TECHNICAL REPORT

ISO/TR 15608

Second edition
2005-10-15

Welding — Guidelines for a metallic materials grouping system

Soudage — Lignes directrices pour un système de groupement des matériaux métalliques

Reference number
ISO/TR 15608:2005(E)

ISO copyright office
Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
E-mail copyright@iso.org
Web 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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

In exceptional circumstances, when a technical committee has collected data of a different kind from that which is normally published as an International Standard ("state of the art", for example), it may decide by a simple majority vote of its participating members to publish a Technical Report. A Technical Report is entirely informative in nature and does not have to be reviewed until the data it provides are considered to be no longer valid or useful.

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.

ISO/TR 15608 was prepared by the European Committee for Standardization (CEN) Technical Committee CEN/TC 121, *Welding*, in collaboration with Technical Committee ISO/TC 44, *Welding and allied processes*, Subcommittee SC 10, *Unification of requirements in the field of metal welding*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

This second edition cancels and replaces the first edition (ISO/TR 15608:2000), which has been technically revised.

Introduction

Requests for official interpretations of any aspect of this Technical Report should be directed to the Secretariat of ISO/TC 44/SC 10 via your national standards body. A complete listing of these bodies can be found at www.iso.org.

Welding — Guidelines for a metallic materials grouping system

1 Scope

This Technical Report provides a uniform system for grouping of materials for welding purposes. It may also apply to other purposes such as heat treatment, forming, non-destructive testing.

This Technical Report covers grouping systems for the following standardized materials:

- steel;
- aluminium and its alloys;
- nickel and its alloys;
- copper and its alloys;
- titanium and its alloys;
- zirconium and its alloys;
- cast iron.

2 Grouping system for steels

Steels are grouped as shown in Table 1. Only those elements that are specified in material standards or specifications are considered. The figures given in groups 1 and 11 refer to the ladle analysis of the materials. The figures given in groups 4 to 10 are based on the elemental content used in the designation of the alloys.

Table 1 — Grouping system for steels

Group	Sub-group	Type of steel
1		Steels with a specified minimum yield strength $R_{eH} \leq 460$ N/mm^2 [a] and with analysis in %: C ≤ 0,25 Si ≤ 0,60 Mn ≤ 1,8 Mo ≤ 0,70 [b] S ≤ 0,045 P ≤ 0,045 Cu ≤ 0,40 [b] Ni ≤ 0,5 [b] Cr ≤ 0,3 (0,4 for castings) [b] Nb ≤ 0,06 V ≤ 0,1 [b] Ti ≤ 0,05
	1.1	Steels with a specified minimum yield strength $R_{eH} \leq 275$ N/mm^2
	1.2	Steels with a specified minimum yield strength 275 N/mm^2 < $R_{eH} \leq 360$ N/mm^2
	1.3	Normalized fine-grain steels with a specified minimum yield strength $R_{eH} > 360$ N/mm^2
	1.4	Steels with improved atmospheric corrosion resistance whose analysis may exceed the requirements for the individual elements as indicated in group 1
2		Thermomechanically treated fine-grain steels and cast steels with a specified minimum yield strength $R_{eH} > 360$ N/mm^2
	2.1	Thermomechanically treated fine-grain steels and cast steels with a specified minimum yield strength 360 N/mm^2 < $R_{eH} \leq 460$ N/mm^2
	2.2	Thermomechanically treated fine-grain steels and cast steels with a specified minimum yield strength $R_{eH} > 460$ N/mm^2
3		Quenched and tempered and precipitation-hardened fine-grain steels except stainless steels with a specified minimum yield strength $R_{eH} > 360$ N/mm^2
	3.1	Quenched and tempered fine-grain steels with a specified minimum yield strength 360 N/mm^2 < $R_{eH} \leq 690$ N/mm^2
	3.2	Quenched and tempered fine-grain steels with a specified minimum yield strength $R_{eH} > 690$ N/mm^2
	3.3	Precipitation-hardened fine-grain steels except stainless steels
4		Low vanadium alloyed Cr-Mo-(Ni) steels with Mo ≤ 0,7 % and V < 0,1 %
	4.1	Steels with Cr ≤ 0,3 % and Ni ≤ 0,7 %
	4.2	Steels with Cr ≤ 0,7 % and Ni ≤ 1,5 %
5		Cr-Mo steels free of vanadium with C ≤ 0,35 %
	5.1	Steels with 0,75 % ≤ Cr ≤ 1,5 % and Mo ≤ 0,7 %
	5.2	Steels with 1,5 % < Cr ≤ 3,5 % and 0,7 % < Mo ≤ 1,2 %
	5.3	Steels with 3,5 % < Cr ≤ 7,0 % and 0,4 % < Mo ≤ 0,7 %
	5.4	Steels with 7,0 % < Cr ≤ 10,0 % and 0,7 % < Mo ≤ 1,2 %

Table 1 *(continued)*

Group	Sub-group	Type of steel
6		High vanadium alloyed Cr-Mo-(Ni) steels
	6.1	Steels with 0,3 % ≤ Cr ≤ 0,75 %, Mo ≤ 0,7 % and V ≤ 0,35 %
	6.2	Steels with 0,75 % < Cr ≤ 3,5 %, 0,7 % < Mo ≤ 1,2 % and V ≤ 0,35 %
	6.3	Steels with 3,5 % < Cr ≤ 7,0 %, Mo ≤ 0,7 % and 0,45 % ≤ V ≤ 0,55 %
	6.4	Steels with 7,0 % < Cr ≤ 12,5 %, 0,7 % < Mo ≤ 1,2 % and V ≤ 0,35 %
7		Ferritic, martensitic or precipitation-hardened stainless steels with C ≤ 0,35 % and 10,5 % ≤ Cr ≤ 30 %
	7.1	Ferritic stainless steels
	7.2	Martensitic stainless steels
	7.3	Precipitation-hardened stainless steels
8		Austenitic stainless steels, Ni ≤ 31 %
	8.1	Austenitic stainless steels with Cr ≤ 19 %
	8.2	Austenitic stainless steels with Cr > 19 %
	8.3	Manganese austenitic stainless steels with 4 % < Mn ≤ 12 %
9		Nickel alloy steels with Ni ≤ 10,0 %
	9.1	Nickel alloy steels with Ni ≤ 3,0 %
	9.2	Nickel alloy steels with 3,0 % < Ni ≤ 8,0 %
	9.3	Nickel alloy steels with 8,0 % < Ni ≤ 10,0 %
10		Austenitic ferritic stainless steels (duplex)
	10.1	Austenitic ferritic stainless steels with Cr ≤ 24 %
	10.2	Austenitic ferritic stainless steels with Cr > 24 %
11		Steels covered by group 1 [c] except 0,25 % < C ≤ 0,85 %
	11.1	Steels as indicated in group 11 with 0,25 % < C ≤ 0,35 %
	11.2	Steels as indicated in group 11 with 0,35 % < C ≤ 0,5 %
	11.3	Steels as indicated in group 11 with 0,5 % < C ≤ 0,85 %

NOTE Based on the actual product analysis, group 2 steels may be considered as group 1 steels.

[a] In accordance with the specification of the steel product standards, R_{eH} may be replaced by $R_{p0,2}$ or $R_{t0,5}$.

[b] A higher value is accepted provided that Cr + Mo + Ni + Cu + V ≤ 0,75 %.

[c] A higher value is accepted provided that Cr + Mo + Ni + Cu + V ≤ 1 %.

3 Grouping system for aluminium and aluminium alloys

Aluminium and aluminium alloys are grouped as shown in Table 2. The figures given are based on the elemental content used in the designation of the alloys.

Table 2 — Grouping system for aluminium and aluminium alloys

Group	Sub-group	Type of aluminium or aluminium alloy
21		Pure aluminium with ≤ 1 % impurities or alloy content
22		Non-heat-treatable alloys
	22.1	Aluminium-manganese alloys
	22.2	Aluminium-magnesium alloys with Mg ≤ 1,5 %
	22.3	Aluminium-magnesium alloys with 1,5 % < Mg ≤ 3,5 %
	22.4	Aluminium-magnesium alloys with Mg > 3,5 %
23		Heat-treatable alloys
	23.1	Aluminium-magnesium-silicon alloys
	23.2	Aluminium-zinc-magnesium alloys
24		Aluminium-silicon alloys with Cu ≤ 1 %
	24.1	Aluminium-silicon alloys with Cu ≤ 1 % and 5 % < Si ≤ 15 %
	24.2	Aluminium-silicon-magnesium alloys with Cu ≤ 1 %; 5 % < Si ≤ 15 % and 0,1 % < Mg ≤ 0,80 %
25		Aluminium-silicon-copper alloys with 5 % < Si ≤ 14 %; 1 % < Cu ≤ 5 % and Mg ≤ 0,8 %
26		Aluminium-copper alloys with 2 % < Cu ≤ 6 %

NOTE Groups 21 to 23 are generally for wrought materials and groups 24 to 26 are generally for cast materials.

4 Grouping system for copper and copper alloys

Copper and copper alloys are grouped as indicated in Table 3.

Table 3 — Grouping system for copper and copper alloys

Group	Sub-group	Type of copper or copper alloy
31		Copper with up to 6 % Ag and 3 % Fe
32		Copper-zinc alloys
	32.1	Copper-zinc alloys, binary
	32.2	Copper-zinc alloys, complex
33		Copper-tin alloys
34		Copper-nickel alloys
35		Copper-aluminium alloys
36		Copper-nickel-zinc alloys
37		Copper alloys, low-alloyed (less than 5 % other elements) not covered by groups 31 to 36
38		Other copper alloys (5 % or more other elements) not covered by groups 31 to 36

5 Grouping system for nickel and nickel alloys

Nickel and nickel alloys are grouped as indicated in Table 4. The figures given are based on the elemental content used in the designation of the alloys.

Table 4 — Grouping system for nickel and nickel alloys

Group	Type of nickel or nickel alloy
41	Pure nickel
42	Nickel-copper alloys (Ni-Cu) with Ni ≥ 45 %, Cu ≥ 10 %
43	Nickel-chromium alloys(Ni-Cr-Fe-Mo) with Ni ≥ 40 %
44	Nickel-molybdenum alloys (Ni-Mo) with Ni ≥ 45 %, Mo ≤ 32 %
45	Nickel-iron-chromium alloys (Ni-Fe-Cr) with Ni ≥ 31 %
46	Nickel-chromium-cobalt alloys (Ni-Cr-Co) with Ni ≥ 45 %, Co ≥ 10 %
47	Nickel-iron-chromium-copper alloys (Ni-Fe-Cr-Cu) with Ni ≥ 45 %
48	Nickel-iron-cobalt alloys (Ni-Fe-Co-Cr-Mo-Cu) with 31 % ≤ Ni ≤ 45 % and Fe ≥ 20 %

6 Grouping system for titanium and titanium alloys

Titanium and titanium alloys are grouped as indicated in Table 5.

Table 5 — Grouping system for titanium and titanium alloys

Group	Sub-group	Type of titanium or titanium alloy
51		Pure titanium
	51.1	Titanium with $O_2 < 0{,}20$ %
	51.2	Titanium with $0{,}20\ \% < O_2 \leq 0{,}25$ %
	51.3	Titanium with $0{,}25\ \% < O_2 \leq 0{,}35$ %
	51.4	Titanium with $0{,}35\ \% < O_2 \leq 0{,}40$ %
52		Alpha alloys [a]
53		Alpha-beta alloys [b]
54		Near-beta and beta alloys [c]

[a] Alloys covered by group 52 are: Ti-0,2Pd; Ti-2,5Cu; Ti-5Al-2,5Sn; Ti-8Al-1Mo-1V; Ti-6Al-2Sn-4Zr-2Mo; Ti-6Al-2Nb-1Ta-0,8Mo

[b] Alloys covered by group 53 are: Ti-3Al-2,5V; Ti-6Al-4V; Ti-6Al-6V-2Sn; Ti-7Al-4Mo.

[c] Alloys covered by group 54 are: Ti-10V-2Fe-3Al; Ti-13V-11Cr-3Al; Ti-11,5Mo-6Zr-4,5Sn; Ti-3Al-8V-6Cr-4Zr-4Mo.

7 Grouping system for zirconium and zirconium alloys

Zirconium and zirconium alloys are grouped as indicated in Table 6.

Table 6 — Grouping system for zirconium and zirconium alloys

Group	Type of zirconium or zirconium alloy
61	Pure zirconium
62	Zirconium with 2,5 % Nb

8 Grouping system for cast iron

Cast irons are grouped as indicated in Table 7.

Table 7 — Grouping system for cast iron

Group	Sub-group	Type of cast iron
71		Grey cast irons with specified tensile strength or Brinell hardness
72		Spheroidal-graphite cast irons with specified mechanical properties
	72.1	Spheroidal-graphite cast irons, ferrite type, with specified tensile strength, 0,2 % proof stress, elongation and specified impact resistance values
	72.2	Spheroidal-graphite cast irons, ferrite type, with specified tensile strength, 0,2 % proof stress and elongation or specified Brinell hardness
	72.3	Spheroidal-graphite cast irons EN-GJS-500-7 and EN-GJS-450-10 (if > 20 % perlite) or specified Brinell hardness
	72.4	Spheroidal-graphite cast irons, perlite type, with specified tensile strength, 0,2 % proof stress and elongation or specified Brinell hardness
73		Malleable cast irons
74		Austempered ductile cast irons
75		Austenitic cast irons
76		Cast irons excepting groups 71 to 75

ICS 25.160.01

Price based on 6 pages