



Andhra Pradesh State Road Transport Corporation
Office of the Managing Director, Bus Bhavan, Hyderabad - 500 624.

No: OP3/462/ISUZU MIDI/2015-MED

CIRCULAR No.21/2015-MED, Dated.31.12.2015.

Sub: **MAINTENANCE** - Introduction of **ISUZU "S7 Next" BS-III Buses in Chittoor Region** - Salient features and maintenance aspects communicated - Reg.

- 1.00** Corporation has recently introduced **ISUZU- 5100 mm Wheel Base, 75 kw, "S7 Next" 5100 BS-III Buses** at Depots of Chittoor Region under JnNURM-II scheme. The following is the depot wise allotment details of vehicles.

S.No	Depot	Fleet held
1	Mangalam	22
2	Tirupathi	11
3	Alipiri	12
4	SKHT	13
5	Tirumala	2
Total		60

- 2.00** The salient technical specifications and features of aggregates of these buses are enclosed at **Annexure-I**.
- 3.00** The OEM recommended lubricants, coolant, greases & clutch fluid for these buses and the system capacities and change periodicities are given at **Annexure-II**.
- 4.00** The system wise preventive maintenance schedules are similar to the existing periodicities furnished at **Annexure-III**.
- 5.00** This bus meets the JnNURM Urban Bus Specifications-2 and the significant features incorporated in this bus are given under.

a) Engine Management system of M/s BOSCH

The functions of critical components of engine management system like ECU, sensors & actuators and other system sensors in the vehicle for ease in day to day maintenance and The Do's & Don'ts to be followed during routine maintenance are given at **Annexure-IV**.

b) Multiplexing System of M/s ACTIA

The multiplexing wiring system supplied by M/s ACTIA, is of master-master type multiplexing. The main feature of this type of multiplexing is, in case one ECU fails other ECUs work independently to avoid enroute stoppage of bus. The advantages of multiplexing over conventional wiring, its main components and their functions are explained at **Annexure-V**.

The Multiplexing wiring architecture with ITS (Intelligent Transport System) diagram is given at **Annexure-XI**.

The diagram of Electronic Instrument Cluster is given at **Annexure-XII**.

c) Pneumatic doors of M/s ROTEX

These buses are equipped with Electro - Pneumatic Door control Mechanism provided by M/s Rotex Manufacturers & Engineers (P) Ltd. The Pneumatic Door mechanism actuates the open / close movements of bus door through one double acting cylinder with linkage. To prevent people from being clamped, the door system adopts pneumatic sensor, human sensor and timer, so that the door will retract automatically when any obstruction occurs. All the units are mounted above the door. The detailed technical data and troubleshooting chart are given at **Annexure-VI & Annexure-VII**.

d) Intelligent Transport System (ITS) of M/s CASTMASTER

The ITS is provided by M/s CASTMASTER and the important components and their function are explained at **Annexure-VIII**.

The ITS consists of Bus Driver Console which is provided for driver control like selecting routes, names of crew, messages that to be announced or displayed on Internal Destination Board & Speakers. It also helps in monitoring certain vehicle health parameters useful for day to day maintenance which are given at **Annexure-IX**.

6.00 ADDITIONAL TOOLS REQUIRED FOR MAINTENANCE:

S.NO	PART NAME	PART NO
1	Engine Diagnostic tool +OBD Cable	XT 99829
2	Multiplex wiring Diagnostic tool (SDAIG)	16ZZ1113112467
3	OIL FILTER WRENCH	49 0636 146
4	WRENCH, DRAIN PLUG	49 9803 535
5	RING SPANNER SOBP FILTER	49 0636 147
6	PULLER, BEARING	49 0710 502

7.00 ESSENTIAL SPARES TO BE STOCKED AT DEPOTS

The essential spare parts required at Depots for maintenance of these buses is given at Annexure-X.

8.00 The Dy.CMEs are advised to educate the staff on operation and maintenance of SML ISUZU MIDI buses at the depots duly providing necessary tools required for day to day maintenance. They are also advised to monitor the performance of these buses and furnish the feedback on HSD KMPL, BDs, problems in preventive maintenance etc. to CME(O), Head Office regularly.

9.00 The Controllers of Stores and WMs are advised to supply required spare parts & units to the Depots furnished by DMs & Dy.CMEs.

10.00 The Depot Managers and Maintenance incharges are advised to ensure proper maintenance to the vehicles and see that the vehicles are utilized without any breakdown and obtain optimum performance.

EXECUTIVE DIRECTOR (E&IT)

Encl: Annexure I to XII.

To

All Depot Managers of Chittoor Region

Copy to: Personal Secretary to VC&MD for information

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

Copy to: ED (NLR), ED(VJA), ED(VZM) & ED(KDP) for information.

Copy to: CME(O), CCOS, CM(F&A), CME(C&B), CE(IT), CPM for infn. & n/action.

Copy to: All RMs for information & necessary action.

Copy to: DyCMEs, WMs, COS & DyCAOs of CTR Region for necessary action.

Copy to: All Principals of ZSTCs & TA/VJA for information.

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

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

Annexure-I

TECHNICAL SPECIFICATIONS:

1.0 Engine

- Bus Model: **"S7 Next" 5100**
- Engine Model: SLHT 3E - 4 Cylinder, Turbocharged, Intercooled with Common Rail Diesel Injection system
- Max. Power: 75 kw @2800 rpm
- Max. Torque: 315 Nm @1500 +/-100 rpm
- Cylinder Bore x Stroke: 100 x 110 mm
- Capacity: 3455 cc
- Cylinder Liners: Dry type (Slid fit)
- Compression Ratio: 16.4:1
- Firing order: 1-3-4-2
- Valve clearance: Intake - 0.30 mm, Exhaust - 0.35 mm

2.0 Fuel System

- Common Rail Diesel Injection system of BOSCH
- High pressure Pump: Inline type with two plungers (CB-18)
- Governor: Electronic Control Unit (ECU) for Fuel Injection Equipment
- Injector: Timing controlled by electrical signals to the injector solenoid.
- Common Rail: 1400 bar working pressure & a mechanical Pressure Relief Valve which starts opening at 1400 bar and fully opened at 1600bar
- Hand primer: Mounted on Fuel Filter.
- Fuel Filters: Two stage Fuel filtration with Primary fuel filter and micro CRS fuel filter with water sedimentor fitted on the low pressure side before HP Pump.
- Metallic Fuel tank capacity: 180 Lts

3.0 Air Intake System

- Air cleaner: Dry type two stage paper filter with sensor operated service Indicator
- Intercooler: Aluminum core with fins located in front of radiator
- Turbocharger(TC): Radial flow type with Waste gate arrangement

4.0 Lubrication system:

- Full flow pressure circulation is similar to the existing model (TATA/AL) vehicles.
- The total system capacity is 8.5 lts.
- Twin filters of 1.0 It capacity Main Engine Oil Filter and 0.5 It By-pass filter provided
- Engine oil gallery pressures (Max/Min) - 4.0 / 0.3 kg/cm²

- Oil pump relief pressure is 6.5 kg/cm²
- Engine oil warning lamp activation pressure is 0.3 kg/cm²
- Engine breather is provided on Valve Cover

5.0 Cooling system:

- The total cooling system capacity is 12.5 Lts.
- Fan (410 mm, 8 leaves fiber fan) is directly coupled to water pump.
- The engine fan belt is of V groove type of size 1150MM /1125 **mm length.**
- Cooling system pressure is 1.05 kg/cm² (15 psi)
- Thermostat opens at a temperature of 82°C and fully opens at 95°C, Check & Ensure the maximum lift of thermostat (8.5 mm at 95°C) with the help of thermostat checking apparatus.
- Coolant supplied to water cooled Air Compressor Head for cooling the air supplied for Brake system.

6.0 Clutch

- Hydraulic clutch operating system with 310 mm Dia Diaphragm type Pressure Plate with Single Plate Dry Type clutch disc.

7.0 Transmission

- Type: Synchronesh on all forward gears and reverse gear
- No. of speeds: 5 forward and 1 reverse
- Gear Ratio: 1st - 7.61, 2nd - 3.7, 3rd - 2.2, 4th - 1.5, 5th - 1.0, Reverse - 7.0

8.0 Front Axle

- Type: Forged I beam, Reverse Elliot type
- King pin dia - 30 mm

9.0 Rear Axle

- Type: Single reduction, hypoid gears with fully floating axle shafts
- Gear Ratio: 6.142:1

10.0 Steering

- ZF Make power Steering
- Vane pump model ID 7613955127
- Steering wheel diameter - 430 mm
- Steering gear ratio - 22.64:1

11.0 Suspension

- Semi - Elliptical type multi leaf spring with Anti roll bar
- Shackle pins & bushes with grease lubrication

- Shock absorbers - Hydraulic dampers, double acting telescopic type (Front & Rear)

12.0 **Brakes**

- Service brake with BIL foundation in Front and Rear
- Type: Dual circuit full Air 'S' cam brake system with DDU
- **Air compressor:** Single cylinder 160 cc belt driven water Cooled
- **Operating Pressure** : 8.1 kg/cm²
- **Size/Length of Compressor Fan Belt** : 1427 ± 6 mm
- Slack adjuster : Automatic (WABCO make)
- Front Brake Lining width/Area : 140 mm/1580 sq.cm
- Rear Brake Lining width/Area : 120 mm /1361 sq.cm
- Brake Drum Dia.(Front & Rear) : 325 mm
- Exhaust Brake - Air operated exhaust brake operated by electromagnetic switch (Interlinked with clutch & accelerator).

13.0 **Exhaust System**

- Normal silencer muffler provided

14.0 **Wheel & Tyre**

- Size: 225/75 R17.5 - 14PR
- Wheel rim: 6.75 X 17.5

15.0 **Electrical system**

- Battery: 2 x 12v - 110 AH
- Alternator model & capacity: Lucas/75 AMP/ 24 V (3SA45-24V-75A)
- Starter type: Lucas 5SM114-24 V (ANTI-CLOCK)
- Isolation switch - New era 24 volt

Electrical wiring harness mainly consists of Seven modules i.e., Front, Rear, Engine, Head Lamp, Bus Body (Designed by SML ISUZU), ITS (Designed by CASTMASTER) and Pneumatic door (Designed by ROTEX) connected by Controlled area network (CAN) cables for communication of signals.

16.0 **Performance**

- Max Speed: 80 kmph
- Gradeability: 18 %

Annexure-II

a) RECOMMENDED LUBRICANTS, COOLANT, GREASES & CLUTCH FLUID

Description	Specification	Brand of Lubricants & Coolants		
		VEEDOL	IOCL	Capacity
Engine Oil	SAE15W40 API CI-4 (Plus)	Veedol SM Genuine Engine Oil	--	8.5 lts
Gear Box oil	SAE 80W90	Veedol SM Genuine Gear Oil	--	4 lts
Differential Oil	SAE 85W140	Veedol SM Genuine Differential Oil	--	3 lts
Power Steering oil	DEXTRON II D	--	Castrol TQ Oil	1.2 lts
Wheel Bearing Grease	IS 12203	--	Balmer Lawrie MG LL3	2 kgs
Chassis Grease	Lithium MP	--	IOC S Grease HTXX, IOC Servo Grease CVJ	--
Coolant	Non Amine type Ethylene Glycol based	--	Sun Star	12.5 lts 10% Coolant
Clutch Fluid	FMVSS DOT3	--	Brakes India - TVS Girling	200 ml

b) MAINTENANCE SCHEDULES

LUBRICANTS, COOLANT & FILTERS CHANGE PERIODICITIES		
1	Engine Oil & Filter	First at 5,000 kms & at every 30,000 kms
2	Engine Oil Main Filter	First at 5,000 kms & at every 15,000 kms
3	Engine Oil By-pass Filter	First at 5,000 kms & at every 30,000 kms
4	FUEL Filter Element (Close to Fuel Tank)	15,000 kms
5	Fuel Filter Elements (Close to Engine)	30,000 kms
6	Gear Box oil	First at 5,000 kms & at every 15,000 kms
7	Differential Gear oil	First at 5,000 kms & at every 15,000 kms
8	Power Steering Oil & filter	30,000 kms
9	Clutch fluid	30,000 kms
10	Wheel Bearing Grease	60,000 kms
11	Air Filters	30,000 kms
12	Coolant	Once in a year

Annexure-III**System-wise maintenance recommended by M/s SML ISUZU**

Description of Activity	Sch-I	Sch-II	Sch-III	Sch-IV
	Daily	Weekly	9,000 kms	27,000 kms
ENGINE				
Check Engine oil level & arrest leakage	✓	✓	✓	✓
Check engine mounting pads			✓	✓
Check & adjust engine valve clearance (in cold condition)			✓	✓
Check and tighten intake & exh.manifold nuts		✓	✓	✓
Check and tighten turbo charger mounting nuts & bolts		✓	✓	✓
Check fuel lines for leakages	✓	✓	✓	✓
Drain water from fuel Sedimentor		✓	✓	✓
Clean Fuel tank				✓
Check condition of Air Cleaner & clean with compressed air	At every 5,000 kms			
Air intake hose clamps		✓	✓	✓
Turbo charger & Inter cooler hose clamps		✓	✓	✓
Check Engine Coolant Level	✓	✓	✓	✓
clean the radiator		✓	✓	✓
Replace coolant	Every Year			
Fan belt tension	✓	✓	✓	✓
CLUTCH AND TRANSMISSION				
Clutch pedal travel & free play		✓	✓	✓
Clutch fluid & gear oil leaks	✓	✓	✓	✓
Gear box mounting bolts		✓	✓	✓
PP shaft mounting bolts & nuts	✓	✓	✓	✓
STEERING				
Steering linkages for play		✓	✓	✓
King pins greasing		✓	✓	✓
Steering oil level		✓	✓	✓
BRAKES				
Brake pedal free play		✓	✓	✓
Air pressure leakages	✓	✓	✓	✓
Operation of parking brake		✓	✓	✓
Functioning of air compressor			✓	✓
All brake valves functioning		✓	✓	✓
Foundation of Brake chambers (F&R)	✓	✓	✓	✓
Low pressure warning lamp functioning			✓	✓
check front and rear liner thickness		✓	✓	✓
check and build air pressure upto 8.1 bar	✓	✓	✓	✓
TRANSMISSION				
Check Gear box oil leakages/level	✓	✓	✓	✓
Check Looseness in gear control mechanism		✓	✓	✓

Description of Activity	Sch-I	Sch-II	Sch-III	Sch-IV
	Daily	Weekly	9,000 kms	27,000 kms
AXLES				
Wheel bearing play		✓	✓	✓
Wheel nuts torque		✓	✓	✓
Rear axle shaft bolts		✓	✓	✓
Rear axle oil leaks	✓	✓	✓	✓
SUSPENSION				
Check F&R Suspension U-bolt / nuts tightness		✓	✓	✓
Check shackle bushes, nuts & bolts		✓	✓	✓
Check broken spring blades	✓	✓	✓	✓
ELECTRICAL				
check error codes with digi-tech	At every 5,000 kms			
check all fuses and relays for proper rating and fitment	At every 5,000 kms			
Attend battery maintenance		✓	✓	✓
Check all lights & switches		✓	✓	✓
OTHERS				
check for door operation for proper opening & closing, sensitivity, emergency buttons.		✓	✓	✓
check door cabinet and fuses		✓	✓	✓
Check Tyre inflation pressures		✓	✓	✓
Remove Trapped stones, replace Tyres at 2mm NSD	✓	✓	✓	✓
Tyres rotation		✓	✓	✓
Lubricate oil greasing points		✓	✓	✓
Check operation of exhaust brake		✓	✓	✓
Check all chassis bolts & nuts		✓	✓	✓

Annexure-IV

The Following are the critical components of Engine Management system.

- 1) Engine Control Unit: ECU is mind of the engine, it determines the injection timing depending upon the information received by various sensors
 - The Electronic Diesel Control includes ECU, Sensors, Actuators, electronically controlled CB-18 pump and solenoid type fuel injectors.
 - The Micro-controller inside the ECU continuously evaluates the signals from sensors. Electronic Control Unit performs certain calculations based on algorithms and function groups to control Vehicle operations like fuel injection, timing, governing, emission control, error identification, self test and safety checks with the help of actuators in the engine/vehicle system.
- 2) Crank sensor: Determines engine speed and crank shaft position
- 3) Cam shaft sensor: Determines Cam shaft position
- 4) Water sensor in Fuel System: Senses the water accumulated in CRS fuel Filter.
- 5) High pressure pump: Generate fuel pressure in the common rail
- 6) Common rail pressure sensor: Maintains and controls the fuel pressure in the rail
- 7) Injectors: Injects the fuel into the cylinder
- 8) Boost pressure sensor: Measures the Intake manifold pressure.
- 9) Coolant temp sensor: It is located in engine block which senses the temperature of the engine coolant
- 10) Vehicle speed sensor: Determines the vehicle speed
- 11) Accelerator pedal module: Communicates drivers demand to Electronic Control Unit (ECU)

In addition to the above, the following other system sensors are installed in this vehicle to facilitate the ease in day to day maintenance.

1. Clutch pedal sensor
2. Gear Neutral position sensor
3. Coolant level sensor
4. Engine Oil level sensor
5. Engine oil pressure sensor
6. Engine oil temperature sensor
7. Air service indicator sensor
8. Air pressure gauge sensors

As the fuel injection system consists of number of electronic components and in order to protect them from damage against voltage surge certain safety measures are very vital. The Do's & Don'ts furnished here under are to be followed during routine maintenance to get best performance from the bus.

1. **After ignition key is switched off, Wait for 1min to switch OFF** the Isolation switch as ECU will be receiving power for one minute after ignition switch is off for proper shutdown of the ECU (Else there is a chance of failure of rail pressure sensor)
2. Avoid any damages to ECU while handling and repairing
3. Avoid short-circuit with battery terminals to evade flow of high current to ECU
4. While ignition is ON avoid jump starting and avoid removing or assembling ECU coupler
5. Ensure correct polarity of terminal connections on battery
6. Check for condition of fuses, relay & wiring harness before replacing ECU
7. While unscrewing high pressure pipe always use two spanners.
8. Do not disconnect any electrical connection when ignition switch is ON
9. After mounting ECU, as soon as possible assemble the harness connector
10. Make sure there are no joints in the cable between PC/laptop & K-line connector
11. Ensure no power interruptions, communication loss during flashing of dataset to ECU
12. ECU should not be stored near strong magnetic field
13. Always use anti-static mat, straps & gloves while handling ECU to avoid electrical overstress (EOS)
14. Check the Engine Lamp Indicator (CEL) for ON/Blinking, if so keep the vehicle a side and switch off the Ignition and wait for 30seconds. Then crank the engine again and check whether CEL Indicator is ON/Blinking, if it exists then the faults in Engine Management system are to be analyzed through Engine diagnostic tool.

Annexure-V

MULTIPLEX WIRING SYSTEM:

The major advantages of multiplexing over conventional wiring is -

- Totally protected electrical system without fuses or relays
- Easier to maintain - no fuses or relays to change
- Easy fault diagnosis with diagnostic tool
- Detailed diagnostics with PC based tool
- Real time status monitoring of the vehicle electrical system
- Spare modules standardization

System Components are-

- ❖ **"Power 33"** Electronic Control Units - 3 Nos.
- ❖ Electronic Instrument Cluster (EIC) - 1 No
- ❖ 24-12 V Convertor - 1 No

- i. **Electronics Instrument Cluster (EIC)** receives the inputs from Combination Switch and sends this information over CAN to respective Power 33 (ECUs) to perform their operations, EIC also displays the information received by CAN which are:

Vehicle speed, Engine RPM, Battery Voltage, Engine Oil Temperature, Engine Oil Pressure, Engine Coolant Temperature, Air Pressure, Gear neutral position, Fog lamp, Parking lamp, Head lamps, Left and Right turn Indicators, Gear reverse, Malfunction indicator lamp, Low pressure indicator, Parking brake indicator, Air cleaner choke indicator, Battery not charging indication etc.

The Electronics Instrument Cluster contains TFT screen (LCD Panel) through which the some of the bus body and engine health parameters can be checked.

- ii. **Power 33 ECUs** receives the signals from switches through CAN and controls all the electrical associated with the vehicles and send the information about any malfunction back to EIC via CAN. The same information is transmitted to ITS system by CAN and error messages are displayed on the Bus Driver Console (BDC).

- iii. **24 -12 V convertor** typically performs the function of stepping down the voltage from 24 V to 12 V, this is required because the BOSCH engine management system works on 12V.

General Precautions:

- Battery cables to be disconnected in case of any welding on the vehicle.
- Wiring harness of the vehicle should not be tampered by tapping extra electrical connections. Separate provision is given in the vehicle fuse box for taking extra electrical connections for items like music system, additional lamps etc.
- Ensure proper connection of ECU positive cable directly from Battery positive as well as connectivity of ECU/Sensor connectors with wiring Harness. Any loose connections in the circuit will result in malfunctioning of the engine.
- Fuses with correct specifications should be used and Keep Spare fuses in Fuse box cover.

Annexure-VI

ELECTRO PNEUMATIC DOOR:

Technical Data:


- a) Operating Pressure: > 6.0 kg/cm²
- b) Rated Voltage: 12 / 24 V DC
- c) Open / close time: <= 4 sec
- d) Timer sensor actuating time: 4 sec

Description of the Product:


- The double acting cylinder used in Bus Door Control Mechanism (BDC) is of 63 mm Bore X 100 mm stroke with ball joint fitted at cylinder end.
- 5/2 Electrical operated valve (Operation control valve) is provided which is used for opening / closing of the cylinder.
- One 3/2 pilot operated valve (System Control valve) is also provided for emergency operation.
- 3/2 Electrical operated valve (Emergency Reset valve) is provided which is used for electrical reset after emergency.
- 3/2 Push - Pull valve (Main Cut Off valve) is provided which is used for main air supply cut off at the dash board end.
- One Non return valve is provided for compensation of air in the pilot/ emergency line.

Parts Description:


1. **Cylinder** (Ø 63 x 100 mm): The Cylinder drives the door to open and close.

Working Medium	Filtered Compressed Air	
Pressure Range	1 - 10 bar	
Front Fixing	Ball & Socket Joint	
Speed	3 m/sec max	
Life	20,000 kms	
Cushioning adjustment	Both ends	

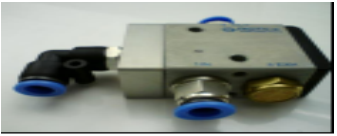
2. **Solenoid valve SVAJ214** (Coil Operated): It drives the cylinder to open and close.

Working Medium	Filtered Compressed Air	
Pressure Range	1 - 10 bar	
Position	5/2	
Flow rate	290 lit / min	
Connection	¼" BSP INLET/OUTLET 1/8" BSP EXHAUST	

3. **Solenoid valve DSA213** (Coil operated) Reset valve: It is used to reset the system after emergency.

Working Medium	Filtered Compressed Air	
Pressure Range	2 - 10 bar	
Position	3/2	
Flow rate	290 lit / min	
Connection	¼" BSP INLET/OUTLET	

4. **Solenoid valve DSA110** (3/2 Pilot Operated): It is used to maintain air flow in the system.

Working Medium	Filtered Compressed Air	
Pressure Range	2 - 10 bar	
Flow rate	290 lit / min	
Connection	¼" BSP INLET/OUTLET	


5. **Sp Non Return valve**: Its function is to maintain air pressure in the pilot line to compensate air loss if there is any leakage in the system.



6. **Speed Control valve** (Online flow control): The timing for the door to close or open can be controlled, with proper adjustment of this valve.




7. **Pressure switch**: Its function is to give feedback to the system after obtaining required pressure in the system for operation.

Working Medium	Filtered Compressed Air	
Pressure Range	0.2 - 2 bar	
Connection	1/8" BSP(F)x 8/6 PU tube connection	

8. **Anti Pinch sensor** (PDV): When there is any obstruction occurs to the door, due to difference of air pressure in cylinders, mechanical switch gets operated by the signal sensed by the controller and door retracts immediately.

9. **Buzzer cum Indicator:** During the door closing, the buzzer beeps to warn the driver. In case of emergency, the beeping frequency changes to warn the driver.
10. **Magnetic Sensor (Reed Switch):** The reed switch is installed on the slots provided on the square profile of the cylinder tube. The reed switch senses the magnet ring on the piston and gives signal to the microcontroller. As long as the door is in closed condition, the reed switch will glow. When the door is opened, the piston of the cylinder goes back to the end of the cylinder, thus the light on the reed switch stops glowing. So when the door is fully closed the controller will not work.

Working Medium	Magnetic Field	
Connection	2 wire cable	
Mounting	Clamp fixed on cylinder, adjustment by screw.	
Supply voltage	10V - 220V DC / AC	

11. **Pneumatic/Electrical emergency valve:** It is used to exhaust the system pressure and open the door manually. There are two types of covers provided in which the emergency valve/switch is fitted. The round cover is installed near the door at outer side and the square one is inside.
12. **Controller:** This is a micro processor based and it controls the entire operation and the safety features are inbuilt in the circuit. The controller rating is 24V DC/55W/5 Amp.

Oiling and greasing shall be done on Mechanical Parts, once in a week for smooth functioning and long life of the system.

Annexure-VII

Trouble Shooting Chart for Pneumatic Door

S. No.	Trouble	Cause	Solution
1	Door not working.	1. Leakage in cylinder	1. Tight the fittings.
		2. Solenoid valve failure.	2. Replace.
		3. Controller wiring harness is damaged	3. Correct the harness connection.
		4. Check the buttons on the dash board for proper functioning.	4. Check the connectors and wiring
		5. Low pressure at the main cut off valve	5. Start the engine to build pressure or else check for bending in pipe line
2	Pneumatic sensor failure.	1. Wrong circuit connection.	1. Check loose wire at the sensor end.
		2. Air pipe leakage	2. Change pipe
		3. Sensor damage	3. Change sensor
3	Door not get closed fully and retract automatically without any obstruction	1. setting have to be done on PDV	1. tight the screw of PDV
4	Door not get retract while obstruction	1. setting have to be done on PDV	1. tight the screw of PDV
5	Emergency Switch failure (pneumatic).	1. No pressure found while pressing	1. Check for bend in the pipe line for emergency
		2. If continuous flow of air found while pressing	2. Manual override in off condition at the reset valve. The MA should be towards the coil.
		3. System control valve not working	3. Change the valve.
6	Emergency Switch failure (Electrical).	1. No signal found at the controller.	1. Check for electrical connection.
			2. Change the switch.
7	Doors open by itself.	1. Check the cylinder at zero stroke when the doors are in closed condition.	1. Change the position of the linkage on the spline shaft.
		2. Closing time increased from the set time.	2. Remove blockage while door closing.
		3. Door alignment not ok.	3. Change the position of eccentric bolts fitted at the door top end.
		4. Door close not sensed.	4. Change the reed switch position when the door in close condition.
8	Door open/close either too fast/slow	1. Flow control not adjusted.	1. Rotate the knob of the flow control to adjust the air flow.
		2. Cushioning screw adjustmen	2. Adjust the cushioning screw to avoid jerks during door close/open.
9	Push button not working	1. Wiring not ok.	1. Check for wiring at connector end.
10	System doesn't reset after emergency.	1. Wiring problem for the reset valve.	1. Check for loose connection or damage in the wiring.
		2. Manual override in on condition.	2. The MA should be towards the coil.
		3. Pressure switch damage	3. Change the pressure switch.
11	Beeping continues after doors close	1. Reed adjustment problem	1. Check the reed LED glows, when the door closes completely

Annexure-VIII

INTELLIGENT TRANSPORT SYSTEM (ITS):

The ITS is provided by M/s CASTMASTER and the important components and function is explained here under.

- o Single control unit: 1 no
- o Bus driver console: 1 no
- o Digital video recorder: 1 no
- o Destination board: 2 no
- o Inner display board: 1 no
- o Cameras: 3 no
- o Microphone: 1 no
- o Speakers: 4 no
- o Antenna: 1 no

1. **Single Control Unit:** The main control unit of the ITS System, it controls the display boards, GPS, BDC, microphone and Speaker
2. **Bus Driver Console:** For driver control, selection of routes, names of driver and also for monitoring vehicle health parameters as per **Annexure-X** attached.
3. **Digital Video Recorder:** Records all the data captured by the cameras
4. **Destination Board:** Displays the destination of the bus on route
5. **Inner Display Board:** Displays messages for the passengers in the bus
6. **Camera:** Captures the passenger's activities
7. **Microphone:** Used to make the announcements in the bus
8. **Speaker:** To announce route and information for passengers
9. **Antenna:** To receive the GPS, WIFI and 3G signals

Advantages:

- Track the bus location over the air and automatic pre-feed broadcast of stages to the passenger
- GSM/GPRS facility to communicate with back office to monitor bus location.
- Online contact with the bus driver for any kind of message or information to be given to passenger
- Display of important message remotely.
- Vehicle Health and vehicle performance can also be monitored from back office.
- Surveillance cameras provided, to ensure the safety of everyone i.e., to record Passengers activity, moments inside the bus and video recording up to 48 hrs
- Panic facility in case of emergency which will record video for 15 minutes in high resolution mode.
- Reverse camera will be activated on BDC (Bus Driver Console) screen, when reverse gear is engaged.

Annexure-IX

List of Important Spare parts for Maintenance of Buses

S.No.	Description	Part No.	System	Approx. Qty. for 60 buses
1	Front Brake Lining	LP 50 33 301	Brakes	5
2	Rear Brake Lining	LP 49 26 351	Brakes	5
3	Engine Oil Filter Cartridge	LP 02 23 802	Engine	5
4	Engine Oil SOBP Filter	LP 01 14 V61	Engine	5
5	Air Filter (Primary)	LP 60 13 327	Engine	5
6	Air Filter (Secondary)	LP 60 13 326	Engine	5
7	Diesel Filter Element - Pre	LP 01 23 570	Fuel	5
8	CRS filter Element	LP 60 13 852	Fuel	5
9	FUEL FILTER CUM SEDIMENTER ASSY.	LP6013850	Fuel	5
10	DUAL BRAKE VALVE (M600510)	LP4943680	Brakes	2
11	GRAD. HAND CONTROL VALVE (M303710)	LP4944610	Brakes	2
12	SPRING BRAKE ACTUATOR TYPE 16/24 (M251840)	ZLP5126610	Brakes	2
13	SPRING BRAKE ACTUATOR TYPE 16/24 (M251850)	ZLP5126710	Brakes	2
14	DISTRIBUTION AND DRYING UNIT	LP4942260	Brakes	1
15	PHASE SENSOR	LP6018511	Elect	1
16	COOLANT TEMP.SENSOR ASSY.	LP5018302	Elect	1
17	IAT MAP SENSOR	LP5018303 A	Elect	1
18	SENSOR WATER LEVEL	855315610 B	Elect	2
19	CRANK POS. SENSOR (speed sensor)	LP6018512	Elect	2
20	VEHICLE SPEED SENSOR	LP6066412	Elect	2
21	OIL TEMP. SENSOR 24 V	ZLP6418517	Elect	2
22	OIL LEVEL SENSOR 24 V	ZLP6418518	Elect	2
23	SENSOR(SPEEDO-METER)	LPX266400	Elect	2
24	UNIT W LEVEL SENSOR	135215620 B	Elect	1
25	VALVE MAGNETIC 24V	ZLP6441260	Elect	2
26	ECU - SL DIESEL ENGINE	LP6013740 A	Elect	1
27	Rail Press. Sensor	LP6013692	Elect	1
28	Injector Asm.	LP6013H50	Elect	4
29	IDLER PULLEY ASSY. (AIR COMP.)	LP0210010 D	Engine	2
30	V-BELT(XPA 1132)	LP0218381	Engine	5
31	V-BELT(XPA 1165)	LP0218381 A	Engine	5
32	STRAP ALTERNATOR (FIXED)	LP4918386 A	Engine	1
33	BELT 'V'	W06532611	Engine	5

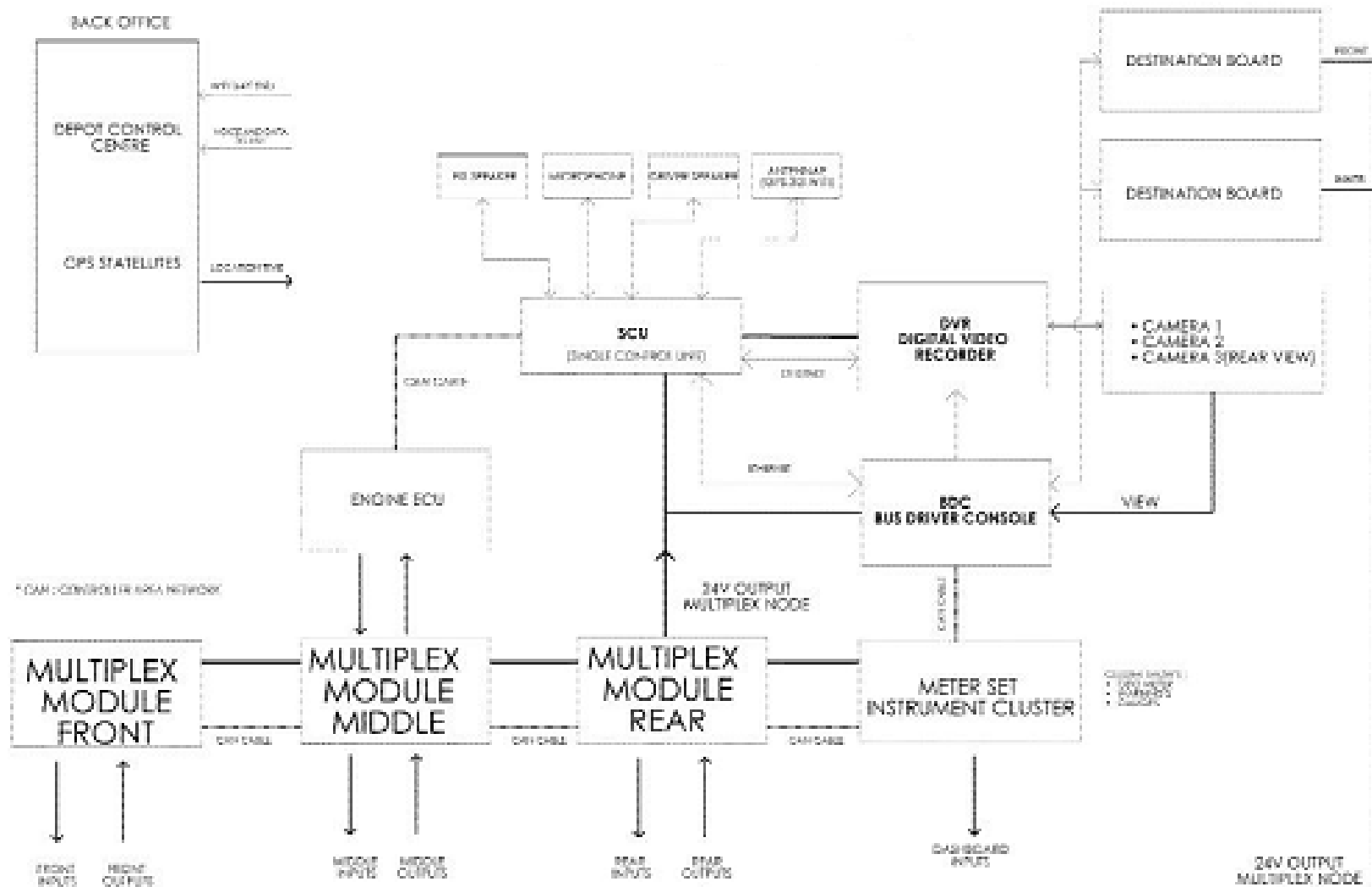
S.No.	Description	Part No.	System	Approx. Qty. for 60 buses
34	BELT COMPRESSOR (B-54)	LP4918381	Engine	5
35	Gasket sensor water level	855315611	Engine	2
36	Tube ext. front	LP6040005	Engine	5
37	clip hose	992831200	Engine	5
38	Connector	LP6040003	Engine	5
39	Tube ext. front	LP6040006	Engine	5
40	clip hose	992831100	Engine	5
41	Connector	LP6040004	Engine	5
42	EXHAUST BRAKE UNIT	LP2441800	Engine	1
43	Gasket turbo	LP6013471	Engine	2
44	Gasket turbo Exhaust	LP6013472	Engine	2
45	Delivery hose Air comp.(Teflon)	LP5142441 A	Engine	2
46	Idle Pulley Asm. (lower)	LP4910020	Engine	1
47	Air Compressor	LP4043610	Engine	2
48	Pipe oil in Turbo	LP6014830	Engine	2
49	Stay radiator	LP40 38 710A	Engine	4
50	RAIL HFRN16	LP6013695	Fuel	2
51	H.P. PUMP, CB18	LP6013696	Fuel	1
52	PUMP - P. STG	LP2632600	Steering	1
53	GEAR & PITMAN - P.STG RHD	LP2632920	Steering	1
54	Alternator (with Vacuum pump)	ZLP64 18 300	Elect	2
55	Starter	ZLP64 18 400	Elect	2
56	Solenoid valve exh. (24V)	ZLP64 41 260	Elect	2
57	Power 33	ZLP64 66 750	Elect	1
58	Multic (CWF1 for Multiplex wiring)	ZLP64 55 450	Elect	1
59	Oil level sensor - Engine	ZLP64 18 518	Elect	2
60	Oil temp. sensor- Engine	ZLP64 18 517	Elect	2
61	Wiring harness engine	LP6467030	Elect	1
62	Wiring harness starter	LP0118 004 B	Elect	1
63	Wiring Harness - Front	LP6467200	Elect	1
64	Wiring Harness - Rear	LP6467090	Elect	1
65	DC-DC Converter	LZ02 66 046	Elect	1
66	4ST Relay	ZLP64 18 005	Elect	2

Annexure-X**List of Vehicle Health Monitoring & Diagnostic (VHMD) Parameters:**

S.No.	Parameter
1	Engine Oil Level
2	Engine Oil Pressure
3	Accelerator Pedal Position
4	Engine Coolant Temperature
5	Engine Speed in RPM
6	Vehicle Speed (Torque)
7	Turn Right Bulb Front
8	Turn Left Bulb front
9	Turn Right Bulb Rear (and side)
10	Turn Left Bulb Rear (and side)
11	Stop Light (LH, RH)
12	Fuel Level
13	Alternator Excitation (Charging fail)
14	Reverse Gear Switch(indicator)
15	Left High Beam 1st filament
16	Right High Beam 1st filament
17	Right High Beam 2nd filament
18	Left High Beam 2nd filament
19	Right Low Beam
20	Left Low Beam
21	Washer Master Motor
22	Front Fog RH
23	Front Fog LH
24	Reverse Lamp RH+LH
25	Parking Light R(L+R)
26	Air Pressure2
27	Air Pressure 1
28	Front Height Marker + Parking (L+R)
29	Rear Height Marker + License Plate
30	Roof Light -2,3,4
31	Exhaust Brake Solenoid - Popup Not Required
32	Horn
33	Stop Request Buzzer
34	Driver Fan
35	Park Brake Solenoid

Annexure-XI

MULTIPLEXING ARCHITEXUTURE WITH ITS (Intelligent Transport System)



Annexure-XII

ELECTRONIC INSTRUMENT CLUSTER (METER SET)

