Unit 3
Design for Manufacturing and Assembly

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DFMA Definition

- **Design for Manufacture (DFM):** Design of components taking into consideration the processes that will be used to manufacture them to ensure that manufacturing costs are minimized.
- **Design for Assembly (DFA):** Design of the product for ease of assembly.
- Design for manufacture and Assembly (DFMA): DFA + DFM.

Example of DFMA

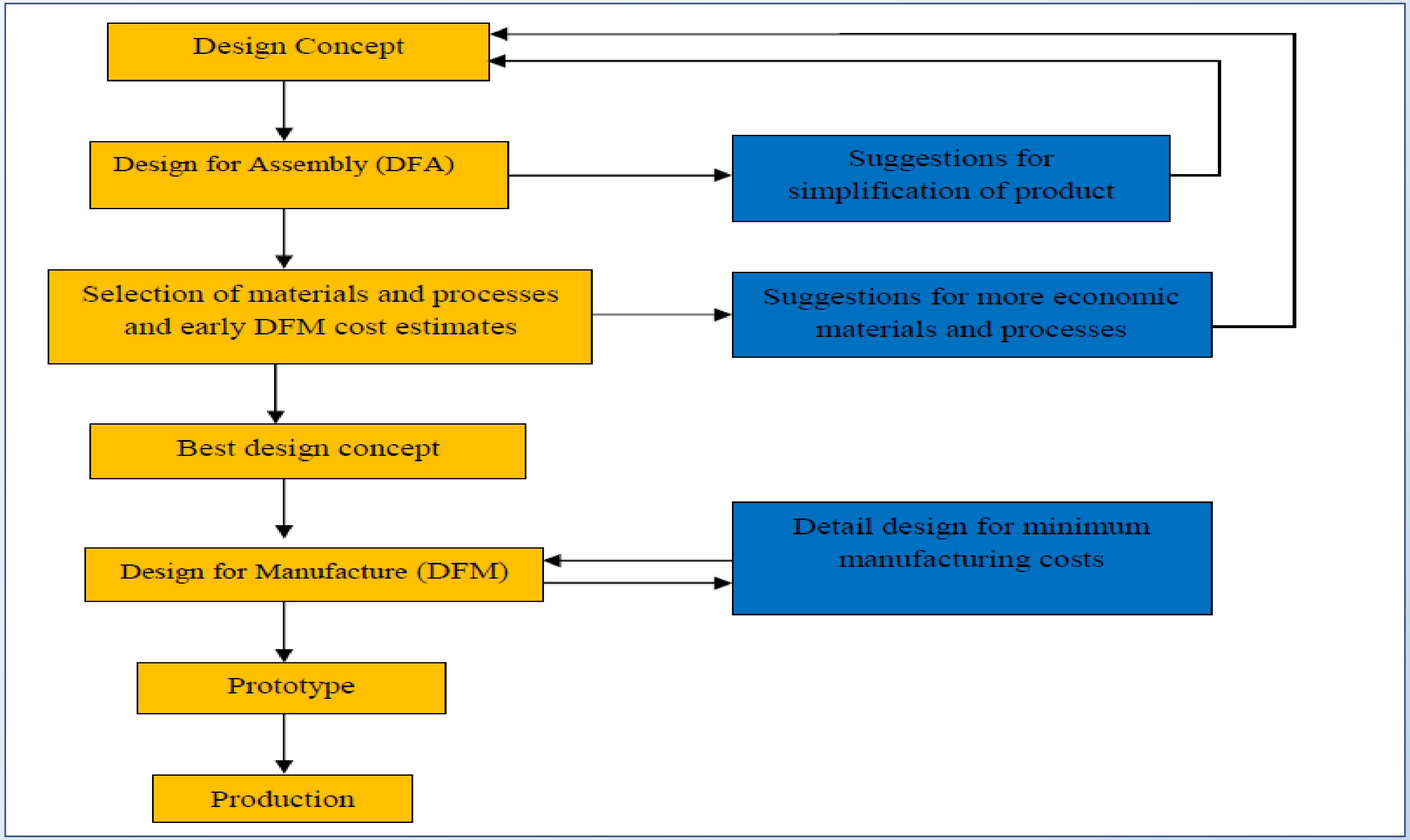
- DFMA shortens the time to bring the product to market
- DFMA reduces product costs

Results of Ingersoll-Rand project with DFMA		
	Before	After
Compressor/ oil cooler parts	80	29
Number of fasteners	38	20
Number of assembly operations	159	40
Assembly time, min	18.5	6.5

Advantages of DFMA

- Reduces the time to market and quality of the product.
- Provides a systematic procedure for analysing a proposed design from the point of view of assembly and manufacture.
- Any reduction in the number of parts reduces the cost as well as the inventory
- Increases Reliability

Steps involved in DFMA



Reasons for not using DFMA

- No time: Designers are constrained to minimize their “design to manufacture time” for a new product.
- The ugly baby syndrome: Designer ego crashes if there is some suggestion for design change.
- Low assembly cost: Since assembly cost of a particular product is less as compared to the total material and manufacturing cost, DFA analysis is not required.
- Low volume: Often it is expressed that DFMA is applicable for large quantity production.
- Refuse to use DFMA: Individual doesn't have the incentive to adopt the new technology and use the tools available.

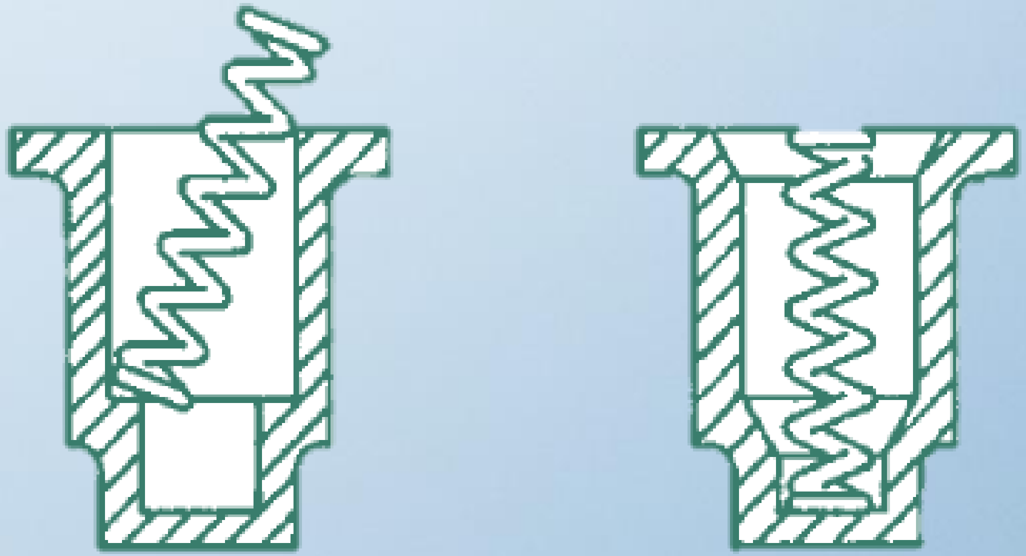
DESIGN GUIDELINES FOR DFA

- Eliminate the need for workers to make decisions or adjustments
- Ensure accessibility and visibility
- Eliminate the need for assembly tools and gauges (self-locating parts)
- Minimize the number of different parts - use "standard" parts
- Minimize the number of parts
- Avoid or minimize part orientation during assembly (symmetrical parts)
- Prefer easily handled parts that do not tangle or nest within one another

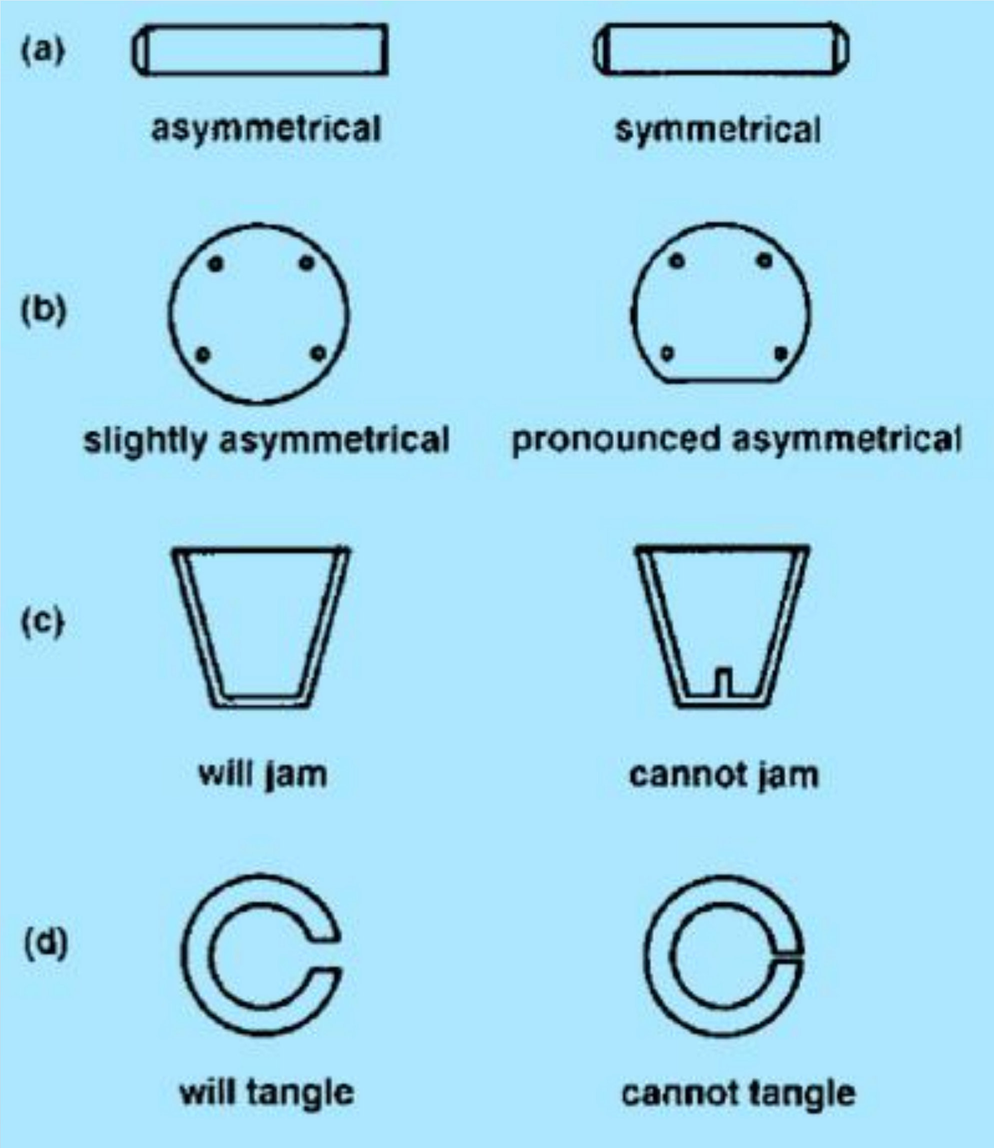
Many such products are sold as "ready-to-assemble" kits or require that assembly be shifted to cheaper labor markets.

GENERAL DESIGN GUIDELINES FOR MANUAL ASSEMBLY [1]

- The process of DFA can be divided into two separate areas:
    1. Handling (acquiring, orienting, and moving the parts)
    2. Insertion and Fastening (mating a part to another part or group of parts)



PART HANDLING

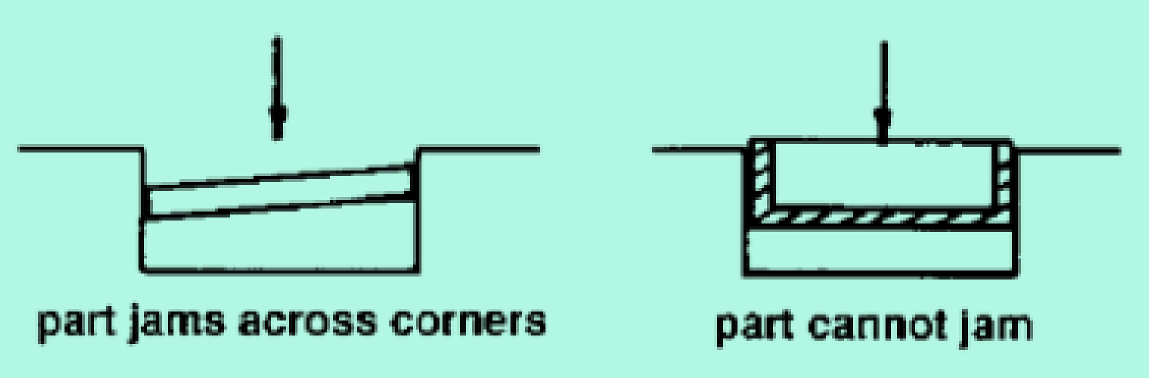


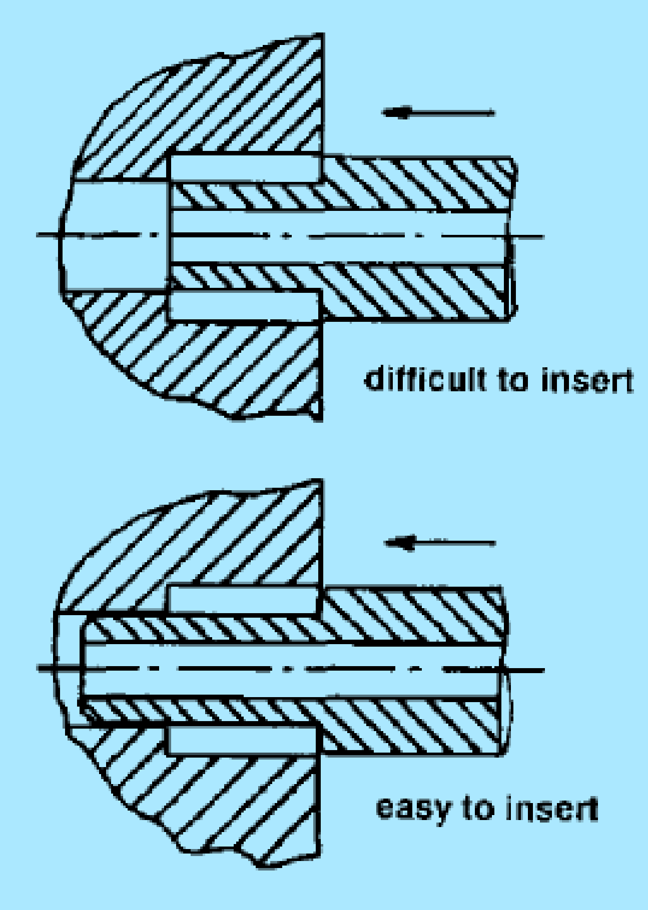
a) Parts must have end-to-end symmetry and rotational symmetry about the axis of insertion.
b) Part cannot be made symmetric, are obviously asymmetric.
c) Provide features that will prevent jamming of parts that tend to nest or stack when stored in bulk
d) Parts which can tend to nest or stack when stored in bulk,
e) Parts must be tangled free
f) Avoid parts that are sharp and splinter easily

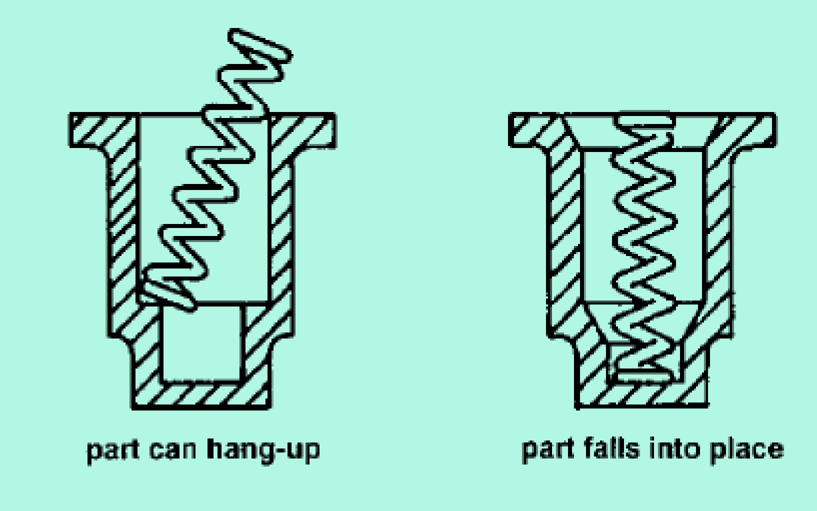
(f)

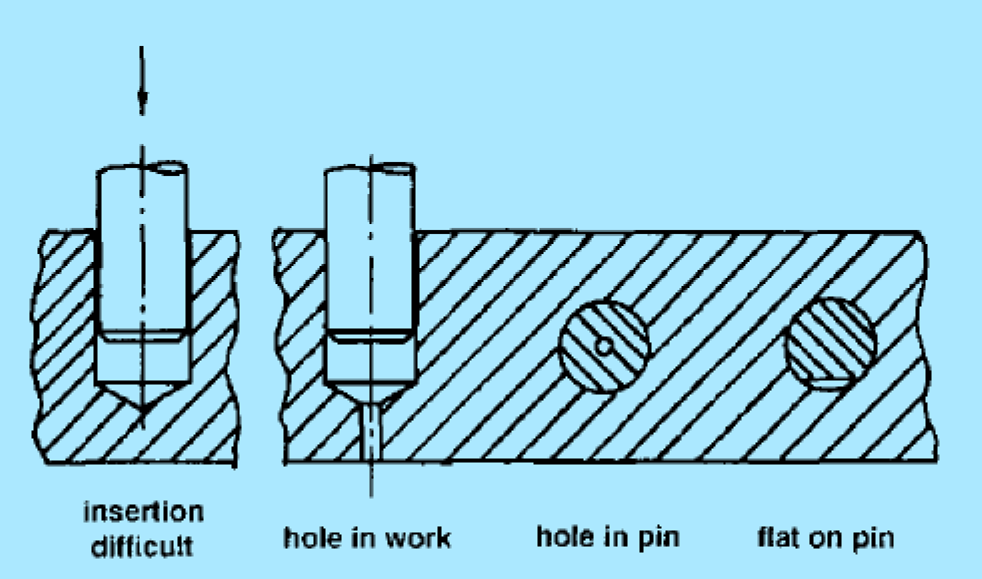
FOR INSERTION AND FASTENING

1. Design so that there is little or no resistance to insertion and provide chamfers to guide insertion of two mating parts.



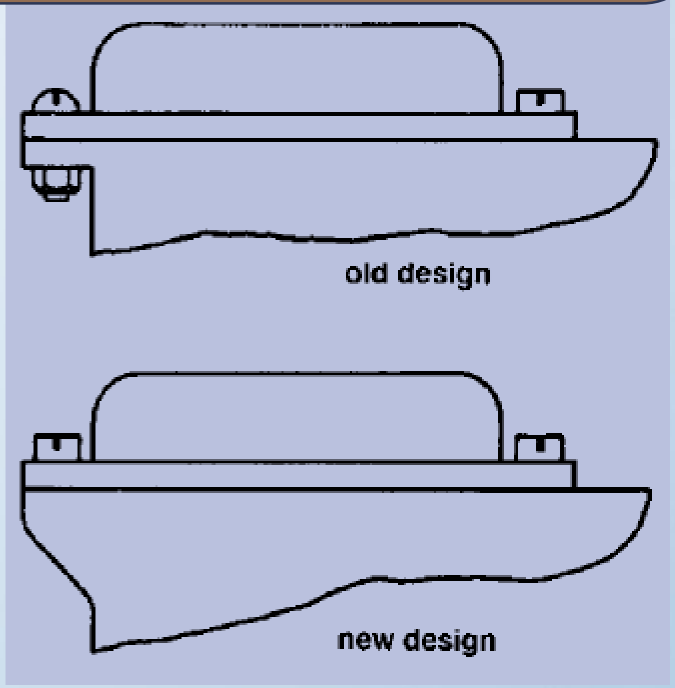




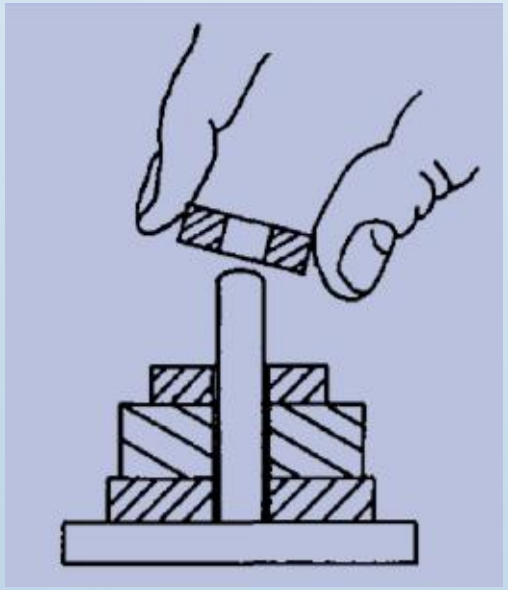


Cont……

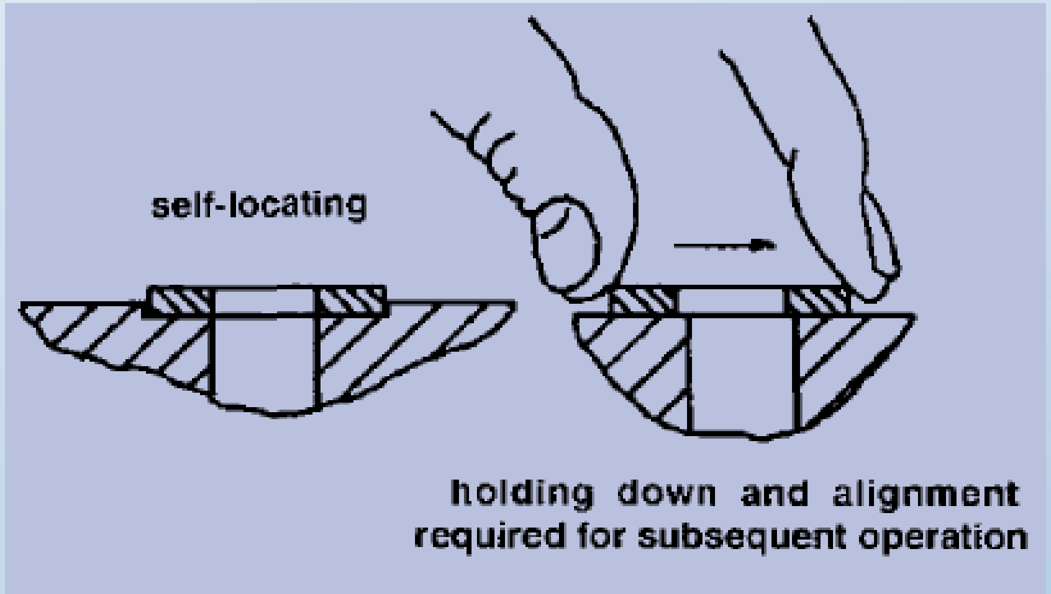
2. Standardize of Parts, Processes and Methods across all models.
3. Use pyramid assembly
4. Avoid the necessity for holding parts down to maintain their
5. orientation during manipulation of the subassembly.
6. Design so that a part is located before it is released.
7. Cost of different fastening processes



(a)



(b)



(c)

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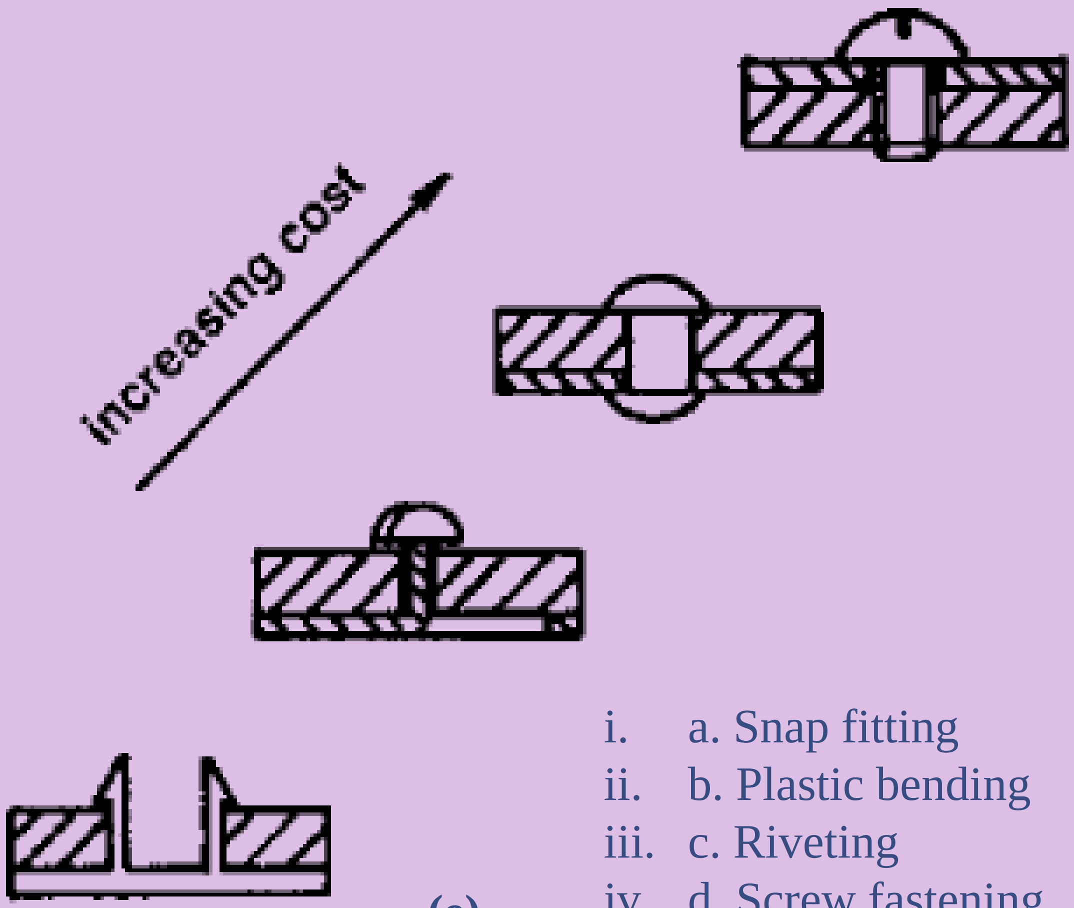
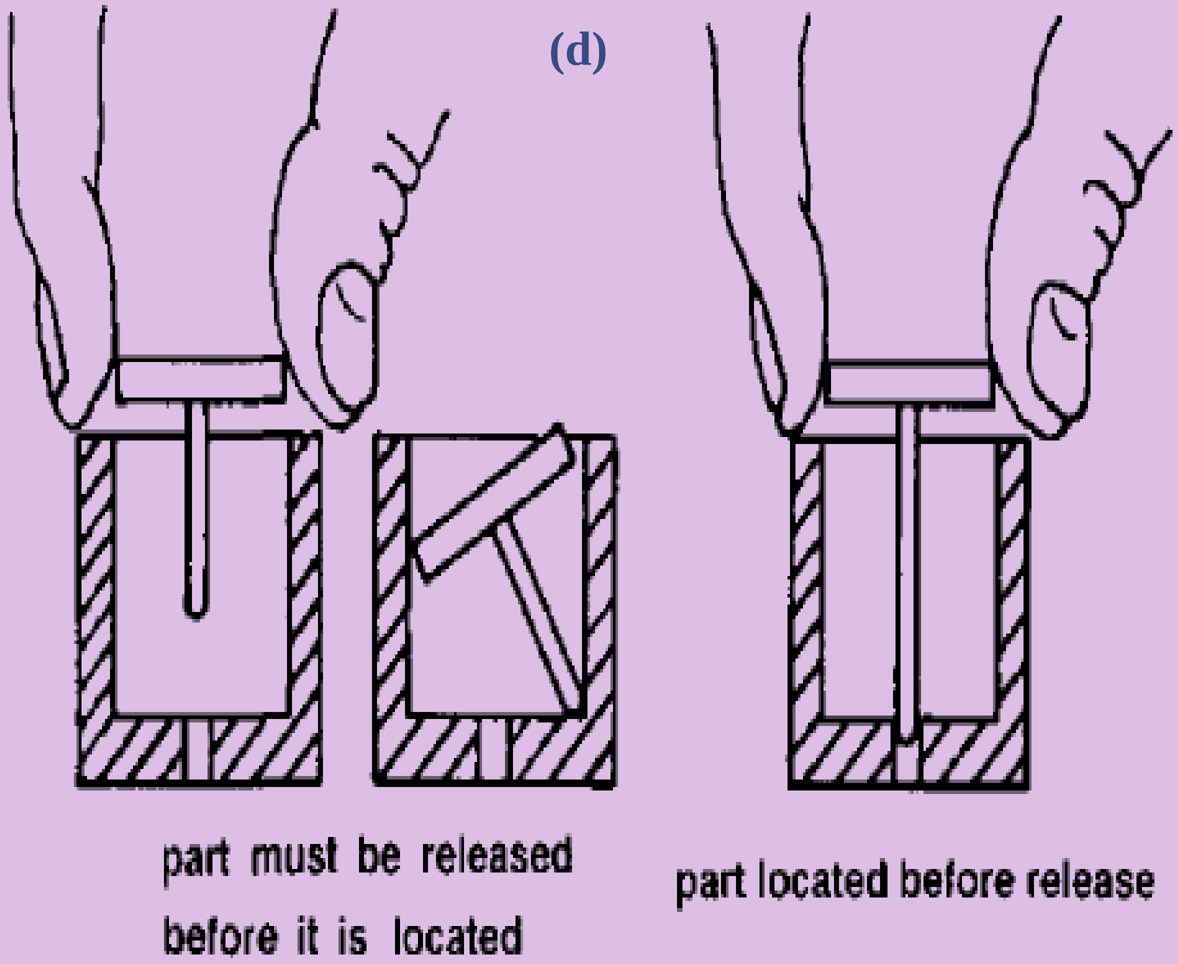


(e)

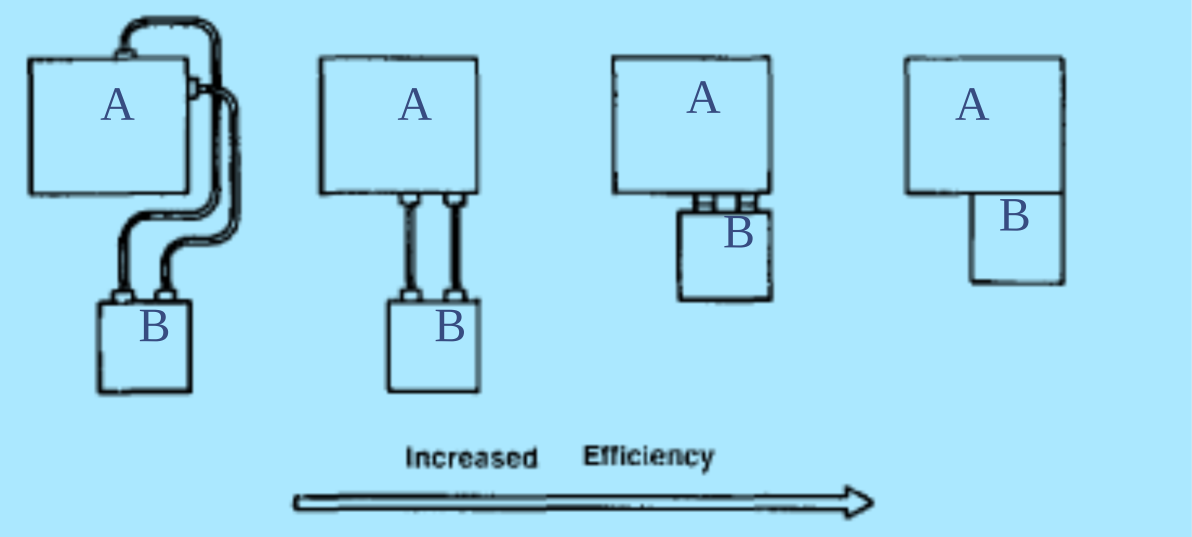
i. a. Snap fitting
ii. b. Plastic bending
iii. c. Riveting
iv. d. Screw fastening



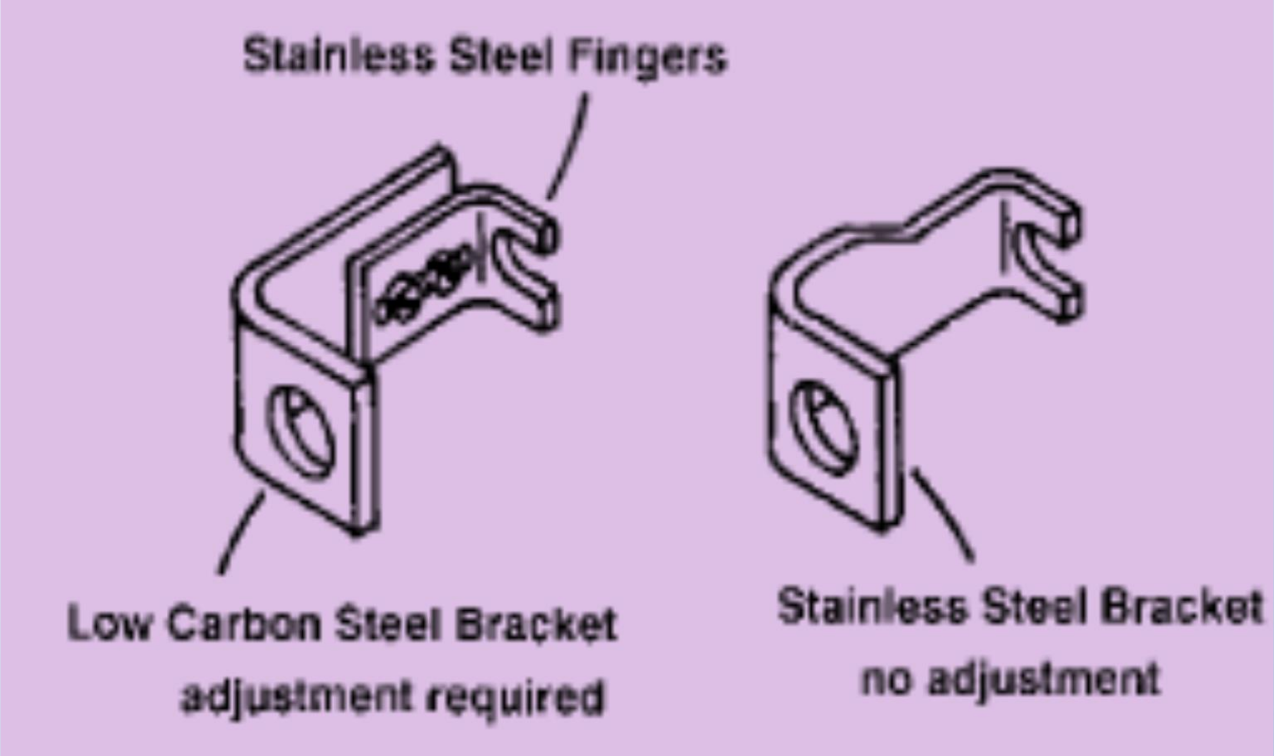
(d)

FURTHER DESIGN GUIDELINES

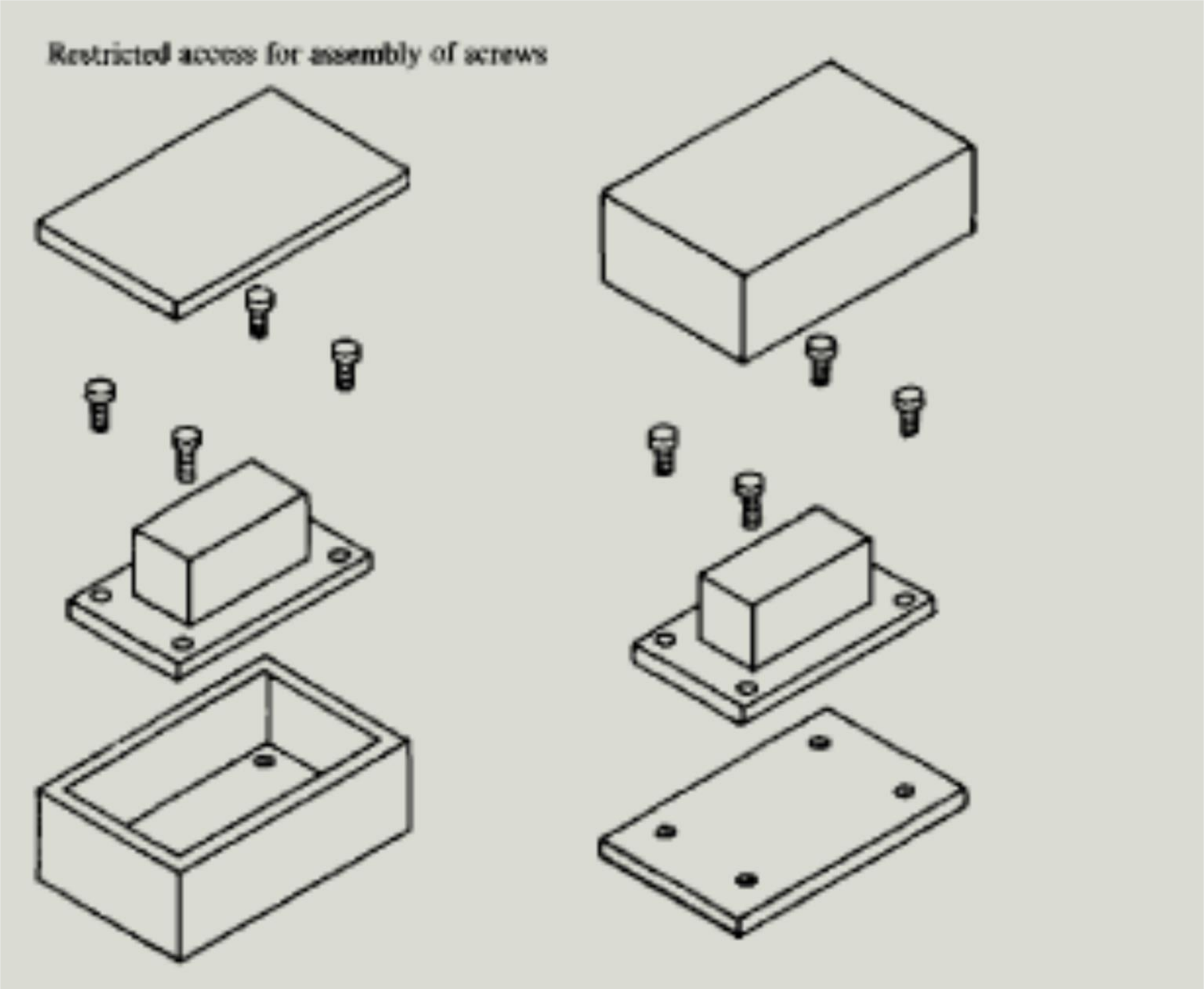
1. Avoid connections

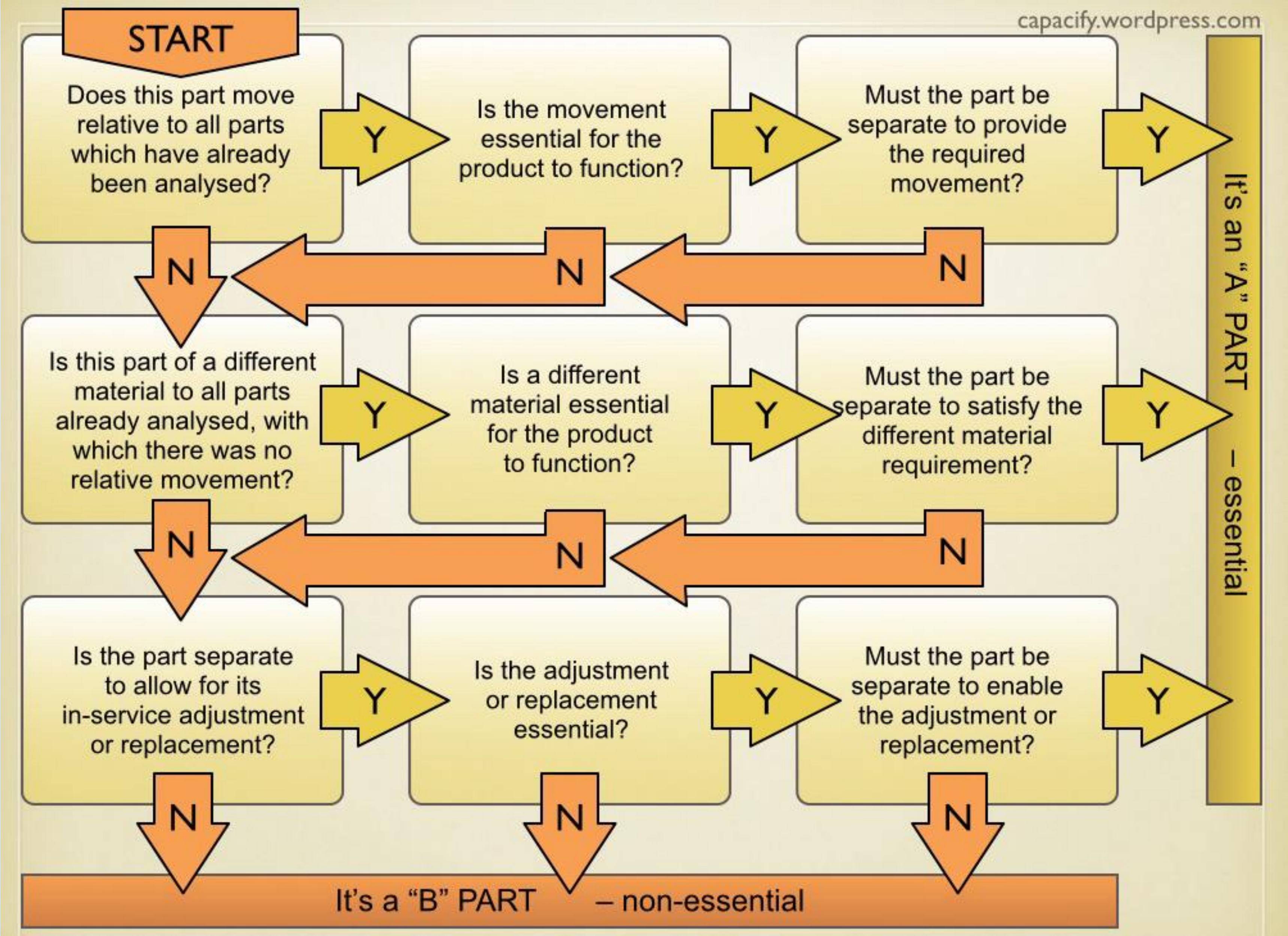


2. Avoid adjustments



3. Design so that access for assembly operations is not restricted




capacify.wordpress.com
START
Does this part move relative to all parts which have already been analysed?
Y
Is the movement essential for the product to function?
Y
Must the part be separate to provide the required movement?
Y
N
N
N
Is this part of a different material to all parts already analysed, with which there was no relative movement?
Y
Is a different material essential for the product to function?
Y
Must the part be separate to satisfy the different material requirement?
Y
N
N
N
Is the part separate to allow for its in-service adjustment or replacement?
Y
Is the adjustment or replacement essential?
Y
Must the part be separate to enable the adjustment or replacement?
Y
N
N
N
It's an "A" PART – essential
It's a "B" PART – non-essential

Design Efficiency

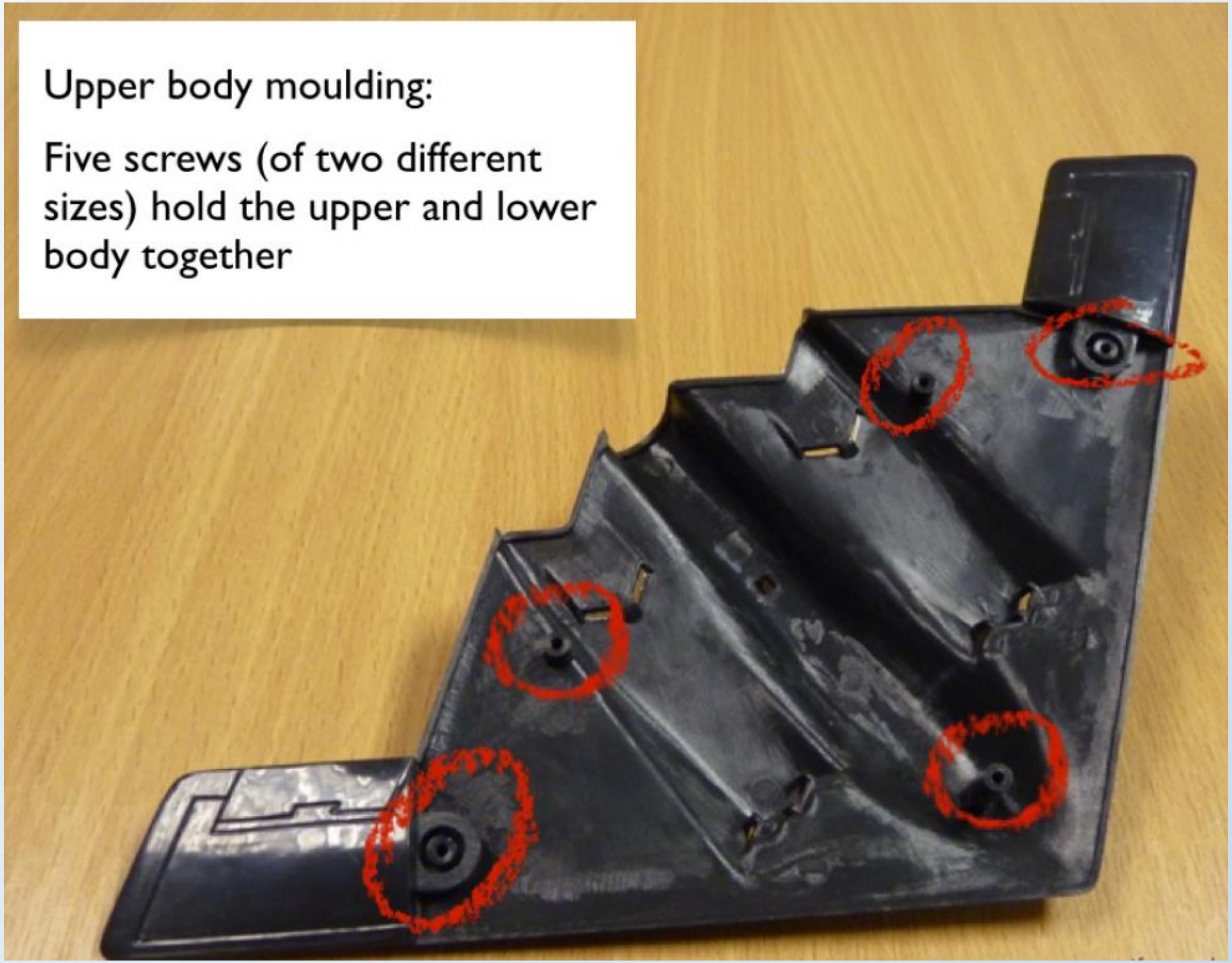
- Design Efficiency is the number of essential parts divided by the total number of parts, expressed as a percentage:

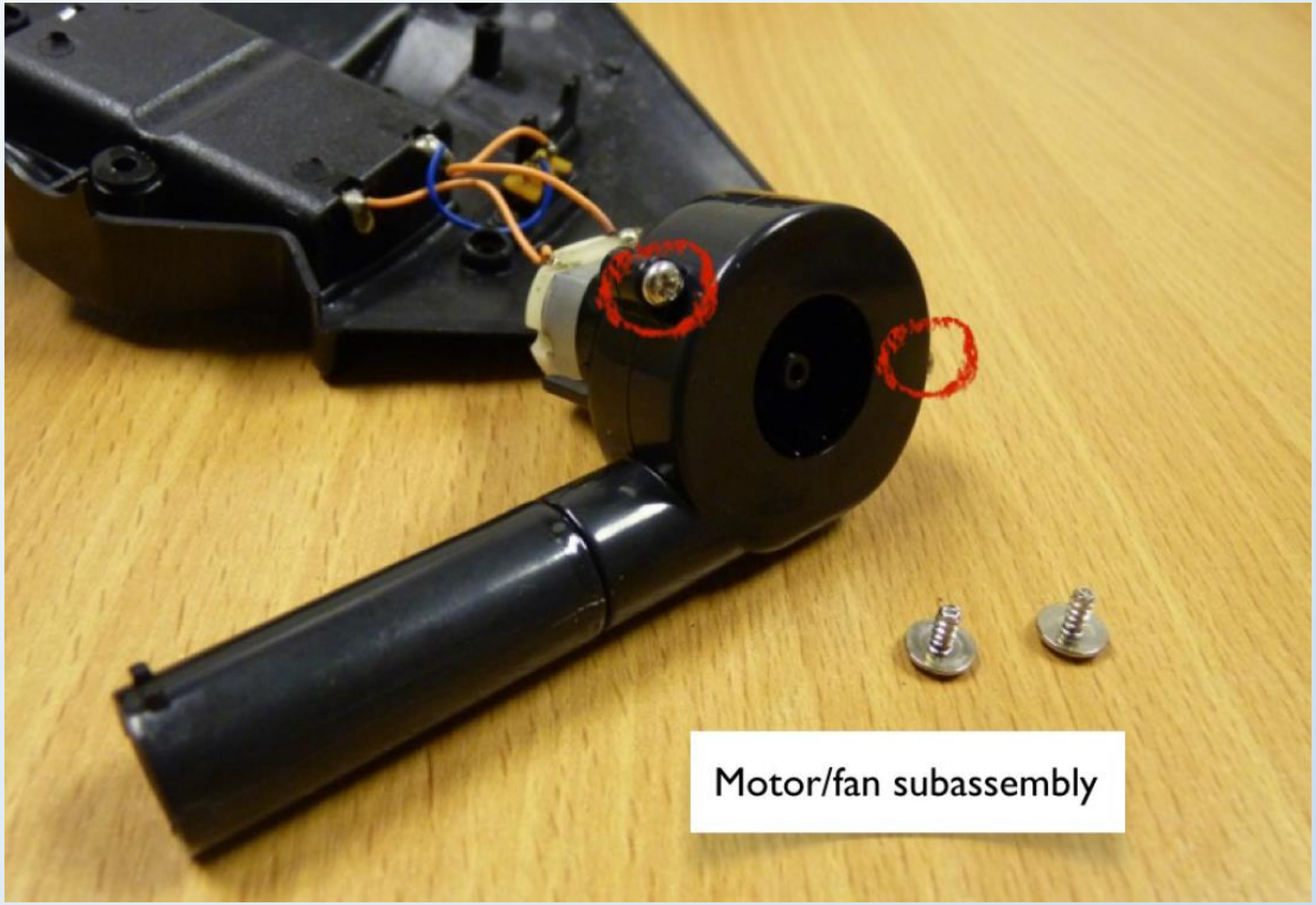
$$\frac{A}{A+B} \times 100\ \%$$

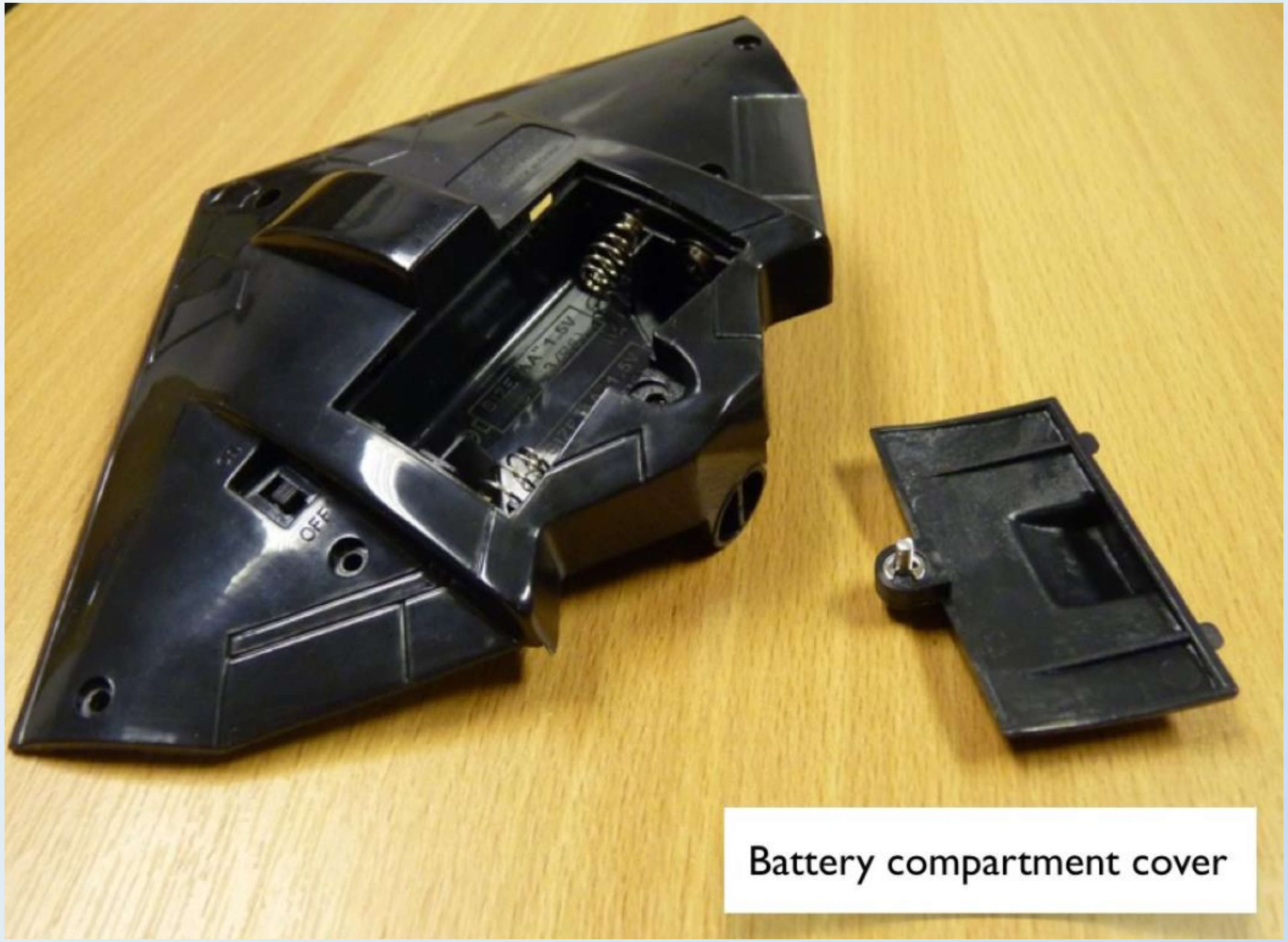
- The Lucas methodology labels parts as ‘A’ (essential) and ‘B’ (target for designing out).

- Boothroyd& Dewhurst use ‘1’ and ‘0’, but the result is similar.

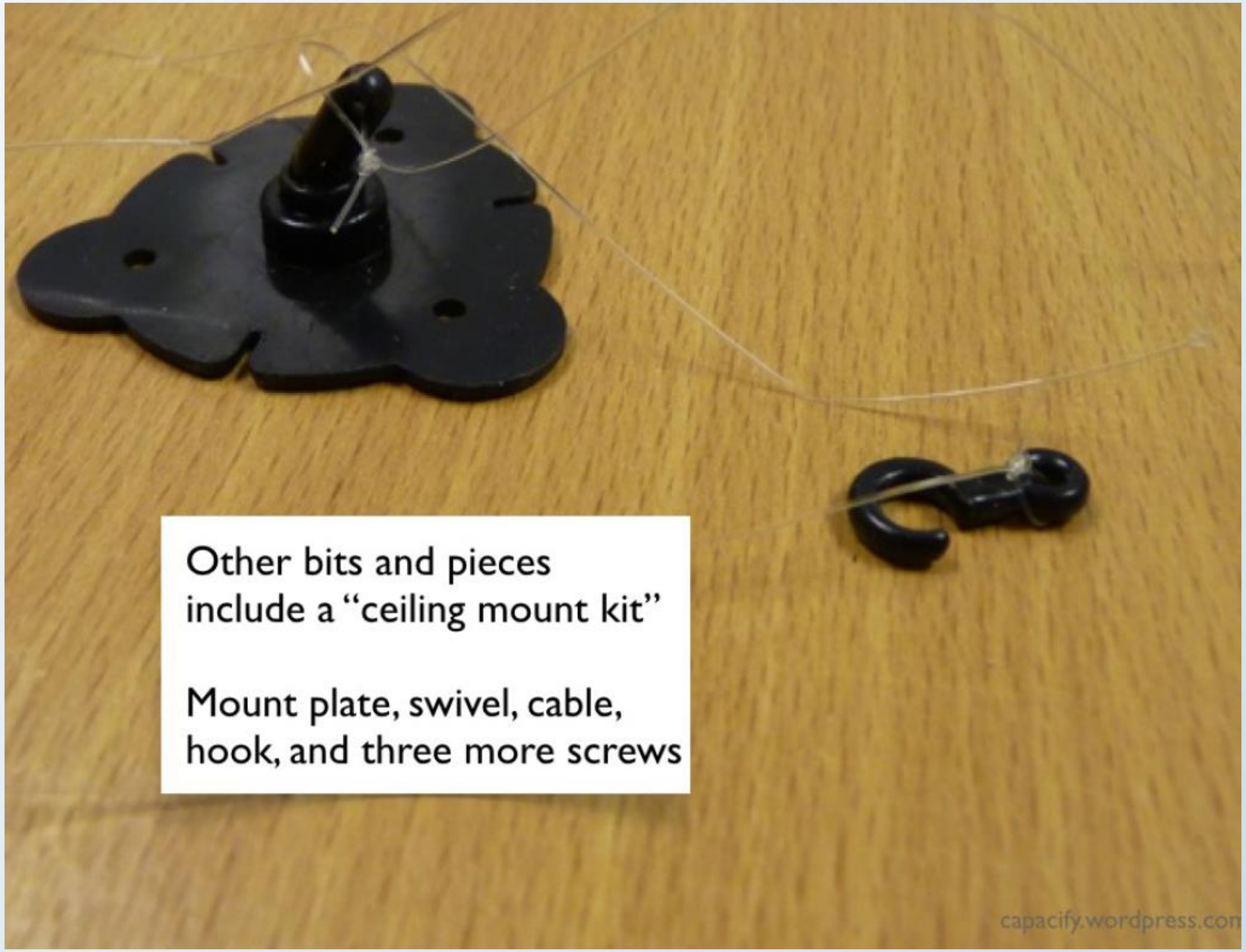
Low budget version


Upper body moulding:
Five screws (of two different sizes) hold the upper and lower body together


Motor/fan subassembly


Battery compartment cover


Captive screw on battery compartment cover:
A screw fixing is required on battery compartments for toys, for safety


Other bits and pieces
include a "ceiling mount kit"

Mount plate, swivel, cable,
hook, and three more screws
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Bill of Materials analysed

- Complete toy
  - Packaging **A**
  - Aeroplane assembly
    - Upper body **A**
    - Long screws (3) **B**
    - Short screws (2) **B**
    - Battery compartment cover subassembly
      - Battery compartment cover **B**
      - Captive screw **B**
      - Circlip **B**
    - Lower body Subassembly
      - Lower body moulding **A**
      - Motor/fan subassembly (bought in) **A**
      - Motor mount screws **B**
      - Switch **A**
      - Wiring & solder (3) … **B**

- Only parts need to be identified as essential or non-essential – not subassemblies

Result Analysis of DFA

Eleven parts were found essential (A):

- The box the toy came in
- The ceiling mount plate, swivel and cable
- The upper and lower body mouldings
- The motor, and attached fan
- The switch
- The spring steel battery contacts (3 parts)

Total there were 30 parts (A+B)

Design Efficiency

$\frac{A}{A+B} \times 100\ \% = \frac{11}{30} \times 100\ \%$

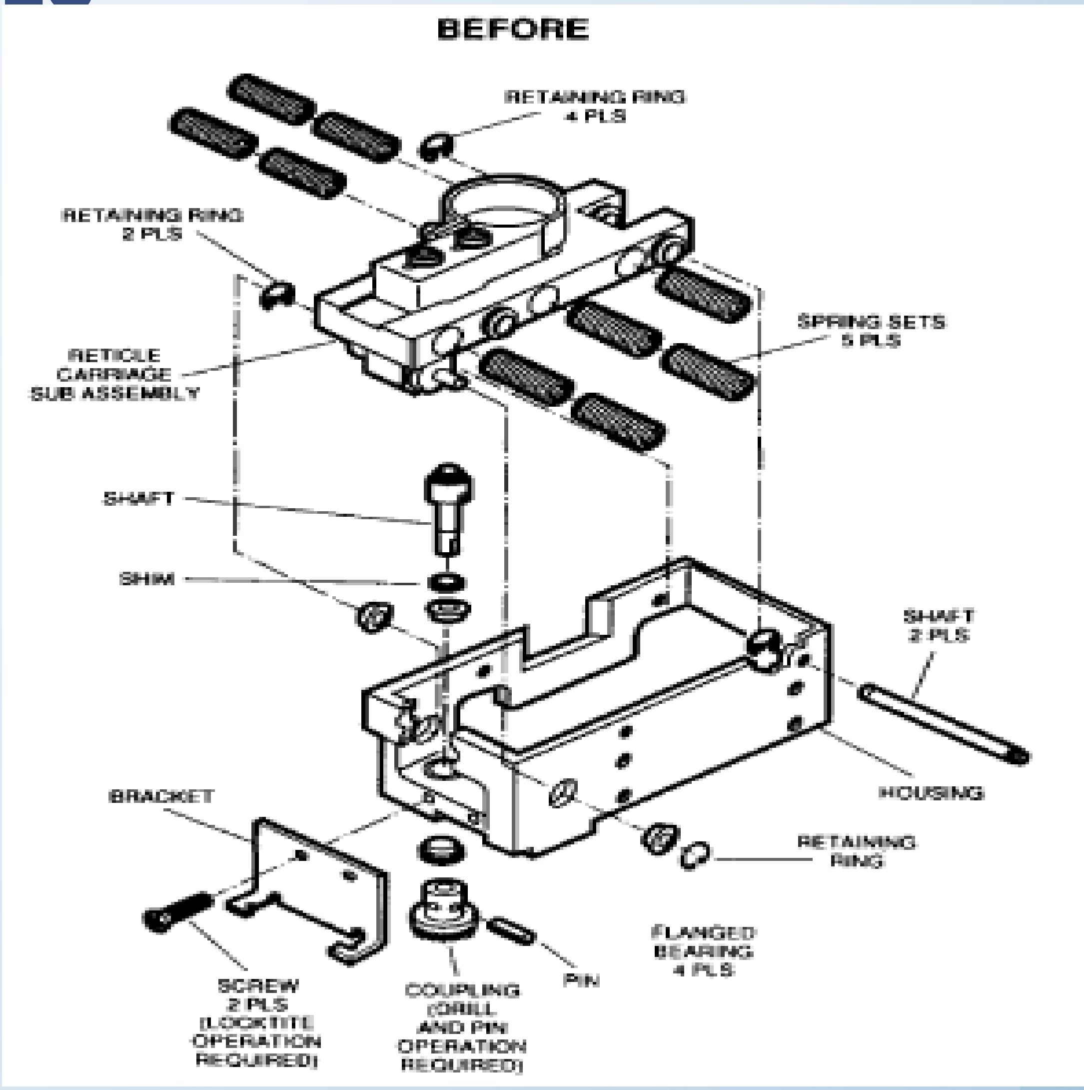
= 36.7 %

Making use of Design Efficiency

- Some companies use design efficiency as a decision gate (for example, proceed with the design if efficiency is over 45%)
- Use design efficiency to compare two or more alternative design concepts, and go with the best one
- Examine each 'B' part in turn, and state how it might be designed out (if reasons such as manufacturing complexity prevent its elimination, record the reasons)

TYPICAL DFMA CASE STUDIES
Defense Industry

- Figure shows original design of a **reticle assembly for a thermal gun sight** used in a ground-based armored vehicle.
- Used to track and sight targets at night, under adverse battlefield conditions, and to align the video portion of the system with the trajectory path of the vehicle's weapon to ensure accurate remote controlled aiming.



TYPICAL DFMA CASE STUDIES
Defense Industry

- The new design was analyzed using DFA
- Table 1.5: results for original design and for redesign.
- In the original design there were 24 different parts and in the new design only eight.
- 16 part types has been eliminated.

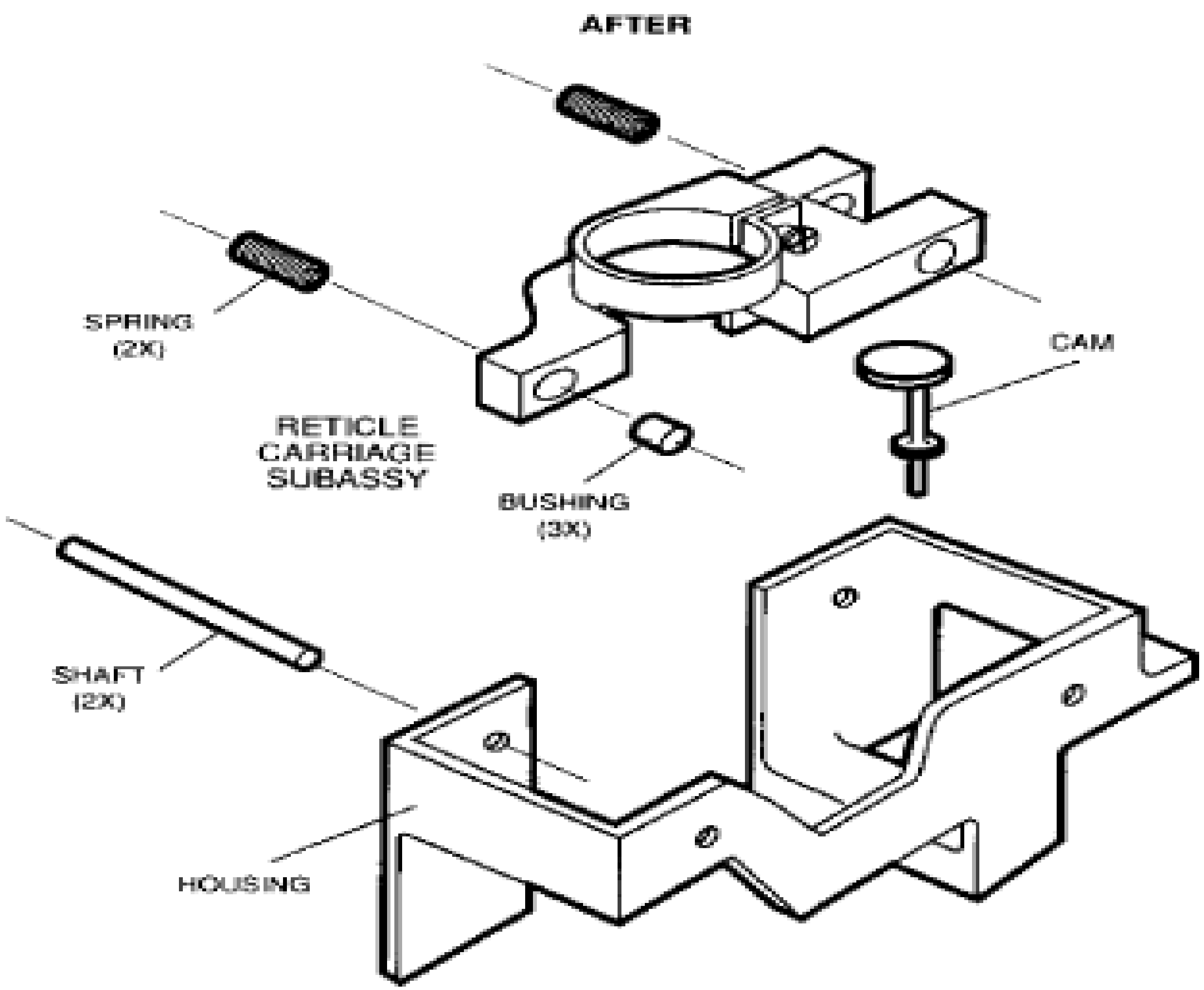


FIG. 1.16 Reticle assembly—new design. (Courtesy Texas Instruments, Inc.)

TYPICAL DFMA CASE STUDIES
Defense Industry

TABLE 1.5 Comparison of Original and New Designs of the Retical Assembly

	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
Metal fabrication time (h)	12.63	3.65	71.1
Weight (lb)	0.48	0.26	45.8

Source: Texas Instruments, Inc. (Raytheon Systems).

Table of Content

➢ Design features to facilitate :

Machining

Drills

Milling - Cutters

Keyways

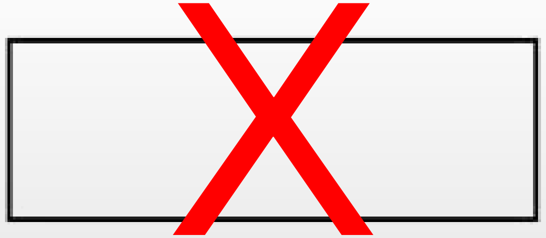
Design features to facilitate machining

❑ Design features to facilitate Machining [1]:

1 Avoid machining operations if possible.

2 Part should be easy for fixturing and secure holding.

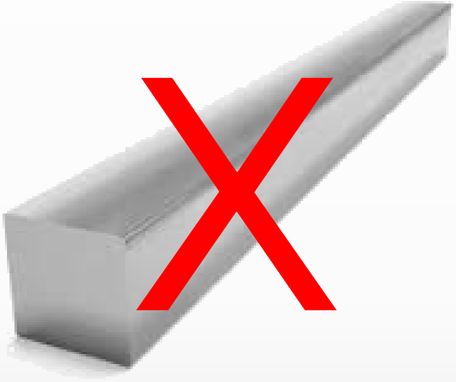
Work piece
For planner
machine



❑ Design features to facilitate Machining [1] :

3 Interrupted cuts should be avoided in all single-point machining operations.

Work piece for lathe



4 Avoid machining of hardened or difficult-to-machine materials.

❑ Design features to facilitate Machining [1] :

5 Parts should be rigid enough to withstand the forces of clamping and machining without distortion

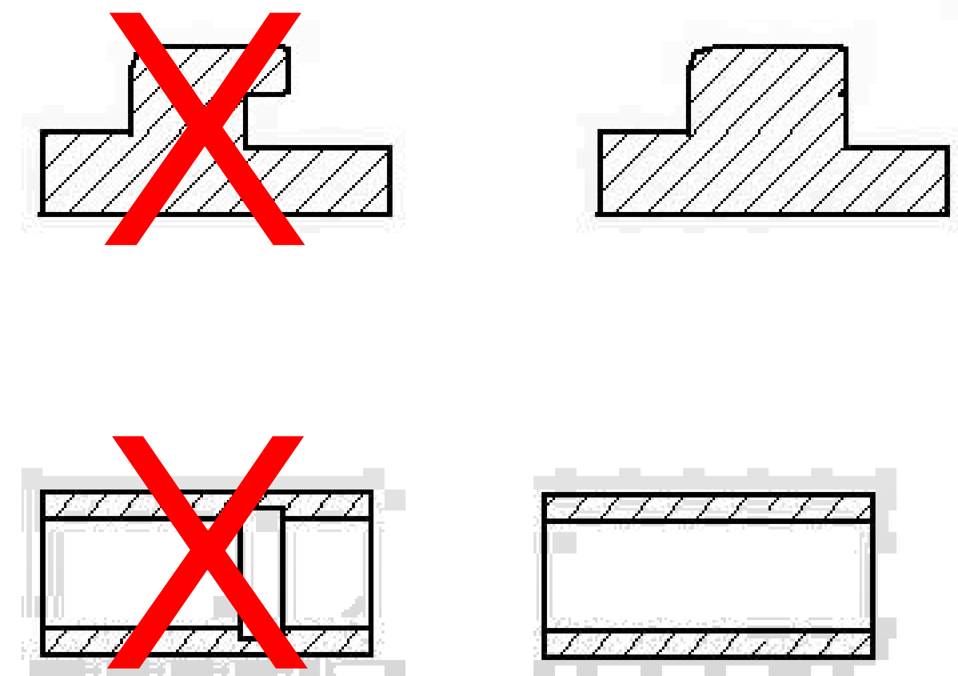
Work piece to
be clamped
in lathe chuck

6 Provide sufficient allowances to the stock for both rough and finish machining.

❑ Design features to facilitate Machining [1] :

7 Number of operations required are reduced by using the same plane for subsequent machining.

8 Avoid undercuts to avoid separate operation of specially ground tools.



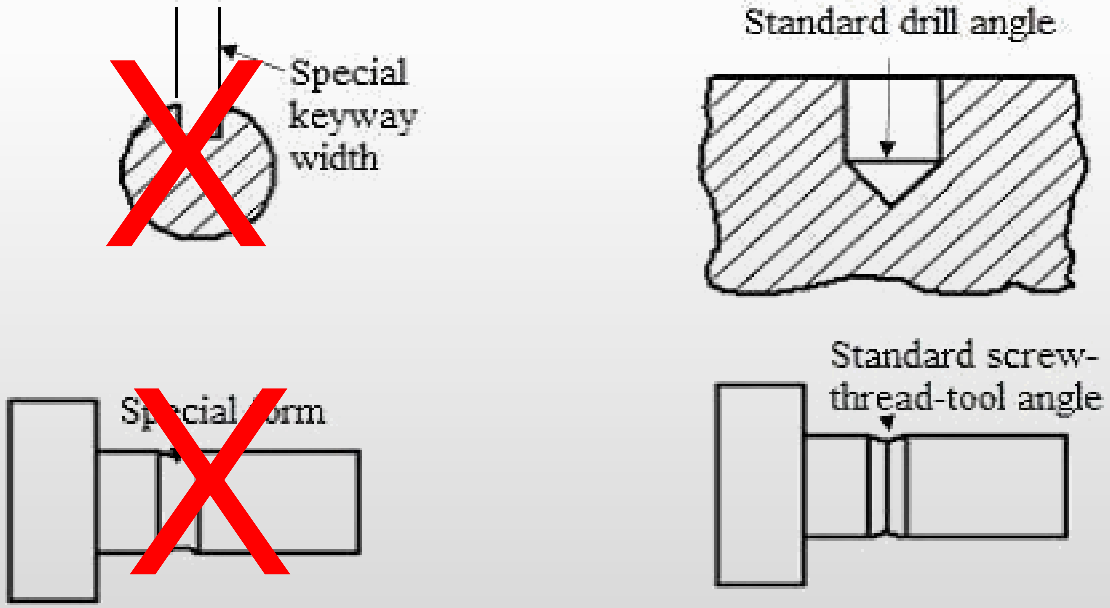
❑ Design features to facilitate Machining [1] :

9 Provide access room for cutters bushing and fixture.

10 Avoid parting lines or draft surfaces for clamping or locating surfaces.

11 Provide relief space for burr removal.

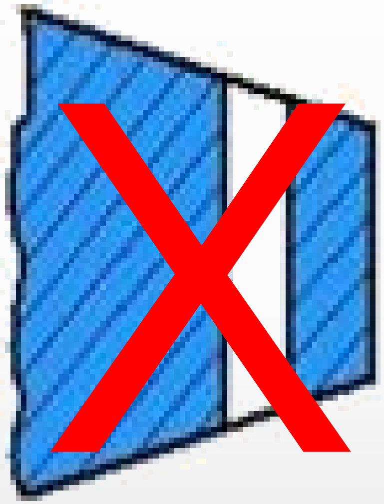
12 Work piece should permit use of standard cutters.



Design features to facilitate Drill

❑ Design features to facilitate Drill [2] :

1 The drill bit should be always perpendicular to the drilling surface.



Entry Exit Surface for Holes

This avoids the starting problems and also helps in ensuring the proper location of the hole.

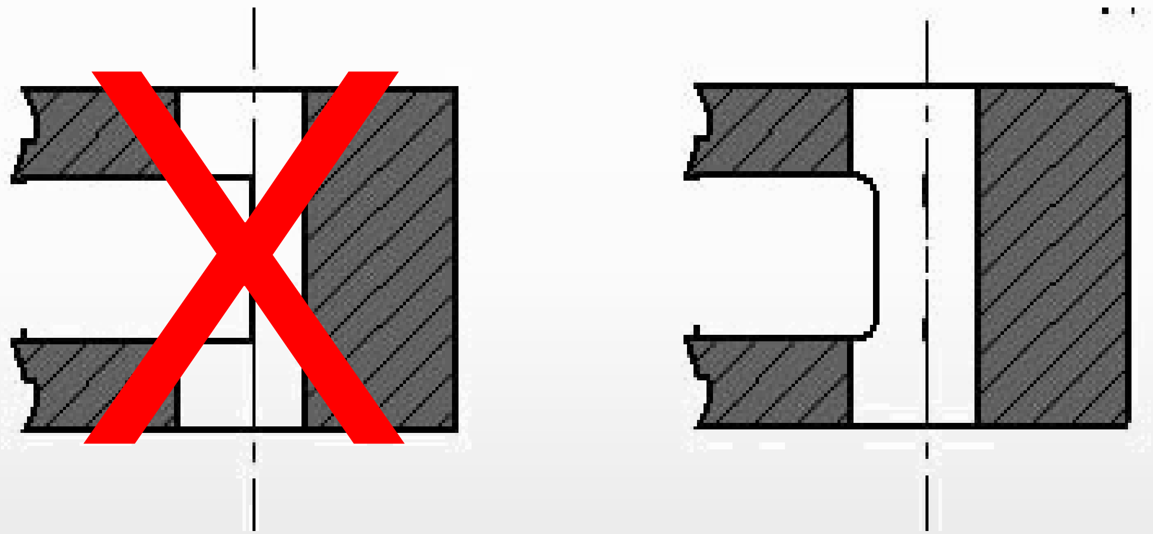
❑ Design features to facilitate Drill [2] :

2

Avoid interrupted cut when straightness of hole is important.

It is advised to use a guide bush at each re-entry surface.

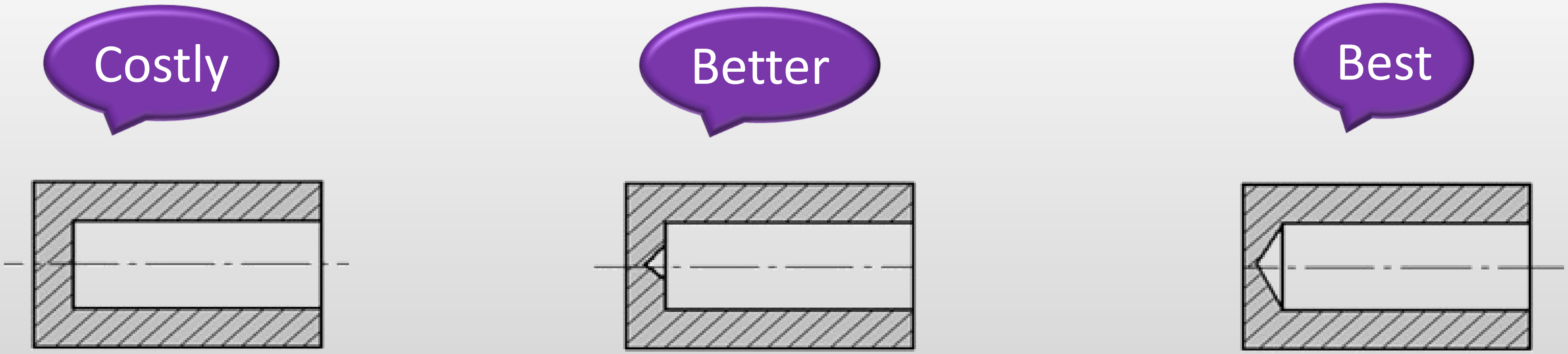
The center point of the drill must remain in the work piece throughout the cut.



❑ Design features to facilitate Drill [2] :

3 Through holes are preferable than blind holes. It provides clearance to the tool and chip in secondary operations like reaming, tapping, or honing.

4 The drill bit always generates pointed holes in blind holes. Flat bottoms are costlier in blind holes as secondary operations are required.



❑ Design features to facilitate Drill [2] :

5

Recommended depth of the hole is maximum 3 times that of the diameter of the hole.

If it is more, it creates chip clearance problems and the possibility of deviations from straightness.

Special tooling, equipment and techniques are used for deep hole drilling.

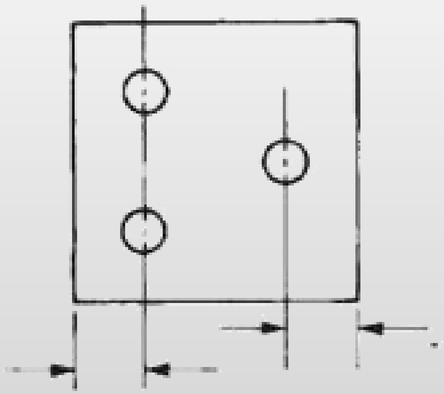
For example, Gun barrel bored holes can be as deep as 5 times that of the hole diameter.

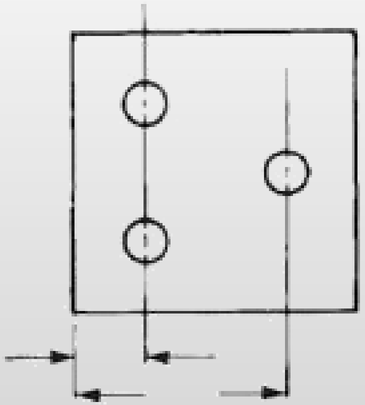
❑ Design features to facilitate Drill [2] :

6 A minimum diameter about 3mm is preferred for hole drilling as small diameter drills are more prone to breakage.

7 It is required to dimension holes from the same surface to simplify fixturing.

Dimensioning from different surface





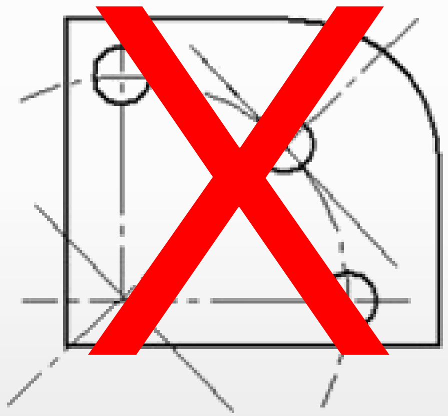
Dimensioning from Same surface

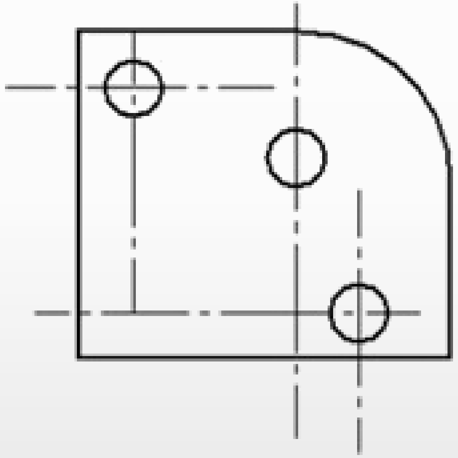
❑ Design features to facilitate Drill [2] :

8

Rectangular coordinates are more preferable than angular coordinates to designate the location of hole.

Angular coordinate





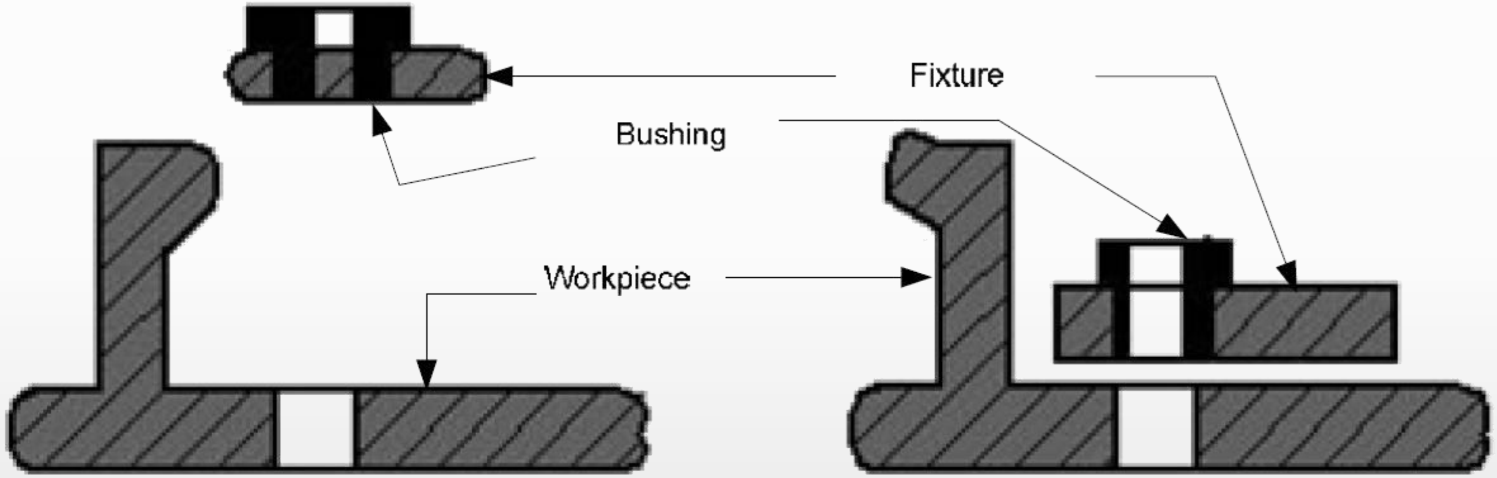
Rectangular coordinate

9

Design of parts should be such that all holes can be drilled from one side or from the few number of sides.

❑ Design features to facilitate Drill [2] :

10 Allow room for drill bushings close to the work piece surface to be drilled.



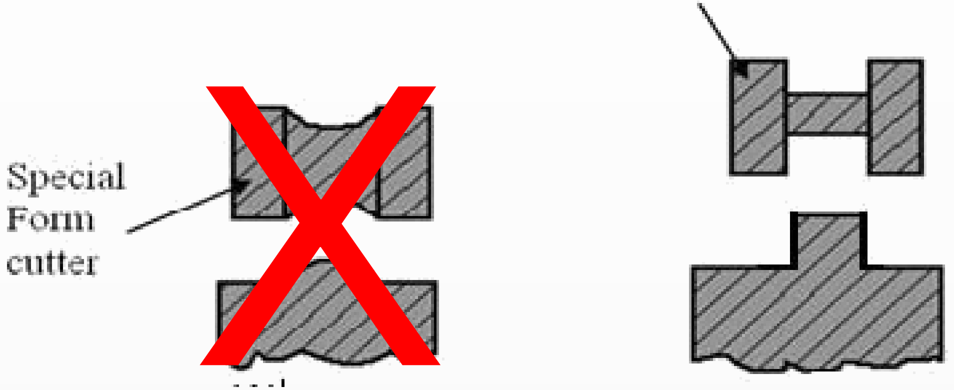
11 For multiple-drilling arrangements, the spacing between the holes should not be less than 19 mm for small holes.

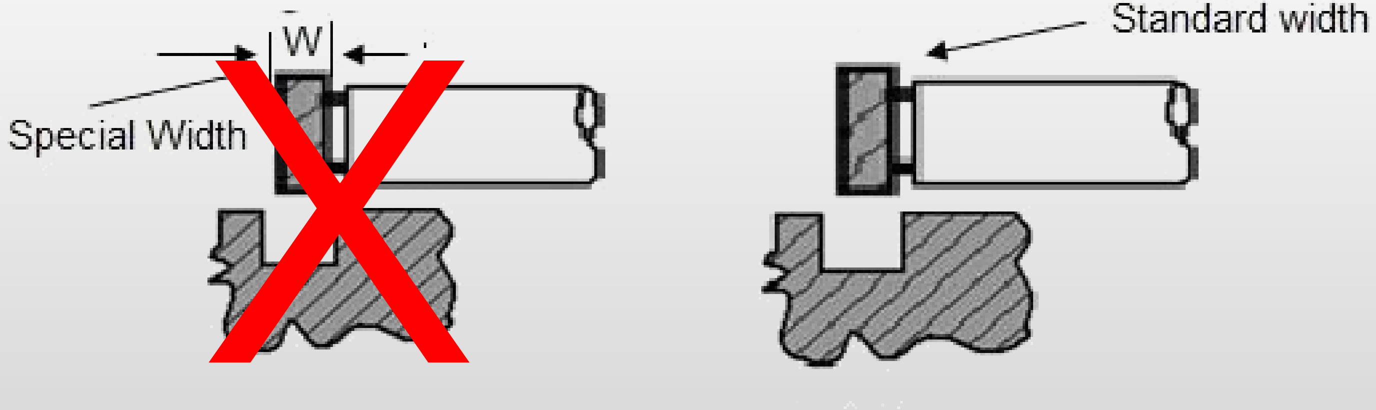
Design features to facilitate Milling-cutters

❑ Design features to facilitate Milling-cutters [3] :

1 Use standard cutter shapes and sizes.

Specialized nonstandard cutters are costly and difficult to maintain.

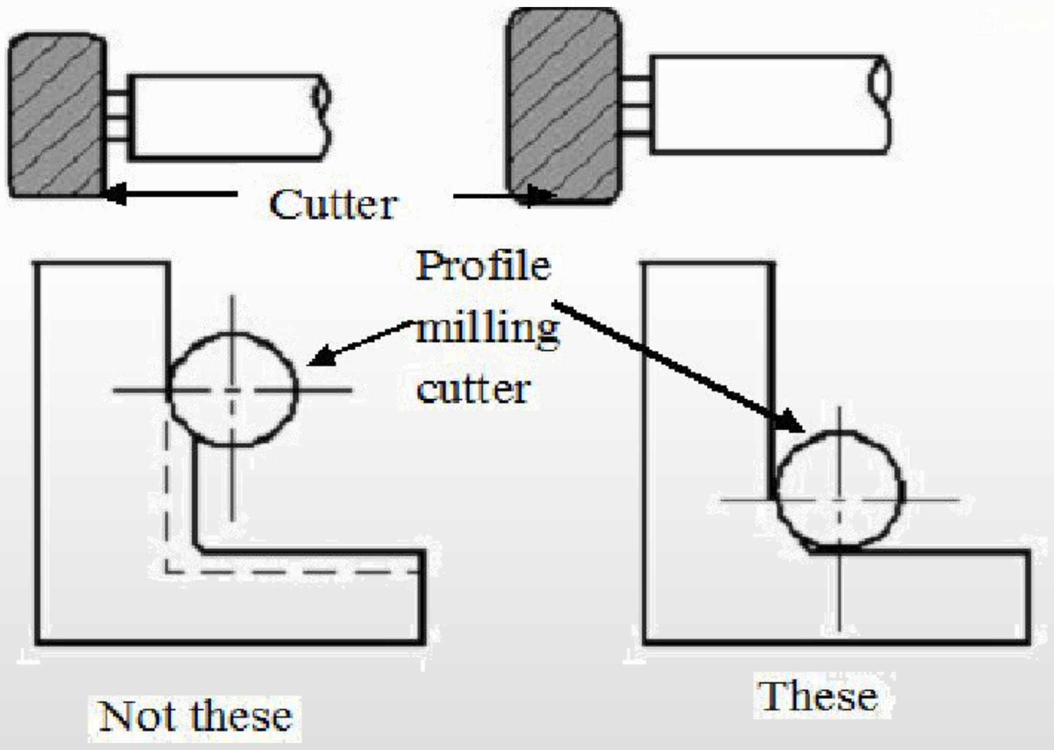


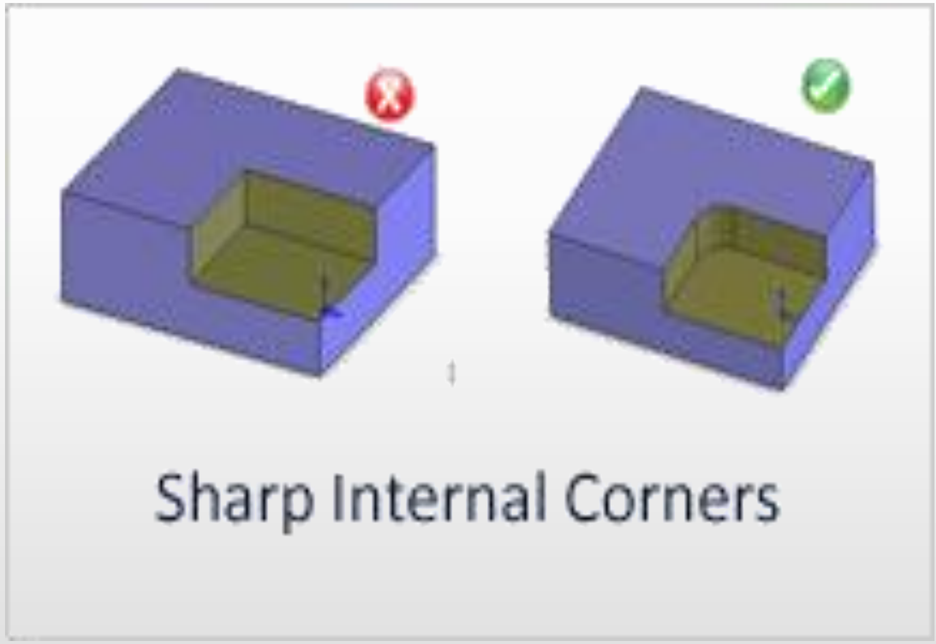


❑ Design features to facilitate Milling-cutters [3] :

2

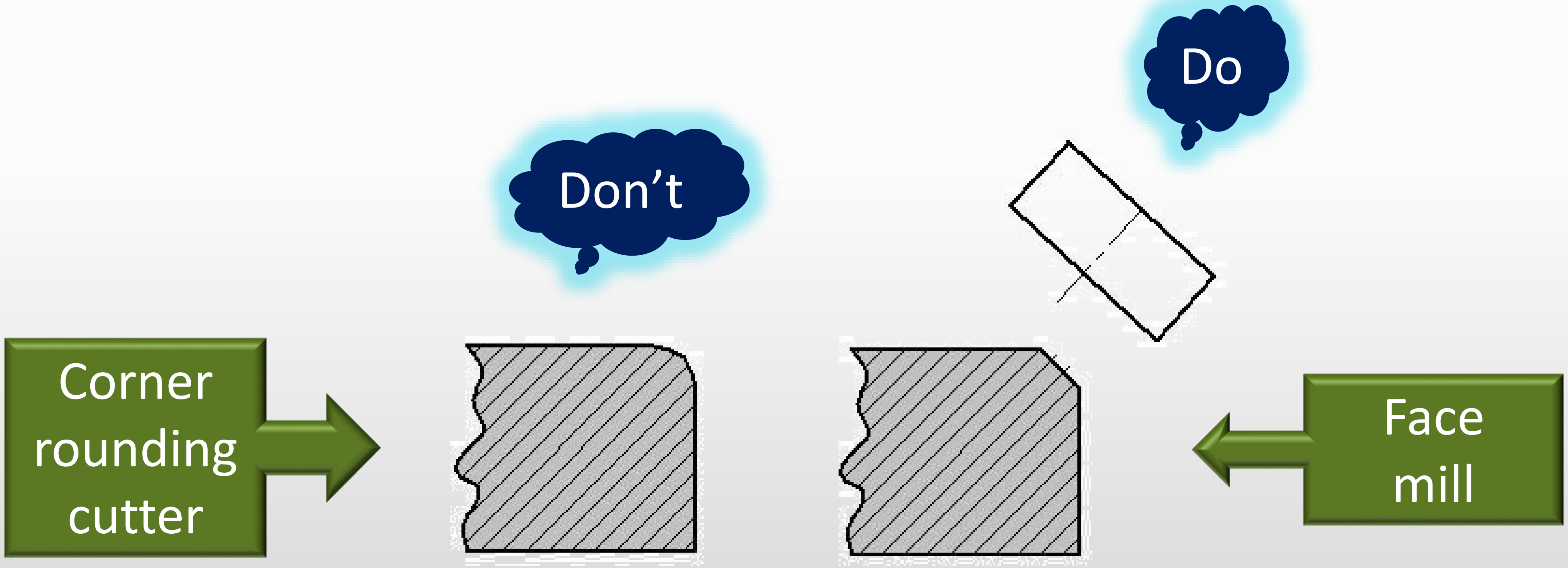
Product design should permit the use of the radii provided by the cutting tool.





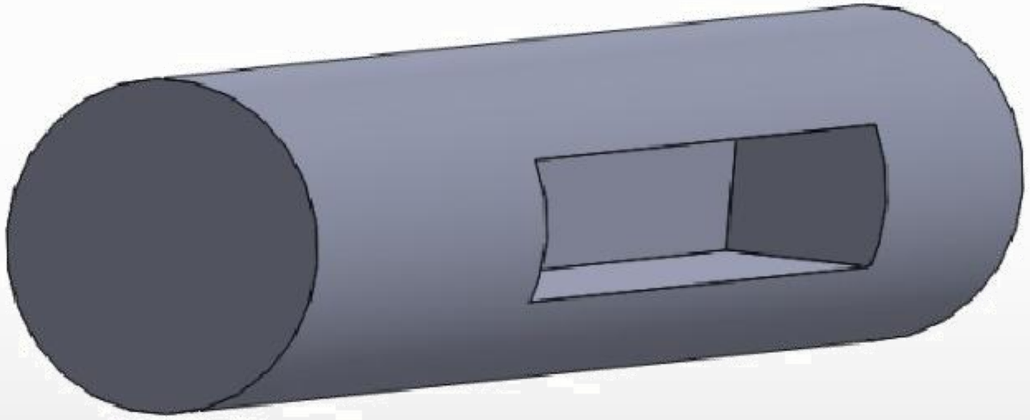
❑ Design features to facilitate Milling-cutters [3] :

3 Allowing a beveled rather than a rounded corner for more economical machining.



Design features to facilitate Milling-cutters [3] :

4. Use standard cutter to produce both sides and ends of keyways in one operation.

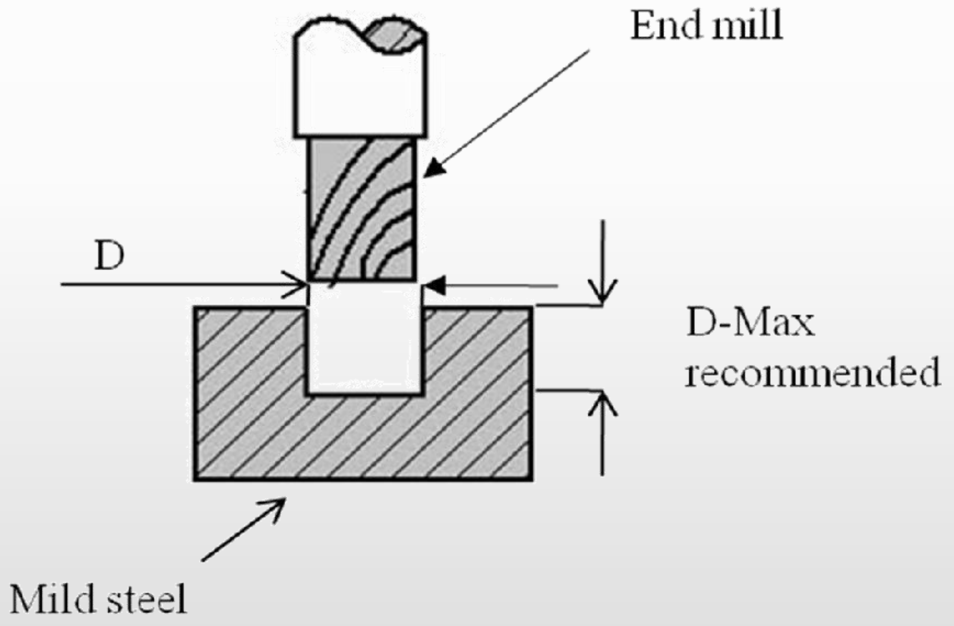


5. Avoid milling at parting lines, flash areas, and weld-ments for higher cutter life.

❑ Design features to facilitate Milling-cutters [3] :

6 Surfaces in the same plane or at least in the same direction and in parallel planes are preferred.

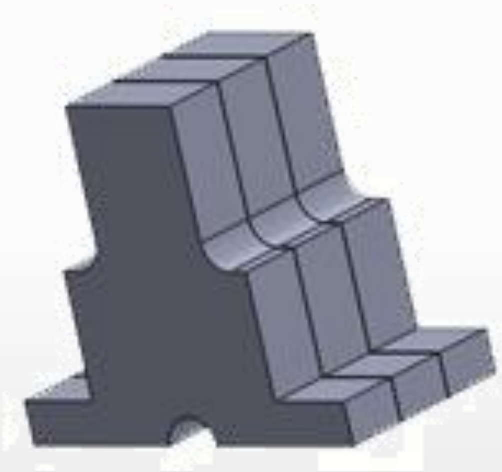
7 End-milling slots in mild steel should not be deeper than the diameter of the cutter.



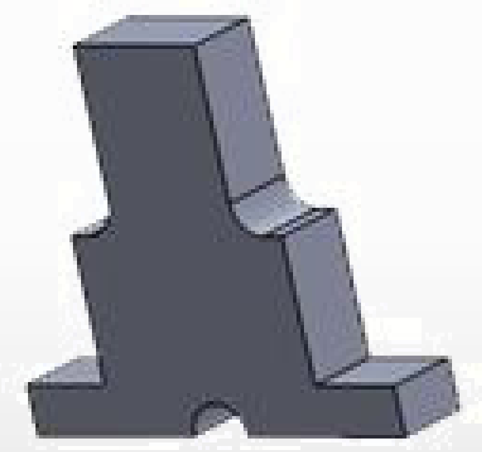
Design features to facilitate Milling-cutters [3] :

8

Form milling is an economical approach if product design permits stacking or slicing operations.



Stacked and milled



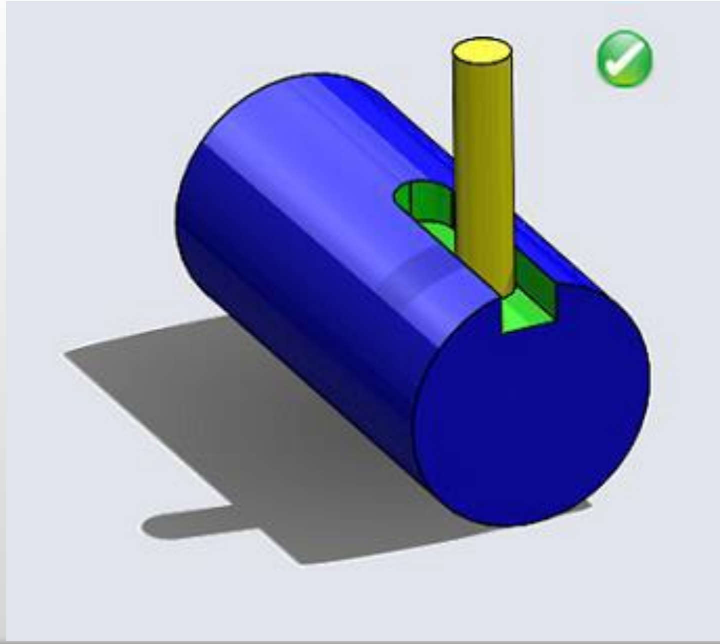
Un -stacked

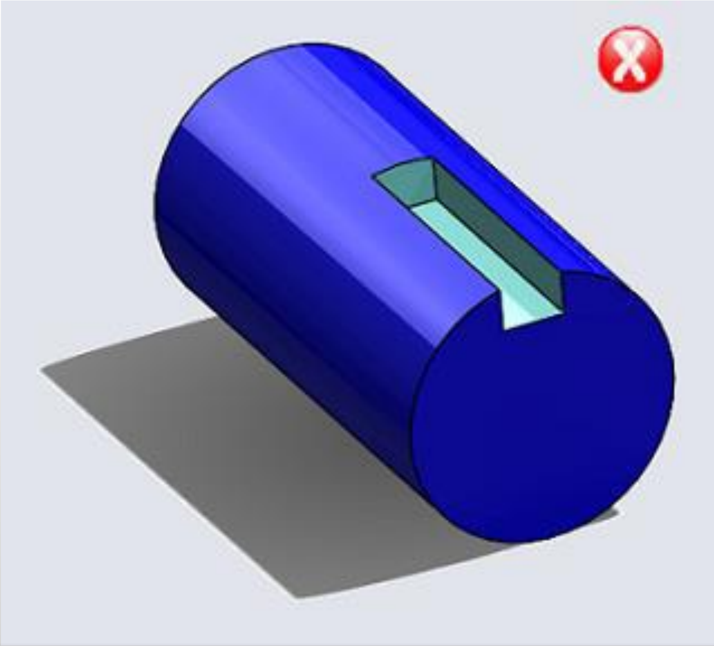
Design features to facilitate Keyways

❑ Design features to facilitate Keyways [4]:

1 For generating external keyways, end milling cutter or a slotting cutter has to be used and can be done much faster compared to other processes.

To suit a cutting tool, blind axial keyways should be radiused at the end.

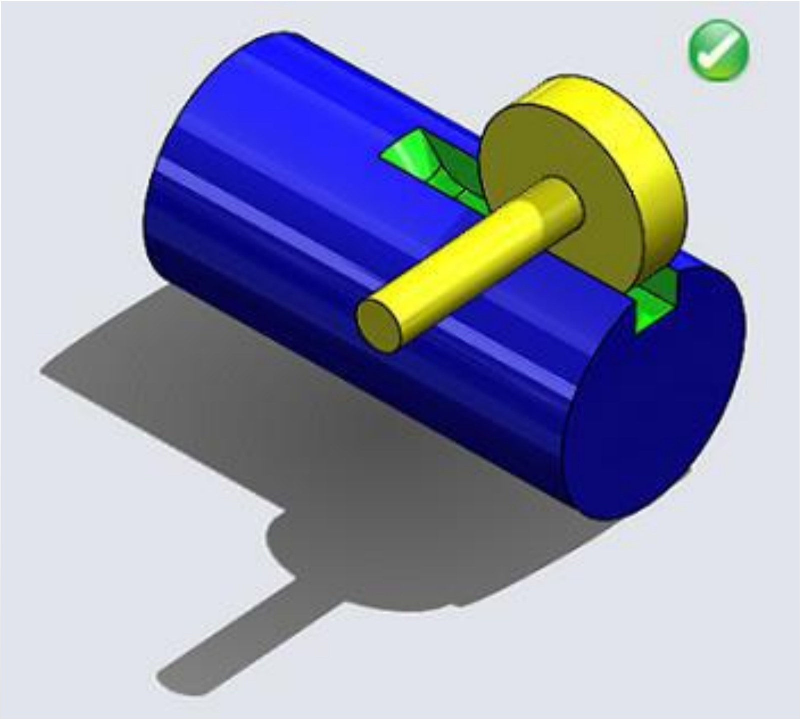




❑ Design features to facilitate Keyways [4] :

2 Width of keyways should be such that standard cutters can be used.

3 If the end of keyway is radiused in such a way that it could be cut by a slotting cutter, it will improve the speed of machining keyways.



❑ Design features to facilitate Keyways [5] :

4 Milling and shaping is not recommended for internal keyways generation.

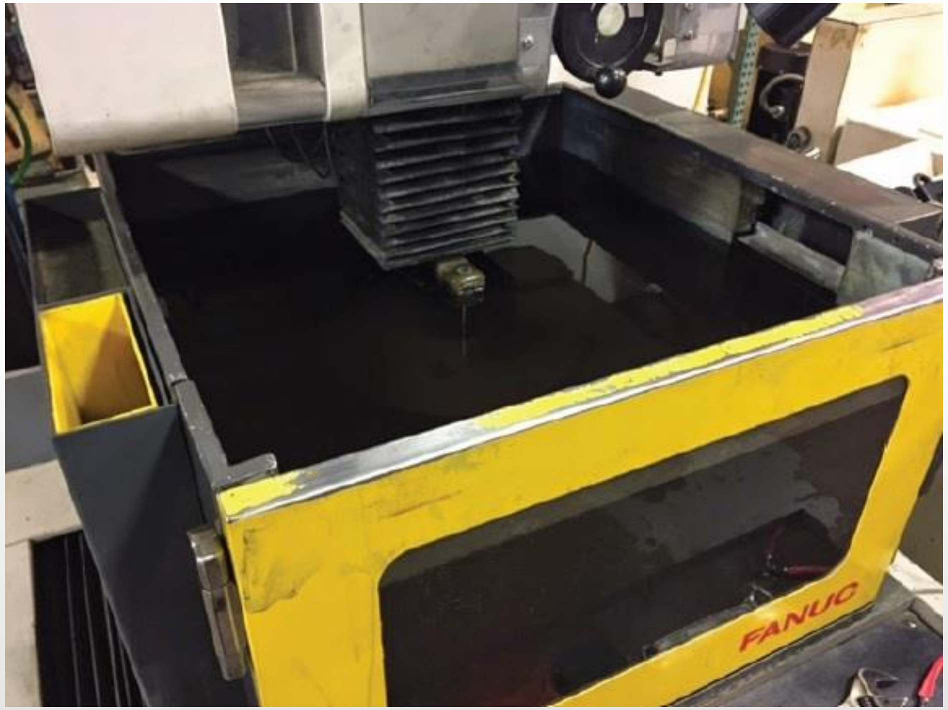
For internal keyways, broaching machine should be used.

Horizontal Broaching Machine

Vertical Broaching Machine

❑ Design features to facilitate Keyways [5] :

5 For keyways in hardened material, wire-cut EDM is recommended.



Wire-cut EDM

Broaching and wire-cut EDM can't be used for blind keyway.

DESIGN GUIDELINES FOR WELDING

Introduction

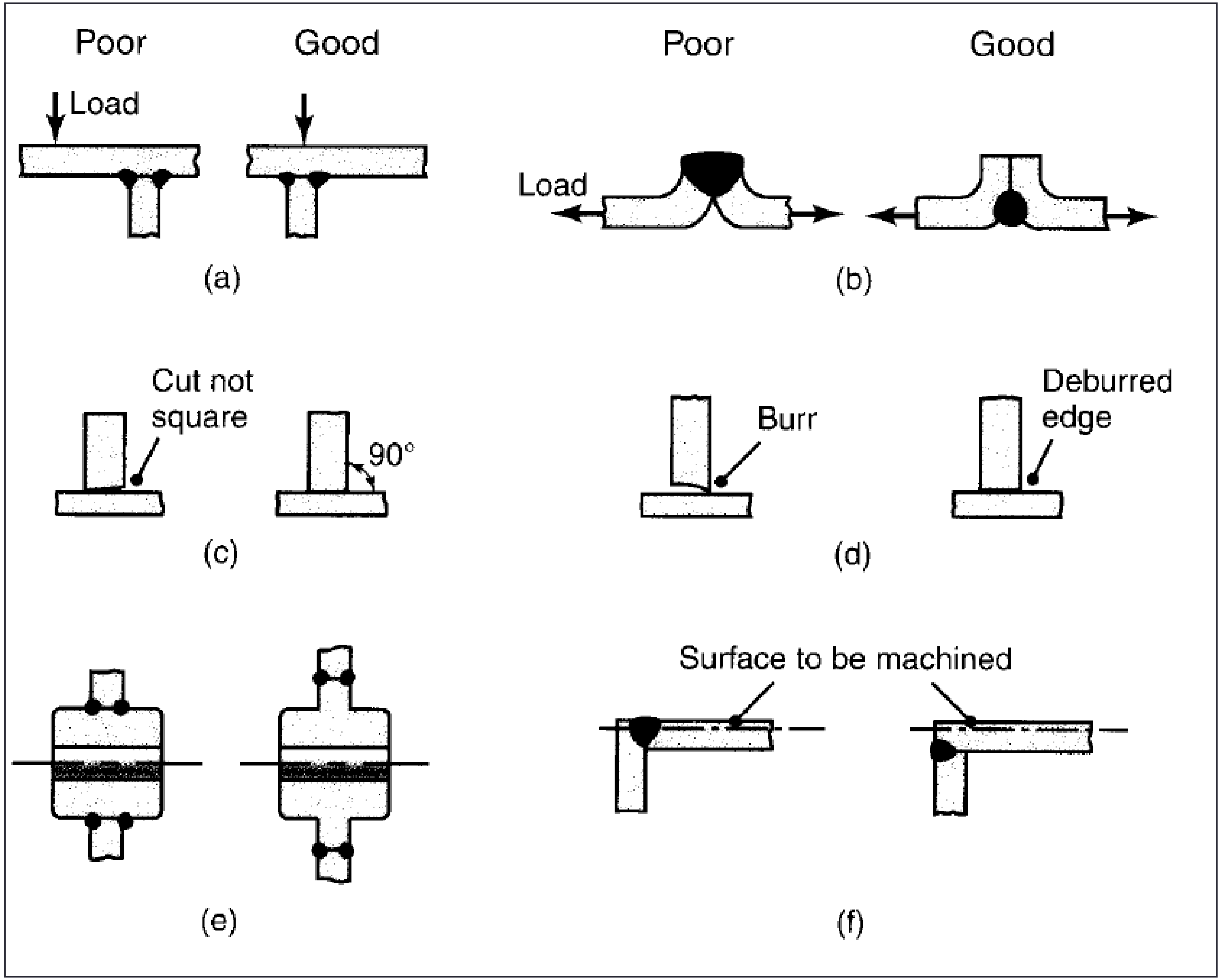
- Arc welding can be used to weld almost any kind of assembly.
- Commonly produced devices by arc welding are tube fittings, storage tanks, pressure vessels, machine frames, structures for industrial equipment, railroad cars etc.

Design guidelines for welding

- Welded assemblies should have **few parts**.
- Weld joints should be placed in such a way that there is **easy access of the welding nozzle**.
- Provide minimum amount of **weld filler**, with respect to both **fillet size and length** that meets functional requirements of the assembly.
- Welding should be done **horizontally**, with the stick or electrode holder pointing downward during welding

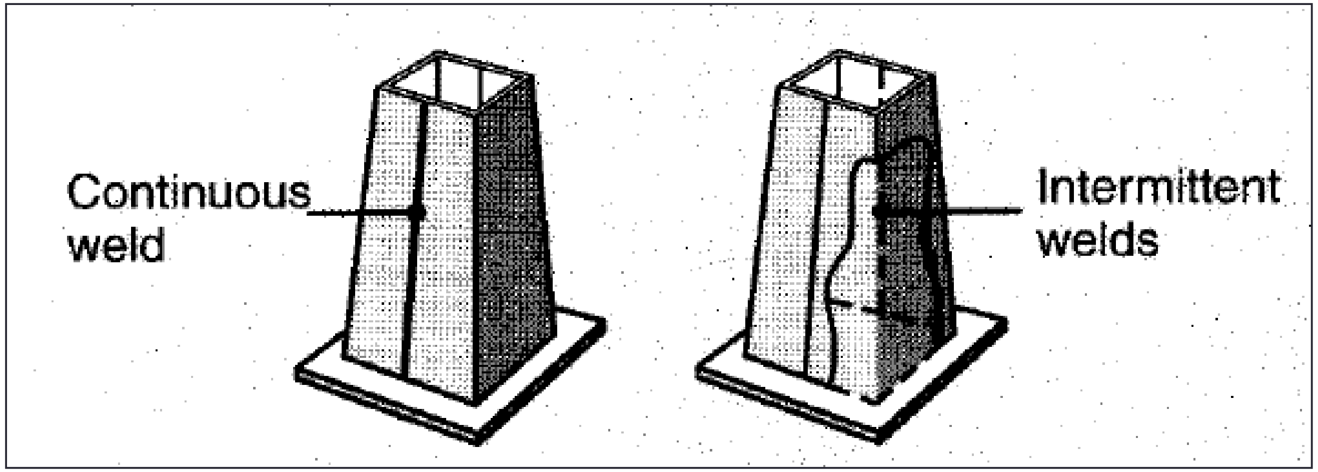
Design guidelines for welding

- Product design should **minimize the number of welds** because, unless automated.
- Weld location should be selected so as to avoid **excessive stresses or stress concentrations** in the welded structure and for appearance.
- Components should **fit properly** prior to Welding. The method used to prepare edges, such as sawing, machining, or shearing, also can affect weld quality.
- The need for **edge preparation** should be avoided or minimized.
- **Weld-bead size** should be as small as possible, While maintaining the strength of the joint, to conserve Weld metal and for better appearance


Poor
Good
Load
(a)
Poor
Good
Load
(b)
Cut not square
90°
(c)
Burr
Deburred edge
(d)
(e)
Surface to be machined
(f)

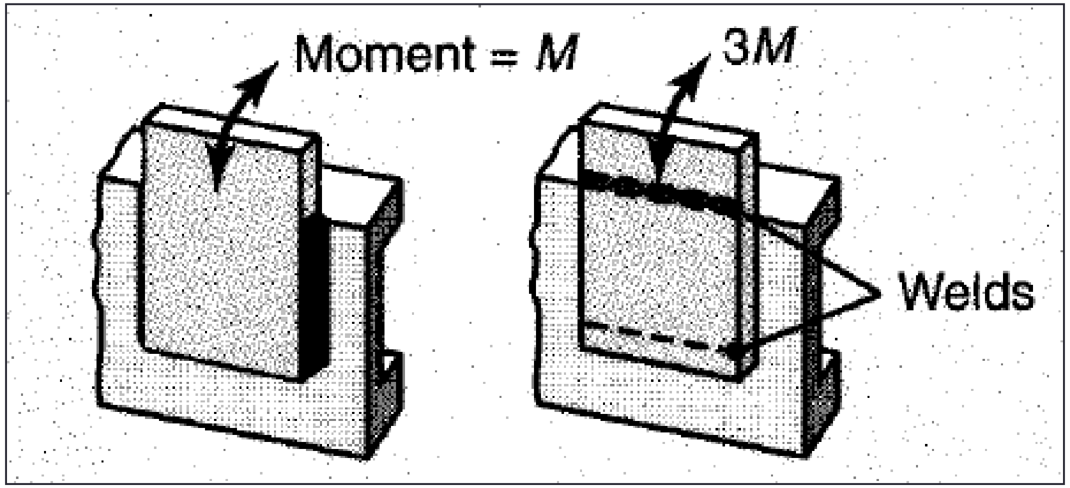
Design guidelines for Welding

- The two vertical joints can be welded either externally or internally.
- Full-length external welding will take considerable time and will require more weld material than the alternative design, which consists of intermittent internal welds.



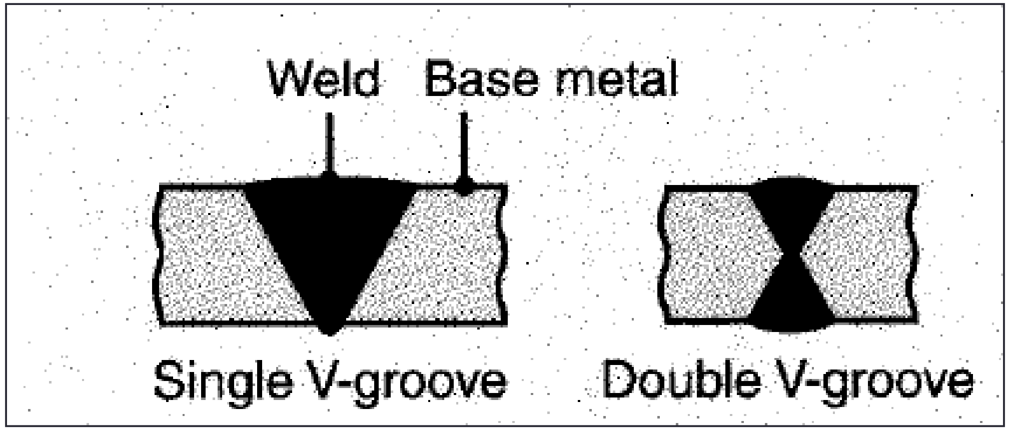
Design Guidelines for welding

- Design on the right can carry 3 times the moment ‘M’ of the one on the left.
- Both designs require the **same amount of weld metal and Welding time.**



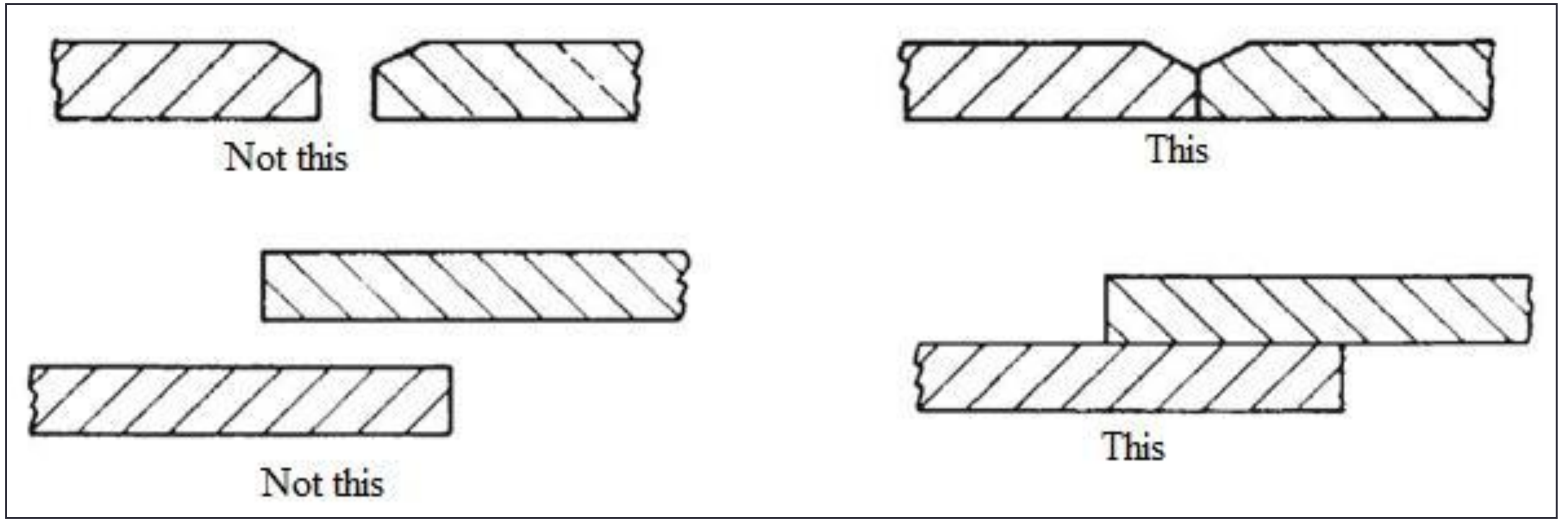
Design guidelines for welding

- Left side welding - **weld metal is twice** the amount of weld material than welding on the right.
- **Edge preparation** for left side weld requires more time than on right side because of more material



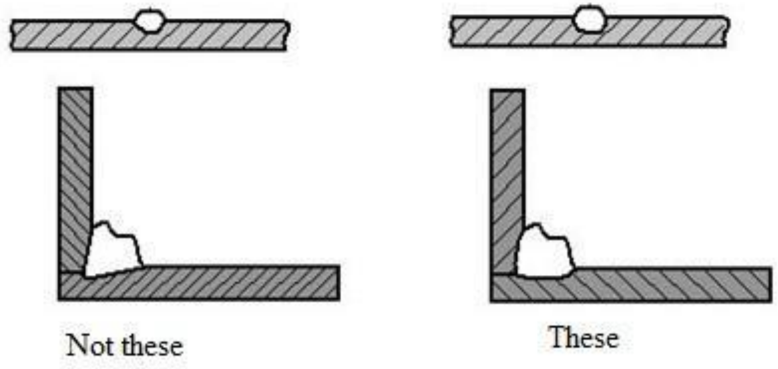
Design guidelines for welding

- The designer should be aware of **poor and good fit-up** of parts at the weld joint. It is essential not only for welding speed but also for minimizing distortion of the finished weldment.

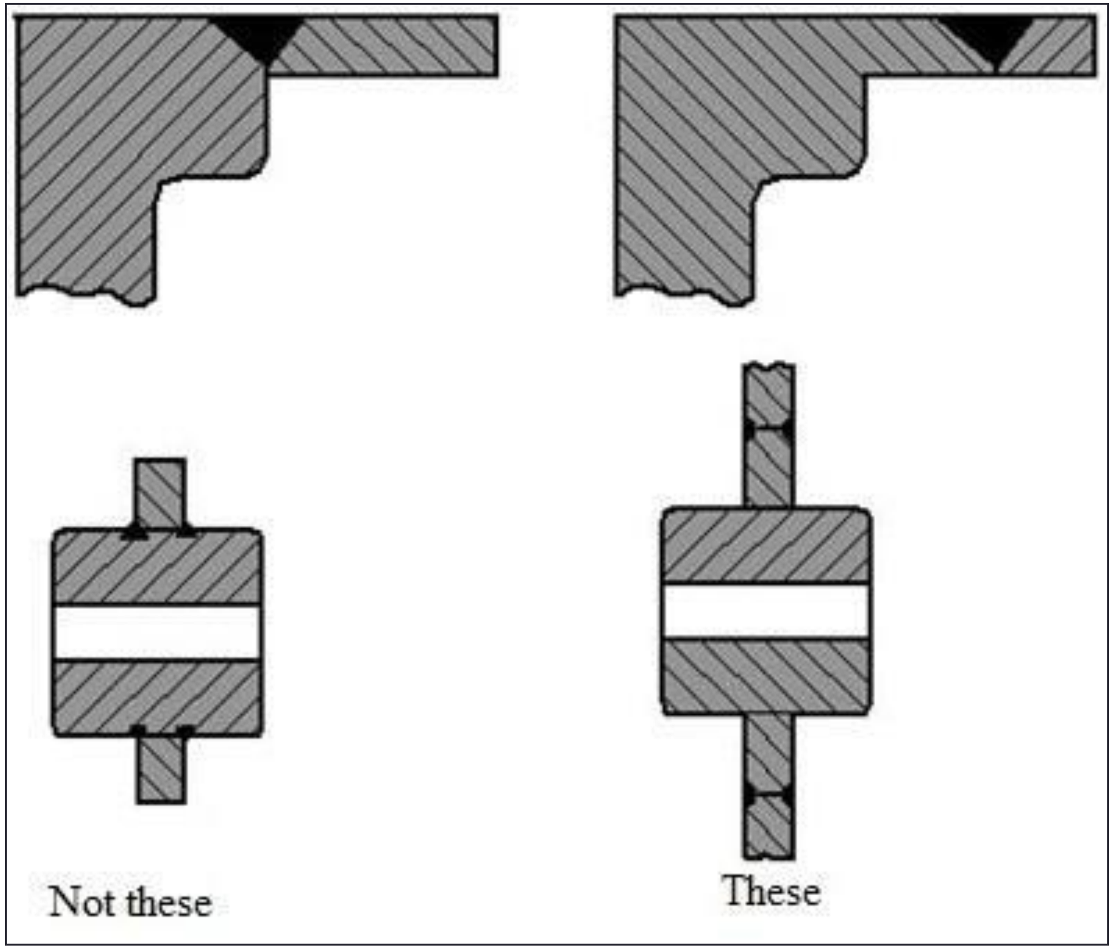


Design guidelines for welding

- The **build-up of weld fillets** should be kept to a minimum as it doesn't add **significant strength** to the joint
- If Forgings or castings are part of a welded assembly, one should ensure good fit-up of the parts to be welded. For example **untrimmed parting-line areas shouldn't be included in the welded joint.**
- In the **cast part the wall thickness** of both parts to be joined should be equal at the joint.

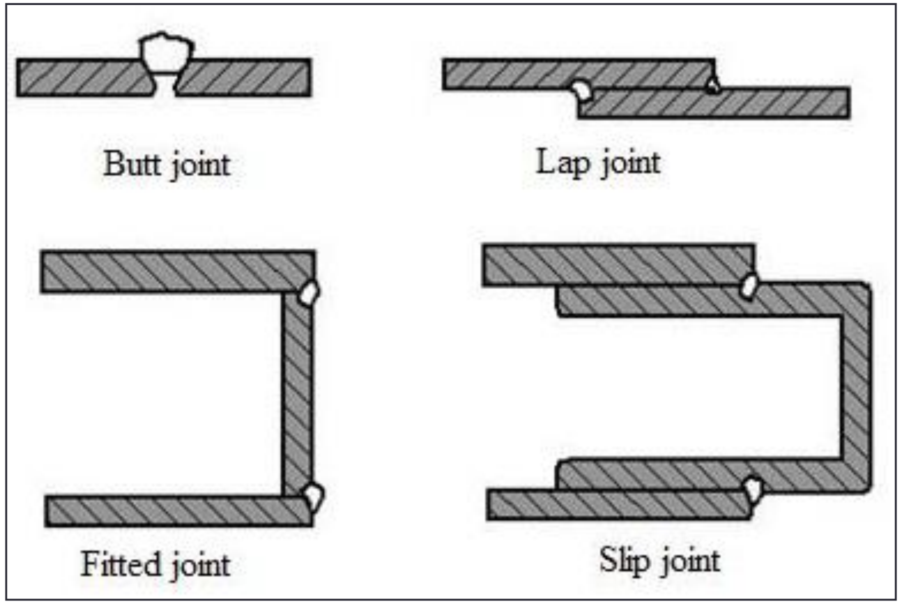


Design guidelines for welding



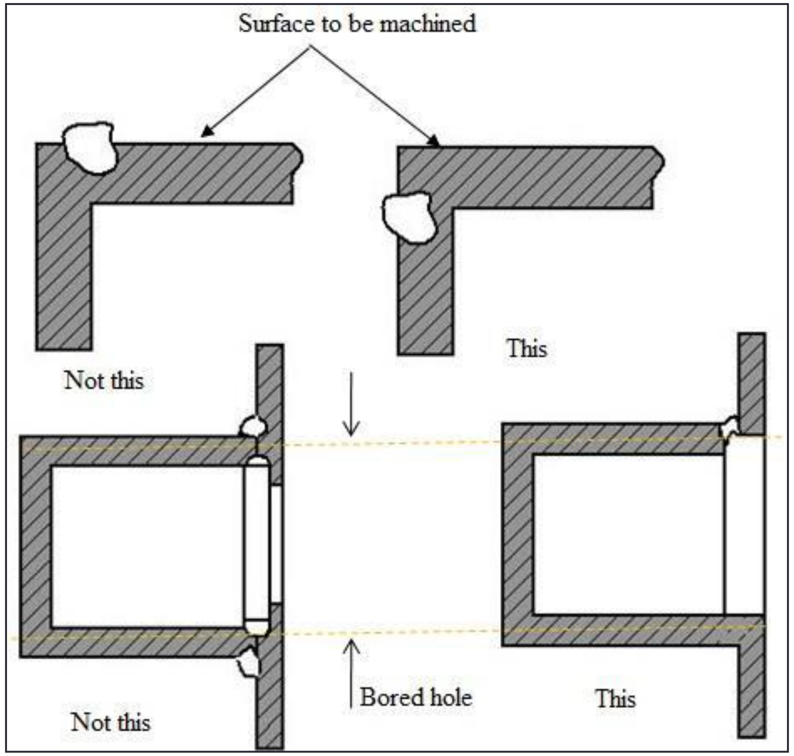
Design guidelines for welding

- The joint should be designed so that it **requires minimal edge preparation**. For this, one should use **slip or lap joints** in welded assemblies to avoid the cost of close edge preparation and to simplify fit-up problems.



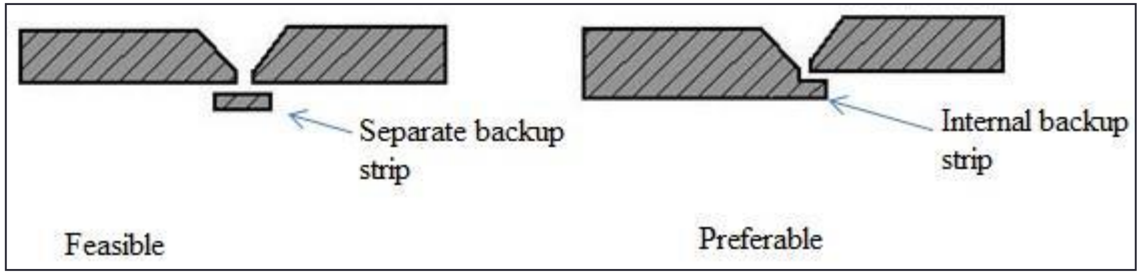
Design guidelines for welding

- If machining after welding is required, it is advisable to place welds away from the material to be machined to avoid machining problems.
- In the second figure the welded portion on right side is not desirable because the hole to be bored will be difficult.

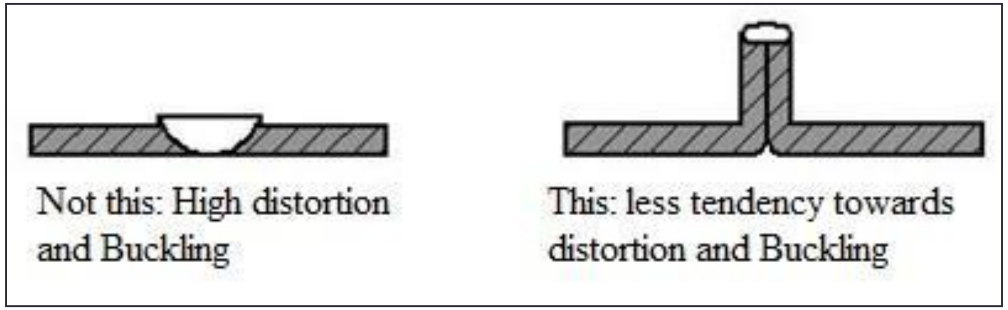


Design guidelines for welding

- Sometimes it is advantageous to include a **weld backup** strip as an integral part of one of the component to be welded.

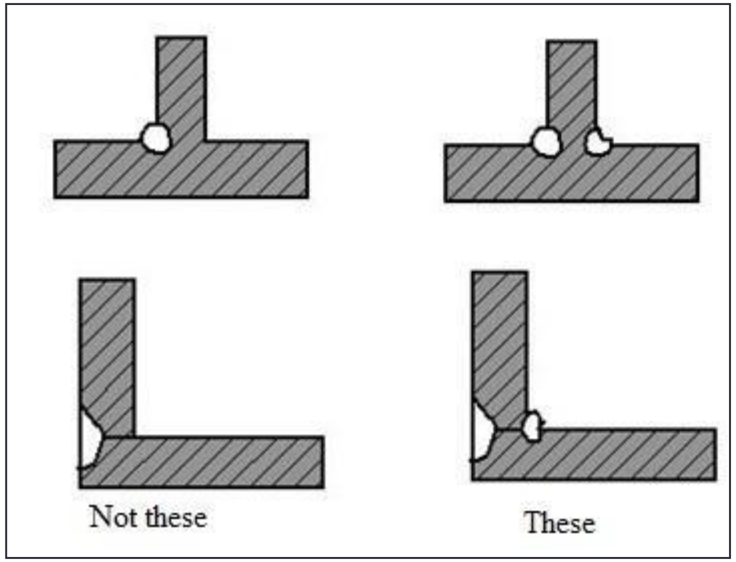


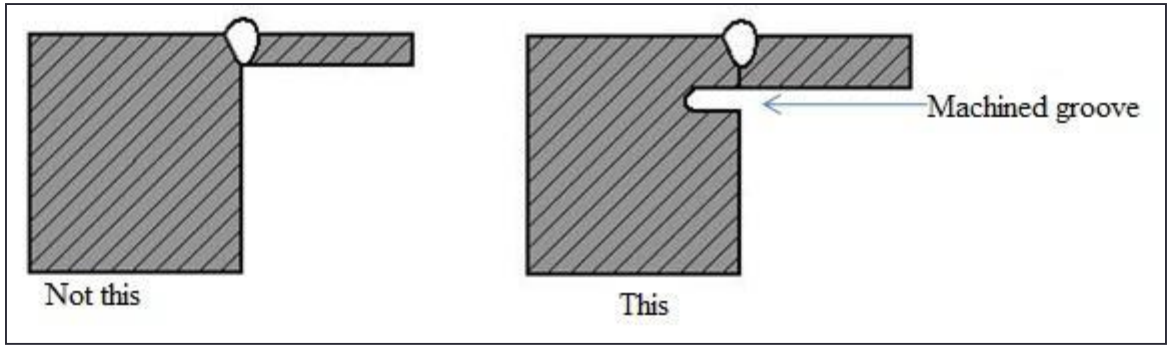
- Short flanged **butt joints are preferable to join thin materials**. Unless joints have good supports long sections of thinner material, when welded together, are apt to distort and buckle.



Design guidelines for welding

- If possible, place **welds opposite** one another to reduce distortion.
- If sections of **unequal thickness** are to be welded, distortion can be reduced by equalizing wall thickness at the joint by machining a groove in the thicker piece adjacent to the weld joint

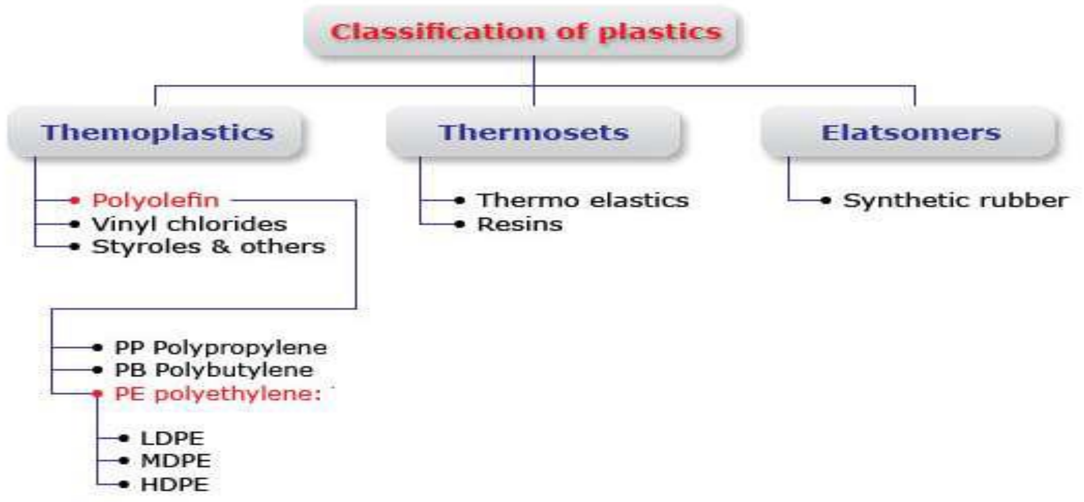


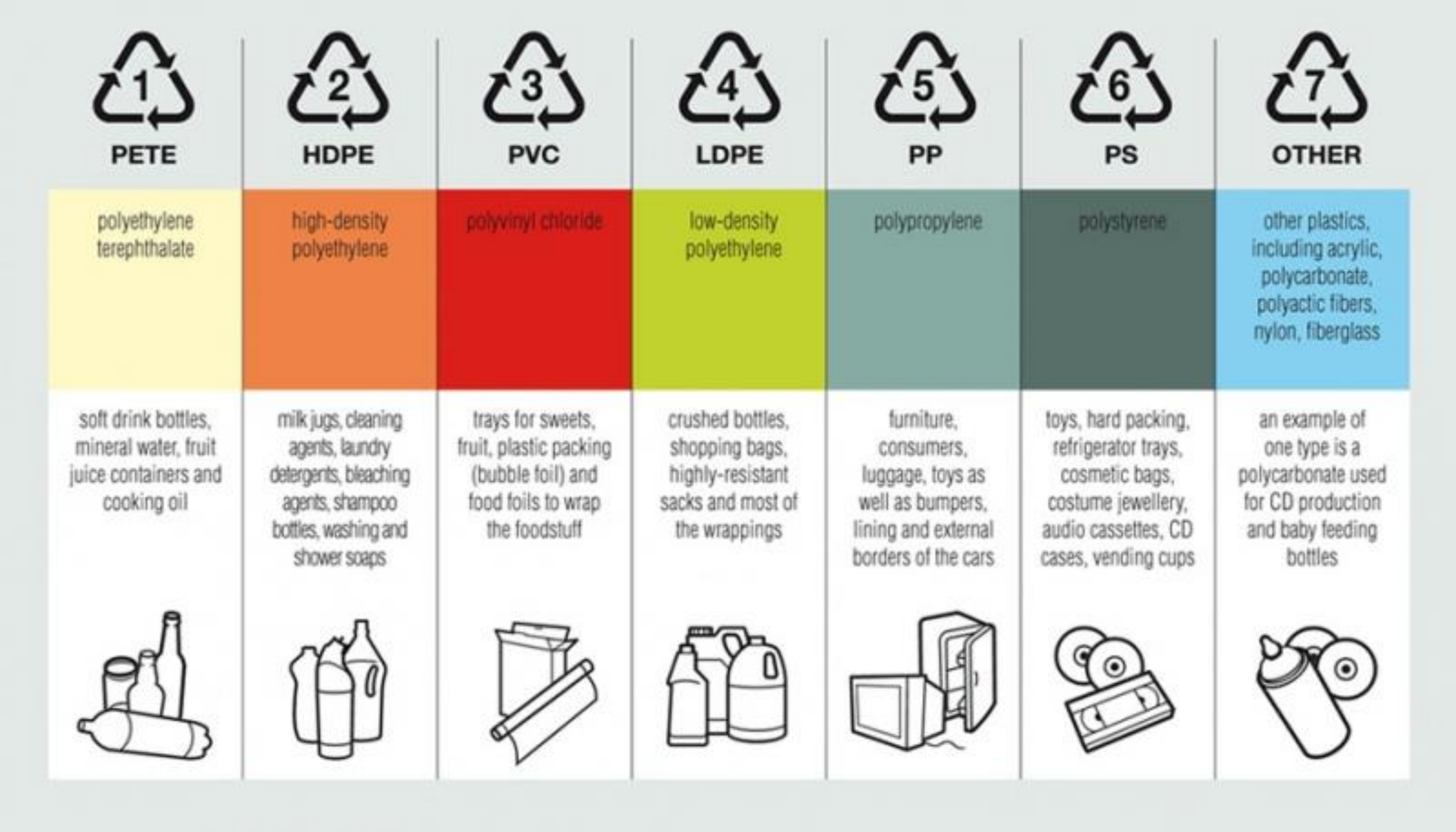


DESIGN GUIDELINES FOR PLASTICS, RUBBER AND CERAMIC

Plastics

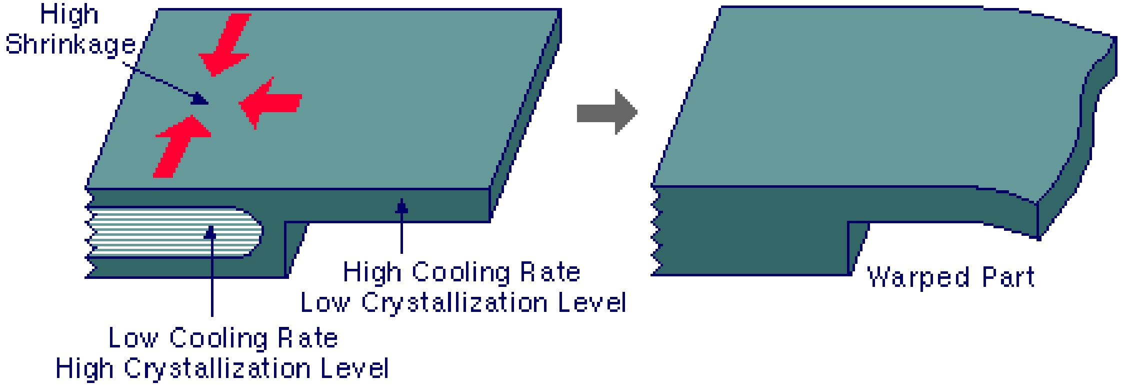
- A polymer is a compound consisting of long-chain molecules, each molecule made up of repeating units connected together
- Polymers can be separated into plastics and rubber. As engineering materials, they are relatively new compared to metals and ceramics, dating only from around the mid-1800s.




1 PETE
polyethylene terephthalate
soft drink bottles, mineral water, fruit juice containers and cooking oil
2 HDPE
high-density polyethylene
milk jugs, cleaning agents, laundry detergents, bleaching agents, shampoo bottles, washing and shower soaps
3 PVC
polyvinyl chloride
trays for sweets, fruit, plastic packing (bubble foil) and food foils to wrap the foodstuff
4 LDPE
low-density polyethylene
crushed bottles, shopping bags, highly-resistant sacks and most of the wrappings
5 PP
polypropylene
furniture, consumers, luggage, toys as well as bumpers, lining and external borders of the cars
6 PS
polystyrene
toys, hard packing, refrigerator trays, cosmetic bags, costume jewellery, audio cassettes, CD cases, vending cups
7 OTHER
other plastics, including acrylic, polycarbonate, polyactic fibers, nylon, fiberglass
an example of one type is a polycarbonate used for CD production and baby feeding bottles

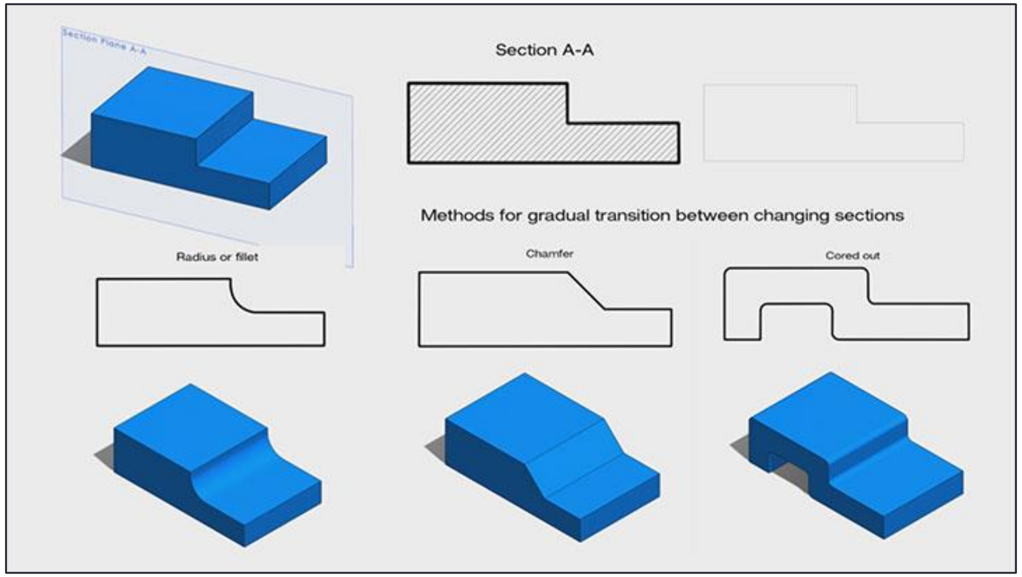
Design guidelines for Plastic

- **Wall thickness:** Uniform wall thickness is desirable in an extruded cross section. Variations in wall thickness result in non-uniform plastic flow and uneven cooling that tend to warp the extrudate.



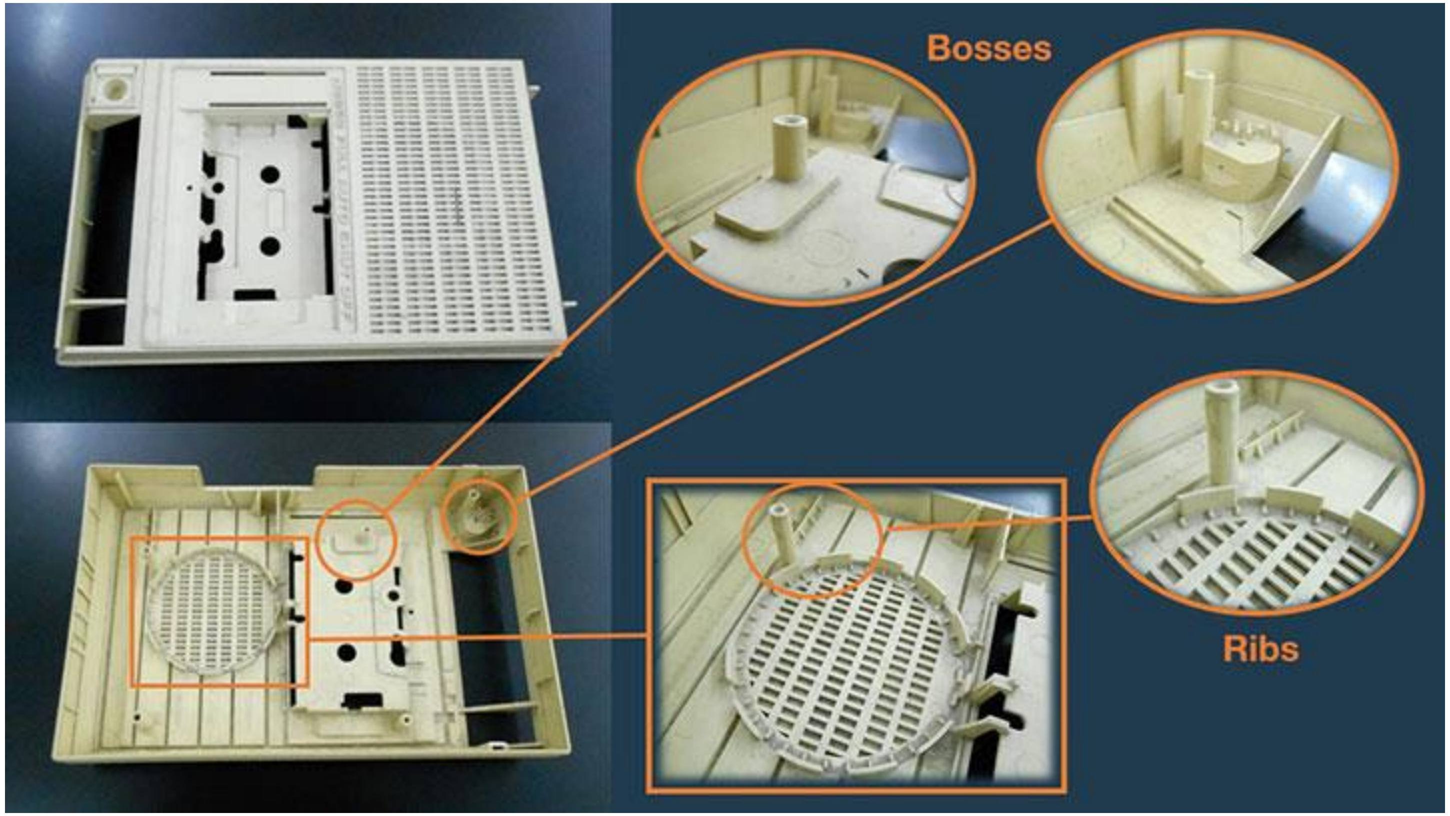
Design guidelines for Plastic

- Always try to keep wall thickness uniform
- There should be gradual transition between changing sections.
- Wall thickness for reinforced materials 0.75 mm to 3 mm and for unreinforced material it is 0.5 mm to 5 mm



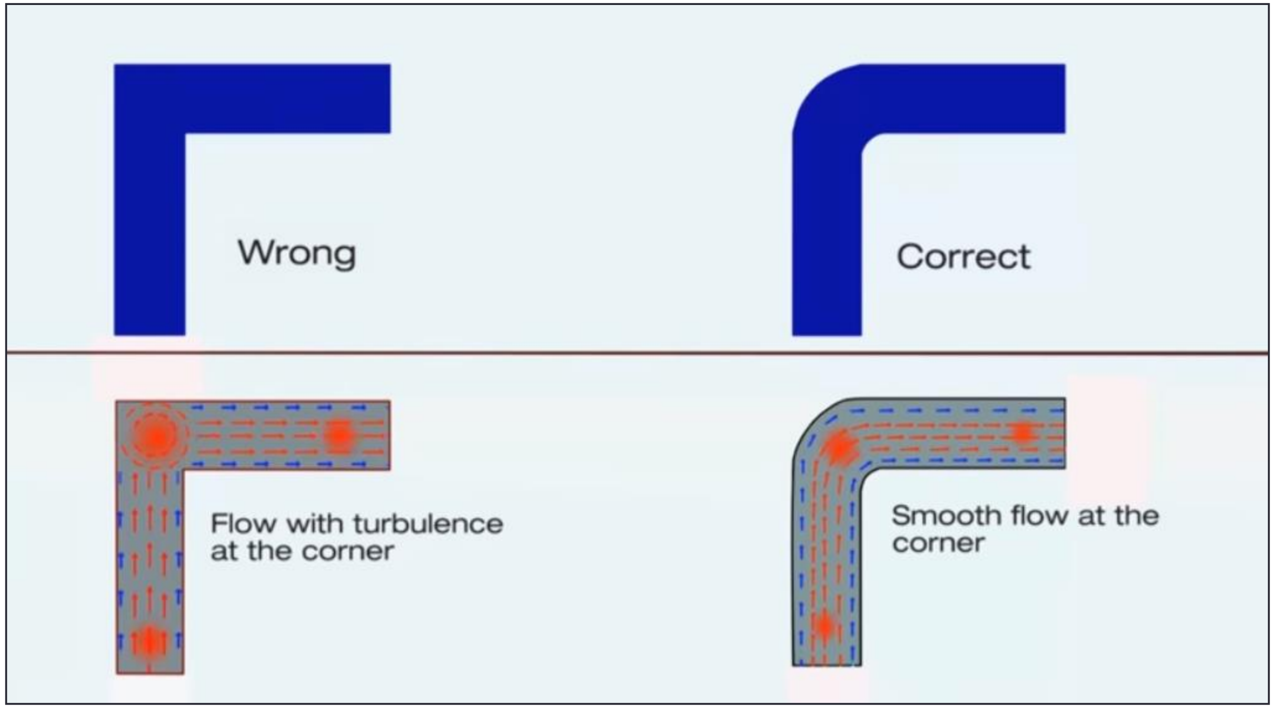
Design guidelines for Plastic

- **Hollow sections** complicate die design and plastic flow. It is desirable to use extruded cross sections that are not hollow yet satisfy functional requirements



Design guidelines for Plastic

- **Sharp corners, inside and outside**, [Notch sensitivity will occur] should be avoided in the cross section, Because they result in uneven flow during processing and stress concentrations in the final product.

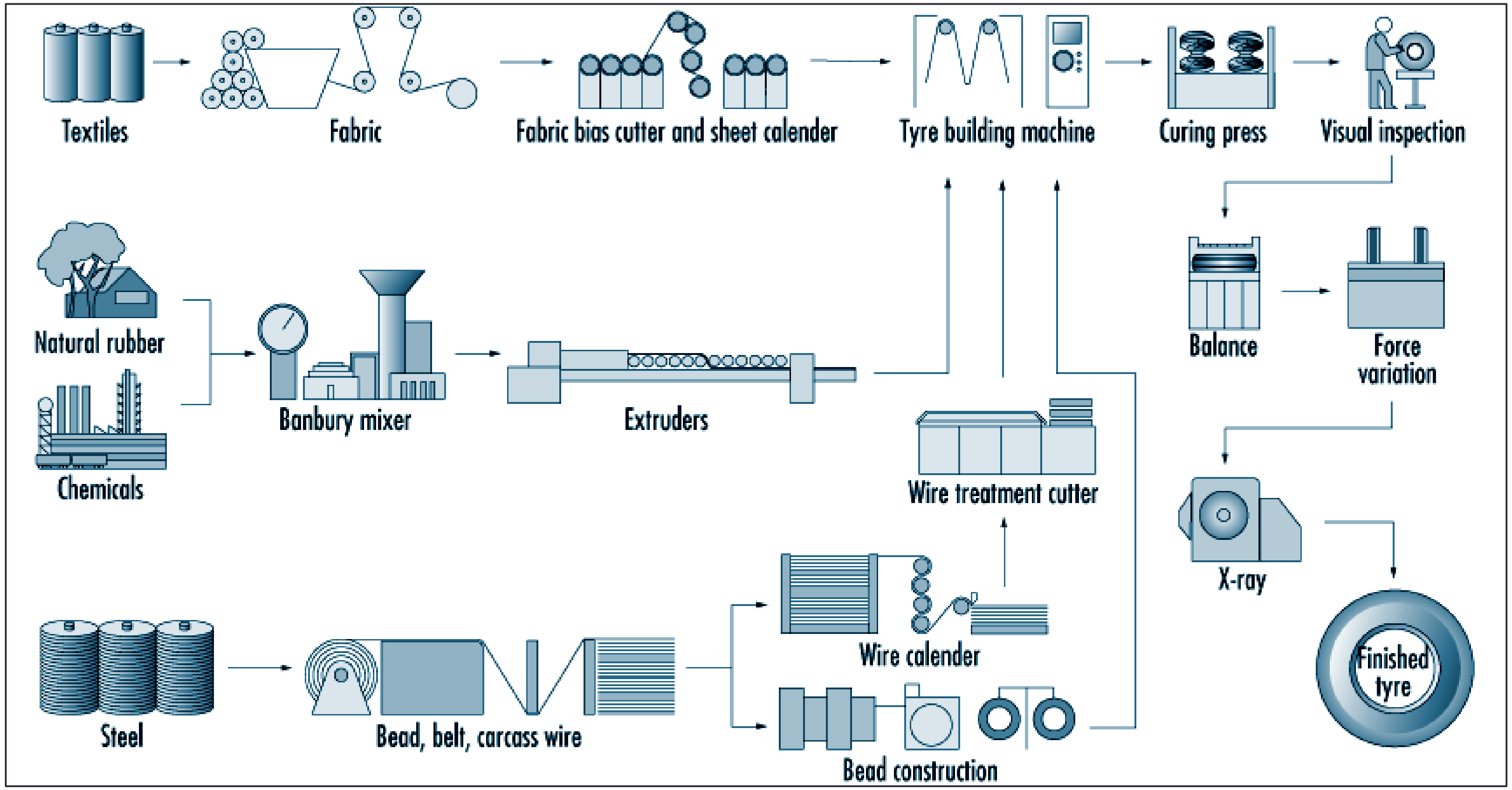


Design guidelines for Plastic

- **Economic production quantities:** Each molded part requires a unique mold, and the mold for any of these processes can be costly, particularly for injection molding.

Process	Minimum number of pieces
Injection Molding	> 10000
Transfer Molding	1000 to 10000
Compression molding	>1000

Manufacturing of rubber



Design guidelines for Rubber

- **Economic production quantities.** Rubber parts produced by compression molding (the traditional process) can often be produced in quantities of a thousand or less.
- The mold cost is relatively low compared with other molding methods. Injection molding, as with plastic parts, requires
- **Draft** is usually **unnecessary** for rubber molded parts. The **flexibility** of the material allows it to deform for removal from the mold.
- The low stiffness and high elasticity of the material permits removal from the mold.
- **Holes are difficult** to cut into the rubber after initial forming, due the flexibility of the material. It is generally desirable to mold holes into the rubber during the primary shaping process.

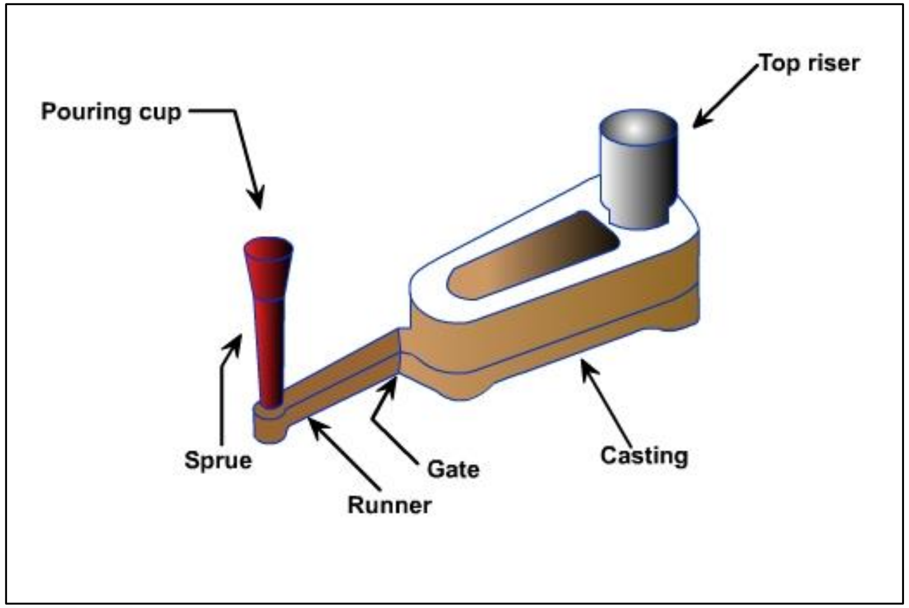
Design considerations for ceramics

- Ceramic components should be designed to be subjected to **compressive stresses**, not tensile stresses.
- Ceramic parts should not be used in applications that involve **impact loading or high stresses** that might cause fracture.
- **Deep holes, channels, and undercuts** should be avoided,
- **Part shrinkage** in drying and firing (for traditional ceramics) and sintering (for new ceramics) may be significant and must be taken into account by the designer in dimensioning and tolerancing
- **Screw threads** in ceramic parts should be avoided.

Design Consideration for castings

Introduction

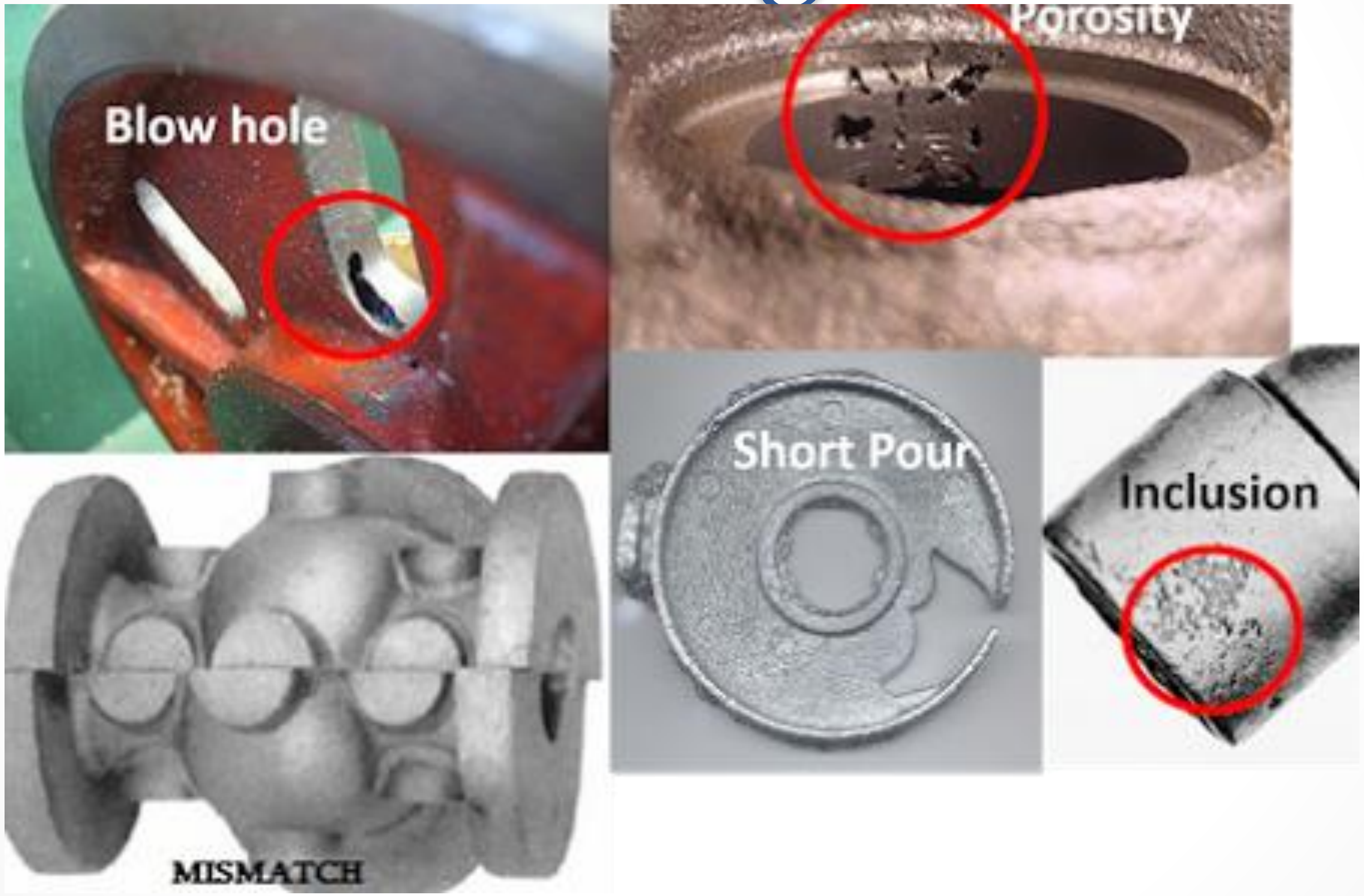
- Variables in Casting process: characteristics of the metals (or alloys) casts, method of casting, mold/die materials, mold/die design.
- The **flow** of the molten metal in the mold cavities, the **gating** systems, the **rate** of cooling, and the **gases** evolved all influence the quality of a casting.



Design Considerations in Casting

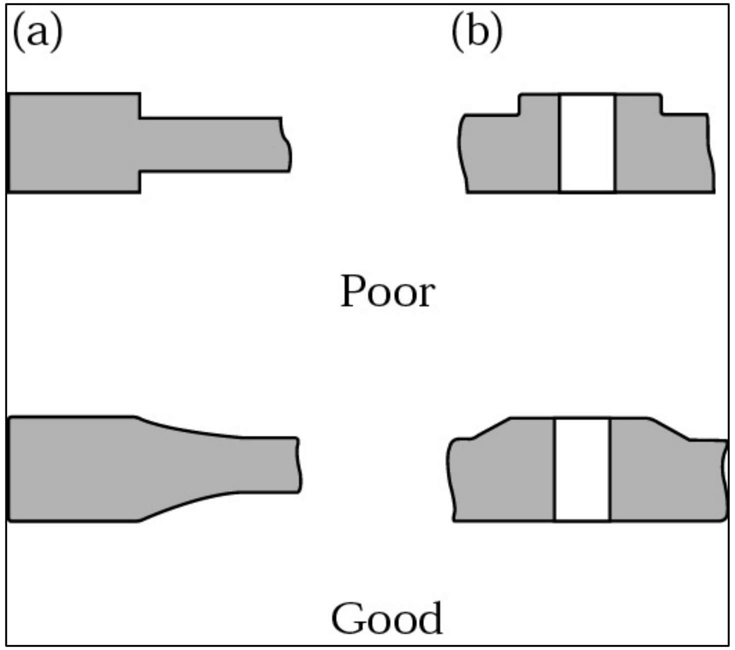
1. Design the part so that the shape is cast easily.
2. Select a casting process and material suitable for the part, size, mechanical properties, etc.
3. Locate the parting line of the mold in the part.
4. Locate and design the gates to allow uniform feeding of the mold cavity with molten metal.
5. Select an appropriate runner geometry for the system.
6. Locate mold features such as sprue, screens and risers, as appropriate.
7. Make sure proper controls and good practices are in place.

Why design considerations for casting?



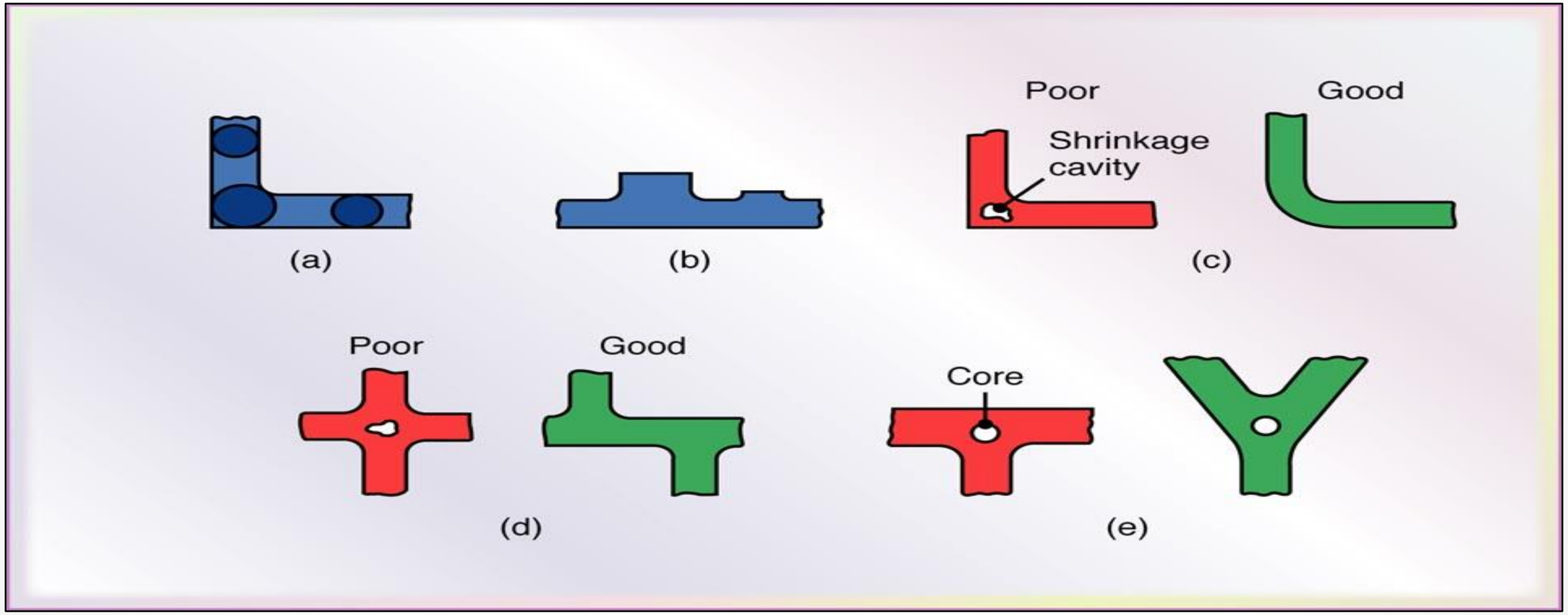
Design Considerations in Casting

- **Corners, angles and section thickness**: avoid using sharp corners and angles (act as stress raisers) and may cause cracking and tearing during solidification. Use fillets with radii ranging from 3 to 25 mm



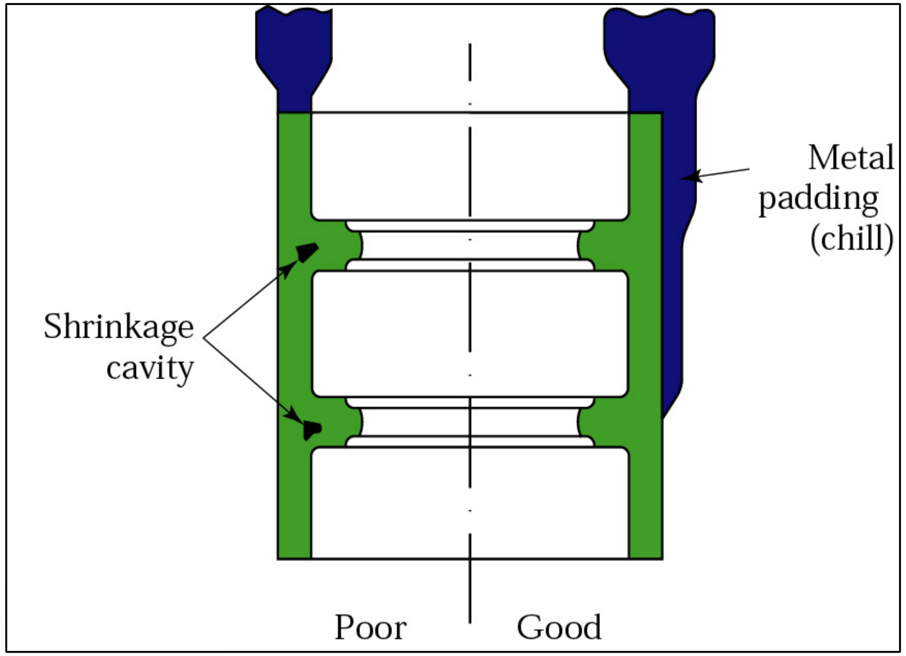
Design Considerations in Casting

- Sections changes in castings should be blended smoothly into each other.
- Because the cooling rate in regions with large circles is lower, they are **called hot spots**.
- Cavities at hot spots can be eliminated by using small cores (e).



Design Considerations in Casting

- It is important to maintain (as much as possible) uniform cross sections and wall thicknesses throughout the casting to avoid or minimize shrinkage cavities. Metal chills in the mold can eliminate or minimize hot spots.



The use of metal padding (chills) to increase the rate of cooling in thick regions in a casting to avoid shrinkage cavities

Design Considerations in Casting

- **Draft:** a small draft (taper) typically is provided in sand mold pattern to enable removal of the pattern without damaging the mold. Depending on the quality of the pattern, draft angles usually range from 0.5^o to 2^o.
- **Dimensional tolerances:** tolerances should be as wide as possible, within the limits of good part performance; otherwise, the cost of the casting increases. In commercial practices, tolerances are usually in the range of ± 0.8 mm for small castings. For large castings, tolerances may be as much as ± 6 mm.

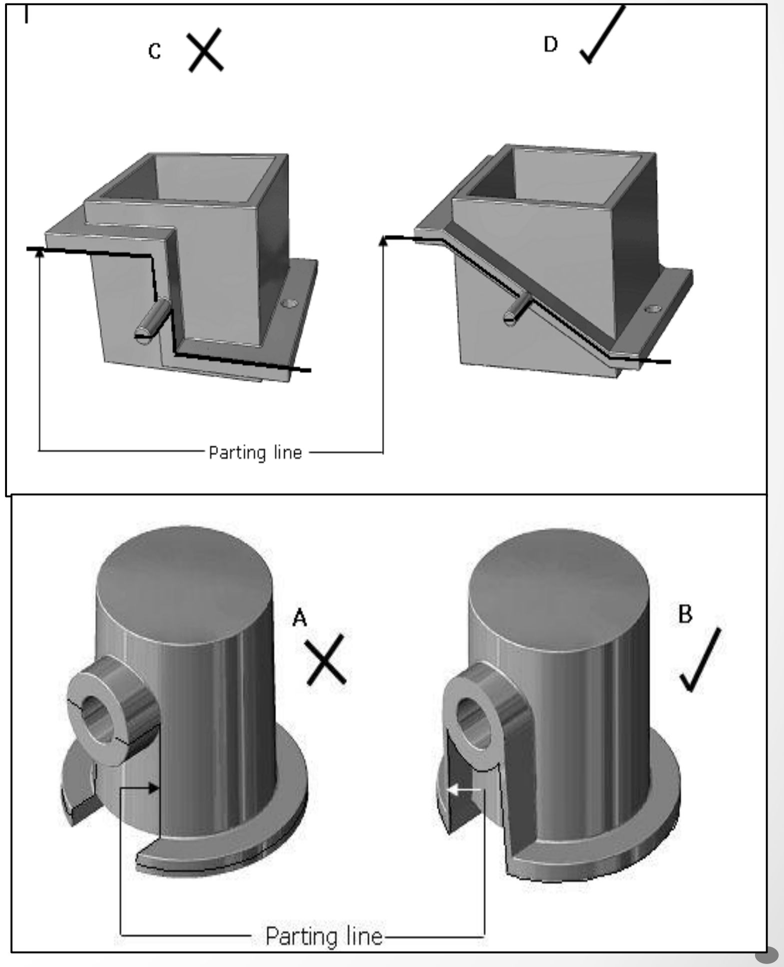
Design Considerations in Casting

- **Lettering and markings:** it is common practice to include some form of part identification (such lettering or corporate logos) in castings. These features can be sunk into the casting or protrude from the surface.

- **Machining and finishing operations:** should be taken into account. For example, a hole to be drilled should be on a flat surface not a curved one. Better yet, should incorporate a small dimple as a starting point. Features to be used for clamping when machining.

Design Considerations in Casting - Locating the parting line

- A part should be oriented in a mold so that the large portion of the casting is relatively lower and the height of the casting is minimized.
- The parting line is a line or a plane separating the upper (cope) and lower (drag) halves of mold. In general, the parting line should **be along a flat plane** rather than be contoured.
- The parting line should be placed as low as possible relative to the casting for less dense metal (such as aluminum alloys) and located at around mid-height for denser metals (such as steels).



Design Considerations in Casting - Locating the parting line

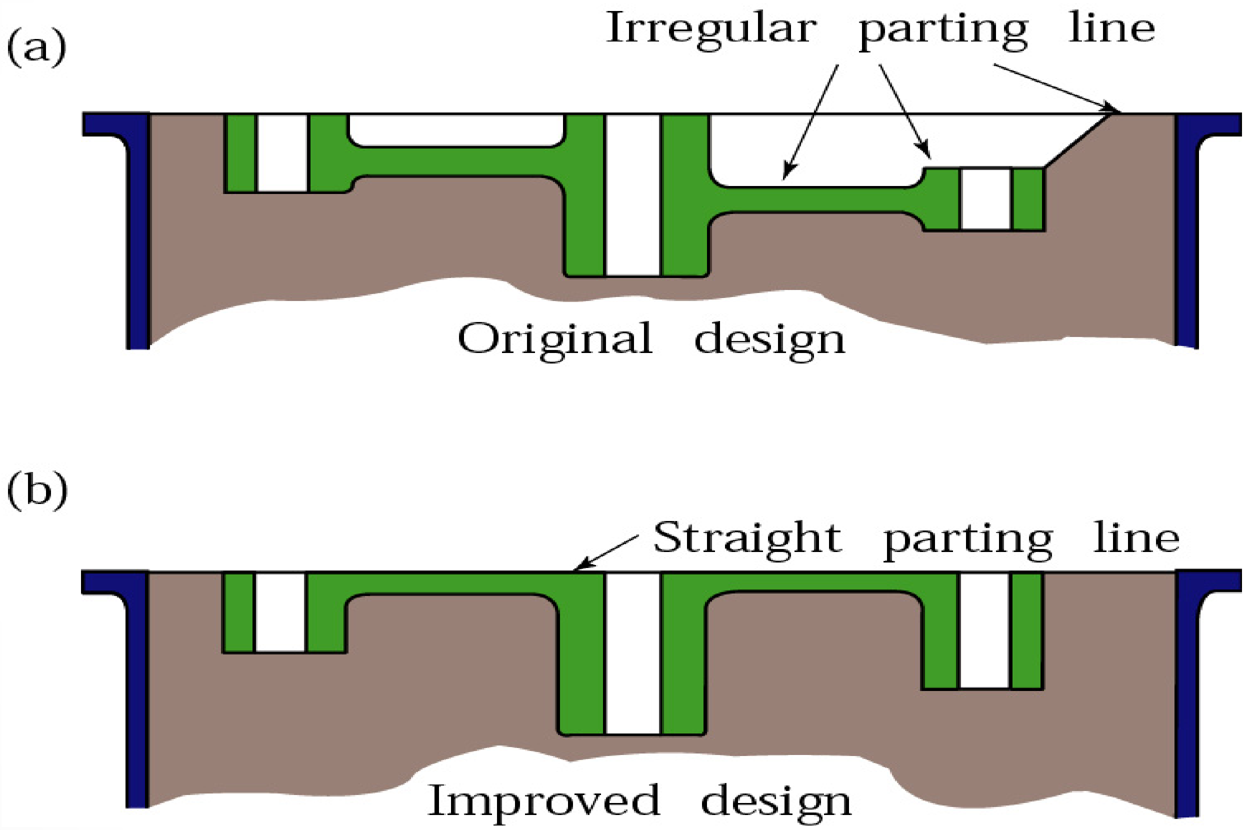


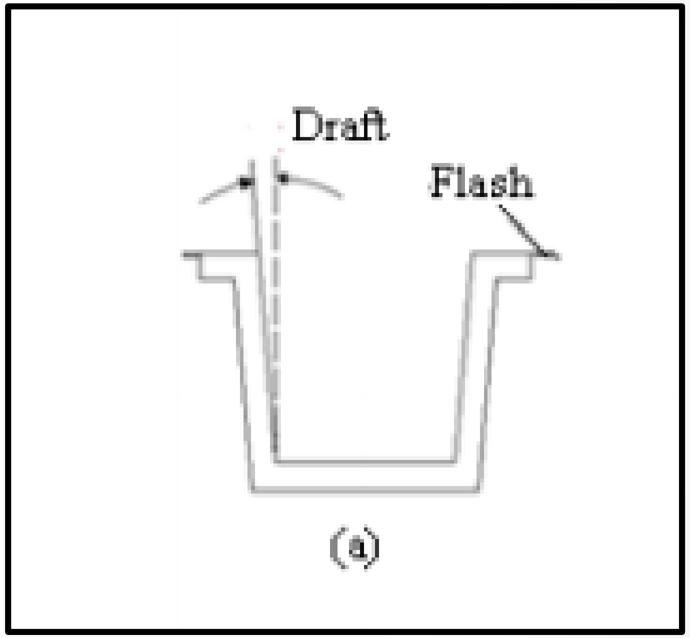
Figure 12.5 Redesign of a casting by making the parting line straight to avoid defects.

Factors affecting selection of parting direction and parting line

- **Draft-** To facilitate removal of manufactured component from mould the cross-sectional area should gradually decrease from the parting surface in parting direction.

- Necessary draft has to be applied to the part in the parting direction if the projected area does not decrease on the parting direction.

- An optimal parting direction and line will have minimum possible draft.



Factors affecting selection of parting direction and parting line

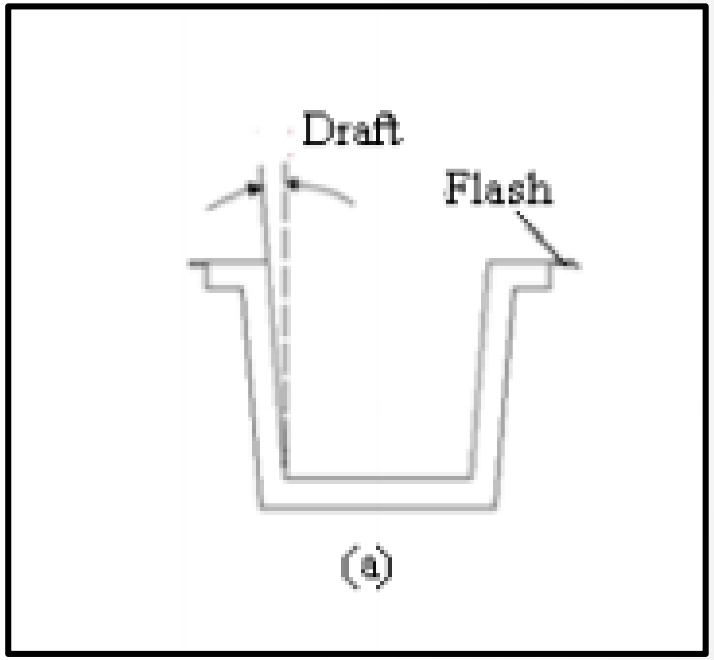
- **Flash**- Material flowing into gaps at the plane of separation of the two mould halves produces fin like protrusions or flash and is treated as imperfection.

- This is generally trimmed after manufacturing. For optimal parting direction and parting line the flash must be less and easy to trim.

- **Flatness**- The selection of the parting direction should ensure the flatness of the parting line.

- A flat parting line alone can take care of the other aspects like side thrust, dimensional stability, sealing off, flash etc.

- The complexity of a non-flat parting line should be minimum possible



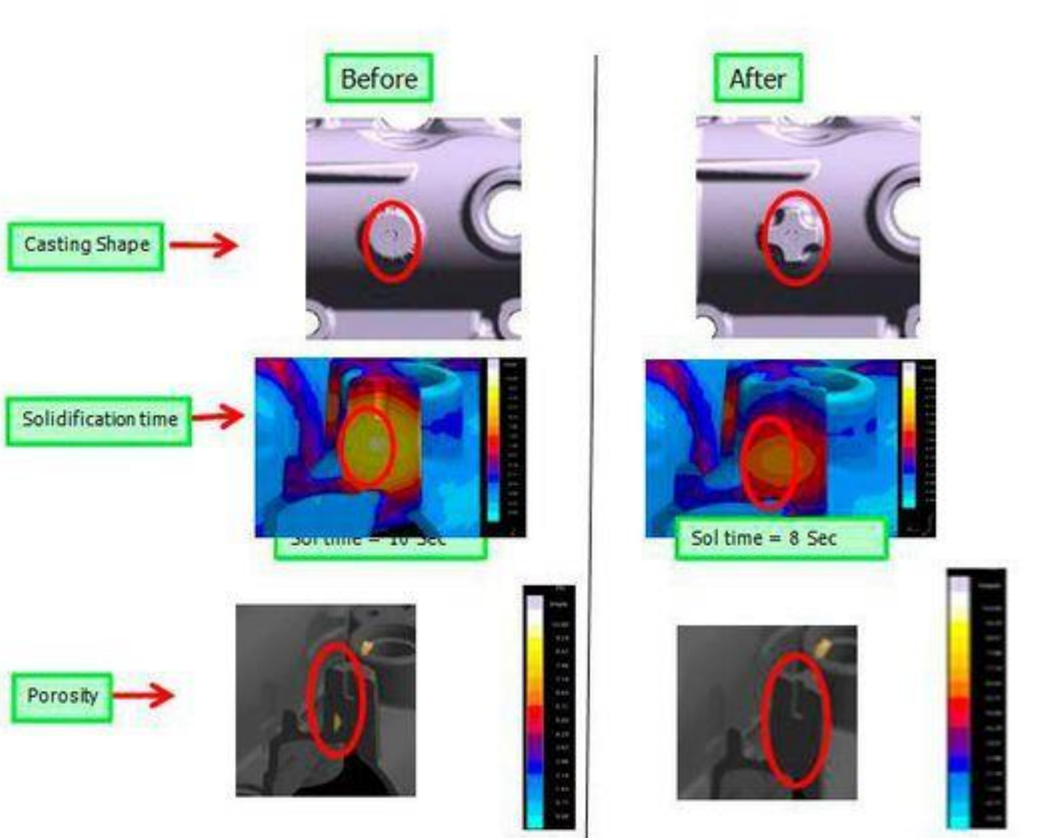
Decision criteria for parting line selection

- Factors affecting parting line selection are rated according to high, medium and low priority.
- The criteria with high priority are number of undercuts, draft, projected area and dimensional stability.
- Criteria with medium priority are draw, flash, flatness and placement of ejector pins.
- The criteria with low priority are side thrust, placement of overflow wells, trimming and finishing operations, scrap generated.

Change in Parting Line

The example shown in figure indicates the effect of Air Pressure in the cavity before (~3.8 bar) and after changing the parting line (~1.8 bar) in the product design. The customer requirement was porosity level 1 as per ASTM E 505.

Source: ALUCAST India

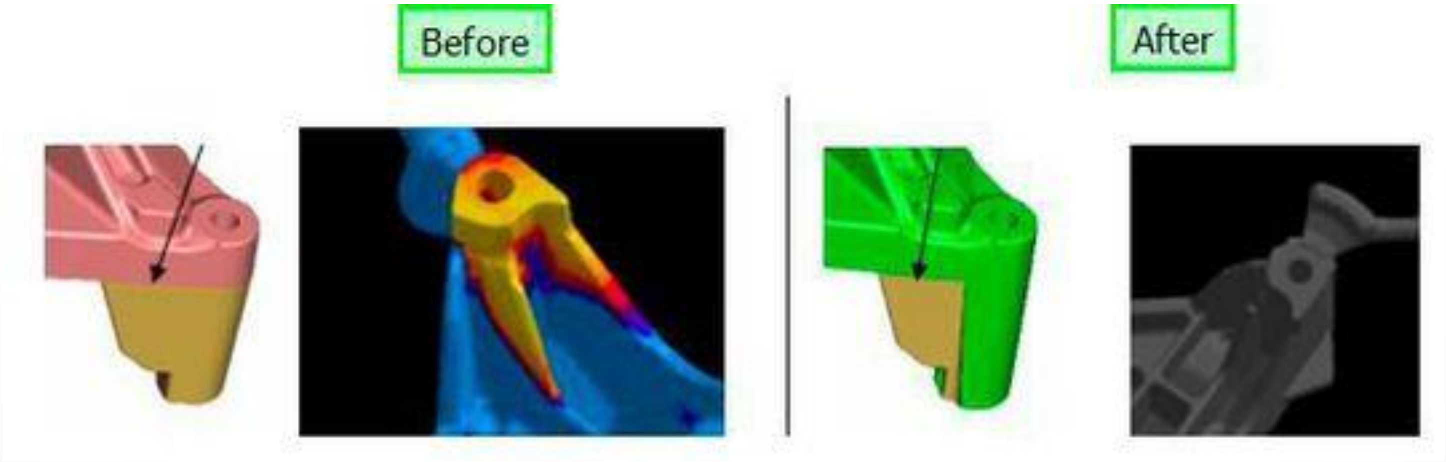


Solidification Time – Before (10 Sec) and after (8 Sec) change in shape of the boss

Additional rib for providing material flow

The following example indicates how the addition of ribs change the filling pattern and sudden change in cross section to improve the material filling and reduce the air pressure in the cavity. This has helped to reduce the cold fill and shrink porosity.

Source: ALUCAST India



Air Pressure – Before (3.8 bar) and after 1.8 bar) change in parting line near the boss.


Thank
you