

JIS

JAPANESE INDUSTRIAL STANDARD

**Steel Bars for Concrete
Reinforcement**

 **JIS G 3112** —1987

Translated and Published

by

Japanese Standards Association

**In the event of any doubt arising,
the original Standard in Japanese is to be final authority.**



JAPANESE INDUSTRIAL STANDARD

J I S

Steel bars for concrete reinforcement

G 3112-1987
(Reaffirmed: 1992)

1. Scope This Japanese Industrial Standard specifies the round steel bar ⁽¹⁾ and deformed steel bar ⁽¹⁾ manufactured by hot rolling to be used for concrete reinforcement.

Note ⁽¹⁾ The steel bars in coil form are included. However, those specified in JIS G 3117 are excluded.

Remarks: The units and numerical values given in { } in this Standard are in accordance with the International System of Units (SI) and are appended for informative reference.

Further, the traditional units and numerical values in this Standard shall be replaced by the SI units and relevant numerical values on and after January 1, 1991.

2. Grade and symbol The round and deformed steel bars shall be classified into two and five categories, respectively, and their symbols shall be as given in Table 1-1 or Table 1-2.

Table 1-1. Grade and symbol (applicable till the end of 1990)

Division	Symbol of grade
Round steel bars	SR 24
	SR 30
Deformed steel bars	SD 30 A
	SD 30 B
	SD 35
	SD 40
	SD 50

Table 1-2. Grade and symbol (applicable on and after January 1, 1991)

Division	Symbol of grade	
	SI unit	(Informative reference) Traditional unit
Round steel bars	SR 235	SR 24
	SR 295	SR 30
Deformed steel bars	SD 295 A	SD 30 A
	SD 295 B	SD 30 B
	SD 345	SD 35
	SD 390	SD 40
	SD 490	SD 50

3. Chemical composition The round and deformed steel bars shall be tested in accordance with 8.1, and the cast analysis values shall conform to Table 2-1 or Table 2-2.

Table 2-1. Chemical composition (applicable till the end of 1990)

Symbol of grade	Chemical composition %					
	C	Si	Mn	P	S	$C + \frac{Mn}{6}$
SR 24	—	—	—	0.050 max.	0.050 max.	—
SR 30	—	—	—	0.050 max.	0.050 max.	—
SD 30 A	—	—	—	0.050 max.	0.050 max.	—
SD 30 B	0.27 max.	0.55 max.	1.50 max.	0.040 max.	0.040 max.	—
SD 35	0.27 max.	0.55 max.	1.60 max.	0.040 max.	0.040 max.	0.50 max.
SD 40	0.29 max.	0.55 max.	1.80 max.	0.040 max.	0.040 max.	0.55 max.
SD 50	0.32 max.	0.55 max.	1.80 max.	0.040 max.	0.040 max.	0.60 max.

Table 2-2. Chemical composition (applicable on and after January 1, 1991)

Symbol of grade	Chemical composition %					
	C	Si	Mn	P	S	$C + \frac{Mn}{6}$
SR 235	—	—	—	0.050 max.	0.050 max.	—
SR 295	—	—	—	0.050 max.	0.050 max.	—
SD 295 A	—	—	—	0.050 max.	0.050 max.	—
SD 295 B	0.27 max.	0.55 max.	1.50 max.	0.040 max.	0.040 max.	—
SD 345	0.27 max.	0.55 max.	1.60 max.	0.040 max.	0.040 max.	0.50 max.
SD 390	0.29 max.	0.55 max.	1.80 max.	0.040 max.	0.040 max.	0.55 max.
SD 490	0.32 max.	0.55 max.	1.80 max.	0.040 max.	0.040 max.	0.60 max.

4. Mechanical properties The round and deformed steel bars shall be tested in accordance with 8.2, and their yield points or 0.2 % proof stresses, tensile strengths, elongations and bendabilities shall conform to Table 3-1 or Table 3-2.

Furthermore, in the case of bend test, it shall be free from crack on the outside of the bent portion.

Table 3-1. Mechanical properties (applicable till the end of 1990)

Symbol of grade	Yield point or 0.2 % proof stress kgf/mm ² (N/mm ²)	Tensile strength kgf/mm ² (N/mm ²)	Tensile test piece	Elongation (%)	Bendability	
					Bend angle	Inside radius
SR 24	24 min. (235) min.	39 to 53 (382 to 520)	No. 2	20 min.	180°	1.5 × Nominal diameter
			No. 3	24 min.		
SR 30	30 min. (294) min.	45 to 61 (441 to 598)	No. 2	18 min.	180°	Diameter up to and incl. 16 mm 1.5 × nominal diameter
			No. 3	20 min.		Diameter over 16 mm 2 × nominal diameter
SD 30 A	30 min. (294) min.	45 to 61 (441 to 598)	Equivalent to No. 2	16 min.	180°	Up to and incl. D 16 1.5 × nominal diameter
			Equivalent to No. 3	18 min.		Over D 16 2 × nominal diameter
SD 30 B	30 to 40 (294 to 392)	45 min. (441) min.	Equivalent to No. 2	16 min.	180°	Up to and incl. D 16 1.5 × nominal diameter
			Equivalent to No. 3	18 min.		Over D 16 2 × nominal diameter
SD 35	35 to 45 (343 to 441)	50 min. (490) min.	Equivalent to No. 2	18 min.	180°	Up to and incl. D 16 1.5 × nominal diameter
			Equivalent to No. 3	20 min.		Over D 16, up to and incl. D 41 2 × nominal diameter
SD 40	40 to 52 (392 to 510)	57 min. (559) min.	Equivalent to No. 2	16 min.	180°	2.5 × Nominal diameter
			Equivalent to No. 3	18 min.		
SD 50	50 to 64 (490 to 628)	63 min. (618) min.	Equivalent to No. 2	12 min.	90°	Up to and incl. D 25 2.5 × nominal diameter
			Equivalent to No. 3	14 min.		Over D 25 3 × nominal diameter

Note (2) For the deformed steel bar exceeding designation D 32, 2 % shall be deducted from the elongation value of Table 3-1 for each increase of 3 in the number of the designation. However, the limit of reduction shall be 4 %.

Table 3-2. Mechanical properties (applicable on and after January 1, 1991)

Symbol of grade	Yield point or 0.2 % proof stress N/mm ²	Tensile strength N/mm ²	Tensile test piece	Elongation (²) %	Bendability	
					Bend angle	Inside radius
SR 235	235 min.	380 to 520	No. 2	20 min.	180°	1.5 × Nominal diameter
			No. 3	24 min.		
SR 295	295 min.	440 to 600	No. 2	18 min.	180°	Diameter up to and incl. 16 mm 1.5 × nominal diameter
			No. 3	20 min.		Diameter over 16 mm 2 × nominal diameter
SD 295 A	295 min.	440 to 600	Equivalent to No. 2	16 min.	180°	Up to and incl. D 16 1.5 × nominal diameter
			Equivalent to No. 3	18 min.		Over D 16 2 × nominal diameter
SD 295 B	295 to 390	440 min.	Equivalent to No. 2	16 min.	180°	Up to and incl. D 16 1.5 × nominal diameter
			Equivalent to No. 3	18 min.		Over D 16 2 × nominal diameter
SD 345	345 to 440	490 min.	Equivalent to No. 2	18 min.	180°	Up to and incl. D 16 1.5 × nominal diameter
			Equivalent No. 3	20 min.		Over D 16, up to and incl. D 41 2 × nominal diameter
SD 390	390 to 510	560 min.	Equivalent to No. 2	16 min.	180°	2.5 × Nominal diameter
			Equivalent to No. 3	18 min.		
SD 490	490 to 625	620 min.	Equivalent to No. 2	12 min.	90°	Up to and incl. D 25 2.5 × nominal diameter
			Equivalent to No. 3	14 min.		Over D 25 3 × nominal diameter

Note (²) For the deformed steel bar exceeding designation D 32, 2 % shall be deducted from the elongation value of Table 3-2 for each increase of 3 in the number of the designation. However, the limit of reduction shall be 4 %.

5. Shape, dimension, mass and tolerances

5.1 Shape, dimension, mass and tolerances for round steel bars The shape, dimension, mass and tolerances for the round steel bar shall conform to JIS G 3191. However, the standard length and its tolerance shall conform to Tables 5 and 6.

5.2 Shape, dimension, mass and tolerances for deformed steel bars

5.2.1 Shape The shape shall be in accordance with the following:

- (1) The deformed steel bar shall have protrusions on the surface ⁽³⁾.

Note ⁽³⁾ Protrusions in axial direction are referred to "ribs", and those in another directions "knots".

- (2) Knots of the deformed steel bar shall be distributed at about a fixed interval throughout the whole length and shall have the identical shape and dimension. However, in the case where letters or the like are indicated in the form of raised mark, the knots in that part may be lacked.
- (3) The root parts of the knots of the deformed steel bar of designation D 16 or over shall be so shaped as to minimize the stress concentration.

5.2.2 Shape, dimension, mass and tolerances Shape, dimension, mass and tolerances shall be as follows:

- (1) Dimension, mass and allowable limits of knot for deformed steel bars shall conform to Table 4.

Table 4. Dimension, mass and allowable limits of knots

Designation	Nominal diameter (<i>d</i>) mm	Nominal peripheral length (<i>l</i>) cm	Nominal sectional area (<i>S</i>) cm ²	Unit mass kg/m	Maximum value of mean interval between knots mm	Height of knot		Maximum value of sum of clearance between knots mm	Angle between knot and axial line
						Minimum value mm	Maximum value mm		
D 6	6.35	2.0	0.316 7	0.249	4.4	0.3	0.6	5.0	45° min.
D 10	9.53	3.0	0.713 3	0.560	6.7	0.4	0.8	7.5	
D 13	12.7	4.0	1.267	0.995	8.9	0.5	1.0	10.0	
D 16	15.9	5.0	1.986	1.56	11.1	0.7	1.4	12.5	
D 19	19.1	6.0	2.865	2.25	13.4	1.0	2.0	15.0	
D 22	22.2	7.0	3.871	3.04	15.5	1.1	2.2	17.5	
D 25	25.4	8.0	5.067	3.98	17.8	1.3	2.6	20.0	
D 29	28.6	9.0	6.424	5.04	20.0	1.4	2.8	22.5	
D 32	31.8	10.0	7.942	6.23	22.3	1.6	3.2	25.0	
D 35	34.9	11.0	9.566	7.51	24.4	1.7	3.4	27.5	
D 38	38.1	12.0	11.40	8.95	26.7	1.9	3.8	30.0	
D 41	41.3	13.0	13.40	10.5	28.9	2.1	4.2	32.5	
D 51	50.8	16.0	20.27	15.9	35.6	2.5	5.0	40.0	

Remarks 1. The method of calculating the nominal sectional area, nominal peripheral length and unit mass shall be as follows:

Nominal sectional area (*S*) = $\frac{0.7854 \times d^2}{100}$: to be rounded off to 4 places of significant figures.

Nominal peripheral length (*l*) = $0.3142 \times d$: to be rounded off to 1 place of decimal.

Unit mass = $0.785 \times S$: to be rounded off to 3 places of significant figures.

- The interval between knots shall be 70 % or under of the nominal diameter and be rounded off to 1 place of decimal.
- The sum of clearances between knots ⁽⁴⁾ shall be 25 % or less of the nominal peripheral length, and the calculated value shall be rounded off to 1 place of decimal.

Note ⁽⁴⁾ Clearances between knots shall be, in the case where a rib and knot are separated from each other, or where no rib is provided, the width of the position devoid of knots and, where a knot and rib are connected, shall be the width of the rib.

- The height of knot shall conform to the following table, and the calculated value shall be rounded off to 1 place of decimal.

Size	Height of knot	
	Minimum	Maximum
Designation D 13 or under	4.0 % of nominal diameter	Minimum value $\times 2$
Designation over D 13, up to D 19 excl.	4.5 % of nominal diameter	Minimum value $\times 2$
Designation D 19 or over	5.0 % of nominal diameter	Minimum value $\times 2$

- (2) The standard length for the deformed steel bar shall conform to Table 5.

Table 5. Standard length

Unit : m

3.5	4.0	4.5	5.0	5.5	6.0	6.5	7.0	8.0	9.0	10.0	11.0	12.0
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	------	------	------

Remarks: This table shall not apply to coils.

- (3) The tolerances on length for the deformed steel bar shall conform to Table 6.

Table 6. Tolerances on length

Length	Tolerances
7 m or under	+ 40 mm 0
Over 7 m	For each increase of 1 m in length or its fraction, further 5 mm shall be added to the tolerances on the plus side given above. The maximum value, however, shall be limited to 120 mm.

Remarks 1. This table shall not apply to coils.

2. The purchaser may designate the tolerances other than given above.

- (4) The tolerances on mass for one piece of the deformed steel bar shall conform to Table 7.

Table 7. Tolerances on mass of one piece

Dimension	Tolerance	Remarks
Designation up to and excl. D10	+ Not specified - 8 %	The sampling methods of specimen and calculation of tolerances shall be in accordance with 8.3.2.
Designation D 10 and over, up to and excl. D 16	$\pm 6 \%$	
Designation D 16 and over, up to and excl. D 29	$\pm 5 \%$	
Designation D 29 and over	$\pm 4 \%$	

- (5) The tolerances on mass of one set of the deformed steel bar shall conform to Table 8. However, this table shall be applied only when specified by the purchaser in advance.

Table 8. Tolerances on mass of one set

Dimension	Tolerance	Remarks
Designation up to and excl. D10	$\pm 7 \%$	The sampling methods of specimen and calculation of tolerances shall be in accordance with 8.3.2.
Designation D 10 and over, up to and excl. D 16	$\pm 5 \%$	
Designation D 16 and over, up to and excl. D 29	$\pm 4 \%$	
Designation D 29 and over	$\pm 3.5 \%$	

6. Appearance The round and deformed steel bars shall be free from defects that are detrimental to practical use.

7. Manufacturing method The round and deformed steel bars shall be manufactured by hot rolling from steel ingots (including continuously casted ones).

8. Tests

8.1 Analytical test The analytical test shall be as given in the following:

- (1) The general requirements for chemical analysis and sampling method of specimens shall be in accordance with 3. of JIS G 0303.
- (2) The analytical method shall be in accordance with appropriate one(s) of the following standards:

JIS G 1211, JIS G 1212, JIS G 1213, JIS G 1214, JIS G 1215, JIS G 1253, JIS G 1256, JIS G 1257

8.2 Mechanical test

8.2.1 Test in general The general requirements for mechanical testing shall be in accordance with 4. of JIS G 0303. In this case, sampling method of specimens shall be in accordance with Class A, and number of test pieces shall be as follows:

- (1) The number of tensile test piece and bend test piece shall be each one piece taken from each lot of the same heat and several sizes where the difference of diameter or nominal diameter among them falls within 10 mm. However, respective two pieces shall be taken from a lot exceeding 50 t.

8.2.2 Tensile test piece and bend test piece The tensile and bend test pieces shall be as follows. However, the test piece shall be the product as it is, not finished mechanically.

- (1) The tensile test piece shall be No. 2 test piece specified in JIS Z 2201 (for the deformed steel bar, the applicable size shall be under designation D 25) or No. 3 test piece (for the deformed steel bar, the applicable size shall be designation D 25 or over), and the gauge length and length of parallel portion of the deformed steel bar shall be determined according to the nominal diameter.
- (2) The bend test piece shall be No. 2 test piece specified in JIS Z 2204.

8.2.3 Method for tensile test and bend test The method for tensile test and bend test shall conform to the standards given below. However, as to the sectional area for obtaining the yield point or 0.2 % proof stress and tensile strength, the nominal sectional area given in Table 4 shall be used.

- (1) JIS Z 2241
- (2) JIS Z 2248

8.3 Measurement of shape, dimension and mass

8.3.1 Sampling method for measurement of shape, dimension and mass of round steel bars The sampling method of specimens for measurement of shape, dimension and mass of the round steel bar shall be in accordance with JIS G 3191.

8.3.2 Sampling method of specimen and measuring method of shape, dimension and mass for deformed steel bar The sampling method of specimens and measuring method of shape, dimension and mass for the deformed steel bar shall be as follows.

- (1) For the deformed steel bar, the measuring method of the shape of knot and dimension and sampling method of the specimen shall be as follows.
 - (a) One specimen 0.5 m or over in length shall be taken from every lot of products rolled to the same shape and dimension within an identical roll chance. In the case of coil form, however, it shall be subjected to tests after being straightened at an ordinary temperature.

- (b) The angle formed by the knot and the axial line of the deformed steel bar shall be measured with the development figure of surface of the deformed steel bar.
- (c) The mean interval between knots shall be obtained by dividing into 10 equal parts either the sum of ten consecutive knot intervals measured on the center line of knots, or a length corresponding to this measured on another line in the axial direction.
- (d) The height of a piece of knot shall be obtained by averaging the values of three heights measured at points dividing the knot into four equal parts.
- (e) The clearance between knots shall be determined either by measuring the distance between the end lines of confronting knots of the product itself as well as vertical to the end line using vernier callipers and the like, or by measuring the development figure of the surface of the deformed steel bar. However, in the case where these distances are not uniform, the mean value shall be obtained by measuring the distance covering the consecutive ten knots.

Informative reference: The development figure may be obtained, for example, by rolling a deformed steel bar on a sheet of oil clay.

- (2) As to measurement of mass for the deformed steel bar, the sampling method of the specimen and calculation method of tolerance on mass shall be as follows.

- (a) The sampling method of specimen for measurement of mass of one piece shall be in accordance with (1) (a) of 8.3.2.

As to calculation method of tolerance on mass in this case, it shall be expressed in percentage of quotient of the difference between the theoretical mass, that is a product of the unit mass given in Table 4 and the length, and actually measured mass divided by the said theoretical mass.

- (b) As to the specimen for measurement of mass of one set of products, one specimen shall be taken from a lot of products of the identical shape and dimension, and of 1 t or more in mass. When the number of pieces corresponding to 1 t does not amount to 10 pieces, however, more than 10 pieces shall be taken to be one set.

Further, as to calculation method of tolerance on mass in this case, it shall be expressed in percentage of quotient of the difference between the theoretical mass, this is a product of the unit mass given in Table 4, the length and the number of pieces of one set and the actually measured mass divided by the said theoretical mass.

9. Inspection Inspection shall be as follows:

- (1) Chemical composition, mechanical properties, shape, dimension, mass and appearance shall conform to 3., 4., 5. and 6.
- (2) Regarding the deformed steel bar of the designation D 32 or under for SD 30 B and SD 35 (applicable till the end of 1990) or SD 295 B and SD 345 (applicable on and after January 1, 1991), the purchaser, as particularly required, may designate a reverse bend test instead of bend test. In this case, the sampling method, test method, acceptance criterion, etc. shall be agreed on, in advance, between the purchaser and supplier.
- (3) The round and deformed steel bars which have not passed the tensile test or bend test may be retested for acceptance in accordance with 4.4 of JIS G 0303.
- (4) In the case of sampling inspection where the mass of one piece of deformed steel bar sampled has failed to conform to 5.2.2 (4), two additional specimens shall be taken. When the test results for both meet the requirements, the lot shall be deemed as acceptable.

10. Marking The round and deformed steel bars shall be marked as specified in 10.1 and 10.2. However, the markings of the coil of the round steel bar and the coil of the deformed steel bar of designation D 6 shall be in accordance with 10.2.

10.1 Marking on each piece The marking on each piece shall be as follows:

- (1) The round and deformed steel bars shall indicate the markings identifying the grade in accordance with Table 9-1 or Table 9-2. However, the markings identifying the grade of the deformed steel bar shall employ the rolling mark method with exception of SD 30 A (applicable till the end of 1990) or SD 295 A (applicable on and after January 1, 1991), and only the deformed steel bar of designation D 6 and the deformed steel bar having screw-thread-shaped marks may be identified by colouring.

Table 9-1. Marking method for grade identification
(applicable till the end of 1990)

Symbol of grade	Marking method for grade identification	
	Marking by rolling mark	Marking by colouring
SR 24	Not applied	Red (on one side section)
SR 30		White (on one side section)
SD 30 A	Without rolling mark	Not applied
SD 30 B	1 or I	White (on one side section)
SD 35	Number of protrusions, one piece (.)	Yellow (on one side section)
SD 40	Number of protrusions, two pieces (..)	Green (on one side section)
SD 50	Number of protrusions, three pieces (...)	Blue (on one side section)

Table 9-2. Marking method for grade identification
(applicable on and after January 1, 1991)

Symbol of grade	Marking method for grade identification	
	Marking by rolling mark	Marking by colouring
SR 235	Not applied	Red (on one side section)
SR 295		White (on one side section)
SD 295 A	Without rolling mark	Not applied
SD 295 B	1 or I	White (on one side section)
SD 345	Number of protrusions, one piece (.)	Yellow (on one side section)
SD 390	Number of protrusions, two pieces (..)	Green (on one side section)
SD 490	Number of protrusions, three pieces (...)	Blue (on one side section)

- (2) The deformed steel bar shall indicate the raised mark denoting the name of manufacturer or its abbreviation by rolling. However, exclusively in the case of the deformed steel bar of designation D 6 in size (excluding coils) and those of which name of manufacturer is self-evident due to the shape of the raised mark, these indications may be omitted.

10.2 Marking on each bundle The round and deformed steel bars shall be marked the following details by appropriate means.

- (1) Symbol of grade
- (2) Heat number or inspection number
- (3) Diameter or designation
- (4) Manufacturer's name or its abbreviation

11. Report The report shall be in accordance with 8. of JIS G 0303.

Cited standards:	JIS G 0303	General rules for inspection of steel
	JIS G 1211	Methods for determination of carbon in iron and steel
	JIS G 1212	Methods for determination of silicon in iron and steel
	JIS G 1213	Methods for determination of manganese in iron and steel
	JIS G 1214	Methods for determination of phosphorus in iron and steel
	JIS G 1215	Methods for determination of sulfur in iron and steel
	JIS G 1253	Method for photoelectric emission spectrochemical analysis of iron and steel
	JIS G 1256	Method for X-ray fluorescence spectrometric analysis of iron and steel
	JIS G 1257	Methods for atomic absorption spectrochemical analysis of iron and steel
	JIS G 3117	Rerolled steel bars for concrete reinforcement
	JIS G 3191	Shape, dimensions, weight and tolerance for hot rolled steel bar and bar-in-coil
	JIS Z 2201	Test pieces for tensile test for metallic materials
	JIS Z 2204	Bend test pieces for metallic materials
Related standard:	JIS Z 2241	Method of tensile test for metallic materials
	JIS Z 2248	Method of bend test for metallic materials
	JIS G 0203	Glossary of terms used in iron and steel (products and quality)

G 3112-1987
Edition 6

Japanese Text

Established by Minister of International Trade and Industry

Date of Establishment: 1964-07-01

Date of Revision: 1987-03-01

Date of Reaffirmation: 1992-10-01

Date of Public Notice in Official Gazette: 1992-10-26

Investigated by: Japanese Industrial Standards Committee

Divisional Council on Iron and Steel

**This English translation is published by:
Japanese Standards Association
1-24, Akasaka 4, Minato-ku,
Tokyo 107 Japan
© JSA, 1987**

**Printed in Tokyo by
Hohbunsha Co., Ltd.**

0-16

