

Standardized manufacturing and production testing procedures with PC- and EtherCAT-based control

Vaillant Group sets high standards in quality optimization

The Vaillant Group, headquartered in Remscheid, Germany, is an internationally operating heating, ventilation and air conditioning company. In order to meet the highest quality standards, all Vaillant appliances are subjected to comprehensive tests. The company specified a standardized test procedure for its worldwide production sites and uses Beckhoff control technology throughout its test bench implementations.







The screwdrivers in the assembly lines are also among the system peripherals. The set values for the screwing forces are read by the Assembly Management System from the database and written to the screwdriver controller. The actual values are written back to the database and documented.

One of the Vaillant Group's core business areas is the production of heating appliances. The product range extends from appliances designed for conventional fuels to system solutions that use regenerative energies. The Production Test Development Department is responsible for the testing concept of the Vaillant Group and for the development of testing methods, test benches and the Assembly Management System (AMS). "The test standards developed by us are binding for nine international production sites of the Vaillant Group. Presently we attend to about 200 test and assembly management applications that are in production," explains Christian Kron, head of the Production Test Development Department. "The philosophy of the Vaillant Group is to check our products throughout 100 percent of the process. It starts with the incoming goods, where we carry out random checks, and extends as far as the 'shipping audit.' In production and assembly we perform inline and end-of-line checks to test the appliances for correct assembly and functions." The Vaillant Group's thorough test strategy is applied to the entire product range.

Flexible and scalable test bench solutions from the Beckhoff automation toolkit

The control hardware for the test benches comes from the Beckhoff automation toolkit; i.e. the system configuration is not fixed, but is adapted modularly to the test task at hand. "We predominantly use Industrial PCs from the C5210, C6915 and C6930 series as well as Control Panels from the CP6201, CP6907, CP7201, CP7709 and CP7901 series. Moreover, we use a customized panel based on the CP7901 that was developed with Beckhoff according to our specifications," Christian Kron reports.

Each Vaillant test bench is controlled by the company's proprietary UTS software which runs on Beckhoff Industrial PCs. With a further assembly management software platform developed by the Vaillant Group, the work sequences of different assembly stations in a production line can be executed in parallel. The



The Vaillant Group uses EtherCAT, Ethernet TCP/IP, PROFIBUS, RS232 and USB as physical interfaces for communication with devices and server databases.

work sequence of each station is thus controlled individually on the basis of the production orders.

Connection of all system components via flexible EtherCAT Terminals

The periphery required for the assembly and test applications is connected via Beckhoff EtherCAT Terminals. As Christian Kron points out, the specialists from the Vaillant Group have concentrated on a few standard EtherCAT Terminals in order to keep individual parts stocking as manageable as possible. Different hardware components such as scanners or RFID units for product tracking are controlled via gateways and interfaces. The screwdrivers in the assembly lines are also part of the system periphery. The set values for the screwing forces are read from the database by the Assembly Management System and written to the screwdriver controller; the actual values are written back to the database and documented. "The system also encompasses error recognition. If the worker has forgotten a screw, for example, he is 'guided' by the system and reworks the missing screwed connection," explains Christian Kron.

With EtherCAT as the central bus system, the local controllers that are usually deployed at each station are replaced by a central Industrial PC. With an average number of 30 stations per production line, this results in significant cost savings. The software maintenance of the system also becomes more efficient, since it concentrates only on the Industrial PCs used in a line. Thus, the Assembly Management System also helps increase production efficiency.

Up to 300 test contents are documented

All test steps and results, including the measured values, are recorded and documented. Traceability is guaranteed for every product on the basis of the documented test report. The main measured variables recorded during the test sequences are pressure, flow, temperature, current, voltage and frequency. Sig-



A Vaillant heating appliance is pushed into the test bench.



The test process can be monitored via the Beckhoff Control Panel specially customized for the Vaillant Group.

nal conditioning takes place in the sensors and test adaptors. The Vaillant Group has mainly standardized on 4 to 20 mA as the analog signal form.

The recorded test signals are transmitted via the EtherCAT Terminals to the PC and evaluated by the UTS software. All test benches and Assembly Management Systems from the Vaillant Group are connected to a database. Up-to-date article-specific test sequences and parameters are downloaded from there before each test. "That is in some cases involves up to 300 parameters and the associated test sequence, including the test steps," affirms Christian Kron. These parameters are used by the UTS Software for evaluation; subsequently, the determined and qualified data from each test procedure are written back to the database.

Standardization offers clear benefits

The high degree of standardization of the test methods and the test benches allows them to be managed internationally by a small, central team with local support, despite the large number of applications. The employees operating locally in the respective teams are trained in the use of the checking and test facilities. Beyond that, the Remscheid team offers so-called "Second Level Support." "This means that if the colleagues on site require assistance, we connect to the system remotely and help resolve support issues," explains Christian Kron. He is particularly proud of an additional benefit: "The consistent reuse of our test benches following the discontinuation of a product is made possible by the high degree of standardization and also represents a significant cost-saving factor."



Christian Kron, Head of the Production Test Development Department, from the Vaillant Group together with Wilm Schadach, Beckhoff Sales Office, Rhine-Ruhr, Germany (from left)

Vaillant Group

The Vaillant Group, with head office in Remscheid, Germany, is an internationally operating heating, ventilation and air conditioning company. As one of the worldwide market and technology leaders, the Vaillant Group develops and produces tailor-made products, systems and services for room comfort. The product range extends from efficient heating appliances using conventional fuels to system solutions that use regenerative energies. The company, which has been family-owned since its establishment in 1874, achieved sales of around 2.3 billion euros in the 2012 financial year with more than 12,000 employees.

Further Information:

www.vaillant-group.com