THE UNIVERSITY OF NEW SOUTH WALES
SCHOOL OF MECHANICAL AND MANUFACTURING ENGINEERING
MECH3110 MECHANICAL DESIGN 1
SEMESTER 2, 2015

T7: Bolt Assignment (10%)

Due: Friday, Week 12

A new 2 stroke engine is proposed for use in ride on lawn-mowers, go-carts etc and for simplicity a single cylinder has been chosen of 250 cc capacity.

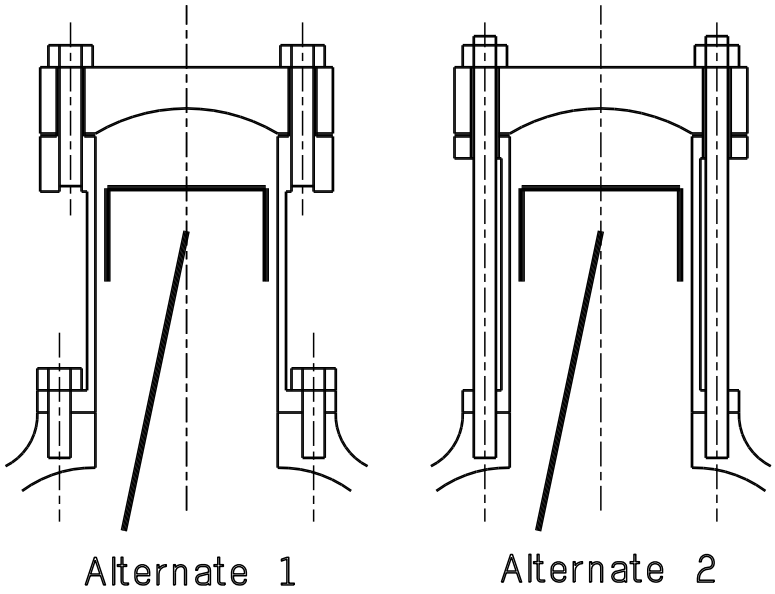
The construction of the engine needs to be considered, in particular the mounting of the cylinder and head to the crankcase.

The first alternative is to fix the cylinder to the crankcase using 4 hexagon headed screws through the flange at the bottom of the cylinder into tapped holes in the crankcase and the head to the cylinder in the same way (tapped into the top of the cylinder).

The second method is to fix both cylinder and head by 4 long studs fitted into tapped holes in the crankcase passing through guide holes in the cylinder flanges and through the head with the whole assembly clamped by nuts on the top of the head.

Design the screws/studs for the engine specified for each of the cases above. The specified thicknesses of flanges and head are not to be changed without good reason and any change must be justified (ie. convince the chief engineer who nominated them).

Make a recommendation on the preferred alternative and specify the bolt size, grade, tightening requirements etc. and support with reasons from calculations. (Based on bolt and engine operation consideration.)



SCHEMATIC LAYOUT OF ALTERNATIVE ENGINE CONSTRUCTION.

ENGINE SPECIFICATIONS.

Capacity	-	250 cc
Bore	-	70 mm
Stroke	-	64 mm
Head		
material	-	Aluminium
thickness	-	25 nominal
Cylinder		
material	-	Cast Iron
wall thickness	-	3 mm
length	-	135 between flange faces
flange thickness	-	8 mm top and bottom
tapped pylons	-	20 mm thick if required
Crankcase		
material	-	Aluminium
tapped pylons	-	20 mm thick
Gaskets		
crankcase	-	None
head	-	1 mm Aluminium
Combustion pressure		
normal	-	1.1 N/mm^2
badly tuned	-	2.0 N/mm^2

Possible Steps to Follow

Force Flow Diagrams to find load paths

Force on piston at design pressure

Static calculation to estimate bolt size (optional but good idea)

Spring model of system and determine spring rates, k

Member

End caps

Cylinder

Bolts

Pretension force in bolts (for % of Sy)

Spriing Rate Diagram (check for separation)

Determine mean and alternating forces/stresses in bolt

Draw Goodman Diagram for bolt
- Su
- Sy
- Se for bolt

Locate selectied bolt on Goodman Diagram

Check suitability

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