SERVICE CIRCULAR

TATA MOTORS

SC/ 2014/14	Model : LPO 1613 CNG BSIV OBDII	Group: 00	Feb'14

All Dealers / TASSs' / Fleet Owners:

Subject: Introduction of LPO 1613 CNG BS-IV OBDII fully built bus for PMPML

We are pleased to inform you about introduction of LPO 1613 CNG BS-IV OBDII front engine buses for **Pune Mahanagar Parivahan Mahamandal Ltd (PMPML).** The unique feature of the bus is 5.7 SGI CNG NA engine with common rail, gas injection system for achieving lower emissions meeting BS IV OBDII norms. The representative picture is as shown below:

Chassis type designation: 482026 and VC No: 27762655000R

We are enclosing following details for this model:

- Technical Specifications **Annexure – 1**
- Salient features **Annexure – 2**
- Engine components location **Annexure – 3**
- Schematic CNG flow circuit **Annexure – 4**
- Sensors / Actuators details **Annexure – 5**
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- Oil & Lubricants , Warranty & Free services **Annexure – 7**
- Diagnostic equipment details **Annexure – 8**

Annexure - 1

Technical Specifications:

ENGINE	
Model	TATA 5.7 SGI Bharat Stage IV.
Type	Water cooled, Stoichiometric, Naturally Aspirated, CNG engine
No. Of cylinders	6 inline
Bore / Stroke (mm)	97 x 128
Capacity (cc)	5675
Max.Engine Output	96 kw (130PS) @ 2500 rpm
Max. Torque	405Nm (41.3mkg) at 1250-1500 rpm
Compression Ratio	12.5:1
Firing Order	1-5-3-6-2-4
Air Filter	Dry type remote mounted.
Oil Filter	Full flow paper type
Fuel filter	Particulate filter in HP line
Fuel injection system	Gas injection through injector
Cooling system capacity (Ltrs)	20
Crankcase Oil Capacity (Ltrs)	Max. 14.0 , Min. 12.0
Weight Of Engine (Kg)	415 Kg (Dry) Alternator but without starter & air Compressor.
Radiator Frontal Area (cm²)	3974
Coolant	Water and ehtylene glycol in 1:1 ratio premixed
Exhaust	Catalytic convertor for efficient emissions control, with catcon temperature indication on instument cluster
CLUTCH	
Type	Single plate dry friction
Outer lining diameter (mm)	330
Frictional Area (cm²)	435.6
GEAR BOX	
Model	GBS-40
Type	Synchromesh on all forward gears and constant mesh on reverse gear
No. of gears	5 Forward ,1 Reverse
Gear Ratios	1st - 8.02, 2nd - 4.77, 3rd - 2.75, 4th -1.66, 5th -1.00 , Rev - 8.29
REAR AXLE	
Model	RA 109RR
Type	Single reduction,heavy duty, hypoid gears, fully floating axle shafts
Ratio	6.833 (41/6)
FRONT AXLE	
Type	Heavy duty forged I beam Reverse Elliot type
STEERING	
Type	Hydraulic power steering.
Ratio	20.2:1
BRAKES	
Service Brake	Dual circuit full air S-cam NGT brake system
Brake Drum Diameter (mm)	Rear - 410
Lining Area (cm²)	Front- 2500, Rear- 2750, Total- 5250
Parking Brake	Hand operated
Type	Spring actuated parking brake acting on rear wheels with graduated hand brake valve

FRAME	
Type	Ladder type heavy duty frame with Riveted/bolted cross members Side Members are of channel section Depth : 285mm (max), Width: 65mm & Thickness: 7mm
SUSPENSION	
Type	Weveller-Semi elliptical leaf spring at front and pneumatic suspension at rear, Antiroll bar at both front & rear.
Spring Span (mm)	Front-1638 Rear -NA
Leaf width (mm)	Front-70 Rear -NA
Shock Absorber	Hydraulic double acting telescopic type at front-2 nos and rear-4 nos.
WHEELS AND TYRES	
Tyres	10.0R x 20 -16PR
Wheel Rims	7.5 x 20
No. Of Wheels	Front - 2, Rear - 4, Spare - 1
FUEL SYSTEM	
Capacity (Ltrs)	4 CNG Cylinders of 135 lit.WC @200 bar each. 1 CNG Cyl.of 110 lit WC @ 200 bar
CAB	
Type	Front end struture
ELECTRICAL SYSTEMS	
System Voltage	24 V
Alternator Capacity	90 Amps
Battery	2x12V, 150 Ah capacity
MAIN CHASSIS DIMENSIONS (mm)	
Wheel Base	5545
Track front	1964
Track rear	1814
Overall Length	11120
Max. Width	2434
Front Overhang	2250
Rear Overhang	3325
WEIGHTS (Kg)	
Full chassis kerb weight with cab and loadbody	6300
Max. Permissible FAW	6000
Max. Permissible RAW	10200
Max. Permissible GVW	16200

Bus Body Features And Specifications:

S.No.	Parameter	Specification
1	Body Dimensions	As per Offer drawing
2	Body Structure	Structure with tubular & fabricated sections.
3	Height of Bus Floor	Height ~ 900 mm from ground level in Kerb weight condition. Bus floor height shall be as per chassis height.
4	Floor Structure	Tubular floor frame structure integrated with chassis floor frame
5	Front Structure	Front face in sheet metal & FRP Garnish.
6	Rear Structure	Rear face in sheet metal
7	Exterior Side Paneling	Stretch panel in GP & skirt panel in 1.2mm thick aluminium. Skirt rail is provided
8	Exterior Roof Paneling	Roof outer panel will be in G.P.
9	Interior Paneling	Pre-painted G.P. panel 0.5 mm thk. Sides - Dark Grey, Roof & Window Panels - White colour
10	Step well assembly	Fabricated step well. Step height ~ 400mm +/- 30 from ground in kerb weight condition. Step well painted with different colour as per PMPML code. Steps to be heavy duty to carry crush load.
11	Dashboard	Dashboard made of FRP of FR grade
12	Flooring	Flooring of 3.0mm thick Aluminium chequered plate. 5 nos wear strips provided in the gang way. Heat Melt sheet used between floor structure & chequered plate for sealing.
13	Passenger Door	LH Front:- Electro-Pneumatically operated jack knife door of a minimum 800 mm.(excluding door leafs) LH Rear :-Electro-Pneumatically operated jack knife door 1200+25mm aperture width (Excluding door leafs). Door height -minimum 1950 mm. C) On RH side , Two nos. twin jack knife doors Electro-Pneumatically operated is provided of aperture width 1200mm +/- 20 upto to the bus floor level.All doors equipped with sensitivity kit.Pneumatic system is covered with covers and inspection lid to have budget locks. Bus Rapid Transit System (BRTS) :Passengers can board / exit the bus with two large double leaf Jack Knife doors opening to inside the bus with the help of electro-pneumatic system controlled by driver from his cabin
14	Passenger Seat	33 nos. Jayshree make plastic moulded type seats. Armrest to be provided for the seats on aisle side. Last Row - Centre Seat also to have armrest. Last Row 2 seater to also have one armrest each.
15	Emergency Exit	Rear Windshield acts as emergency exit 2 nos. Glass Breaking hammers are provided near the rear windshield
16	Driver Door	Hinge type driver door with sliding window provided. Ventilation window provided ahead of Driver Door at top and bottom. Additional railway latch provided for the driver door.
17	Side Windows	Top fixed and bottom sliding windows (min ht 550mm) provided. All glasses of clear toughened without any tint.
18	Front Windshield	Laminated glass - 2 piece in beading
19	Rear Windshield	Toughened glass - 2 piece in beading
20	Wipers	Pantograph type
21	Driver's Partition	Tubular driver partition of M.S. provided. Pipes in GREY colour powder coated.Portion behind the driver have vertical pipes upto waist rail & Bottom covered with wooden panel.Above the engine hood a pipe partition is provided such that the engine hood can be opened without removal of the pipe partition. 2 nos. hooks are provided on the Driver's partition on the driver side.
22	Front & Rear Bumper	Front & Rear Bumper will be in Sheet Metal. Aluminium chequered plate foot steps are provided for windshield cleaning.
23	Roof Hatch	2 nos. Roof Hatch are provided.
24	Reverse Horn	1 no. are provided.
25	Stanchion Pipe & Entrance Rails	Stanchion pipes is provided in M.S. pipes GREY colour powder coated.

26	Grab Rail	Two rows of grab rail is provided in M. S.GREY powder coated.
27	Window Guard Rail	2 nos. window guard rail outside of bus is provided in black colour. Additional guard rail are provided wherever the seat is raised.
28	Driver's Seat	Adjustable driver seat is provided
29	Driver's fan	Provided.
30	Battery cut off Switch	Battery cut of switch with control switch on dashboard provided .
31	Insulation	Glass-wool insulation provided on Roof & Sides
32	Battery Box	Provided below the floor on LH side. Rubber mat is provided below the batteries.
33	Hand Straps	Hand straps 30 nos. are provided. Advertisement panel type hand-straps are provided.
34	Rear View Mirror	Manually operated provided.
35	Fire Extinguisher	Two number standard quality 2 kg capacity, fire extinguishers along with bracket are fitted behind driver and in front of rear LH doors. FIRE EXTINGUISHER STICKER ARROW POINTING DOWNWARDS PROVIDED
36	First Aid Box	Provided above the driver seat on RH side.
37	Destination Board	Two destination board frames of size 31 X 9 to be provided, 1 on dash board at LH side and 1on LH side adjacent to rear door on stretch panel
38	Saloon Lights	8 nos. FLUORESCENT tube lamps has been provided
39	Driver Cabin Lamp	Provided.
40	Height Markers	Front (white lens) 2 nos. & rear (red lens) 2 nos. height markers are provided.
41	Side Marker Lamps	Provided as per CMVR norms
42	Grab Handles	2 nos. of handles are provided below Front & Rear windshield glass to assist cleaning.
43	Seat Belts	Driver seat belt is provided. Lap Belt is provided at middle seat of last row 5 seater, LH side 1st single seater & LH side 1st 2 seater (both seats for physically challenged) .
44	Stickers	Retro reflective tape 50mm width has been provided, White at Front. Red at Rear & Yellow on the Sides as per CMVR. a) Emergency exit sticker is provided on rear windshield.
45	Electrical wiring	Standard electrical wiring with multiplexing. Wiring is routed along the Cant rail from inside of the saloon
46	Bell Switch	Bell switches are provided close to passenger door area
47	Logos & Monograms	To be provided as per the PMPML norms.
48	Colour scheme	Colour scheme - Base Colour Signal Red -1 colour
49	Towing hook	Front towing provided
50	Engine hood	Fire retardant FRP moulded engine hood is provided
51	Saloon mirror	Provided.
52	Mud flaps	Water Spray suppression type mud flaps are provided behind the tyres
53	Additional fitments	**a**. CNG sticker is provided at the front & rear
		b. 2 nos. grab handles to be provided on the LH side rear door.
		c. Provision is made for fitment of speakers in the roof.
		d. Bus architecture compatible with ITS requirement, as provided by customer
		e. Wheel chair arrangement provided. - ie support partition with Grey wood backrest and belt for holding wheel chair
		f. Rub Rails to be provided at Sides & Rear
		g. Wheel arch Beadings provided
		h. Channel at Sides & Rear for flex board insertion with locking provision provided.
		i . Gear Box inspection lid, CNG filler inspection lid & the Rear Axle centre inspection lid with hinges provided
		j . Rope type bell provided on the LH side of the bus
		k. Chassis horn fitted towards driver side
		l . CNG Vent pipe canopy provided.
		m.All the Door canopies provided with Rain channels

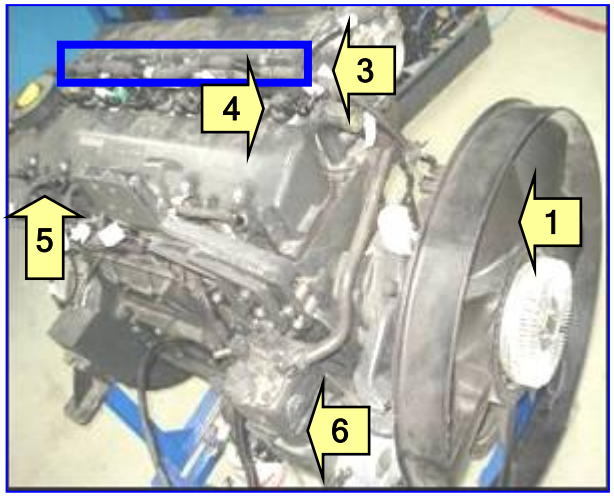
Annexure – 2

Salient features:

- Sequential Gas injection (SGI) naturally aspirated engine for low emissions.
- Electronically controlled engine performance through ECU by combination of input signal from various sensors & output commands from ECU to actuators.
- CNG common rail and CNG injectors for precise fuel delivery at proper timing.
- 2 CNG filters: Low pressure (LP) filter built into the CNG rail and High pressure (HP) particulate filter in HP line.
- Electronically controlled Intake air supply through Electronic Throttle Body (ETB) mounted on the Inlet manifold.
- Accelerator pedal sensor fitted to provide signal of pedal travel to the ECU.
- Engine overrunning and Skip fire modes incorporated to improve fuel economy.
- Neutral switch mounted on gear box has following feature:

  (a).Unable to start vehicle in gear when engaged

  (b).For road speed limiter application (optional)



1. **Jet Ring type viscous fan**: Viscous drive phenomenon fan is provided with jet ring type design , so as to direct / focus maximum flow of cooling air stream at the desired location . This results in better / efficient cooling of the radiator.
2. **Electronic Throttle Body:** The throttle action in response to accelerator pedal pressing is electronically regulated by the Electronic Throttle Body.
3. **CNG common Rail:** The CNG gas supply is through a common rail supplying the gas at optimum pressure / in precise quantity at the proper timing to the injectors.
4. **Injector:** Individual injector for each of the six cylinders in the engine, supplies the gas at a regulated rate. Thus efficient control of fuel combustion process results in lowered exhaust emissions, meeting prescribed BS IV norms.
5. **Cigar type HT coil on plugs:** The HT Coils are directly mounted on the spark plugs, so as to ensure efficient trouble free working of the ignition system.
6. **Water cooled air compressor:** The energy efficient type with cylinder head unloading mechanism type air compressor is provided with water cooling to ensure better performance.

Fuel economy features: Distinct unique features for improving fuel economy.

- **Skip fire mode**: After attaining 60°C, if the engine remains for more than 15 sec at idle RPM (i.e. zero acceleration), it gets shifted to **Skip fire** mode. It means that firing takes place only in 3 cylinders at a time rather than all 6 cylinders. It fires in two cylinder banks arrangement i.e. cylinder no. 1-3-2 and subsequently cylinder no. 5-6-4 , alternatively activated within span of 1 minute periodically . This saves the CNG fuel considerably. The monitoring is through ECU.
- **Engine overrunning**: On down gradients, the engine RPM increases without accelerator pedal not pressed at all. As soon as the RPM exceeds 950, ECU gets signal from the Engine speed sensor and stops the CNG fuel supply to the engine. Hence considerable fuel saving is achieved.

CATCON over Temp Indicator / Buzzer & Malfunction indicator (MIL) on Dashboard:

INSTUMENT CLUSTER
LPO 1613 CNG BS-IV PMPML

CATCON over Temperature Indicator/Buzzer:

The CATCON Over Temperature Indicator/Buzzer functionality is integrated in the EMS ECU. The post Catalytic Converter (CATCON) exhaust temperature is measured by the PT200 temperature sensor. This sensor is mounted immediately after CATCON. The PT200 sensor output is continuously read by the ECU. When the post CATCON exhaust temperature exceeds 850°C - 860°C the Instrument Cluster Tail Tale / Lamp ON command is issued by the ECU. The same output also controls the Buzzer that gives audio indication to the driver.

Testing: The above sensor can be tested with the multimeter. The resistance measured at sensor terminals is 220 Ohms @ 25°C

Check Engine Lamp (CEL)

This symbol indicates the vehicles engine condition.
1. It comes “ON” when ignition is switched “ON” and it goes “OFF” when engine is cranked.
2. It remains “ON” if there is a problem in the Engine management system/engine components.

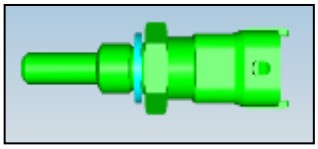
Note: *If the check engine lamp remains “ON” when the engine is running then take your vehicle to a TATA Authorized service centre.*

Malfunction Indicator Lamp (MIL)

This symbol comes ON when the ignition is turned “ON” and goes “OFF” once the engine is cranked.

Note: *This symbol will remain “ON” for any engine related fault, which may cause increase in emission levels of the vehicle beyond the regulatory limit. Take your vehicle to a TATA nearest Authorized service centre immediately.*

Coolant Temperature Sensor:



The Coolant Temp measurement functionality is integrated in the EMS ECU. The Coolant temperature is measured by the NTC type temperature sensor. This sensor is mounted on oil cooling plate below Exhaust manifold. The Coolant Temp sensor output is continuously read by the ECU.

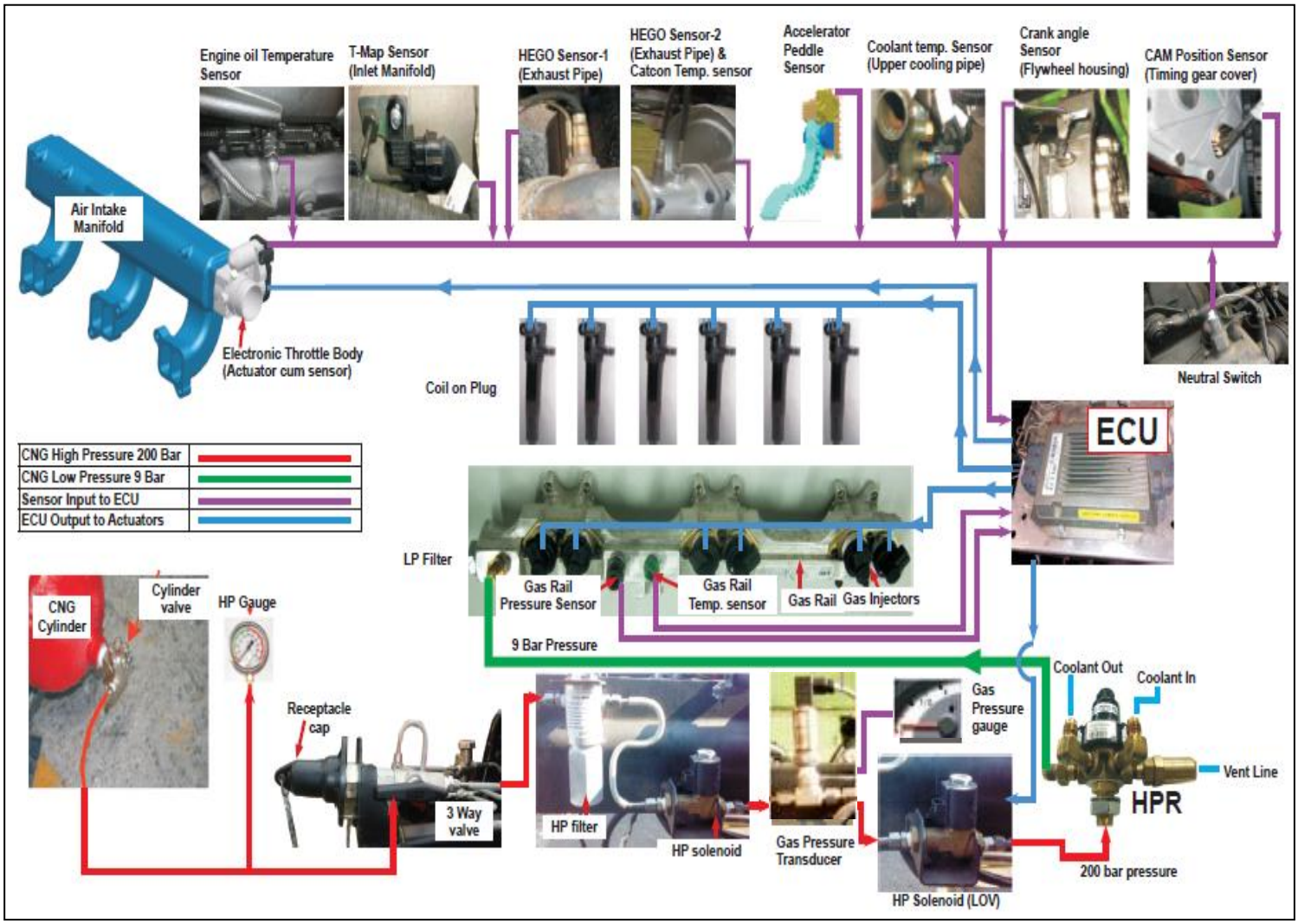
Testing: The above sensor can be tested with the multimeter. The resistance measured at sensor terminals is 2.5 KOhms @ 20°C

Engine Oil Temperature Sensor:

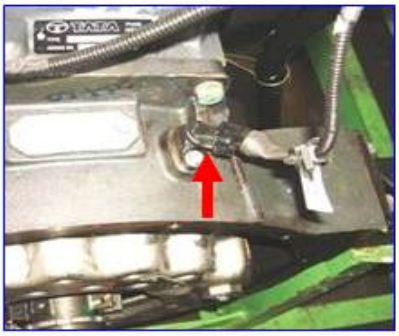
The Engine Oil Temperature Sensor is used to read the Engine Oil temperature. It houses the NTC-resistor, the temperature dependant resistor. The resistance decreases with the increase in the oil temperature and vise versa. This signal is read by the ECU to determine the Engine oil temperature

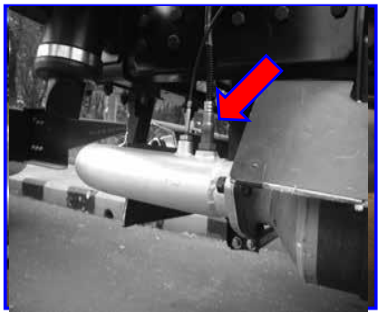
Annexure – 4

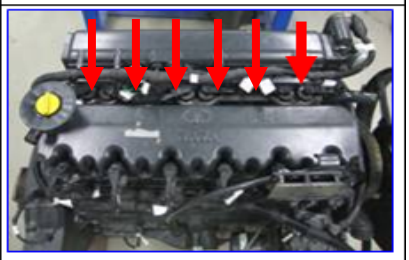
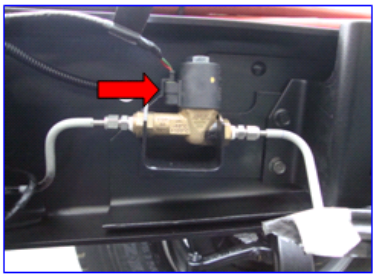
Schematic CNG Flow Circuit:



Sensors & Actuator details:

SENSORS			
Description	**Function**	**Location**	**Photo**
Cam position sensor	The function of the cam position sensor is to give signal to ECU regarding the position of piston before TDC in 1st cylinder in compression stroke to ensure ignition as per firing order starting from 1st cylinder, whenever the engine is started.	On timing gear housing cover	
Crank angle sensor	The functional objective for the crank angle sensor is to determine the position and rotational speed (RPM) of the engine. Based on this information ECU ensures sequential gas injection and ignition at correct timing as per the firing order. The engine speed input is also important for ECU to operate the engine in **'Skip Fire'** and **'Over Run'** mode.	On the flywheel housing	
Coolant temp. sensor	The coolant sensor in the cooling system monitors coolant temperature for the ECU. Using this input, the ECU adjusts ignition timing and also ensures activation of 'Skip Fire" feature of the engine.	On cylinder head near thermostat	
CNG temperature sensor	It provides signal to ECU regarding temperature of CNG inside the CNG rail for fuel injection quantity compensation.	On common CNG Rail	
CNG pressure sensor	The fuel pressure sensor is needed for fuel injection quantity compensation on CNG. It provides signal to ECU regarding pressure of CNG Gas inside the CNG rail.	On common CNG Rail	

Upstream & Downstream Oxygen (Lambda) Sensor	The Lambda Sensor is an electronic device that measures the proportion of the Oxygen in the exhaust gas. This sensor has made the modern electronic fuel injection and emission control possible. The Lambda sensor helps determine, in real time, if the air fuel ratio of the internal combustion engine is rich or lean. Since Oxygen sensor is located in the exhaust stream, it does not directly measure the air or the fuel entering the engine. But when the information from the sensor is couple with information from other sources, it can be used to indirectly determine air-to-fuel ratio. Closed loop feedback controlled fuel injection varies the fuel injector output according to real time sensor data. The sensor does not actually measure Oxygen concentration, but rather the difference between the amount of oxygen in the exhaust gas and the amount of oxygen in the air. Rich mixture causes an oxygen demand. Lean mixture causes low voltage, since there is an oxygen excess.The Lambda Sensor LSF4 is a planer 2-state =1 sensor with integrated heater.	One on the adapter pipe immediately after the exhaust manifold & the other after the CATCON	 
T - MAP (Combo temp/ pressure) sensor	The T-MAP Sensor supplies engine load information based on the vacuum inside the intake manifold. It provides instantaneous pressure/ temperature information to the ECU. This is necessary to calculate air density and determine the engine's air mass flow rate, which in turn is used to calculate the appropriate CNG to be injected.	On inlet manifold	
Accelerator pedal sensor	The accelerator pedal sensor consists of two potentiometers which gives signal of pedal travel to the ECU. The change in resistance is the input signal to the ECU and the ECU gives output signal to the ETB which controls the throttle valve. The two potentiometers of different characteristics serve as a safety for each other. In case of failure of any one, the vehicle goes in limp home mode.	On accelerator pedal bracket	
Electronic throttle body (ETB)	It opens and closes the valve in accordance with the accelerator pedal effort, and controls the amount of air sucked into the engine	At the end corner of the air inlet manifold	

ACTUATORS			
Description	**Function**	**Location**	**Photo**
Cigar type HT ignition coil	The Cigar type HT ignition coil is an induction coil working as an actuator in ignition system which transforms a storage battery's 12 volts to the thousands of volts needed to spark the spark plugs.	On cylinder head	 
CNG injectors	CNG Injector is an actuator which meters the volume of CNG to be injected into each combustion cylinder based on the reading from the ETB, Pressure sensors and Oxygen sensor through ECU. An exhaust oxygen (lambda) sensor is utilized to obtain Air-Fuel ratio reading and the ECU calibrates the best injection volume per cylinder in obtaining a stoichiometric ratio.	On CNG common rail	 
ECU controlled High Pressure Solenoid Valve "LOV"	When the ignition switch is put ON, the ECU opens the HP solenoid valve which allows the gas to flow to the CNG common rail system	On left hand side, on Long member Near front axle	

Annexure - 6

Enhanced Service schedule:

Sr. No.	Operation	Frequency (Kms) / Periodicity
SERVICE OPERATIONS TO BE PERFORMED BY CUSTOMER		
1	Check engine oil level, top up if necessary	Weekly
2	Check fluid level in Clutch, Brake (Air Pressure level & warning indicators), Steering, Coolant, Windshield washer, top up if necessary	Weekly
3	Carry out visual inspection of vehicle for fuel (CNG) leakages, traces of oil / fluid on ground, if any.	Daily
4	Check Service indicator on air filter (for the red band). Contact nearest Tata dealership if red band appears . Do not clean air filter element.	Daily
5	Check tyre pressure including spare wheel	Daily
6	Check tyres condition for abnormal wear	Weekly
7	Check for proper functioning of switches / gauges / warning lamps on instrument cluster , buzzers , all lights , other electrical controls.	Daily
8	Check head lamp focusing. Adjust with head lamp leveling switch, if necessary.	As required
9	Drain condensed water from air tanks	Weekly
10	Return Air filter - Clean (needs to be cleaned more frequently, if its operated in more dusty environment)	Monthly
11	Check for switching sound of gas shut off solenoid valve after inserting ignition key	Daily
12	Close all the cylinder valves and start the engine. If engine does not stop , get the valves checked / replaced. Check that the pressure gauge shows full reading now.	Weekly
13	Check whether gas pressure indicator in instrument cluster is indicating correctly compared to high pressure gauge	Daily
14	Wash the vehicle	As required
SERVICE OPERATIONS TO BE PERFORMED AT WORKSHOP		
Sr. No.	Activity	Frequency (Kms) / Periodicity
Engine		
1	Drain off Engine oil while hot . Clean drain plug. Change oil filter & engine oil. Clean engine breather	20000
2	Check following for free rotation/damage: (a) Water pump , (b) Belt Tensioner pulley , (c) Belt Idler pulley , (e) Fan pulley (f) AC belt tensioner (If fitted) (g) alternator pulley (h) AC compressor pulley (If fitted)	40000
3	Check for external clogging of intercooler (if fitted) , condenser (if fitted) & radiator , clean if necessary with compressed air & water	20000
4	Check proper sealing of air intake system by checking hose & pipe condition / proper tightness of clamps. . Replace any defective item.	20000
5	Check pipes & hoses of engine lubrication / fuel / coolant / air conditioning (If fitted) / wind shield washing system. Replace if required	80000
6	Check cylinder head valve clearance and adjust, if necessary.	20000
7	Drain cooling system - reverse flush. Check thermostat for proper operation. Refill system with fresh coolant. Use mixture of clean water & recommended anti freeze agent in specified ratio.	3,20,000 km or 2 years whichever is earlier
8	Check condition & tension of drive belts for water pump / alternator / fan / AC compressor (If fitted) / steering .If necessary adjust / replace belt .	20000
9	If Red band appears on Service indicator, replace primary filter (Do not clean) . Replace secondary (safety filter) during every 3rd replacement of primary filter. Remove and Clean dust bowl / dust evacuator of air filter	10000
10	Replace all spark plugs	20000
11	Check and replace engine mounting rubber pads , if required	2,00,000 Km or 2 years whichever is earlier
12	Check for ECU errors with diagnostic system. (as applicable)	10000

Fuel system - CNG		
13	Check the loosening of EGO **(Lambda Sensor -1 & Lambda Sensor -2**) on exhaust pipe, If found loose. tighten the same. Check functioning of EGO sensor output using the multi-meter	10000
14	Clean HP fuel filter & replace "O" ring.Filter cleaning procedure; Close all cylinder valves, start engine, continue till the engine stops on its own. Ensure there is no gas in the system. Open filter cap & separate it from the HP filter body. Dismantle, clean with air and refit. Check for leakage of joints using snoop solution. \There should be no leakage.	10000
15	Check wiring for damage/ deterioration, loose connections. Check electrical connections to a) Gas Injectors b) Cigar Coils (Coil on plug)	10000
16	Inspect the cover of CNG pressure Relief Device (PRD) and vent line for any damage / dislodging. Rectify if required.	10000
17	Check the clamping of exhaust pipe and catcon. Check external damage and severe discoloration of Catcon.	20000
18	Clean HP solenoid valve inlet filter **(LOV)**	60000
19	Replace HP fuel Filter Element **with** body "O" ring	60,000 or 6 months whichever is earlier
20	Replace O-ring of CNG solenoid injector	40000
21	Replace a) HP solenoid valve inlet filter (*LOV) b) Replace LP fuel filter in common rail assembly	100000
22	Replace CNG low pressure hoses	1,80,000/ 2 yrs. whichever earlier
23	Replace 'O' rings of CNG receptacle	3,20,000 / 5 yrs. whichever is earlier
24	Recertification of CNG cylinders as per gas cylinder rules to be carried out by competent authorities.	Every 3 years
Clutch & Transmission		
25	Replace clutch oil. In case of any complaint on gear box front cover actuation, dismantle master cylinder / slave cylinder / clutch booster & replace affected parts.	80000
26	Check distance between release bearing and clutch, adjust if necessary	10000
27	Change oil in gear box. Drain while hot .Clean drain plug and breather	80000
Front axle		
28	Grease with grease gun: (a) Kingpins, (b) Tie rod ends, (c) Drag link ends	10000
29	Remove front hub cap, fill 3/4th full with wheel bearing grease & refit.	20000
30	Remove front wheel hubs. Dismantle and clean bearing & other components. Replace damaged / worn out parts. Replace with fresh wheel bearing grease and refit. Adjust wheel hub bearing play.	40000
Rear axle		
31	Change oil in rear axle. Drain while hot, clean drain plug and breather.	80000
32	Adjust crown wheel thrust pad .	20000
33	Remove rear wheel hubs. Dismantle and clean bearings and other components. Replace damaged/Worn-out parts. Repack with fresh wheel bearing grease and refit. Adjust wheel hub bearing play.	40000
Wheels and tyres		
34	Check tyre pressure	Daily, at every 10000 kms
35	Rotate tyre position adhering as per recommended procedure	10000
36	Check tyres condition. It abnormal wear is noticed, check wheel alignment and adjust as required .	20000
Brakes		
37	Check lining thickness. Change brake lining if worn up to 1 mm above indicator slot	10000
38	Drain off air from all air tanks . If condensed water is found, replace air drier desiccant cartridge.	10000
39	Check for oil droplets / excessive oil accumulation (slight traces of oil are acceptable) at air drier exhaust port . If yes , then carry out following activities : (a) check / replace compressor piston rings , (b) clean compressor head , (c) check / replace compressor outlet pipe in case of carbon formation (d) Clean oil separator	10000
40	Check for proper functioning of service brake, parking brake. Adjust / replace if necessary	10000
41	Dismantle pneumatic aggregates of brake system. Clean / inspect & replace parts if necessary	1,80,000 kms / 2 years whichever is earlier
42	Replace air drier desiccant cartridge	Every 2 year

Suspension & Steering		
43	Drain off hydraulic oil of power steering. Replace filter cartridge. Fill in fresh oil. Test the system with test equipment.	80000
44	Check condition (leak/damage) of shock absorber and its rubber bushes and replace, if necessary.	20000
45	Check / replace rubber bushes of front Weveller Suspension.	40000 (uneven bad roads) 80000 (plain good roads)
46	Check for any damage to air bellows of rear air suspension. Check mounting and static height of air bellows. Check function of level control valve	20000
Electricals		
47	(a) Check battery mountings, (b) Clean battery posts and terminals. Tighten terminals & smear vaseline/petroleum Jelly. Check battery condition like voltage/specific gravity/ electrolyte level. Check with indicator on battery (wherever available).	10000
48	Check proper functioning of switches/ gauges; warning lamps in instrument cluster, all lights, other electrical and pneumatic controls, buzzers(including CNG leak detection buzzer near dash board) / CNG leak detection LED	Daily, at every 10,000
49	Check head lamp focusing. Adjust if necessary.(Additionally to be done after every bulb change).	10000
50	Check electrical system health: Ensure usage of genuine fuses with correct rating, Condition of fuse and relay holding base. Extra load tapping from unauthorised points, earthing connections	20000
51	Check and tighten the terminals of Mega fuse	20000
Body		
52	Check for any paint peeling , rusting & damage to body panels & structure all around & underneath	10000
53	Check for proper functioning of doors, seat , sun visors . Check body for unusual noise	10000
54	Check for proper functioning of side & rear flap locks & gas stays, emergency roof hatch	10000
55	Check that fixed & sliding window glasses are intact	10000
Pneumatic Door		
56	Change oil from the pneumatic door filter (add oil up to half of filter bowl)	10000
57	Clean/Replace Filter cartridge, Check sealing of Air cylinder, solenoids Valve, emergency switch valves, sensors	10000
58	Check sealing of Air cylinder, solenoids valve, emergency switch valves, sensors	10000
General		
59	Wash the vehicle	As required
60	Check & top up levels of : 1. Oil (at engine /clutch / power steering / brakes , cab tilt mechanism) . Oils of GB/Transaxle & rear axle need to be checked only if leakage is observed , 2. engine coolant , 3. windshield washer tank	10000
61	Check for / Rectify the leakages of 1. Oil (at engine /clutch / gearbox / differential / air conditioning (If fitted) / shock absorbers / rear axle/ power steering / brakes / cab tilt mechanism) , 2. **CNG fuel cylinders** , pipelines / hoses & engine 3. engine coolant , 4. engine exhaust , 5. Pneumatic & Hydraulic circuit (doors / brakes)	10000
62	Check fire extinguisher for proper fitment and expiry date. Replenish before expiry date	20000
63	Check and tighten all fasteners if necessary as per the check list #	20000
64	Grease as per the list ##	20000
65	Conduct road test for vehicle handling and functioning of aggregates.	20000

# Check List of Fasteners requiring periodic checking & tightening		
66	**Gas circuit** : 3 way valve / CNG pressure transducer / receptacle / HP filter / LP filter / HP regulator / HP solenoid valve / Gas cylinder	20000
67	**Engine peripherals** : Engine mounting & accessories mountings , clamps , fuel tank brackets, all fasteners on turbocharger, air filter mounting, radiator mounting, thermostat, exhaust muffler/pipe mounting hangers & brackets, air duct hose connections	20000
68	**Driveline** : Gearbox or transaxle mounting / propeller shaft coupling flange / center bearing bracket / Rear axle carrier housing mounting studs. clutch housing , mounting of clutch master cylinder and slave cylinder , gear shift mechanism.	20000
69	**Electricals** : Starter motor / wiper motor / alternator / switches & gauges / tail lamp / head lamp / blinker lamp.	20000
70	**Steering** : Steering box /drag link/ pitman arm/Tie rod/Steering column	20000
71	**Suspension**: Anti roll bar mounting / shock absorber mounting / suspension (leaf springs 'U' bolt,spring pin, shackle pin, spring hanger & slide support butt), Weveller Suspension: Hanger Bolts	20000
72	**Wheels & Tyres** : wheel mounting nuts (also once after 100 kms after each wheel replacement) , mounting of spare wheel carrier	20000
73	**Brakes**: Spring actuators, pneumatic lines and hoses	20000
74	**Body** : Seats ,RVM, floor cutouts , hat racks , pneumatic door rollers / guides/ brackets , fasteners & clamps underneath the bus & on the rooftop , RVM mounting , roof hatch , door hinges , side penal hinges , door locks , stay rods , door striker plates	20000
75	**General** : Apart from above, check visually any other fasteners for loosening	20000
## List of items requiring periodic greasing		
76	**Clutch**: Clutch Release Bearing, Cltch Cross Shaft , Clutch Pedal Bush	20000
77	**Front Axle** : King pin	20000
78	**Prop shaft**: UJ cross joints , sliding yoke (also check the condition of rubber boot) , center bearing	20000
79	**Steering** : Steering tie rod ends/ ball joints, Drag links, center link, idler arm, spindle / sleeves,column	20000
80	**Suspension**: Front & rear suspension spring pin	20000
81	**Brake**: Slack Adjuster /Front & Rear Brake, S-Cam Shaft Bushes & Roller End	20000
82	**Body** : Lubricate with oil can Door hinges, outer door handle, door latches, dove tails & striker plates, bonnet stay rod, pivot pins & luggage box door	20000

Annexure - 7

Oil & Lubricants:

Aggregate	Filling capacity (Ltrs.)	Frequency (Km)	Recommended Grade	Specified Brand			
				Bharat Petroleum	Castrol	Shell	IOCL
Engine	Max. - 16 Min. - 14	20000	SAE 15W40	MAK TATA MOTORS GEM 15W40	CASTROL RX CNG (T) 15W40		
Gear Box	5.2 Ltrs	80000	SAE 80W90 with 7% Anglomol 6097 by weight	MAK TATA MOTORS SPIROL LL 80W90	CASTROL EXTRA LONG LIFE GEAR OIL 80W90	Shell Spirax T2 G 80W90 API GL5	Servo Synchro TM 80W90
Rear Axle	14 Ltrs	80000	SAE 85W140 with 7% Anglomol 6043 by weight	MAK TATA MOTORS SPIROL LL 85W140	CASTROL EXTRA LONG LIFE REAR AXLE OIL 85W140	Shell Spirax T2 A 85W140 API GL5	Servo Gear Axle TM

Warranty: LPO 1613 CNG BS-IV OBDII fully built buses will have warranty from the date of delivery to PMPML **(Pune Mahanagar Parivahan Mahamandal Ltd.)**

Vehicle: 1,50,000 Km or 18 months which ever expires earlier.
Body: 1,50,000 Km or 18 months which ever expires earlier.

Free Services:

Sl.No.	Service	Kms covered	Months
1	First Service	3,000 $^{\pm 500}$ Kms	4
2	Second Service	10,000 $^{\pm 500}$ Kms	8
3	Third Service	20,000 $^{\pm 500}$ Kms	12

Annexure - 8

Diagnostic equipment details:

The Electronics in the vehicle is increasing which raises a need to support complex diagnostics on the newer vehicles. To support the newer BS-III & BS-IV vehicles diagnostic we have introduced the new Samtec VCI. The VCI is capable of diagnosing the ECU (Electronic Control Unit) on a K-Line interface. The VCI diagnostics tester comprises of a Vehicle Interface Unit, Custom Built applications software installed in the Laptop.

Part No.	Description
210323259933	Samtec HS LIGHT INTERFACE FOR DIAGNOSTICS - **Hardware**
210323269955	OBD-II CONNECTOR CABLE - **Hardware**
210323609978	Diagnostic **Software** for LCV/ICV/HCV - 497/697TC BS-III & BS-IV

The single software is capable for diagnosing the following vehicles LCV (BSIII & BSIV), ICV (BSIII & BSIV), HCV (BSIII & BSIV). Channel partners will have to procure the above software and hardware through SPD as normal practice.