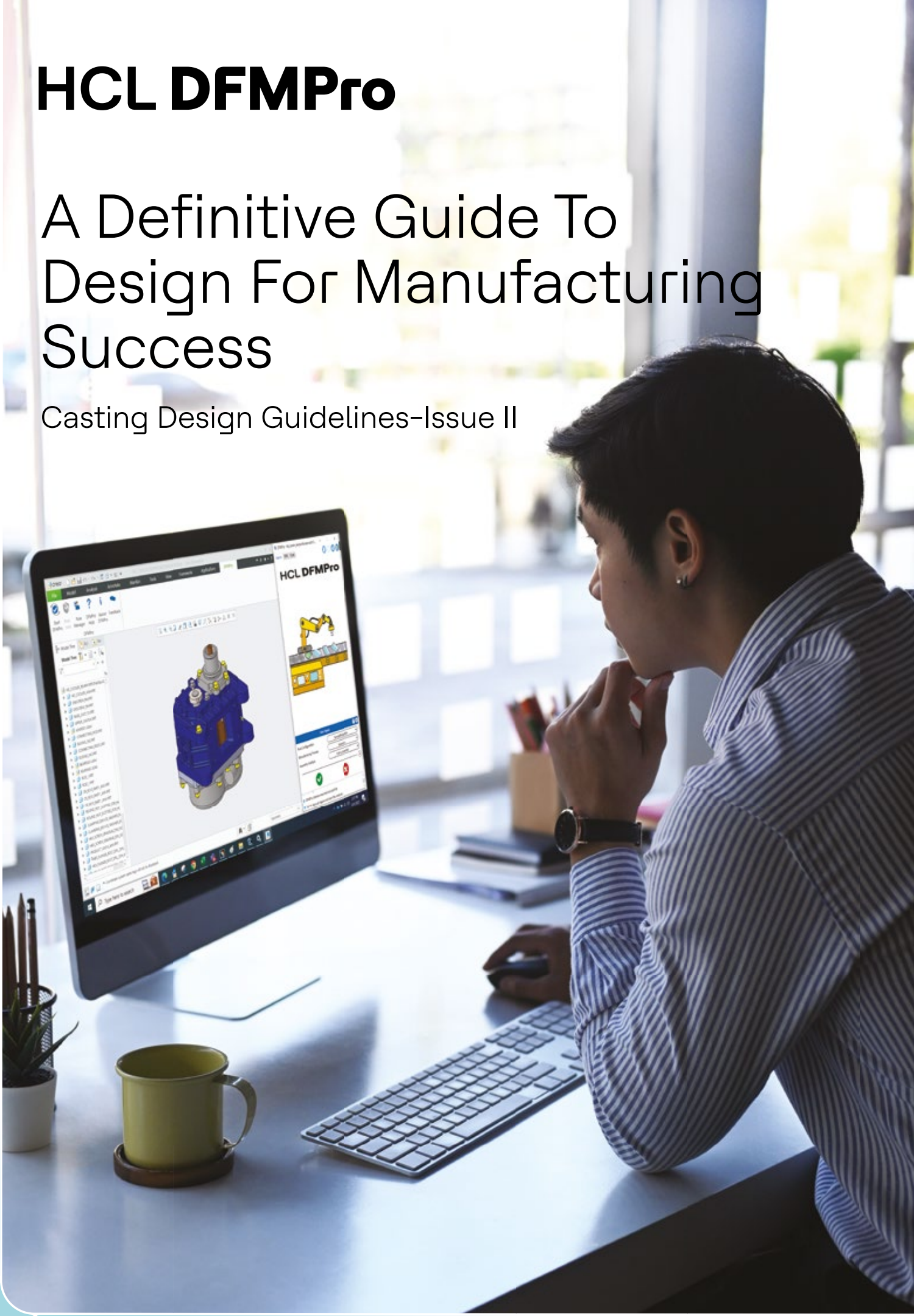
HCL DFMPro

A Definitive Guide To Design For Manufacturing Success

Casting Design Guidelines-Issue II



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Welcome to the second issue of the DFM Guidebook. We highly appreciate your feedback for our first issue. Please continue sending us your comments, suggestions and ideas for subsequent issues.

This week we will provide a comprehensive summary of important design guidelines for casting. Casting is one of oldest manufacturing processes and it is still preferred by various industries with its demand primarily driven by the automotive industry.

Though there are many kinds of casting processes with distinct design and manufacturing guidelines, we will initially look at the ones which are common to most casting processes. The rules covered in this issue are Fillet Radius, Uniform Wall Thickness, Mold Wall Thickness, Wall Thickness Variations, Undercuts and Draft Angle. Following these guidelines ensures that cast part is manufactured with desired dimensional accuracy, surface finish and quality.

We hope that you will find this information handy for reference whenever you need it. The objective of this guidebook is also to provide upfront information for design engineers to design efficiently with minimal rework and cost.

Thanks once again and we hope you'll continue this journey with us as we acquire, share, and disseminate knowledge.

DFMPro Marketing
HCL Software

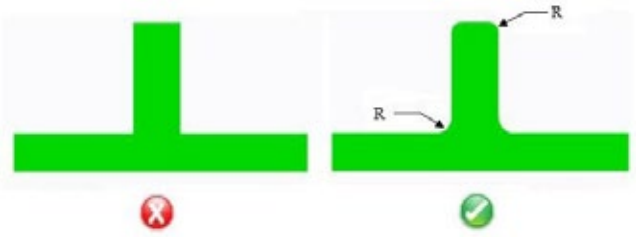
Contents

Fillet Radius

Sharp corners, edges and rapid changes in cross section should be avoided in cast parts. Fillets should be added to sharp corners and edges.

Inside corners should be designed with fillets, and outside corners should have radii as large as possible. Depending on the casting process, minimum fillet radii should be provided on the inside and outside corners of the components. For example, in die casting, a minimum radius of 1.5 times the wall thickness should be provided.

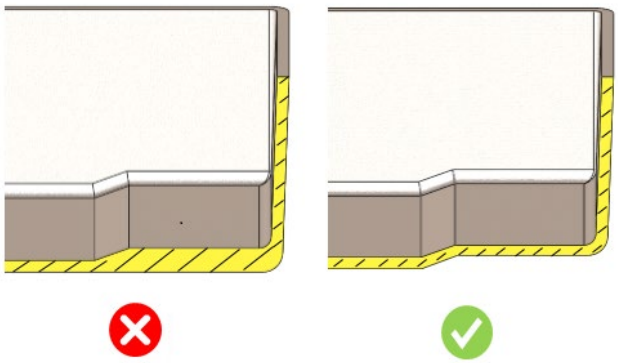
Example



Uniform Wall Thickness

Wall thickness should be kept uniform as it helps to create high quality cast parts. Sudden variations and geometry changes in wall thickness affect the metal flow, resulting in air enclosures and poor surface finish of parts. The recommended range of wall thickness is two times the thinnest wall section. The transition from thick to thin walls should also be gradual.

Example

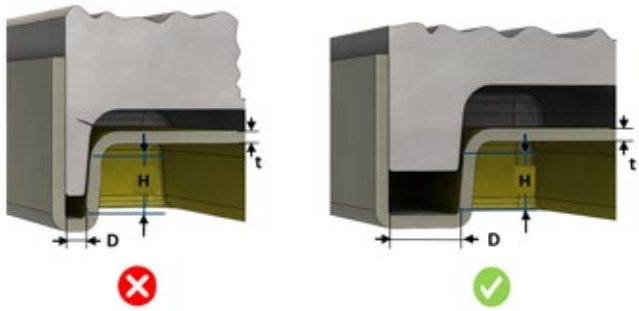


Mold Wall Thickness

Mold wall thickness is an important aspect to be considered in casting. If the mold wall is too thin and elongated, stresses are developed in the mold, reducing mold life. Also, special materials are required to create the molds and they may need regular replacement and service. Ribs and bosses which are too close to each other can result in thin mold walls.

Hence the minimum allowable mold wall thickness should be decided based on process and material considerations. The minimum clearance between features of a cast component will be based on the casting process, component material and tool material.

Example



Wall Thickness Variation

Wall thickness variations in the casting result in differing cooling rates, shrinkage, warping, and distortion. Ideally, the wall thickness should be uniform throughout the part (equal to the nominal wall thickness).

In reality, this variation is unavoidable due to functional and aesthetic requirements. However, the amount of variation should be minimized and within a certain tolerance limit.

Example

Undercuts

It is recommended that undercuts should be avoided for ease of manufacturing. Undercuts require additional mechanisms, adding to mold cost and complexity. Clever part design or minor design concessions can often eliminate complex mechanisms for undercuts.

Example

Draft Angles

Draft is the taper given to core and cavity for easy removal of casting (or pattern). Adding proper drafts on the cast parts improves cycle time and the quality of surfaces. The sidewalls of the castings and other features perpendicular to the parting line must be drafted as much as possible.

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

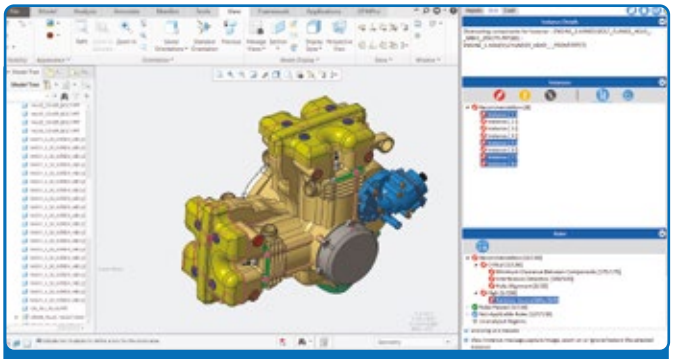
Captures design issues early and reduce engineering rework

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

Avoids late stage engineering changes and time-consuming rework

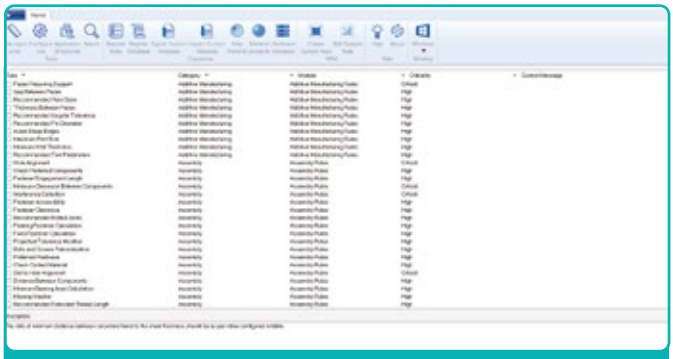
Captures best practices and bring in standardization in design review process

Easy and Powerful DFM Software to Drive Measurable Results Fast



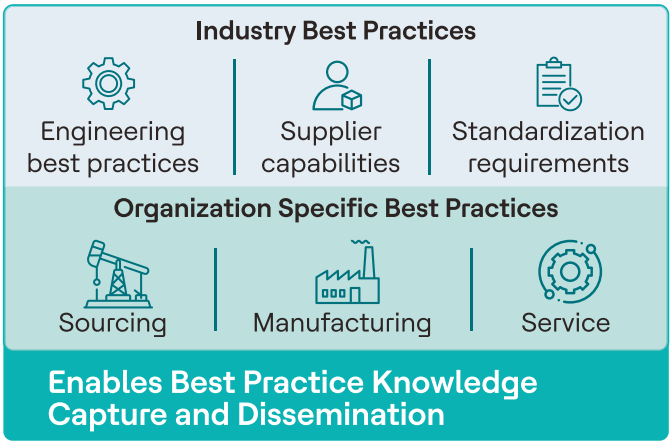
Automates the DFM Review Process

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



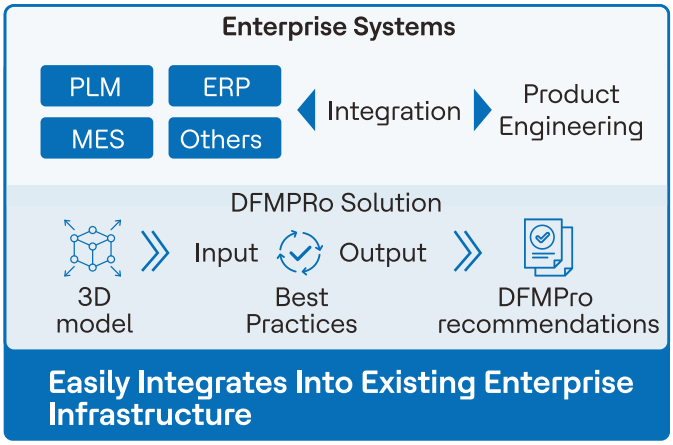
Rule Manager

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



Enables Best Practice Knowledge Capture and Dissemination

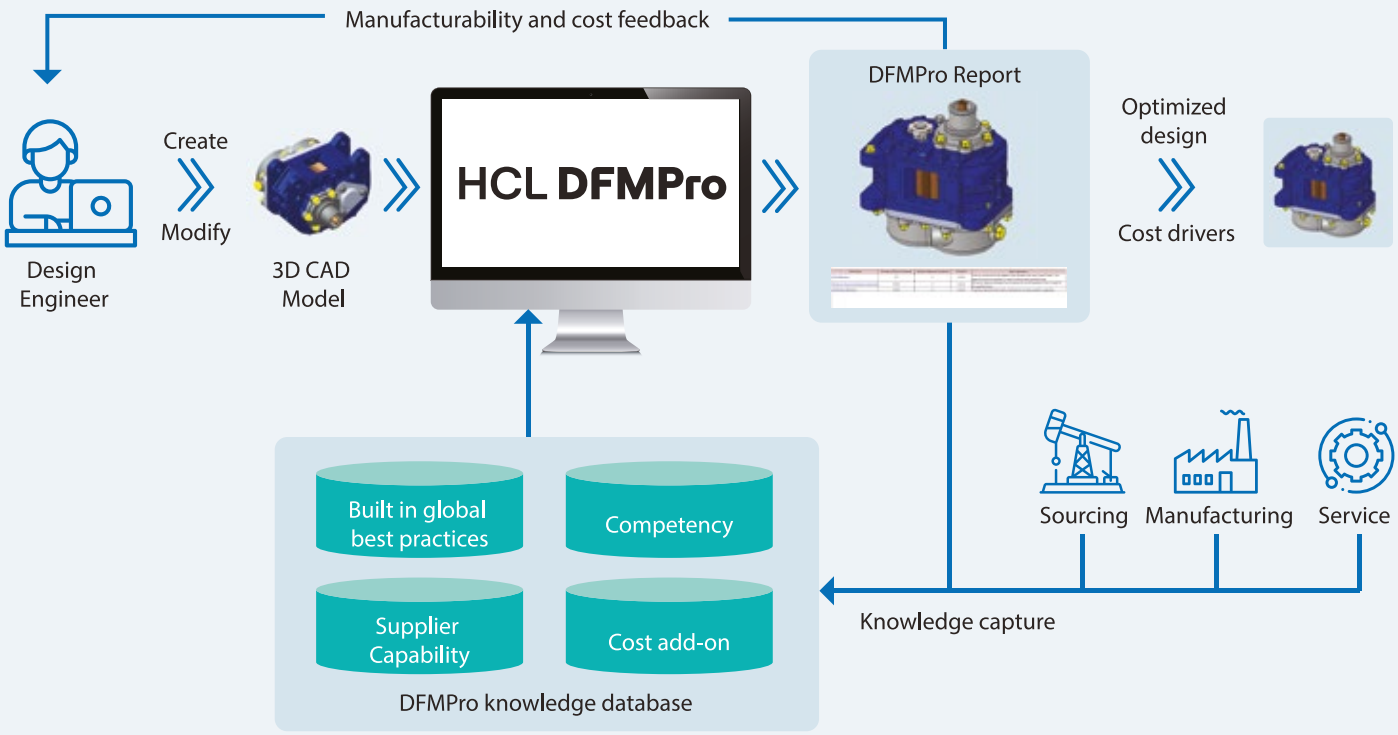
- Customizable framework to capture in-house best practices, tribal knowledge and industry standards
- Facilitates continuous design improvements and knowledge retention of retiring workforce



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®

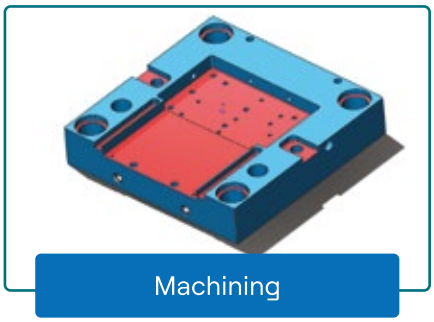
DFMPro for NX

SIEMENS
Ingenuity for life

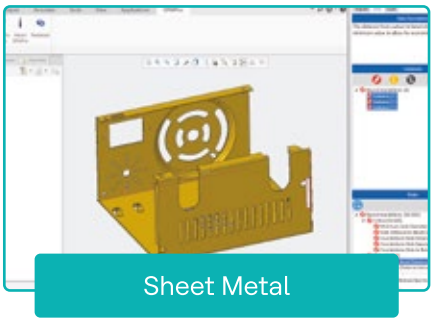
DFMPro for SOLIDWORKS

SOLIDWORKS

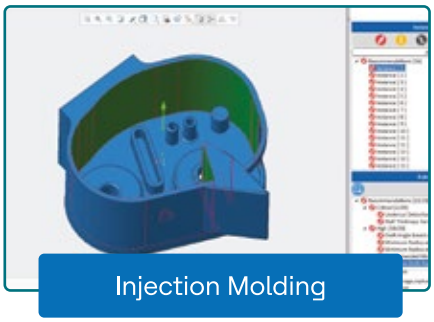
HCL DFMPro Supports all Manufacturing Processes



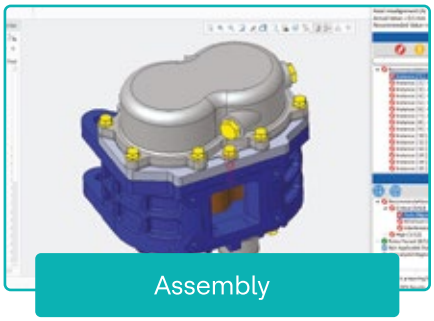
Machining



Sheet Metal

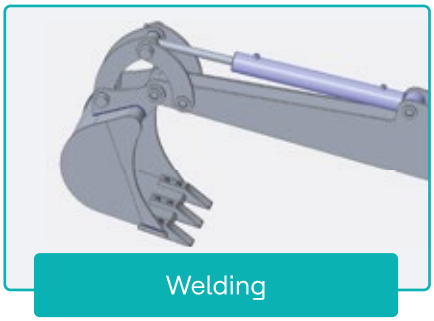


Injection Molding



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.

Biren Kothari
NPI Technical Lead,
Mechanical, Cisco Systems
San Jose, California USA

HCLSoftware

HCL DFMPro

For more information:
dfmpro.marketing@hcl.com
https://www.dfmpro.com

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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