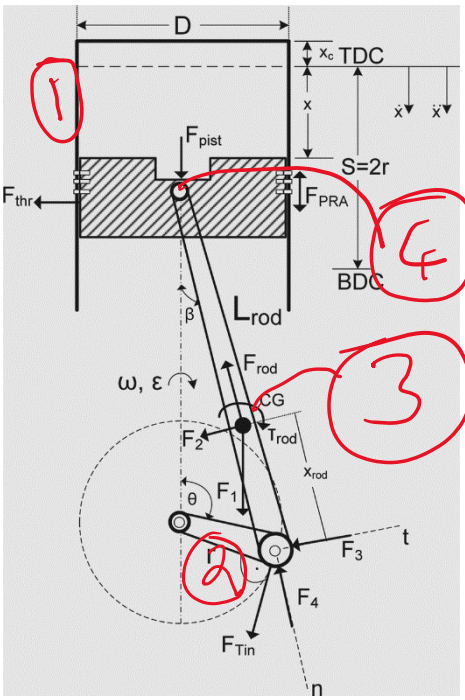
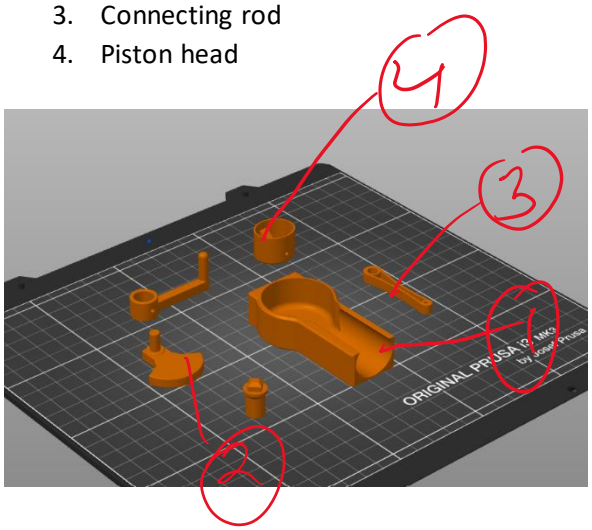
Piston as a four link mechanism

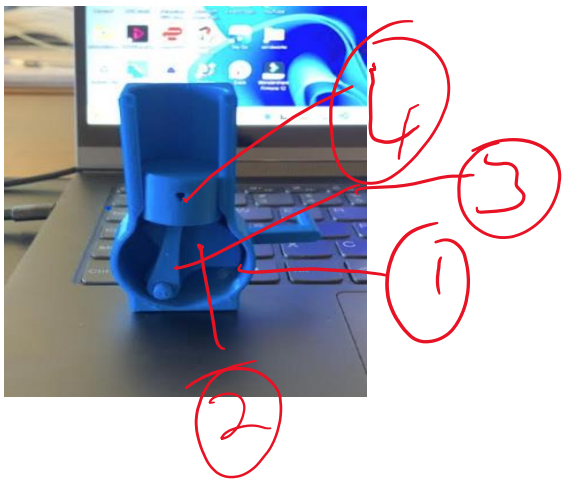
A piston slider is a four link mechanism. It has 3 revolute joints and one prismatic (sliding) joint. A piston follows a crank slider mechanism. The rotation of the crank drives the linear movement of the slider and the explosion and then expansion of the gases against a sliding piston in a cylinder can drive the rotation of the crank. The connecting rod translates the cranks rotational movement into linear movement as the piston moves up and down the cylinder based off the different strokes of the system.



Numbers 1-4 represent the 4 different kinematic links in a piston: See the crank slider piston schematic, the 3d printed parts, and the real life model for reference.

1. Frame and cylinder
2. Crankshaft
3. Connecting rod
4. Piston head





Standard Dimensions of a piston:

The dimensions of the matlab simulation are as follows:

Connecting rod (coupler): 145 mm (0.145 m)

Crank diameter – 43.2 mm (0.0432 m) = radius of 22.6 mm (0.026 m)

These dimensions are based off values taken from a report noting the optimum values for connecting rod designs for diesel engines (Kaya T, 2016).

Equation used to calculate piston position:

$$\underline{rcos(a) + \sqrt{b^2 - r^2 * sin(a)^2}}$$

Where:

Piston position (m)

r = crankshaft radius (m)

b = length of the piston (m)

a = angle of the crankshaft (degrees)

Materials and manufacturers of pistons:

Pistons are usually made from a low carbon steel or aluminum alloy. Carbon steels minimize the effects of differential thermal expansion between the piston and cylinder walls. The top manufacturers of pistons around the world include MAHLE group, Tenneco Inc and Rheinmetall Automotive AG.

Applications of pistons

Pistons can be found in a wide range of applications. They are most commonly known for there function in internal combustion engines for automobiles, aircraft, boats and other vehicles, compressors in refrigerators, gas pipelines, pistons are used in steam engines as locomotive power generators and have used in firearms as well as they convert the energy from the burning gunpowder to the bullet.