



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

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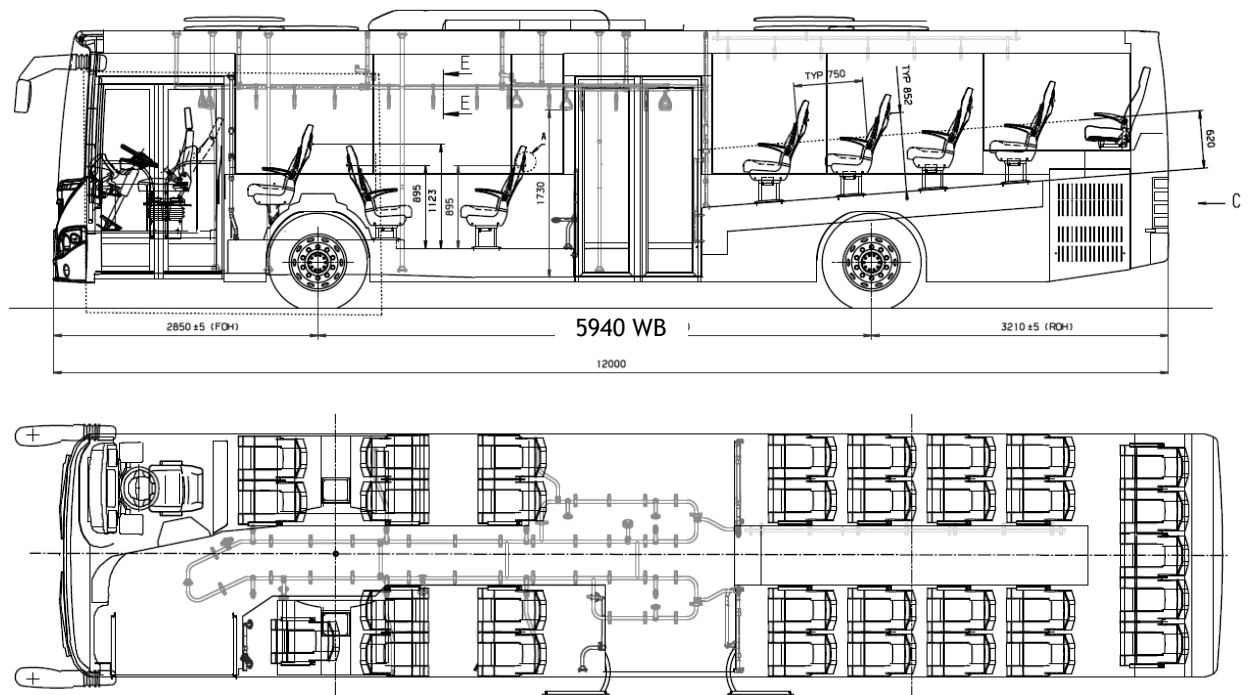
Sub : MAINTENANCE - Introduction of **Volvo 8400 - B7R RLE (BS-IV) Fully Built A/c s** - Salient features and maintenance aspects communicated - Reg.

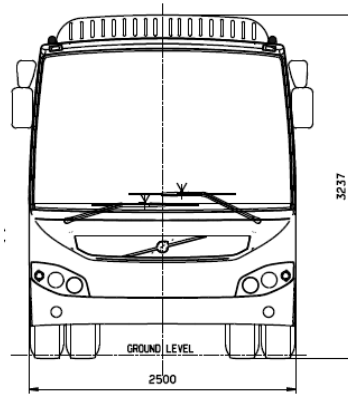
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The corporation is introducing the fully built Volvo 8400 (B7R RLE BS-IV) A/c buses under premium class Low entry city buses. These buses are being introduced under JnNURM scheme with features complying with the MOUD guidelines. Except a few changes like integrated ITS (Intelligent Transport System), Exhaust gas treatment (SCR) etc., the buses are similar to those introduced earlier in Hyderabad City i.e, Volvo 8400 BS-III Rear engine Low Entry.

The salient features of the bus and other details of operation & maintenance are furnished hereunder.

CHASSIS SPECIFICATIONS





DIMENSIONS

Wheel base, mm	5940
Front Over Hang	2850
Rear Over Hang	3210
Overall length	12000
Overall width, mm	2510
Overall height	3200
Front track	2070
Rear track	1820
Minimum ground clearance	190
Floor height in drive position	350
Turning radius	9.00 mtr

ENGINE

Engine is designated as D7E290 which complies with BS-IV emission standards and equipped with SCR technology. This is a in-line six cylinder 4-stroke turbo-charged diesel with overhead valves and electronically controlled injection, Common Rail fuel system, Volvo EMS engine control system, Electronic oil level sensor, Fan with electronic thermostat, Crank case ventilation pipe, On-off viscous fan, on-board diagnostic to detect, warn and to take action for malfunctions.

The specification data of the engine is as follows



ENGINE SPECIFICATION

Model Volvo	D7E290
Type	Six-cylinder in-line, Turbocharged and inter-cooled, CRDI, BS-IV emission
Bore x stroke, mm	108x130 mm
Displacement	7146 cm ³
Compression ratio	18.1 : 1
Max. Engine output, Kw	213 kW @ 2100 rpm
Max. Torque, Nm @ rpm	1200 Nm @ 1050-1650 rpm
Air cleaner type	Paper filter, Dry type

SCR System: The SCR system is a part of the exhaust system to control emission in order meet BS-IV norms. It has a dosing unit to spray Adblue (32.5% urea solution with de-ionized water) for treatment of exhaust gases. The capacity of the Adblue tank is 40 ltrs. The SCR system meets the OBD-II requirement for BS-IV vehicles

Fuel System: This is an electronically controlled common rail fuel system (EMS). The firing order is 1-5-3-6-2-4. The injection pressure is up to 1600 bar. The amount and injection point are controlled electronically via the engine electronic control unit (EECU) which receives signals from a number of sensors.

The feed pump draws fuel up through the fuel tank filter towards pre-filter at a pressure of 0.5-1.0 bar. The fuel is pressurized up to 10.5 - 13 bar pressure by the feed pump and fed into the main filter. The fuel distributor divides and sent to high pressure pumps. From High pressure pumps, the fuel goes to the unit injectors through high pressure pipes. The surplus return fuel leaves the injectors through channels drilled in the cylinder head and returned back to the fuel tank. The capacity of the fuel tanks is 310 liters (155 x 2).

Coolant System: The rear part of the coolant pump is machined directly into the engine block. The thermostat housing is formed directly inside the cylinder head. Thermostat begins to open at 83^o C and fully opens at 96^o C. Volvo premixed Coolant VCS in yellow colour (Part No.VO 85108914) shall only be used for BS4 LE buses which contain different type of additives which is not compatible with the Green colour coolant used on earlier Mark-3/2 & B9R vehicles. Under any circumstance two types of coolants i.e, "Green" and "Yellow" shall not be mixed with one another.

Transmission: The vehicle is provided with ZF Ecolife 6AP1400B fully automatic transmission with built in hydrodynamic retarder. The gear selector has three positions i.e, 'D', 'N' and 'R' indicating Drive, Neutral and Reverse.

Front Axle: Rigid type steerable front axle similar to Mark-II and Mark-III model vehicles.

Rear Axle: Fully floating single reduction axle with 5.63:1 reduction ratio. The wheel hubs are provided with maintenance-free wheel bearings which do not require any adjustment. The entire hub has to be changed whenever the bearings fail.

Steering: It is a hydraulic power steering with a 500mm dia steering wheel. The height and angle adjustment mechanism is provided in the steering column. The steering gear has a progressive gear ratio, which means that the output torque varies between straight ahead and full locks positions. The gear ratio is 22.2:1 in straight ahead position and 26.2:1 at full lock.

Suspension: Electronically controlled Air suspension system (ECS) is provided with 2 Air bellows at front and 4 air bellows in rear. Hydraulic telescopic shock absorbers are provided in front & rear. Antiroll bar mechanism is provided both front & rear. ECS facilitates three different levels of floor height, i.e, Kneel, Drive, Lift with ± 60 mm.

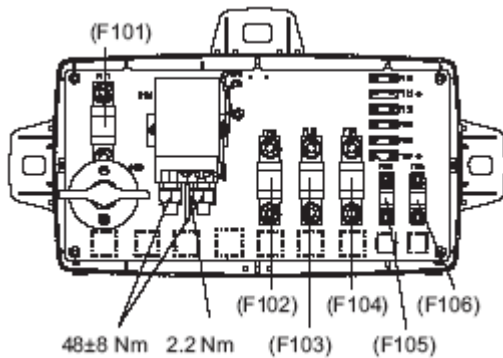
The Three level sensors (One in Front & two at rear) consist of potentiometers of which the signal voltage is dependent on the bellows height. The control unit reads these signals and compares the bellows height with the reference values stored in the control unit memory. Based on the input values, the control units sends signals to the solenoid valve blocks located on the front axle and rear axle. On getting actuated by control unit, the solenoid valves either fills the bellows or deflate the bellows to maintain the normal height. The kneeling and level control can be actuated by the driver using the switches in the dash board. A warning lamp glows (or an icon appears) on the display whenever the bus height is being altered. It also displays the faults in the system.

Brake system: It is a dual circuit compressed air braking system with a hand controlled parking brake. The air tanks comprises of one main reservoir and two service reservoirs of 30 ltrs capacity each for holding compressed air. The operating pressure of the pneumatic system is 9.01 - 10.8 kg/cm². The signals to the solenoid valves are received from a control unit which in turn receives information from the four pulse sensors, one in each wheel that senses the wheel rotation.

The foundation brakes are disc type. No adjustment is required for the disc pads and the system is completely lubrication-free. Disc pad wear can be read on the display and there is an ocular wear indicator on each disc brake. The brake disc is enclosed by a brake caliper. The floating brake caliper has pneumatic brake cylinders. The brake cylinders are mounted directly on the brake caliper. There is a single membrane cylinder mounted on the front brake circuit, while the rear circuit has a spring loaded cylinders for parking brake provision.

Electrical System: Electrical & Electronics are the vital systems of this vehicle. The vehicle electrical system voltage is 24 and the chassis & engine block are used as ground. The battery positive terminal is connected to front distribution Box via an isolator switch and the negative pole is connected directly to the chassis. The capacity of the batteries is 2x 180Ah. The vehicle is equipped with double main switches, one in the Front Distribution Box (used for longer lay-ups) and another switch in instrument panel for normal switching.

The Front Distribution box (located at Battery box) contains the following rated fuses



Max. permissible current drain from the electrical distribution box

- Max. permissible current drain from the electrical distribution box:
 - in continuous operation: 300 A
 - for max. 3 minutes: 750 A
 - for max. 60 seconds: 2400 A

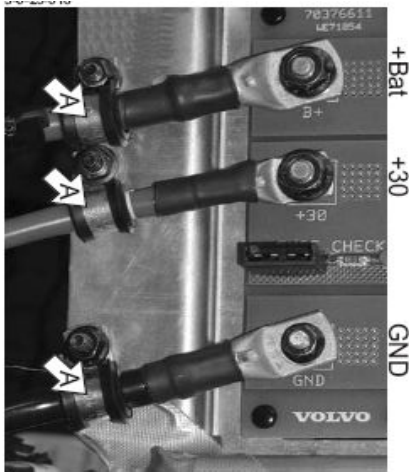
Fuse	Description	Max.load
F101	Chassis B+	150A
F102	Chassis +30	150A

F103	Body +30	150A
F104	Body +30	100A
F105	Body +30	50A
F106	Body +30	50A
F107	Chassis +30	5A
F108	Body +30	10A
F109	Body +30	10A
F110	Body B+	25A
F111	Body B+	25A
F112	Body +30	5A

F101 - MEDU B+
F102 - MEDU +30
F106 - Body Fuse box supply
F105 - Power Inverter supply

Fuses F101, F110, F111 and F112 are before the main switch and therefore always under power. The other fuses in the Distribution box are after the main switch and therefore receive power only when the switch is 'ON'

Fuses F107 supplies power to +30, Fuses F102 to F106 are used for body work connections. All blade fuses except F112 are also used for body work.

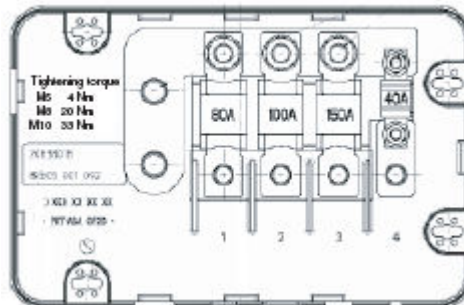


The terminal B+ is connected directly from Battery through fuse & isolator 101 and must be used for loads which have to be worked even when the key switch is OFF.

Terminal +30 is connected after the Key switch is ON

“GND” is negative terminal connected to the Chassis.

The REDB (Rear Electrical Distribution Box) located near the engine is mainly used for starting, charging & air conditioning purposes.



Max. permissible current drain from the electrical distribution box, B7R at B7RLE

- Max. permissible current drain from the electrical distribution box:
 - in continuous operation: 300 A
 - for max 3 minutes: 750 A
 - for max 30 seconds: 1500 A

The power supply to the REDB comes from Batteries via a connection on the alternators. The following fuses are provided in REDB

Fuse	Description	Max.load
F201	Pre-heating	150A
F202	Body +30	150A
F203	Body +30	10A
F204	Body +30	10A
F205	Body +30	10A
F206	Body work +30	10A
F207	Body work +30	10A
F208	Body work +30	25A
F209	Body work +30	10A
F210	Body work +30	10A
F211	Preheating	5A
F212	Body work +30	10A

The incoming and outgoing cables are connected on the rear of the distribution box. The REDB has a control panel with 3 switches.

1. Start Inhibitor - The start inhibitor has two positions, 1 and 0. When the switch is turned clockwise (position 1), the engine can be started from both the dashboard and engine bay. When the switch is in turned off (position 0), the engine cannot be started either from driver position or from the engine bay. The switch must be kept in position 0 whenever any work is carried out in engine bay.
2. Starter button - When the inhibitor is turned clockwise (position 1), the engine can be started with the started button
3. Stop button - Used for stopping the engine through engine bay.

Alternator and Starter Motor: The B7RLE bus has two 110 Amp alternators. The alternators are fan cooled and have built-in transistorized regulators. The alternators are located at the side of the engine and are driven by drive belts from the engine timing gears.

The starter motor is 24volt with power output of 5 kw. The Starter has a built-in planet gear that reduces the rotor speed and increases the torque at the starter motor's driver gear that engages with the engine flywheel gear.

BEA2 Bus Electrical System: The electrical system in Volvo B7RLE is designated as BEA 2. In this system, the control units communicate via a data network or control unit network. The control units can thereby exchange information with each other. This applies to both driveline control and chassis function control units. The data buses in the system are J1708 and a number of J1939. The data links J1708 are used for sending messages that do not require faster transfer speed such as oil pressure signals to activate the oil gauge on the instruments panel. Fault code messages are also sent on this link.

J1939 is used for sending information that requires fast response e.g. the accelerator pedal position signal from the potentiometer to the VECU and further to the EECU which naturally cannot have delays. The error codes are generated from each key aggregate via the data bus to the instrument panel.

Instruments: The switches are placed on both sides of the steering wheel having a satellite design. The satellites move along with the steering wheel when it is adjusted. The left satellite contains functions that are associated with operating the bus viz., lighting, battery isolator switch,TCR,retarder, electric rear view mirrors, level adjustment, kneeling etc.

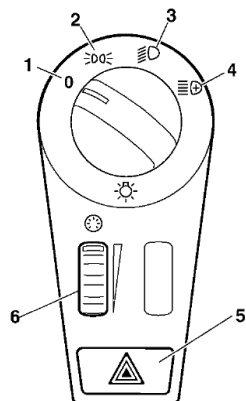
Right satellite consists the functions for automatic gearbox and switches for bodywork functions (driving position lighting, general lighting, door opening/closing/reset etc)

Instrument Cluster: Instrument cluster consists of the following gauges.

Engine oil pressure, Coolant temperature, Turbocharge pressure, Tachometer, Speedometer, Fuel guage, Braking air pressure. In addition to these gauges, there is a centrally located display. There are three warning lamps located above the display that indicate when required i.e, A stop message, A warning message and an information message. If any of these three lamps light, a message and symbols will be shown automatically on the display.



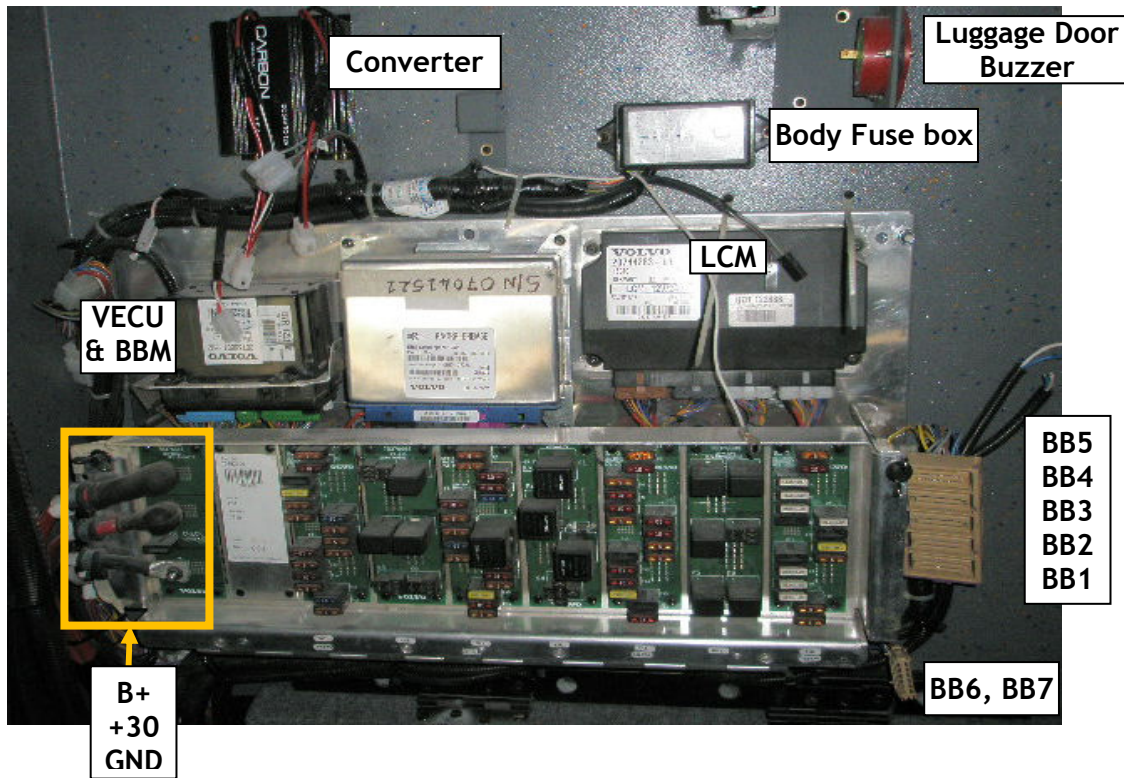
LCP (Light Control Panel): There are different lighting functions operated through LCP. The selections are head lights, parking lights, fog lamps, full and dip beam, spot lights and extra spot lights.



- | |
|--|
| <ol style="list-style-type: none">1. OFF2. Parking Lights3. Head Lights4. Fog & Driving Lights5. Hazard Lights6. Dimmer Control |
|--|

The control has a rotatable knob for adjusting the instrument lighting and a hazard warning flasher switch.

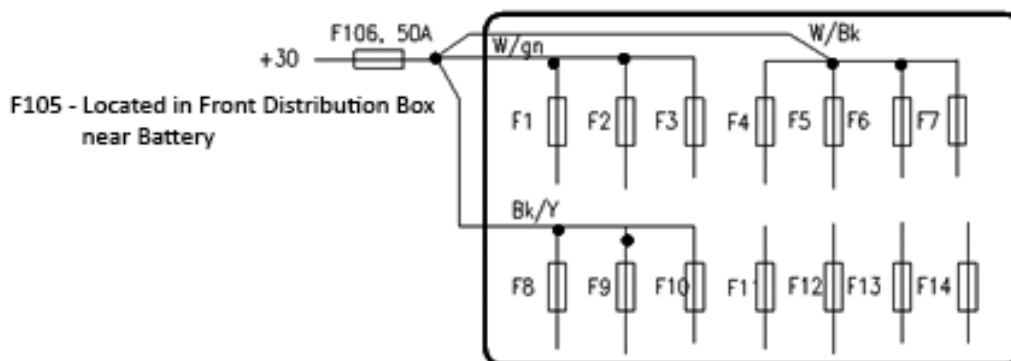
MAIN ELECTRICAL DISTRIBUTION BOX (MEDB):



The following are the control units located in the MEDB.

MID No	Designation	Description
MID 128	EECU	Engine Control Unit
MID 130	TECU	Transmission Control Unit
MID 136	EBS	Brake system Control Unit
MID 140	BIC	Instrument Panel
MID 144	VECU	Vehicle Electronic Control Unit
MID 150	ECS	Suspension Control Unit
MID 216	LCM	Exterior Lighting Control unit
MID 222	RECU	Retarder Control Unit
MID 249	BBM	Body builder control unit

Body Fuse Box: Body fuse box is located at the top of the Main Distribution Box



F.No	Colour	Description	Rating
F1	Gy/R	Driver and Step lights	5A
F2	Gy/y	Engine service light	5A
F3	Gy	Luggage com.Lights	5A
F4	Bl/W	Night Lamps	5A
F5	Bl/Y	Reading Light (RH)	10A
F6	R/Y	Reading light (RH)	10A
F7	Y/gn	Tube light	10A
F8	R/gn	Converter	10A
F9	R/Bl	Mirror	5A
F10	W/bk	A/C control circuit	5A
F11		Vacant	
F12		Vacant	
F13		Vacant	
F14		Vacant	

Direction Indicators and Windscreen wiper stalk: The direction indicator stalk is provided at the left side of the Steering wheel. This is also used for dip and dim beam, cruise control.

The direction indicators are operated by moving the stalk upwards for right turn and downwards for left turn

The main beam is actuated by moving the stalk towards driver side until it clicks. Once the headlights are on, the main beam gets engaged.

Direction indicators and main beam switch have check lamps in the instrument cluster. Green arrow glows for direction and blue lamp for main beam.

The toggle switch on the left side stalk is used to increase or decrease the engine idle speed during the cruise control mode.

Windscreen wiper stalk is provided on the right side of the steering wheel. The same stalk is also windscreen spray jet actuation and headlamps and control the display. Intermittent wiping is can be enabled by moving the lever to intermittent position.

Display: The display is in the middle of the instrument cluster and presents the driver with information. Certain information is displayed automatically (viz warnings)

The display has 13 different menus. Menus 7 to 13 are accessible only when the vehicle is stationary and at speeds below 3 km/hr. The menus will be locked at higher speeds. Several submenus are protected by passwords when stationary.

The upper most part of the display is called the “menu zone” where menus and automatic alarms, warnings and information messages are displayed

At the top left there is text explaining which menu is currently active. The number on the right side mentions which menu is selected out of total number of menus.


The center of the display is called “own selection”. The left side displays the information that the driver has selected to see using the display menu. A clock showing the current time is displayed in the right.


The lower part of the display is called the “Status row”. The side shows current status icons. The odometer is displayed on the right.


Display Control Lever: The info display is operated with the control lever on the right side of the steering wheel. The information can be accessed by operating this lever.



ESC (Escape button) is used to return to the previous menu and discontinue a setting/operation

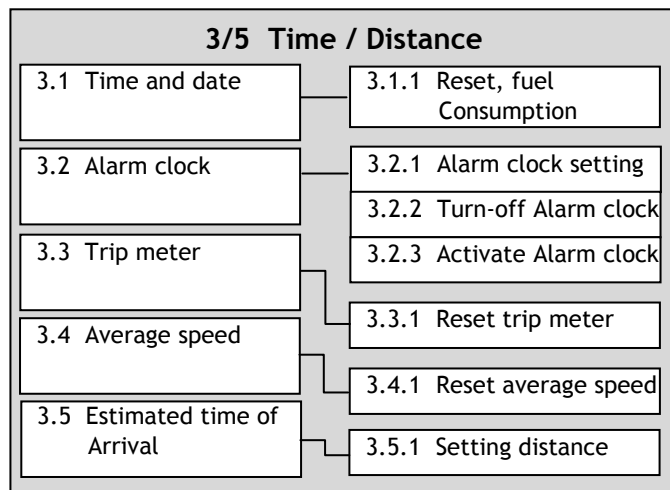
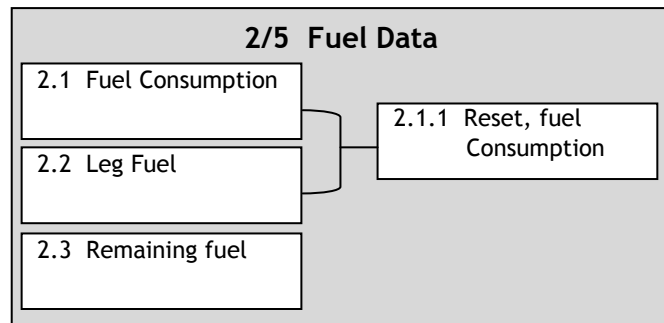
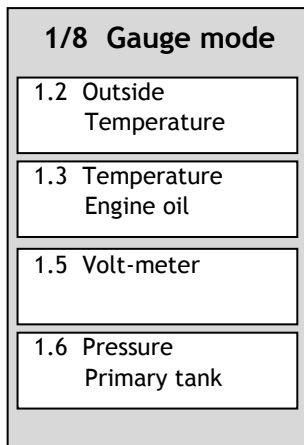
 (Enter button) confirms the selected choice of the menu or symbol

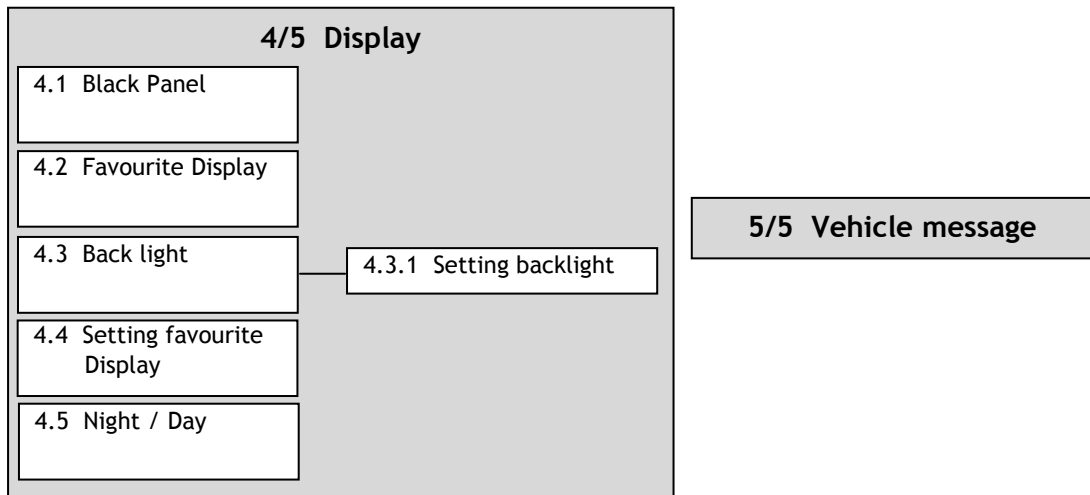
 (Up button) Moves the cursor up and is used when setting numbers/ letters

 (Down button) Moves the cursor down and is used when setting numbers/ letters

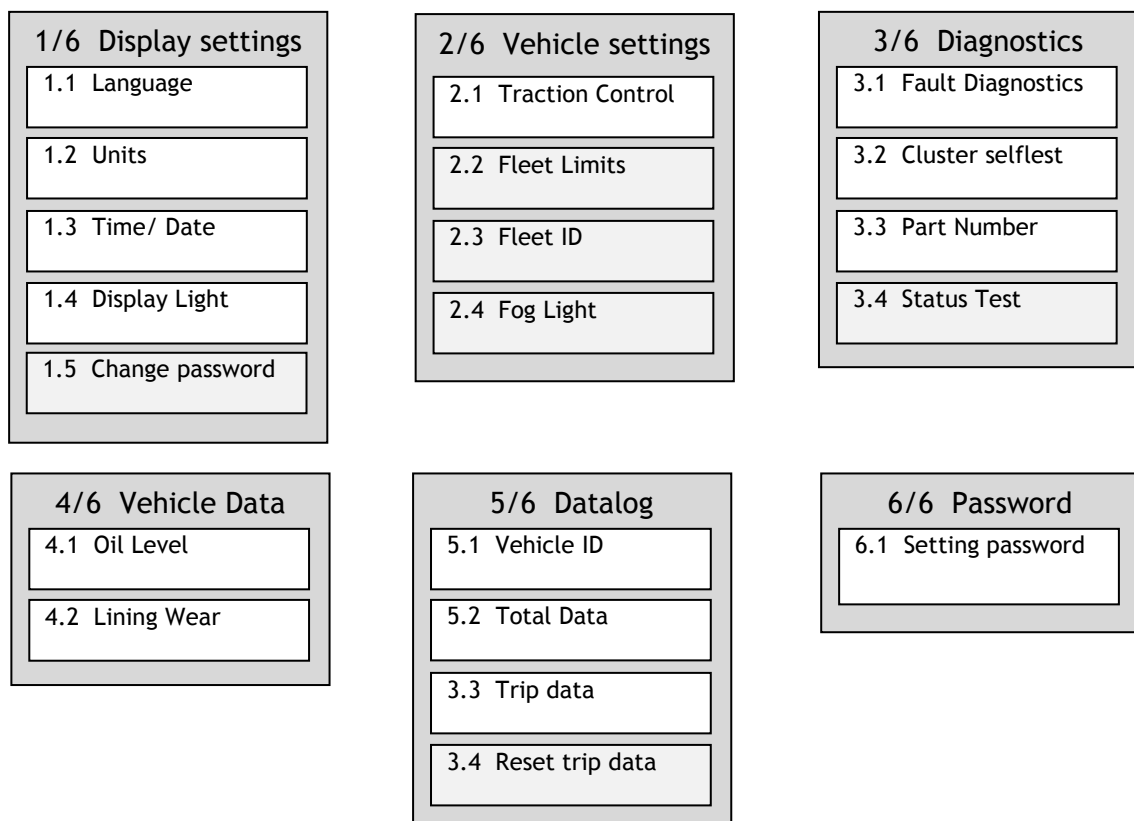
The toggle button on the right hand side stalk is used to access the details of the vehicle aggregates via the instrument cluster display.

Menus while Driving: The following menus 1 to 5 are accessible at all times (both at stationary and while moving). There are also sub-headings under the respective menu. Sub-headings with dashed outlines are not standard menu items.





Menus while stationary: The following menus can be accessed only when the vehicle is at stationary (or the vehicle speed is not more than 3 km/hr). The menus shown in grey boxes are protected by password.



There are three passwords for the display. The passwords set by the factory at the time of vehicle delivery are

- 1) workshop-1 password is 0000, 2) Operators password is 1234 and 3) workshop-2 password is 5678

Note: When the starter key has been in the stop position for more than 60 seconds or if the battery has been disconnected, the password must be entered again in order to access all functions.

In menu 3/6 “Diagnostics”, it is possible to carry out fault diagnostics of the bus control unit to see whether they are in working order. It is also possible to run an instrument test to see whether gauges and LEDs of the instrument cluster are intact. The control unit part number can be determined in the part number menu. The following menus are available,

3/6 Diagnostics:

- 3.1 Fault Diagnostics
- 3.2 Cluster self test
 - 3.2.1 Indication Lamps test
 - 3.2.2 Gauge test
 - 3.2.3 Display test
 - 3.2.4 Loudspeaker test
- 3.3 Part number
- 3.4 Status test

In menu 3.1 “Fault Diagnostics”, any fault codes that have been generated for control unit can be read.

The display will then contain the following information

- 1: Identification of control unit
- 2: Identification of parameter/ complaint
- 3: Identification of fault type
- 4: Identification whether fault is active or inactive
- 5: “Number of occurrences” shows how many times the fault has been registered since last reset. If there is no information available for how many times the error code been registered, only “Active” is shown (fault remains). Alternatively, “Inactive” is displayed.

MID - MESSAGE ID : identifies the control unit. For example, MID 128 equals the engine ECU. Each control unit has a specific number

PID - PARAMETER ID : Identifies a function that can send variable signals. For example MID 128 PID 94 equals fuel delivery pressure

PPID - PROPRIETARY ID: identifies a Volvo specific function.

SID - SUB-SYSTEM ID : identifies a component which is defective. For example MID 128 SID 1 equals injector 1.

PSID - PROPRIETARY SUB-SYSTEM ID : identifies a Volvo specific component which is defective.

A fault code also consist of MID (P)PID/SID but with an additional FMI (Failure Mode Identifier). The FMI is a number that describes the type of fault. There are 15 FMIs. For example MID 128 PID 94 FMI 1 equals low fuel pressure, where FMI 1 in itself means “too low value”.

Fault codes are stored in the control units and may be read out with a diagnostic software. It is also possible to display them in the instrument display. To find out what a fault code means, find the corresponding MID table in the complete body building instruction with fault code tables.

Some important fault codes will appear in the instrument display as they are set, but most will only be stored in the control units.







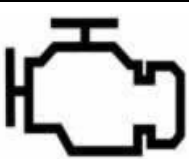
FAULT CODE	DESCRIPTION OF FAULT
MID 128 PID 111	Coolant level
MID 128 PID 97	Water in Fuel
MID 128 PID 100	Engine oil Pressure
MID 128 PID 105	Boost Air Temperature
MID 128 PID 102	Boost Pressure
MID 128 PID 107	Air filter differential pressure
MID 128 SID 42	Fuel control unit
MID 128 PISD 96	Fuel Common rail pressure
MID 128 PID 94	Fuel Delivery pressure
MID 128 SID 1/6	Injectors Fault codes
MID 128 PID 110	Coolant temperature
MID 128 PID 158	Battery Voltage
MID 136 SID 70/75	Uneven wear on brake pads
MID 136 SID 1/6	Wheel speed sensors
MID 136 SID 7/12	Modulators
MID 136 PID 46	Air pressure low
MID 144 PSID 1	Height Level sensors
MID 150 PSID 2	Pressure sensor
MID 150 PSID 40	Inadequate Adblue quality
MID 128 PSID 45/46	NOx Sensor
MID 128 PSID 115	Empty Adblue Tank
MID 128 PSID 42	Interrupted Dosage

FAILURE MODE INDICATORS (FMI)

FMI	DISPLAY TEXT	SAE TEXT
0	Too high value	Data valid but above normal operational range
1	Too low value	Data valid but below normal operational range
2	Incorrect data	Data erratic, intermittent, or incorrect
3	Electrical fault	Voltage above normal or shorted high
4	Electrical fault	Voltage below normal or shorted low
5	Electrical fault	Current below normal or open circuit
6	Electrical fault	Current above normal or grounded circuit
7	Mechanical fault	Mechanical system not responding properly
8	Mech.or Elec.fault	Abnormal frequency, pulse width, or period
9	Communication fault	Abnormal update rate
10	Mech.or Elec.fault	change Abnormal rate of change
11	Unknown fault	mode not identifiable
12	Component fault	Bad intelligent device or component
13	Incorrect Calibration	Out of Calibration
14	Unknown fault	Special Instructions
15	Unknown fault	Reserved for future use

The vehicle shall be parked in a safe position on appearing STOP symbol.

The STOP symbol will appear in the event of the following alarming messages

	Stop Request
	Door Open while Driving
	Fire Alarm
	Low Oil pressure
	Low Air pressure in Brake circuit
	Coolant temperature High
	Engine fault

DAILY CHECK LIST FOR BUSES

S.N	ITEM	Daily	Weekly
OUTSIDE OF THE BUS			
1	Lamp glass	✓	✓
2	Detachable items, moldings, mud flaps	✓	✓
	DRIVER AREA (BEFORE STARTING)		
CHECKS AFTER STARTING			
1	Warning lamp	✓	✓
2	Passenger door opening & closings	✓	✓

S.N	ITEM	Daily	Weekly
CHECKS DURING TEST DRIVE			
1	Speedometer, instruments, pickup & speed	✓	✓
2	Side pulling while braking		✓
3	Abnormal noise from Gearbox	✓	✓
4	Abnormal noise from differential	✓	✓
5	Abnormal noise from Engine	✓	✓
6	Retarder function	✓	✓
7	Exhaust smoke		✓
8	Air condition system, cooling	✓	✓
ENGINE			
1	Driver belts	✓	✓
2	Coolant level	✓	✓
3	Engine oil level	✓	✓
4	Turbocharger Oil leakage	✓	✓
5	Valve cover oil leakage	✓	✓
6	Timing cover oil leakage	✓	✓
7	Radiator fan		✓
8	Fuel filter protection plate		✓
9	Belt tensioner cable	✓	✓
ELECTRICAL SYSTEM			
1	Electrolyte level	✓	✓
2	Voltage		✓
3	Specific gravity		✓
4	All lights & fuses	✓	✓
BRAKE			
1	Air Pressure building time	✓	✓
2	Leakages	✓	✓
3	Brake pads wear condition		✓
STEERING			
1	Power steering oil level	✓	✓
2	Power steering oil leakage	✓	✓
SUSPENSION			
1	Air bellow condition		✓
2	Bellow leveling valves function	✓	✓
3	Tire Pressure		✓

PREVENTIVE MAINTENANCE SCHEDULE

S. N	Part Number	Description	Qty	30,000	60,000	90,000	1,20,000	1,50,000	1,80,000	2,10,000	2,40,000	2,70,000	3,00,000	3,30,000	3,60,000	3,90,000	4,20,000	4,50,000	4,80,000
1	349619	Power Steering Filter	1			✓			✓			✓			✓			✓	
2	67-18003	Engine oil VDS III (ltrs)	30	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
3	20998807	Engine oil filter	1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
4	21276079	Diesel filter	1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
5	21088101	Water separator	1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
6	21064484/ 21743197	Fuel tank breather filter	1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
7	21333097	AdBlue filter	1			✓			✓			✓			✓			✓	
8	8149064	Air filter insert (Pri) 90000 kms or whenever filter choked	1			✓			✓			✓			✓			✓	
9	21041296	Air filter insert (Sec)	1									✓							
10	85108914	Coolant premixed (ltr) (wherever applicable)	40												✓				
11	85117346	Gear oil TE-ML 20 (Oil sump temp. upto 110 OC) ZF Lubricant Class - 20F	24				✓				✓				✓				✓
12	21654583	Gear oil filter	1				✓				✓				✓				✓
13	1161279	Rear axle oil (ltrs)	15				✓				✓				✓				✓
14	20773824	Air Dryer filter	1			✓			✓			✓			✓				✓
15	21612861	Alternator charge regulator	2								✓								✓
16	20860507	Coolant pump, Alternator belt	1			✓			✓			✓			✓				✓
17	20581953	Fan belt	1			✓			✓			✓			✓				✓
18		Valves adjustment			✓		✓		✓		✓		✓		✓		✓		✓
19		Cyl. Head, compressor, leakage check				✓			✓			✓			✓				✓
20		Alternators cleaning		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

DO's & DON'Ts IN VOLVO B7R LE BUSES

WHILE UNDERTAKING WELDING WORKS:

In order to avoid failure of ECUs in buses due to electric welding in buses, the following components shall be disconnected before doing welding.

- 1) Batteries
- 2) Alternators
- 3) All ECU connectors

Emergency Switch: Emergency switch is provided to use it in emergency situations to cut-off the power. Drivers/ Mechanics shall not resort to operate this switch unnecessarily which may cause severe damage to the EECU.

Cleaning of Engine compartment & alternator: Care shall be taken while cleaning the engine compartment, as the life of alternators may seriously get affected when exposed to water.

The engine shall be stopped before undertaking any cleaning work in the engine compartment. The dust in the alternators can be cleaned by using compressed air (not more than 7 bar pressure) by blowing air onto the outside of the house and into all openings of the alternator.

The alternators shall be properly covered with waterproof plastic covers whenever engine compartment is taken up for water cleaning. While using high pressure water jets, the water pressure must not exceed 80 bar and a distance of 100-150mm shall be maintained between the nozzle and the parts.

IMPORTANT SPECIAL TOOLS

S.N	Nomenclature	Tool Number
1	Ball joint removing tool	9996201
2	Bellow height measuring tool	9990834
3	Big Ratchet for filter removal	680666
4	Brake Caliper removing tool	9998573/ 99998829
5	Caliper removing socket (Flower socket)	9998573
6	Chain pulley for water separator removing	9996672
7	Coolant/E.Oil Drain hose	9996049
8	Cranking tool	8880014
9	Crimping tool	
10	Front Crank oil seal remover	9998673
11	Front Hub check nut spanner	9998111
12	Front Hub cap removing tool	9998457
13	Injector copper sleeve removing tool	9998252/88880014/ 88800198
14	Rear end oil seal replacement tool	9998672
15	Rear Hub check nut removing tool	9998457
16	Two leg bearing puller	88810013

PASSENGER SAFETY



A protection against incidental squeezing
 C door emergency opening from inside
 E Glass Breaking Hammers in emergency
 G roof hatch - safety exit
 I emergency switch

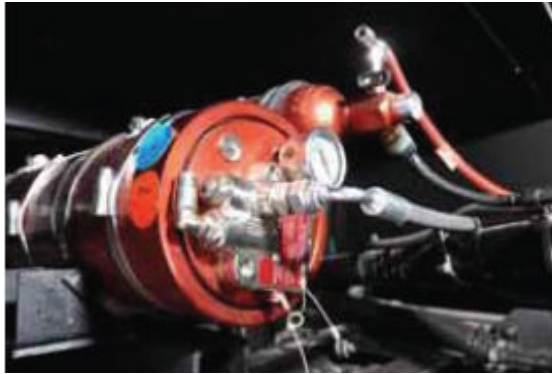
B first-aid box
 D Emergency opening from outside
 F powder extinguisher
 H warning triangle

The bus ensures a high safety level (it corresponds to the requirements of the regulations concerning the bus structure strengths). The special sensors in the door System protects passengers against incidental squeezing, and the door brake disables bus start when a door is not closed.

Bus has a first-aid kit* located in a compartment in the dashboard and a powder extinguisher*. The driver should know where these things are placed and how to use them. In emergency the driver can use wheel chocks (to additionally block the wheels).

In danger, there are three emergency methods. Manual releasing of the door safety valve results in opening them. Also after reaching the handle and pushing the roof hatches out, the emergency exits will be created. If necessary, the side windows may be used as emergency exits. To break the windows, use special hammers located inside the vehicle, under the air ducts.

Volvo B7RLE is also provided with automatic Fire detection & suppression system in the engine compartment.



The maintenance activities to be carried out during the basic service and during Annual service are furnished in the annexure. Further, a copy of agreement between Volvo & APSRTC with regard to warranty conditions and other provisions is also enclosed.

The Dy.CMEs are advised to make note of the salient features, maintenance aspects, operating instructions etc and educate the field staff to ensure proper maintenance of Volvo B7R LE buses and make the operation of these buses successful.


EXECUTIVE DIRECTOR (E)

Encl: 1) A copy of agreement on PO conditions
2) Details of Basic maintenance activities

Copy to: Director V&S for information
Copy to: all EDs for information
Copy to: CME(O), CME(C&B), CCOS, CE(IT) & CE(IEU) for necessary action
Copy to: RMs HYD & SEC'BAD for necessary action
Copy to: Dy.CMEs HYC, CRMR, SD & SNG for necessary action
Copy to: WM/UPL & COS/UPL for necessary action
Copy to: Dy.CME(P), Dy.CME(C&B), Dy.CME(IEU) & Dy.CME(IT) for necessary action.
Copy to: all DMs of GHZ for necessary action
Copy to: Manual section for record
Copy to: Resident Audit Inspector, AG/Bus Bhavan for information

BASIC SERVICE

Lubrication, Oil and Fluid Level Check

- 1 Check Oil Level in Rear Drive Axle
- 2 Check Oil Level in Power Steering
- 3 Check Fluid Level in Clutch Fluid Reservoir
- 4 Check Coolant Freeze Protection and Coolant Level (Check SCA Level)
- 5 Check Fluid Levels in Windshield Wiper and Headlamp Wiper Reservoirs
- 6 Check Air Dryer
- 7 Lubrication of Battery box
- 8 Lubrication of Steering axle
- 9 Chassis Lubrication
- 10 Check Oil Level in Automatic Transmission
- 11 Check Oil Level in Retarder
- 12 Body
- 13 Cab Lubrication of doors, gliding rail

Check at Drivers position

- 14 Check Warning and Control Lamps
- 15 Check for Fault Codes in the Vehicle Electronic Control Unit
- 16 Check for Fault Codes in the Engine Electronic Control Unit
- 17 Check for Fault Codes in the ABS, anti-lock brakes
- 18 Check for Fault Codes in Transmission
- 19 Start engine and check starter element
- 20 Check pressure regulator cut out and cut-in pressure
- 21 Check compressor function and condition
- 22 Check pressure drop in compressed air system
- 23 Check parking brake and blocking valve
- 24 Check gear shift linkage and clutch pedal
- 25 Check brake pedal and foot brake valve
- 26 Driver seat
- 27 Check Retarder Control
- 28 Safety check, fault codes
- 29 Safety check, doors
- 30 Safety check, hatches safety switch
- 31 Roof hatches
- 32 Safety check, disabled persons lift
- 33 Safety check, wheelchair ramp
- 34 Check handrail and support rail installation
- 35 Check doors, screw unions tightening
- 36 Floor, floor hatches
- 37 Wall panels

- 38 Remaining equipment
- 39 Passenger seats
- 40 Check roof hatches and emergency hammers
- 41 Safety equipment, first aid package, warning triangle, warning plates
- 42 Remaining safety equipment

External Checks

- 43 Function Check Lighting
- 44 Check Mirrors and Reflectors
- 45 Function Check of Wipers and Washers
- 46 Check fuse boxes, battery box and engine
- 47 Check ground points chassis, frame and body
Check Batteries - dirt, leakage, attachment, Fluid Levels, connections and
- 48 battery box
- 49 Check Water Separator for Fuel System, draining of condensating water
- 50 Check Tire Wear
- 51 Check AdBlue system
- 52 Luggage compartment hatches

Engine Compartment Checks

- 53 Check Alternator Mounting
Check electrical connections and cables for alternator, starter motor and
- 54 preheating unit
- 55 Check fire alarm sensor
- 56 Check Drive Belts and belt tensioners
- 57 Check drive shaft for alternator and AC unit
- 58 Check Radiator mountings
- 59 Check radiator, charge air cooler, hoses, pipes and air through-flow
- 60 Check sealing on engine
- 61 Check Fuel Pipes and Lines
- 62 Check for Exhaust Leakage
- 63 Check air pipe between air intake and turbocharger
- 64 Check engine sound baffles

Front suspension, steering gear

- 65 Check sealing on servo pump, oil connections, oil hoses, and steering gear
- 66 Check leakage, hydraulic steered axle
- 67 Check steering link system
- 68 Check front wheels
- 69 Check axial play, V-Stay
- 70 Check V-Stay and reaction rod
- 71 Check cross stay and reaction rod

Check Underneath the vehicle

- 72 Check sealing on gearbox, check wiring
- 73 Check transmission ventilation
- 74 Check sealing on rear axle
- 75 Check Bearing Clearance in Pinion and Rear Axle Input Shaft
- 76 Check rear axle ventilation
- 77 Check Exhaust Pipe, Silencer, or Particulate Filter
- 78 Check Brake Linings & Brake pads
- 79 Check brake lever travel
- 80 Check Slack in Mechanical Linkage for Clutch
- 81 Check clutch hydraulic and pneumatic control system
- 82 Check clutch cylinder stroke
- 83 Check sealing of oil cooler for automatic transmission
- 84 Check tightness on Retarder and lines
- 85 Check Brake Disc and Calipers

Road Test

- 86 Check After Start
- 87 Check During Test Driving
- 88 Check After Test Driving
- 89 Finish

Clutch

x1	
x2	
Y	

Battery Status

Battery	Test Code
Inner/Front Battery	
Outer/ Rear battery	

Brakes & Tyres

Brake Linings, thickness in mm	Right								
	Left								
Brake levers - stroke in mm	Right								
	Left								
Observations on Tyre wear	Right								
	Left								
Action:									

ANNUAL SERVICE

Lubrication, Oil and Fluid Level Check

- 1 Check Oil Level in Rear Drive Axle
- 2 Check Oil Level in Power Steering
- 3 Check Fluid Level in Clutch Fluid Reservoir
- 4 Check Coolant Freeze Protection and Coolant Level (Check SCA Level)
- 5 Check Fluid Levels in Windshield Wiper and Headlamp Wiper Reservoirs
- 6 Check Air Dryer
- 7 Lubrication of Battery box
- 8 Lubrication of Steering axle
- 9 Chassis Lubrication
- 10 Check Oil Level in Automatic Transmission
- 11 Check Oil Level in Retarder
- 12 Body
- 13 Cab Lubrication of doors, gliding rail

Check at Drivers position

- 14 Check Warning and Control Lamps
- 15 Check for Fault Codes in the Vehicle Electronic Control Unit
- 16 Check for Fault Codes in the Engine Electronic Control Unit
- 17 Check for Fault Codes in the ABS, anti-lock brakes
- 18 Check for Fault Codes in Transmission
- 19 Start engine and check starter element
- 20 Check pressure regulator cut out and cut-in pressure
- 21 Check compressor function and condition
- 22 Check pressure drop in compressed air system
- 23 Check parking brake and blocking valve
- 24 Check gear shift linkage and clutch pedal
- 25 Check brake pedal and foot brake valve
- 26 Driver seat
- 27 Check Retarder Control
- 28 Safety check, fault codes
- 29 Safety check, doors
- 30 Safety check, hatches safety switch
- 31 Roof hatches
- 32 Safety check, disabled persons lift
- 33 Safety check, wheelchair ramp
- 34 Check handrail and support rail installation
- 35 Check doors, screw unions tightening
- 36 Floor, floor hatches
- 37 Wall panels
- 38 Remaining equipment

- 39 Passenger seats
- 40 Check roof hatches and emergency hammers
- 41 Safety equipment, first aid package, warning triangle, warning plates
- 42 Remaining safety equipment

External Checks

- 43 Function Check Lighting
- 44 Check Mirrors and Reflectors
- 45 Function Check of Wipers and Washers
- 46 Check Head Lamps
- 47 Check fuse boxes, battery box and engine
- 48 Check ground points chassis, frame and body
Check Batteries - dirt, leakage, attachment, Fluid Levels, connections and
- 49 battery box
- 50 Check Water Separator for Fuel System, draining of condensating water
- 51 Draining of Fuel tank
- 52 Check Tire Wear
- 53 Check AdBlue system
- 54 Luggage compartment hatches

Engine Compartment Checks

- 55 Check Alternator Mounting
Check electrical connections and cables for alternator, starter motor and
- 56 preheating unit
- 57 Check fire alarm sensor
- 58 Check Drive Belts and belt tensioners
- 59 Check drive shaft for alternator and AC unit
- 60 Check refrigerant condenser pipes and hoses
- 61 Check engine mountings
Check Radiator Fan, bearing tolerance, screw unions, Fan shroud & Fan ring
- 62 with rubber seal
- 63 Check radiator, charge air cooler, hoses, pipes and air through-flow
- 64 Check radiator mountings
- 65 Check sealing on engine
- 66 Check Fuel Pipes and Lines
- 67 Check for Exhaust Leakage
- 68 Check air pipe between air intake and turbocharger
- 69 Check engine sound baffles

Front suspension, steering gear

- 70 Check sealing on servo pump, oil connections, oil hoses, and steering gear
- 71 Check leakage, hydraulic steered axle
- 72 Check steering link system
- 73 Check front shock absorbers

- 74 Check kingpin bearings
- 75 Check front wheel bearing (unit bearing)
- 76 Check front wheels
- 77 Check axial play, V-Stay
- 78 Check V-Stay and reaction rod
- 79 Check cross stay and reaction rod

Check Underneath the vehicle

- 80 Check sealing on the speedometer
- 81 Check sealing on gearbox, check wiring
- 82 Check sound baffle for gearbox
- 83 Check transmission ventilation
- 84 Check PP shaft Universal joints & sliding joints
- 85 Check sealing on rear axle
- 86 Check Bearing Clearance in Pinion and Rear Axle Input Shaft
- 87 Check rear axle ventilation
- 88 Check Exhaust Pipe, Silencer, or Particulate Filter
- 89 Check antiroll bar
- 90 Check Rear shock absorbers
- 91 Check fuel tank hoses, air vent pipe and mountings
- 92 Check chassis frame and cross members
- 93 Check rear wheel bearings
- 94 Check Brake Linings & Brake pads
- 95 Check clutch hydraulic and pneumatic control system
- 96 Check clutch cylinder stroke
- 97 Check sealing of oil cooler for automatic transmission
- 98 Check tightness on Retarder and lines
- 99 Check Airfilter modulator valve
- 100 Check Airbellows level sensors and level valves
- 101 Check height regulation for air suspension
- 102 Check brake cylinders
- 103 Check Brake Disc and Calipers

Road Test

- 104 Check After Start
- 105 Check During Test Driving
- 106 Check After Test Driving
- 107 Finish

Clutch

x1	
x2	
Y	

Battery Status

Battery	Test Code
Inner/Front Battery	
Outer/ Rear battery	

Brakes & Tyres

Brake Linings, thickness in mm	Right								
	Left								
Brake levers - stroke in mm	Right								
	Left								
Observations on Tyre wear	Right								
	Left								
Action:									

AGREEMENT ON CONDITIONS OF PURCHASE CONTRACT



ఆంధ్రప్రదేశ్ రాష్ట్రం ఆంధ్ర ప్రదేశ్ ANDHRA PRADESH

Sl.No. 5384 Date 09-06-2014

Sold to: Shri J. M. S. of. selvaraj J. M.

For Whom: Volvo Buses India Pvt Ltd, Bangalore

BE 270724

G. MADHU

LICENCED STAMP VENDOR

Lic.No.15-11-015/2011, Ren.No.15-11-039/201

H.No.5-1-68, Kukatapally, R.R Dist-072

Cell No. 98490 41134

PART F : FORMAT OF AGREEMENT COMPRISING THE CONTRACT

THIS BUS SUPPLY CONTRACT is made on 12th June 2014 between Andhra Pradesh State Road Transport Corporation having principle place of business at Hyderabad hereinafter called "APSRTC" of the one part and M/s. Volvo Buses India Private Limited having its principle place of business at Yalochahally, Tavarekeru Post, Hosakote Taluk, Bangalore - 562112 hereinafter called "the Contractor" of the other part.

WHEREAS:

A. APSRTC is desirous to procure the Buses /Chassis and services during the warranty period to be provided by the Contractor, viz. Design, Manufacture, Supply & Commissioning of Buses including prescribed warranty period of 2 years or 2,00,000 Kms, whichever is earlier and has accepted the Bid submitted by the Contractor for the said Buses and services.

B. The Contractor has been selected pursuant to a competitive bid process and has agreed and undertaken to discharge the scope of services in consideration of the Price Bid submitted by it and has submitted the Performance Security as required pursuant to the RFP Document.

NOW THIS CONTRACT WITNESSETH as follows:

1. In this Contract words and expression shall have the same meaning as are respectively assigned to them in the Conditions of Contract hereinafter referred to. 2. The Contract comprises of the following documents:

For Andhra Pradesh State Road Transport Corporation



- (1) This cover agreement;
- (2) Schedules to the Contract, including the General Conditions of Contract;
- (3) RFP document dated 12.12.2013 in its entirety
- (4) Addendum and Response to Queries dated 03.01.2014
- (5) Bidders Bid
- (6) Performance Security.
- (7) LOA dated 22.02.2014, received with covering letter dated 02.06.2014.
- (8) Any amendment or clarificatory agreed to between the Parties whether by way of letters or agreements.

3. In consideration of the payments to be made by APSRTC to the Contractor as hereinafter mentioned, the Contractor hereby covenants with APSRTC to discharge the scope of work as provided in Clause 1.2 of the RFP Documents, including delivery of the Buses and providing the spares and after sales services, and guarantees the same to be in conformity in all respects with the provisions of the Contract.

4. APSRTC hereby covenants to pay the Contractor in consideration of the provision of buses and services and guarantee of the same, the Contract Price at the times and in manner prescribed by the Contract.

5. The Contractor agrees that essence of Contract and other contractual obligation shall become effective from the date of Letter of Award i.e. LOA. The Contractor further agrees that pre estimated damages mentioned in RFP Document, are fair and genuine pre-estimate and not by way of penalty. The Contractor shall not dispute the same in future in any manner. IN WITNESS WHEREOF the parties here have caused their respective Common Seals to be hereunto affixed (or have hereunto set their respective hands and seals) the day and year first above written.

SIGNED, SEALED AND DELIVERED

for Volvo Buses India Private Limited

Name **Authorised Signatory**
On behalf of the Contractor **PRASAD, A.G**

In the presence of
Witness **[Signature]**
Name **SHRI RAM.S**
Address.....

VOLVO BUSES INDIA PVT LTD
65/2, BLOCK A, 5TH FLR
PARIN BUILDING, BAGMANE TECH PARK
CV. RAMAN NAGAR, BANGALORE
560093



For Andhra Pradesh State Road Transport Corporation

Chief Mechanical Engineer (C&B)
Chief Mechanical Engineer (C&B)

APSRTC, Hyderabad.

In the presence of
Witness **[Signature]**
Name **Y. VISHVA KUMAR REDDY**
Address **AHE (A)**
APSRTC BUS BHAVAN
HYDERABAD

RFP TERMS & CONDITIONS UNDER CLAUSE 32 & 36 OF THE DOCUMENT
(Contractor means M/s Volvo Buses India Pvt Ltd)

32. Safety Measures

- 32.1. Contractor should take all precautionary measures in order to ensure protection of his own personnel moving about or working on the premises of Andhra Pradesh State Road Transport Corporation i.e. APSRTC.
- 32.2. Contractor should abide by and conform to all rules and regulations of APSRTC in force from time to time and ensure that the same are followed by his representatives, agents, sub-Contractor or workmen working in the premises of APSRTC.
- 32.3. Contractor should ensure that while working in the premises of APSRTC, unauthorized, careless or inadvertent operation of installed equipment which may result in accident to staff and/ or damage to equipment, does not occur.
- 32.4. Contractor should indemnify and keep the APSRTC indemnified and harmless against all actions, suits, claims, demands, costs, charges or expenses arising in connection with any accident, death or injury, sustained by any person or persons within the premises of APSRTC and any loss or damage to property of APSRTC sustained due to the acts or omissions of Contractor irrespective of whether such liability arises under Workman's Compensation Act or the Fatal Accidents Act or any other statute in force from time to time.

36. Warranty

- 36.1. Contractor shall be responsible for any defect or failure of Buses/Chassis or equipment i.e. aggregates and bus body items, provided in these buses due to defective design, material or workmanship, for a period Specified in the RFP Summary individually for each Bus from the date of issuance of Final Acceptance Certificate of APSRTC, the rectification/ replacement of failed components/ equipment shall have to be undertaken by Contractor free of charge at APSRTC's workshop/ depot. Contractor shall collect failed & defective components/ equipment from APSRTC site and send them to the works of the Contractors at his cost and responsibility. This shall be arranged directly by the Contractor or his representative.
- 36.2. Contractor shall be required to station required number of competent engineers/ supervisors along with necessary spare parts during commissioning of Buses at his cost. However, at least one competent engineer for 100 buses or part thereof, shall necessarily be stationed during the entire warranty period for evaluation of performance of Buses & keeping liaison with the APSRTC. Necessary technical personnel shall also be deputed by the Contractor at his cost for investigating defects and failures and carrying out modifications as and when required during the warranty period.

- 36.3. Contractor shall ensure to supply the required aggregates and spares by maintaining adequate floats and inventory for repair of buses/chassis within the time line as per the table below.

Sl. No	Nature of Repair	Repair or Replacement time in number of days.
1	All minor repair & replacement of aggregates like- Air Compressor, Intercooler, Clutch plate, Alternator, Injectors, AC-compressor, Retarder etc.	3
2	All major repair & replacement of aggregates like-Engine, Gear Box , Rear Axle, Front Axle, etc.	7
3	Minor repair or replacement of parts	3
4	Major repair or replacement of parts.	7

The above days are excluding the days taken by the APSRTC in sanctioning the repair / replacement days, if any (as some repair / replacement may be carried out at cost for which approval / sanction of the APSRTC would be necessary).

- 36.4 In case of delay in making the buses on road for want of spares and aggregates as above during warranty period, it attracts penalty @ Rs. 1000/- per day per bus.
- 36.5 If any mishap happens to the bus during warranty period for any technical reason like bus burning, serious injuries to the passengers after conducting the joint inspection, the contractor shall replace/reimburse the cost of the bus within three months from the date of incident.