## Fuel Injection - Cycle

***ANIMATION***

The chart shows the cycle for one complete fuel injection for one cylinder. ⇨ *Table 26. Key ( 4-59)*

**Table 25.**

| | | |
|---|---|---|
| **A** | Camshaft sensor signal | Signal is generated by camshaft target disc **3** and sensor **2**. Processed by the ECU **1** to determine which cylinder to inject. |
| **B** | Crank position sensor signal | Signal is generated by flywheel mounted target disc **5** and sensor **4**. Processed by the ECU **1** to determine timing of injection. |
| **C1**, **C2** | Current pulse - injector solenoid coil | Sent to the injector (**6**) solenoid coil by the ECU **1** to initiate injection. Time of pulse calculated by the ECU to control the amount of fuel injected. Pulse **C1** controls pilot injection. Pulse **C2** controls the main injection. |
| **D1**, **D2** | Fuel Injection | Start and duration of actual injection. It can be seen that there is a time shift between the current pulse and actual injection. This is due to electrical resistance and the individual characteristics on the fuel injector assembly **6**. **D1** indicates the pilot injection and **D2** the main injection. Total fuel injected for one cycle = **D1** + **D2**. |
| **TDC** | Top dead centre | Shows when piston is at top dead centre in relation to the injection sequence. |

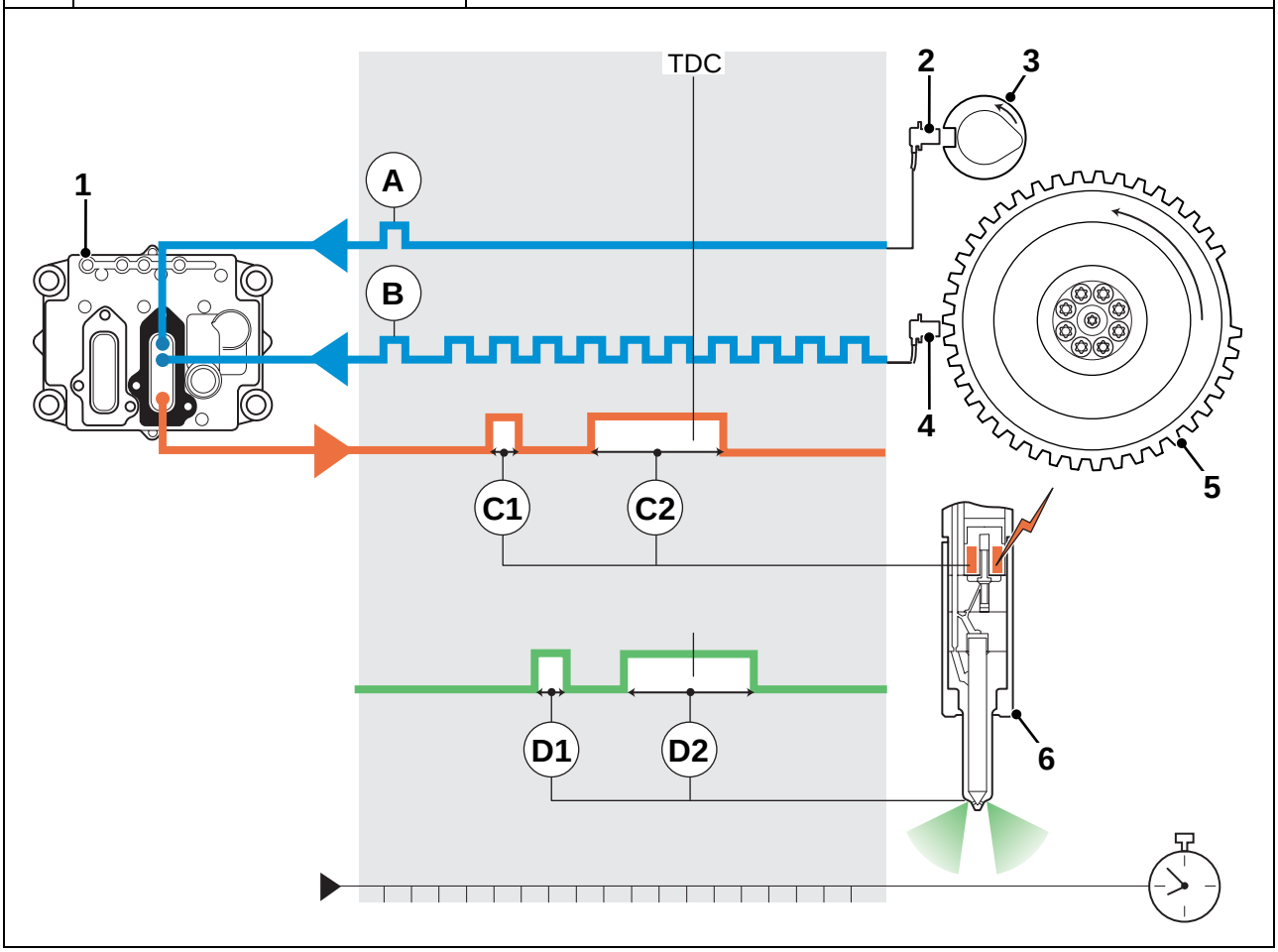

**Table 26. Key**

| ⇨ *Table 25. (📄 4-58)* | |
|---|---|
| **1** | Engine electronic control module (ECU) |
| **2** | Camshaft position sensor |
| **3** | Camshaft `target disc' |
| **4** | Crankshaft position sensor |
| **5** | Flywheel mounted crankshaft `target disc' |
| **6** | Fuel injector |

### Idle Speed Control

The ECU incorporates an engine idle speed control module. When the operator closes the throttle the ECU initiates the idle control. The minumum fuel is calculated to maintain the programmed idle speed.

### Engine Shut Down

The ECU initiates engine shut down in response to inputs from an operator controlled stop (key) switch.

Engine shut down is achieved by ceasing fuel injection. When an engine stop input is recieved by the ECU no current is sent to the injector solenoid coils.

Other operating parameters may initiate automatic engine shut down by the ECU. For example low engine oil pressure or sensor faults.

### Engine Fault Diagnostics

Since the ECU continually scans for expected inputs from all connected devices it is capable of detecting related electrical faults. These faults are `datalogged' in the ECU memory. By connecting diagnostics software any faults recorded can be displayed in code form. This assits service personnel when tracing faults with the fuel injection system.

In addition to fault datalogging, the ECU will respond to some faults by shutting the engine down, thus preventing serious engine damage.

The ECU also has the facility to drive cab mounted warning devices such as coolant temperature and oil pressure displays.

## Electrical Sensors

***Note:*** *Not all the sensors listed may be fitted. Fitment of some sensors is dependant on engine application.*

The tables describe how the sensors operate, how the signal from the sensor is interpreted by the ECU and typically how the ECU responds. It must be remembered that the ECU processes signals from the sensors continually and its response will be based on an evaluation of the combination of sensor signals.

### Crankshaft Position Sensor

| **Method of operation** |
|---|
| The sensor **A** detects the passing of teeth on a flywheel mounted target disc **B**. |
| **ECU interpretation** |
| Processes signal to determine engine rotating speed and crankshaft position. |
| **ECU response** |
| Adjusts injection timing and fuel pressure. |