Best Practices for Solid Modeling in Alibre Design

Good rules to follow during the solid modeling phase of the design process.

Part Design Guidelines

When creating a solid model the following elements should be created in the order shown:

1

1. **Reference elements – planes, lines, and points.**
2. **Functional parts (s) - part without drafts and fillets.**
3. **Drafts – create them as late in the design history as possible.**
4. **Fillets and Chamfers – create them as late in the design history as possible.**

Use multiple solid bodies (for complex molds, and castings)

2

1. **A body for each function of the part.**
2. **Nothing in the main part body except dress up features that are specific to it.**
3. **Machining in a separate body.**
4. **At the end of the design all bodies must be grouped together in the main part body using Boolean operations.**

Use part design features in their scope.

3

Don't use the draft modifier to create inclined faces that have nothing to do with part manufacturing, or don't use the 'Extrude Cut' command in place of the 'Hole' command to create a simple hole.

Choose the most applicable coordinate system.

4

1. **Design in 'Part' position, not in 'Assembly' position.**
2. **Select the coordinate system in relation to the part – symmetry plane, rotation axis.**

Recommendations for fillet creation.

5

1. **Create fillets that aid in the creation of other fillets**
2. **Start with the most complex fillets – ex. variable fillets.**
3. **From biggest to smallest**
4. **Finish with fillets that overlap other fillets**
5. **Group fillets with the same value as long as they don't touch each other.**

Explanations

1.1.1 Reference Elements

Reference elements should be considered as the framework or skeleton of the part you're creating. They should be used to support your sketches and constraints. It's always a better idea to link solid features to reference elements instead of other solids. The reason for this is if one solid feature is modified or deleted, the others will still update.

1.1.2 Functional Parts

Create the rough geometry of your part, consisting of one or more assembled bodies, but without fillets, chamfers, or other dress-up geometry. What you're striving for is a stable base part. In the case of updating problems after a major modification the fillets, chamfers, and drafts can be suppressed and re-activated when the design problem is corrected.

1.1.3 Drafts

Insert them as late as possible in the design history hierarchy, but as close to the part geometry that needs to be drafted.

1.1.4 Fillets and Chamfers

As with drafts, insert them as late as possible in the design history hierarchy, but as close to the part geometry that needs to be drafted. Fillets that aid in the creation of faces that need to be drafted should be done before the draft, even though they will be deformed by the draft.

2.1.1

Use a solid body for each function of the part.

2.1.2

No dress up features in the main body except those specific to it.

2.1.3

Create any machining (material removal) operations as a separate part body, which will be removed at the end of the design with the Boolean Subtract, command...

2.1.4

At the end of the design, all bodies will be grouped in the main part body with the Boolean commands.

The reasoning behind this type of part creation is to make editing of complex parts more efficient by limiting the complexity of the history tree, and to preserve the integrity of the part in the event of a catastrophic update failure. Simple, individual part bodies are much easier to edit than is one complex part body based on a multitude of sketches, extrude, and dress up functions. Although this requires a more rigorous approach to part planning it will pay dividends when it comes to future modifications.

3. Design Features

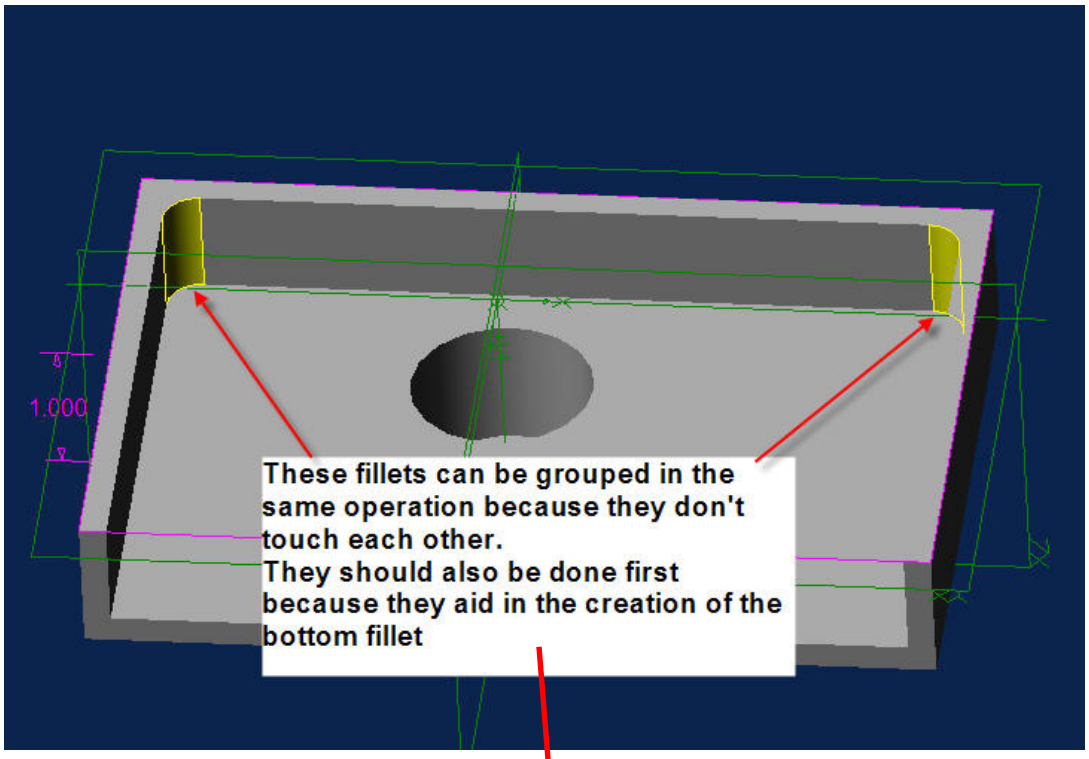
Use all design features as intended. Drafts are to be applied to casting surfaces only, not to inclined faces of a solid, and the 'Hole' command should be used to create all cylindrical holes, not the 'Extrude Cut' command, unless the hole feature is an integral part of the design. An example of this would be the cylinder feature in an engine block.

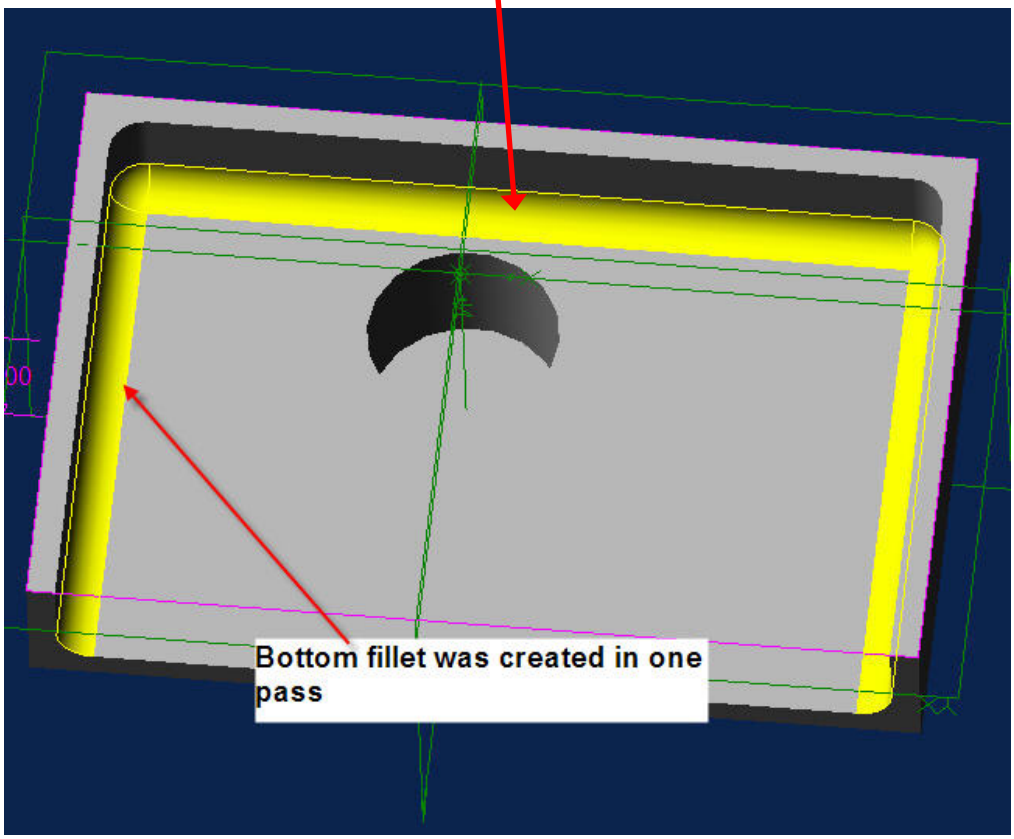
4.1-4.2 Choosing a Coordinate System

Whenever possible, always design in the part position, not in an assembly position. The reason for this is that multi-use parts created in ‘Assembly Position’ will be harder to place in other assemblies, and could possibly create a larger space envelope that necessary in subsequent assemblies. Also, if possible, select the coordinate system based on the final orientation of the part in relation to the assembly. This makes placing assembly constraints easier and more efficient. Again, this requires more planning in the beginning stages of the design.

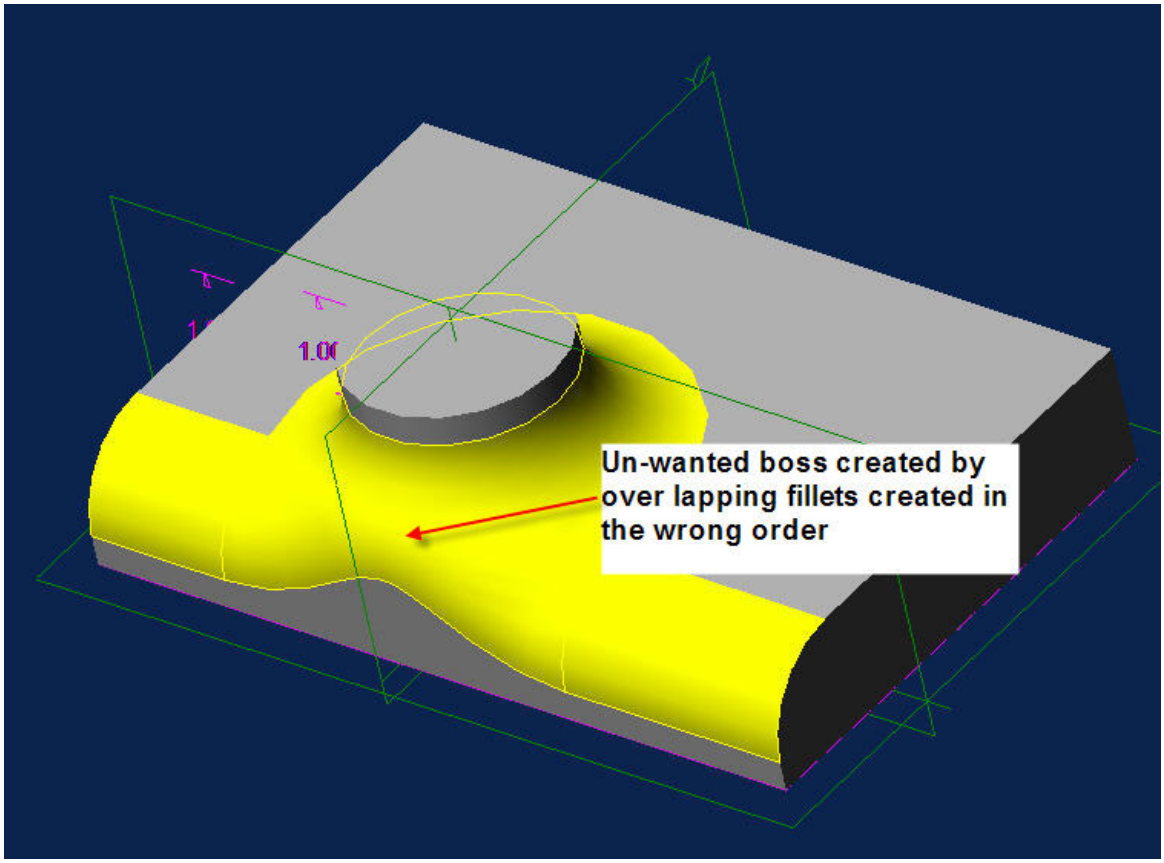
5.1-5.5 Fillet Recommendations

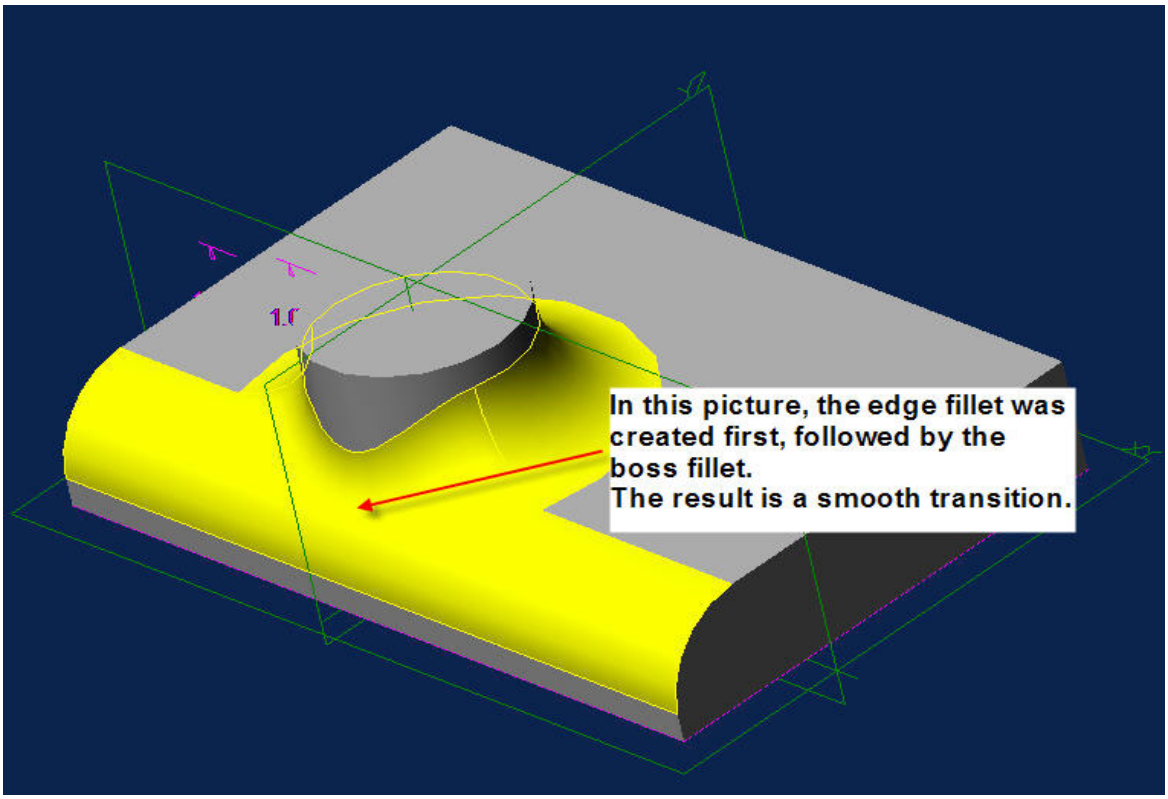
As with drafts, insert them as late as possible in the design history hierarchy, but as close to the part geometry that needs to be drafted. Fillets that aid in the creation of faces that need to be drafted should be done before the draft, even though they will be deformed by the draft.





Another example of using fillets properly is shown in the examples below.
The fillet surrounding the cylindrical boss was created before the edge fillet. The result is an unwanted boss.





The importance of planning can never be overstressed when it comes to the design process. Many designers jump into a job with little regard for the future of their design. They're under a lot of pressure to get the work done and get on to the next hot project. Believe me, it's worth the extra time you spend to scrutinize all aspects of the design before you begin to sketch and extrude parts. How do the features relate to one another? How can they be created with the least number of operations, the fewest number of constraints, and the best possible outcome if the parts are to be included in an assembly? Minimalism should be the mantra of all good designers. Another thing to consider early on in the design phase of a new part or product is how it will be produced. Manufacturing operations can have a major impact on part cost. Approaching every design from a Design For Manufacturing and Assembly standpoint can result in lower manufacturing, assembly, inventory, and warranty costs.