

## Vestas Creates Quality Synergies Worldwide

Vestas Wind System A/S, headquartered in Aarhus, Denmark is the largest global supplier of wind energy solutions in the world. With annual revenues of \$7 billion, Vestas commands 15% share of the global market. The company operates manufacturing plants in nine countries and has installed more than 43,000 turbines worldwide.

### Business Units

Each of four subdivisions or “Product Business Units” is dedicated to the manufacture of a specific section of the wind turbine. There are aspects of quality management, such as data collection and component traceability, which affect all units. At the same time, each unit has unique quality needs.

**Nacelle.** The Nacelle consists of gears and bearings built around the main shaft which is driven by the blade assembly. Quality requirements here include the collection of torque data on all fasteners, SPC and traceability of components and materials.

**Tower.** The tower is the pillar, the base upon which the nacelle is mounted. It consists of three-to-six tubes formed by welding together several plates, each of which has a unique shape. Primary quality concerns here are the collection and analysis of weld data, documentation of builds of material, and traceability.

**Blade Assembly.** Each turbine requires three blades made of carbon fiber and glass, ranging in length from twenty to sixty-five meters. The main quality focus with blade assembly involves controlling the weight of the units and assessing the shape of leading and trailing edges. The cost of scrapping one of these units is considerable, so heading off defects is essential.



**Control Systems.** This is the hardware and software that controls the turbine. The emphasis here is on achieving first time part yield goals, supply chain management and tracing parts and errors.

### Standardizing Data Collection Globally

Given the size of Vestas’ operations, the complexity of its quality challenges and the global dispersion of its manufacturing base, reconciling data and reports generated in different plants by production equipment sourced from a variety of vendors is a major challenge. Millions of measurements are collected and analyzed daily.

ODA is installed on the central server where it manages data collection, storage and distribution. The software standardizes quality data by ensuring that measurements are taken for the same critical characteristics in accordance with established rules and

conditions, maintained in a uniform format, and subjected to the same analytical treatment. Consistent, disciplined quality practices start at the point of data collection, making sure all data is valid and meaningful before being imported and distributed. This guarantees comparability of all data from each plant and all machinery worldwide.

### Implementation and Quality Integration

For Vestas, the first step in introducing any new product or solution into the company is a successful pilot installation. Pilots for QDA data collection and SPC began in 2008 at headquarters. There the software was set up to capture data from over 350 devices and databases, including in-house proprietary devices specifically designed to Controls and Blades, as well as welding machines, Zeiss CMMs, Leitz laser trackers and Shimoda test equipment. In Vestas' foundry operations, QDA also supports connectivity to spectrometers and thermography devices, devices that collect data for tensile, impact and hardness tests, and microscopes. In the case of microscopes, data is read automatically and images are often attached to illustrate the source of the measurement value taken. Vestas takes advantage of QDA's graphical capabilities in other areas as well, incorporating images and adapting them for use in:

- > Data collection – to illustrate characteristics, provide work instructions and support testing
- > Quality planning – enabling visualization of attribute measurements and fault detection, such as casting error and pinholes.

Pilots for additional modules followed, including those for FMEA, PPAP, Control Plan and Process Flow, MSA and Complaint Management, Incoming Inspection and Traceability. Following their success and acceptance, ASI DATAMYTE and Vestas have worked together to roll QDA out at key plants

worldwide. As of June, 2011, it has been installed in 28 locations.

### The ERP Connection

QDA is integrated with and receives information from Vestas' ERP System. It automatically captures part data, supplier master data and manufacturing orders.

### The Synergies

QDA ensures that collected data, whether from torque readings, bearing and gear dimensions, blade attributes or assembly fit, is error-proof and valid from the point of origin. Having rock-solid, known-good data at the point of data collections pays off up the line. By building an integrated quality management system using additional QDA modules, Vestas gets the most out of the data. In addition to applying SPC analyses, it can be sent along to build supplier management checklists and provide the backbone for quality planning, compliance and verification, complaint management and continuous improvement.

Automated analysis and notification functions applied all along the quality value chain provide for real time problem resolution. Advanced graphical reporting gets clearly-presented, meaningful intelligence in front of the right eyes at the right times.

### Customer Focus

Vestas' success hinges on successful turbine installation and operation on the part of its customers. The company takes an active consultative role, working with clients to develop their unique requirements and lending its expertise throughout the planning phase. The QDA-based quality system is a critical part of the process, operating in COP (customer oriented production) mode. The software applies demand-driven production set-ups for quality control at each process step, defines strict and concise tack times, applies SPC with six-sigma targets, establishes employee

certification processes and standardizes equipment and tool management.

### Customized Analysis

ASI DATAMYTE developed an automated work instruction whereby QDA assesses whether the production line is in balance. It analyzes the output of certain operations to determine if they are performing at an optimal level, or whether the testing and data collection processes, which are very time sensitive, need to be adjusted.

Another customized module was created by which QDA automatically releases test certificates and produces test reports using a module called FixturePlot.

### Nacelle Assembly

The entire nacelle assembly routine is organized within a single QDA check plan, with each step being defined as a process. The check plan, which contains “order” fields and information about the sample, requires that each step be formally accepted as verification that it has been successfully completed. It also ensures that each component is traceable. These check plans contain up to 450 processes and cover several hundred characteristics.



QDA retains all assembly information, providing a database from which all relevant documentation and work instructions can be updated. Previously all checks were performed

manually. Documentation was created with pen and paper.

After a nacelle is assembled, including connection of all the cables, collected data is imported into QDA using the import manager. When QDA determines that the test results are positive and the assembly “passes”, it summarizes the findings in the appropriate reports and automatically generates and distributes an acceptance certificate.

### Quality Management and KPI Reporting

QDA also manages data that feed Key Performance Indicators. Reliability expectations of wind turbines demand that 100% of blades, nacelles and other components be tested. The process generates millions of records, and QDA logs the test results, identifies errors, tracks rework and calculates the values that go into KPIs which provide meaningful comparisons. First Pass Yield is tracked, measured and reported as well. It’s a metric that indicates the percentage of items moving through a process with no problems on the very first pass.

With QDA at the nucleus of Vestas’ quality management platform, the company has rolled out what all leading manufacturers are trying to achieve – an exemplary integrated quality system that improves quality continually on several planes, reduces costs on a grand scale and ensures product performance worldwide.

**Vestas has created a model globally integrated quality system that is just beginning to reap big returns. This is how it’s done.**

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