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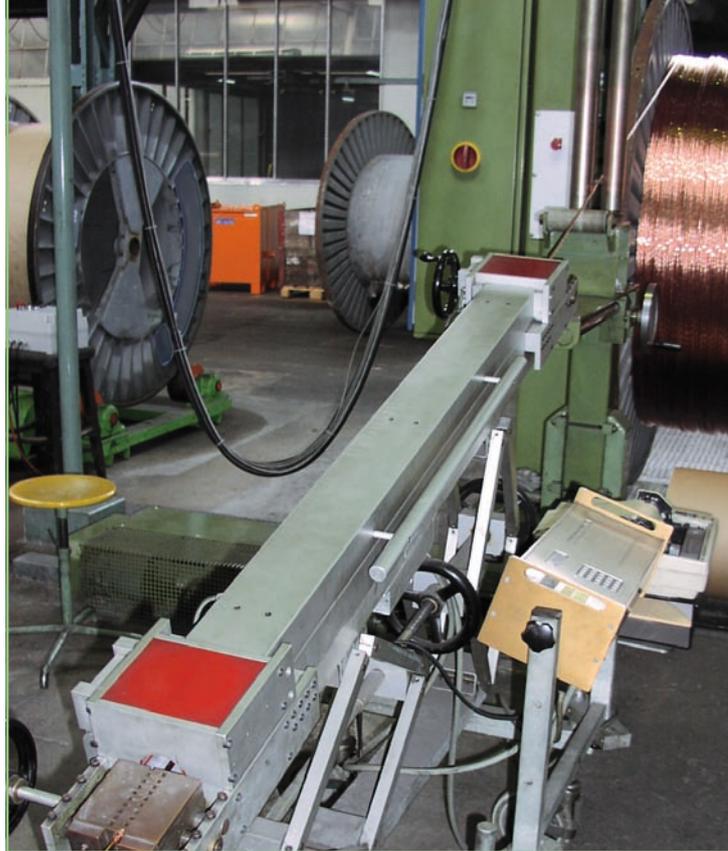
Stable quality situation

AESA Cortailod S.A.

Chemin de la Plaine 7
2013 Colombier, Switzerland
Tel.: +41 32 8415177
Fax: +41 32 8424865
E-Mail: aesa@aesa.ch
Website: <http://www.aesa.ch>

Stable quality situation

Measuring technology and process control in the cable industry have undergone major changes during the last few years. Most of the machines and testing equipment are fitted with electronic measuring and data acquisition systems, which – each one separately – deliver sets of high-precision data. However, only networked, near real time data acquisition, process control in quasi real time as well as an all-embracing database accessible by all involved in the production process enable real progress and provide the basis for consistent improvement.



Resistance measurement at the end of a conductor production line
Photo and graphs: AESA Cortailod

During the last few years, many cable manufacturers have made heavy investments in measuring and testing equipment as well as process control systems. Electronic measuring devices and machines with dedicated data acquisition features have become standard today. This has resulted in – historically grown – “quality islands”, the data of which are not accessible for cross-use in other areas.

Measured values and testing data used to be written down by hand and control cards were manually produced. “Paper clutter” was the order of the day. The “electronic data” were often stored in non-uniform formats.

As measurements were often made only on a random basis at the beginning and end of a production length, it was impossible for the operators to immediately notice during running production any violation of tolerance limits and occurring defects in the produced cable.

Swift and objective assessments of defects, detailed evaluations as well as exact cause-analysis used to be extremely time-consuming because the data were difficult to access.

Special requirements of the cable industry

The production of high-grade cable products has some characteristics which call for a quality assurance system with extraordinary capabilities. Cable manufacturing is like producing component parts where complex relationships exist between the individual elements. In contrast to single-piece production, all process data must be

captured and stored relative to a specific length and time. Individual lengths must be tracked, cut lengths organised and running length corrections considered by the on-line data acquisition system.

Apart from this, the data volumes to be handled are extremely large. HF measuring and process data capturing systems create several 100MB per day.

Whereas the first production steps are usually initial product centric, the downstream manufacturing is done according to production orders. This involves repeated testing and sorting out between the individual process steps. Moreover, the combination of mechanical and electrical tests makes the planning of the tests problematic.

Especially manufacturers of high-grade products or of a wide range of different products must be sure that whenever their machines resume production after alterations they immediately produce the same good quality as before.

Conclusion: Despite the high complexity of production processes and testing operations, a high and stable quality level must be reached, maintained and documented. This is only achievable if continuous process data and “manual” tests are captured near real time and networked. Then the data are immediately available to all involved in the complete production chain. Continuous quality improvement can only be achieved if detailed cause-analysis is enabled. Therefore it is necessary to store the data from the complete production chain and make it available company-wide.

One uniform solution for the cable industry

In practice this means that it will be necessary to network historically grown “quality islands” in many production facilities within a uniform system and store the measured values and the test results in a centralised database accessible by all involved in the production process.

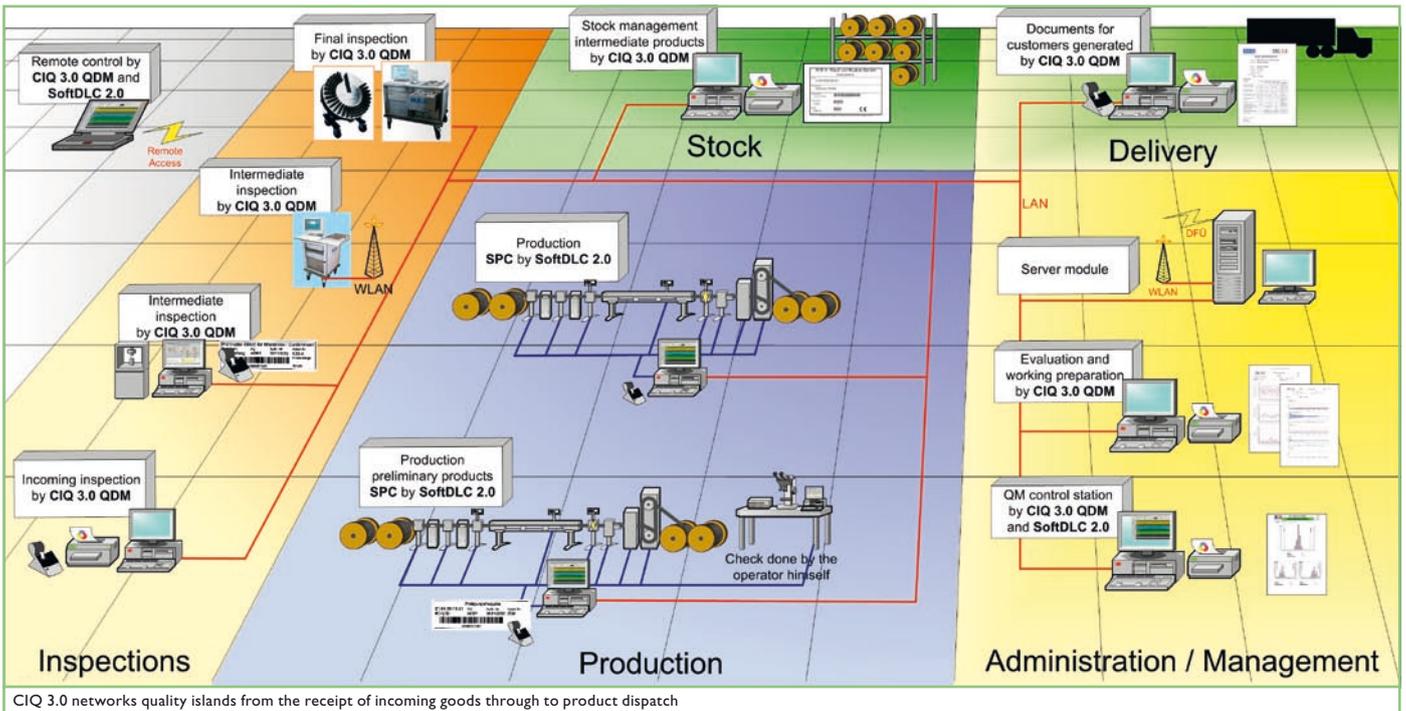
The CIQ 3.0 software solution offered by AESA Cortailod links the measuring and testing equipment and the production machines (process data and setting parameters) and makes the data available to the operators and employees in the various departments. It comprises the complete production chain – embracing all production stages – and all quality inspection activities for initial, semi-finished and finished products, including the receipt of incoming goods and the dispatch of manufactured products.

M.E.A. Mauf und Rudow GmbH, whose core activities have been integrated in AESA Cortailod, developed CIQ 3.0 together with leading cable manufacturers in perfect line with the specific requirements of the cable industry.

Well organised testing

First of all, CIQ 3.0 supports classical testing procedures such as the measurement of mechanical and electrical properties. As a great number of procedures are automated, the time required for planning and performing the tests is dramatically reduced.

For example for similar products, CIQ 3.0 uses basic and product family inspection plans. This reduces the effort of manual



data input. A comprehensive library of formulas based on international standards makes the generation of inspection plans much easier and more convenient. CIQ 3.0 also takes into account individual works situations. If the same product is produced on several machines, it is possible to set individual limit values for each machine taking into account the specific machine configuration. This guarantees that the same final result is achieved for all products although they have been produced on different machines. When the tester performs a test, he can call up all important application data, such as working instructions, drawings, setting parameters and control cards, directly at the testing location.

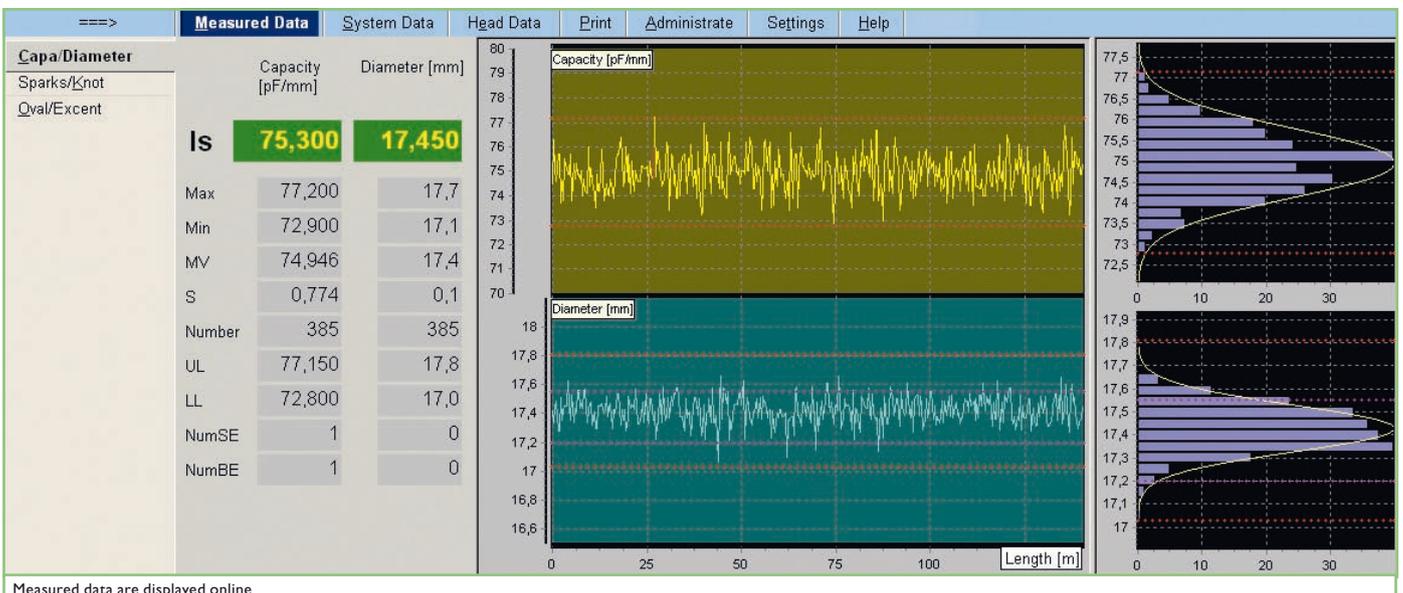
Production under control

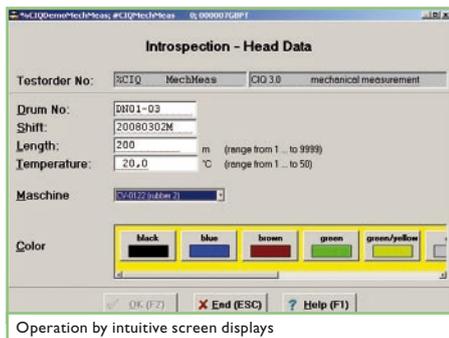
Unlike traditional CAQ systems, CIQ 3.0 not only comprises quality assurance functionalities. The integrated "SoftDLC 2.0" module also enables online data acquisition of all process steps for initial, semi-finished and finished products. Visualising the measured values at the production machines and at the control station enables trends to be recognised at an early stage during production and corrective action to be taken before any defects occur. This guarantees that only completely flawless material leaves the factory. With the process data sheet, production parameters can be set tailored to the specific production machine. Moreover the

system can be parameterised in such a way that as soon as a preset limit value is exceeded the product is automatically blocked. This ensures that the product will only be further processed after the cause of the problem has been eliminated. Acquiring the data online makes many manual intermediate tests superfluous and reduces manual inspection costs. Online data acquisition also cuts cycle times and increases machine throughput rates because the cables no longer need to be stored to wait their turn at the test bench.

Documented quality

Data acquisition and storage form the basis for the possibility of generating exact





documentation of all dispatched cable products. CIQ 3.0 generates documents such as reports, labels and certificates. Documentation is in accordance with ISO 9001. In addition, CIQ 3.0 provides complete traceability across all stages of the production chain.

The use of filters enables evaluations by most diverse criteria. The production manager, for example, may analyse the data by other criteria than the quality department. He may use the data to gradually approximate closer to the allowable limits in order to fully exploit existing tolerances. This makes for more efficient use of the input material and saves material costs.

The storage of data from all production stages and areas provides the quality assurance personnel with the necessary information to perform detailed weak point analyses and systematically identify existing problems.

The design department will get to appreciate the product search function as a highly valuable tool. In the case of customer queries the properties of similar products manufactured in the past can be evaluated with a view to their suitability for the new application.

Use of existing systems

When designing CIQ 3.0, a main objective was to use most extensively existing infrastructure in the works and avoid as much as possible additional expenses incurred by the purchase of new hardware components.

As for most of the measuring equipment commonly used in the cable industry interfaces already exist, the adaptation effort for new devices is minimal. Existing PCs can usually be continued to be used because processing capacity requirements are low. The system is thus designed that it can be individually tailored to the requirements of the users and expanded step by step.

The fact that CIQ 3.0 uses existing hardware relieves the investment budget. Also software costs are moderate: Apart from the full license for users in production and quality assurance, AESA also offers lower-priced

read-only licenses for employees using the software only for evaluation purposes.

Install, start and manufacture

The installation of the software is extremely easy. When the software is first installed by AESA together with the user, the core functions of the individual process steps are generally ready for use within two days.

All modules use the same user interface; operation is intuitive. The training efforts for the testing personnel at the line are extremely low. Users keep telling us that a brief instruction is sufficient to be able to securely handle the system. This is among others due to the fact that each user only receives those data which he needs for a particular task and that he is offered only those input options which are required for the fulfilment of that task. The user interface is available in several languages. The user may also make his own changes to the displayed texts, for example in order to include company-specific technical terms. Comments may also be added to the context sensitive help. Intuitively useable tools are provided to manage user privileges and generate and modify screen masks and lists. As CIQ 3.0 consists of freely parameterisable software modules, it can be flexibly configured to meet the requirements of the individual operator. The use of the build in WEKAScript programming language enables the generation of formulas, screen masks and reports.

Open system

CIQ 3.0 has been designed to communicate with other systems and exchange data with other EDP systems. It is possible to export and import different formats, for example from and to Excel files, with SQL data bases or business solution systems such as SAP. Data can be sent by e-mail or long-distance data transmission (VPN). On the basis of standard testing plans it computes process limit values by means of dedicated formulas or imports them from other EDP systems.

Physically, CIQ 3.0 runs on PCs, either on a file sharing basis or within a client/server architecture via TCP/IP. For some of its customers AESA has already realised access from different user locations via VPN.

Conclusion

The networking of quality islands and the combination of quality assurance and process data acquisition improve product quality and reduce costs in many areas of a company.

The introduction of automated test planning and testing procedures saves labour

Acquisition of testing data

CIQ 3.0 features a wide range of interfaces to measuring devices:

Mechanical properties:

- Tensile testing
- Friction testing
- Weight
- Force measurement
- Elongation at tear
- Geometry
- Diameter and wall thickness
- Profile projectors
- Camera systems
- Bending tests

Electrical properties:

- Insulation measurement
 - Milliohm meter
 - High-frequency measurement including TDR (Time Domain Reflectometer)
 - Low-frequency measurement
 - High-voltage measurement
- Optical properties (optical fibre):
- Reflectometer (OTDR - Optical Time Domain Reflectometer)

Manual

- Head data, e.g. head, coil or order number
- Electrical measurement results

Visual tests

- Results

Laboratory tests

- Transfer impedance and screening attenuation
- Type approval tests
- Thermal tests with heating cabinet control

and costs. In addition, direct access to the stored data enables near real time analyses which could not be realised in the past at reasonable effort – from quality checks of individual products through to higher-level cause finding and weak point analyses.

Online acquisition of process data enables the operator crew to take swift action and produce optimal quality while efficiently exploiting the input material.

In many works around the world the system has already contributed decisively to improving the security of the production process, guaranteeing the quality of the products, streamlining administration and cutting costs. ◀

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