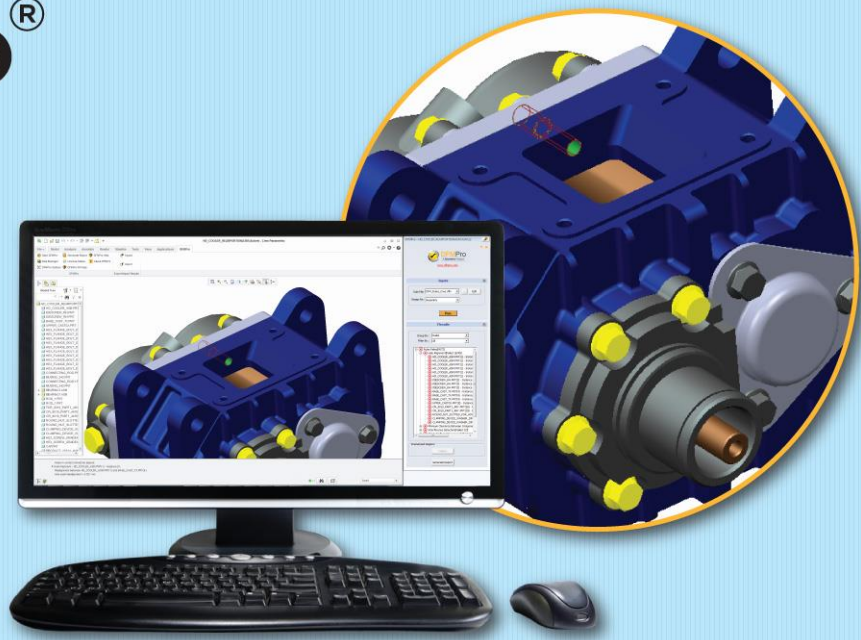
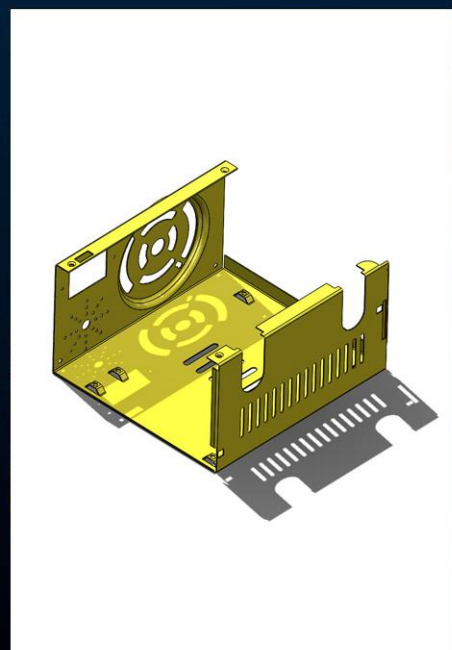
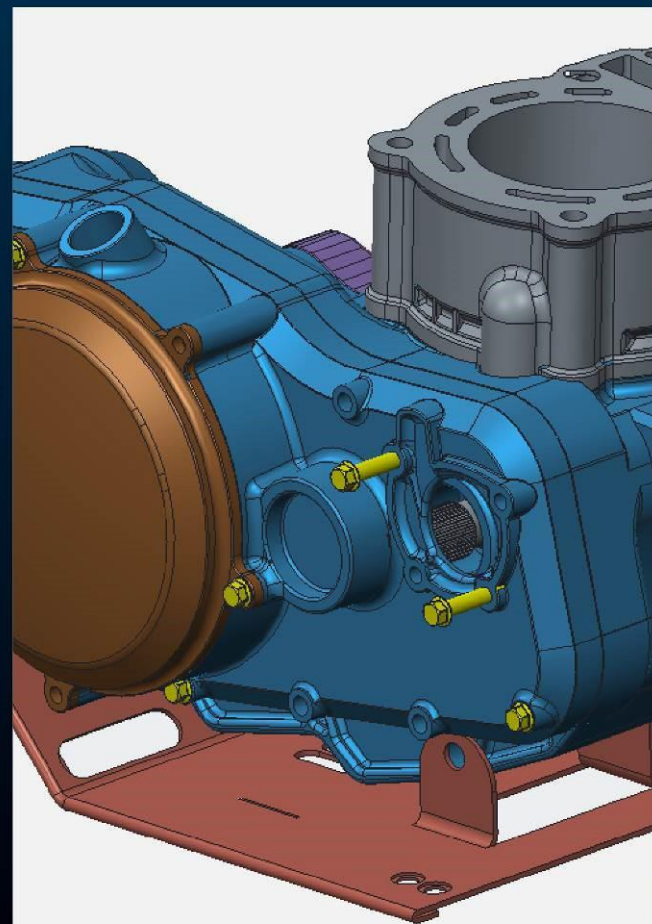
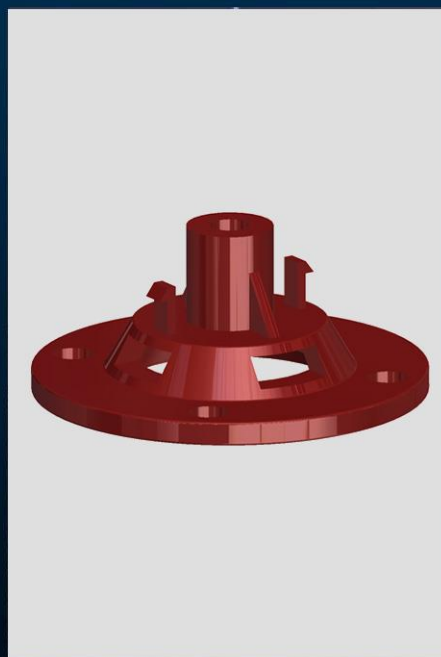
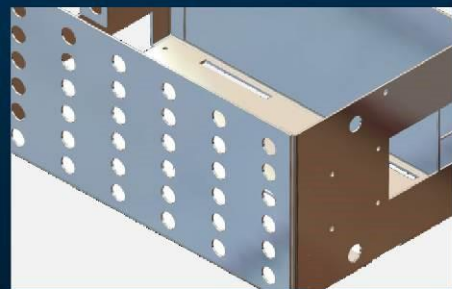




An HCL Technologies Product



A DEFINITIVE GUIDE TO DESIGN FOR MANUFACTURING SUCCESS



Machining Design Guidelines

Drill Rules

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We are delighted to share with you the first edition of the Design for Manufacturing Guidebook. Through this guidebook, our endeavor is to reach out to the design and engineering ecosystem and share our insights; tips and best practices that will help designers simplify the product design process and minimize the iterations in new product development process.

Leveraging our strengths in engineering and collective knowledge of our subject matter experts with varied industry experience, we have compiled over 300 design guidelines for various manufacturing processes - sheet metal, machining, casting, injection molding among others.

To begin with, in this issue, we will cover a few design rules for drilling - such as selection of sizes, depth of drilled holes, partial holes and holes entry and exit surfaces, etc.

We will be happy to receive your feedback and hear from you on any particular areas that may be of interest to you. You can also share your experiences which we can publish with due credit. Do write to us at info@dfmpro.com.

Welcome to this journey of learning and sharing!

DFMPro Marketing
HCL Technologies Ltd

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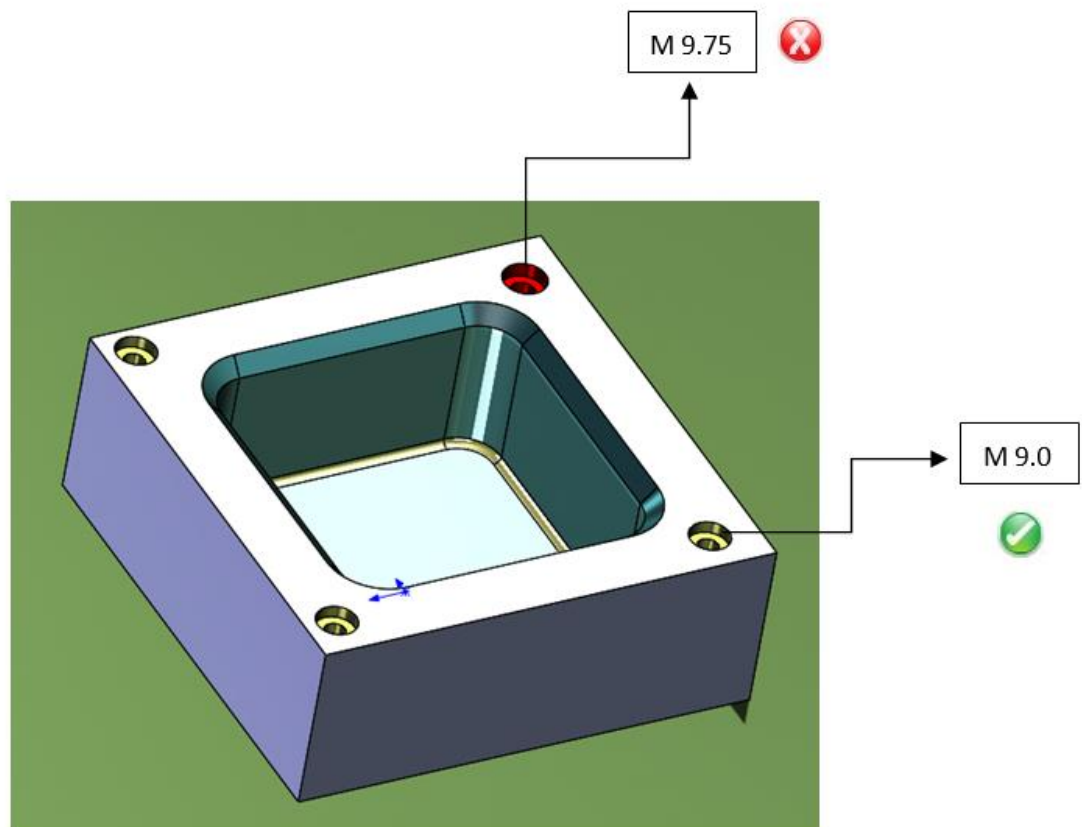
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Standard Hole Sizes

Specify standard hole sizes as they can be created using a standard drill. Unusual hole sizes are not recommended as they require custom tools and increase the cost of manufacturing through purchasing and inventory.

Reducing variations in holes size will further reduce assembly accessories like fasteners, pin, rivets, etc.

Example



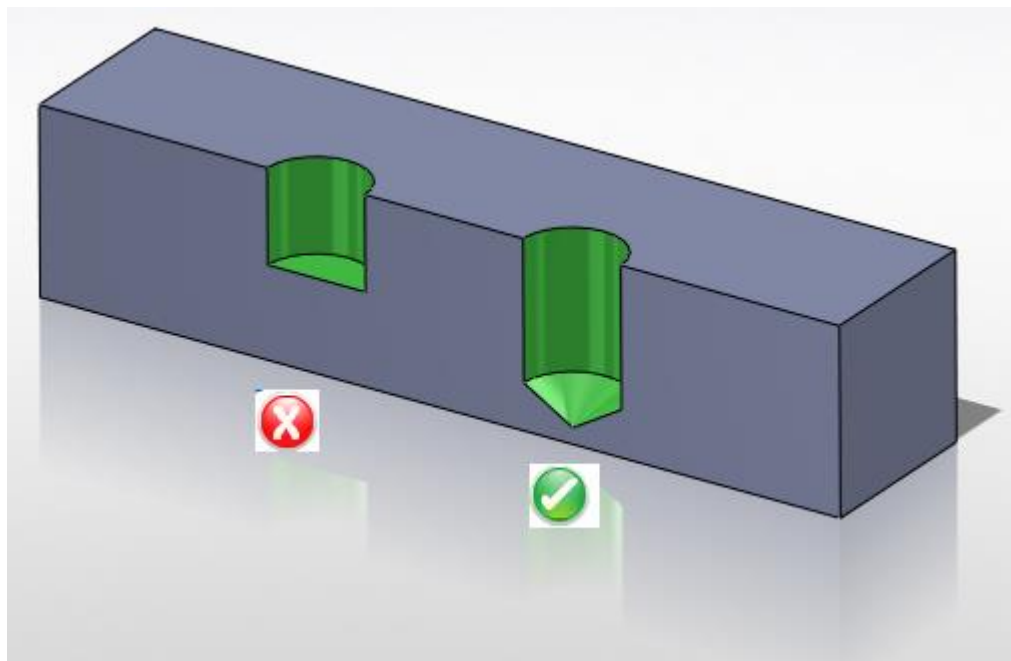
In this example – Choose a diameter M9.0 and not M 9.75.

Holes with Flat Bottoms

It is recommended to make blind holes with conical and not flat bottoms. Flat bottomed holes cause problems in subsequent operations (for example: reaming). Also, flat bottomed holes require special tooling operations leading to increase in manufacturing cost and time.

A standard twist drill is used to create a hole with conical bottom.

Example



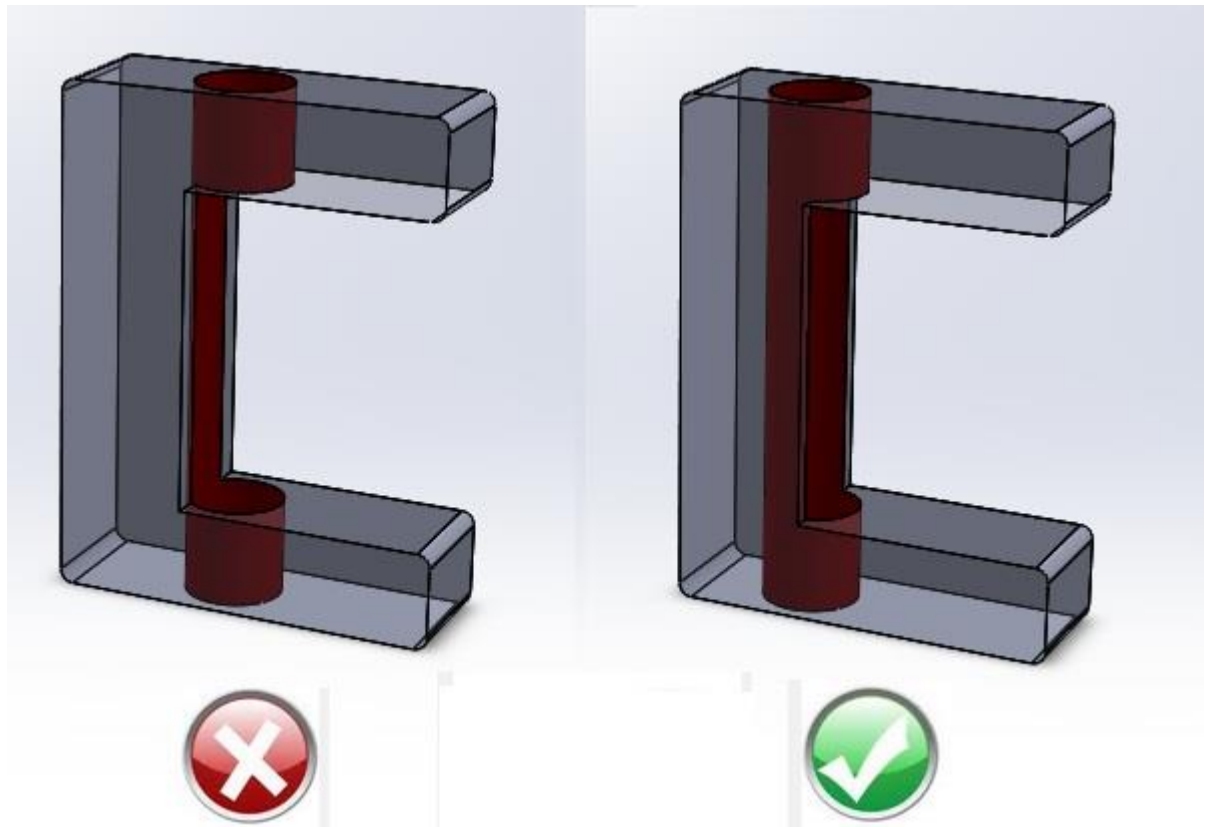
In this example, hole size is less than 45 mm; preferred operation will be drilling. It is recommended to use conical bottom holes.

Holes Intersecting Cavities

In drilling operation, it is recommended to avoid holes intersecting with cavities.

If not, there are chances that the drill tool will wander. This also increases the chances of drill tool breakage.

Example

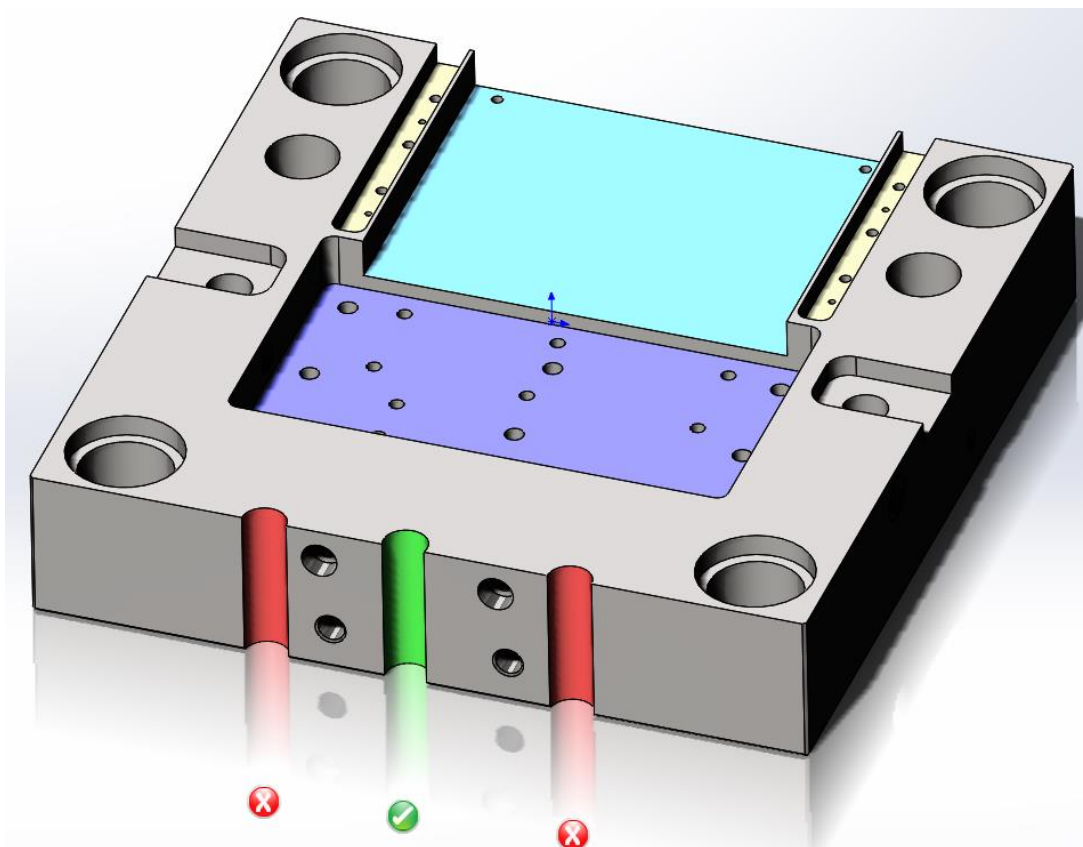


In this example, if an intersection is unavoidable, at a minimum, the centerline of the hole should be outside the cavity as shown in image. Order of machining can also impact the drilling condition.

Partial Holes

Avoid partial holes as there are high chances that drill will wander if a large portion of the hole is outside the material. The problem can become even more severe if the axis of hole is on or near the edge of the material. If partial hole is unavoidable, then ensure that at least 75% of hole area should be within the material.

Example

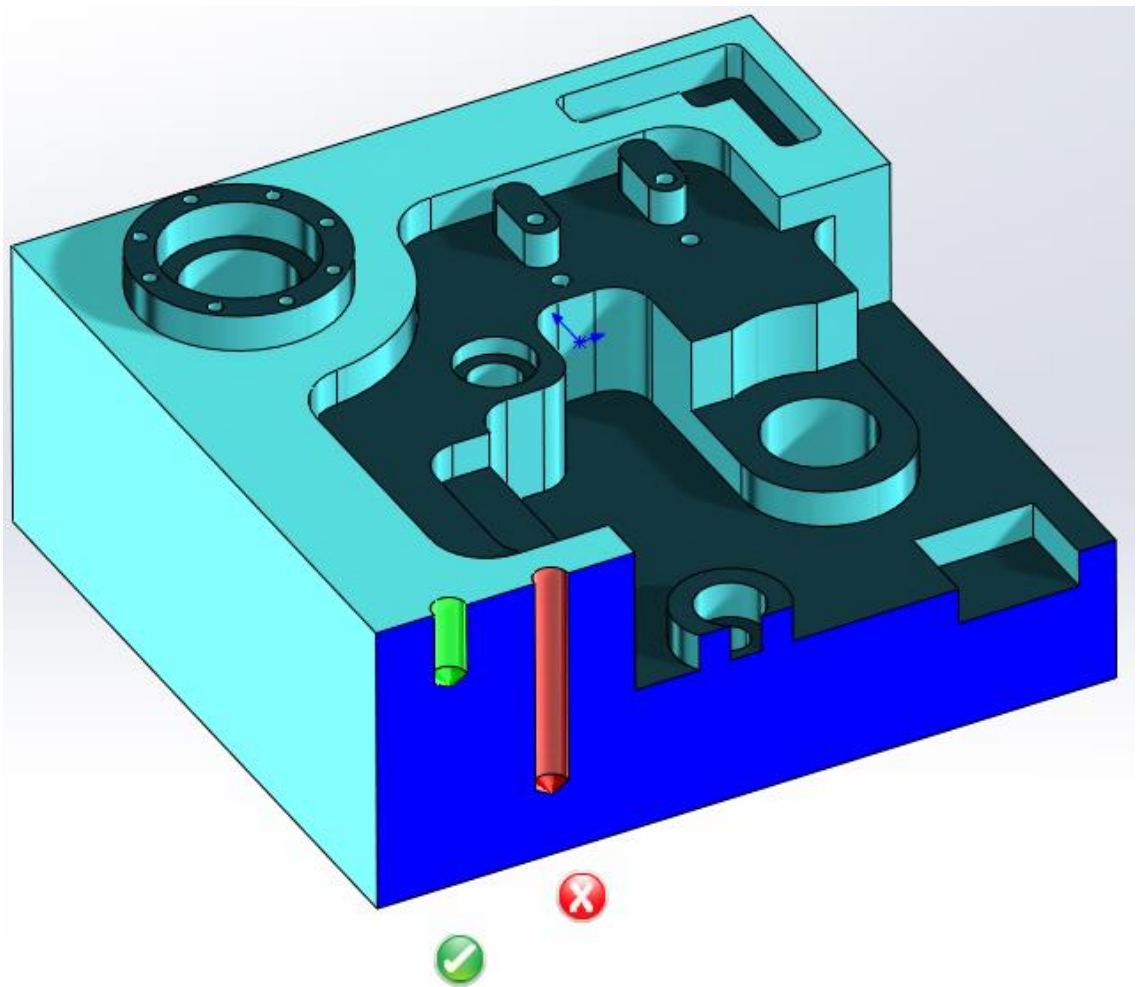


Deep Holes

Deep, small diameter holes should be avoided as they are difficult to machine. Small diameter drills tend to wander and are prone to breaking. Chip removal also becomes difficult while drilling deep holes.

It is recommended that the hole depth to diameter ratio should be less than 3.

Example



In this example, recommended hole diameter to depth ratio is less than 3.

Entry/Exit Surface for Holes

Drills should enter and exit surfaces that are perpendicular to the centerline of the hole. If the drill tip contacts the non-planer surface, then tip will wander as its axis is not perpendicular.

Also exit burrs will be uneven around the circumference of the exit hole, which can make burr removal difficult.

Example

