

Conditioning media for e-drives

Emulating thermal loads in various circuits precisely and efficiently is vital for development of modern EVs



The electrification of powertrains requires the development of components that are adapted to the specific needs of electrical and thermal operating conditions. This means not only the electric motors and gearboxes, inverters and control units but all components involved in the thermal management of the heating and cooling systems for the battery and HVAC systems in addition to their control and regulation via pumps, valves and heat exchangers.

Effective thermal management requires the use of different cooling and heating circuits at different temperature levels. Increasingly complex demands are therefore being placed on the validation of components. The requirement to test across temperature ranges from 40°C to 150°C combined with the use of different media and coolants makes it challenging to provide suitable testing environments.

It is not sufficient to simply apply standard conditioning equipment currently available on the market. Rather, secondary circuits must be set up to precisely regulate to the required temperatures, pressures and flow rates. Moreover, high dynamic requirements with gradients of several K/min in cooling and heating must be guaranteed. In addition, it is not uncommon for components under test to be operated via several circuits, and even with mixed media such as water-glycol and oils. To enable precise balancing of the thermal output, the conditioning circuits must be equipped with enough suitable sensors.

EUtech Scientific Engineering has harnessed the know-how it has acquired over many years in the field of test rig development and component conditioning, and incorporated it into the development

of a mobile conditioning unit that is tailored to current requirements while retaining sufficient flexibility to respond to specific customer needs. The EUmedicon mobile media conditioning unit focuses on the testing and test operation of electric motors and gearboxes as well as converters and control units.

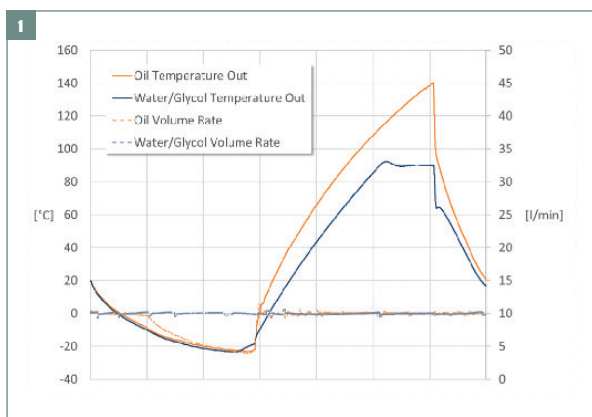
At the system's core is a single unit with one or two independently conditionable secondary circuits, available in different variants and freely configurable in terms of capacity, flow rate and other features. The two media circuits can operate with different media such as water-glycol and various oils, and be controlled independently of each other in a temperature range of -40°C to +150°C.

The trace shown in Figure 1 reveals that the increasing viscosity of oil during cooling at temperatures below -10°C affects the maximal achievable flow rate in this specific test case. During the heating period, the desired flow rate of 10 l/min is restored when the -10°C temperature value is exceeded. The media circuit operated with water-glycol shows no temperature influence on the volume rate. The limitation of the maximum temperature, which is given by the evaporation characteristic of the coolant, is also shown. The temperature control keeps a safety margin on the boiling temperature. Higher temperatures are achievable in the water-glycol circuit by choosing a closed circuit with active pressure control, which enables operation of the circuit at any pressure up to 10 bar.

The flexibility of EUmedicon is made possible by its modular control software, which, in combination with the selected hardware structure, enables many other features such as pressure and flow control, and active recirculation for open circuits, where it must be ensured that enough medium is returned to the conditioning plant.

The system is operated either as a standalone solution via a local display or remotely via various interfaces including EtherCAT, CAN, LIN, Profibus, ModBus, TCP/IP and analog. In this way, it seamlessly integrates into users' test stand automation and safety circuits. Operation and monitoring via web application is also possible.

Due to the compact mobile setup, the conditioning unit can be rapidly deployed in various test environments without any specific modifications, with only power and water supplies required. Due to the modular platform design and the use of standard components that allow flexible configuration and quick adaptation to specific requirements, short delivery times can be ensured – an increasingly important consideration in times of supply chain problems. ©



1: The temperature and flow rate trace of two different media circuits, a closed water-glycol circuit (blue) and an open oil circuit (orange)

2: The EUmedicon media conditioning unit

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