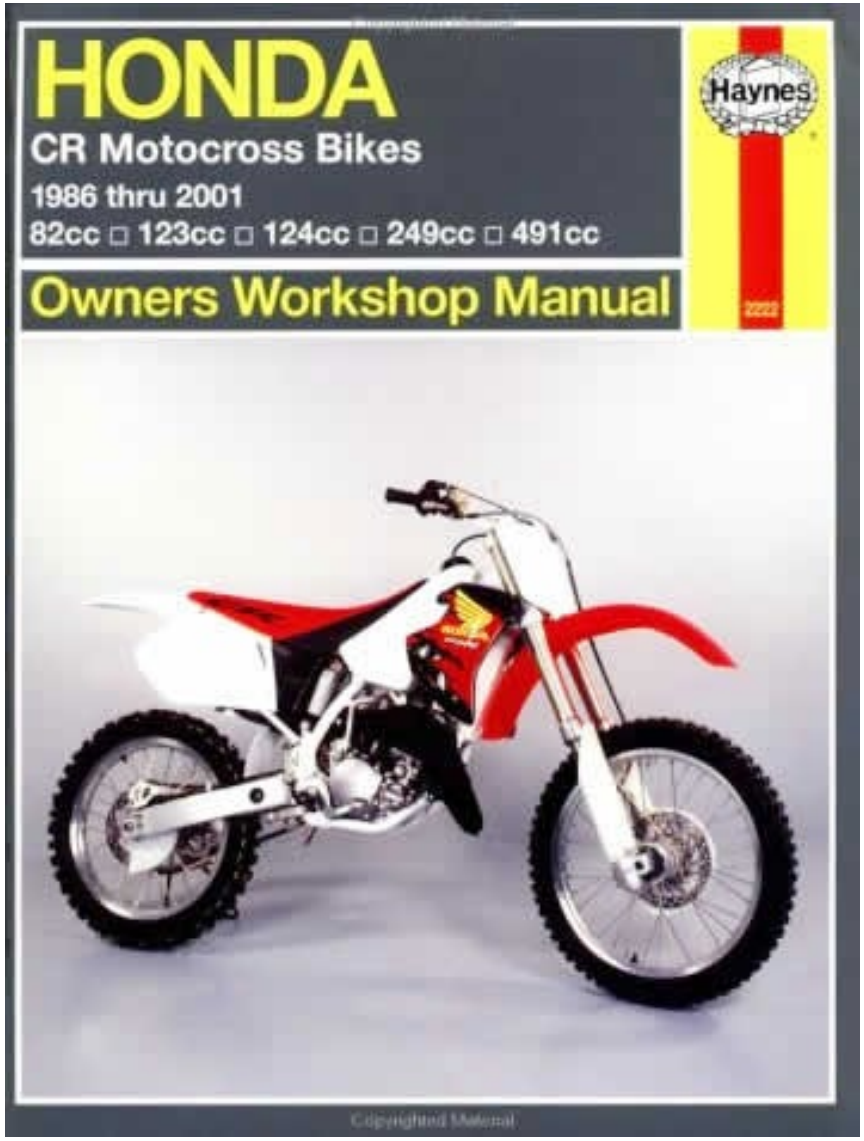
Engine Displacement

The term ‘engine displacement’ may not be familiar to you, or maybe it is…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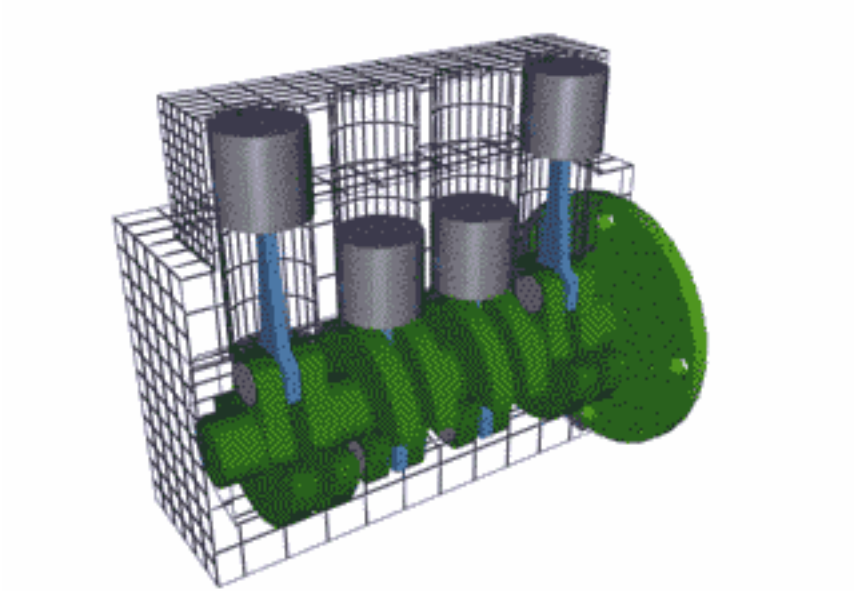
So in layperson's terms, 'displacement' is a description of an engine's size.

But we're learning about engines so let's look a little closer….

Definition of Engine Displacement:

The combined volume that the pistons of an engine move through as they travel from BDC to TDC.



Common Units:

Imperial

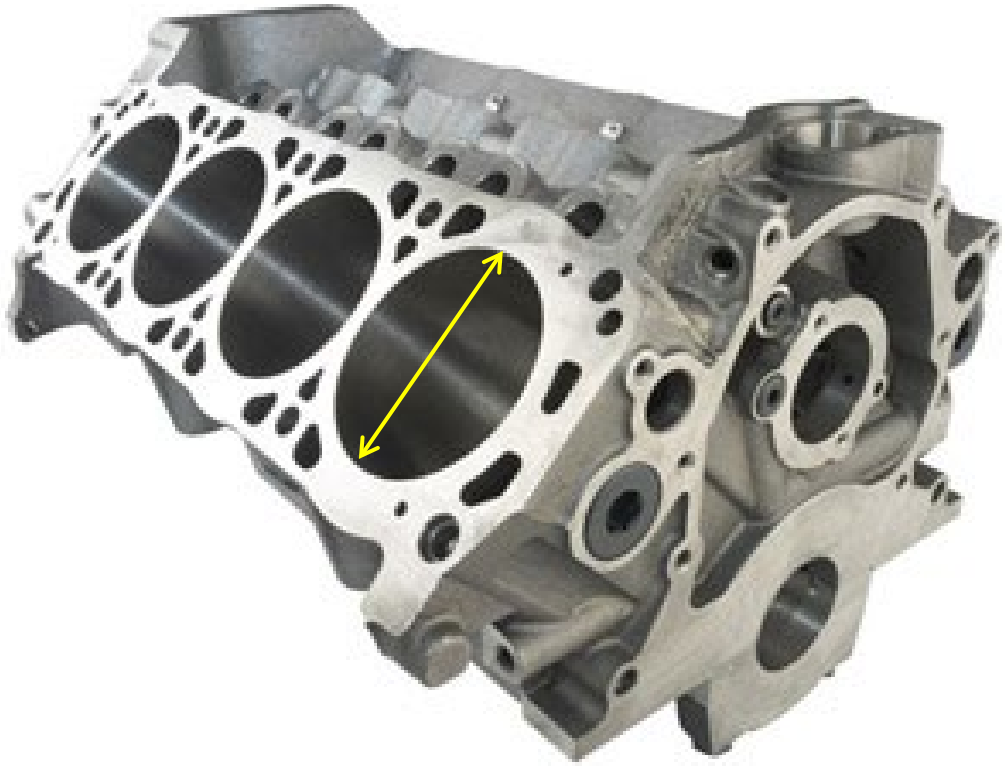
- Cubic Inches (c.i.)

Metric

- Cubic Centimeters (c.c.)
- Litres (L)

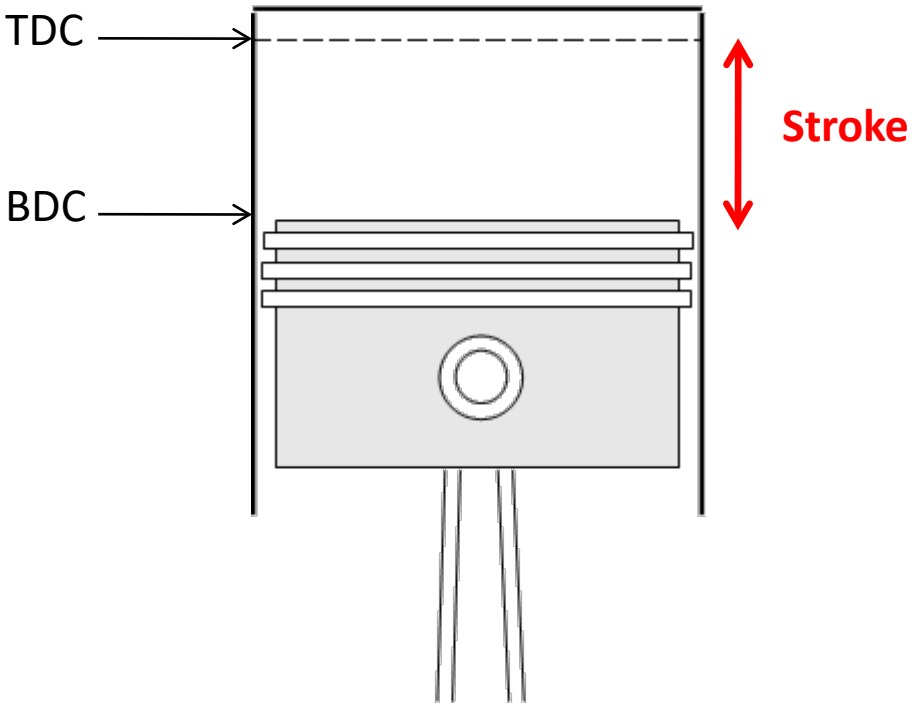
Terms to understand:

1. Clylinder Bore: *Diameter of the cylinder*



Terms to understand:

2. Stroke: *Distance traveled by piston as it moves from BDC to TDC*



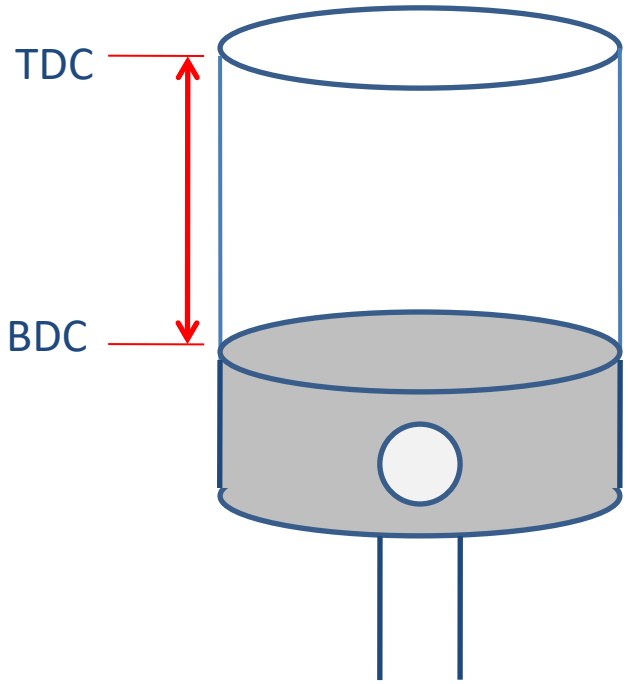
Calculating Engine Displacement

You’re about to be asked to figure out the size, or ‘displacement’, of your Briggs & Stratton Engine

Thankfully, it’s not really that tough, so pay close attention to these next instructions and you should have no problem with the job that follows.

1. Establish a formula

Part of finding an engine's displacement is determining the volume the piston moves through as it travels from BDC to TDC, sometimes called 'swept volume'.

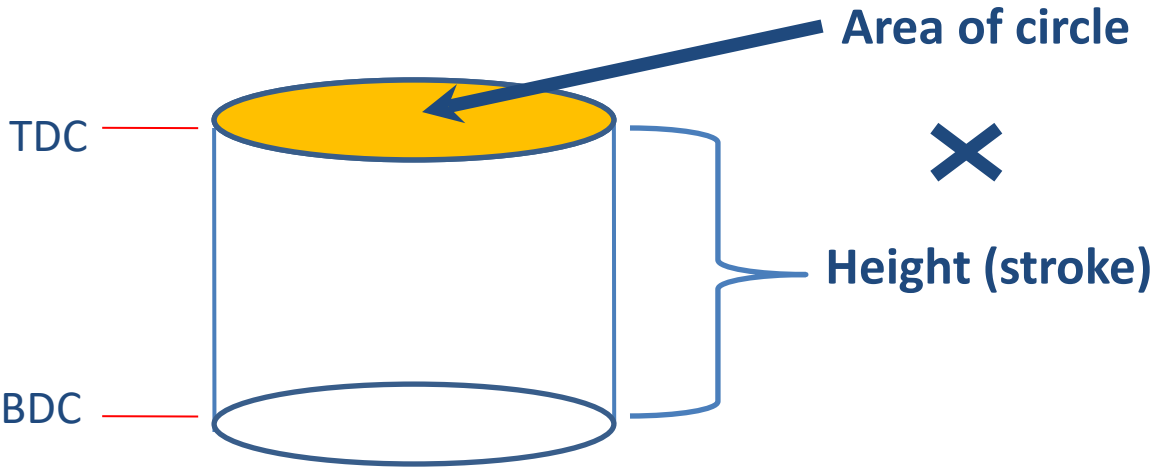


After finding the 'swept volume' for a single piston, we'll multiply this by the number of cylinder's, or pistons, the engine has

1. Establish a formula cont'd.

Let's simplify things a bit…

What we really need to determine is the volume of a cylinder.



Written as an equation = πr^2 x stroke

1. Establish a Formula cont'd.

Now it looks like we've go ourselves a formula for displacement

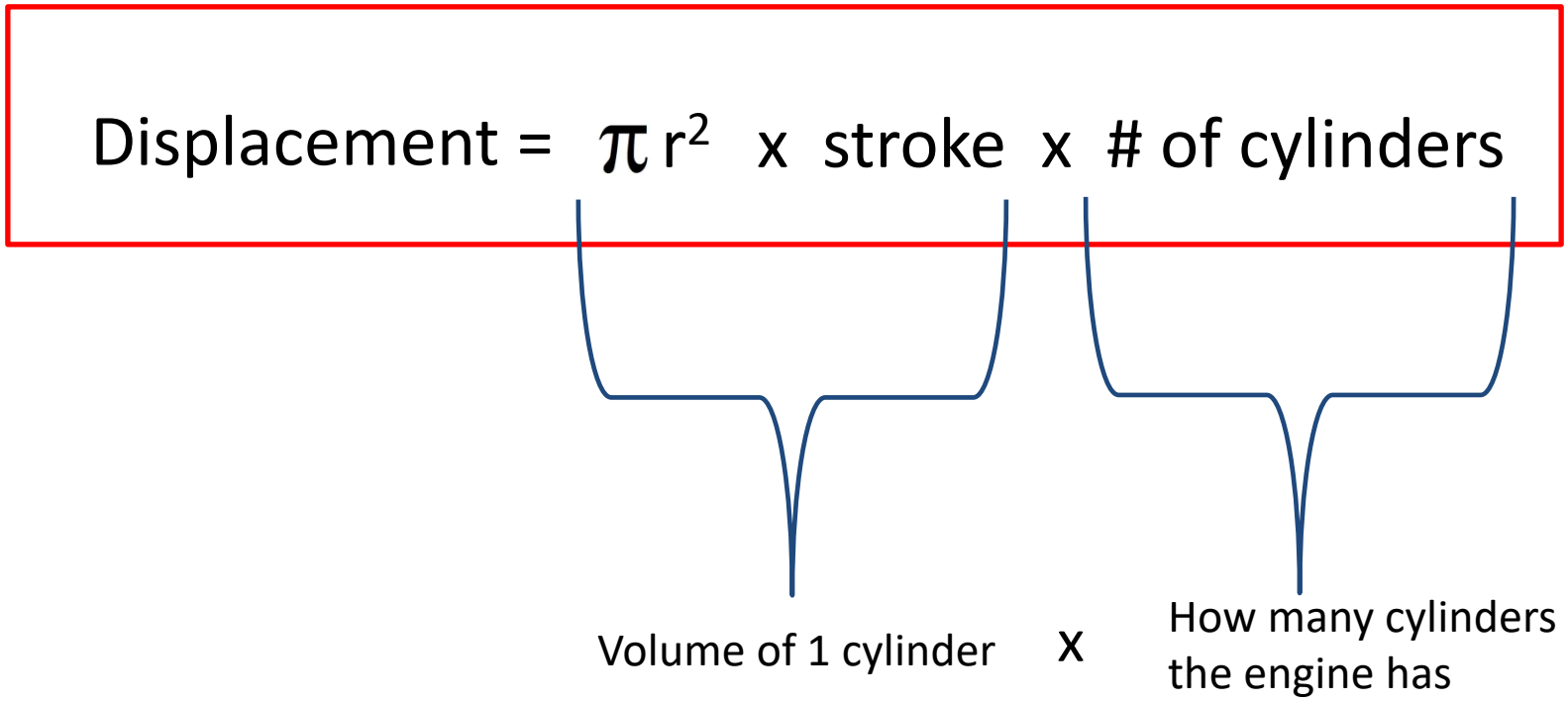
$$\pi r^2 \text{ x stroke}$$

But if you remember back, we're missing one last component.

"The combined volume that the pistons of an engine move through as they travel from BDC to TDC."

And therefore the complete formula looks like this…

1. Establish a Formula cont'd.



2. Collect required info

Displacement = πr^2 x stroke x # of cylinders

Measure the cylinder bore & divide by 2 to get the radius.

Measure the piston travel between BDC & TDC

3. Substitute & Calculate

Let's pretend the engine measurements were:

Bore = 2"
Stroke = 2"
# of cylinders = 1

$$\text{Displacement} = \pi r^2 \times \text{stroke} \times \#\text{ of cylinders}$$

$$= 3.14 \quad (1"^2) \quad \times \quad 2" \quad \times \quad 1$$

$$= 6.28 \quad \text{c.i.}$$

Let's try another quick example

Let's say the engine measurement were:

Bore = 40 mm
Stroke = 40 mm
# cylinders = 1

Caution

The final unit we're looking for is cubic centimeters (cc). It is a **VERY** good idea to change things to cm before going any further!

Bore = 4 cm
Stroke = 4 cm
# cylinders = 1

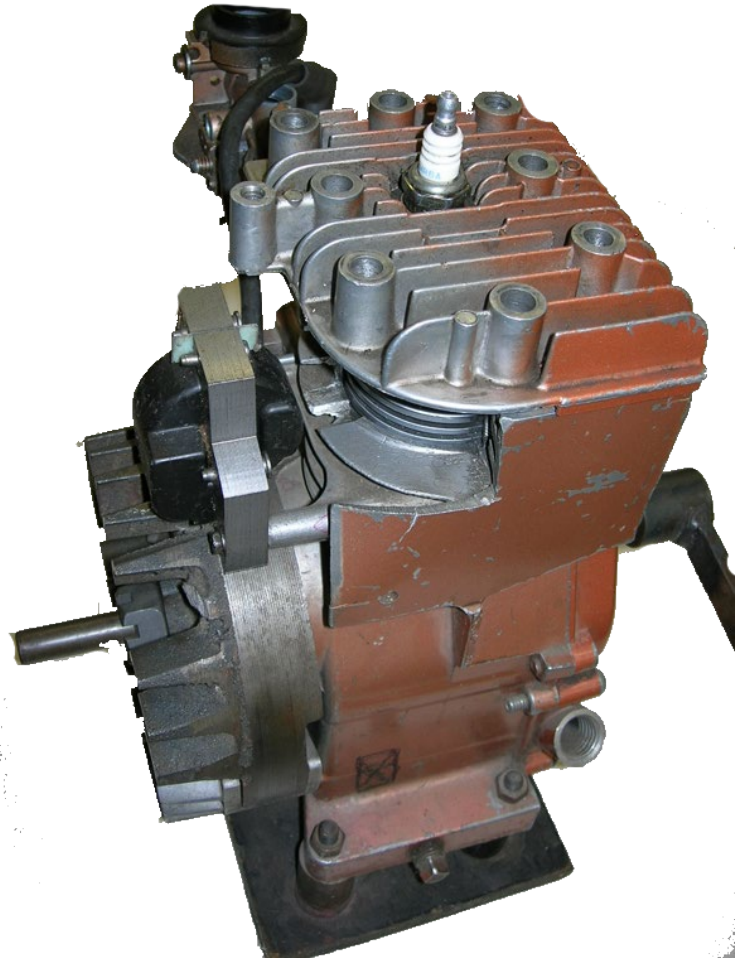
First the formula → Displacement = πr^2 x stroke x # of cylinders

Then, substitute → = 3.14 $(2cm^2)$ x 4 cm x 1

Finally, the answer → = 50 c.c.

A couple of words about doing the actual job

You will be removing and installing the cylinder head and this takes special care.



When removing or installing a cylinder head the fasteners must be removed and installed in a ‘sequence’ as specified by the manufacturer. This is generally called the ‘Torque sequence’. HINT: In the book – Section 6, Page 3

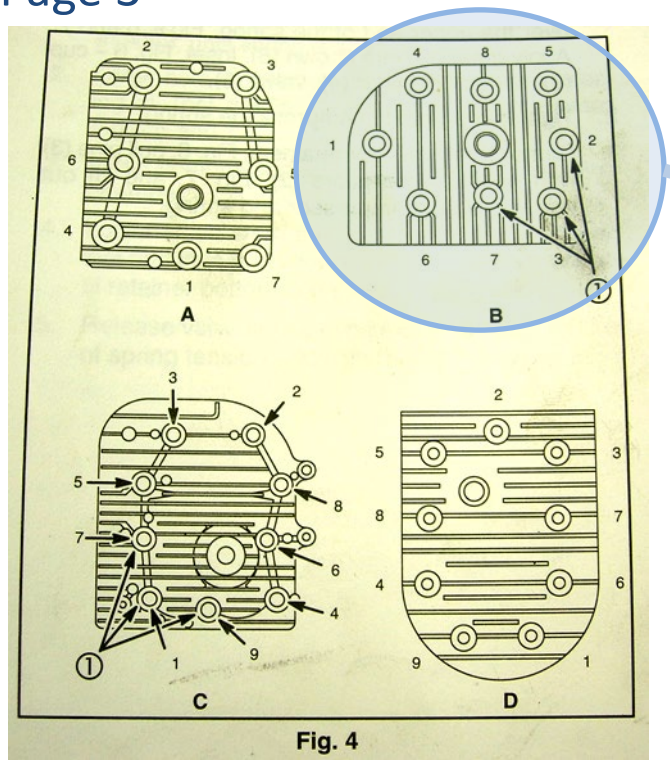
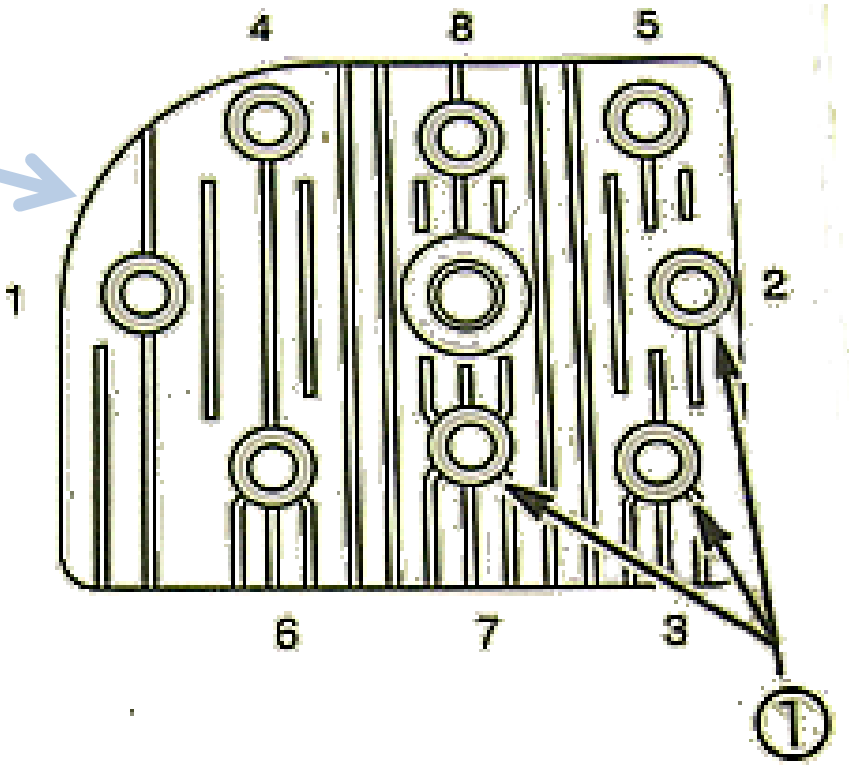


Fig. 4



Note: the sequence specified is always the ‘tightening’ sequence and therefore we work in reverse order to undo the head.

What is the purpose of following a tightening sequence?

When tightening the cylinder head we not only follow the sequence, but we also must ‘torque’ the fasteners to the specified value.

It is <u>best practice</u> to work up to the final torque in two or three steps

Why do you think it is often necessary to ‘torque’ fasteners when assembling engine parts?

Knowing Materials

The lab is going to ask you what the material is that your cylinder head, and your engine block for that matter are made from.

Material Type: Aluminum

Advantages:

1. Light
2. Conducts heat well

Disadvantage: Relatively expensive