ASQ CRE Prep course

Lesson III. A. 3.

FMEA and FMECA

A common risk assessment tool

FMEA / FMECA

Concept

Effects – severity rating

Occurrence – probability rating

Controls – detection rating

RPN = Severity x Probability x Detection

Projector Lamp Design FMEA (with missing or incorrect elements for teaching purposes)

Function	Potential Failure Mode	Potential Effect(s) of Failure	SEV	Class	Potential Cause(s)	OCC	Current Design Controls (Prevention)	Current Design Controls (Detection)	DET	RPN	Recommended Action(s)
Provide reliable light for image transfer at a minimum of 1000 lumens for 2000 hours of operation	lamp burns out prematurely	no light on image, customer dissatisfied	8		hot spots on glass due to over touching	5	ANSI Guideline for incandescent bulbs	Lamp environmental test #123	3	120	Implement new glass coating to minimize impact of touching on bulb durability
											Revise Lamp environmental test #123 to include periodic touching of glass
					gas leak at base of glass due to overheating	2		Lamp environmental test #123	1	16	
					inadequate voltage to lamp due to corrosion of base	8	Sneak circuit analysis on projector system	Lamp durability test #456	7	448	Change lamp base to material ABC in order to be less corrosive.
											Revise Lamp durability test #456 to add corrosion inducement and checking.
											Revise the interface between bulb base and electrical connection to ensure positive connection, with increased connection force.
	lamp shatters	no light, potential for injury to user	10		over pressure in lamp due to wrong gas	2	Projector lamp Design Guide #ABC	Lamp durability test #456	8	160	Install additional plastic shield on projector to ensure no injury to user if glass shatters.
											Modify projector lamp Design Guide #ABC to include correct bulb gas.
											Conduct Design of Experiments on projector bulb gas to determine the optimum gas specification to desensitize bulb pressure to gas variation.
											Modify Lamp durability test #456 to include induced gas pressure build up.
	low light output	user may have difficulty viewing image	6		lamp filament has low resistance due to wrong filament material	3	Projector lamp design guide #ABC		2	36	
					slow gas leak due to customer abuse during installation	6		Lamp durability test #456	8	288	Modify lamp durability test #456 to include moderate customer abuse during installation process.

Example courtesy of Carlson, Carl. *Effective FMEAs Achieving Safe, Reliable, and Economical Products and Processes Using Failure Mode and Effects Ana* Hoboken, N.J.: John Wiley & Sons, 2012

Basic Steps to Accomplish

- Review the process
- Brainstorm potential failure modes
- List potential effects of each failure mode
- Assign a severity rating for each effect
- Assign an occurrence rating for each failure mode
- Assign a detection rating for each failure mode and/or effect
- Calculate the risk priority number for each effect
- Prioritize the failure modes for action
- Take action to eliminate or reduce the high risk failure modes
- Calculate the resulting RPN after changes occur

Failure Mechanism v Failure Modes

Failure mode is what the customer experiences – the symptom of a problem

Failure mechanism is the physics or chemistry – the cause of a problem

Sometimes the causal chain is long

Is it useful to outsource an FMEA?

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Lesson III. A. 4.

Common Mode Failure Analysis