



COMMERCIALLY CONFIDENTIAL

DT339/2(EN)

# DP210 Pumps

**EQUIPMENT:** Dynamic Timing Kit YDT262

**SUBJECT:** Introduction and Use

## 1. INTRODUCTION

Increasingly more stringent emissions legislation, in the form of Tier2, Off Highway emission levels, demands more precise and durable fuel injection systems to maintain compliance to the new legislation. To meet this requirement it is necessary for the DP210 pump to engine timing to be set dynamically.

A Dynamic Timing Kit: part no. YDT262 has been developed to determine dynamically the correct position to lock the pump drive-shaft in readiness for fitting to an engine. The ability to identify dynamically and then position and lock the pump drive-shaft, gives a greater degree of accuracy than was previously possible using the static timing method. An accuracy of +/- 0.25 degrees (pump) is now possible, which is a 50% improvement over the original method and results in a positive reduction of exhaust emissions.

## 2. OPERATION

Timing dynamically is possible when an electronic pulse generated at a precise point in drive-shaft rotation is compared to a pulse generated by the pumping action of the plungers delivering fuel. For this to occur, a special drive coupling that contains an electronic encoder is fitted and keyed to the pump drive-shaft taper. The encoder generates an electronic signal once every 360 degrees.

A Piezo sensor is fitted in one of the high-pressure lines and at a predetermined point in the line pressure rise that takes place when delivery occurs; a second electronic signal is generated.

The two signals are then compared and the relationship between them is displayed on the monitor of the machine as an angle. This angle is then interpreted for use as an overcheck angle to confirm correct pump to engine correlation or, as an instruction for the number of degrees that the drive-shaft has to be turned through for 'locking' prior to fitment to an engine.

## 3. PROCEDURE – SETTING

The Dynamic timing kit can be fitted to the pump prior to pump testing and setting, when first fitting the pump to the test bench. At the appropriate point in the test plan the kit is then powered on and brought into action.

### 3.1 Fitting the kit to the pump and test bench.

- Fit the pump to the test bench mounting bracket.
- Fit a woodruff key to drive-shaft.

- Fit the dynamic timing coupling/encoder and tighten the drive-shaft nut to Nm 90 (796 lbf.ins).
- Tighten the encoder bracket to the pump mounting.
- Fit the Piezo sensor to the specified high-pressure outlet (see test plan).
- Connect the timing kit as shown in the diagram Fig.1.
- At the appropriate point in the test plan setting procedure, turn the power on. (Ensure the correct voltage has been selected to suit local supply).
- Ensure the test bench and pump is at normal operating temperature.

### 3.2 Operating the Dynamic Timing Kit

- Operate the appropriate button controls on the control panel. See Fig.1.
  - a) (Green button advances one screen at a time).
  - b) (Grey buttons advance or reduce the screen values).
- Screen 1 – “Version” – (Select a suitable language).
- Screen 2 - “Zero angle Recorded” or “Zero angle Error”. (Not required for initial setting).
- Screen 3 - “Off-set”– (Input the Off-set angle specified in the test plan).
- Screen 4 - “Trigger level”– (Input the Trigger % level specified in the test plan).
- Screen 5 - “Variation”– Check that reading remains constant at 360 degrees.
- Screen 6 - “Sampling”– Wait while the programme records a series of readings.
- Screen 7 - “Please stop test machine” – Stop the test bench.
- Screen 8 - “Overcheck angle”– Not required for initial setting.
- Screen 9 - “Rotate to zero”– (Turn in direction of pump rotation).

### 3.3 Removing the pump from the test bench

- Tighten the drive-shaft locking bolt when the reading is 0° to 17.0 Nm. (150 lbf/ins)
- Check the screen reading is still on 0° after locking. (Re-set if moved).
- Disconnect pump drive from test bench drive.

*Note: If test bench drive clamping screws are not accessible, slacken the drive-shaft bolt and rotate drive by hand until screws can be accessed. Once free, disconnect the pump drive from the bench drive and then repeat from the beginning of section 3.3.*

- Undo and remove the drive-shaft nut.
- Check the screen reading is still on 0° after nut removal.
- If not 0°, release drive-shaft lock bolt and re-set to 0° and re-lock.

- Switch off the power to the dynamic timing box.
- Use an appropriate extractor to remove the coupling encoder from the pump drive-shaft.
- Remove the pump from the test bench.
- Remove the woodruff key.

#### **4. PROCEDURE - OVERCHECK**

It is important that, when first received, the pump is submitted as removed from the engine with the drive-shaft locked in the "Timed" position. This will enable the technician to verify the 'pump to engine' timing as part of a comprehensive diagnostic procedure. The following sequence will identify any anomaly and permit correction, if necessary. It will also ensure that, as in item 3.3, the locked position is not inadvertently lost on removal of the pump drive coupling/encoder.

*Note 1: It may not be possible to determine the root cause or origin of any timing discrepancy. The pump is timed and the shaft locked extremely accurately on production at Delphi Diesel Systems and is unlikely to be the cause of any anomaly. The most likely cause of any anomaly is from the pump to engine assembly/disassembly process. In diagnosing an engine problem whilst a minor timing discrepancy, on its own, may affect non-visible emissions a major discrepancy would produce audible and running problems from fitment and be prevented from entering service. Therefore warranty claims, against Delphi, for "Dynamic timing incorrect" will not be accepted.*

*Note 2: Pumps in production may or may not have a "Scribed Mark" on the pump flange. Where present, this is for indicative purposes only and is not used by the engine manufacture for pump to engine timing either on production or in service.*

##### **4.1 Pre-Test bench checks**

- Pump received to remain locked. (Ensure a minimum of 17.0 Nm. (150 lbf/ins) torque is applied).
- Fit a woodruff key to drive-shaft.

##### **4.2 Fitting the pump to the test bench**

- Fit the pump to the test bench mounting bracket.
- Fit the dynamic timing coupling/encoder and tighten the drive shaft nut to an initial torque of 20.0 Nm (180 lbf/ins).
- Tighten the encoder bracket to the pump mounting bracket.
- Fit the Piezo sensor to the specified high pressure outlet (see test plan).
- Connect the timing kit as shown in the diagram fig.1.

##### **4.3 Record/Verify the "as received" dynamic timing value of the pump**

- Turn the power on – (Ensure the correct voltage has been selected to suit local supply).
- Operate the appropriate button controls on the control panel. See Fig.1
  - a) (Green button advances one screen at a time).
  - b) (Grey buttons advance or reduce the screen values).

- Screen 1 – “Version” – (Select a suitable language).
- Screen 2 - “Zero angle Recorded” or “Zero angle Error”. (This records the 'as received' position of the locked drive shaft).

*Note: The power switch on the timing box must be left on or the 'as received' (Zero) angle will be lost.*

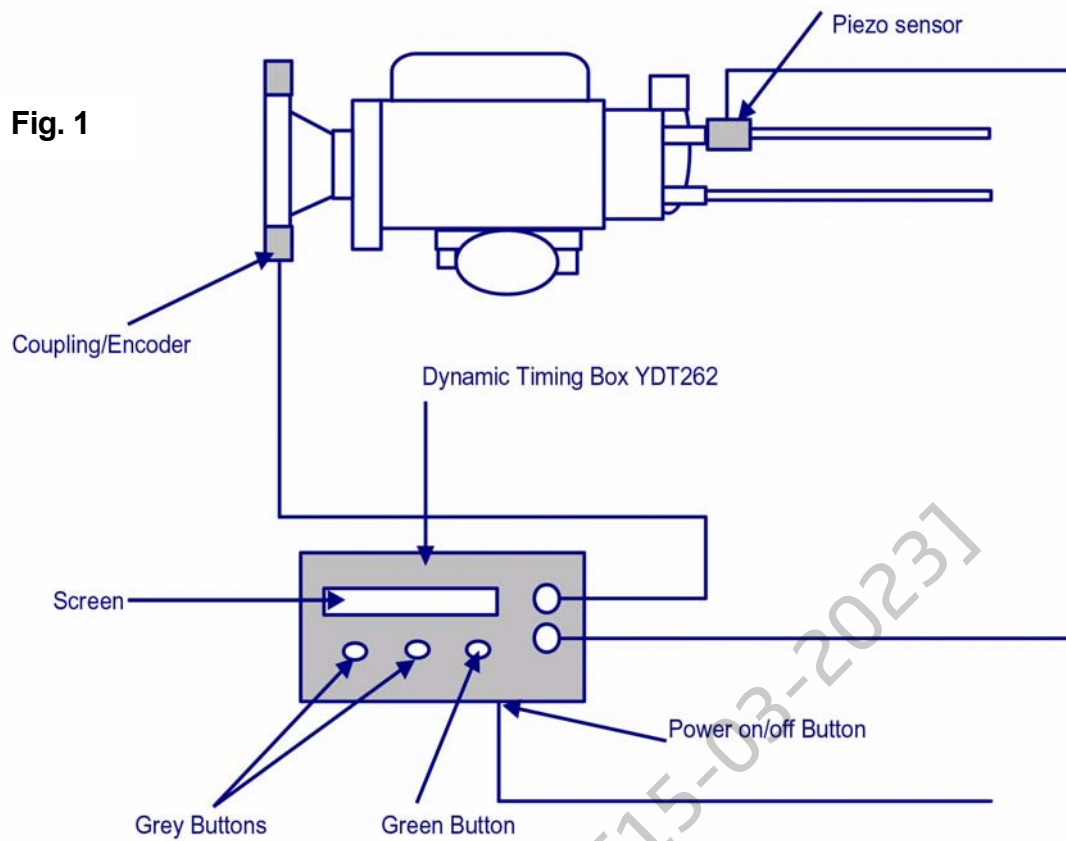
- Release the drive-shaft lock bolt.
- Finally tighten the coupling/encoder drive shaft nut to 90.0 Nm. (796 lbf/ins).
- Bolt the pump to the test bench drive.
- Complete the fitting of high and low pressure pipes.
- Start the test bench and run until normal operating temperature is obtained.
- Continue with the overcheck until instructed to check the dynamic timing.
- Screen 3 - “Off-set”– (Input the Off-set angle specified in the test plan).
- Screen 4 - “Trigger level”– (Input the Trigger % level specified in the test plan).
- Screen 5 - “Variation”- Check that reading remains constant at 360 degrees.
- Screen 6 - “Sampling”- Wait while the programme records a series of readings.
- Screen 7 - “Please stop test machine” – Stop the test bench.
- Screen 8 - “Overcheck angle”– record the angle specified. If  $0^{\circ} \pm 1^{\circ}$ , the pump was correctly timed on production and on assembly to the engine.
- Screen 9 - “Rotate to  $0^{\circ}$ ” - (turn in the direction of pump rotation).

*Note: It follows that if the “Overcheck angle” recorded from Screen 8 is outside of the limits, then the pump drive-shaft has moved during assembly/removal from the engine.*

#### **4.4 Remove the pump from the test bench**

- Remove the pump from the test bench as detailed in section 3.3.

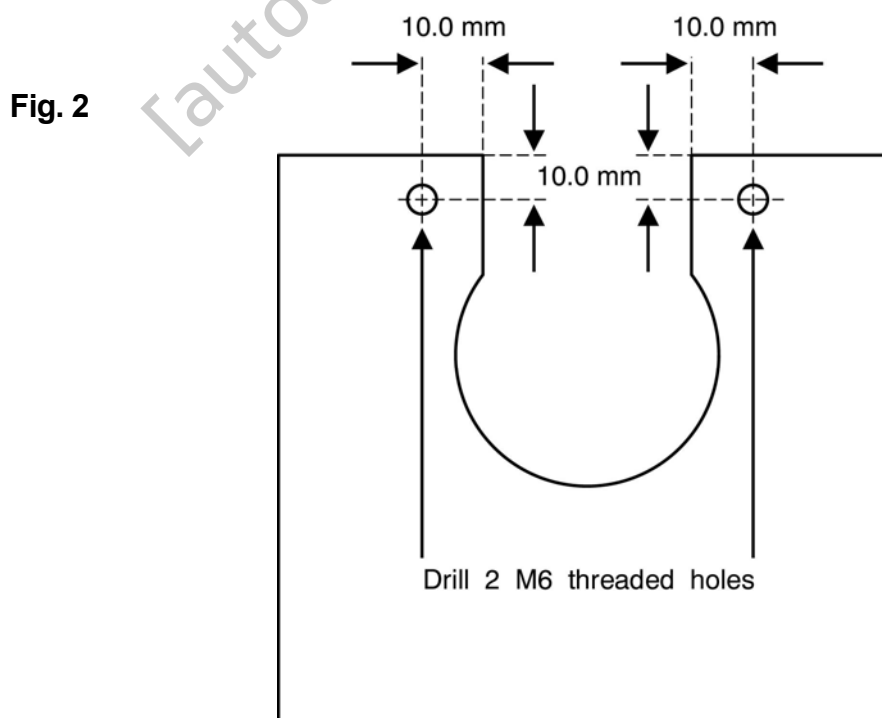
## 5. CONNECTIONS



## 6. TOOLING

Tools required:

Existing pump mounting brackets can be modified see fig 2. (All new brackets will have the coupling/encoder threaded bracket hole incorporated in it).



Dynamic timing kit - YDT262 contains:

- Master control box.
- Coupling /encoder.
- Piezo sensor.
- Piezo lead.

Additional Tools required:

- Woodruff key - NK1-22.
- Mains lead – suitable for local area.
- Coupling/encoder holding spanner – available from AT&T.
- Coupling/encoder extractor – available from AT&T.
- Mounting bracket - available from AT&T.

[autodizelmm] - [15-03-2023]