STL File

- Try to keep it < 100 MB
- 500 MB file will fail
- To reduce file size when generating STL:
  - Increase Angle
  - Deviation has minimal effect on file size
- For good results (high res & small file)
  - 5 degrees
  - minimum deviation

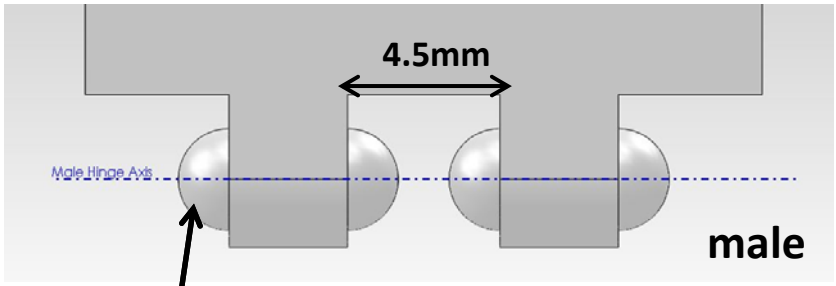
Assemblies

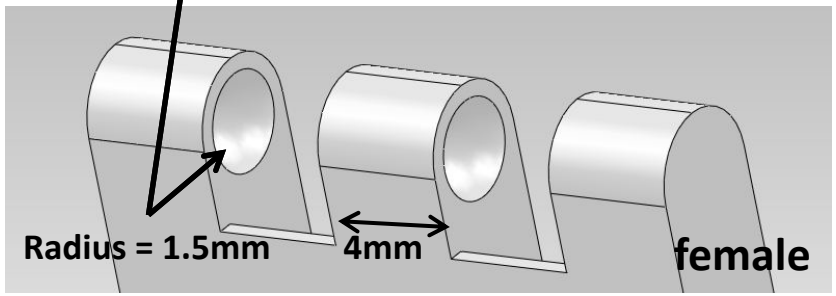
- Min 0.25 mm clearance between parts in joint
- Evaluate / Clearance Verification (from SW)
  - Run before saving STL
  - Any overlap in joint will weld joint in place
- Configure assembly as compact as possible before generating STL
- Some assemblies can not be freed after they are built and should not be built pre-assembled:
  - Large diameter shafts
  - Small diameter shafts
    - < 5mm may break off
  - Mechanically connected joints (e.g. gears) that require multiple joints to be freed simultaneously

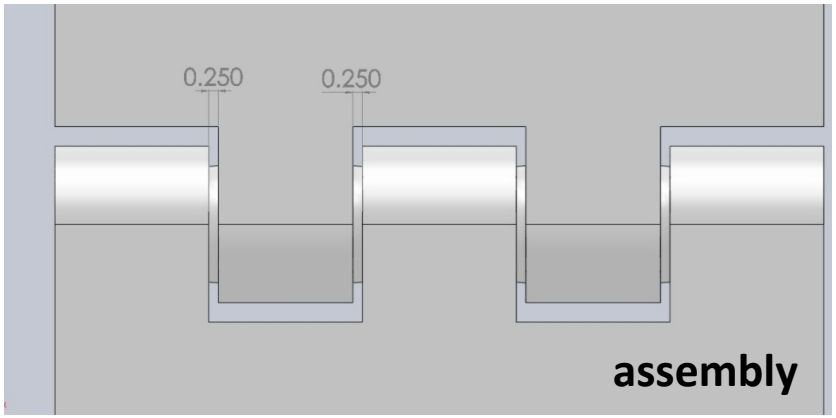
Hinge

The following hinge design works well:

- Ball radius = 1.5mm
- Male and female sides are negatives of each other
- Male gap 0.5mm wider than female tab
- Must build as an assembly



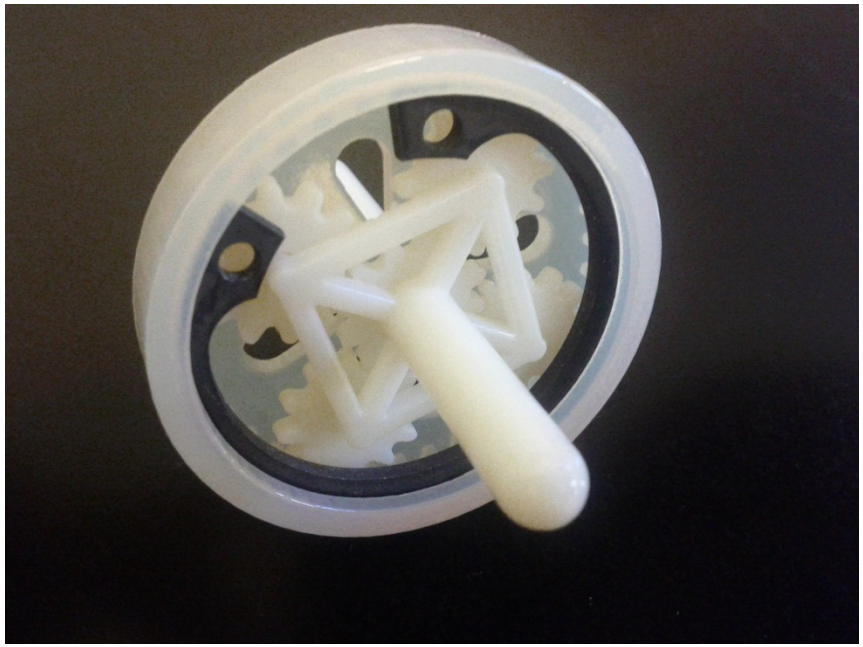




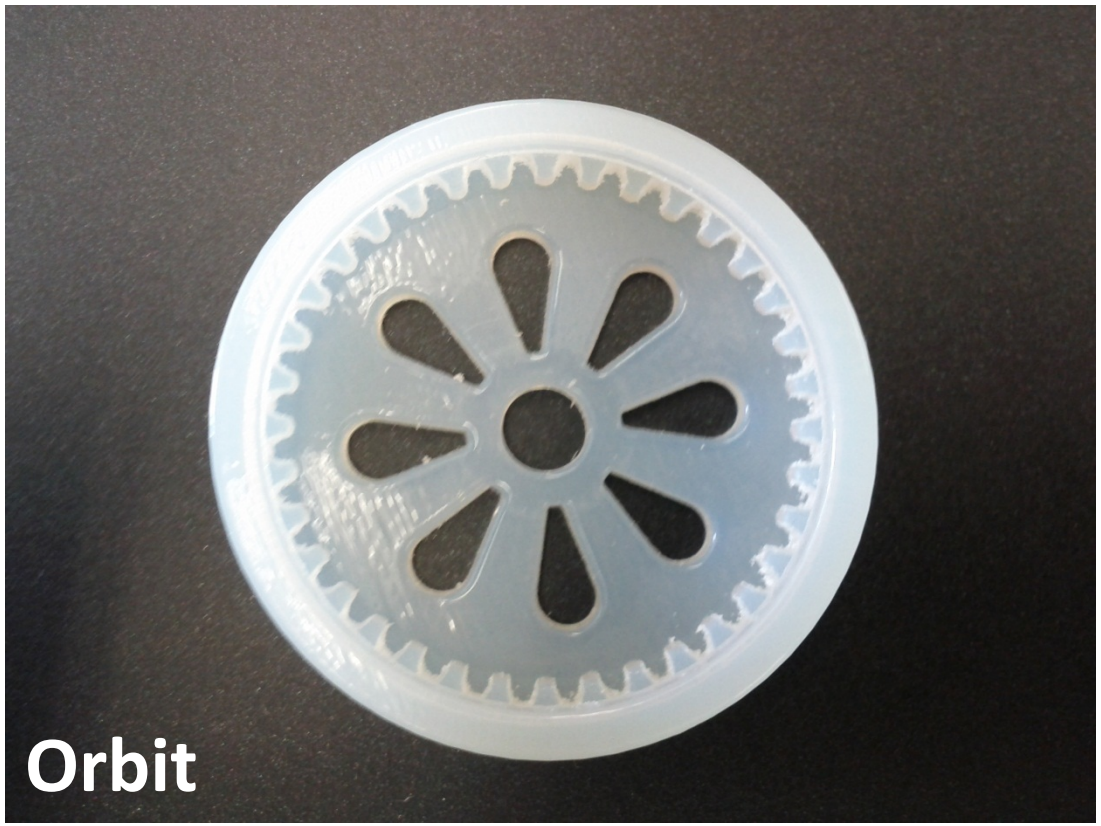
Example: Planetary Gear Set

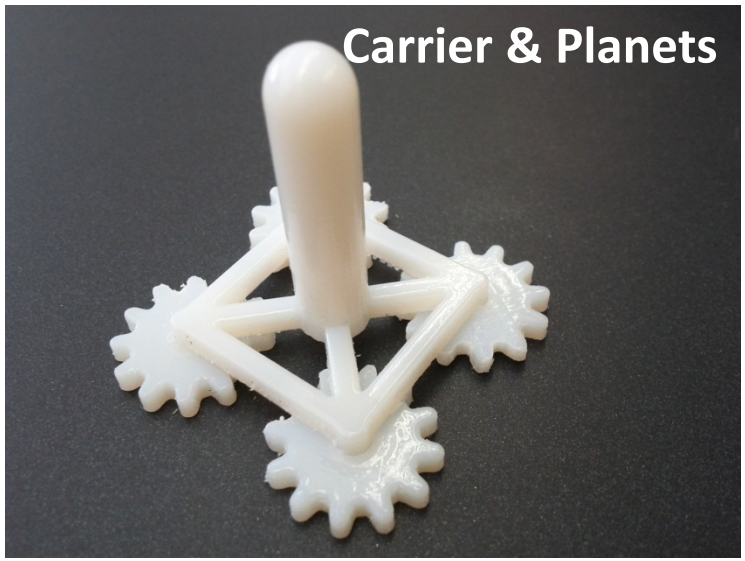
This example includes the use of:

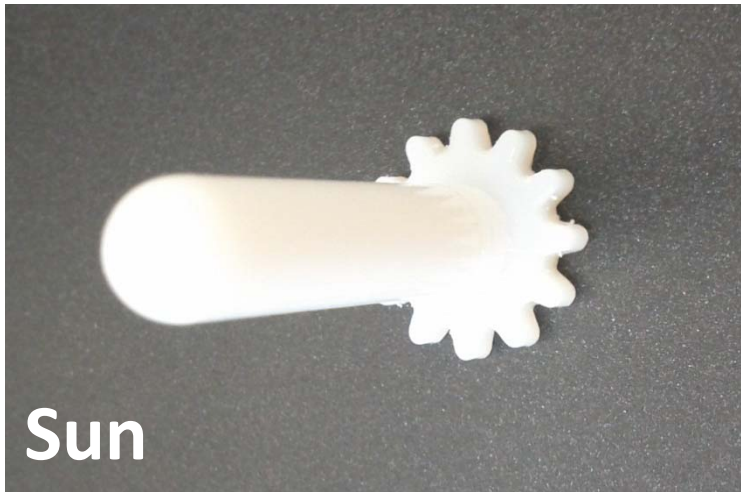
- External Gears
- Internal Gears
- Captive Shafts
- External Retaining Rings
- Internal Retaining Rings



Planetary Gear Set Components



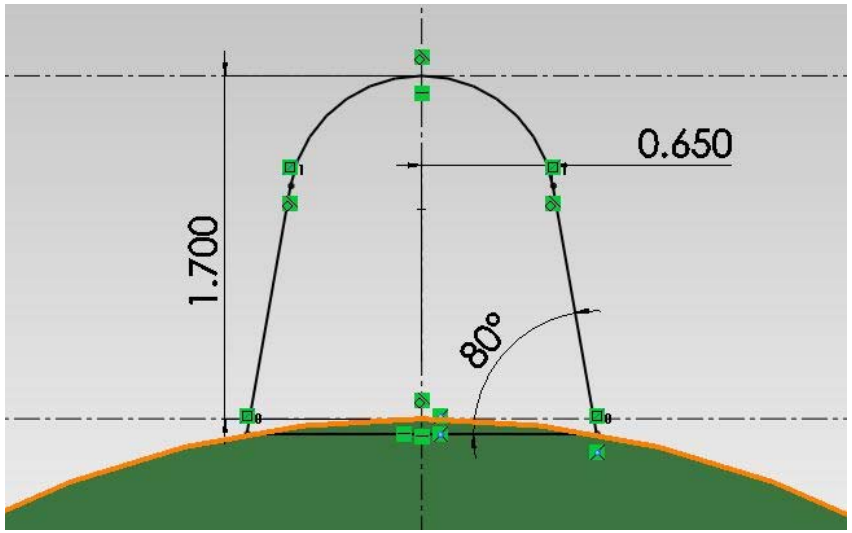


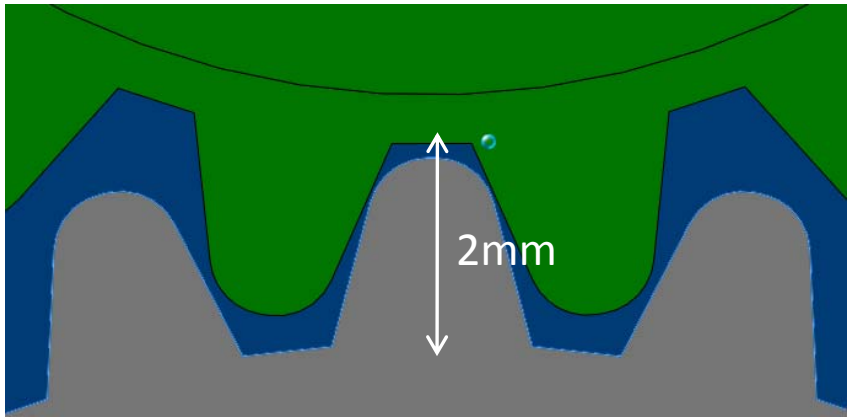


External Gears

The following spur gear design works well:

- Wheel diam = #teeth - 2
- Tooth **corner** coincides with wheel surface
- Tooth comprised of two lines and a tangent arc
- Align mating gears so that distance between gear wheel surfaces is 2mm
- Gear should be at least 2mm thick

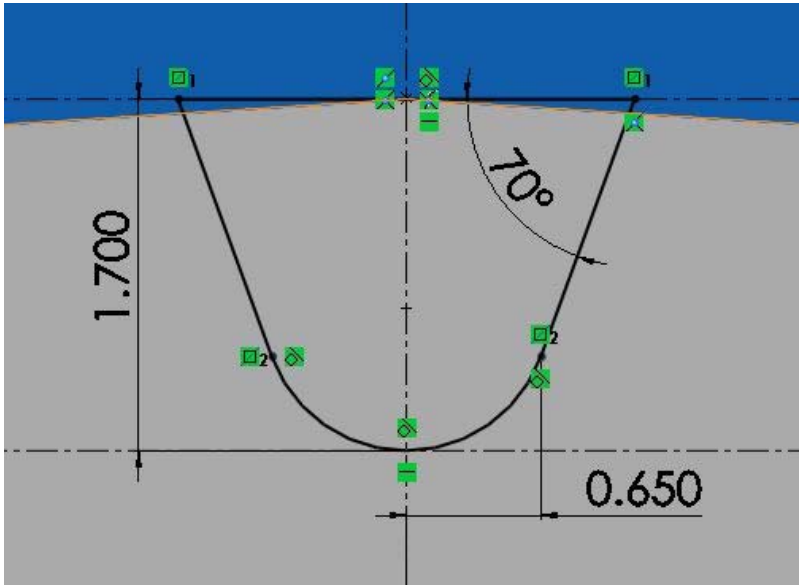


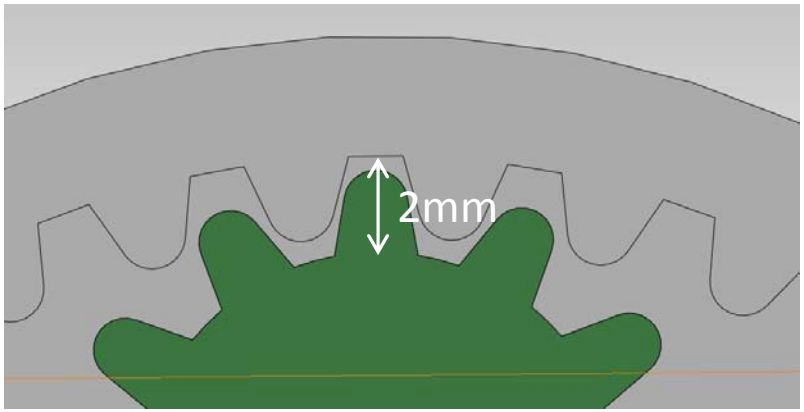


Internal Gears

The following spur gear design works well:

- Wheel diam = #teeth + 2
- Tooth **center** coincides with wheel surface
- Tooth comprised of two lines and a tangent arc
- Align mating gears so that distance between gear wheel surfaces is 2mm
- Gear should be at least 2mm thick

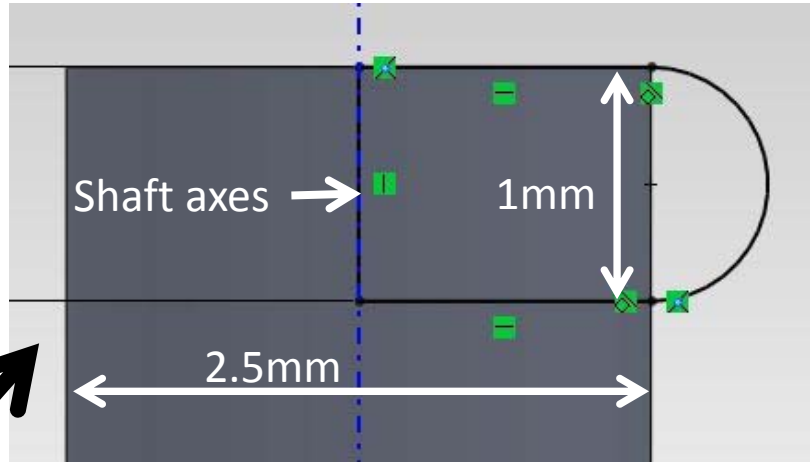


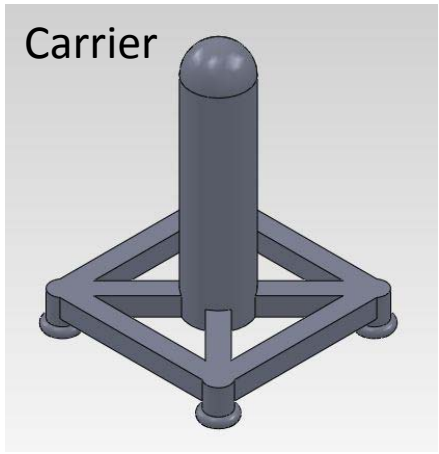


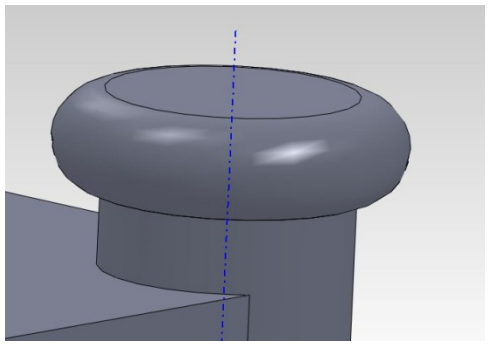
Captive Shafts - Male

Designing captive shafts:

- Draw a shaft with the required dimensions
- Define the axis of the shaft
- Sketch the shape shown (figure above) in the middle of the shaft
- Revolve the sketch around the shaft axis





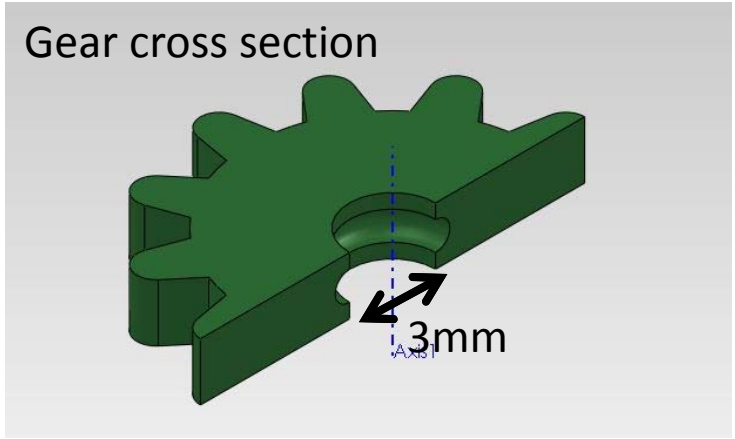


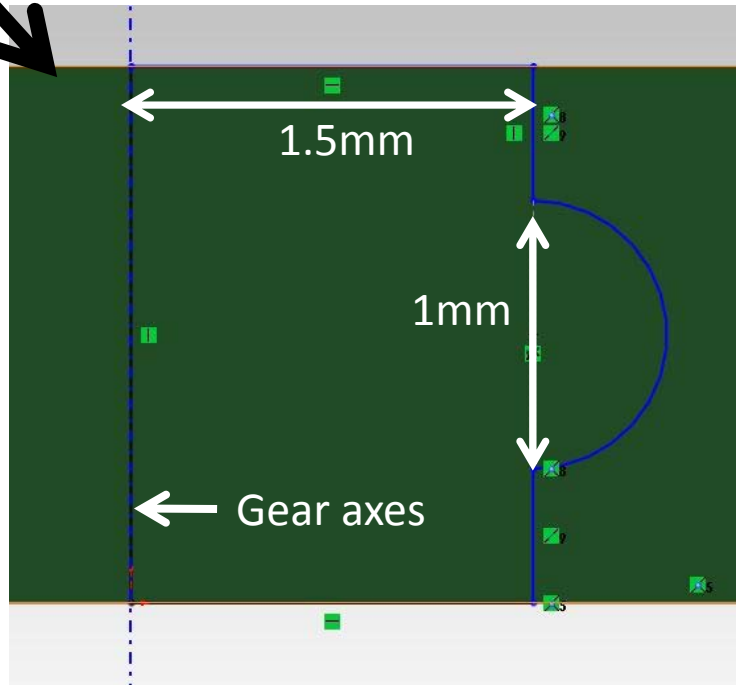
Captive shaft

Captive Shafts - Female

To make the female component:

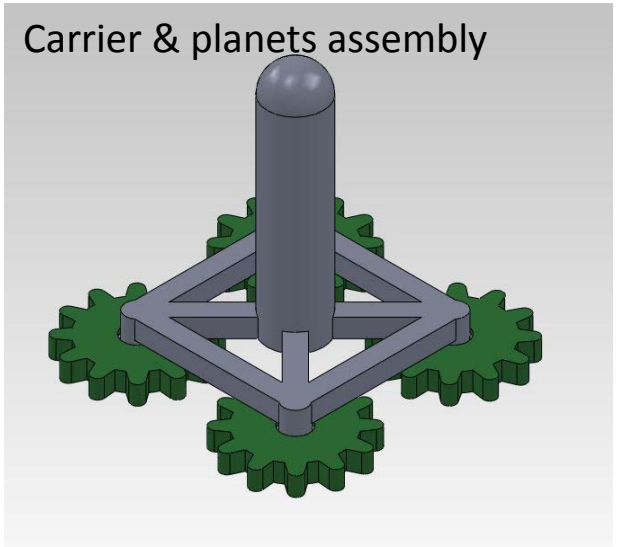
- Define the rotation axis
- Sketch the shape shown (bottom figure) in the middle of the part
- The radius of the half circle must be equal to that of the male part
- Include 0.25mm clearance on each side of the shaft
- Revolve cut the sketch around the rotation axis

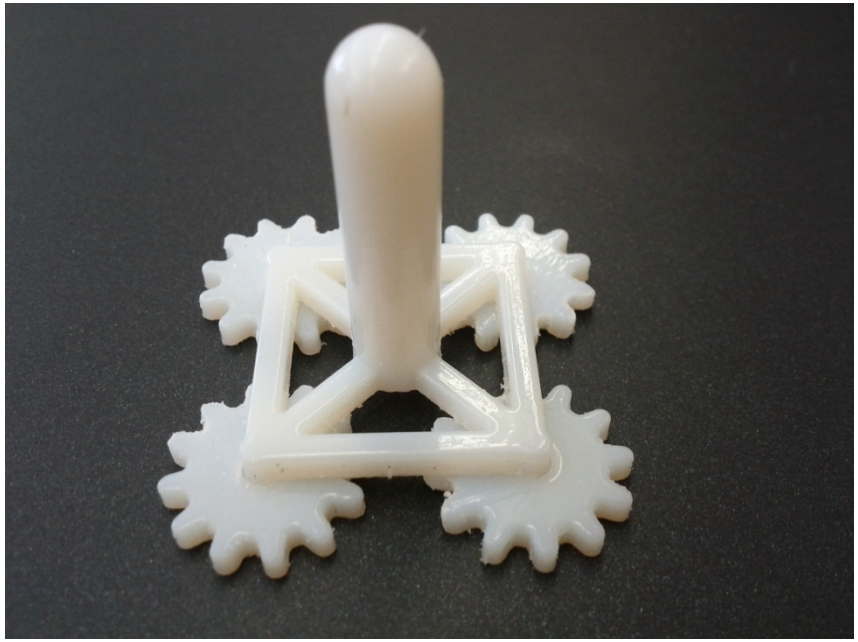




Captive Shafts

- Make as an assembly
- Check for interference (SolidWorks feature) before saving as STL
- Carefully free up components after printing





External Retaining Rings

To create a slot for an external retaining ring:

- 3 important dimensions to look for:
  - ID = Inner Diameter
  - OD = Outer Diameter
  - T = Thickness
- Sketch the shaft:
  - ID’ <= ID – 0.2mm
  - T’ >= T + 0.2mm
- Create a revolved cut

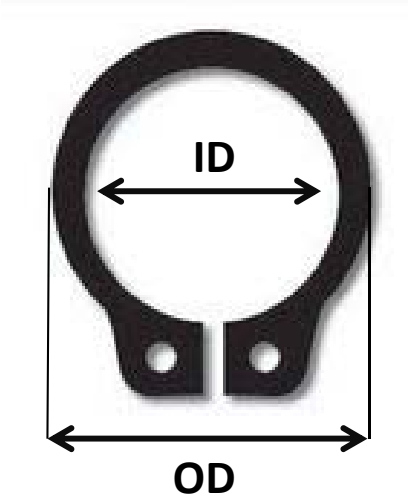
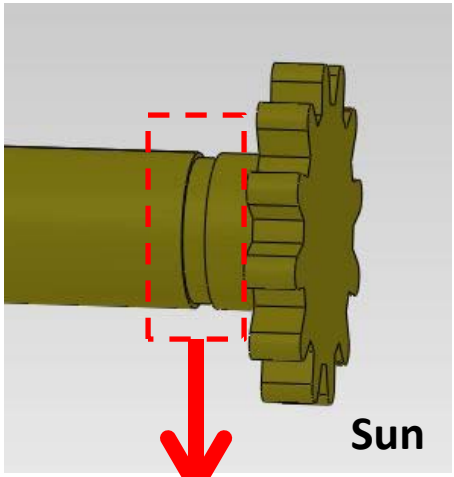
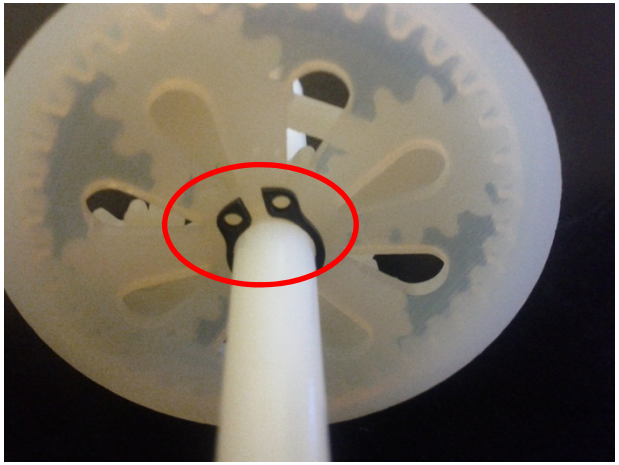
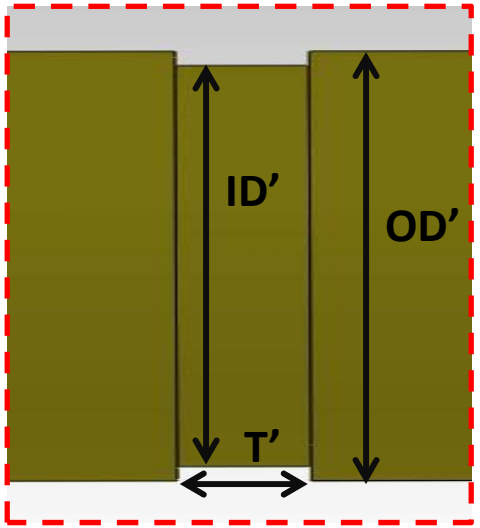


Image source: arconring.com







Internal Retaining Rings

To create a slot for an internal retaining ring:

- 3 important dimensions to look for:
  - ID = Inner Diameter
  - OD = Outer Diameter
  - T = Thickness
- Sketch the slot:
  - OD’ >= OD + 0.2mm
  - T’ >= T + 0.2mm
- Create a revolved cut

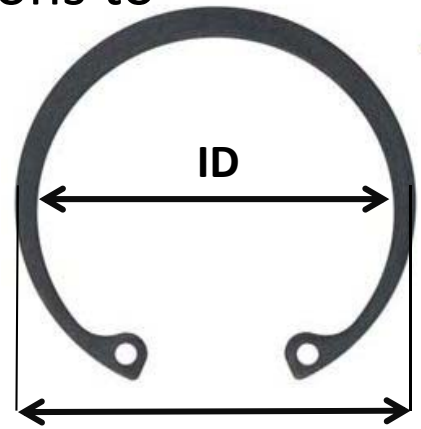
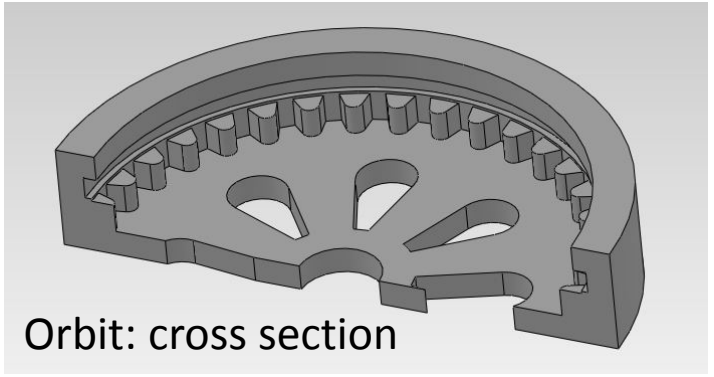
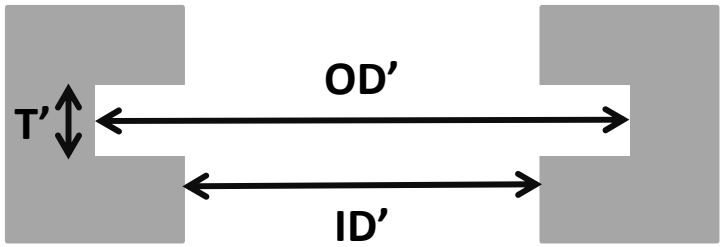


Image source: use-enco.com


Orbit: cross section



cross section