Incorporating FMEAs in the quality control loop

Too valuable to end up in a drawer

Nowadays, the automotive supply industry only places an order, if the supplier has a carefully created FMEA (Failure mode and effect analysis) and has analyzed their manufacturing processes in advance for possible failures, with the view of offering reliable delivery. But far too often, the FMEA plays no part in the following quality assurance process. Instead, it tends to end up in a drawer after an order has been placed and is not used to its full potential.

The ZF Friedrichshafen AG in Friedrichshafen also decided to make greater use of the potential that lies dormant in their FMEAs, and started the search for a CAQ-software that links FMEAs and SAP Complaints Management in the quality control loop. The search was successful and the company found the solution at iqs Software GmbH with its headquarters in Bühl, Germany.

Bühl / Friedrichshafen - With pride, the ZF Friedrichshafen AG can look back this year on one hundred years of history, having evolved into a leading technology company, specializing in Driveline and Chassis Technology and developing active and passive safety technology. The company, which took over TRW Automotive in May 15, 2015, is now represented in around 230 locations in 40 countries. In 2014 the companies, both independent at that point, achieved sales of over 30 billion Euros, employing 134,000 associates.

Quality Campaign

This kind of market position can only be held when applying the highest quality standards. ZF, with its headquarters in Friedrichshafen, also acknowledged this fact and launched a quality campaign in 2007, designed to examine efficiency and performance of their quality assurance system for assembly. The campaign demonstrated that FMEAs, created with great effort and expense, were not used for the subsequent manufacturing process after placement of order, but lay unused and archived in a drawer. Potential for development was also discovered in other areas: the initial sample inspection report was still stamped manually at this time and Measures Management managed with MS-Word and MS-Excel. The aim was now to use the large and untapped potential of FMEAs and make them part of an integrated, preventive and efficient quality management system.

Increased integration of FMEA

The search began for a software solution that was able to integrate FMEA in the quality control loop. It started with an in-house project and subsequently 40 suppliers of quality management software received a question catalog to determine the CAQ-systems that fulfill the desired requirements (integrated approach, structure based on databases). Eight CAQ-providers were shortlisted and invited to make a presentation to Friedrichshafen. A large group of participants from all concerned departments assessed both technical aspects as well as the credibility of the presentation. iqs Software GmbH received top marks and won the contract.

Experimental phase with real data

The initial approach was to carry out an iqs test installation, linking the FMEA via an iqs-programmed interface with the assembly quality database and feed it with master ›

data. In a narrowly defined area of assembly, the iqs FMEA was fed with real failures, i.e. real data from the Complaint Management of the quality database as part of the pilot project. Failures were analyzed in weekly failure management meetings, attended by all product managers, quality staff, foremen and associates involved in the project. The pilot phase showed at an early stage that when posing new software questions like „What is the cause of the failure?“ or „What happens when the failures occurs?“ they could now be answered by the software-system – questions previously only answered by very experienced staff.

The pilot phase also revealed that the new software could be used not only in assembly, but also in manufacturing to increase profitability. After six months, the pilot project was successfully completed. It was decided to acquire a site license for the location Friedrichshafen and plan the rollout.

Implementation

Parallel to the rollout, the Complaint Management from quality databases was transferred to SAP in a separate project and a bidirectional interface to iqs FMEA was developed. Since then, SAP issues a unique complaint number for each failure. In order to facilitate the work for the user, a web entry screen with the possibility to link to iqs FMEA was provided. An additional tab was included in the user interface of the SAP quality notification to allow linking.

Due to many individual requests by software users and the increasing number of areas within manufacturing, which were part of the new system (rollout), made it necessary to constantly adjust the programming of the CAQ-system. Major changes to the software were always carried out at the weekend, so that standard operation was guaranteed. Despite numerous and extensive adjustments, iqs was able to guarantee perfect functionality of the new software at all time.

Key user

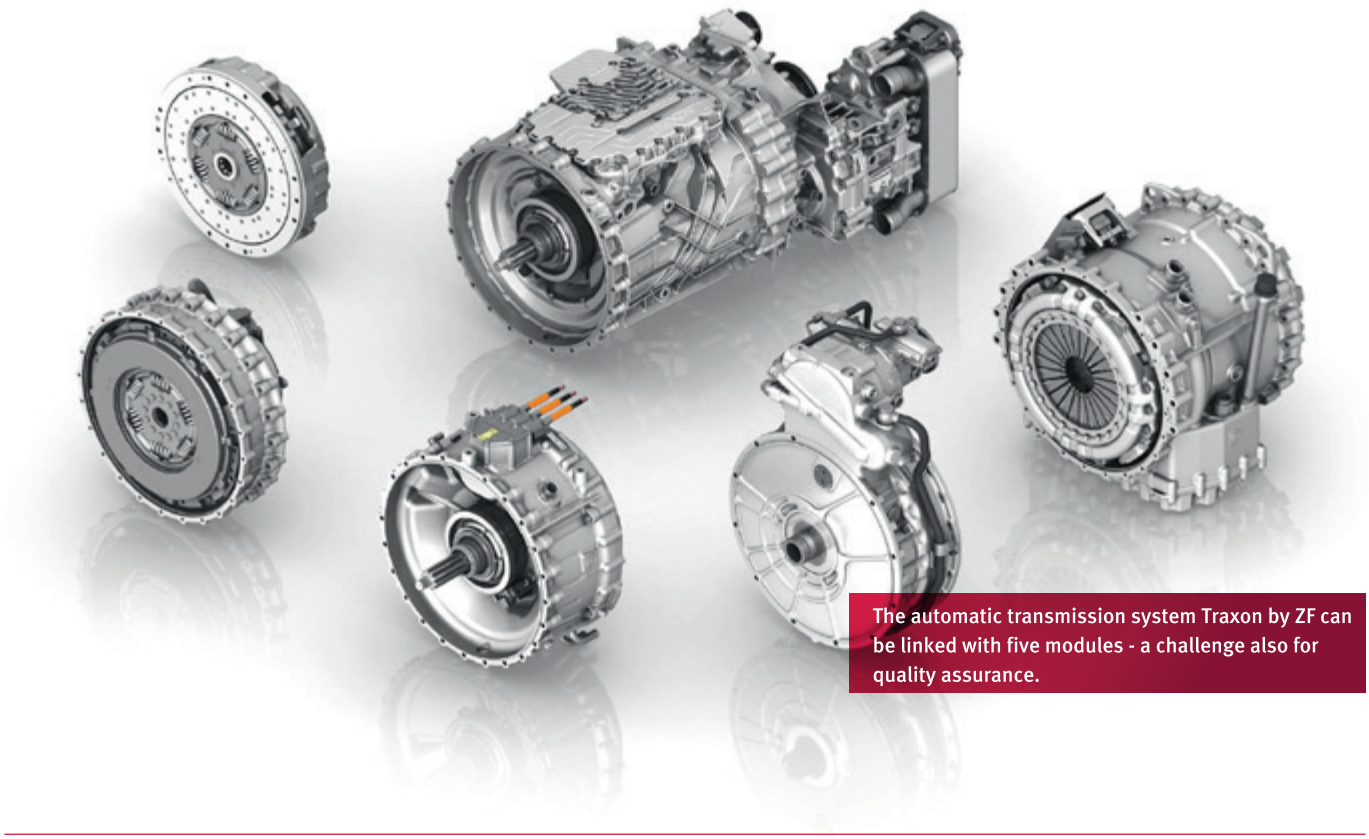
In order to gain as much expertise in dealing with the software within the company, a well-functioning network of key users was set up from the start. The initial key users were trained on-site by iqs regarding iqs FMEA. These key users perform the so-called first-level support, and check whether the failure was caused by the user and be fixed by him/her, or whether iqs must intervene and provide support. Moreover, the key users train other users within their area. The same structures were established for the initial sample inspection report (iqs ISIR) and key users are regularly trained by iqs.

Inheritance and module technology

iqs-owned module technology in conjunction with inheritance, provided an excellent service when creating FMEAs for manufacturing. As some products have several thousand features, the conclusion was drawn not to create a completely new FMEA for each product but to generate base-FMEAs and various FMEA-modules for similar or almost identical products. Associates from iqs provided valuable support with their extensive experience and know-how when defining meaningful process modules.

Inheritance technology is invaluable, not only when drafting the FMEA, but also for the continuous maintenance of the FMEA, i.e. if a sub-process is changed, which is applicable to various overall processes, FMEAs must no longer be maintained manually, but are adjusted automatically. This means that the building blocks for a new FMEA, are always up-to-date. Once a process step is modified, this change is automatically reflected in all future FMEAs using this block.

„This has a two-fold effect: on one hand we eliminate redundant testing in a very efficient manner and reduce the amount of testing to an absolute minimum, on the other hand, we consistently avoid recurrent mistakes. Our entire know-how is incorporated in ›



The automatic transmission system Traxon by ZF can be linked with five modules - a challenge also for quality assurance.

constantly updating FMEA to develop new parts, reduces testing costs and increases product and process quality significantly. We were able to more than halve our external and internal PPM-rates over the past year and get closer to achieve the target of zero-failure strategy, „said Christine Schmitt, CAQ-officer, production facility Friedrichshafen.

Cooperative interplay between iqs and SAP

Complaints and failures at ZF remain to be recorded in SAP, but relevant data is communicated directly to iqs FMEA. Comprehensive failure and root cause analysis take place here. Should the cause of failure for instance be in the process itself, iqs FMEA will methodically analyze where the process must be optimized in order to avoid a so-called Zero-Kilometer complaint. This approach enables iqs FMEA to gradually build up valuable manufacturing know-how.

Repeat failures are recognized as such, based on the chain of causality and measures are reviewed. The findings and results are then played back to the SAP-system as part of the 8D method.

Simple tracking of measures

The close cooperation between iqs FMEA and iqs Measures Management (iqs MM) greatly reduce the workload. The tight integration creates the iqs MM straight from the FMEA. The measures from the FMEA are made available to both originator and editor (implementing measures) in a central overview.

Write permissions are not required for the FMEA to update the measures. Moreover, numerous Excel and Word lists, which had been used as a catalog of measures, were abolished in the areas and transferred to the iqs-system. Reminders are sent to the responsible associates via Outlook who can monitor and process the measures directly. This ensures that the FMEA is always up-to-date.

High praise during audits

In addition to the significant decrease of repeat failures and clear cost reduction for generating FMEAs, inspecting auditors and certification bodies are impressed with the database-oriented structure and the integration of FMEA in the quality control loop, showing that data and information in the individual quality modules is consistent. Audits clearly show that ZF applies a comprehensive failure management.

Additional iqs modules

Coinciding with the introduction of iqs FMEA, the production facility in Friedrichshafen introduced the initial sample inspection report (iqs ISIR), which is currently used successfully in manufacturing - for internal and external suppliers - and also utilized for OEM-sampling.

An additional module was programmed specifically for ZF by iqs Software GmbH: DFA (Design For Assembly) / DFM (Design for Manufacturing). This module is able to evaluate the cost of production (manufacturing and assembly) in advance and, for example, answer the question whether the product can be produced using the existing machinery. Adjusting product structure to manufacturing needs make consistent cost-effective and failure-free manufacturing and assembly possible. Whereas DFA and DFM analyze the product development from the economic point of view (costs/time), the FMEA examines the processes from the perspective of preventive quality assurance. DFA and DFM are closely linked to iqs FMEA, hence forming an ideal team to launch the development of new products.

Future developments

Based on excellent past experiences with iqs, further iqs-modules will be added to the Quality Assurance System in the coming years. A subsequent project should pursue the integrated approach and the quality control loop should be closed permanently. This includes the integration of inspection features from drawing into test planning (iqs AZ) as well as an exchange between iqs-FMEA Detection Measures and the SAP-inspection plan. The aim is to close the control loop between the findings of the failure management by using iqs- FMEA-failure analysis and actual necessary checks in the SAP-inspection plan.

Interview was conducted with user:

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