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# Steel bars for concrete reinforcement



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## Foreword

This Japanese Industrial Standard has been revised by the Minister of Economy, Trade and Industry through deliberations at the Japanese Industrial Standards Committee as the result of proposal for revision of Japanese Industrial Standard submitted by The Japan Iron and Steel Federation (JISF) with a draft being attached, based on the provision of Article 12, paragraph (1) of the Industrial Standardization Act applied mutatis mutandis pursuant to the provision of Article 16 of the said Act. This edition replaces the previous edition (**JIS G 3112**:2010), which has been technically revised.

However, **JIS G 3112**:2010 may be applied in the **JIS** mark certification based on the relevant provisions of Article 30, paragraph (1), etc. of the Industrial Standardization Act until 19 April 2021.



Attention is drawn to the possibility that some parts of this Standard may conflict with patent rights, published patent application or utility model rights. The relevant Minister and the Japanese Industrial Standards Committee are not responsible for identifying any of such patent rights, published patent application or utility model rights.

# Steel bars for concrete reinforcement

## Introduction

This Japanese Industrial Standard has been prepared based on **ISO 6935-1**:2007, Edition 2, and **ISO 6935-2**:2019, Edition 4, with some modifications of the technical contents.

The vertical lines on both sides and dotted underlines indicate changes from the corresponding International Standards. A list of modifications with the explanations is given in Annex JA.

## 1 Scope

This Standard specifies requirements for round steel bars [1)] and deformed steel bars [1)] manufactured by hot rolling to be used as reinforcement in concrete. This Standard does not apply to rerolled steel bars for concrete reinforcement specified in **JIS G 3117**.

NOTE The International Standards corresponding to this Standard and the symbol of degree of correspondence are as follows.

ISO 6935-1:2007 *Steel for the reinforcement of concrete—Part 1: Plain bars*

ISO 6935-2:2019 *Steel for the reinforcement of concrete—Part 2: Ribbed bars* (overall evaluation: MOD)

In addition, symbols which denote the degree of correspondence in the contents between the relevant International Standards and **JIS** are IDT (identical), MOD (modified), and NEQ (not equivalent) according to **ISO/IEC Guide 21-1**.

Note [1)] Including those in coil form.

## 2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this Standard. The most recent editions of the standards (including amendments) indicated below shall be applied.

JIS G 0201 *Glossary of terms used in iron and steel (Heat treatment)*

JIS G 0202 *Glossary of terms used in iron and steel (Testing)*

JIS G 0203 *Glossary of terms used in iron and steel (Products and quality)*

JIS G 0320 *Standard test method for heat analysis of steel products*

JIS G 0404 *Steel and steel products—General technical delivery requirements*

JIS G 0415 *Steel and steel products—Inspection documents*

JIS G 3117 *Rerolled steel bars for concrete reinforcement*

JIS G 3191 *Dimensions, mass and permissible variations of hot rolled steel bars and bar in coil*

JIS Z 2241 *Metallic materials—Tensile testing—Method of test at room temperature*

JIS Z 2248 *Metallic materials—Bend test*

JIS Z 8401 *Rounding of numbers*

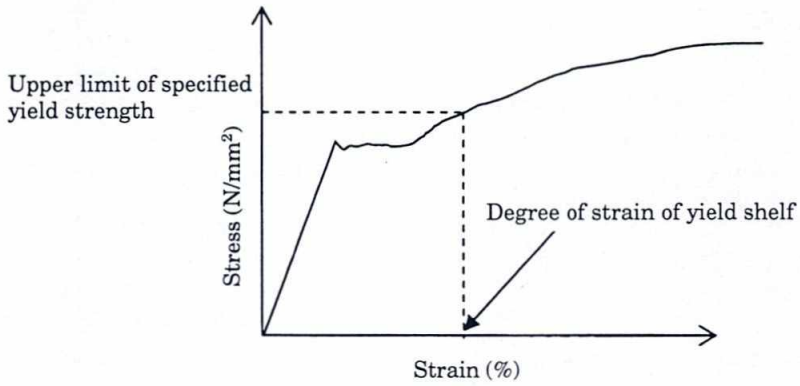
## 3 Terms and definitions

For the purpose of this Standard, the following terms and definitions given in **JIS G 0201**, **JIS G 0202** and **JIS G 0203**, and the following apply.

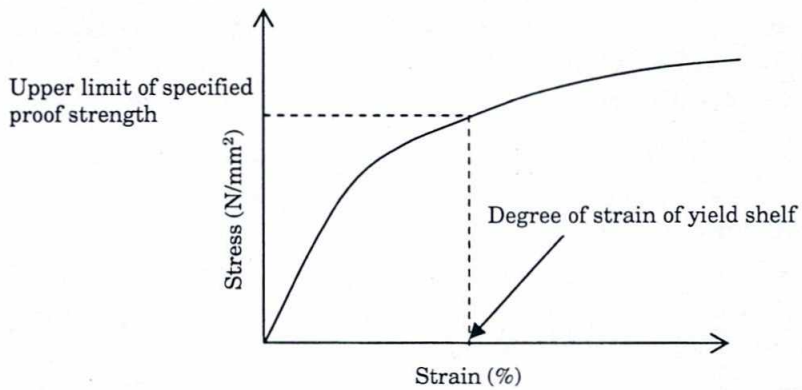
**3.1**

**degree of strain of yield shelf**

strain when the stress-strain curve passes the upper limit of the specified yield strength or proof strength (see Figure 1)




**a) Clear yield strength**




**b) Unclear yield strength**

**Figure 1 Degree of strain of yield shelf**

**3.2**

**thread knot reinforcing steel bar**

deformed steel bars having thread knots

## 4 Symbol of grade

The round steel bars and deformed steel bars shall be classified into 3 grades and 10 grades, respectively, and their symbols shall be as given in Table 1.

**Table 1 Symbol of grade**

| Symbol of grade | |
|---|---|
| Round steel bar | SR235<br>SR295<br>SR785 [a)] |
| Deformed steel bar | SD295<br>SD345<br>SD390<br>SD490<br>SD590A<br>SD590B<br>SD685A<br>SD685B<br>SD685R [a)]<br>SD785R [a)] |
| Note [a)] Mainly used for shear reinforcement. | |

## 5 Manufacturing method

The round steel bars and deformed steel bars shall be manufactured by hot rolling from ingots (including semi-finished products produced by continuous casting) and shall be supplied as rolled.

## 6 Chemical composition

### 6.1 Heat analysis values

The round steel bars and deformed steel bars shall be tested in accordance with **10.1**, and the heat analysis values shall be as given in Table 2.

### 6.2 Carbon equivalent

The value of carbon equivalent shall be determined by the following formula using the heat analysis values obtained in **10.1** and shall be as given in Table 2.

$$Ceq = C + \frac{Mn}{6} + \frac{Si}{24} + \frac{Ni}{40} + \frac{Cr}{5} + \frac{Mo}{4} + \frac{V}{14}$$

where, $Ceq$ : carbon equivalent (%)

**Table 2 Chemical composition** [a)]

Unit: %

| Symbol of grade | | Heat analysis value | | | | | Carbon equivalent |
|---|---|---|---|---|---|---|---|
| | | C | Si | Mn | P | S | |
| Round steel bar | SR235 | — | — | — | 0.050 max. | 0.050 max. | — |
| | SR295 | — | — | — | 0.050 max. | 0.050 max. | — |
| | SR785 | 0.45 max. | 1.00 max. | 2.00 max. | 0.040 max. | 0.040 max. | 0.80 max. |
| Deformed steel bar | SD295 | 0.27 max. | 0.55 max. | 1.50 max. | 0.050 max. | 0.050 max. | — |
| | SD345 | 0.27 max. | 0.55 max. | 1.60 max. | 0.040 max. | 0.040 max. | 0.60 max. |
| | SD390 | 0.29 max. | 0.55 max. | 1.80 max. | 0.040 max. | 0.040 max. | 0.65 max. |
| | SD490 | 0.32 max. | 0.55 max. | 1.80 max. | 0.040 max. | 0.040 max. | 0.70 max. |
| | SD590A | 0.45 max. | 1.00 max. | 2.00 max. | 0.040 max. | 0.040 max. | 0.80 max. |
| | SD590B | 0.45 max. | 1.00 max. | 2.00 max. | 0.040 max. | 0.040 max. | 0.80 max. |
| | SD685A | 0.50 max. | 2.00 max. | 2.00 max. | 0.035 max. | 0.035 max. | 0.85 max. |
| | SD685B | 0.50 max. | 2.00 max. | 2.00 max. | 0.035 max. | 0.035 max. | 0.85 max. |
| | SD685R | 0.40 max. | 1.00 max. | 1.50 max. | 0.040 max. | 0.040 max. | 0.80 max. |
| | SD785R | 0.45 max. | 1.00 max. | 2.00 max. | 0.040 max. | 0.040 max. | 0.80 max. |

Note [a)] Alloy elements not listed in this table and elements for which "—" is given in this table may be added where necessary.

## 7 Mechanical properties

The round steel bars and deformed steel bars shall be tested in accordance with **10.2**, and the yield strength or proof strength, tensile strength, yield ratio, elongation and bendability shall be as given in Table 3. For SD590A, SD590B, SD685A and SD685B, the degree of strain of yield shelf shall be in accordance with Note [c)] to Table 3.

In the test of bendability, the bend test piece shall be free from cracks on the outer surface.

**Table 3 Mechanical properties**

| Symbol of grade | | Yield strength or proof strength N/mm² | Tensile strength N/mm² | Yield ratio % | Tensile test piece | Elongation [a)] % | Bendability | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | Bending angle | Inside radius |
| Round steel bar | SR235 | 235 min. | 380 to 520 | — | No. 2 | 20 min. | 180° | 1.5 times the nominal diameter |
| | | | | | No. 14A | 22 min. | | |
| | SR295 | 295 min. | 440 to 600 | — | No. 2 | 18 min. | 180° | Outside diameter 16 mm or under: 1.5 times the nominal diameter |
| | | | | | No. 14A | 19 min. | | Outside diameter over 16 mm: 2 times the nominal diameter |
| | SR785 | 785 min. | 924 min. | — | Test piece equivalent to No. 2<br>Test piece equivalent to No. 14A | 8 min. | 90° [b)] | 1.5 times the nominal diameter [b)] |

**Table 3 (continued)**

| Symbol of grade | | Yield strength or proof strength N/mm² | Tensile strength N/mm² | Yield ratio % | Tensile test piece | Elongation [a] % | Bendability | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | Bending angle | Inside radius |
| Deformed steel bar | SD295 | 295 min. | 440 to 600 | — | Test piece equivalent to No. 2 | 16 min. | 180° | Designation D16 or under: 1.5 times the nominal diameter |
| | | | | | Test piece equivalent to No. 14A | 17 min. | | Designation over D16: 2 times the nominal diameter |
| | SD345 | 345 to 440 | 490 min. | 80 max. | Test piece equivalent to No. 2 | 18 min. | 180° | Designation D16 or under: 1.5 times the nominal diameter |
| | | | | | | | | Designation over D16 Designation D41 or under: 2 times the nominal diameter |
| | | | | | Test piece equivalent to No. 14A | 19 min. | | Designation D51: 2.5 times the nominal diameter |
| | SD390 | 390 to 510 | 560 min. | 80 max. | Test piece equivalent to No. 2 | 16 min. | 180° | 2.5 times the nominal diameter |
| | | | | | Test piece equivalent to No. 14A | 17 min. | | |
| | SD490 | 490 to 625 | 620 min. | 80 max. | Test piece equivalent to No. 2 | 12 min. | 90° | 2 times the nominal diameter |
| | | | | | Test piece equivalent to No. 14A | 13 min. | | |
| | SD590A | 590 to 679 [c] | 695 min. | 85 max. | Test piece equivalent to No. 2 Test piece equivalent to No. 14A | 10 min. | 90° | 2 times the nominal diameter |
| | SD590B | 590 to 650 [c] | 738 min. | 80 max. | Test piece equivalent to No. 2 Test piece equivalent to No. 14A | 10 min. | 90° | 2 times the nominal diameter |
| | SD685A | 685 to 785 [c] | 806 min. | 85 max. | Test piece equivalent to No. 2 Test piece equivalent to No. 14A | 10 min. | 90° | 2 times the nominal diameter |
| | SD685B | 685 to 755 [c] | 857 min. | 80 max. | Test piece equivalent to No. 2 Test piece equivalent to No. 14A | 10 min. | 90° | 2 times the nominal diameter |
| | SD685R | 685 to 890 | 806 min. | — | Test piece equivalent to No. 2 Test piece equivalent to No. 14A | 8 min. | 90° [b] | 1.5 times the nominal diameter [b] |
| | SD785R | 785 min. | 924 min. | — | Test piece equivalent to No. 2 Test piece equivalent to No. 14A | 8 min. | 90° [b] | 1.5 times the nominal diameter [b] |

**Table 3 (concluded)**

NOTE 1 N/mm² = 1 MPa

Notes a) For the deformed steel bar of which the dimensions exceeds designation D32, 2 shall be deducted from the elongation value in this table for each increase of 3 in the designation. The subtraction shall not exceed 4.

b) By agreement between the purchaser and the manufacturer, values for bending angle and inside radius may be changed.

c) The degree of strain of yield shelf shall be 1.4 % or more.

## 8 Shape, dimensions, masses and tolerances

### 8.1 Shape, dimensions, masses and tolerances of round steel bars

The shape, dimensions, masses and tolerances of round steel bars shall be in accordance with **JIS G 3191**. The standard lengths and length tolerances shall be as given in Tables 6 and 7. Standard diameter of round steel bars shall be in the range from 5.5 mm to 50 mm in Table 1 of **JIS G 3191**.

### 8.2 Shape, dimensions, masses and tolerances of deformed steel bars

#### 8.2.1 General shape

The shape shall be as follows.

a) The deformed steel bar shall have protrusions on the surface.

NOTE Protrusions provided continuously along the bar axis are referred to as ribs, and protrusions given in any other direction as knots.

b) The knots shall be spaced along the entire length of the deformed steel bars at approximately uniform intervals, and shall have the identical shape and dimensions. When characters or the like are embossed, the knots at these locations may be omitted.

c) The root parts of the knots of deformed steel bar having designation D16 or over shall have a shape with less stress concentration.

#### 8.2.2 Shape, dimensions, masses and tolerances

The shape, dimensions, masses, and tolerances of deformed steel bars shall be as follows.

a) The dimensions of deformed steel bars shall be represented by the designations, and the corresponding dimensions, unit masses and permissible limits of knots shall be as given in Table 4.

For measurements of height of knots, and interval and clearance between knots, an example is shown in Figure 2. For thread knot reinforcing steel bars, the example provided in Figure 3 shall be referred to.

When SD685R and SD785R are used for shear reinforcement, permissible limits of knots of D10, D13, D16 in Table 4 may be changed by agreement between the purchaser and the manufacturer.

**Table 4 Dimensions, unit masses, and permissible limits of knots of deformed steel bars**

| Designation | Nominal diameter ($d$) mm | Nominal perimeter [a] ($l$) mm | Nominal cross sectional area [a] ($S$) $mm^2$ | Unit mass [a] ($w$) kg/m | Permissible limits of knot | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | Maximum value of mean interval between knots [b] mm | Height of knot [c] | | Maximum value of sum of clearances between knots [d] mm | Minimum value of angle between knot and bar axis |
| | | | | | | Minimum mm | Maximum mm | | |
| D4 | 4.23 | 13.3 | 14.05 | 0.110 | 3.0 | 0.2 | 0.4 | 3.3 | 45° |
| D5 | 5.29 | 16.6 | 21.98 | 0.173 | 3.7 | 0.2 | 0.4 | 4.3 | |
| D6 | 6.35 | 20.0 | 31.67 | 0.249 | 4.4 | 0.3 | 0.6 | 5.0 | |
| D8 | 7.94 | 24.9 | 49.51 | 0.389 | 5.6 | 0.3 | 0.6 | 6.3 | |
| D10 | 9.53 | 29.9 | 71.33 | 0.560 | 6.7 | 0.4 | 0.8 | 7.5 | |
| D13 | 12.7 | 39.9 | 126.7 | 0.995 | 8.9 | 0.5 | 1.0 | 10.0 | |
| D16 | 15.9 | 50.0 | 198.6 | 1.56 | 11.1 | 0.7 | 1.4 | 12.5 | |
| D19 | 19.1 | 60.0 | 286.5 | 2.25 | 13.4 | 1.0 | 2.0 | 15.0 | |
| D22 | 22.2 | 69.8 | 387.1 | 3.04 | 15.5 | 1.1 | 2.2 | 17.5 | |
| D25 | 25.4 | 79.8 | 506.7 | 3.98 | 17.8 | 1.3 | 2.6 | 20.0 | |
| D29 | 28.6 | 89.9 | 642.4 | 5.04 | 20.0 | 1.4 | 2.8 | 22.5 | |
| D32 | 31.8 | 99.9 | 794.2 | 6.23 | 22.3 | 1.6 | 3.2 | 25.0 | |
| D35 | 34.9 | 109.7 | 956.6 | 7.51 | 24.4 | 1.7 | 3.4 | 27.5 | |
| D38 | 38.1 | 119.7 | 1 140 | 8.95 | 26.7 | 1.9 | 3.8 | 30.0 | |
| D41 | 41.3 | 129.8 | 1 340 | 10.5 | 28.9 | 2.1 | 4.2 | 32.5 | |
| D51 | 50.8 | 159.6 | 2 027 | 15.9 | 35.6 | 2.5 | 5.0 | 40.0 | |

The expression of results of the calculations given in Notes [a] to [d] below shall be in accordance with Rule A of **JIS Z 8401**.

Notes [a] Nominal cross sectional area, nominal perimeter and unit mass are calculated by the following formulae using the value of nominal diameter ($d$).

The nominal cross sectional area ($S$) is expressed to four significant figures, the nominal perimeter ($l$) to one decimal place, and the unit mass to three significant figures assuming 1 $cm^3$ of steel as 7.85 g.

Nominal perimeter ($l$): $l = 3.142 \times d$

Nominal cross sectional area ($S$): $S = 0.785\,4 \times d^2$

Unit mass ($w$): $w = 7.85 \times 10^{-3} \times S$

[b] The maximum value of mean interval between knots is 70 % of the nominal diameter ($d$), and expressed to one decimal place.

[c] The height of a knot shall be as given in Table 5 and expressed to one decimal place.

[d] The maximum value of sum of clearances between knots in the circumferential direction (see Figures 2 and 3) is 25 % of the nominal perimeter ($l$) in millimetres, and expressed to one decimal place. The clearance between knots is considered as the width of absent part of knots if the rib and the knots are separate or if the rib is not provided, and as the width of rib if the rib and the knots are continuous.

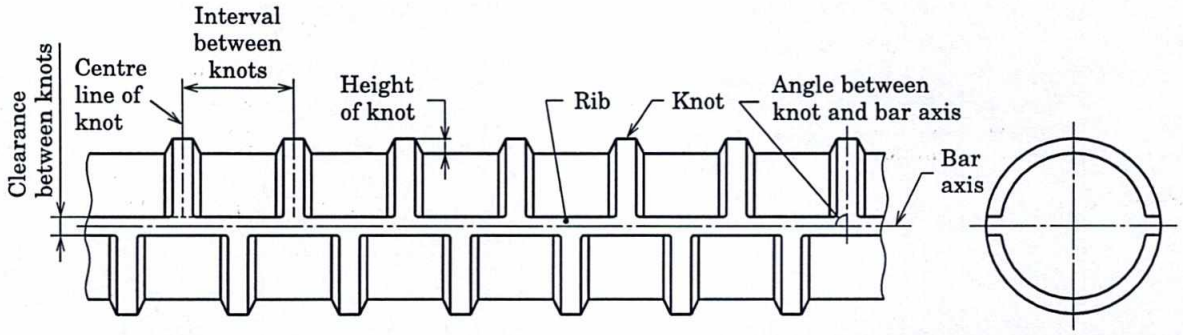



**Figure 2 Example of shape and measurement position of deformed steel bars**

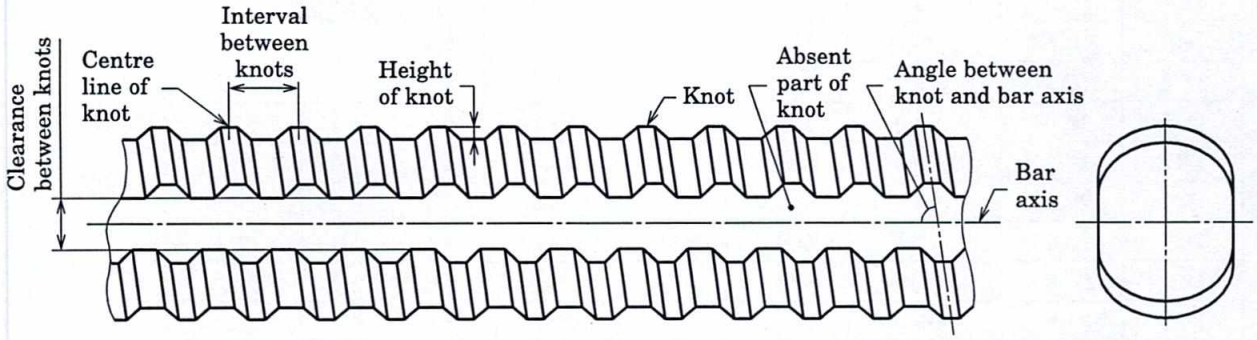



**Figure 3 Example of shape and measurement position of thread knot reinforcing steel bar**

**Table 5 Height of knot of deformed steel bars**

| Designation | Height of knot | |
|---|---|---|
| | Minimum | Maximum |
| D13 or under | 4.0 % of nominal diameter | 2 times the minimum value |
| Over D13 to and excl. D19 | 4.5 % of nominal diameter | 2 times the minimum value |
| D19 or over | 5.0 % of nominal diameter | 2 times the minimum value |

b) The standard lengths of deformed steel bars shall be as given in Table 6. This does not apply to bars in coil form.

**Table 6 Standard lengths**

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 |

c) The tolerances on length of deformed steel bars shall be as given in Table 7. This does not apply to bars in coil form.

**Table 7 Tolerances on length**

| Length | Tolerance |
|---|---|
| 7 m or under | +40 mm<br>0 |
| Over 7 m | Add 5 mm to the plus tolerance given above for each increment of 1 m or its fraction in length. The maximum value shall be 120 mm. |
| The purchaser may specify other tolerances than those given in this table. | |

d) The tolerances on difference in mass of one piece of deformed steel bar shall be as given in Table 8.

**Table 8 Tolerances on difference in mass of one piece of deformed steel bar**

| Designation | Tolerance | Remarks |
|---|---|---|
| Less than D10 | + Not specified<br>− 8 % | The methods for sampling and calculation of difference in mass shall be in accordance with **10.3.2 b) 1)**. |
| D10 or over to and excl. D16 | ± 6 % | |
| D16 or over to and excl. D29 | ± 5 % | |
| D29 or over | ± 4 % | |

e) The tolerances on difference in mass of one lot of deformed steel bars shall be as given in Table 9. These tolerances shall be applied only when requested by the purchaser beforehand.

**Table 9 Tolerances on difference in mass of one lot of deformed steel bars**

| Designation | Tolerance | Remarks |
|---|---|---|
| Less than D10 | ± 7 % | The methods for sampling one lot of deformed steel bars and for calculation of difference in mass shall be in accordance with **10.3.2 b) 2)**. |
| D10 or over to and excl. D16 | ± 5 % | |
| D16 or over to and excl. D29 | ± 4 % | |
| D29 or over | ± 3.5 % | |

## 9 Appearance

The round steel bars and deformed steel bars shall be free from defects detrimental to use. The coiled steel products may contain some defects because the inspection usually does not afford the manufacturer the opportunity to readily detect and remove defective portions over the entire length. Treatment of any defects detected in coils that are found to be detrimental to use, if required, shall be as agreed between the purchaser and the manufacturer.

## 10 Tests

### 10.1 Chemical analysis

The chemical analysis shall be as follows.

a) General requirements for chemical analysis and sampling method for heat analysis shall be in accordance with Clause **8** of **JIS G 0404**.

b) The analytical method shall be in accordance with **JIS G 0320**.

### 10.2 Mechanical tests

#### 10.2.1 General requirements for tests

General requirements for mechanical test shall be in accordance with Clause **7** and Clause **9** of **JIS G 0404**. In this case, the sampling method shall be in accordance with Class A.

The test pieces shall be as follows.

a) Take one test piece each for tensile test and bend test from each lot of the same heat and several sizes where the difference of diameter or nominal diameter among them falls less than 10 mm. If one lot exceeds 50 t in mass, two test pieces each shall be taken.

b) The test pieces shall be as-manufactured, i.e. shall not be given any machining treatment.

#### 10.2.2 Tensile test

The tensile test shall be as follows.

a) The test piece for tensile test shall be Test piece No. 2 (for the deformed steel bar, the applicable size shall be under designation D25) or Test piece No. 14A (for the deformed steel bar, the applicable size shall be designation D25 or over) that are specified in **JIS Z 2241**, or equivalent to these. The gauge length and length of parallel portion of the deformed steel bar shall be determined according to the nominal diameter. Equivalent test piece refers to those of which the parallel portion has a knot and/or rib.

b) The tensile test method shall be in accordance with **JIS Z 2241**. Where the yield strength or proof strength, and tensile strength of deformed steel bars are to be calculated, the nominal cross sectional area specified in Table 4 shall be used for the calculation.

#### 10.2.3 Bend test

The bend test shall be as follows.

a) The bend test piece shall be Test piece No. 2 specified in **JIS Z 2248** or equivalent to this. Equivalent test piece refers to those of which the parallel portion has a knot and/or rib.

b) The bend test method shall be in accordance with **JIS Z 2248**.

### 10.2.4 Rebend test

For deformed steel bars of designation D32 or under in size of SD295 and SD345, the purchaser may designate the rebend test instead of the bend test if specially required. In this case, the sampling method of test pieces, test method, acceptance criteria, or any other test requirements shall be as agreed between the purchaser and the manufacturer beforehand.

NOTE The rebend test is used to verify the ageing properties of the bent steel bars. Normally, after the test piece bent at the specified angle is heated and aged artificially, it is rebent at the specified angle and examined for presence of cracks on the surface.

## 10.3 Measurement of shape, dimensions and masses

### 10.3.1 Sampling for measurement of shape, dimensions and masses of round steel bars

Take one sample of 0.5 m or over in length from each lot of products rolled to the same shape and dimensions within an identical roll chance. In the case of coil form, it shall be subjected to tests after being straightened at an ordinary temperature.

### 10.3.2 Sampling for measurement of shape, dimensions and masses of deformed steel bars and measuring method

The sampling for measurement of shape, dimensions and masses of deformed steel bars and the measuring method shall be as follows.

a) The method for measurement of shape and dimensions of knots of deformed steel bars and the sampling method shall be as follows.

1) Take one sample of 0.5 m or over in length from each lot of products rolled to the same shape and dimensions within an identical roll chance. In the case of coil form, it shall be subjected to tests after being straightened at an ordinary temperature.

2) The angle between the knots and the axis of deformed steel bar shall be measured on a development [2)] of the surface of deformed steel bar. For bars with the knots forming an angle of 90° with the bar axis, the measurement on a development figure may be omitted.

Note [2)] The development figure can be obtained, for example, by rolling a deformed steel bar over oil clay.

3) The mean interval between knots shall be obtained by averaging the measurements of the intervals of 10 consecutive knots. The interval between knots shall be measured on the centre line of knots, or length corresponding to this shall be measured on intersection points of the rib and knots.

4) 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.

5) 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[2)] of the surface of the deformed steel bar. In the case where these distances are not uniform, the mean value shall be obtained by measuring the distance covering the 10 consecutive knots.

b) As to measurement of mass for the deformed steel bar, the sampling method and calculation method of difference in mass shall be as follows.

1) For measurement of mass of one piece of bar, the sampling method shall be as specified in **10.3.2 a) 1)**. As to calculation method of difference in mass in this case, it shall be expressed in percentage of quotient of the difference between the calculated mass, that is a product of the unit mass given in Table 4 and the length, and measured actual mass divided by the said calculated mass.

2) For measurement of mass of one lot of bars, take one set of samples of 1 t or more in mass from each lot of products rolled to the same shape and dimensions within an identical roll chance. When 1 t of samples taken consists of less than 10 pieces, take at least 10 pieces to make one set. As to calculation method of difference in mass in this case, it shall be expressed in percentage of quotient of the difference between the calculated mass, that is a product of the unit mass given in Table 4 and the ordered length and the number of pieces of one set, and measured actual mass divided by the said calculated mass.

## 11 Inspection

### 11.1 Inspection

Inspection shall be as follows.

a) The general requirements of the inspections shall be as specified in **JIS G 0404**.

b) The chemical composition shall conform to the requirements in Clause **6**.

c) The mechanical properties shall conform to the requirements in Clause **7**.

d) The shape, dimensions and masses shall conform to the requirements in Clause **8**.

e) The appearance shall conform to the requirements in Clause **9**.

### 11.2 Reinspection

The reinspection shall be as follows.

a) Round steel bars and deformed steel bars having failed in the tensile test and the bend test may be subjected to the retest according to **9.8** of **JIS G 0404** for further acceptance judgement.

b) When the mass of one piece of deformed steel bar obtained by sampling fails to conform to the requirements in **8.2.2 d)**, take two other samples for measurement. When both samples conform to the requirement, the lot is considered to have passed the inspection.

## 12 Marking

### 12.1 Marking method

The marking on round steel bars and deformed steel bars shall be in accordance with **12.2**. When round steel bars and deformed steel bars are bundled or when round steel bars and deformed steel bars in coil form are bundled, the marking shall be in accordance with **12.3**. When the size of deformed steel bars is designation D8 or under, indication of the rolling mark in Table 10 may be omitted.

### 12.2 Marking on each piece or coil

a) For each piece or coil of round steel bars and deformed steel bars, identification of grade shall be made by rolling marks and/or by colouring as given in Table 10.

Identification of grade shall be made by rolling marks for deformed steel bars excluding SD295, SD685R, SD785R and by both rolling marks and colouring for SD590A, SD590B, SD685A, SD685B. SD345, SD390, SD490 requires rolling marks only and markings by colouring is unnecessary. Deformed steel bars of designation D8 or under in size may be given markings by colouring only.

b) The deformed steel bars shall be marked by rolling to denote the manufacturer's name or its abbreviation. The deformed steel bars of designation D8 or under in size and those of which manufacturer's name is self-evident due to the shape of the deformed surface, these indications may be omitted.

**Table 10 Marking method for grade identification**

| Symbol of grade | Marking method for grade identification | |
|---|---|---|
| | Marking by rolling mark | Marking by colouring [a] |
| SR235 | Not applied | Red (on one side section) |
| SR295 | | White (on one side section) |
| SR785 | | Not applied |
| SD295 | Without rolling mark | Not applied |
| SD345 | One protrusion ( • ) | Yellow (on one side section) |
| SD390 | Two protrusions ( • • ) | Green (on one side section) |
| SD490 | Three protrusions ( • • • ) | Blue (on one side section) |
| SD590A | Four protrusions ( • • • • ) | Light blue (on one side section) [b) c)] |
| SD590B | Four protrusions ( • • • • ) | Pink (on one side section) [b) c)] |
| SD685A | Five protrusions ( • • • • • ) | Red (on one side section) [b) c)] |
| SD685B | Five protrusions ( • • • • • ) | Black (on one side section) [b) c)] |
| SD685R | Without rolling mark | Ocher (on one side section) [b) c)] |
| SD785R | Without rolling mark | Purple (on one side section) [b) c)] |

Notes [a] This does not apply to bars in coil form.

[b] The colouring on section may be given in different locations upon agreement between the purchaser and the manufacturer.

[c] When indications by colouring cannot be provided due to restrictions on equipment, etc., grades can be identified by the indication of rolling marks upon agreement between the purchaser and the manufacturer.

### 12.3 Marking on each bundle

When coils, and round steel bars and deformed steel bars are bundled, the following items shall be marked on each bundle by a suitable means such as labelling.

By agreement between the purchaser and the manufacturer, part of the items may be omitted as far as the product can still be identified.

a) Symbol of grade

b) Heat number or other manufacture (inspection) number

c) Diameter, nominal diameter or designation

d) Manufacturer's name or its abbreviation

## 13 Report

The manufacturer shall submit an inspection document to the purchaser when so requested by the purchaser. The report shall be in accordance with Clause **13** of **JIS G 0404**. Unless otherwise specified in the order, the type of the inspection document to be submitted shall be in accordance with **5.1** of **JIS G 0415**.

For the chemical composition, the content rate of alloy elements included in the calculation of carbon equivalent shall be reported. If Note [a)] to Table 2 is applied, the content rate of alloy element(s) added shall be included in the test results table.

# Annex JA (informative)
# Comparison table between JIS and corresponding International Standards

| **JIS G 3112**:2020 *Steel bars for concrete reinforcement* | **ISO 6935-1**:2007 *Steel for the reinforcement of concrete—Part 1: Plain bars*<br>**ISO 6935-2**:2019 *Steel for the reinforcement of concrete—Part 2: Ribbed bars* |
|---|---|

| (I) Requirements in **JIS** | | (II) International Standard number | (III) Requirements in International Standard | | (IV) Classification and details of technical deviation between **JIS** and the International Standard by clause | | (V) Justification for the technical deviation and future measures |
|---|---|---|---|---|---|---|---|
| No. and title of clause | Content | | No. of clause | Content | Classification by clause | Detail of technical deviation | |
| 1 Scope | Round steel bars and deformed steel bars manufactured by hot rolling to be used as reinforcement in concrete. | **ISO 6935-1**<br>**ISO 6935-2** | 1 | Round steel bars and deformed steel bars manufactured by hot rolling to be used as reinforcement in concrete. Deformed steel bars manufactured by cold working are also included. | Alteration | **JIS** covers products finished by hot-working only.<br>**ISO** also covers deformed steel bars manufactured by cold working. | Since in **ISO** cold worked products are allowed as deformed bars, TS/YP is 1.1 or over which is lower than TS/YP of hot rolled products and different from the design criterion in **JIS**. The grades of **JIS** used in the earthquake-prone country like Japan have been proposed to be added to **ISO** and accepted. Therefore, **ISO** covers products specified in **JIS**, those having low yield ratio specified in **ASTM** and those having high yield ratio specified in **EN**. |
| 2 Normative references | | | | | | | |

| (I) Requirements in **JIS** | | (II) International Standard number | (III) Requirements in International Standard | | (IV) Classification and details of technical deviation between **JIS** and the International Standard by clause | | (V) Justification for the technical deviation and future measures |
|---|---|---|---|---|---|---|---|
| No. and title of clause | Content | | No. of clause | Content | Classification by clause | Detail of technical deviation | |
| 3 Terms and definitions | Definition of terms | **ISO 6935-1**<br>**ISO 6935-2** | 4 | Definition of terms | Addition | Add "degree of strain of yield shelf" to **JIS**. | Degree of strain of yield shelf is unique to Japan. |
| 4 Symbol of grade | 3 grades of round steel bars.<br>10 grades of deformed steel bars. | **ISO 6935-1** | 1, 7 | 10 grades of plain bars (those having three different yield strength are classified into 4 grades A to D according to ductility class). | Deletion | While in **JIS** 3 grades of round steel bars are specified, in **ISO** they are classified into 10 grades according to ductility class A to D (expressed in reciprocal of yield ratio). | The proposal of addition of high TS/YP products of **JIS** to **ISO** has been accepted; as a result, the ductility class is divided into 4 grades A to D and in Class D (yield ratio of 0.80 max.) the grades of **JIS G 3112** and **ASTM A 706** have been added. |
| | | **ISO 6935-2** | 1, 8 | 33 grades of ribbed bars (those having 8 different yield strength are classified into 4 grades A to D according to ductility class). | | While in **JIS** 10 grades of deformed steel bars are specified, in **ISO** they are classified into 33 grades according to 4 ductility classes. | |
| 5 Manufacturing method | The round and deformed steel bars are produced by hot rolling from steel ingots. | **ISO 6935-1**<br>**ISO 6935-2** | 1 | Described in scope. | Alteration | **ISO** covers deformed steel bars produced by cold working. | See 1 Scope. |

| (I) Requirements in **JIS** | | (II) International Standard number | (III) Requirements in International Standard | | (IV) Classification and details of technical deviation between **JIS** and the International Standard by clause | | (V) Justification for the technical deviation and future measures |
|---|---|---|---|---|---|---|---|
| No. and title of clause | Content | | No. of clause | Content | Classification by clause | Detail of technical deviation | |
| 6 Chemical composition | Depending on the type of bars, P and S only, 5 elements or 5 elements + carbon equivalent are specified. | **ISO 6935-1**<br>**ISO 6935-2** | 6<br>7 | In Ductility class D which ensures the weldability, 5 elements + N + carbon equivalent (for welding) are specified for round and deformed steel bars. For other grades P and S are specified. | Deletion | The chemical compositions are almost the same. | The chemical composition for grade of Ductility class D is the same as the one specified in **JIS G 3112** and **ASTM A 706**. |
| | | | | | | However, for deformed steel bars of higher strength, the maximum value for N is specified in **ISO**. | The stipulation of the maximum value for N is the countermeasure against ageing. In Japan the actual value for N is within the maximum value in **ISO**. |
| | | | | | Alteration | For carbon equivalent, CEV is used in **ISO** and *Ceq* is used in **JIS**. | Different formulae are applied among different countries. |
| 7 Mechanical properties | Tensile properties (tensile strength, yield strength or proof strength, and elongation), yield ratio, degree of strain of yield shelf and bendability are specified. | **ISO 6935-1**<br>**ISO 6935-2** | 7<br>8 | Round steel bars: Tensile test, bend test<br>Deformed steel bars: Tensile test, bend test + rebend test (higher strength products) + (fatigue test if required) | Alteration | In **ISO** for deformed steel bars of yield strength 400 N/mm$^2$ or more the rebend test is carried out. In **JIS** for deformed steel bars of SD295 and SD345 of size designation D32 or under the rebend test may be designated by the purchaser instead of the bend test. | In **JIS** ageing is not a big issue. As shown in the left column the rebend test may be carried out corresponding to ageing. Therefore, **JIS** almost corresponds to **ISO**. |
| | | | | | | For evaluation of resistance to earthquakes, **JIS** specifies the degree of strain of yield shelf in addition to yield ratio for bars of yield strength 590 N/mm$^2$ or more. | Degree of strain of yield shelf is unique to Japan. |

| (I) Requirements in **JIS** | | (II) International Standard number | (III) Requirements in International Standard | | (IV) Classification and details of technical deviation between **JIS** and the International Standard by clause | | (V) Justification for the technical deviation and future measures |
|---|---|---|---|---|---|---|---|
| No. and title of clause | Content | | No. of clause | Content | Classification by clause | Detail of technical deviation | |
| 8 Shape, dimensions, masses and tolerances | 8.1 Shape, dimensions, masses and tolerances of round steel bars<br>8.2 Shape, dimensions, masses and tolerances of deformed steel bars (including ribbed bars) | **ISO 6935-1**<br><br>**ISO 6935-2** | 5<br><br>5<br><br>6 | Round steel bars: Shape, dimensions, masses and tolerances<br>Deformed steel bars: Shape, dimensions, masses and tolerances<br>Deformed steel bars: Ribbed bars | Alteration | The specified dimensions (mm) are as follows.<br>**JIS** / **ISO**<br>Round bars: 5.5 to 50 / 6 to 22<br>Deformed steel bars: 4.23 to 50.8 / 6 to 50 | Shapes of rib of deformed steel bar are different between **JIS** and **ISO**. It is difficult to change the shape of rib in **JIS** to correspond to **ISO**. The addition proposals of "Requirements for rib parameters may be specified by agreement between the manufacturer and purchaser." and the requirements for mean interval between knots of thread knot reinforcing bars have been submitted to **ISO** and both accepted. |
| 9 Appearance | Steel bars shall be free from defects that are detrimental to use. | — | — | — | Addition | **JIS** specifies requirements for appearance only. | The proposal of addition of requirements for appearance will be submitted to **ISO**. |
| 10 Tests | 10.1 Chemical analysis<br>10.2 Mechanical tests<br>10.3 Measurement of shape, dimensions and masses | **ISO 6935-1**<br><br><br><br>**ISO 6935-2** | 8<br>11.3<br><br><br>9<br>12.3 | Mechanical tests<br>Evaluation of characteristic values — Chemical composition<br>Mechanical tests<br>Evaluation of characteristic values — Chemical composition | Alteration | For tensile test, yield strengths are the same but tensile strengths are different between **JIS** and **ISO**.<br>The bending radius for bend test are different between **JIS** and **ISO**. | Since Ductility class D in **ISO** is specified based on **JIS**, specified values of tensile test are the same as those in **JIS**.<br>For the bend test, test conditions are almost the same. |

| (I) Requirements in **JIS** | | (II) International Standard number | (III) Requirements in International Standard | | (IV) Classification and details of technical deviation between **JIS** and the International Standard by clause | | (V) Justification for the technical deviation and future measures |
|---|---|---|---|---|---|---|---|
| No. and title of clause | Content | | No. of clause | Content | Classification by clause | Detail of technical deviation | |
| 11 Inspection | Inspection and reinspection | **ISO 6935-1** | 10 | Marking | Deletion | In **ISO** the certification testing method is also specified. | Conditions for inspection are almost the same. |
| | | | 11 | Certification and inspection | | | |
| | | **ISO 6935-2** | 11 | Marking | Alteration | **JIS** cites **JIS G 0404** for inspection and reinspection. | |
| | | | 12 | Certification and inspection | | | |
| 12 Marking | Requirements for marking | **ISO 6935-1**<br>**ISO 6935-2** | 11 | Marking | Alteration | **JIS** specifies requirements for marking by grade and size. | **ISO** provides Annex A to describe examples in some countries for different business transactions. |

Overall degree of correspondence between **JIS** and International Standard(s) (**ISO 6935-1**:2007, **ISO 6935-2**:2019): MOD

NOTE 1 Symbols in sub-columns of classification by clause in the above table indicate as follows:

— Deletion: Deletes the specification item(s) or content(s) of International Standard.

— Addition: Adds the specification item(s) or content(s) which are not included in International Standard.

— Alteration: Alters the specification content(s) which are included in International Standard.

NOTE 2 Symbol in column of overall degree of correspondence between **JIS** and International Standard(s) in the above table indicates as follows:

— MOD: Modifies International Standard(s).

Errata for JIS (English edition) can be downloaded in PDF format at Webdesk (purchase information page) of our website (https://www.jsa.or.jp/).

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