

Powertrain and Control

M5X00404

Week 2

Introduction

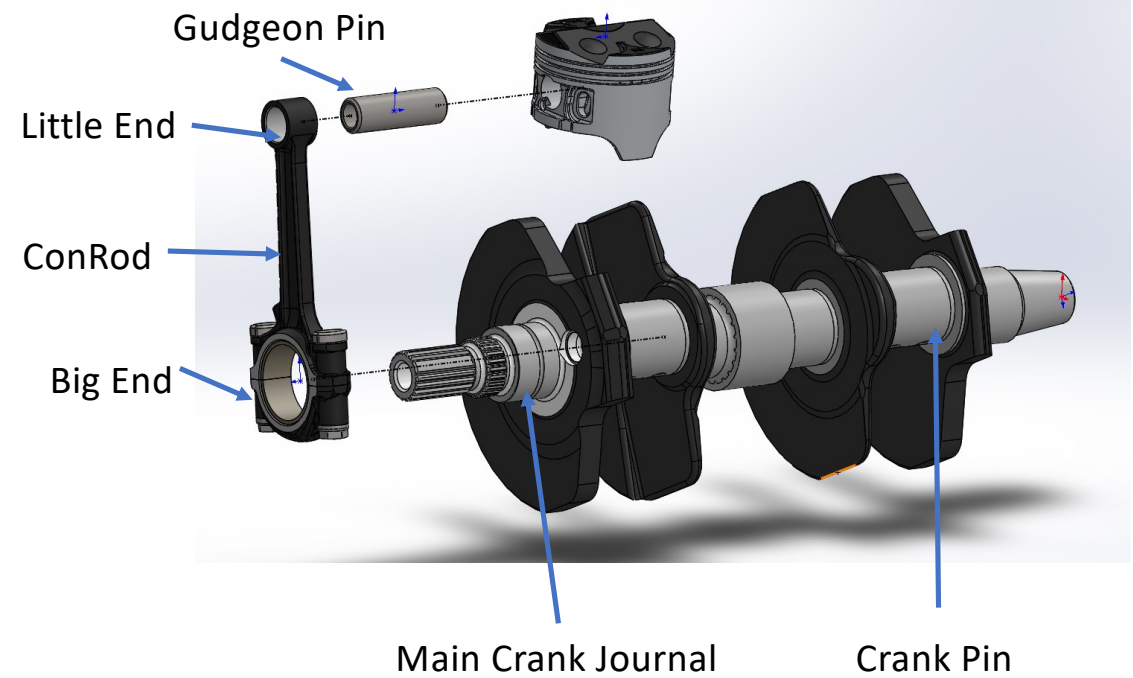
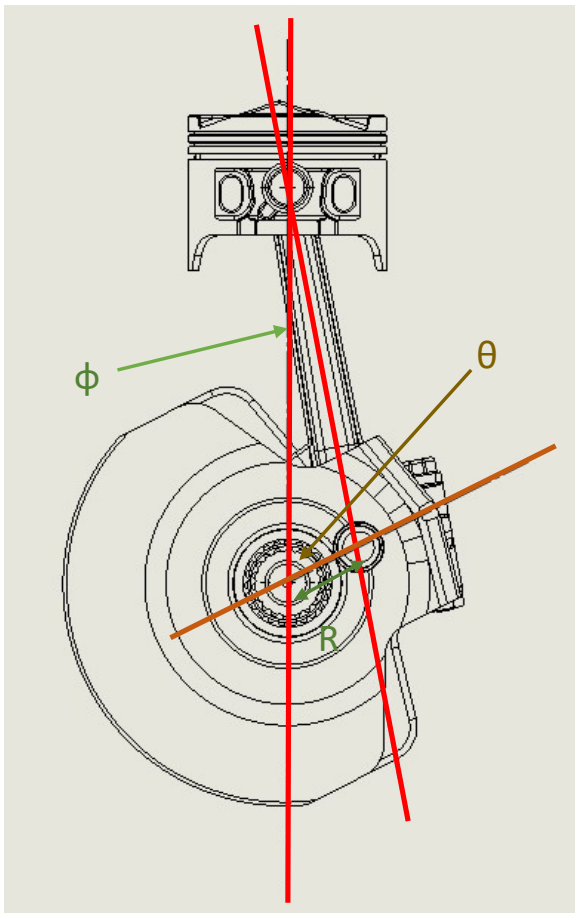
- Students present research to last weeks questions.
 - What is the successor to the NEDC and how is it different?
 - Why do you want to lower the temp in cylinder after combustion?
 - What are we trying to achieve with good flow in a cylinder head?



V8 5.7l with a 90° bank angle.

Each cylinder has a displacement of $\frac{5.8}{8} = 0.7l = 700cc$

Terminology

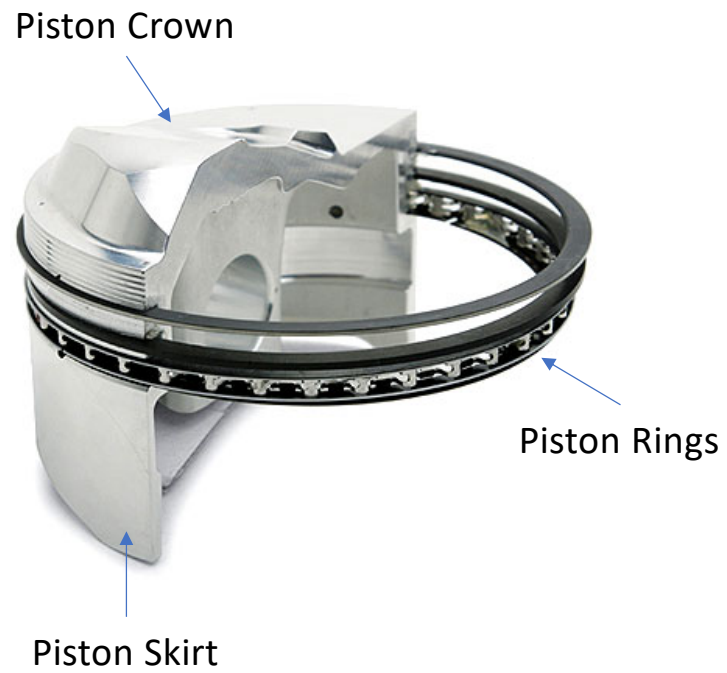


Lubrication

Bearing shells that have had low oil supply or oil starvation.



Piston



Piston Force

- The total downforce at peak pressure = Pressure x Area

E.g. Pressure = 70 Bar = $70 \times 10^5 \text{ N/m}^2$

Bore Area = 98mm

Therefore total downforce = $(70 \times 10^5) \times \frac{\pi \times 0.098^2}{4} = 52800 \text{ N} = 53 \text{ KN} =$
5.3 Tons

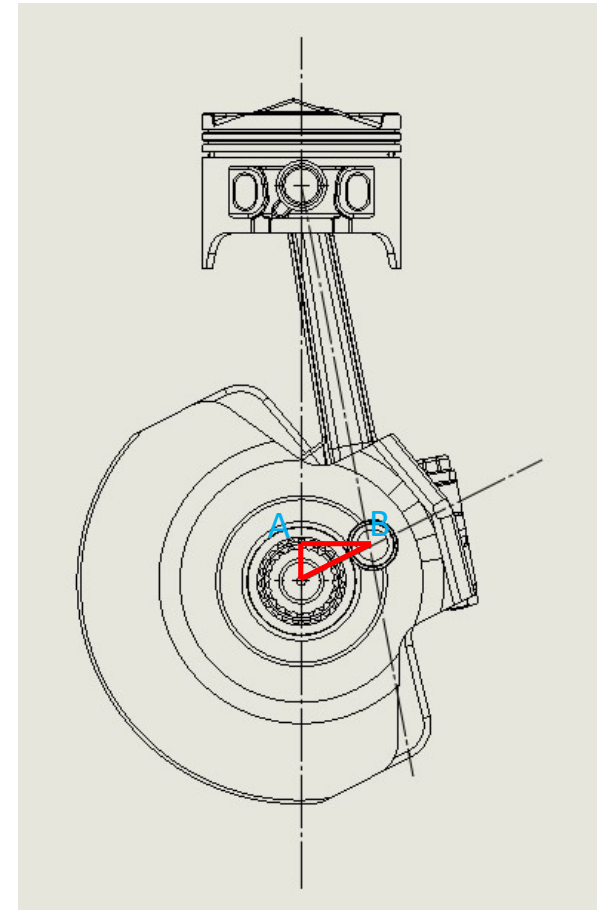
Torque

θ = Crank Angle

Torque from vertical force = 53000 x A.B (Nm)

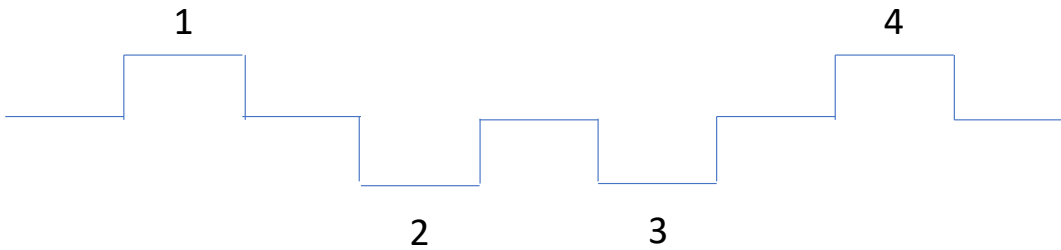
= 53000 x R.Sin θ

Therefore Torque = $P \times \frac{\pi \times B^2}{4} \times R \cdot \sin\theta$ (Nm)



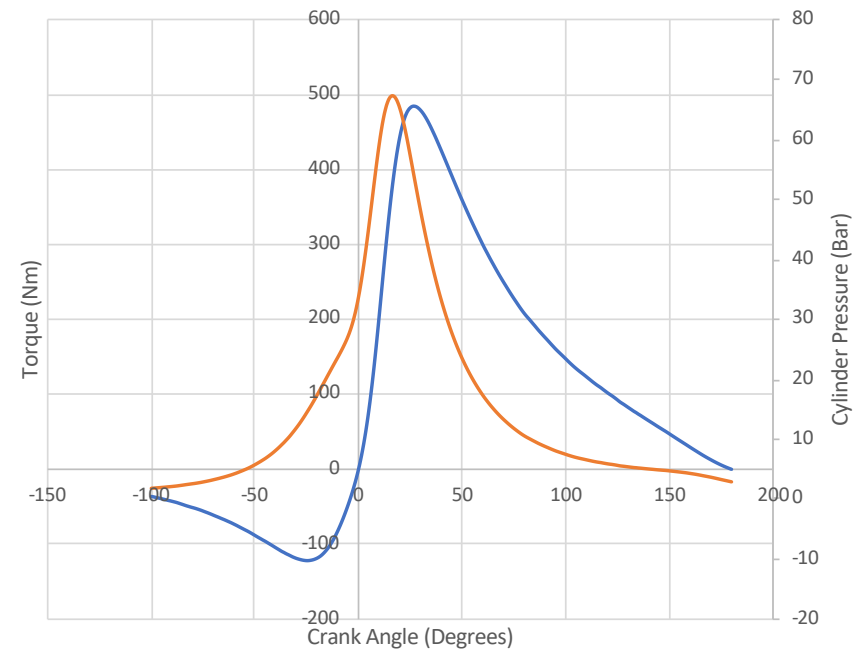
Firing Orders

Inline 4 Crank Layout



- On an inline 4 there are two firing orders – 1342, and 1243.

Cylinder Pressure & Combustion Torque vs Crank Angle



Engine Power Calculations

- Honda Civic 2l, max power is at 8500 RPM
- 4 Cylinder engine, so each cylinder = $\frac{2000}{4} = 500\text{cc/cylinder}$.
- Each cylinder sucks in air once in 2 revolutions, in 1 revolution the engine intakes 1000cc of air (if volumetric efficiency is 100%).

Engine Power Calculations

- Air/fuel ratio = 14.7:1 (Stoichiometric)
- Calorific value of Gasoline $\approx 44 \times 10^6 \text{ J/kg}$
- Calorific value of Ethanol $\approx 30 \times 10^6 \text{ J/kg}$
- 1 HP = 0.746 kw

Other fuels

- Calorific value of Gasoline $\approx 44 \times 10^6 \text{ J/kg}$ with AFR of 14.7:1
- Calorific value of Ethanol $\approx 30 \times 10^6 \text{ J/kg}$ with AFR of 10:1
- Calorific value of Methanol $\approx 23 \times 10^6 \text{ J/kg}$ with AFR of 6:1

Individual Task

- Calculate the following using the Civic parameters but with Ethanol and Methanol –
- Potential Energy
- Final HP at 30% efficiency