

2.72 MACHINE LABORATORY #2

FALL 2001

The second machine laboratory will use the same lawnmower engine which was disassembled to answer some general questions about its function and design in Lab#1. Please disassemble the engine to the extent necessary to answer the following specific questions (quantitatively where required). Measurement of component sizes and calculations can be approximate (i.e. +/- 1/8 inches and +/- 10-20%). Please note that the lab will count as a PS (towards 40% of your grade) and that you have all of this week's lab hours to complete the lab report (not just the hour spent in the lab).

- 1) For its peak horsepower and torque output, what determines and limits the minimum physical size of this engine??? (i.e. why isn't it half its size?). BRIEFLY discuss 2-3 of the engine's functional components (main housing, main shaft, cam shaft, piston, fly-wheel, carburetor, starter mechanism...etc.) in terms of their size and why they were not made smaller.
- 2) The output torque/speed curve for this engine shows a maximum torque output at a particular speed (which is approximately the same as the speed at which the engine puts out its maximum horsepower). BRIEFLY discuss why HP and output torque peak at a certain speed and drop off below and above that speed.
- 3) For the same overall engine configuration how would you change the displacement of the engine (i.e. piston area and/or the stroke) to produce 1/2 the peak output horsepower of this engine?
- 4) If you wanted the peak horsepower of the new engine (1/2 of present HP) to remain at about the same engine speed as on the present engine, suggest a new piston diameter and stroke. Measure the present piston and stroke and use them as a guide. BRIEFLY explain why you chose the new sizes.
- 5) Measure the maximum functional dimensions of the main shaft (output shaft diameter and length, length of crankshaft portion of main shaft, support diameters of main shaft at the two support ends and the piston rod bearing). Make a scaled sketch of the main shaft (isometric and side view). How would your new piston and stroke specifications effect all of these dimensions?? (i.e. could you make them half size? Or what ratio?). Why?
- 6) To minimize the overall size of the new engine (1/2 peak HP of present engine), would you try to keep the speed at which maximum HP occurs at about the same speed as the existing engine (as in 4-5) or would you increase or decrease that speed? Why?

Feel free to discuss the questions within your lab group and make common measurements, but make necessary calculations/estimates and respond to the questions individually. Refer to the text-book, Mark's Handbook, and/or other references as necessary.