ANDHRA PRADESH STATE ROAD TRANSPORT CORPORATION

Office of the VC & MD,
Mushirabad, Hyderabad-20

No: OP4/462(5)/2007-MED.

CIRCULAR No : 18/2007-MED, Dt.06/09/2007

Sub : **MAINTENANCE** – Proper Maintenance of Engine cooling system – Reiteration of instructions – Reg.

Ref : 1. Cir No: 40/94-MED, Dt.07.12.1994
2. Cir No: 17/95-MED, Dt.14.08.1995
3. Cir No: 26/98-MED, Dt.24.09.1998
4. Cir No: 27/99-MED, Dt.06.09.1999
5. Cir No: 33/99-MED, Dt.30.10.1999
6. Cir No: 27/2003-MED, Dt.11.07.2003
7. Cir No: 33/2003-MED, Dt.20.11.2003

1.0 The purpose of the coolant in the engine is to dissipate the heat developed in the engine during the combustion process and maintain a stable operating temperature. The cooling system plays very important role in the performance of the Engine. The life of the Engine and its components mainly depend upon the efficiency of the cooling system.

1.1 Many advanced technologies have been introduced in the cooling system on both Ashok Leyland and Tata vehicles over the years to improve the efficiency, reduce the maintenance and the cost of operation as well. The Corporation has been procuring the expensive & best quality coolants in order to get the optimum performance from the engines. The existing cooling system provided to the vehicles is virtually "**No loss cooling**" system and does not warrant any top-up between the coolant change intervals. Hence the consumption of coolant shall be bare minimum for top-up and other miscellaneous purposes. But it is not happening in practice, as the consumption of coolant towards top-up is exceeding the quantity required for coolant changes thus resulting in heavy expenditure. During the year 2006-07, **the total consumption of coolant is 2,47,833** liters for both Tata & Leyland areas. Whereas, the quantity required for periodical coolant changes based on the volume of operations is only 1,26,084 liters and the rest of the coolant has been consumed towards top-up & other miscellaneous purposes. As such, every **Tata vehicle** has consumed about **9.85 liters** and **Leyland vehicle consumed about 4.65** liters per annum towards top-up thus defeating the purpose of "No loss" system provided to the vehicles. The loss incurred due to wastage in terms of rupees is about **1.32 crores** for the year 2006-07 on coolant.

1.2 This excess consumption of coolant is mainly due to lack of awareness among the supervisors and maintenance staff on the maintenance of cooling system. The guidelines issued on proper maintenance of cooling system from time to time through circulars seem to be neglected and the coolant consumption is neither being monitored at Depot level nor reviewed at regional level. The following are some of the lapses commonly observed at Depots which are contributing to excess consumption of Radiator coolant.

- **Opening the Radiator cap abruptly without giving enough time** for coolant to cool and settle at the time of Sch.I maintenance causing spillage of coolant due to excess pressure in the system.

- **Topping of Coolant without ensuring the coolant level** in the Radiator. Any quantity of coolant beyond the maximum mark will come out through overflow pipe thus resulting in wastage.

- **Stocking the coolant mixture in large containers** (200 liter capacity barrels) with leaky taps, improper lids and filling cans. There is no monitoring on the use of coolant by the Shift incharges and maintenance incharges.

- **Mixing of coolant additive with water in incorrect ratios** and in majority of the cases the coolant is observed in highly diluted condition.

- **Not taking proper care to collect the coolant from the engine** into a clean container while carrying out the works like replacement of Cyl.Head, Radiator, Water pump, Radiator hoses, Thermostat, oil cooler etc for reusing the coolant.

- **Not providing the Radiator caps** with proper seals and chain.

- **Improper mounting of Radiators** causing damage to the Radiator hoses due to heavy vibrations resulting in leakages.

- **Damaged/ missing Radiator shrouds**, **broken Fan blades** on the vehicles leading to overheating of the coolant.

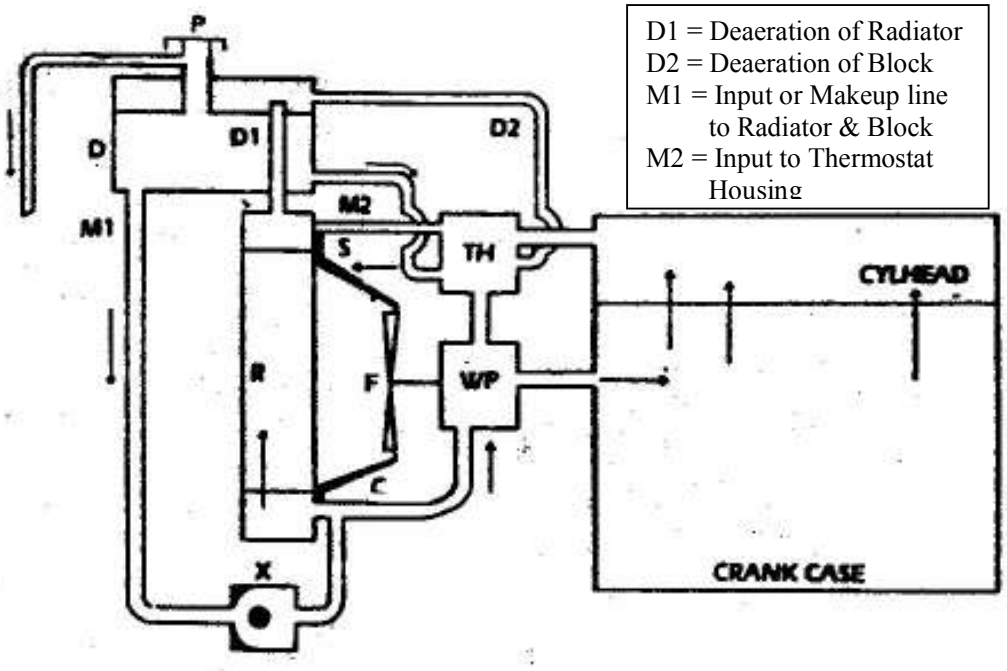
- **Fitment of hoses of incorrect lengths** resulting in twists and cracks leading to coolant loss.

1.3 Hence, it is felt necessary to reiterate the salient features of cooling system along with the latest developments and the precautions to be taken to avoid loss of coolant and proper maintenance practices related to cooling system to improve the life of engines.

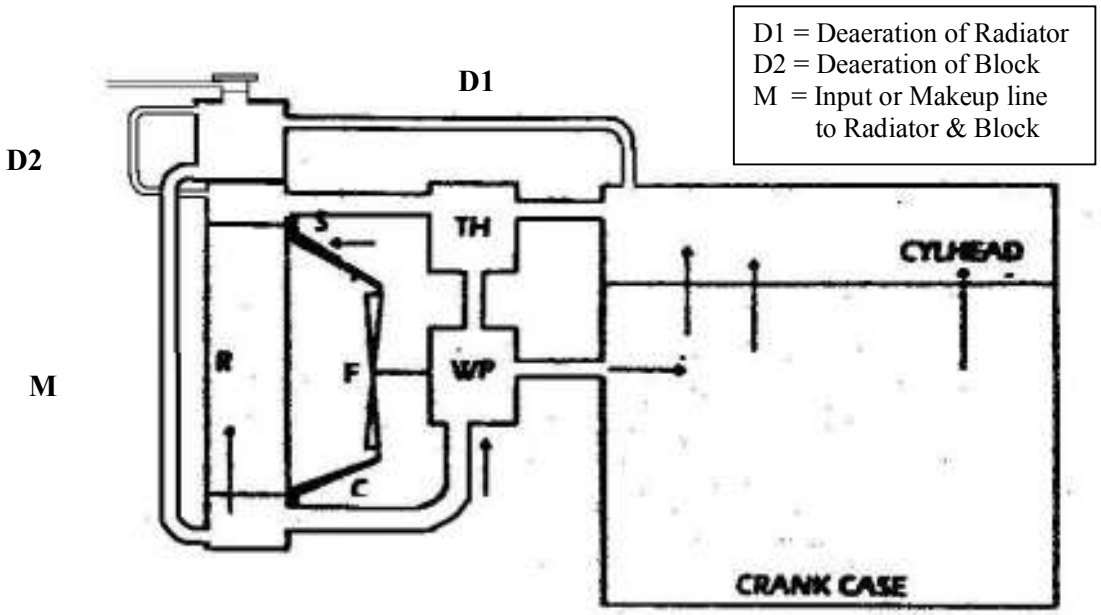
2.0 DEVELOPMENTS IN COOLING SYSTEM :

2.1 **De-aeration cooling system** : This facilitates **elimination of air pockets** in the coolant passages which other-wise **may cause local overheating**, **reduced heat transfer, faster corrosion of components and reduced pumping efficiency**. The schematic diagrams of de-aeration cooling system of Tata & Layland vehicles are shown below.

LEYLAND HINO DE-AEARATION COOLING SYSTEM



TATA CMVR/ BS-II DE-AERATION COOLING SYSTEM



R - Radiator **WP – Water Pump**
F - Cooling Fan **TH - Thermostat**
S - Shroud **X - One way Valve**

2.2 Use of Ethylene glycol based coolants for better cooling, anti-corrosion and antifreeze properties. The **boiling temperature of this coolant is higher** than ordinary coolant media; hence the **loss of evaporation is greatly reduced** by using these coolants.

2.3 **Introduction of Plastic tanks** on the Radiators to know the coolant level during routine maintenance without opening the Radiator cap.

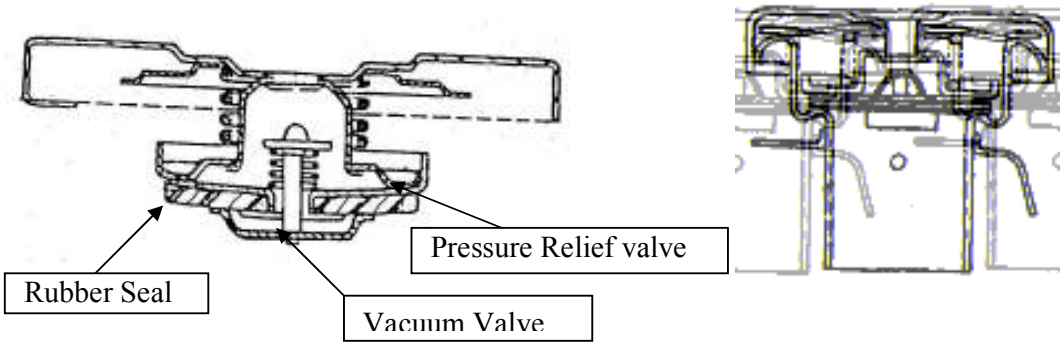
2.4 **Introduction of Viscous clutch cooling fans** in order to attain operating temperature quickly and to save the fuel by way of reducing the power consumed by the fan.

2.5 **Introduction of Aluminum Radiators** for better heat transfer, longer life, corrosion free and better serviceability.

3.0 DIFFERENT COMPONENTS OF COOLING SYSTEMS & THEIR MAINTENANCE :

3.1 RADIATOR CAP & FILLER NECK

3.1.1 Pressurised Radiator cap is provided **to enhance the system pressure** by 0.50 kg/sq.cm over that of atmospheric pressure besides preventing loss of coolant. Because of the increase in the system pressure, the **boiling temperature of the coolant increases substantially and avoids vapourisation** thereby enhancing the heat transfer efficiency. The important components of the Radiator cap are shown in the figure.



3.1.2 Since the entire cooling system is closed loop type with no-loss coolant system, it is essential to **keep the Radiator cap always fitted**.

3.1.3 The Radiator cap has **to be replaced if the rubber seals become hard/ perished** and if the springs loose their tension.

3.1.4 Radiator Filler Neck is also as important as the Radiator cap in maintaining the required pressure in the cooling system. The **Filler neck has to be replaced if the neck Ramp edges gets damaged or worn out** and if the rubber seal seating area inside the neck gets damaged.

3.2 RUBBER HOSES & CLAMPS :

3.2.1 Rubber **hoses of recommended sizes shall only be used**. Use of longer hoses other than the specified sizes will lead to twisting there by restricting the flow of coolant. Hoses of extra length may get punctured due to rubbing with other components.

3.2.2 Clamps of suitable sizes shall be used. Improper tightening of hose clamps may lead to leakage of coolant.

3.2.3 The condition of all Radiator hoses has to be thoroughly inspected during Sch.III/IV maintenance. The perished rubber hoses have to be replaced in time.

3.3 RADIATOR ASSY AND ITS FOUNDATION

3.3.1 The performance of the coolant system and the life of its major components mostly dependent upon the condition of the Radiator and its foundation.

3.3.2 The Radiator foundation bolts, Stay rods and rubber buffers have to be fitted properly to avoid damage to the Radiator and rubber hoses due to vibration. The stocking of these items has to be ensured at all Depots.

3.3.3 Radiator has to be thoroughly cleaned by flushing at the time of coolant change. If the Radiator capacity falls down drastically due to severe scaling/ choking inside the tubes then the bottom & top tanks have to be removed and cleaned thoroughly.

3.3.4 For Aluminum Radiators, the guidelines issued on repairs and overhauling vide circular No: **27/2003**-MED, Dt.11.07.2003 have to be followed.

3.3.5 The Radiator after fitment to the vehicle has to be kept under observation for at least half an hour with engine under running condition to ensure that the Radiator is free from leakages.

3.3.6 The **Radiator fins have to be thoroughly cleaned during every sch.III/IV by applying compressed air of 1 kg/sq cm pressure**. In any case, the radiator fins **shall not be cleaned by applying water or high pressure air**.

3.3.7 The **dust and debris settled between the Radiator and Intercooler in BS-II vehicles have to be cleaned during every sch.II**

3.3.8 The drain cock fitted to the radiator must be in good working condition without any leakage.

3.4 THERMOSTAT

3.4.1 The purpose of the Thermostat is to attain the optimum working temperature as soon as the engine is started. This is very much essential to avoid formation of acids inside the combustion chambers which may cause corrosive wear on the cylinder liners, pistons and rings.

3.4.2 Detailed guidelines have already been communicated on checking of thermostat working condition.

3.5 WATER PUMP :

3.5.1 The working condition of the Water pump has to be ensured during every Sch.II maintenance.

3.5.2 Water pump shall be replaced immediately on observing excess play in the shaft and leakage of coolant from the glands.

3.5.3 Filling the grease cups shall be ensured during every Sch.II maintenance in the case of Tata 697, CMVR & BS-II Engines.

3.6 COOLING FAN :

3.6.1 Cooling fan with broken blades shall be replaced immediately

3.6.2 The functioning of Viscous Fan totally depends on the condition of temperature sensing bi-metallic coil/ strip. In order to ensure proper functioning of the Viscous fan, **the dust & dirt accumulated on the sensing coil should be cleaned** periodically. The checking procedure of Viscous fan and its maintenance have been explained in the Cir No:15/2006-MED and Cir No: 4/2007-MED

3.6.3 The **Belt tension** is one of the important aspects which affect the performance of cooling system adversely if neglected. Fan belt tension has to be checked and adjusted during every sch.II maintenance.

3.6.4 Missing of **Distance piece on the Pulley hub** in case of Tata 697 & CMVR vehicles will cause the overheating problem due to increased gap between the Radiator and Fan.

3.7 FAN SHROUD :

3.7.1 This is one of the important items in the Cooling system which is generally neglected at Depots. The shroud fitted to the Radiator in front of the Cooling fan allows the air to be sucked only through the radiator fins so that the coolant gets cooled thoroughly. In the event of any damage/ missing of Shroud, the cooling fan sucks the air from the engine surroundings instead of sucking it across the radiator. This may lead to engine overheating and water boiling. Hence, **under no circumstance the vehicle shall run without shroud**.

3.8 TEMPERATURE SENSORS

3.8.1 The temperature transducers provided for knowing the coolant temperature in the instrument panel shall always be kept under working condition. This gives an indication of correct temperature of the coolant and helps the driver in taking corrective action without allowing the vehicle to run further causing damage to the engine.

4.0 Apart from ensuring proper maintenance to the cooling system on the vehicles, the following measures have to be taken to control the consumption of coolant.

5.0 PREPARATION & STOCKING OF COOLANT MIXTURE :

5.1 The antifreeze additive mixed with water in the prescribed ratios shall be used in both Tata & Leyland cooling systems. The coolant with antifreeze additive serves the following purposes.

- It **increases the boiling point** of the coolant medium
- It acts as an **anti-corrosive agent**
- It **prevents** coolant from **freezing** in severe cold conditions.

5.2 The following are the coolant filling capacities, mixing ratios and change periodicities for different types of Radiators in Tata & Leyland.

Type of Radiator	Model	Coolant Capacity in liters	Additive - Water Mix ratio	Drain Periodicity
Brass-Copper	Leyland Hino*	22.5	1:4	75,000 kms
Aluminum	Leyland BS-II*	19	1:1	75,000 kms
Brass-Copper	Tata 697	18	1:1	3,20,000 kms OR 2 Yrs
Brass-Copper	Tata Cummins	24	1:1	3,20,000 kms OR 2 Yrs
Aluminum	Tata CMVR	20	1:1	3,20,000 kms OR 2 Yrs
Aluminum	Tata BS-II	20	1:1	3,20,000 kms OR 2 Yrs

*** -** M/s Ashok Leyland Ltd have proposed use of long life coolant for all Hino range vehicles with a change periodicity of 2.00 lakh kms for which separate instructions will be issued.

5.3 Proper care shall be taken while preparing the coolant mixture. **Clean water shall only be used** for mixing with the antifreeze solution.

5.4 **Correct ratios of coolant additive & water** shall be maintained at the time of making the mixture preparation and this has to be made under the supervision of Shift Supervisor.

5.5 The prepared **mixture shall be kept under the custody of Shift supervisor** in a clean plastic **container of capacity not exceeding 20 liters** on a suitable stand. This solution shall be used exclusively for top-up.

5.6 For Coolant change as per the prescribed programme, the coolant mixture has to be prepared separately by mixing the additive with clean water in a separate container. The additive drawn for this purpose shall be accounted separately by **issuing MTS-2 for the individual vehicle**.

5.7 For Ashok Leyland Depots holding BS-II vehicles with **Aluminum Radiators**, a separate container has to be maintained with **coolant mixture in 1:1 ratio** indicating the same with bold letters on the container.

5.8 The container shall have a **proper lid on the top** and a tap at the bottom. A **tray** has to be provided under the tap to avoid spillage.

5.9 Mixing of water to the coolant in the container causing **dilution shall never be allowed**.

6.0 CHECKING & FILLING OF COOLANT ON THE VEHICLES :

6.1 The Radiator cap **shall not be opened immediately** on arrival of vehicle onto the pit. It shall be opened slowly after allowing the coolant to cool and settle.

6.2 The level of the coolant inside the De-aeration tank **shall be checked with a suitable gauge** as explained above.

6.3 For Tata vehicles fitted with **Plastic tanks**, there is no need to open the Radiator cap. **The level can be checked visually**. The tank shall be kept clean and transparent for better visibility of coolant level.

6.4 The coolant shall be topped up only when its level is fallen down to minimum mark. (**Under any circumstance, the coolant level shall not exceed the maximum mark and there shall be enough space for entrapped air to escape from the coolant**)

6.5 As there shall not be any need for refilling the coolant in De-aeration system, the **root cause for coolant consumption shall be ascertained** in the event of low coolant level.

6.6 There **shall not be any overflow from the Radiator** overflow pipe under normal conditions. If there is excess overflow from the overflow pipe, the condition of the pressure relief valve in the Radiator cap, its rubber sealing washer and the neck ramp shall be checked thoroughly and replace if necessary.

7.0 REQUIREMENT OF COOLANT FOR MISCELLANEOUS PURPOSES :

7.1 Proper care shall be taken while draining the coolant from the Radiator at the time of top overhauls, head replacement, Oil cooler replacement, Thermostat replacement, Hoses replacement etc. The coolant shall be drained into a clean container by opening the Radiator drain cock avoiding the spillage. **The coolant drained from the vehicle shall be stored in the clean container with a proper lid for reuse**.

7.2 **The coolant contaminated** with engine oil **shall not be reused.**

7.3 The removed coolant from the vehicles at the time of Coolant change shall be thrown in the depot drains so that it is not reused again.

8.0 ACCOUNTAL & REVIEW :

8.1 The **vehicle-wise top-up particulars** of coolant shall be recorded properly by the Shift incharge

8.2 The DC/ADC(oils) **shall issue separate MTS-2** for Coolant used for top-up and coolant changes everyday.

8.3 The Maintenance Incharge and **Depot Manager shall monitor the consumption** of Coolant and vehicle-wise issues.

8.4 The **vehicles consuming more coolant** towards top-up shall be detained for **thorough inspection and rectification of defects**.

8.5 The daily and cumulative total **consumption of Coolant per lakh kms** shall be worked out and recorded in a Register.

8.6 The trends in the coolant consumption at all Depots of the Region shall be **reviewed by Dy.CME & RM** during the review meetings and inspection of Depots and take necessary action if the consumption is high.

9.0 All the Depot Managers are advised to create awareness among the Supervisors and Maintenance staff on the expenditure incurring towards Radiator coolant, importance of proper maintenance to the cooling system and educate them to inculcate correct maintenance procedures as explained above.

VICE CHAIRMAN & MANAGING DIRECTOR

To
All Depot Managers.

Copy to: Director (Vig. & security), ED(E&IT), ED (P&AM), ED (A), ED (O), FA, CAO & ED(T&C) for information
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