International Standard

ISO 14344

Third edition
2024-09

Welding consumables — Procurement of filler materials and fluxes

Produits consommables pour le soudage — Approvisionnement en matériaux d'apport et flux

Reference number
ISO 14344:2024(en)

ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Email: copyright@iso.org
Website: www.iso.org

Published in Switzerland

Contents

Page

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 document 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).

ISO draws attention to the possibility that the implementation of this document may involve the use of (a) patent(s). ISO takes no position concerning the evidence, validity or applicability of any claimed patent rights in respect thereof. As of the date of publication of this document, ISO had not received notice of (a) patent(s) which may be required to implement this document. However, implementers are cautioned that this may not represent the latest information, which may be obtained from the patent database available at www.iso.org/patents. ISO shall not be held responsible for identifying any or all such patent rights.

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

For an explanation of 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 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,* in collaboration with the European Committee for Standardization (CEN) Technical Committee CEN/TC 121, *Welding and allied processes,* in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

This third edition cancels and replaces the second edition (ISO 14344:2010), which has been technically revised.

The main changes are as follows:

— content from scope has been moved to the introduction;

— in Clause 2, reference is made to ISO 544, ISO 10474 and EN 10204;

— in Clause 3, terms and definitions have been revised and the list expanded;

— Clause 5 has been significantly revised.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html. Official interpretations, where they exist, are available from this page: https://committee.iso.org/sites/tc44/home/interpretation.html. Official interpretations, where they exist, are available from this page: https://committee.iso.org/sites/tc44/home/interpretation.html.

Introduction

In production, the components of welding consumables are divided into discrete, predetermined quantities so that satisfactory tests with a sample from that quantity will establish that the entire quantity meets specification requirements. These quantities, known by such terms as heats, lots, blends, batches and mixes, vary in size according to the manufacturer. For identification purposes, each manufacturer assigns a unique designation to each quantity. This designation usually consists of a series of numbers or letters, or combinations thereof, which will enable the manufacturer to determine the date and time (or shift) of manufacture, the raw materials used, and the details of the procedures used in producing the welding consumable. This designation stays with the welding consumable and can be used to identify the material later, in those cases in which identification is necessary.

Welding consumables — Procurement of filler materials and fluxes

1 Scope

This document specifies tools for communication between a purchaser and a supplier of welding consumables within quality systems, such as those based upon ISO 9001.

This document, together with an applicable welding consumable standard (ISO or other), provides a method for preparing the specific details needed for welding consumable procurement which consists of:

a) the welding consumable classification (selected from the applicable welding consumable standard);

b) the lot classification (selected from Clause 4);

c) the testing schedule (selected from Clause 5).

Selection of the specific welding consumable classification, lot classification, and testing schedule depends upon the requirements of the application for which the welding consumable is being procured.

This document does not apply to non-consumable electrodes or shielding gases.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. 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 10474, *Steel and steel products — Inspection documents*

EN 10204, *Metallic products – Types of inspection documents*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 544 and the following apply.

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

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

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

3.1
controlled chemical composition
<covered or tubular electrodes> covering or core ingredients consisting of one or more wet mixes, dry batches, or dry blends that are subjected to sufficient tests to ensure that all within the *lot* (3.8) are equivalent

Note 1 to entry: These tests shall include chemical analysis, the results of which shall fall within the manufacturer's acceptance limits. The identification of the test procedure and the results of the tests shall be recorded.

3.2
controlled chemical composition
<solid welding consumables and solid source materials> materials used to fabricate welding consumables (core rod for covered electrodes and strip or tube for tubular wire or rod) consisting of one or more heats that are subjected to sufficient tests to ensure that all within the *lot* (3.8) are equivalent

Note 1 to entry: These tests shall include chemical analysis, the results of which shall fall within the manufacturer's acceptance limits. The identification of the test procedure and the results of the tests shall be recorded.

Note 2 to entry: Mill coils from mills that do not permit spliced-coil practice shall be sampled on at least one end. Coils from mills that permit spliced-coil practice with a maximum of one splice per coil shall be sampled on both ends. Coils with more than one splice are not permitted.

3.3
dry batch
quantity of dry ingredients mixed at one time in one mixing vessel

Note 1 to entry: Liquid(s), such as binders, when added to a dry batch, produce a wet mix. A dry batch can be divided into homogeneous smaller quantities, in which case addition of the liquid(s) produces a corresponding number of smaller wet mixes.

3.4
dry blend
two or more *dry batches* (3.3) from which quantities of each are combined proportionately, then mixed in a mixing vessel to produce a larger quantity in which the ingredients are as uniformly dispersed as they would have been had the entire quantity been mixed together at one time in one large mixer

Note 1 to entry: A dry blend, as in the case of a *dry batch* (3.3), can be used singly or divided into smaller quantities, in which case addition of liquid(s) produces a corresponding number of smaller wet mixes.

3.5
heat
<open hearth, electric arc, basic oxygen, argon-oxygen processes> material obtained from one furnace melt, where slag-metal or gas-metal reactions occur in producing the specified alloy

Note 1 to entry: For solid welding consumables and solid source materials used to fabricate welding consumables (core rod for covered electrodes and strip or tube for tubular wire or rod), the specific definition is dependent on the method of melting and refining of the metal.

Note 2 to entry: Neither mill splicing of coils from different heats nor coils containing transition heats is permitted.

3.6
heat
<induction melting in controlled atmosphere or vacuum> uninterrupted series of melts from one controlled batch of metals and alloying ingredients in one melting furnace under the same melting conditions, where each melt conforms to the chemical composition range approved by the purchaser of the material

Note 1 to entry: For solid welding consumables and solid source materials used to fabricate welding consumables (core rod for covered electrodes and strip or tube for tubular wire or rod), the specific definition is dependent on the method of melting and refining of the metal.

Note 2 to entry: Neither mill splicing of coils from different heats nor coils containing transition heats is permitted.

3.7
heat
<consumable electrode remelt> uninterrupted series of remelts in one furnace under the same remelting conditions using one or more consumable electrodes produced from a single melt, each remelt conforming to the chemical composition range approved by the purchaser of the material (i.e., the producer of the welding consumable) in processes involving continuous melting and casting

Note 1 to entry: For solid welding consumables and solid source materials used to fabricate welding consumables (core rod for covered electrodes and strip or tube for tubular wire or rod), the specific definition is dependent on the method of melting and refining of the metal.

Note 2 to entry: Neither mill splicing of coils from different heats nor coils containing transition heats is permitted.

3.8
lot
unique identifying designation for a specific type and quantity of welding consumable, usually beginning with the word "lot" and followed by a series of numbers and/or letters

Note 1 to entry: The lot class, as identified in Clause 4, details the requirements for grouping consumables into a single lot.

3.9
production schedule
manufacturing campaign comprising of either a single manufacturing operation or a series of manufacturing operations, any part of which is uninterrupted by the production of any other product or any other lot number of the same product

3.10
solid welding consumable
fully metallic solid welding consumable

Note 1 to entry: Solid welding consumable includes wires, rods, strips, consumable inserts and metallic powders.

3.11
wet mix
combination of liquid(s) and a *dry batch* (3.3), *dry blend* (3.4), or a portion thereof, mixed at one time in one mixing vessel

3.12
manufacturer
<welding consumables> party who is actually manufacturing or the legal entity responsible for the product placed on the market

Note 1 to entry: In case the legal entity is not the actual manufacturer, it shall have traceability to the documents of the actual manufacturer concerning the items to be certified.

3.13
distributor
<welding consumables> party who receives the consumable from a *manufacturer* (3.12) and distributes it under the manufacturer's brand name

3.14
supplier
<welding consumables> *manufacturer* (3.12) or *distributor* (3.13)

3.15
purchaser
party who purchases the welding consumable from a *supplier* (3.14)

4 Lot classification

4.1 General

A lot class is a two character designation consisting of a letter representing the form of the consumable and a number designating how the grouping of a quantity of consumables into a single lot is allowed. The lot class shall be selected by the purchaser from those listed below.

4.2 Solid welding consumables

4.2.1 Lot class S1

This lot class corresponds to the quantity of solid welding consumables not exceeding the manufacturer's standard lot, as defined in the manufacturer's quality management system.

4.2.2 Lot class S2

This lot class corresponds to the quantity of solid welding consumables:

— not exceeding 45 000 kg;

— of one classification and dimension produced in a 24 h production schedule (i.e. consecutive normal work shifts) on one production line;

— from one heat as defined in 3.5, 3.6, or 3.7 or from controlled chemical composition material as defined in 3.2

When a production schedule consists of a series of manufacturing operations, only those that affect the chemical composition and operability as defined by the manufacturer's acceptance limits are subject to the 24 h limitation. In these cases, each of those individual manufacturing operations rather than the manufacturing campaign is subject to an independent 24 h limitation.

The 24 h production schedule can be a combination of consecutive normal work shifts, for example 1 x 24 h, 2 x 12 h, 3 x 8 h.

Annex A gives examples of how to apply the 24 h limitation.

4.2.3 Lot class S3

This lot class corresponds to the quantity of solid welding consumables of one classification and dimension produced in one production schedule as defined in 3.9 from one heat as defined in 3.5, 3.6, or 3.7.

4.2.4 Lot class S4

This lot class corresponds to the quantity of solid welding consumables:

— not exceeding 45 000 kg;

— of one classification and dimension produced under one production schedule as defined in 3.9;

— from one heat as defined in 3.5, 3.6, or 3.7 or from controlled chemical composition material as defined in 3.2.

4.2.5 Lot Class S5

This lot class corresponds to the quantity of solid welding consumables of one classification from one heat as defined in 3.5, 3.6, or 3.7.

This lot class applies only to consumables for non-alloy and fine-grained steels, high tensile and creep resisting steels when testing is to schedule 4, 5 or 6.

4.3 Tubular cored electrodes and rods

4.3.1 Lot Class T1

This lot class corresponds to the quantity of tubular welding consumables not exceeding the manufacturer's standard lot, as defined in the manufacturer's quality management system.

4.3.2 Lot Class T2

This lot class corresponds to the quantity of tubular welding consumables:

— not exceeding 45 000 kg, of one classification and dimension produced in a 24 h production schedule (i.e. consecutive normal work shifts) on one production line;

— from rod, tube, or strip from one heat as defined in 3.5, 3.6, or 3.7 or by controlled chemical composition as defined in 3.2; and

— core ingredients from one dry batch as defined in 3.3, one dry blend as defined in 3.4, or controlled chemical composition as defined in 3.1.

When a production schedule consists of a series of manufacturing operations, only those that affect the chemical composition and operability as defined by the manufacturer's acceptance limits are subject to the 24 h limitation. In these cases, each of those individual manufacturing operations rather than the manufacturing campaign is subject to an independent 24 h limitation.

The 24 h production schedule can be a combination of consecutive normal work shifts, for example 1 x 24 h, 2 x 12 h, 3 x 8 h.

Annex A gives examples of how to apply the 24 h limitation.

4.3.3 Lot Class T3

This lot class corresponds to the quantity of tubular welding consumables of one classification and dimension produced from rod, tube, or strip from one heat as defined in 3.5, 3.6, or 3.7, and core ingredients from one dry batch as defined in 3.3 or one dry blend as defined in 3.4.

4.3.4 Lot Class T4

This lot class corresponds to the quantity of tubular welding consumables:

— not exceeding 45 000 kg, of one classification and dimension produced under one production schedule as defined in 3.9;

— from rod, tube or strip from one heat as defined in 3.5, 3.6, or 3.7 or by controlled chemical composition as defined in 3.2; and

— core ingredients from one dry batch as defined in 3.3, one dry blend as defined in 3.4, or controlled chemical composition as defined in 3.1.

4.4 Covered electrodes

4.4.1 Lot Class C1

This lot class corresponds to the quantity of covered electrodes not exceeding the manufacturer's standard lot, as defined in the manufacturer's quality management system.

4.4.2 Lot Class C2

This lot class corresponds to the quantity of covered electrodes, not exceeding 45 000 kg, of one classification and dimension produced in a 24 h production schedule (i.e. consecutive normal work shifts) on one production line.

When a production schedule consists of a series of manufacturing operations, only those that affect the chemical composition and operability as defined by the manufacturer's acceptance limits are subject to the 24 h limitation. In these cases, each of those individual manufacturing operations rather than the manufacturing campaign is subject to an independent 24 h limitation.

The 24 h production schedule can be a combination of consecutive normal work shifts, for example 1 x 24 h, 2 x 12 h, 3 x 8 h.

Annex A gives examples of how to apply the 24 h limitation.

4.4.3 Lot Class C3

This lot class corresponds to the quantity of covered electrodes, not exceeding 45 000 kg, of one classification and dimension produced under one production schedule as defined in 3.9 from core wire from one heat as defined in 3.5, 3.6, or 3.7 or controlled chemical composition as defined in 3.2 and covering ingredients from one wet mix as defined in 3.11 or controlled chemical composition as defined in 3.1.

4.4.4 Lot Class C4

This lot class corresponds to the quantity of covered electrodes of one classification and dimension produced from core wire from one heat as defined in 3.5, 3.6, or 3.7 and covering ingredients from one wet mix as defined in 3.11.

4.4.5 Lot Class C5

This lot class corresponds to the quantity of covered electrodes of one classification and dimension produced from core wire from one heat as defined in 3.5, 3.6, or 3.7 and covering ingredients from one dry batch as defined in 3.3 or one dry blend as defined in 3.4.

4.5 Fluxes for electroslag and submerged arc welding

4.5.1 Lot Class F1

This lot class corresponds to the quantity of flux not exceeding the manufacturer's standard lot, as defined in the manufacturer's quality management system.

4.5.2 Lot Class F2

This lot class corresponds to the quantity of flux produced from the same combination of raw materials under one production schedule as defined in 3.9.

5 Testing schedule

5.1 General

The level of the testing schedule shall be selected by the purchaser from those listed in Table 1. If no level of testing schedule is specified, the level shall be schedule 1 or F.

Table 1 — Testing schedules [a]

Schedule [b]	Requirements	Reference	Minimum Inspection Document Type [c, d]
1 or F	Manufacturer's standard testing schedule	5.2	2.1
2 or G	All tests prescribed for classification in the applicable welding consumable standard, from any product manufactured within the 12 months preceding the date of the purchase order	5.3	2.2
3 or H	Chemical analysis of the specific lot	5.4	3.1
4 or I	Tests called for by Table 2, for the specific lot	5.5	3.1
5 or J	All tests prescribed for classification in the applicable welding consumable standard, for the specific lot	5.6	3.1
6 or K	All tests specified by the purchaser for the specific lot	5.7	3.1

[a] Testing shall be conducted in accordance with the applicable filler metal classification standard, unless otherwise agreed upon by purchaser and supplier.

[b] Either the numeric or alphabetic designations may be used interchangeably.

[c] Inspection document types in accordance with ISO 10474 or EN 10204 that give requirements for their use.

[d] The inspection document type can be used to specify technical delivery conditions, but it should not be implied to show compliance to a specific testing schedule.

5.2 Schedule 1 or F

The level of testing shall be the manufacturer's standard. A statement, "the product supplied will meet the requirements of the applicable welding consumable standard, when tested in accordance with that standard", and a summary of the typical properties of the material, when tested in that manner, shall be supplied upon written request.

5.3 Schedule 2 or G

Test results shall be supplied from any product manufactured within the 12 months preceding the date of the purchase order. These shall include the results of all tests required for that classification in the applicable welding consumable standard.

5.4 Schedule 3 or H

Chemical analysis of the specific lot of consumables shall be supplied. The analysis shall include those elements required for that classification in the applicable welding consumable standard.

5.5 Schedule 4 or I

Results of the tests called for in Table 2 for the specific lot of consumables shall be supplied. The tests shall be performed as prescribed for that classification in the applicable welding consumable standard.

NOTE These tests represent a consensus of those frequently requested for consumables certification; however, they do not necessarily include all tests required for schedule 5 or J.

Table 2 — Required tests for schedule 4 or I in Table 1

Product type	Alloy group [a]						
	Non-alloy and fine grain steel	High tensile and creep resisting steel	Stainless and heat resisting steel	Nickel and nickel alloys	Aluminium and aluminium alloys	Copper and copper alloys	Titanium and titanium alloys
Solid wires and rods for gas-shielded metal arc welding, gas-shielded tungsten arc welding, plasma arc welding, and electro-gas welding	1[b], 2, 4	1[b], 2, 4	1[b]	1[b]	1, 4	1	1
Solid and metal cored wires and strips for submerged arc welding	1	1	1	1	—	—	—
Electrode-flux combinations for submerged arc welding and electro-slag welding	1, 2, 3, 4	1, 2, 3, 4	1	1	—	—	—
Tubular cored wires for metal arc welding with or without gas shielding, and for electro-gas welding	1, 2, 3, 4	1, 2, 3, 4	1	1	—	—	—
Covered electrodes for manual metal arc welding	1, 2, 3, 4	1, 2, 3, 4	1	1	1, 4	1, 4	—

Key

1 Chemical composition
2 Tensile strength
3 Impact toughness
4 Soundness (X-ray) (not required by ISO welding consumable standards, but required by some national standards)

[a] Tests called for in this table shall be performed only when required by the applicable welding consumable standard for the particular classification involved. Tests shall be performed in the manner prescribed by the applicable standard. Testing to one current and polarity is sufficient.

[b] Also applicable to consumable inserts and metallic powders.

5.6 Schedule 5 or J

Results of all of the tests required for classification in the applicable welding consumable standard for the specific lot of consumables shall be supplied.

5.7 Schedule 6 or K

Results of all tests required by the purchaser for the specific lot of consumable shall be supplied.

The purchaser shall identify on the purchase order the specific tests to be conducted, the procedure to be followed, the requirements that shall be met and the results to be reported.

6 Certification

6.1 General

The manufacturer shall declare that the product conforms with the applicable welding consumable standard and classification in at least one of the following three ways:

— by affixing a label on the product in accordance with the applicable welding consumable standard and classification;

— by providing a certificate (see 6.2);

— by providing an inspection document (see 6.3).

Distributors shall provide copies of the manufacturer's documentation without changes if requested.

6.2 Certificates

6.2.1 Certificate of compliance

A statement that the product meets the requirements of the ISO, or other applicable welding consumable standard and classification. A summary of results may be included and may be in the form of averages, ranges, or single representative values and is not necessarily from a single set of tests run at the same time, or even unique for a specific size. For example, schedule 1 or F meets the requirements of a certificate of compliance.

6.2.2 Certificate of conformance

A test report documenting that the product conforms to the requirements of the ISO, or other applicable welding consumable specification/classification. The reported results shall be in the form of a single set of tests run at the same time, using representative material/product, and may be for a specific size (diameter) or for all sizes (diameters) required to be tested for classification. Actual test values for all tests required of the applicable welding consumable specification/classification shall be reported and include a date showing when these actual tests were completed (there is no requirement as to how recently they have to be completed). It is not usually specific to the specific lot supplied. The report shall not consist of averages, ranges, or single random or "representative" values.

6.2.3 Certified material test report (CMTR)

The certified material test report shall include the actual results of all required tests on the specific lot supplied. For example, schedules 3 or H, 4 or I, 5 or J or 6 or K meet the requirements of a certified material test report.

6.3 Inspection documents

Inspection documents in accordance with ISO 10474 or EN 10204 shall be issued in accordance with the applicable welding consumable standard.

Purchase orders of inspection certificates of types 3.1 or 3.2 in accordance with ISO 10474 or EN 10204 may refer to lot classes as specified by this document (ISO 14344). Schedule 6 or K applies, unless Schedule 3 or H, Schedule 4 or I, or Schedule 5 or J is requested.

Annex A
(informative)

Examples of how to apply the 24 h limitation

Those steps that significantly affect the chemical composition or operability of a welding consumable are subject to a 24-hour restriction for some lot classifications. The intent of this restriction is to assure consistency in the chemical composition and operability within one lot of the welding consumable. This goes beyond meeting the requirements for a specific classification of electrode, such as the chemical composition limits, diameter limits, diffusible hydrogen limits or limits on cast or helix.

The steps subject to 24-hour restriction will vary, depending on the manufacturing process. For the same manufacturer, this might further vary by the processing steps for various alloys. The examples below are not inclusive of most product types or manufacturing processes, but are included for guidance.

EXAMPLE 1

A solid wire is drawn or rolled from a larger diameter rod stock to an S2 lot classification. The rod stock is from one heat and one diameter of electrode is produced. The following outlines the series of steps in the manufacturing operation:

a) the wire is pre-treated and undergoes a first reduction;

b) the wire is annealed in an inert atmosphere to allow further reduction;

c) the wire is reduced to its final size;

d) the wire is cleaned, wound onto spools and packaged.

Steps a) and b) are not subject to any time restriction. Step c) is subject to a 24-hour restriction. Step d) is subject to a separate 24-hour restriction.

EXAMPLE 2

A solid wire is drawn or rolled from a larger diameter rod stock to an S2 lot classification. The rod stock is from one heat and one diameter of electrode is produced. The following outlines the series of steps in the manufacturing operation:

a) the wire is pre-treated and undergoes a first reduction;

b) the wire is annealed in an inert atmosphere to allow further reduction;

c) the wire is reduced to its final size and cleaned;

d) the wire is cut to length and packaged.

Steps a), b) and d) are not subject to any time restriction. Step c) is subject to a 24-hour restriction.

EXAMPLE 3

A solid wire is drawn or rolled from a larger diameter rod stock to an S2 lot classification. The rod stock is from one heat and one diameter of electrode is produced. The following outlines the series of steps in the manufacturing operation:

a) the wire is pre-treated and undergoes a first reduction;

b) the wire is annealed in an inert atmosphere to allow further reduction;

c) the wire is copper coated;

d) the wire is reduced to its final size;