Flow and pressure testing with imc measurement systems

Testing automotive oil filters according to ISO 3968

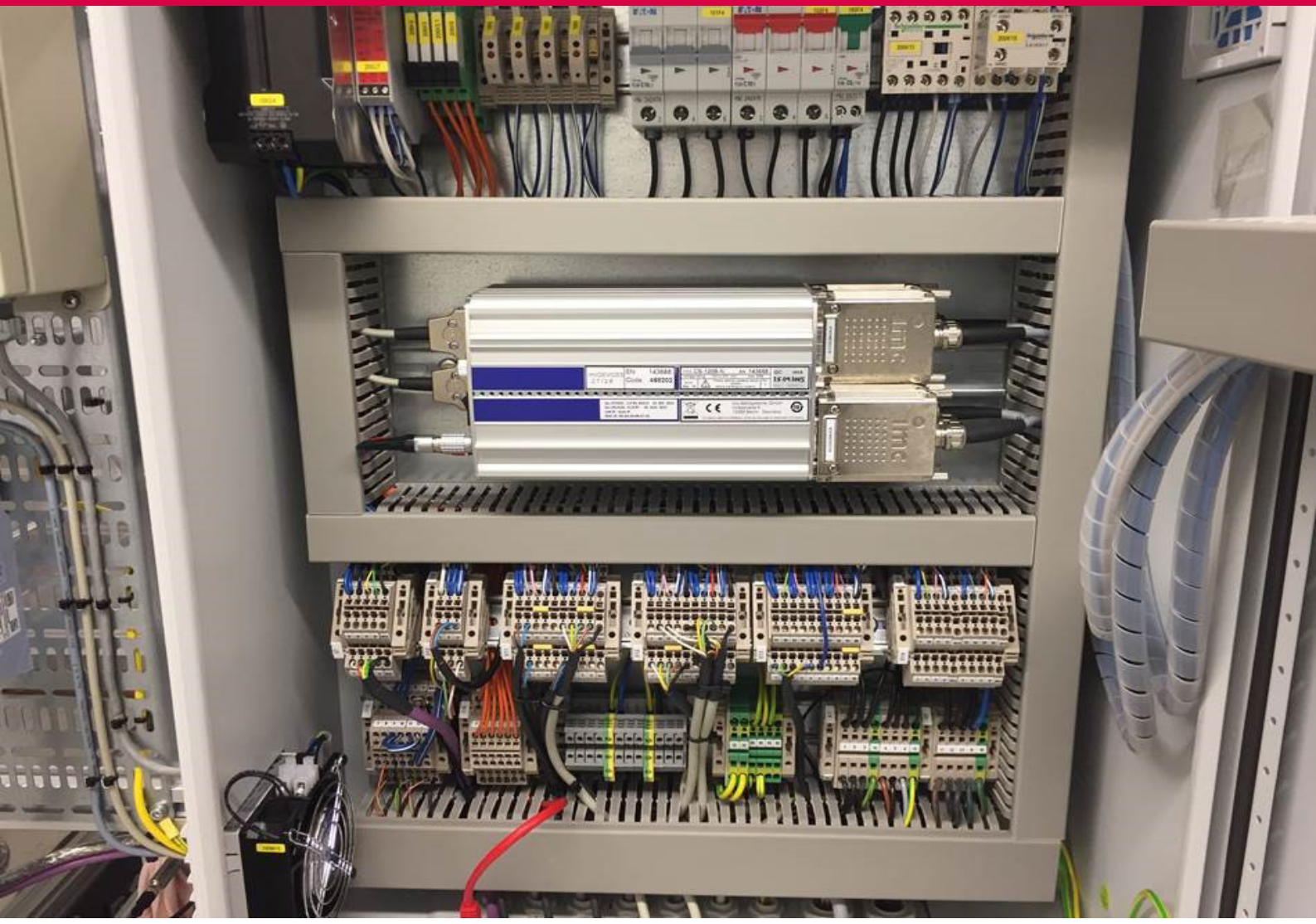


Fig. 1: The heart of the system: imc C-SERIES CS1208-N. Only one imc device was needed for all measurement and control tasks.

Keeping oil clean

Used in or around gearboxes, differentials and motors, oil filters are essential components in automobile hydraulic systems. Each type of filter has its own characteristics with respect to cleanliness, pressure drop and flow rate. Through standardized testing, these characteristics are determined according to ISO 3968 in order for manufacturers and consumers to be certain of each filter's specific integration within the overall system.

Recently, imc's subsidiary in Benelux, imc Test & Measurement B.V., worked with NTZ Filter Netherlands to help realize an oil filter test bench that is capable of carrying out the necessary testing to comply with ISO 3968 standards.

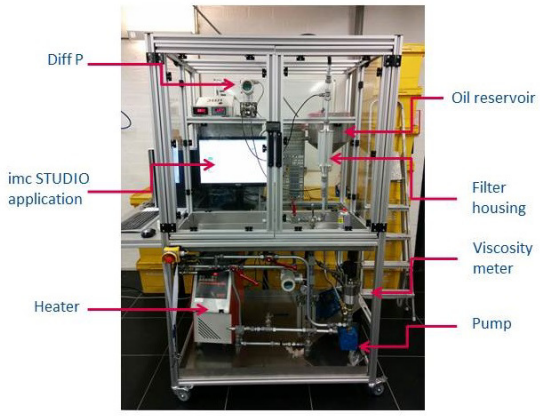


Fig. 2: Oil filter test bench

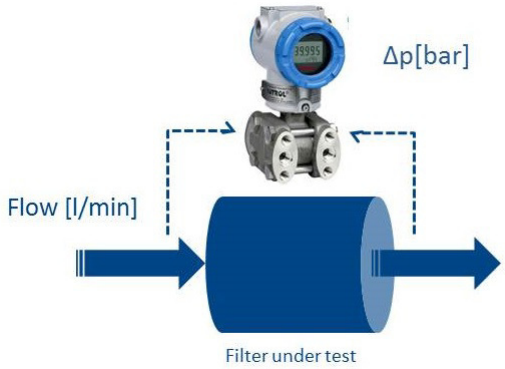


Fig. 3: Measuring pressure vs. flow

Testing according to the standard

The ISO 3968 standard describes in detail how the differential pressure versus flow rate is to be measured and evaluated. This includes such factors as pipe diameter and the positioning of various elements like pressure transducers, temperature sensors and flow meter. The oil is pumped from the reservoir through the filter, then back into the reservoir. A manually-operated bypass valve and variable pump speed regulate the flow and pressure.

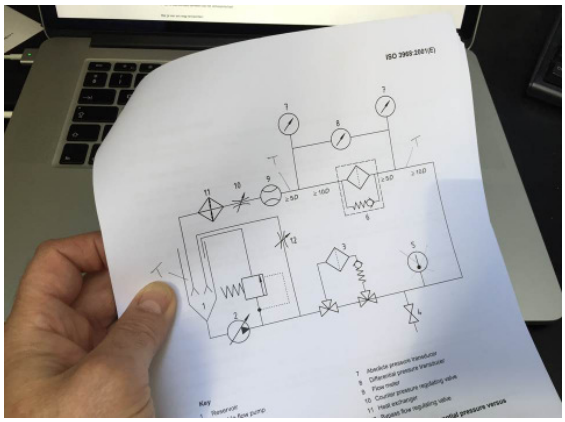


Fig. 4: Oil circuit

Selecting the right equipment

When it came time to choose the appropriate measurement device, the following test requirements had to be taken into consideration:

- Measurements from 4…20mA signals via current plug
- Digital outputs onto Phoenix relays
- Motor control via CAN, with digital enable line
- Emergency circuit hardwired, but also via digital-in

To meet these criteria, the imc C-SERIES CS1208-N was a logical choice. It provides comprehensive, intelligent trigger functions; limit monitoring; minimum, maximum and

mean value storage; as well as internal signal processors (imc Online FAMOS) for extensive real-time computing and control functions.

Fig. 5: imc C-SERIES: all-in-one data acquisition system for electromechanical testing

imc STUDIO – integrated software for the entire testing process

Administrative and pre-test information

According to the ISO 3968 standard, certain values must be accounted for that enable necessary measurement corrections during testing. This includes information about such things as the pipework and the characteristics of the filter housing, filter assembly and by-pass valve. The imc STUDIO panel page that was designed by imc Test & Measurement B.V. allows these values to be systematically entered, and the user is automatically directed to the next step.

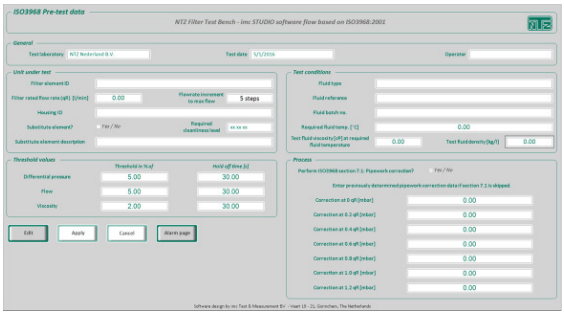


Fig. 6: Pre-test information page in imc STUDIO

Automated testing

Using imc STUDIO, an automated test procedure was created with accompanying panel page that allows testing to be performed with a simple click of the mouse. The clean design of the GUI provides real-time graphical views of temperature, flow and pressure, as well as integrated warning alarms when the values exceed set limits. The motor speed (via CAN-Open) is controlled by imc STUDIO.

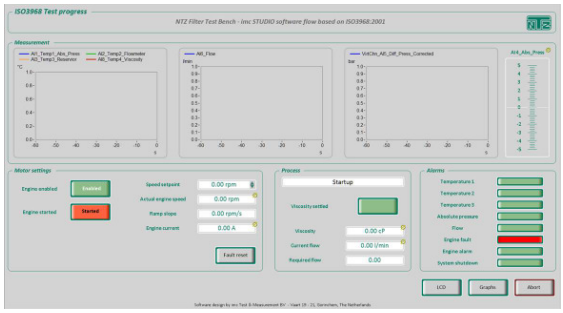


Fig. 7: GUI created and operated in imc STUDIO

Signal inputs and outputs

To enable access to the actual numerical values of the measured data, a separate “LCD” readout page was created that can be selected per mouse-click from the main page. It delivers real-time values of the following data:

- 4 temperature locations (Pt100, 4…20mA)
- Absolute pressure (4…20mA)
- Differential pressure (4…20mA)
- Flow (4…20mA)
- Viscosity (4…20mA)
- Motor data via CANOpen

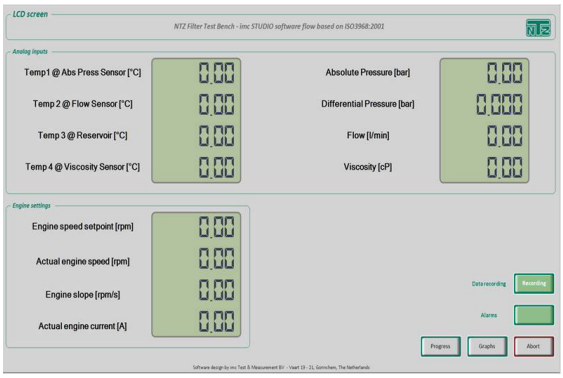


Fig. 8: “LCD” indicators on PC screen

Manual testing mode

For situations that require special considerations or one-off testing, a manual-mode was created. This enables the operator to have full control of the test procedure.

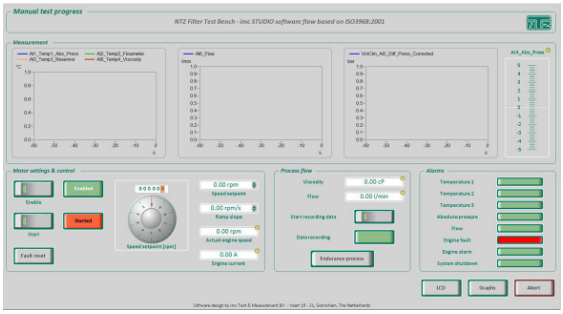
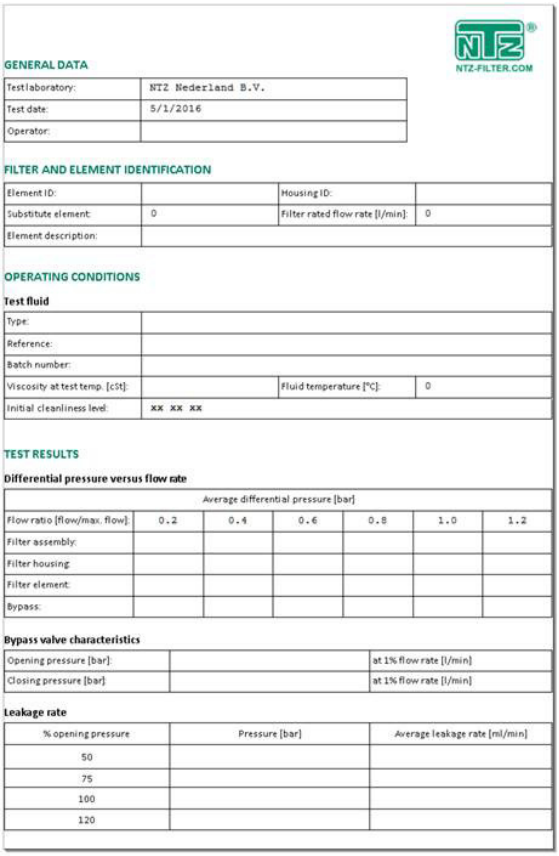


Fig. 9: Panel page for operation in manual-mode

Automated test reports

With all the metadata and measurement data collected, a complete report is automatically generated by imc STUDIO at the press of a button.



NTZ-FILTER.COM

GENERAL DATA

Test laboratory:	NTZ Nederland B.V.
Test date:	5/1/2016
Operator:	

FILTER AND ELEMENT IDENTIFICATION

Element ID:		Housing ID:	
Substitute element:	0	Filter rated flow rate [l/min]:	0
Element description:			

OPERATING CONDITIONS

Test fluid

Type:			
Reference:			
Batch number:			
Viscosity at test temp. [cSt]:		Fluid temperature [°C]:	0
Initial cleanliness level:	xx xx xx		

TEST RESULTS

Differential pressure versus flow rate

	Average differential pressure [bar]					
Flow ratio [flow/max. flow]:	0.2	0.4	0.6	0.8	1.0	1.2
Filter assembly:						
Filter housing:						
Filter element:						
Bypass:						

Bypass valve characteristics

Opening pressure [bar]:		at 1% flow rate [l/min]
Closing pressure [bar]:		at 1% flow rate [l/min]

Leakage rate

% opening pressure	Pressure [bar]	Average leakage rate [ml/min]
50		
75		
100		
120		

Fig. 10: Automated test report at the push of a button

Conclusion

Working in collaboration with their customer, the experts at imc Test & Measurement B.V. were able to design and realize an oil filter test bench that performs seamlessly throughout the entire testing process. With the help of imc STUDIO software, the operator is first guided throughout the administrative steps of pre-testing, then the automated testing procedures are initiated with corresponding monitoring, evaluating and archiving, and finally finishing up with a print-ready test report that all adhere to the ISO 3968 standard.

Additional information:

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imc Test & Measurement GmbH is a manufacturer and solution provider of productive test and measurement systems. imc implements metrological solutions for research, development, service and production. imc has particular expertise in the design and production of turnkey electric motor test benches. Precisely outfitted sensor and telemetry systems complement our customer applications.

Our customers from the fields of automotive engineering, mechanical engineering, railway, aerospace and energy use imc measurement devices, software solutions and test stands to validate prototypes, optimize products, monitor processes and gain insights from measurement data. As a solution provider, imc offers their customers an attractive and comprehensive range of services. These include project consulting, contracted measurements, data evaluation, specialist deployment, customer-specific software development and system integration. imc consistently pursues its claim of providing services for “productive testing”.

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