

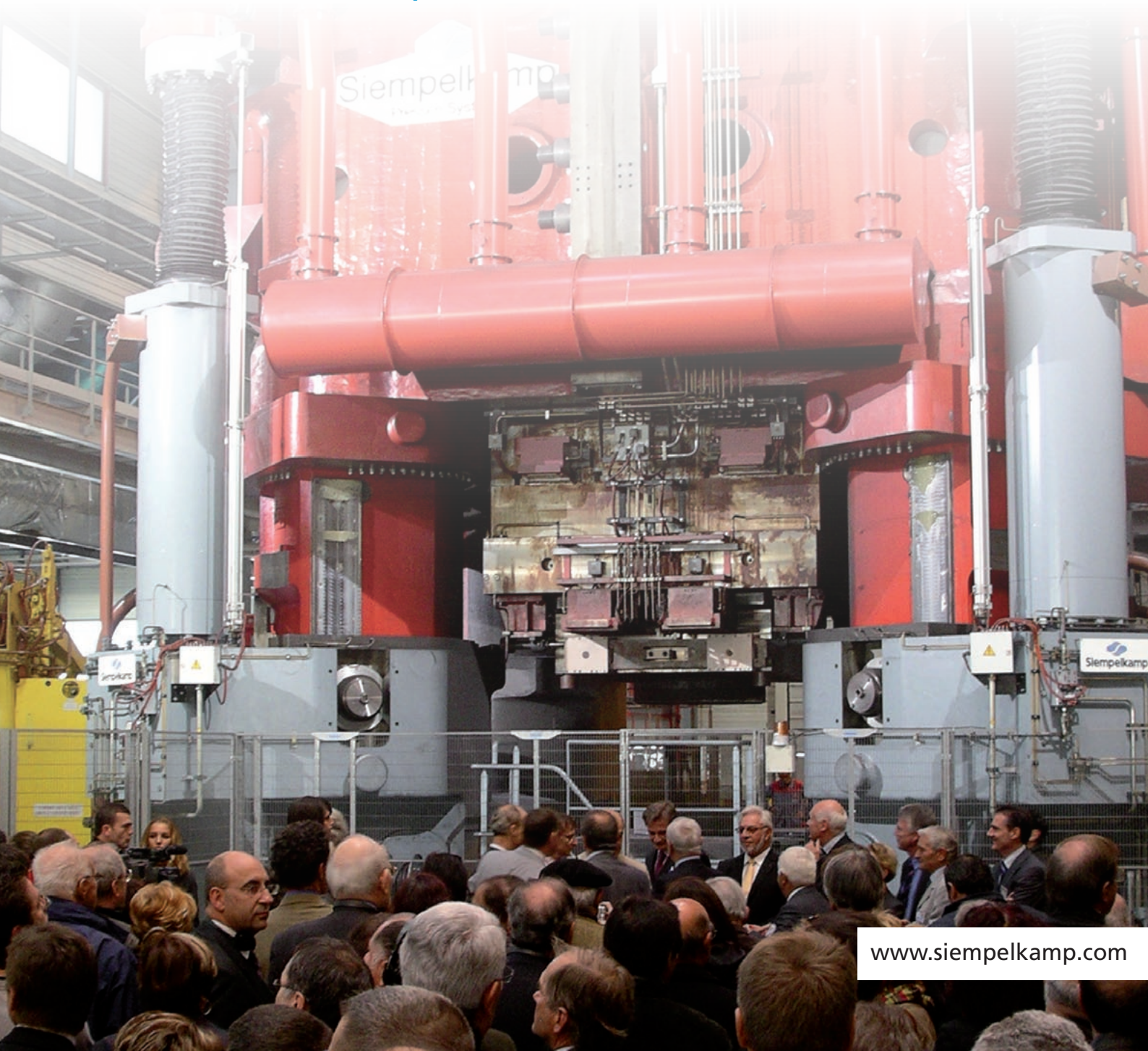


Siempelkamp

Maschinen- und Anlagenbau

Metal Forming Presses

with components made of nodular cast iron



www.siempelkamp.com

Each extra-large press is one of a kind

A large press is not purchased every day

Before a new machine, which was produced in serial production, is introduced to the market, the manufacturers will test prototypes and initial batches thoroughly. Many details are optimized in this way before serial production starts.

For large presses this is completely different. In their performance class every machine is unique. Oftentimes a press represents the backbone of a factory. If it is not working, production comes to a standstill.

The conclusion:

This means that from the day the press is put into operation it has to work reliably, efficiently, and precisely day in and day out for many decades.



References

125 years of Siempelkamp – experienced, competent, and flexible

Siempelkamp has the experience of many decades in the design and construction of metal forming presses. The company specializes in custom-made presses with large press capacities:

- Compacting presses
- Open-die forging presses
- Closed-die forging presses
- Isothermal forging presses

- Plate forming presses
- Straightening presses
- Hydroforming presses
- Heat exchanger plate presses
- Rubber pad presses

By request Siempelkamp supplies complete plants including the sensor system, the actuating elements, the control technology, and the hyd-

raulics. Siempelkamp also designs and builds the entire hydraulic and electronic controls for the equipment assuring the perfect and reliable integration of all components.

The scope of supply also includes the auxiliary systems for the manipulating, lifting, lowering, and transversing of the workpieces as well as the installation and startup.



OPEN-DIE FORGING PRESS



CLOSED-DIE FORGING PRESS



STRAIGHTENING PRESS FOR HEAVY PLATES



PIPE-FORMING PRESS



HYDROFORMING PRESS

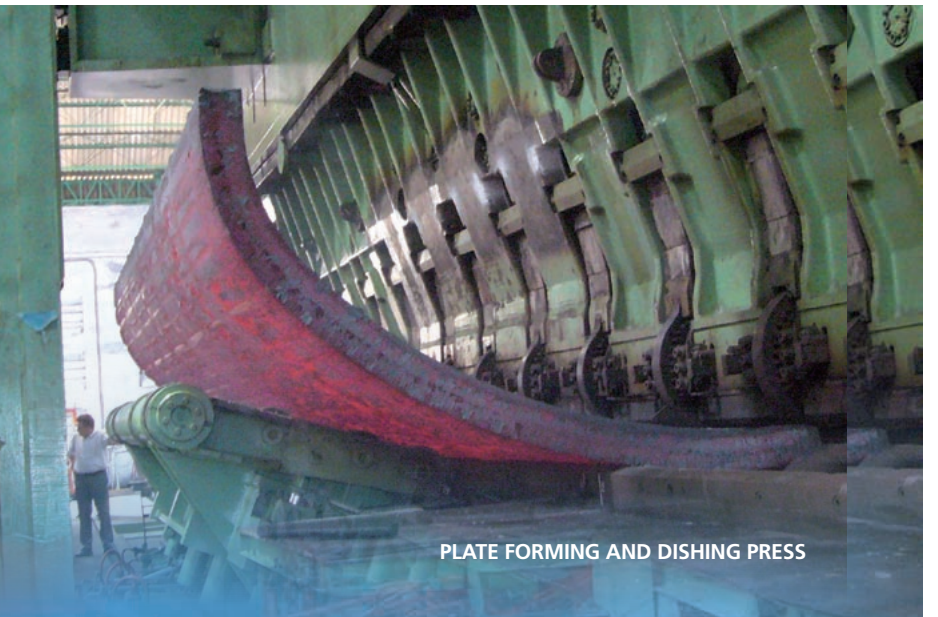


PLATE FORMING AND DISHING PRESS



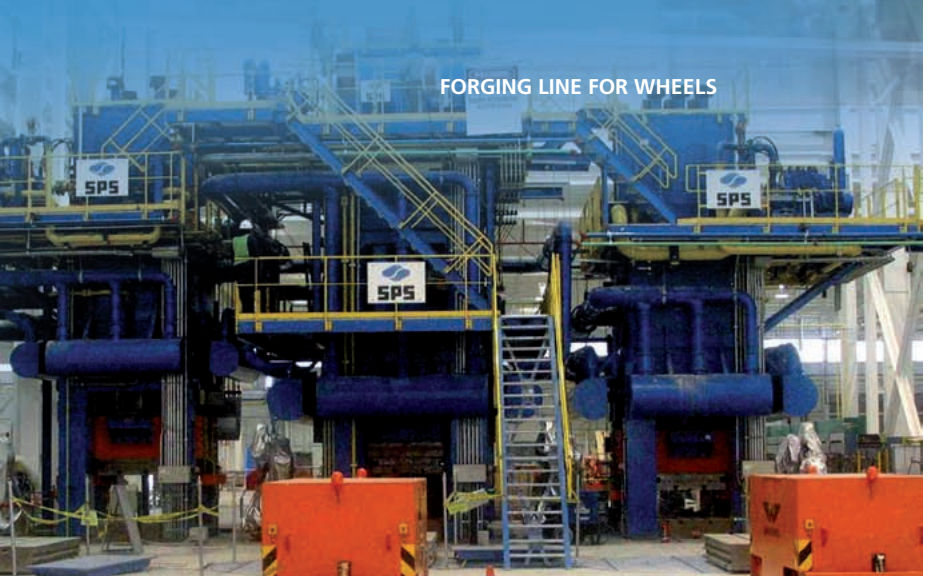
O-FORMING PRESS



CRIMPING PRESS



RUBBER PAD PRESS



FORGING LINE FOR WHEELS



Conceptual design

Design engineers, casters and machining under one roof

At Siempelkamp, designing a new press is a repetitive process in which engineers of different fields take part. A continuous dialogue between design engineering, engineering, foundry and production departments, close cooperation with the customer as well as the use of the latest simulation methods make sure that the optimal solution is found for each task.

Siempelkamp has the experience of more than 125 years in designing and building large presses. The engineers handle the large forces which occur during bending, straightening

and forging processes. For each new press they benefit from the background knowledge gained from previous comparable orders.

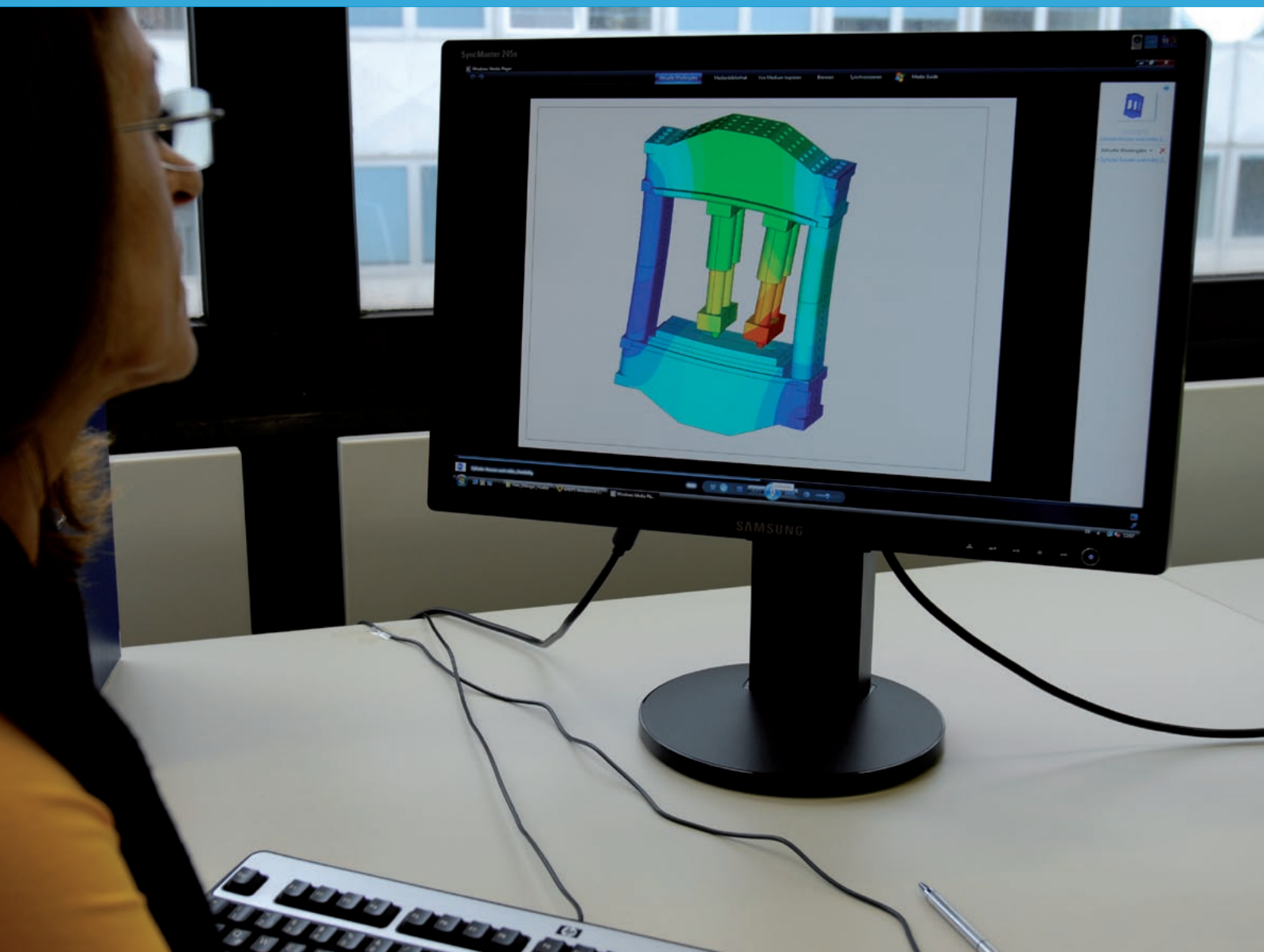
The result: Siempelkamp presses provide the security of meeting required specifications and the efficient operation for many decades.

Highly-stressed press components – a science in its own right

The development of a press, which has to accommodate enormous forces, makes special demands. On the one hand the components have to be sized adequately; on the other

hand the weight has to be kept within a limit.

With cast parts the design engineer can achieve the goal of optimally tailoring the shape of a component to its future function. To increase the load capacity of different areas, the designer can specifically add more material in some places and can take it away from other areas that are less stressed in order to reduce the weight of the component. Changes in sections can be streamlined to lower stress concentrations. The detailed knowledge of the used material is essential.



Nodular cast iron – the economic solution for large presses

For the thick-walled components of large presses, nodular cast iron has been found to be the best technical and most economic solution.

It offers many advantages:

- **Building 'to the point'**

Nodular cast iron with spheroidal graphite offers a large creative freedom for the design. It allows thin but nevertheless rugged structures (e.g., in the center of a casting) as well as massive structures for highly-stressed areas. Closed, high-strength systems can be economically implemented with nodular cast iron.

- **More strength for less money**

Compared to cast steel, structural elements with the same strength can be produced at about 10% less of the cost.

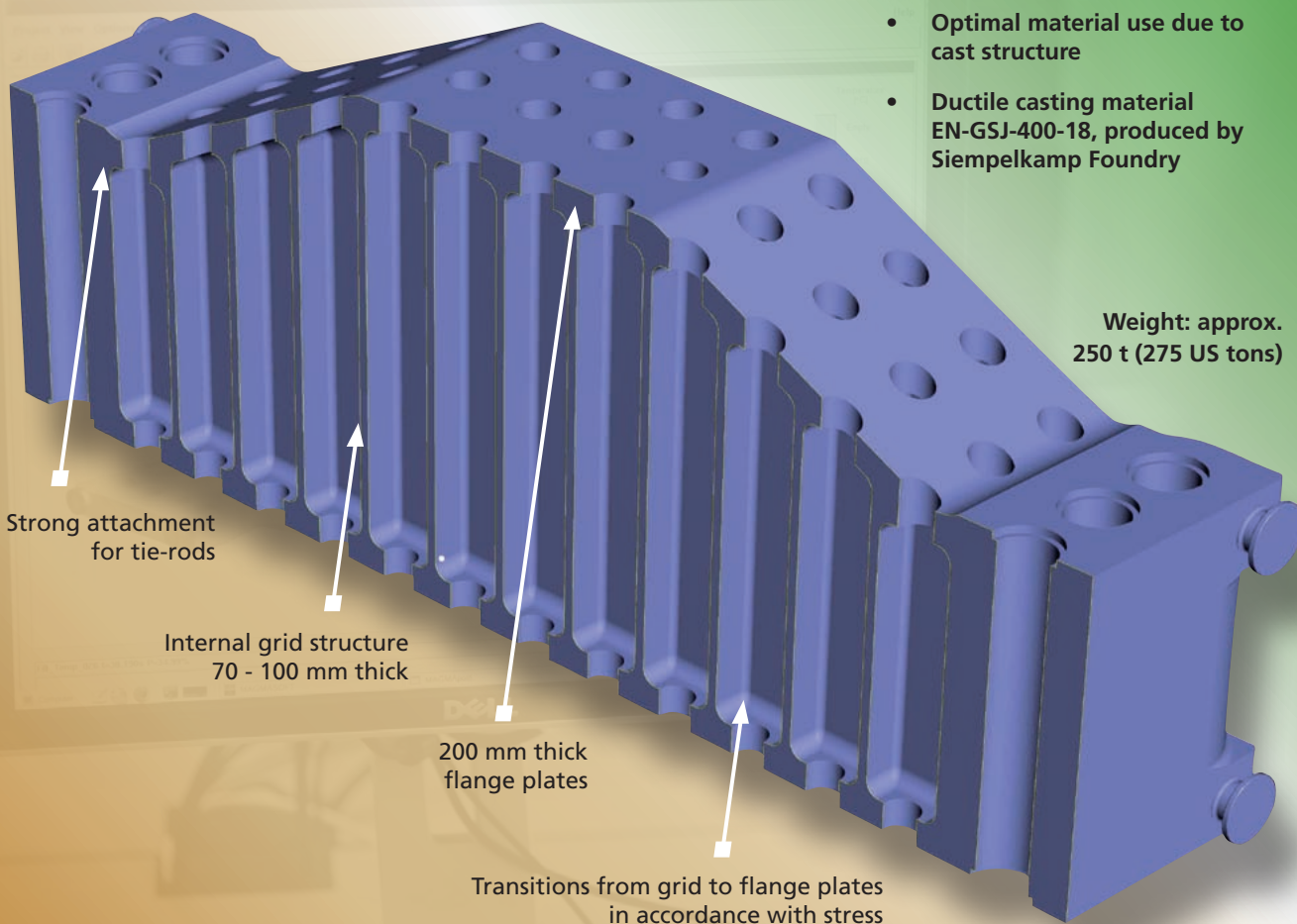
Contrary to cast steel, the melt of spheroidal graphite cast iron is characterized by the self-feeding behavior. Due to this fact, the dreaded shrinkage cavities known from cast steel will be avoided. This is a large advantage especially for component parts that are highly stressed in certain areas. The ferritic cast iron types used by Siempelkamp can accommodate the same forces and deformations as cast steel types.

- **Economics**

Because no heat treatment is necessary, nodular cast iron cuts down on one entire production step and saves energy. For weights of up to 300 t (331 US tons) this makes for considerable budget relief. The near-net-shape casting reduces the time needed for the mechanical machining. Also, machining becomes easier due to the graphite in the cast part.

Because of the high fracture toughness and fatigue strength as well as the good damping characteristics, nodular cast iron has an extremely long life cycle.

UPPER BOLSTER – INTERNAL STRUCTURE



Design engineering

The designing process – a continuous dialogue

For a typical project, the customer first defines the requirements: here, the press capacity and durability of the press take center stage.

Then, Siempelkamp deals with the project in several predetermined phases and always with multidisciplinary teams which are in a constant exchange of ideas.

The design phase

As one of the first steps, the engineers examine the feasibility of different options and develop the macro-structure of the press. This is a creative process during which the different manufacturing processes such as welding and casting are put to the test. If the decision goes towards 'casting', the design engineers examine cast steel as well as nodular cast iron.

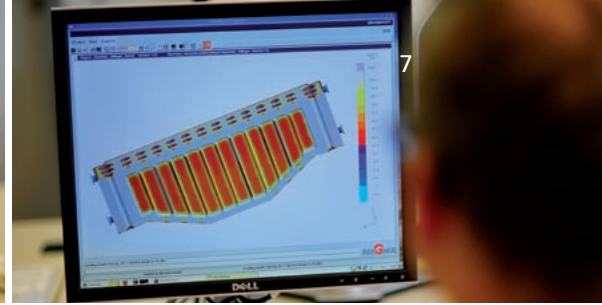
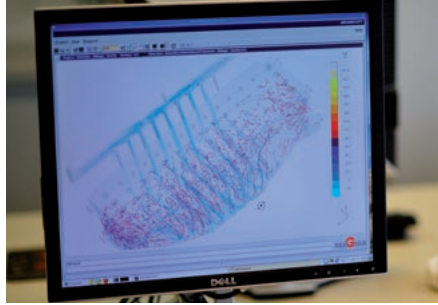
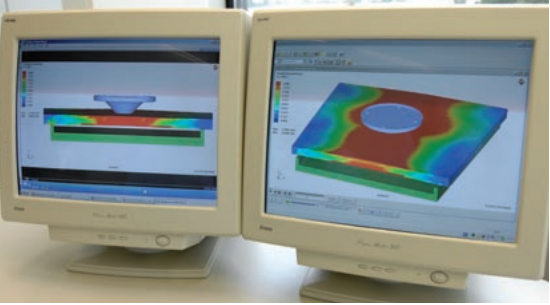
The result is a 3D model which is presented to the customer. Together with the customer, the requirements are then defined in detail.

Detailing, Engineering

During engineering, the model is tested under simulated working conditions with static and dynamic stresses. The Siempelkamp engineers model statics and dynamics according to the finite element method.



CUSTOMER
REQUIREMENTS



During this process multi-body contact systems are used to determine the interdependencies of the different components. Afterwards, the process kinematics, for example for movable stamps, is determined. If the result is not optimal the design is changed and newly tested.

At the end of this process the structure of the press is defined and the forces, power requirements, and dimensions of the components are known.

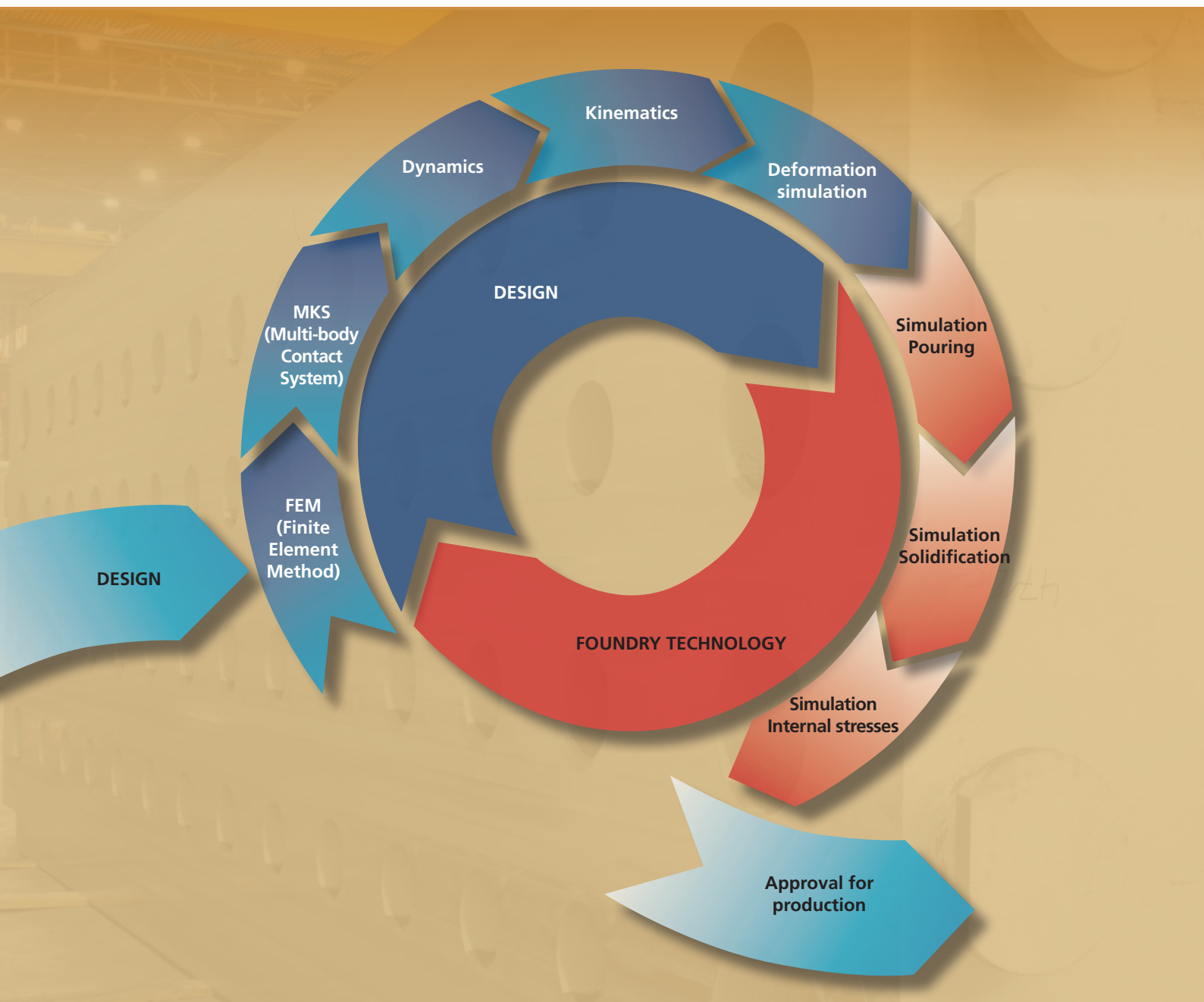
A continuous dialogue with the Foundry

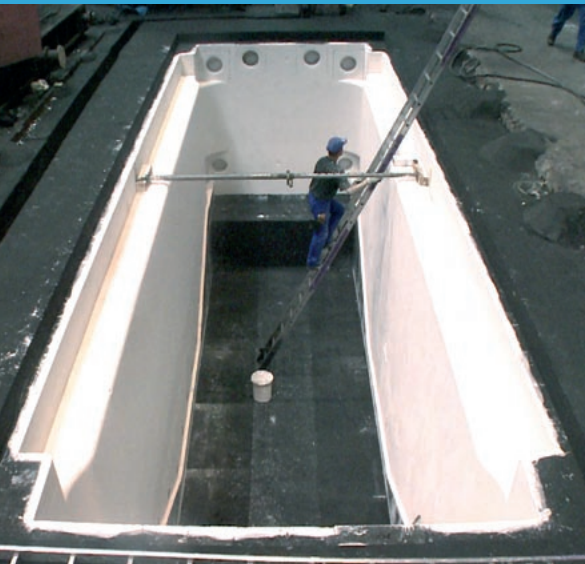
After the decision to cast the components has been made, the design engineers discuss the design with their colleagues in the foundry. What is the best pouring position? How are the casting cores arranged? Where will the cooling and degassing ducts be placed?

Thereupon, the casters simulate the production process from the pou-

ring to the solidification, to the calculation of the internal stresses in the finished casting. With in-house developed software, Siempelkamp transfers these results back to the finite element analysis. If necessary the process runs through another iteration in the design department.

The result: After several steps the prototype, with a functional and casting-suitable design which is optimized in regards to quality and costs, exists on screen.





The Foundry – specializing in nodular cast iron

The structural components, which are made of nodular cast iron, are cast in Siempelkamp's own foundry. The foundry, which is one of the largest hand-molding foundries in the world, specializes in castings made of nodular cast iron. Even for casting thick-walled components, the casters have specific metallurgic

know-how. This allows setting the optimal conditions for the solidification process during crystallization of the matrix and the graphite nodules. Only a few foundries worldwide possess this specific knowledge. Each year the foundry produces approx. 70,000 t (77,162 US tons) of molten iron; castings with weights of more

than 250 t (276 US tons) are the daily routine. The world record from 2009 proves the capacity of the foundry: For the new straightening press of Dillinger Hüttenwerke, Siempelkamp cast the upper bolster with a raw casting weight of 270 t (297 US tons) which corresponds to the weight of 200 medium-sized vehicles.



Production



The machine shop – designed for over-size parts

For the machining of the castings, Siempelkamp possesses a comprehensive facility with CNC-controlled large-scale machines including a portal machining center with a gantry design which can accommodate workpieces with a length of up to 22 m (72 ft) and a height of up to 6 m (20 ft). When machining the

bolster for the new straightening press for Dillinger Hüttenwerke, Siempelkamp achieves a tolerance of 0.1 mm for the parallelism and 0.1 mm for the evenness of the surfaces. The tolerance for the height dimension is 0.2 mm, the tolerance for the width dimension is 0.1 mm.



Quality assurance

Final inspection – Testing with certified quality

A characteristic of large, thick-walled workpieces is that certain areas have to be tested intensely – the highly stressed zones have to be absolutely free of weak points.

The quality control department completes all tests, ranging from the raw materials to the mechanical-technological as well as metallographic final inspections of the finished casting.

As a foundry laboratory accredited according to EN ISO/IEC 17025 it possesses a wide spectrum of test systems ranging from spectral analysis to non-destructive testing.







Siempelkamp location Krefeld, Germany

The Siempelkamp Group is a technology supplier operating internationally. The Group consists of three business units, the machinery and plants, the foundry, and the nuclear technology business units. As a systems supplier of presses and press li-

nes for the metal industry as well as complete plants for the wood-based products industry the company is internationally recognized.

The Group employs a total of 2,750 people.



Siempelkamp
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