



# GASOLINE ENGINE PRACTICUM MODULE



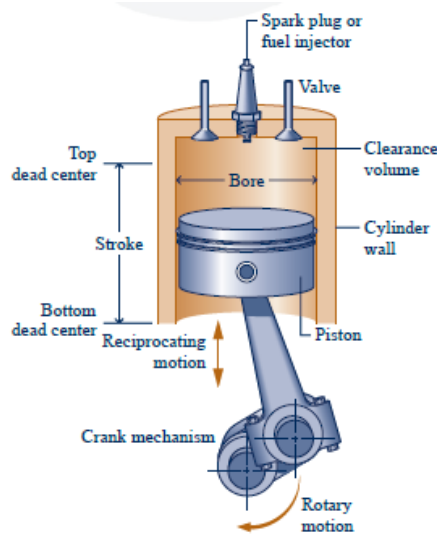
*Thermal  
Engineering*

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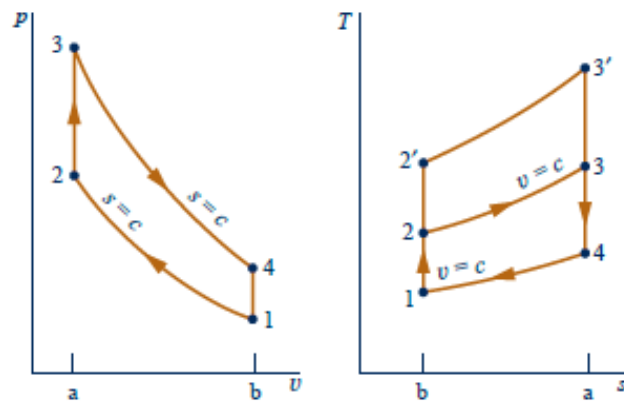
**2022**

A **gasoline engine** is an internal combustion engine that uses a spark plug to ignite a fuel-air mixture (gas). In modern gasoline engines, the fuel is injected directly into the combustion chamber, so that the fuel-air mixes in the cylinder chamber. This gasoline engine, also known as the Otto engine, is designed with a four-stroke and two-stroke process. However, the two-stroke process produces less complete combustion, so the use of this type of engine has been reduced. Otto engine terminology is displayed in Figure 1.



**Figure 1.** Otto Engine Terminology

A work cycle in otto engine is called Otto Cycle. At ideal condition, there are four main process working in Otto cycle that displayed in Figure 2.



**Figure 2** Otto Cycle Scheme in p-v and T-s Diagram

Process 1-2 is an isentropic compression of air as the piston moves from bottom dead center to top dead center. Process 2-3 is a constant-volume heat transfer to the air from external source while the piston is at top dead center (represent ignition). Process 3-4 is an isentropic expansion (represent power stroke after combustion). And process 4-1 is completes the cycle by a constant volume process in wich heat is rejected from the air while piston is at bottom dead center.

# ***GASOLINE ENGINE***

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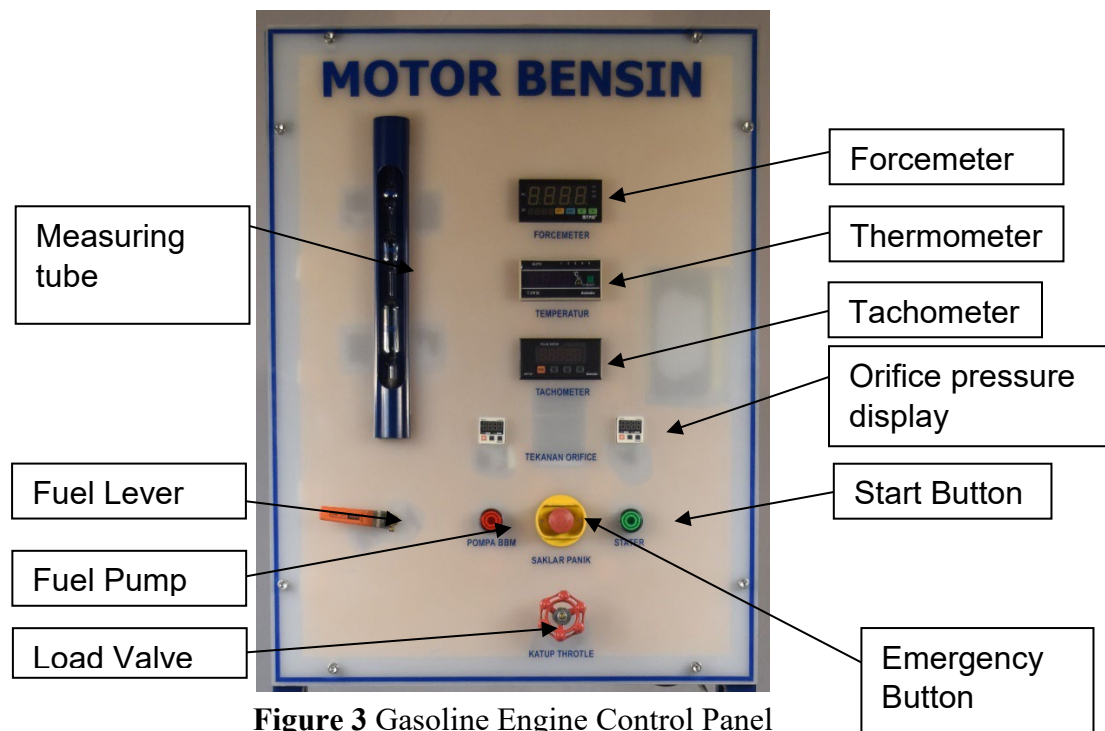
## GASOLINE ENGINE

### Purpose

Study the characteristics and parameters of gasoline engine.

### Gasoline Engine Control Panel

This control panel is equipped to meet the needs of the gasoline engine performance testing practicum which consists of:



**Figure 3** Gasoline Engine Control Panel

- Measuring tube with a capacity of 8 ml, 16 ml and 32 ml cannot be empty when the machine is operating. The minimum limit is still visible in the transparent hose. The bottom is equipped with a three-pronged valve to regulate the flow of fuel from the pump to the measuring cup and to the engine (see flow instructions). Fill fuel by pressing the fuel pump button while paying attention to the fuel elevation in the tube. Avoid fuel overfilling in the upper transparent hose.
- Emergency button, to deal with dangerous failures. Always closed position (OFF) for safety when the machine is not operating.
- Start button, to run the machine.
- Orifice pressure display at orifice inlet and outlet. The pressure difference is seen from the difference between the two pressures on the display. The unit uses a vacuum mmH<sub>2</sub>O.

- e. The forcemeter in Newton units is the result of measurement on the hydrobrake with the radius of force occurring at 111.5 mm from the turning point.
- f. The tachometer measures the rotation of the motor in revolutions per minute.
- g. Temperature (°C) consists of five channels where: 1. Air enters the orifice, 2. Exhaust gas channel, 3. Lubricating Oil, 4. Cooling air exits and 5. Hydrobrake water.
- h. Load Valve, regulates the filling of water in the hydrobrake, does not close the maximum flow (for hydrobrake safety).

### Testing Procedure

- a. Preparation before running
  - 1) Check the water for the hydrobrake in the reservoir filled  $\frac{1}{2}$  to  $\frac{2}{3}$  of the reservoir.
  - 2) Check the lubricating oil on the dipstick.
  - 3) Emergency button is closed.
  - 4) The position of the gas valve opening at low rotation conditions.
  - 5) Fill fuel in the fuel tank.
  - 6) Plug in the battery cable.
  - 7) Make sure nothing is intergering with moving or rotating parts.
  - 8) Connect the panel electricity to a 220VAC power source.
- b. Running Test Equipment
  - 1) Open the emergency button (turn right)
  - 2) Turn the engine switch key to the ON position, the instrument and water pump become active.
  - 3) Press the fuel pump button, if necessary fill the measuring hose.
  - 4) Position of fuel faucet flow is horizontal.
  - 5) Wait until the water comes out of the hydro brake drainage.
  - 6) Press the starter button, until the engine runs.
  - 7) Pull the cock lever, if the engine is difficult to start and press it again when it is running.
  - 8) Let the engine run until it is stable (normal) at minimum load.
  - 9) Keep the measuring hose not empty, press the fuel pump button if necessary at the Vertical faucet position.
- c. Testing
  - 1) Check whether all instruments are functioning properly.
  - 2) The test is carried out at a fixed load, open the water valve according to the required load (pay attention to forcemeter).
  - 3) Set the engine speed by shifting the gas valve opening lever (pay attention to the rotation).
  - 4) Increase the engine speed according to the required data instructions.
  - 5) Hold the engine, move the fuel valve when flow to engine and timer is activated.

- 6) Observation or measurement of the required fuel volume data, pay attention to the timer while looking at the measuring hose.
  - 7) After holding the load for a while, set the rotation and load lever to a minimum.
  - 8) While the engine is running the measuring hose must always be filled with fuel.
  - 9) Repeat from steps 5 to 8 until sufficient data is obtained.
  - 10) Turn off the Machine.
- d. Stopping testing equipment
- 1) Turn the engine switch key to the OFF position, the engine and all instruments and water pump stop.
  - 2) Press the emergency button.
  - 3) Remove the Battery.
  - 4) Empty the fuel in the tubr and tank.
  - 5) Empty the hydrobrake water in the reservoir.

### **Safety instruction**

- a. Press the emergency button in an out of control situation.
- b. Avoid engine speed exceeding the maximum rotation.
- c. Hydrobrake water always flows when the machine is operating to avoid damage to the hydrobrake.
- d. Avoid overfilling the tank and measuring tube.
- e. Avoid emptying the fuel in the transparent hose under the measuring tube.
- f. Empty fuel in tank and measuring cup when not operating.
- g. Removing the panel's electrical connection to a 220VAC power source
- h. Disconnect the battery when not in use.
- i. It is not permitted to change the installation of instruments, both cables and hoses.
- j. Open the back cover of the instrument panel.
- k. Do not operate the machine alone.
- l. Do not smoke or start a fire.
- m. Always have a fire extinguisher handy.

### **Keyword For Theoretical Foundations**

1. Twisting Moment ( $M_t$ )
2. Fuel Consumption ( $B_e$ )
3. Average Effective Pressure ( $P_e$ )
4. Volumetric Efficiency ( $\eta_v$ )
5. Thermal Efficiency ( $\eta_{th}$ )

## Supporting Tools



**Figure 4** Gas Analyzer Gasboard 5020



**Figure 5** BST 360



**Figure 6** Opacity Meter Gasboard