

Collaborative Engineering



Design for Assembly




- Product Assembly – Need
- Manual / Automatic Assembly
- DFA Principles

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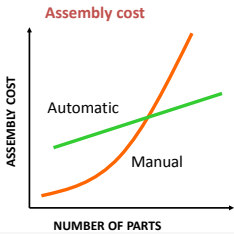
Product Assembly

- **Assembly is required when:**
 - part materials are different
 - there is relative motion between parts
 - manufacturing is simpler or less expensive.
- **Types of assembly:**
 - interchangeable (complete or partial)
 - fitting (minor adjustments)
 - using an adjustable element
 - selective assembly (for high accuracy)



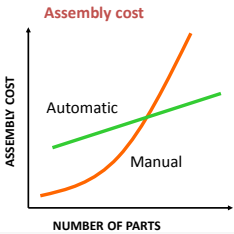
Assembly: Manual or Automatic

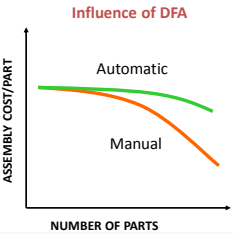
- Manual: flexible and 'inexpensive' but cumbersome, error-prone, accident-prone.
- Automatic: expensive, limited flexibility.



Manual vs. Automatic Assembly

- Design for Assembly is required when:
 - Number of parts is large
 - Significant proportion of assembly is manual.





Design for Assembly

- **Designing a product for minimising assembly time and cost.**
- **Assembly implies:**
 - Procuring, storing, managing, retrieving, handling, transportation and inspection of parts.
 - Associated costs, time and overheads.
 - Possibility of damage, misplacement, loss, accidents.

DFA Principles

- **Avoid assembly altogether if possible.**
- **Minimise the number of parts**
 - Minimise the number of different parts
 - Minimise the total number of parts
 - Combine several parts into one
 - Avoid separate fasteners

Eliminate a part if it

- does not move relative to others
- need not be made of a different material
- need not be separate for ease of manufacture/service.

DFA Principles

- **Minimise assembly time**
 - Reduce the number of assembly directions
 - Preferably all parts assembled in vertical direction
 - Provide access to locating surfaces
 - Incorporate symmetry wherever possible, otherwise
 - Emphasize asymmetry (minimize ambiguity)
 - Provide self alignment (tapers/guides for insertion)
 - Avoid or minimize adjustments

DFA Principles

- **Ensure comfortable and safe assembly**
 - Avoid parts that can become tangled
 - Avoid parts that are difficult to pick up: heavy, flat, tiny
 - Avoid parts with sharp edges
 - Avoid parts with fragile features
 - Avoid parts which are sticky or slippery
 - Avoid parts which are flimsy or too flexible
 - Avoid simultaneous fitting operations

SUMMARY

- Design for assembly to reduce overall product costs
- Avoid assembly altogether, if possible
- Reduce number of parts, reduce assembly time
- Ensure assembly is safe and comfortable

