sub-sample shall be tested for the requirements given in **8.6** and **8.7**.

A.2.3.6 Two sub- samples of sockets of size as given in column (5) of Table **9** shall be drawn from the sample selected as **A.2.2.2** and each item in the sub-sample shall be tested for the requirements given in **8.7.1** and **8.7.2.**

A.2.3.7 If the lot has been found satisfactory in respect of the requirements when examine under **A.2.3.1, A.2.3.2, A.2.3.3, A.2.3.4** and **A.2.3.5,** each pipe of the sub-sample tested as in **A.2.3.5** shall be tested for the requirement given in **8.3** and **8.4** or **8.5** as appropriate.

A.2.3.8 If the lot has been found satisfactory in respect of the requirements when examine under **A.2.3.1, A.2.3.2, A.2.3.2, A.2.3.3, A.2.3.4** and **A.2.3.6,** another sub-sample of sockets of size as given in column (5) of Table **9** shall be tested for the requirement given in **8.3**.

A.2.4 Criteria for conformity

9.2.4.1 A lot shall be declared as conforming to the requirements of this standard if the following conditions are satisfied.

a) Each pipe/socket inspected as in **A.2.3.1** satisfies the relevant requirements.

b) Each pipe/socket inspected as in **A.2.3.2(a)/A.2.3.2(b)** satisfies the relevant requirements.

c) The number of pipes/sockets not conforming to the requirements when examined as in **A.2.3.3** is less than or equal to the corresponding acceptance number given in column (7) of Table **9**.

d) Each pipe/socket tested as in **A.2.3.4** satisfies the relevant requirements.

e) Each pipe tested as in **A.2.3.5** satisfies the relevant requirement as appropriate.

f) Each socket tested as in **A.2.3.6** satisfies the relevant requirement as appropriate

g) Each pipe tested as in **A.2.3.7** satisfies the relevant requirements.

h) Each socket tested as in **A.2.3.8** satisfies the relevant requirements.

APPENDIX B
EDDY CURRENT TESTING OF PIPES AS AN ALTERNATIVE TO THE HYDRAULIC LEAK TIGHTNESS TEST

B.1 METHODS OF TEST

B.1.1 The pipe shall be sufficiently straight to ensure the validity of the test and the surfaces shall be free from any foreign matter that would interfere with the interpretation of the test.

B.1.2 Two methods of test are permitted, the choice being at the option of the manufacturer.

a) Method **A**, in which the pipe to be tested is passed through the concentric test coil.
b) Method **B**, in which the pipe to be tested or the test coil assembly is rotated and translated relative to the other so the test coil described helical path over the pipe surface. The pitch of the helical scan shall ensure that the whole of the pipe surface is covered.

B.2 CALIBRATION OF TEST EQUIPMENT

B.2.1 The equipment shall be calibrated using a test piece containing either reference holes as described in **B.2.3** for method **A**, or a reference notch as described in **B.2.4** for method **B**.

B.2.2 The test piece shall have similar electromagnetic properties and the same diameter and thickness as the pipe to be tested.

B.2.3 For method **A**, the test piece shall have three circular holes drilled rapidly through the pipe wall. The holes shall be circumferentially displaced 120^{o} from each other and sufficiently separated longitudinally from each other and the extremities of the test piece so that clearly distinguishable signal indications are obtained. Use a drill with the appropriate diameter given in Table **10** to produce the reference holes.

TABLE 10- Drill diameters

Outside diameter of pipe(d) mm	Drill diameter mm
$d \leq 25$	1.2
$25 < d \leq 45$	1.7
$45 < d \leq 65$	2.2
$65 < d \leq 100$	2.7
$100 < d \leq 140$	3.2
$140 < d \leq 180$	3.7

B.2.4 For method **B**, the surface of the test piece that will be adjacent to the test coils shall contain a parallel sided notch formed parallel to the longitudinal axis of the tubular test piece. The dimensions of the notch shall be as follows:

a) Width : Not greater than notch depth with a minimum of 0.50 mm.
b) Depth : 12.5 per cent of the specified thickness with a minimum of 0.6 mm. The tolerance on the depth shall be ± 15 per cent.
c) Length : A convenient length selected by the manufacturer for calibration and checking purposes.

B.3 CALIBRATION PROCEDURES

B.3.1 The equipment and test coils shall be adjusted to produce in a consistent manner a clearly identifiable signal from the reference standard(s) and this signal shall be used to set the trigger/alarm level of the equipment. For calibration purposes the relative speed between the test piece containing the reference standard(s) and the test coils shall be the same as that used during the production test.

B.3.2 The calibration of the equipment shall be checked at the commencement and at the end of each working period and at intervals not exceeding 2 hours.

B.3.3 If on checking during production testing the reference standard is not detected even after changing the sensitivity by 2 dB to allow for equipment drift, the equipment shall be recalibrated. Following recalibration, all pipes tested since the previous check shall be retested, unless recordings from individually identified pipes are available that permit classification of those pipes into ‘suspect’ and ‘acceptable’ categories.

B.4 TEST PROCEDURE

Pass the pipe to be inspected through the test unit at the appropriate speed, maintaining the production speed constant within ± 10 per cent under conditions identical to those used in the calibration of the equipment.

NOTE: *Identical conditions include all instrument settings, mechanical motion, positioning of the encircling coil(s) in relation to the pipe and any other factor that affects the validity of the technique*.

B.5 ASSESSMENT OF RESULTS

B.5.1 Any pipe that does not produce signals giving the trigger/alarm condition shall be deemed to have passed the test.

B.5.2 Any pipe that produces a signal giving the trigger/alarm condition shall be either designated suspect or, at the manufacturer’s option, retested.

B.5.3 If upon retesting no signal giving a trigger/alarm condition is obtained the pipe shall be deemed to have passed the test. Pipes giving a trigger/alarm condition shall be designated suspect.

B.5.4 For suspect pipe one or other of the following actions shall be taken:

a) Crop off the suspect area. The remaining length shall be deemed to have passed test.
b) The pipe shall be deemed not to have passed test.

APPENDIX C
STEEL PIPES WITH THICKNESS DIFFERENT FROM LIGHT, MEDIUM AND HEAVY SERIES

C.1 GENERAL

This appendix gives the dimensions and mass per meter length of steel black pipes, which have wall thickness and mass different from Table **1** and Table **2**.

C.2 REQUIREMENTS

The steel pipes shall conform to the technical requirements specified in Clause **5**, except dimensions of steel pipes (**5.4.1**), which shall be in accordance with Table **11**.

Steel pipes shall be tested and complied in accordance with Clause **8** except leak tightness test (**8.2**). Marking shall be complied with Clause **6.**

TABLE 11 - Dimensions and mass per meter length of light (L_1) steel black pipes

Nominal size (DN) (1)	Thread size designation (2)	Outside diameter, mm		Wall thickness mm (5)	Mass per meter length kg/m (6)
		Max (3)	Min (4)		
15	1/2	21.4	21.0	1.8	0.866
20	3/4	26.9	26.4	1.8	1.11
25	1	33.8	33.2	2.0	1.56
32	1 1/4	42.5	41.9	2.3	2.27
40	1 1/2	48.4	47.8	2.3	2.61
50	2	60.2	59.6	2.3	3.29
65	2 1/2	76.0	75.2	2.6	4.71
80	3	88.7	87.9	2.9	6.15
100	4	113.9	113.0	3.2	8.77

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