Hydraulic Press Systems and Direct Processes
for Fiber-Reinforced Thermoplastics and Duroplastics
INNOVATION IS IN OUR GENES – SINCE 1873

The Beginnings
Dieffenbacher was founded in 1873 by Jakob Dieffenbacher as a small machine shop that initially performed all kinds of forging and fitting work to meet the regional demand. By the end of the 19th century, it had begun to make its first mass-produced products, including cash boxes, safes, stoves and ovens. Before the start of the First World War, his sons Wilhelm and Friedrich Dieffenbacher expanded the product range to include industrial goods. Driven by the flourishing agricultural industry, the company also manufactured hydraulic oil presses and fruit presses. After the First World War, the brothers went on to expand their oil press business. In the 1920s and 1930s, Dieffenbacher made a name for itself both at home and abroad by supplying entire plants for processing edible oils.

Between the Wars
The two brothers’ courage and ingenuity saved Dieffenbacher from ruin during the global economic crisis in 1928. By developing new products both before and after the Second World War, they laid the foundations for the success that Dieffenbacher currently enjoys. In 1928, it marketed its first hydraulic Bakelite press for the plastics industry. The 1930s saw the introduction of the first multi-level heater presses, which were used to produce wood-based panels, specifically plywood.

1873
Founded by Jakob Dieffenbacher

Around 1910
Hydraulic oil and fruit presses

1928
First hydraulic Bakelite press

1989
Dieffenbacher LFT Directline

1970
First SMC press with parallel motion system
The German Economic Miracle – Dieffenbacher

In the mid-1950s, the third generation of the family, Albert and Gerhard Dieffenbacher, took over the company. They soon celebrated their first successes with Bakelite presses and thermoplastic injection molding machines. They also brought their first metal presses for deep drawing and cold extrusion processes onto the market. Dieffenbacher built the first SMC press at the start of the 1960s, followed by the first large SMC press with a parallel motion system at the beginning of the 1970s. This period also saw a major boom in the wood sector. It was not only the company’s recently added range of particle board presses that conquered the export market, but also its plywood and veneer presses. Following concerns of over-dependency on suppliers, a number of auxiliary products were developed, such as coating, decorative press and laminating systems. Multi-level and single-level particle board presses became core Dieffenbacher products.

Becoming a Global Player

In 1989, Dieffenbacher unveiled its first LFT Directline, heralding a new era for the company. The great-grandson of Jacob Dieffenbacher, Wolf-Gerd Dieffenbacher, turned the global press manufacturer into an international plant construction company.

Dieffenbacher completed its product range by forming new companies and performing strategic takeovers. Since then, the company has successfully supplied both complete plants for producing wood-based panels and complete production lines for manufacturing components made from fiber-reinforced plastics.

2010 D-SMC system

2007 COMPRESS PLUS press systems

2013 AVK Innovation Award for Preform Center

2012 Press system and Preform Center

2015 Wet molding line

Acquisition of Fiberforge tape layup technology
COMPLETE PLANTS
RESEARCH AND DEVELOPMENT
to Reduce Process Costs

Investing heavily in research and development, we strive to continually develop new and innovative solutions when it comes to the design and production of presses or complete production plants. Each supplied plant adds valuable experience to the further development of our proven technologies.

In this respect, our central product development department works closely with research institutions and customers in order to test alternative materials, research new processes, and analyze and incorporate technologies from other industries. These are the principles that form the basis of our customers’ trust all over the world.

Our self-developed process technologies—especially the direct processes for thermoplastic and duroplastic fiber composites—combine the highest level of efficiency with far-reaching flexibility during material selection.

As a technology leader, we believe our challenge lies in the development of new efficient processes.

REDUCTION OF PROCESS COSTS
- Energy efficiency
- Automation
- Cost reduction through mass production
- Research and development
  Continuous development of innovative solutions

Dieffenbacher Technical Center
SYSTEM EXPERTISE

Custom-Designed System Solutions

Future-Oriented Technologies
The basis for our success in plant engineering is a competent and imaginative engineering team, our decades of experience in plant engineering, and our design-approved system components that have proven successful during production.

The vast customer base working with automated press technology is testimony to our leading position on the market. Our engineers plan and adapt processes and production procedures to meet customers’ needs.

Our range of services comprises press systems and installations in the areas of CFK, SMC, GMT and LFT, such as process technologies for manufacturing fiber-reinforced components including finish-machining and direct technologies, as well as complete system solutions with automation.

Such a range allows us to offer future-oriented technologies and comprehensive services for manufacturing molded parts made from fiber composites and for molding both thermoplastics and duroplastics—all from a single source.

ADVANTAGES

- Custom-designed complete solutions through automation
- Reliable mass production
- Demand-oriented project planning and consulting service
AUTOMATION
Individual Automated Solutions

Engineering and Project Management
We always focus on ensuring that our solution is as efficient as possible when it comes to the customer’s process-related requirements.

Dieffenbacher develops individual and efficient automation concepts according to the needs of the customer.

Our specialists provide automation solutions for the provision of semi-finished products, the complete automation of the press environment, and customer-specific finish-machining of the finished product. Detailed project analysis, a demand-oriented project planning service and individual production support complete the portfolio.

ADVANTAGES
- Greater efficiency through process rationalization
- Greater flexibility through modular systems
- Optimum quality through reproducible manufacturing processes
- Enhanced ability to compete through technological advantage
Presses for Fiber-Reinforced Plastics

Dieffenbacher supplies presses in standard specification or as high-accuracy presses with active, servo-controlled parallel motion systems. The design of the press is fully in line with the requirements for fiber-reinforced plastics. Depending on the requirements concerning parts geometry, the specified tolerances and the requirements for the surface quality (Class A), Dieffenbacher is able to supply a suitable press system with process-oriented control.

A proven design principle, the use of field-tested standard components and a powerful global service network represent the highest level of reliability.

COMPRESS LITE - The Compact Press Series

The LITE Press Concept
The press concept, which is available in an upstroke and short-stroke design, boasts a low overall height and an energy-saving drive. The bevel deflection line, which provides an even bend progression of the upper and lower die, and high-precision parallel motion behavior ensure a consistent component thickness and increase the quality of the component.

The exceptional ease of access on all four sides of the press enables rapid, flexible die changes using driving tables as well as optimum clearance for automation tasks. The COMPRESS LITE comes with pressing forces of between 2500 and 36,000 kN. Systems with pressing forces of 10,000 kN or higher are also available with integrated driving tables and die-changing systems.

FEATURES
- Regulated speed profile
- Controlled roller guides
- A regulated opening process that protects components
- Process-oriented control
- Ecological production processes

ADVANTAGES OF COMPRESS LITE
- High level of energy efficiency, low operating costs
- Easy access on four sides – ideal for automation tasks
- Flow control possible
- Reduced overall height for easy installation
COMPRESS ECO - The Efficient Press Series

The ECO Press Concept
The individually removable press concept and the ability to be flexibly adapted to different component sizes make the COMPRESS ECO highly efficient – and therefore an attractive solution.

The series is supplied with pressing forces of between 4000 and 25,000 kN as standard. Systems with pressing forces of 10,000 kN or higher can also be ordered with a regulated closing unit and an actively controlled parallel motion system for the ram.

COMPRESS PLUS - The Energy-Saving Press Series

The PLUS Press Concept
The COMPRESS PLUS press concept—which boasts energy-saving consumption levels and high speeds—represents an attractive solution for increasing efficiency. In addition, the press delivers a high production output and an extremely high level of availability. A proven design, sophisticated proportional valve technology and process-optimized control ensure reliable production.

The COMPRESS PLUS is supplied with pressing forces of between 15,000 and 50,000 kN.

ADVANTAGES OF COMPRESS ECO
- Attractive price/performance ratio
- Modular system in needs-oriented versions

ADVANTAGES OF COMPRESS PLUS
- Energy requirement reduced by 50% and higher thanks to an innovative closing concept
- A high level of precision for manufacturing components of the highest quality
TECHNOLOGIES AND PROCESSES
In the last few years, high-performance fiber composites have become increasingly important. Statutory requirements, high safety standards and rising energy costs make the use of fiber composites an essential requirement. For this reason, there remains a growing need for innovative, energy-efficient developments in lightweight construction.

Dieffenbacher has developed demand-oriented processes for duroplastics and thermoplastics that meet the requirements for a high level of automation, efficiency and production readiness. These processes represent the company’s technological leadership in lightweight construction.

In the field of carbon-fiber-reinforced plastics (CFRP), Dieffenbacher offers the HP-RTM process as a completely automated production line including Preform Center. For predominantly two-and-a-half-dimensional components, wet molding technology rounds off the product portfolio as a more efficient alternative.

In the area of SMC and LFT, Dieffenbacher has developed pioneering direct processes that enable semi-finished products to be manufactured and immediately processed further.

Dieffenbacher is able to meet requirements for the optimized and efficient use of different materials by providing automated tape layup solutions in tailored LFT-D as well as completely automated hybrid lines.

**Processes for Producing Lightweight Components**

**Processes for Duroplastic and Thermoplastic Processes**

- HP-RTM
- Hybrid technology
- Wet molding processes
- SMC and D-SMC
- LFT-D and tailored LFT-D
**HP-RTM**

High-Pressure Resin Transfer Molding

**Turnkey Production Line For Large-Scale Production**

Efficiency, process reliability and reproducibility are the requirements when it comes to the production of components made from carbon-fiber-reinforced plastics.

Dieffenbacher has developed a high-performance, fully automated HP-RTM production line. Successful cooperation with Krauss Maffei and the Fraunhofer Institute for Chemical Technology has enabled turnkey systems from a single source to be supplied around the world for high-pressure resin-injection processes.

Due to its high dynamic strength, the high-pressure resin-injection process known as high-pressure resin transfer molding (HP-RTM) has assumed a key role in structural components and in outer-skin applications.

The HP-RTM line comprises three automated system units, which can be independently or continuously implemented on the line.

- **Preform Center**
- **Press and injection unit**
- **Finish-machining unit**

**ADVANTAGES**

- Weight reduction of up to 50% compared to steel
- Best possible component quality for impregnation, surface and component tolerances
- Short cycle times via automation and use of highly reactive resin systems
- Mass production with continuous process control
Preform Center
The Preform Center is a fully automated production line for producing custom-designed, dimensionally stable preforms from dry fabrics/textiles comprising carbon, glass or aramid fibers.

This process involves cutting the fiber material, incorporating the cuts and applying the binder material, processing from 2D into a dimensionally stable 3D preform, and subsequent storage in load carriers.

The Preform Center is offered as an option, is available with in-line quality control, and can be configured for large or small volumes.

Press and Injection Unit
Dieffenbacher offers modern and flexible press concepts with parallel motion regulation for large-scale production, the design of which meets the requirements for fiber-reinforced plastics. Rationalization and reliable reproducibility are guaranteed through the use of state-of-the-art gripper technology. An innovative dosing system with vacuum-supported tank system and energy-efficient high-precision temperature control ensure process stability and consistently high product quality.

Finish-machining
Flexible finish-machining of the component is carried out in robot-controlled machining centers featuring die cooling systems and die cleaning systems.

ADVANTAGES
- Modular demand-oriented structure
- Short cycle times of under three minutes, depending on the component
- Reliable handling and visualization
- Reproducibility
- Cost reduction through efficient and optimized use of materials
SMC DURONLINE
Sheet Molding Compound

Modern System Concept Using SMC Technology
SMC is an excellent material for manufacturing automotive parts with excellent surface quality. Other important applications are found in the electronics, construction and rail vehicle industries, as well as being used as a replacement for steel and aluminum in structural components.

Dieffenbacher supplies modern press technologies as well as fully automated systems, including finish-machining for SMC. The key component of Duroline is the high-speed high-precision press with active parallel motion regulation.

System components for supplying semi-finished products—such as cutting and packing tools—as well as automation for loading and unloading complete the system. The system can be optionally expanded with the addition of a cooling station, conveyor belts and protective devices.

The higher-level production line control system ensures smooth operation of the plants and complete process monitoring as well as quality assurance.

ADVANTAGES OF SMC
- Fully automated line to ensure reproducible parts quality
- Near-unmanned, low-emission production
- Reduction of rework and scrap by means of high-precision component production

SMC line
Truck bumper system
Trunk lid
SMC DIRECTLINE
Sheet Molding Compound

The advanced D-SMC direct process opens up new possibilities for the use of duroplastic composites in the lightweight construction sector of the automotive industry. Direct compounding technology bypasses the costly maturation, storage and logistics steps required for previous SMC semi-finished products. The controlled, visualized process and the direct further processing procedure for the semi-finished product ensure uniform, reproducible quality.

Using the direct process for SMC, the SMC semi-finished product is manufactured in the forming press immediately prior to processing. In accordance with individual formulas, a compounder is used to form resins, fillers and glass fibers into flat material, which can then be processed in the same way as conventional SMC semi-finished products. An integrated SMC cutting system produces stacks of sheets that are automatically fed to the press die.

ADVANTAGES

- Just-in-time production of the semi-finished product saves on storage, transportation and energy costs
- Uniform “class A” quality
- Continuous process with a high degree of automation, from the compound to the finished component
- Individual series sizes and large range of applications
Production Line for Long-Fiber-Reinforced Thermoplastics

Dieffenbacher LFT-D technology boasts an especially high level of efficiency. At the same time, it can be used to flexibly adapt materials to meet component requirements. For example, LFT-D can be used as an alternative to steel and aluminum for structural and semi-structural components in the automotive industry.

In the extrusion/flow process, a plastic compound is turned into the finished component by means of a high-precision hydraulic press. The compound consists of glass, synthetic or natural fibers as well as plastics such as PP, PA or PET. Optionally, recycled material in the form of granules or chips can also be incorporated inline. Double-belt loading allows for complex layer formations or for two presses to be loaded.

The turnkey production cell is supplied with superimposed line control and integrated quality assurance.

ADVANTAGES

- High level of efficiency through direct processing of semi-finished product
- Faster die and material changes
- High level of productivity through short cycle times
- Excellent recyclability
- High-level component characteristics through preservation of long fibers greater than 20 mm
Tailored LFT-D for Local Reinforcement

In the tailored LFT-D process, additional local reinforcing materials—in combination with the LFT-D material—are placed in the parts of the component that require increased rigidity or toughness.

In order to implement this process, Dieffenbacher offers the Fiberforge Relay Station. Using this station in parallel with the LFT-D plant activates a tape-fiber placement process. The uni-directional fiber tapes consist of glass or carbon fibers embedded in a matrix of thermoplastics and are used as roll material.

The entire procedure for processing the uni-directional fiber tapes is integrated into the LFT-D system technology in a fully automated way.

By incorporating the two materials, the advantages of the high tensile strength and structural rigidity of the fiber tapes combine very well with the advantages of the LFT-D mass. The plastic components therefore meet the requirements for crash performance.

In addition to the high degree of flexibility when it comes to material combinations, thermoplastics with endless fiber reinforcement also offer a cost-effective lightweight construction alternative.

ADVANTAGES

- Fully automated concept for mass production
- High strength properties and high energy absorption capacity
- Reduced weight due to local reinforcement in structural and semi-structural applications
Dieffenbacher offers the thermosetting wet molding process for components with predominantly two and a half dimensional character. This technology is an economical alternative to the HP-RTM process. As a system provider Dieffenbacher offers the entire fully automated plant technology.

**WET MOLDING PROCESS**
Alternative Process for CFRP Mass Production

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**HYBRIDTECHNOLOGY**
For the optimized use of different materials

The Dieffenbacher production line for hybrid components allows the combination of different materials such as various fiber-reinforced plastics or the combination of metal and plastic. With the hybrid technology, parts can be selectively reinforced, hence achieving a high strength at a reduced weight while also saving material costs. As a system provider Dieffenbacher offers the entire fully automated plant technology.

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**VORTEILE**
- Short cycle times due to resin application outside the press
- High level of productivity by multiple insertion of the press

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**VORTEILE**
- High profitability due to short cycle times and material cost savings
- High level of productivity by multiple insertion of the press
SERVICE AND MODERNIZATION
Life-Long Responsibility for Your Plant

Our quick and responsive service centers in Europe, North and South America, South East Asia and China provide an outstanding level of service. Whether you require quick corrective action, state-of-the-art original spare parts or modernization work to increase capacity, a contact person from a Dieffenbacher service center will never be far away. This is true of both our own plants and the plants supplied by our subsidiaries.

24HOUR ONLINE SERVICE
■ Round-the-clock support through online connection to our specialists in the service center.

MAINTENANCE AND SPARE PARTS
■ Rapid supply of original spare parts and services by service companies in the key market regions.

MODERNIZATION AND OPTIMIZATION
■ Whether you require trouble-shooting, regular maintenance, a supply of spare parts or plant modernization work, our global service network will offer you continuous support even after you have purchased a plant.

TRAINING
■ Training in typical plant control systems, regulation concepts and maintenance processes.