


1. Design For Manufacturing (DFM) – The Goal Of DFM Is To Reduce Manufacturing Costs Without Reducing Performance

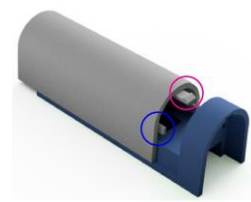
This is the process of designing parts, components or products for ease of manufacturing with an end goal of making a better product at a lower cost

1	Minimise Number of Parts	Reducing the number of parts in a product is the quickest way to reduce cost because you are reducing the amount of material required, the amount of engineering, production, labour, all the way down to shipping costs.
2	Use of Standardise Parts and Materials	Using quality standardised parts can shorten time to production as such parts are typically available and you can be more certain of their consistency. Material is based on the planned use of the product and its function .
3	Create Modular Assemblies	Using non-customised modular assemblies in the design allows you to modify the product without losing its overall functionality. A simple example is a basic automobile that allows you to add in extras by putting in a modular upgrade or software with ability to download updates.
4	Design for Efficient Joining	Can the parts interlock or clip together? Look for ways to join parts without the use of screws, fasteners or adhesives. If you fasteners must be used; Keep the number, size and variation of fasteners to a minimum Use standard fasteners as much as possible. Use self-tapping screws for better placement.
5	Minimize movement of Parts During Assembly	Parts should be designed so that a minimum of manual interaction is necessary during production and assembly
6	Streamline Number of Manufacturing Processes	The more complex the process of making your product, is the more variables for error are introduced.

2. How The Choice Of Materials Affects The Use, Care And Disposal Of Products.

1	Labelling Of Materials To Aid Separation For Recycling	
2	Making Products Easy To Disassemble Or Separate <ul style="list-style-type: none"> <input type="checkbox"/> The fewer fasteners (e.g. glue, screws, etc.) used, the better. <input type="checkbox"/> Common and similar fasteners that require only a few standard tools will help to simplify and speed disassembly. <input type="checkbox"/> Screws are faster to unfasten than nuts and bolts. <input type="checkbox"/> Glues should be avoided. <input type="checkbox"/> Building disassembly instructions into the product will help users understand how to take it apart. 	

3. Maintenance


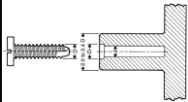
1	Temporary And Integral Fixings	Fastening Plastic Assemblies, Including: <ul style="list-style-type: none"> <input type="checkbox"/> Screws <input type="checkbox"/> Rivets <input type="checkbox"/> Snap Fits And Tabs <input type="checkbox"/> Plastic Welding <input type="checkbox"/> Adhesives And Tapes <input type="checkbox"/> Nuts & Bolts 
2	Use Of Standardised Parts	Easy to source through internet searches allows for replacement of parts which may wear out over time . Motor brushes, Bearings, Hinges.
4	Allowing For Service And Repair/ Replacement Of Parts	Easy access to components which may suffer from wear and tear; eg <ul style="list-style-type: none"> <input type="checkbox"/> Removing the top & back from a washing machine <input type="checkbox"/> Heating elements within an oven <input type="checkbox"/> Hinges to fridge door. <input type="checkbox"/> Various car parts – bulbs, battery.

4. Application Of The Six Rs Of Sustainability

1	Reduce	The quantity of materials, of toxic materials, of damaging materials and associated energy use
2	Reuse	Components and parts – Scrap yard for cars, Old mobile phones.
3	Rethink	As a designer you can suggest using eco friendly alternative materials.
4	Recycle	Turn Materials and/or components into new products
5	Refuse	Are there materials a designer would not use?
6	Repair	Can the product be repaired instead of thrown away?

5. Ease of manufacture

Be Able To Explain, The Different Ways In Which A Product Can Be Designed To Allow For More Efficient Manufacture.

1	Ribs And Webbing To Reduce Material Thicknesses	Look at the chairs you sit on in the Atrium. Where is the ribbing, webbing to improve stiffness without increasing the material thickness.
2	Snap Fittings To Remove The Need For Fixings/Adhesives	
3	Internal Moulded Screw Posts For Use With Self Tapping Screws	
6	Addition Of Texture In Moulding To Reduce Number Of Manufacturing Processes	
7	Self Finishing	When using polymers, the final texture can be achieved through mould design or 2 shot injection moulding.

https://www.ellenmacarthurfoundation.org/assets/downloads/news/EMF_Engineering-the-Circular-Economy_300913.pdf

6. Disassembly

Be Aware Of, And Able To Explain, How A Product Can Be Designed And Manufactured With Disassembly In Mind
Designing for **disassembly** benefits:

- Facilitate maintenance and repair, thereby reducing costs.
- Facilitate part/component re-use, thereby recovering materials and reducing costs.
- Assist material recycling, thereby avoiding disposal and handling of waste.

1	Integral Fixings	Integral fasteners function by interlocking or interfering one component with other components during assembly.
2	Active Disassembly Using Smart Materials Such As SMA.	Active Disassembly (AD) is a technology which is associated with the term Smart Materials (ADSM) This allows for the release of parts. SMA materials offer shape changes at a range of temperatures, which are achieved by methods such as infrared, microwave, supercooling, chemicals or direct heat. The range of "trigger temperatures" for various smart materials means that it is possible to place the products in a heated environment where the outer elements become detached and then move on to a higher temperature zone where internal parts and sub-assemblies are dismantled. Examples of AD fittings; Screws, rivets, ribbons, bars and clips, specially designed to facilitate AD. These will trigger at a pre-determined temperature, depending on the specific application.
3	Biodegradable Parts	Biodegradable materials organically break relatively quickly. These materials depend on microorganisms, UV light exposure or hydrolysis (water) to naturally dissolve the original material into water, carbon dioxide, methane, biomass or other inorganic compounds. Depending on design, the materials may biodegrade more effectively in treatment plants while others may do better in soils.