



Andhra Pradesh State Road Transport Corporation
Office of the Managing Director, Bus Bhavan, Hyderabad - 500 0624.

No: OP3/462(mini)/2011-MED

CIRCULAR No 19/2011-MED, Dt 25.05.2011.

Sub : MAINTENANCE - Introduction of **Bharat Stage -III** compliant **Mini Buses** with **HA4CTI3N engine** by M/s Ashok Leyland Ltd - Salient features and maintenance aspects communicated - Reg.

Ref : Circular No. 27/2009-MED, dt.17.11.09

- 1.00 Corporation has recently introduced Ashok Leyland BS-III compliant Mini Buses (STAG) in Hyderabad City region with a view to provide coverage to the places where the existing buses are difficult to maneuver.
- 2.00 Two types of mini buses i.e, ALFBV 1/6 and ALFBV 1/7 with different wheelbase have been procured from M/s Ashok Leyland Ltd and deployed at various depots of Hyderabad City region. Though, most of the components and their features are common in both models, certain aggregates like Rear axle, Clutch, Propeller shafts (lengths) and tyres are different from one another.
- 3.00 The unique items which cannot be interchanged among the two models are furnished below

S. No	Aggregate	ALFBV1/6 (32 Seater)	ALFBV 1/7 (40 Seater)
1	CLUTCH	330mm Diaphragm	330mm diaphragm
2	REAR AXLE	C 100	RS120
3	PROPELLER SHAFTS 1510	1770 and 1486 mm	1167, 1388 and 1388 mm
4	TYRES (Front & Rear)	7.50 x 16 - 16 PR Nylon	8.25 x 16 PR Nylon

The Wheelbase of ALFBV 1/6 is **4200 mm** and the wheelbase of ALFBV 1/7 is **4900mm**

- 4.00 The features of the individual aggregates are furnished below

5.00 **ENGINE**

Model: **HA4CTI3N** Turbocharged, Intercooled Diesel - 4 Cylinder Inline Engine

Bore & Stroke (mm): **104 x 113**

Displacements (l): **3.839**

Compression ratio: **17.7:1**

Max output: **88.25 KW @ 2400 rpm**

Max. torque: **400 Nm @ 1600 RPM**

Firing order: **1-3-4-2**

Emission Standard: Bharat Stage III mass emission norms

Compression pressure: **29 - 32 kg/cm² @ 280 rpm**

Tappet clearance Intake - **0.30 mm, Exhaust - 0.45 mm**

The regular maintenance like Tappet setting, Cyl Head Nuts tightening, etc., are same as that of existing Hino BS-II/III vehicles

5.01 FUEL SYSTEM:

FIP: **VP37 EDC** - Electronic Rotary Distributor type Fuel injection pump

Control Unit: **Electronic Control Unit** for Fuel Injection equipment

(There are no control lever and mechanical linkages in FIE)

Injector: **Multi Hole Nozzle**

Feed pump: Engine driven feed pump mounted on FIP timer cover

Fuel filter: (Fleet Guard) **Fuel filter cum water separator** fitted at the pressure side before FIP and Fuel strainer is fitted before feed pump.

Nozzle opening pressure: **248 to 260 Bar**

Fuel Injection timing: **0.3 ± 0.02 mm plunger lift** at TDC with No: 1 cylinder on Compression stroke

The maintenance of Fuel system, the procedure for adjustment of Plunger lift, fault diagnostics are similar to those explained in Circular No. 27/2009-MED, Dt 17.11.2009 for BS-III SLF (JnNURM) buses. Draining of water from Fuel system everyday is very very important.

The total capacity of the Fuel tank is **115 ltrs**

5.02 COOLING SYSTEM

Water Pump: Circulating pump type, Forced circulation by volute pump

Drive: **Poly vee belt**

Cooling Fan: **Ten bladed fan with viscous clutch**

Thermostat: Single thermostat wax type

Radiator: **Aluminum**

Coolant mixture shall be prepared with antifreeze solution and water **1:1 ratio**. The capacity of the Cooling system is **14.5 lit (Radiator + Engine)**. The maintenance of cooling system is same as that of earlier Ashok Leyland BS-II/BS-III models. Coolant shall be changed at every **75,000 kms**.

5.03 ENIGNE LUBRICATING SYSTEM

Oil Pump: Circulating pump, driven by timing gear

Oil filter: Full flow paper element

Oil cooler: Plate type oil cooler (5 plates).

The filling capacity of Engine oil is **8.5 liter (including filter)**

The same grade of Engine oil i.e., **SAE15W40 CH4+** shall be used. But the Engine oil & filter change interval is **16,000 kms for Mini buses**.

5.04 AIR INTAKE SYSTEM

Dry type two stage Air filter with Choke Indicator

The working instructions are similar to Dry Air filters of earlier models

6.00 CLUTCH

Type: Single plate dry, **diaphragm type, hydraulically actuated**

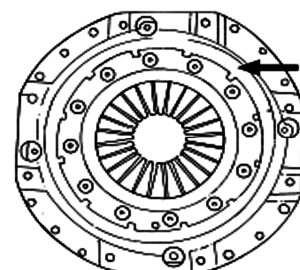
Clutch booster arrangement is available only in ALFBV 1/7 I.E 4900 W.B model

Outside diameter (mm): 330

Total frictional area (cm²): 1116

The diaphragm clutch mainly consists of the following

1. Pressed steel cover
2. Diaphragm Spring
3. Pressure Plate
4. Driving straps
5. Connecting rivets



The hydraulic system of the clutch consists of **master cylinder**, **reservoir** and **slave cylinder**. The master cylinder is mounted just behind clutch pedal and the slave cylinder on the side of the gear box. These units are hydraulically connected with pipes.

The following procedure is to be followed for hydraulic clutch actuation adjustment.

1. Clutch pedal free play **4 to 7 mm**. This dimension has to be maintained by adjusting **pedal stopper bolt**.
2. The initial stand out of slave cylinder push rod is **159 ± 7 mm** which is achieved by slave cylinder bracket position. **No specific adjustment required**.
3. As the vehicle continues to run and the disc wears of, the stand out reduces.
4. When the stand out **becomes 118 mm**, **replace the clutch disc**.
5. **After replacement of new disc, ensure initial setting of clutch and follow the above procedure.**

Bleeding of Hydraulic System:

Bleeding the hydraulic system is not a routine maintenance job and should be necessary only when some portion of the equipment has been disconnected, the fluid drained off or it is suspected that air has trapped in to the system.

Air will enter into the hydraulic line if the level of fluid in the master cylinder reservoir is allowed to fall too low and leaks develop in the pipe unions. As a result the pedal will feel spongy or it may require a pump action, or even become completely inoperative. In such cases the bleeding should be done, as follows:

- Remove the filler cap from the reservoir and arrange to keep the fluid level topped up throughout the bleeding operation.
- Remove the cap from the bleed screw on the slave cylinder / clutch booster and attach a transparent rubber bleeding tube.
- Allow the free end of the tube to dip into a clean glass containing hydraulic fluid.
- Depress the clutch pedal fully and allow it to return. Continue the same for 5 times and then hold the pedal in depressed condition. Slacken the bleed screw and allow the oil in the system to escape. Air bubbles can be found escaping from the oil through the transparent tube.
- Tighten the bleeding screw and repeat the above steps until pure oil escapes during slackening of bleeding screw (without any trace of air bubbles).
- Finally tighten the bleed screw, remove the bleeding tube and refit the rubber cap on the bleed screw.

Ensure that the clutch pedal lever is physically stopped before its extreme end by proper adjustment of stopper screw to avoid failure by jamming of seal inside master cylinder. Do not keep the entire weight of gearbox hanging on clutch plate while fitting gear box assembly. Care should be taken to avoid damage to withdrawal plate.

7.00 GEAR BOX

Type: ZF S5-36 GEAR BOX 6.50 First gear ratio for ALFBV 1/6 and ZF S5-36 GEAR BOX 7.20 First gear ratio for ALFBV 1/7.

Gear Ratios for ALFBV 1/6 : I - 6.50:1, II - 4.22:1, III - 2.44:1, IV - 1.52:1, V - 1.00:1, Reverse - 8.05:1

Gear Ratios for ALFBV 1/7 : I - 7.20:1, II - 4.22:1, III - 2.44:1, IV - 1.52:1, V - 1.00:1, Reverse - 8.05:1

The features and maintenance of ZF Synchromesh Gear box are similar to those of Synchromesh gear boxes in earlier models

The filling capacity of the S5-36 model Gear box is **6.5 litres**. The oil change shall be done at every **60,000 kms**. The grade of the oil is same as that of ZF Gear boxes in BS-II/BS-III vehicles.

8.00 REAR AXLE

Model: C 100 for ALFBV 1/6, 32 seater & RS120 for ALFBV 1/7 40 seater buses

Type: Fully floating, single speed, hypoid gears
Axle capacity (kg): 4500 for C100 & 5800 for RS120
Axle ratio: 4.56:1

The filling capacity of the oil is **6.0 lit** for **C-100** (32 seater) and **6.5 lit** for **RS 120** (40 seater). The grade of oil is similar to that of Hypoid Rear axles in BS-II/BS-III vehicles. The oil change interval for **C-100** and **RS-120** rear axles is **60,000 kms**. The maintenance is same as Hypoid Rear axles fitted in the earlier model vehicles.

9.00 PROPELLER SHAFTS

Two propeller shafts are fitted in 4200 WB & Three propeller shafts are fitted in 4900 WB between the gearbox and rear axle supported by a centre bearing at the centre. The front shaft has a fixed joint near the gear box and rear end is supported on the centre bearing with a splined stub shaft to take up the rear propeller shaft. The rear shaft consists of a fixed joint at rear end and a slip joint at the front end.

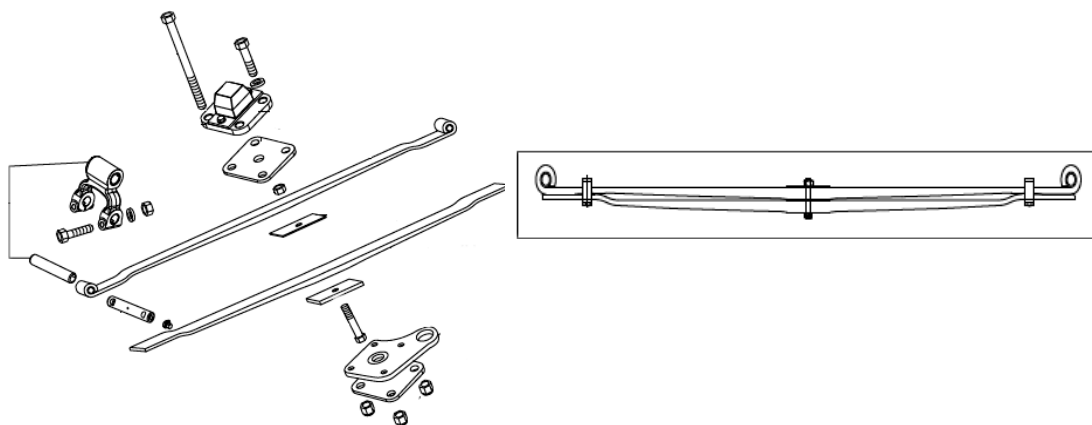
Though the design of Propeller shafts is same in both models of mini buses, the lengths of PP shafts vary due to difference in wheelbase.

ALIGNMENT OF PROPELLER SHAFTS:

The propeller shafts are balanced to avoid vibration and whipping. Arrow marks are provided on yoke and tube for proper alignment and balance. Further, it shall be ensured that the yokes of front and rear propeller shafts are in the same plane when fitted.

10.00 SUSPENSION

Type: **Parabolic leaf springs**
Shock absorbers: Double acting, telescopic type



11.00 STEERING SYSTEM

Type: ZF Power or Rane Power Steering

Ratio: ZF-20.2 : 1 and Rane - 20.4:1

The filling capacity of Steering system is 3.5 Lit for Rane and 4.5 lit for ZF. The maintenance, oil grade and oil/filter change periodicities are same as those of existing models.

12.00 BRAKE SYSTEM

Type : Dual line 'S' cam Full Air brakes

Front braking area (cm²): 1280 (for Stag with 10mm thickness),
1235 (for Stag with 12.7mm thickness)

Rear braking area (cm²): 1280 (for Stag with C100 axle),
1360 (for Stag with RS120 axle)

Lining thickness (mm) : 10 (for Stag with C100),
12.7 (for stag with RS120 axle)

Exhaust brakes: Butterfly valve, pneumatically operated

The working principle is same as that of existing model BS-II vehicles. DDU and Relay valves are provided. Maintenance of Brake system is similar to that of existing vehicles.

13.00 ELECTRICAL SYSTEM

System Voltage: 12V

Battery : 120 Ah (20 HR rating) OR 150 Ah (20 HR rating)

Alternator (Max. output): 65 Amps

14.00 WHEELS & TYRES

Rim size : G 6.00 x 16'', 131.5 mm offset

Tyre size: 7.50 x 16 - 16 PR Nylon (both front & rear) for ALPSV 3/31

8.50 x 16 - 16 PR Nylon (both front & rear) for ALPSV 3/73

Inflation Pressures : For 7.50x16 and 8.50x16 size tyres

Front - 7.03 kg/cm² (100.5 psi)

Rear - 5.60 kg/cm² (80 psi)

15.00 MAINTENANCE SCHEDULES

The specific maintenance activities applicable for Mini buses (other than those stipulated in the regular Sch-I/II, III/IV and FC) are furnished hereunder. The regular Sch-I/II/III & IV activities as being done in the case of other vehicles shall be followed in Toto. The same periodicity of 9,000 kms for Sch-III and 27,000 kms for Sch-IV shall be adopted for mini buses also.

LUBRICANTS, COOLANT & FILTERS CHANGE PERIODICITIES		
1	Engine Oil (15w40 CH4 grade) & E.Oil Filter change	16,000 kms
2	Spin-on Fuel Filter replacement	25,000 kms
3	Strainer (Baby Filter) replacement	50,000 kms
4	Repalce Gear oil (Synchromesh) SAE-90, API GL 4 with Anglamol 99 additive	60,000 kms
5	Replace Gear oil (Hypoid gears) AE 85W140 API GL5 oil with special additive Anglamol 99	60,000 kms
6	Replace Power Steering Oil & filter	80,000 kms
7	Replace Wheel Bearing Grease (RR3)	48,000 kms

8	Air Cleaner Primary replacement	On appearance of Red Band or 72,000 kms whichever is earlier
9	Air Cleaner Secondary replacement	At third replacement of primary filter or 2,16,000 kms
10	Antifreeze Coolant for Aluminum Radiator (1:1)	75,000 kms
11	Change clutch fluid	40,000 kms

ELECTRONIC DIESEL CONTROL		
1	Check tightness of all mating connectors & ensure proper connection	Sch-III & Sch-IV
2	Check & ensure wiring harness away from high temperature zone on the engine/ vehicle	Sch-III & Sch-IV
3	Check tightness of engine speed sensors and clean the sensor tip for any dirt & dust	Sch-III & Sch-IV
4	Check functioning of EDC & Sensors with diagnostic tool	96,000 kms or During FC

BRAKE SYSTEM		
1	Check Air compressor inlet & delivery rubber hoses and pipes of deterioration & replace if necessary	Sch-III & Sch-IV
2	Check & tighten A/C cylinder head mounting bolts & end cover bolts for correct torque values	Sch-III & Sch-IV
3	Check for leak from oil seal and rectify	Sch-III & Sch-IV
4	Remove A/C Cyl.Head and check for excessive carbon deposit, condition of reed valve rivets, decarbonize Cyl. Head and overhaul if necessary	96,000 kms or During FC
5	Check for Carbon deposit in delivery pipe line	96,000 kms or During FC
6	Overhaul the Air compressor, DB Valve, Relay valve, Hand Brake Valve, Front Brake chamber, Spring Brake Actuator	1,60,000 kms or 2 years whichever is earlier
7	Overhaul DDU duly replacing Desiccant cartridge	First at 2,40,000 kms there after 1,60,000 kms or 2 years whichever is earlier
8	Overhaul Automatic slack adjuster	When De-adjustment torque falls below 18N-m

16.00 ESSENTIAL SPARES TO BE STOCKED AT DEPOTS

S. No.	Part Number	Description	Min. Qty to be stocked
1	X7472800	Water Temp Sensor	5
2	X7472700	Engine Speed Sensor	5
3	X1102242	Speed Sensor Mtg. Block	5
4	B9221201	S/A Of Inj. Pipe – 1	5
5	B9221202	S/A Of Inj. Pipe – 2	5
6	B9221203	S/A Of Inj. Pipe – 3	5
7	B9221204	S/A Of Inj. Pipe – 4	5
8	B9221205	S/A Of Injector Leak Off Pipe	5
9	X7473600	Injector -Nbf 1St Cyl.	2
10	P0982751	Piston Ring Set	5
11	X1708000	Gasket, Air Intake Pipe	5
12	X7478300	Boost Pressure Sensor	5
13	F7103622	Alternator Mtg. Bracket	3
14	F3570911	Adjusting Link Bolt	3
15	F0535915	Split Bush	
16	X0301650	Poly V Belt (Fenner)	5
17	X0301750	Poly V Belt (Roulunds)	5
18	F8306000	Main Relay For Bs3 122Kw EDC System	
19	B9100104	S/A Of Vehicle Speed Sensor	5
20	F8313500	Brake Switch	5
21	F8313600	Clutch Switch	5
22	F1942650	Rubber Hose (Air intake)	5
23	F0831610	Hose Clip(Size:Ox)	
24	F0810410	Clamp For Air Intake Pipe	5
25	B3740401	Pendant Type Electronic Apm (Accelerator)	5
26	B3740402	S/A Accelerator Pedal Mounting Bracket	2
27	X3962700	Air Cleaner - Outer Element	5
28	X3962800	Air Cleaner - Inner Element	5
29	B1303702	Driven Disc 1.5" Spline	5
30	B1305305	330 Dia Clutch Disc Assy-Closed Window Design	5
31	X0204110	Clutch Withdrawal Bearing	5
32	F7873530	Clutch Master Cylinder	5
33	X7413400	Clutch Slave Cylinder	5
34	X3400922	Clutch Withdrawal Sleeve	5
35	F7406600	Ball Joint(Improved)-Reaction Rod	5
36	F7406700	Ball Joint (Improved)	5
37	B2154502	S/A Front Prop Shaft - 4200 WB (With Centre Bearing Assy)	5
38	F8286800	Front Prop.Shaft - 4200 Wb (W/O Centre Brg Assy)	5

S. No.	Part Number	Description	Min. Qty to be stocked
39	F8246700	Drive Shaft (After Centre Brg To Pinion Shaft)	5
40	P4500451	U/J Kit	5
41	P4500432	Tube Yoke	5
42	P4502533	Midship Tube Shaft	5
43	P4500514	Companion Falnge	5
44	P4500835	Shaft Nut	5
45	P4500426	Centre Bearing Rubber	5
46	P4501139	Centre Bearing With Retainer	5
47	P4500104	Centre Bearing Bracket	5
48	P4501932	Flange Yoke	5
49	P4503039	Slip Yoke Assy	5
50	P4502433	Tube Shaft	5
51	P4500432	Tube Yoke	5
52	P4300317	Gasket - Carrier To Housing	
53	P4301027	Oil Seal Pinion	5
54	F2730300	Oil Seal Assy - Hub Inner	10
55	F0246010	Bearing Hub Inner	5
56	P4305851	Kit Lining Set Brake	10
57	P4301236	Shoe Spring Expander End	10
58	F0245910	Bearing Outer	10
59	X2702250	Outer Oil Seal	10
60	F1762900	Joint For Axle Shaft	10
61	F3584911	Wheel Bolts	50
62	F3598815	Wheel Nut	50
63	F1869822	Brake Drum	5
64	F0951615	King Pin Kit	5
65	P2403439	End Assy RH - Drag Link (D/L)	5
66	F0244610	Wheel Bearing Inner (F/A)	5
67	F0244710	Wheel Bearing Outer (F/A)	5
68	F1869822	Brake Drum Front	5
69	P4305851	Kit Lining Set Brake	10
70	X8003700	Head Lamp Relay	5
71	F8039100	Front Direction Indicator RH	2
72	F8039200	Front Direction Indicator LH	2
73	F8039300	Combination Switch - Cargo Type	2
74	F8018700	Reverse Light Switch	
75	F7447400	Starter Switch	
76	B5412222	Ignition Switch	5

17.00 TOOLS REQUIRED FOR MAINTENANCE

SMT NO	DESCRIPTION	QTY
	HA4CTI3N ENGINE	
3802	Drift Oil Seal Gear Case	1
3805	Drift (1) oil Seal Flywheel HSG (4 mm)	1
3808	Adapter Injector Removal	1
3810	Locking Device Fip Flywheel	1
3812	Wrench Cylinder Head Bolt	1
3816	Compressor Piston Ring	1
3818	Adapter Injector Removal WO 6D	1
3819	Puller Vibration Damper 4D	1
3830	Timing Toop fip	1
3837	Lock Screw FIP Flywheel WO 4D/6D Type 661/209	1
3838	Hino Spanner Injector	1
3840	Wrench Engine Cranking	1
3842	Drift (II) Oil Seal flywheel HSG (6mm)	1
	CLUTCH DIAPHRAGM	
3817	Fixture Diaphragm 310 mm	1
3935	Centraliser Clutch Disc	1
	GEAR BOX - ZF S5 36	
3901	Lifting Device	1
3916	Gear Box Socket Flange Nut A/F 50	1
	REAR AXLE	
3828	Hub Puller Rear RS.120	1
6901	Flange Holder	1
3849	Restrainer Crown Wheel Bolt	1
3936	Spanner Hub Nut	1
3999	Drift Rear Hub Oil Seal	1
	FRONT AXLE	
5002	Drift King pin Bush (909) Type 50	1
5003	Spanner Hub Nut Type 50	1
5004	Puller Hub Inner Bearing 909 Cargo	1
	STEERING	
3748	Puller Drop arm (Rane) & Iveco Cargo	1
	PROPELLER SHAFT	
1401	Extractor Centre Bearing Iveco	1
	SUSPENSION	
7001	Spanner Spring "U" Bolt Nut (Cargo)	1
	BRAKES	
3941	Remover Shoe Return Spring (SAW)	1
3002	Installer & Remover "E" Clip Cargo	1
3005	Drift Circlip Expander Assy Cargo	1
3004	Installer & Extractor SPG Cage Cargo	1
3006	Drift Excluder Assy Fitment Cargo	1

- 18.00 The Dy.CMEs of Hyderabad City zone are advised to educate the staff on operation and maintenance of Mini buses at the depots under their jurisdiction duly providing necessary tools required for day to day maintenance. They are also advised to monitor the performance of Mini buses and furnish the feedback to Head Office at regular intervals.
- 19.00 The Controller of Stores, UPL is advised to supply required spare parts to the Depots duly fixing the limits in consultation with respective Dy.CMEs.
- 20.00 The Depot Managers and Maintenance incharges are advised to ensure proper maintenance to the vehicles and see that the vehicles are utilized to the full extent without any breakdown.


EXECUTIVE DIRECTOR (E&IT)

To
The Depot Managers of City Zone .

Copy to: VC & MD for information.

Copy to: Dir (V&S), ED (O&MIS), ED (A), FA, CAO, ED (HRD&Med) for infn.

Copy to: ED (GHZ&HZ), ED (HYD), ED (KRMR), ED (VJA), ED (VZM), ED(NLR), ED(KDP) for information.

Copy to: All RMs for information.

Copy to: CME (O), CCOS, CA, CFM, CME(C&B), CE (IT), CPM, CM (HRD) for information & n/action.

Copy to: DyCME (O), DyCME (P), DyCME(C&B), DyCME (IED), DyCAO (SP&A), CSTO, COS(C) I & II for information.

Copy to: DyCMEs, WM, COS & DyCAOs of GHZ for necessary action.

Copy to: All AOs & AMEs (T) of GHZ for information & n/action.

Copy to: All Principals of ZSTCs, BTC, HPT & TA/HPT for information.

Copy to: All Maintenance In-charges GHZ depots for necessary action.

Copy to: Resident Audit Officer, Bus Bhavan, Hyd for information.

Copy to: In-charge, Manual Section for record.