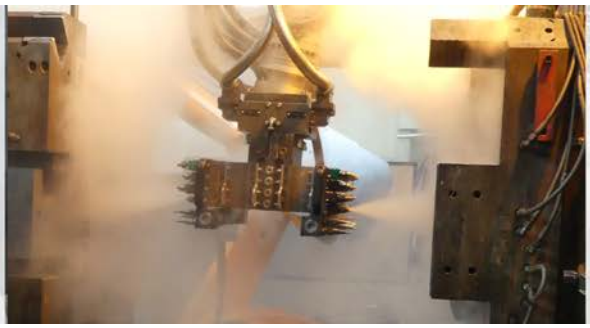
Project Engineering Group

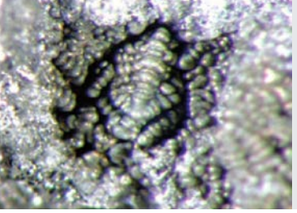




campus Seminare

Seminar program - casting

Casting defect analyses
Industrial engineering
Development
Casting suited component geometry
Metallurgy and melting technology
Q-Control
Supplier management
Planning standards
Casting process
Q-planning
Casting machine
Rheocasting
Purchase
Die-casting mold

Know-how is your advantage



Do you know what this is?

Right answer on page 26.

Table of contents and seminar dates

Know-how is your advantage

Since 1999, Project Engineering GmbH is offering a wide range of engineering services with a focus on light metal casting. In 2014, the range of services was expanded to include a practical seminar program bundeled in the “Project Engineering Campus”. The cooperation with the VDG Academy from Düsseldorf started in 2021. Four events are currently being held in cooperation.

Light Metal Casting | Seminars on gravity, low-pressure and high pressure die casting processes as well as seminars on heat treatment of castings, casting simulations, rheocasting, casting defect analysis and other casting topics.

Iron Casting | Basic seminar as well as casting technology expert knowledge.

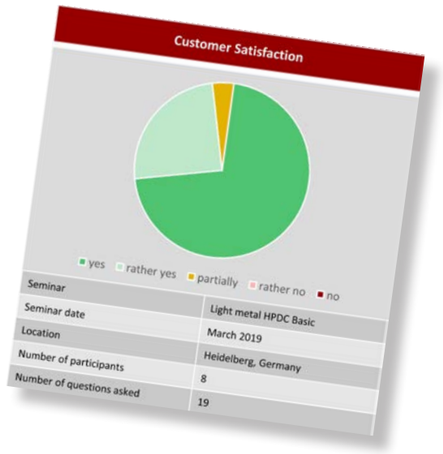
Quality Management | Seminars on “Special Features” and “8D Report”.

All light metall casting seminars are available in German or English. Other languages or simultaneous interpretation on request.

They can be located in Heidelberg or take place as in-house seminars at the customers site. Those seminars allow to be tailored individually to the customers requirements.

Seminar capacities are limited to 15 people. Employees and managers in quality- and supplier management, purchasing, development, production and industrial engineering are the most typical participants.

The QM seminar program can be found at **www.projectengineering.de**.



Let´s get to know us personally ...

Project Engineering **on Euroguss 2024**
Date: 16 –18 January 2024 in Nuremberg - Booth 7-747

EUROGUSS

Casting process-specific seminars

Light metal casting - special topics

Light metal die-casting

Basic knowledge for foundrymen

3 days

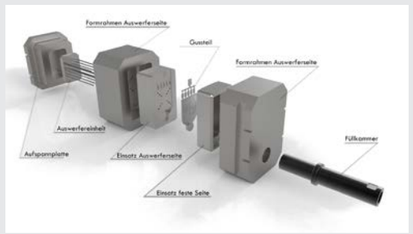
Casting processes are complex. An important aspect for an efficient casting production is qualified personnel at the production plants.

This seminar provides easy-to-understand basic technical knowledge needed for working in a die-casting foundry.

Suitable for career starters, career changers and further education.

Agenda

Technology of the casting process	
A Melting shop	Material, melting, keeping warm, providing, process approval.
B Tool shop	Structure of the die-casting mold, Maintenance and mold care, mold approval
C Foundry	Die-casting machine, die-casting cell, casting process, setup, process approach and process approval, Q-testing.
D Fettling shop	Cleaning, sandblasting, grinding
E Quality Control	Casting defect detection, X-ray, CT inspection, crack inspection, visual inspection, samples, test gauges.



The Event

Location	In English language only available as in-house seminar at this time
Documentation	Handbook according to the training content & participation certificate
Pricing	On request

Light metal die-casting

Basics

4 days

Planning and realization of high quality casting parts require in-depth knowledge of the casting process by everybody involved. Supplier selection, (cast-ready) component development, quality planning and control, production engineering and production organization are significantly influencing on serial production.

This seminar imparts the basics of the large-scale production technique „Light metal die-casting". Learning objective is to empower to work with casting components made of aluminum or magnesium more effective.

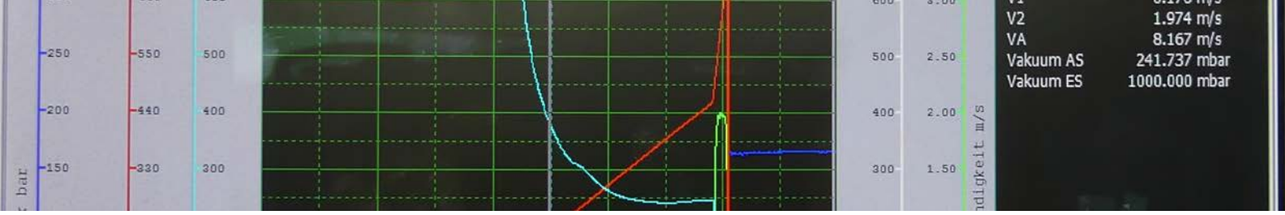
Suitable for members of quality planning and control, supplier management, purchasing, development, production and industrial engineering. The seminar is spitted in 2 blocks of 2 days each.

Agenda

Part 1: Technology of the casting process	
A Metallurgy	Fundamentals of metallic matrix and solidification, alloys (Al and Mg), mechanical properties, melt treatment, process control.
B Elements of die-casting machines	Machine components, control technology, special designs, peripheral devices.
C Design and functions of the mold	Design and materials of the mold, bleed technology, parted molding lines, venting, temperature control and mold care.
D Technology of die-casting processes	Dosing, mold filling, solidification, heat balance, ejection, mold spraying, temperature influences and process technology Vacuum die-casting.
Part 2: Quality standards	
E Casting defect analyses	Strategies to eliminate defects. Main fault types: cavities, bubbles, oxides, cold run, friction points, washouts, cracks.
F Casting suited component geometry	Mold partition, gating position, drafts, section thickness and transitions, tolerances, surface.
■ Workshop planning standards	Procedure and tools using the example of a module mounting. Casting position, calculation, simulation and geometry adjustment.

The Event

Location	In English language only available as in-house seminar at this time
Documentation	Handbook according to the training content & participation certificate
Pricing	On request



Light metal die-casting

Casting technology (expert) — 3 days

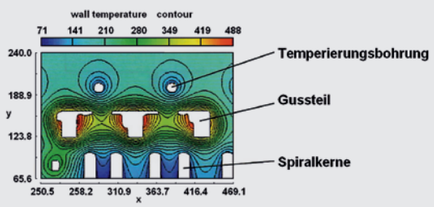
Reproducible casting process planning is the basis for fulfilling the functional requirements of cast components. The right choice of casting position and the quality-oriented design of the casting and feeding system are key elements of this planning strategy.

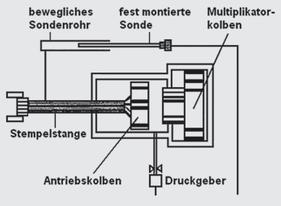
This seminar imparts the technical basics and their practical application for designing the so-called mold cavity, consisting of cast part, feeding or solidification-directing elements, ingate and ventilation.

Suitable for technical process development, component development, production, quality planning and supplier management. Basic knowledge of cast components and casting process are advantageous.

Agenda

Technology of the casting process	
A Metallurgy	Fundamentals of solidification, classification of alloys, mechanical properties
B Casting and feeding technology	Design and calculation of the casting system, design of the venting system, design of the tempering system.
■ Workshop planning standards	Procedure and tools using the example of a module carrier: - *Choice of casting position* - *Adaptation of the component geometry (castable component geometry)* - *Calculation and design of the casting system, Design of the venting and tempering channels under application of simulation technology*





The Event

Location	In English language only available as in-house seminar at this time
Documentation	Handbook according to the training content & participation certificate
Pricing	On request

Light metal die-casting

In practice (expert) — 2 days

This “live in practice” part of our „Light metal die-casting“ seminar series, is deepening the theoretical knowledge from the seminar „Light metal die-casting basics“ by preparing - live - casting tool and casting machine for casting, running the casting process and moving on to casting defect analyzes and evaluation.

This seminar will take place at Heck + Becker. Exclusively for this live workshop, we have a die-casting machine „Müller Weingarten“ with 3200 t clamping force at our disposal.

Appropriate equipment for process evaluation and casting defect analysis is available (X-ray system, saw, stereo microscope).

Agenda

Casting process and fault analysis in practice	
■ Structure and function of the die-casting mold - in practice	Review of a dismantled mold, set-up and preheating of the mold
■ Elements of the die-casting machine - in practice	Machine components, control technology, special designs, peripheral devices
■ Technology of the die-casting process - in practice	Filling tests and influence speed 1st phase, influence of the filling time, influence of the cycle time
■ Casting defect analyses - in practice	Practical approach for the analysis of typical casting errors and derivation of the causes of the defects

Recommendation: Please visit our seminar „Light metal die-casting basics“ in advance. You can find current dates on our homepage www.projectengineering.de or call us on request.

The Event

Location	Heck & Becker GmbH & Co. KG, Gladenbacher Str. 47, 35232 Dautphetal
Documentation	Handbook „Light metal die-casting basics“ (optional) & participation certificate
Pricing	Exclusive seminar in English language on request

Casting of an EEM:
First step in a Comptech “Slurry Maker Carousel“

COMP tech castings and moulding innovation

Rheocasting based on the Comptech-process

Basic knowledge for foundrymen

2 days

Casting processes are complex. An important aspect for an efficient casting production is qualified personnel at the production plants.

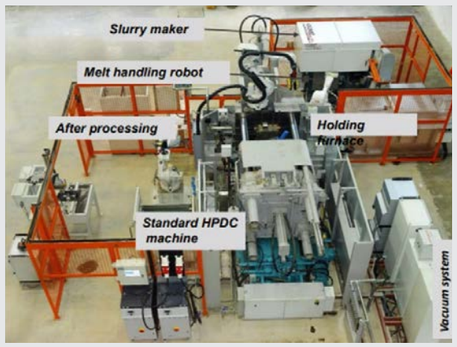
This seminar provides easy-to-understand basic technical knowledge required for operating a rheo-die-casting cell.

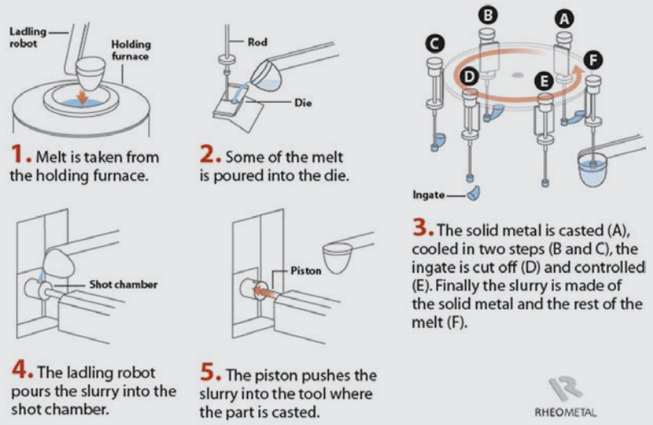
It takes place either in your factory on your casting machine or on the Comtech casting machine in Sweden.

Suitable for operators and casting engineers.

Agenda

A	History of semi-solid material and over-view of rheocasting equipment	Main processes, Comtech-process (slurry maker, dosing device for EEM, dosing robot).
B	Theory of slurry making	Making of slurry, how to set solid fraction and how to check it, what solid fraction to what part, how to trim to right solid fraction.
C	Practical slurry making and process settings	Thermal analysis and how to measure slurry quality, DC machine and process settings and shoot curves, how to measure the slurry, process FMEA and stability of solid fraction.





The Event

Location	In your factory on your casting machine or on the Comtech casting machine in Sweden
Documentation	Handbook according to the training content & participation certificate
Pricing	On request

Rheocasting based on the Comptech-process

Introduction to Rheocasting

1 day

The requirements placed on light metal castings in terms of complexity, mechanical strength and manufacturing costs are increasing. The classic die casting processes are more and more reaching their limits.

The casting of a semi-solid „slurry“ opens up new possibilities in die casting. Rheocasting thus makes it possible to increase component complexity while maintaining high strength and high elongation at break. Heat treatment is also possible without additional technology.

Suitable for quality planning and control, supplier management, purchasing, development, production and industrial engineering. Basic knowledge with cast components and casting process is an advantage

Agenda

A Metallurgy	Overview of rheo-alloys, production of a semi-solid „slurry“, filling and solidification behavior, mechanical properties, tempering, process control.
B Casting cell	Extension of a standard cold chamber die casting casting cell to a rheocasting unit.
C Mold	Adaptation of the casting tool to the rheocasting process.
D Advantages of the procedure	Casting process, tool wear, machine size.
E Applications	Degrees of freedom in the design of rheo-die-cast components and expected mechanical properties, examples.

For a more extensive insight into rheocasting, we additionally recommend attending „Rheocasting - Casting Technology (expert)“.

The Event

Location	In English language only available as in-house seminar at this time
Documentation	Handbook according to the training content & participation certificate
Pricing	On request

Rheocasting based on the Comptech-process

Casting technology (expert)

2 days

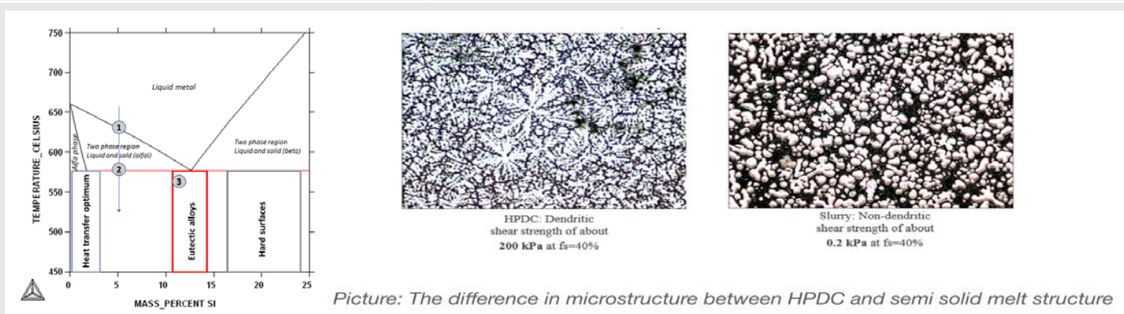
Reproducible casting process planning is the basis for fulfilling the functional requirements of cast components. The right choice of casting position and the quality-oriented design of the casting and feeding system are key elements of this planning strategy.

This seminar imparts the technical basics and their practical application for designing the so-called mold cavity, consisting of cast part, feeding or solidification-directing elements, ingate and ventilation.

Suitable for technical process development, component development, production, quality planning and supplier management. A knowledge level equivalent to the seminar „Light metal die-casting basics“ and „Introduction to Rheocasting“ is recommended.

Agenda

A Metallurgy	In-depth knowledge of rheo-metallurgy: alloys, production of a semi-solid “slurry”, filling and solidification behavior, mechanical properties, tempering, process control.
B Casting and feeding technology	Design and calculation of the casting system, design of the venting system, design of the tempering system.
■ Workshop	Virtual design of a component for rheocasting: - *Choice of the pouring position* - *Adaptation of the component geometry (component geometry suitable for casting)* - *Design of the ventilation and temperature control channels*



Picture: The difference in microstructure between HPDC and semi solid melt structure

The Event

Location	In English language only available as in-house seminar at this time
Documentation	Handbook according to the training content & participation certificate
Pricing	On request

Zinc die-casting

Basics 4 days

Planning and implementation of series-ready cast components requires sound knowledge of the casting process from all those involved. Supplier selection, (casting) component development, quality planning and control, production equipment and organization are just a few examples that have a significant impact on series production.

This seminar imparts the basics of the casting process „zinc die-casting“ which is often used for mass production. Learning objective is to empower to work with Zn casting components more effective.

Suitable for quality planning and control, supplier management, purchasing, development, production and industrial engineering. The seminar is spitted in 2 blocks of 2 days each.

Agenda

Part 1: Technology of the casting process	
A Metallurgy	Fundamentals of metallic matrix and solidification, Zn-die-cast alloys, mechanical properties, process control.
B Elements of die-casting machines	Machine components, control technology, special designs, peripheral devices.
C Structure and function of die-casting molds	Design and materials of die-casting molds, ingate technology, mold division, venting, mold temperature control, mold care.
D Technology of die-casting processes	Melting, mold filling, solidification, ejection, mold spraying, temperature effects.
Part 2: Quality Standards	
E Casting defect analyses	Strategies for defect control, main faults: cavities, bubbles, oxides, cold run, friction points, surface defects, cracks
F Casting suited component geometry	Mold partition, gating position, drafts, section thickness and transitions, tolerances, surface.
■ Workshop planning standards	Procedure and tools - using an example component. Simulation, calculation, casting position, geometry adjustment and verification of the results.

The Event

Location	In English language only available as in-house seminar at this time
Documentation	Handbook according to the training content & participation certificate
Pricing	On request

Aluminum low pressure casting

Basics 4 days

Planning and realization of high quality casting parts require in-depth knowledge of the casting process by everybody involved. Supplier selection, (cast-ready) component development, quality planning and assurance, production engineering and production organization are significantly influencing on serial production.

This seminar imparts the basics of the scale production technique „low pressure casting”. Learning objective is to empower to work with such components more effective.

Suitable for members of quality planning and control, supplier management, purchasing, development, production and industrial engineering. The seminar is spitted in 2 blocks of 2 days each.

Agenda

Part 1: Technology of the casting process	
A Metallurgy	Fundamentals of metallic matrix and solidification, alloys (Al and Mg), mechanical properties, melt treatment, process control.
B Elements of die-casting machines	Machine components, control technology, special designs, peripheral devices.
C Design and function of the casting mold	Mold design, mold division,gating system, ventilation, temperature control, mold care
D Casting and feeding technology	Dosing, mold filling, heat balance, ejecting.
Part 2: Quality Standards	
E Casting defect analyses	Strategies for defect control. Main faults: cavities, bubbles, oxides, cold run, friction points, washouts, cracks
F Casting suited component geometry	Mold partition, gating position, drafts, section thickness and transitions, tolerances, surface.
■ Workshop planning standards	Procedure and tools - using an example component. Simulation, calculation, casting position, geometry adjustment and verification of the results.

The Event

Location	In English language only available as in-house seminar at this time
Documentation	Handbook according to the training content & participation certificate
Pricing	On request

Seminar - 1 day

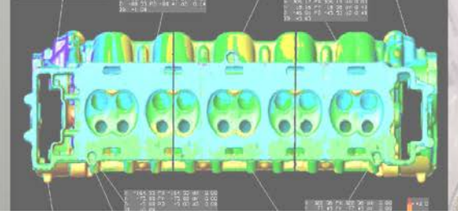
Introduction to rheocasting

on the basis of the Comptech process

In this seminar you will get an overview of the preparation and the properties of a „slurry“, the rheocasting equipment as well as the extended possibilities of die casting with semi-solid materials.

Date : November 30, 2023 in German language

campus Seminare

Aluminum sand- and permanent mold casting

Basics — 4 days

Planning and realization of high quality casting parts require in-depth knowledge of the casting process by everybody involved. Supplier selection, (cast-ready) component development, quality planning and assurance, production engineering and production organization are significantly influencing on serial production.

This seminar, imparts the basics of the small-, medium- and large-scale production technique „aluminum sand- and permanent mold casting" (gravity & low pressure). Learning objective is to empower to work with such components more effective.

Suitable for members of quality planning and control, supplier management, purchasing, development, production and industrial engineering. The seminar is spitted in 2 blocks of 2 days each.

Agenda

Part 1: Technology of the casting process	
A Metallurgy	Fundamentals of metallic matrix and solidification, alloys (Al and Mg), mechanical properties, melt treatment, process control.
B Elements of casting machines	Casting machines for PM casting, sand-casting molding systems.
C Design and function of casting molds	Mold design, mold shaping, mold division, contour elements, frame, clamping elements, ejection unit, guiding, temperature control, sand mold production
D Casting and feeding technology	Designing the casting system, methodology according to Friedrich Nielsen, use of filters in the casting system, design of the feeding system, use of heat sinks in sand molds.
Part 2: Quality Standards	
E Casting defect analyses	Strategies for defect control. main defects: cavities, bubbles, oxides, cold run, friction points, washouts, cracks
F Casting suited component geometry	Mold partition, gating position, drafts, section thickness and transitions, tolerances, surface
■ Workshop planning standards	Procedure and tools - using the example of a component. Simulation, calculation, casting position, geometry adjustment and verification of the results.

The Event

Location	In English language only available as in-house seminar at this time
Documentation	Handbook according to the training content & participation certificate
Pricing	On request

Aluminum sand- and permanent mold casting

Casting technology (expert) — 3 days

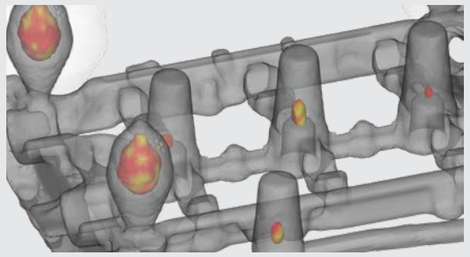
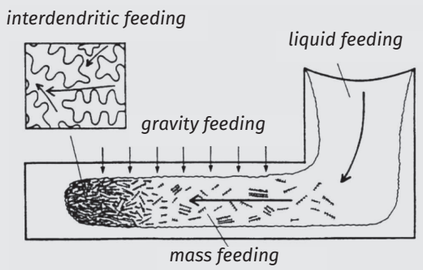
Reproducible casting process planning is the basis for fulfilling the functional requirements of cast components. The right choice of casting position and the quality-oriented design of the casting and feeding system are key elements of this planning strategy.

Voids are avoidable! This seminar imparts technical basics for designing the so-called mold cavity, consisting of cast part, feeding or solidification-directing elements, casting system and ventilation. Practical application is also part of this course.

Suitable for technical process development, development, production, quality planning and supplier management. Basic knowledge of casting parts and casting process are advantageous.

Agenda

Process technology of low pressure and gravity casting	
A Metallurgy	Fundamentals of solidification, classification of casting alloys, mechanical properties.
B Casting and feeding technology	Designing the casting system, methodology according to Friedrich Nielsen, use of filters in the casting system, design of the feeding system, use of heat sinks in sand molds.
■ Workshop planings standards	Procedure and tools - using an example casting component - *Selecting casting process, material and the casting position* - *Adaptation of the component geometry* - *Calculation and design of the casting and feeding system using simulation technology*

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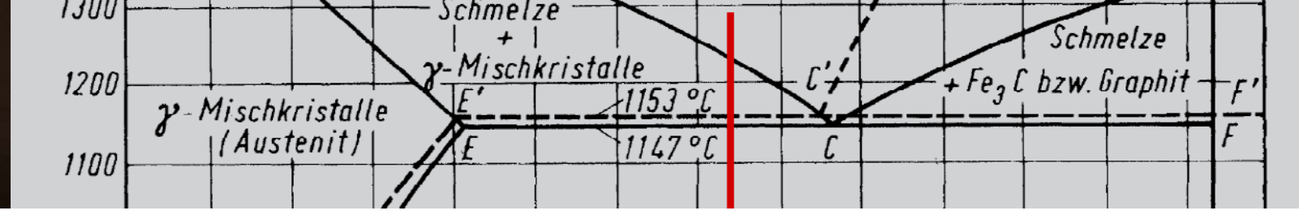


Iron casting

Basics

4 days

Planning and realization of high volume production cast components requires a sound knowledge of the casting process on the part of all parties involved. Supplier selection, (casting-compatible) component development, quality planning and control, equipment technology and production organization are just a few examples that have a significant influence on series production.

This seminar imparts the basics of the casting process „iron casting“ used for serial production. Learning objective is to empower to work with such components more effective.

Suitable for quality planning and control, supplier management, purchasing, development, production and industrial engineering. The seminar takes place in 2 blocks of 2 days each.

Agenda

Part 1: Technology of the casting process	
A Casting material and heat treatment	Fundamentals of solidification, matrix and properties of cast iron materials, melting treatment, heat treatment.
B Machinery and equipment	Overview moulding shop and sand preparation.
C Casting mold	Model, mold making, with casting and feeding system.
Part 2: Quality Standards	
D Casting defect analyses	Main defects: Non-metallic inclusions and sand defects, cavities, bubbles, oxides, leakage defects, deformation and cracks.
E Casting suited component geometry	Mold parting, mold inclination, machining allowances, shrinkage, tolerances and surface properties, strategies for casting-compatible design.
■ Workshop	Procedure for casting-compatible design using the example component „wishbone“ (3D model). Joint considerations, determination of the casting position, simulation (temperature field, mould filling and solidification), geometry adaptation and verification of the results.

The Event

Location	In English language only available as in-house seminar at this time
Documentation	Handbook according to the training content & participation certificate
Pricing	On request

Iron casting

Casting technology (expert)

3 days

Reproducible casting process planning is the basis for meeting the functional requirements of cast components. The correct choice of the casting position and the quality-oriented design of the casting and feeding system are key elements of this planning strategy.

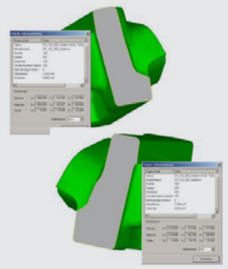
This seminar imparts the technical basics and their practical application for designing the so-called mold cavity, consisting of cast part, feeding or solidification-directing elements, ingate and ventilation.

Suitable for technical process development, component development, production, quality planning and supplier management. Basic knowledge of cast components and casting process are advantageous.

Agenda

Process technology of iron casting	
A Metallurgy	Metallic matrix and solidification, classification of alloys, mechanical properties and melting treatment.
B Casting and feeding technology	Machine components, control technology, special designs, peripherals.
■ Workshop planning standards	Practical application using the example component „wishbone“: - Mould plate assignment, calculation and Design of the risers and the casting system - Adaptation of the component geometry - Verification of the solution by numerical models

Pic. 21 *Quantification of the cut areas as a non-solidification effective surface*



Volume	cm³	23,25
total surface	cm²	55,65
non-affecting 1	cm²	3,15
non-affecting 2	cm²	3,35
non-affecting 3	cm²	0
non-affecting total	cm²	6,50

The Event

Location	In English language only available as in-house seminar at this time
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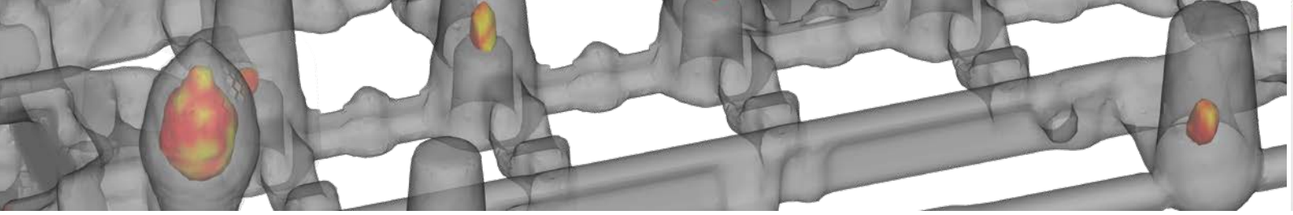
Pricing	On request



Light metal casting - special topics

Casting suited component geometry for Al parts — 1 day

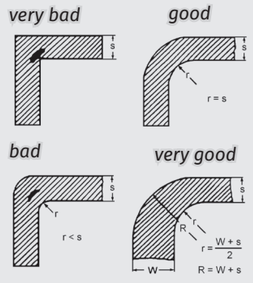
Light metal casting is a primal shaping process. This means that the internal structure of the cast component is the result of the state of aggregation change from „liquid“ to „solid“ (solidification). The shape and properties of the cast component are inextricably linked to the mold filling and solidification process.

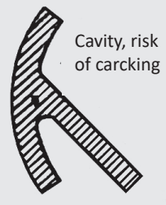
This seminar imparts the technical basics of designing casting suitable components.

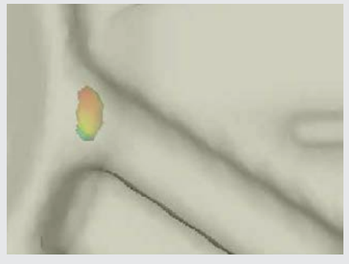
Suitable for technical process development, development and quality planning. Basic knowledge of cast components and casting process are advantageous.

Agenda

A Metallurgy	Fundamentals of solidification, classification of casting alloys, mechanical properties.
B Casting suited component geometry	Construction guidelines, mold division, cores, ingate position, draft angles, wall thicknesses and transitions, holes and openings, tolerances, surface
■ Exemplary application on an example component	Procedure and tools: - *Selecting casting process, material and the casting position* - *Adaptation of the component geometry (casting suited component geometry)*

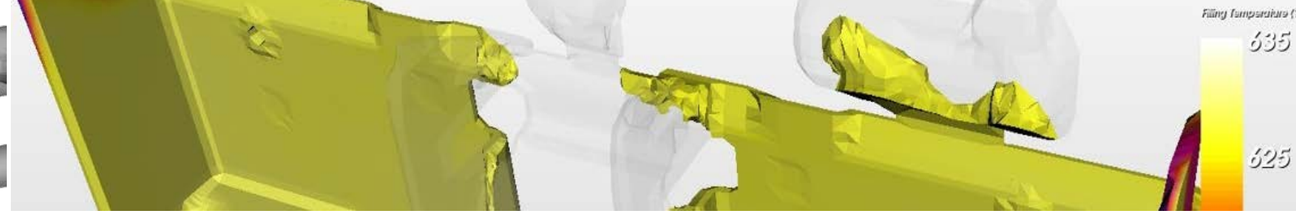






The Event

Location	In English language only available as in-house seminar at this time
Documentation	Handbook according to the training content & participation certificate
Pricing	On request



Light metal casting - special topics

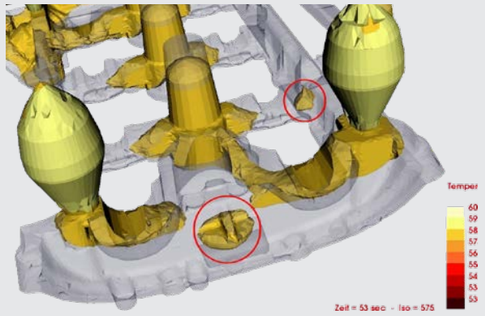
Rating and reading of casting-simulations — 1 day

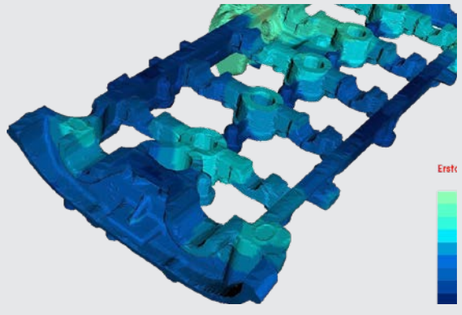
Efficient process planning for highly complex light metal casting components is requiring simulation technology as a prerequisite. In this seminar we impart knowledge in order to evaluate casting simulations and to interpret simulation results correctly.

Suitable for members of quality planning and control, supplier management, purchasing, development, production and industrial engineering. Basic knowledge of casting parts and casting process are advantageous.

Agenda

A Basics	Basics of simulation technology, common simulation software tools
B Correct application of simulations in process planning	Temperature field analysis, concept calculation, process simulation. Prerequisites and implementation
C Correct visualization and reading of simulation results	Procedure-dependent approach, primary functions and criterion functions, presentation of results, assessment and conclusions.
■ Workshop	Procedure and interpretation of the simulation results using the example of a component. Existing simulation results can be brought along





The Event

Location	In English language only available as in-house seminar at this time
Documentation	Handbook according to the training content & participation certificate
Pricing	On request

Light metal casting - special topics

Rating and analysis of casting defects

1 day

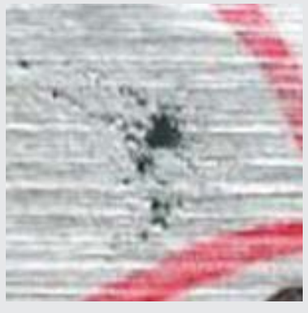
Proper evaluation of existing casting defects in casted light metal components is a prerequisite for effective error reduction. Only if the casting defect is identified correctly, its cause can be determined and the right measures to improve can be initiated.

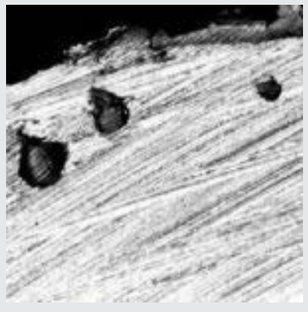
This seminar imparts how to analyze casting defects with the right tools and name defects correctly. Afterwards we discuss measures to avoid the identified casting defects. Existing components with visible casting defects can be brought along.

Suitable for members of quality planning and control, supplier management, purchasing, development, production and industrial engineering. Basic knowledge of castings and casting process are advantageous.

Agenda

■ Basics of casting defect analysis	Strategies for defect control. main defects: cavities, bubbles, oxides, cold run, friction points, washouts, cracks
■ Common defect types and possibilities for successful defect detection	Cavities, blisters, bubbles, oxides, leakage defects, friction points, washouts, cracks.
■ Workshop	Identification and interpretation of casting defects by means of examples.





Note: Own components / cuts with visible casting defects, as well as x-ray pictures etc. can and should be brought along.

The Event

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Light metal casting - special topics

Heat treatment of aluminum castings

1 day

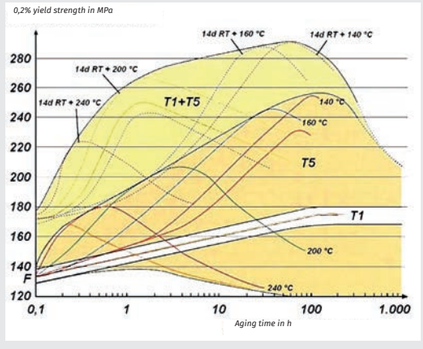
The characteristics of aluminum casting alloys can be specifically improved by heat treatment. The type of heat treatment is based on the intended effect, casting alloy and / or the casting process.

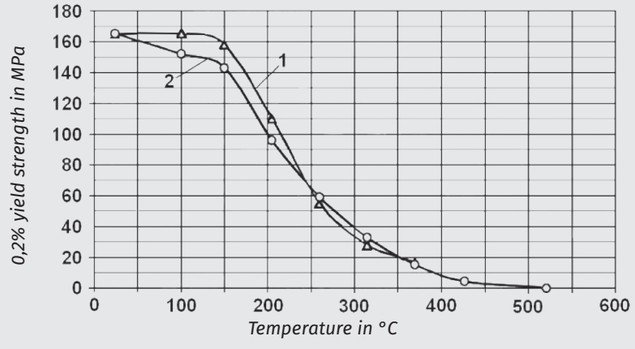
This seminar imparts the basics of the annealing of aluminum cast components and discuss possibilities for getting out the maximum possible material potential depending on the desired target.

Suitable for members of quality planning and control, supplier management, development, production. Basic knowledge of casting parts and casting process are advantageous.

Agenda

■ Hardening	Basics of hardening, normal case of hardening (solution annealing, quenching, aging), special cases of hardening.
■ Heat treatment for special purposes	General heat treatment, stress-relief annealing, soft annealing, alloy-dependent heat treatment
■ Facilities for heat treatment	Heat treatment facilities such as annealing furnaces, quenching tanks, paging ovens and peripherals





The Event

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Light metal casting - special topics

Cooling water concept for foundries — 1 day

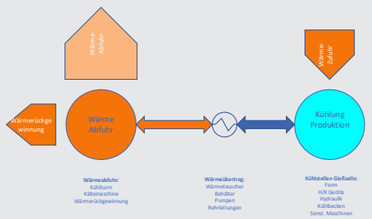
A prerequisite for reproducible casting quality is a stable, homogeneous and continuously available cooling water supply for temperature control of the casting machine, casting tool and quenching bath.

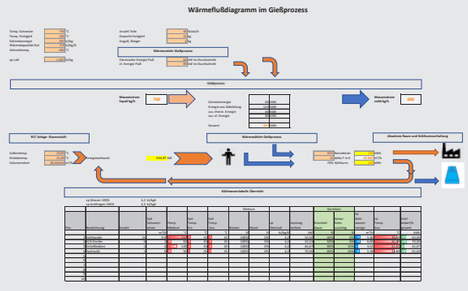
This seminar imparts the basic concept and possibilities of a cooling water supply system as well as possibilities for influencing the cooling requirements of heat exchangers, casting tools and auxiliary units.

Typical concepts of a cooling water supply system will be jointly considered and evaluated in the subsequent workshop.

Agenda

■ Basics of cooling water supply	- Cooling concepts open, closed, adiabatic, hybrid, cooling machines, centralized, decentralized, satellite systems. - Compilation of a cooling load table. - Relationship between paid services, circulation, pressure losses. - Usable heat recovery.
■ Water-hydraulic design	Pump design, circulation quantities, pressures, water quality, filtration
■ Workshop	Discussion and analysis of practical examples. Own concepts can be brought along.





The Event

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Light metal casting - special topics

Detection, evaluation and avoidance of paint defects — 1 day

The correct evaluation of paint defects on cast components, especially in the visible area, is a prerequisite for effective defect elimination. Only when the type of defect is established beyond doubt can the cause be deduced and the correct measures for improvement be initiated.

In this seminar, we impart basic knowledge on how to analyze and correctly name coating defects. We will then discuss measures to avoid them. Existing components with paint defects are welcome to be brought along.

Suitable for members of quality planning and control, supplier management, purchasing, development, production and industrial engineering. Basic knowledge of surface finishing and casting process are advantageous.

Agenda

■ Basics of painting	Basis for general understanding
■ The influence of the substrate and pretreatment	Focus topics variable depending on group of participants
■ Methods of definite error assignment	Basics for error correction and preventive methods for error avoidance
■ Measures to prevent painting defects	To control painting processes and recognize the impact on defects. Constructive methods for preventing painting defects

The Event

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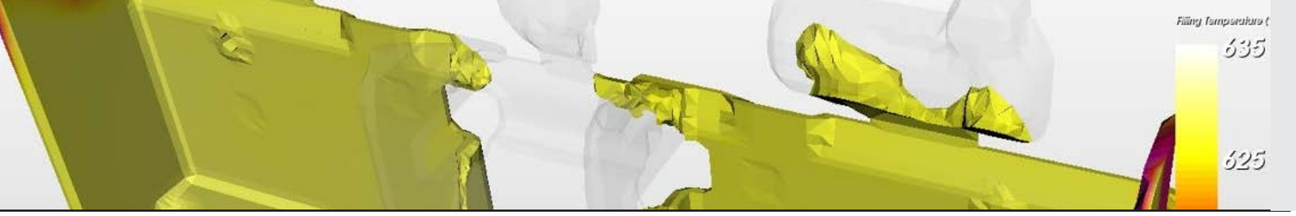


- *High-quality seminar papers*
- *in German and English - other languages on request*
- *bound as a technical book*

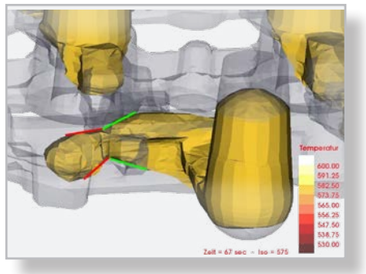
Casting know-how is our daily work

PE supports costumers in projects related to production process improvement. Our focus is on light metal casting and subsequent processes.

Optimization of production processes and production equipment | Increasing output, improvement of product quality, reduction of scrap rates, improvement of process repeatability, reduction of production costs, the increase of plant OEE and related topics.

Casting suited component design | Support of your component development by early reviews of the component geometry with consideration of casting suitability, such as:

- Temperature field analysis
- Determine the casting position (position of the component in the mold)
- Development of the casting system (mold filling and feeding)
- Casting suitable optimization of the component geometry by carrying out mold filling and solidification simulation
- Reporting



Developing casting processes | Planning your casting process, beginning by checking the geometry of the component up to supporting your production staff during implementation and ramp up.

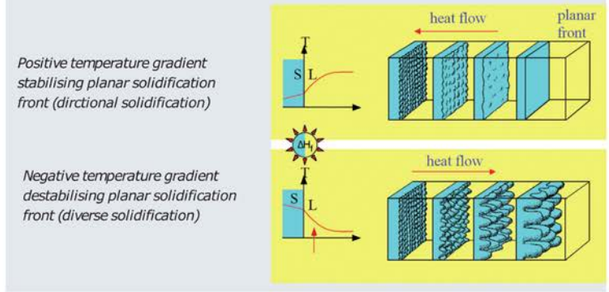
- Temperature field analysis
- Determine the casting position (position of the component in the mold)
- Development of the casting system (mold filling and feeding)
- Conceptual design of the mold and consulting the mold manufacturer under consideration of casting suitable design
- Supporting your production staff during ramp up

Casting defect trouble-shooting | Analysis of casting processes and casting defects with special tools and high grade expertise to define adequate countermeasures. PE effectively manages this topic by running own casting simulation software. It allows us to perform in house temperature field, mold filling and solidification analysis.

PROJECT ENGINEERING

A

Picture 22
Morphology of solidification front due to direction of heat flow



Positive temperature gradient stabilising planar solidification front (dirctional solidification)

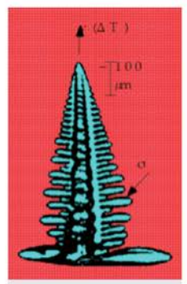
Negative temperature gradient destabilising planar solidification front (diverse solidification)

The local increase of concentration in front of the solidif cation front leads to a reduction of the liquidus temperature compared to the phase diagram: The melting undercools (constitutional undercooling). The higher the undercooling, the higher the instability of the crystal growth front. The actual temperature in front of the solidif cation front depends on the temperature gradient.

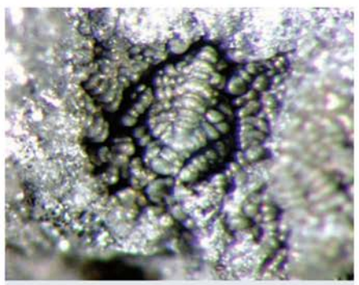
- ➡ Steep temperature gradient =no, or only slight constitutional undercooling =planar growth front
- ➡ Decreasing temperature gradient =increasing constitutional undercooling =Roughening of the solidif cation front =dendritic growth up to the creation of globular crystals.

In *picture 23* a dendrite in stalky form is shown, while *picture 24* shows an actual aluminum – mixed crystal in form of a globular dendrite with a 40x magnification.

This is a cavitiy!!!



Picture 23
Stalked dendrite



Picture 24
Globular dendrite (primary Al – mixed crystal)

26

Worldwide operation

- Quality planning, quality control, start-up management, supplier management, supplier development
- Designing of production facilities and factories
- Production experience, particularly in light metal casting
- Planning of casting process, casting suited component geometry, planning of casting process
- Training and seminars
- Business development and support partner

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