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

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## Foreword

This translation has been made based on the original Japanese Industrial Standard 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 the draft being attached, based on the provision of Article 12 Clause 1 of the Industrial Standardization Law applicable to the case of revision by the provision of Article 14.

Consequently **JIS G 4053**:2008 is replaced with this Standard.

However, **JIS G 4053**:2008 may be applied in the **JIS** mark certification based on the relevant provisions of Article 19 Clause 1, etc. of the Industrial Standardization Law until November 20, 2017.

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# Low-alloyed steels for machine structural use

## Introduction

This Japanese Industrial Standard has been prepared based on the second edition of **ISO 683-1** published in 2012, the first edition of **ISO 683-2** published in 2012, the first editions of **ISO 683-3** and **ISO 683-5** published in 2014 with some modifications of the technical contents.

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

## 1 Scope

This Standard specifies low-alloyed steels for machine structural use (hereafter referred to as steel products) manufactured by hot rolling, hot forging and hot extruding. This Standard applies to steel products with a uniform cross-section, which are generally supplied for use after further processes of forging, cutting and heat treatment. This Standard is not applicable to steel tubes <sup>1)</sup>.

The manufacturing method and quality requirements for hot-extruded sections are given in Annex JA.

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

ISO 683-1:2012 *Heat-treatable steels, alloy steels and free-cutting steels—Part 1: Non-alloy steels for quenching and tempering*

ISO 683-2:2012 *Heat-treatable steels, alloy steels and free-cutting steels—Part 2: Alloy steels for quenching and tempering*

ISO 683-3:2014 *Heat-treatable steels, alloy steels and free-cutting steels—Part 3: Case-hardening steels*

ISO 683-5:2014 *Heat treatable steels, alloy steels and free-cutting steels—Part 5: Nitriding steels* (overall evaluation: MOD)

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

Note <sup>1)</sup> Steel tubes are covered in **JIS G 3441** (Alloy steel tubes for machine purposes).

## 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 0320 | <i>Standard test method for heat analysis of steel products</i>                                  |
| JIS G 0321 | <i>Product analysis and its tolerance for wrought steel</i>                                      |
| JIS G 0404 | <i>Steel and steel products—General technical delivery requirements</i>                          |
| JIS G 0415 | <i>Steel and steel products—Inspection documents</i>                                             |
| JIS G 3191 | <i>Dimensions, mass and permissible variations of hot rolled steel bars and bar in coil</i>      |
| JIS G 3192 | <i>Dimensions, mass and permissible variations of hot rolled steel sections</i>                  |
| JIS G 3193 | <i>Dimensions, mass and permissible variations of hot rolled steel plates, sheets and strips</i> |
| JIS G 3194 | <i>Dimensions, mass and permissible variations of hot rolled flat steel</i>                      |

### 3 Classification and symbols

The steels are classified into 40 grades, their respective symbols are shown in Table 1.

**Table 1 Symbols of grades**

| Classification                                      | Symbols of grades                                                                    | Classification            | Symbols of grades                                                                                                    | Classification                   | Symbols of grades                                                                                                                                                                           | Classification                      | Symbols of grades     |  |  |  |
|-----------------------------------------------------|--------------------------------------------------------------------------------------|---------------------------|----------------------------------------------------------------------------------------------------------------------|----------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------|-----------------------|--|--|--|
| Manganese steel                                     | SMn420 <sup>a)</sup><br>SMn433<br>SMn438<br>SMn443                                   | Chromium molybdenum steel | SCM415 <sup>a)</sup><br>SCM418 <sup>a)</sup><br>SCM420 <sup>a)</sup><br>SCM421 <sup>a)</sup><br>SCM425 <sup>a)</sup> | Nickel chromium steel            | SNC236<br>SNC415 <sup>a)</sup><br>SNC631<br>SNC815 <sup>a)</sup><br>SNC836                                                                                                                  | Aluminium chromium molybdenum steel | SACM645 <sup>b)</sup> |  |  |  |
| Manganese chromium steel                            | SMnC420 <sup>a)</sup><br>SMnC443                                                     |                           | SCM430<br>SCM432<br>SCM435<br>SCM440<br>SCM445<br>SCM822 <sup>a)</sup>                                               | Nickel chromium molybdenum steel | SNCM220 <sup>a)</sup><br>SNCM240<br>SNCM415 <sup>a)</sup><br>SNCM420 <sup>a)</sup><br>SNCM431<br>SNCM439<br>SNCM447<br>SNCM616 <sup>a)</sup><br>SNCM625<br>SNCM630<br>SNCM815 <sup>a)</sup> |                                     |                       |  |  |  |
| Chromium steel                                      | SCr415 <sup>a)</sup><br>SCr420 <sup>a)</sup><br>SCr430<br>SCr435<br>SCr440<br>SCr445 |                           |                                                                                                                      |                                  |                                                                                                                                                                                             |                                     |                       |  |  |  |
| Notes <sup>a)</sup> Mainly used for case hardening. |                                                                                      |                           |                                                                                                                      |                                  |                                                                                                                                                                                             |                                     |                       |  |  |  |
| <sup>b)</sup> Mainly used for surface nitriding.    |                                                                                      |                           |                                                                                                                      |                                  |                                                                                                                                                                                             |                                     |                       |  |  |  |

### 4 Manufacturing method

The manufacturing method shall be as follows. The manufacturing method for hot-extruded sections is specified in **JA.1**.

- The steel products shall be manufactured from killed steel.
- The steel products shall be manufactured by hot working such as rolling and forging with a forging ratio of not less than 4S. The forging ratio may be less than 4S

if the purchaser is to perform further hot working such as rolling or forging on the steels, provided that a prior agreement is made between the purchaser and the manufacturer.

- c) The steel products shall normally be supplied as hot-rolled or hot-forged, but may be given heat treatment if specified by the purchaser<sup>2)</sup>.

Note <sup>2)</sup> Mechanical properties values for heat-treated products may be agreed upon between the purchaser and the manufacturer.

- d) Steel plates, sheets and strips which cannot be manufactured by hot rolling due to their required thickness may be manufactured by cold rolling upon agreement between the purchaser and the manufacturer. Cold-rolled steel plates, sheets and strips shall normally be annealed after rolling.

## 5 Chemical composition

When tested in accordance with clause 7, the steel products shall satisfy the heat analysis values given in Table 2. If a product analysis is agreed between the purchaser and the manufacturer, the steel products shall be tested in accordance with clause 7 and shall satisfy the requirements in Table 2 within the tolerances given in Table 4 of **JIS G 0321**.

**Table 2 Chemical composition**

Unit: %

| Symbol of grade | C               | Si              | Mn              | P             | S             | Ni           | Cr              | Mo | Cu           |
|-----------------|-----------------|-----------------|-----------------|---------------|---------------|--------------|-----------------|----|--------------|
| SMn420          | 0.17 to<br>0.23 | 0.15 to<br>0.35 | 1.20 to<br>1.50 | 0.030<br>max. | 0.030<br>max. | 0.25<br>max. | 0.35<br>max.    | a) | 0.30<br>max. |
| SMn433          | 0.30 to<br>0.36 | 0.15 to<br>0.35 | 1.20 to<br>1.50 | 0.030<br>max. | 0.030<br>max. | 0.25<br>max. | 0.35<br>max.    | a) | 0.30<br>max. |
| SMn438          | 0.35 to<br>0.41 | 0.15 to<br>0.35 | 1.35 to<br>1.65 | 0.030<br>max. | 0.030<br>max. | 0.25<br>max. | 0.35<br>max.    | a) | 0.30<br>max. |
| SMn443          | 0.40 to<br>0.46 | 0.15 to<br>0.35 | 1.35 to<br>1.65 | 0.030<br>max. | 0.030<br>max. | 0.25<br>max. | 0.35<br>max.    | a) | 0.30<br>max. |
| SMnC420         | 0.17 to<br>0.23 | 0.15 to<br>0.35 | 1.20 to<br>1.50 | 0.030<br>max. | 0.030<br>max. | 0.25<br>max. | 0.35 to<br>0.70 | a) | 0.30<br>max. |
| SMnC443         | 0.40 to<br>0.46 | 0.15 to<br>0.35 | 1.35 to<br>1.65 | 0.030<br>max. | 0.030<br>max. | 0.25<br>max. | 0.35 to<br>0.70 | a) | 0.30<br>max. |
| SCr415          | 0.13 to<br>0.18 | 0.15 to<br>0.35 | 0.60 to<br>0.90 | 0.030<br>max. | 0.030<br>max. | 0.25<br>max. | 0.90 to<br>1.20 | a) | 0.30<br>max. |
| SCr420          | 0.18 to<br>0.23 | 0.15 to<br>0.35 | 0.60 to<br>0.90 | 0.030<br>max. | 0.030<br>max. | 0.25<br>max. | 0.90 to<br>1.20 | a) | 0.30<br>max. |
| SCr430          | 0.28 to<br>0.33 | 0.15 to<br>0.35 | 0.60 to<br>0.90 | 0.030<br>max. | 0.030<br>max. | 0.25<br>max. | 0.90 to<br>1.20 | a) | 0.30<br>max. |
| SCr435          | 0.33 to<br>0.38 | 0.15 to<br>0.35 | 0.60 to<br>0.90 | 0.030<br>max. | 0.030<br>max. | 0.25<br>max. | 0.90 to<br>1.20 | a) | 0.30<br>max. |
| SCr440          | 0.38 to<br>0.43 | 0.15 to<br>0.35 | 0.60 to<br>0.90 | 0.030<br>max. | 0.030<br>max. | 0.25<br>max. | 0.90 to<br>1.20 | a) | 0.30<br>max. |
| SCr445          | 0.43 to<br>0.48 | 0.15 to<br>0.35 | 0.60 to<br>0.90 | 0.030<br>max. | 0.030<br>max. | 0.25<br>max. | 0.90 to<br>1.20 | a) | 0.30<br>max. |

**Table 2 (continued)**

Unit: %

| Symbol of grade | C            | Si           | Mn           | P          | S          | Ni           | Cr           | Mo           | Cu        |
|-----------------|--------------|--------------|--------------|------------|------------|--------------|--------------|--------------|-----------|
| SCM415          | 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 | 0.30 max. |
| SCM418          | 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 | 0.30 max. |
| SCM420          | 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 | 0.30 max. |
| SCM421          | 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 | 0.30 max. |
| SCM425          | 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 | 0.30 max. |
| SCM430          | 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 | 0.30 max. |
| SCM432          | 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 | 0.30 max. |
| SCM435          | 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 | 0.30 max. |
| SCM440          | 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 | 0.30 max. |
| SCM445          | 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 | 0.30 max. |
| SCM822          | 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 | 0.30 max. |
| SNC236          | 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 | a)           | 0.30 max. |
| SNC415          | 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 | a)           | 0.30 max. |
| SNC631          | 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 | a)           | 0.30 max. |
| SNC815          | 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 | a)           | 0.30 max. |
| SNC836          | 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 | a)           | 0.30 max. |
| SNCM220         | 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 | 0.30 max. |
| SNCM240         | 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 | 0.30 max. |
| SNCM415         | 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 | 0.30 max. |
| SNCM420         | 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 | 0.30 max. |
| SNCM431         | 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 | 0.30 max. |
| SNCM439         | 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 | 0.30 max. |
| SNCM447         | 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 | 0.30 max. |