MANUFACTURING DOESN'T JUST COME AT THE END OF THE DESIGN PROCESS. ENGINEERS HAVE TO DESIGN THEIR PRODUCTS FOR MANUFACTURE RIGHT FROM THE START. IT'S NO USE HAVING A PROTOTYPE THAT'S PASSED ALL YOUR TESTS, BUT IS IMPOSSIBLE TO MAKE!

THE LEAN, MEAN MANUFACTURING MACHINE

Japanese car people Toyota pioneered ‘Lean Manufacturing’ — identifying and eliminating muda (waste). Engineers aim to develop new products with less effort, less manufacturing space, less investment in tools, and less engineering time. At Dyson, engineers created a very complicated, large injection moulded part for the DC08 vacuum cleaner. This did the job of two or three parts – cutting muda.

TOOLING

During the early stages of the design process, engineers work with tool manufacturers to produce the tools that make Dyson components. For every component you need a tool, and as they are very costly, design engineers are challenged to design machines with the minimum number of parts necessary.

ASSEMBLY

It is about putting things in and out, but not your arms and legs. ‘Pokie yoke’ comes from Poka-yoke meaning fail-safing (or idiot-proofing). Engineers pokie yoke a design so that people can only put it together one way, avoiding mistakes and confusion. Think about how USB sticks and floppy disks can only be inserted one way round.

THE PLASTICS JARGON DICTIONARY

<table>
<thead>
<tr>
<th>Word</th>
<th>Meaning</th>
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<tbody>
<tr>
<td>flash</td>
<td>A bit of plastic that seeps through the sides of the mould.</td>
</tr>
<tr>
<td>spew</td>
<td>A large amount of material that escapes through the sides of the mould.</td>
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<tr>
<td>packing</td>
<td>The action of squirting liquid plastic into a mould cavity.</td>
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<tr>
<td>split line</td>
<td>The line showing where two sides of an injection mould meet.</td>
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INJECTION MOULDING: YOUR EASIEST ROUTE TO COMPLICATED SHAPES.

Think jelly moulds and sand castles. Plastic pellets (1) are heated to a molten state (2) and injected into a mould cavity (3), that is made of two halves. The plastic cools, the part is ejected (4), and the cycle is repeated.

DESIGN IT

IT

MAKE IT

TOOL IT

TEST IT

PROTOTYPE IT