Traceability in the Automotive Industry Using the Example of Wiring Harness Production

Bernd Jost, Managing Director
DiIT AG
www.diit.de

Traceability is a basic requirement in vehicle manufacturing. It has to be possible to uniquely identify each part and component and assign each to the respective process step. In the production of wiring harnesses, special MES solutions provide a specific history for each wiring section.

Bernd Jost, Managing Director at DiIT AG in Krailling (near Munich), Germany

Recalls in the automotive industry are always spectacular actions. When manufacturers have to recall vehicles to workshops, they can certainly expect media attention. Recently for example, **Toyota** had to recall 2.9 million vehicles due to defective airbags and **Audi** in China had to recall almost one million cars on safety grounds, publicity that the manufacturers concerned could probably do without.

Such recalls are the result of subsequently recognized quality defects. The more complex industrial production processes become—and processes in the automotive industry have now become highly complex—the more complicated and difficult it is to ensure the necessary quality standards. It is not only a question of retaining a continuous overview of tens of thousands of parts and components from the wire harness through to complete transmission systems, but also remembering that these parts originate from an almost incalculable number of suppliers who themselves use the complex tiered structures of their own upstream suppliers.

Therefore, at all levels in order to ensure their quality standards, manufacturers must "know" each and every component used, which means that they not only need to know who produced it and when, but which batches of intermediate products or raw materials were used, which machines and systems were used and finally which employees were involved. In other words, they have to guarantee continuous traceability for each part.

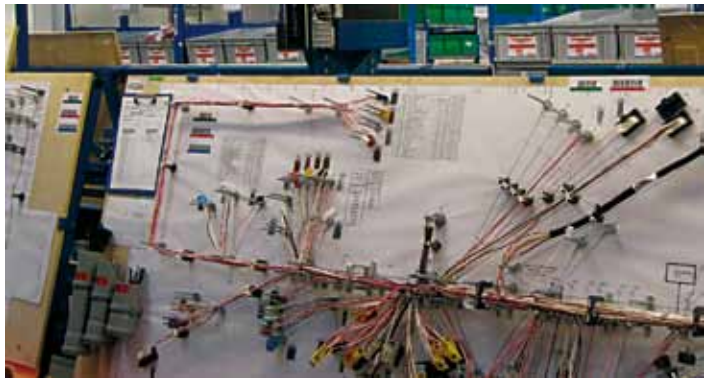
Due to the huge volume of data involved, traceability can only be provided by using a relevant software system. For this reason alone, automotive production at the current level would be inconceivable without software control. Continuous "End-to-End" traceability enables:

- **Quality assurance.** Traceability enables the specific detection of a fault so it can be determined exactly which batch on which machine is responsible for a fault, which also means that targeted counter-measures can be implemented promptly.
- **Product liability:** Traceability also makes it possible to trace the defective parts to their respective suppliers, thereby making it possible to lodge or even prevent any ensuing damages claims within the scope of product liability.
- **Recalls:** Traceability enables faults to be isolated so that manufacturers do not have to recall complete series, but can restrict the recall to those vehicles in which the faulty parts were incorporated, or which were produced with a specific machine. This aspect is obviously of huge commercial significance because this is the decision point as to whether 200 or 200,000 vehicles have to be recalled.

Traceable Wire Harnesses

Therefore in modern production processes, traceability is an indispensable yet also a very demanding task. It is generally organized within the Manufacturing Execution System (MES). The example of the production of a wiring harness—the backbone of modern vehicle electronics—demonstrates how complex a task this is, especially as this process is both highly automated and also at times almost completely manual.

The manufacture of wiring harnesses usually includes the three production steps of cutting, pre-assembly and final assembly and is controlled by an integrated MES software application. This software can also calculate



the production documents on the basis of a specific just-in-time delivery schedule and produces a wiring system for a specific vehicle.

The first production step is highly automated. The wires are machined to a certain length, fitted with connections and grouped into bundles. In this process the cutting machines are highly clocked and the wires are often very thin. The MES not only ensures the optimum distribution of the orders across the various machines, but also the traceability from the outset by assigning a unique ID to each wire bundle by means of a corresponding laser imprint and thus continuously managing its history. And even when the vehicle is finished, this imprint can be used to determine when and with which cutting machine the relevant wire piece was processed.

In the next production phase, pre-assembly, wire bundles are assembled, largely manually, into kits for example by crimping, welding or twisting. Once again the MES updates the history of the component, then during the manufacture of a kit, a new ID is generated, which references all the parts included in this kit. Therefore, as a basis for traceability, the history covers all production phases through to ever more complex components.

In the final assembly phase, the wires and kits are manually assembled into wiring harnesses on so-called assembly boards. Given that wiring harnesses are frequently produced to be customer specific, the work steps differ from wiring harness to wiring harness. Even when the work itself is performed manually, the assigned MES software such as the Production and Logistics System (PLS) from DiIT, controls the process and again records the ID involved in the history of the now complete wiring harness. This now consists of thousands of components with the wiring harness MES retaining a complete history for each component as well as for the entire harness. It can also accurately document on which day, on which machine, by which employee and with which tools the individual components were produced. This means that it can be determined at any time in which vehicles wire harnesses are used with wire from a specific batch. This therefore enables any repairs or recalls to be targeted accurately.

Specifically, in relation to new developments in the automotive industry—with the keywords being e-mobility and autonomous driving—total traceability becomes a basic requirement. Totally new procedures will be used for totally new products and of course the need for optimization will also be higher. Based on experience, faults cannot be totally excluded, but they must be detected very quickly and located with precision. A faulty connector in an autonomously driven car can lead to catastrophic consequences. Therefore, for liability reasons the manufacturers and suppliers

involved must be able to precisely assign weak points in products and processes.

For further discussion, contact the author at **DiIT AG** in Germany or visit: *www.diit.de* **WHCC**

More About DiIT AG...

DiIT AG is the world's leading supplier of manufacturing execution systems (MES) for the production of cable sets and wiring harnesses for industries such as automotive. For more than 25 years, the company's innovative software solutions optimize and control complex development, manufacturing and logistics processes for international manufacturers and support quality assurance and traceability. The company offers a comprehensive range of services, from consulting and project management right through to customer-specific implementation and training for both large and small customers. **www.diit.de**