

MAXIMATOR®

Maximum Pressure.



High Pressure Technology • Testing Equipment
Hydraulics • Pneumatics

How do we push the realms
of possibility?

» With testing and production
systems up to 20,000 bar.



High pressure with system.



Whether it's automobiles, commercial vehicles, heavy duty diesels or in aviation - Maximator sets global standards in the high-tech industry with its testing and production technology.

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Your partner for high-pressure and testing technology

MAXIMATOR GmbH successfully develops complex systems in high-pressure and testing technology, hydraulics and pneumatics and has been the market leader in these segments for decades. As a specialist in high pressure technology up to 20,000 bar, we pursue the aim of optimally supporting each and every customer with our products to develop business potential. With our top services, we are a partner to

well-known companies in the automobile and supplying industry, as well as the chemicals, plastic, oil and gas industry. We give professional advice, plan projects and supply testing and manufacturing systems. We also develop special solutions precisely customised to the requirements of manufacturers.

Application-oriented concepts

Maximator has many years of experience with components, power units and systems. The testing and production technologies we offer include autofrettage, pressure fatigue tests, leak tests and testing technologies for plastic components and hydrogen applications. We test hoses, pipes, filters and containers made of metal, plastic or ceramic, among others. In the vehicle sector we process special components in diesel injection technology and other technical components. With our innovative testing and production technologies as well as optimised

project processes, we offer tailor-made solutions to all testing work. We have our own test laboratories where it is possible to test the product before the beginning of the project and take over exceptional individual and series testing. All tests, records, documentation of test results and test data administration take place according to the latest standards.

Overview of competencies



In order to solve your testing challenges optimally and efficiently, we guide you with our engineering know-how from preparation of the machine specifications through to commissioning and staff training.

- **Analysis and feasibility studies:**

We analyse your product and the test requirements in detail.

- **Research and development:**

We develop customised solutions for pressure generation and to adapt your test specimens. Our testing centres guarantee the highest, constant quality.

- **High pressure and testing technology:**

More than 70 engineers, technicians and programmers support us for maximum professionalism.

- **Production:**

More than 140 specialists from mechanical processing, electrics and mechatronics have just one aim: systems with the highest quality.

- **Service:**

We test your products in our service centers. And we are always there to help you in operating your systems with more than 20 service professionals.



How do you prevent a 2 kilo-gram injector from bringing 500,000 tons to a standstill?

» With autofrettage.

Autofrettage is a manufacturing process for highly pressurised components. Industry branches such as shipping, aviation or heavy vehicle constructions use the innovative technology to significantly increase the service life of high pressure components and therefore reduce costs.

Effect of the technology

Components made of ductile steel are given fatigue strength with autofrettage without needing structural or material customisations. Workpieces are subjected to high pressure of up to 20,000 bar once only. Internal stresses develop between the inner and outer component walls that make the structure more resilient and durable. Autofrettaged components can withstand high operating pressure and fatigue stress reversals.

Our autofrettage solutions

The advantage of Maximator systems is in effective autofrettage in which a minimum number of components are subjected to high pressure. This means you achieve minimum setup and cycle times, maximum systems availability and lower costs for wear parts.

We offer autofrettage technologies for prototypes and series products. Our systems for prototypes are used in the development area. The autofrettage pressure is generated using a MAXIMATOR pressure intensifier. Using hydraulically driven proportional valves, the clamping pressures are quickly and individually adapted to the inner pressure of the workpiece. This means there is less strain on components, damages are avoided and productivity maximised.

The autofrettage systems for series products are designed for the automatic production process. Systems are setup manually or using a handling module or robot. Processing the workpieces takes place fully automatically. Autofrettage pressures of up to 20,000 bar can be reliably achieved.



Maximator systems can autofrettage:

- Diesel injection technology components (common rails, injection nozzles, pump housings, injection nozzle holders and diesel lines)
- High pressure technology components (pipes, fittings, components and high pressure pumps etc.)
- Inner high pressure moulding components
- Water jet technology components

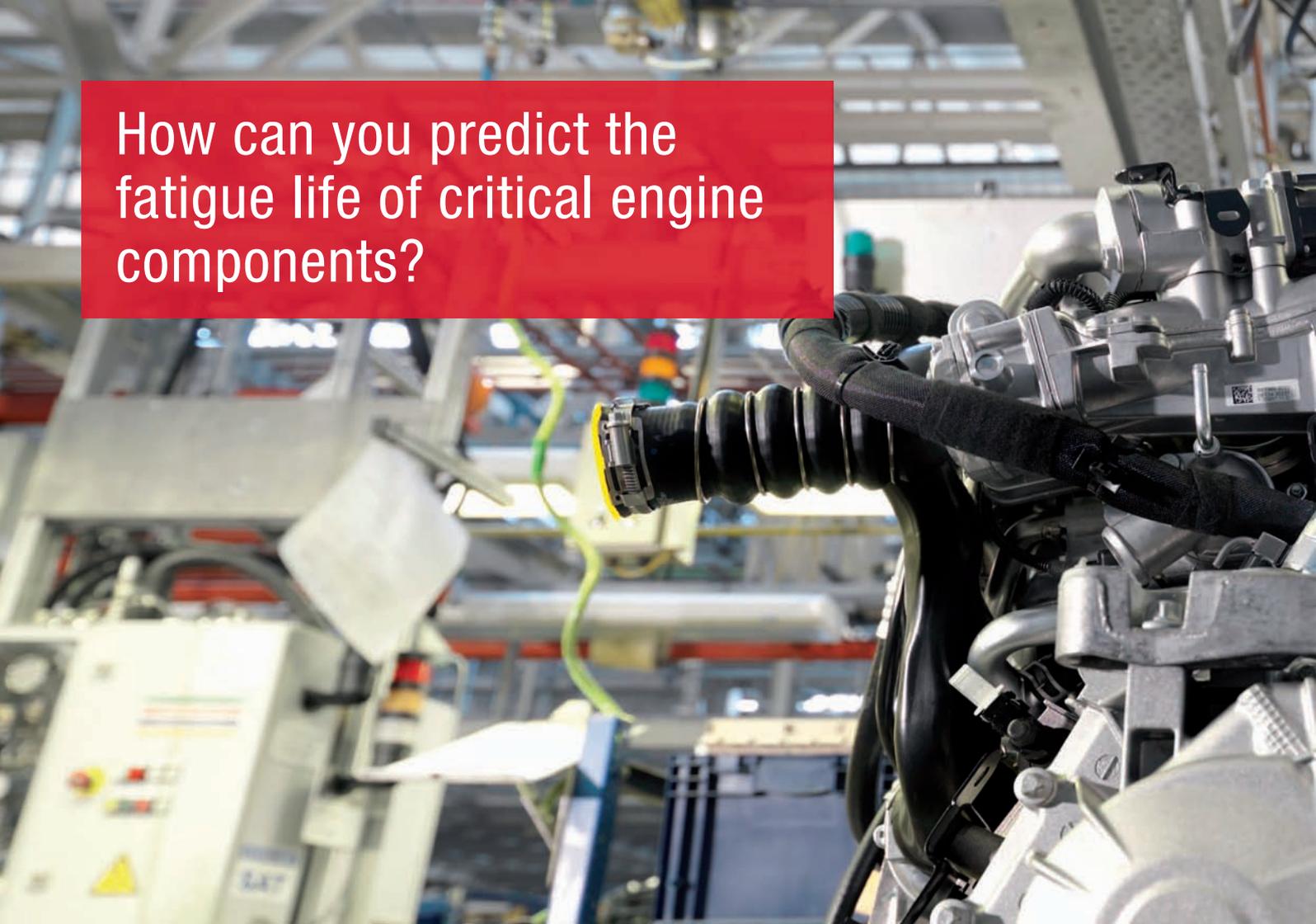
Application areas in the process

- Autofrettage system for prototypes - in development or sampling for research and development, individual component autofrettage and small batches
- System for series products – in production

Performance features:

- Short setup times
- Optimised cycle times
- High system availability
- High process reliability
- Automated autofrettage process
- Proportional clamping technology
- User-friendly device change
- Generation of autofrettage pressures up to 20,000 bar





How can you predict the fatigue life of critical engine components?

» With pressure fatigue testing technology.

With the pressure fatigue testing conducted on MAXIMATOR's highly engineered impulse test benches the fatigue strength of materials and components is established under realistic conditions. In the automobile industry and in mechanical engineering, they allow the initial and calculation concepts (FEA and simulation) to be reviewed to optimise the construction and design of components in diesel injection technology and to validate it.

Effect of the technology

Pressure fatigue test benches are used to evaluate the failure mechanics of pressurised hollow bodies. A hydraulically driven pressure intensifier generates a sinus-shaped pressure wave together with a highly dynamic servo valve. The failures of test specimens under load show the potential weak points of components with respect to material and design.

Our pressure fatigue technology

MAXIMATOR pressure fatigue testing systems fulfil a variety of requirements and achieve high precision test results. Fully programmable sinus curves can be tested as load spectra as well as individual tests.

The fatigue pressure reaches up to 6,000 bar at a maximum test frequency depending on the component volumes and is precisely controlled via a digital signal processor. Operating load real-time tests for practical examination of the pressure strength can also be performed with our testing systems. The intelligent testing software documents up to 24 tested components at the same time. The system then determines statistical data based on normal distribution.

The test benches include an integrated telemetry module and can automatically send a message by text in the event of test sample failure, fault, or unscheduled test rig shutdown, so that an operator does not need to be present 24/7. We also offer the option of remote monitoring (telemonitoring), with which several users can follow the test directly at their PC.



Maximator systems test:

- Diesel injection technology components (rails, injection nozzles, pump housings, injection nozzle holders and lines)
- High pressure technology components (pipes and fittings etc.)
- Pressure sensors
- Pressurised components for industrial applications (e.g. on hydraulic quick clamp jaws for processing centres)

Performance features:

- High system availability
- Very high control accuracy
- Test statistics based on normal distribution
- Fully programmable sinus, trapezoid and triangle curves
- Pulse pressure up to 6,000 bar
- Energy-efficient system design
- Redundant in situ high pressure measurement and monitoring





How do you ensure your leak-tight parts are truly sealed?

» With leak testing technology.

Pressure and leak tests are efficient methods for analysing the functional and tightness properties of pressurized components. Manufacturers in the automobile industry, mechanical engineering and chemical industry determine product and component characteristics with this method.

Effect of the technology

A basic requirement for the function of many technical components is their tightness. With professional leak tests, hoses, pipes, containers, cooling and air-conditioning systems, fuel and injection systems, filters and hydraulic components are tested for leakage. Calculated tightness values can be checked directly on the component under almost realistic conditions with this method.

Our leak testing technology

All MAXIMATOR leak test benches are specially developed and built according to customer requirements for the needs of the component. This means that different test methods such as pressure drop measurement, differential pressure testing or the use of special test gases or liquids can be applied.

In coordination with the customer, the procedure is selected that implements suitable test specimen recording including the necessary handling and the collection and processing of process parameters. The traceability of the tests is a fundamental part of testing. The test results are documented by a reliable process using a barcode, DMC or other traceability concepts.



Maximator systems test:

- Pressurised components
- High pressure technology components (pipes and fittings etc.)
- Hoses
- Diesel injection components

Test methods

- Verification procedure with test gas (H₂, SF₆, N₂O, N₂)
- Verification using pressure drop measurement
- Leak test with pressure compensation and gas volume measurement

Performance features:

- Short setup times
- Short cycle times
- High system availability
- Automated test processes





How can cars be more fuel efficient?

» With high pressure tests on plastic components.

At MAXIMATOR qualified test procedures for plastic components pave the way for safe basis innovations in vehicle construction. Special test systems make load tests on these components possible in running production operations, which allow the vehicle weight to be reduced and contribute to savings in fuel.

Effect of the technology

Tests on plastic components provide information on whether the components fulfil the planned functions. Different testing methods such as burst pressure testing, leak tests and pressure load change testing are parts of suitability testing and quality monitoring in ongoing production. In order to achieve realistic component reactions, many tests take place under climate conditions (-40°C to +180°C) and using various test media (e.g. gases, oil, water-glycol mixture).

Our test solutions for plastic components

Maximator module test benches allow cost-efficient and flexible tests on plastic components. The systems unite the test chamber, pressure generation and control. For heavy burst pressure test, we equip our systems with an additional test chamber lining.

The module test benches are fitted out with a pressure intensifier or with Maximator high pressure pumps; both of which are operated with compressed air. We achieve test pressures with very high repetition accuracy.

The drive control of the pumps or the pressure intensifier drive is controlled with sequentially controlled proportional pressure control valves. Different load conditions of the components being tested can be practically adjusted, automatically shut down and documented with freely programmable test stages.



Maximator systems test

- pressurised plastic components in the automotive field:
 - Cooling water system
 - Pressure compensation tank
 - Suction module
 - Pipes and lines in the motor
 - Filter housing

Performance features

- Customised concepts
- Tests according to DIN norms or specific customer requirements
- Pressure load change test with different liquids/gases
- Modular setup with temperature chamber (up to 300°C) or climate chamber (-40°C - +180°C)
- Safety: test chambers integrated in closed „containers“
- Backfire tests
- Flow measurements
- Pressure fatigue tests
- Burst pressure tests
- Leak tests



How does hydrogen technology become as certain as the next gasoline price increase?

» With testing technology for H₂ applications.

Precise tests on components carrying hydrogen make a valuable contribution to environmentally-friendly innovations in vehicle construction. Tested components that fulfil the legal specifications are important elements in the development of future technologies for automobile manufacturers and their suppliers.

Effect of the technology

Hydrogen counts as the energy carrier for the future, which is already being used today as a fuel for fuel cell-operated vehicles. The hydrogen is either stored cryogenically in liquid form (LH₂, liquid H₂) or compressed under high pressure at 350 bar or 700 bar (CGH₂, Compressed Gaseous Hydrogen) respectively. Due to its extremely good diffusion and reaction capacity, hydrogen places significant demands on this technology's pressure components. The high pressure reservoirs, tank valves, filling nozzles, connection elements and safety and pressure

control valves used must be pressure resistant and leak-proof. In order to verify these properties in the development phase and also in subsequent series production, reliable testing and handling technology plays a key role. Maximator faces this challenge with innovative high pressure testing technology.

Our technology solutions for components carrying hydrogen

MAXIMATOR testing systems fulfil all prerequisites to serve all legal test requirements for innovative fuel cell vehicles. We offer test-related solutions for all components carrying hydrogen in the automobile industry. This includes the strength test, leak test, verification of endurance and the burst test.

Hydrogen-related applications generally require exact dosing. We offer automobile manufacturers and supplying companies reliable gas control technology for this application area.



Maximator systems enable:

- All tests of high pressure carrying components in hydrogen mobility such as pressure reservoirs, tank valves, filling nozzles, pressure control valves, safety valves and pipelines etc.
- Compression and „handling“ of hydrogen with high pressure carrying components that fulfil the criterion „hydrogen resistant“ with respect to the material suitability

Performance features

- Strength tests
- Leak tests
- Verification of endurance
- Burst tests



You will find clear processes with us.

Individual development

- Review of various solution approaches for feasibility and suitability
- Practical testing of the test and production systems in our test centres

» Contact

Analysis of your task

- Establishment of needs: process integrated or stand-alone
- Determination of criteria for high pressure generation, clamping, adapting and handling the test specimen

» Research

» Engineering

Your test solution

- Realisation of individual test procedures
- Constructional implementation by experts for hydraulics and pneumatics, mechanics, control and regulation technology and PC programming

And we are there to help - wherever you may be.

As a market leader in the area of high pressure technology up to 20,000 bar, we realize complex testing and production systems for renowned manufacturers. We design individual system solutions using our many years of experience and development expertise. You are welcome to contact us with questions on testing tasks in your company.

Unique cooperation: Maximator processes

Our testing and production technologies as well as our optimized project sequences offer you fundamental advantages in the realization of your testing or production tasks. As a specialist in the area of high pressure technology with our own test laboratories, we enable your product to be tested from the beginning of a project and the data gained forms the baseline for the development of your testing system.

Fast tracks: Maximator worldwide

Benefit from our know-how in the development, project planning and manufacture of special testing and production systems for a variety of application areas - and all on a global scale.

With our international partner companies, experienced specialists in high pressure technology are always available to assist you. We have compiled more detailed contact information on our international partners on our website at: www.maximator.de/worldwide+distribution

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Installation of your system

- Checking and optimisation of each individual production parameter
- System operator and maintenance personnel training

» Production

» Commissioning

» Service

Manufacture of your system

- Mechanical processing of high pressure components and system assembly
- Programming and setup of the system by the interdisciplinary engineering team

Optimum system availability

- More than 20 service professionals
- Worldwide services: maintenance, inspection, retrofitting, repair and supply with original spare parts



» Visit our website:
www.maximator.de