

## Overview :

If you have ever built or modified an engine, changed a camshaft, or done more than basic engine maintenance - you will appreciate that accurately locating Top Dead Centre ( TDC ) can sometimes be a trying experience and still leaves the open question of if its the compression or exhaust stroke.

Whilst the “in theory” description of finding TDC sounds straightforward, actually doing it in practice can be more time consuming, sometimes requiring expensive equipment and / or removing engine covers to gain access to the required internal parts.

What we are describing here is an alternative means of quickly and cheaply finding compression TDC on assembled engines. This is a “how to build” article, we provide you with the concept and construction suggestions, leaving it to you to build it with parts you make or find and to whatever quality standard you wish.

Those with little or no workshop equipment may still be able to build the device by carefully selecting off the shelf components - more advanced facilities will allow a much more “photogenic” product to be built.

No matter which path you head down, the end product will be useful.

## How It Works :

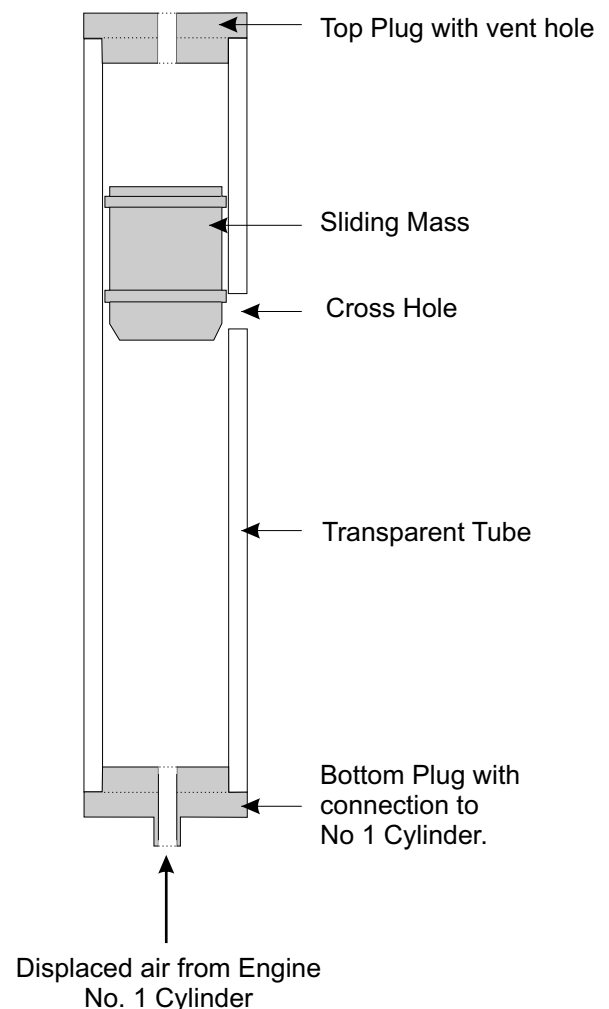
The underlying principle is to detect the displacement of air from the cylinder as the piston travels up the bore. When the engine reaches TDC, the piston is no longer rising and the flow of displaced air stops.

The device requires that the No. 1 Sparkplug be removed. A “bung” is placed in the Sparkplug hole with an airline that transfers the displaced air to a transparent tube containing a sliding mass. Approximately half way up the transparent cylinder is a through hole allowing the displaced air to escape once the sliding mass has lifted sufficiently.

So in practice the engine is rotated by hand, air is displaced from No. 1 cylinder into the device lifting the mass up the transparent tube until the cross hole is exposed. At this point the mass is supported by the continuing air flow and sits at a constant height.

When the flow of air from the engine stops ( its reached TDC ) the mass is no longer supported by the displaced airflow and suddenly drops down the transparent cylinder - indicating TDC has been reached.

It's a simple mechanism but is surprisingly accurate.



## Construction Considerations :

### The Mass

The mass needs to be cylindrical in shape. and long enough so that it is prevented from tipping sideways in the tube and hence jamming.

The taper on the bottom end of the mass assists in the progressive venting of the air after it has lifted the mass. A sharp edge could cause oscillation around the venting point.

If the mass is being manufactured, the reduction in diameter between the raised bands helps reduce sliding friction

The diameter relationship between the sliding mass and the transparent tube is a balance between a close fit, which promotes rapid response and sensitivity - with the need to have sufficient clearance to allow the air leakage required to permit the mass to suddenly fall when airflow ceases.

A lighter mass will lift more quickly with applied airflow but fall more slowly when airflow ceases.

### The Transparent Tube

As it is necessary to provide a cross hole or slot in the tube to vent the applied air, it is wise to select a material that is easy to work with. Whilst glass tubing is technically suitable it is significantly more difficult to cleanly cut to the required length and create the cross hole. We suggest rigid plastic tubing.

The devices sensitivity is improved with smaller tube diameters

The cross hole can be replaced with a hacksaw cut across the tube

### The Top and Bottom Plugs

There are almost limitless possibilities for manufacture, however the inclusion of a wire hanger on the top plug allows the device to be suspended conveniently.

The bottom plug needs to be sealed to the transparent tube. A neat push fit is acceptable but, be careful as tubing can easily crack if excessive force is applied.

### The SparkPlug Bung

A tapered rubber bung of appropriate diameter is ideal to make the connection to the cylinderhead. A straight metal tube extension to the bung may be usefull on engines with deeply recessed sparkplugs to apply the required force to insert and remove the bung.

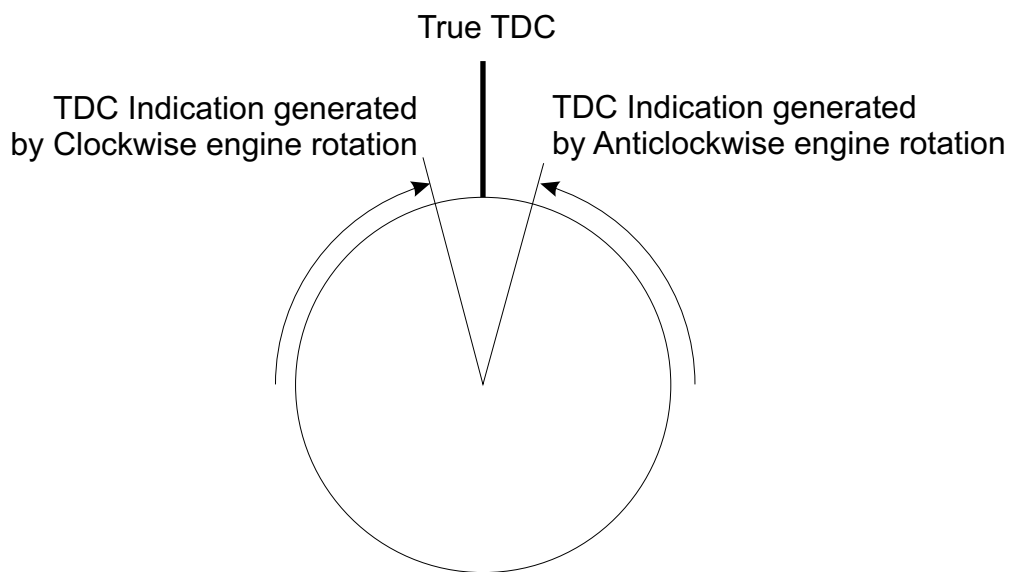


If you have an existing compression tested, you may already have high quality screw in, sparkplug fittings.

## Usage Suggestions

The device should be kept vertical during use.

As is common practice with any TDC indicator regardless of cost, the most accurate TDC determination is made by noting the TDC indication when the engine is turned towards TDC from both directions. True TDC is obtained by halving the difference between the readings obtained in each direction



## Safety Warnings

The engine must only be rotated by hand. Injury to the operator / device damage could be caused by the use of the starter motor.

Whenever a sparkplug is removed from an engine the possibility exists of foreign materials entering the engine and causing subsequent damage. Cleanliness is advised.

The correct seating / reseating torque must be applied to the sparkplug when it is replaced to avoid thread damage and provide proper thermal transfer between the sparkplug and the cylinder head.

Any under-bonnet work exposes the user to the risk of contact with sharp / hot engine parts. Safe working practices should be applied at all times.