

Collaborative Engineering

Design for Assembly Guidelines



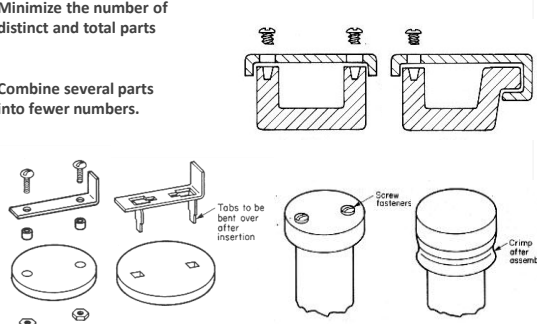
- Design for Assembly Guidelines
- Minimizing number of parts
- Minimize assembly time
- Make assembly safe

OrthoCAD Lab, I.I.T. Bombay

DFA Guidelines

Minimize the number of distinct and total parts

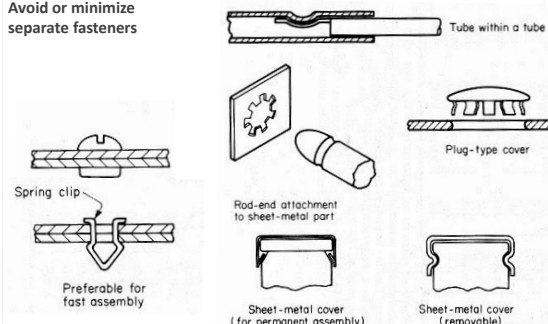
Combine several parts into fewer numbers.



[Source: J.G. Bralla, Handbook of Product Design for Manufacturing, McGraw-Hill]

DFA Guidelines

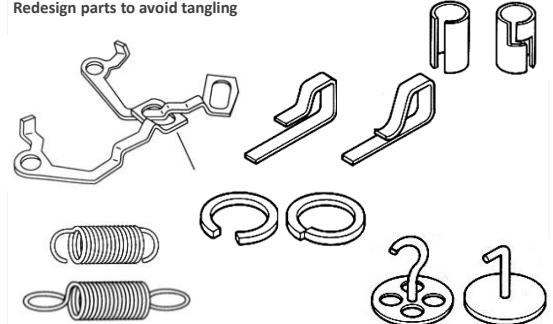
Avoid or minimize separate fasteners



[Source: J.G. Bralla, Handbook of Product Design for Manufacturing, McGraw-Hill]

DFA Guidelines

Redesign parts to avoid tangling

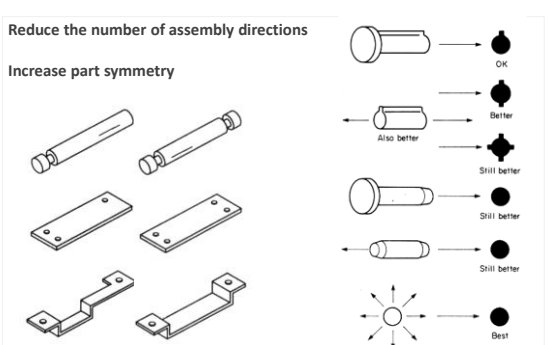


[Source: J.G. Bralla, Handbook of Product Design for Manufacturing, McGraw-Hill]

DFA Guidelines

Reduce the number of assembly directions

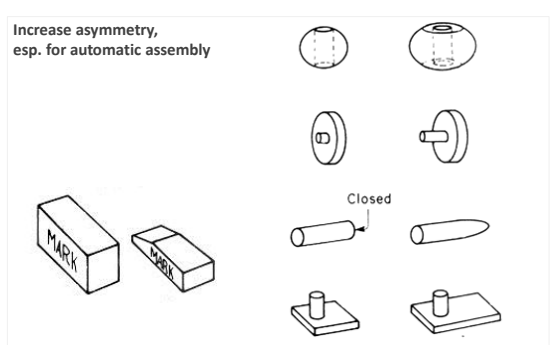
Increase part symmetry



[Source: J.G. Bralla, Handbook of Product Design for Manufacturing, McGraw-Hill]

DFA Guidelines

Increase asymmetry, esp. for automatic assembly



[Source: J.G. Bralla, Handbook of Product Design for Manufacturing, McGraw-Hill]

DFA Guidelines

Redesign part for easy insertion of mating parts

[Source: J.G. Bralla, Handbook of Product Design for Manufacturing, McGraw-Hill]

DFA Guidelines

Minimise the need for adjustments

[Source: J.G. Bralla, Handbook of Product Design for Manufacturing, McGraw-Hill]

DFA Example

BEFORE AFTER

	Original design	Redesign	Improvement (%)
Assembly time (h)	2.15	0.33	84.7
Number of different parts	24	8	66.7
Total number of parts	47	12	74.5
Total number of operations	58	13	77.6
Material fabrication time (h)	12.63	3.65	71.1
Weight (lb)	0.48	0.26	45.8

Source: Texas Instruments, Inc.

DFA Example

Key

- NIB individual parts
- Assembled component
- Location in fixed wing
- Fixed wing

	Old: Many single parts	New: Casting-version	Weight (%)	Costs (%)
Number of parts	6 Machined parts of 9 sheet metal parts 164 Fasteners	1 casting	Goal -15	±0
Weight (kg)	2.0	1.6	Achieved -20	-25

[Source: J. Corbett et al., Design for Manufacture, Addison-Wesley, 1991]

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

Metric	Reduction Percentage
Assembly time	61%
Assembly operations	53%
Separate fasteners	69%
Assembly defects	68%
Service calls	57%
Time to market	50%