



Andhra Pradesh State Road Transport Corporation  
Mechanical Engineering Department  
Office of the VC&MD, Bus Bhavan, Hyderabad-624

No. OP2/462(1)/2007-MED

**CIRCULAR NO. 11/2009-MED, Date: 26-06-2009**

Sub : **MAINTENANCE** - Common failures of Tata BS-II vehicles - Certain instructions on preventive measures to be taken at Depots - Reg.

- Ref :
1. Circular No: 04/2007-MED, Dt.05.02.2007
  2. Circular No: 16/2007-MED, Dt.23.07.2007
  3. Lr.No. even dated 14.02.2007
  4. Lr.No. even dated 01.03.2007
  5. Lr.No. even dated 26.03.2007
  6. Lr.No. even dated 23.05.2007
  7. Lr.No. even dated 02.07.2007
  8. Lr.No. even dated 27.03.2008
  9. Lr.No. even dated 04.04.2008
  10. Lr.No. even dated 24.09.2008
  11. Lr.No. even dated 28.01.2009

- 1.00 In Compliance with Central Motor Vehicle Rules, Corporation has been procuring the BS-II vehicles from Apr'2003 onwards. In Tata zones, the population of BS-II vehicles has crossed 2000 nos by Mar'09, constituting about 25% of total Tata fleet. The features of Tata BS-II vehicles and their maintenance systems have already been communicated through circular cited.
- 1.01 During the initial stages, there were several problems with operation and maintenance of Tata BS-II vehicles at the Depots and the failures were on very much high side. In order to make our Drivers & Maintenance staff familiar with the new technology, several training programmes have been organized with the support of Vehicle Manufactures apart from conducting number of service campaigns in all regions. With all these measures, there has been significant reduction in the failure rate and the performance of BS-II vehicles started improving consistently at many places.
- 1.02 But, there are several depots where the awareness levels are not upto the mark and vehicles are failing frequently due to lapses on account of ignorance and negligence. On review of the Vehicle-wise Breakdowns of Tata BS-II model during the year 2008-09, it is observed that majority of BS-II vehicle failures are on account of fuel system. Further, the review of unit lives indicates drastic fall in the life of Distributor type Fuel Injection Pumps and Engines among all the Tata regions, which can be attributed to abusive maintenance at depots. Therefore it is felt necessary to reiterate the instructions on proper maintenance of BS-II vehicles once again.
- 2.00 Fuel Injection system is one of the areas where adequate attention is not being paid at depots. The common failures observed in the fuel system on BS-II vehicles owing to the negligence in maintenance are as follows.

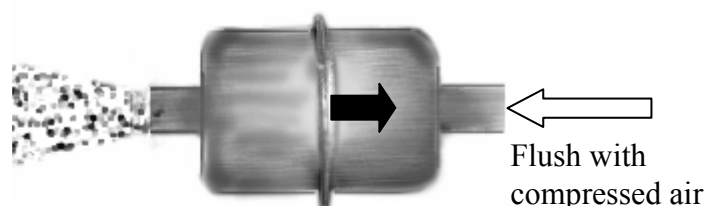
- i. Air Lock Trouble
- ii. Failure of Electric Feed pump
- iii. Diesel leakage from the Control lever bush/ shaft
- iv. Damage to the Timer Piston
- v. Damages to the Vanes, Cross disc, pressure Control Valve and Distributor head, Drive shaft, pump housing and KSB unit
- vi. Breakage of High pressure pipes
- vii. Crank case Dilution

2.01 **Air Lock Trouble** : On critical analysis of breakdowns during 2008-09, it is observed that Air lock trouble is the common complaint at all places which is badly affecting the performance and life of the FIP besides resulting in enroute failures and loss of kilometers & earnings. As the internal components of Rotary pump are lubricated with diesel itself, presence of any trapped air in the fuel system causes irreparable damage to the precision parts of the Pump & Governor mechanism.

Causes for Air Lock :

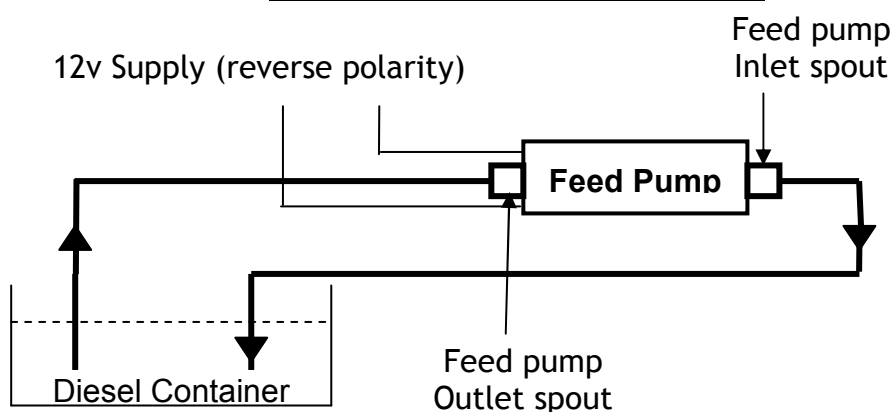
- i. Choking of Fuel Strainer (Baby filter)
- ii. Choking of Electric Feed pump
- iii. Choking of Fuel filters
- iv. Loose banjo connectors in the suction lines
- v. Cracks/ damages in the pipe lines on suction side

Cause & Effect	Remedy
<p>i) <b><u>Choking of Strainer (Baby filter)</u></b> : The choked Strainer causes trapping of air in the suction line sucked through the hand primer O’ring of the Fuel-Water Separator because of the vacuum developed between the strainer and Electrical Feed pump. This trapped air in the fuel system not only causes air lock trouble but also leads to failure of the pump due to hitting of Timer piston with the pump body at the time of starting due to its sudden movement because of trapped air.</p>	<ul style="list-style-type: none"> <li>➤ The Strainer (Baby filter) has to be cleaned <b>thoroughly during every Sch-III</b> maintenance to prevent its choking with dirt &amp; dust.</li> <li>➤ While cleaning the Strainer, the compressed air has to be applied in the reverse direction (opposite to the Arrow mark) so that the trapped dirt is ejected out from the wire mesh of the strainer.</li> <li>➤ The strainer has to be fitted only after ensuring that it is completely clear from the dirt. After cleaning, the strainer shall be fitted in such a manner that its ‘in’ and ‘out’ connections are correctly made as per the Arrow indication</li> </ul>



Cause & Effect	Remedy
<p><b>ii) Choking of Electric Feed Pump:</b> Sometimes, the Electric feed pump also gets choked with fine dirt due to which the delivery capacity of the pump falls down resulting in reduced fuel supply and air lock</p> <p>As the electrical feed pump works with 12 Electrical volts supply, the electrical connection to the Feed pump is tapped from 24 volts ignition supply line which is stepped down to 12 volts by a SERIES RESISTOR (Located in the left side chassis long member). Any attempt to bypass the resistor and connect the feed pump with 24 volts, the system will not function and the motor may burn out.</p>	<ul style="list-style-type: none"> <li>➤ The following checks have to be made during the scheduled maintenance to ensure that the pump is working satisfactorily. <ul style="list-style-type: none"> <li>i. Check the condition of Electric feed pump fuse during <b>every Sch.III.</b></li> <li>ii. Check the routing of wiring harness all along upto the feed pump during <b>every Sch.III.</b></li> <li>iii. Check complete engagement of all Electrical sockets of the wiring harness every <b>Sch.III.</b></li> <li>iv. Check the battery voltage/ specific gravity during every <b>Sch.II &amp; III.</b></li> <li>v. Check the correct functioning of Feed pump during <b>every alternate Sch.IV.</b> If the flow rate is found less than 2 lit per minute, clean the electric feed pump by giving reverse polarity so that the sediments are flushed out from the pump inlet.</li> </ul> </li> <li>➤ The Resistor shall be checked periodically for its output voltage. Voltage higher than 12 volts may lead to failure of Electric Feed pump.</li> <li>➤ The Electrical Feed Pump gets supply and starts working as soon as the Ignition Key gets inserted into the Ignition switch. Hence, for getting improved life of the Feed Pump, Ignition Key should be removed from the switch as soon as the Engine was stopped</li> </ul>

### Cleaning of Electrical Feed Pump

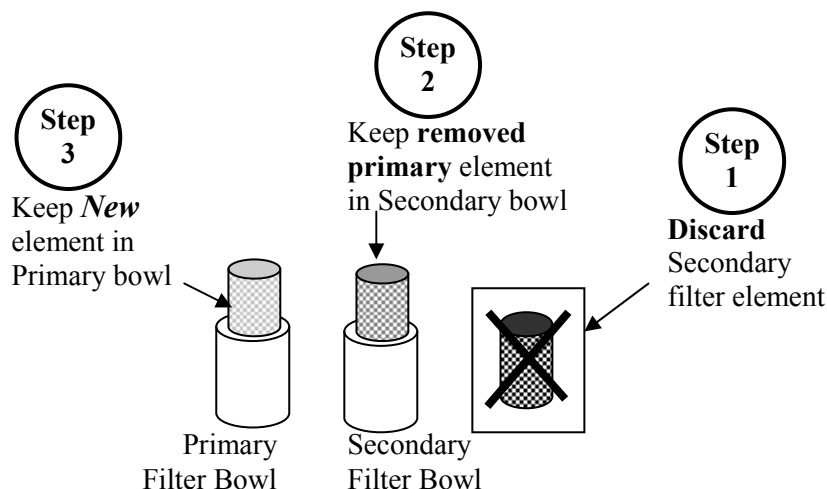


Cause & Effect	Remedy
<p><b>iii) Choking of Fuel filters:</b> Since the life &amp; efficiency of the Fuel pump greatly depend on the quality of fuel and its filtration level, the condition of Fuel filters plays very important role in the fuel system.</p> <p>As the filtration efficiency of the filter elements falls down after certain period owing to various reasons, there is scope for reduction in the fuel rate causing Air lock problems</p>	<ul style="list-style-type: none"> <li>➤ In Tata BS-II vehicles, both primary and secondary fuel filters are provided with Star type Paper elements for better filtration.</li> <li>➤ The filter elements have to be replaced strictly as per the <b>prescribed periodicity of 18,000 kms for both the filters.</b></li> <li>➤ While changing the filter elements, it must be ensured that the periodicity of <b>primary &amp; secondary filters changes is staggered such that both elements are not replaced at a time.</b></li> <li>➤ The fuel system has to be bleed properly while changing the fuel filters to avoid entry of air into the fuel pump which otherwise would cause damage to the pump body and timer piston.</li> </ul>

**FILTER CHANGE PROCEDURE AT EVERY 9,000 Kms:** The following system shall be adopted for changing Fuel filter elements.

1. Initially at 9,000 kms, remove the secondary filter element and discard it.
2. Take out the fuel filter element from the primary filter bowl and fix it in the secondary filter bowl.
3. Put a new filter element in the Primary filter bowl.
4. Adopt the same procedure at every 9,000 kms thereafter.

Thus at every 9,000 kms only element needs to be replaced and hence only one filter element shall be drawn from the Stores. The above filter change periodicity shall be incorporated in the VEMAS module for obtaining the advance programme.



Cause & Effect	Remedy
iv) <b><u>Loose banjo connectors &amp; hose clips in the suction lines:</u></b> In majority of the cases, the air lock trouble occurs due to entry of air from loose Banjo connectors and hose clips in the suction side.	<ul style="list-style-type: none"> <li>➤ It is advised to check the tightness of Banjo bolts and hose clips during the scheduled maintenance.</li> <li>➤ Banjo bolts shall never be over-tightened as this may lead to cracking of banjo body, sealing washer and distortion of seating surface.</li> </ul>

Cause & Effect	Remedy
v) <b><u>Cracks/ damages in the pipe lines on suction side:</u></b> In most of the cases, the failures like Air lock trouble and fuel leakage occur due to breakage of fuel pipes owing to rubbing and fouling with other parts.	<ul style="list-style-type: none"> <li>➤ It is one of the important aspects to be ensured during scheduled maintenance that the pipe lines are clamped properly to avoid vibrations and fouling with other parts. The clamping shall be made in such a way that the pipes are firmly positioned in the clamp grooves.</li> </ul>

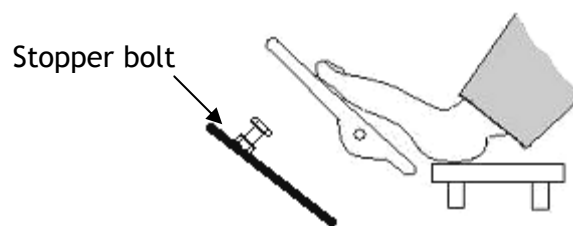
2.02 **The Procedure for Bleeding air from the Fuel System** : After attending the Air lock complaints or on completion of works like replacement of fuel hoses, pump, pipes etc., the trapped air shall be removed from the system before cranking the engine as explained below.

- a. Clean the Vent hole of the HSD tank cap and fix the tank cap firmly
- b. Ensure sufficient stock of HSD oil in the tank
- c. Open the bleed screw on the Fuel-Water Separator and bleed the air by pumping the fuel by priming. Tighten the bleed screw firmly after bleeding.
- d. Open the bleed screw on the Fuel filter cover and pump the fuel using the primer slowly. Continue the priming as long as the Air bubbles come out along with the fuel from the bleed screw. Close the bleed screw on observing continuous fuel flow without any air bubbles
- e. Open the Overflow valve on the Rotary FIP; bleed the air by pumping the fuel again by priming. Tighten the overflow valve on observing free fuel flow without air.
- f. Open the HP pipe connectors of all Injectors and crank the engine for few seconds, Tighten the Injector pipe connectors with correct torque.
- g. Start the engine and keep under idling for few minutes

3.00 **Damages to the FIP components like Vanes, Cross disc, pressure Control Valve, Distributor head, Drive shaft, pump housing etc:** The stripping analysis of Tata Rotary FIPs (645 nos) at Zonal Workshops during 2008-09 reveals the following

- Diesel leakage from Accelerator cam bush ... 72%
- Timer Piston Damage ... 17%
- Distributor Head & Drive shaft damage ... 4%
- Vane, Pressure Control Valve, Cross Disc damage ... 2%
- Others ... 5%

- 3.01 **Diesel leakage from Accelerator Cam Bush** : Majority of the failures are on account of diesel leakage from Accelerator cam bush. This defect was occurred partially due to the design fault and M/s BOSH Ltd have modified the Control lever shaft and other parts from Se'08 onwards to avoid leakage from the guide bush. The modified Part Numbers have already been communicated to the Zonal Stores & Zonal Workshops advising the Works Managers to replace the old parts with modified ones whenever the pumps are taken for attention at Workshops.
- 3.02 **Stopper Bolt for Accelerator Pedal Travel** : In many cases, the Stopper bolt for Accelerator pedal is found missing in the vehicles. If the Stopper bolt is not provided, the pedal travel movement will exceed the normal travel which leads to overloading of FIP lever, lever shaft and guide bush resulting in premature failure and diesel leakage from the guide bush. The height of the Stopper bolt shall be adjusted in such a way that it touches the accelerator pedal just before reaching the maximum travel by the pump lever.

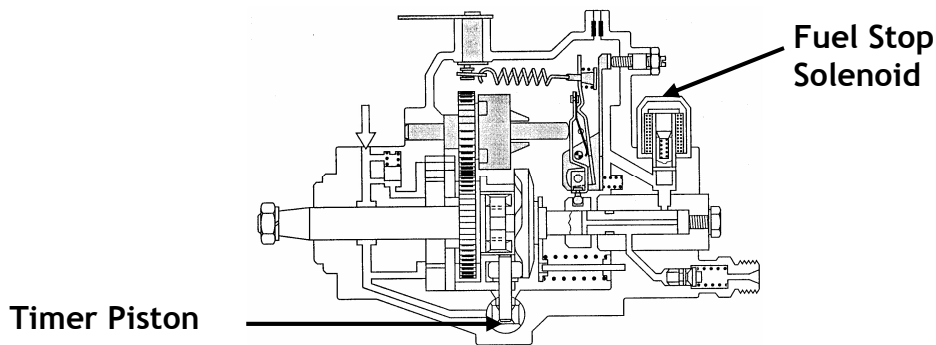


- 3.03 With regard to the failure of other components like Timer Piston, Cross disc, Vanes, Drive shaft, Distributor Head etc., which are mostly avoidable are occurring due to abusive maintenance at Depots.
- 3.04 **Bleeding of water everyday from the Fuel water separator** - The negligence in bleeding the water settled in the Fuel-water separator daily will cause severe damage to the precision parts of the FIP due to rust formation. The entry of moisture into the FIP is highly detrimental to the FIP as there is no separate lubrication provided for Rotary FIPs. There have been several cases of premature failure of Rotary FIPs due to this reason.



Entry of water into the fuel system, trapped air and long cranking of engine without bleeding the fuel system are the prime causes for Pump failures. There is need to create awareness among the maintenance staff in proper maintenance of fuel system on BS-II vehicles. Also, the drivers shall be thoroughly educated on handling the BS-II vehicles to avoid such failures.

- 3.05 **Tampering the Spring & Nipple in the FIP solenoid system** - At some depots, the spring and Nipple in the Fuel stop solenoid are being removed. In such cases, the Fuel available in the line between the Electrical feed pump and the FIP gets sucked into the FIP even though the engine is stopped. This again will cause a low pressure in the fuel line whereby air is sucked into the system leading to the failures.

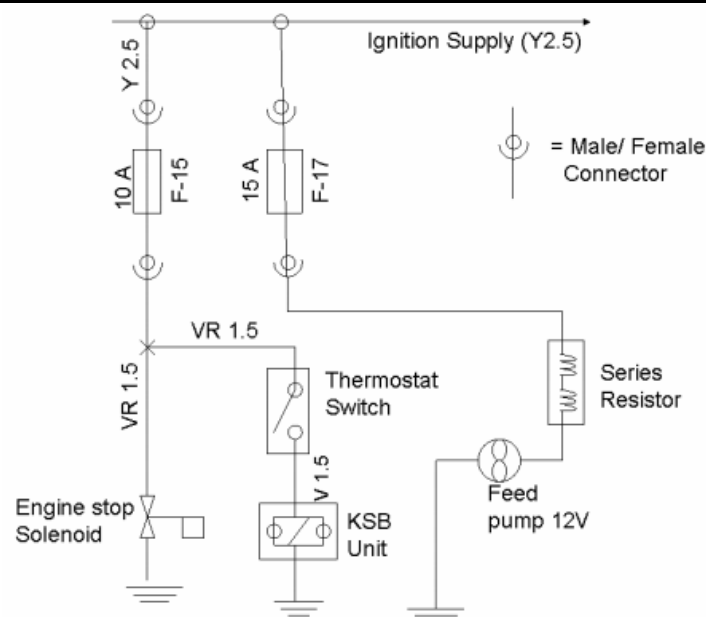


3.06 **KSB unit on Fuel Injection Pump** : The function of KSB Unit (Cold starting device) is to advance the injection timing in the Rotary FIE in extreme cold conditions by sensing the temperature from a thermostat switch. The unit works with electrical power. The power connection is tapped from the Ignition supply with 10A fuse. As the fuel supply from the FIP varies with the signal from the Temperature Transducer, any attempt to remove the transducer or its connections with KSB will affect the performance of Fuel injection Pump.

3.07 **Fitment of correct rated Fuses for Engine Stop Solenoid, KSB & Feed pump** : In order to protect the wiring harness from damage in case of short circuit and overloads, fuses of glass cartridges as per IS 2577 are provided in a transparent fuse box. The particulars of consumers served by each fuse are printed on the fuse box. Precautions shall necessarily be taken to replace the fuses with fuse cartridges of designated rating only. Never attempt to tamper the fuses and never use over rated fuses. Tampered fuses will not protect the wiring in the event of overloading/ short circuit. The ampere ratings of the fuses are given on the fuse box cover. The fuses of different ratings are easily available in the market and the cost of these fuses is very less. The fuse links can be identified for amperage by colour codes; Light brown-5 Amps, Red-10 Amps, Blue-15 Amps and Yellow-20 Amps.

Ensure that the details of fuses printed on the fuse box cover are clearly visible so that it will be easy to check the respective fuse in the case of fault in the electrical system. Proper care shall be taken while painting to avoid paint marks on the fuse box cover.

**CIRCUIT DIAGRAM FOR ENGINE STOP SOLENOID, KSB & FEED PUMP**



- 4.00 **Crank Case Dilution** : The defective Fuel Overflow valve & Ejector valve may build up excess pressure in the fuel pump gallery and may lead to leakage from the weaker points like pump shaft seal causing Crankcase dilution. The functioning of the valves shall be checked thoroughly during the scheduled maintenance to avoid fuel leakages and CCD. The FIP shall be replaced immediately on observing CCD due to leakage of fuel from Pump shaft seal.
- 5.00 **High Pressure Pipe Lines** : The breakage/ failure of HP lines on BS-II vehicles are mainly on account of improper handling of pipe connectors at the time of loosening/ tightening while setting plunger lift. Attempting to loosen the HP pipe connectors with a single spanner without holding the DV holder will cause the DV holder to rotate and once the DV holder is rotated it is difficult to disconnect the pipe connector from the holder. In such cases, the pipes have to be cut for removing the HP connectors. Therefore, it is advised to hold the Delivery valve holder with 14mm Single end spanner firmly with one hand and loosen the HP pipe connector with 17mm special wrench (Part no: H-SAKDEP-20) with the other hand ensuring that the DV holder is not rotated in the pump housing. Over-tightening the DV holders shall never be allowed, as this will not only cause damage to the DV holder seating but also affects the function of the valve.
- 6.00 **Setting of Plunger Lift** : Necessary training has been given to the KMPL Mechanics and HRG Mechanics at all Tata depots on correct setting of Plunger lift for Rotary FIPs. The **plunger lift, once adjusted normally does not get disturbed and hence need not be checked periodically.** However, whenever there is Black smoke/White smoke is observed or at the time of fitment of new pump or there is any drop in fuel efficiency or in the event of any disturbance in the pump mounting, the Plunger lift has to be checked using the special adaptor (Part No: H-F/EPEP-32) and dial indicator. It shall be ensure that the FIP mounting bolts are tightened to correct torque after setting the plunger lift. Any looseness in the mounting bolts may lead to serious problems.
- 7.00 **Valve Sinking problems in Engines:** In Tata BS-II vehicles, there is a common complaint of faster wear in inlet valves/ valve seat inserts resulting in 'Valve Sinking' and disturbed valve clearance at an early stage. Since, this has been identified as manufacturing defect, M/s Tata Motors have agreed to replace the Valves & Valve Seat inserts under 'Free of Cost' for the vehicles which fall under warranty. As this is a serious problem which not only affects the fuel efficiency of the vehicle but also lead to failure of cam shafts, push rods and tappets; instructions have been issued to inspect all the BS-II engines thoroughly and identify the vehicles having such problems at the depots and get them rectified duly consulting the local service personnel of M/s Tata Motors. In case, the vehicle crosses the warranty period, it is advised to get the defect rectified by replacing the Cylinder heads supplied by Zonal Workshops. Under any case, the vehicles shall not be allowed to run with defective valve mechanism.
- 8.00 A Video CD prepared by the Zonal Workshop, Vizianagaram on the functioning of rotary pump, trouble shooting and the precautions to be taken to achieve the best performance is also being circulated to all the Tata depots for imparting training and educating the Mechanics at the Depots.
- 9.00 The Depot Managers and Maintenance Incharges of Tata Depots are advised to carry out the prescribed maintenance for Tata BS-II vehicles without any deviation and educate the Drivers and Maintenance staff suitably.



- 10.00 The Dy.Chief Mechanical Engineers are advised to propagate above instructions on maintenance of Tata BS-II vehicles at the Depots under their jurisdiction and ensure strict implementation.
- 11.00 The Works Managers are advised to inform the Depots about the maintenance lapses & abuses observed from the failed units and advise the Depot Managers/ Maintenance Incharges to take suitable corrective action.



**VICE CHAIRMAN & MANAGING DIRECTOR**

To  
All Depot Managers of Tata Depots.

Copy to: Dir (V&S), ED (E&IT), ED (O&MS), ED (A&P), FA, CAO, ED (T&C) for infn.  
Copy to: ED (AM&HCZ), ED (HYD), ED (KRMR), ED (V&V), ED (K&N) for information.  
Copy to: All RMs for necessary action.  
Copy to: CME (O), CCOS, CA, CFM, CME(C&B), CE (IT), for information.  
Copy to: DyCME (O), DyCME (P), DyCME(C&B), DyCME (IED), COS(C) I & II for n.action  
Copy to: All DyCMEs, WMs, COSs & DyCAOs for necessary action.  
Copy to: All Principals of ZSTCs, BTC, HPT & TA/HPT for information.  
Copy to: All Maintenance In-charges of Tata depots for necessary action.  
Copy to: In-charge, Manual Section for record.