

JAPANESE
INDUSTRIAL
STANDARD

Translated and Published by
Japanese Standards Association

JIS G 3479 : 2021

(JISF)

**Steel tubes for machine structure with
specified hardenability bands**

ICS 77.140.10 ; 77.140.75

Reference number : JIS G 3479 : 2021 (E)

PROTECTED BY COPYRIGHT

Date of Establishment: 2015-05-20

Date of Revision: 2021-05-20

Date of Public Notice in Official Gazette: 2021-05-20

Investigated by: Japanese Industrial Standards Committee

Standards Board for ISO area

Technical Committee on Metal and Inorganic Materials

JIS G 3479 : 2021, First English edition published in 2021-12

Translated and published by: Japanese Standards Association
Mita MT Building, 3-13-12, Mita, Minato-ku, Tokyo, 108-0073 JAPAN

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

© JSA 2021

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
1 Scope	1
2 Normative references	1
3 Terms and definitions	1
4 Symbol of grade	1
5 Manufacturing method	2
6 Chemical composition	2
7 Flattening property	4
8 Metallographic properties	4
8.1 Hardenability	4
8.2 Austenitic grain size	5
9 Dimensions and dimensional tolerances	6
9.1 Dimensions	6
9.2 Dimensional tolerances	6
10 Appearance	6
11 Tests	7
11.1 Chemical analysis	7
11.2 Flattening test	7
11.3 Metallographic property test	8
12 Inspection and reinspection	9
12.1 Inspection	9
12.2 Reinspection	9
13 Marking	9
14 Report	10
Annex A (informative) Examples of test to be applied by the agreement between the purchaser and the manufacturer	35

Foreword

This Japanese Industrial Standard has been revised by the Minister of Economy, Trade and Industry through deliberations at the Japanese Industrial Standards Committee as the result of proposal for revision of Japanese Industrial Standard submitted by The Japan Iron and Steel Federation (JISF) with a draft being attached, based on the provision of Article 12, paragraph (1) of the Industrial Standardization Act applied mutatis mutandis pursuant to the provision of Article 16 of the said Act. This edition replaces the previous edition (**JIS G 3479: 2016**), which has been technically revised.

However, **JIS G 3479: 2016** may be applied in the **JIS** mark certification based on the relevant provisions of Article 30, paragraph (1), etc. of the Industrial Standardization Act until 19 May 2022.

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

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

Steel tubes for machine structure with specified hardenability bands

1 Scope

This Japanese Industrial Standard specifies the requirements for the steel tubes for machine structure with specified hardenability bands used mainly for machine parts (hereafter referred to as tubes).

2 Normative references

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

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

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

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

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

JIS G 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 0561 *Method of hardenability test for steel (End quenching method)*

3 Terms and definitions

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

4 Symbol of grade

The tubes shall be classified into 24 grades, and their symbols shall be as given in Table 1.

Table 1 Symbols of grade and symbols of manufacturing method

Classification	Symbol of grade	Symbol of manufacturing method		
		Tube manufacturing method	Finishing method	Marking
Manganese steel	SMn420HTK SMn433HTK SMn438HTK SMn443HTK	Seamless : S Electric resistance welding : E	Hot finished : H Cold finished : C As electric resistance welded : G	As given in 13 b).
Manganese chromium steel	SMnC420HTK SMnC443HTK			
Chromium steel	SCr415HTK SCr420HTK SCr430HTK SCr435HTK SCr440HTK			
Chromium molybdenum steel	SCM415HTK SCM418HTK SCM420HTK SCM425HTK SCM435HTK SCM440HTK SCM445HTK SCM822HTK			
Nickel chromium steel	SNC415HTK SNC631HTK SNC815HTK			
Nickel chromium molybdenum steel	SNCM220HTK SNCM420HTK			

5 Manufacturing method

The manufacturing method shall be as follows.

- Tubes shall be manufactured by combination of the tube manufacturing method and the finishing method which are indicated in Table 1. If required, tubes may be subjected to the appropriate heat treatment. The symbols of manufacturing method shall be as given in Table 1.
- If required, the purchaser may specify the heat treatment.
- Tubes shall be finished with plain ends unless otherwise specified.

6 Chemical composition

The tubes shall be tested in accordance with 11.1, and the obtained heat analysis values shall be as given in Table 2. In the case where a product analysis is requested by the purchaser, the test shall be conducted in accordance with 11.1, and the product analysis values shall satisfy the requirements in Table 2 to which tolerances in Table 4 of JIS G 0321 are applied.

Table 2 Chemical composition

Unit : %

Symbol of grade	C	Si	Mn	P	S	Ni	Cr	Mo	Cu
SMn420HTK	0.16 to 0.23	0.15 to 0.35	1.15 to 1.55	0.030 max.	0.030 max.	0.25 max.	0.35 max.	a)	0.30 max.
SMn433HTK	0.29 to 0.36	0.15 to 0.35	1.15 to 1.55	0.030 max.	0.030 max.	0.25 max.	0.35 max.	a)	0.30 max.
SMn438HTK	0.34 to 0.41	0.15 to 0.35	1.30 to 1.70	0.030 max.	0.030 max.	0.25 max.	0.35 max.	a)	0.30 max.
SMn443HTK	0.39 to 0.46	0.15 to 0.35	1.30 to 1.70	0.030 max.	0.030 max.	0.25 max.	0.35 max.	a)	0.30 max.
SMnC420HTK	0.16 to 0.23	0.15 to 0.35	1.15 to 1.55	0.030 max.	0.030 max.	0.25 max.	0.35 to 0.70	a)	0.30 max.
SMnC443HTK	0.39 to 0.46	0.15 to 0.35	1.30 to 1.70	0.030 max.	0.030 max.	0.25 max.	0.35 to 0.70	a)	0.30 max.
SCr415HTK	0.12 to 0.18	0.15 to 0.35	0.55 to 0.95	0.030 max.	0.030 max.	0.25 max.	0.85 to 1.25	a)	0.30 max.
SCr420HTK	0.17 to 0.23	0.15 to 0.35	0.55 to 0.95	0.030 max.	0.030 max.	0.25 max.	0.85 to 1.25	a)	0.30 max.
SCr430HTK	0.27 to 0.34	0.15 to 0.35	0.55 to 0.95	0.030 max.	0.030 max.	0.25 max.	0.85 to 1.25	a)	0.30 max.
SCr435HTK	0.32 to 0.39	0.15 to 0.35	0.55 to 0.95	0.030 max.	0.030 max.	0.25 max.	0.85 to 1.25	a)	0.30 max.
SCr440HTK	0.37 to 0.44	0.15 to 0.35	0.55 to 0.95	0.030 max.	0.030 max.	0.25 max.	0.85 to 1.25	a)	0.30 max.
SCM415HTK	0.12 to 0.18	0.15 to 0.35	0.55 to 0.95	0.030 max.	0.030 max.	0.25 max.	0.85 to 1.25	0.15 to 0.30	0.30 max.
SCM418HTK	0.15 to 0.21	0.15 to 0.35	0.55 to 0.95	0.030 max.	0.030 max.	0.25 max.	0.85 to 1.25	0.15 to 0.30	0.30 max.
SCM420HTK	0.17 to 0.23	0.15 to 0.35	0.55 to 0.95	0.030 max.	0.030 max.	0.25 max.	0.85 to 1.25	0.15 to 0.30	0.30 max.
SCM425HTK	0.23 to 0.28	0.15 to 0.35	0.55 to 0.95	0.030 max.	0.030 max.	0.25 max.	0.85 to 1.25	0.15 to 0.30	0.30 max.
SCM435HTK	0.32 to 0.39	0.15 to 0.35	0.55 to 0.95	0.030 max.	0.030 max.	0.25 max.	0.85 to 1.25	0.15 to 0.35	0.30 max.
SCM440HTK	0.37 to 0.44	0.15 to 0.35	0.55 to 0.95	0.030 max.	0.030 max.	0.25 max.	0.85 to 1.25	0.15 to 0.35	0.30 max.
SCM445HTK	0.42 to 0.49	0.15 to 0.35	0.55 to 0.95	0.030 max.	0.030 max.	0.25 max.	0.85 to 1.25	0.15 to 0.35	0.30 max.
SCM822HTK	0.19 to 0.25	0.15 to 0.35	0.55 to 0.95	0.030 max.	0.030 max.	0.25 max.	0.85 to 1.25	0.35 to 0.45	0.30 max.
SNC415HTK	0.11 to 0.18	0.15 to 0.35	0.30 to 0.70	0.030 max.	0.030 max.	1.95 to 2.50	0.20 to 0.55	a)	0.30 max.
SNC631HTK	0.26 to 0.35	0.15 to 0.35	0.30 to 0.70	0.030 max.	0.030 max.	2.45 to 3.00	0.55 to 1.05	a)	0.30 max.
SNC815HTK	0.11 to 0.18	0.15 to 0.35	0.30 to 0.70	0.030 max.	0.030 max.	2.95 to 3.50	0.55 to 1.05	a)	0.30 max.
SNCM220HTK	0.17 to 0.23	0.15 to 0.35	0.60 to 0.95	0.030 max.	0.030 max.	0.35 to 0.75	0.35 to 0.65	0.15 to 0.30	0.30 max.
SNCM420HTK	0.17 to 0.23	0.15 to 0.35	0.40 to 0.70	0.030 max.	0.030 max.	1.55 to 2.00	0.35 to 0.65	0.15 to 0.30	0.30 max.
Any alloy elements not given in this table shall not be intentionally added for other purposes than finishing the heat. Upon agreement between the purchaser and the manufacturer, B may be added. If added, the B content shall be not more than 0.005 0 %, and the designation B shall be suffixed to the symbol of grade. Note a) As necessary, Mo may be added. When added, the Mo content shall be less than 0.15 %.									

7 Flattening property

Electric resistance welded steel tubes shall be tested in accordance with **11.2**, and the cracks shall not be generated on the weld of test piece when it is flattened until the distance between the plates reaches seven eighth of outside diameter. When agreed between the purchaser and the manufacturer, the specifications for flattening property need not be applied.

8 Metallographic properties

8.1 Hardenability

The hardenability shall be as follows.

- a) The purchaser shall specify the distance from the quenched end for measurement of hardness, and the lower limit (if indicated) and the upper limit of hardness at the specified distance as given in Table 3 to Table 26. If the distance from the quenched end is not shown in the table, the upper and lower limits of hardness shall be determined based on the values read from the chart, upon agreement between the purchaser and the manufacturer.
- b) The tubes shall be tested in accordance with **11.3.1**, and the obtained hardenability at the specified distance from the quenched end of test piece shall be within the hardness specified in **a**).

Example : When hardness is specified at 7 mm from the quenched end of test piece (A – A') shown in Figure 1, indicate “J 7 mm = 31/44”.

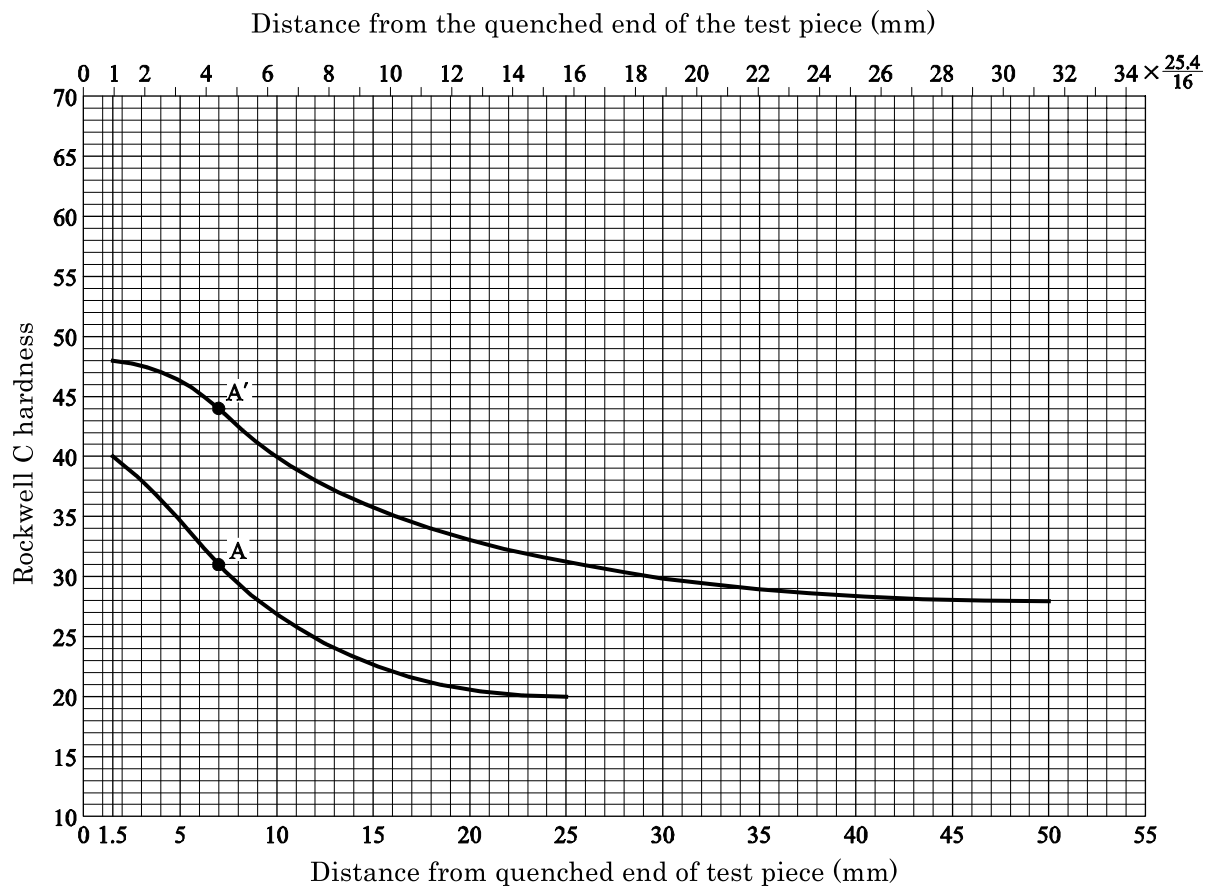


Figure 1 Specification of hardenability

8.2 Austenitic grain size

The tubes shall be tested in accordance with 11.3.2, and the austenitic grain size shall be as given in **Table 27**.

Table 27 Austenitic grain size

Symbol of grade	Austenitic grain size
SMn433HTK, SMn438HTK, SMn443HTK, SMnC443HTK SCr430HTK, SCr435HTK, SCr440HTK, SCM435HTK, SCM440HTK, SCM445HTK, SNC631HTK	Average grain size number in heat treatment ^{a)} 5.0 min.
SMn420HTK, SMnC420HTK, SCr415HTK, SCr420HTK SCM415HTK, SCM418HTK, SCM420HTK, SCM425HTK SCM822HTK, SNC415HTK, SNC815HTK, SNCM220HTK SNCM420HTK	Average grain size number in carburizing ^{b)} 6.0 min.
Note ^{a)} Average grain size number obtained by heat-treated grain size test.	
Note ^{b)} Average grain size number obtained by carburized grain size test	

9 Dimensions and dimensional tolerances

9.1 Dimensions

The dimensions shall be upon the agreement between the purchaser and the manufacturer.

9.2 Dimensional tolerances

The dimensional tolerances shall be as follows.

- a) The tolerances on the outside diameter and the wall thickness of tubes shall be as given in Table 28 and Table 29, respectively. For hot finished seamless steel tubes, Class 1 given in Table 28 and Table 29 shall apply. For other tubes, the division to be applied shall be determined according to the agreement between the purchaser and the manufacturer.
- b) The tolerances on the length of tubes shall be $^{+50}_0$ mm, unless otherwise agreed between the purchaser and the manufacturer.

Table 28 Tolerances on outside diameter ^{a)}

Division	Outside diameter mm	Tolerances on outside diameter
Class 1	Under 50	±0.5 mm
	50 or over	±1 %
Class 2	Under 50	±0.25 mm
	50 or over	±0.5 %
Class 3	Under 25	±0.12 mm
	25 or over to and excl. 40	±0.15 mm
	40 or over to and excl. 50	±0.18 mm
	50 or over to and excl. 60	±0.20 mm
	60 or over to and excl. 70	±0.23 mm
	70 or over to and excl. 80	±0.25 mm
	80 or over to and excl. 90	±0.30 mm
	90 or over to and excl. 100	±0.40 mm
	100 or over	±0.50 %
Note ^{a)} For local repaired parts, tolerances in this table do not apply.		

Table 29 Tolerances on wall thickness

Division	Wall thickness mm	Tolerances on wall thickness
Class 1	Under 4	+0.6 mm −0.5 mm
	4 or over	+15 % −12.5 %
Class 2	Under 3	±0.3 mm
	3 or over	±10 %
Class 3	Under 2	±0.15 mm
	2 or over	±8 %

10 Appearance

The appearance shall be as follows.

- a) The tubes shall be straight for practical purposes and the both ends shall be at right angles to the tube axis.
- b) The tubes shall be smoothly finished and free from defects detrimental to use.
- c) The tubes may be repaired by grinding, machining or other methods, provided that the wall thickness after repair still satisfies the specified tolerances on the wall thickness.

- d) The surface of repaired part shall be smooth along the contour of the tube.
- e) A special request concerning the surface finishing of tubes, if any, shall be upon the agreement between the purchaser and the manufacturer.

11 Tests

NOTE Examples of test to be applied by the agreement between the purchaser and the manufacturer are given in Annex A.

11.1 Chemical analysis

11.1.1 General requirements and sampling method

General requirements for chemical analysis and sampling method shall be in accordance with Clause 8 of **JIS G 0404**. The sampling method, when the product analysis is requested by the purchaser, shall be in accordance with Clause 4 of **JIS G 0321**.

11.1.2 Analysis method

The heat analysis method shall be in accordance with **JIS G 0320**. The product analysis method shall be in accordance with **JIS G 0321**.

11.2 Flattening test

11.2.1 General

General requirements for flattening test shall be in accordance with Clause 7 and Clause 9 of **JIS G 0404**. However, the sampling method for flattening test shall be in accordance with Class A specified in 7.6 of **JIS G 0404**.

11.2.2 Sampling method

The sampling method shall be as given in Table 30.

Table 30 Sampling method

Outside diameter	Sampling method
65 mm or under	Take one sample from each 2 000 m and its fraction of tubes of the same dimensions ^{a)} and the same heat treatment batch ^{b) c)} .
Over 65 mm up to and incl. 100 mm	Take one sample from each 1 000 m and its fraction of tubes of the same dimensions ^{a)} and the same heat treatment batch ^{b) c)} .
Over 100 mm up to and incl. 200 mm	Take one sample from each 500 m and its fraction of tubes of the same dimensions ^{a)} and the same heat treatment batch ^{b) c)} .
Over 200 mm	Take one sample from each 250 m and its fraction of tubes of the same dimensions ^{a)} and the same heat treatment batch ^{b) c)} .
Note ^{a)} The same dimensions refer to the same outside diameter and the same wall thickness. Note ^{b)} Applicable to heat-treated tubes. When the heat treatment is performed in a continuous furnace, the “same heat treatment batch” refers to a unit of tubes produced in one continuous operation of furnace under consistent heat treating conditions, and tubes heat-treated before and after furnace stoppage, if any, are not regarded as belonging to the same heat treatment batch. Note ^{c)} In the case of sampling from a unit of tubes from the same heat, the tubes in the unit may be of the same heat treatment condition, instead of being from the same heat treatment batch.	

11.2.3 Test pieces

Take one test piece of length 50 mm or longer from each sample. For tubes whose wall thickness is 15 % or over of the tube outside diameter, a C-shaped test piece prepared by removing a part of the circumference of a ring-shaped test piece may be used.

11.2.4 Test method

Place the test piece at ordinary temperature (5 °C to 35 °C) between two flat plates and flatten by compression until the distance (H) between the plates is decreased to seven eighths of the outside diameter or less, then examine for cracks on the weld of test pieces. Place the weld, as shown in Figure 2, such that the line between the centre of the tube and the weld is perpendicular to the direction of compression. Place a C-shaped test piece as shown in Figure 3.

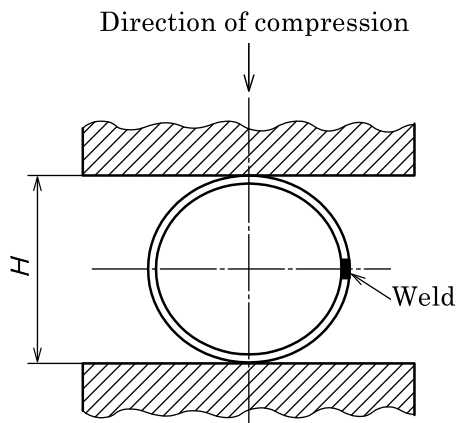


Figure 2 Flattening test
(using ring-shaped test piece)

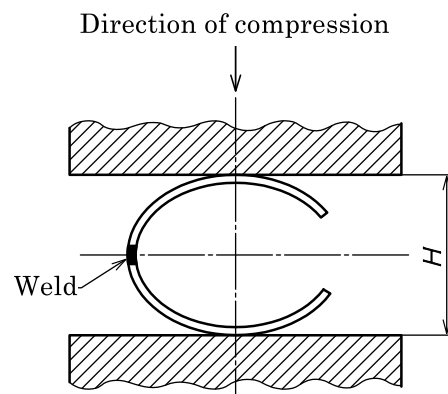


Figure 3 Flattening test
(using C-shaped test piece)

11.3 Metallographic property test

11.3.1 Hardenability test

The hardenability test shall be as follows.

- The sampling method and the number of test pieces shall be upon the agreement between the purchaser and the manufacturer.
- The test method shall be in accordance with **JIS G 0561**.

11.3.2 Austenitic grain size test

The austenitic grain size test shall be as follows.

- The sampling method and the number of test pieces shall be upon the agreement between the purchaser and the manufacturer.
- The test method shall be in accordance with **JIS G 0551**. However, the heat treated grain size test shall be either quenching and tempering method (Gh) or pickling method (Go).

12 Inspection and reinspection

12.1 Inspection

The inspection shall be as follows.

- a) General requirements for inspection shall be as specified in **JIS G 0404**.
- b) Chemical composition shall conform to the requirements of Clause 6.
- c) Flattening property shall conform to the requirements of Clause 7.
- d) Hardenability and austenite grain size shall conform to the requirements of Clause 8.
- e) Dimensions shall conform to the requirements of Clause 9.
- f) Appearance shall conform to the requirements of Clause 10.

12.2 Reinspection

The tubes having failed in the flattening test may be subjected to the retest according to 9.8 of **JIS G 0404** for further acceptance judgement.

13 Marking

Each tube which has passed the inspection shall be marked with the following items. When the marking on tube is difficult because its outside diameter is small or when so requested by the purchaser, the marking may be given on each bundle of tubes by a suitable means. The order of markings is not specified. Any information among the following not essential for identification of the product may be omitted upon agreement between the purchaser and the manufacturer.

- a) Symbol of grade
- b) Symbol for manufacturing method The symbols of manufacturing method shall be as follows. The dash may be replaced with a blank.
 - 1) Hot finished seamless steel tube : – S – H
 - 2) Cold finished seamless steel tube : – S – C
 - 3) As electric resistance welded steel tube : – E – G
 - 4) Hot finished electric resistance welded steel tube : – E – H
 - 5) Cold finished electric resistance welded steel tube : – E – C
- c) Dimensions

The outside diameter and the wall thickness shall be marked.

- d) Name of manufacturer or identifying brand
- e) Designation to indicate the addition of boron (B)

If boron (B) is added, the designation B shall be suffixed to the symbol of grade.