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Characteristics Assessment of a Manual Domestic Compactor

Investigating a safe approach to compacting at home.

Affiliations

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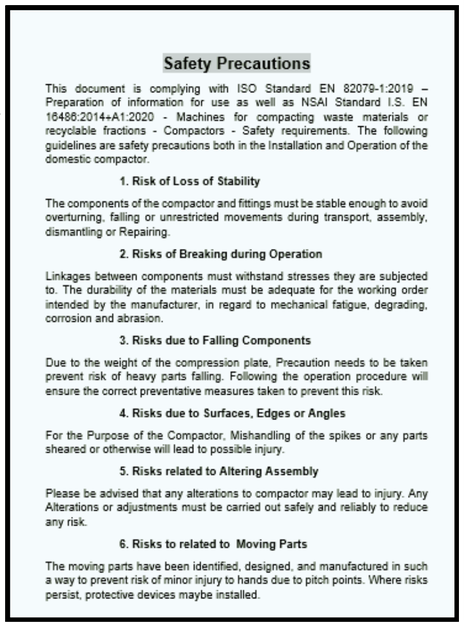
02. Background

The Basis of this Project is to make a prior project into a a viable marketable product, In order to do that, a number of characteristic assessment must be completed, Testing, trying to figure out the limitations of the compactor, Risk Assessment, trying to identify the potential hazards in operation of the compactor, User Manual, to inform the operate of any crucial information and Assembly guide, to ensure the Compactor is assembled correctly. Theses assessments are among some of the objectives that needed to be explored.

03. User Manual

Designing a User Manual requires A significant amount of research around Standards such as EN 82079 to correctly write a User Manual. Five steps were taken to Design the USER Manual.

- *Research & Review*
- *Review CAD Model*
- *Quick Assessment Details*
- *Safety Procedures & Precautions*
- *FAQ*



Safety Precautions

This document is complying with ISO Standard EN 82079-1:2019 – Preparation of information for use as well as NSAI Standard I.S. EN 16486:2014+A1:2020 - Machines for compacting waste materials or recyclable fractions - Compactors - Safety requirements. The following guidelines are safety precautions both in the Installation and Operation of the domestic compactor.

1. Risk of Loss of Stability

The components of the compactor and fittings must be stable enough to avoid overturning, falling or unrestricted movements during transport, assembly, dismantling or Repairing.

2. Risks of Breaking during Operation

Linkages between components must withstand stresses they are subjected to. The durability of the materials must be adequate for the working order intended by the manufacturer, in regard to mechanical fatigue, degrading, corrosion and abrasion.

3. Risks due to Falling Components

Due to the weight of the compression plate, Precaution needs to be taken prevent risk of heavy parts falling. Following the operation procedure will ensure the correct preventative measures taken to prevent this risk.

4. Risks due to Surfaces, Edges or Angles

For the Purpose of the Compactor, Mishandling of the spikes or any parts sheared or otherwise will lead to possible injury.

5. Risks related to Altering Assembly

Please be advised that any alterations to compactor may lead to injury. Any Alterations or adjustments must be carried out safely and reliably to reduce any risk.

6. Risks to related to Moving Parts

The moving parts have been identified, designed, and manufactured in such a way to prevent risk of minor injury to hands due to pitch points. Where risks persist, protective devices maybe installed.

01. Aims of the Project

The nature of this project was to explore the safety procedures and standards surrounding manufacturing a marketable product. As well as an in-depth examination and testing of the compactor to discover the limitations of the compactor.

- *Researching Health and Safety Procedures set by NSAI (National Standards Authority of Ireland).*
- *Compiling Data into a Risk Assessment.*
- *Designing of a User-Friendly Manual to be provided with the Product.*
- *Debugging and Test Final Design using a variety of tests, such as Tensile testing.*
- *Comparison of the Final Design versus a new Alternative Design*
- *Comparison of the Physical Design studies versus the simulated design study of the compactor.*

04. Risk Assessment - FMEA

Conducting this risk assessment requires carrying out five steps.

- *Identifying the risks in relation to the project*
- *Identifying the severity of the risks involved.*
- *Identifying the probability of the risk occurrence.*
- *Identifying the method in which the risk can be detected.*
- *Assessing the current controls and determine what is needed to mitigate/reduce the risks involved*

Failure Mode and Effect Analysis (FMEA)

Project Title:	Domestic Manual Compactor	Risk Priority Number (RPN)	
		1 - 24	Non-Critical Failure
K No:	K00276155	25 - 49	Moderate Failure
		> 50	Critical Failure

Item	Part	Potential Failure Mode	Potential Effect(s)	SEV	Potential Cause	OCC	Current Control	DET	RPN	Mitigation
	What is the part?	In what way can it fail?	What is the impact if it fails?	How severe is the effect?	What causes the failure to occur?	How often is it likely to occur?	What are the existing controls to prevent the failure?	How probable is detection of failure?	SEV x OCC x DEV	What actions will reduce or eliminate the risk?
1	Spikes	Falling onto the Head of a User	Extreme	5	Mishandling of the compression plate - Loss of Life or Serious Injury	5	Blunting of spikes	2	50	Installation of Safety Pulley system.
2	Wall Mount attachment	Incorrectly bolted to the wall	Medium	3	Bolt are not tightened enough - Damage Wall	3	Tightened the Bolt fully	3	27	Double checking the tightness of the bolts.
3	Wall Mount attachment	Detaching	Low	4	Shoulder bolt snapping - Operations Halted	2	Regular maintenance	2	16	Replacing Bolt with a Pin.
4	Compression Shaft	Buckling	Low	4	Compressing the bar beyond the limitations of the shaft. - Compression failure	2	Making the shaft thicker to resist buckling.	2	16	Fixed solid points.
5	Hollow Shaft	Buckling	Low	4	Compressing the bar beyond the limitations of the shaft. - Compression failure	2	Making the shaft thicker to resist buckling.	2	16	Fixed solid points.
6	Collar Attachment	Snapping	Minor	4	Wear and Tear - Operations Halted	1	None	2	8	Compressed collar onto the Solid Shaft
7	Tube Adapters	Buckling	Minor	2	Overloading the adapter with weight at an awkward angle - Compression Failure	2	Doubling efforts to ensure the tube is perpendicular to the main shaft.	2	8	None
8	Compression Plate	Detaching	Minor	4	Shoulder bolt snapping - Operations Halted	2	Regular maintenance	1	8	Replace bolt with a Pin.
9	Grips	Slipping	Minor	3	Hands not place correctly onto the grips - Slips,Trips & Falls	2	None	1	6	Dry hands with gloves

05. Testing

The Testing phase consisted of taking 5 different individuals of different height, gender and weight to use the compactor at varying adjustment lengths of the compactor to see the varying forces as well as the reductions that were measured within the 240 litre wheelie bin. The test was conducted using normal domestic cardboard to calculate the compression force, volume reduction and the mechanical advantage of using the compactor.

Specimens	Weight (kg)	Compactor Weight (kg)	Force (N)	Mechanical Advantage @ Distance (m)			Compression (N)	Reduction (mm)
				Input				
				1.16 @ 0.58m	1.36 @ 0.68m	1.56 @ 0.78m		
1	85.4	22	1053.594	908.27	774.70	675.38	449.00	134.70
2	72.1	22	923.121	795.79	678.77	591.74	419.09	125.73
3	74.4	22	945.684	815.24	695.36	606.21	510.80	153.24
4	130	22	1491.12	1285.45	1096.41	955.85	836.74	251.02
5	64	22	843.66	727.29	620.34	540.81	314.42	94.33

Wheelie Bin (Litres)	Volume @ 30%	Reduction (m^3)	Miniinium Input		
240	72	0.072	1.16 @ 0.58m	1.36 @ 0.68m	1.56 @ 0.78m
Cardboard Density (kg/m^3)	Mass (kg)	Compression Target (N)	304.45	259.68	226.38
500	36	353.16			

06. Conclusion

This Project looked at how to conduct a Risk Assessment for the purpose of investigating the safety factor of a product, Write a User Manual, which has very specific standards for a manufacturer to provide a consumer that purchase the product, Finally Testing the Product, trying to determine the limitations of the compactor using multiple individuals with varying weight, height and gender at different adjustment intervals.
Future Recommendations for other literation of this project should conduct a Cost analysis along with investigating the viably to mass manufacture the compactor.

07. References

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- *NHSF (2018) Manual handling and people handling policy*