Health and Safety regarding moving Heavy Machinery with Castors

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Aim of the Project

The aims of the project are to research health and safety procedures regarding moving heavy machinery. This will be tied into the bracket made for the FANUC RoboDrill.

Background

Health and Safety procedures are important for several reasons. The first, and most important, is to prevent injury or death. Another reason these procedures are important is to avoid damage to expensive machinery and products through proper guidelines and precautions.

There are many tools that can be used to maximize health and safety in the workplace and for the design and use of products. These include manual handling training, risk assessment forms and FMEA (failure mode and effects analysis) and all of its family forms such as DFMEA (design FMEA).

The FMEA family can be applied to the design and use of the bracket made last semester in the group project seen in figure 2.

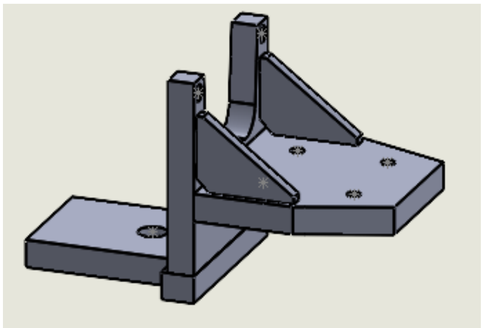

Figure 2: Bracket for FANUC Robodrill

FMEA

FAILURE MODE AND EFFECTS ANALYSIS

Item: Bracket
Model: Current
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Responsibility: T. Kinahan
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FMEA number: 123456
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FMEA Date (Orig) 1/1/2024 Rev: 1

Process Function	Potential Failure Mode	Potential Effect(s) of Failure	Sev	Class	Potential Cause(s)/ Mechanism(s) of Failure	Occur	Current Process Controls	Detec	RPN	Recommended Action(s)	Responsibility and Target Completion Date	Action Results				
												Actions Taken	Sev	Occ	Det	RPN
Hole Positions	Hole too close to upright	Castor cant complete full rotation	7		Improper modelling of bracket	3	Problem will be found through prototyping	1	21	Test several prototypes	R. Laporga 05/04/2024					0
Weld	Weld Failure	Potential Criticical Failure of bracket	10		Improper training / human error	1	Weld testing (non-destuctive, destructive and visual)	2	20							0
Material Selection	Damage to bracket	Potential Criticical Failure of bracket	10		Improper research of materials mechanical properties	1	Von Mises conducted on each individual part	1	10							0

Figure 1: FMEA Example for Castor Bracket

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Failure Mode and Effects Analysis is a tool used to calculate the risk of a failure happening, the severity of that risk and how easily that failure will be detected.

The RPN (Risk Priority Number) is calculated by multiplying the severity, occurrence and detection numbers together. Anything over 300 is considered unsafe.

Severity is ranked from 1-10, 1 being the failure mode will not have much effect to 10 being the most severe, complete failure of a part/product.

Occurrence is also rated between 1-10, 10 being that this particular failure mode will definitely happen.

FMEA is used in the pre-prototype stage of design. By ranking the above criteria, the necessary changes can be made to a design. The higher the RPN the faster the failure mode should be addressed. Thus a systematic way to identify these failure modes has been established and dealt with accordingly.

It is important to note that FMEA can be used on an overall design and for individual parts.

Risk Assessment

Risk Assessment can be used as a general way to systematically identify risks and overcome them. Risk assessment, while also proactive, differs from FMEA in how it assess an ongoing procedure. In the case of using the castor bracket to move the FANUC RoboDrill, would require a risk assessment.

There are 5 main steps in risk assessment. The 5 steps our outlined below with an example relating to moving the FANUC RoboDrill.

1) Identify the risk: the RoboDrill is a 2-ton machine that can fall.
2) Identify whos at risk: The operators moving the machine.
3) Remove/reduce risk: Introduce an extra person to help with the heavy load.
4) Keep written records.
5) Review thye risk assessment.

Below are the steps to DFMEA, part of the FMEA family

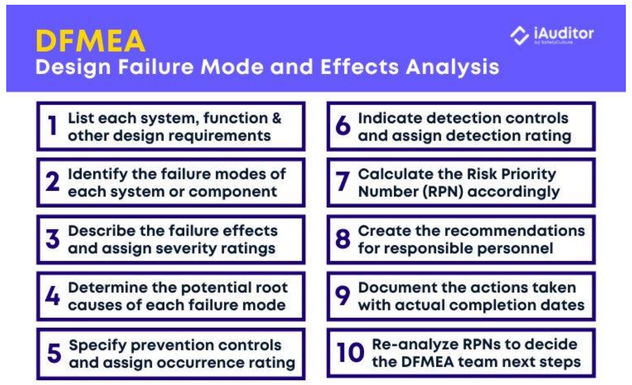

Figure 3: DFMEA Steps

Conclusion

Without Health and Safety procedures company's would open themselves up be liable for the injury caused by their product or improper training.

Through the use of risk assessment and forms such as FMEA this risk is minimized along with the liabilty.

These methods have become standard practice in industry and are essential for an engineer to learn how to conduct the necessary practices.

References

https://asq.org
https://www.sparqa.com
https://safetyculture.com/iauditor/
https://www.sciencedirect.com