

Design and Assembly Optimization for COM1 letterbox manufactured by Safety Letterbox Company Ltd.

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Introduction

The Safety Letterbox Company is a leading British manufacturer of secure mail and parcel delivery boxes for over for over 34 years. In 2012 the company become a part of the German RENZ Group in order to 'straighten the excellent market position here and support international growth'. The project analysed the COM1 letterbox designed and manufactured by SLB Company. The letterbox is manufactured form aluminium extrusion components ; AMC-716, AMC-985, AMC-730.

Project Aims

- mas reduction the letterbox;;
- continues improvement for manufacturing processes and assembly procedures adapted;
- total cost reduction.

Product description

- Suitable for both domestic and commercial use
- Suitable for internal and external installation
- Material; AA 6063 T6 .
- Available in three configurations; A4, A3, Lateral
- Complies with 'Secured by Design' guide for standardization
- RAL colours finishes

Methodology

- FEA simulation for aluminium extrusion components;
- Lean Six Sigma ; DMAIC approach; (Design, Measure, Analysis, Improve, Control)
- Design for Assembly (DFA)
- Process Failure Mode Effect Analysis (PFMEA)
- - Ohn's seven wastes



Figure 1. COM1 letterbox manufactured by SLB Company.

Results

1. FEA simulation results

Table 1. COM1 components Mass reduction .

Current design			Proposed design	
Aluminium Extrusion	length [mm]	mass [kg]	[kg]	Reduction [kg]
2 x AMC_716	265	0.625	0.625	0
2 x AMC_716	389	0.929	0.928	0
1 x AMC_985	235	0.473	0.392	-0.082
1 x SAL_501	231	0.314	0.314	0
1 x AMC 730	234	0.082	0.080	-0.002
	total	2.423	2.339	-0.084
Mass reduction				3.5%

1.Cost of Extrusions for current design

-Provisional cost of 1xCOM1=£8.45 (£3.5 per kg)

-Approximate lost through waste production = £1.50 (£0.70 per kg of scrap)

Al Extrusions for proposed design
Provisional cost of 1xCOM1= £8.05 (£3.5 per kg)

Approximate lost though waste production = £1.45 (£0.70 per kg of scrap)

PFMEA

Table 2. RPN for Failure mode effect for the process.

Process	Failure	RPN
1.Cutting	Measurement mistake	288
2.Cutting	Scrap, rework	216
	Poor work	
3.Painting	standardization	168
	Small, flying pieces of	
4.Cutting	Al	150
5.Bending	Fracture/cracks of Al	147

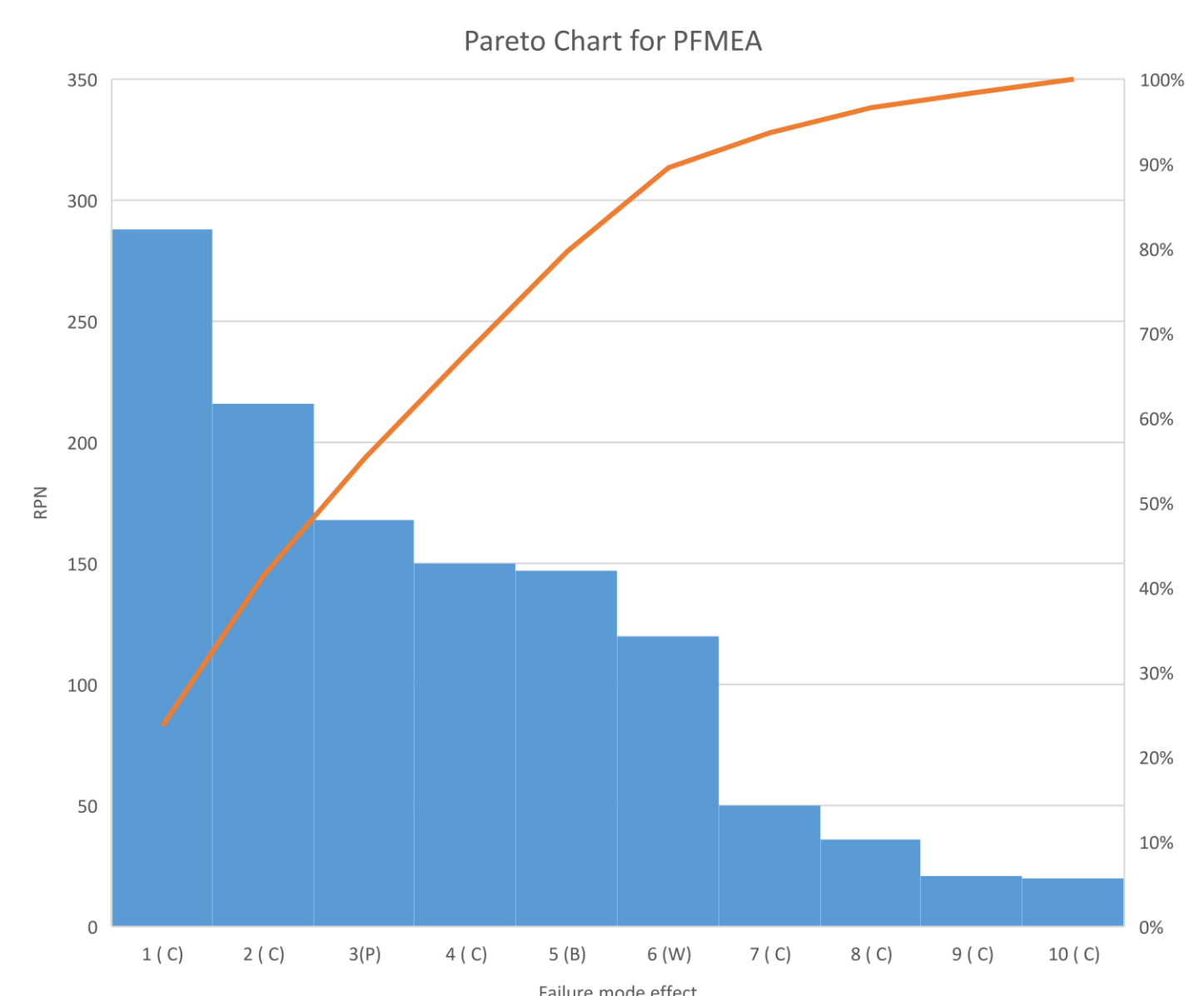


Figure 2 Pareto Chart for PFMEA. (C=cutting, P=painting, W=welding, B=bending)

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References

- [1] J. Bicheno and M. Hoiweg, The Lean Toolbox, 4 ed., England: PICSIE Books, 2009
- [2] R. Davies, "Safety Letterbox Company Ltd. secures it's future," Safety Letterbox Company Ltd., [Online]. Available: <https://safetyletterbox.com/the-safety-letterbox-company-secures-its-future/>
- [3] A. E. Council, "Aluminium Extrusions," 2017. [Online]. Available: https://cdn.ymaws.com/www.aec.org/resource/resmgr/iae/dc/iaedc2018/2017-18AO_DesignLimits_REVOc.pdf.