AS 1302—1991

Australian Standard®

Steel reinforcing bars for concrete

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The following interests are represented on committee BD/23:

Australian Institute of Steel Construction

AUSTROADS

Bureau of Steel Manufacturers of Australia

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Institute of Steel Service Centres of Australia

Metal Trades Industry Association of Australia

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PREFACE

This Standard was prepared by the Standards Australia Committee on Structural Steel and is to supersede AS 1302–1982, *Steel reinforcing bars for concrete.*

AS 1302 was originally published in part as AS A81, AS A92 and AS A97 in 1965. AS A83 was first published in 1966. These four Standards were revised, amalgamated and redesignated as AS 1302 in 1973. However, they ran concurrently with the new Standard until 1976 when they were withdrawn.

The following significant changes have been made to the previous edition of the Standard:

(a) The grades of steel have been amended to bring them into line with AS 3600. Grade 410 has been reduced to Grade 400 and Grade 230 increased to Grade 250.

(b) Cold–worked bars of Grade 410 are no longer included.

(c) A chemical analysis of the product is now included.

(d) Fabrication requirements have been amended to comply with AS 3600.

(e) Tolerances on straightness of reinforcing bars have been added.

(f) Although plain round bars may be ordered in accordance with this Standard, material specified in AS 3679 is also deemed to comply with AS 1302.

(g) Methods of deformation measurements reflect current shapes and arrangements of deformed bars manufactured in Australia.

(h) The values and mechanical test requirements for tensile strength, yield strength, elongation and the bend test are fully revised.

(i) A reverse–bend test has been added for information only.

(j) A new Appendix B, ‘Means for demonstrating compliance with this Standard’, has been included.

CONTENTS

STANDARDS AUSTRALIA

Australian Standard
Steel reinforcing bars for concrete

1 SCOPE This Standard specifies requirements for plain and deformed hot-rolled steel bars for use as reinforcement for concrete.

It applies to reinforcement supplied in straight lengths or in coil form. For coiled material, the requirements apply to the straightened product.

NOTES:

1 For 'Purchasing Guidelines', see Appendix A.
2 For 'Means for demonstrating compliance with this Standard', see Appendix B.
3 For welding of bars complying with this Standard, see AS 3600 and AS 1554.3.
4 This Standard is not applicable to prestressing steels.

2 REFERENCED DOCUMENTS The following documents are referred to in this Standard:

AS

1050	Methods for the analysis of iron and steel
1199	Sampling procedures and tables for inspection by attributes
1213	Iron and Steel—Methods of sampling
1391	Methods for tensile testing of metals
1399	Guide to AS 1199—Sampling procedures and tables for inspection by attributes
1554	SAA Structural Steel Welding Code
1554.3	Part 3: Welding of reinforcing steel
2706	Numerical values—Rounding and interpretation of limiting values
3600	Concrete structures
3679	Hot-rolled structural steel bars and sections
3900	Quality systems—Guide to selection and use
3904	Quality systems—Guide to quality management and quality system elements
K1	Methods for the sampling and analysis of iron and steel

ISO

Guide 44—1985	General Rules for ISO or IEC International Third Party Certification Scheme for Products

3 DEFINITIONS For the purposes of this Standard, the following definitions apply.

3.1 Angle of deformation flanks—the included angle at which the sides of the transverse deformations rise from the core of the bar.

3.2 Bar size(d_b)—the diameter, in millimetres, of a circular section of steel having the same mass per metre as the deformed bar.

3.3 Calculated mass per metre—the mass per linear metre calculated from the bar size on the basis of the density of steel being 7850 kg/m^3 (0.00785 kg/m.mm^2).

3.4 Deformed bar—a steel bar which has a rolled raised pattern occurring at regular intervals. It may or may not have longitudinal ribs.

3.5 Longitudinal rib—a continuous deformation of uniform height parallel to the longitudinal axis of the bar.

3.6 Nominal area—the cross-sectional area of the bar taken as the calculated area of a circle having the same diameter as the bar size and rounded off to the nearest 10 mm^2.

3.7 Plain round bar—a steel bar which has a plain circular cross-section.

3.8 Transverse deformation—a raised deformation on the surface of the bar inclined at an angle of not less than 45° to the longitudinal axis of the bar.

3.9 Transverse deformation angle—the included acute angle between a transverse deformation and the longitudinal axis of the bar.

3.10 Transverse deformation spacing—the average distance between the corresponding points of transverse deformations, measured parallel to the axis of the bar.

4 GRADE CLASSIFICATION AND DESIGNATION

4.1 Classification The grade classification shall be based on the minimum yield strength of the steel as given in Table 10.

4.2 Designation The grades shall be designated by the number of this Australian Standard i.e. AS 1302, with an appropriate suffix to define the minimum yield strength of the bars, as follows—

(a) *400Y,* for deformed bars of 400 MPa minimum yield strength;

(b) *250S,* for deformed bars of 250 MPa minimum yield strength; or

(c) *250R,* for plain round bars of 250 MPa minimum yield strength. Material conforming to AS 3679-250 shall be deemed to comply with this Standard.

Examples:

AS 1302—400Y

AS 1302—250S

AS 1302—250R

5 CHEMICAL COMPOSITION

5.1 General The method of sampling for chemical analysis shall be in accordance with AS 1213. Chemical composition shall be determined by the procedures specified in AS 1050, AS K1, or any other procedures which have the same or better accuracy than the stated Standards.

5.2 Cast analysis A chemical analysis of the liquid steel shall be made to determine the proportions of the specified elements. In cases where it is impracticable to obtain samples from liquid steel, analysis on test samples taken in accordance with AS 1213 may be reported as cast analysis.

The cast analysis of the steel shall conform to the limits specified in Table 5 for the appropriate grade.

Test certificates reporting cast analysis shall indicate values for those elements necessary to establish compliance with the appropriate grade, and any other element intentionally added to the steel.

TABLE 5
CHEMICAL COMPOSITION

Grade	Type of analysis	Chemical composition, percent maximum by mass					
		C	Si	Mn	P	S	Carbon equivalent (CE) (see Note 1)
400	Cast	0.22	0.40	*	0.040	0.040	0.39
	Product	0.25	0.45	*	0.050	0.050	0.39
250	Cast	0.25	0.40	*	0.040	0.040	0.43
	Product	0.29	0.45	*	0.050	0.050	0.43

NOTES:

1. Carbon equivalent *(CE)* is calculated from the following equation:

$$CE = C + \frac{Mn}{6} + \frac{(Cr + Mo + V)}{5} + \frac{(Ni + Cu)}{15}$$

2. '*' indicates that no limit is specified.

3. Grain refining and micro-alloying elements niobium, titanium and vanadium may be added provided that the total content of these elements does not exceed 0.15 percent.

5.3 Product analysis It is not a mandatory requirement of this Standard that the finished product be chemically analyzed, but if the steel is subjected to a product analysis, the results of the analysis shall conform to the appropriate product analysis limits specified in Table 5.

5.4 Residual elements Elements not shown in Table 5 shall not be intentionally added to the steel, other than for the purpose of deoxidizing. All reasonable precautions shall be taken to prevent the addition of elements which may be detrimental to the intended use of the steel.

The following elements may be present to the limits stated:

(a) Copper . . . . . 0.50 percent maximum

(b) Nickel . . . . . 0.35 percent maximum

(c) Chromium . . . . . 0.25 percent maximum

(d) Molybdenum . . . . . 0.10 percent maximum

6 MARGINS OF MANUFACTURE Bars shall be manufactured in accordance with the area and mass given in Tables 6.1 and 6.2 as appropriate.

At any cross-section of a plain round bar of Grade 250R, the maximum variation in the diameter shall not exceed 0.08 times the bar size.

The tolerance on bar length shall be as follows:

(a) For 3 7 m . . . . . +0, -40 mm.
(b) For > 7 m 3 15 m . . . . . +40, -40 mm.
(c) For > 15 m . . . . . +60, -40 mm.

The tolerance on calculated mass shall be as follows:

(a) For bar sizes 3 10 mm . . . . . ±5.0 percent.
(b) For bar sizes . 12 mm . . . . . ±3.5 percent.

The tolerance on straightness shall be—

(a) for bar sizes 3 16 mm . . . . . *L*/50; percent
(b) for bar sizes . 20 mm . . . . . *L*/100, percent

where L is the length of the bar being checked and the variation is measured from a straight line between the ends.

TABLE 6.1
AREA AND MASS REQUIREMENTS FOR DEFORMED BARS

Bar size (db) mm	Calculated mass per metre kg/m	Calculated area mm^2	Nominal area mm^2
12	0.888	113.1	110
16	1.578	201.1	200
20	2.466	314.2	310
24	3.551	452.4	450
28	4.834	615.8	620
32	6.313	804.2	800
36	7.990	1017.9	1020
40	9.865	1256.6	1260
50	15.413	1963.5	1960

TABLE 6.2
AREA AND MASS REQUIREMENTS FOR PLAIN ROUND BARS

Bar size (db) mm	Calculated mass per metre kg/m	Calculated area mm^2	Nominal area mm^2
6.5	0.260	33.2	30
10	0.617	78.5	80
12	0.888	113.1	110
16	1.578	201.1	200
20	2.466	314.2	310
24	3.551	452.4	450
27	4.495	572.6	570
33	6.714	855.3	860
36	7.990	1017.9	1020

NOTE: The bar sizes given in Tables 6.1 and 6.2 are the preferred sizes.

7 QUALITY OF FINISHED BAR Bars shall be free from pipe, harmful segregation, and other defects in manufacture revealed during processing of the material and which may be detrimental to their end use as reinforcement for concrete.

The presence of millscale or rust shall not be cause for rejection of reinforcement provided that a clean sample meets the requirements of Tables 6.1 and 8 for deformed bars, or Table 6.2 for plain bars.

8 DEFORMATION REQUIREMENTS FOR ANCHORAGE WITH CONCRETE

8.1 General Deformed bars shall have two or more rows of transverse deformations separated by either longitudinal ribs or longitudinal gaps. Longitudinal ribs used solely for identification purposes do not need to comply with this Clause. The method of measuring deformations and ribs is specified in Appendix D.

8.2 Spacing of transverse deformations Transverse deformations of similar size and shape shall be spaced along the bar at substantially uniform intervals on each side. The average spacing of deformations on each side shall be not less than $0.5d_b$, and not greater than $0.7d_b$. (See column 2 of Table 8.)

8.3 Transverse deformation angle Transverse deformations shall be inclined to the longitudinal axis of the bar at an acute angle of not less than 45°.

If the transverse deformation angle is between 45° and 70°, then—

(a) at least one row of such deformations shall be in the reverse direction to the other row or rows; or

(b) at least one longitudinal rib shall be present.

8.4 Gap between rows of transverse deformations The overall length of transverse deformations shall be such that the gap between the extreme ends of two contiguous rows is not greater than $0.125\pi d_b$. (See column 3 of Table 8.)

The sum of all gaps shall not exceed $0.25\pi d_b$.

Where the ends of transverse deformations terminate at longitudinal ribs, the sum of the width of each rib shall be taken as the gap.

8.5 Height of transverse deformations The height of any transverse deformation above the body of the bar shall be not less than—

(a) for measurements by the average height method . . . . . $0.05d_b$
(See column 4 of Table 8.); or

(b) for measurements by the peak height method . $0.065d_b$
(See column 5 of Table 8.)

8.6 Height of longitudinal rib Where a longitudinal rib is required by Clause 8.3, its height shall be not less than the minimum average height of $0.05d_b$. (See column 4 of Table 8.)

8.7 Angle of deformation flanks The angle of the flank of the deformations shall be not less than 45°.

NOTE: Slight rounding is permitted at the join between any deformation and the core.

TABLE 8
DEFORMATION REQUIREMENTS

millimetres

1	2	3	4	5
Bar size (d_b)	**Maximum average spacing**	**Maximum transverse gap**	**Maximum Average height**	**Maximum peak height**
12	8.4	4.7	0.6	0.78
16	11.2	6.3	0.8	1.04
20	14.0	7.9	1.0	1.30
24	16.8	9.4	1.2	1.56
28	19.6	11.0	1.4	1.82
32	22.4	12.6	1.6	2.08
36	25.2	14.1	1.8	2.34
40	28.0	15.7	2.0	2.60
50	35.0	19.6	2.5	3.25

9 PREPARATION OF TEST PIECES FOR MECHANICAL TESTING

9.1 General The preparation of test pieces shall be as follows:

(a) Test pieces shall be selected from the ends of a bar if straight, or from the end of a coil if the material to be tested is still in coil form.

NOTE: A sample taken from a bar on site may render the remainder too short for use in its scheduled location.

(b) Test pieces from coiled product shall be cold-straightened before testing. Cold-working during straightening shall be kept to a minimum to avoid a reduction in the strength of the sample.

(c) A test piece which develops flaws during preparation or which shows defects shall be discarded and another test specimen shall be submitted.

(d) All bars shall be tested in full section as rolled and the tensile properties shall be determined on the nominal area of the bar.

9.2 Tensile test pieces A test piece for tensile testing shall be prepared from each test specimen in accordance with AS 1391.

9.3 Bend test pieces A test piece, of sufficient length for bend testing, shall be prepared from each test specimen.

10 MECHANICAL TEST REQUIREMENTS

10.1 Tensile test The tensile test shall be carried out in accordance with AS 1391. The yield strength, tensile strength, and the percentage elongation of a test piece shall conform to the limits given in Table 10. If no defined yield point is obtained, the 0.2 percent proof stress shall be deemed to be the yield strength.

10.2 Bend test The bend test shall be carried out by bending the test piece through an angle of 180° around a former of diameter shown in Table 10. The test shall be carried out at room temperature.

The surface of the test piece shall not show evidence of cracking.

NOTE: Cracks which are not visible to the naked eye, or slight surface fissures at the base of the deformations, may be disregarded.

TABLE 10

MECHANICAL TEST REQUIREMENTS

Grade	Minimum yield strength (f_{sy}) MPa	Minimum tensile strength MPa	Minimum percentage elongation %	Bend test-diameter of former, for bar sizes mm
400Y	400	1.10*YS*	16	$3d_b$ for 12 mm and 16 mm $4d_b$ for 20 mm and above
250S & 250R	250	1.10*YS*	22	$3d_b$ for sizes 3 36 mm $4d_b$ for sizes > 36 mm

f_{sy} = the yield strength of reinforcing steel as specified in AS 3600, taken to be the minimum yield strength, in megapascals

YS = the yield stress as determined from the tensile test being performed, in megapascals

d_b = the bar size of the test piece, in millimetres

The gauge length for elongation testing is $5d_b$

11 ROUNDING OF NUMBERS

11.1 General For the purpose of deciding whether a particular requirement of this Standard is complied with, the determined value, observed or calculated, shall be rounded off in accordance with AS 2706. The number of significant places retained in the rounded-off value shall be the same as that of the specified value in the appropriate material Standard.

11.2 Tensile properties The determined value of tensile strength shall be rounded off to the nearest 10 MPa, and the determined value of yield strength shall be rounded off to the nearest 5 MPa.

12 REVERSE-BEND TEST The manufacturer shall ensure that reinforcing bars of size 20 mm or less shall be capable of meeting the requirements of a reverse-bend test.

NOTE: The reverse-bend test is not part of day-to-day testing procedures. Steels which comply with the chemical and physical requirements of this Standard are normally capable of being bent and rebent, or straightened, without fracture if the internal diameter of the bend is not less than the bend test specified in Clause 10.2. Where a test for reverse bending is required by the purchaser, a suitable method is presented in Appendix C.

13 MARKING To enable the manufacturing plant and the grade to be identified, deformed bars shall have marks rolled on their surface at not more than 1.5 m intervals.

Each bundle and coil supplied from the manufacturer shall be securely tied and tagged to identify—

(a) the manufacturer;

(b) the grade of steel;

(c) the Standard to which it is manufactured;

(d) the heat number; and

(e) the mass of the bundle.

NOTES:

1 Manufacturers making a statement of compliance with this Australian Standard on a product, or on packaging or promotional material related to that product, are advised to ensure that such compliance is capable of being verified.

2 Independent certification is available from Standards Australia under the StandardsMark Product Certification Scheme. The StandardsMark, shown below, is a registered certification trade mark owned by Standards Australia and granted under license to manufacturers whose products comply with the requirements of suitable Australian Standards and who operate sound quality assurance programs to ensure consistent product quality.

3 Further information on product certification and the suitability of this Standard for certification is available from Standards Australia's Quality Assurance Services, 1 The Crescent, Homebush, N.S.W. 2140.

APPENDIX A
PURCHASING GUIDELINES
(Informative)

A1 INFORMATION TO BE SUPPLIED BY THE PURCHASER The purchaser should supply the following information at the time of enquiry or order, after making due reference to the explanation, advice and recommendations contained in this Appendix:

(a) Designation of grade and Standard number (see Clause 4).

NOTE: Grade 250S deformed bars are normally available only as size 12 mm (S12) although other sizes in economical rolling quantities are negotiable with the supplier.

(b) Quantity and delivery instructions (dates, schedules, delivery point).

(c) Dimensions of steel, e.g. bar size and length, mass of bundle or coil.

(d) Whether a test certificate or certificate of compliance is required.

(e) Any information concerning processing or end-use that the purchaser considers would assist the manufacturer.

(f) Whether it is the intention of the purchaser to inspect the steel at the manufacturer's works (see Paragraph A3).

(g) Any exceptions to the Standard and any special or supplementary requirements, e.g. reverse-bend test (see Paragraph C5 of Appendix C).

A2 CERTIFICATES OF COMPLIANCE AND TEST CERTIFICATES

A2.1 Certificates of compliance A certificate of compliance states that the material has been tested and results comply with the appropriate material Standard.

A2.2 Test certificates A test certificate shows such results as may be required by agreement between the purchaser and the manufacturer, relating to—

(a) tests performed by the manufacturer for the purpose of establishing compliance with the appropriate material Standard; or

(b) additional tests as agreed between the purchaser and manufacturer.

A3 INSPECTION If it is the purchaser's intention to undertake any of the following functions at the manufacturer's works, this should be notified at the time of enquiry or order, and should be accomplished in a manner which will not interfere with the operation of the works:

(a) Inspect the steel during manufacture.

(b) Selecting and identifying test samples.

(c) Witness the tests being made.

The manufacturer should provide all reasonable facilities to enable the purchaser to be satisfied that the steel is in accordance with this Standard.

APPENDIX B
MEANS FOR DEMONSTRATING COMPLIANCE WITH THIS STANDARD
(Informative)

B1 SCOPE This Appendix sets out the following different means by which compliance with this Standard can be demonstrated by the manufacturer or supplier:

(a) Assessment by means of statistical sampling.

(b) The use of Standards Australia's StandardsMark scheme.

(c) Assurance using the acceptability of the supplier's quality system.

(d) Other such means proposed by the manufacturer or supplier and acceptable to the customer.

B2 STATISTICAL SAMPLING Statistical sampling is a procedure that enables decisions to be made about the quality of batches of items after only a portion of those items has been inspected or tested. This procedure will only be valid if the sampling plan has been determined on a statistical basis and the following requirements are met:

(a) The sample is drawn randomly from a population of product of known history that enables verification that the product was made from known materials at essentially the same time by essentially the same processes and under essentially the same system of control.

(b) For each different situation, a suitable sampling plan is defined. A sampling plan for one manufacturer of given capability and product throughput may not be relevant to another manufacturer producing the same items.

For statistical sampling to be meaningful to the customer, the manufacturer or supplier needs to demonstrate how the above conditions have been satisfied. Sampling and the establishment of a sampling plan should be carried out in accordance with AS 1199, guidance to which is given in AS 1399.

B3 PRODUCT CERTIFICATION—STANDARDSMARK The general purpose of StandardsMark certification is to provide independent assurance of the claim by the manufacturer that products comply with the stated Australian or International Standard.

It is a certification scheme which meets the criteria of an ISO Type 5 scheme as specified by ISO Guide 44 in that, as well as full type testing from independently sampled production and subsequent verification of conformance, it requires the manufacturer to maintain an effective quality plan to control production to ensure conformance with the relevant Standard.

The StandardsMark serves to indicate that the products consistently conform to the requirements of the Standard.

The StandardsMark can only be used by manufacturers approved and licensed by Standards Australia and only when accompanied by the number of the applicable Standard.

B4 SUPPLIER'S QUALITY SYSTEM Where the manufacturer or supplier can demonstrate an audited and registered quality management system complying with the requirements of the appropriate or stipulated Australian or International Standard for suppliers' quality systems, such demonstration may provide the necessary confidence that the specified requirements will be met. The quality assurance requirements need to be agreed between the customer and supplier and should include a quality or inspection and test plan to ensure product conformity.

Guidance in determining the appropriate quality management system is given in AS 3900 and AS 3904.

B5 OTHER MEANS OF ASSESSMENT

B5.1 General If the above methods are considered inappropriate, determination of compliance with the requirements of this Standard may be assessed on the basis of the results of sampling and testing as specified in Paragraph B5.2, or as otherwise agreed between purchaser and supplier, coupled with the manufacturer's guarantee of product conformance.

Irrespective of acceptable quality levels (AQLs) or test frequencies, the responsibility remains with the manufacturer or supplier to deliver products that conform with the full requirements of the Standard.

NOTE: The designation of an acceptable level or a low test frequency does not imply that the supplier has the right knowingly to deliver defective items or units of production.

B5.2 Sampling and testing Samples for tensile testing and bend testing should be taken from each grade and bar size, produced from the same cast, as follows:

(a) One sample for a rolling not exceeding 50 tonnes.

(b) One additional sample for the balance of the rolling.

B5.3 Compliance Each rolling complies with this Standard if all of the samples tested give results which are within the specified limits.

If any of the properties of the tested samples give results outside the specified limits, the requirements of Paragraph B5.4 apply.

B5.4 Retests Should a test piece from a sample first selected not comply with the test requirements, two further tests should be made on samples taken from the material represented. If the results of both these further tests comply with the test requirements, the material represented should be deemed to comply with this Standard. If either of these additional tests does not comply with the test requirements, the material represented should be deemed not to comply with this Standard.

APPENDIX C
REVERSE-BEND TEST FOR REINFORCING BARS
(Informative)

C1 SCOPE This test describes a suitable method of determining the ability of a reinforcing bar, which otherwise complies with this Standard, to withstand a single rebend without fracture. The test is limited to bars of size 20 mm or less.

C2 APPARATUS The following are required:

(a) One of the following bending apparatus—
  (i) bending machine with suitable rebending blocks;
  (ii) a proprietary bending and rebending tool; or
  (iii) pipe with an internal diameter not greater than three times the bar size to be tested.

(b) Oven capable of attaining a temperature of 100°C.

(c) Diameter of former as given in Table 10.

C3 PREPARATION OF THE TEST PIECE Test pieces should be prepared in accordance with Clause 9.

C4 PROCEDURE The procedure should be as follows:

(a) At room temperature, bend the straight test sample through an angle of 90° around the former.

(b) Age the bent sample at 100°C in the oven for 2 hours.

(c) Cool the bent sample to room temperature.

(d) At room temperature, straighten the test sample by applying a uniform force using one of the bending apparatus in Paragraph C2(a).

NOTE: A bar which has an offset not greater than one bar size on either side of the bend should be considered as straight in the context of rebending or straightening steel.

(e) Check for any signs of fracture.

C5 ASSESSMENT OF RESULTS OF THE REVERSE-BEND TEST Assessment of results of the reverse-bend test should be as follows:

(a) Testing of the sample may result in cracks occurring in the bar surface. Such cracks should be categorized as either of the following:
  (i) *Type A—Deformation compression cracking* These are cracks due to the design of the deformation pattern. Such cracks occur at the radius or junction of the deformation with the bar.
  (ii) *Type B—Brittle cracking* These are cracks due to an inability to comply with the test requirements. Such cracks normally propagate at 90° to the major axis of the bar.

(b) If no cracks are visible after rebending, the material should be deemed to have met this performance requirement.

(c) Material showing visible cracks which are defined as Type A, and which are not wider than the specified minimum height of the deformation should be deemed to meet this performance requirement provided that after rebending—
  (i) a tensile test is performed in accordance with Clause 9 on the straightened sample ; and
  (ii) the results comply with Clause 10.

(d) Material showing visible cracks which are defined as Type A, and which are wider than the specified minimum height of the deformation should be deemed not to have met the performance requirement.

(e) Material showing visible cracks which are defined as Type B should be deemed not to have met the performance requirement.

APPENDIX D
METHOD OF MEASUREMENT OF DEFORMATIONS
(Normative)

D1 TRANSVERSE DEFORMATIONSPACING The average spacing of transverse deformations shall be determined by dividing a measured length of bar by the number of deformations on one side of the bar. The measured length shall be taken over 10 spaces between deformations, but in no case less than $10d_b$.

D2 HEIGHT OF TRANSVERSE DEFORMATIONS

D2.1 Average height method The average height of a transverse deformation shall be obtained from the average of measurements taken at its midpoint and two quarter points.

D2.2 Peak height method The peak height of a transverse deformation shall be measured at its maximum height.

D3 HEIGHT OF LONGITUDINAL RIB The height of a longitudinal rib shall be measured midway between two consecutive transverse deformations which terminate on the same side of the longitudinal rib.

D4 ANGLE OF DEFORMATION FLANKS Any reproducible method of measurement may be used.

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