

An analysis of main product to find out all possible failures that could occur during product's life cycle by using FMECA-methodology"Case Study"

The FMEA (Failure Mode and Effect Analysis) is a logical and structured method that uses to analyze system, sub-system, device or process. It regards as most commonly analysis technique that performs within reliability and system safety.

The application of FMEA aims to identify possible failures modes, their causes and the effects, further a proper identification of failures may lead to enhance the overall reliability and safety of the selected asset. Initially, it should be used at the design stage, but it also could be used throughout the life cycle of the asset to identify all possible failures that occur during operating time. The development level of applying FMEA depends upon the detail needed and the availability of information, also a criticality assessment is added to become FMECA (Failure Mode Effect and Criticality Analysis). There are two main FMECA-types, functional and hardware, and two directions Top-down and Bottom-Up, furthermore each one has own using area and characteristics. Additionally, functional – bottom-up approach has been selected in this case study to conduct the project in a proper way and to accomplish the desired result, because the analysis is performed on a final product to determine all possible failures that could occur during its life cycle. Moreover, the product has been broken down into small systems, sub-systems and components to be able to analyze each unit systematically.

Purpose

The main goal of this project is to detect and identify all possible failures that will occur during product's life cycle, their effects and causes by using FMECA-methodology, as well the analysis is applied on company's main product called XY.

The company

XXAB is an industrial company situated in Sweden. It started during 1970 as a private firm. Since the business has been successful for it the firm became a shared company in 1983. The company manufactures a broad variety of water filters types. The filters treat the most usual water problems, on the other hand the company offers several solutions for the costumers. Additionally, XXAB produces the filters according to costumer's needs and demands. The following are company's products, iron and manganese filter, PH filter, soft water filter, radon separator filter, carbon human filter, sylph filter, drink water radiator, oxygen activator, UV bacteria filter, fluoride filter, nitrate filter etc.

Description of the product

The company produces water filters that can filter off the iron and manganese from the water efficiently. (Without affecting water's color, smell or taste).

The filtered water uses for example in the bathtub, basin and for the laundry etc. Additionally, the filter treats the PH value in the water that can affect house's water pipes. Furthermore, the most famous products for the company called XY- Kb and XY- K.

FMECA-application

The table below shows the analysis throughout the selected product (main product XY). The product has been divided into small systems, sub-systems and components to be able to identify component/sub-system function, possible failure/failure mode, failure effect(s), failure reason, probability of occurrence of failure, severity of failure, likelihood of detecting the failure and finally the risk priority number (RPN) that could possible occur during product life cycle. Furthermore, the assessment of the RPN is based on a comprehensive analysis, data gathered and documents, interviews with plant manager and operators.

Customer	XXAB	Issued by	HaAl	Detail Name	Water filter	Detail nr.		Design FMEA	X
Project leader	HaAl	Date	2007-03-22	Follow up date		Remarks		Process FMEA	
FMECA									
Part nr	Components	Function	Possible failure	Failure effect	Failure reason	Probability of occurrence of failure	Severity of failure	Likelihood of detecting the failure	Risk priority number RPN
1	XY	Fe and Mn reduction	No water filtered	Not having clean water	The water only comes from one side if the vacuum doesn't come	1	8	9	72
2	Silver bend	Controlling water amount	The water not coming out	Produces/causes a stoppage in the pressure process	Big particles in the water	2	8	9	144
3	Vacuum valve	Allowing the air inside the cylinder	Allowance of the air	Decreasing of the pressure in the system	Big particles in the water affect the functioning of the component	2	8	9	144
4	Pump	Pumping water	Bad water pumping	Unclean water	Overload or bad manufacturing	1	4	5	20

5	Air circulation pump	Circulation air	Circulation pump becomes hot	Affect the air circulation negatively	Air inside the pump or it is close	1	4	6	24
6	Back ventilator	Filter of the mass from the water	Inefficient filtering off	The mass followed with returning water	The ventilator is not tight or the pump gives more water	1	3	4	12
7	Hot water tap	Pumps hot water	Air push in the hot water system	Affect the pressure of the air inside the hot water system	Out ...air inside of the water broaden when the water warms up	1	2	3	6
8	Strength of the welding of XYs tank	Keeping the pressure stable & Not allowing other substances to be mixed	Corrosion of the metal, crack on the welding	Unstable pressure, unclean water and mixer of different substances	Bad welding, bad selecting material, and corrosion	1	3	2	6

Analysis and Results

This analysis highlights the major and most important problems which can occur during product operating time that can interrupt the entire process. The values in the table are distributed in accordance with their importance. Furthermore, when these problems occur the filter must be sent to service. Moreover, the main reasons/causes that lie behind these problems depends in general on dirt in the silver bend, bad capacity of the water pump, mass filter or due to low level of the mass refilling.

Some of these problems such as Silver bend and Vacuum Valves problems could be avoided if the customer cleans the bend, the vacuum ventilator and checking it regularly to assure that it is in the right place in compliance with manufacture's instruction.

Regarding the problem that occurs in the pump, the first step that must be taken into account is to measure the quantity of the water per minute, to assure that the capacity of the pump is all right; if it is not, the options are either send the pump to service or replace it with a new one. The heating of the air circulation pump indicates that there is some air inside the air circulations pump, or maybe the pump needs to be cleaned, thus the costumer must clean up the pump in this case in order to restore it in its desired condition.

The problem that sometimes occurs in the back ventilator depends maybe on the dirt or there is something wrong with the capacity of the water flow. It recommends checking both causes to be able to eliminate any connection or contribution between them.

A control must be done by returning the rinsing of the water to check out the volume per minute, if the capacity of the water pumping is too high, in this case the pump must be strangled.

When the hot water system gets some air push inside its system, there are two options, the filter needs a special ventilator to be assembled and connected with the water broaden, or to open the water tap to let the air comes out. Additionally, the failure could occur sometimes due to bad welding, selecting of bad material or corrosion and in this case the filter has to be sent to service.

There are other failure(s) that could occur during filter's operating time such as crack on the bottom or on the top of the bigger container/tank of the pumps. The failure can appears as a circumferential crack or only as a little crack inside the filter. This failure causes extensive water damage in the property where it is installed.

While analyzing the stresses and forces on the filter during the operating time, two main sources of stress are identified. There is a stress originating at the bottom of the filter caused by internal water pressure and the weight of the sand, and the second one is on the top caused by internal air pressure.

Moreover, according to the data gathered, the analysis, FMECA-assessment and the discussion with company's vice president a redesign of the main product is proposed in order to avoid the mentioned problems that in return lead to affect company's profitability and competitiveness negatively.

OBS: A few sections, data and information have been taken away from this case study because these are confidential.

Best regards
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