

Alloys and information on orders, tenders and surface pretreatment

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Aluminium Products in the Building and Construction Industry

Alloys and information on orders, tenders and surface pretreatment

1 Orders and tenders

Orders or tenders for the coating of aluminium products should contain the following information:

- a. the form and type of product (see section 3)¹ :
 - the form of the product (sheet, strip, plate, profile, forging, shaped casting etc.);
 - the designation of the aluminium or the wrought aluminium alloy according to EN 573-3 or the aluminium casting alloy according to EN 1706
- b. the metallurgical temper of the material for delivery according to EN 515 and, if different, the metallurgical temper for use (see section 3)¹
- c. the dimensions of the semi-finished product:
 - sheet, strip, plate width, thickness, length
 - profiles width, height, maximum wall thickness or drawing of the cross section, length
 - round tube external diameter², internal diameter², wall thickness², length
 - round rod diameter, length
 - square and hexagonal bar length of sides or width across flats, length
 - rectangular bar width, thickness, length
 - forgings width, thickness, length
- d. the quantity:
 - number of pieces or mass
- e. the surface pretreatment prior to coating:
 - GSB approved
 - pickling treatment: alkaline, acidic
 - pickling loss depending on the chemical composition of the alloy, under- and overpickling can lead to problems during surface pretreatment
 - conversion coating/passivation: yellow chromate conversion coating, green chromate conversion coating, chrome-free pre-treatment or pre-anodisation
- f. the coating system³:
 - GSB approved
 - coating material: powder or liquid paint
 - structure of coating
 - coating thickness
 - colouring
 - gloss level

¹ Example: profile EN-AW 6060-T6 or sheet EN-AW 5005A-H24

² Only two of these dimensions are specified, not all three.

³ If semi-finished products are intended to form a specific area, they should all be coated using a coating system from the same producer on material from the same manufacturing batch and where possible in the same operation.

- g. the anodising treatment⁴
 - technical conditions of delivery according to DIN 17611 or specification according to DIN EN 12373-1
 - surface pretreatment
 - coating thickness
 - colouring
 - quality-control samples
 - semi-finished product in anodising quality for decorative applications
- h. the requirements for the packaging:
 - type of packaging
 - protective film⁵

2 Factors influencing surface treatment

Some factors that can affect the degreasing, pickling, application of the conversion coating/passivation and coating of aluminium products are listed below:

- a. alloy and temper
 - Structure in accordance with the method of manufacture
 - Heterogeneous microconstituents and their solubility
- b. auxiliary materials used in production
 - rolling oils
 - extrusion oils
 - piston lubricants
 - releasing agents
- c. transport and storage of uncoated products
 - storage
 - storage time
 - storage conditions
 - packaging

⁴ If semi-finished products are intended to form a specific area, they should all be ordered from the same manufacturing batch because different manufacturing batches, semi-finished products, alloys and anodising processes can lead to different surface appearances.

⁵ Type, thickness, adhesive properties, formability, tensile strength and lightfastness should be taken into account when choosing the protective film. Only certain films can be exposed to the elements and then only for a limited time period.

3 Aluminium and aluminium alloys

3.1 Wrought alloys

3.1.1 Semi-finished product types

The follow table contains aluminium alloys that according to EN 1999-1-1, EN 1999-1-4 and DIN 4113-1/A1 can be used for components that are subject to certain static requirements⁶, together with details of temper and type of semi-finished product.

Alloys EN 573-3 EN AW-	Alloys EN 573-3 EN AW-	Typical tempers EN 515 ⁷	Strip, sheet, plate EN 485-1	Profiles EN 755-1 EN 754-1	Precision profiles EN 12020-1	Forgings EN 586-1
1050A	Al 99,5	O, H111, H112 H12, H22 H14, H24 H16, H26 H18, H28	X			
3003	Al Mn1Cu	H18	X			
3004	Al Mn1Mg1	H14, H24, H34 H16, H26, H36 H18, H28, H38	X			
3005	Al Mn1Mg0,5	H14, H24 H16, H26 H18, H28	X			
3103	Al Mn1	H14, H24 H16, H26 H18	X			
3105	Al Mn0,5Mg0,5	H18, H28				
5005	Al Mg1(B)	O, H111, H112 H12, H22, H32 H14, H24, H34 H 18	X			
5005A	Al Mg1(C)	see 5005				
5049	Al Mg2Mn0,8	O, H111, H112 H116 H14, H24, H34	X			
5051A	Al Mg2(B)	O, H111, H112 H12, H22, H14, H24 H16, H26 H18, H28	X			
5052	Al Mg2,5	H12, H22, H32 H14, H24, H34 H16, H26, H36 H18, H28, H38	X			
5083	Al Mg4,5Mn0,7	O, H111, H112 F H12, H22, H32 H14, H24, H34	X	X		X
5251	Al Mg2Mn0,3	H16, H26, H36 H18, H28, H38	X			
5454	Al Mg3Mn	O, H111 H14, H24, H34	X			
5754	Al Mg3	O, H111 H14, H24, H34	X	X		X
6005A	Al SiMg(A)	T6		X		
6060	Al MgSi	T5 T6, T64, T66		X	X	
6061	Al Mg1SiCu	T4, T451 T6, T651	X	X		
6063	Al Mg0,7Si	T5 T6, T66		X	X	

⁶ The alloys EN AW-1050A and EN AW-5051A do not belong to the alloys listed in the standards but are used for decorative sheet-metal parts that are not subjected to any static requirements; they are included here for the sake of completeness.

⁷ The H4X temper is only used for coil-coated sheet.

Alloys EN 573-3 EN AW-	Alloys EN 573-3 EN AW-	Typical tempers EN 515 ⁸	Strip, sheet, plate EN 485-1	Profiles EN 755-1 EN 754-1	Precision profiles EN 12020-1	Forgings EN 586-1
6082	Al Si1MgMn	T4, T451 T5 T6, T651 T61, T6151	X	X		X
6106	Al MgSiMn	T6		X		X
7020	Al Zn4,5Mg1	T6, T651	X	X		X
8011A	Al FeSi	H14, H24 H16, H26	X			

⁸ The H4X temper is only used for coil-coated sheet.

3.1.2 Chemical compositions of alloys

The table contains the chemical compositions of the individual alloys according to EN 573-3. The values given are the minimum and maximum content of the alloy constituents expressed as percentage by mass. The aluminium content is the difference between 100% and the sum of the individual constituents.

Number EN AW-	Alloy constituents												Other elements	
	Si	Fe	Cu	Mn	Mg	Cr	Ni	Zn	Ti	Ga	V	Comments	Each	Total
1050A	0.25	0.40	0.05	0.05	0.05	-	-	0.07	0.05	-	-	-	0.03	-
3003	0.6	0.7	0.05- 0.20	1.0- 1.5	-	-	-	0.10	-	-	-	-	0.05	0.15
3004	0.30	0.7	0.25	1.0- 1.5	0.8- 1.3	-	-	0.25	-	-	-	-	0.05	0.15
3005	0.06	0.7	0.30	1.0- 1.5	0.20- 0.6	0.10	-	0.25	0.10	-	-	-	0.05	0.15
3103	0.50	0.7	0.10	0.9- 1.5	0.30	0.10	-	0.20	-	-	-	0.10 Zr+Ti	0.05	0.15
3105	0.6	0.7	0.30	0.30- 0.8	0.20- 0.8	0.20	-	0.40	0.10	-	-	-	0.05	0.15
5005	0.30	0.7	0.20	0.20	0.50- 1.1	0.10	-	0.25	-	-	-	-	0.05	0.15
5005A	0.30	0.45	0.05	0.15	0.7- 1.1	0.10	-	0.20	-	-	-	-	0.05	0.15
5049	0.40	0.50	0.10	0.50- 1.1	1.6- 2.5	0.30	-	0.20	0.10	-	-	-	0.05	0.15
5051A	0.30	0.45	0.05	0.25	1.4- 2.1	0.3	-	0.20	0.10	-	-	-	0.05	0.15
5052	0.25	0.40	0.10	0.10	2.2- 2.8	0.15- 0.35	-	0.10	-	-	-	-	0.05	0.15
5083	0.40	0.40	0.10	0.40- 1.0	4.0- 4.9	0.025- 0.25	-	0.25	0.15	-	-	-	0.05	0.15
5251	0.40	0.50	0.15	0.10- 0.50	1.7- 2.4	0.15	-	0.15	0.15	-	-	-	0.05	0.15
5454	0.25	0.40	0.10	0.50- 1.0	2.4- 3.0	0.05- 0.20	-	0.25	0.20	-	-	-	0.05	0.15
5754	0.40	0.40	0.10	0.50	2.6- 3.6	0.30	-	0.20	0.15	-	-	0.10-0.6 Mn+Cr	0.05	0.15
6005A	0.50- 0.9	0.35	0.30	0.50	0.40- 0.7	0.30	-	0.20	0.10	-	-	0.12- 0.50 Mn+Cr	0.05	0.15
6060	0.30- 0.6	0.10- 0.30	0.10	0.10	0.35- 0.6	0.05	-	0.15	0.10	-	-	-	0.05	0.15
6061	0.40- 0.8	0.7	0.15- 0.40	0.15	0.8- 1.2	0.04- 0.35	-	0.25	0.15	-	-	-	0.05	0.15
6063	0.20- 0.6	0.35	0.10	0.10	0.45- 0.9	0.10	-	0.10	0.10	-	-	-	0.05	0.15
6082	0.7- 1.3	0.50	0.10	0.40- 1.0	0.6- 1.2	0.25	-	0.20	0.10	-	-	-	0.05	0.15
6106	1.0- 1.5	0.50	0.20	0.20	0.25- 0.6	0.10	-	0.20	0.15	-	-	-	0.05	0.15
7020	0.35	0.40	0.20	0.05- 0.50	1.0- 1.4	0.10- 0.35	-	4.0- 5.0	-	-	-	⁹	0.05	0.15
8011A	0.40- 0.8	0.50- 1.0	0.10	0.10	0.10	0.10	-	0.10	0.05	-	-	-	0.05	0.15

⁹ 0.08-0.20 Zr; 0.08-0.25 Zr+Ti

3.1.3 Comparison of EN 573-3 with DIN 1725-1

The following table compares alloy designations according to EN 573-3 with those for DIN 1725-1, which has been withdrawn.

EN 573-3 Designation		DIN 1725-1 Material	
Numerical	Chemical symbols	Number	Symbol
EN AW-1050A	EN AW-Al 99,5	3.0255	Al99,5
EN AW-3003	EN AW-Al Mn1Cu	3.0517	AlMnCu
EN AW-3004	EN AW-Al Mn1Mg1	3.0526	AlMn1Mg1
EN AW-3005	EN AW-Al Mn1Mg0,5	3.0525	AlMn1Mg0,5
EN AW-3103	EN AW-Al Mn1	3.0515	Al Mn1
EN AW-3105	EN AW-Al Mn0,5Mg0,5	3.0505	AlMn0,5Mg0,5
EN AW-5005	EN AW-Al Mg1(B)	-	-
EN AW-5005A	EN AW-Al Mg1(C)	3.3315	AlMg1
EN AW-5049	EN AW-Al Mg2Mn0,8	3.3527	AlMg2Mn0,8
EN AW-5051A	EN AW-Al Mg2(B)	3.3326	AlMg1,8
EN AW-5052	EN AW-Al Mg2,5	3.3523	AlMg2,5
EN AW-5083	EN AW-Al Mg4,5Mn0,7	3.3547	AlMg4,5Mn0,7
EN AW-5251	EN AW-Al Mg2Mn0,3	3.3525	AlMg2Mn0,3
EN AW-5454	EN AW-Al Mg3Mn	3.3537	AlMg3Mn
EN AW-5754	EN AW-Al Mg3	3.3535	AlMg3
EN AW-6005A	EN AW-Al SiMg(A)	3.3210	AlMgSi0,7
EN AW-6060	EN AW-Al MgSi	3.3206	AlMgSi0,5
EN AW-6061	EN AW-Al Mg1SiCu	3.3211	AlMg1SiCu
EN AW-6063	EN AW-Al Mg0,7Si	-	-
EN AW-6082	EN AW-Al Si1MgMn	3.2315	AlMgSi1
EN AW-6106	EN AW-Al MgSiMn	-	-
EN AW-7020	EN AW-Al Zn4,5Mg1	3.4335	AlZnMgCu0,5
EN AW-8011A	EN AW-Al FeSi	3.0915	AlFeSi

3.2 Cast alloys

3.2.1 Casting processes

The follow table contains aluminium alloys used for components that are subject to certain static requirements according to EN 1999-1-1, together with details of temper and casting process.

Alloy EN 1706		Casting process and temper
EN AC-42100	EN AC-Al Si7Mg0,3	permanent mould casting T6 permanent mould casting T64
EN AC-42200	EN AC-Al Si7Mg0,6	permanent mould casting T6 permanent mould casting T64
EN AC-43000	EN AC-Al Si10Mg(a)	permanent mould casting F
EN AC-43300	EN AC-Al Si9Mg	permanent mould casting T6 sand casting T6 permanent mould casting T64
EN AC-44200	EN AC-Al Si12(a)	permanent mould casting F sand casting F
EN AC-51300	EN AC-Al Mg5	permanent mould casting F sand casting F

3.2.2 Chemical compositions of alloys

The table contains the compositions of the individual alloys according to EN 1706. The values given are the maximum contents expressed as percentage by mass. Ranges give the minimum and maximum contents of the alloying constituents expressed as percentage by mass. The aluminium content is the difference between 100% and the sum of the individual constituents.

Number EN AC-	Alloying constituents											Other elements	
	Si	Fe	Cu	Mn	Mg	Cr	Ni	Zn	Pb	Sn	Ti	Each	Total
42100	6.5-7.5	0.19 (0.15)	0.05 (0.03)	0.10	0.25-0.45 (0.30-0.45)	-	-	0.07	-	-	0.08-0.25 (0.10-0.18)	0.03	0.10
42200	6.5-7.5	0.19 (0.15)	0.05 (0.03)	0.10	0.45-0.70 (0.50-0.70)	-	-	0.07	-	-	0.08-0.25 (0.10-0.18)	0.03	0.10
43000	9.0-11.0	0.55 (0.40)	0.05 (0.03)	0.45	0.20-0.45 (0.25-0.45)	-	0.05	0.10	0.05	0.05	0.15	0.05	0.15
43300	9.0-11.0	0.19 (0.15)	0.05 (0.03)	0.10	0.25-0.45 (0.30-0.45)	-	-	0.07	-	-	0.15	0.03	0.10
44200	10.5-13.5	0.55 (0.40)	0.05 (0.03)	0.35	0.35	-	-	0.10	-	-	0.15	0.05	0.15
51300	1.5 (1.3)	0.55 (0.45)	0.10 (0.05)	0.45	4.5-6.5 (4.8-6.5)	-	-	0.10	-	-	0.20 (0.15)	0.05	0.15

3.2.3 Comparison of EN 1706 and DIN 1725-2

The following table compares alloy designations according to EN 573-3 with those for DIN 1725-2, which has been withdrawn.

EN 1706 Designation		DIN 1725-2 Material	
Numerical	Chemical symbols	Number	Symbol
EN AC-42100	EN AC-AI Si7Mg0,3	3.2371	GK-AISi7Mg
EN AC-42200	EN AC-AI Si7Mg0,6	-	-
EN AC-43000	EN AC-AI Si10Mg(a)	3.2381	GK-AISi10Mg
EN AC-43300	EN AC-AI Si9Mg	3.2373	G/GK-AISi9Mg
EN AC-44200	EN AC-AI Si12(a)	3.2581	G/GK-AISi12
EN AC-51300	EN AC-AI Mg5	3.3561	G/GK-AIMg5

Note: Components produced by die-casting are not approved for use in load-bearing applications.

3.2.4 Special properties of aluminium alloys

3.2.4.1 Corrosion behaviour

Aluminium is a metal that forms an oxide layer spontaneously. The oxide layer is transparent, strongly adherent and completely resistant over a pH range from approx. 5 to 8. This passivation of the metal surface by the formation of a natural oxide film enables aluminium and wrought aluminium alloys of the types AlMg, AlMn, AlMgMn and AlMgSi to be used outdoors without any additional surface protection against corrosion. According to DIN V 4113-3, EN 1999-1-1 and EN 1999-1-4, aluminium structures made from the alloys listed in the following table can therefore generally be used under normal atmospheric conditions without additional corrosion protection if they are designed in such a way that there are no areas that are poorly aerated and at the same time difficult to access, and where contact corrosion could thus occur. Differences in corrosion behaviour have led to the introduction of resistance classes that enable an estimation of the necessary protective measures to be made for critical applications (see DIN V 4113-3, EN 1999-1-1 and EN 1090-3).

The term 'seawater resistance' has come to be used for alloys that exhibit good corrosion behaviour in marine environments. The term comes from the shipbuilding industry and although it is not defined further in any way, it can nevertheless be regarded as a material property. It says that the respective alloy is suitable for use as a constructional material because of its strength, its weldability and the good corrosion behaviour it exhibits in seawater. Seawater resistance does not therefore rule out surface corrosion, though this does not as a rule affect the function of the component. Germanischer Lloyd uses the expression 'suitable for use in seawater', which is nearer to the point and does not imply complete resistance.

Exposure tests carried out on Helgoland and in the Persian Gulf showed that although pitting and shallow craters formed on unprotected samples of certain aluminium alloys, the maximum depth of attack was limited over the years to a few tenths of a millimetre. This proved that materials designated as being resistant to seawater are fundamentally suitable for use in marine environments. All statements refer to aluminium with an

as-rolled or as-extruded finish. DIN 81249-1 to -4 give a very good overview of the behaviour of aluminium alloys in seawater and marine atmospheres.

Aluminium alloys Designation		Corrosion behaviour	
Numerical	Chemical symbols	Resistance class ¹⁰	Suitable for use in seawater
EN AW-1050A	EN AW-Al 99,5	A	X ^{11 12}
EN AW-3003	EN AW-Al Mn1Cu	A	X
EN AW-3004	EN AW-Al Mn1Mg1	A	X
EN AW-3005	EN AW-Al Mn1Mg0,5	A	X ¹¹
EN AW-3103	EN AW-Al Mn1	A	X ¹²
EN AW-3105	EN AW-Al Mn0,5Mg0,5	A	X
EN AW-5005	EN AW-Al Mg1(B)	A	X ¹²
EN AW-5005A	EN AW-Al Mg1(C)	A	X
EN AW-5049	EN AW-Al Mg2Mn0,8	A	X ¹¹
EN AW-5051A	EN AW- Al Mg2(B)	A	X
EN AW-5052	EN AW-Al Mg2,5	A	X ¹²
EN AW-5083	EN AW-Al Mg4,5Mn0,7	A ¹³	X ^{11 12 13}
EN AW-5251	EN AW-Al Mg2Mn0,3	A	X ¹²
EN AW-5454	EN AW-Al Mg3Mn	A	X ^{11 12}
EN AW-5754	EN AW-Al Mg3	A	X ^{11 12}
EN AW-6005A	EN AW-Al SiMg(A)	B	X
EN AW-6060	EN AW-Al MgSi	B	X ^{11 12}
EN AW-6061	EN AW-Al Mg1SiCu	B	X ¹¹
EN AW-6063	EN AW-Al Mg0,7Si	B	X ¹²
EN AW-6082	EN AW-Al Si1MgMn	B	X ^{11 12}
EN AW-6106	EN AW-Al MgSiMn	B	X ¹²
EN AW-7020	EN AW-Al Zn4,5Mg1	C ¹⁴	X ^{14 15}
EN AW-8011A	EN AW-Al FeSi	B	-
EN AC-42100	EN AC-Al Si7Mg0,3	B	X ¹²
EN AC-42200	EN AC-Al Si7Mg0,6	B	X ¹²
EN AC-43000	EN AC-Al Si10Mg(a)	B	-
EN AC-43300	EN AC-Al Si9Mg	B	X
EN AC-44200	EN AC-Al Si12(a)	B	-
EN AC-51300	EN AC-Al Mg5	B ¹³	X ¹²

¹⁰ According to DIN V 4113-3, EN 1999-1-1, EN 1090-3 and DIN 81249-1 to -4

¹¹ Alloys that are used preferentially in marine environments.

¹² Alloys for shipbuilding, marine and offshore applications according to EN 13195-1

¹³ The alloys EN AW-5083 and EN AC-51300 can be susceptible to intercrystalline corrosion at unfavourable operating temperatures, e.g. prolonged periods at above 70 °C. The manufacturer of the semi-finished product should be contacted for special advice.

¹⁴ The alloy EN AW-7020 has a tendency to undergo exfoliation corrosion and stress corrosion after welding. An ageing treatment after the final weld pass is recommended.

¹⁵ Only in 'quenched and artificially aged' temper

3.2.4.2 Surface pretreatment prior to coating

Aluminium alloys Designation		Recommendations for surface treatment prior to coating
Numerical	Chemical symbols	
EN AW-1050A	EN AW-Al 99,5	
EN AW-3003	EN AW-Al Mn1Cu	Cu 0.05-0.2%, see section 3.1.3
EN AW-3004	EN AW-Al Mn1Mg1	
EN AW-3005	EN AW-Al Mn1Mg0,5	
EN AW-3103	EN AW-Al Mn1	
EN AW-3105	EN AW-Al Mn0,5Mg0,5	
EN AW-5005	EN AW-Al Mg1(B)	Acidic post-treatment recommended
EN AW-5005A	EN AW-Al Mg1(C)	Acidic post-treatment recommended
EN AW-5049	EN AW-Al Mg2Mn0,8	Acidic post-treatment recommended
EN AW-5051A	EN AW-Al Mg2(B)	Acidic post-treatment recommended
EN AW-5052	EN AW-Al Mg2,5Mn0,3	Acidic post-treatment necessary
EN AW-5083	EN AW-Al Mg4,5Mn0,7	Acidic post-treatment necessary
EN AW-5251	EN AW-Al Mg2	Acidic post-treatment recommended
EN AW-5454	EN AW-Al Mg3Mn	Acidic post-treatment necessary
EN AW-5754	EN AW-Al Mg3	Acidic post-treatment necessary
EN AW-6005A	EN AW-Al SiMg(A)	
EN AW-6060	EN AW-Al MgSi	
EN AW-6061	EN AW-Al Mg1SiCu	Cu content > 0.2% can contaminate acidic treatment baths and rinses; monitor Cu content of baths
EN AW-6063	EN AW-Al Mg0,7Si	
EN AW-6082	EN AW-Al Si1MgMn	
EN AW-6106	EN AW-Al MgSiMn	
EN AW-7020	EN AW-Al Zn4,5Mg1	Contamination of treatment baths with Zn possible
EN AW-8011A	EN AW-Al FeSi	Al FeSi pickling stains possible
EN AC-42100	EN AC-Al Si7Mg0,3	Si pickling stains can only be removed with fluoride additive
EN AC-42200	EN AC-Al Si7Mg0,6	Si pickling stains can only be removed with fluoride additive
EN AC-43000	EN AC-Al Si10Mg(a)	Si pickling stains can only be removed with fluoride additive
EN AC-43300	EN AC-Al Si9Mg	Si pickling stains can only be removed with fluoride additive
EN AC-44200	EN AC-Al Si12(a)	Si pickling stains can only be removed with fluoride additive
EN AC-51300	EN AC-Al Mg5	Acidic post-treatment necessary

Note: With all alloys of the AlMg type (EN AW-5XXX and EN AC-5XXXX), thicker oxide layers that form after prolonged storage (> 12 months) should be removed using acid activation.

3.2.4.3 Surface pretreatment and anodisability

Aluminium alloys Designation		Recommendations for surface treatment prior to anodising	Anodisability ^{16 17}	
Numerical	Chemical symbols		Decorative ¹⁸	Technical
EN AW-1050A	EN AW-Al 99,5		2 ¹⁹	1
EN AW-3003	EN AW-Al Mn1Cu	Cu 0.05-0.2%, see section 3.1.3	4	1
EN AW-3004	EN AW-Al Mn1Mg1		4	1
EN AW-3005	EN AW-Al Mn1Mg0,5		4	1
EN AW-3103	EN AW-Al Mn1		4	1
EN AW-3105	EN AW-Al Mn0,5Mg0,5		4	1
EN AW-5005	EN AW-Al Mg1(B)	Acidic post-treatment recommended	3 (EQ=1) ¹⁹	1
EN AW-5005A	EN AW-Al Mg1(C)	Acidic post-treatment recommended	3 (EQ=1) ¹⁹	1
EN AW-5049	EN AW-Al Mg2Mn0,8	Acidic post-treatment recommended	4	2
EN AW-5051A	EN AW-Al Mg2(B)	Acidic post-treatment recommended	3 (EQ=1) ¹⁹	1
EN AW-5052	EN AW-Al Mg2,5	Acidic post-treatment necessary	2	1
EN AW-5083	EN AW-Al Mg4,5Mn0,7	Acidic post-treatment necessary	4	2
EN AW-5251	EN AW-Al Mg2	Acidic post-treatment recommended	4	2
EN AW-5454	EN AW-Al Mg3Mn	Acidic post-treatment necessary	4	2
EN AW-5754	EN AW-Al Mg3	Acidic post-treatment necessary	2 (EQ=1) ¹⁹	1
EN AW-6005A	EN AW-Al SiMg(A)		2	1
EN AW-6060	EN AW-Al MgSi		1 ¹⁹	1
EN AW-6061	EN AW-Al Mg1SiCu	Cu content > 0.2% can contaminate treatment baths and rinses; monitor Cu content of baths	3	1
EN AW-6063	EN AW-Al Mg0,7Si		1 ¹⁹	1
EN AW-6082	EN AW-Al Si1MgMn		3	1
EN AW-6106	EN AW-Al MgSiMn		3	1
EN AW-7020	EN AW-Al Zn4,5Mg1	Contamination of treatment baths with Zn possible	3	2
EN AW-8011A	EN AW-Al FeSi		5	5
EN AC-42100	EN AC-Al Si7Mg0,3	Si pickling stains can only be removed with fluoride additive	6	4
EN AC-42200	EN AC-Al Si7Mg0,6	Si pickling stains can only be removed with fluoride additive	6	4
EN AC-43000	EN AC-Al Si10Mg(a)	Si pickling stains can only be removed with fluoride additive	3	4
EN AC-43300	EN AC-Al Si9Mg	Si pickling stains can only be removed with fluoride additive	6	4
EN AC-44200	EN AC-Al Si12(a)	Si pickling stains can only be removed with fluoride additive	6	4
EN AC-51300	EN AC-Al Mg5	Acidic post-treatment necessary	1	1

Notes: With all alloys of the AlMg type (EN AW-5XXX and EN AC-5XXXX), thicker oxide layers that form after prolonged storage (> 12 months) should be removed using acid activation.

Due to their less homogenous grain structure, it is not possible to produce oxide layers on castings that are as uniform as those produced on wrought semi-finished products. Castings should have a surface that is as compact, smooth and free from shrinkage cavities, pores and cracks as possible, as well as having a uniform, fine-grained structure.

¹⁶ Dr.-Ing. John Datta, *Aluminium-Werkstoff-Datenblätter*. Aluminium-Verlag, Düsseldorf, 4th ed., 2004

¹⁷ Relative anodisability of aluminium-based materials from 1 (very good) to 6 (unsuitable).

¹⁸ Where decorative requirements apply, the semi-finished product should be ordered in anodising quality (EQ; DIN 17611).

¹⁹ Semi-finished products of this alloy are available in anodising quality (EQ)

3.2.4.4 Intermetallic phases in wrought aluminium alloys

The following section includes a list of various intermetallic phases that occur in wrought aluminium alloys and can influence degreasing and pickling.

The data are based on a consideration of the thermodynamic equilibrium at 450 °C (using the FactSage program from GTT-Technologies). For more precise statements, it is essential to have knowledge of the process steps in detail and the exact alloy composition. At temperatures < 200 °C, the phases marked with an asterisk (*) might also be observed.

Aluminium Alloys		Intermetallic phases	
Designation			
Numerical	Chemical symbols		Additional phases at < 200°C
EN AW-1050A	EN AW-Al 99,5	alpha AlFeSi (2:1)	
EN AW-3003	EN AW-Al Mn1Cu	Al(Fe,Mn)Si, Al ₆ (Mn,Fe)	
EN AW-3004	EN AW-Al Mn1Mg1	Al(Fe,Mn)Si, Al ₆ (Mn,Fe)	* Mg ₂ Si
EN AW-3005	EN AW-Al Mn1Mg0,5	Al(Fe,Mn)Si, Al ₆ (Mn,Fe)	* Mg ₂ Si
EN AW-3103	EN AW-Al Mn1	Al(Fe,Mn)Si, Al ₆ (Mn,Fe)	
EN AW-3105	EN AW-Al Mn0,5Mg0,5	Al(Fe,Mn)Si, Al ₆ (Mn,Fe)	* Mg ₂ Si
EN AW-5005	EN AW-Al Mg1(B)	Al(Fe,Mn)Si, Al ₃ Fe	* Mg ₂ Si, Al ₆ (Mn,Fe), Al ₂ CuMg
EN AW-5005A	EN AW-Al Mg1(C)	Al(Fe,Mn)Si, Al ₃ Fe	* Mg ₂ Si, Al ₆ (Mn,Fe)
EN AW-5049	EN AW-Al Mg2Mn0,8	Mg ₂ Si, Al ₆ (Mn,Fe)	
EN AW-5051A	EN AW-Al Mg2(B)	Al(Fe,Mn)Si, Al ₃ Fe	* Mg ₂ Si, Al ₆ (Mn,Fe)
EN AW-5052	EN AW-Al Mg2,5	Al ₃ Fe, Mg ₂ Si, AlCrMgMn	* Al ₆ (Mn,Fe)
EN AW-5083	EN AW-Al Mg4,5Mn0,7	Mg ₂ Si, Al ₆ (Mn,Fe), AlCrMgMn	* beta Al ₃ Mg ₂
EN AW-5251	EN AW-Al Mg2	Al(Fe,Mn)Si, Al ₆ (Mn,Fe)	* Mg ₂ Si
EN AW-5454	EN AW-Al Mg3Mn	Mg ₂ Si, Al ₆ (Mn,Fe), AlCrMgMn	
EN AW-5754	EN AW-Al Mg3	Mg ₂ Si, Al ₆ (Mn,Fe)	
EN AW-6005A	EN AW-Al SiMg(A)	Mg ₂ Si, beta AlFeSi (1:1)	* Si
EN AW-6060	EN AW-Al MgSi	Mg ₂ Si, beta AlFeSi (1:1)	* Si
EN AW-6061	EN AW-Al Mg1SiCu	Mg ₂ Si, alpha AlFeSi (2:1), Al ₁₃ Cr ₄ Si ₂	* Al ₇ Cu ₂ Fe, Si ₄ Al ₃ Fe
EN AW-6063	EN AW-Al Mg0,7Si	Mg ₂ Si, alpha AlFeSi (2:1)	* AlFe ₃
EN AW-6082	EN AW-Al Si1MgMn	Al(Fe,Mn)Si, Mg ₂ Si	* Si
EN AW-6106	EN AW-Al MgSiMn	Al(Fe,Mn)Si, Mg ₂ Si	* beta AlFeSi (1:1)
EN AW-7020	EN AW-Al Zn4,5Mg1	Al ₃ Fe, Al(Fe,Mn)Si, Al ₆ (Mn,Fe), Al ₇ Cr	* Mg ₂ Si, MgZn ₂
EN AW-8011A	EN AW-Al FeSi	beta AlFeSi (1:1)	* Si

Calculations made using FactSage program of GTT-Technologies: Prof. Dr. Olaf Engler, Dr. Lothar Löchte, Hydro Aluminium Deutschland GmbH, Bonn.

4 Standards and guidelines

GSB AL 631	International quality regulations for the coating of aluminium building components, GSB International, Schwäbisch Gmünd, (German version: May 2006)
DIN EN 485-1	Aluminium and aluminium alloys. Sheet, strip and plate. Part 1: Technical conditions for inspection and delivery (German version: 1994-01)
DIN EN 515	Aluminium and aluminium alloys. Wrought products. Temper designations (German version: 1993-12)
DIN EN 573-3	Aluminium and aluminium alloys. Chemical composition and form of wrought products. Part 3: Chemical composition and form of products (German version: 2003-10)
DIN EN 586-1	Aluminium and aluminium alloys. Forgings –Part 1: Technical conditions for inspection and delivery (German version: 1997-10)
DIN EN 754-1	Aluminium and aluminium alloys. Cold drawn rod/bar and tube. Part 1: Technical conditions for inspection and delivery (German version: 1997-08)
DIN EN 755-1	Aluminium and aluminium alloys. Extruded rod/bar, tube and profiles –Part 1: Technical conditions for inspection and delivery (German version: 1997-08)
DIN EN 1706	Aluminium and aluminium alloys. Castings. Chemical composition and mechanical properties (German version: 1998-06)
DIN 1725-1	Aluminium alloys, wrought alloys, February 1983; withdrawn and replaced by DIN EN 573-3
DIN 1725-2	Aluminium alloys, casting alloys, sand castings, gravity die-castings, pressure die castings, investment castings, February 1986; withdrawn and replaced by DIN EN 1706
EN 1999-1-1	Eurocode 9. Design of aluminium structures. Part 1-1: General rules. General rules and rules for buildings (German version May 2006)
EN 1999-1-4	Eurocode 9. Design of aluminium structures. Part 1-4: Cold-formed structural sheeting (German version: May 2006)
prEN 1090-3	Execution of steel structures and aluminium structures. Part 3: Rules for the execution of aluminium structures (German version: June 2005)
DIN 4113-1:	Aluminium constructions under predominantly static loading. Part 1: Static analysis and structural design ((German version: May 1980)
DIN 4113-1/A1	Aluminium constructions under predominantly static loading. Part 1: Static analysis and structural design; Amendment A1 to DIN 4113-1:1980-05, September 2002
DIN V 4113-3:	Aluminium constructions under predominantly static loading. Part 3: Execution and qualification of constructors, (German version: November 2003)
DIN EN 12206-1	Paints and varnishes. Coating of aluminium and aluminium alloys for architectural purposes. Part 1: Coatings prepared from coating powder (German version: 2004-09)
DIN EN 12020-1	Aluminium and aluminium alloys. Extruded precision profiles in alloys EN AW-6060 and EN AW-6063. Part 1: Technical conditions for inspection and delivery (German version: 2001-07)
DIN EN 12373-1	Aluminium and aluminium alloys. Anodizing. Part 1: Method for specifying decorative and protective anodic oxidation coatings on aluminium (German version: 2001-10)
DIN EN 12487	Corrosion protection of metals. Rinsed and non-rinsed chromate conversion coatings on aluminium and aluminium alloys (German version: 2007-07)
DIN EN 13195-1	Aluminium and aluminium alloys. Wrought and cast products for marine applications (shipbuilding, marine and offshore). Part 1: Specifications (German version of EN 13195-1:2002)
DIN 17611	Anodized products of wrought aluminium and wrought aluminium alloys. Technical conditions of delivery (German version: 2000-12)
DIN 81249-1	Corrosion of metals in sea water and sea atmosphere. Part 1: Definitions, basic information (German version: 1997-11)
DIN 81249-2	Corrosion of metals in sea water and sea atmosphere. Part 2: Free corrosion in sea water (German version: 1997-11)
DIN 81249-3	Corrosion of metals in sea water and sea atmosphere. Part 3: Galvanic corrosion in sea water (German version: 1997-11)

DIN 81249-4 Corrosion of metals in sea water and sea atmosphere. Part 4: Corrosion in sea atmosphere
(German version: 1997-11)

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