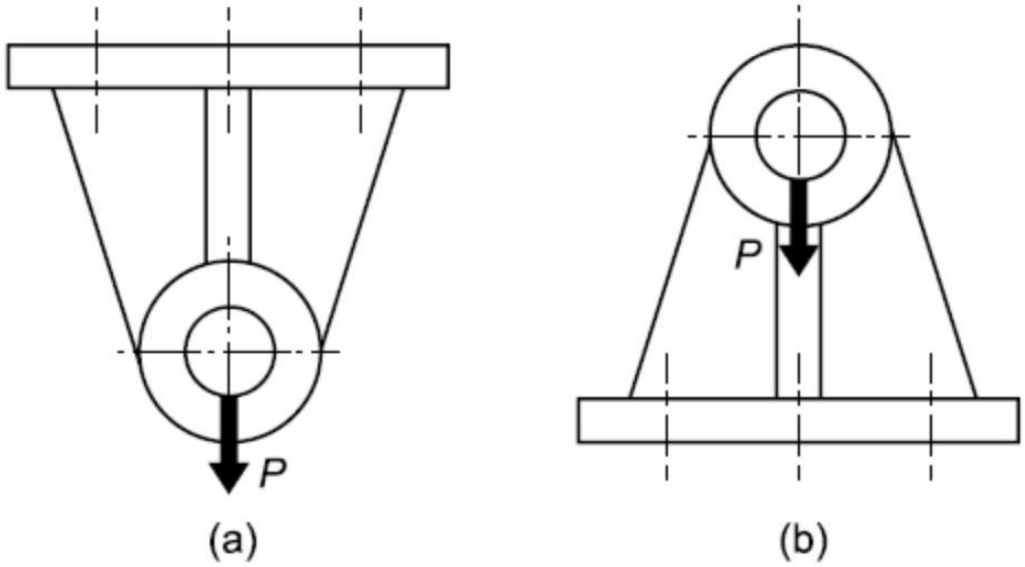
Design considerations of Castings

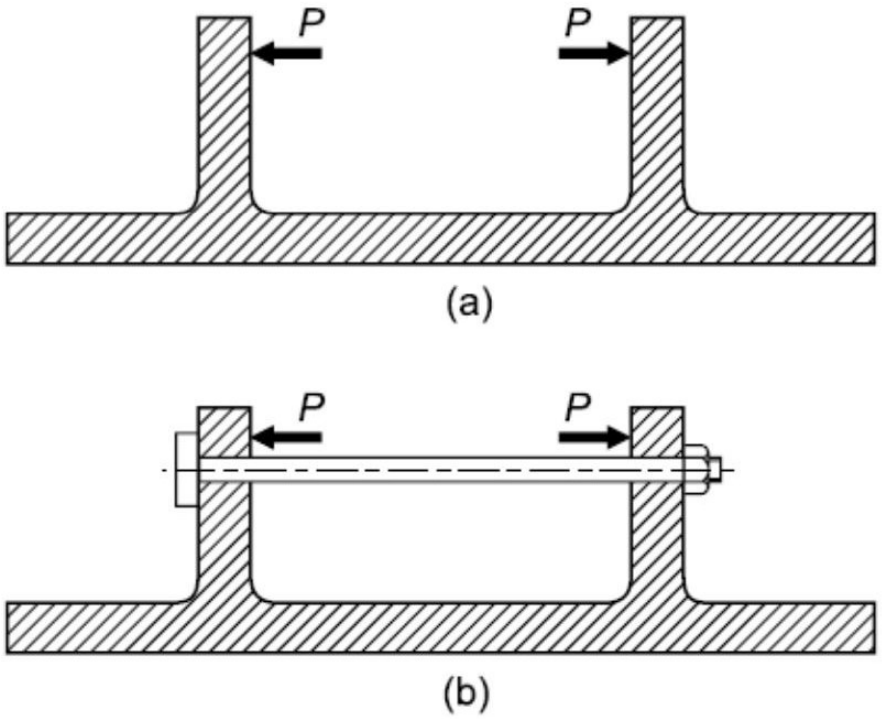
Poor shaping of casted components can adversely affect their strength. So designer should consult the foundry man and the pattern maker. General principles for design of castings are as follows:

(a) Always keep stresses areas of the part in compression



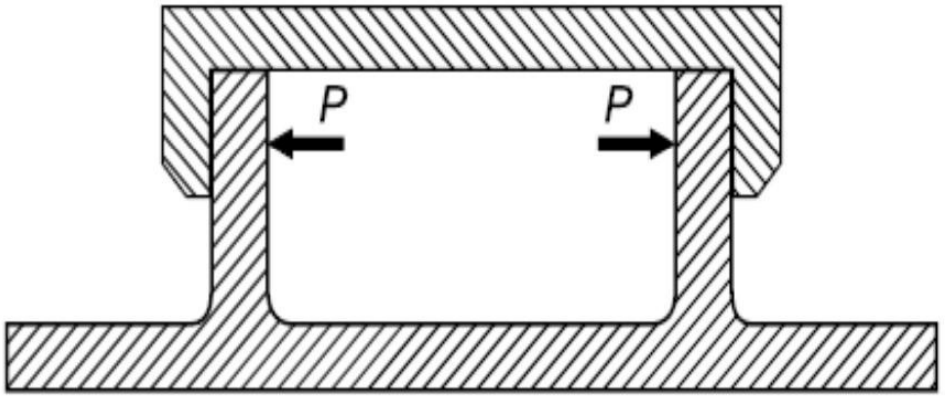
Design considerations of Castings

When the tensile stresses are unavoidable, a clamping device such as '**tie rod**' can be considered.



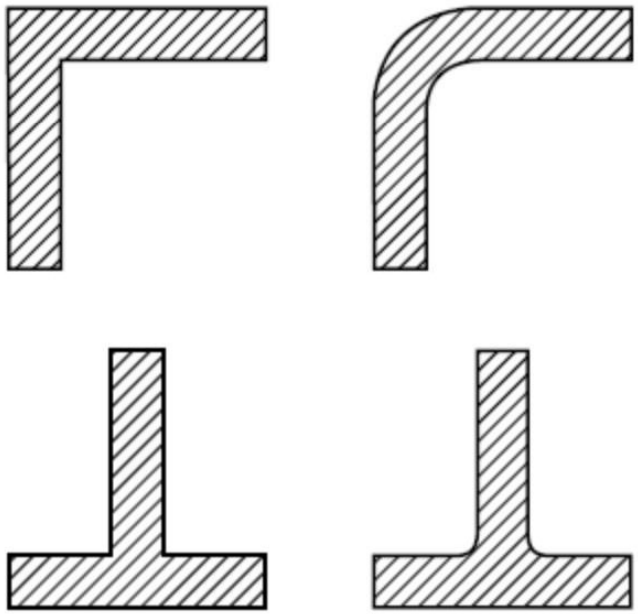
Design considerations of Castings

When the tensile stresses are unavoidable, a clamping device such as '**bearing cap**'can be considered.



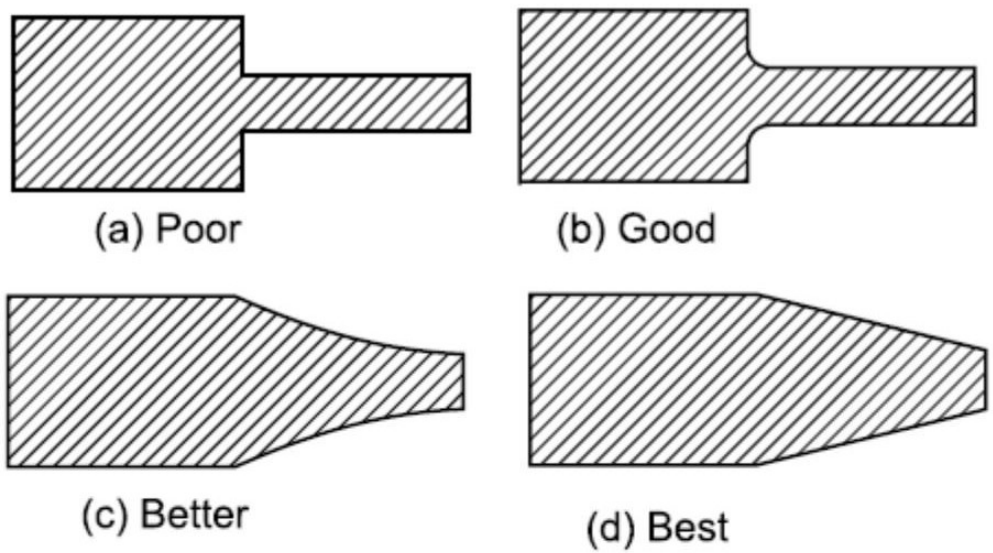
Design considerations of Castings

(b) Round all external corners. It has two advantages: (i) it increases endurance limit and (ii) reduces formation of brittle chilled edges



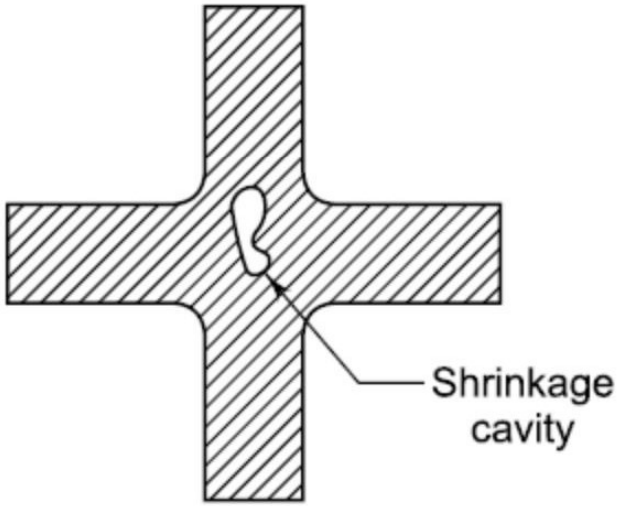
Design considerations of Castings

(c) Whenever possible, the section thickness throughout should be held as uniform as compatible with overall design considerations.



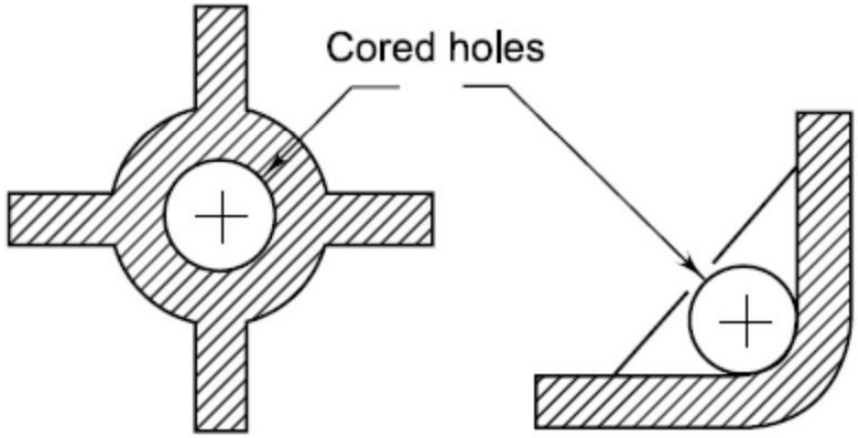
Design considerations of Castings

(d) 'Avoid concentration of metal at the junction' as the same is likely to result in shrinkage cavity or a blow hole.



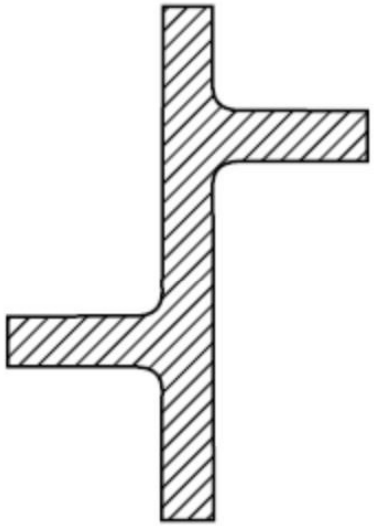
Design considerations of Castings

To avoid concentration of metal at the junction, one way is to provide cored openings in webs and ribs.



Design considerations of Castings

Alternatively, staggering can also be considered for ribs and webs.



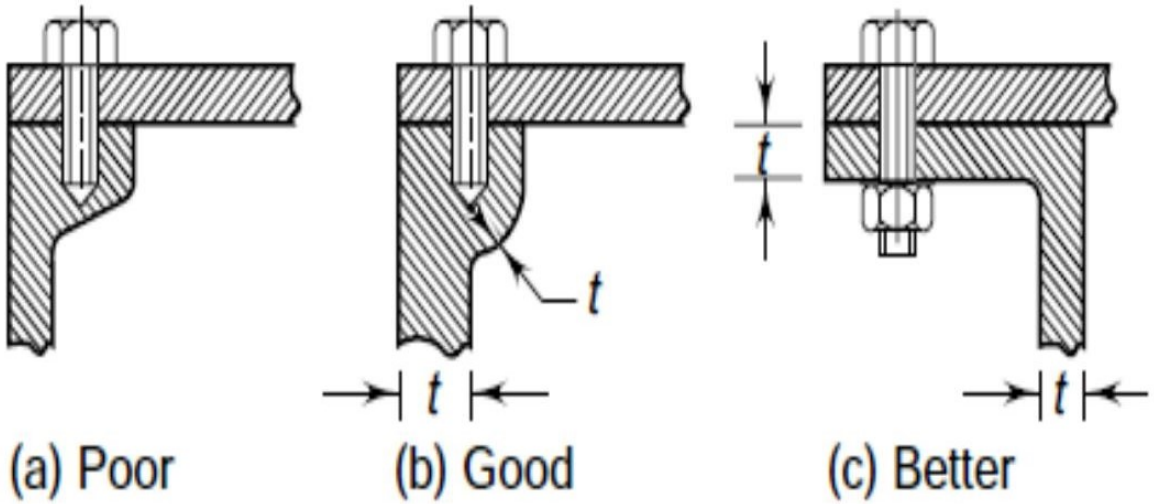
Staggered ribs

Design considerations of Castings

(e) Avoid very thin sections. In case from design point of view, the calculated thickness is small, same should be increased so as the same can be properly casted. In general, minimum thickness for grey cast iron components is about 7 mm for parts up to 500 mm long.

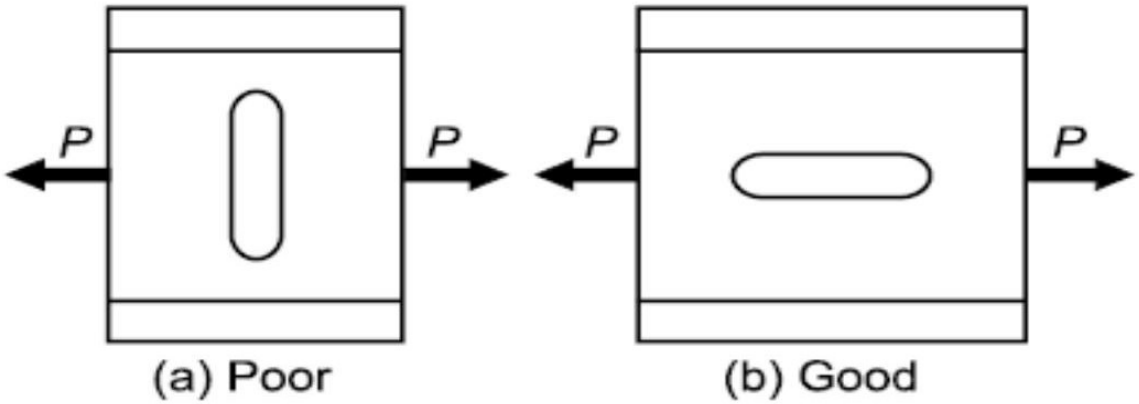
(f) Shot blast the parts, wherever possible. It significantly increases endurance limit particularly in case of thin sections.

Design considerations of Castings



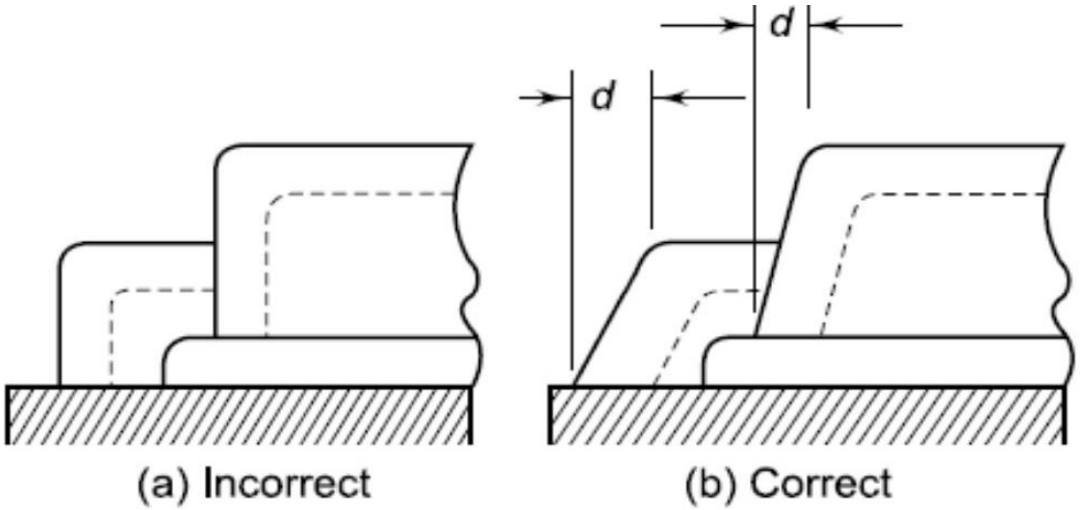
Uniform wall thickness

Design considerations of Castings



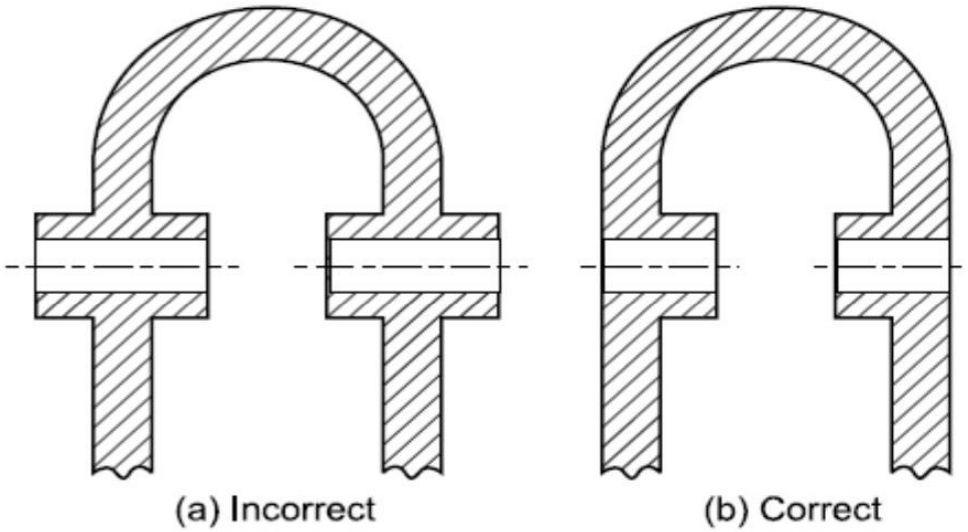
Holes in the direction of forces

Design considerations of Castings



Provision of draft

Design considerations of Castings



Outside bosses should be omitted

Design considerations of Castings - Summary

(a) Always keep stressed areas of the part in compression

(b) Round all external corners

(c) Whenever possible, the section thickness throughout should be held as uniform as possible

(d) 'Avoid concentration of metal at the junction' as the same is likely to result in shrinkage cavity or a blow hole.

(e) Avoid very thin sections. In case from design point of view, the calculated thickness is small, same should be increased so as the same can be properly casted.

(f) Shot blast the parts, wherever possible. It significantly increases endurance limit particularly in case of thin sections.

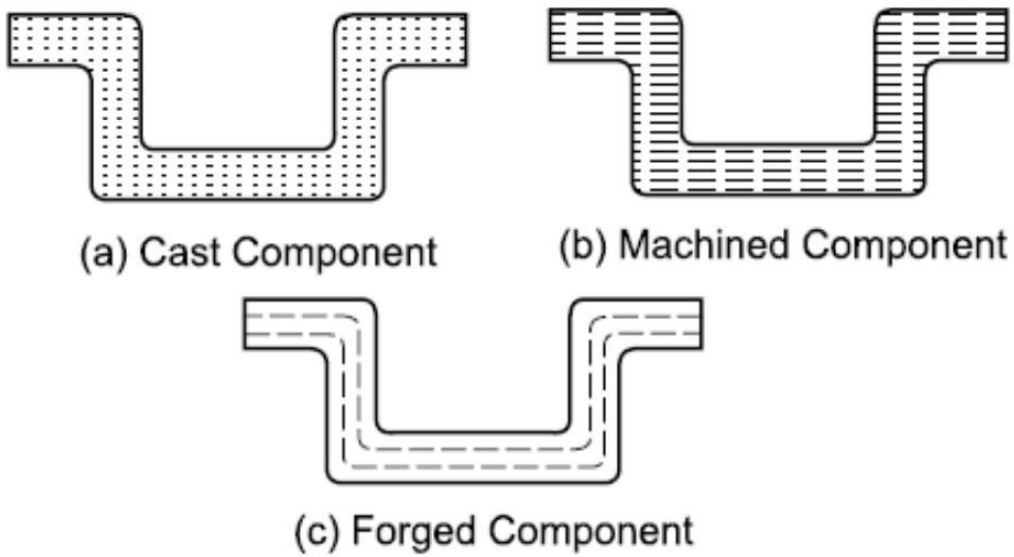
Design considerations of Forgings

Forged components are used in following circumstances:

- Moving components should be light weight to reduce inertia forces (connecting rod)
- Components subjected to excessive stresses (IC Engine components)
- Small components that must be supported by other structures (hand tools)
- Components that must be free from internal cracks (valve bodies)
- Components whose failure may cause injury or expensive damage

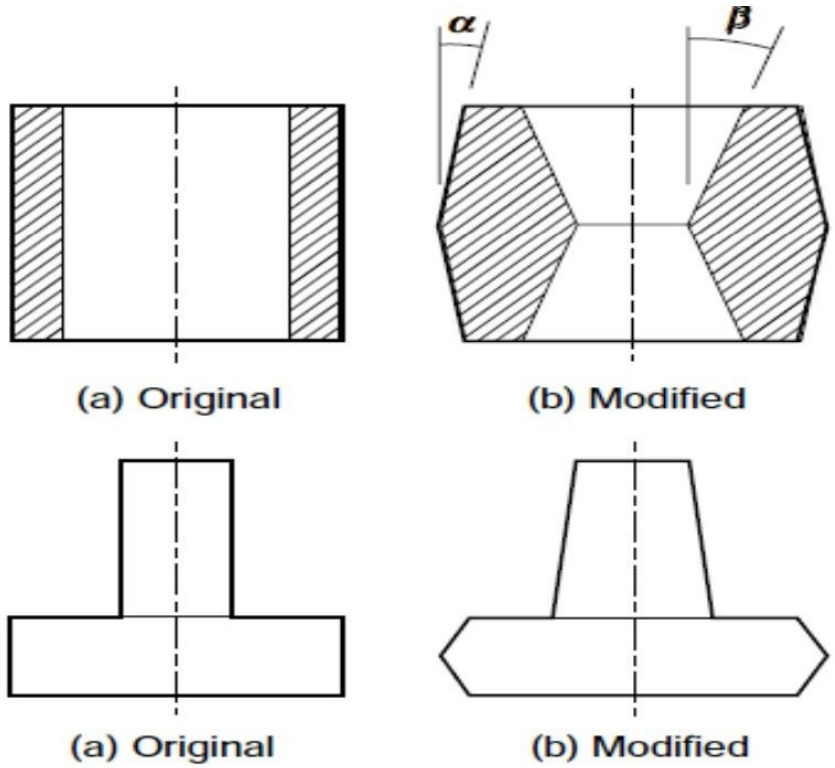
Design considerations of Forgings

(a) While designing a forging, advantage should be taken of direction of fiber lines. While designing a forging, the profile is selected in such a way that fiber lines are parallel to tensile forces and perpendicular to shear forces.



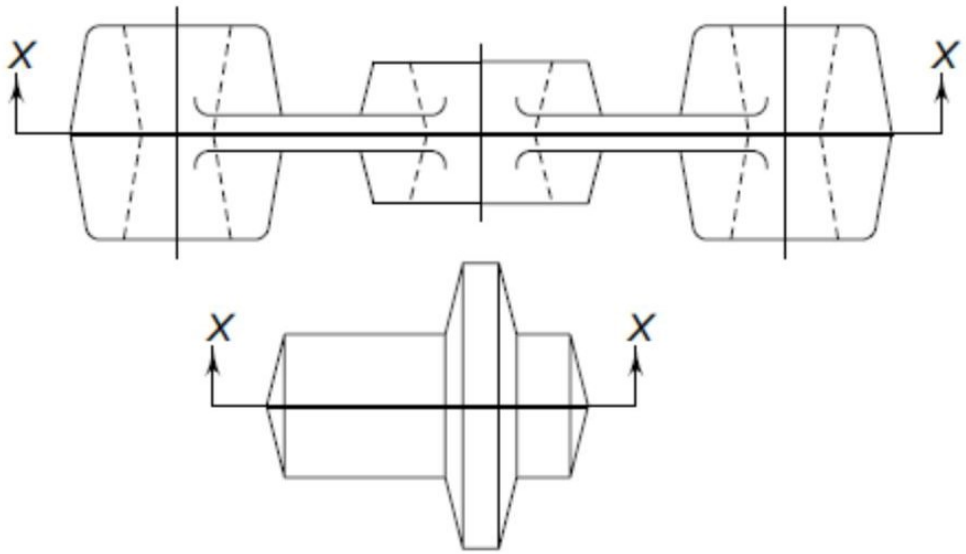
Design considerations of Forgings

(b) The forged component should be provided with an adequate draft for easy removal of part from the die impression



Design considerations of Forgings

(c) The parting line should be in one plane as far as possible and it must divide the forging into two equal parts.



Design considerations of Forgings

(d) The forgings should be provided with adequate fillet and corner radii, as sharp corners result in increasing difficulties in filling the material, excessive forging forces and poor die life.

(e) Thin sections and ribs should be avoided in forged components

Design considerations of Forgings - Summary

(a) While designing a forging, advantage should be taken of direction of fiber lines

(b) The forged component should be provided with an adequate draft for easy removal of part from the die impression

(c) The parting line should be in one plane as far as possible and it must divide the forging into two equal parts

(d) The forgings should be provided with adequate fillet and corner radii

(e) Thin sections and ribs should be avoided in forged components

Design considerations of Machined parts

Machined components are used in following circumstances:

- Components requiring precision and high dimensional accuracy
- Components requiring flatness, roundness, parallelism or circularity for their proper functioning
- Components of interchangeable assembly
- Components that requires relative motion with each other

Design considerations of Machined parts

(a) As far as possible, secondary machining operations should be avoided

(b) Specify liberal dimensional and geometrical tolerances. Closer the tolerance, higher the cost

(c) Designer should avoid shapes that requires sharp corners

(d) Stock dimensions should be promoted as far as possible

(e) Components with thin walls or webs should be avoided as the same induces significant cutting forces on the component

(f) Avoid shoulders and undercuts as the same requires separate tools

(g) Avoid hard materials as these are difficult to machine