# **EN NORMS FOR FOUNDRY ALUMINIUM ALLOYS**

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**Abstract.** Being light Al is a metal with an increasing usage in order to reduce energy consumption and limit the material thrown into landfills. In the metallurgy sector, aspects involving norms have greatly diversified the offer of foundry alloy and aluminium casting produced inside the European Community. EN norms for castings and EN 1676 for alloys are discussed in the paper for aluminium and its alloys together with technical tests that guarantee the correct performance of the castings.

Keywords: Aluminium alloys foundry; EN Norms.

### 1. INTRODUCTION

Aluminium is a metal that is growing worldwide: new applications are being studied in order to reduce energy consumption and limit the materials thrown into landfills. Solutions are being sought using materials with a high rate of recovery and which are light enough to enable means of transport to save fuel.

The result is that the most interesting innovations studied by design engineers involve cars, rail transport, aeroplanes and nautical engineering. However, there are other sectors in which aluminium is creating an innovative presence, many of which involve solution using foundry products.

#### 2. ALLOYS SYSTEMS

Aluminium casting alloys must contain, in addition to strengthening elements, sufficient amounts of eutecticforming elements (usually silicon) in order to have adequate fluidity to feed the shrinkage that occurs in all but the simplest castings. Required amounts of eutectic formers depend in part on casting process. Alloys for sand casting generally are lower in eutectics than those for casting in metal molds, because sand molds can tolerate a degree of hot shortness that would lead to extensive cracking in nonyielding metal molds. The range of cooling rates characteristic of the casting process being used controls to some extent the distribution of alloying and impurity elements. For example, the extremely high cooling rates inherent in die casting result in fine dispersion of strengthening and eutectic-forming constituents, and reasonably good castings can be obtained in spite of impurity contents that would render sand or plaster-mold castings unacceptable. However, with these minor exceptions, most aluminium foundry alloys can be cast by all processes, and choice of casting technique usually is controlled by factors other than alloy composition.

A large number of aluminium alloys has been developed for casting, but most of them are varieties of six basic types: aluminium-copper, aluminium-copper-silicon, aluminium-silicon, aluminium-magnesium, aluminiumzinc-magnesium and aluminium-tin alloys.

# 3. ALUMINIUM PRODUCTION AND APPLICATIONS

Since 1997, when it overtook Germany, the historic leader in sector, the Italian industry is the leader of aluminium foundry alloys in Europe. At world level, only the USA and Japan produce more than Italy. In countries like France and Germany, end-uses in the transport in percentage terms are the highest (80% in Germany and almost 90% in France).

The transport industry absorbs 57% of production of aluminium foundry industry; 18% represents the production of aluminium heating radiators. The remaining percentages of end-uses are equally split among electrical apparatus, 8.5%, durables for domestic office use, 8.5% and mechanical engineering in general 8% (Figure 1).



Figure 1. End use of aluminium alloy castings

#### 4. NORMS [1]

In the metallurgy sector in particular, aspects involving norms are one of the elements that, from country to country have greatly diversified the offer of foundry alloys and aluminium castings produced inside European Community. Today it is a true harmonisation, and there is one set of norms for the whole of Europe.

The new EN norms are the fruit of a project that started within the CEN (European Norm Commission) about 18 years ago, in which all the sectors involved in all countries of the Community took part – users of castings, casting foundries and alloy procedures. The result is a compromise between the various needs and requirements of all operators involved, that will make it possible to use a single language, at least at norm level.

## 5. EN-NORMS FOR ALUMINIUM CASTINGS AND ALLOYS

En-Norms for castings are EN 1706 and for alloys are EN 1676 and describe:

- the type of alloy (AlSi, AlCu, AlMg etc.)
- their numerical designation EN AC or AB no. xxxxxx
- their designation using chemical symbols (AlSi11Cu2Fe)
- their chemical composition: Si, Fe, Cu, Mn, Mg, Cr, Ni, Zn etc.
- the comparison of foundry characteristics, mechanical characteristics and other characteristics of the castings
- the mechanical characteristics of alloys for castings obtained from separately cast specimens

A significant aspect which should be constantly stressed is the responsibility of products if they are obtained using non standardised alloys.

The casting producer is obviously free to use any type of alloy, but if he uses non-standard alloys, he has to assume the responsibility for the necessary obligations to prove the product's quality. He must therefore supply technical tests that warrant the correct performance of the castings, affected before the casting is used. The technical tests involve: [2]

- fluidity
- resistance to cracking due to shrinkage
- pressure seal
- corrosion resistance
- attitude to polishing
- linear thermal expansion
- electrical conductivity
- thermal conductivity
- resistance to various temperatures
- impact resistance
- ductility or fatigue strength
- tensile strength
- elongation
- Brinell hardness
- designation of metallurgical state

Foundries are obliged to satisfy all these specifications, especially those operating under a quality certification regime. Only alloys corresponding to norms posses all these indispensable detailed analyses.

Table 2. Comparison between the percentages of EN foundry alloys and those of the main similar alloys

Type         Norm Performation         St         Pe         Cut         Nin         Ng         Cr         N         Pr         St         Fr         Outes           AlCu         2100         AlCu4TiMg         0.15         0.30         4.2-5.0         0.10         0.200-0.35         0.05         0.15         0.05         0.15-0.30         0.15-0.30         0.07         0.15-0.35         0.06         0.07         0.15-0.32         0.10         0.05-0.30         0.05-0.20         0.07-0.15         0.15-0.30         0.06         0.07         0.15-0.32         0.10         0.05         0.05         0.07         0.15-0.32         0.10         0.05         0.07-0.15         0.15         0.15         0.15         0.15         0.15         0.15         0.05         0.07         0.07         0.07-0.15         0.15         0.05         0.00         0.05 <td< th=""><th>Trme</th><th>Norm</th><th>Denomination</th><th><b>C</b>:</th><th>Ē</th><th><u>C.</u></th><th>Mn</th><th>Ma</th><th>Č.</th><th>NI:</th><th>7.</th><th>Db</th><th>£.,</th><th>т:</th><th>Othors</th></td<>	Trme	Norm	Denomination	<b>C</b> :	Ē	<u>C.</u>	Mn	Ma	Č.	NI:	7.	Db	£.,	т:	Othors
of alloy EX-AB         AICu         2100         AICuTTMg         0.15         0.30         4.2-5.0         0.10         0.05         0.10         0.05         0.15         0.15         0.16           21100         AICuTTMg         0.15         0.15         0.30         4.2-5.0         0.05         0.05         0.05         0.05         0.05         0.15         0.05         0.15         0.05 <td< th=""><th>Type</th><th>INOPHI ENLAD</th><th>Denomination</th><th>51</th><th>ге</th><th>Cu</th><th>IVIII</th><th>Nig</th><th>Cr</th><th>INI</th><th>ZII</th><th>ru</th><th>511</th><th>11</th><th>Others</th></td<>	Type	INOPHI ENLAD	Denomination	51	ге	Cu	IVIII	Nig	Cr	INI	ZII	ru	511	11	Others
AlCu         2100         AlCu411Mg         0.15         0.03         4.2-5.0         0.10         0.200-35         0.07         0.07         0.00         0.06         0.05         0.06         0.07         0.00         0.07         0.00         0.07	of alloy	EN-AB													total
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	AlCu	21000	AlCu4TiMg	0.15	0.30	4.2-5.0	0.10	0.20-0.35		0.05	0.10	0.05	0.05	0.15-0.25	0.10
21100         AlCu4Ti         0.15         0.15         4.2-5.0         0.055          0.07         0.15-0.25         0.10           AlSiMgTi         14000         AlSi12MgTi         1.6-2.4         0.50         0.08         0.50-0.65         0.05         0.16         0.300-045         0.07         0.07         0.100.18         0.100         0.080-025         0.10         0.080-025         0.10         0.05         0.10         0.05         0.10         0.05         0.15         0.15         0.15         0.15         0.15         0.15         0.15         0.15         0.15         0.15				(0.20)	(0.35)			(0.15 - 0.35)		0.05	0.10	0.05	0.05	(0.15 - 0.30)	
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$		21100	AlCu4Ti	0.15	0.15	4.2-5.0	0.55				0.07			0.15-0.25	0.10
AlsiMgTi         41000         Alsi12MgTi         1.6-2.4         0.50         0.88         0.30-0.50         0.050-0.65         0.05         0.10         0.05         0.07         0.16         0.03         0.10         0.300-045         0.07         0.10         0.10         0.10         0.08         0.10         0.05				(0.18)	(0.19)									(0.15 - 0.30)	
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	AlSiMgTi	41000	AlSi12MgTi	1.6-2.4	0.50	0.08	0.30-0.50	0.50-0.65		0.05	0.10	0.05	0.05	0.07-0.15	0.15
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	0		0		(0.60)	(0.10)		(0.45 - 0.65)						(0.05 - 0.20)	
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	AlSi7Mg	42000	AlSi7Mg	65-75	0.45	0.15	0.35	0.25-0.65		0.15	0.15	0.15	0.05	0.05-0.20	
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	1 libi/lilg	12000	7 HOT/ MIG	0.5 7.5	(0.55)	(0.20)	0.55	$(0.20 \cdot 0.65)$		0.15	0.15	0.15	0.05	$(0.05 \ 0.20)$	0.15
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$		42100	A18:7M-0.2	6575	0.15	0.02	0.10	0.20-0.05)			0.07			(0.03-0.23)	
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$		42100	AISI/Mg0.5	0.3-7.3	(0.13)	0.05	0.10	(0.30 - 0.43)			0.07			(0.08, 0.25)	0.10
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$		12200			(0.19)	(0.05)	0.10	(0.25 - 0.45)			0.07			(0.08-0.25)	0.10
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$		42200	AlSi/Mg0.6	6.5-7.5	0.15	0.03	0.10	0.50-0.70			0.07			0.10-0.18	0.10
AlSi10Mg         43000         AlSi10Mg         9.0-11.0         0.40         0.03         0.45         0.30-0.45         0.05         0.10         0.05         0.05         0.15         0.15           43100         AlSi10Mg         9.0-11.0         0.45         0.08         0.45         0.30-0.45         0.05         0.10         0.05         0.05         0.15         0.15           43200         AlSi10Mg(Cu)         9.0-11.0         0.45         0.08         0.45         0.20-0.45         0.15         0.35         0.10         0.05         0.05         0.15         0.15         0.15         0.15           43200         AlSi10Mg(Cu)         9.0-10.0         0.15         0.03         0.10         0.30-0.45         0.07         0.07         0.15         0.15         0.15           43400         AlSi10Mg(Fe)         9.0-11.0         0.45 - 0.9         0.08         0.25         0.20 - 0.50         0.15<					(0.19)	(0.05)		(0.45 - 0.70)						(0.08-0.25)	
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	AlSi10Mg	43000	AlSi10Mg	9.0-11.0	0.40	0.03	0.45	0.30-0.45		0.05	0.10	0.05	0.05	0.15	0.15
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$					(0.55)	(0.05)		(0.25 - 0.45)							
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$		43100	AlSi10Mg	9.0-11.0	0.45	0.08	0.45	0.30-0.45		0.05	0.10	0.05	0.05	0.15	0.15
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$			Ţ.		(0.55)	(0.10)		(0.25 - 0.45)							
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$		43200	AlSi10Mg(Cu)	9.0-11.0	0.55	0.30	0.55	0.20-0.45		0.15	0.35	0.10		0.15	0.15
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$			8(14)		(0.65)	(0.35)		(0.20-0.45)						(0.20)	
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$		43300	A1Si9Mg	9.0-10.0	0.15	0.03	0.10	0 30-0 45			0.07			0.15	0.10
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$		45500	moning	2.0 10.0	(0.19)	(0.05)	0.10	$(0.25 \cdot 0.45)$			0.07			0.15	0.10
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$		42400		0.0.11.0	0.15	0.09	0.55	(0.25 - 0.43)		0.15	0.15	0.05		0.15	0.15
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $		45400	AlSi10Mg(Fe)	9.0-11.0	(1.0)	(0.08)	0.55	(0.23 - 0.50)		0.15	0.15	0.05		0.13	0.15
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $		44000	4.10.1.1	10.0.11.0	(1.0)	(0.10)	0.10	(0.20-0.30)			0.07			(0.20)	0.10
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$		44000	AlSill	10.0-11.8	0.15	0.03	0.10	0.45			0.07			0.15	0.10
44100         AISi12         10.5-13.5         0.55         0.10         0.55         0.10         0.10         0.15         0.10         0.15					(0.19)	(0.05)									
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$		44100	AlSi12	10.5-13.5	0.55	0.10	0.55	0.10		0.10	0.15	0.10		0.15	0.15
AlSi       44200       AlSi12       10.5-13.5       0.40       0.03       0.35       0.05       0.10       0.10       0.10       0.15       0.15       0.15         44300       AlSi12(Fe)       10.5-13.5       0.45-0.9       0.08       0.55       0.08       0.55       0.10       0.15					(0.65)	(0.15)								(0.20)	
AlSi12         (0.55)         (0.05)         (0.10)         (0.05)         (0.05)         (0.10)         (0.05)         (0.05)         (0.10)         (0.05)         (0.05)         (0.10)         (0.05)         (0.05)         (0.10)         (0.05)         (0.05)         (0.10)         (0.05)         (0.05)         (0.15)         (0.05)         (0.15)         (0.05)         (0.05)         (0.15)<	AlSi	44200	A10:10	10.5-13.5	0.40	0.03	0.35				0.10			0.15	0.15
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $			AISI12		(0.55)	(0.05)									
44400         AlSi9         8.0-11.0         0.55         0.08         0.50         0.10         0.05         0.15         0.05         0.15		44300	AlSi12(Fe)	10.5-13.5	0.45-0.9	0.08	0.55				0.15			0.15	0.15
44400         AlSi9         8.0-11.0         0.55         0.08         0.50         0.10         0.05         0.15         0.05         0.15					(1.0)	(0.10)									
AlSi5Cu         45000         AlSi6Cu4         5.0-7.0         0.0         0.00         0.00         0.10         0.00         0.10         0.00         0.10         0.00         0.10         0.00         0.10         0.00         0.10         0.00         0.10		44400	A1Si9	80-110	0.55	0.08	0.50	0.10		0.05	0.15	0.05	0.05	0.15	0.15
AlSi5Cu         45000         AlSi6Cu4         5.0-7.0         0.9         3.0-5.0         0.20-0.65         0.15         0.45         2.0         0.30         0.15         0.20         0.30         0.15         0.20         0.30         0.15         0.20         0.30         0.15         0.20         0.30         0.15         0.20         0.30         0.15         0.20         0.30         0.15         0.20         0.30         0.15         0.20         0.30         0.15         0.20         0.30         0.15         0.20         0.30         0.15         0.20         0.30         0.15         0.20         0.30         0.15         0.20         0.35         0.35         0.35         0.30         0.15         0.20         0.35		11100	11017	0.0 11.0	(0.65)	(0.10)	0.50	0.10		0.05	0.15	0.05	0.05	0.15	0.15
Alsibelia       45000       Alsibelia       5.0-7.0       0.9       5.0-5.0       0.20-0.05       0.13       0.43       2.0       0.50       0.13       0.20       0.50       0.20       0.53       0.13       0.43       2.0       0.50       0.15       0.20       0.50       0.20       0.53       0.15       0.43       2.0       0.50       0.15       0.20       0.15       0.20       0.15       0.25       0.20       0.15       0.25       0.20       0.15       0.25       0.20       0.15       0.25       0.20       0.15       0.25       0.25       0.15       0.25       0.20       0.15       0.25       0.20       0.15       0.25       0.25       0.15       0.25       <	A1\$55Cu	45000	A1\$;6Cu4	5070	0.0	2050	0.20.0.65	0.55	0.15	0.45	2.0	0.20	0.15	0.20	0.25
45100         AlSi5Cu3Mg         4.5-6.0         0.50 (0.60)         2.6-3.6 (0.60)         0.20-0.65 (0.15-0.45)         0.10         0.20 0.10         0.10         0.20 0.10         0.10         0.20 0.10         0.10         0.20 0.10         0.10         0.20 0.10         0.10         0.20         0.10         0.20         0.10         0.20         0.10         0.20         0.10         0.20         0.10         0.20         0.10         0.20         0.10         0.20         0.10         0.20         0.10         0.20         0.10         0.20         0.10         0.20         0.15         0.25         0.25           45200         AlSi5Cu1Mg         4.5-5.5         0.55         1.0-1.5         0.55         0.40-0.65         0.25         0.15         0.05         0.20         0.15         0.25         0.25         0.15         0.25         0.15         0.25         0.25         0.15         0.25         0.15         0.25         0.25         0.25         0.25         0.25         0.15         0.25         0.25         0.15         0.25         0.25         0.15         0.25         0.25         0.15         0.05         0.20         0.15         0.25         0.25         0.15         0.25         0.1	AISIJCu	45000	AISI0Cu4	5.0-7.0	(1.0)	5.0-5.0	0.20-0.03	0.55	0.15	0.45	2.0	0.30	0.15	(0.25)	0.35
45100       AlSi5Cu3Mg       4.5-6.0       0.50       2.6-3.6       0.55       0.20-0.65       0.10       0.20       0.10       0.20       0.10       0.20       0.10       0.20       0.10       0.20       0.10       0.20       0.10       0.20       0.10       0.20       0.10       0.20       0.10       0.20       0.10       0.20       0.10       0.20       0.10       0.20       0.15       0.20       0.10       0.20       0.10       0.20       0.10       0.20       0.10       0.20       0.15       0.20       0.10       0.20       0.10       0.05       0.20       0.15         45200       AlSi5Cu1Mg       4.5-5.5       0.55       1.0-1.5       0.55       0.40-0.65       0.25       0.15       0.05       0.05       0.15       0.05       0.05       0.15       0.05       0.05       0.15       0.05       0.15       0.05       0.15       0.05       0.15       0.05       0.15       0.05       0.15       0.05       0.15       0.05       0.15       0.05       0.15       0.15       0.05       0.15       0.05       0.15       0.05       0.15       0.05       0.15       0.15       0.05       0.15       0.15		45100	110:50 014	15.60	(1.0)	2626	0.55	0.00.0.65		0.10	0.00	0.10	0.05	(0.23)	0.15
45200         AlSi5Cu3Mg         4.5-6.0         0.7         2.5-4.0         0.20-0.55         0.40         0.30         0.55         0.20         0.10         0.15         0.25           45300         AlSi5Cu1Mg         4.5-5.5         0.55         1.0-1.5         0.55         0.40-0.65         0.25         0.15         0.15         0.05         0.05         0.15         0.05         0.15         0.20         0.15         0.20         0.15         0.20         0.15         0.20         0.15         0.25         0.15         0.15         0.05         0.15         0.15         0.05         0.15         0.15         0.05         0.15         0.15         0.05         0.15         0.15         0.05         0.15         0.15         0.05         0.15		45100	AlS15Cu3Mg	4.5-6.0	0.50	2.6-3.6	0.55	0.20-0.65		0.10	0.20	0.10	0.05	0.20	0.15
45200       AlSi5Cu3Mg       4.5-6.0       0.7       2.5-4.0       0.20-0.55       0.40       0.30       0.55       0.20       0.10       0.15       0.25         45300       AlSi5Cu1Mg       4.5-5.5       0.55       1.0-1.5       0.55       0.40-0.65       0.25       0.15       0.15       0.05       0.15       0.25         45400       AlSi5Cu3       4.5-6.0       0.50       2.6-3.6       0.55       0.05       0.10       0.20       0.10       0.05       0.20       0.15					(0.60)			(0.15-0.45)						(0.25)	
45300         AlSi5Cu1Mg         4.5-5.5         0.55         1.0-1.5         0.55         0.40-0.65         0.25         0.15         0.05         0.05         0.15           45400         AlSi5Cu3         4.5-6.0         0.50         2.6-3.6         0.55         0.05         0.10         0.20         0.10         0.05         0.15         0.15		45200	AlSi5Cu3Mg	4.5-6.0	0.7	2.5-4.0	0.20-0.55	0.40		0.30	0.55	0.20	0.10	0.15	0.25
45300         AlSi5Cu1Mg         4.5-5.5         0.55         1.0-1.5         0.55         0.40-0.65         0.25         0.15         0.05         0.05         0.15           45400         AlSi5Cu3         4.5-6.0         0.50         2.6-3.6         0.55         0.05         0.10         0.20         0.10         0.05         0.20         0.15					(0.8)									(0.20)	
45400         AlSi5Cu3         4.5-6.0         0.50         2.6-3.6         0.55         0.05         0.10         0.20         0.10         0.20         0.15		45300	AlSi5Cu1Mg	4.5-5.5	0.55	1.0-1.5	0.55	0.40-0.65		0.25	0.15	0.15	0.05	0.05-0.20	0.15
45400 AlSi5Cu3 4.5-6.0 0.50 2.6-3.6 0.55 0.05 0.10 0.20 0.10 0.05 0.20 0.15			_		(0.65)			(0.35 - 0.65)						(0.05-0.25)	
		45400	AlSi5Cu3	4.5-6.0	0.50	2.6-3.6	0.55	0.05		0.10	0.20	0.10	0.05	0.20	0.15

				(0.60)									(0.25)	
	46000	AlSi9Cu3(Fe)	8.0-11.0	0.6-1.1	2.0-4.0	0.55	0.15-0.55	0.15	0.55	1.2	0.35	0.25	0.20	0.25
				(1.3)			(0.05 - 0.55)						(0.25)	
	46100	AlSI11Cu2(Fe)	10.0-12.0	0.45-1.0	1.5-2.5	0.55	0.30	0.15	0.45	1.7	0.25	0.25	0.20	0.25
				(1.1)									(0.25)	
	46200	AlSi8Cu3	7.5-9.5	0.7	2.0-3.5	0.15-0.65	0.15-0.55	0.15	0.35	1.2	0.25	0.15	0.20	0.25
				(0.8)			(0.05 - 0.55)						(0.25)	
	46300	AlSi7Cu3Mg	6.5-8.0	0.7	3.0-4.0	0.20-0.65	0.35-0.60		0.30	0.65	0.15	0.10	0.20	0.25
				(0.8)			(0.30-0.60)						(0.25)	
	46400	A1Si0Cu3Mg	8.3-9.7	0.7	0.8-1.3	0.15-0.55	0.30-0.65		0.20	0.8	0.10	0.10	0.10-0.18	0.25
		Alsi)Cu3Mg		(0.8)			(0.25 - 0.65)						(0.10-0.20)	
	46500	AlSi9Cu3(Fe)(	8.0-11.0	0.6-1.2	2.0-4.0	0.55	0.15-0.55	0.15	0.55	3.0	0.35	0.25	0.20	0.25
		Zn)		(1.3)			(0.05 - 0.55)						(0.25)	
	46600	AlSi7Cu2	6.0-8.0	0.7	1.5-2.5	0.15-0.65	0.35		0.35	1.0	0.25	0.15	0.20	0.15
				(0.8)									(0.25)	
	47000	AlSi12(Cu)	10.5-13.5	0.7	0.9	0.05-0.55	0.35	0.10	0.30	0.55	0.20	0.10	0.15	0.25
-				(0.8)	(1.0)								(0.20)	
	47100	AlSi12Cu1(Fe)	10.5-13.5	0.6-1.1	0.7-1.2	0.55	0.35	0.10	0.30	0.55	0.20	0.10	0.15	0.3
				(1.3)									(0.20)	
	48000	AlSi12CuNiM	10.5-13.5	0.6	0.8-1.5	0.35	0.9-1.5			0.35				0.15
	.0000	g	1010 1010	(0.7)	010 110	0.00	(0.8-1.5)		0.7-1.3	0.00				0110
	-1000		0.45	0.15	0.00	0.45				0.10			0.15	0.5
AIMg	51000	AIMg3	0.45	0.45	0.08	0.45	2.7-3.5			0.10			0.15	0.5
-			(0.55)	(0.55)	(0.10)		(2.5-3.5)						(0.20)	
	51100	AlMg3	0.45	0.40	0.03	0.45	2.7-3.5			0.10			0.20	0.15
	51000		(0.55)	(0.55)	(0.05)	0.55	(2.5-3.5)		0.10	0.07	0.10	0.10	(0.15)	0.15
	51200	AIMg9	2.5	0.45-0.9	0.08	0.55	8.0-10.0		0.10	0.25	0.10	0.10	0.15	0.15
-				(1.0)	(0.10)		10.55						(0.20)	
	51300	AlMg5	0.35	0.45	0.05	0.45	4.8-6.5			0.10			0.15	0.15
-			(0.55)	(0.55)	(0.10)		(4.5-6.5)						(0.20)	
	51400	AlMg5(Si)	1.3	0.45	0.03	0.45	4.8-6.5			0.10			0.15	0.15
	51000		(1.5)	(0.55)	(0.05)	0.40	(4.5-6.5)	0.15	0.05	-	0.05	0.07	(0.20)	0.15
AlZnMg	71000	AlZn5Mg	0.25	0.70	0.15-	0.40	0.45-0.70	0.15	0.05	4.5-6.0	0.05	0.05	0.12-0.20	0.15
			(0.30)	(0.80)	0.35		(0.40-0.70)	(0.60)					(0.10-0.25)	

# 6. CONCLUSIONS. EUROPE BEFORE EN NORMS

Table 1 illustrates a number of names according to national norms of similar alloys before the introduction of EN Norms.

Although they correspond to the application level there is no similar correspondence in terms of composition. The new alloys have meant more or less significant variations in their analytical content.

The table 2 shows details of the comparison between the percentage composition of EN foundry alloys and of those of the main similar alloys. The content referring to the castings is shown in brackets.

#### Table 1. Correspondence between DIN, AFNOR and BS Norms; similar or equivalent alloys

• DIN 226	• DIN 231
• AFNOR AS 9 U	• AFNOR AS 12 U
• BS LM 24	• BS LM 2

# REFERENCES

- [1] \*\*\* European Norms on Aluminium Foundry Alloys and Products for similar or equivalent aluminium alloys
- [2] M. Dobrescu, M. Vasilescu. Tratamente termice aplicabile aliajelor de aluminiu deformabile, Ed. Politehnica Press, 2009