HCL DFMPro

A Definitive Guide To Design For Manufacturing Success

Machining Design Guidelines- Drilling 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 dfmpro.marketing@hcl.com.

Welcome to this journey of learning and sharing!

HCL DFMPro Marketing
HCL Software

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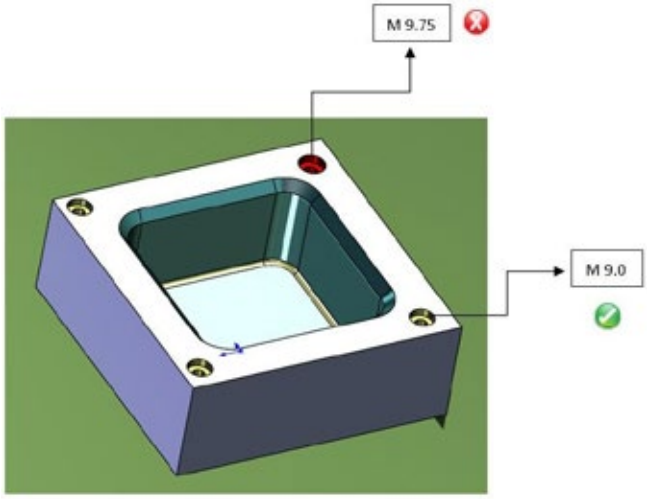
Standard Hole Sizes

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 hole size will further reduce assembly accessories like fasteners, pins, rivets, etc.

Example



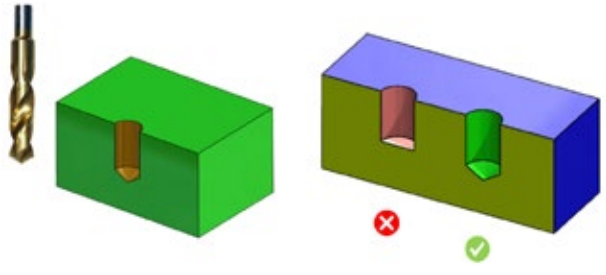
In this example – Choose a diameter M9.0 and not M 9.75

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 increased manufacturing costs and time.

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

Example

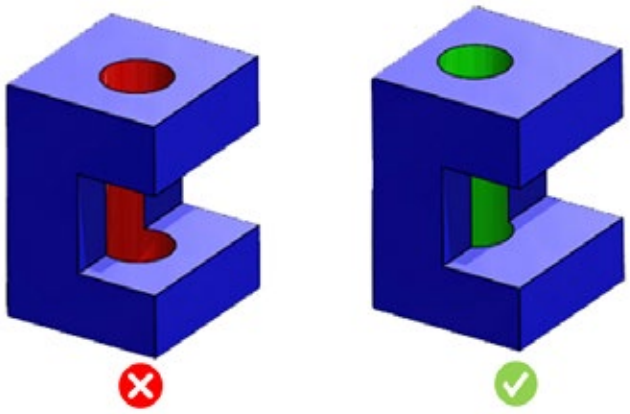


In this example, hole size is less than 45 mm; preferred operation will be drilling. It is recommended to use conical bottom holes.

Holes Intersecting Cavities

The drill follows a path of least resistance when it intersects a cavity during machining. There is a good chance that the drill will wander when it re-enters the material. Also, if the drill intersects another opening on one side, some deflection will occur. The entry point of the drill must remain in the material throughout the cut to avoid extreme deflection and possible drill breakage.

Example

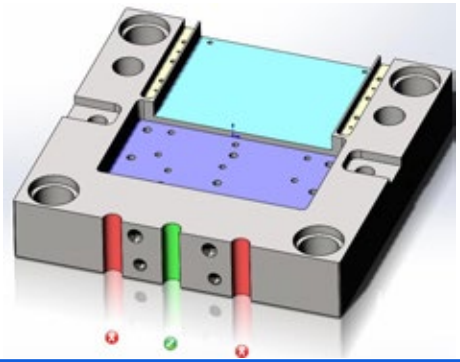


In this example, if an intersection is unavoidable, at a minimum, the centerline of the hole should be outside the cavity, as shown in the image. Order of machining can also impact the drilling condition.

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 the hole is on or near the edge of the material. If the partial hole is unavoidable, ensure that at least 75% of the hole area should be within the material breakage.

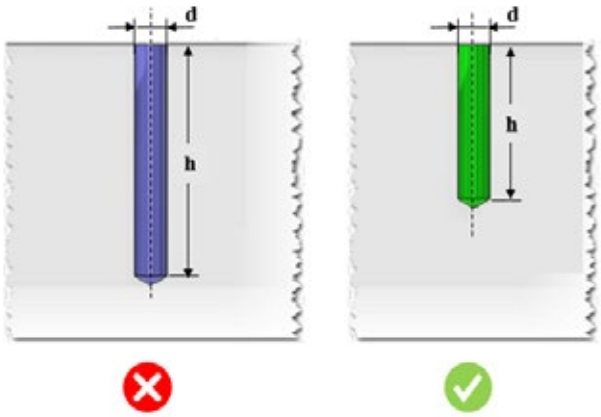
Example



Deep Holes

- Small diameter drills tend to wander & are more prone to breakage. Deep hole drilling is not convenient for mass production.
- Removal of the chip becomes difficult while drilling deep holes.
- A deep narrow hole causes tool deflection and is susceptible to breakage, which increases tooling costs.
- A deep hole requires special operation gun drilling, which increases machining costs.

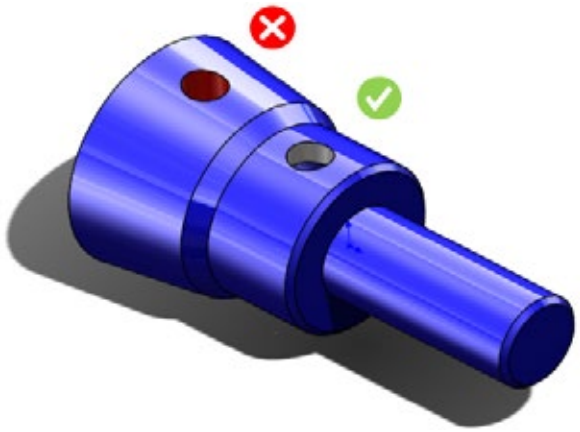
Example



Entry/ Exit Surface for Holes

- When the drill tip gets in contact with a surface, the tip will wander if the surface is not perpendicular to the drill axis.
- Uneven exit burrs around the circumference of an exit hole will make removal of the burr difficult.
- If the drill entry face is perpendicular to the hole axis, then proper placement of holes can be ensured. If the drill exit surface is perpendicular to the hole axis, drill tool breakage problems can be avoided while the drill leaves the work.

Example



About HCL DFMPro

HCL DFMPro: A Powerful Design for Manufacturing Software

In today's time organizations spend millions of dollars on Engineering Change Orders (ECOs). A single ECO can cost up to $30,000. A small investment using DFX at the design stage to address manufacturing and assembly requirements help save significant time to market.

HCL DFMPro is an easy-to-use CAD integrated Design-for-Manufacturing (DFM) software. It identifies and provides recommendations to resolve potential downstream manufacturing issues.

It helps reduce time consuming design iterations resulting into faster development of high-quality products.

Product Design Challenges

Overwhelming engineering change orders (ECO / ECN)

Product cost escalations and depleting margins

Product launch delays

Dispersed organization knowledge

HCL DFMPro Benefits

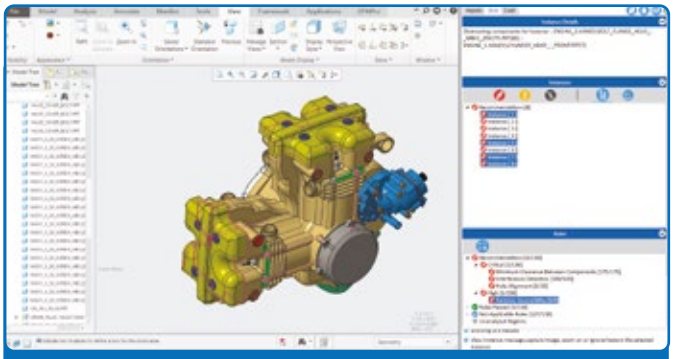
Captures design issues early and reduce engineering rework

Understands opportunities for cost reduction right at design stage and save cost

Avoids late stage engineering changes and time-consuming rework

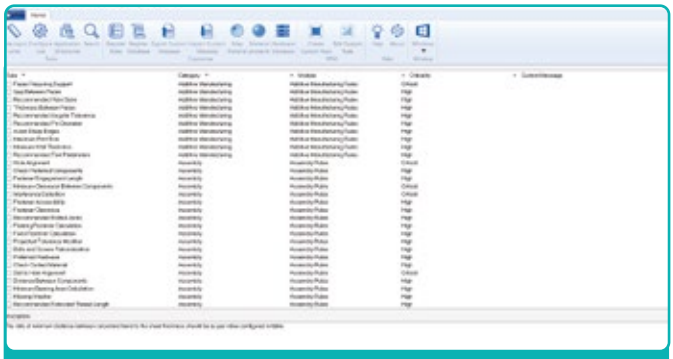
Captures best practices and bring in standardization in design review process

Easy and Powerful DFM Software to Drive Measurable Results Fast



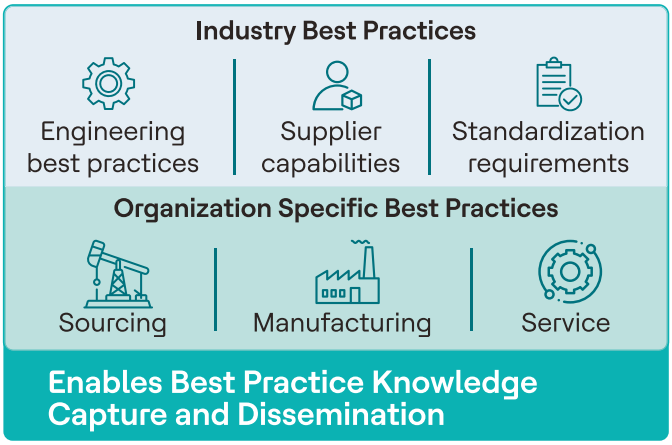
Automates the DFM Review Process

- DFMPro automates and formalizes the design review process
- Seamlessly integrated inside DS CATIA V5, PTC CREO Parametric™, Siemens NX™, and SOLIDWORKS®



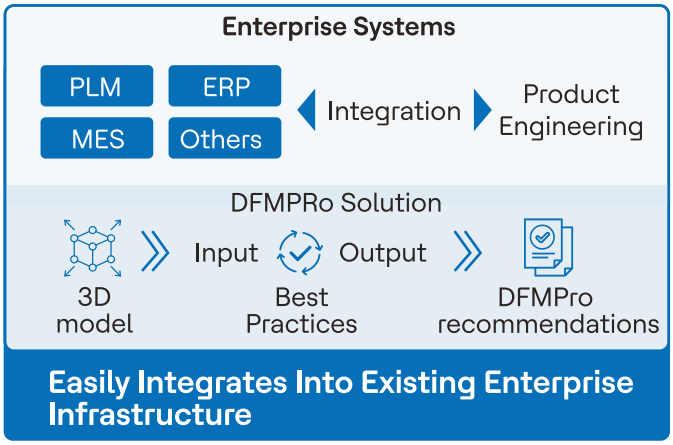
Rule Manager

- Selects and configures organization specific guidelines as design rules
- Brings standardization in design review process



Enables Best Practice Knowledge Capture and Dissemination

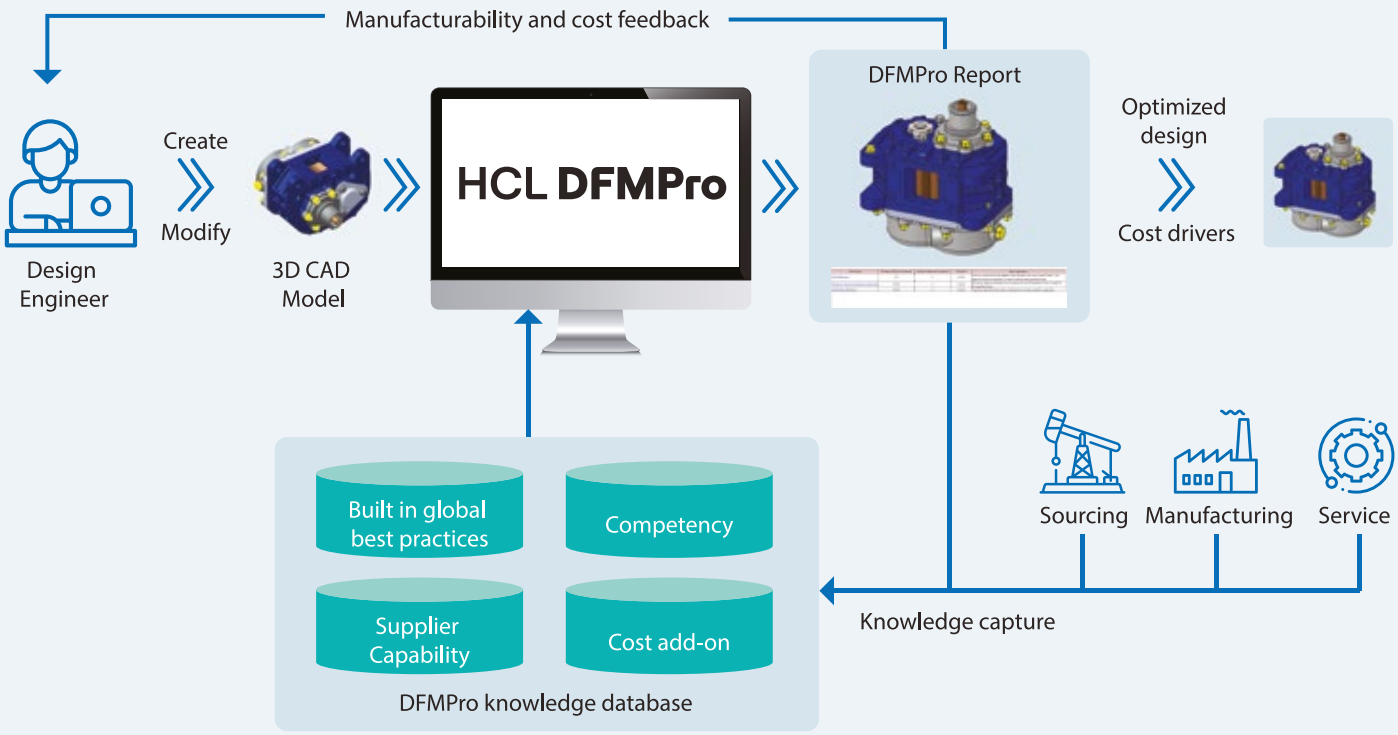
- Customizable framework to capture in-house best practices, tribal knowledge and industry standards
- Facilitates continuous design improvements and knowledge retention of retiring workforce



Easily Integrates Into Existing Enterprise Infrastructure

- Integrates easily with PLM, ERP, and MES systems
- Scalable framework for capturing and disseminating manufacturing knowledge upstream

HCL DFMPro – A Digital Design Expert



- CAD integrated easy to use digital design expert
- Automatically captures and highlight issues that leads to engineering rework
- Identifies opportunities for cost reduction for a component
- Digital collaboration between downstream stakeholders for design reviews

HCL DFMPro Supports various CAD platforms

DFMPro for CATIA V5

CATIA V5

DFMPro for CREO

creo®

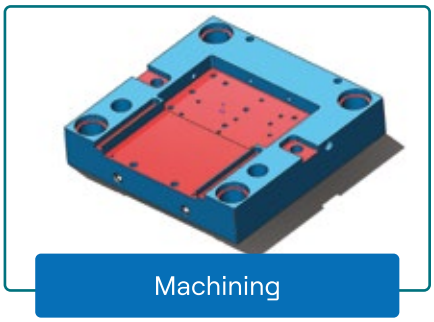
DFMPro for NX

SIEMENS
Ingenuity for life

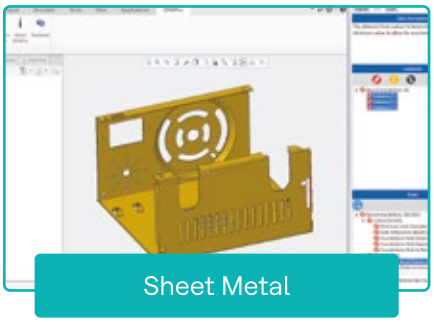
DFMPro for SOLIDWORKS

SOLIDWORKS

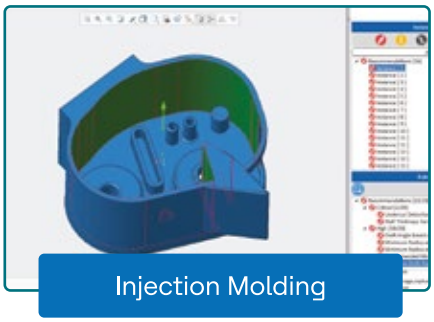
HCL DFMPro Supports all Manufacturing Processes



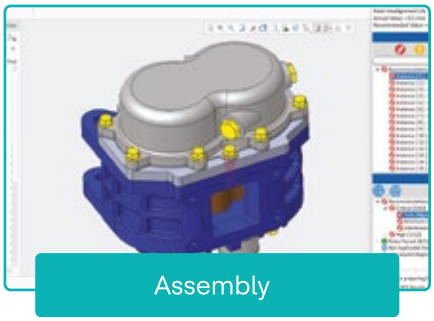
Machining



Sheet Metal

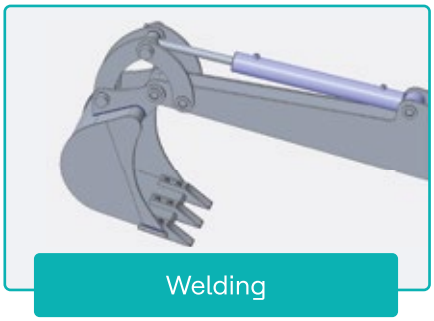


Injection Molding



Assembly

Die casting



Welding

+ many more

In our organization, time to market is of utmost importance besides other factors. HCL DFMPro product enabled us to digitize the design rules for a quick & timely feedback.

Apart from sets of standard design guidelines in the DFMPro, we partnered with HCL to add Cisco specific design rules that caters to our organization. DFMPro is the only automated tool for Design for Manufacturability (DFM) analysis besides input from manufacturer or analyzing parts manually. We have DFMPro configured for Sheet Metal, Plastic & Die-cast parts to ensure that the parts are designed for manufacturability.

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HCL DFMPro

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About HCLSoftware

HCLSoftware develops, markets, sells, and supports product families in the areas of Digital Transformation, Data, Analytics & Insights, AI & Automation and Enterprise Security platforms. HCLSoftware is the cloud-native solution factory for enterprise software and powers millions of apps at more than 20,000 organizations, including more than half of the Fortune 1000 and Global 2000 companies. HCLSoftware's mission is to drive ultimate customer success with its IT investments through relentless product innovation.
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