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**MANUAL
FOR
PISTON-HEIGHT-MEASUREMENTS
AND
VOLUME-MEASUREMENTS**





Introduction.

This brief manual is made by VHM to give a clear insight into the way of measuring that is used by VHM. And to see the advantages of this way of measuring

In order to have a precise way of measuring, VHM has designed special tools. These tools are; a piston height measuring tool, a volume measuring mould (for combustion chamber volume measurement) and a pipette with fine adjustment.

With these tools we can find very precisely the volume of a combustion chamber.

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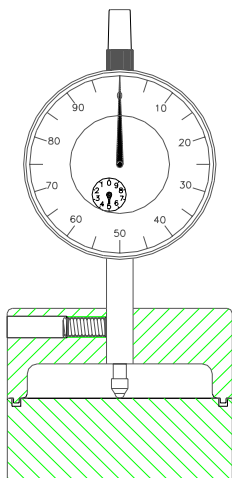
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Why this method and these measuring tools.

1. To set the piston at the right height, this because tolerances on conrod length, crank case height, cylinder height, gasket etc. can be out of measure.
2. To be able to measure in an early stage the sag of the piston crown due to overheating.
3. By measuring the piston height in our way, the compression ratio can be more precise defined. This is very important when you work close to the detonation limit.
4. By measuring on the volume measuring mould, instead of on the cylinder, the engine doesn't have to be removed from the frame. (Because, if you measure, the spark plug hole has to be horizontal.)
5. There are no leaking problems, like for example alongside the piston ring.
6. Piston heights on the engine who are not the same as the height that is written on the mould, can be easily settled. So that the real combustion chamber volume can be simple defined.
7. The right liquid and the pipette with fine adjustment make it possible to have an easy and exact measure.
8. All of this has come out of practical experience and is fully tested in practice.

Zero adjustment piston height measuring tool.

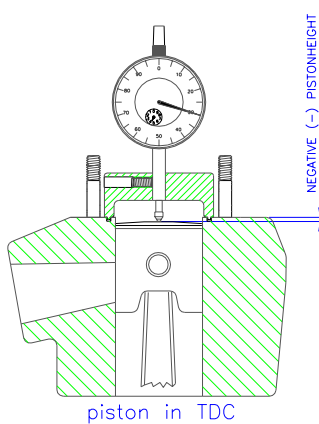


drawing 1

Before using the measuring tool, there first has to be put a zero level on the clock. This has to be done before every measurement.

1. Put the top part on the bottom massive cylinder.
2. Put the clock in the top part and adjust the zero level at 5mm, by moving the clock in the upper
3. Fasten the bolt light (Be careful, do not fasten it to strong. because the measuring pin should be able to move.).
4. Check if the big hand is pointing at zero, if not, then the outer ring can be turned to adjust the clock on zero.

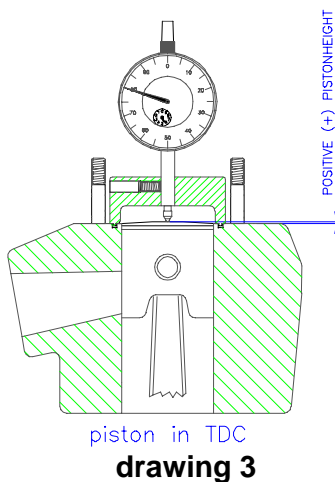
Application of the height measuring tool.



drawing 2

During the measurements, the piston has to be in TDC and there has to be no dirt underneath the measuring area. To be sure that the piston is in TDC, you can turn the crankshaft a bit and find the TDC.

In drawing 2 we speak about a negative(-) piston height. This means that the piston in TDC is lower than the upper part of the cylinder.



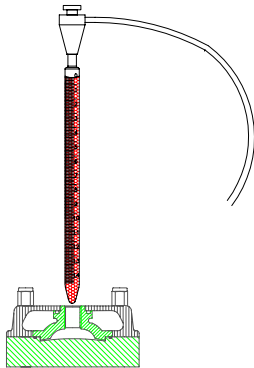
In drawing 3 we speak about a positive(+) piston height. This means that the piston in TDC is higher than the upper part of the cylinder.

How to use the volume measuring mould.

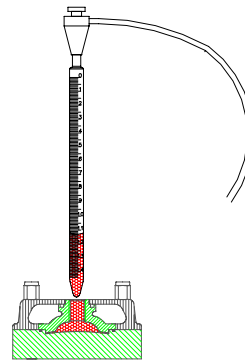
A volume measuring mould is a copy of the cylinder top with a piston in TDC at the standard height.

By putting your cylinder head on the volume measure mould, you can use the pipette and the liquid to fill the combustion chamber to the top of the spark plug hole. (see drawing 4)

before the measurement



after the measurement



drawing 4

After this the volume is easy to see at the pipette level. Now you know that the volume of your combustion chamber with a piston height A (A = pistonheight of the volume measuring mould) is for example 11.0cc

If the piston height in the mould is equal to the piston height in the engine, then the engine has also a combustion chamber volume of 11.0cc. (This is a volume including the sparkplug hole, so it is no real value of the combustion chamber.)



Calculation example.

On the volume measuring mould (with a piston height of +2.00mm) you measured a volume of 11.0cc. But the real situation on the engine is so that the piston height is +1.90cc. This means that the piston is 0.1mm lower than 'the piston' in the mould. So the combustion chamber volume will be more than 11.0cc

How much bigger will the real combustion chamber be?

surface of the cylinder x difference in piston height =
 $0.25 \times \pi \times D^2 \times \text{difference in piston height}$
where D = cylinder bore
 $\pi = 3.1416$

Our bore (D) is 54mm, so
 $0.25 \times 3.1416 \times 54 \times 54 = 2290.22 \text{ mm}^2$
 $= 22.90 \text{ cm}^2$

$22.90 \text{ cm}^2 \times 0.01 \text{ cm} = 0.229 \text{ cm}^3 = 0.229 \text{ cc}$
(Here is the difference in piston height of 0.1mm placed in the formula as 0.01cm)

The real combustion chamber volume is $11.0\text{cc} + 0.229\text{cc} = 11.229\text{cc}$

In this way every difference in piston height can be settled, also when the piston height increases for example to +2.10mm. Only the volume of 0.229cc has to be subtracted from 11.0cc, so $11.0 - 0.229 = 10.771\text{cc}$



How to use VHM-cylinderheads.

With the VHM-cylinderheads you can work in the same way as described in the previous pages.

Only now we have put the exact data on the boxes with the combustion chambers (drawing 5). So if you work with VHM -cylinderheads you can see directly which combustion chamber you have got. In the example (drawing 5) is a piston height of +2.00mm, a volume of 11.0cc and a squish of 0.65mm. The only thing you have to do is measure the piston height and if necessary settle the volume.

Also an advantage of our system is that the squish is always known, by increasing or decreasing the squish with the difference in piston height, you can simply calculate the squish.



Art Nr.	32011-A
Zuigerhoogte	+2.00 mm
Inhoud	11.00 cc
Squish	0.65 mm

drawing 5

If an engine has a piston height of +1.90 (calculation example pag 6) and the VHM-cylinderhead is used. Then it would have a volume of 11.229cc and a squish of $0.65 + 0.1 = 0.75\text{mm}$.