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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 4051**:2005 is replaced with this Standard.

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Carbon steels for machine structural use

Introduction

This Japanese Industrial Standard has been prepared based on the first editions of **ISO 683-1** and **ISO 683-11** published in 1987 with some modifications of the technical contents.

The portions given sidelines are the matters modified from the original International Standards. A list of modifications with the explanations is given in Annex JA (informative).

1 Scope

This Standard specifies carbon steels (hereafter referred to as “steels”) for machine structural use mainly manufactured by hot forming such as hot rolling and hot forging. Steels are generally used after further processes of forging, cutting and heat treatment.

In addition, in the case of steel plates and steel strips, those cold reduced may be included according to the thickness as well as those hot rolled.

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

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*

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

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

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 *Standard test methods for heat analysis of steel products*

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 *Steels—Micrographic determination of the apparent grain size*

JIS G 0553 *Steel—Macroscopic examination by etching*

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 *Steels—Determination of depth of decarburization*
- JIS G 0561 *Method of hardenability test for steel (End quenching method)*
- JIS G 0901 *Classification of structural rolled steel plate and wide flat for building by ultrasonic test*
- JIS G 3141 *Cold-reduced carbon steel sheet and strips*
- JIS G 3191 *Dimensions, mass and permissible variations of hot rolled steel bars and bar in coil*
- JIS G 3192 *Dimensions, mass and permissible variations of hot rolled steel sections*
- JIS G 3193 *Dimensions, mass and permissible variations of hot rolled steel plates, sheets and strips*
- JIS G 3194 *Dimensions, mass and permissible variations of hot rolled flat steel*
- JIS Z 2241 *Method of tensile test for metallic materials*
- JIS Z 2242 *Method for Charpy pendulum impact test of metallic materials*
- JIS Z 2243 *Brinell hardness test—Test method*
- JIS Z 2245 *Rockwell hardness test—Test method*
- JIS Z 2320-1 *Nondestructive testing—Magnetic particle testing—Part I: General principles*
- JIS Z 2344 *General rule of ultrasonic testing of metals by pulse echo technique*

3 Classification and symbol

The steel shall be classified into 23 grades and the respective symbols shall be as given in table 1. Three grades, namely S09CK, S15CK and S20CK, however, are used for case-hardening purposes.

4 Manufacturing method

The manufacturing method shall be as follows.

- a) The steel shall be manufactured from killed steel.
- b) The steel shall be rolled or forged from steel ingot with forging ratio of not less than 4S unless otherwise specified. The forging ratio of the billet for forging or rolling may be less than 4S, provided that a prior agreement between the purchaser and the manufacturer has been acquired.
- c) Steels shall be as hot rolled or hot forged unless otherwise specified. For steel plates and steel strips, if cold rolling is performed upon the agreement between the purchaser and the manufacturer, they shall be generally annealed after rolling.

5 Chemical composition

When steels are tested in accordance with 7.1, the heat analysis values shall be as given in table 1. When the product analysis on steels is performed upon the agreement between the purchaser and the manufacturer, steels are tested in accordance with 7.1 and allowable deviation on table 1 shall be as given in table 3 of JIS G 0321.