इंटरनेट मानक

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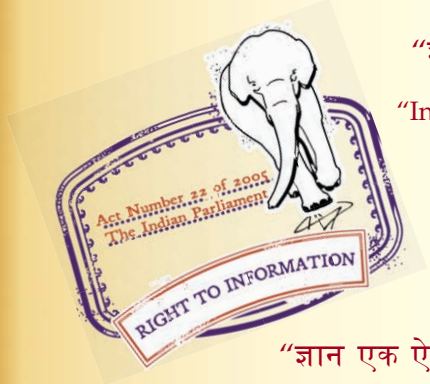
IS 5504 (1997): Spiral Welded Pipes [MTD 19: Steel Tubes, Pipes abd Fittings]



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"Knowledge is such a treasure which cannot be stolen"

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भारतीय मानक

सर्पिल वैल्डित पाईप — विशिष्टि

(पहला पुनरीक्षण)

Indian Standard

SPECIFICATION FOR SPIRAL WELDED PIPES

(First Revision)

ICS 23.040.10

BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

September 1997

Price Group 3

Steel Tubes, Pipes and Fittings Sectional Committee, MTD 19

FOREWORD

This Indian Standard (First Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Steel Tubes, Pipes and Fittings Sectional Committee had been approved by the Metallurgical Engineering Division Council

This standard was first published in 1969 to meet the increased application of spiral welded pipes The revision of this standard has been prepared incorporating the following main modifications

a) To bring it in line with latest practice of spiral welded pipes for general use

b) Ladle and product analysis for the material has been specified

c) Tensile test requirements have been modified

d) Hydrostatic test requirements have been modified

e) The standard has been brought in line with other International Standards on welded steel pipes

In preparation of this standard assistance has been taken from the following publications

ASTM-A-134	Specification for electric fusion (Arc) welded steel plate pipe size 400 mm and over
ASTM-A-252	Specification for welded and seamless steel pipe piles

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 IS 2 1960 Rules for rounding of numerical values (*revised*) The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard

AMENDMENT NO. 1 MAY 2002
TO
IS 5504 : 1997 SPECIFICATION FOR SPIRAL WELDED PIPES

(First Revision)

(*Page* 1, *clause* **6.1.1**, *para* 2) — Substitute the following for the existing

'The tensile strength, the yield stress and the percentage elongation shall be determined in accordance with the methods specified in IS 1608 '

(*Page* 2, *Fig* 1) — Delete and subsequent figures may be renumberd accordingly, wherever they appear

(*Page* 3, *clause* **6.3.1.1**) — Substitute the following for existing clause

'One face bend and one root bend specimen, both conforming to Fig 1 shall be bent approximately 180° in jig substantially in accordance with Fig 2 for any combination of diameter and wall thickness and grade The manufacturer shall use a jig based on this dimension or a smaller dimension at his option The maximum value for jig dimension *A* may be calculated by the formula given below

$$A = \frac{1\ 15\ (D-2\ t\ )}{\frac{eD}{t} - 2e-1}$$

where

1 15 = peaking factor,

D = specified OD in mm,

t = specified wall thickness in mm,

e = strain in mm,

= 0 132 5 for Grade Fe 330

= 0 1275 for Grade 410 and Grade Fe 450

The specimen shall not fracture completely and no cracks or other defects exceeding 3 mm in any direction shall be present in the weld metal or between the weld metal and the pipe metal Cracks which originate at the edges of the specimen and which are less than 7 mm long shall not be the cause for rejection At the option of the manufacturer, specimen may be flattened before testing

[*Page* 3, *Fig* 3 (*renumbered Fig* 3)] — Insert the following under Fig 2

$$R_A = \frac{A}{2} \quad B = A + 2t + 3.2 \text{ mm}$$

$$R_B = \frac{B}{2}$$

(MTD 19)

Reprography Unit BIS New Delhi India

AMENDMENT NO. 2 AUGUST 2007
TO
IS 5504 : 1997 SPECIFICATION FOR SPIRAL WELDED PIPES

(First Revision)

(*Page* 1, *clause* **2.1**, *Reference Standard*) — Substitute the following for the existing

'IS 1608 2005/ISO 6892 1998 Metallic materials – Tensile testing at ambient temperature (*third revision*)'

(*Page* 2 *clause* **6.1.1**, *tabular matter*) — Substitute the following for the existing

'Tensile strength (Min) MPa	*Yield stress* (Min) MPa	*Elongation on gauge length* 5 65 $\sqrt{S_0}$ Min Percent
410	240	20'

(MTD 19)

Reprography Unit BIS New Delhi India

AMENDMENT NO. 3 APRIL 2008
TO
IS 5504 : 1997 SPECIFICATION FOR SPIRAL WELDED PIPES

(First Revision)

[*Page* 3, *clause* **6.3.1.1** (*see also Amendment No* 1)] — Delete 'in mm' from 'e = strain in mm'

(MTD 19)

Reprography Unit, BIS, New Delhi, India

AMENDMENT NO. 4 JUNE 2010
TO
IS 5504 : 1997 SPECIFICATION FOR SPIRAL WELDED PIPES

(First Revision)

(*Page* 1, *clause* **1**, *first sentence*) — Substitute the following for the existing:

'This standard covers the requirements of spiral seam welded steel pipe over 457 mm dia and up to 3 250 mm dia with wall thickness up to 25 mm inclusive.'

(MTD 19)

Reprography Unit, BIS, New Delhi, India

Indian Standard
SPECIFICATION FOR SPIRAL WELDED PIPES
(First Revision)

1 SCOPE

This standard covers the requirements of spiral seam welded steel pipe over 457 mm dia and upto 2 000 mm dia with wall thickness upto 12 5 mm inclusive The pipe is intended for general use The suitability of pipe for various purposes is dependent on its dimensions, properties and condition of service The purpose for which the pipe is intended should be stated in the enquiry and order

2 REFERENCES

2.1 The following Indian Standards are necessary adjuncts to this standard

No		*Title*
		Methods of chemical analysis of steels issued in various parts
1387	1993	General requirements for the supply of metallurgical materials (*second revision*)
1608	1995	Mechanical testing of metals– Tensile testing (*second revision*)

3 SUPPLY OF MATERIAL

General requirements relating to the supply of spiral welded pipes shall conform to IS 1387

4 MANUFACTURE

4.1 Pipe shall be made from steel produced by the open hearth or electric or one of the basic oxygen processes Other processes may be used by agreement with the purchaser

4.2 The pipes shall be made by rolling a strip, sheet or plate so that a helical seam is formed around the circumference of the pipe The helical seam shall be welded by one of the following processes

a) Electric fusion butt welding internally and submerged arc welding externally

b) Electric resistance welding

c) Automatic submerged -arc welding using at least two weld passes, one of which shall be on the inside of the pipe All end welding of spiral seams of submerged-arc welding pipe if not done by automatic submerged-arc welding, shall be done by a procedure and welder qualified in accordance with Annex A

4.3 The coil or sheet used for manufacture of the pipe shall be trimmed to the proper width and given special edge treatment required by the welding process The material then shall be rolled so that a helical seam is formed around the circumference of the pipe The electric arc welding operation performed to fuse or seal the edges or surface of helical seam shall produce generally uniform weld

5 CHEMICAL COMPOSITION

5.1 Ladle Analysis

The ladle analysis of the steel when analysed in accordance with the relevant parts of IS 228 shall be as given below

C percent (*Max*)	S percent (*Max*)	P percent (*Max*)
0 25	0 05	0 05

5.2 Product Analysis

Variation in case of product analysis from the limits specified in 5.1 shall be as follows

Element	*Variation Over and Above Specified Limit* percent
C	0 02
P	0 005
S	0 005

6 PHYSICAL TESTS

6.1 Tensile Test

6.1.1 One tensile test, either longitudinal or transverse as required, shall be made on a length of pipe from each lot of 200 lengths or less

Test shall include yield stress, tensile strength and elongation requirements as under when determined

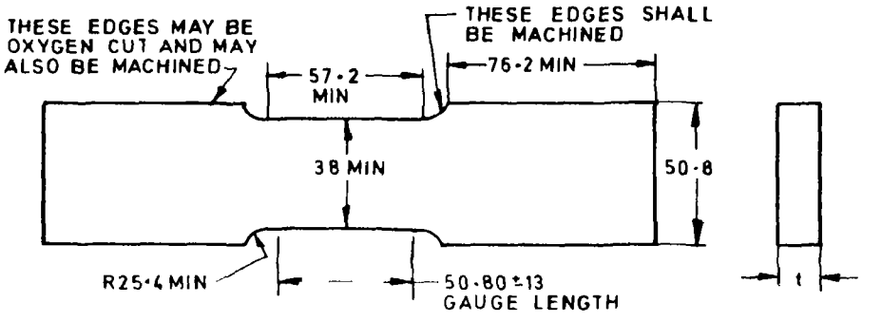


FIG 1 TENSILE TEST SPECIMEN

in accordance with IS 1608 and with the test piece given in Fig 1

U T S (*Min*)	Y S (*Min*)	E Percent (*Min*) on $5.65\sqrt{S_o}$
410 MPa	240 MPa	20

6.1.2 Tensile test specimen, shall be taken at such a portion that the centre of the specimen is located at least on quarter the distance adjacent to weld convolutions

6.1.3 *Retests*

If the tensile test specimen representing a lot of pipe fails to conform to the specified requirements, the manufacturer may elect to make retests on two additional lengths from the same lot If both retest specimens conform to the requirements all the lengths in the lot shall be accepted except the length from which the initial specimen was taken If one or both the retest specimens fail to conform to the specified requirements, the manufacturer may elect to test individually the remaining lengths in the lot in which case determinations are required only for the particular requirements with which the specimens failed to comply in the preceding tests

6.1.3.1 If any tensile test specimen shows defective machining or develops flaws, it may be discarded and another specimen substituted When the elongation of any tensile test specimen is less than that specified and if any part of the fracture is outside the middle third of the gauge length as indicated by scribe scratches marked on the specimen before testing a retest shall be allowed

6.2 Flattening Tests

6.2.1 For electric resistance-welded pipes produced in single lengths, the crop ends cut from each end of each length shall be flattened between parallel plates until opposite walls of the pipe meet The tests from each end shall be made alternately with the welds at 0° and 90° (point of maximum bending) No opening in the weld shall take place until the distance between the plates is less than two-thirds of the original outside diameter of the pipe, and no cracks or breaks in the metal, elsewhere than in the weld, shall occur until the distance between the plates is less than one-third of the original outside diameter of the pipe Also evidence of laminations or burnt metal shall not develop during the entire flattening operation If any crop end fails to conform to these requirements additional tests shall be made on specimens cut from the same end of the same length of pipe until the requirements are met except that the finished pipe shall not be shorter than 80 percent of its length after the initial cropping Precautions shall be taken so that the crop ends can be identified with respect to the length of pipe from which they were cut

6.2.2 For electric-resistance-welded pipe produced in multiple lengths and subsequently cut into single lengths, the crop ends cut from each end of each multiple length shall be flattened between parallel plates until opposite walls of the pipe meet The tests shall be made with the weld at 90° (point of maximum bending) The tests shall also be made on two intermediate rings cut from each multiple length of pipe with the weld at 0° If any of the specimens fail to conform to the requirments specified in **6.2.1** the manufacturer may elect to make retests cut from each end of each individual length as provided in **6.2.1** Retests shall be made with the welds alternately at 0° and 90°

6.3 Submerged-Arc Weld Tests

6.3.1 For submerged-arc welds, the spiral weld and the skelp end weld shall be tested by either of the following tests at the option of the manufacturer The

required specimens shall be cut from a length of pipe from each lot of 50 lengths or less of each size The specimen shall not contain any repair welding made by the manual metal-arc process

6.3.1.1 *Guided-bend tests*

For each weld being tested, one face-bend and one root-bend specimen, both conforming to Fig 2 shall be bent approximately 180° in a jig shown in Fig 3 The specimens shall not fracture completely and no cracks or other defects exceeding 3 mm in any direction shall be present in the weld metal or between the weld metal and the pipe metal Cracks which originate at the edges of the specimens and which are less than 7 mm long shall not be the cause for rejection At the option of the manufacturer, specimens may be flattened before testing

6.3.1.2 *Retests*

If the guided-bend test specimens fail to conform to the specified requirements, the manufacturer may elect to repeat the tests on specimens cut from two additional lengths of pipe from the same lot If such specimens conform to the specified requirements all the lengths in the lot shall be accepted except the length initially selected for test If any of the

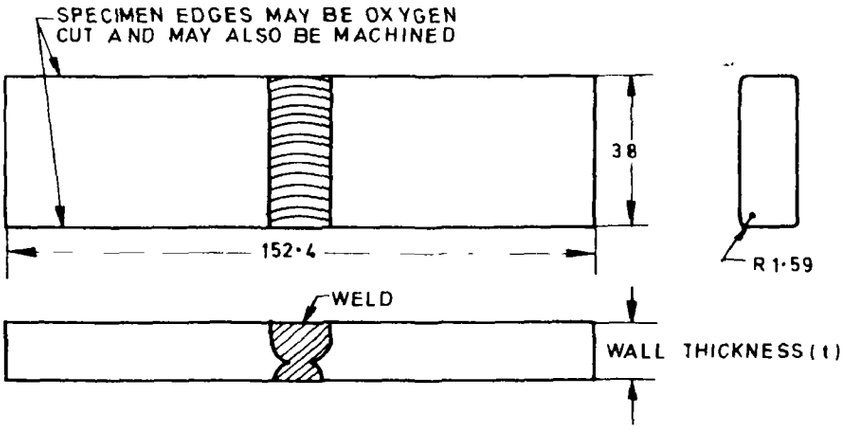
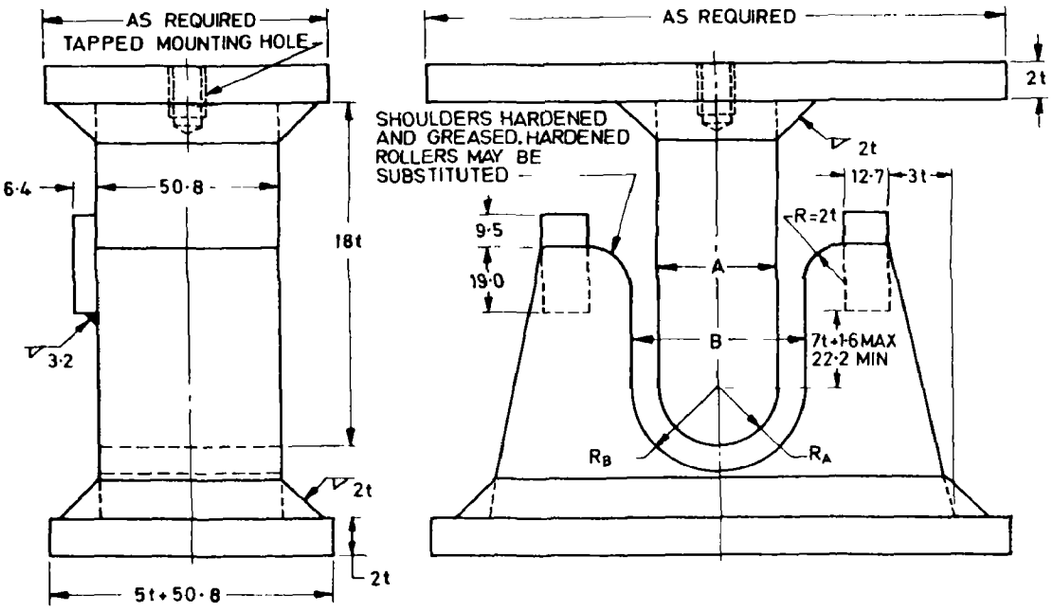


FIG 2 GUIDED BEND TEST SPECIMEN



All dimensions in millimetres

FIG 3 JIG FOR GUIDED BEND TEST

retest specimens fail to pass the specified requirements, the manufacturer may elect to test specimens cut from the individual lengths remaining in the lot Specimens for retests shall be taken in the same manner as specified in **6.1.3**

7 HYDROSTATIC TEST

Unless otherwise specified each length of the pipe shall be tested at mill to a hydrostatic pressure, equal to a minimum of 150 percent of working pressure required In no case the maximum stress produced exceeds 40 percent of minimum ultimate tensile strength envisaged in the steel

NOTE Steel tensile strength may be assumed as 410 MPa normally and unless otherwise agreed

The pressure shall be calculated from the following equation

$$P = 2st/D$$

where

P = test pressure MPa,

s = stress in MPa (normally 40 percent of 410 MPa that is, 164 MPa),

t = specified wall thickness in mm, and

D = specified outside diameter in mm

8 PERMISSIBLE VARIATIONS IN DIMENSIONS

8.1 Lengths

Steel pipe shall be supplied in single random length between 4 to 7 m or double random length of 7 to 14 m For order over 200 metres it shall be permissible to supply short random length of 2 to 4 m provided total or such lengths does not exceed 7 5 percent of supply

8.2 Thickness and Diameter

8.2.1 The tolerance on wall thickness shall be +15 percent and −12 5 percent unless otherwise agreed in plate/coil specification

8.2.2 The tolerance on outside diameter of pipe shall be as follows

Upto 1 000 mm OD = ±0 75 percent

Over 1 000 mm OD = ± 1 percent

8.2.3 The ovality of pipe shall be within ± 0 75 percent

9 FINISH

The finished pipe shall be reasonably straight free from injurious defects and with ends prepared as specified in the purchase order

9.1 The pipe shall be substantially round, outside circumference of the pipe shall not vary more than 1 0 percent from the nominal outside circumference based on diameter specified

10 REPAIR BY WELDING

Injurious defects in pipe wall provided their depth does not exceed one third of the specified wall thickness shall be repaired by welding Defects in the welds, such as sweats and leaks, unless otherwise specified shall be repaired or piece rejected at the option of the manufacturer Repairs of this nature shall be made by completely removing the defect cleaning the cavity and then welding

All repaired pipe shall be re-tested hydraulically in accordance with 7

11 PROTECTIVE COATING

After pipe is subjected to hydrostatic test if so specified by the purchaser outside surface may be given a protective coating of the kind specified by the purchaser

12 MARKING

Each length of pipe shall be legibly marked with appropriate symbol stenciling or painting to show the name or brand of manufacturer, size (wall thickness and diameter)

12.1 The pipes may also be marked with BIS Certification Mark

12.1.1 The use of the Standard Mark is governed by the provisions of *Bureau of Indian Standards Act* 1986, and the Rules and Regulations made thereunder The details of conditions under which the licence for the use of Standard Mark may be granted to manufacturers or producers may be obtained from the Bureau of Indian Standards

13 INFORMATION TO BE SUPPLIED BY THE PURCHASER

The purchaser shall state in his enquiry or order

a) Outside diameter, nominal thickness and total length of pipe required,

b) Purpose for which pipes are intended to be used

c) Length range in individual tube to be supplied

d) Working pressure for the pipe envisaged in conveying fluid, if any,

e) Whether any protective coating is needed on outside surface,

f) Whether he himself or representative wishes to witness hydrostatic test of individual pipe and

g) Any special markings required

ANNEX A

(*Clause* 4 2)

REPAIR-WELDING PROCEDURE AND WELDER PERFORMANCE TESTS

A-1 GENERAL

A-1.1 All manual and semi-automatic submerged-arc and gas-shielded-arc repair welds and manual and semi-automatic metallic-arc repair welds using coated electrodes shall be made according to a tested procedure and by a repair-welder tested in a flat position as specified in **A-2 and A-3** When the base metal temperature of the material to be repair welded is below 10°C, submerged-arc, gas-shielded-arc or manual metallic-arc methods with low hydrogen electrodes shall be used for the repair-welding test The manufacturer shall maintain a record of the procedure and performance test results Test welds may be made either on plate stock or pipe stock at the option of the manufacturer

A-2 REPAIR-WELDING PROCEDURE TESTS

A-2.1 Repair-welding procedure tests are required on two specimens from each test of every grade and on material which is on the high side of the chemical specification and which is at least as thick as the pipe on which welds are to be made The repair-welding procedure test shall be made at a temperature at or below the lowest temperature at which repair welds are made

A-2.2 Transverse Tensile Test

The transverse tensile test specimen (*see* Fig 4) shall be approximately 38 mm wide and shall have the transverse metallic-arc butt weld perpendicular to the longitudinal axis at the centre of the test specimen The weld reinforcement shall be removed from both faces The ultimate tensile strength shall be at least equal to the minimum specified for the grade

A-2.3 Longitudinal Tensile — Elongation Test

The longitudinal tensile-elongation test specimen shall conform to Fig 5 The weld shall be made in a groove as shown The elongation after complete rupture of the test specimen in tension shall be at least equal to the minimum elongation specified for the grade

A-2.4 Transverse Guided — Bend Test

The transverse guided-bend test specimen shall conform to Fig 6 The weld shall be made in a groove as shown The specimen shall be placed on the die with the weld at mid-span and shall be bent approximately 180° in a jig in accordance with Fig 3 with the exposed surface of the weld in tension The bend test shall be considered acceptable if

a) No crack or other defect exceeding 3 mm in any direction is present in the weld metal or between the weld and the pipe metal after bending Cracks which originate along the edges of the specimen during testing and which are less than 6 5 mm measured in any direction shall not be considered

b) The specimen cracks or fractures during bending and the exposed surface shows complete penetration and fusion throughout the entire thickness of the weld specimen not more than 1 gas pocket per square cm with the greatest dimension not exceeding 1 6 mm and no slag inclusions greater than 0 8 mm deep or 3 mm wide and separated by at least 13 mm of sound metal (If necessary the specimen shall be broken apart to permit examination of the fracture)

A-2.5 Nick-Break Test

The nick-break specimen shall conform to Fig 7 The weld shall be made in a groove as shown The specimen shall be hacksaw-notched from both edges at the centre of the weld and shall be broken by pulling or hammer blows at the centre or one end The exposed surface of the specimen shall be considered acceptable if it shows not more than

a) One gas pocket for nominal wall thicknesses of 6 35 mm and less

b) Two gas pockets for nominal wall thicknesses of 12 7 mm or less but greater than 6 35 mm

c) Three gas pockets for nominal wall thicknesses greater than 12 7 mm The greatest dimension of a gas pocket shall not exceed 1 6 mm Slag inclusion shall be separated by at least 13 mm of sound metal and shall be not greater than 0 8 mm deep or 3 mm wide

A-3 REPAIR-WELDERS PERFORMANCE TEST

A-3.1 Repair-welders performance tests are required on two specimens from each test of every grade, except that a welder qualified on one grade is also qualified for any lower grade If either of the two specimens fails to conform to the requirements specified, four retests shall be required if made immediately, or two retests shall be required if the welder takes further instructions in the practice before making a retest All retests shall conform to the requirements specified Further performance tests are required at a minimum of one-year intervals and also if the repair-welder is not engaged in the tested repair-welding procedure for a period of three months or more or if there is some specific reason to question his ability Both of the following tests shall be made

a) Transverse guided-bend test as stipulated under welding procedure test (*see* **A-2.4**) and

b) Nick-break test as stipulated under welding-procedure test (*see* **A-2.5**)

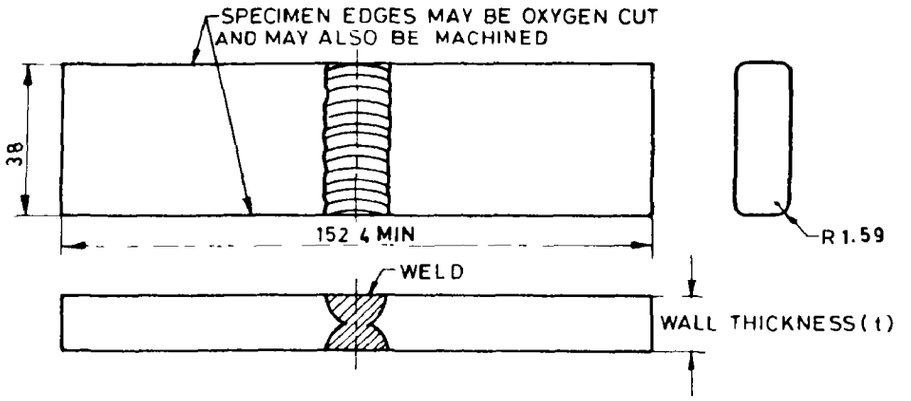
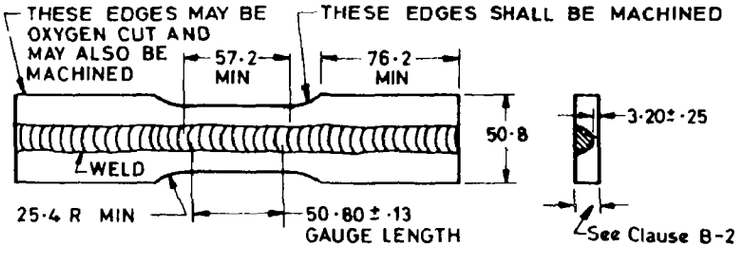
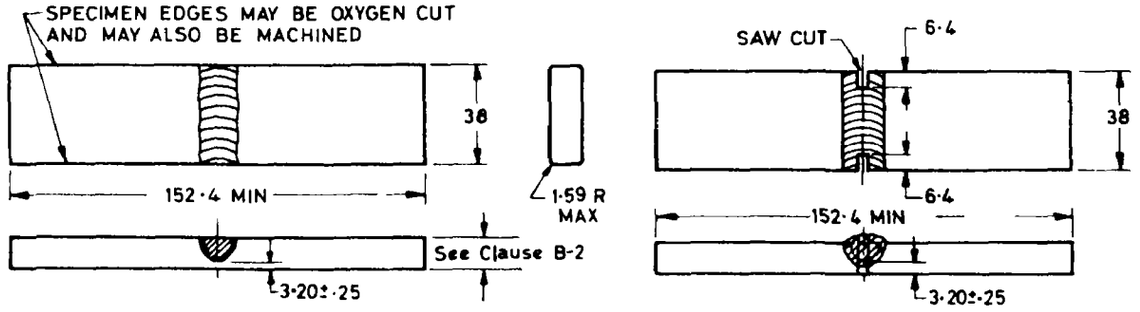


FIG. 4 TRANSVERSE TENSILE TEST SPECIMEN



All dimensions in millimetres

FIG. 5 TENSILE ELONGATION TEST SPECIMEN



NOTE — Weld reinforcement shall be removed

All dimensions in millimetres

FIG. 6 GUIDED BEND TEST SPECIMEN

All dimensions in millimetres

FIG. 7 NICK BREAK TEST SPECIMEN

Bureau of Indian Standards

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Review of Indian Standards

Amendments are issued to standards as the need arises on the basis of comments. Standards are also reviewed periodically; a standard along with amendments is reaffirmed when such review indicates that no changes are needed; if the review indicates that changes are needed, it is taken up for revision. Users of Indian Standards should ascertain that they are in possession of the latest amendments or edition by referring to the latest issue of 'BIS Handbook' and 'Standards : Monthly Additions'.

This Indian Standard has been developed from Doc No MTD 19 (3271)

Amendments Issued Since Publication

Amend No.	Date of Issue	Text Affected

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