Citroen 2.5TD Turbo repair

Does your 2.5TD lack that sparkle in terms of pulling power whether overtaking or pulling a heavy load? Whilst there are many permutations of faults which can lead to this condition a very important one is the wastegate on the turbo.

On a 2.5TD the wastegate on the turbo is purely mechanically controlled. There is no electric, electronic or any other wizardry connected to the turbo. The turbo spins due to the volume of exhaust gases leaving the engine being pushed through the exhaust turbine which drives the compressor via a common shaft. The compressor draws in fresh air through the air filter and raises its pressure to approximately 1 Bar(gauge) or 14.5 psi in old money. The discharge pressure from the turbo is experienced by all of the downstream components including the piping, intercooler, inlet manifold and most importantly the wastegate actuator. A small (approx 5mm diameter) plastic hose is connected to the piping just downstream of the turbo outlet. The plastic hose is connected to the wastegate actuator. The actuator consists of a set of bellows mounted inside a tube. The bellows act against a spring and the spring maintains the bellows in a compressed state when at rest. On the end of the bellows there is a circular plate with a rod fixed to the centre. The rod passes out of the tube and is fitted with an eyelet at the extreme end. In between the actuator and the eyelet is a threaded section which is used to lengthen or shorten the rod. This adjustment in length affects the pressure at which the wastegate opens. The eyelet is then fitted over a pin on the end of a short crank. The other end of the crank is welded to the pivot point of the wastegate valve itself. As the crank rotates from its rest position the wastegate valve opens. The wastegate valve allows the exhaust gases leaving the engine to bypass the turbine into the car exhaust thereby failing to impart energy to the incoming fresh air stream via the compressor. This is the condition required of the wastegate valve when the turbo pressure is not required (eg during deceleration).

When the outlet pressure from the turbo rises, the sensed pressure travels along the plastic hose and inflates the bellows in the actuator. When the pressure in the bellows overcomes the spring pressure acting in the opposite direction then the rod begins to be pushed out of the actuator by the bellows. The greater the rise in pressure the further the rod is pushed out of the actuator. The more the rod is pushed the more the crank is rotated about its pivot. The greater the rotation of the crank the further the wastegate is opened and the more the exhaust gas is bypassed around the turbine. This causes the turbine to slow down and in turn the compressor produces less pressure. Equilibrium is reached at a pressure determined by the adjusted length of the rod and the strength of the spring in the actuator. (in technical terms the rod length sets the ‘zero’ and the spring ‘k’ value determines the ‘span’. The distance over which the actuator travels or the pressure changes is called the ‘proportional band’). When the pressure from the turbo reduces the reverse of the above sequence takes place.

The photographs below were taken after removing the turbo from the car. To do this the front portion of the exhaust must be removed along with the off-side drive shaft. The 4 bolts holding the turbo to the exhaust manifold are difficult to get to but possible. To slacken them the first time I had to use an oxy-acetylene torch on the nuts to slacken them. The nuts are M8’s but not the usual 13mm across the flats. The outside of the nuts are splined with approx 12 points. I found that a 12 point 10mm ring spanner fitted the nuts and removed them without much problem.

The plastic piping which carries fresh air from the filter to the inlet to the turbo must be removed to allow the turbo to be removed through the space between the rear of the engine and the front crossmember. One end is held onto the turbo inlet by two 10mm bolts which are accessible through the wheel arch. The other end is fixed to a joint in the piping behind the engine with a jubilee clip. The jubilee clip is accessible from below the car.
The plastic piping on the discharge of the turbo is secured with another two 10mm bolts. Again these are accessible through the wheel arch.
The two oil hoses are easily removed but a temporary plug is required on the sump connection to prevent the contents of the sump ending up on the garage floor.

There follows a sequence of annotated photographs of the turbo to illustrate the above description of operation.

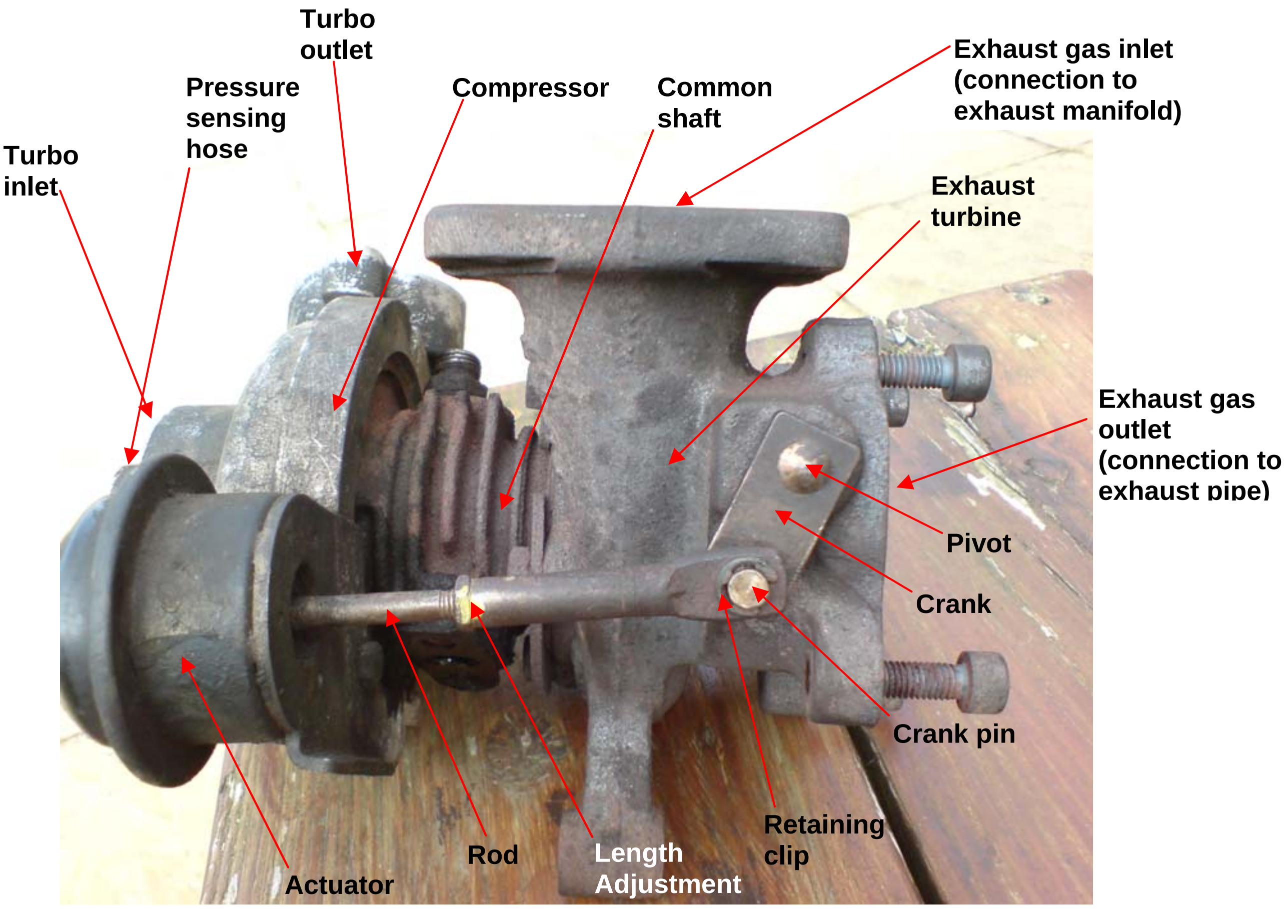

Photo1 – Complete assembled turbo

The photo below shows the eyelet at the end of the actuator rod disconnected from the crank pin after having removed the retaining clip.

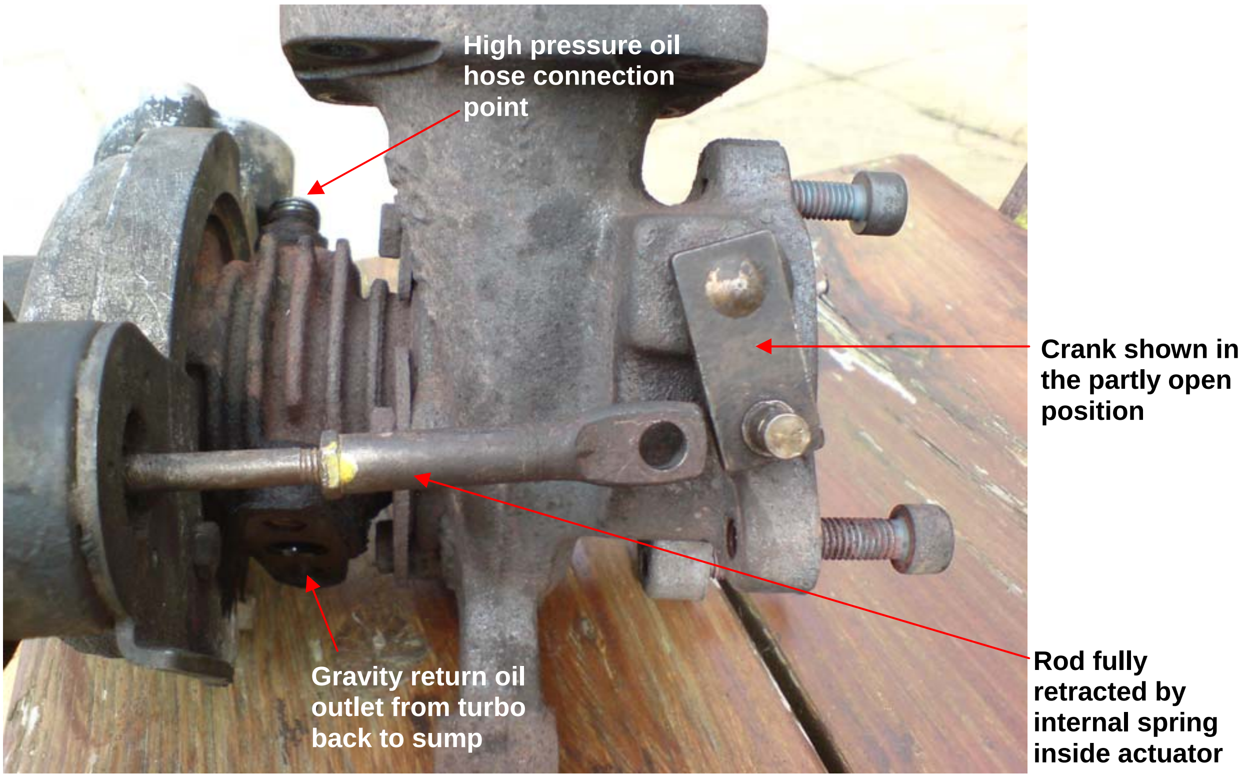

Photo2 – Crank arm disassembled

The following photo shows the wastegate valve in the fully closed position (maximum pressure/boost)

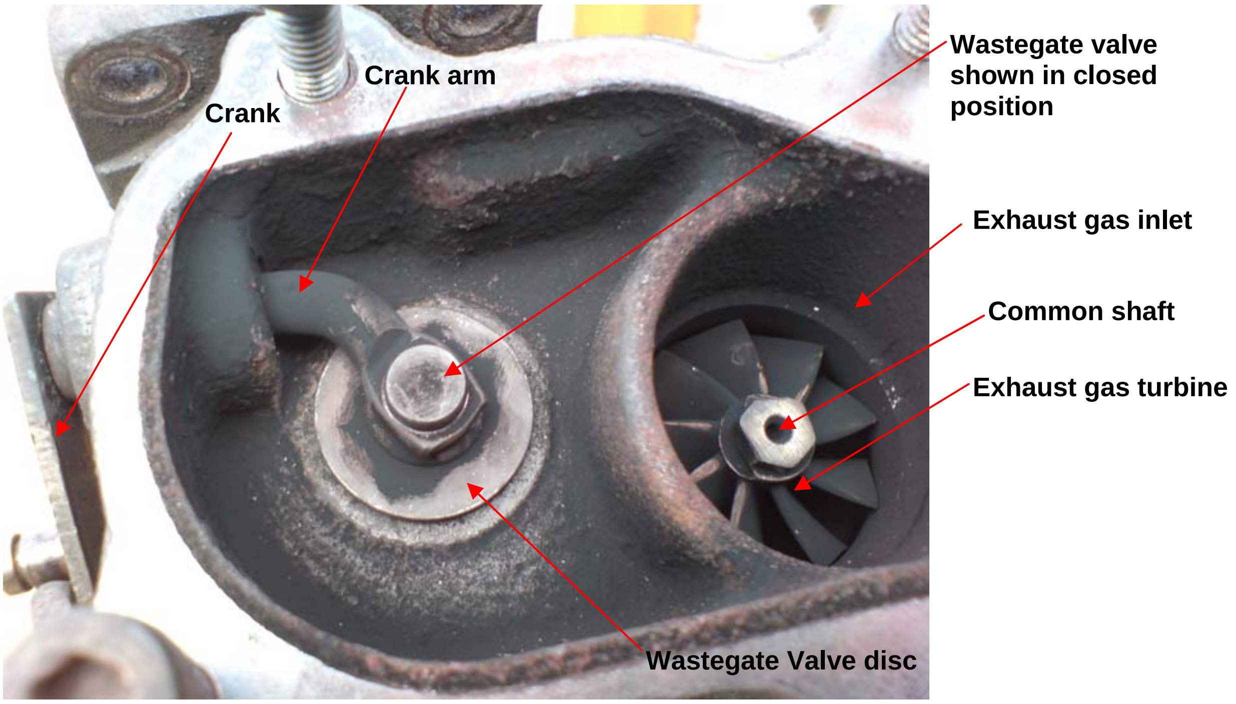

Photo3 – Wategate full boost

The following photo shows the wastegate valve in the partly open position (medium pressure/boost)

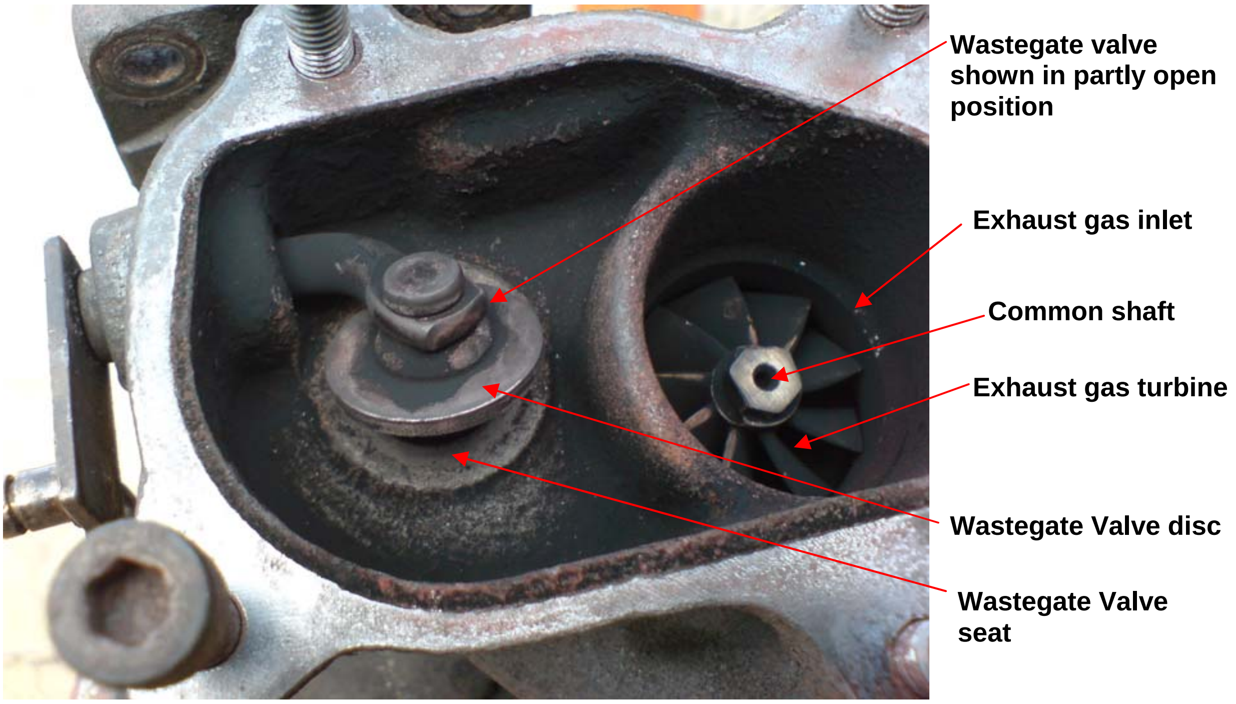

Photo4 – Wastegate part boost

The following photo shows the wastegate valve in the fully open position (zero pressure/boost). In practise it never gets this far open.

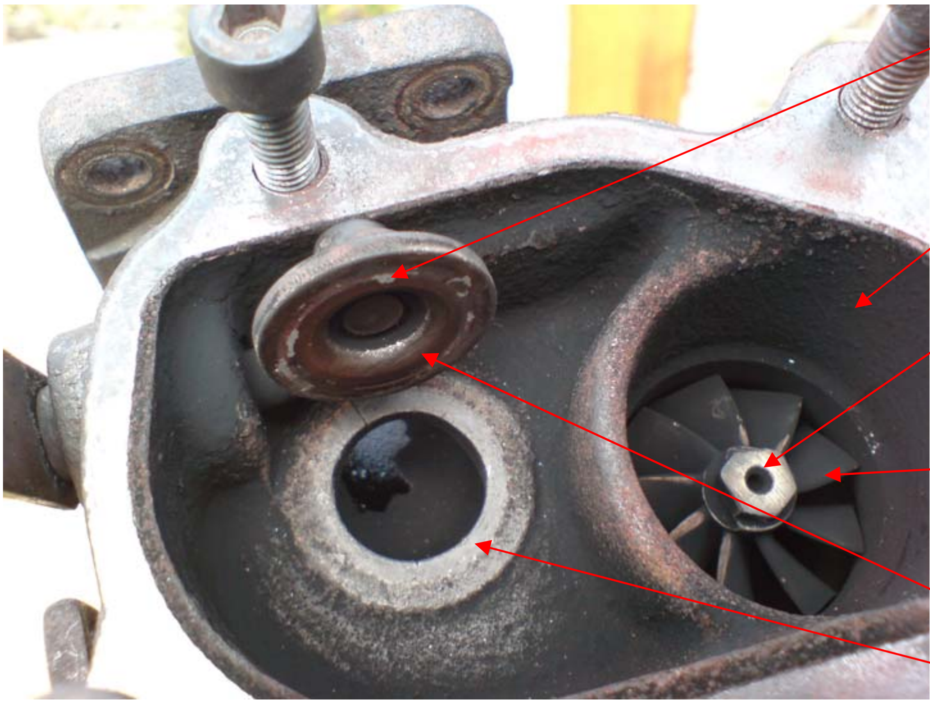

Photo5 – Wastegate zero boost

The following photo shows my suggested adjustment. With the actuator rod in its fully retracted position and the wastegate valve firmly closed adjust the length of the rod so that the crank pin is **not** fully lined up with the hole in the eyelet as shown below:

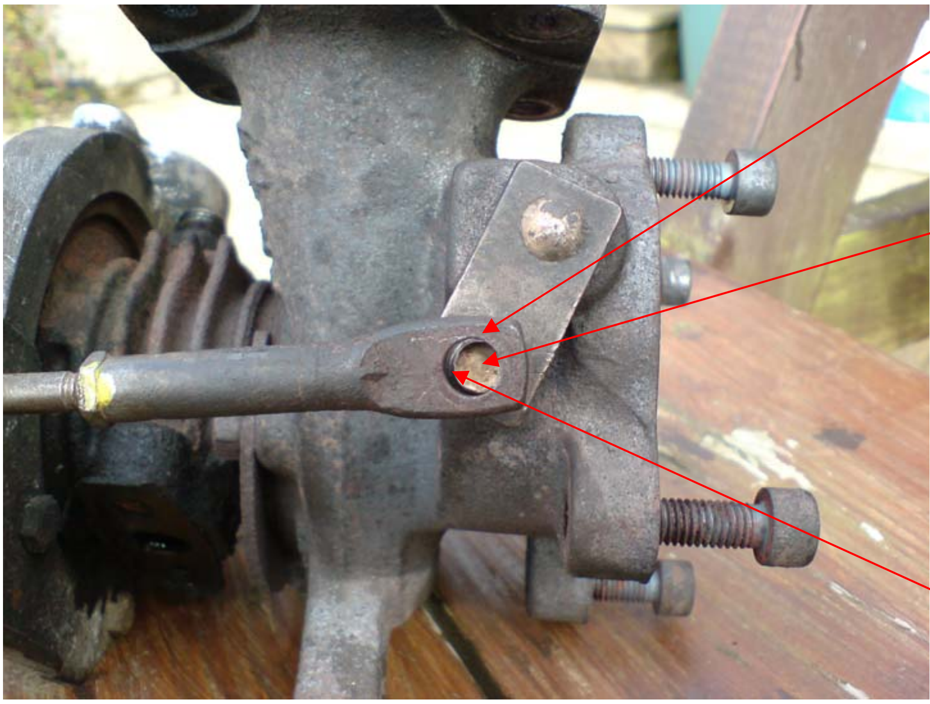

Photo6 – Rod adjustment

Once the rod length has been adjusted as above you should be able to pull on the rod until it the eyelet slips over the end of the crank pin. The residual tension in the rod keeps the wastegate valve fully closed when maximum boost is needed.

The following photograph shows the centre of the fresh air inlet at the compressor end of the turbo

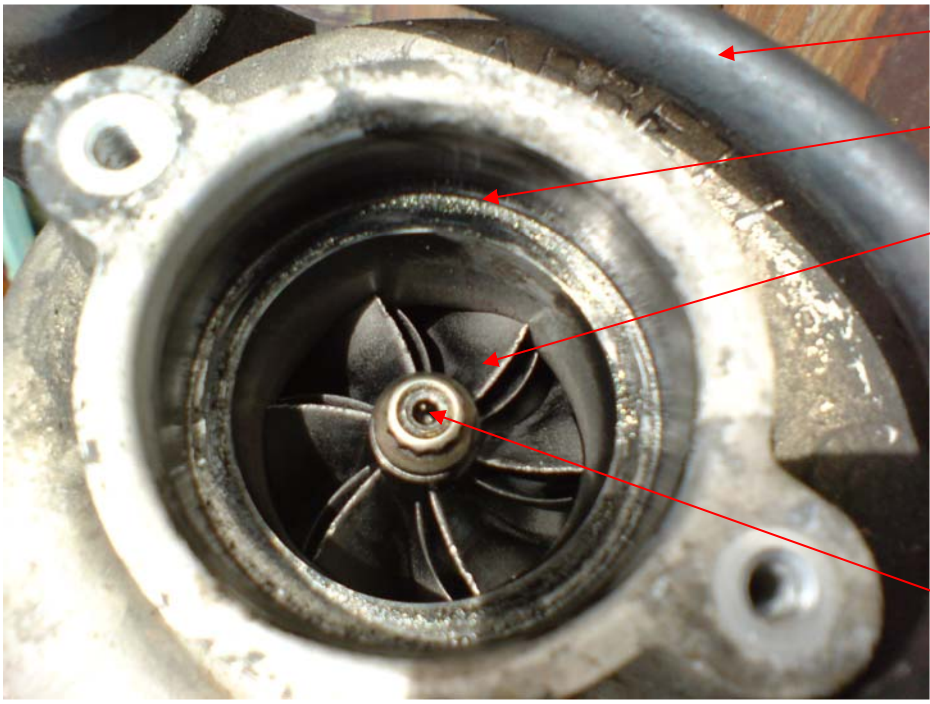

Photo7 – Compressor inlet

The most common problem associated with the turbo on a 2.5TD is that the eyelet on the end of the actuator rod seizes on the crank pin.

If it seizes in the position where the wastegate valve is fully closed then the turbo will produce over maximum boost at all times. This will cause the inlet manifold pressure to rise to 2 Bar (gauge). With a boost pressure of 2 bar you will feel the awesome power of the 2.5TD but unfortunately your engine won't last that long before it self destructs. Curiously there is a kind of self-protection mechanism in that the MAP sensor reads the manifold pressure and if it detects that its too high the ECU momentarily cuts the fuel to the engine to slow it down. The power returns after a second or so once the pressure has reduced. The engine then accelerates again until the pressure increases where the cycle repeats itself. This happens approximately every 8 seconds. However, this mechanism doesn't work at lower pressures even if they are too high.

If it seizes in the position where the wastegate is partly open then the turbo will never produce maximum boost and the engine will have lacklustre performance. Indeed if its stuck too far open the engine will perform as if it has no turbo at all.

It is important not only to check that the eyelet can pivot freely on the crank pin but also that the crank returns to the position where the wastegate valve is fully closed. This can only be accurately determined by separating the eyelet from the crank pin. Having separated them, push on the crank until you can feel that the valve is fully closed. Check the position of the crank pin through the eyelet hole. It should match photograph 6. If not, adjust the rod length until it does.

To prevent further seizing in the future I initially greased the crank pin and reassembled. However, the grease burned off very quickly and the pin seized again. The next time I drilled the eyelet out to 7.0mm diameter so that there was approx 0.5mm clearance between the eyelet and the crank pin. Since doing this I've had no further problems.

