

Andhra Pradesh State Road Transport Corporation

Office of the VC & MD,
Hyderabad,

No.OP2/462(7)/2006-MED,

Circular No : 15/2006-MED, Dt.24-11-2006.

Sub : **MAINTENANCE** – Introduction of Bharat Stage –II compliant Hino 6 Cylinder Engines (6ETI 2) – Reiteration of instructions – Reg.

Ref : Circular No.18/2003-MED, Dt.09.06.2003.

Consequent upon introduction of Hino BS-II engines by M/s Ashok Leyland Ltd on their vehicles, in order to comply with the new emission norms notified by the Ministry of Road Transport & Highways for implementation with effect from 1st Apr,2003, a circular has been issued vide reference cited on the salient features of modifications carried out in the new engines. The BS-II compliant vehicles were initially fitted with Distributor type FIP and the engine was designated as **Hino 6DTI2D**. (All these vehicles have been supplied to Hyderabad City Region).

Now, M/s Ashok Leyland Ltd have started supplying **BS-II vehicles with Inline FIPs** with the Engine designated as **Hino 6ETI2**. The salient features of modifications & maintenance procedures are reiterated hereunder.

Aspiration	: Turbocharged with inter cooler
Max output	: 84 kw @ 2400 rpm
Max torque	: 410 Nm @ 1700 - 1800 rpm
Bore and Stroke	: 104 x 118 mm
Piston displacement	: 6.014 lit
Compression Ratio	: 17.9 : 1
Firing order	: 1-4-2-6-3-5
Direction of rotation	: Counter clockwise viewed from flywheel.
Compression pressure (Limit - 25.356 kg/cm ²)	: 36 - 39 kg/cm ² @ 280 rpm
Idling revolution	: 600 ± 50 rpm
Fuel Injection Equipment	: Inline pump with manifold compensator
Valve clearance (when cold)	: Intake 0.30 mm, Exhaust 0.45 mm
Engine oil cooler	: Multi plates types (5 plates), water cooled
Injector opening pressure	: 247 - 260 bar
Turbocharger	: Without wastegate

AIR INTAKE SYSTEM:

1. All the Hino BS-II Engines are provided with **Turbocharger** and **Intercooler** (placed before the Radiator) for higher specific power outputs.
2. Cylinder Head swirl variations controlled and port flow improved
3. Intake manifold is modified to enhance engine breathing
4. Inter cooler is provided for cooling the Charge Air after Turbocharger for better charge air density.
5. Being BS-II Engine which calls for strict control of oil carry over, **Dry type air Filters** are introduced in place of Oil bath Air cleaners. The air cleaner fitted is of 10.76 cu.m capacity. The air cleaner is located on front LH side of the chassis. Service Indicators are provided near dashboard to indicate the choking condition of Air filters.

FUEL SYSTEM :

1. In line FIP with Manifold Pressure compensator
2. Injection line pressures are higher to achieve soot free combustion (To reduce particulates).
3. Combustion bowl and nozzle are modified to optimize combustion
4. Injector opening pressure is 247 – 260 kg/cm²
5. Spin-on type Fuel filter cum Water Separator replacing the existing twin fuel filters and mechanical water separator & banjo filter installed in fuel line.
6. Fuel Strainer in the pipe line between tank and feed pump.

LUBRICATING SYSTEM :

1. The Engine oil grade is changed to **API 2 CG4 Multigrade oil 15w40** with change periodicity at **16,000 kms**
2. There is a change in size of the Lub oil filter element, bowl and Mounting bolt from that of earlier Hino engines (6D, E0 & E1)

COOLING SYSTEM :

1. **Aluminum Radiators** are introduced in BS-II vehicles with coolant – water mix in **1:1 ratio**.
2. **VISCOUS FAN** is introduced in place of ordinary fan. This is a 470 mm dia, 10 bladed fan with Viscous clutch and works on the principle of fluid clutch. Fan clutch is a sealed unit and is a progressive clutch. Fan clutch engages when the sensor senses at 55°C (air temperature). Reduces fan power consumption at low temperatures, thereby improving fuel economy.

The Clutch has 3 sections,

- Engine powered driving section
- Viscous coupled Driven section (connected to fan)
- Separating disc
- The separating disc divides the internal chamber into supply & working chamber of fluids

The separating disc is connected to the center of a bimetallic coil, which acts as a temperature sensor. The coil senses the temperature of the air after it passes through the Radiator/Charge Air Cooler. The other end of the sensor coil is fixed. The coil will expand when the temperature increases causing the center shaft and the separating disc to rotate.

The clutch-driving disc receives the drive through the water pump pulley and transmits the power to the output through the internal friction of the highly viscous fluid. There is no mechanical connection between the input and the output discs. (There is always a small amount of slippage between the output and the input drive)

When the clutch rotates, the fluid in the working chamber is continuously drained to the supply chamber and this is returned to the working chamber through a valve, which is regulated by the separating disc.

When the temperature is low, the separating disc closes the valve thereby not permitting the fluid to return to the working chamber. The working chamber empties and the clutch disengages.

The fan clutch needs to be handled carefully in the field. Any dust or mud over the bimetallic temperature sensing coil will affect the performance. The same needs to be cleaned using a brush. At any point the fan clutch assembly must not be painted.

Checking procedure for Fan Clutch : The following is the procedure for checking the working of fan clutch in the vehicle,

1. Start the engine in neutral & run the engine for 3 minutes in idling
2. Run the engine at max rpm
3. Fan speed will be less than 1000 rpm
4. Observe water temperature
5. In case Radiator is blocked increasing the water temperature, a circular hole is to be made in the sheet aligning the axis of bi metal coil (temperature sensing element) so that the fan is able to sense the air temperature
6. Fan will engage around 80 – 90^o C water temperature. (Fan engagement can be confirmed by the change in the noise and also air flow in the engine tunnel
7. Fan will again disengage when the water temperature drops to around 80^oC

In case the fan clutch is not engaging, the Radiator and CAC (Charge Air Cooler) are to be checked for choking of fins. If so blow clean with pressurized air (1 kg/cm²) and once again check the fan for engagement.

3. **Heavy Duty Water Pump** : Since the fan clutch is heavier than existing fan, the water pump is made sturdier with **55mm diameter** shaft as against 35mm diameter for Hino 6E engines. The Water pump is of integral shaft bearing type. The **Fan diameter is bigger** (470mm as against 430mm) and hence the Radiator cowl also changes.

Peripheral Changes : The peripheral changes include,

- a) Modified Air intake cross over pipe to suit vehicle intake system. The air cleaner is in the front LH side while the Turbocharger comes in the RH side of the engine.
- b) Provision for injector pipe clamping provided on the inlet manifold
- c) Change in dipstick & dipstick guide and bracket
- d) Oil filling cap shifted to the rear for ease of oil filling
- e) Cast Elbow fitted on turbocharger outlet port for connection to exhaust pipe
- f) Spherical insert used in between exhaust elbow and exhaust pipe

EXHAUST SYSTEM: To meet the prescribed noise levels **heavy duty Exhaust Muffler** is provided in BS-II vehicles.

BRAKES:

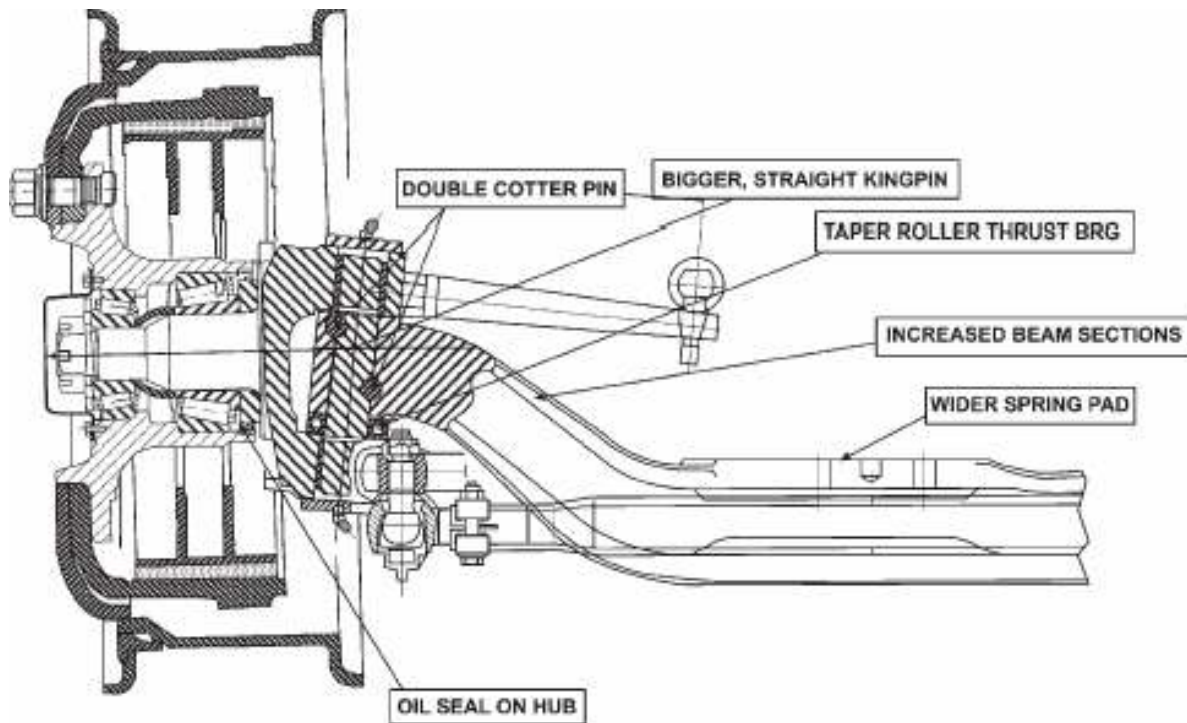
- a) **Polyamide Brake Pipes** have been introduced in place of Metal pipes. These pipes have advantage of freedom from rust, greater flexibility in positioning, improved routing, longer life, good serviceability, ease of replacement and reduced maintenance.
- b) **Relay Valve & Quick release Valve:** Relay valve is provided in the Rear Brake system and Quick Release Valve in the Front Brake System for faster actuation and quick release of brakes. This will improve the life of the Brake liners, drums and tyres as well besides enhancing the fuel efficiency.
- c) **Air Dryer:** Air Dryer is provided to absorb the moisture from the compressed air and discharge automatically during the unloading cycle. The Dryer helps in preventing rust formation in the metallic pipes & reservoirs and thereby improves the life of brake valves.

SPRINGS: The spring assemblies have been modified with **10 leaves in front** and **12 leaves in rear**.

FRONT AXLE: **FA90 Type Front Axles** with 6 tonne rating have been introduced in place of existing 5Tonne (ALFA 50) Front Axles with the following salient features.

- These front axles can be identified by observing the specification Number punched on I' beam as ALFA 90/100 for AAL Brakes and ALFA 90/200 for BIL brakes
- **Double cotter pin** arrangement for improved kingpin integrity with kingpin bore, to avoid kingpin play/ elongation of kingpin bore, for increased front end stability and for increased durability of kingpin & bush.
- The King pin is a Straight one with **38.2mm dia** against stepped king pin of 33.3mm dia provided in earlier models.
- The maximum wheel lock angle is **increased to 42 degrees** from 38 degrees for better maneuverability at acute turns by lessening the Turning Circle Diameter. The wheel track is thereby improved from 1918mm to **1963mm**.
- The axle section is increased **by 1mm**
- **Wider spring pads** are provided to accommodate spring centers varying from 31" to 38"
- The Kingpin inclination is increased from current 3.5 degree to **6 degrees** for better self centering, for improved directional stability and to maintain the scrub radius at minimum possible level.
- For optimized steering effort, Thrust Bearing is introduced in place of Trust button with an **axial play of 1 to 4 thou**.
- **Oil seal location** is changed from Brake carrier to Hub. The thickness of the Brake carrier flange is reduced from **35mm to 15mm** and hence mounted through bolt/ nut arrangement instead of stud mounting.
- The hub wall thickness at bearing seat area is increased **from 8.4mm to 12.2mm** and the inner bearing location moved outward for optimized bearing life.

- The tie-rod assy is provided with **bigger track rod** and **bigger ball pin** and assembled from **bottom of the levers** (steering arms). The tie-rod size is increased from 36 dia x 4mm thickness to **50 dia x 6mm** thickness. The Ball pin neck dia is increased from **16.6mm to 21mm**.
- **M20 bolts** are provided in place of 3/4" BSF bolts for mounting Steering arms.



PROPELLER SHAFTS (1550 Series) : Propeller shaft with Cold Drawn Welded (CDW) tube (90x3mm) is fitted in place of Electric Resistance Welded (ERW) tube (76.2 x 3.25mm) with Rubber mounted center bearing to reduce vibration and noise. The fitted lengths of the PP shafts are as follows.

MODEL	Front		Middle	Rear
	ZF G.Box	GB13		
203" Cheetah	1305	1351	863	1726
210" Cheetah	1305	1351	1041	1726
210" Viking	1305	1351	1465	1726
222" Viking	1305	1351	1770	1726

Part Numbers :

Flange Yoke : P4501932
 UJ Kit : P4500451
 Companion Flange : F4500514
 Center Bearing Kit : F0257010

PREVENTIVE MAINTENANCE SCHEDULE FOR BS-II ENGINES :

The following maintenance schedules are recommended for BS-II engines.

- Oil drain with filter change @ 1,000 kms initially and thereafter at every 16,000 kms.
- Fuel Filters changes – Change the Spin-on type Fuel filter cum Water Separator at every 22,000 kms and Fuel Strainer (in the chassis) at every 50,000 kms
- Drain the water from the Fuel Filter cum Water separator every day.

- Check the injector opening pressure at 20,000 kms initially and at every 60,000 kms thereafter.
- Check & adjust Tappet clearance at 1,000 kms initially and at every Sch.III maintenance thereafter.
- Change coolant mixture at every 75,000 kms (in 1:1 ratio for aluminum radiators)
- Check Cylinder Head tightness at 1,000 kms initially and at every Sch.III maintenance thereafter.
- Clean the Primary filter element of Dry type Air filter immediately on observing red band appearance in the restriction indicator. Replace the Primary filter element after two cleanings. Replace secondary filter element at the time of third replacement of primary filter element.
- Replace the Air Dryer desiccant at 1.50 lakh kms.
- Check and adjust the Kingpin end play (0.001” to 0.004”) at every Sch.IV maintenance.
- Check and adjust the toe-in (0-2mm) in every sch.II

PART NUMBERS OF IMPORTANT CONSUMABLES : The unique parts required for BS-II vehicles have already been communicated vide circular No.18/2003-MED. The following are some of the critical items which are not covered in the above circular.

- Engine Oil filter element – X 4000600
- Oil filter Bowl – X 1102713
- Mounting Bolt – X 3512115
- Fan belt – F 0031250 (common with Hino E0 & EI)
- UJ Kit for 1550 series - P4500451
- Center Bearing Kit – F0257010
- King pin for ALFA90 – F0977015
- Thrust Bearing ALFA90 – F0255910
- Thrust Bearing ALFA90 – F0256910
- King pin Bush ALFA90 – F0500342
- Front Hub oil seal ALFA90 – F2754200
- V-Seal (Top/ bottom) ALFA 90 – F2717400
- Max-Cut Screw ALFA90 – F3525310
- Cotter pin ALFA 90 – F0982715/ F0282815/ F0282915
- Cotter pin ALFA90 – F0983015/ F0983115/ F0983215
- Tie-Rod End assy RH (Rane Track rod) – P2410639
- Tie-Rod End assy LH (Rane Track rod) – P2410739
- Spin-on type Fuel Filter cum Water separator – F8813500
- Fuel Strainer – F 8824500

The Depot Managers and Maintenance incharges are advised to make note of the above features of Bharat Stage-II vehicles and educate all the Maintenance staff about the changes incorporated in the vehicle for proper maintenance. The DMs & Maintenance I/Cs are advised to paint as “Bharat Stage-II” on the vehicles at conspicuous place for identification.

The Dy.CMEs are advised to ensure proper maintenance of BS-II vehicles as indicated above during their inspection of Depots.

EXECUTIVE DIRECTOR (ENGG)

To
all Depot Managers.

Copy to: Director (Vig. & security), ED (MIS), ED (A), ED (O), FA, CAO & ED (HRD) for information

Copy to: All ED(Zones) for favour of information and necessary action.

Copy to: CCOS & CME(C&B) for necessary action.

Copy to: All Regional Managers for necessary action.

Copy to: All DVMs/WMs/COSs for necessary action

Copy to: All Dy.CMEs with an advise to educate the maintenance staff on the modifications during their inspection of Depots..

Copy to: Principal,

Copy to : Manual section, H.O.

ANDHRA PRUDISH STATE ROAD TRANSPORT CORPORATION

O/o the VC & MD,
MSRD, Hyderabad
Dt.26.02.2007.

No: OP3/463(7)/06-MED,

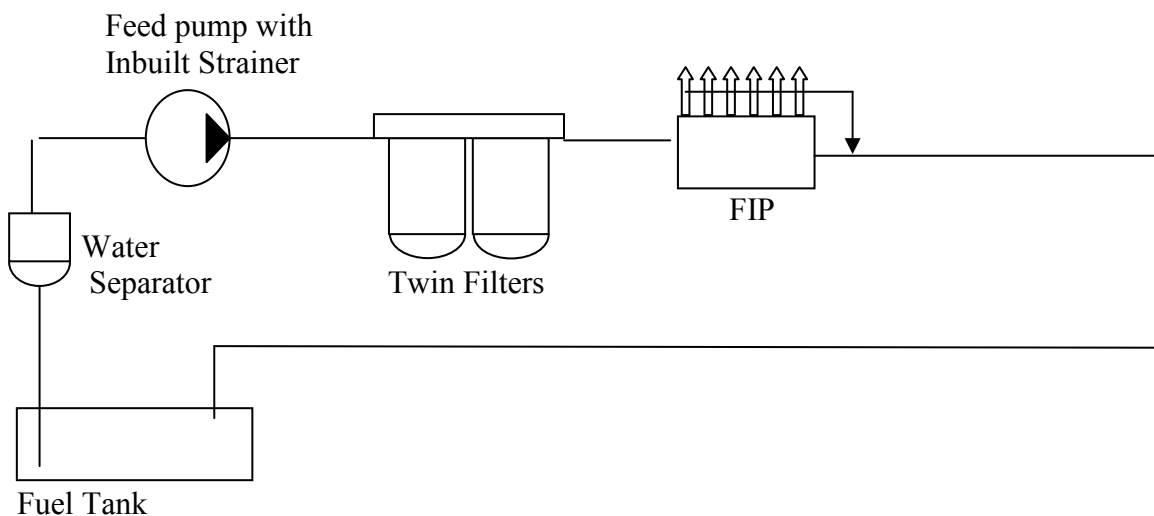
To
All Depot Managers of Ashok Leyland Area.

Sub : **MAINTENANCE** – Introduction of Spin-on Fuel Filter cum Water Separator on Ashok Leyland vehicles – Certain instructions issued – Reg.
Ref : Circular No : 15/2006-MED, Dt. 24.11.2006.

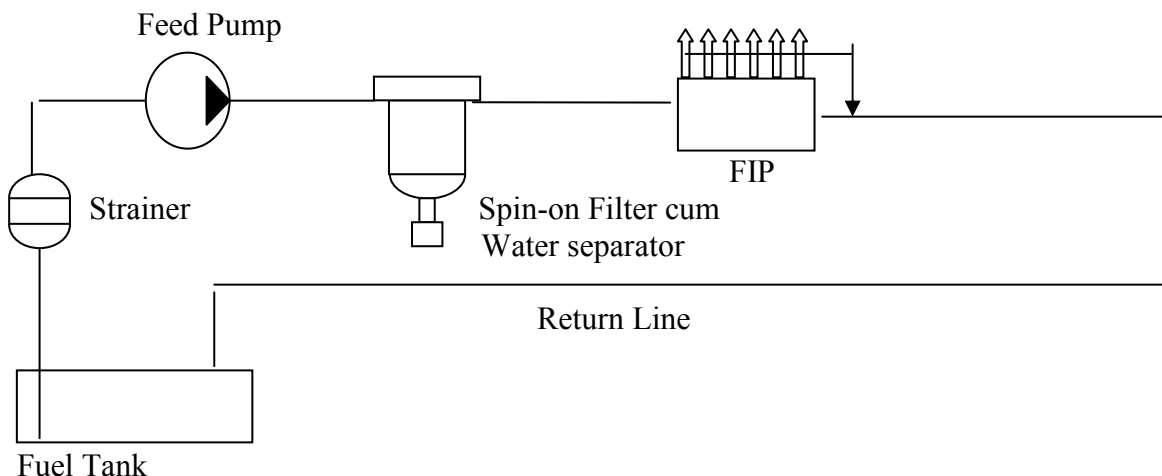
M/s Ashok Leyland Ltd have introduced Fleetguard make Fuel Filter cum Water Separator on their new vehicles replacing the earlier system of Twin filter filtration system. In this new system, only one filter of “Spin-on” type is provided with inbuilt water separator. A drain valve is provided at the bottom of the filter bowl for draining the water from the filter during daily maintenance.

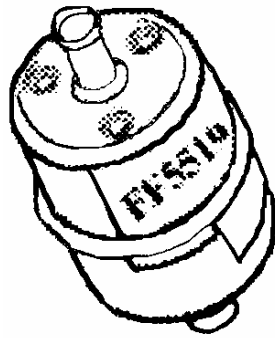
The difference in the lay out of earlier version and new version is shown below

EARLIER VERSION WITH TWIN FILTERS & WATER SEPARATOR

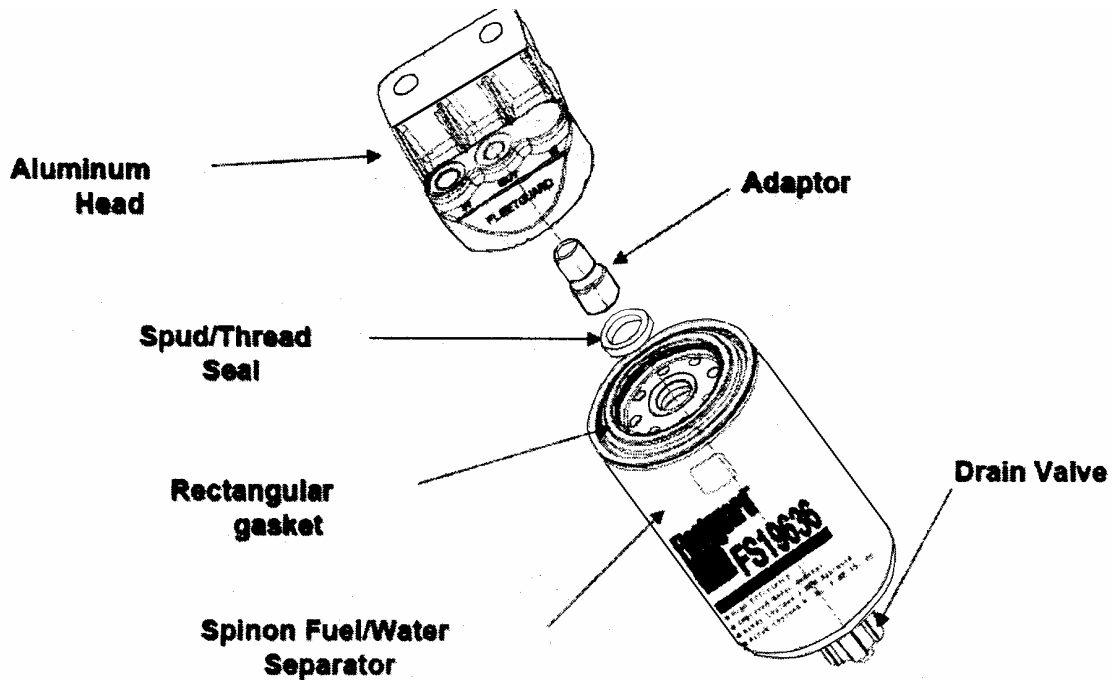


NEW VERSION WITH SPIN-ON FILTER CUM WATER SEPARATOR





FUEL STRAINER



SPIN-ON FUEL FILTER CUM WATER SEPARATOR

INSTALLATION INSTRUCTIONS FOR SPIN-ON FILTERS :

1. Remove the old filter using a filter wrench
2. Clean filter base, ensuring that all the old gasket material is completely removed
3. Check the filter mounting adaptor for tightness
4. Install thread seal
5. Apply thin coat of clean engine oil to the gasket sealing surface of new filter. Press the gasket firmly into the gasket retainer groove while lubricating the sealing gasket. Do not use Grease.
6. Carefully read the installation instructions printed on the outside of the filter to determine the number of turns the filter must be rotated past gasket contact for proper installation and gasket compression.
7. Pre-fill the new filter with clean fuel.
8. Spin on the new filter until the sealing gasket makes contact with the sealing surface on the fuel filter head.
9. Mark a reference point on the filter and head to identify the point that the sealing gasket first makes contact with the sealing surface of the head
10. Rotate the filter the number of turns past gasket contact indicated by the installation instructions printed on the side of the filter container
11. Start the engine and check for fuel leakage around the sealing gasket and filter assembly

DRAINING WATER FROM SPIN-ON FILTER CUM WATER SEPARATOR

1. Rotate the drain cock anti-clockwise
2. Drain the water till the fuel starts to flow
3. Rotate the drain cock clockwise the number of turns as indicated by the installation instructions printed on the side of the filter container
4. Start the engine and check for fuel leakage around the sealing gasket and filter assembly
5. Never use a spanner for rotating the drain cock
6. Drain water daily

Caution : Drain cock should be hand tightened fully. Never use any spanner

PERIODICAL MAINTENANCE :

1. Replace the Fuel/ Water Separator at **every 25,000 kms** (This has been changed from 22,000 kms furnished earlier in the circular cited)
2. Replace the Fuel Strainer at **every 50,000 kms**
3. Drain water from the Fuel/Water Separator **everyday**

SPARE PARTS DETAILS

1) Hose Assy – Tank to Strainer	-	B 4461902
2) Fuel Strainer	-	F 8824500
3) Hose Assy – Strainer to Feed Pump	-	B 4461903
4) Hose Assy – Feed pump to Filter	-	B 4439703
5) S/A of Fuel Filter – Fleetguard	-	B 4461901
6) Hose Assy – Filter to FIP	-	B 4439704
7) Rubber ended Hose – Return Line	-	B 4455102

The Depot Managers and Maintenance Incharges are advised to make note of the above modifications in the fuel system of new Ashok Leyland vehicles and ensure that the instructions on installation and periodical maintenance are followed scrupulously.

The Controller of Stores', Uppal, Karimnagar and Nellore are advised to ensure stocking and supply of the above spares to the Depots under their jurisdiction.

The Dy.Chief Mechanical Engineers are advised to ensure that the maintenance staff at all the Depots under their jurisdiction are familiarized with new system.

EXECUTIVE DIRECTOR (ENGG)

Copy to : All EDs for information

Copy to : RMs NLR, OGL, HCR, RR, MBNR, NLG, MDK, KMM, WL, NZB, ADB, KRMR and ADB for necessary action.

Copy to : WMs UPL, NLR and KRMR for necessary action

Copy to : COS' NLR, UPL and KRMR for necessary action

Copy to : Dy.CMEs Hyd Zone, KRMR zone and Dy.CME/NLR for necessary action.

Copy to : DVMs or HYD, KRMR zones, NLR and OGL Regions for necessary action

ANDHRA PRADESH STATE ROAD TRANSPORT CORPORATION

Office of the VC & MD
Mushirabad, Hyderabad
Dt.17.08.2007

No.OP2/760(1)/2006-MED,

To
All Depot Managers of
Hyderabad zone, Karimnagar zone,
Ongole region & Nellore Region.

SUB : **LUBRICANTS** – Use of CH4+ grade 15W40 Engine oil with 36,000 kms (mofussil) & 24,000 kms (city) change periodicity on Leyland BS-II Hino Engines – Certain instructions issued – Reg.

At present, we are using multi grade 15W40 Engine oil of CG4+ grade with change periodicity of 16,000 kms for all Hino BS-II vehicles based on the earlier recommendations of M/s Ashok Leyland Ltd.

Now, M/s Ashok Leyland Ltd have informed that they recommend multi grade engine oil, **15W40 of CH4+ grade for BS-II Hino engines** for which the **drain periodicity is 24,000 kms for City/ Ghat applications and 36,000 kms for other applications (mofussil operation)**. Simultaneously, the **engine oil filter of extended life has to be used** to synchronize with the change interval of Engine oil.

As the BS-II Hino engines (**other than earlier 6DTI2D BS-II model**) have already been installed with long life engine oil filter, CH4+ grade 15W40 engine oil can be directly used on these engines. **The Filter bowl, filter element and mounting bolt on BS-II engines are different from those of ordinary Hino engines** (6D, E-0 & E-I models and earlier 6DTI2D BS-II with rotary FIP).

The part Numbers of the modified filter bowl, mounting bolt and filter element are shown hereunder.

S.No	Part Description	Part Number
1	Oil filter element – Hino	X 4000600
2	Oil filter bowl – Hino	X 1102713
3	Mounting Bolt	X 3512115

The existing suppliers of Engine oil to the Leyland area i.e, M/s Indian Oil Corporation and M/s Hindustan Petroleum Corporation have confirmed that they can supply 15W40 Engine oil complying to CH4+ grade against their existing purchase order quantities. Hence, it is decided to use CH4+ engine oil duly extending the change periodicity upto 36,000 kms for District operation & 24,000 kms for City operation.

The following are the brands of CH4+ 15w40 oil supplied by the above two firms.

Indian Oil Corporation : **Servo Pride XL 15W40**
Hindustan Petroleum Corp. : **HP Dieselino 15W40**

Further, it is also decided to use the above long life oil along with Engine oil filter on the earlier model **Hino 6DTI2D engines** (with Rotary FIPs in HCR) also by retrofitting the modified filter bowl and element. M/s Ashok Leyland Ltd are supplying the **retrofitment Kit under part No: B 8774802** which consists of the following items.

- 1). Filter Bowl
- 2). Filter Element
- 3). Mounting Bolt
- 4). O'ring
- 5). Plug & Spring

The **Dy.CMEs of Ashok Leyland area** are advised to propagate the above information to all the Depots under their jurisdiction and ensure use of long life Engine oil and filters on BS-II vehicles and carry out the EOC/Filter changes at every 36,000 kms for Mofussil Operation and 24,000 kms for City operation. They are also advised to furnish the Depot-wise requirements of Engine oil, Oil filters and Retrofitment Kits (for old version BSII Hino 6DTI2D engines with Rotary FIP in HCR) to the respective Controllers of Stores based on the fleet strength of BS-II vehicles.

The **Controllers of Stores of Leyland Area** are requested to ensure supply of **modified Engine oil filter elements**, the **long life Multigrade Engine oil** and also the **Retrofitment Kits of Oil filter assembly** (for HCR Depots) as mentioned above based on the requirements furnished by the Dy.CMEs of the regions.

All the **Depot Managers and Maintenance incharges** of Leyland area depots are hereby advised to use the above grade Engine oil for all BS-II vehicles duly ensuring fitment of long life oil filters. The EOC & Oil filter change shall be carried out at every **36,000 kms for Mofussil Operations and 24,000 kms for City Operations**. But the first EOC/Filter change shall be carried out at 16,000 kms on the new vehicles. The Depot Managers of HCR region are advised to retrofit the modified Engine Oil Filter Assembly Kits on the old version 6DTI2D BS-II Hino engines with Rotary FIP and use CH4+ grade 15W40 oil on these vehicles also.

The **Chief Engineer (IT)** is requested to **modify the EOC programme** for Ashok Leyland BS-II vehicles in VEMAS module accordingly.

EXECUTIVE DIRECTOR (E&IT)

- Copy to : ED(P&AM) for information & necessary action.
- Copy to : All EDs (zones) for information and necessary action.
- Copy to : FA & CAO for information
- Copy to : CCOS with a request to modify the Purchase Orders accordingly.
- Copy to : CE(IT) for necessary action
- Copy to : All RMs for necessary action.
- Copy to : COS(C)-II, Dy.CME(C&B), Dy.CME(IEU), Dy.CME(P) for information
- Copy to : All Dy.CMEs for information & necessary action
- Copy to : All Controllers of Stores for information & necessary action.
- Copy to : All Works Managers for information & necessary action.
- Copy to : All Dy.CAOs & AOs for information
- Copy to : All Principals, ZSTCs & Principal, TA/HPT for information
- Copy to : All Maintenance incharges of Hyd zone, KRMR zone, NLR region & OGL region for necessary action.