IN FORM

NEWSLETTER

Dear customers,

last year we celebrated the company's 90th anniversary. From a local craftsman's workshop to a renowned, leading supplier of high-quality castings in aluminum and copper based alloys – the company has come a long way. The way, a continuous development, was made out of uncounted small steps and several large steps.

How did we continue to develop Dietermann in the course of last year? Let me name just four examples:

- In order to answer questions regarding dimensional accuracy of patterns, molds, blanks and machined parts quickly and correctly, we bought a measuring arm. Any possible dimension can now be quickly and reliably measured and even compared inline to CAD data.
- In order to better understand, control and set up the metallurgy of metals molten in our furnaces, we made an investment into a melt laboratory, consisting of thermal and density analyses. Thus, microstructure and impurities of our different alloys can be closely supervised.
- In order to guarantee continued production for many years to come, the manufacturer of our automated molding lines conducted major overhaul work on both lines for us. Equally, we exchanged our IT server infrastructure completely.
- In order to better cope with workload fluctuations in the course of the year – and thus with demand peaks – we established working time accounts for all employees.

We would like to continue our development with you, too. For that, in this issue of IN FORM we give you ideas on what we can do for you besides casting, and we introduce an aluminum alloy to you that we find very interesting.

We look forward to a continued good cooperation!

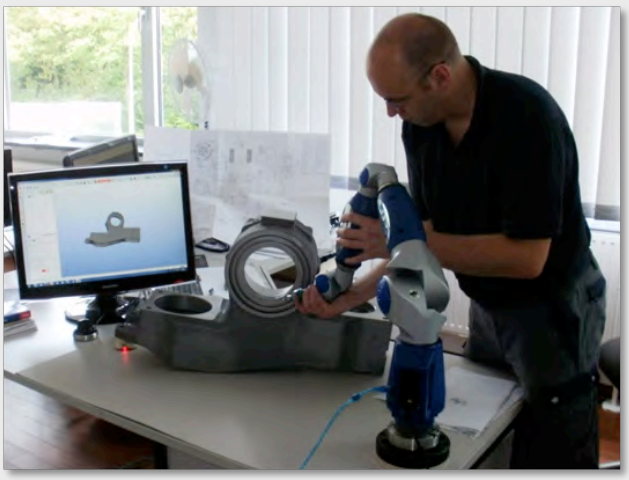
Yours sincerely,

Added value: Machining and surface treatment

Dietermann also is a foundry.

First and foremost, however, we are a service provider for our customers, who require castings, too, but who mainly require solutions to their requirements. With increasing importance, customers combine the complete range of their demands for castings, ranging from single pieces for prototypes through large series at the peak of the product life cycle to low quantities for spare part demands, in one hand. And it is just this requirement that we set up our broad production portfolio up for.

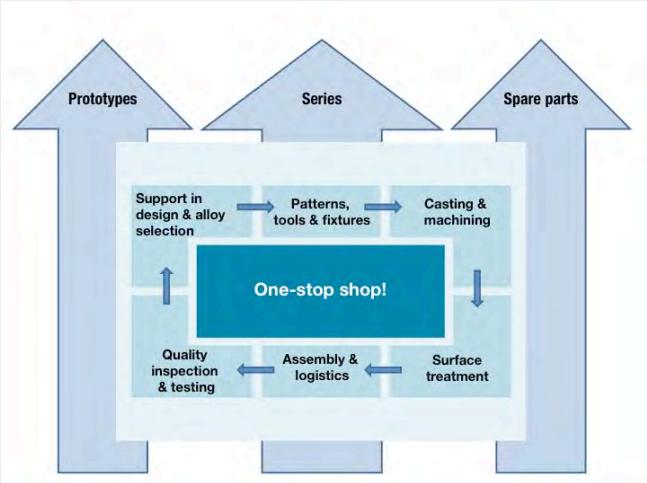
Equally, we see a trend towards integration of processes downstream in the value chain. Often, the process owner of the most complex process, i.e. the foundry, is confronted resp. selected to manage these downstream processes, too. This is reason enough for us to give you an overview of added values for castings that we offer:



- **Product design:** Casting and machining optimization, support in alloy selection, pattern making, production of prototypes
- **Machining:** milling, drilling, turning: all machining processes are offered for all dimensions and batch sizes offered by us for castings
- **Quality inspection:** dimensional analysis, tightness test, crack detection, X-ray (analogous and digital), strength and hardness test, metallurgical tests
- **Surface treatment:** Passivation, andodization, wet paint, powder coating
- **Assembly and logistics:** Machining of assemblies, logistics of third party parts, thread inserts, compilation of assembly kits, logistics

A healthy balance between purchasing some of these services and doing them in-house is crucial to us. Reliability in quality and delivery performance are the criteria that we use to make a make-or-buy decision. When we subcontract, we use reliable local long-term partners. Apart from that, an organization that knows how to manage downstream processes and that sees supplying additional services as part of their business, and not as a burden, is essential for good performance.

That is, what Dietermann stands for!



By the way: we are a foundry, too!

Background:

Self-hardening aluminum alloy

Constantly rising requirements to reduce weight on structural elements and increasingly complex part designs are a fact. Together, they lead to higher requirements of mechanical capabilities regarding the technical alloys in use. Aluminum castings (typically made of various AlSiMg, AlSiCu, AlMg or AlCu alloys) used in automotive and mechanical engineering applications have an important, growing share in this (seemingly!) area of conflict.

Mechanical capabilities as present after the casting process of aluminum alloys can often be significantly increased by executing a heat treatment. This heat treatment process typically consists of three steps:

- Solution annealing (depending on the alloy at 520-535°C over 5-12 h)
- Quenching (typically in water at room temperature)
- Artificial ageing (at 160-180°C over 4-16 h)

During the annealing, the strength of the casting blanks is very low. If handled improperly, this will easily lead to deformation of the parts. It is easy to imagine that quenching equally leads to internal stress and thus deformation. To compensate these deformations before machining, flattening work is required, a time-consuming process that requires very skilled staff. Flattening is conducted between quenching and artificial ageing.

This procedure of heat treatment is common practice, with the secrets for success laying in the details. While looking at the sequence of the different process steps, it becomes evident that heat treatment is a time and energy consuming process which can give cause to multiple faults. Especially deformation during the different steps of the heat treatment is a very common fault cause in the machining that follows.

A good alternative solution is in many cases a self-hardening alloy: for all casting processes equally interesting is the alloy complex AlZn10Si8Mg. With this alloy, mechanical properties similar to those of the alloys named in the beginning after heat treatment can be reached without heat treatment!

One day after casting, 50% of the final mechanical properties are reached; at this stage, flattening can still be conducted. After three days, 80% of the final properties are available. Within ten days, just by storing at room temperature, the parts will reach their final mechanical properties. When temperatures decrease after casting, the hardening occurs through precipitation of the AlZnMg complex followed by regrouping to the preferred locations in the microstructure of the mixed Aluminum crystal lattice. This regrouping leads to a tensioning of the lattice and thus to increased meachanical properties.

Below you find a comparison of technical properties between a self hardening alloy and the alloys most commonly used with heat treatment:

Ref. to DIN EN 1706	AlZn10Si8Mg	AlSi7Mg0,3 T6	AlSi10Mg (b) T6
0,2%- elastic limit Rp0,2 (N/mm²)	190	190	180
Tensile strength Rm (N/mm²)	210	230	220
Elongation at fracture A (%)	<1	2	1
Brinell hardness HBW	90	75	75
Machinability	++	+	+
Corrosion resistance	o	+	+/o

Further properties of AlZn10Si8Mg:

-**Corrosion resistance** against climatic and atmospheric influences is good; however, if in constant contact with water, parts cast with this alloy are less suitable. Through galvanic surface treatment, corrosion resistance can equally be increased.

-**Creep rupture properties:** through its self-hardening properties, these alloys are able to regenerate themselves after overloading / overstressing. If exposed to long and high thermal load, they will regain their original mechanical properties after some time at room temperature.

-**Further mechanical processing:** castings out of these alloys can be welded with all standard welding processes. This alloy is very well suited for machining and shows an excellent shine after polishing.

High strength without heat treatment and almost no disadvantages: self-hardening alloys are are often used for large, complex structural elements that require high properties: in mechanical engineering, for household appliances, in defense industry as well as in medical engineering.

Contact us regarding self hardening alloys. We are happy to discuss the casting feasibility of your articles in this or in other alloys!

Outlook: new @ Dietermann…

- **Casting process simulation:** until recently, we used this tool only sporadically through external support. Now, we have installed one simulation workplace in-house, which will help us to become ready for series production quicker and to reach process stability faster.
- **Five axis machining at large dimensions:** in the second quarter of 2012 we will substantially expand our machining capabilities through an investment into a large machining centre. Five-axis machining and combined milling-turning operations will be possible in-house up to diagonals of 1400mm; four-axis machining will be in-house possible up to 2600mm length!

We will write about it shortly!

By the way: Why do we call our newsletter IN FORM? This is a German play on words between "to inform" as in information and the technical term "Form", which means "mold" in German.

Dietermann: a prime address for prime castings.

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