# **FMEA**



As a method for preventively avoiding failures the FMEA is an important tool for quality planning. Conducting a FMEA requires a consequent structuring of dependencies that are often very complex. The iQ-FMEA software module helps to keep track of these dependencies and reuse knowledge once acquired. The product is aimed to product and process FMEA as well.

## Workflow

The software support provided by iQ-FMEA begins with a presentation of the system that is to be analyzed and its splitting into components. After describing the functions of the components the functions of the overall system can be described as a hierarchical structure of the single functions. The next step comprises the specification of possible failures for each function and afterwards the analyzation of the hierarchical dependencies between the failures. Based on an assessment of the effects and root causes of the failures it is then possible to perform a risk analysis to detect the critical parts of the system. Alternatively a failure tree analysis can be conducted to determine the reliability of the overall system. By applying dedicated actions the weak parts are improved until the required reliability of the overall system is reached.

## **Important Features at a Glance**

#### Fields of application

- Product FMEA
- Process FMEA

## Integration in iQ-Basis

- Preparing a FMEA as quality project in *iQ-PROJEKTE*
- Availability of master data
- Action tracking and escalation using *iQ-PROJEKTE*

## Editing and representation of the system's structure

- Collection and representation of any elements and partial aspects of the overall system in one single form
- Splitting into components is possible up to any detail

- Reusing components as building parts supported by a search and a copy feature
- Easy and quick conduction of several variants thanks to a smart versioning concept

## Creation of a function and failure structure

- Modern graphical user interface
- Creation of different function and failures structures for various aspects of the overall system
- Automatic update of failures sequences and root causes for a maximum data consistency
- Definition of characteristics including corresponding specifications

AND Overview FMEA system structure	
DROSSELKLAPPE / 1st version	Header data Product / process Function structure
😑 🎭 1 / Throttle valve actuator	
A Set up air cross section according to control	DROSSELKLAPPE ***Throttle valve actuator ¥
🖃 🔻 Air section not enlarged in spite of control	
A No torque transmission from actuator to throttle valve	FMEAtype PRD system-FMEA product
Hysteresis of air section adjustment is too large	
Torque transmission from actuator to throttle valve is sluggish	Method VDA-PRD Product
🖃 🍓 1.1 / Servo motor	
🛕 Drosselklappe entsprechend Ansteuerung über Getriebe antreiben	Special characteristics V
🖃 🍓 1.2 / Gear box	
🖃 🔺 Transform driving torque between drive and throttle valve with a defined gear transmission ratio	Responsibilities and deadlines
Vo torque transmission from actuator to throttle valve	
Air section not enlarged in spite of control	Responsible AHP* Supervisor
Jam on the primary gearwheel axis	
Klemmt an der Lagerstelle im Gehäuse	Business partner
Jam on the primary gearwheel axis	
🗢 Breaks in gear teeth area	
Torque transmission from actuator to throttle valve is sluggish	ready by 01.02.2008
Hysteresis of air section adjustment is too large	
Jam on the primary gearwheel axis	Comments
Klemmt an der Lagerstelle im Gehäuse	Product FMEA Throttle valve actuator according to VDA-4
<b>2</b> 04.11.2010	
🖃 🎭 1.2.1 / Primary gearwheel	
Transfer torque from output shaft to secondary gearwheel	
Jam on the primary geanwheel axis	
Breaks in gear teeth area	V
No torque transmission from actuator to throttle valve	
🔠 🖙 Kadien der Verzannungsgeometrie zu klein ausgelegt	Version
Iorque transformation	I list version
Moderial Environment 22 M/mm2	
A Rearing diameter = 2 mm + (-0.1 mm)	
A Outride diameter = 18 mm +/- 0,1 mm	SxO-Matrix SxD-Matrix OxD-Matrix RMR Action Priority
Generative diameter = 10 min +/- 0,2 min Generative according to customer requirements	SvO-Matrix
Oceaning geometry according to customet requirements	
Radian der Verzahnungsgeometrie zu klein ausgelent	
Reaks in near teeth area	10
Surface rating = xxx um	8
<sup>(k)</sup> 1.2.2 / Primary gearwheel axis	7
Primārzahnrad im Gehäuse lagern	
∀ Klemmt an der Lagerstelle im Gehäuse	
No torque transmission from actuator to throttle valve	
Torque transmission from actuator to throttle valve is sluggish	
🗑 🗢 Längentoleranz zu groß gewählt	
🗃 🗇 Oberfläche in der Lagerstelle zu rauh	123456789185
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## <u>Risk analysis</u>

- Assessment of the meaning of failures sequences and the probability of detection and occurrence of failures root causes
- Standardized assessment using risk priority numbers

### <u>Risk matrix</u>

- Representation of the matrices BxA, BxE, AxE as well as the risk matrix rank and the task priority
- Visualization via the traffic light colors red (high risk), yellow (medium risk) and green (low risk)

### Failures tree analysis

 Alternative way to determine critical failures from the minimum intersection and estimate the reliability of the overall system

## **Optimizing critical failures**

- Complete overview of any optimizations that have been conducted
- Specification of detection and abatement actions including an optional action tracking using the standard in *iQ-PROJEKTE*

## Reuse existing knowledge

- System elements built up by components can be reused as building parts in other FMEA's.
- It is possible to create and maintain failure and root cause catalogues to ease creation and improve comparability.

## <u>Other features</u>

- Assignment of costs and efforts e.g. for meetings
- Definition and processing of check lists

#### **Documentation**

- Form sheet according to VDA 4 optionally with a complete optimization recording
- Results of the failure tree analysis

### <u>Reporting</u>

- Pareto analysis RPN for root causes
- Pareto analysis RPN frequency distribution



#### **Interfaces to Other Modules**

- *iQ-PROJEKTE* for planning and monitoring the activities of a FMEA and tracking actions
- *iQ-GL* for a centralized maintenance of all master data that is relevant in other modules, too
- *iQ-DOKU* for storing and managing supplemental documents
- *iQ-QMS* to refer to a FMEA out of a quality message indicated as "originator self"
- *iQ-APQP*, to directly take over characteristics from a FMEA into the inspection characteristics of a control plan
- *iQ-INFO* for user-defined reporting e.g. based on Crystal Reports