



JAPANESE
INDUSTRIAL
STANDARD

Translated and Published by
Japanese Standards Association

JIS G 4311 : 2011

(JSSA/JSA)

Heat-resisting steel bars and wire rods

ICS 77.140.10;77.140.60

Reference number : JIS G 4311 : 2011 (E)

PROTECTED BY COPYRIGHT

Date of Establishment: 1964-09-01

Date of Revision: 2011-02-21

Date of Public Notice in Official Gazette: 2011-02-21

Investigated by: Japanese Industrial Standards Committee
Standards Board
Technical Committee on Iron and Steel

JIS G 4311 : 2011, First English edition published in 2012-01

Translated and published by: Japanese Standards Association
4-1-24, Akasaka, Minato-ku, Tokyo, 107-8440 JAPAN

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

© JSA 2012

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from the publisher.

Printed in Japan

PROTECTED BY COPYRIGHT

Contents

	Page
Introduction	1
1 Scope	1
2 Normative references	1
3 Grade and symbol	2
4 Manufacturing method	3
5 Chemical compositions	4
5.1 Heat analysis value	4
5.2 Product analysis value	4
6 Mechanical properties	7
6.1 General matters	7
6.2 Mechanical properties of austenitic series	7
6.3 Mechanical properties of ferritic series	8
6.4 Mechanical properties of martensitic series	8
6.5 Mechanical properties of bars as cold drawn	9
7 Shapes, dimensions and tolerances	10
7.1 Standard dimension	10
7.2 Tolerances on shapes and dimensions	10
8 Calculation method of mass of bar	13
9 Appearance	14
10 Depth of flaw of wire rods	14
11 Tests	14
11.1 Chemical analysis test	14
11.2 Mechanical test	14
11.3 Flaw detection test of wire rods	15
12 Inspection	15
13 Marking	16
13.1 Marking of bars	16
13.2 Marking of wire rods	16
14 Report	16
Annex JA (informative) Heat treatment of heat-resisting steel bars	18
Annex JB (informative) Main usages of heat-resisting steel bars and wire rods	19
Annex JC (informative) Comparison table between JIS and corresponding International Standards	21

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 Japan Stainless Steel Association (JSSA)/Japanese Standards Association (JSA) 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 4311:2007** is replaced with this Standard.

This **JIS** document is protected by the Copyright Law.

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 or utility model right 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 or utility model right which have the said technical properties.

Heat-resisting steel bars and wire rods

Introduction

This Japanese Industrial Standard has been prepared based on the third edition of **ISO 4955** published in 2005 and the second edition of **ISO 683-15** published in 1992 with some modifications of the technical contents. As a reference, main usages of heat-resisting steel bars and wire rods are shown in Annex JB.

The portions given sidelines or dotted underlines are the matters in which the contents of the original International Standards have been modified. A list of modifications with explanations is given in Annex JC. Annex JA and Annex JB are not stated in the original International Standards.

1 Scope

This Standard specifies heat-resisting steel bars (round bars, square bars, hexagonal bars and flat bars, hereafter referred to as “bars” generically) and heat-resisting steel wire rods (hereafter referred to as “wire rods”).

The semi-finished products and forgings are out of scope of this Standard; however, clause 5 of this Standard may apply to the chemical compositions thereof.

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

ISO 4955 : 2005 *Heat-resistant steels*

ISO 683-15 : 1992 *Heat-treatable steels, alloy steels and free-cutting steels — Part 15 : Valve steels for internal combustion engines* (Overall evaluation : MOD)

The 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**.

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 B 0401-1 *ISO system of limits and fits — Part 1 : Bases of tolerances, deviations and fits*

JIS G 0320 *Standard test method 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*

NOTE : Corresponding International Standard : ISO 404 *Steel and steel products — General technical delivery requirements* (MOD)

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

NOTE : Corresponding International Standard : ISO 10474 *Steel and steel products — Inspection documents* (IDT)

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 0567 *Method of elevated temperature tensile test for steels and heat-resisting alloys*

NOTE : Corresponding International Standard : ISO 783 *Metallic materials — Tensile testing at elevated temperature* (MOD)

JIS G 4303 *Stainless steel bars*

JIS G 4308 *Stainless steel wire rods*

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

NOTE : Corresponding International Standard : ISO 6892-1 *Metallic materials — Tensile testing — Part 1 : Method of test at room temperature* (MOD)

JIS Z 2242 *Method for Charpy pendulum impact test of metallic materials*

JIS Z 2243 *Brinell hardness test — Test method*

NOTE : Corresponding International Standard : ISO 6506-1 *Metallic materials — Brinell hardness test — Part 1 : Test method* (MOD)

JIS Z 8401 *Guide to the rounding of numbers*

3 Grade and symbol

Bars and wire rods are classified into 35 grades, and their symbols and classifications shall be as given in table 1.

Table 1 Symbol of grade and classification

Symbol of grade ^{a) b)}	Classification	Symbol of grade ^{a) b)}	Classification
SUH31 SUH35 SUH36 SUH37 SUH38 SUH309 SUH310 SUH330 SUH660 SUH661	Austenitic series	SUS304 SUS309S SUS310S SUS316 SUS316Ti SUS317 SUS321 SUS347 SUSXM15J1	Austenitic series
SUH446	Ferritic series	SUS405 SUS410L SUS430	Ferritic series
SUH1 SUH3 SUH4 SUH11 SUH600 SUH616	Martensitic series	SUS403 SUS410 SUS410J1 SUS431	Martensitic series
		SUS630 SUS631	Precipitation hardening series
NOTE : The abolishment of SUH661 will be discussed at the revision of next time. Notes ^{a)} In the case where the products are required to be expressed as bars by the symbol, -B (hot finished steel bars) or -CB (cold finished steel bars) shall be suffixed to the symbol of grade. Example : SUH309-B ^{b)} In the case where the products are required to be expressed as wire rods by the symbol, -WR shall be suffixed to the symbol of grade. Example : SUH11-WR			

4 Manufacturing method

The manufacturing method shall be as follows.

- Bars are usually heat-treated after the hot working such as hot rolling, hot forging. The representative heat treatment conditions are shown in Annex JA. The types of heat treatment shall be upon the agreement between the purchaser and the manufacturer, including the omission of heat treatment.
- When being used as the material for the cold finished steel bars, the heat treatment may be omitted upon the agreement between the purchaser and the manufacturer.
- Unless otherwise specified by the purchaser, the heat treatment shall be omitted for the bars manufactured by cold drawing, grinding, cutting or the combination thereof.
- Wire rods shall be as hot rolled; however, pickling or heat treatment or the like may be performed, if necessary.

- e) Black scales generated by heat treatment shall be removed, if necessary, by pickling, cutting or other suitable means.
- f) Symbols expressing the heat treatment and the surface finishing method shall be as given in table 2.

Table 2 Symbol for heat treatment and surface finishing method

Item	Symbol
As hot worked	R
Solution treatment	S
Aging treatment after solution treatment	H
Annealing	A
Quenching and tempering	Q
Pickling finish	P
Cold drawing	D
Cutting	T
Grinding	C
The symbol for heat treatment may be separately determined upon the agreement between the purchaser and the manufacturer.	

5 Chemical compositions

5.1 Heat analysis value

Bars and wire rods shall be subjected to the test of 11.1 and their heat analysis values shall be as given in table 3 to table 5. The heat analysis values of symbol SUS in table 1 shall be as specified in **JIS G 4303** and **JIS G 4308**.

5.2 Product analysis value

When the product analysis values of bars and wire rods are requested by the purchaser, the test of 11.1 shall be performed, and the tolerances thereof shall be as given in table 5 of **JIS G 0321**. However, the tolerances of chemical compositions other than those specified in table 5 of **JIS G 0321** may be upon the agreement between the purchaser and the manufacturer.

Table 3 Chemical compositions of austenitic series

Unit : %

Symbol of grade	C	Si	Mn	P	S	Ni	Cr	Mo	W	Co	V	N	Others
SUH31	0.35 to 0.45	1.50 to 2.50	0.60 max.	0.040 max.	0.030 max.	13.00 to 15.00	14.00 to 16.00	—	2.00 to 3.00	—	—	—	—
SUH35	0.48 to 0.58	0.35 max.	8.00 to 10.00	0.040 max.	0.030 max.	3.25 to 4.50	20.00 to 22.00	—	—	—	—	0.35 to 0.50	—
SUH36	0.48 to 0.58	0.35 max.	8.00 to 10.00	0.040 max.	0.040 to 0.090	3.25 to 4.50	20.00 to 22.00	—	—	—	—	0.35 to 0.50	—
SUH37	0.15 to 0.25	1.00 max.	1.00 to 1.60	0.040 max.	0.030 max.	10.00 to 12.00	20.50 to 22.50	—	—	—	—	0.15 to 0.30	—
SUH38	0.25 to 0.35	1.00 max.	1.20 max.	0.18 to 0.25	0.030 max.	10.00 to 12.00	19.00 to 21.00	1.80 to 2.50	—	—	—	—	B 0.001 to 0.010
SUH309	0.20 max.	1.00 max.	2.00 max.	0.040 max.	0.030 max.	12.00 to 15.00	22.00 to 24.00	—	—	—	—	—	—
SUH310	0.25 max.	1.50 max.	2.00 max.	0.040 max.	0.030 max.	19.00 to 22.00	24.00 to 26.00	—	—	—	—	—	—
SUH330	0.15 max.	1.50 max.	2.00 max.	0.040 max.	0.030 max.	33.00 to 37.00	14.00 to 17.00	—	—	—	—	—	—
SUH660	0.08 max.	1.00 max.	2.00 max.	0.040 max.	0.030 max.	24.00 to 27.00	13.50 to 16.00	1.00 to 1.50	—	—	0.10 to 0.50	—	Ti 1.90 to 2.35, Al 0.35 max., B 0.001 to 0.010
SUH661	0.08 to 0.16	1.00 max.	1.00 to 2.00	0.040 max.	0.030 max.	19.00 to 21.00	20.00 to 22.50	2.50 to 3.50	2.00 to 3.00	18.50 to 21.00	—	0.10 to 0.20	Nb 0.75 to 1.25

Table 4 Chemical compositions of ferritic series

Unit : %

Symbol of grade	C	Si	Mn	P	S	Cr	N
SUH446 a) b)	0.20 max.	1.00 max.	1.50 max.	0.040 max.	0.030 max.	23.00 to 27.00	0.25 max.
Notes a) 0.30 % max. of Cu may be contained. b) 0.60 % max. of Ni may be contained.							

Table 5 Chemical compositions of martensitic series

Unit : %

Symbol of grade	C	Si	Mn	P	S	Ni	Cr	Mo	W	V	N	Nb
SUH1 a) b)	0.40 to 0.50	3.00 to 3.50	0.60 max.	0.030 max.	0.030 max.	—	7.50 to 9.50	—	—	—	—	—
SUH3 a) b)	0.35 to 0.45	1.80 to 2.50	0.60 max.	0.030 max.	0.030 max.	—	10.00 to 12.00	0.70 to 1.30	—	—	—	—
SUH4 a)	0.75 to 0.85	1.75 to 2.25	0.20 to 0.60	0.030 max.	0.030 max.	1.15 to 1.65	19.00 to 20.50	—	—	—	—	—
SUH11 a) b)	0.45 to 0.55	1.00 to 2.00	0.60 max.	0.030 max.	0.030 max.	—	7.50 to 9.50	—	—	—	—	—
SUH600 a) b)	0.15 to 0.20	0.50 max.	0.50 to 1.00	0.040 max.	0.030 max.	—	10.00 to 13.00	0.30 to 0.90	—	0.10 to 0.40	0.05 to 0.10	0.20 to 0.60
SUH616 a)	0.20 to 0.25	0.50 max.	0.50 to 1.00	0.040 max.	0.030 max.	0.50 to 1.00	11.00 to 13.00	0.75 to 1.25	0.75 to 1.25	0.20 to 0.30	—	—
Notes a) 0.30 % max. of Cu may be contained. b) 0.60 % max. of Ni may be contained.												