

Ensuring the leak-tightness of electronic control units (ECUs)

Quality control in the production process

Electronic Control Units - External Loads and Risks

Electronic control units (e.g., power control units, inverters) must operate reliably under a wide variety of conditions.

Apart from external factors (depending on the area of use), heat is generated during operation, resulting in temperature-induced pressure changes. In the case of sealed products, this leads to cyclic mechanical stress on gaskets and seams. This can result in leaks. In other products, pressure compensation elements are used to reduce this mechanical stress. These venting elements are watertight but air-permeable. During leak testing, the product must sometimes be filled through the pressure compensation element. Alternatively, a venting opening is installed in the plug area, through which the product can then be filled directly.

These products must meet a wide range of requirements. This includes being sealed against dirt and moisture. The ingress of liquids can lead to serious malfunctions and consequential damage. For this reason, leak testing - conducted as a 100% routine test as part of the end-of-line testing in the production process - is of particular importance.



Electronic control unit

Leak testing of directly fillable products

<p>Test process Leak Test with single-sided filling</p>	<p>Filling through a reliably leaky connector area</p> <p>Filling through an opening in the connector area (Ø 1 mm sufficient)</p> <p>Filling opening only for the purpose of leak testing (not permitted in the product) ⇒ Close the filling opening Clip in a pressure compensation element</p>
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Leak testing of products with pressure compensation elements (PCE)

<p>Test process</p> <ol style="list-style-type: none"> 1. PCE test (installation, integrity) 2. Leak test of the housing (fine leak test) 	<p>Filling the test part via a pressure compensation element</p> <p>The filling process is extended by the pressure compensation element.</p> <p>The test pressure must be reliably reached inside the component</p> <p>Pre-filling at a higher pressure ⇒ Shortening the filling time and, as a result, the total test time</p>
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Leak testing of encapsulated products

<p>Test process</p> <ol style="list-style-type: none"> 1. Gross leak test 2. Fine leak test 	<p>No filling opening available</p> <p>Testing in a product-specific test hood that is pressurised</p> <p>Measurement of the pressure change caused by leakage inside the test part</p> <p>Test hood ⇒ Air gap of approximately 0.5 to 2 mm all around between the hood and the outer contour of the product</p> <p>Consideration of product tolerances in the hood design</p>
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Example of application

Test part	Electronic control unit with a filling opening in the connector area
Adaptation	Direct filling via the connector area
Filling volume	120 cm ³
Measuring line	12,6 cm ³ (1 m 6/4 PA)
Measuring circuit volume	6 cm ³ (in the test device)
Effective test volume V_{eff}	138,6 cm ³ (sum of measuring circuit volume, measuring line and test part)
Test pressure p	500 mbar (derived from the operating temperature range -40°C bis +85°C)
Permissible leakage rate Q_L	0,01 mbar*l/s = 0,6 ml/min (housing should be waterproof)
Pressure gradient dp/dt	7,2 Pa/s
Phase times	Filling: 3.0 s / Stabilisation: 4.0 s / Testing: 6.0 s / Venting: 0.5 s
Total test time	approx. 14 s (including internal test device delay times)
Type of test device	Leak tester with differential pressure sensor (suitable from 1 Pa/s)

The pressure gradient is determined by the effective test volume and the permissible leakage rate.

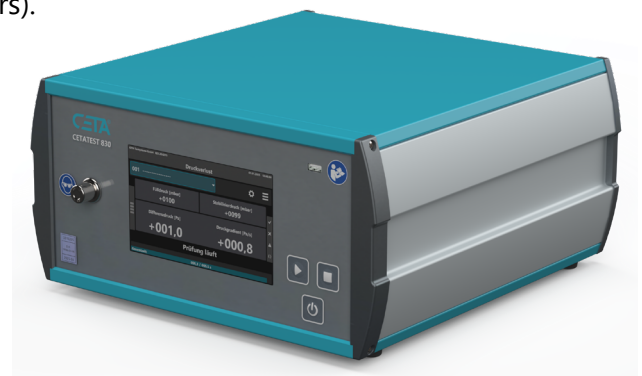
Testing technology - Leak testers with differential pressure sensors

When leak testing electronic control units, leak testers with differential pressure sensors are frequently used due to the low permissible leakage rates. The test pressures range from 100 to 800 mbar.

The CETATEST 825 and CETATEST 830 test device series, with a pressure range of 1 bar and a measurement range of 500 Pa, are suitable for this application. Standard features include digital I/O interfaces, RS-232, USB (host) and Ethernet. The usual industrial interfaces are available as options. The testers are

supplied with an internationally recognised calibration certificate (DIN EN ISO/IEC 17025) and a warranty of up to three years (optionally extendable to five years).

Leak tester CETATEST 830



CETA Testsysteme GmbH

CETA Testsysteme GmbH has been active for more than 35 years as a solution partner and quality manufacturer of "Made in Germany" leak and flow testers for 100% end-of-line testing. Compressed air is used as the test medium. With a comprehensive range

of testers and suitable accessories, the right testing technology can be found for nearly any testing task. Several thousand CETA test devices are in use worldwide for quality assurance in production lines. www.cetatest.com

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CETA Testsysteme GmbH - Solution partner for industrial leak and flow testing

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