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(JISF)

**Low-alloyed steels for machine  
structural use**

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ICS 77.140.10; 77.140.20; 77.140.70

**Reference number : JIS G 4053 : 2003 (E)**

## Foreword

This translation has been made based on the original Japanese Industrial Standard established by the Minister of Economy, Trade and Industry through deliberations at the Japanese Industrial Standards Committee according to the proposal of establishing a Japanese Industrial Standard from The Japan Iron and Steel Federation (JISF), with a draft of Industrial Standard based on the provision of Article 12 Clause 1 of the Industrial Standardization Law.

This revision has been made based on **ISO 683-1 : 1987 Heat-treatable steels, alloy steels and free cutting steels—Part 1 Direct-hardening unalloyed and low-alloyed wrought steel in form of different black products** and **ISO 683-11 : 1987 Heat-treatable steels, alloy steels and free cutting steels—Part 11 Wrought case-hardening steels** for the purposes of making it easier to compare this Standard with International Standard; to prepare Japanese Industrial Standard conforming with International Standard; and to propose a draft of an International Standard which is based on Japanese Industrial Standard, reviewing **JIS G 4102 : 1979**, **JIS G 4103 : 1979**, **JIS G 4104 : 1979**, **JIS G 4105 : 1979** and **JIS G 4106 : 1979**, and integrating these five Japanese Industrial Standards into one Standard. In this revision, a part of the former specification of **JIS** of chemical composition specification and so on are revised to match the **ISO** Standards mentioned above at the level of “MOD” in **ISO/IEC Guide 21**.

Consequently, **JIS G 4102 : 1979**, **JIS G 4103 : 1979**, **JIS G 4104 : 1979**, **JIS G 4105 : 1979** and **JIS G 4106 : 1979** are replaced with **JIS G 4053 : 2003**.

Attention is drawn to the possibility that some parts of this Standard may conflict with a patent right, application for a patent after opening to the public, utility model right or application for registration of utility model after opening to the public which have technical properties. The relevant Minister and the Japanese Industrial Standards Committee are not responsible for identifying the patent right, application for a patent after opening to the public, utility model right or application for registration of utility model after opening to the public which have the said technical properties.

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In the event of any doubts arising as to the contents,  
the original JIS is to be the final authority.

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## Low-alloyed steels for machine structural use

**Introduction** This Japanese Industrial Standard has been prepared based on the first edition of **ISO 683-1** *Heat-treatable steels, alloy steels and free-cutting steels—Part 1 Direct-hardening unalloyed and low-alloyed wrought steel in form of different black products* and **ISO 683-11** *Heat-treatable steels, alloy steels and free-cutting steels—Part 11 Wrought case-hardening steels*, published in 1987, modifying some of the technical contents, and has been integrated with the following standards:

**JIS G 4102** *Nickel chromium steels*, **JIS G 4103** *Nickel chromium molybdenum steels*, **JIS G 4104** *Chromium steels*, **JIS G 4105** *Chromium molybdenum steels* and **JIS G 4106** *Manganese steels and manganese chromium steels for machine structural use*.

The portions with continuous sidelines in this Standard show the matters the International Standards. The table of modifications is shown in Annex (informative) with explanations.

**1 Scope** This Standard specifies alloy steels mainly used in machine structural steels, which are manufactured by hot forming, such as hot rolling and hot forging, usually consequently formed, such as by forging, cutting, cold-drawing, and so on and heat treated by quenching/tempering, normalizing, carburizing/quenching, and so on, hereinafter referred to as “steel”.

**Remarks :** The International Standards corresponding to this Standard are as follows:

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**.

ISO 683-1 : 1987 *Heat-treatable steels, alloy steels and free-cutting steels—Part 1 Direct-hardening unalloyed and low-alloyed wrought steel in form of different black products* (MOD)

ISO 683-11 : 1987 *Heat-treatable steels, alloy steels and free-cutting steels—Part 11 Wrought case-hardening steels* (MOD)

**2 Normative references** The standards listed in Attached Table 1 contain provisions which, through reference in this Standard, constitute provisions of this Standard. The most recent editions of the standards (including amendments) shall be applied.

**3 Classification and symbols** Steel shall be classified into 39 classifications, and the classification symbols shall be as given in Table 1.

**Table 1 Classification and symbol**

| Symbol of classification | Grouping                 | Symbol of classification | Grouping                  | Symbol of classification | Grouping                         | Symbol of classification | Grouping                         |
|--------------------------|--------------------------|--------------------------|---------------------------|--------------------------|----------------------------------|--------------------------|----------------------------------|
| SMn 420                  | Manganese steel          | SCr 445                  | Chromium steel            | SCM 445                  | Chromium molybdenum steel        | SNCM 431                 | Nickel chromium molybdenum steel |
| SMn 433                  |                          |                          |                           | SCM 822                  |                                  | SNCM 439                 |                                  |
| SMn 438                  |                          | SCM 415                  | Chromium molybdenum steel | SNC 236                  | Nickel chromium steel            | SNCM 447                 |                                  |
| SMn 443                  |                          | SCM 418                  |                           | SNC 415                  |                                  | SNCM 616                 |                                  |
| SMnC 420                 | Manganese chromium steel | SCM 420                  |                           | SNC 631                  |                                  | SNCM 625                 |                                  |
| SMnC 443                 |                          | SCM 421                  |                           | SNC 815                  |                                  | SNCM 630                 |                                  |
| SCr 415                  | Chromium steel           | SCM 425                  |                           | SNC 836                  |                                  | SNCM 815                 |                                  |
| SCr 420                  |                          | SCM 430                  |                           | SNCM 220                 | Nickel chromium molybdenum steel |                          |                                  |
| SCr 430                  |                          | SCM 432                  |                           | SNCM 240                 |                                  |                          |                                  |
| SCr 435                  |                          | SCM 435                  |                           | SNCM 415                 |                                  |                          |                                  |
| SCr 440                  |                          | SCM 440                  |                           | SNCM 420                 |                                  |                          |                                  |

Remarks : SMn 420, SMnC 420, SCr 415, SCr 420, SCM 415, SCM 418, SCM 420, SCM 421, SCM 425, SCM 822, SNC 415, SNC 815, SNCM 220, SNCM 415, SNCM 420, SNCM 616 and SNCM 815 are mainly used for case hardening.

**4 Chemical composition** Steel shall be subjected to the test of clause 7, and the ladle analysis test value shall be as given in Table 2.

**Table 2 Chemical composition**

Unit: %

| Symbol of classification | C            | Si           | Mn           | P          | S          | Ni           | Cr           | Mo           |
|--------------------------|--------------|--------------|--------------|------------|------------|--------------|--------------|--------------|
| SMn 420                  | 0.17 to 0.23 | 0.15 to 0.35 | 1.20 to 1.50 | 0.030 max. | 0.030 max. | 0.25 max.    | 0.35 max.    | —            |
| SMn 433                  | 0.30 to 0.36 | 0.15 to 0.35 | 1.20 to 1.50 | 0.030 max. | 0.030 max. | 0.25 max.    | 0.35 max.    | —            |
| SMn 438                  | 0.35 to 0.41 | 0.15 to 0.35 | 1.35 to 1.65 | 0.030 max. | 0.030 max. | 0.25 max.    | 0.35 max.    | —            |
| SMn 443                  | 0.40 to 0.46 | 0.15 to 0.35 | 1.35 to 1.65 | 0.030 max. | 0.030 max. | 0.25 max.    | 0.35 max.    | —            |
| SMnC 420                 | 0.17 to 0.23 | 0.15 to 0.35 | 1.20 to 1.50 | 0.030 max. | 0.030 max. | 0.25 max.    | 0.35 to 0.70 | —            |
| SMnC 443                 | 0.40 to 0.46 | 0.15 to 0.35 | 1.35 to 1.65 | 0.030 max. | 0.030 max. | 0.25 max.    | 0.35 to 0.70 | —            |
| SCr 415                  | 0.13 to 0.18 | 0.15 to 0.35 | 0.60 to 0.90 | 0.030 max. | 0.030 max. | 0.25 max.    | 0.90 to 1.20 | —            |
| SCr 420                  | 0.18 to 0.23 | 0.15 to 0.35 | 0.60 to 0.90 | 0.030 max. | 0.030 max. | 0.25 max.    | 0.90 to 1.20 | —            |
| SCr 430                  | 0.28 to 0.33 | 0.15 to 0.35 | 0.60 to 0.90 | 0.030 max. | 0.030 max. | 0.25 max.    | 0.90 to 1.20 | —            |
| SCr 435                  | 0.33 to 0.38 | 0.15 to 0.35 | 0.60 to 0.90 | 0.030 max. | 0.030 max. | 0.25 max.    | 0.90 to 1.20 | —            |
| SCr 440                  | 0.38 to 0.43 | 0.15 to 0.35 | 0.60 to 0.90 | 0.030 max. | 0.030 max. | 0.25 max.    | 0.90 to 1.20 | —            |
| SCr 445                  | 0.43 to 0.48 | 0.15 to 0.35 | 0.60 to 0.90 | 0.030 max. | 0.030 max. | 0.25 max.    | 0.90 to 1.20 | —            |
| SCM 415                  | 0.13 to 0.18 | 0.15 to 0.35 | 0.60 to 0.90 | 0.030 max. | 0.030 max. | 0.25 max.    | 0.90 to 1.20 | 0.15 to 0.25 |
| SCM 418                  | 0.16 to 0.21 | 0.15 to 0.35 | 0.60 to 0.90 | 0.030 max. | 0.030 max. | 0.25 max.    | 0.90 to 1.20 | 0.15 to 0.25 |
| SCM 420                  | 0.18 to 0.23 | 0.15 to 0.35 | 0.60 to 0.90 | 0.030 max. | 0.030 max. | 0.25 max.    | 0.90 to 1.20 | 0.15 to 0.25 |
| SCM 421                  | 0.17 to 0.23 | 0.15 to 0.35 | 0.70 to 1.00 | 0.030 max. | 0.030 max. | 0.25 max.    | 0.90 to 1.20 | 0.15 to 0.25 |
| SCM 425                  | 0.23 to 0.28 | 0.15 to 0.35 | 0.60 to 0.90 | 0.030 max. | 0.030 max. | 0.25 max.    | 0.90 to 1.20 | 0.15 to 0.30 |
| SCM 430                  | 0.28 to 0.33 | 0.15 to 0.35 | 0.60 to 0.90 | 0.030 max. | 0.030 max. | 0.25 max.    | 0.90 to 1.20 | 0.15 to 0.30 |
| SCM 432                  | 0.27 to 0.37 | 0.15 to 0.35 | 0.30 to 0.60 | 0.030 max. | 0.030 max. | 0.25 max.    | 1.00 to 1.50 | 0.15 to 0.30 |
| SCM 435                  | 0.33 to 0.38 | 0.15 to 0.35 | 0.60 to 0.90 | 0.030 max. | 0.030 max. | 0.25 max.    | 0.90 to 1.20 | 0.15 to 0.30 |
| SCM 440                  | 0.38 to 0.43 | 0.15 to 0.35 | 0.60 to 0.90 | 0.030 max. | 0.030 max. | 0.25 max.    | 0.90 to 1.20 | 0.15 to 0.30 |
| SCM 445                  | 0.43 to 0.48 | 0.15 to 0.35 | 0.60 to 0.90 | 0.030 max. | 0.030 max. | 0.25 max.    | 0.90 to 1.20 | 0.15 to 0.30 |
| SCM 822                  | 0.20 to 0.25 | 0.15 to 0.35 | 0.60 to 0.90 | 0.030 max. | 0.030 max. | 0.25 max.    | 0.90 to 1.20 | 0.35 to 0.45 |
| SNC 236                  | 0.32 to 0.40 | 0.15 to 0.35 | 0.50 to 0.80 | 0.030 max. | 0.030 max. | 1.00 to 1.50 | 0.50 to 0.90 | —            |
| SNC 415                  | 0.12 to 0.18 | 0.15 to 0.35 | 0.35 to 0.65 | 0.030 max. | 0.030 max. | 2.00 to 2.50 | 0.20 to 0.50 | —            |
| SNC 631                  | 0.27 to 0.35 | 0.15 to 0.35 | 0.35 to 0.65 | 0.030 max. | 0.030 max. | 2.50 to 3.00 | 0.60 to 1.00 | —            |
| SNC 815                  | 0.12 to 0.18 | 0.15 to 0.35 | 0.35 to 0.65 | 0.030 max. | 0.030 max. | 3.00 to 3.50 | 0.60 to 1.00 | —            |
| SNC 836                  | 0.32 to 0.40 | 0.15 to 0.35 | 0.35 to 0.65 | 0.030 max. | 0.030 max. | 3.00 to 3.50 | 0.60 to 1.00 | —            |
| SNCM 220                 | 0.17 to 0.23 | 0.15 to 0.35 | 0.60 to 0.90 | 0.030 max. | 0.030 max. | 0.40 to 0.70 | 0.40 to 0.60 | 0.15 to 0.25 |
| SNCM 240                 | 0.38 to 0.43 | 0.15 to 0.35 | 0.70 to 1.00 | 0.030 max. | 0.030 max. | 0.40 to 0.70 | 0.40 to 0.60 | 0.15 to 0.30 |
| SNCM 415                 | 0.12 to 0.18 | 0.15 to 0.35 | 0.40 to 0.70 | 0.030 max. | 0.030 max. | 1.60 to 2.00 | 0.40 to 0.60 | 0.15 to 0.30 |
| SNCM 420                 | 0.17 to 0.23 | 0.15 to 0.35 | 0.40 to 0.70 | 0.030 max. | 0.030 max. | 1.60 to 2.00 | 0.40 to 0.60 | 0.15 to 0.30 |
| SNCM 431                 | 0.27 to 0.35 | 0.15 to 0.35 | 0.60 to 0.90 | 0.030 max. | 0.030 max. | 1.60 to 2.00 | 0.60 to 1.00 | 0.15 to 0.30 |
| SNCM 439                 | 0.36 to 0.43 | 0.15 to 0.35 | 0.60 to 0.90 | 0.030 max. | 0.030 max. | 1.60 to 2.00 | 0.60 to 1.00 | 0.15 to 0.30 |
| SNCM 447                 | 0.44 to 0.50 | 0.15 to 0.35 | 0.60 to 0.90 | 0.030 max. | 0.030 max. | 1.60 to 2.00 | 0.60 to 1.00 | 0.15 to 0.30 |
| SNCM 616                 | 0.13 to 0.20 | 0.15 to 0.35 | 0.80 to 1.20 | 0.030 max. | 0.030 max. | 2.80 to 3.20 | 1.40 to 1.80 | 0.40 to 0.60 |
| SNCM 625                 | 0.20 to 0.30 | 0.15 to 0.35 | 0.35 to 0.60 | 0.030 max. | 0.030 max. | 3.00 to 3.50 | 1.00 to 1.50 | 0.15 to 0.30 |
| SNCM 630                 | 0.25 to 0.35 | 0.15 to 0.35 | 0.35 to 0.60 | 0.030 max. | 0.030 max. | 2.50 to 3.50 | 2.50 to 3.50 | 0.30 to 0.70 |
| SNCM 815                 | 0.12 to 0.18 | 0.15 to 0.35 | 0.30 to 0.60 | 0.030 max. | 0.030 max. | 4.00 to 4.50 | 0.70 to 1.00 | 0.15 to 0.30 |

- Remarks 1 As impurities, Cu shall not exceed 0.30 % in any classifications in Table 2.
- 2 When the product analysis on steel is requested by the agreement between the purchaser and the supplier, the allowable tolerance to the ladle analysis specification given in Table 2 shall conform to Attached Table 4 in **JIS G 0321**.

## 5 Appearance and shape, dimensions and tolerances thereon

### 5.1 Hot rolled steel bar and wire rod

**5.1.1 Appearance** Hot rolled steel bar and wire rod shall be well finished and free from defects detrimental to use. However, since it is difficult to detect the defects through the whole length of a steel bar which is supplied in coil form, and there is no chance to eliminate such defects, the abnormal part may be included. As for the decision on the inclusion or exclusion of the abnormal part, it depends upon the agreement between the purchaser and the supplier.

#### 5.1.2 Reference of flaw dressing and the permissible depth of remaining flaw

- a) **Steel bar for general forging** Flaw dressing of steel bar for general forging shall be performed smoothly and to the depth not exceeding 4 % of nominal size (however 5 mm max.) and below nominal size, and the total width not exceeding 1/4 of the circumferential length of the same section. If the dressed portion is within the permissible tolerance, however, it shall not be considered as the portion dressed.

The permissible amount of any remaining flaw shall be as agreed upon between the purchaser and the supplier.

- b) **Round bar for direct machining** The flaw dressing of the round bar for direct machining generally shall not be performed. When it is, the reference shall be as agreed between the purchaser and the supplier. The permissible depth of the flaw of a round bar for direct machining shall be up to the value given in Table 3 from the nominal size.

**Table 3 Permissible depth of flaw of round bar for direct machining (hot rolled steel bar)**

| Diameter mm                  | Permissible depth of flaw                                      |
|------------------------------|----------------------------------------------------------------|
| Under 16                     | Not exceeding 4 % of nominal size with the maximum of 0.5 mm   |
| 16 and over to and excl. 50  | Not exceeding 3 % of nominal size with the maximum of 1.0 mm   |
| 50 and over to and excl. 100 | Not exceeding 2 % of nominal size with the maximum of 1.5 mm   |
| 100 and over                 | Not exceeding 1.5 % of nominal size with the maximum of 3.0 mm |

- c) **Steel bar for cold drawing** The flaw dressing of steel bar for cold drawing shall be performed smoothly and the permissible limit for repair shall be from the permissible minimum size up to the value given in Table 4.

The permissible amount of any remaining flaw shall be as agreed upon between the purchaser and the supplier.

**Table 4 Permissible limit of repair for bar for cold drawing  
(hot rolled steel bar)**

| Diameter or width across flats mm | Permissible limit of repair                                     |
|-----------------------------------|-----------------------------------------------------------------|
| Under 16                          | 0.15 mm                                                         |
| 16 and over to and excl. 50       | Not exceeding 1 % of nominal size with the maximum of 0.35 mm   |
| 50 and over to and excl. 100      | Not exceeding 0.7 % of nominal size with the maximum of 0.50 mm |
| 100 and over up to and incl. 130  | Not exceeding 0.5 % of nominal                                  |

- d) **Other steel bar** Other steel bars shall be as agreed upon between the purchaser and the supplier if the flaw dressing is necessary.
- e) **Wire rod** The permissible depth of flaw of wire rod shall be as agreed upon between the purchaser and the supplier.

**5.1.3 Standard dimension** The standard dimensions of hot rolled steel bar (round, square and hexagonal) and wire rod shall be as in Table 5.

**Table 5 Standard dimension of hot rolled steel bar and wire rod**

Unit: mm

| Round bar (diameter) |      |    |       | Square bar<br>(width across flats) | Hexagonal bar<br>(width across flats) | Wire rod (diameter) |      |
|----------------------|------|----|-------|------------------------------------|---------------------------------------|---------------------|------|
| (10)                 | (24) | 46 | 100   | 40                                 | 100                                   | 5.5                 | (17) |
| 11                   | 25   | 48 | (105) | 45                                 | (105)                                 | 6                   | (18) |
| (12)                 | (26) | 50 | 110   | 50                                 | 110                                   | 7                   | 19   |
| 13                   | 28   | 55 | (115) | 55                                 | (115)                                 | 8                   | (20) |
| (14)                 | 30   | 60 | 120   | 60                                 | 120                                   | 9                   | 22   |
| (15)                 | 32   | 65 | 130   | 65                                 | 130                                   | 9.5                 | (24) |
| 16                   | 34   | 70 | 140   | 70                                 | 140                                   | (10)                | 25   |
| (17)                 | 36   | 75 | 150   | 75                                 | 150                                   | 11                  | (26) |
| (18)                 | 38   | 80 | 160   | 80                                 | 160                                   | (12)                | 28   |
| 19                   | 40   | 85 | (170) | 85                                 | 180                                   | 13                  | 30   |
| (20)                 | 42   | 90 | 180   | 90                                 | 200                                   | (14)                | 32   |
| 22                   | 44   | 95 | (190) | 95                                 |                                       | (15)                |      |
|                      |      |    | 200   |                                    |                                       |                     |      |
|                      |      |    |       |                                    | 46                                    | 16                  |      |

Remarks : It is desirable to avoid using dimensions in parentheses.

**5.1.4 Shape and dimensional tolerances** The shape and dimensional tolerances of hot rolled steel bar and wire rod shall be as the following a) to c) outlines with the exception of those subjected to heat treatment.

- a) The shape and dimensional tolerances of hot rolled round bar and square bar shall be as in Table 6.

**Table 6 Shape and dimensional tolerances of hot rolled round bar and square bar**

| Item                                              | Shape and dimensional tolerance                                                                                                 |                                                                                                         |
|---------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------|
| Tolerance on diameter or width across flats       | $\pm 1.5 \%$ with the minimum value of 0.4 mm                                                                                   |                                                                                                         |
| Deviation of diameter <sup>(1)</sup> or deviation | Not exceeding 70 % of range of tolerance on diameter or width across flats                                                      |                                                                                                         |
| Tolerance on length                               | For length not exceeding 7 m                                                                                                    | Positive tolerance shall be +40 mm, and negative tolerance shall be 0 mm.                               |
|                                                   | For length exceeding 7 m                                                                                                        | Add 5 mm to positive tolerance for every 1 m or fraction thereof, and negative tolerance shall be 0 mm. |
| Roundness of corners (R)                          | 10 % to 20 % of width across flats as standard                                                                                  |                                                                                                         |
| Twist                                             | To be practically straight                                                                                                      |                                                                                                         |
| Bend                                              | Not exceeding 3 mm for every 1 m and not exceeding $3 \text{ mm} \times \frac{\text{length (m)}}{1 \text{ m}}$ for total length |                                                                                                         |

Note (1) Deviation of diameter means the difference between the maximum value and the minimum value of the diameter in the same section of wire rod.

b) The shape and dimensional tolerances of hot rolled hexagonal bar shall be as in Table 7.

**Table 7 Shape and dimensional tolerances of the hot rolled hexagonal bar**

| Item                                             | Width across flats                                                                                                              |      |                                                                                                         |      | Tolerance on width across flats | Deviation of width across flats |
|--------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------|------|---------------------------------------------------------------------------------------------------------|------|---------------------------------|---------------------------------|
| Tolerance and deviation of width across flats mm | (12)                                                                                                                            | 13   | 14                                                                                                      | 17   | ± 0.7                           | 1.0 and under                   |
|                                                  | 19                                                                                                                              | 22   | 24                                                                                                      | 27   | ± 0.8                           | 1.1 and under                   |
|                                                  | 30                                                                                                                              |      |                                                                                                         |      |                                 |                                 |
|                                                  | 32                                                                                                                              | 36   | 41                                                                                                      | 46   | ± 1.0                           | 1.4 and under                   |
|                                                  | 50                                                                                                                              |      |                                                                                                         |      |                                 |                                 |
|                                                  | 55                                                                                                                              | 60   | 63                                                                                                      | 67   | ± 1.2                           | 1.7 and under                   |
|                                                  | 71                                                                                                                              | (75) | (77)                                                                                                    | (81) |                                 |                                 |
| Tolerance on length                              | For length not exceeding 7 m                                                                                                    |      | Positive tolerance shall be +40 mm, and negative tolerance shall be 0 mm.                               |      |                                 |                                 |
|                                                  | For length exceeding 7 m                                                                                                        |      | Add 5 mm to positive tolerance for every 1 m or fraction thereof, and negative tolerance shall be 0 mm. |      |                                 |                                 |
| Twist                                            | To be practically straight                                                                                                      |      |                                                                                                         |      |                                 |                                 |
| Bend                                             | Not exceeding 3 mm for every 1 m and not exceeding $3 \text{ mm} \times \frac{\text{length (m)}}{1 \text{ m}}$ for total length |      |                                                                                                         |      |                                 |                                 |

Remarks : It is desirable to avoid using dimensions in parentheses.

- c) The dimensional tolerances of hot rolled wire rod shall be as in Table 8.

**Table 8 Dimensional tolerances of hot rolled wire rod**

Unit: mm

| Diameter                       | Tolerance on diameter | Deviation of diameter |
|--------------------------------|-----------------------|-----------------------|
| 15 and under                   | $\pm 0.3$             | 0.4 and under         |
| Over 15 and up to and incl. 25 | $\pm 0.4$             | 0.5 and under         |
| Over 25 and up to and incl. 32 | $\pm 0.5$             | 0.6 and under         |

## 5.2 Hot rolled steel plate and strip

**5.2.1 Appearance** The appearance of hot rolled steel plate and strip shall be as given in clause 6 in **JIS G 3193**.

**5.2.2 Reference of flaw dressing** The reference of flaw dressing of steel plate and strip shall be as given in (3) of clause 6 in **JIS G 3193**. The application of welding repair and permissible amount of remaining flaw shall be as agreed upon between the purchaser and the supplier.

**5.2.3 Standard dimension** The standard dimensions of the hot rolled steel plate and strip shall be as given in clause 3 in **JIS G 3193**.

**5.2.4 Shape and dimensional tolerances** The shape and dimensional tolerances of hot rolled steel plate and strip shall be as given in clause 4 in **JIS G 3193**.

## 5.3 Hot rolled flat steel

**5.3.1 Appearance** The appearance of hot rolled flat steel shall be as given in a) of clause 10 in **JIS G 3194**.

**5.3.2 Reference of flaw dressing** The reference of flaw dressing of flat steel shall be as given in b) of clause 10 in **JIS G 3194**. The application of welding repair and permissible amount of remaining flaw shall be as agreed upon between the purchaser and the supplier.

**5.3.3 Standard dimension** The standard dimensions of hot rolled flat steel shall be as given in clause 5 in **JIS G 3194**.

**5.3.4 Shape and dimensional tolerances** The shape and dimensional tolerances of hot rolled flat steel shall be as given in clause 7 in **JIS G 3194**.

**5.4 Other steel** The appearance, reference of flaw dressing, shapes, dimensions and dimensional tolerance thereof of steel other than specified in 5.1, 5.2 and 5.3 shall be as agreed upon between the purchaser and the supplier.

## 6 Manufacturing method

- a) Steel shall be manufactured from the killed steel.
- b) Steel shall be rolled or forged as the forming ratio of 4S or over unless especially specified. However, blooms for forging or rolling of the forming ratio of under 4S shall be beforehand agreed upon between the purchaser and the supplier.
- c) Steel shall be as rolled or forged unless especially specified.

## 7 Tests Analytical test shall be as follows:

- a) General items of the analytical tests and sampling method of the ladle analysis sample shall be as 7.6 and clause 8 in **JIS G 0404**.
- b) The sampling method of the product analysis sample shall be as clause 4 in **JIS G 0321**.
- c) The analytical method shall be in accordance with any one of the following standards:  
**JIS G 1211, JIS G 1212, JIS G 1213, JIS G 1214, JIS G 1215, JIS G 1216, JIS G 1217, JIS G 1218, JIS G 1219, JIS G 1238, JIS G 1253, JIS G 1256, JIS G 1257, JIS G 1258**

## 8 Inspection

### 8.1 Inspection Inspection shall be as follows:

- a) The general items for inspection shall be as the specification of **JIS G 0404**.
- b) The chemical composition shall conform to the requirements specified in clause 4.
- c) The appearance and shape, dimension and tolerances thereof shall conform to the requirements specified in clause 5.

**8.2 Other inspections** In addition to the inspection specified in 8.1, the following tests may be specified upon the agreement between the purchaser and the supplier (In this case, the purchaser shall have prior agreement with the manufacturer upon inspection items, method of sampling, test method and the criteria of acceptance or rejection):

Magnetic particle inspection, ultrasonic inspection, decarburization inspection, non-metallic inclusion inspection, grain size inspection, mechanical properties inspection, hardenability inspection, macrostructure inspection, macro-streak flaw inspection and microscopic structure inspection.

The test methods shall be in accordance with the following standards respectively:

**JIS G 0565, JIS G 0901, JIS Z 2344, JIS G 0558, JIS G 0555, JIS G 0551, JIS Z 2201, JIS Z 2241, JIS Z 2202, JIS Z 2242, JIS Z 2243, JIS Z 2245, JIS G 0561, JIS G 0553, JIS G 0556**

## 9 Marking

**9.1 Flat steel, steel bar and wire rod** The following items shall be marked on each hot rolled flat steel, steel bar and wire rod in a suitable way. Flat steel and steel of diameter or width across flats less than 30 mm may be bound up, and marking may be made on each bundle by a suitable method:

Further, some of the following items may be omitted as agreed upon between the purchaser and the supplier.

- a) Symbol of classification
- b) Ladle number or other production number
- c) Dimension
- d) Manufacturer's name or abbreviation

**9.2 Steel plate and strip** The following items shall be marked on each steel plate or strip or on each bundle in a suitable way.

Further, some of the following items may be omitted as agreed upon between the purchaser and the supplier.

- a) Symbol of classification
- b) Ladle number or other production number
- c) Dimension
- d) Manufacturer's name or abbreviation

**10 Report** The report shall be in accordance with clause 13 in **JIS G 0404**. However, the type of report shall be 2.3 or 3.1.B of Table 1 in **JIS G 0415** unless otherwise specified at the stage of order.

Further, the report for 8.2 shall be as agreed upon between the purchaser and the supplier.

**Attached Table 1 Normative references**

- JIS G 0321 *Product analysis and its tolerance for wrought steel*
- JIS G 0404 *Steel and steel products—General technical delivery requirements*
- JIS G 0415 *Steel and steel products—Inspection documents*
- JIS G 0551 *Methods of austenite grain size determination for steel*
- JIS G 0553 *Macrostructure detecting method for steel*
- JIS G 0555 *Microscopic testing method for the non-metallic inclusions in steel*
- JIS G 0556 *Method of macro-streak-flaw test for steel*
- JIS G 0558 *Methods of measuring decarburized depth for steel*
- JIS G 0561 *Method of hardenability test for steel (End quenching method)*
- JIS G 0565 *Method for magnetic particle testing of ferromagnetic materials and classification of magnetic particle indication*
- JIS G 0901 *Classification of structural rolled steel plate and wide flat for building by ultrasonic test*
- JIS G 1211 *Iron and steel—Methods for determination of carbon content*
- JIS G 1212 *Iron and steel—Methods for determination of silicon content*
- JIS G 1213 *Iron and steel—Methods for determination of manganese content*
- JIS G 1214 *Iron and steel—Methods for determination of phosphorus content*
- JIS G 1215 *Iron and steel—Methods for determination of sulfur content*
- JIS G 1216 *Iron and steel—Methods for determination of nickel content*
- JIS G 1217 *Methods for determination of chromium in iron and steel*
- JIS G 1218 *Iron and steel—Methods for determination of molybdenum content*
- JIS G 1219 *Iron and steel—Methods for determination of copper content*
- JIS G 1238 *Steel and iron—Determination of chromium content—Potentiometric or visual titration method*
- JIS G 1253 *Iron and steel—Method for spark discharge atomic emission spectrometric analysis*
- JIS G 1256 *Iron and steel—Method for X-ray fluorescence spectrometric analysis*
- JIS G 1257 *Iron and steel—Methods for atomic absorption spectrometric analysis*
- JIS G 1258 *Iron and steel—Methods for inductively coupled plasma atomic emission spectrometry*
- JIS G 3193 *Dimensions, mass and permissible variations of hot rolled steel plates, sheets and strip*

- JIS G 3194 *Dimensions, mass and permissible variations of hot rolled flat steel*
- JIS Z 2201 *Test pieces for tensile test for metallic materials*
- JIS Z 2202 *Test pieces for impact test for metallic materials*
- JIS Z 2241 *Method of tensile test for metallic materials*
- JIS Z 2242 *Method of impact test for metallic materials*
- JIS Z 2243 *Brinell hardness test—Test method*
- JIS Z 2245 *Rockwell hardness test—Test method*
- JIS Z 2344 *General rule of ultrasonic testing of metals by pulse echo technique*

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

| JIS G 4053 : 2003 Low-alloyed steels for machine structural use |                                                                                                                                                                                                                                                                 | ISO 683-1 : 1987 Heat-treatable steels, alloy steels and free-cutting steels—Part 1 Direct-hardening unalloyed and low-alloyed wrought steel in form of different black products<br>ISO 683-11 : 1987 Heat-treatable steels, alloy steels and free-cutting steels—Part 11 Wrought case-hardening steels                                                        |                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|-----------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| (I) Requirements in JIS                                         |                                                                                                                                                                                                                                                                 | (II) International Standard numbers                                                                                                                                                                                                                                                                                                                            | (III) Requirements in International Standards                                                                                                                                                                                                                                                        | (IV) Classification and details of technical deviation between JIS and the International Standards by clause<br>Location of deviation: text<br>Indication method: continuous sidelines | (V) Justification for the technical deviation and future measures                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Clause                                                          | Content                                                                                                                                                                                                                                                         | Content                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| 1 Scope                                                         | Specifies the alloyed steel used for structural construction which are manufactured by hot rolling, hot forging—further process (forging, cutting, cold-drawing and so on)—heat treatment (quenching/tempering, normalizing, carburizing/quenching, and so on). | <b>ISO 683-1</b><br><b>ISO 683-11</b><br><b>ISO 683-1</b><br><b>ISO 683-11</b><br><br>Subject products:<br>Semi-finished products, bar, wire rod, hot rolled plate and forged steel of carbon steel or low alloy steel.<br><br>Subject heat treatment:<br>• Q-T or austempering, partially normalized for machine parts.<br>• Case hardened for machine parts. | MOD/deletion<br><br>The standard systems are not the same.<br><b>ISO</b> specifies according to the heat treatment and the usage.<br><b>JIS</b> specifies according to the classification, and not to the heat treatment and the usage. However, the actual range of application is almost the same. |                                                                                                                                                                                        | The system of <b>JIS</b> takes into consideration that “one classification of steel shall be used after various types of heat treatments are applied.” The domestic consumers are familiar with the material selection and heat treatment selection as used for themselves. For this reason, the present standard system is better for them for its greater freedom (in other words, loose regulation). The merit of having a standard for each classification shall be proposed to <b>ISO</b> in the future. |

| (I) Requirements in JIS      |                                                                                                                                                | (II) International Standard numbers | (III) Requirements in International Standards                                                                       | (IV) Classification and details of technical deviation between JIS and the International Standards by clause<br>Location of deviation: text<br>Indication method: continuous sidelines |                                                                                                                                                                                                                                                         | (V) Justification for the technical deviation and future measures                                                                                                                |
|------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------|---------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Clause                       | Content                                                                                                                                        |                                     | Content                                                                                                             | Classification by clause                                                                                                                                                               | Detail of technical deviation                                                                                                                                                                                                                           |                                                                                                                                                                                  |
| 2 Normative references       | Quoted from JIS.                                                                                                                               | ISO 683-1<br>ISO 683-11             | Quoted from ISO Standards.                                                                                          | MOD/<br>addition                                                                                                                                                                       | The normative reference numbers are not the same because of the difference between JIS and ISO numbering systems. However, the basic standards and the test standards of JIS include the contents of ISO Standard and are in harmony with ISO Standard. |                                                                                                                                                                                  |
| 3 Classification and symbols | Based upon the symbol system of JIS. Specifies 6 types of steel (Mn, Mn-Cr, Cr, Cr-Mo, Ni-Cr, Ni-Cr-Mo steel) and 39 classifications of steel. | ISO/TR 4949                         | Based upon the symbol system of ISO. Specifies 7 types of steel (JIS+Cr-V series), and 36 classifications of steel. | —                                                                                                                                                                                      | The symbol systems of JIS and ISO are not the same. This time one type of ISO steel is newly introduced.                                                                                                                                                | Each country has its own symbol system and they became established in their market. TR 4949 is now under amendment and every country is recognizing to admit each symbol system. |

| (I) Requirements in JIS                                   |                                                                      | (II) International Standard numbers | (III) Requirements in International Standards                      | (IV) Classification and details of technical deviation between JIS and the International Standards by clause<br>Location of deviation: text<br>Indication method: continuous sidelines |                                                                                                                                            | (V) Justification for the technical deviation and future measures                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|-----------------------------------------------------------|----------------------------------------------------------------------|-------------------------------------|--------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Clause                                                    | Content                                                              |                                     | Content                                                            | Classification by clause                                                                                                                                                               | Detail of technical deviation                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| 4 Chemical composition                                    | Chemical compositions for 39 classifications of steel are specified. | ISO 683-1<br>ISO 683-11             | Chemical composition of 36 classifications of steel are specified. | MOD/alteration                                                                                                                                                                         | The number of the same classification of steel is 11. Other ISO Standard specifications are different and not used in the domestic market. | For the 11 classifications between JIS and ISO mentioned in the left column, the specification is revised within the range of keeping the quality level and preventing meaningless cost increase. P and S (for JIS 0.030 or under and for ISO 0.035 or under), which may be linked to a decline in quality, shall be proposed for revision to ISO in the next time of reconsidering. The non-matching specifications shall be proposed for revision to ISO in the appropriate time of reconsidering in the case it is necessary. |
| 5 Appearance and shape, dimensions and tolerances thereon | Specified.                                                           | ISO 683-1<br>ISO 683-11             | Based upon the agreement between the parties concerned.            | MOD/addition                                                                                                                                                                           | As mentioned in the left.                                                                                                                  | The details of the existing specification are decided as a result of discussion between the domestic manufacturers and users. As the specification is within the range of ISO specification, the specification shall be followed.                                                                                                                                                                                                                                                                                                |

| (I) Requirements in JIS                                   |               | (II) International Standard numbers                                                                                                                              | (III) Requirements in International Standards                                                                                                                                                                                                                                                                            | (IV) Classification and details of technical deviation between JIS and the International Standards by clause<br>Location of deviation: text<br>Indication method: continuous sidelines |                                                                                                                                                                                                                                                                                             | (V) Justification for the technical deviation and future measures                                                                                                                                                              |
|-----------------------------------------------------------|---------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Clause                                                    |               | Content                                                                                                                                                          | Content                                                                                                                                                                                                                                                                                                                  | Classification by clause                                                                                                                                                               | Detail of technical deviation                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                |
| 5 Appearance and shape, dimensions and tolerances thereon | Appearance    | Welding repair of steel plate and strip shall be based upon the agreement between the parties concerned.                                                         | Welding repair is not admitted.                                                                                                                                                                                                                                                                                          | MOD/deletion                                                                                                                                                                           | As mentioned in the left.                                                                                                                                                                                                                                                                   | Welding repair of steel may be admitted according to the level of C content depending upon the agreement between the parties concerned. Shall be proposed to ISO.                                                              |
| 6 Manufacturing method                                    |               | <ul style="list-style-type: none"> <li>• Killed steel.</li> <li>• Forming ratio 4 or more.</li> <li>• As rolled or forged unless otherwise specified.</li> </ul> | <ul style="list-style-type: none"> <li>• Killed steel.</li> <li>• Delivery condition: Basically as rolled. However, it is possible to decide normalizing and so on for heat treatment, and acid pickling and so on for surface finishing according to the agreement. So to speak, optional items are offered.</li> </ul> | MOD/alteration                                                                                                                                                                         | <ul style="list-style-type: none"> <li>• Basic delivery condition shall be as rolled for JIS and ISO also.</li> <li>• ISO specifies the special condition with special specification agreed upon between the purchaser and the supplier.</li> <li>• JIS specifies forming ratio.</li> </ul> | It is an issue concerning the entire JIS Standard system to specify the optional items. However, from this viewpoint, there will be no essential problem.                                                                      |
| 7 Tests                                                   | Hardenability | Specifies in another standard; JIS G 4052 (H steel). Total of 22 classifications of steel. No specification in the objective standard.                           | Specifies the additional classification as H-steel and HH-steel.                                                                                                                                                                                                                                                         | MOD/deletion                                                                                                                                                                           | JIS specifies in another standard. ISO specifies in the same standard.                                                                                                                                                                                                                      | JIS Standard system is the same as AISI. For there are few cases where the mechanical property of hardening is requested in the domestic market, it is clearer and more convenient to specify it in a separate standard (as it |
| 8 Inspection                                              |               |                                                                                                                                                                  |                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                |

| (I) Requirements in JIS |                                                                           | (II) International Standard numbers | (III) Requirements in International Standards                                                                                                              | (IV) Classification and details of technical deviation between JIS and the International Standards by clause<br>Location of deviation: text<br>Indication method: continuous sidelines |                                                                                                                   | (V) Justification for the technical deviation and future measures                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|-------------------------|---------------------------------------------------------------------------|-------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Clause                  | Content                                                                   |                                     | Content                                                                                                                                                    | Classification by clause                                                                                                                                                               | Detail of technical deviation                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|                         | 7 Tests<br>8 Inspection                                                   |                                     |                                                                                                                                                            |                                                                                                                                                                                        |                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|                         | Hardenability                                                             |                                     |                                                                                                                                                            |                                                                                                                                                                                        |                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|                         | Machinability and shearing ability                                        |                                     | In the case of improvement of forming ability, the upper limit of hardness shall be specified and specification value is given according to the agreement. | MOD/deletion                                                                                                                                                                           | No specification in JIS. In ISO, it may be specified on the agreement, and the specification value is also given. | is now). However, the specification details of JIS G 4052 shall be reconsidered after being established.<br><br>Even in the domestic business transaction, heat treatment for the purpose of improvement of forming ability is required. But the hardness specification varies according to the users' equipment and technical ability and easily becomes overspecified under a uniform settlement. Even in ISO specification it is an agreement item, and in JIS Standard it shall not be decided as before. It will be proposed to ISO to not specify the above. |
|                         | Mechanical property after heat treatment of hardening and tempering of TP |                                     | Tensile strength characteristic and Charpy impact characteristic are specified.                                                                            | MOD/deletion                                                                                                                                                                           | As mentioned in the left.                                                                                         | There are few cases of request for the mechanical properties after treatment of hardening and tempering of TP in the domestic market. As the mechanical property after treatment of hardening and tempering done on the purchaser's side will be greatly influenced by the equipment                                                                                                                                                                                                                                                                               |

| (I) Requirements in JIS                                                         |                                                                            | (II) International Standard numbers | (III) Requirements in International Standards                  | (IV) Classification and details of technical deviation between JIS and the International Standards by clause<br>Location of deviation: text<br>Indication method: continuous sidelines |                               | (V) Justification for the technical deviation and future measures |
|---------------------------------------------------------------------------------|----------------------------------------------------------------------------|-------------------------------------|----------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------|-------------------------------------------------------------------|
| Clause                                                                          | Content                                                                    |                                     | Content                                                        | Classification by clause                                                                                                                                                               | Detail of technical deviation |                                                                   |
| 9 Marking                                                                       | Symbol of classification, ladle number, manufacturer's name, and dimension | ISO 683-1<br>ISO 683-11             | Classification of symbol, ladle number and manufacturer's name | MOD/<br>addition                                                                                                                                                                       | JIS specifies dimensions.     | Adding the dimension shall be proposed.                           |
| 10 Report                                                                       | Specifies basic report type.                                               | ISO 683-1<br>ISO 683-11             | Based the agreement.                                           | MOD/<br>addition                                                                                                                                                                       | As mentioned in the left.     |                                                                   |
| Designated degree of correspondence between JIS and International Standard: MOD |                                                                            |                                     |                                                                |                                                                                                                                                                                        |                               |                                                                   |

Designated degree of correspondence between JIS and International Standard: MOD

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

- MOD/deletion: Deletes specification item(s) or content(s) of International Standard.
- MOD/addition: Adds specification item(s) or content(s) not included in International Standard.
- MOD/alteration: Alters the specification content(s) included in International Standard.

2 Symbol in column of designated degree of correspondence between JIS and International Standard in the above table indicates as follows:

- MOD: Modifies International Standard.

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