

Rover SD1 Efi System - Cold Start Function - Explanation and Testing of the Thermotime Switch and Cold Start Injector

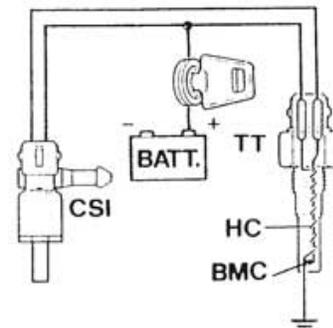
Introduction

- Some of the notes here are repetitious in order to review the devices from different viewpoints of their function and operation.
- When the Rover SD1 Efi engine is started from cold the initial requirement is to provide a rich mixture to make the engine snap into life. The colder the engine the more time may be needed to allow the engine to fire and run.
- As soon as the engine fires this extra rich mixture must cease immediately or over-fuelling will flood and stall the engine.

Location and Operation

- The method for cold starting the Rover Efi System has two separate functions.
- The first is under the control of the ECU whereby an electrical supply from the starter circuit signals pin 4 of the ECU for an increased “open time” for all eight injectors during cranking.
- The second employs the thermotime switch (TT) fitted to time the operation of the cold start injector (CSI).
- Located in the coolant gallery at the left front of the inlet manifold, alongside but slightly in front of the coolant temperature sensor, the thermotime switch determines cold start injector “open time”.
- The colder the engine at start-up, the longer the injection time, but only during the cranking sequence.
- To achieve a satisfactory start in adverse conditions the cold start injector, mounted on the R/H side of the plenum chamber, is positioned to spray directly against incoming air to give the best atomization of the additional fuel it supplies.

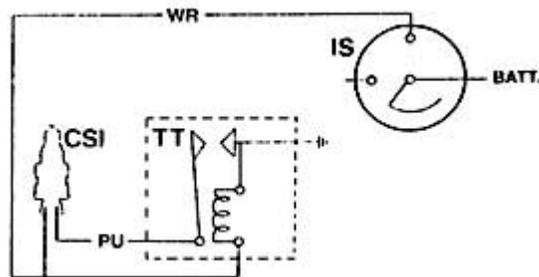
- Cold start injector arrangement
 - CSI Cold start injector
 - BATT Battery supply (when cranking)
 - TT Thermotime switch
 - HC Heater coil
 - BMC Bimetal contacts



- The thermotime switch contains a heater coil (HC) around bimetal operated contact points (BMC), and works as follows.
- During cranking in cold conditions current can pass through the closed contact points of the thermotime switch and cause the injector to operate. Simultaneously, current is passing through the heater coil to warm the bimetal. After a maximum of 12 seconds the expansion of the bimetal will open the contact points. The injector then ceases to operate to avoid an over-fuelling condition.
- In any case the injector will cease to operate as soon as the engine fires because it is only connected to the ignition system during cranking. When correctly tuned, the engine will fire and run long before the maximum 12 second limit is reached.
- At higher coolant temperatures the operating time progressively lessens, until at 35°C approximately, the thermotime switch contact points remain open and the cold start injector will not operate.

The Electrical Circuit

- The thermotime switch (TT) seen here has a pair of contacts, one of which is mounted on a bimetal strip fitted with a heater coil.
- The cold start system is under the control of the ignition switch (IS) and will only operate when the ignition is in the 'crank' position.



- When it can operate, the thermo-time switch ensures that:
 - The injector does not operate if the coolant temperature is greater than 35°C.
 - The injector operates only up to a maximum of 12 seconds to avoid flooding, and the time depends on coolant temperature. In other words the injector only operates for the maximum 12 second period in temperatures of - 20°C. Warmer than this and the operating time gets proportionally less.
- In cold conditions the bimetal contacts are closed. Current is fed via the white/red wire to the injector, then via the purple/blue wire to the contacts and earth, activating the injector. Because the bimetal is temperature sensitive, if the coolant is already above 35°C the contacts will be open and the injector cannot operate.
- The other connection from the white/red wire passes current through the heater element raising the temperature of the bimetal which, after a maximum of 12 seconds breaks the contacts disconnecting the injector, even if cranking continues.

- Test condition as above except
 - Engine hot (over 35°C)
 - Connect an ohmmeter between the purple/blue wire (PU) at the cold start injector plug and earth.
 - Reading should be infinite indicating the contacts opened correctly when hot.
 - If incorrect renew the thermotime switch.

Conclusions

- Uninformed mythology surrounding the thermotime switch and the cold start injector would have one believe that they are collectively responsible for all sorts of fault conditions, when in truth, both components are relatively benign.
- Indeed, in a mild climate like the UK, the cold start system can be permanently disconnected without much adversity and many owners choose to do that.
- Even so, this only eliminates the cold start circuit consisting of the thermotime switch and the cold start injector. The fuel enrichment function triggered by the starter circuit signal to pin 4 of the ECU remains operational.
- Yes! On a very cold morning the cold start system will encourage a properly tuned engine to fire up quickly but the same effect can be achieved by giving the accelerator a couple of sharp boots-full during cranking. After that the system is self-redundant when restarting a hot engine.
- Yes! A faulty thermotime switch can cause uncontrolled over-fuelling during cranking if the internal contacts are permanently closed. Also the cold start injector can cause over-fuelling if its pintle is jammed, leaking fuel continuously.
- So, in general, if Rover SD1 Efi System problems are suspected, removing the connectors from both cold start components or simply disconnecting/removing the injector and sealing its plenum orifice, immediately isolates the components whilst the rest of the system will be unaffected. If problems still persist then the solution definitely lies elsewhere.
- As with most components of the Rover SD1 Efi System, substitution of the cold start injector and the thermotime switch can be an alternative (short cut) route to fault diagnosis although this does not detect any wiring or connector problems.
- Never-the-less, there are still plenty of inexpensive used items available through the second hand spares market or popular auction sites making it worthwhile picking up spare items when the opportunity arises.

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