ICON RESEARCH LTD

How to Carry Out a TDC Offset Adjustment

A TDC offset adjustment compensates for the difference in the angle between where the TDC marker has been positioned on the shaft or flywheel, and the angle of top-dead-centre of cylinder 1, conventionally referred to as the 0° angle. For every one degree that the TDC angle setting is incorrect, the calculated indicated power figures will be in error by 7-8%. It is therefore vital that the TDC offset is adjusted accurately. This technical note describes how to carry out this adjustment.

Before measurements are taken with the instrument, attention should be paid to the angular resolution that is being used. Higher angular resolution enables finer adjustment of the TDC offset angle and potentially more accurate power figures.

The DK-20 instrument automatically samples all readings at 0.1^o resolution. On a DK-2 the angular resolution must be manually input in the SETTINGS menu of the instrument. For a main engine, we recommend a resolution of a maximum 0.2^o, and for a generator a maximum of 0.5° be used.

The objective is to align Pcomp at 0° on the pressure-angle graph. The method of setting the angle differs depending on the timing of the engine. Different cases are discussed below. This note applies to Version 6 software only.

Permissions

Before you start, make sure you have the required permissions to adjust the TDC. To do this, first click the padlock button 🔒 and the box below will appear.
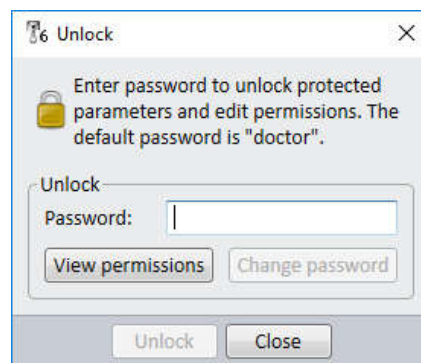
At this point, you can click on **View permissions** but you cannot make any changes unless you enter the correct password. The default password is *doctor* and, when entered, the box will appear as below.
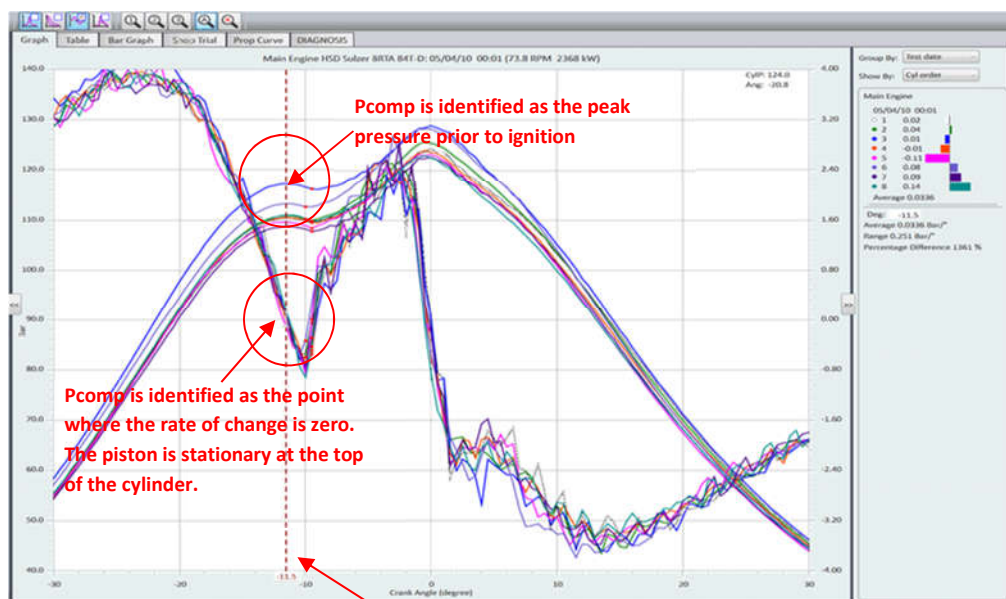
You can now change the actions that are password protected by clicking on **Edit Permissions**. The following box will appear. Ensure that *Adjust TDC* is selected and select **Apply** and then **OK.**
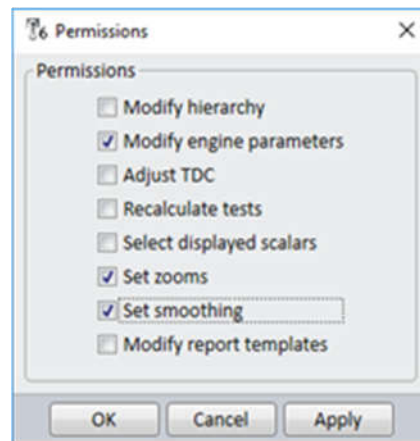
You are now ready to make the adjustment.

**Adjusting TDC with Late Firing (After TDC) Engines**

Late-firing engines are usually straightforward to adjust as Pcomp is normally clearly visible. The image below shows both the pressure-angle, and the derivative of pressure traces prior to correction. The TDC angle can be identified either as the peak pressure prior to combustion or where the rate of change of pressure dP/dA (bar/degree on the right-hand axis) is zero. Note the cursor has been set to the correct value.

You are now ready to make the adjustment. The process to do so is the same regardless of the timing of the engine. Please note the process described here is for version 6 software. Version 5 software may still run on latest Windows systems but is no longer supported by Icon Research.

Select the date/time of the trace to be adjusted by right-clicking on it and you will see the pop-up menu as below:
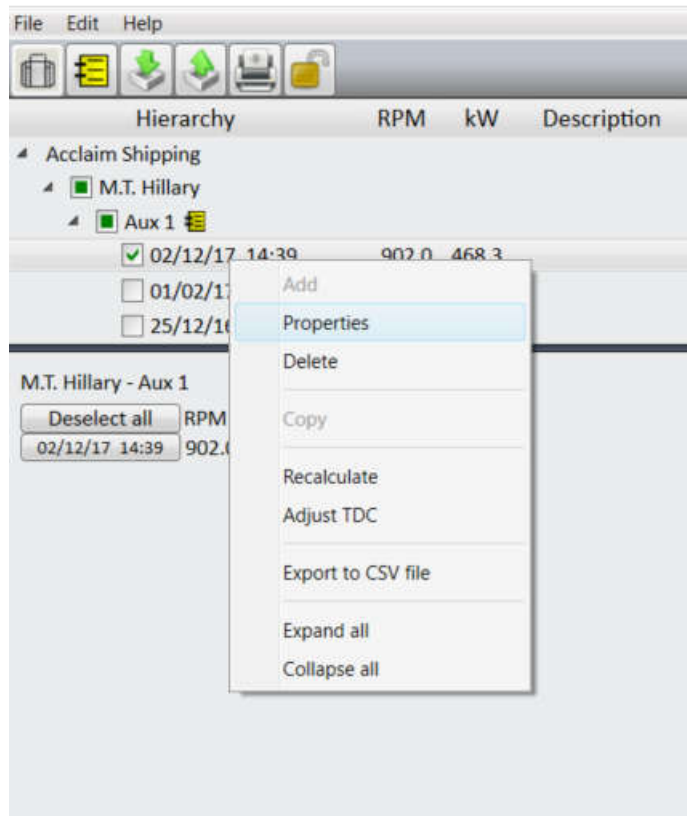
Select *Adjust TDC* and the following box will appear. Note that as well as adjusting the angle you can select which tests to be updated. If this is the first test then you would select *This test and all new tests*. If, however you have made a number of tests and you are adjusting the most recent then select *This test, previous tests, and all new tests*. On occasion you may wish to adjust a single test only and this option is available.
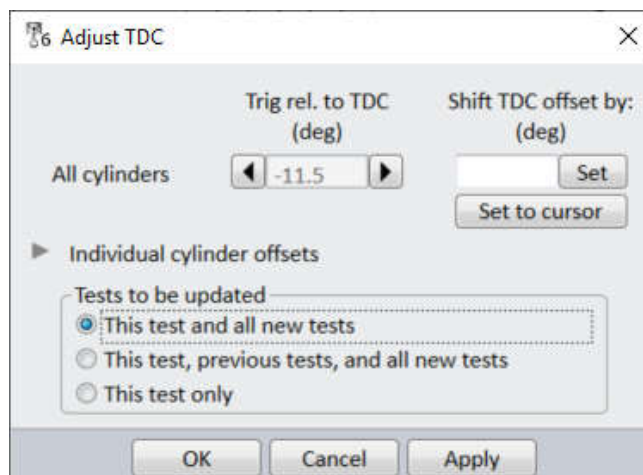
You can either enter a value for the TDC adjustment and select **Set** or, if you have placed the cursor in the correct position, you can simply select **Set to Cursor.** Select **Apply** and **OK** and the TDC angle will be set correctly as in our example below. The cursor is positioned at TDC and bisects the compression peak pressure and the point where the rate of change of pressure is zero after its deceleration. You can also shift the curve incrementally by using the left and tight arrow buttons.
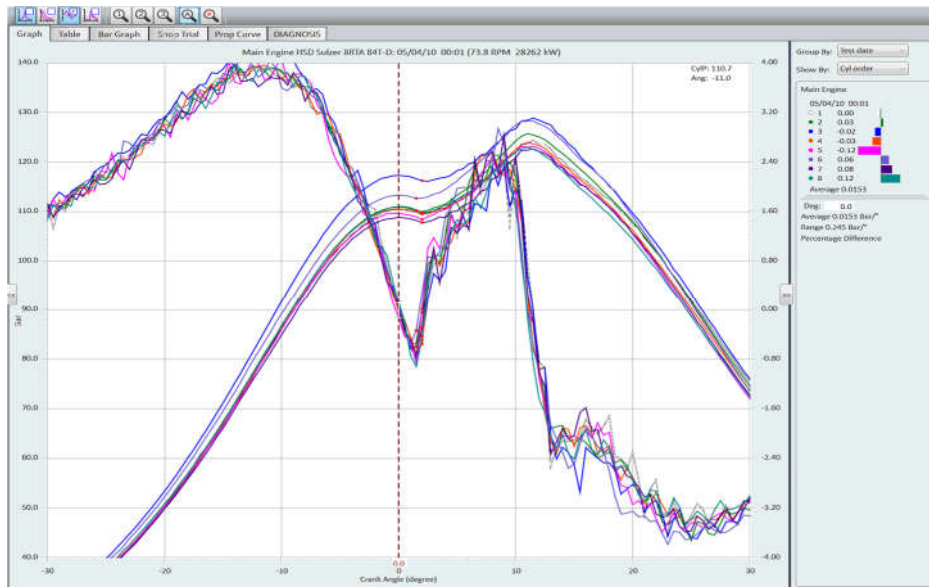

Engines firing before TDC

For engines firing ahead of TDC it is usually simplest to use the derivative (dP/dA) traces to set TDC. This because there may not be an obvious Pcomp value in the pressure-angle curve. The dP/dA curve may not actually cross the zero bar per degree line but it can easily be extrapolated visually to do so. The example below shows an example of a correctly adjusted trace. The red dotted line shows the extrapolation to zero degrees.
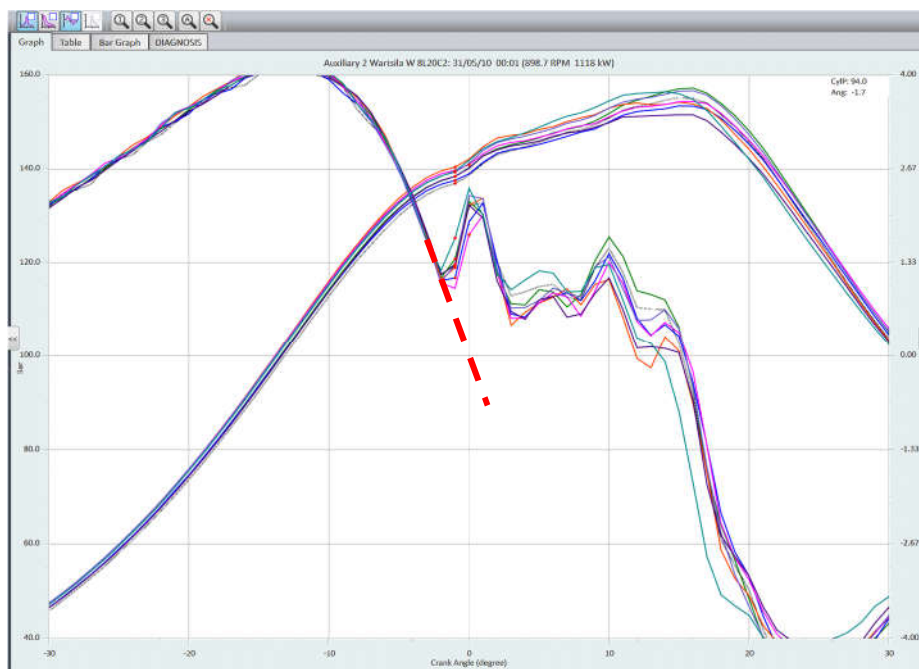
Very Early Firing Engines

When firing is well ahead of TDC, visual extrapolation is harder. An example is shown below.
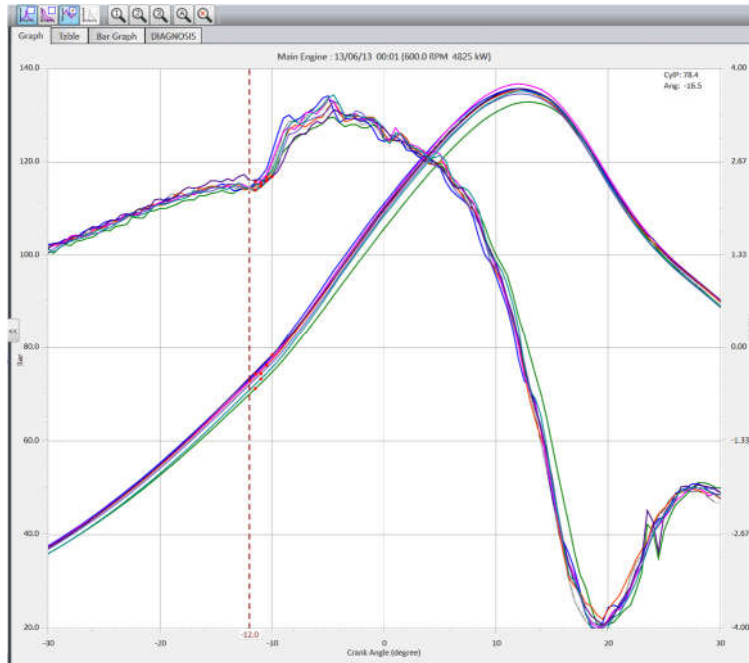
Extrapolation of the dP/dA is still possible but it is recommended that a "motored" reading be taken. This involves removing the fuel from a single cylinder and carrying out a test. As there is no fuel in the cylinder no combustion takes place and a pure compression curve is the result. The picture below shows a motored reading where the TDC is offset by -14 degrees. The peak pressure corresponds to the TDC (provided there are no leaks in the cylinder). The dP/dA trace crosses the zero line also at TDC. The TDC adjust can be made as described above when discussing late firing engines
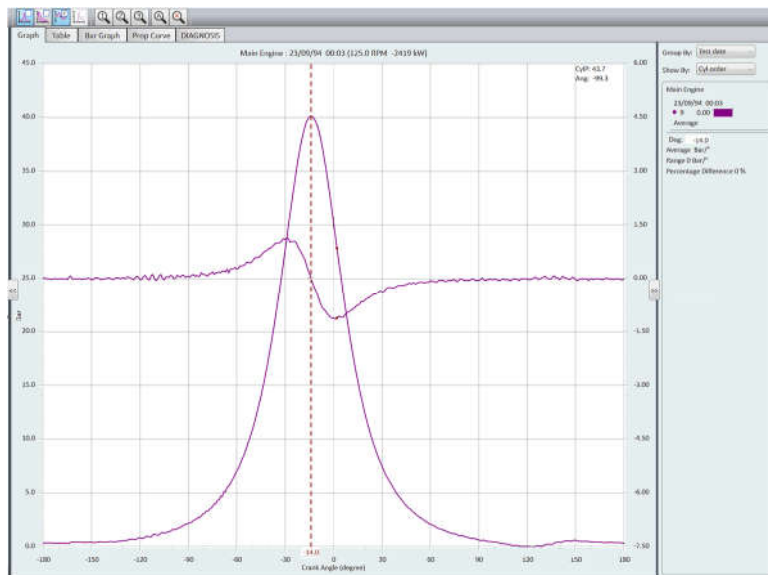
Individual Cylinder TDC Adjustments

In some unusual cases, different offsets may be needed for each cylinder. It is not recommended to do so unless there are special circumstances. Valid reasons for using independent TDC offsets for each cylinder are:

- Engines designed with uneven angles between cylinders to lessen vibration

- Differences in indicator passageways or indicator valves causing different delays

- Twisted crankshafts

The Diesel Doctor software facilitates individual cylinder TDC offsets. When adjusting the TDC select *Individual TDC Offsets* as per box below. Individual cylinder angle values may now be entered manually.

The Diesel Doctor