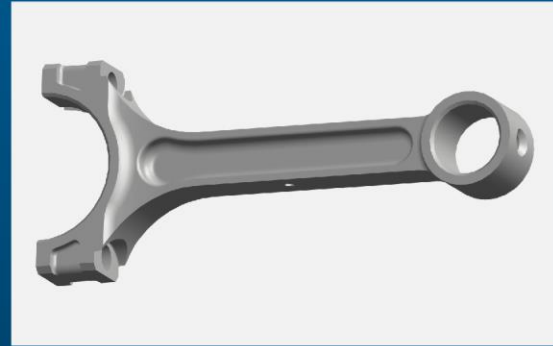
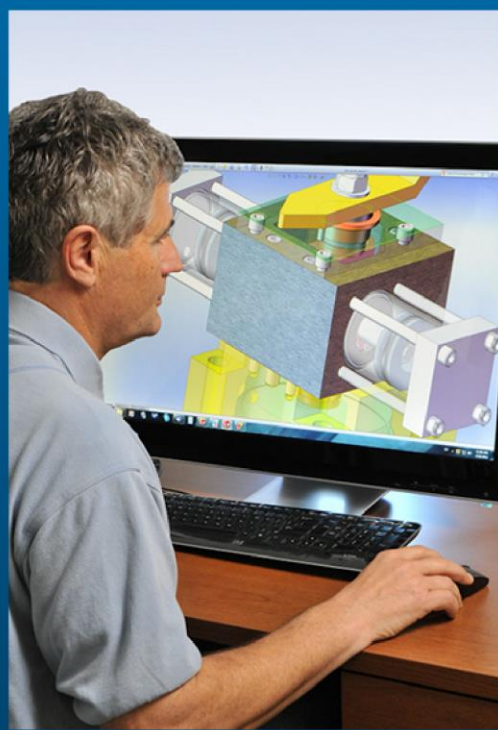
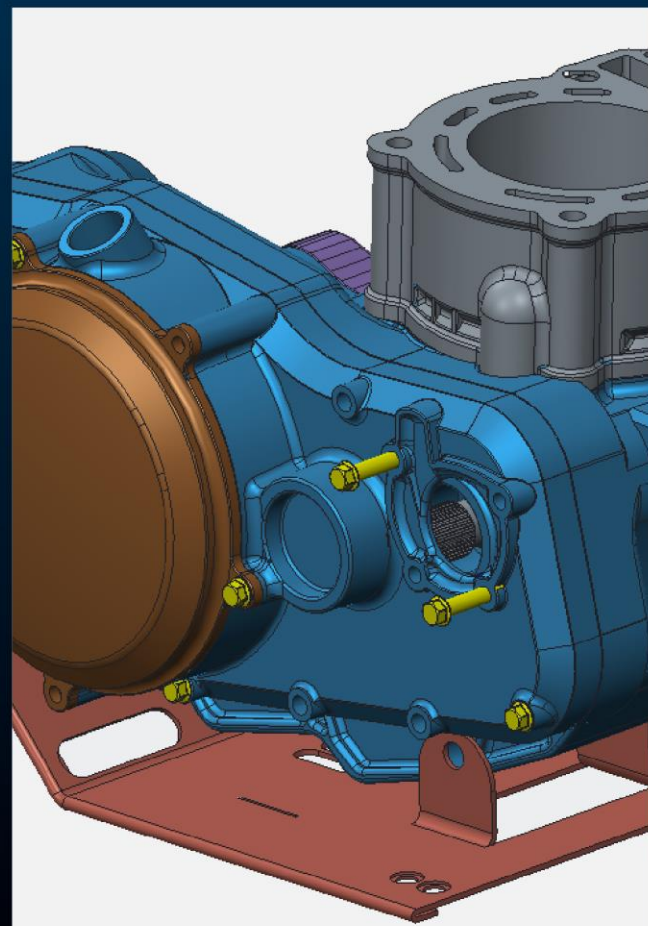
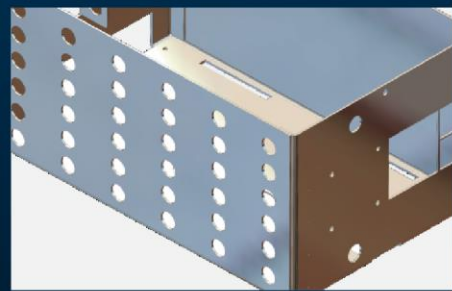




DFMPro
A Geometric Product



A DEFINITIVE GUIDE TO **DESIGN FOR MANUFACTURING SUCCESS**



Casting Design Guidelines

Issue II, Dec 2014

Copyright Notice

© Geometric Limited. All rights reserved.

No part of this document (whether in hardcopy or electronic form) may be reproduced, stored in a retrieval system, or transmitted, in any form or by any means, electronic, mechanical, photocopying, recording, or otherwise, to any third party without the written permission of Geometric Limited. Geometric Limited reserves the right to change the information contained in this document without prior notice.

The names or trademarks or registered trademarks used in this document are the sole property of the respective owners and are governed/ protected by the relevant trademark and copyright laws.

This document is provided by Geometric Limited for informational purposes only, without representation or warranty of any kind, and Geometric Limited shall not be liable for errors or omissions with respect to the document. The information contained herein is provided on an “AS-IS” basis and to the maximum extent permitted by applicable law, Geometric Limited hereby disclaims all other warranties and conditions, either express, implied or statutory, including but not limited to, any (if any) implied warranties, duties or conditions of merchantability, of fitness for a particular purpose, of accuracy or completeness of responses, of results, of workmanlike effort, of lack of viruses, and of lack of negligence, all with regard to the document.

THERE IS NO WARRANTY OR CONDITION OF NON-INFRINGEMENT OF ANY INTELLECTUAL PROPERTY RIGHTS WITH REGARD TO THE DOCUMENT. IN NO EVENT WILL GEOMETRIC LIMITED BE LIABLE TO ANY OTHER PARTY FOR LOST PROFITS, LOSS OF USE, LOSS OF DATA, OR ANY INCIDENTAL, CONSEQUENTIAL, DIRECT, INDIRECT, OR SPECIAL DAMAGES WHETHER UNDER CONTRACT, TORT, WARRANTY, OR OTHERWISE, ARISING IN ANY WAY OUT OF THIS DOCUMENT, WHETHER OR NOT SUCH PARTY HAD ADVANCE NOTICE OF THE POSSIBILITY OF SUCH DAMAGES.



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.

Rahul Rajadhyaksha
Senior Product Manager
Geometric Limited

Contents

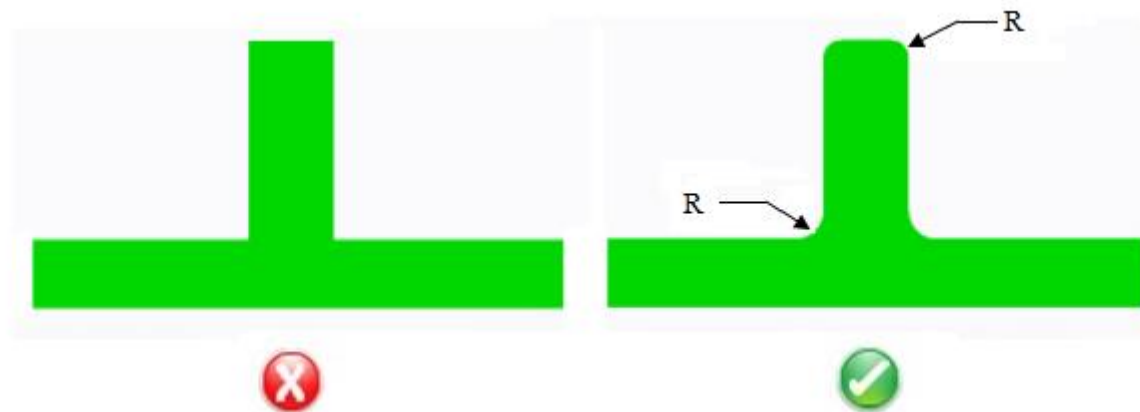
Fillet Radius.....	6
Uniform Wall Thickness	7
Mold Wall Thickness	8
Wall Thickness Variation.....	9
Undercuts.....	10
Draft Angles.....	11

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 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

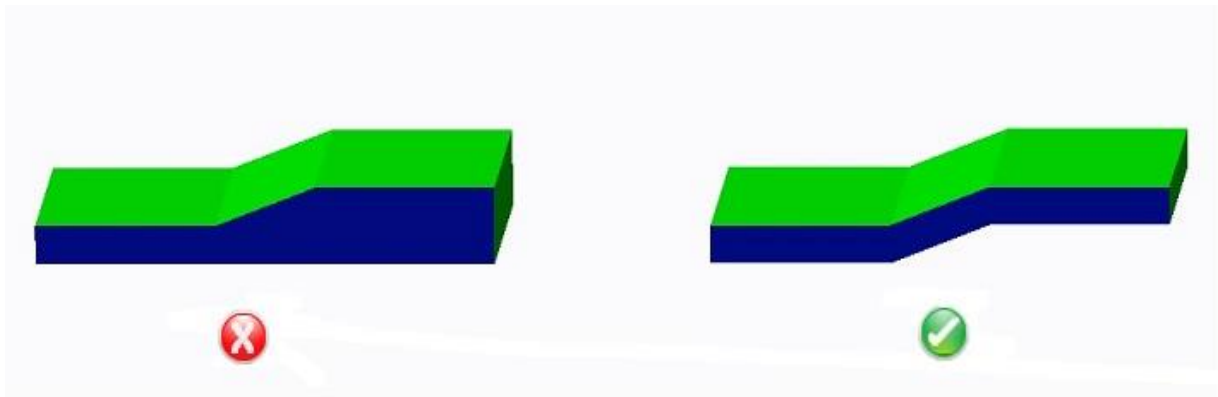


Uniform Wall Thickness

Wall thickness should be kept uniform as it helps to create high quality cast parts. Sudden variations and geometry changes and in wall thickness affects 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 as gradual as possible.

Example

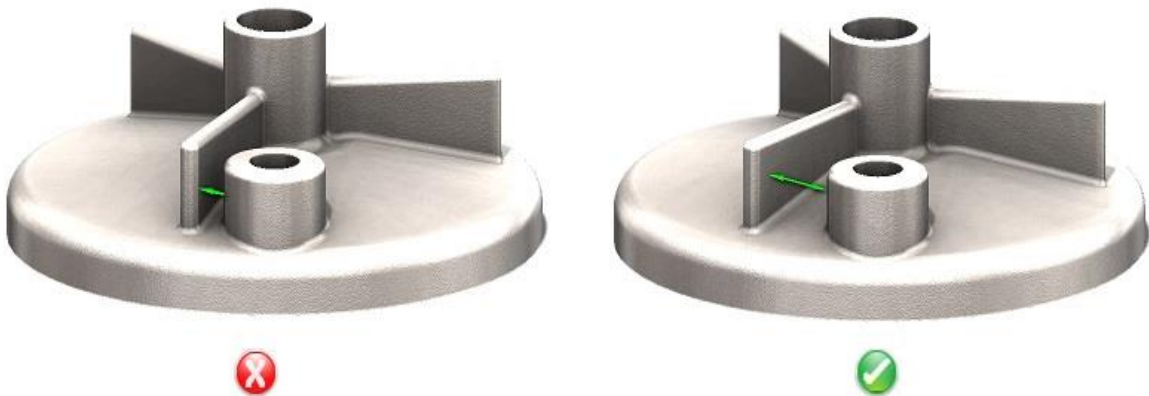


Mold Wall Thickness

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

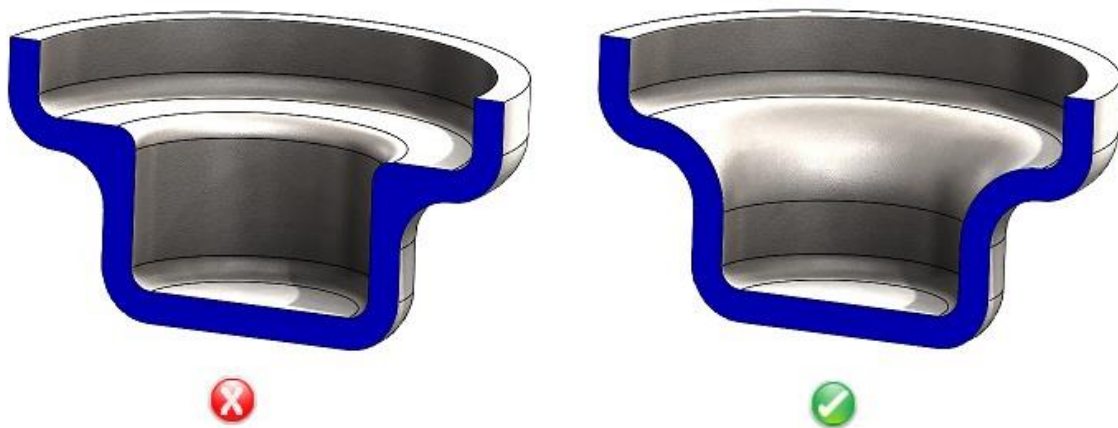


Wall Thickness Variation

Wall thickness variations in the casting result in differing rates of cooling, 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.

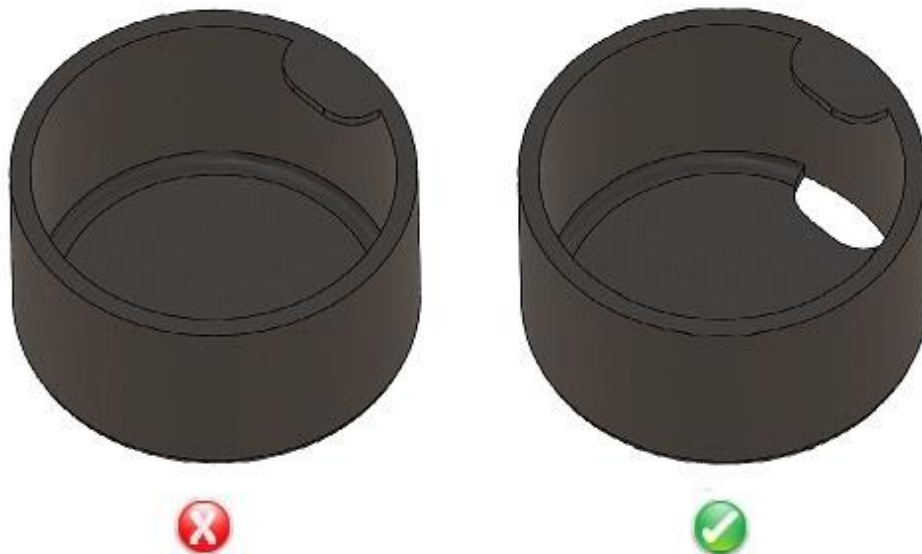
Example



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 quality of surfaces. The sidewalls of the castings and other features perpendicular to the parting line must be drafted as much as possible.

The draft angle will depend upon the type of material and varies inversely with height of the wall.

Example

