moehwald inside

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best testing - best quality

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Bosch Group

Inhalt

HDA measuring head with measuring computer

1| HDA – a straightforward principle for meeting strict measuring requirements

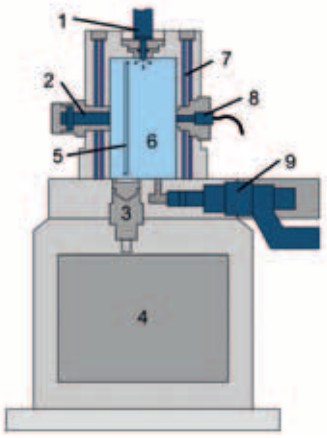
The measuring principle behind the Hydraulic Pressure Increase method is over 50 years old, and was first described in 1961 in the Technical Automobile Journal (MTZ Volume 22 No. 9, W. Zeuch). From 2006 on, BOSCH has used this as the basis for the introduction of its patented Hydraulic Pressure Increase Analyzer (HDA in German), an innovative injection measuring technology.

Here, the injection valve injects into a closed measuring chamber that is filled with fluid. Since the volume remains constant, the additional mass introduced causes an increase in pressure within the chamber, and since the pressure spreads at the speed of sound and the system is able to operate without moving parts, it is possible to perform an injection process measurement with high timing accuracy. The time derivative for the pressure itself is proportional to the time derivative for the mass introduced, and is dependent on the medium used. After each injection, the injected mass is drained off again through a “drainage valve.” Since this measuring method makes strict demands on the pressure sensor, the control system, and the data logging, alternative measuring methods, such as the injection quantity indicator (EMI 21), were initially developed for industrial use.

The method was taken up again and improved by Robert Bosch GmbH. A new feature today is the method patented by Bosch to determine the media properties by measuring the sonic velocity of the medium directly in the interior of the measuring chamber. This allows the introduced mass to be measured more precisely using different media, without the media properties or the temperature being known.

In 2005, Moehwald refined this method in the form of a precise and easy-to-use measuring device. Since then, the HDA has established itself as a standard measuring device for injector and nozzle development. By combining several measuring devices in one measuring system, the HDA can, in addition to the standard measurands of the EMI 21, offer a much higher resolution for the injection signal in the range below 10 µs, and measurement of a high-resolution injection process. Additionally, the powerful computer system also allows the measurands for the spray timing analysis to be determined online using measurement parameters such as injection lag and spray distance.

Owing to its sturdy design, the HDA is also proving popular in areas such as endurance testing, and, thanks to the media-independent measuring principle, it has also made inroads into other fields like e.g. the gasoline testing technology.



Scheme of the HDA measuring head

Function

1 Injector
2 Pressure control valve
3 Ultrasonic sensor
4 Electronic evaluation system
5 Ultrasonic path
6 Tempered stainless steel chamber
7 Cooling channels
8 Pressure sensor, 0 – 100 bar
9 Draining valve

Ralf Wannemacher
Phone +49 6841 707 315
r.wannemacher@moehwald.de

2| DPS 60 – Universal test bench for peak pressures up to 3000 bar

Basic bench DPS 60

Owing to the increase in the system pressure used in diesel injection systems up to 2,500 bar, existing test equipment has reached its limits, both in terms of the drive technology and in the areas of hydraulics and safety technology. In order to achieve the targets we have set ourselves for a universal test stand capable of achieving a system pressure of up to 3,000 bar for the diesel segment of the future, Moehwald, working in close collaboration with the DS development department at Bosch, has developed a modular design test stand with the name DPS 60.

The extremely compact DPS 60 basic stand was designed as a powerful, universal, and energy-efficient drive bench for pump, injector, and system development.
In addition to the basic test bench without sound installation shown in the illustration, the Moehwald portfolio for pump, injector, application, and endurance testing includes a DPS 60 version with integrated sound insulation and a comprehensive range of measuring technologies.
The test stand is designed in such a way that the quick-change modules for application, pump, and injector testing as used in the DS development department can also be set up. The basic test bench still offers sufficient space for integrating a wide range of measuring systems, such as a 12-cell continuous flow meter, or a measurement tower with Coriolis mass flow meters into the upper frame.
The drive system, with a speed range between 0 and ± 8,000 min^{-1}, can be designed as standard with a continuous drive output of 44 kW or 62 kW, and features engine speed gradients of up to 7,000 min^{-1}/s, such as are required e.g. for applications in the hybrid field. For still higher engine speed gradients and performance requirements, a drive system with a continuous output of 82 kW can be used.
As an option, the moment of inertia of the drive train can be individually adjusted for the specific testing purpose using a quickly changeable flywheel mass that remains on the test stand (see image).

Exchange flywheel

The test oil supply system, which can be removed for servicing, provides a flow rate of up to 15 l/min in suction or controlled pressure mode and at a variable feed temperature of between 40 and 120°C (for high-temperature tests).
A range of monitoring functions have been integrated into the basic stand, in line with the increased risk potential that will be associated with future requirements. These include extraction, leak, temperature, and spray monitoring, as well as flow guards in the test medium's heating and return circuit.
An operator terminal with touch screen integrated into the measuring technology cabinet is used to operate and control the basic stand. In addition to performing the automation and safety tasks, this terminal also provides the communication interface for the higher-level test stand control. On request, the DPS60 basic stand can be supplemented with coordinated test modules, measuring technology, and software from Moehwald.

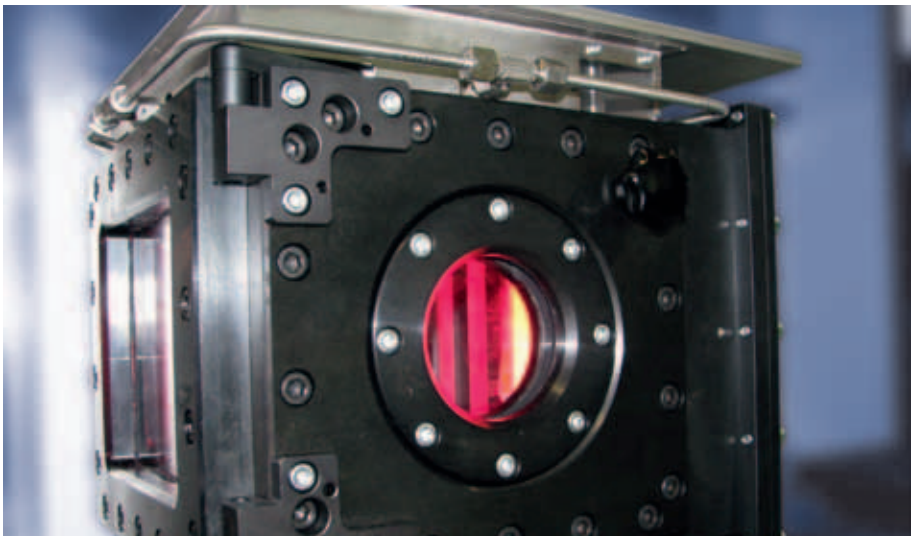
Stefan Klesen
Phone +49 6841 707 312
s.klesen@moehwald.de

3| DFB 1000 – Flow and spray testing now available in a single test stand

In developing and optimizing gasoline direct injection (GDI) systems, it is extremely important to have efficient test systems to assess the behavior of the injection system, as well as systems to measure the separate components and their characteristics.

DFB 1000 with integrated spray form test

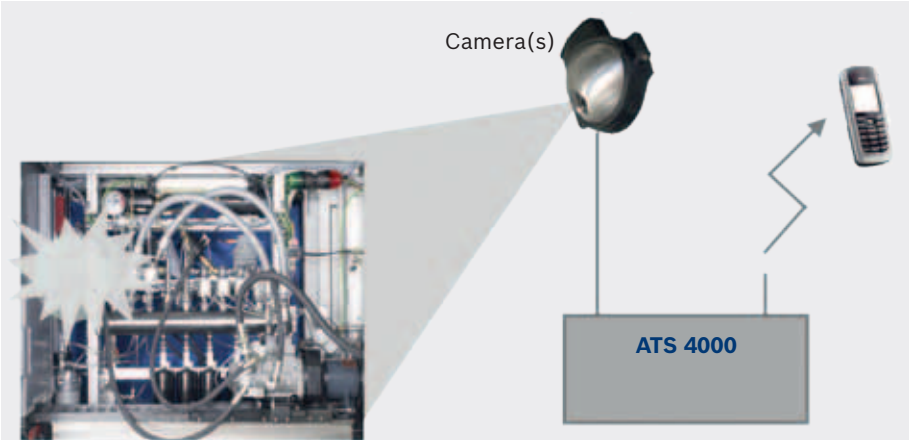
Over the last few years, we have substantially refined our application test stands to test the full system with all the relevant engine components, and also our test stands for high-pressure injection valves.
Spray testing can now also be integrated into our DFB 1000 flow test stand as an option. Our customers therefore have the option of modeling two key test functions using a combined testing device, in conjunction with the benefits of reduced space requirements and lower investment costs.
This flexible design enables different test pressures to be generated of up to a maximum pressure of 300 bar. With the two universal actuation units available, injection valves can be used with solenoid and/or piezo drivers. With the help of appropriate parameterization, injection valves from virtually any manufacturer can be tested. The hydraulic circuit has been modified and optimized for the extended pressure range. The modular design of the DFB 1000 enables individual solutions to be devised for each customer in terms of model range, actuation, and test pressures. As well as the static and dynamic flow of the high-pressure injection valve, it is possible to determine characteristic parameters from the actuator current pattern and the voltage shape, and also from the needle lift signal. The additional integration of the spray test with a back-pressure chamber with nitrogen flowing through it opens up additional applications in development areas such as valve, engine, and combustion system development, and also in the field of quality assurance. Spray testing is performed with the same set-up as for the flow test, and is based on an automated image capture and image evaluation system using the transmitted light process. Using adjustable injection parameters (frequency and injection time), spray images can be evaluated after different time periods in terms of their geometric parameters (e.g. spray dispersion angle, spray direction angle, and spray level angle). Spray dispersion analyses can also be carried out.
Different requirements can also be specified for the spray tests in terms of chamber back pressure, lighting, and the camera system used. Depending on customer requirements, chamber pressures ranging from almost atmospheric pressure up to 50 bar are possible. Using the option of automated or manual rotation about the valve axis, the spray pattern can be determined and evaluated from different viewing angles.



Back-pressure chamber for spray testing

Dr. Juergen Vollmar
Phone +49 6841 707 320
j.vollmar@moehwald.de

4| ATS 4000 – Automated endurance test monitoring



Supervised internal area of a test bench

The process of monitoring test equipment is both expensive and time-consuming – especially when it comes to endurance test stands. Tools for remote diagnosis, automated alarm systems, or linking to a building management system can all help to simplify this task. The ATS 4000 (automatic test stand supervision), an automated monitoring system specially designed for use with test stands, can handle all these tasks, and also provides the user with additional functions.

In the case of endurance test stands, reliable information on the operating condition is particularly important. The ATS 4000 combines modern video monitoring with telecontrol functionality, and is also able to identify, report, and record specific events independently (intelligent motion detection). The system uses a video server that digitizes images from up to four different analog cameras, including any CCTV systems that may already be present, and analyzes these for changes and makes them available on an IP network. The highly compact cameras can be integrated virtually anywhere. They are shockproof and vibration-proof, and provide high-resolution images even in poor lighting conditions (< 0.5 lux). A nitrogen-filled water- and gas-proof IP69 housing, wide temperature ranges, and automatic heating of the lens glass to protect it against frost or condensation make these cameras especially suitable for applications in industrial settings. The explosion-proof version of the ATS 4000 features the world's smallest explosion-protected camera, offering an inexpensive alternative or addition to previous systems.

Live images from the cameras can be viewed simultaneously by authorized users, from any location on a computer connected to the network. The browser-based remote monitoring includes a powerful and flexible software program for managing events. This enables images to be uploaded, and it also handles alarm alerts and I/O controls. The user-defined video motion detection system allows the user to produce a descriptive video documentation using a variable buffer before and after a detected event (spray detection, a tube breaking off, visible damage to a test item, etc.).

In conjunction with the integrated GSM module, the ATS 4000 can function as a fault center and send up to 16 different messages as SMS messages or e-mails to any recipient, according to the digital inputs, which can also be logically linked to one another. Other higher-level systems can also be integrated in addition to the test stand's own internal control system. Text messages (up to 150 characters), which can be freely programmed for each input, can be sent to a total of 36 different telephone numbers (four call profiles with nine numbers for each), either with or without acknowledgement. OK messages can be sent regularly as a functional check, or an SMS can be sent to the system to request a status report. The ATS 4000 also features a data logger that stores all incoming and outgoing messages.

Andreas Henne
Phone +49 6841 707 224
a.henne@moehwald.de

Spotlights

Anniversaries in 2011

10 Years:

- Karin Bachmann , Marc Ewerling Stefan Harig, Markus Heinz, Peter Kunz, Jürgen Stephanek, Gerd Wagner

25 Years:

- Achim Cloß, Wolfgang Geenen, Stefan Glanzmann, Franz-Josef Haubenthal, Wolfgang Höhn, Gabriele Schlicher

News

- From January 1st, 2011: Fusion of mechanical design and project management; head of department Dr. Juergen Vollmar
- New market field cleanliness test benches: several machines for customers are already in production.

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Publisher
Moehwald
Editors
Stefan Klesen, Peter Maue,
Dr. Juergen Vollmar, Andreas Henne
Adress
Moehwald GmbH
Michelinstrasse 21
66424 Homburg/Germany
Phone +49 6841 7070
Fax +49 6841 79108
sales@moehwald.de
www.moehwald.de

Moehwald service-hotline +49 6841 707 110
Monday to Friday from 6.00 a.m. until 7.00 p.m.
service@moehwald.de