भारतीयमानक
Indian Standard

IS 5856 : 2022
ISO 14343 : 2017

वेल्डिंग उपभोग्य वस्तुएं — स्टेनलेस और गर्मीप्रतिरोधी स्टील्स के आर्क वेल्डिंग के लिए तार इल्कट्रोड, स्ट्रिपइल्कट्रोड, तार और छड़ — वर्गीकरण

(तीसरा पुनरीक्षण)

Welding Consumables — Wire Electrodes, Strip Electrodes, Wires and Rods for Arc Welding of Stainless and Heat Resisting Steels — Classification

(Third Revision)

ICS 25.160.20

भारतीय मानक ब्यूरो
BUREAU OF INDIAN STANDARDS
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October 2022 **Price Group 9**

Welding General and its Applications Sectional Committee, MTD11

NATIONAL FOREWORD

This Indian standard which is identical to ISO 14343 : 2017 ‘Welding consumables —Wire electrodes strip electrodes wires and rods for arc welding of stainless and heat resisting steels—Classification’ issued by the International Organization for Standardization (ISO), was adopted by the Bureau of Indian Standards on the recommendation of the Welding General and its Applications Sectional Committee and approval of the Metallurgical Engineering Division Council.

This standard was originally published in 1970 and subsequently revised as IS 5856 : 1991‘Corrosion and heat-resisting chromium-nickel and chromium-steel solid welding rods and bare electrodes — Specification (*first revision*)’. In second revision the committee adopted ISO 14343 : 2009 under dual numbering system. The third revision of this standard has been undertaken to align it with the latest version of ISO 14343 : 2017.

The changes in this version as compared to the previous edition are as follows:

a) A number of new alloy designations have been added to Table 1 and Table A.1;
b) The chemistries of some alloy designations have been revised in Table 1;
c) The mechanical properties of some alloy designations have been revised in Table A.1;
d) Clause 7 has been updated to new text for all new and revised standards;
e) Examples for Z designations have been added to Clause 10.

The text of ISO standard has been approved as suitable for publication as an Indian Standard without deviations. Certain terminologies and conventions are, however, not identical with those used in Indian Standard. Attention is especially drawn to the following:

a) Wherever the words `International Standard’ appear referring to this standard, it should be read as `Indian Standard’
b) Comma (,) has been used as a decimal marker while in Indian Standards the current practice is to use a point (.) as the decimal marker.

In this adopted standard, reference appears to certain International Standards for which Indian Standards also exists. The corresponding Indian Standards which is to be substituted in their place are listed below along with their degree of equivalence for the edition indicated.

International Standard	*Corresponding Indian Standard*	*Degree of Equivalence*
ISO 80000-1 : 2009 Quantities and units —Part 1: General corrected by ISO 80000-1 : 2009/Cor 1 : 2011	IS/ISO 80000-1 : 2009 Quantities and units: General	Identical

The Technical Committee responsible for the preparation of this standard has reviewed the provisions of following International Standards referred in these adopted standards and has decided that they are acceptable for use in conjunction with this standard.

International Standard	*Title*
ISO 544	Welding consumables — Technical delivery conditions for filler materials and fluxes— Type of product, dimensions, tolerances and markings ISO
ISO 14344	Welding consumables — Procurement of filler materials and fluxes

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation on the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see the following URL: www.iso.org/iso/foreword.html

This document was prepared by Technical Committee ISO/TC 44, *Welding and allied processes*, Subcommittee SC 3, *Welding consumables*.

This third edition cancels and replaces the second edition (ISO 14343:2009), which has been technically revised and contains the following changes:

— a number of new alloy designations have been added to Table 1 and Table A.1;

— the chemistries of some alloy designations have been revised in Table 1;

— the mechanical properties of some alloy designations have been revised in Table A.1;

— Clause 7 has been updated to new text for all new and revised standards;

— examples for Z designations have been added to Clause 10.

Requests for official interpretations of any aspect of this document should be directed to the Secretariat of ISO/TC 44/SC 3 via your national standards body. A complete listing of these bodies can be found at www.iso.org.

Introduction

This document provides a classification system for wire electrodes, strip electrodes, wires and rods for arc welding of stainless and heat resisting steels. It recognizes that there are two somewhat different approaches in the global market to classifying a given welding consumable, and allows for either or both to be used, to suit a particular market need. Many, but not all, commercial products addressed by this document can be classified using both approaches, and suitable products can also be marked.

System A uses the *nominal composition* approach with designators to indicate the principal alloying elements at their nominal levels, in a particular sequence, and which is sometimes followed by chemical element symbols to indicate compositional modifications to the original grade. System B uses the *alloy type* approach with three- or four-digit designations for certain grades, sometimes followed by one or more chemical element symbols indicating compositional modifications of the grade. In both approaches, classification is based upon the chemical composition of the product. In many cases, a given product can be classified using both approaches, because the composition ranges, although slightly different, overlap to a considerable extent between the two.

For stainless steel welding consumables, there is no unique relationship between the product form (wire electrode, strip electrode, wire or rod) and the welding process used (gas-shielded metal arc welding, gas tungsten arc welding, plasma arc welding, submerged arc welding, electroslag welding and laser beam welding). For this reason, the wire electrodes, strip electrodes, wires or rods can be classified on the basis of any of the above product forms and can be used, as appropriate, for more than one of the above processes.

Classification according to system A, by nominal composition, is based mainly on EN 12072[1], while that of system B, by alloy type, is mainly based upon standards used around the Pacific Rim.

Indian Standard

WELDING CONSUMABLES — WIRE ELECTRODES, STRIP ELECTRODES, WIRES AND RODS FOR ARC WELDING OF STAINLESS AND HEAT RESISTING STEELS — CLASSIFICATION

(Third Revision)

1 Scope

This document specifies requirements for classification of wire electrodes, strip electrodes, wires and rods for gas-shielded metal arc welding, gas tungsten arc welding, plasma arc welding, submerged arc welding, electroslag welding and laser beam welding of stainless and heat-resisting steels. The classification of the wire electrodes, strip electrodes, wires and rods is based upon their chemical composition.

This document is a combined specification providing for classification utilizing a system based upon nominal composition (system A), or utilizing a system based upon alloy type (system B).

a) Paragraphs which carry the label “classification according to nominal composition” and the suffix letter “A”, or “ISO 14343-A”, are applicable only to products classified according to system A;

b) Paragraphs which carry the label “classification according to alloy type” and the suffix letter “B”, or “ISO 14343-B”, are applicable only to products classified according to system B.

c) Paragraphs which carry neither label nor suffix letter are applicable to products that can be classified according to either system A or B or both.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 544, *Welding consumables — Technical delivery conditions for filler materials and fluxes— Type of product, dimensions, tolerances and markings*

ISO 14344, *Welding consumables — Procurement of filler materials and fluxes*

ISO 80000-1:2009, *Quantities and units — Part 1: General.* Corrected by ISO 80000-1:2009/Cor 1:2011

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— IEC Electropedia: available at http://www.electropedia.org/

— ISO Online browsing platform: available at http://www.iso.org/obp

3.1
rod
form of welding filler metal, normally packaged in straight lengths, that does not conduct the welding current, used in gas tungsten arc and plasma arc welding

3.2
strip electrode
form of welding filler metal, normally packaged as coils, having a rectangular cross-section of width much greater than thickness, that becomes part of the welding circuit through which current is conducted, and that terminates at the arc for submerged arc welding, or at the slag bath for electroslag welding

3.3
wire
form of welding filler metal, normally packaged as coils, spools or drums, that does not conduct the welding current, for gas tungsten arc, plasma arc welding and laser beam welding

3.4
wire electrode
form of welding filler metal, normally packaged as coils, spools or drums, that becomes part of the welding circuit through which electrical current is conducted, and that terminates at the arc, used in gas-shielded metal arc and submerged arc welding

4 Classification

4.1 General

A wire electrode, strip electrode, wire or rod shall be classified according to its chemical composition as given in Table 1.

The classification is divided into two parts:

a) the first gives a symbol indicating the product/process to be identified;

b) the second gives a symbol indicating the chemical composition of the wire electrode, strip electrode, wire or rod.

4.2 Symbols for products/processes

4.2A Classification according to nominal composition

The symbol for the wire electrode, strip electrode, wire or rod used in the arc welding process shall be the letter

— "G" for gas metal arc welding,

— "W" for gas tungsten arc welding,

— "P" for plasma arc welding,

— "S" for submerged arc welding,

— "B" for submerged arc welding or electroslag welding with strip electrode, or

— "L" for laser beam welding, placed at the beginning of the designation.

See Clause 10 for designation examples.

4.2B Classification according to alloy type

No symbol is used to indicate the welding process.

The symbol for solid stainless and heat-resisting steel wire electrodes, wires and rods for use in all welding processes shall be the letters "SS". The initial "S" indicates solid wire as distinguished from covered electrodes or from tubular cored wires or tubular cored rods.

The symbol for strip electrodes for use in submerged arc welding or electroslag welding shall be the letters "BS". The "B" indicates a strip electrode, while the second "S" in "SS" and the "S" in "BS" indicates that the alloy system is stainless or heat-resisting steel.

See Clause 10 for designation examples.

4.3 Symbols for chemical composition

The symbols presented in Table 1 indicate the chemical composition of the wire electrode, strip electrode, wire or rod determined using the analysis specified in Clause 6.

Table 1 — Chemical composition requirements

Alloy designation[a] according to		Chemical composition, % by mass[b]											
Nominal composition[c] ISO 14343-A	Alloy type ISO 14343-B[c]	C	Si	Mn	P	S	Cr	Ni	Mo	N	Cu	Nb[d]	Other
Martensitic/ferritic types													
—	409	0,08	0,8	0,8	0,03	0,03	10,5 to 13,5	0,6	0,50	—	0,75	—	Ti 10 × C to 1,5
—	409Nb	0,08	1,0	0,8	0,04	0,03	10,5 to 13,5	0,6	0,50	—	0,75	10 × C to 0,75	—
13	(410)	0,15	1,0	1,0	0,03	0,02	12,0 to 15,0	0,5	0,5	—	0,5	—	—
(13)	410	0,12	0,5	0,6	0,03	0,03	11,5 to 13,5	0,6	0,75	—	0,75	—	—
13 L	—	0,05	1,0	1,0	0,03	0,02	12,0 to 15,0	0,5	0,5	—	0,5	—	—
13 4	(410NiMo)	0,05	1,0	1,0	0,03	0,02	11,0 to 14,0	3,0 to 5,0	0,4 to 1,0	—	0,5	—	—
(13 4)	410NiMo	0,06	0,5	0,6	0,03	0,03	11,0 to 12,5	4,0 to 5,0	0,4 to 0,7	—	0,75	—	—
—	420	0,25 to 0,40	0,5	0,6	0,03	0,03	12,0 to 14,0	0,6	0,75	—	0,75	—	—
16 5 1	—	0,04	0,2 to 0,7	1,2 to 3,5	0,02	0,01	15,0 to 17,0	4,5 to 6,5	0,9 to 1,5	—	0,5	—	—
17	(430)	0,12	1,0	1,0	0,03	0,02	16,0 to 19,0	0,5	0,5	—	0,5	—	—
(17)	430	0,10	0,5	0,6	0,03	0,03	15,5 to 17,0	0,6	0,75	—	0,75	—	—
—	430Nb	0,10	0,5	0,6	0,03	0,03	15,5 to 17,0	0,6	0,75	—	0,75	8 × C to 1,2	—
(18 L Nb)	430LNb	0,03	0,5	0,6	0,03	0,03	15,5 to 17,0	0,6	0,75	—	0,75	8 × C to 1,2	—
18 L Nb	(430LNb)	0,03	0,5	0,8	0,03	0,02	17,8 to 18,8	0,5	0,5	0,02	0,5	0,05 + 7(C+N) to 0,6	—
18 L Nb Si	—	0,03	0,5 to 1,5	1,0	0,03	0,03	17,5 to 19,5	0,5	0,5	0,02	0,5	0,05 + 7(C+N) to 0,6	—
18 L Nb Ti	—	0,03	1,5	1,0	0,03	0,03	17,5 to 19,5	0,5	0,5	0,02	0,5	8 × C to 0,8	Ti 10 × C to 0,5

Table 1 *(continued)*

Alloy designation[a] according to		Chemical composition, % by mass[b]											
Nominal composition[c] ISO 14343-A	**Alloy type ISO 14343-B[c]**	**C**	**Si**	**Mn**	**P**	**S**	**Cr**	**Ni**	**Mo**	**N**	**Cu**	**Nb[d]**	**Other**
—	439	0,04	0,8	0,8	0,03	0,03	17,0 to 19,0	0,6	0,5	—	0,75	—	Ti 10 × C to 1,1
—	446LMo	0,015	0,4	0,4	**0,02**	0,02	25,0 to 27,5	[g]	0,75 to 1,00	0,015	[g]	—	—
Austenitic types													
—	209	0,05	0,90	4,0 to 7,0	0,03	0,03	20,5 to 24,0	9,5 to 12,0	1,5 to 3,0	0,10 to 0,30	0,75	—	V 0,10 to 0,30
—	218	0,10	3,5 to 4,5	7,0 to 9,0	0,03	0,03	16,0 to 18,0	8,0 to 9,0	0,75	0,08 to 0,18	0,75	—	—
—	219	0,05	1,00	8,0 to 10,0	0,03	0,03	19,0 to 21,5	5,5 to 7,0	0,75	0,10 to 0,30	0,75	—	—
—	240	0,05	1,00	10,5 to 13,5	0,03	0,03	17,0 to 19,0	4,0 to 6,0	0,75	0,10 to 0,30	0,75	—	—
—	308	0,08	0,30 to 0,65	1,0 to 2,5	0,03	0,03	19,5 to 22,0	9,0 to 11,0	0,75	—	0,75	—	—
—	308Si	0,08	0,65 to 1,00	1,0 to 2,5	0,03	0,03	19,5 to 22,0	9,0 to 11,0	0,75	—	0,75	—	—
19 9 L	(308L)	0,03	0,65	1,0 to 2,5	0,03	0,02	19,0 to 21,0	9,0 to 11,0	0,5	—	0,5	—	—
(19 9 L)	308L	0,03	0,30 to 0,65	1,0 to 2,5	0,03	0,03	19,5 to 22,0	9,0 to 11,0	0,75	—	0,75	—	—
19 9 L Si	(308LSi)	0,03	0,65 to 1,2	1,0 to 2,5	0,03	0,02	19,0 to 21,0	9,0 to 11,0	0,5	—	0,5	—	—
(19 9 L Si)	308LSi	0,03	0,65 to 1,00	1,0 to 2,5	0,03	0,03	19,5 to 22,0	9,0 to 11,0	0,75	—	0,75	—	—
—	308N2	0,10	0,90	1,0 to 4,0	0,03	0,03	20,0 to 25,0	7,0 to 11,0	0,75	0,12 to 0,30	0,75	—	—
19 9 Nb	(347)	0,08	0,65	1,0 to 2,5	0,03	0,02	19,0 to 21,0	9,0 to 11,0	0,5	—	0,5	10 × C to 1,0	—

Table 1 *(continued)*

Alloy designation[a] according to		Chemical composition, % by mass[b]											
Nominal composition[c] ISO 14343-A	Alloy type ISO 14343-B[c]	C	Si	Mn	P	S	Cr	Ni	Mo	N	Cu	Nb[d]	Other
(19 9 Nb)	347	0,08	0,30 to 0,65	1,0 to 2,5	0,03	0,03	19,0 to 21,5	9,0 to 11,0	0,75	—	0,75	10 × C to 1,0	—
19 9 Nb Si	(347Si)	0,08	0,65 to 1,2	1,0 to 2,5	0,03	0,02	19,0 to 21,0	9,0 to 11,0	0,5	—	0,5	10 × C to 1,0	—
(19 9 Nb Si)	347Si	0,08	0,65 to 1,00	1,0 to 2,5	0,03	0,03	19,0 to 21,5	9,0 to 11,0	0,75	—	0,75	10 × C to 1,0	—
—	347L	0,03	0,65	1,0 to 2,5	0,03	0,03	19,0 to 21,5	9,0 to 11,0	0,75	—	0,75	10 × C to 1,0	—
—	347H	0,04 to 0,08	0,65	1,0 to 2,5	0,03	0,03	19,0 to 21,5	9,0 to 11,0	0,75	—	0,75	10 × C to 1,0	—
—	316	0,08	0,30 to 0,65	1,0 to 2,5	0,03	0,03	18,0 to 20,0	11,0 to 14,0	2,0 to 3,0	—	0,75	—	—
—	316Si	0,08	0,65 to 1,00	1,0 to 2,5	0,03	0,03	18,0 to 20,0	11,0 to 14,0	2,0 to 3,0	—	0,75	—	—
19 12 3 L	(316L)	0,03	0,65	1,0 to 2,5	0,03	0,02	18,0 to 20,0	11,0 to 14,0	2,5 to 3,0	—	0,5	—	—
(19 12 3 L)	316L	0,03	0,30 to 0,65	1,0 to 2,5	0,03	0,03	18,0 to 20,0	11,0 to 14,0	2,0 to 3,0	—	0,75	—	—
19 12 3 L Si	(316LSi)	0,03	0,65 to 1,2	1,0 to 2,5	0,03	0,02	18,0 to 20,0	11,0 to 14,0	2,5 to 3,0	—	0,5	—	—
(19 12 3 L Si)	316LSi	0,03	0,65 to 1,00	1,0 to 2,5	0,03	0,03	18,0 to 20,0	11,0 to 14,0	2,0 to 3,0	—	0,75	—	—
—	316LCu	0,03	0,65	1,0 to 2,5	0,03	0,03	18,0 to 20,0	11,0 to 14,0	2,0 to 3,0	—	1,0 to 2,5	—	—
19 12 3 Nb	(318)	0,08	0,65	1,0 to 2,5	0,03	0,02	18,0 to 20,0	11,0 to 14,0	2,5 to 3,0	—	0,5	10 × C to 1,0	—
(19 12 3 Nb)	318	0,08	0,30 to 0,65	1,0 to 2,5	0,03	0,03	18,0 to 20,0	11,0 to 14,0	2,0 to 3,0	—	0,75	8 × C to 1,0; 0,2 min.	—
—	318L	0,03	0,65	1,0 to 2,5	0,03	0,03	18,0 to 20,0	11,0 to 14,0	2,0 to 3,0	—	0,75	8 × C to 1,0; 0,2 min.	—

Table 1 *(continued)*

Alloy designation[a] according to		Chemical composition, % by mass[b]											
Nominal composition[c] ISO 14343-A	**Alloy type ISO 14343-B[c]**	**C**	**Si**	**Mn**	**P**	**S**	**Cr**	**Ni**	**Mo**	**N**	**Cu**	**Nb[d]**	**Other**
19 12 3 Nb Si	—	0,08	0,65 to 1,2	1,0 to 2,5	0,03	0,02	18,0 to 20,0	11,0 to 14,0	2,5 to 3,0	—	0,5	10 × C to 1,0	—
—	317	0,08	0,30 to 0,65	1,0 to 2,5	0,03	0,03	18,5 to 20,5	13,0 to 15,0	3,0 to 4,0	—	0,75	—	—
(18 15 3 L)	317L	0,03	0,30 to 0,65	1,0 to 2,5	0,03	0,03	18,5 to 20,5	13,0 to 15,0	3,0 to 4,0	—	0,75	—	—
—	321	0,08	0,30 to 0,65	1,0 to 2,5	0,03	0,03	18,5 to 20,5	9,0 to 10,5	0,75	—	0,75	—	Ti 9 × C to 1,0; 0,2 min.
Ferritic-austenitic types (sometimes referred to as austenitic-ferritic types)													
22 9 3 N L	(2209)	0,03	1,0	2,5	0,03	0,02	21,0 to 24,0	7,0 to 10,0	2,5 to 4,0	0,10 to 0,20	0,5	—	—
(22 9 3 N L)	2209	0,03	0,90	0,5 to 2,0	0,03	0,03	21,5 to 23,5	7,5 to 9,5	2,5 to 3,5	0,08 to 0,20	0,75	—	—
23 7 N L	2307	0,03	1,0	2,5	0,03	0,02	22,5 to 25,5	6,5 to 9,5	0,8	0,10 to 0,20	0,5	—	—
25 7 2 L	—	0,03	1,0	2,5	0,03	0,02	24,0 to 27,0	6,0 to 8,0	1,5 to 2,5	—	0,5	—	—
25 9 3 Cu N L	—	0,03	1,0	2,5	0,03	0,02	24,0 to 27,0	8,0 to 11,0	2,5 to 4,0	0,10 to 0,20	1,5 to 2,5	—	—
25 9 4 N L	2594	0,03	1,0	2,5	0,03	0,02	24,0 to 27,0	8,0 to 10,5	2,5 to 4,5	0,20 to 0,30	1,5	—	W 1,0
—	329J4L	0,03	0,90	0,5 to 2,5	0,03	0,03	23,0 to 27,0	8,0 to 11,0	3,0 to 4,5	0,08 to 0,30	1,0	—	—
Fully austenitic types[e]													
18 15 3 L[e]	(317L)[e]	0,03	1,0	1,0 to 4,0	0,03	0,02	17,0 to 20,0	13,0 to 16,0	2,5 to 4,0	—	0,5	—	—
18 16 5 N L[e]	—	0,03	1,0	1,0 to 4,0	0,03	0,02	17,0 to 20,0	16,0 to 19,0	3,5 to 5,0	0,10 to 0,20	0,5	—	—

Table 1 *(continued)*

Alloy designation[a] according to		Chemical composition, % by mass[b]											
Nominal composition[c] ISO 14343-A	Alloy type ISO 14343-B[c]	C	Si	Mn	P	S	Cr	Ni	Mo	N	Cu	Nb[d]	Other
19 13 4 L[e]	(317L)[e]	0,03	1,0	1,0 to 5,0	0,03	0,02	17,0 to 20,0	12,0 to 15,0	3,0 to 4,5	—	0,5	—	—
19 13 4 N L[e]	—	0,03	1,0	1,0 to 5,0	0,03	0,02	17,0 to 20,0	12,0 to 15,0	3,0 to 4,5	0,10 to 0,20	0,5	—	—
20 25 5 Cu L[e]	(385)[e]	0,03	1,0	1,0 to 4,0	0,03	0,02	19,0 to 22,0	24,0 to 27,0	4,0 to 6,0	—	1,0 to 2,0	—	—
(20 25 5 Cu L)[e]	385[e]	0,025	0,50	1,0 to 2,5	0,02	0,03	19,5 to 21,5	24,0 to 26,0	4,2 to 5,2	—	1,2 to 2,0	—	—
20 25 5 Cu N L[e]	—	0,03	1,0	1,0 to 4,0	0,03	0,02	19,0 to 22,0	24,0 to 27,0	4,0 to 6,0	0,10 to 0,20	1,0 to 2,0	—	—
20 16 3 Mn L[e]	—	0,03	1,0	5,0 to 9,0	0,03	0,02	19,0 to 22,0	15,0 to 18,0	2,5 to 4,5	—	0,5	—	—
20 16 3 Mn N L[e]	316LMn[e]	0,03	0,30 to 0,65	5,0 to 9,0	0,03	0,03	19,0 to 22,0	15,0 to 18,0	2,5 to 3,5	0,10 to 0,20	0,5	—	—
25 22 2 N L[e]	—	0,03	1,0	3,5 to 6,5	0,03	0,02	24,0 to 27,0	21,0 to 24,0	1,5 to 3,0	0,10 to 0,20	0,5	—	—
26 23 5 N[e]	—	0,02	1,0	1,5 to 5,5	0,02	0,01	25,0 to 27,0	21,0 to 25,0	4,0 to 6,0	0,30 to 0,40	0,5	—	—
27 31 4 Cu L[e]	(383)[e]	0,03	1,0	1,0 to 3,0	0,03	0,02	26,0 to 29,0	30,0 to 33,0	3,0 to 4,5	—	0,7 to 1,5	—	—
(27 31 4 Cu L)[e]	383[e]	0,025	0,50	1,0 to 2,5	0,02	0,03	26,5 to 28,5	30,0 to 33,0	3,2 to 4,2	—	0,7 to 1,5	—	—
—	320[e]	0,07	0,60	2,5	0,03	0,03	19,0 to 21,0	32,0 to 36,0	2,0 to 3,0	—	3,0 to 4,0	8 × C to 1,0	—
—	320LR[e]	0,025	0,15	1,5 to 2,0	0,015	0,02	19,0 to 21,0	32,0 to 36,0	2,0 to 3,0	—	3,0 to 4,0	8 × C to 0,40	—
—	33–31	0,015	0,50	2,00	0,02	0,01	31,0 to 35,0	30,0 to 33,0	0,5 to 2,0	0,35 to 0,60	0,3 to 1,2	—	—

Table 1 *(continued)*

Alloy designation[a] according to		Chemical composition, % by mass[b]											
Nominal composition[c] ISO 14343-A	Alloy type ISO 14343-B[c]	C	Si	Mn	P	S	Cr	Ni	Mo	N	Cu	Nb[d]	Other
Special types (often used for dissimilar metal joining)													
—	307[e]	0,04 to 0,14	0,30 to 0,65	3,30 to 4,75	0,03	0,03	19,5 to 22,0	8,0 to 10,7	0,5 to 1,5	—	0,75	—	—
18 8 Mn[e]	—	0,20	1,2	5,0 to 8,0	0,03	0,03	17,0 to 20,0	7,0 to 10,0	0,5	—	0,5	—	—
20 10 3	(308Mo)	0,12	1,0	1,0 to 2,5	0,03	0,02	18,0 to 21,0	8,0 to 12,0	1,5 to 3,5	—	0,5	—	—
(20 10 3)	308Mo	0,08	0,30 to 0,65	1,0 to 2,5	0,03	0,03	18,0 to 21,0	9,0 to 12,0	2,0 to 3,0	—	0,75	—	—
—	308LMo	0,04	0,30 to 0,65	1,0 to 2,5	0,03	0,03	18,0 to 21,0	9,0 to 12,0	2,0 to 3,0	—	0,75	—	—
23 12 L	(309L)	0,03	0,65	1,0 to 2,5	0,03	0,02	22,0 to 25,0	11,0 to 14,0	0,5	—	0,5	—	—
(23 12 L)	309L	0,03	0,30 to 0,65	1,0 to 2,5	0,03	0,03	23,0 to 25,0	12,0 to 14,0	0,75	—	0,75	—	—
22 11 L[f]	309LD[f]	0,03	0,65	1,0 to 2,5	0,03	0,03	21,0 to 24,0	10,0 to 12,0	0,75	—	0,75	—	—
23 12 L Si	(309LSi)	0,03	0,65 to 1,2	1,0 to 2,5	0,03	0,02	22,0 to 25,0	11,0 to 14,0	0,5	—	0,5	—	—
(23 12 L Si)	309LSi	0,03	0,65 to 1,00	1,0 to 2,5	0,03	0,03	23,0 to 25,0	12,0 to 14,0	0,75	—	0,75	—	—
23 12 Nb	(309LNb)	0,08	1,0	1,0 to 2,5	0,03	0,02	22,0 to 25,0	11,0 to 14,0	0,5	—	0,5	10 × C to 1,0	—
(23 12 Nb)	309LNb	0,03	0,65	1,0 to 2,5	0,03	0,03	23,0 to 25,0	12,0 to 14,0	0,75	—	0,75	10 × C to 1,0; 0,2 min.	—
22 12 L Nb[f]	309LNbD[f]	0,03	0,65	1,0 to 2,5	0,03	0,03	20,0 to 23,0	11,0 to 13,0	0,75	—	0,75	10 × C to 1,2; 0,2 min.	—
—	309Mo	0,12	0,30 to 0,65	1,0 to 2,5	0,03	0,03	23,0 to 25,0	12,0 to 14,0	2,0 to 3,0	—	0,75	—	—

Table 1 *(continued)*

Alloy designation[a] according to		Chemical composition, % by mass[b]											
Nominal composition[c] ISO 14343-A	Alloy type ISO 14343-B[c]	C	Si	Mn	P	S	Cr	Ni	Mo	N	Cu	Nb[d]	Other
23 12 2 L	(309LMo)	0,03	1,0	1,0 to 2,5	0,03	0,02	21,0 to 25,0	11,0 to 15,5	2,0 to 3,5	—	0,5	—	—
(23 12 2 L)	309LMo	0,03	0,30 to 0,65	1,0 to 2,5	0,03	0,03	23,0 to 25,0	12,0 to 14,0	2,0 to 3,0	—	0,75	—	—
(21 13 3 L)	309LMoD[f]	0,03	0,65	1,0 to 2,5	0,03	0,03	19,0 to 22,0	12,0 to 14,0	2,3 to 3,3	—	0,75	—	—
21 13 3 L[f]	(309LMoD)	0,03	0,65	1,0 to 2,5	0,03	0,03	19,0 to 22,0	12,0 to 14,0	2,8 to 3,3	—	0,75	—	—
29 9	(312)	0,15	1,0	1,0 to 2,5	0,03	0,02	28,0 to 32,0	8,0 to 12,0	0,5	—	0,5	—	—
(29 9)	312	0,15	0,30 to 0,65	1,0 to 2,5	0,03	0,03	28,0 to 32,0	8,0 to 10,5	0,75	—	0,75	—	—
Heat resisting types													
16 8 2	(16–8-2)	0,10	1,0	1,0 to 2,5	0,03	0,02	14,5 to 16,5	7,5 to 9,5	1,0 to 2,5	—	0,5	—	—
(16 8 2)	16–8-2	0,10	0,30 to 0,65	1,0 to 2,0	0,03	0,03	14,5 to 16,5	7,5 to 9,5	1,0 to 2,0	—	0,75	—	—
19 9 H	(19–10H)	0,04 to 0,08	1,0	1,0 to 2,5	0,03	0,02	18,0 to 21,0	9,0 to 11,0	0,5	—	0,5	—	—
(19 9 H)	19–10H	0,04 to 0,08	0,30 to 0,65	1,0 to 2,0	0,03	0,03	18,5 to 20,0	9,0 to 11,0	0,25	—	0,75	0,05	Ti 0,05
—	33–31	0,015	0,50	2,00	0,02	0,01	31,0 to 35,0	30,0 to 33,0	0,5 to 2,0	0,35 to 0,60	0,3 to 1,2	—	—
(19 9 H)	308H	0,04 to 0,08	0,30 to 0,65	1,0 to 2,5	0,03	0,03	19,5 to 22,0	9,0 to 11,0	0,50	—	0,75	—	—
19 12 3 H	(316H)	0,04 to 0,08	1,0	1,0 to 2,5	0,03	0,02	18,0 to 20,0	11,0 to 14,0	2,0 to 3,0	—	0,5	—	—
(19 12 3 H)	316H	0,04 to 0,08	0,30 to 0,65	1,0 to 2,5	0,03	0,03	18,0 to 20,0	11,0 to 14,0	2,0 to 3,0	—	0,75	—	—

Table 1 *(continued)*

Alloy designation[a] according to		Chemical composition, % by mass[b]											
Nominal composition[c] ISO 14343-A	Alloy type ISO 14343-B[c]	C	Si	Mn	P	S	Cr	Ni	Mo	N	Cu	Nb[d]	Other
21 10 N[e]	—	0,06 to 0,09	1,0 to 2,0	0,3 to 1,0	0,02	0,01	20,5 to 22,5	9,5 to 11,0	0,5	0,10 to 0,20	0,5	—	Ce 0,03 to 0,08
22 12 H	(309)	0,04 to 0,15	2,0	1,0 to 2,5	0,03	0,02	21,0 to 24,0	11,0 to 14,0	0,5	—	0,5	—	—
(22 12 H)	309	0,12	0,30 to 0,65	1,0 to 2,5	0,03	0,03	23,0 to 25,0	12,0 to 14,0	0,75	—	0,75	—	—
—	309Si	0,12	0,65 to 1,00	1,0 to 2,5	0,03	0,03	23,0 to 25,0	12,0 to 14,0	0,75	—	0,75	—	—
25 4	—	0,15	2,0	1,0 to 2,5	0,03	0,02	24,0 to 27,0	4,0 to 6,0	0,5	—	0,5	—	—
25 20[e]	(310)[e]	0,08 to 0,15	2,0	1,0 to 2,5	0,03	0,02	24,0 to 27,0	18,0 to 22,0	0,5	—	0,5	—	—
(25 20)[e]	310[e]	0,08 to 0,15	0,30 to 0,65	1,0 to 2,5	0,03	0,03	25,0 to 28,0	20,0 to 22,5	0,75	—	0,75	—	—
—	310S[e]	0,08	0,65	1,0 to 2,5	0,03	0,03	25,0 to 28,0	20,0 to 22,5	0,75	—	0,75	—	—
—	310L[e]	0,03	0,65	1,0 to 2,5	0,03	0,03	25,0 to 28,0	20,0 to 22,5	0,75	—	0,75	—	—
25 20 H[e]	—	0,35 to 0,45	2,0	1,0 to 2,5	0,03	0,02	24,0 to 27,0	18,0 to 22,0	0,5	—	0,5	—	—
25 20 Mn[e]	—	0,08 to 0,15	2,0	2,5 to 5,0	0,03	0,02	24,0 to 27,0	18,0 to 22,0	0,5	—	0,5	—	—
18 36 H[e]	(330)	0,18 to 0,25	0,4 to 2,0	1,0 to 2,5	0,03	0,02	15,0 to 19,0	33,0 to 37,0	0,5	—	0,5	—	—
(18 36 H)[e]	330	0,18 to 0,25	0,30 to 0,65	1,0 to 2,5	0,03	0,03	15,0 to 17,0	34,0 to 37,0	0,75	—	0,75	—	—
28 35 N[e]	—	0,03 to 0,09	0,5 to 1,0	1,0 to 2,0	0,02	0,02	26,5 to 29,0	33,0 to 36,0	0,5	—	0,5	—	—

Table 1 *(continued)*

Alloy designation[a] according to		Chemical composition, % by mass[b]											
Nominal composition[c] ISO 14343-A	**Alloy type ISO 14343-B[c]**	**C**	**Si**	**Mn**	**P**	**S**	**Cr**	**Ni**	**Mo**	**N**	**Cu**	**Nb[d]**	**Other**
—	3556	0,05 to 0,15	0,20 to 0,80	0,50 to 2,00	0,04	0,015	21,0 to 23,0	19,0 to 22,5	2,5 to 4,0	0,10 to 0,30	–	0,30	Co 16,0 to 21,0 W 2,0 to 3,5 Ta 0,30 to 1,25 Al 0,10 to 0,50 Zr 0,001 to 0,100 La 0,005 to 0,100 B 0,02
Precipitation hardening type													
—	630	0,05	0,75	0,25 to 0,75	0,03	0,03	16,00 to 16,75	4,5 to 5,0	0,75	—	3,25 to 4,00	0,15 to 0,30	—
Other compositions													
Z[c]		Any other agreed composition											

[a] A designation in parentheses, e.g. (308L) or (19 9 L), indicates a near match in the other designation system, but not an exact match. The correct designation for a given composition range is the one not in parentheses. A given product may, by having a more restricted chemical composition which fulfills both sets of designation requirements, be assigned both designations independently.

[b] Single values shown in the table are maximum values. Two values shown indicate minimum and maximum limits for a range.

[c] Wire electrodes, strip electrodes, wires or rods not listed in the table shall be symbolised similarly and prefixed by the letter "Z". The chemical composition ranges are not specified and therefore, two electrodes with the same Z classification might not be interchangeable.

[d] Up to 20 % of the amount of Nb can be replaced by Ta.

[e] The all-weld metal is in most cases fully austenitic and therefore can be susceptible to microfissuring or hot cracking. The occurrence of fissuring/cracking is reduced by increasing the weld metal manganese level, and in recognition of this, the manganese range is extended for a number of grades.

[f] These compositions are mainly used in low dilution overlay welding such as electroslag strip cladding.

[g] Ni + Cu ≤ 0,5 %.

5 Properties of all-weld metal

Properties of the all-weld metal are not part of the classification.

NOTE 1 The influence of the shielding gas or flux on the chemical composition of the all-weld metal is considered. Differences between the chemical composition of the all-weld metal and the wire electrode, wire or rod can occur.

NOTE 2 Proof strength and tensile strength of the weld metal made by a consumable listed in Table 1 is expected to comply with the minimum requirements given in Annex A. Elongation and impact properties of the weld metal can deviate from the minimum values specified for the corresponding parent metal as a result of variations in the microstructure.

NOTE 3 Table A.1 lists expected minimum tensile properties of weld metal.

6 Chemical analysis

Chemical analysis shall be performed on specimens of the product or the stock from which it is made. Any analytical technique may be used, but in case of dispute, reference shall be made to established published methods.

7 Rounding procedure

Actual test values obtained shall be subject to ISO 80000-1:2009, B.3, Rule A. If the measured values are obtained by equipment calibrated in units other than those of this document, the measured values shall be converted to the units of this document before rounding. If an average value is to be compared to the requirements of this document, rounding shall be done only after calculating the average. The rounded results shall fulfil the requirements of the appropriate table for the classification under test.

8 Retesting

If any test fails to meet the requirement, that test shall be repeated twice. The results of both retests shall meet the requirement. Specimens for the retest may be taken from the original sample or from a new sample. For chemical analysis, retesting need only be for those specific elements that failed to meet their testing requirement. If the results of one or both retests fail to meet the requirement, the material under test shall be considered as not meeting the requirements of this specification for that classification.

In the event that, during preparation or after completion of any test, it is clearly determined that prescribed or proper procedures were not followed in preparing the weld test assembly or test specimen(s), or in conducting the tests, the test shall be considered invalid, without regard to whether the test was actually completed, or whether the test results met, or failed to meet, the requirements. That test shall be repeated, following proper prescribed procedures. In this case, the requirement for doubling the number of test specimens does not apply.

9 Technical delivery conditions

Technical delivery conditions shall be in accordance with ISO 544 and ISO 14344.

10 Examples of designation

The designation of the welding consumable shall follow the principle given in the examples below.

EXAMPLE 1 A wire electrode for gas-shielded metal arc welding, also applicable to submerged arc welding, having a chemical composition within the limits for the alloy symbol 20 10 3 and within the limits for the alloy symbol 308Mo of Table 1:

Classification according to nominal composition	Classification according to alloy type
ISO 14343-A - G 20 10 3 and/or **S 20 10 3**	**ISO 14343-B - SS308Mo**

EXAMPLE 2 A rod for gas tungsten arc welding having a chemical composition within the limits for the alloy symbol 20 10 3 and within the limits for the alloy symbol 308Mo of Table 1:

Classification according to nominal composition	Classification according to alloy type
ISO 14343-A - W 20 10 3	**ISO 14343-B - SS308Mo**

EXAMPLE 3 A wire electrode for gas-shielded metal arc welding having a chemical composition within the limits for the alloy symbol 19 12 3 L Si and within the limits for alloy symbol 316LSi of Table 1:

Classification according to nominal composition	Classification according to alloy type
ISO 14343-A - G 19 12 3 L Si	**ISO 14343-B - SS316LSi**

EXAMPLE 4 A strip electrode for submerged arc welding or electroslag welding has a chemical composition within the limits for the alloy symbol 23 12 2 L and within the limits for alloy symbol 309LMo of Table 1:

Classification according to nominal composition	Classification according to alloy type
ISO 14343-A - B 23 12 2 L	**ISO 14343-B - BS 309LMo**

where, in all four examples

ISO 14343-A = the number of this document, classification by nominal composition (system A);

G or S or W or B = product or process symbol (see 4.2);

20 10 3, 19 12 3 L Si or 23 12 2 L = the chemical composition of the product (see Table 1).

ISO 14343-B = the number of this document, classification by alloy type (system B);

SS or BS = product or process symbol (see 4.2);

308Mo, 316LSi or 309LMo = the chemical composition of the product (see Table 1).

EXAMPLE 5 A wire electrode gas tungsten arc welding has a chemical composition (17 % and Ti stabilized) not listed in Table 1 and therefore designated with “Z”:

Classification according to nominal composition	Classification according to alloy type
ISO 14343-A – G Z 17Ti	**ISO 14343-B – G Z 17Ti**

where,

ISO 14343-A = the number of this document, classification by nominal composition (system A);

G = product or process symbol (see 4.2);

Z = the chemical composition of the product is not specified (see Table 1);

17Ti = the nominal chemical composition of the product as agreed between manufacturer and customer (see Table 1).

where,

ISO 14343-B = the number of this document, classification by nominal composition (system B);

G = product or process symbol (see 4.2);

Z = the chemical composition of the product is not specified (see Table 1);

17Ti = the nominal chemical composition of the product as agreed between manufacturer and customer (see Table 1).

Annex A
(informative)

Expected minimum tensile properties of all-weld metal

See Table A.1.

Table A.1 — Expected minimum tensile properties of all-weld metal

Alloy symbol classification according to		Mechanical property			Postweld heat treatment
Nominal composition ISO 14343-A	Alloy type ISO 14343-B	Proof strength $R_{p0,2}$ MPa	Tensile strength R_m MPa	Elongation[a] %	
—	409	180	380	15	None
—	409Nb	250	450	15	[b]
13[c]	410[b]	250	450	15	[c] or [b]
13 L	—	250	450	15	[c]
13 4	410NiMo	500	750	15	[d]
—	420	250	450	15	[c]
16 5 1	—	400	600	15	None
17	430	300	450	15	[e]
—	430Nb	250	450	15	[e]
18 L Nb	430LNb	220	410	15	None
18 L Nb Si	—	220	410	15	None
18 L Nb Ti	—	N/A	N/A	N/A	N/A
—	439	220	410	15	None
—	446LMo	N/A	N/A	N/A	N/A
—	209	350	690	15	None
—	218	550	760	15	None
—	219	490	620	15	None
—	240	350	690	15	None
—	308	350	550	25	None
—	308Si	350	550	25	None
19 9 L	308L	320	510	25	None
19 9 L Si	308LSi	320	510	25	None
—	308N2	345	690	20	None
19 9 Nb	347	350	550	25	None
19 9 Nb Si	347Si	350	550	25	None
—	347L	320	510	25	None
—	347H	350	550	25	None
—	316	320	510	25	None
—	316Si	320	510	25	None
19 12 3 L	316L	320	510	25	None
19 12 3 L Si	316LSi	320	510	25	None

Table A.1 *(continued)*

Alloy symbol classification according to		Mechanical property			Postweld heat treatment
Nominal composition ISO 14343-A	Alloy type ISO 14343-B	Proof strength $R_{p0,2}$ MPa	Tensile strength R_m MPa	Elongation[a] %	
—	316LCu	320	510	25	None
19 12 3 Nb	318	350	550	25	None
—	318L	320	510	25	None
19 12 3 Nb Si	—	350	550	25	None
—	317	350	550	25	None
18 15 3 L	317L	300	480	25	None
—	321	350	550	25	None
22 9 3 N L	2209	450	550	20	None
23 7 N L	2307	450	570	20	None
25 7 2 L	—	500	700	15	None
25 9 3 Cu N L	—	550	620	18	None
25 9 4 N L	2594	550	620	18	None
—	329J4L	450	690	15	None
18 15 3 L	—	300	480	25	None
18 16 5 N L	—	300	480	25	None
19 13 4 L	—	350	550	25	None
19 13 4 N L	—	350	550	25	None
20 25 5 Cu L	385	320	510	25	None
20 25 5 Cu N L	—	320	510	25	None
20 16 3 Mn L	—	320	510	25	None
20 16 3 Mn N L	316LMn	320	510	25	None
25 22 2 N L	—	320	510	25	None
26 23 5 N	—	400	700	25	None
27 31 4 Cu L	383	240	500	25	None
—	320	320	550	25	None
—	320LR	300	520	25	None
—	33–31	500	720	25	None
—	307	350	590	25	None
18 8 Mn	—	350	500	25	None
20 10 3	308Mo	400	620	20	None
—	308LMo	320	510	30	None
23 12 L	309L	320	510	25	None
22 11 L	309LD	320	510	20	None
23 12 L Si	309LSi	320	510	25	None
23 12 Nb	309LNb	350	550	25	None
22 12 L Nb	309LNbD	320	510	20	None
—	309Mo	320	510	25	None
23 12 2 L	309LMo	350	550	25	None
21 13 3 L	309LMoD	320	510	20	None
29 9	312	450	650	15	None

Table A.1 *(continued)*

Alloy symbol classification according to		Mechanical property			Postweld heat treatment
Nominal composition ISO 14343-A	Alloy type ISO 14343-B	Proof strength $R_{p0,2}$	Tensile strength R_m	Elongation[a]	
		MPa		%	
16 8 2	16–8-2	320	510	25	—
19 9 H	19–10H	350	550	30	—
—	308H	350	550	30	—
19 12 3 H	316H	350	550	25	—
21 10 N	—	350	550	30	—
22 12 H	309	350	550	25	—
—	309Si	350	550	25	—
25 4	—	450	650	15	—
25 20	310	350	550	20	—
—	310S	350	550	20	—
—	310L	320	510	20	—
25 20 H	—	350	550	10[f]	—
25 20 Mn	—	350	550	20	—
18 36 H	330	350	550	10[f]	—
28 35 N	—	350	550	25	—
—	3556	N/A	N/A	N/A	N/A
—	630	725	930	5	[g]

[a] Gauge length is equal to five times the specimen diameter.

[b] 730 °C/760 °C for 1 h, furnace cooling down to 600 °C, then air cooling.

[c] 840 °C/870 °C for 2 h, furnace cooling down to 600 °C, then air cooling.

[d] 580 °C/620 °C for 2 h, air cooling.

[e] 760 °C/790 °C for 2 h, furnace cooling down to 600 °C, then air cooling.

[f] These wire electrodes, strip electrodes, wires and rods deposit high carbon weld metal for service at high temperatures. Room temperature elongation has little relevance to such applications. Weld metal can have elongation lower than that of the parent metal.

[g] 1 025 °C/1 050 °C for 1 h, air cool to ambient, then 610 °C/630 °C for 4 h, air cool.

Bibliography

[1] EN 12072*Welding consumables — Wire electrodes, wires and rods for arc welding of stainless and heat-resisting steels — Classification*[1)],

1) Replaced by ISO 14343:2009.

(*Continued from second cover*)

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis shall he rounded off in accordance with IS 2 : 2022 'Rules for rounding off numerical values *(second revision)*'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

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This Indian Standard has been developed from Doc No.: MTD 11 (19345).

Amendments Issued Since Publication

Amend No.	Date of Issue	Text Affected

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Published by BIS, New Delhi