guilty generally applies. However, shifting the burden of proof reverses this obligation to produce evidence, so the accused must prove their innocence if they have acted negligently.

Application of the standards is considered the state of the art in our case. Deviating from these standards shifts the burden of proof in case of damage. This burden of proof means that evidence must be provided, showing that the implementation was equal to or better than the standard. Based on my many years of practical experience, I can only recommend to you: Read the manual!

Safety yes – headaches no

Machinery and facility planners who have come into contact with the topic of functional safety are sure to have realised just how complex and multifaceted it is. Operators and planners of protective devices bear tremendous responsibility for the risk of damage. Needing to procure components that are safe, they are faced by a mountain of figures and formulas. In the end, they still don't know whether everything was calculated correctly.

JUMO SAFETY PERFORMANCE shows that there is an easier way. All JUMO products and services for SIL and PL are combined under this brand name. With JUMO SAFETY PERFORMANCE, we offer a certified, compact system for functional safety in accordance with SIL and PL that has been established for many years. No calculations are necessary. It is also suitable for ATEX/IECEx/EAC applications and the Machinery Directive.

JUMO guarantees safety in compliance with standards and the law. In short: It is a complete safety system consisting of a sensor, logic and relay output to operate the actuator – from one source.

The application of the technical rules and standards presented above, in combination with the overall system certification of JSP for pump monitoring, can lead to a different kind of error analysis. Up to 45 % of systematic and systemic errors can be prevented by this complete solution.

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Growing market for container pressure testing pumps

The market for pressure vessels for energy storage and for the transport and utilization of industrial gases is growing, mainly due to the desire to use hydrogen as a fuel.

KAMAT has recently developed market-ready and standardized pump systems that are specially adapted to the testing of pressure vessels and take into account all aspects of this task. This includes the pressure test itself, but also the temperature control of the test medium and the modeling of test and pressure curves.

The task: Vessels from small to very large volumes must be tested in three categories. Using water as the test medium, also with anti-corrosion additives, pressure vessels are 1. burst tested, 2. cycled and 3. subjected to pressure retention tests. Until now, testing options for large vessels have been limited. Pneumatic or hydraulic intensifier pumps are often used when high pressure is required. However, the flow rates of these pumps are limited, which means that the desired cycle times cannot be achieved or that life tests of 20,000 cycles take too long. Other pump technologies must be used. Plunger pumps are the first choice because they can provide both high pressures and high flow rates. KAMAT pumps operate at pressures of up to 3500 bar and flow rates in excess of 280 m³/h.

Fig. 1: Valve arrangement of a combined test system

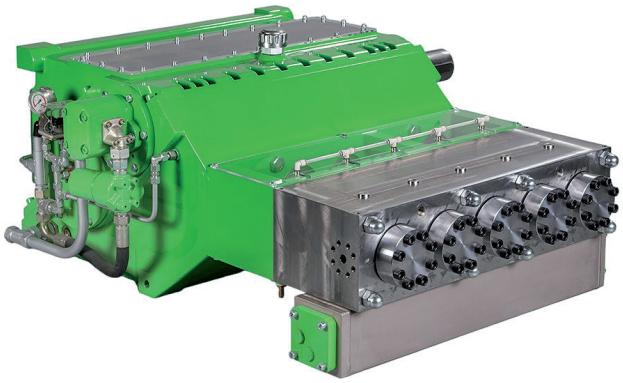

Fig. 2: Suitable for big vessel testing: KAMAT high-pressure pump of type K50018A-3G

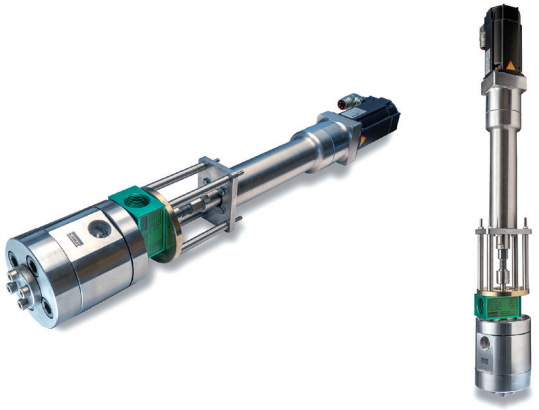

Fig. 3: KAMAT control throttle 3000 bar for modulation of cycling test curves

When designing a pump system, it is important to consider that, depending on the size of the tank, 1-10 cycles per minute are performed when pressurizing a tank, i. e. the tank is pressurized to test pressure and then depressurized. At 10 cycles per minute, a flow rate of 250 l/min or more is quickly required. Despite the high flow rate, the upper and lower test pressures must be approached very precisely. This is a challenge in a dynamic hydraulic system. KAMAT therefore develops both the necessary valve technology (valves, control throttle, sensors) and the control algorithms of the control system itself. This ensures that upper test pressures are not exceeded and lower holding pressures are not undershot. Due to the design of the KAMAT pump, test pressures up to 3500 bar can be achieved in this setup. Burst tests are also possible at up to 3500 bar.

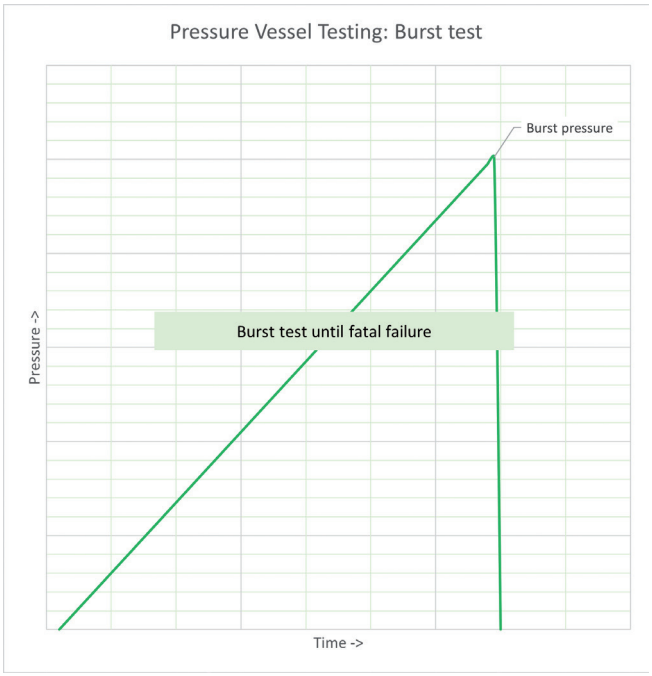

Fig. 4-6: Test curves for pressure vessel testing

KAMAT units can be quickly and optimally customized to meet customer requirements. The optimized modular pump system can be used for the high-pressure section. This results in three categories of equipment:

- Cycling unit with the necessary valve technology, regulating throttle and control technology
- Bursting device with the necessary valve technology and control technology. This is already possible, for example, with KAMAT's smallest pump, the K108.
- Device for pressure retention tests (leak detection)

Of course, the functionalities can also be combined if required.

In a world increasingly focused on sustainability and efficiency, KAMAT's innovative pump systems stand at the forefront of the container pressure testing market. By offering solutions that blend high performance with precision and adaptability, KAMAT is not only meeting the growing demand for safe and efficient energy storage and transport but is also paving the way for a more sustainable future powered by hydrogen fuel.

KAMAT - 50 years of pump innovation: A succinct success story

KAMAT has been a beacon of innovation and sustainability since its inception in 1974 as Myers Europe GmbH, laying the groundwork for a broad range of high-pressure pumps by focusing on triplex high-pressure plunger pump manufacture.

In 1979, after the separation from its American parent company, Dipl.-Ing. Karl J. Sprakel took the helm, rebranding to Myers-Europe Pumps and initiating product development and international market expansion, setting the stage for KAMAT's growth.

The period from 1983 to 1987 marked a phase of organic growth and strategic acquisitions, notably the Hochdruck-Apparatebau Witten merger, enhancing the product line and necessitating a production area expansion in the Witten-Annen industrial park.

Between 1987 and 2012, KAMAT experienced significant technological advancements and expansion, led by Jan Sprakel and Dirk K. Sprakel. This era saw the introduction of the "water mist" division, later becoming the independent FOGTEC GmbH.

2012 was a transformative year for KAMAT, with upgrades to facilities and expansion of the production space. This period also introduced unmanned production capabilities and modernized infrastructure, reflecting the company's adaptability and innovation drive.

With the generation change in 2012, Jan Sprakel and Dr.-Ing. Andreas Wahl took over the management and continue the legacy of innovation and expansion. With the name change to KAMAT GmbH & Co. KG in 2014 demonstrated that KAMAT manufactures much more than just pumps.

KAMAT's 50-year history has been marked by continuous innovation, strategic development and a commitment to quality and sustainability. The company's pioneering spirit promises to keep it at the forefront of the high-pressure pump industry for the foreseeable future. Right down to the sourcing of materials that are truly "Made in Germany".

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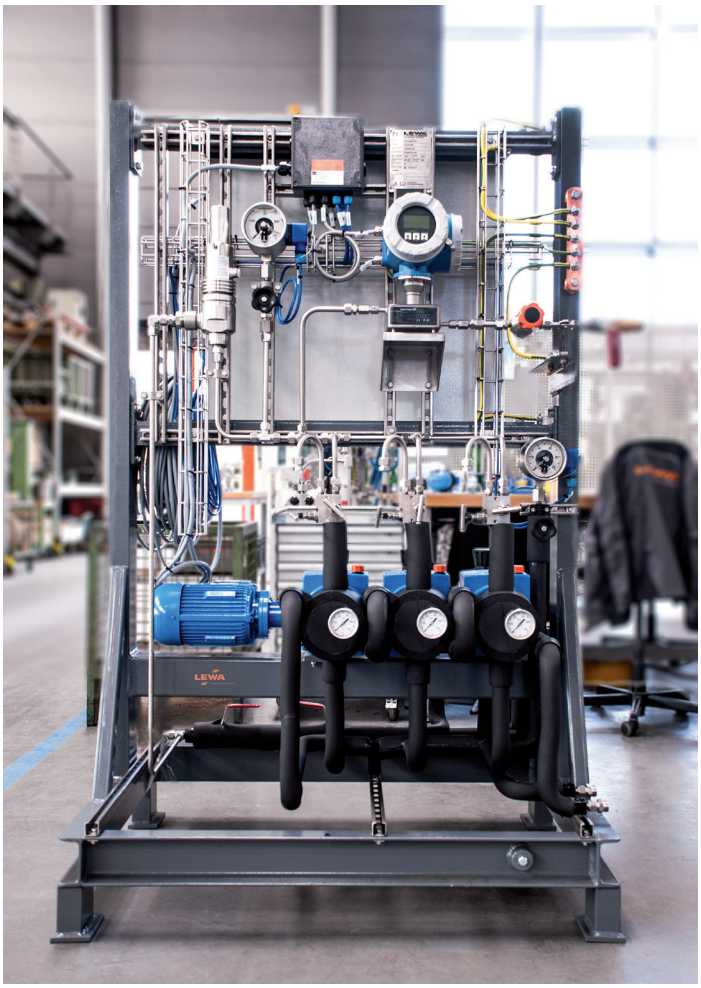
Foam extrusion

Risk-free process optimization: Rentable testing system precisely meters different blowing agents even with fluctuating extruder pressure

Includes cooling unit for CO_2 and explosion-proof design for flammable media

A lower density, better mechanical and insulating properties and significantly reduced raw material consumption. Given these advantages, it is no wonder that foamed plastics have taken the market by storm in recent years. They are mainly used as packaging components and for shock absorption, thermal insulation and soundproofing. However, the variance in blowing agents and their process conditions, such as high pressure or deviating temperatures, require specified systems and quickly make the extrusion process relatively complex. The LEWA ecofoam metering system provides a remedy. A fail-safe complete solution for all known blowing agents, it is characterized by consistently precise metering even for fluctuating parameters. The LEWA ecofoam testing system offers users a cost-efficient opportunity to see the reliable quality of the extruder system and the end products for themselves in everyday operation without obligation.

Depending on the intended use and desired properties of the plastic product, different blowing agents are used in foam extrusion. For example, they can be carbon dioxide, propane, butane, pentane or halogenated hydrocarbons such as Freon 152a. Although the discharge pressures and temperatures of these media differ from one another, the metering of the blowing agent into the plastic melt must be consistently precise in order to achieve a homogeneous and high-quality end product. The proven LEWA ecofoam metering system was therefore specially designed to meter all common blowing agents precisely and reliably.



Universal extruder system for testing with all blowing agents

To ensure the required constant foam quality, the quantity of blowing agent in the LEWA ecofoam is adjusted proportionally to the rotation speed of the extruder. The smart control technology developed by LEWA itself comes into play here. It continuously compares the signal from the flow meter with the guide signal and regulates the rotation speed of the drive motor accordingly. Due to the pump's pressure-stiff characteristic curve, metering remains constant even for fluctuating extruder pressure.

At its core, the hermetically tight and therefore low-maintenance system consists of a LEWA ecoflow diaphragm metering pump, which delivers the blowing agent at a pressure of 50 to 350 bar. The flow rate depends on the set pressure and the compressibility of the medium. For example, it can be 13 kg/h CO_2, 8 kg/h i-butane or 20 kg/h H_2O at 250 bar. Since the LEWA ecofoam testing system was designed for all known blowing agents, it is already explosion-proof for flammable media such as propane or butane as standard and is equipped with a cooling unit for carbon dioxide.

To ensure that the system can be easily transported for testing purposes, all components are securely mounted on a common mount base. It can be rented for up to six weeks without obligation, although longer periods are also possible by arrangement. This gives users the