ME-418

HEAT ENGINE SESSIONAL

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Contents

1 Experiment 04: PERFORMANCE TEST OF A PETROL ENGINE AT WIDE OPEN THROTTLE (WOT) CONDITION (Ehsan Sir)

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- Accelerator: Change the position of throttle valve
- Main power control mechanism → throttle
- Crank-piston mechanism → rotational torque (created by the push of pressure)
- Mechanical power: Torque × Angular velocity
- If throttle opens, Torque ↑, speed ↑
- Variable speed engine. 3 ways:-
  (a) Torque same, speed different,
  (b) Torque different, speed same,
  (c) Torque different, speed different. (in this experiment, this is the case. Also automotive industries follow this.)
- Without high speed, we can't get high power.
- Rated power: The maximum power that can be operated by machine.
- BSFC: Brake specific fuel consumption. (Fuel consumption per unit power, unit - kg/kW-hr or g/hp-hr)
- The less the BSFC, the better the engine efficiency.
- BSFC is measured mass basis, not volume basis. Just to maintain consistancy in all weather or place condition.
- To get the mass basis, have to multiply specific gravity with volume basis.
- Dynamometer: A device to measure torque. In real life, it is not used. It is used to check before actual action. Only for performance evaluation.
- Types of Dynamometer:
  a) Mechanical brake dynamometer
  b) Hydraulic dynamometer / Water brake dynamometer
  c) eddie current dynamometer
- Hydraulic dynamometer is more effective than others, taking less space.
- off load / idle condition: When there is really no load, then there will be no power. When there exist something to comsume power, then it is called on load condition.
- Brake → Mechanical Energy → Friction → Heat
- Viscosity responsible for braking in water brake.
- High speed, high braking power or high resistance.
- In this experiment: we won't allow to cross the temperature more than 60°. As boiling doesn't occur. Will remove the hot water.
- Variable load: By changing the water level. Depending on water level, resistance will also vary.
- the more the horse power, more heat or temperature will be produced.
- Will change the orientation of blade, by lead screw mechanism.
- $Q = \dot{m} C_v dT$
  a) Q = heat energy
  b) $\dot{m}$ = mass flow rate. Q Can be changed by varying $\dot{m}$
  c) C_v = specific heat capacity at constant volume. Constant
  d) dT = change in temperature. Limited to 60°C
- Engine: 2 power.
  a) Indicated power: $W = \int P\, dv$. Inside cylinder.
  b) Brake power: Indicated power - Internal loss = output power = Torque × Speed
- Speed measure: Magnetic induction tachometer. Magnetic flux intensity mechanism.
- Intensity depends on: materials and magnetic field.
- Speed: There are some grooves (khaj) in shaft. so distance varies. As a result, although having the same magnetic field, magnetic intensity differs. By faraday law, voltage will be induced in milivolt scale. From there, rotation speed can be measured.
- Torque: Measured indirectly from reaction torque. Because, directly torque measing from a moving object is not so easy. We engine will start, due to reaction, an opposite sudden move of casing will be generated. From there, reaction torque is measured.
- Here, first we measure force. The transducer which can measure force in Load cell. Here, whitstone bridge principle is used.
- After calculating force, from calibration chart equivalent load in calculated.

- Then, torque is calculated from the equivalent load and radial distance.
- $hp = \frac{W \times N}{3000}$, given my the machine manufacturer to easily calculate the horse power.
- Derating: When the engine is not in good condition, then the power will be less than the rated power.
- BS5514: 100 KPa [atm pressure], 27°C, 60% humidity.
- α, β = comparison between local condition with ISO condition. Depending on environmental condition, performance can vary 2-5%. These values calculated from the book provided by sir.

Follow Lab sheet also.