Fusion länk. (VG)

https://a360.co/33ZPlNk

Foto på printade konstruktion (VG)

Rendering på konstruktionen (VG)

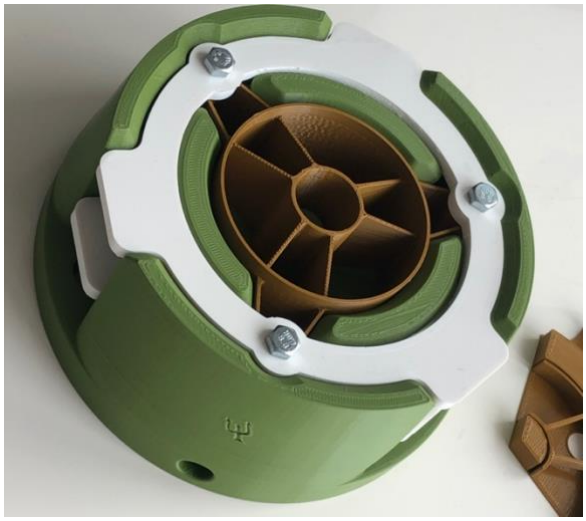
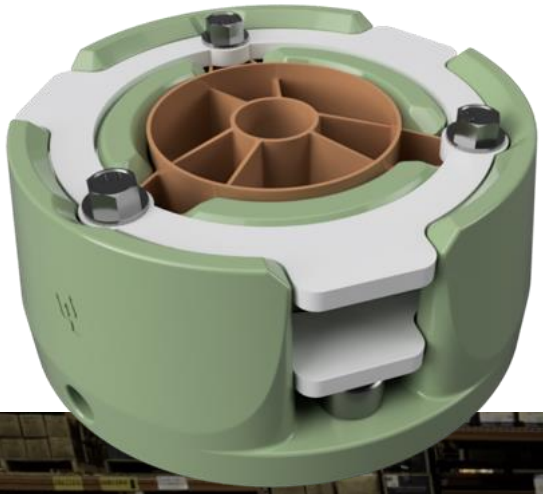


Fig 1 - Photo of final printed and assembled spindle and fixture. Own work.

Fig 2 - Rendered assembled fixture. Own work. Rendered in Fusion 360.



Bottom Fig - Rendering representing a potential use case. Fixture fastened to the table to allow quick assembly of spindle. Own work. Rendered in Fusion 360. Render HDRI CC0 hdrihaven.com.

Offset (VG)

For the parts to easily fit one another, maintain alignment to allow assembly, and be easily removable from the form after assembly, a clearance of **0.6 mm** is designed into the fixture.

Fig 3 - Test print of 0.6 mm clearance on all vertical faces of the fixture. Spindle printed without modification from previous lesson. Own work.

FDM printers have some limitation to their accuracy. This limitation is typically accounted for by designing in some offset or clearance to the parts. If the parts are to fit for example, a hole inner diameter to a shaft outer diameter, 0.2 mm between the parts is often sufficient in my experience, on the Creality Ender 3 FDM printer. The Ultimaker 2+ has proven to be slightly less accurate and a clearance of 0.5 mm is required. Armed with this knowledge, a clearance of 0.6 mm has been applied to all vertical faces. The horizontal faces are less important as long as the pieces to assemble each other can be touching one another during assembly.

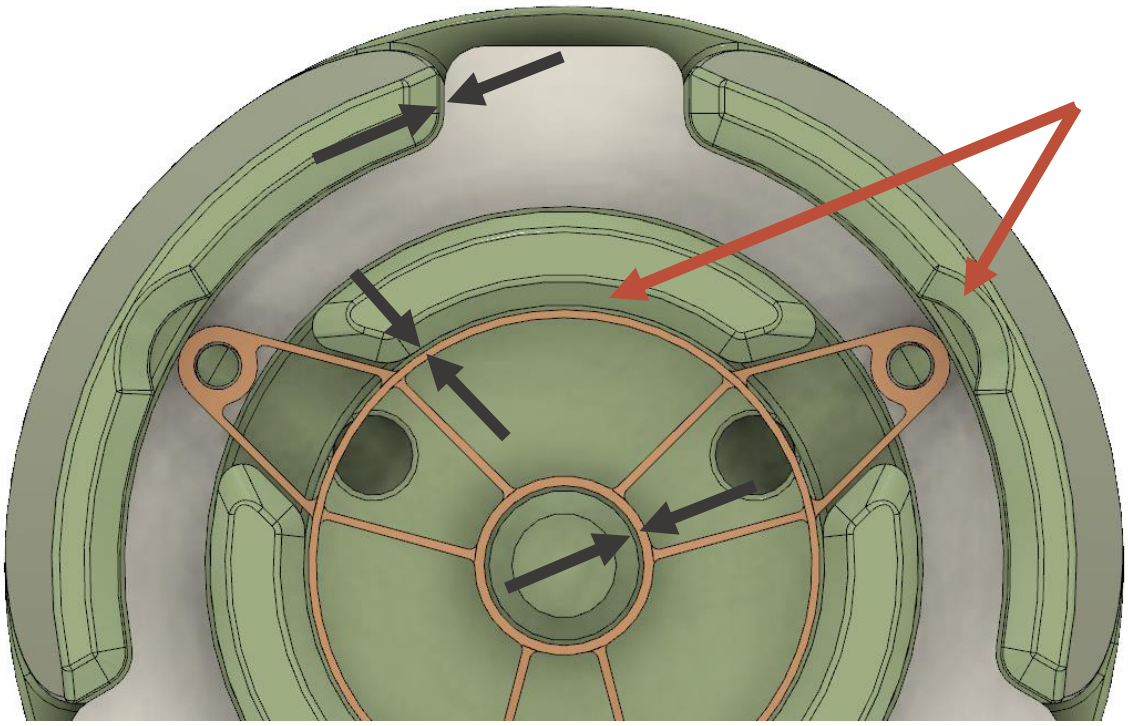


Fig 4 - View from above with grey arrows noting 0.6 mm clearance. Red arrows note tapered edge design for ease of assembly.

Designprocessen - CAD mm (VG)

A solid design process can lead to quick and good results. This process can be broken down into several major steps: Become aware of the need, understand the problem, create a general idea of a solution, prototype, hone the prototype, test, and final result.

I find it most important to be very aware of the problem one is attempting to solve before beginning any of the design process. By understanding the problem, factors contributing to the problem and all potential use cases, one might uncover a different or more efficient solution than the one that is simply presented.

In this case we have a set of parts to be manufactured which require a fixture for rapid and repeatable assembly. This requires ease of fit, ease of assembly and ease of removal post-assembly. This is accomplished with the offset as stated above and a taper around the fixture, so the pieces slide in easily with little effort required from the assembler in terms of alignment and placement (fig 5). The fixture is designed to fully encapsulate the spindle and rings adding to ease of spindle placement and assembly. This design has the benefit of added strength.

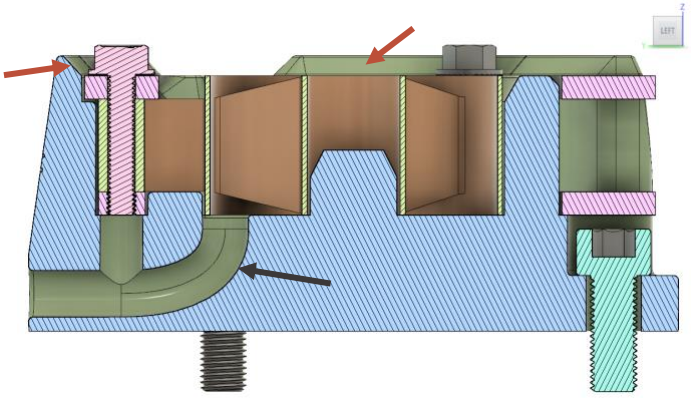


Fig 5 - Cutaway view of fixture and assembled spindle. Red arrows noting taper for ease of assembly. Grey arrows noting drain channels for easy cleaning. Own work. Image captured in Fusion 360 design workspace.

The design requirements state that the mounting diameter should not be more than 140 by 140 mm. This design is exactly 140 mm circular with three 10 mm fasteners to attach the fixture to a surface. Furthermore, drain channels are added for easy cleaning (fig 5). Additive manufacturing allows for such complex additions at no extra difficulty in manufacturing.

All sharp edges are made soft by fillets. This should keep the fixture from damaging the parts if they happen to be made of soft materials. Soft edges are also more comfortable for a human to handle.

The fixture is designed to easily print without support material or the need for post processing.

I designed the fixture completely within Fusion 360. It is very simple to import the components and make simple extrude cuts to achieve the desired shape. From there it is simply to offset the faces our desired amount. The offsets are designed parametrically for easy adjustment if larger or smaller part clearances are desired.

Övriga egna reflektioner (ej betygsgrundande)

In order to make the best design possible it would be good to have more information on the use case of this spindle and fixture. What is the spindle used for? In what kind of environment is the fixture to be used, will it be wet, dirty or oily? What will it be attached to?

There is a website with very high quality, free to use, open source HDRI images for rendering environments. The website is https://hdrihaven.com. The rendered workshop image (Bottom fig on first page) was obtained from that site.