2025-05-28

Utdrag ur standarder

-att användas av eleven vid teoriprov för Internationell svetsare, IW. Varje elev ska ha tillgång till eget exemplar av standardutdragen vid provtillfället.

Vissa frågor i teoriproven för internationell svetsare handlar om vad som står i standarder. Det viktigaste innehållet i de vanligaste standarderna ska eleven kunna utantill.

I tabellen nedan finns lämpliga utdrag från sex ”mindre vanliga” standarder som det också finns frågor om i teoriprovet.

Observera att vissa av de sex utdragen bara behöver användas för frågor i viss teorimodul, t.ex. gassvetsning (SG) eller aluminium (PAL). Vilken standard bladet behandlar står högst upp på varje sida.

Sida 2	ISO 20378:2018	Tillsatsmaterial för svetsning – Svetsstavar för gassvetsning av olegerat och varmhållfast stål – Indelning.
Sida 3	SS-EN ISO 2503:2009	Svetsutrustning – Gassvetsning – Tryckregulatorer för gasflaskor för tryck till och med 300 bar (30 MPa)
Sida 4 - 7	SS-EN ISO 2560:2020	Tillsatsmaterial för svetsning – Belagda elektroder för manuell metallbågsvetsning av olegerat stål och finkornstål – Indelning
Sida 8 - 9	SS-EN ISO 636:2024	Tillsatsmaterial för svetsning – Stavar, trådar och svetsgods för TIG-svetsning av olegerat stål och finkornstål – Indelning
Sida 10	SS-EN ISO 9692-3:2016	Svetsning och besläktade förfaranden – Rekommendationer för fogutformning – Del 3: MIG- och TIG-svetsning av aluminium
Sida 11-15	SIS-CEN ISO/TR 15608:2017	Svetsning – Riktlinjer för ett system för gruppering av metalliska material

Tabell 1: Beteckning för kemisk sammansättning hos svetsstavar

Symbol	Chemical composition[a] % (by mass)									
	C	Si	Mn	P	S	Mo	Ni	Cr	Cu[b]	Others
I	0,03 to 0,12	0,01 to 0,20	0,35 to 0,65	0,030	0,025	0,3	0,3	0,15	0,35	V 0,03
II	0,03 to 0,20	0,05 to 0,25	0,50 to 1,20	0,025	0,025	0,3	0,3	0,15	0,35	V 0,03
III	0,05 to 0,15	0,05 to 0,25	0,95 to 1,25	0,020	0,020	0,3	0,35 to 0,80	0,15	0,35	V 0,03
IV	0,08 to 0,15	0,10 to 0,25	0,90 to 1,20	0,020	0,020	0,45 to 0,65	0,3	0,15	0,35	V 0,03
V	0,10 to 0,15	0,10 to 0,25	0,80 to 1,20	0,020	0,020	0,45 to 0,65	0,3	0,80 to 1,20	0,35	V 0,03
VI	0,03 to 0,10	0,10 to 0,25	0,40 to 0,70	0,020	0,020	0,90 to 1,20	0,3	2,00 to 2,20	0,35	V 0,03
45	0,08	0,10	0,50	0,035	0,040	0,20	0,30	0,20	0,30	Al 0,02
60	0,15	0,10 to 0,35	0,90 to 1,40	0,035	0,035	0,20	0,30	0,20	0,30	Al 0,02
65	0,15	0,10 to 0,70	0,90 to 1,60	0,035	0,035	0,20	0,30	0,40	0,30	Al 0,02
100	0,18 to 0,23	0,20 to 0,35	0,70 to 0,90	0,025	0,025	0,15 to 0,25	0,40 to 0,70	0,40 to 0,60	0,15	Al 0,02
Z	Any other agreed composition[c]									

[a] Single values shown in the table are maximum values.

[b] Including coating.

[c] Consumables for which the chemical composition is not listed in this table shall be symbolized with the prefix Z. The chemical composition ranges are not specified and therefore, it is possible that two electrodes with the same Z classification are not interchangeable.

6. Kemisk analys

Kemisk analys utförs på prover av staven. Vilken analysteknik som helst kan användas, men vid tvist ska hänvisning göras till etablerade publicerade metoder.

9. Tekniska leveransvillkor

Tekniska leveransvillkor ska uppfylla kraven i ISO 544.

10. Beteckning

Ett exempel på beteckning för en tråd för gassvetsning som har en kemisk sammansättning inom gränserna för legeringssymbolen III i enlighet med tabell 1:

ISO 20378 - O III

där:

ISO 20378 = standardnummer;

O = svetsprocessen (Gassvetsning);

III = trådens kemiska sammansättning (se tabell 1).

Bilaga A (informativ. ISO 20378:2018

Svetsningsbeteende

Stavar med symbolen I till VI har olika svetsbeteende. I tabell A.1 listas det typiska svetsbeteendet för olika stänger.

Tabell A.1 — Svetsbeteende för olika stänger

Beteckning/ beteende	O I	OII	OIII	OIV	OV	OVI
Fluiditet	Starkt flytande	Mindre flytande	Trögflytande			
Sprut	Mycket	Mindre	Nej			
Känslighet för porösitet	Ja	Ja	Nej			

- Nominellt inloppstryck, p_1, angivet av tillverkaren (endast oxygen och andra komprimerade gaser)
- Den gas som ska användas (om gasens fullständiga namn inte kan stämplas in, ska symbolerna i tabell 5 användas)

Tabell 5 – Kodbokstäver för gaser som skall användas för märkning av tryckregulatorer

Typ av gas	Kodbokstav
acetylen	A
oxygen	O
hydrogen	H
komprimerad gas	D
gasol	P
metylacetylenpropadien	Y
naturgas	M
CO_2, kvävgas, naturgas	N

10. Instruktion om användning

Med varje tryckregulator ska tillverkaren, leverantören eller distributören lämna instruktioner om användning som minst innefattar

a) Tryckregulatorns användningsområde
b) Beskrivning av tryckregulatorn och dess innebörd
c) Säker och riktig montering av tryckregulatorn
d) Provningar vid igångsättning som är nödvändiga för säker och riktig installation för användning
e) Användning och underhåll av tryckregulatorn (avsett för operatören) omfattande risker och säkerhetsåtgärder i samband med oxygen.

11. Typprovningar

11.1 Allmänt

Kontroll av att regulatorn överensstämmer med kraven i denna standard kan bekräftas av ett oberoende organ.

Urbränningsprovning med oxygen (se 11.5.3) ska utföras mellan funktionsprovningarna (se 11.4) och lämplighetsprovningen (se 11.5.1.1).

ANM Dessa provningar är endast tillämpliga på regulatorer som ha kontrollerats för överensstämmelse enligt denna internationella standard, d.v.s typprovningar, och avses som program för produktionsprovningar av alla regulatorer

Table 3A — Symbol for chemical composition of all-weld metal
(Classification by yield strength and 47 J impact energy)

Alloy symbol	Chemical composition % (by mass)[a,b,c]		
	Mn	Mo	Ni
No symbol	2,0	—	—
Mo	1,4	0,3 to 0,6	—
MnMo	1,4 to 2,0	0,3 to 0,6	—
1Ni	1,4	—	0,6 to 1,2
Mn1Ni	1,4 to 2,0	—	0,6 to 1,2
2Ni	1,4	—	1,8 to 2,6
Mn2Ni	1,4 to 2,0	—	1,2 to 2,6
3Ni	1,4	—	2,6 to 3,8
1NiMo	1,4	0,3 to 0,6	0,6 to 1,2
Z[c]	Any other agreed composition		

[a] If not specified, Mo < 0,2; Ni < 0,3; Cr < 0,2; V < 0,05; Nb < 0,05; Cu < 0,3.

[b] Single values shown in the table mean maximum values.

[c] Consumables for which the chemical composition is not listed in the table shall be symbolized similarly and prefixed by the letter Z. The chemical composition ranges are not specified and therefore two electrodes with the same Z-classification may not be interchangeable.

Table 3B — Symbol for chemical composition of all-weld metal
(Classification by tensile strength and 27 J impact energy)

Alloy symbol	Chemical composition	
	Principal alloy element(s)	Nominal level % (by mass)
No symbol, –1, –P1 or –P2	Mn	1,3
–1M3	Mo	0,5
–3M2	Mn Mo	1,5 0,4
–3M3	Mn Mo	1,5 0,5
–N1	Ni	0,5
–N2	Ni	1,0
–N3	Ni	1,5
–3N3	Mn Ni	1,5 1,5
–N5	Ni	2,5
–N7	Ni	3,5
–N13	Ni	6,5
–N2M3	Ni Mo	1,0 0,5
–NC	Ni Cu	0,5 0,4
–CC	Cr Cu	0,5 0,4
–NCC	Ni Cr Cu	0,2 0,6 0,5
–NCC1	Ni Cr Cu	0,6 0,6 0,5
–NCC2	Ni Cr Cu	0,3 0,2 0,5
–G[a]	Any other agreed composition	

[a] The chemical composition ranges are not specified and therefore two electrodes with the same G-classification may not be interchangeable.

5.5 Symbol for type of electrode covering

5.5A Classification by yield strength and47 J impact energy

The type of covering of a covered electrode depends substantially on the types of slag-forming components. The symbols indicating the covering type shall be in accordance with Table 4A.

5.5B Classification by tensile strength and 27 J impact energy

The type of covering of a covered electrode depends substantially on the types of slag-forming components. The type of covering also determines the positions suitable for welding and the type of current, in accordance with Table 4B.

Table 4A — Symbol for type of covering
(Classification by yield strength and 47 J impact energy)

Symbol	Type of covering
A	Acid covering
C	Cellulosic covering
R	Rutile covering
RR	Rutile thick covering
RC	Rutile-cellulosic covering
RA	Rutile-acid covering
RB	Rutile-basic covering
B	Basic covering

NOTE A description of the characteristics of each of the types of covering is given in Annex B.

Table 4B — Symbol for type of covering
(Classification by tensile strength and 27 J impact energy)

Symbol	Type of covering	Welding positions[a]	Type of current[b]
03	Rutile basic	All[c]	AC and DC (±)
10	Cellulosic	All	DC (+)
11	Cellulosic	All	AC and DC (+)
12	Rutile	All[c]	AC and DC (–)
13	Rutile	All[c]	AC and DC (±)
14	Rutile + iron powder	All[c]	AC and DC (±)
15	Basic	All[c]	DC (+)
16	Basic	All[c]	AC and DC (+)
18	Basic + iron powder	All[c]	AC and DC (+)
19	Ilmenite	All[c]	AC and DC (±)
20	Iron oxide	PA, PB	AC and DC (–)
24	Rutile + iron powder	PA, PB	AC and DC (±)
27	Iron oxide + iron powder	PA, PB	AC and DC (±)
28	Basic + iron powder	PA, PB, PC	AC and DC (+)
40	Not specified	Manufacturer's recommendations	
45	Basic	All[d]	DC (+)
48	Basic	All	AC and DC (+)

NOTE A description of the characteristics of each of the types of covering is given in Annex C.

[a] Positions in accordance with ISO 6947:2019. PA = flat, PB = horizontal vertical fillet, PC = horizontal, PG = vertical down.

[b] Alternating current = AC; direct current = DC.

[c] The indication "all positions" may or may not include vertical down welding. This shall be specified in the manufacturer's literature.

[d] Not including PF (vertical up).

5.7 Symbol for electrode efficiency and type of current

5.7A Classification by yield strength and 47 J impact energy

The symbols in Table 5A indicate electrode efficiency, determined in accordance with ISO 2401 with the type of current shown in Table 5A.

Table 5A — Symbol for electrode efficiency and type of current
(Classification by yield strength and 47 J impact energy)

Symbol	Electrode efficiency, η, %	Type of current[a,b]
1	$\eta \leq 105$	AC and DC
2	$\eta \leq 105$	DC
3	$105 < \eta \leq 125$	AC and DC
4	$105 < \eta \leq 125$	DC
5	$125 < \eta \leq 160$	AC and DC
6	$125 < \eta \leq 160$	DC
7	$\eta > 160$	AC and DC
8	$\eta > 160$	DC

[a] If an electrode is suitable for both DC and AC operation, the electrode efficiency shall be based on AC testing only.

[b] Alternating current = AC; direct current = DC.

5.7B Classification by tensile strength and 27 J impact energy

There is no specific symbol for electrode efficiency and type of current. Type of current is included in the symbol for type of covering (Table 4B). Electrode efficiency is not addressed.

5.8 Symbol for welding position

5.8A Classification by yield strength and 47 J impact energy

The symbols in Table *6A* for welding positions indicate the positions for which the electrode is tested in accordance with ISO 15792-3. For testing requirements (see Clause 8).

Table 6A — Symbol for welding position
(Classification by yield strength and 47 J impact energy)

Symbol	Welding positions in accordance with ISO 6947:2019
1	PA, PB, PC, PD, PE, PF, PG
2	PA, PB, PC, PD, PE, PF
3	PA, PB
4	PA
5	PA, PB, PG

5.8B Classification by tensile strength and 27 J impact energy

There is no specific symbol for welding position. The welding position requirements are included with the symbol for type of covering (Table 4B).

5.9 Symbol for diffusible hydrogen content of deposited metal

The symbols in Table 7 indicate diffusible hydrogen content determined in deposited metal from an electrode of size 4 mm in accordance with the method given in ISO 3690. The current used shall be 70 % to 90 % of the maximum value recommended by the manufacturer. Electrodes recommended for use with AC and DC shall be tested using AC. Electrodes recommended for DC only shall be tested using DC with electrode positive.

The manufacturer shall provide information on the recommended type of current and redrying conditions for achieving the diffusible hydrogen levels.

Table 7 — Symbol for diffusible hydrogen content of deposited metal

Symbol	Diffusible hydrogen content maximum ml/100 g of deposited weld metal
H5	5
H10	10
H15	15

Annex D provides additional information about diffusible hydrogen.

6 Mechanical tests

6A Classification by yield strength and 47 J impact energy

Tensile and impact tests and any required retests shall be carried out in the as-welded condition using an all-weld metal test assembly type 1.3 in accordance with ISO 15792-1:2020 and the welding conditions described in 6.1 and 6.2.

6B Classification by tensile strength and 27 J impact energy

Tensile and impact tests and any required retests shall be carried out in the as-welded condition and/or in the post-weld heat-treated condition, using an all-weld metal test assembly type 1.3 in accordance with ISO 15792-1:2020 and the welding conditions described in 6.1 and 6.2.

When diffusible hydrogen removal treatment is specified by the manufacturer, it shall be carried out in accordance with ISO 15792-1.

6.1 Preheating and interpass temperatures

The preheating and interpass temperatures shall be measured using temperature indicator crayons, surface thermometers or thermocouples (for example, in accordance with ISO 13916).

6.1A Classification by yield strength and 47 J impact energy

Preheating is not required; welding may start from room temperature. The interpass temperature shall be in the range 90 °C to 175 °C. If, after any pass, the interpass temperature is exceeded, the test assembly shall be cooled in air to a temperature below that limit.

To reach tensile test requirements and impact properties at the same time, it can be necessary to keep the interpass temperature in a small range.

6.1B Classification by tensile strength and 27 J impact energy

Preheating and interpass temperature for electrodes with no chemical composition symbol or with the –1 symbol in Tables 3B and 8B shall be 100 °C to 150 °C. Preheating and interpass temperatures for all other compositions shall be 90 °C to 110 °C.

5.2 Symbol for strength and elongation of all-weld metal

5.2A Classification by yield strength and 47 J impact energy

The symbol in Table 1A indicates yield strength, tensile strength, and elongation of the all-weld metal in the as-welded condition determined in accordance with Clause 6.

Table 1A — Symbol for strength and elongation of all-weld metal

Symbol	Minimum yield strength[a] MPa	Tensile strength MPa	Minimum elongation[b] %
35	355	440 to 570	22
38	380	470 to 600	20
42	420	500 to 640	20
46	460	530 to 680	20
50	500	560 to 720	18

[a] For yield strength, the lower yield (R_{eL}) is used when yielding occurs. Otherwise, the 0,2 % proof strength ($R_{p0,2}$) is used.

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

5.2B Classification by tensile strength and 27 J impact energy

The symbol in Table 1B indicates yield strength, tensile strength, and elongation of the all-weld metal in the as-welded condition or in the post-weld heat-treated condition determined in accordance with Clause 6.

Table 1B — Symbol for strength and elongation of all-weld metal

Symbol[a]	Minimum yield strength[b] MPa	Tensile strength MPa	Minimum elongation[c] %
43X	330	430 to 600	20
49X	390	490 to 670	18
55X	460	550 to 740	17
57X	490	570 to 770	17

[a] X is "A" or "P". Where "A" indicates testing in the as-welded condition and "P" indicates testing in the post weld heat-treated condition.

[b] For yield strength, the lower yield (R_{eL}) is used when yielding occurs. Otherwise, the 0,2 % proof strength ($R_{p0,2}$) is used.

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

5.3 Symbol for impact properties of all-weld metal

5.3A Classification by yield strength and 47 J impact energy

The symbols in Table 2 indicate the temperature at which impact energy of 47 J is achieved under the conditions given in Clause 6.

Three test specimens shall be tested. Only one individual value can be lower than 47 J, but not lower than 32 J. The average of the three values shall be at least 47 J.

5.3B Classification by tensile strength and 27 J impact energy

The symbol in Table 2 indicates the temperature at which impact energy of 27 J is achieved in the as-welded condition or in the post-weld heat-treated condition under the conditions given in Clause 6.

Five test specimens shall be tested. The lowest and highest values obtained shall be disregarded. Two of the three remaining values shall be equal or greater than the specified 27 J level. One of the three can be lower, but shall not be less than 20 J. The average of the three remaining values shall be at least 27 J.

The addition of the optional symbol U immediately after the symbol for condition of heat treatment indicates that the supplemental requirement of 47 J impact energy at the normal 27 J impact test temperature has also been satisfied. For the 47 J impact requirement, the number of specimens tested and values obtained shall meet the requirement of 5.3A.

Table 2 — Symbol for impact properties of all-weld metal

Symbol	Temperature for minimum average impact energy of 47 J[a] or 27 J[b] °C
Z	No requirements
A[a] or Y[b]	+20
0	0
2	−20
3	−30
4	−40
5	−50
6	−60
7	−70
8	−80
9	−90
10	−100

[a] Classification by yield strength and 47 J impact energy.

[b] Classification by tensile strength and 27 J impact energy.

5.4 Symbol for the chemical composition of rods or wires

The symbol in Table 3A or Table 3B indicates the chemical composition of the rods or wires and includes an indication of characteristic alloying elements.

Tabell 1 – Svetsfogar för stumsvetsar, svetsade från en sida

Dimensions in millimetres

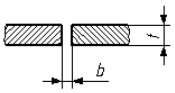
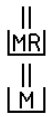
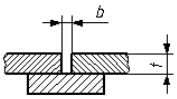
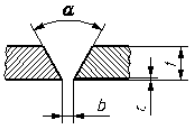
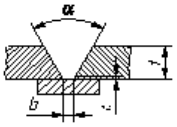
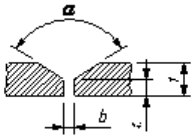
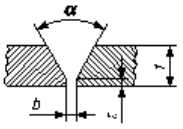
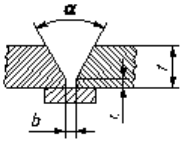
Weld					Joint preparation						
Ref. No.[a]	Workpiece thickness t	Designation	Symbol[b]	Illustration	Cross-section	Angle α, β	Gap b	Thickness of root face c	Other dimensions	Recommended welding process[c]	Remarks
1.1	$t \leq 4$	Square butt weld				—	$b \leq 1$	—	—	141	Chamfering on the root side is recommended
	$2 \leq t \leq 4$	Square butt weld with temporary (MR) or permanent (M) backing				—	$b \leq 1{,}5$	—	—	131	—
1.2	$3 \leq t \leq 5$	Single-V butt weld				$60° \leq \alpha \leq 90°$	$b \leq 2$	$c \leq 2$	—	131	—
		Single-V butt weld with removable/ temporary (MR) or permanent (M) backing				$60° \leq \alpha \leq 90°$	$b \leq 4$	$c \leq 2$	—	131	—
1.3	$3 \leq t \leq 6$	Single-V butt weld				$90° \leq \alpha \leq 120°$	$b \leq 1$	$1 \leq c \leq 2$	—	141	—
	$3 \leq t \leq 15$	Single-V butt weld with broad root face				$\alpha \geq 60°$	$b \leq 2$	$c \leq 2$	—	131	—
	$6 \leq t \leq 25$	Single-V butt weld with broad root face with temporary (MR) or permanent (M) backing				$\alpha \geq 60°$	$4 \leq b \leq 10$	$c \leq 3$	—	131	—

Table 1 — Grouping system for steels

Group	Subgroup	Type of steel
1		Steels with a specified minimum yield strength $R_{eH} \leq 460$ N/mm² [a] and with analysis in per cent (%):
		C ≤ 0,25
		Si ≤ 0,60
		Mn ≤ 1,8
		Mo ≤ 0,70[b]
		S ≤ 0,045
		$P \leq 0,045$
		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/mm²
	1.2	Steels with a specified minimum yield strength 275 N/mm² < $R_{eH} \leq 360$ N/mm²
	1.3	Normalized fine-grain steels with a specified minimum yield strength $R_{eH} > 360$ N/mm²
	1.4	Steels with improved atmospheric corrosion resistance whose analysis may exceed the requirements for the single 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/mm²
	2.1	Thermomechanically treated fine-grain steels and cast steels with a specified minimum yield strength 360 N/mm² < $R_{eH} \leq 460$ N/mm²
	2.2	Thermomechanically treated fine-grain steels and cast steels with a specified minimum yield strength $R_{eH} > 460$ N/mm²
3		Quenched and tempered and precipitation hardened fine-grain steels except stainless steels with a specified minimum yield strength $R_{eH} > 360$ N/mm²
	3.1	Quenched and tempered fine-grain steels with a specified minimum yield strength 360 N/mm² < $R_{eH} \leq 690$ N/mm²
	3.2	Quenched and tempered fine-grain steels with a specified minimum yield strength $R_{eH} > 690$ N/mm²
	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 %

[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 Cr + Mo + Ni + Cu + V ≤ 0,75 %.

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

Table 1 *(continued)*

Group	Subgroup	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 ≤ 35 %
	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 % and Ni > 4 %
	10.2	Austenitic ferritic stainless steels with Cr > 24 % and Ni > 4 %
	10.3	Austenitic ferritic stainless steels with Ni ≤ 4 %
11		Steels covered by group 1[c] except 0,30 % < C ≤ 0,85 %
	11.1	Steels as indicated under 11 with 0,30 % < C ≤ 0,35 %
	11.2	Steels as indicated under 11 with 0,35 % < C ≤ 0,5 %
	11.3	Steels as indicated under 11 with 0,5 % < C ≤ 0,85 %
Based on the actual product analysis, group 2 steels may be considered group 1 steels. If a material has different minimum specified yield strengths depending on the thickness, the highest yield strength shall be used for the determination of the subgroup.		
[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 Cr + Mo + Ni + Cu + V ≤ 0,75 %. [c] A higher value is accepted, provided Cr + Mo + Ni + Cu + V ≤ 1 %.		

5 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 element content used in the designation of the alloys.

Table 2 — Grouping system for aluminium and aluminium alloys

Group	Subgroup	Type of aluminium and aluminium alloy
21		Pure aluminium ≤ 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.	

6 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	Subgroup	Type of copper and 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

7 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 element content used in the designation of the alloys.

Table 4 — Grouping system for nickel and nickel alloys

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

8 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	Subgroup	Type of titanium and titanium alloy
51		Pure titanium
	51.1	Titanium with $O_2 \leq 0{,}20$ %
	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.

9 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 and zirconium alloy
61	Pure zirconium
62	Zirconium with 2,5 % Nb

10 Grouping system for cast irons

Cast irons are grouped as indicated in Table 7.

Table 7 — Grouping system for cast irons

Group	Subgroup	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 71 to 75