Tata SA/SAK 1212 BS-III

Operator's Service Book

(The contents given in this book are not binding, are subject to change without notice and are for illustration purposes only)

Edition : XLI/RV-01/M-2016/4501-5000

TATA MOTORS LIMITED

Mumbai Jamshedpur Pune Lucknow Dharwad Pantnagar Sanand

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Customer Assistance Centre

In our constant endeavour to provide better service to our customer, TATA MOTORS has set up an **All India "Customer Assistance Centre" (CAC)** at **Mumbai**, at the following address :

Customer Assistance Centre (Commercial Vehicles)
TATA Motors Limited
20th Floor, One Indiabulls Centre,
Tower 2A, 841, Senapathi Bapat Marg,
Elphinstone Road, Mumbai 400 013 (Maharashtra).

Toll Free No.	**:**	**1 800 209 7979**
Fax No.	:	(022) 66586010
E -mail	:	cac@tatamotors.com
Website	:	www.customercare-cv.tatamotors.com
Working hours	:	24 hours service (All 7 days of the week)

This centre is equipped to provide the following services to you :

1. Redressal of grievances through a single window.
2. Breakdown assistance on highways by involving Dealer/ TASS/TAS network.
3. Product information, Technical specifications of all models.
4. Service & Maintenance information for all models.
5. Sales information (in respect if commercial vehicles).

This facility will enable you to have a single window contact for receiving the above mentioned services, Kindly make use of this facility and give us an opportunity to serve you better.

Plans are also afoot to establish such centers at other locations.

Tata Motors is committed to achieve customer satisfaction.

Environmental Protection

TATA MOTORS is committed to produce the vehicles using environmentally sustainable technologies. A number of features have been incorporated in **Tata commercial vehicles** which have been designed to ensure environmental compatibility through out their life cycle. We would like to inform you that your vehicle meets appropriate environmental norms and this is being regularly validated at all the stages of the manufacturing.

As a user, you too can protect the environment by operating your vehicle in a pro-active manner. A lot depends on your driving style and the way you maintain your vehicle. We are giving below a few tips for your guidance.

Driving

- Avoid frequent and violent acceleration.
- Do not carry any unnecessary weight on the vehicle as it overloads the engine.
- Avoid using devices requiring high power consumption during slow traffic condition.
- It is not advisable to warm up the engine during the first start of the day by idling, as cold temperatures within engine could cause rise in the emissions such as CO & HC particulate.
- Monitor the fuel consumption of the vehicle regularly and if it shows a rising trend, get the vehicle immediately attended at our Authorised Service Station/Workshop
- Switch off the engine during long stops at traffic jams or signals. If the situation demands that engine be kept running, avoid frequent revving up of the engine. Also avoid frequent stopping and restarting, if uncalled for.
- It is not necessary to rev up the engine before turning it off as it unnecessarily burns the fuel.
- Shift to higher gears as soon as possible. Use each gear upto 2/3rd of it's maximum engine speed.

Maintenance of the vehicle

- Ensure that recommended maintenance is carried out on the vehicle regularly at our Authorised Service Outlets.
- As soon as you see any leakages of oil, fuel, air, and coolant in the vehicle, get it attended immediately.
- Use only recommended brands and grades of lubricants and clean/uncontaminated fuels.
- Get your vehicle checked for emission periodically by authorised dealer and regularly renew the P.U.C. certificate.

- Ensure that fuel filter, oil filter, breathers are periodically checked and if required, replace the same by only genuine recommended brands.
- Do not pour the used oils or coolants into the sewage drains, garden soil or open streams. Dispose the used filters and batteries in compliance with the current legislation.
- Do not allow unauthorised person to tamper with engine settings or to carry modifications on the vehicle.
- Never allow the vehicle to run out of fuel, which results in misfiring of the engine.
- Parts like brake liners, clutch disc may contain asbestos. Use vacuum cleaner for cleaning these parts. Do not use the compressed air for cleaning these parts which may spread the dust in the atmosphere.

While carrying out the servicing or repairs on your vehicle, you should pay keen attention to some of the important aggregates on the engine which affect the emissions in maximum way. These components are as follows :

1. **Fuel injection pump, injectors/nozzles.**
2. **Air intake and Exhaust system especially for leakages.**
3. **Cylinder head for valve leakage.**
4. **All filters such as air, oil and fuel filters should be changed periodically as recommended.**
5. **Turbocharger**

This Operator Service Book contains further information on driving precautions and maintenance care leading to environment protection. Please familiarise yourself with these aspects before driving.

We are pleased to hand over your **Tata SA/SAK 1212 TC BS-III vehicle,** manufactured by **TATA MOTORS** where **QUALITY** is the watchword and major attention is paid even to minor details at all stages of manufacture of your vehicle.

PLEASE DO READ THIS BOOK. It helps you to know your vehicle better, to ensure your vehicle is ready for operation at all times and to obtain better performance at optimum operating costs.

All lubricating and maintenance tasks are to be carried out at the **specified service intervals.**

Some of the items / accessories / features shown / given in this book may not be fitted on your vehicle, but they are applicable for other versions of vehicles.

For any further assistance, please contact the nearest **Tata Diesel Vehicle Dealer or our Authorised Service Station** or **TASS** or **Customer Assistance Centre** or **our Area Service Office.**

We wish you good luck and prosperity.

TATA MOTORS LIMITED

Chassis type designation

Description	Wheel base	Chassis type	Sales designation
Semi-forward control chassis with cab and four wheel drive, 3 way tipper	3225 mm		SAK 1212TC/32 BS-III
Tipper with semi-forward control cab and Load body	3225 mm	424 093	SAK 1212TC/32 BS III
Tipper with semi-forward control cab and Load body	4225 mm	424 010	SAK 1212 TC/42 BS III
Cab and Load body with Troop carrier	4225 mm	424 119	SA 1212 TC/42 BS-III
Cab without Load body	3225mm	424 006	SA 1212 TC/32 BS-III
Semi-forward control cab without Load body with ABS	4225	424 121	SA 1212TC/42 BS-III
Semi-forward control cab with Troop Carrier Load body with ABS	4225	424 122	SA 1212TC/42 BS-III

Tips for Driver

1. Use only recommended oils and lubricants. Use of thicker engine oil for higher engine oil pressure only reduces engine life.
2. Always use recommended antifreeze agents in cooling system to avoid deterioration of engine components due to corrosion. After filling coolant, fit radiator cap firmly, to keep cooling system pressurised.
3. Maintain correct tyre pressure to ensure better tyre life.
4. Always fit genuine radiator cap for pressurised cooling system
5. New tyres do not give maximum grip straight away and should therefore be run-in at moderate speeds for first 100 km. This will help to make the tyres last longer.
6. New brake linings must always be run-in, they do not have the optimum friction properties during the first 200 km.
7. Avoid mixing of different grades of lubricants clutch fluids during top up.
8. Idle the engine for 3 to 5 minutes before moving the vehicle and stopping the engine.
9. Always start moving the vehicle in first gear.
10. Operate the vehicle in correct temperature range i.e. between $60^{O}C$ and $100^{O}C$.
11. Operate the engine with correct oil pressure and temperature.
12. Daily maintenance is to be regularly performed especially on water separator, coolant level and engine oil level. Always do refit the water separator drain knob during filter replacement.
13. In case of air lock in the fuel system, the bleeding should be done on the high pressure side of the fuel filter and drain manifold and high pressure lines. Ensure that lift pump operation is satisfactory and proper fuel delivery takes place while bleeding out the air.
14. Avoid cranking of engine for more than 30 seconds. A gap of 2 minutes should be left between successive attempts to crank the engine.

15. Drive judiciously, using rpm meter as guide. The engine speed should be in green band at all times for economical and comfortable driving with less gear shiftings.
16. Check battery every week and top up electrolyte, if necessary. Keep battery terminals clean and cable joints tight. Apply vaseline / petroleum jelly on terminals.
17. Watch service indicator of dry type air filter. If it shows red band, clean air filter housing, change primary cartridge and reset the service indicator.
18. Observe correct polarity while connecting alternator to battery.
19. For operating vehicles at low temperatures and high altitudes, contact your nearest T.D.V. dealer for the precautions to be taken.
20. Do not use kerosene as fuel, it reduces engine and fuel pump life.
21. Do not use clutch pedal as a foot rest when driving. This will cause premature clutch lining wear.
22. Do not coast vehicle i.e. drive with engine switched off. This is dangerous and affects the life of gear box.
23. Do not fit bigger size tyres. Do not over or under inflate tyres. This reduces tyre life.
24. Do not top up radiator by pouring cold coolant in hot engine. The cylinder head may crack.
25. Do not overfill engine oil in sump. This may cause engine smoking and high engine oil consumption.
26. Do not keep ignition ON, after the engine has fired. This will damage the starter pinion and/or flywheel ring gear.
27. Do not move vehicle before air pressure is built above 5.6 bar and hand brake is completely released, i.e. 'HAND BRAKE' indicator light and beeper are off.
28. Do not run the alternator without battery or disconnect any lead of alternator while the engine is running.
29. Do not flash the alternator leads to check for current flow.
30. Do not mask head lamp lens (top 1/3 or top 1/2 portion) with black paint. If done, this will reduce head lamp light intensity.
31. Do not keep the engine at full throttle during engine cranking. Keep the engine at idling till the oil pressure builds up.

32. Do not clean exposed painted surface or wind screen with petroleum products i.e. diesel, kerosene & petrol etc.
33. If the red band of service indicator reappears even after replacing primary cartridge, take your vehicle to our nearest authorised workshop.
34. If the air filter primary cartridge is replaced, destroy the old cartridge to prevent its reuse.
35. Ensure that air intake hoses are free from punctures, cuts and damages.
36. Replace the secondary cartridge of air filter after three replacement of primary cartridge.
37. Do not clean the secondary cartridge of air filter.
38. Ensure engine exhaust brake isolator switch is always kept in 'ON' position other than the occasions where exhaust brake isolation is required.
39. Use only designated ampere rated fuses.
40. Connect additional appliances and light system through the power connectors provided in the wiring harness.
41. Use additional fuse box to connect additional blinkers, fog lamps and roof lamps through the connectors provided in the wiring harness.

Do's - for driver

1. Ensure engine exhaust brake isolator switch is always kept in 'ON' position other than the occasions where exhaust brake isolation is required.
2. Keep foot and hand brakes properly adjusted.
3. If the brake pedal travel increases suddenly, it may be that one of the two brake circuits has failed. You can still drive down to the nearest Tata Motors authorised workshop but be prepared to use more pressure on the pedal and allow for longer braking distance on the way.
4. New brake linings must always be run-in, they do not have the optimum friction properties during the first 200 km.
5. When parking on slope use wheel chokes, apply hand brake and keep vehicle in gear.

Don'ts - for driver

1. Do not move vehicle before air pressure is built above 5.6 bar and hand brake is completely released, i.e. 'HAND BRAKE' indicator light and beeper are off.
2. Do not restrict the movements of the pedals. Do not put articles in the foot well which could roll or/slide underneath the pedals.
3. Do not coast vehicle (drive vehicle with engine switched off and in neutral gear), this is dangerous.
4. During running-in do not overload or over-speed. Avoid panic braking. Good running-in ensures long life of vehicle and better fuel efficiency.
5. Do not attempt to clean the DDU (Drying & Distribution Unit) desiccant cartridge and filter. Replace the desiccant cartridge and filter every two years.
6. Avoid panic braking during first 500 km. Drive in lower gear when negotiating steep down gradient, thus avoiding excessive braking and brake overheating. The slightly reduce braking effect can be compensated for by slightly more pressure on the brake pedal. This also applies when new lining have been fitted. Whenever the brake linings are replaced, ensure replacement on both front and rear.
7. Do not disconnect hand brake. This will become safety hazard.

Tips for Maintenance and Lubrication

1. Use only recommended filters for engine oil, fuel, air cleaner, power steering & hydraulic tipping. Replace them at recommended intervals.
2. Disconnect all alternator terminals, while carrying out any welding on the vehicle.
3. Never use water alone in the cooling system. Always use mixture of 50% clean water and 50% antifreeze agent for topping up and for change also. Always carry a five litre can of properly mixed coolant for topping up enroute.
4. Get the cause of low engine oil pressure investigated at our Authorised Workshop.
5. Any change in clutch pedal free play is to be investigated immediately.
6. Get Free and Chargeable Services done at our Authorised Workshop at recommended intervals.
7. Always get engine, gearbox, transfer case, front axle, rear axle oils replaced with recommended oils at prescribed intervals.
8. Always get the genuine and our approved parts fitted on your vehicle by our trained mechanics using special tools at our authorised dealer's workshop.
9. We strongly recommend that all the maintenance and service operations should be carried out by you in our Dealers Workshop/Authorised Services Station.

Helping you to obtain efficient trouble-free service from your TATA DIESEL VEHICLE is our business.

Do's for maintenance

1. The vehicle is fitted with auto slack adjuster. There is no need for brake adjuster on account of brake shoe pad wear.

Don'ts for maintenance

1. Do not remove exhaust brake. Brake lining life is improved with the use of the exhaust brake.
2. Do not apply any lubricant to the butterfly valve shaft of the exhaust brake unit.
3. Do not use brake drum beyond specified repair size, as there will be no service braking or parking brake left due to cam roll over. Before that, drums should be discarded.

Polyamide (PA) Nylon Tubing for Air Brakes

Your vehicle is fitted with latest generation Polyamide (PA) Nylon Tubing for Air Brake.

PA material is preferred for this application for :

- Excellent chemical resistance (against fuel, battery acid, hydraulic oils etc.
- Dimensional stability & impact resistance (against gravel throw from tyres).
- Suitable working temperature is -40°C to 100°C constant working and upto 130°C peaks.
- PA is 7 to 8 times lighter than metal.
- Eliminates rusting problem, gives much lower leakage.
- Rust particles are not generated (like in metal tubes) and thus protects valves, etc.

Preventive maintenance for PA tubing

- Check whether all clamps are in place and suitably tightened.
- Check whether spiral cover is in place.
- Check that all end fittings are properly assembled.
- Check that PA tubes follow routing as per original vehicle.
- Check that PA tubes is not rubbing against any other object on the vehicle such as frame, bracket or connectors.
- In case of repair, use only plastic coated clamps for clamping of PA tubes.
- Ensure that PA tube is **not** touching :

  (a) Hot objects such as exhaust pipe

  (b) Sharp objects such as brackets or sheet metal parts.

  (c) Moving objects such as propeller shaft.

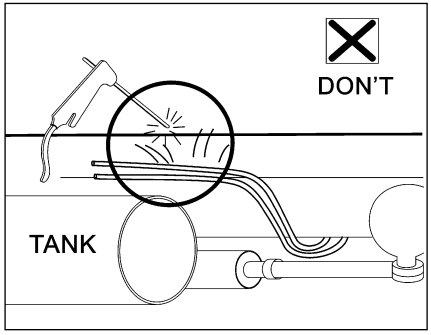
Guidelines and precautions for PA tubing

Following pages 14 to 18 give guidance and precautions for certain expected work practices for vehicles having PA tubing to give trouble free service & long life.

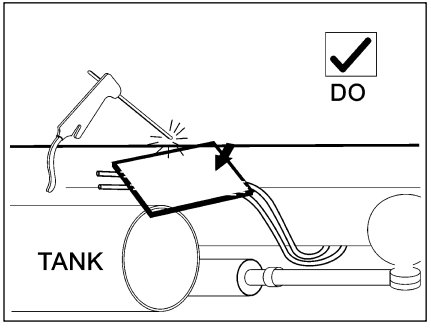
The points mentioned herein are no different than what you would follow with regard to ***battery cables*** or other ***electrical wiring.***

Welding and Gas Cutting

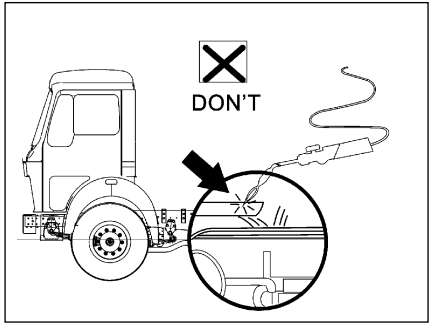
Cover PA tube with suitable object such as metal sheet at the time of welding and gas cutting. This will avoid welding spatter and molten metal from falling on the PA tubes and creating a hole in the PA tube.



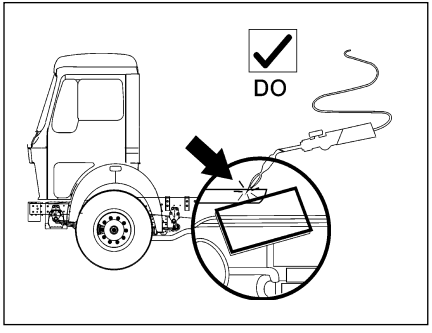
Unprotected areas while welding may damage PA tube



Cover PA tube before welding



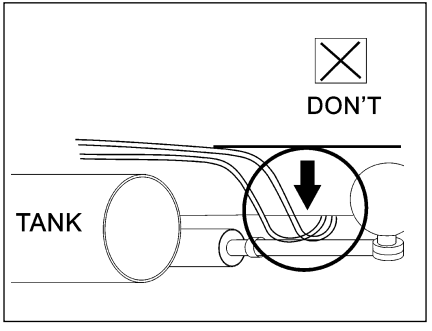
Unprotected areas while gas cutting may damage PA tube



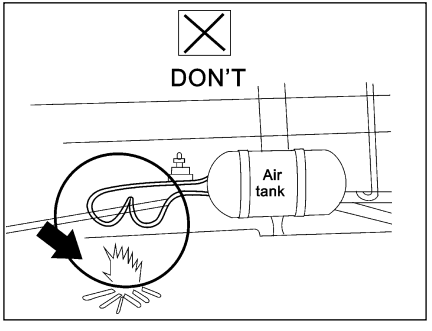
Cover PA tube before gas cutting

Hot Objects

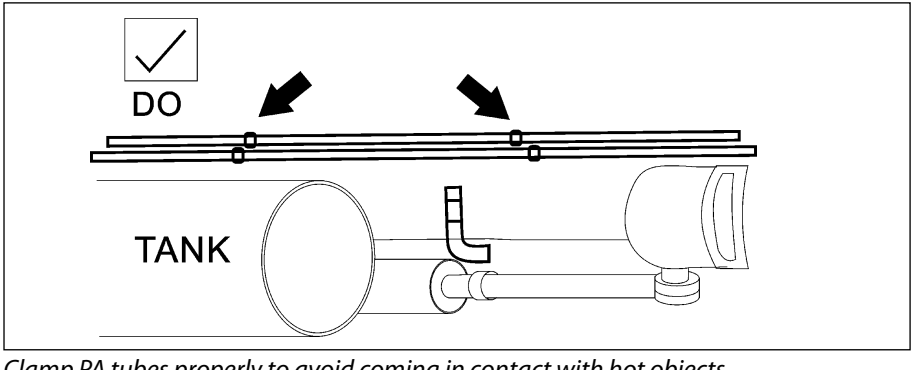
Take care that PA tubes do not touch hot objects such as exhaust pipe. This will avoid burning or melting of PA tube.



Avoid PA tube to touch exhaust pipe



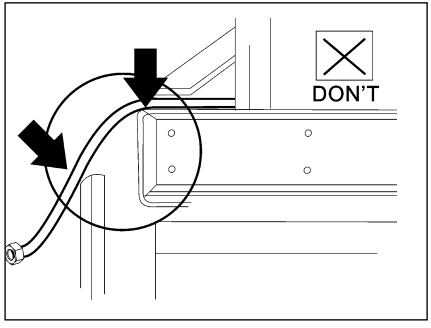
Do not light fire near PA tube



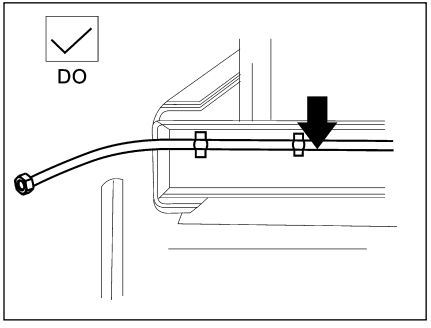
Clamp PA tubes properly to avoid coming in contact with hot objects.

Sharp Objects

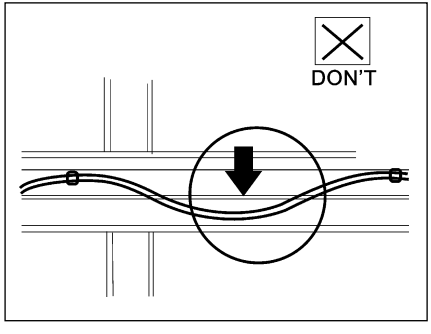
Take care that PA tubes do not come in contact with sharp objects. This will avoid cutting of PA tubes.



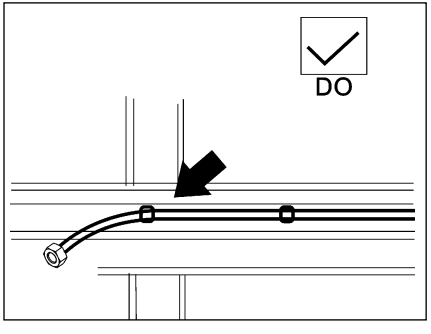
PA tubes should not touch sharp objects



Follow original routing of PA tubes



Avoid loose fitting of PA tube



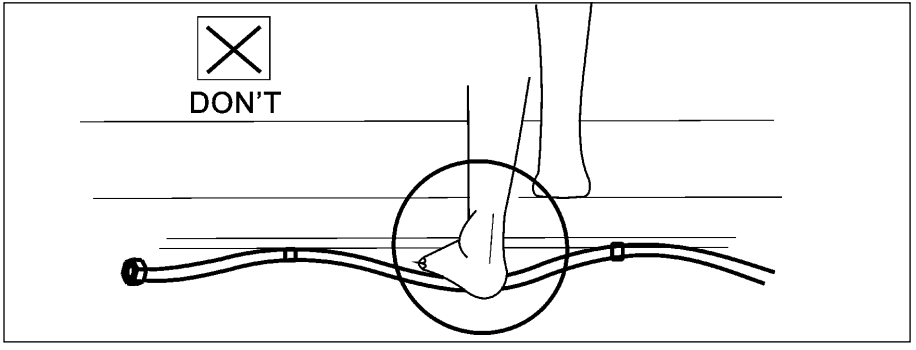
Ensure proper clamping of PA tubes

Loose Fitments

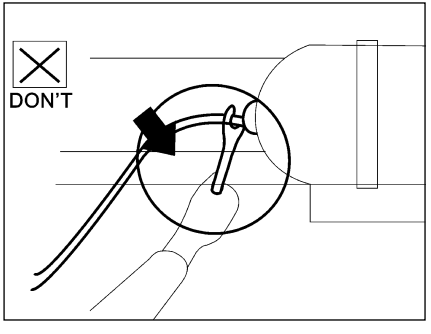
Do not allow loose fitting of PA tube.

Misuse

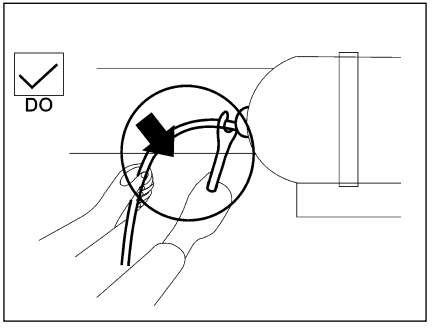
Do not step or hang on connected PA tube. Doing so, will lead to damage of PA tube at the clamps or near end fitting, resulting in leakage.



Do not step on or hang on to PA tube



Do not tighten nut without holding PA tube.

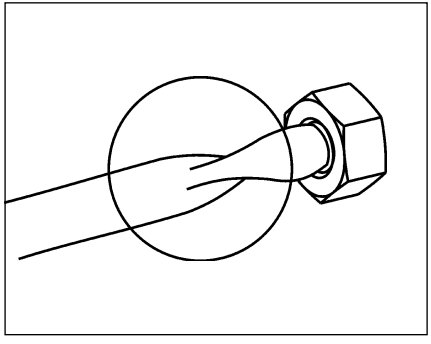


Hold PA tube before tightening nut.

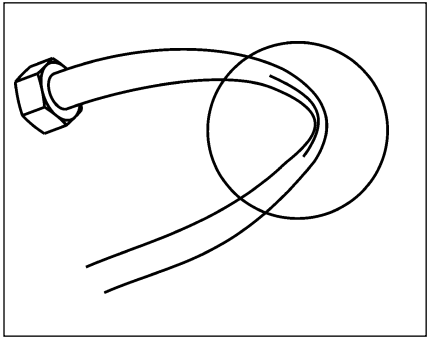
Tube Fitment

In case refitting of PA tube is required

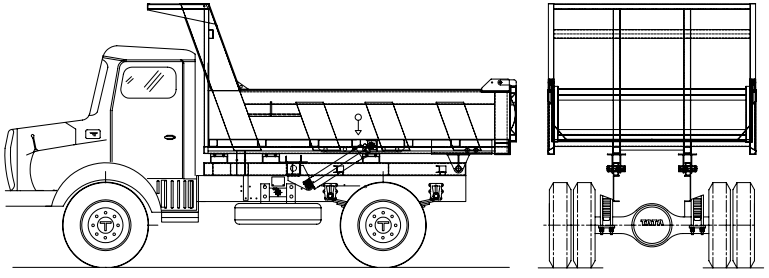
- Follow original routing of PA tube.
- Take care that PA tubes are not forcibly bent or fitted.
- Use plastic coated clamps.
- Use both hands while fitting PA tube. This will avoid twisting and kinking of PA tube.



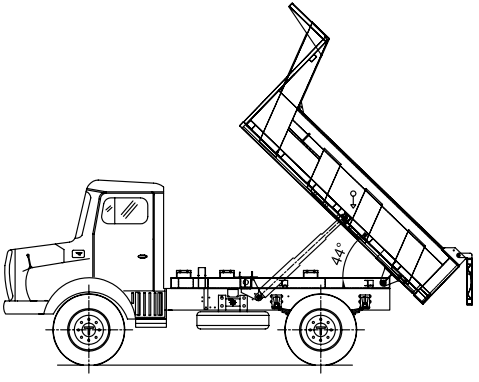
Twisted tube



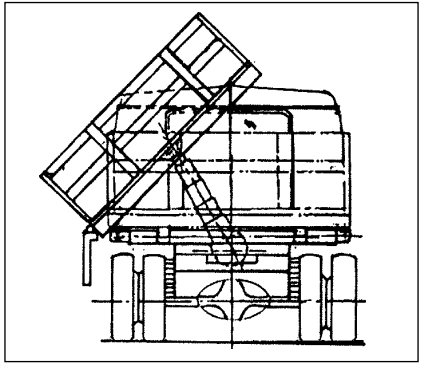
Kinked Tube



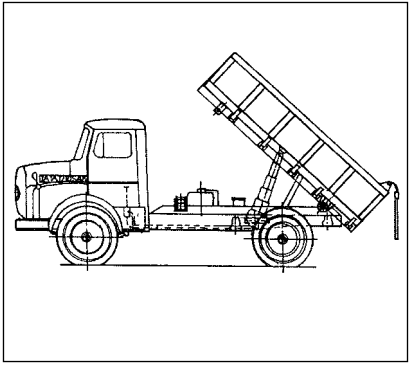
Transportation position (under body tipping)



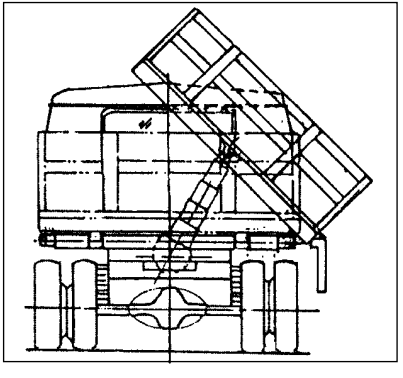
Tipping position (under body tipping)



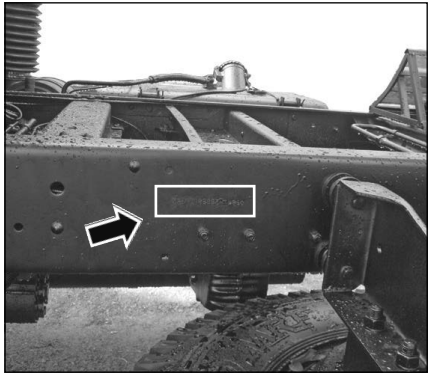
Left side tipping (3 Way tipper)



Rear side tipping (3 Way tipper)

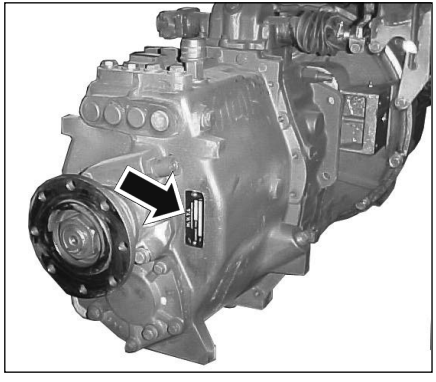


Right side tipping (3 Way tipper)

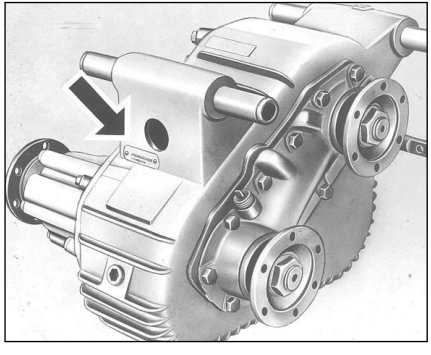


Chassis no. punched on LH long member

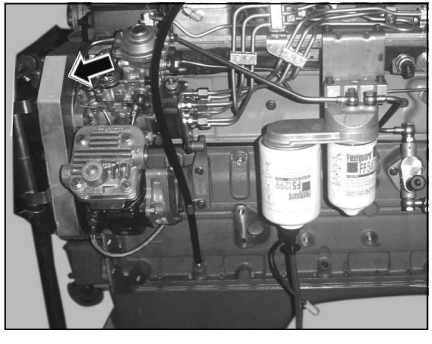
Chassis number plate location



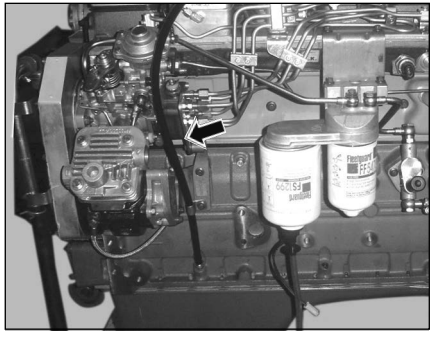
Gear Box-G600



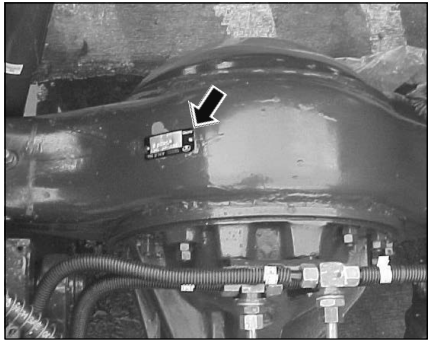
Transfer case



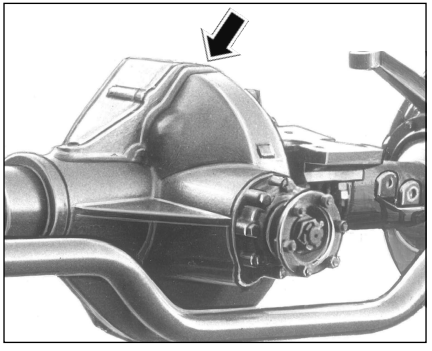
Engine number plate



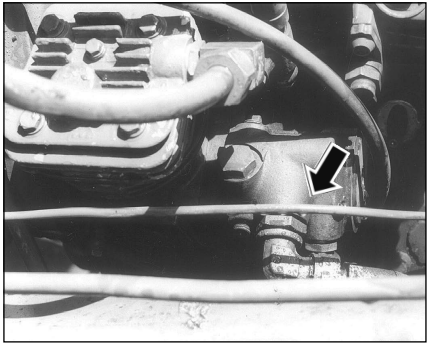
Rotary FIP



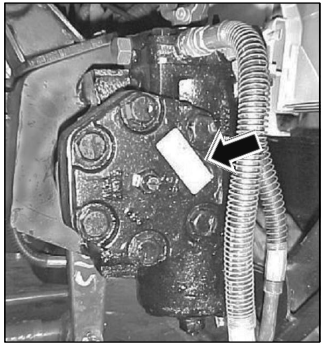
Rear axle



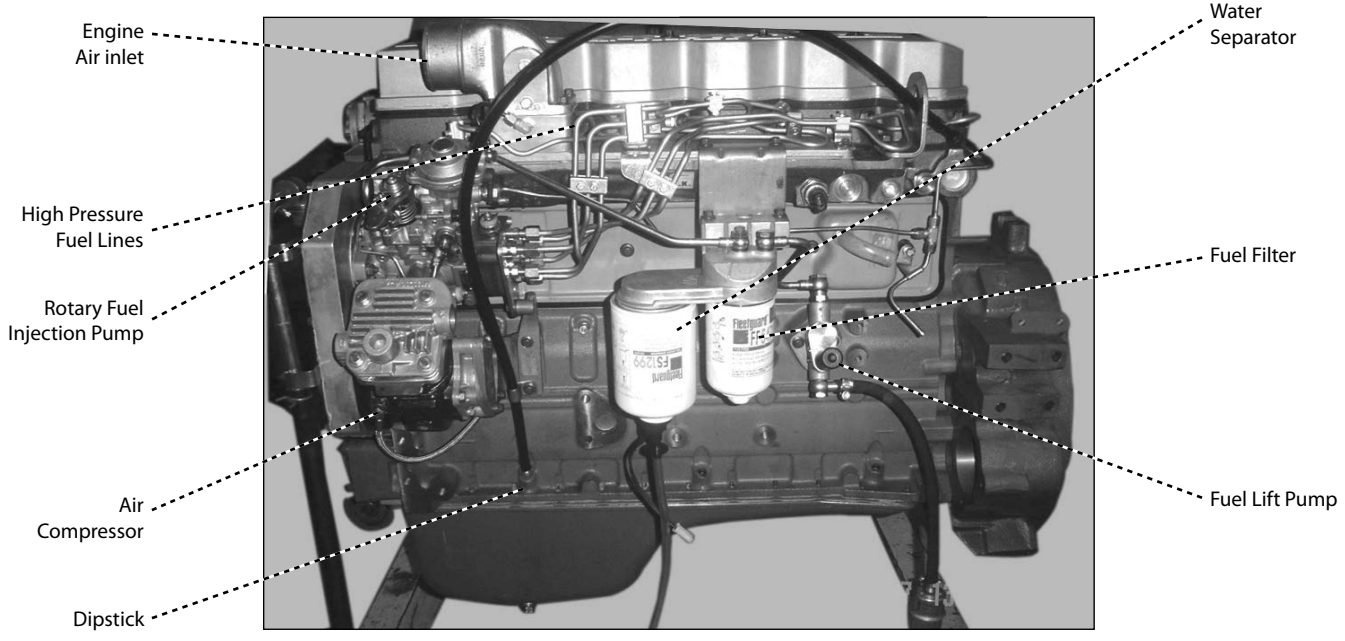
Front axle



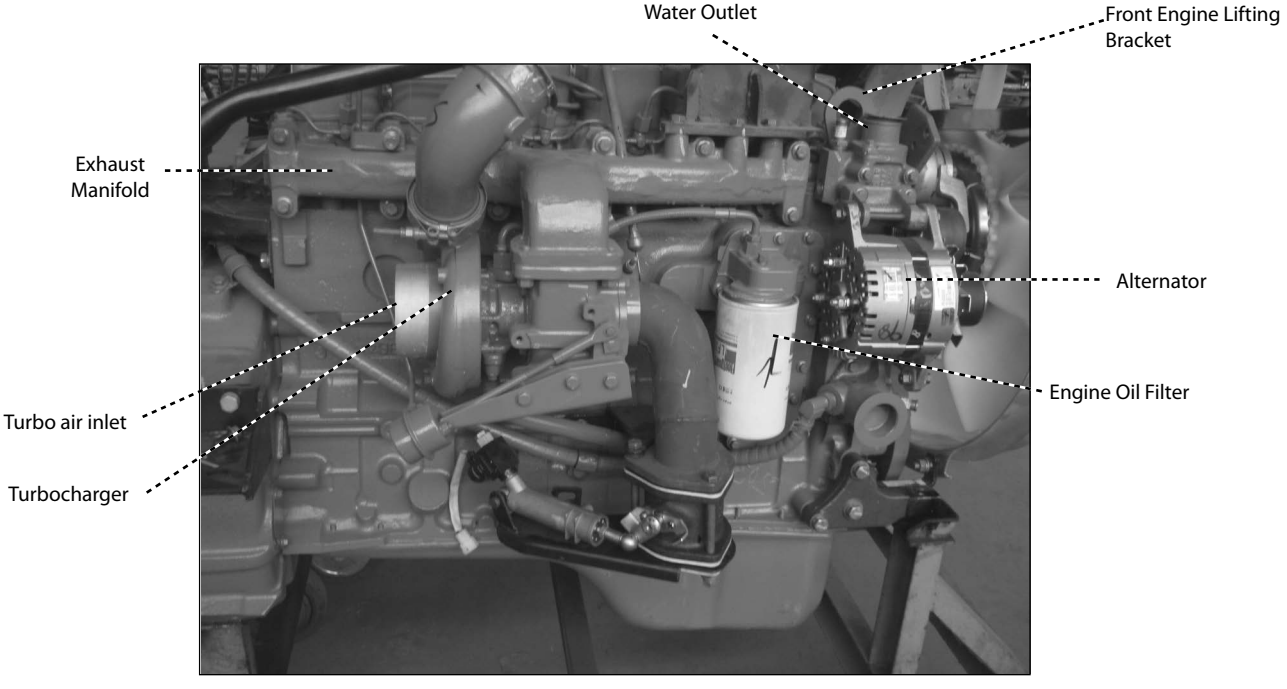
Power steering pump



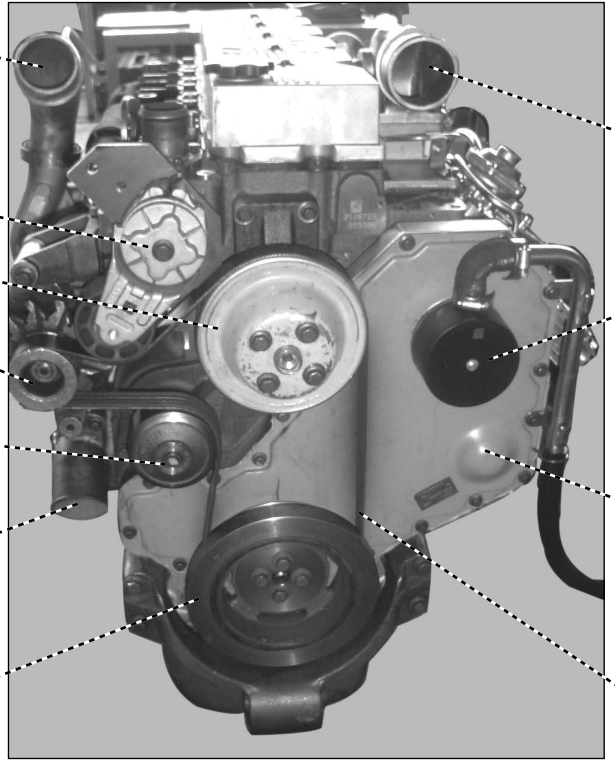
Power steering gear box



FIP Side view



Turbocharger Side View


Turbo Air Outlet
Automatic Belt tensioner
Fan Pulley
Alternator
Water Pump
Water Inlet
Vibration Damper
Turbo Air inlet
Fuel pump drive cover cum breather
Front Gear Cover
Fan Drive Belt

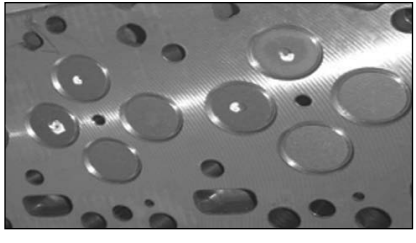
Front View

Salient features of Tata Cummins BS-III engine

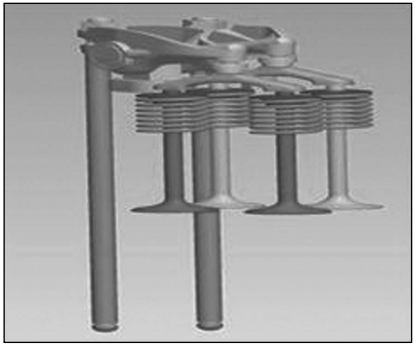
- High performance MICO BOSCH fuel system
- Low temperature AIR to AIR after cooling
- Optimised "Dual NI" resist piston & ring pack
- High performance HOLSET waste gate turbocharger
- Specially strengthened encore block, crankshaft, camshaft
- Cylinder head with 4 valves per cylinder
- Centrally located injectors to improve fuel efficiency and emission
- Improved piston rings to reduce oil consumption and blow by
- Common valve cover (Single piece cylinder head cover)
- Tuned TWO piece exhaust Manifold

CYLINDER HEAD ASSEMBLY

- 4 Valves Per Cylinders
- All Cylinder head bolts are of same length.



- Four valves per cylinder Valve train

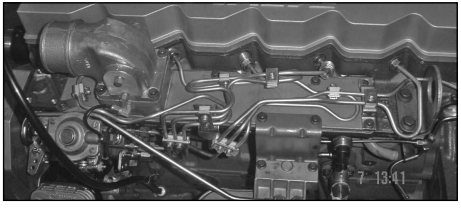


ROCKER ASSEMBLY

PISTON

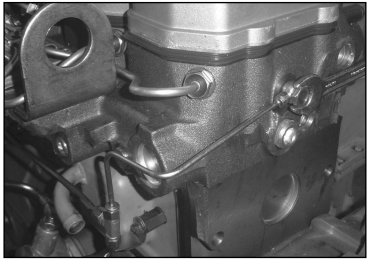
- Central Bowl Piston

HIGH PRESSURE LINES AND INJECTORS



- High Pressure Lines

FUEL RETURN LINE

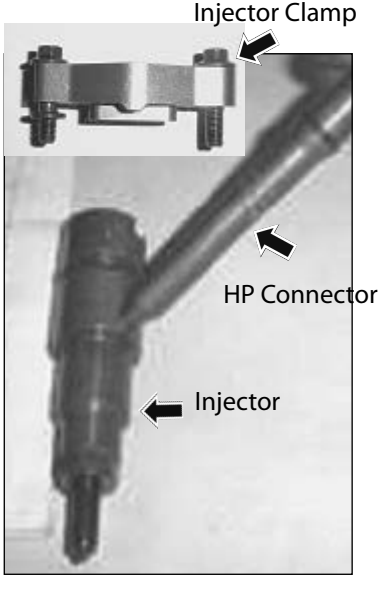


- No External Fuel return line
- Integral Fuel Return Line

THERMOSTAT HOUSING

- Vertical and integral Thermostat housing in cylinder head itself.

INJECTOR

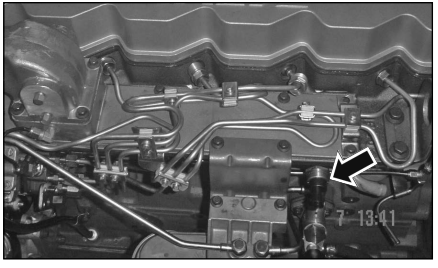


THERMOSTAT

EXHAUST MANIFOLD

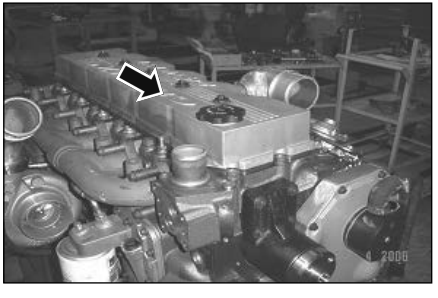
- Two Piece Pulse type exhaust manifold

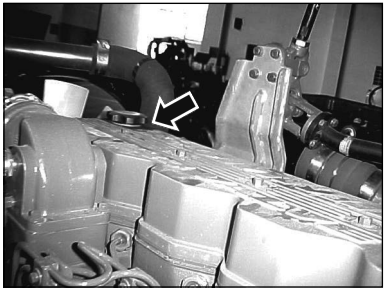
THERMO SWITCH LOCATION



- Cylinder head mounted Thermo switch connecting KSB

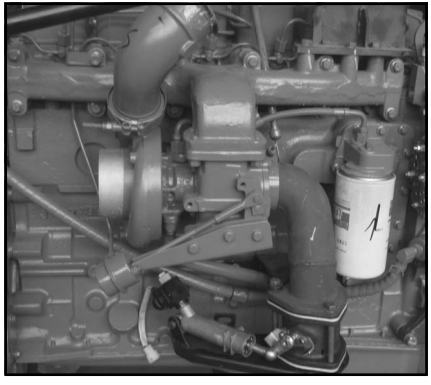
VALVE COVER



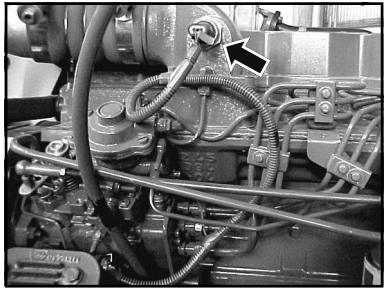


Engine oil filler cap on cylinder head cover

Engine oil filter

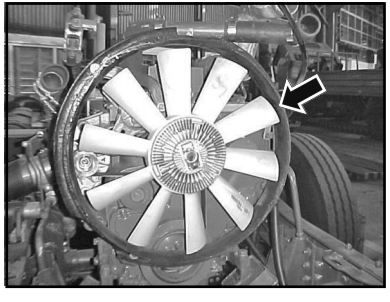


Waste gate connection on turbo charger

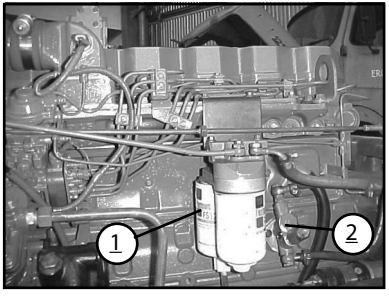


Inlet manifold thermal switch

Single piece cylinder head cover (common valve cover)



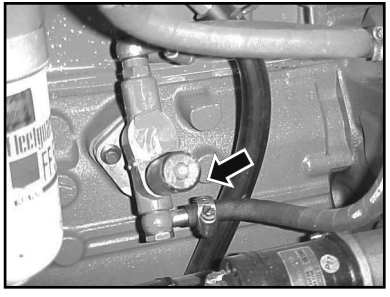
Viscous fan



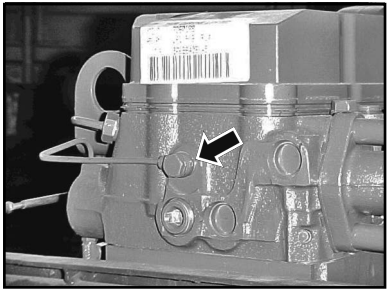
Dual fuel filters

1 Water fuel separator

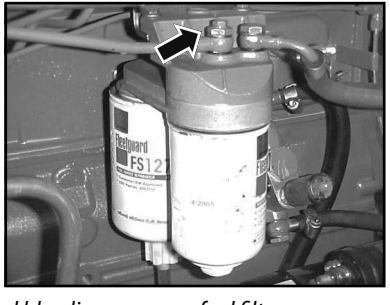
2 Fine filter



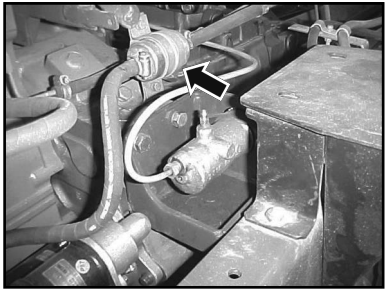
Plunger type fuel feed pump.



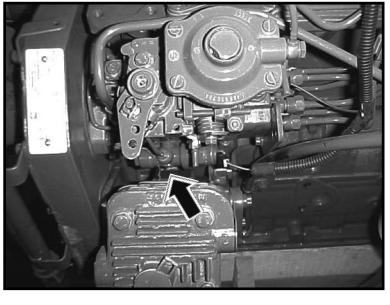
Common fuel return rail from injectors



Fuel bleeding screw on fuel filter

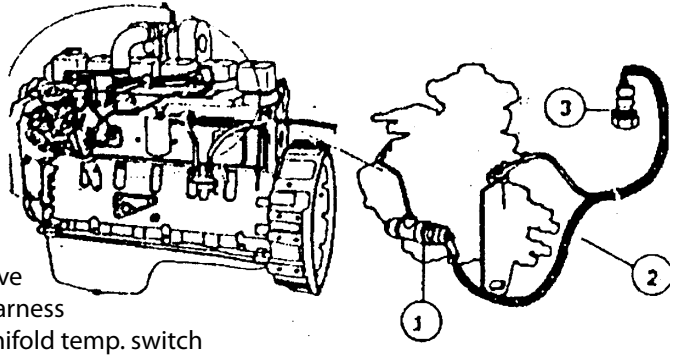


Pre filter



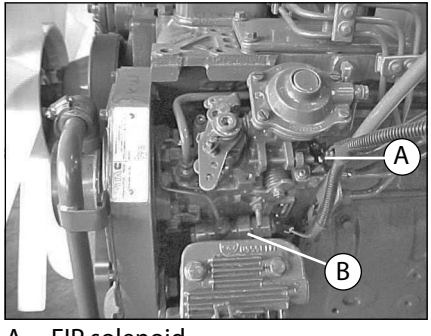
FIP KSB Unit

FIP-KSB unit (for Euro-III vehicles)
When the engine is cold and the intake manifold temperature is below 32°C, the KSB unit comes into operation to fully advance the injection timing and reduce white smoke at low speeds. When the engine reaches normal operating temperature, the KSB unit deactivated and the injection timing is proportionally retarded to reduced emission. Deactivation of the KSB is controlled by a temperature sensor switch located in the air intake manifold. A wiring harness connects the KSB and temperature switch. If wiring is disconnected, the KSB remains deactivated and the injection timing retarded, resulting in increased white smoke at start up.



1. K.S.B. Valve
2. Wiring harness
3. Inlet manifold temp. switch

Do not disconnect electrical connections



A. FIP solenoid
B. KSB Solenoid

Steering lock cum ignition switch

It is located on right hand side of the steering column. It has the following positions :

'LOCK' Position

The key can be inserted or removed in this position only. Steering is in locked position, only when key is removed as well as when key is inserted.

'ACC' Position

Steering gets unlocked in this position. Only accessories are 'ON'.

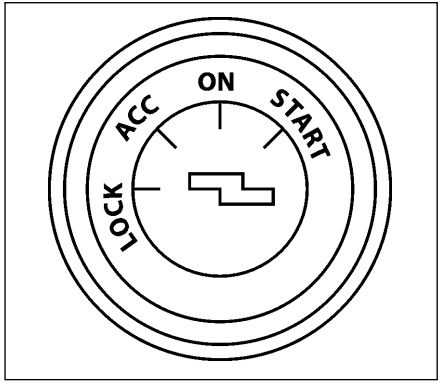
'ON' Position

By turning the key to position 'ON', the low oil pressure lamp, battery charging indicator lamp, parking brake indicator lamp (if applied), brake fail indicator lamp and temperature gauge are switched on. The brake fail indicator lamp should go-off in two seconds. Other electrical systems are ready for operation if needed. **If none of the above warning lamps/gauges are working the chances are that the fuse is blown off in which case engine will not start.**

'START' Position

Turn the key further clockwise to start position to operate the starter motor. This is a spring return position.

As soon as the engine starts, release the ignition key so that the key can come back to 'ON' position and starter motor disengages.



Steering lock cum ignition switch - key positions.

STEERING LOCK CUM IGNITION SWITCH

Position of key		Steering	Electricals
Clockwise direction			
'LOCK'	without key	Locked	All OFF
'LOCK'	with key	Locked	All OFF
'ACC'	with key	Unlocked	ACC ON
'ON'	with key	Unlocked	ACC + IG ON
'START'	with key	Unlocked	IG + ST ON
Anti-clockwise direction			
"ON'	with key	Unlocked	ACC + IG ON
'ACC'	with key	Unlocked	ACC ON
'LOCK'	with key	Unlocked	All OFF
'LOCK'	without Key	Locked	All OFF

(ACC = Accessories)

(IG = Ignition)

(ST = Start)

1. ABS ON/OFF Switch
This switch is used to engage / disengage ABS.

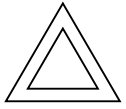
2. Head lamp levelling
Motorised Head lamp focusing shall be adjusted with the help of the knob along the vertical axis as required, depending upon loading condition of the vehicle.

3. Exhaust brake isolator switch/ Indicator
In certain situations like starting of vehicle on an upgradient, simultaneous acceleration and partial braking of vehicle are required. Isolator switch can be used to cut off air supply to exhaust brake, by putting it in off (disengaged) position. Isolator switch should be put on (engaged), as soon as isolation requirement is over.

4. ABS indicator

It glows and indicates fault, if any in the ABS system. During diagnostic checkup, pressing ABS diagnostic switch will give us information (blink codes) about faults of the ABS system.

5. Hazard warning switch



In case of emergency to warn other road users about the hazardous condition of the vehicle, pull the knob to "ON" position. All the turning signals of right and left side starts flashing along with lamp on the knob. Push to put " OFF" the hazard warning.

6. Front Fog Lamp Switch / Indicator (Optional)
Front fog lamps indicator will glow when this switch is switched ON, provided on switch bank.

7. Low Coolant Level Check Switch/ Indicator

When the Low Coolant Level Switch is put to ON position, the Low Level Indicator on the instrument cluster will flash once and the extinguish. This indicates that the Coolant level is within the acceptable limits. If the indicator continues to glow, it indicates

low coolant level. Top up the coolant and recheck with the help of the Switch.

8. Work Area Lamp Switch/ Indicator

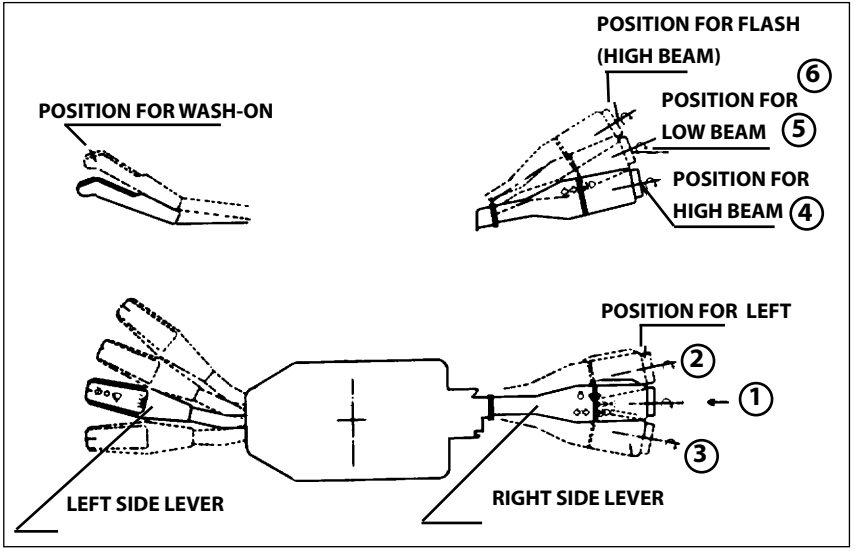
Work area lamp located behind the cabin can be switched ON/OFF by pressing/releasing this switch.

9. PTO ON/OFF switch

PTO is pneumatically operated through an electrical switch located in instrument panel. To engage the PTO, build up air pressure to 8.1 bar. With engine idle, press the clutch pedal fully and put 'ON' the PTO switch. To disengage the PTO press the clutch pedal fully and put 'OFF' the switch.

10. Rear Fog Lamp Switch/ Indicator (Optional)

Rear fog lamps indicator will glow when this switch is switched ON, provided on switch bank.

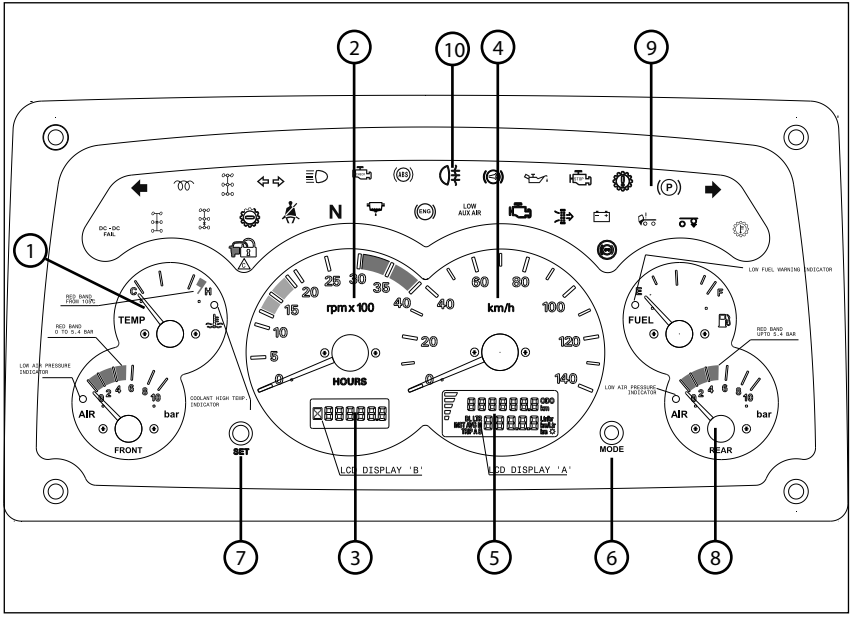


Combination switch

Right side lever at :

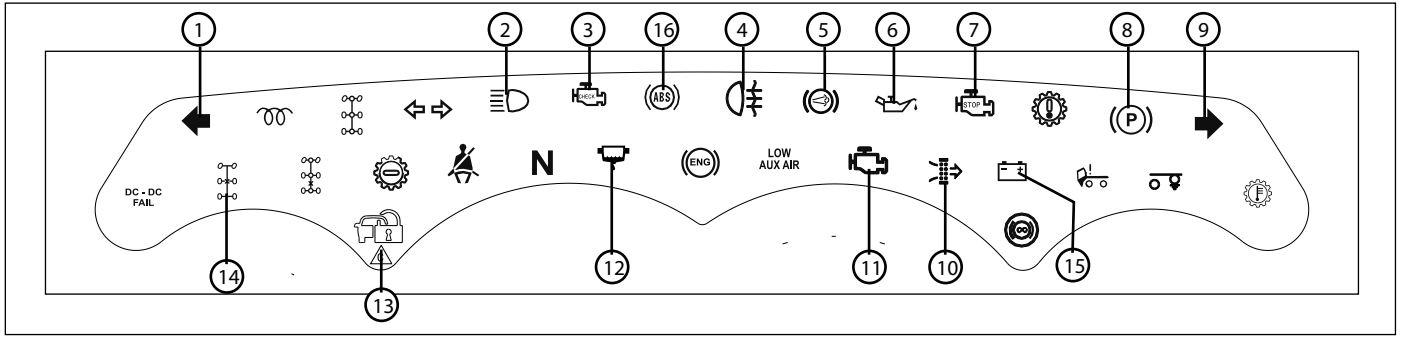
1. *Turn signals and head lamp signals in OFF position*
2. *Left turn signal*
3. *Right turn signal*
4. *High beam*
5. *Low beam*
6. *Flash signal*

Instrument Panel SA/SAK 1212TC



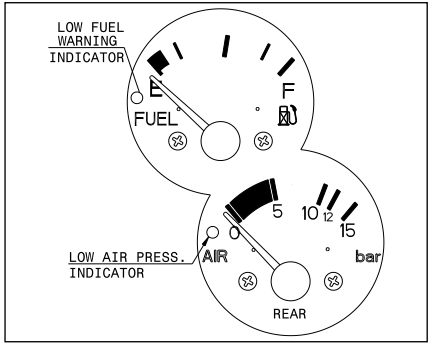
1. Coolant temperature gauge and Front Air Pressure gauge
2. Tachometer / RPM meter
3. Hour meter LCD Display
4. Speedometer and Odometer
5. Odometer Dual Line LCD Functional Display
6. Mode Knob
7. Reset Knob
8. Fuel gauge and Rear air Pressure Gauge
9. Tell Tales
10. Rear Fog lamp (optional)

Note :
Hour meter is fitted on SAK model only.



Indicator Bank

1. Turn indicator, left
2. High beam indicator
3. Check engine lamp indicator
4. Rear fog lamp indicator
5. Engine exhaust brake indicator
6. Low oil pressure indicator
7. Stop engine lamp indicator
8. Parking brake indicator
9. Turn indicator, right
10. Air filter clogged warning Indicator
11. Malfunction indicator
12. Water in fuel indicator
13. Immobilizer indicator
14. Differential lock indicator
15. Battery charging indicator
16. ABS indicator (if fitted)



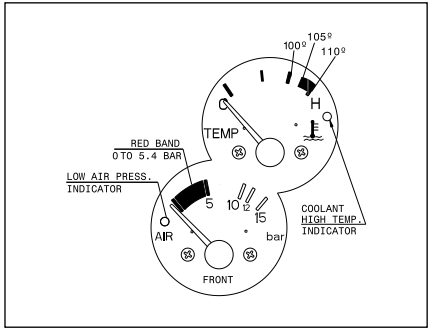
Fuel gauge

Fuel gauge

The fuel gauge indicates the level of fuel in the tank. It is electrically operated. The fuel level is indicated on the gauge through sensing unit mounted on the fuel tank.

Fill fuel when the needle touches reserve band.

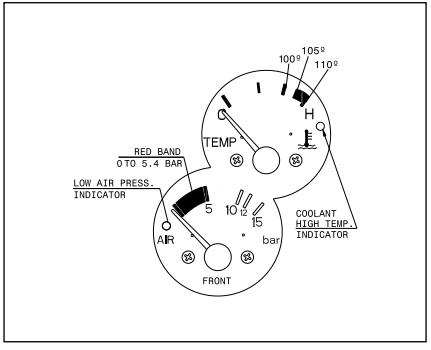
If fuel level falls below the minimum reserve level, low fuel warning indicator on on gauge will glow.



Air pressure gauge

Air pressure gauges

Two separate air pressure gauges have been provided for front and rear brake air circuits. Air connections have been taken from dual brake valves. The vehicle should not be driven till a minimum air pressure of 5.6 bar is reached after starting the engine in both the air tanks. If the air pressure is found to be constantly below 5.3 $\pm$ 0.3 bar, this may be due to leakage or improper functioning of the air compressor.

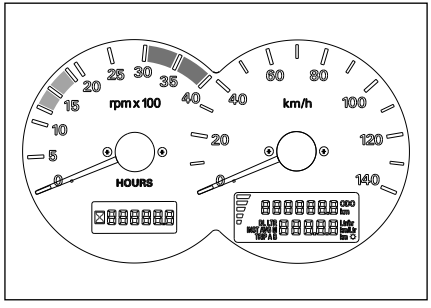


Coolant temperature gauge

Coolant temperature gauge

The temperature gauge shows the temperature of the coolant in the engine in degrees Celsius. The temperature on the gauge is indicated through an electrical signal provided by the temperature sensor unit (Transducer) Mounted on the engine , before thermostat. When the **pointer** goes **in red band on dial**, **it indicates engine overheating,** this may be due to less quantity of coolant in the auxilliary tank. While

driving ,overheating of the engine is observed, and the coolant level in the auxiliary tank is found to be low, **top up only when the engine has cooled down , or engine running at fast idling** as otherwise cylinder head may crack

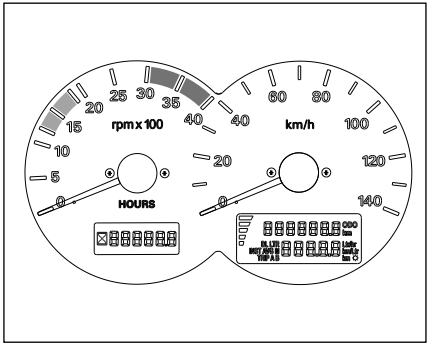


Speedometer, with trip meter

Speedometer :
Speedometer needle position indicates the vehicle speed in kmph. Odometer indicates the distance covered by the vehicle in km. It is driven by a electrical signal coming out from Electronic Speed Sensor fitted in Gearbox.

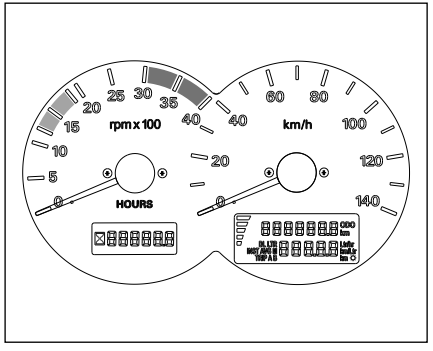
Speedometer ratio is marked on the front.

A trip meter is also incorporated on the speedometer, which enables to note the distance covered during the trips between the origin and destination. The meter can be reset to zero by pushing the knob, after the trip travelled.



RPM meter with Hour meter (For SAK tippers)

The RPM meter cum HOUR meter is provided on tipper vehicles to indicate cumulative hours of operation of engine. Maintenance schedule is recommended based on the hours of operation for the tipper models.



RPM Meter (For SA)

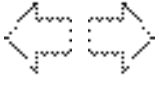
RPM Meter

For optimum fuel economy always drive the vehicle engine RPM in green band.

Low Coolant Level Check Indicator

When the Low Coolant Level Switch is put to ON position, the Low Level Indicator on the instrument cluster will flash once and the extinguish. This indicates that the Coolant level is within the acceptable limits. If the indicator continues to glow, it indicates low coolant level. Top up the coolant and recheck with the help of the Switch.

Side indicators



Marked by arrows, the arrow pointing towards left indicates left hand side and the arrow pointing towards right indicates right hand side. Lamp comes on as soon as the combi switch is put on for LH or RH side indicators.

Engine oil pressure indicator

Indicator comes on as soon as the key is in ON position and goes off as the engine is started and oil pressure builds up.

If indicator continues to glow even after the engine has started, stop the engine, trace out the fault in lubrication system/ electrical connections and rectify.

Water in fuel indicator

It indicates that fuel filter sedimenter contains excess water content.

It will illuminate momentarily when ignition is switched 'ON'

It will continuously illuminate if excess water is accumulated in the fuel filter. Drain the water immediately.

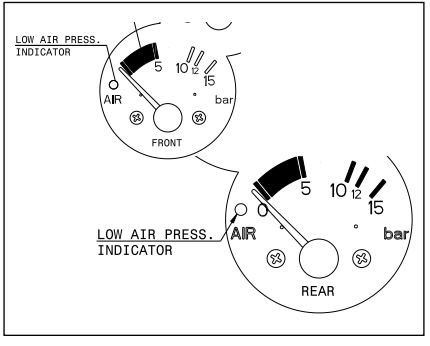
Parking brake indicator

This indicator comes ON when parking brake is applied and goes OFF when it is released.

Battery charging indicator

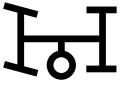
It is provided in the instrument panel. It glows when the key is inserted in the main line switch. With the engine idling the lamp goes off. During the engine vehicle operation if the lamp lights up, it means either battery is not getting charged or alternator is defective. Get the vehicle attended at our authorised dealer/ Authorised service station at once.

Low air pressure indicator



Two low pressure indicators are provided on instrument panel air pressure gauges. When pressure is below 5.4 ± 0.5 bar, Indicator light glows on the air pressure gauges. Simultaneously a beeper beeps indicating low air pressure in the system.

PTO operation for tipper



PTO is pneumatically operated through an electrical switch located in instrument panel. To engage the PTO, build up air pressure to 8.1 bar. With engine idle, press the clutch pedal fully and put 'ON' the PTO switch. To disengage the PTO press the clutch pedal fully and put 'OFF' the switch.

Exhaust brake indicator

Exhaust brake operation is coupled with service brake. Whenever brake pedal is depressed for applying brakes, exhaust brake also gets applied and indicator lamp glows, on the instrument panel.

Stop light switch provides signals both for rear tail lamps as well as for exhaust brake solenoid valve.

Solenoid valve opens, allowing the compressed air to flow to air cylinder thus, operating the exhaust brake, if isolator switch is kept 'ON'.

Check Engine warning Indicator

This lamp comes 'ON' for ~3 secs. When key is turned to IGN position. The lamp goes 'OFF' after 3 secs if the engine management system in the truck is OK. This indicator stays 'ON' continuously if there are any faults occurred in the EMS system. Refer to nearest Authorized Service outlet

Stop Engine warning Indicator

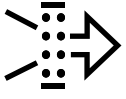
This lamp turns 'ON' for ~3 secs. when key is turned to IGN position.

The lamp goes 'OFF' after 3 secs. if the engine management system in the truck is OK. This indicator stays 'ON' continuously if there are any serious faults occurred in the EMS system.

CAUTION

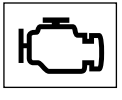
When this warning lamp is 'ON', immediately switch 'OFF' the engine. Refer to nearest Authorized Service outlet.

Air filter clogged warning Indicator



This lamp comes 'ON' for ~3 secs. When key is turned to IGN position. This indicator stays on continuously if the air filter is clogged.

MIL indicator



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.

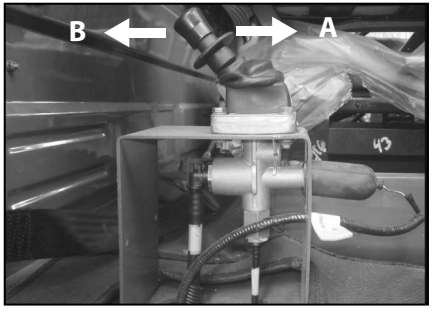
ABS indicator

It glows and indicates fault, if any in the ABS system. During diagnostic checkup, pressing ABS diagnostic switch will give us information (blink codes) about faults of the ABS system.

Lock indicator warning light (Immobilizer)

This system disables the starter motor circuit, ignition supply and fuel cutoff solenoid supply. The vehicle can be unlocked only pressing the "Unlock" button of the corresponding vehicle remote. It will blink when vehicle is immobilized condition. Unlock with remote and start vehicle. This is a provisional Tell tale

1 Steering wheel
2 Combi switch
3 Accelerator pedal
4 Brake pedal
5 Clutch pedal
6 Gear lever
7 Transfer case gear shift lever
8 Horn pad



Graduated Hand brake valve

A ---------- Brake released
B ---------- Brake applied
A to B ----- Gradual application
B to A ----- Gradual release

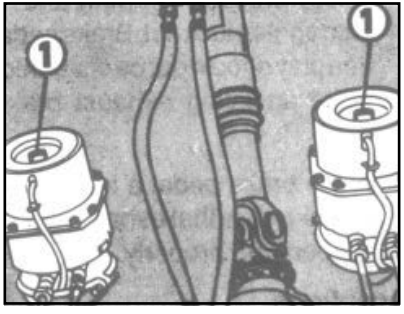
Ensure that :

Parking brake is released before starting the vehicles.

Parking brake is applied after parking the vehicle.

Parking brake hold : 4.6 + 0.4 bar off pressure.

Lift the Collar C to engage/disengage the hand brake



Spring Brake actuator
1) Wind off screw

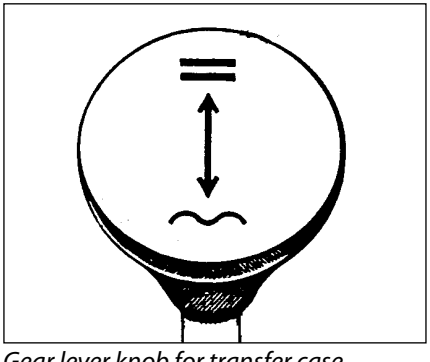
Releasing the automatically applied hand brake

If there is leakage in the hand brake circuit, the hand brake will be automatically applied. In case air pressure could not be built, the hand brake can be released mechanically, to enable to tow the vehicle to the nearest workshop.

- Loosen the check nut 3 of LH side hand brake linkage between brake chamber and brake lever on brake shaft .
- Hold the nut 2 and turn the link rod to increase the length till the yoke of the link is free from brake lever pin.
- This should be repeated on RH side link rod.
- Jack up the axle and check for off road free rotation of wheels.

Parking brakes : 4.6 ± 0.4 bar.
hold off pressure

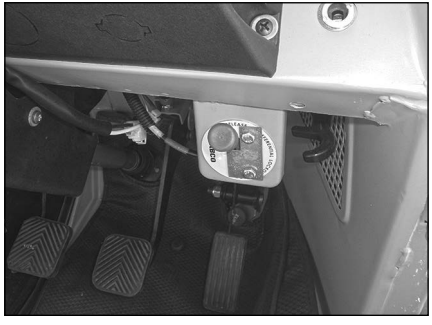
Gear lever knob



Gear lever knob for transfer case

High way 4 x 2

Off highway 4 x 4



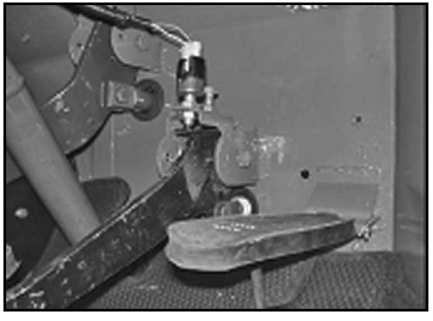
Differential Lock

Diff. lock feature is provided on vehicle to assist driving on slippery or icy surface condition. When the diff. lock is engaged it does not allow any wheel to spin.

Working

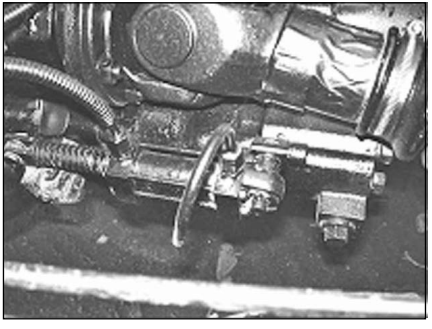
The Indication for engagement status can be seen on Instrument cluster. Activating the solenoid supplies pneumatic pressure the Diff.locks, causing them to engage.

CAUTION : With differential lock in engaged condition drive the vehicle only straight ahead condition. STEERING THE VEHICLE WITH DIFF LOCK ENGAGED MAY RESULT IN AXLE SHAFT BREAKAGE.



Mechanical stop light switch

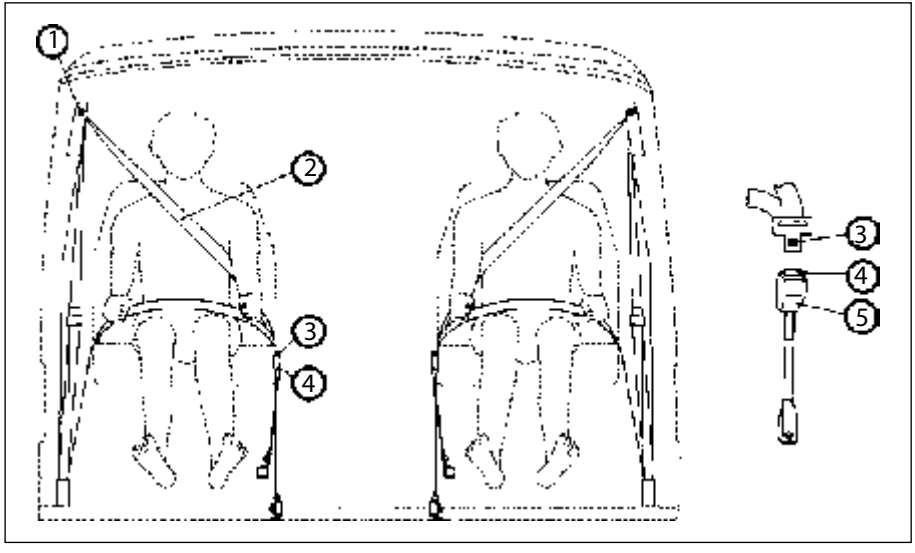
A mechanical stop light switch is mounted at brake pedal lever mounting bracket. Whenever brake pedal is depressed for applying brakes, stop light switch comes into operation and stop lights at rear tail lamps glow.



Air Cylinder for PTO operation

PTO is operated through electro-magnetic cylinder mounted on the axial piston pump . Air is supplied to electro magnetic valve through DDU.

Magnetic valve is activated/deactivated by operating the piano switch “PTO” provided in the dash board.



Schematic - seat belt arrangement

1 Anchor

2 Webbing

3 Tongue

4 Buckle

5 Release button

Seat belt

Vehicle is fitted with three point belt for driver and co-driver.

Fastening the belt

Insert belt tongue into buckle. A positive locking 'click' indicates correct assembly.

Releasing the belt

Press the release button. The tongue will be ejected clear of the locking mechanism within the buckle.

Belt adjustments

When the vehicle is at rest, adjust the belt length in the tongue to suit convenience. Insert belt tongue into buckle and observe that the belt is closed.

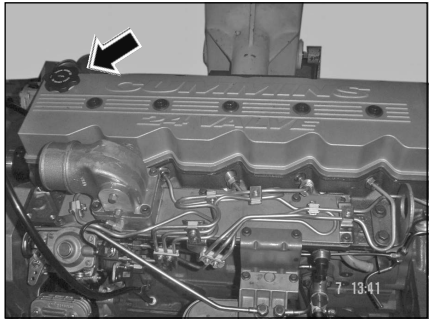
Lap belt (middle passenger, if fitted)

Middle passenger is provided with lap belt. Adjust length of belt in the tongue to suit convenience. Insert belt tongue buckle. A positive click indicates correct assembly. To release, press the release button. The tongue will be ejected from the buckle.

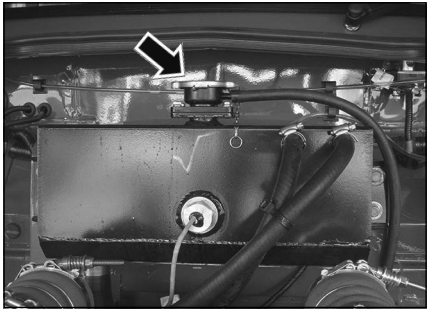
Precautions

- The belt is designed to be used by only one person.
- Avoid twisting the strap during use.
- Webbing must not be allowed to chafe against sharp edges on seat or body work.
- Do not make any alterations or additions to the belt.
- Belts that have been cut, frayed, damaged or have been stressed through impact, should be replaced.
- After vehicle collision if any, belt anchorage points should be checked.
- An occasional wipe with warm soapy water will maintain the webbing in a clean condition. Do not use bleach or dye under any circumstances.
- Periodic inspection of the installation will ensure safe and reliable service of the seat belt.

Engine oil dipstick



Engine oil filler cap



Auxiliary tank with filler neck

Check the following before a trip

Engine oil level

The oil level should always be between the upper and lower marks on the dipstick.

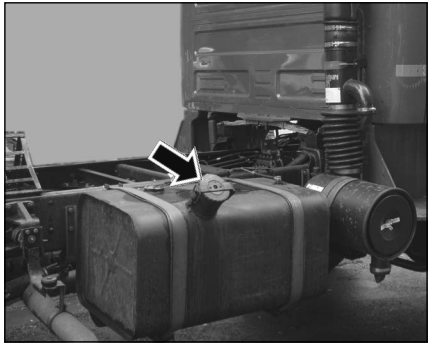
Check oil level before starting the vehicle first time in the morning or atleast 5 minutes after stopping the engine. Top up to the upper marking when going on a long journey. The oil level should not exceed the maximum level mark. Top up with recommended brands of oil only.

Coolant level

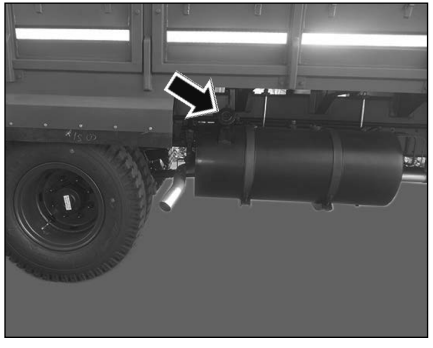
Top up, if necessary and secure cap firmly. Add anti-freezing agent to water in ratio 50 : 50, whenever topping up is done.

Coolant level indicator

Electrically connected float unit is fitted on auxiliary tank. Spring loaded piano switch is fitted on the instrument panel also an indicator lamp is incorporated in the panel along with other warning indicators. With the ignition “ON” by pressing the coolant level switch, the indicator lamp glows, which denotes the electrical circuit is complete.



Fuel tank (SAK & SA 1212 TC/32)



Fuel tank (SA 1212 TC/42)

Fuel level

Check fuel level in fuel tank. Top up if necessary and secure cap.

Tyre pressure

Check and inflate when tyres are cold.

65 PSI for Front & rear - Unladen condition

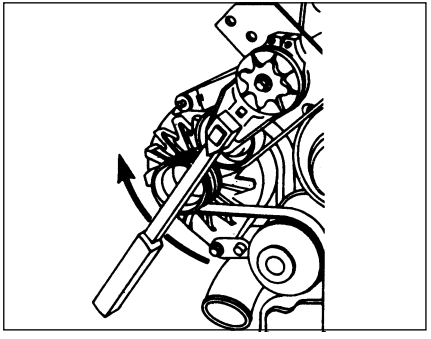
70 PSI for Front & rear - Laden condition

Battery

Battery

Electrolyte level should be 10 to 12 mm above the top of the battery plates. Battery mounting clamps and starter motor terminals must be kept clean and firm. Apply vaseline/ petroleum jelly on battery terminals.

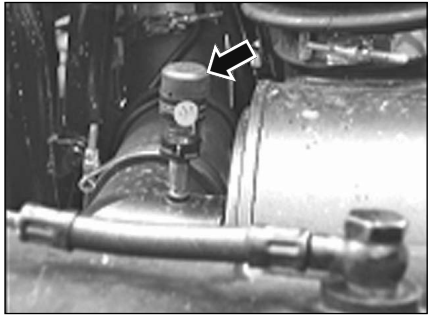
Caution : disconnect the battery terminal before carrying out arc welding work on the vehicle.



Tensioner bearing

Fan belt

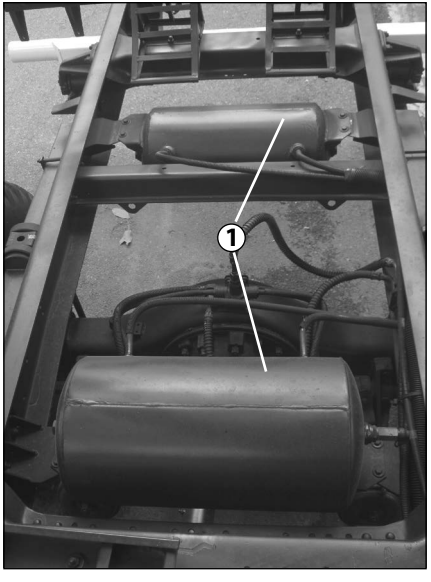
Check condition and tension of the belts.



Service indicator check

Dry type air filter

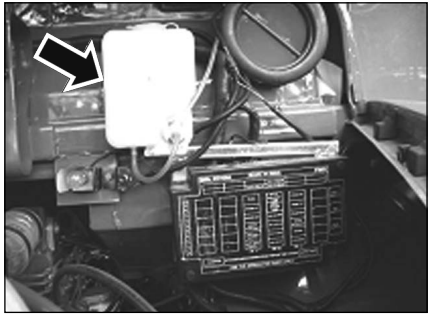
Check service indicator of air filter. When it shows red band, clean air filter housing and replace primary cartridge.



Air tanks

Air system

Drain off condensed water by operating tilt type drain valves located at the bottom of the air tanks.



Windshield washer water reservoir

Windshield washer water reservoir

Check water level in windshield washer water reservoir. Top up, if necessary.

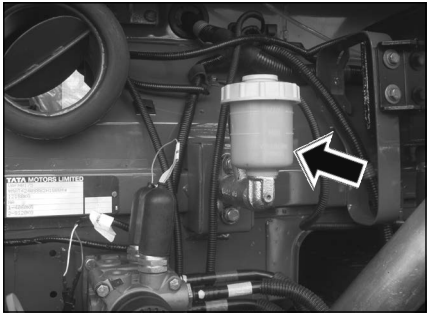
Electrical consumers

Check all lights, horn, blinkers, switches, gauges and wipers for proper functioning.

Leaks

Check for leaks of water, fuel and oil at all gaskets, hose connections. Rectify, if necessary.

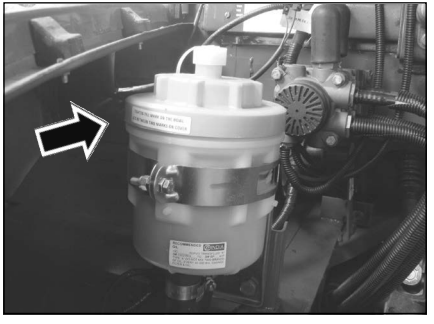
Check for air leakage and rectify, if leakage is found.



Clutch fluid container

Clutch fluid

Check level of fluid in clutch fluid container. Top up with approved brand only.



Power steering oil tank

Power Steering

Check oil level in power steering tank. Top up if necessary

Driving instructions

Before you drive, ensure that your vehicle is road worthy, especially the steering linkages, tyres, brakes and suspension.

DRIVE SAFELY AND JUDICIOUSLY. Always adhere to the maxim 'SAFETY FIRST'

Do not keep driving till you are overcome by fatigue. The reflexes of a tired driver are not as they should be.

Follow road signs and traffic signals.

Ensure all lights signs and traffic signals. Ensure all lights and signals of your vehicle are functioning correctly.

During night driving, dip your vehicle head lamps when a vehicle approaches you from opposite direction.

Replace worn tyres well in time. Over 90% of tyre bursting and consequent damage occur during last 10 % of tyre life.

While driving down a ghat, give way to upcoming traffic.

Do not overtake in ghat section

While driving down the hill, use the same gear, which you would use while climbing/going up the hill.

Use engine exhaust brake while travelling down-hill to reduce vehicle speed.

Observe speed limitations as per road conditions.

Never load the vehicle beyond the recommended height.

Do not apply brakes too violently on slippery road, since the vehicle may start skidding.

Ensure air pressure is above 5.6 bar and parking brake is released before driving.

Drive in the appropriate speeds in the individual gears. Maintain a steady speed avoiding quick acceleration and sudden braking.

Fast driving saves you a little time but increases the fuel and oil consumption. It also causes faster tyre wear.

4x4

Shift to 4x4 made only on difficult terrain where the tractive effort on front wheels is also required. Operating on plain and highway in 4x4 mode will result in faster tyre wear and excessive fuel consumption.

Starting the engine

1. Ensure that parking brake is applied.
2. Move gear shift lever to neutral position.
3. Insert the ignition key in steering lock cum ignition switch. Steering wheel will be in locked condition. Turn the key to 'ACC' position. Steering wheel gets unlocked and accessories will be 'ON'.
4. Turn the key further to 'ON' position. Lamps of battery charging indicator and low oil pressure will come on.
5. Without pressing the accelerator pedal, turn the key further clockwise to 'START' position (spring loaded) to operate starter motor. As soon as engine starts, release the ignition key so that key can come back to 'ON' position and starter motor disengages.
6. If engine misfires and stops, wait for 2 minutes before operating the starter motor once again. This practice should be strictly adhered to, otherwise it will damage the starter motor.
7. After starting a cold engine, bring the engine up to operating speed slowly to allow the oil pressure to stabilize as the engine warms up. Engine oil pressure indicator and battery charging indicator should go off.
8. Keep engine in idling condition for atleast three minutes just after starting it.

   Avoid idling the engine for more than 10 minutes. Long periods of idling is harmful to engine.
9. Allow the engine to warm up at fast idling speed - until cooling system temperature is at least 60°C.
10. Release the parking brake.
11. Now the vehicle is ready for drive.

Stopping the Engine

After parking the vehicle in safe place.

1. Move gear shift lever to neutral position.
2. Apply parking brake.
3. Release the accelerator pedal.
4. Idle the engine for atleast one minute before shutdown. This protects turbocharger from getting damaged due to oil starvation and allows the engine to cool gradually.
5. Turn the ignition key to "ACC" position to stop the engine.
6. Turn the key to "LOCK" position. Still the steering wheel is unlocked.
7. Take out key from steering lock cum ignition switch. Slightly turn steering wheel clockwise or anti clockwise (max. 180°), till click sound is heard, to make sure that steering wheel is locked.
8. While parking the vehicle on a slope, place wheel chokes to prevent vehicle rolling.

Gear lever knob

Driving, gear shifting, braking

The vehicle should not be driven until the air pressure gauge indicates a minimum pressure of 5.6 bar. Ensure that the parking brake valve is in released position.

We recommend that the vehicle should always be started in 1st gear only. The engaging positions for various gears are shown on the gear lever knob.

The vehicle is fitted with synchromesh gear box, double de-clutching is not required while shifting the gear. Clutch must be completely disengaged before shifting the gear. This will ensure longer life of synchronising cone.

The reverse gear should only be engaged when he vehicle has been brought to a complete stop. In case the gear shifting is not done properly, crash engagement will cause damage to the gears and the gear box.

When shifting transfer case gears for changing over from 4 x 2 into 4 x 4 operation and vice versa, it is necessary to bring the vehicle to a complete stop and main transmission brought to neutral.

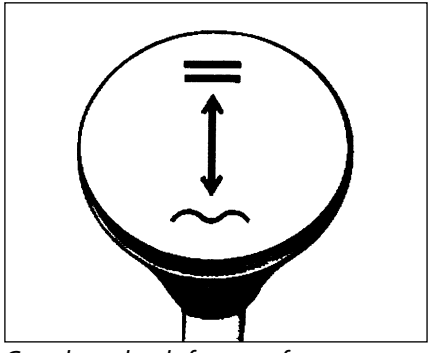
While driving, the left foot must not rest on the clutch pedal. This causes premature wear and tear of clutch lining.

Slowing down of the vehicle should be achieved by changing to next lower gear.

Watch the gauges on instrument panel every now and then while driving.

During running-in period observe speed and load limitations.

The engine design makes it possible to achieve a high output at an extremely low fuel consumption. The vehicle's economy of operation is however influenced considerably by the method of driving. The more evenly the vehicle is driven - the fewer changes of speed there are, the lower will be the fuel consumption. It is therefore advisable to maintain prevailing road and traffic conditions. One should, above all avoid accelerating to high speeds which can be maintained for a short time. The average speed is only insignificantly raised when the vehicle is driven at high speed for short periods.



Gear lever knob for transfer case

Highway 4x2

Off highway 4x4

Erratic driving saves little or no time ; on the other hand it only results in high fuel and oil consumption.

While driving, the foot brakes should be used only when the vehicle is to be brought to a stop. Brakes should not be applied too violently on a slippery road, since the vehicle will then start skidding.

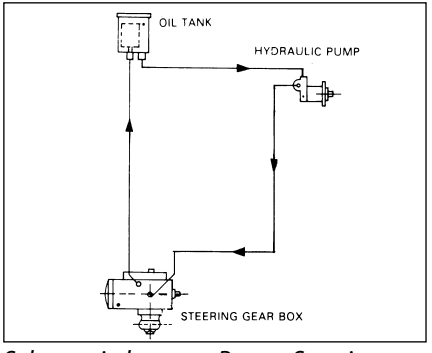
If the brake pedal can be pushed down too close to the toe-board, release it and actuate it twice in rapid succession to pump more brake fluid into the system. However get this defect immediately rectified.

The braking efficiency of the vehicle depends upon the load carried, road surface and the condition of the tyres. Brake application should be gradual, to avoid fast wear and tear of the brake drum, brake lining and tyres.

Generally, the parking brake is meant for use only as a parking brake and in an emergency. Tata vehicles are fitted with spring actuated pneumatic release parking brake arrangement acting on rear wheels.

Power steering

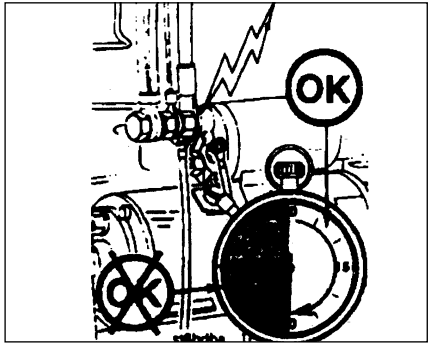
Power steering reduces driver's fatigue and hence ensures longer runs and safe driving.



Schematic layout - Power Steering

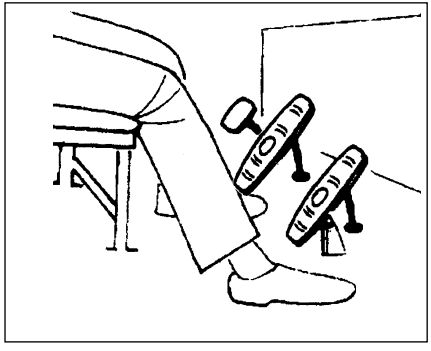
The schematic layout of power steering is shown in the sketch. The hydraulic power steering is of integral design, which ensures availability of power assistance without any time lag on little movement of the steering wheel.

In case of failure in the hydraulic system, it is possible to steer the vehicle with mechanical effort, but to avoid driving fatigue steer the vehicle to road side and arrange to attend to the defect.



Engaging starter motor

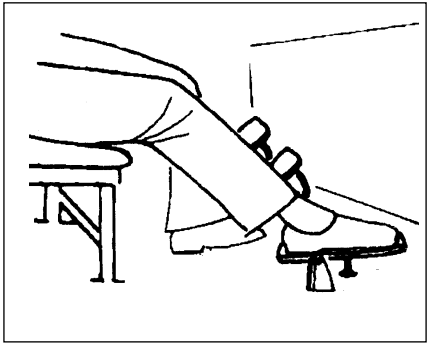
Do not engage starter motor for more than 30 seconds. Wait 2 minutes between each attempt to start.



Throttle position while cranking above 16°C ambient temperature

Foot off throttle

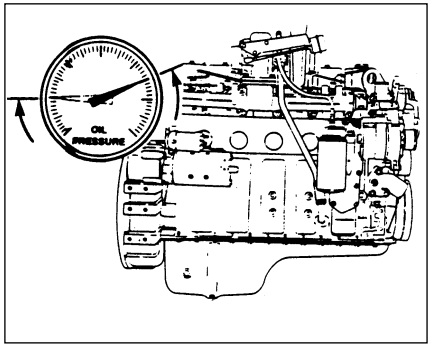
The pump has an internal starting circuit to provide starting fuel delivery.



Throttle position while cranking below 16°C ambient temperature

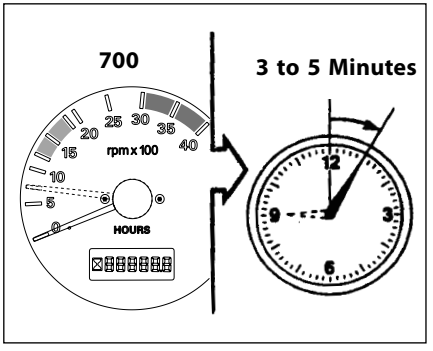
Foot at full throttle

The pump has an internal circuit to provide starting fuel delivery and open throttle helps keep the engine operating once started.



Engine oil pressure

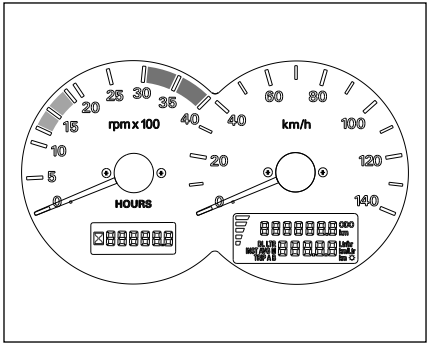
When starting a cold engine, bring the engine up to operating speed slowly, to allow the oil pressure to stabilize as the engine warms up.



Idling time

Idle the engine for 3 to 5 minutes before moving the vehicle.

Avoid idling the engine for more than 10 minutes. Long periods of idling may be harmful to your engine.



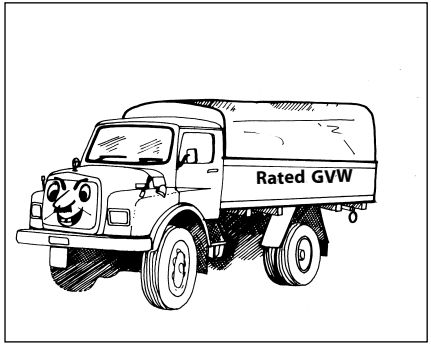
For optimum fuel efficiency operate the vehicle with engine RPM in green band at any speed.

Follow the operating procedures always for optimum performance.

Caution :

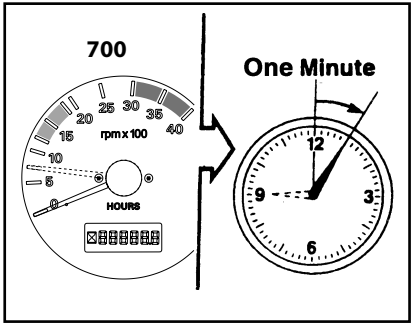
1. Cummins engines are designed to operate successfully at full throttle under transient conditions down to peak torque engine speed (RPM) This is consistent with recommended driving practices for good fuel economy. Excessive full throttle operation below peak torque RPM (peak torque RPM varies from 1,100 RPM to 1,600 RPM, depending upon rated engines speed) will shorten engine life to overhaul, can cause serious engine damage, and is considered engine abuse.

2. Operation of the engine below peak torque RPM can occur during gear shifting due to the difference of ratios between transmission gears, but engine operation must not be sustained more that 1 minute at full throttle below peak torque RPM.



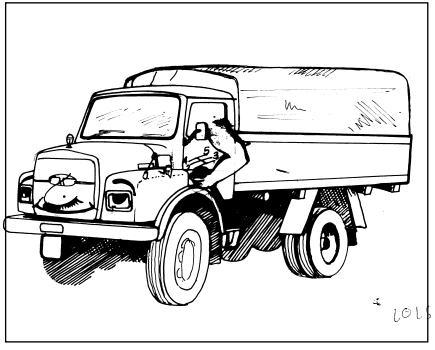
Loading the vehicle

Always load your vehicle within recommended gross vehicle weight.



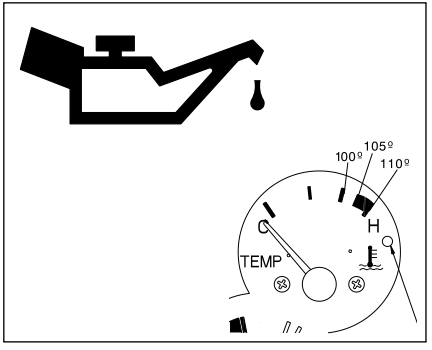
Warming up the engine

Always warm up the engine before placing under load.



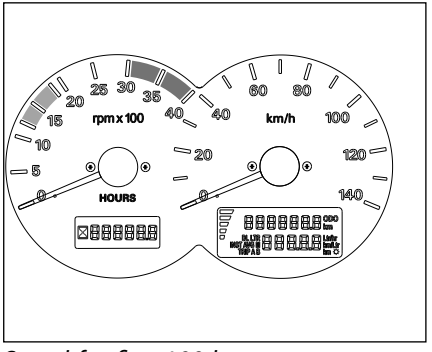
Gear Selection

Use the appropriate gear to prevent engine lugging.



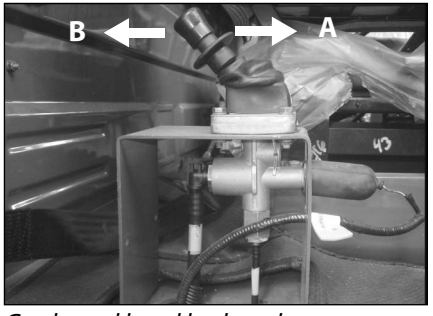
Oil pressure & coolant temperature

Observe lubricating oil pressure and coolant temperature at regular intervals. Shut of the engine if pressure or temperature does not meet the specifications.



Speed for first 100 km

For first 100 kms, do not exceed 40 kmph speed.



Graduated hand brake valve

A. Brake released
B. Brake applied
A to B Gradual application

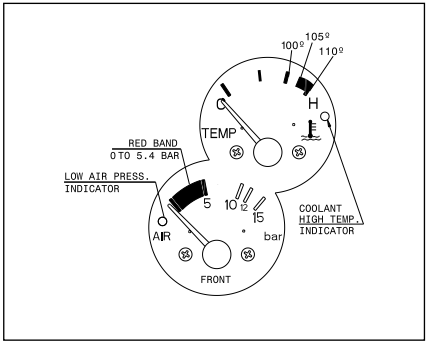
Driving

Before driving ensure the following :

1. *Release parking brake before moving the vehicle.*

   Do not move the vehicle before parking brake is completely released i.e. 'PARKING BRAKE' indicator light and beeper are off.

   Exhaust brake isolator switch is in 'OFF' position.

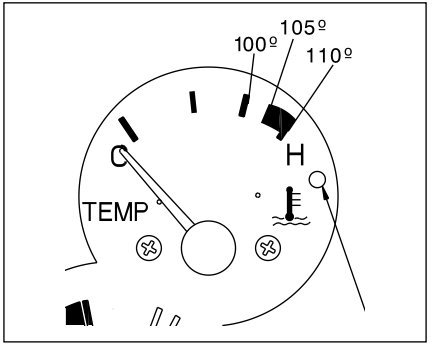


Air pressure gauge

2. *Always move the vehicle in first gear only, when starting from rest.*
3. *Minimum air pressure : 5.4 $\pm$ 0.5 bar in both front and rear circuits.*

   Cut out : 8.1 $\pm$ 0.2 bar

   Cut in : 6.9 bar



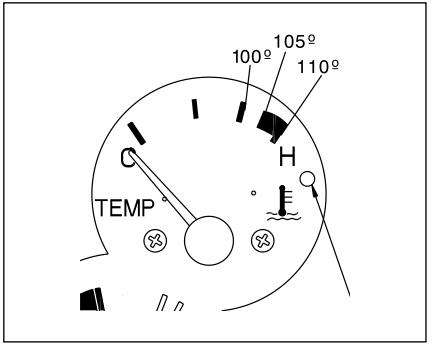
Preparing to drive

Engine coolant temperature is at least 60^0 C, before moving vehicle.

Start driving

Start driving

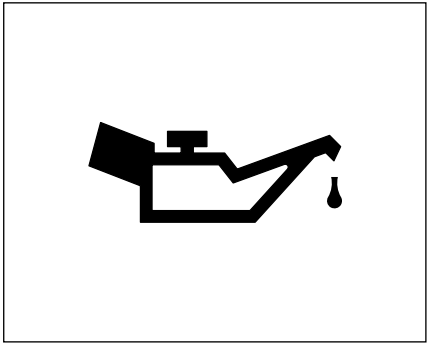
Always move the vehicle in first gear only, when starting from rest.



Temperature gauge

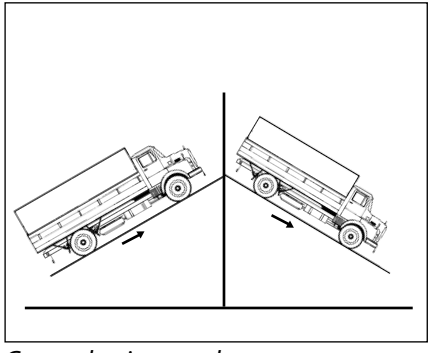
Coolant operating temperature

Continuous operation with low coolant temperature (below 60^0 C) or high coolant temperature (above 100^0 C) can damage the engine.



Engine oil pressure indicator

Do not operate the engine when the oil pressure indicator glows.

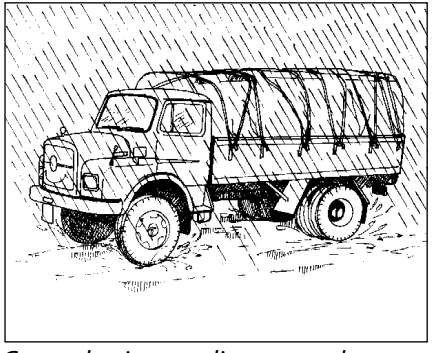


Gear selection on slope

Gear selection on slope

Use same gear selection when ascending and descending the same slope.

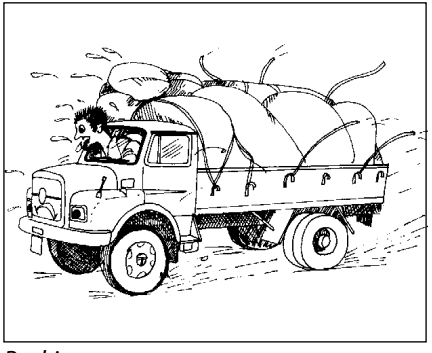
Caution : Operating the engine beyond high idle speed can cause severe engine damage. When descending a steep grade, use a combination of transmission gears and engine or service brakes to control the vehicle and engine speed.



Gear selection on slippery road

Gear selection on slippery road

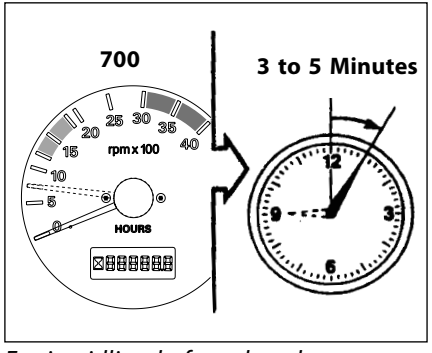
Use lower gear and brake cautiously on wet and slippery roads.



Braking

Braking

Do not resort to panic braking.



Engine idling before shut down

Engine idling before shut down

Idle the engine a few (3-5) minutes before shut down. This allows the engine and turbocharger to cool gradually and uniformly.

Engine exhaust brake

Exhaust brake operation is coupled with service brake. Exhaust brake air cylinder solenoid valve is coupled with service brake pedal operation through stop light switch. An electric isolator (piano type) switch is provided in the dashboard for making the exhaust brake inoperative where required.

On depressing brake pedal the stop light switch comes into operation which passes on electrical signal to solenoid valve on air cylinder. The solenoid valve opens allowing the compressed air from system protection valve to operate air cylinder thus operating the exhaust brake.

When the brake pedal is released, the stop light switch is put off, thus closing the solenoid valve, the air supply is cut off and exhaust brake cylinder spindle retracts allowing the engine to run normally.

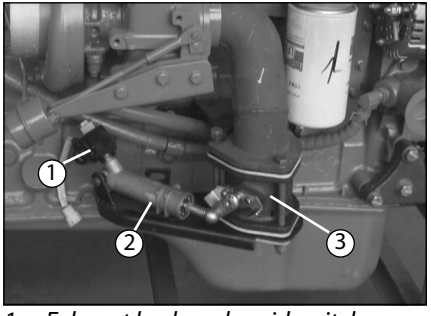
Isolator switch (Exhaust brake)

In certain situations like starting of vehicle on an upgradient, simultaneous acceleration and partial braking of vehicle are required. Isolator switch can be used to cut off electrical supply to air cylinder solenoid by putting in “OFF” position. Isolator switch should be put on (engaged), as soon as isolation requirement is over.

When the brake pedal is released, the stop light switch is put off, thus closing the solenoid valve, the air supply is cut off and exhaust brake cylinder spindle retracts allowing the engine to run normally.

Operation of engine exhaust brake

Every time you apply brake, the engine exhaust brake comes into play. When the brake pedal is depressed, for operating the dual brake valve of the service brakes, simultaneously the stop light comes in operation, and a signal is passed on to solenoid valve, the solenoid valve opens letting



1. *Exhaust brake solenoid switch*
2. *Exhaust brake air cylinder*
3. *Butterfly valve housing*

compressed air into the exhaust brake cylinder. This operates the butterfly valve in the exhaust system and applies the exhaust brake. During this operation, since the accelerator pedal is in idling position and the exhaust opening is restricted, the road wheel will drive the engine, which will act as a compressor (resistor), thus retarding the vehicle speed without in any way being detrimental to the engine/ vehicle. The use of engine exhaust

brake results in increased life of service brake linings and drums.

When the brake pedal is released, the stop light switch is put off, thus closing the solenoid valve, the air supply is cut off and exhaust brake cylinder spindle retracts allowing the engine to run normally.

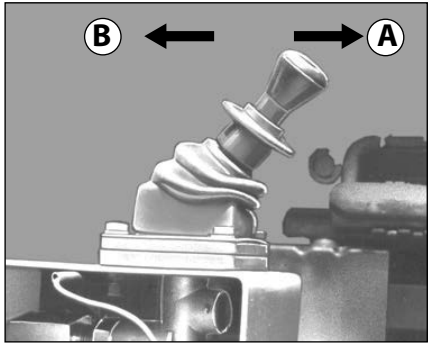
Operating instructions :

1. Ensure air pressure in the tank is above 5 bar.
2. Change to lower gear which is appropriate to road conditions. The engine exhaust brake is very effective below the vehicle speed of 40 kmph.
3. Do not depress the clutch as this would render the exhaust brake ineffective.
4. Press brake pedal fully when the vehicle is to be brought to a stop. For parking the vehicle engage hand brake and low gear.

Lubricating the exhaust brake linkages.

1. The exhaust brake requires a minimum of service.

   Every 9,000 km. a few drops of oil should be applied to the ball pins of outer linkages and friction surfaces.
2. The butterfly valve shaft, which is made of heat resistant material, should not be lubricated since the lube oil would cause seizing of the butterfly valve in the exhaust manifold.



Graduated handbrake valve

A. - Brake released

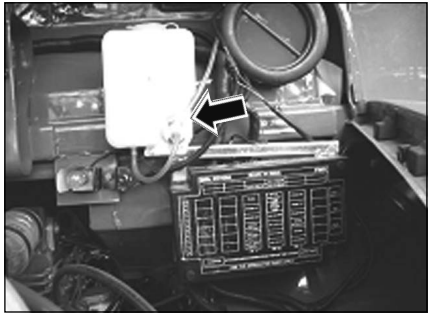
B. - Brake applied

A to B - Gradual application

Graduated type Hand brake

Hand brake system installed on this vehicle consist of two spring brake chambers mounted on the chassis frame cross member and are connected to the parking brake shafts on the rear axle through short linkages. Each spring brake chamber houses helical compression spring and a piston with push rod. The helical compression springs are normally kept compressed (and hence the parking brake is in 'OFF' position) by air pressure from the vehicle compressed air system.

The air supplied to the spring brake chamber is controlled by a graduated pneumatic hand brake valve which is mounted at the right side of driver's seat and can be conveniently operated by the driver. When the hand brake valve is operated, air pressure in the spring brake chambers is gradually vented to the atmosphere and the hand brake is progressively applied by the tension of the helical springs. This valve can also be conveniently used along with isolator valve (exhaust brake) for starting the vehicle on upgradient.



Winds shield washer container

Windscreen Washer

Windscreen washer fitted on this vehicle operates on a 24 Volt electrical system. When windscreen washer switch is pressed, electric motor pumps the water from the water container and throws on the windscreen through two jets provided in front of the windscreen.

Same time, wiper should be operated to clean windscreen. These jets can be adjusted.

Following precautions should be observed.

- Do not use soap solution.
- In cold climates, use anti-freeze to prevent ice formation.
- Do not run the motor when there is no water in container.

Following precautions should be observed .

Check and top up water regularly.

Operation in hilly terrain

The steering linkages and brakes are to be kept in order. Proper gears should be used during climbing or descending, while negotiating down hill gradients. This will relieve driver of fatigue and will increase the life of tyres, brake linings and brake drums. It also reduces fuel consumption.

Engine should not be disengaged or switched off while descending on the down hill gradients.

Diesel oil and hydraulic brake fluids, both being hygroscopic, will absorb moisture from atmosphere. Hence special care should be taken as follows:

1. Drain air tank every week to remove condensed water.
2. Drain water from water separator cum filter by unscrewing the knob.
3. The vehicle should be greased at frequent intervals to prevent formation of rust on the exposed surfaces. The servicing of the vehicle and maintenance of the vehicle should be done exactly as given in this Operator's Service Book, except the changes indicated above.

Operation in sand terrain

The following precautions to be taken while operating in SAND TERRAIN.

1. Make sure that vehicle is fitted with SAND TYRE.
2. Adjust the tyre pressures as specified.
3. Always drive vehicle in 4 x 4 mode when operating in sandy terrain.
4. Engage transfer case in 4 x 4 mode well in advance before entering the sandy terrain.
5. Do not use the lower gears than absolutely necessary on loose sandy stretch. When you see a sandy stretch, try to be in a 2nd or even in 3rd gear before actually reaching it.
6. Approach gradient with speed. Momentum helps in gradability. Select appropriate gear in advance.
7. Avoid abrupt changes in speed and direction while operating on sand.

Lubricating Oil Recommendations/ Specifications

Oil Performance Recommendations
The use of quality engine lubricating oils combined with appropriate oil drain and filter change intervals are critical factors in maintaining engine performance and durability.

The use of high quality SAE 15W40 heavy duty engine oil which meets the American Petroleum Institute (API) performance classification CF4+ and MB 228.1 specifications is recommended.

Note : CC/CD or CD/SF engine oils can be used in areas where API CF4+ *and MB 228.1 oil is not yet available, but the oil change interval must be reduced to one half the interval given in the maintenance schedule.*

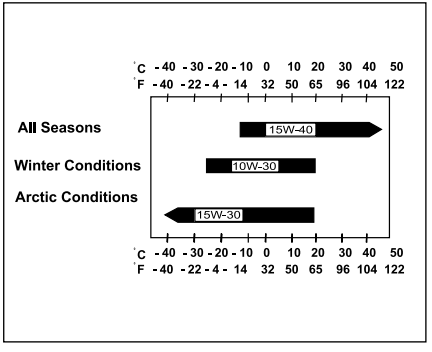
A sulphated ash limit of 1.0 mass percent is suggested for optimum valve and piston deposit and oil consumption control. The sulphated ash must not exceed 1.85 mass percent.

Oil Viscosity Recommendations

The use of multi-viscosity lubricating oil has been found to improve oil consumption control and improve engine cranking in cold temperatures while maintaining lubrication at high operating temperatures.

While 15W40 oil is recommended for most climates, refer to the accompanying table for oil viscosity recommendations for extreme climates.

Note : *Limited use of low viscosity oils, such at 10W-30 may be used for easier starting and providing sufficient oil flow at ambient temperatures below - 5°C. However, continuous use of low viscosity oils can decrease engine life due to wear*



Ambient temperature & oil viscosity

Coolant Recommendations/ Specifications

- **Antifreeze is essential in any climate.**

It broadens the operating temperature range by lowering the coolant freezing point and by raising its boiling point. Do not use more than 50 percent antifreeze in the mixture unless additional freeze protection is required. **Never** use more than 68 percent antifreeze under any condition.

Use soft water in the Coolant mixture. Contaminants in hard water neutralise the corrosion inhibitor components. Water **must not** exceed 300 ppm hardness or contain more than 100 ppm of either chloride or sulphate.

- **Specifications - Use low silicate antifreeze which meets ASTM 4985 test (GM 6038 M spec.) criteria.**

Concentration - Antifreeze must be used in any climate for both freeze and boiling point protection.

Use a 50 percent concentration level of ethylene glycol or propylene glycol in most climates. Antifreeze at 68 percent concentration provides the maximum freeze protection and must never be exceeded under nay condition. Antifreeze protection decreases above 68 percent.

Ethylene Glycol	Propylene Glycol
50% = -37 ^{0}C	50% = - 33 ^{0}C
60% = - 54 ^{0}C	60% = - 49 ^{0}C
68% = - 71 ^{0}C	68% = - 63 ^{0}C

Concentration Testing - Antifreeze concentration must be checked using a refractometer (such as Fleetguard Part No. CC 2800).

Recommended antifreeze brands

1. Servo Cool (IOC)
2. Long life coolant (CASTROL)
3. Golden Cruiser 1200 (Sunstar industries Ltd.)
4. Koolgard (HPCL)
5. Purocool (Ansysco)

Fuel Recommendations/ Specifications

Warning : Do not mix gasoline or alcohol with diesel fuel. This mixture can cause an explosion.

Caution : Due to the precise tolerance of diesel injection systems, it is extremely important that the fuel be kept clean and free of dirt or water. Dirt or water in the system can cause severe damage to both the injection pump and the injection nozzles.

Use ASTM No. 2D fuel with a minimum Cetane number of 40. No. 2 diesel fuel gives the best economy and performance under most operating conditions. Fuels with Cetane numbers higher than 40 may be needed in high altitudes or extremely low ambient temperatures to prevent misfires and excessive smoke.

At operating temperatures below 0^0C, use a blend of No. 1D and No. 2D fuels, also known as "winterized" No. 2D

Note : *No. 1 D fuel can be used, however, fuel economy will suffer.*

Use low sulphur content fuel having a cloud point that is at least 10 degrees below the lowest expected fuel temperature. Cloud point is the temperature at which wax crystals begin to form in diesel fuel.

The viscosity of the fuel must be kept above 1.0 centistokes to provide adequate fuel system lubrication at 40^0C.

Oil for live front axle and rear axle

Recommended oil : Use multigrade oil conforming to SAE 85W90-140 grade and API-GL5 Specifications.

Live front axle and rear axle

Change the Multigrade oil at first 9,000 km, then at 36,000 km and thereafter at every 36, 000 km.

Note : Monograde oils conforming to SAE 90 grade and API GL5 specifications can be used in areas where above mentioned Multigrade oils are not yet available but the oil should be changed at first 9,000 km then at 18,000 km and there after at every 18,000 km.

Recommended Oils and Lubricants

TO BE USED FOR	GRADE/ SPECIFICATION	Brand endorsed by Tata Motors	
		CASTROL	TATA BP
ENGINE : Tata Cummins (Engine oils conforming to API CF4+ & MB 228.1 specifications.)	SAE 15W-40	Castrol RX Super plus 15W-40	Vanellua CA Multigrade 15W 40

TO BE USED FOR	GRADE/ SPECIFICATION	BHARAT PETROLEUM	HP	CASTROL	INDIAN OIL	TIDE WATER (VEEDOL)	CHEMOLEUMS	TATA BP	GULF OIL
SYNCHROMESH GEAR BOX	SAE 85W 90	Bharat Spirol 80 W EP	HP gear oil EP 80	Castrol Hypoy 80 EP Light	Servo Gear HP 80 W	Veedol Multigear 80	Chemoleums Universal Thubol SAE 80 W	TATA BP Hyper Gear oil 80 W	Gulf EP Gear Oil 80 W
REAR AXLE LIVE FRONT AXLE (With Multigrade oil) ♦	SAE 85W 140	Bharat Spirol HD 85W 140	HP Gear Oil XP 85W 140	Castrol EPX Multigrade Oil 85W 140	Servo Gear Super 85W 140T	Veedol Multigear 85W 140HD	TURBO GL5 SAE 85W 140		GULF MPGO 85W 140
REAR AXLE LIVE FRONT AXLE (With Monograde oil) ◆	SAE 85W 140	Bharat Spirol HD 90	HP Gear Oil XP 90	Castrol Hypoy B	Servo Gear Super 90	Veedol MG 90 HD	Chemoleums Multipurpose Thubol SAE 90	TATA BP Hypo Gear oil 90	GULF MP Gear oil 90
AUXILIARY GEAR BOX		Bharat Spirol 90 EP	HP Gear Oil EP 90		Servo Gear HP 90		Chemoleums Universal Thubol SAE 90		Gulf EP Gear oil 90
BRAKES AND CLUTCH HYDRAULIC SYSTEM			HP Super Duty brake fluid	Castrol Universal brake fluid (crimson)	Servo brake fluid Super HD				
WHEEL BEARINGS	RR3 Grease	Bharat Univex-A Grease	HP Multi-purpose Grease 2	Castrol AP Grease (Con-sistency No. 2)	Servo Grease MP	Veedol AP-2 Grease		Energrease LS 2 Mul-tipurpose Grease	Gulf Mul-tipurpose Grease 2

♦ = Oil change frequency is 36000 km for Multigrade oil.

◆ = Oil change frequency is 18000 km for monograde oil.

Recommended Oils and Lubricants

TO BE USED FOR	GRADE/ SPECIFICATION	BHARAT PETROLEUM	HP	CASTROL	INDIAN OIL	TIDE WATER (VEEDOL)	CHEMOLEUMS	TATA BP	GULF OIL
CHASSIS Spring shackles and pivots. Propeller shaft U-joints and sliding yoke. Steering linkages. king pin bushes. Pedal bushes. Gear shift linkages.	Lithium MP	Bharat Univex-A Grease	HP Multipurpose Grease 2	Castrol AP Grease (Consistency No. 2)	Servo Grease MP	Veedol AP-2 Grease		Energrease LS 2 Multipurpose Grease	Gulf Multipurpose Grease 2
LEAF SPRINGS			HP Graphite Grease-50						
HYDRAULIC / EQUIPMENT JACK		Bharat Hydrol 46 or 68	Turbinol 46 or 68 Enklo 46 or 68	Hyspin VG 46 or 68	Servo System 46 or 68	Aturbio 46 or 68		TATA BP Hydraulic oil 46	
CLUTCH (a) Clutch release bearing sleeve. Release fork Support bearing	RR3 Grease		HP MP Grease 2		Servo Grease MP 2				
(b) Felt pad of clutch release bearing if fitted.	Lubricate with engine oil by using oil can.								
BRAKE PNEUMATIC EQUIPMENT		Bharat Univrex-A Grease	HP Multipurpose Grease 2	Castrol AP Grease (Consistency No. 2)	Servo Grease MP	Veedol AP-2 Grease			
POWER STEERING SYSTEM		Bharat Automatic Transmission Fluid A	HP Automatic Transmission Fluid A	Castrol TQ Automatic Transmission Fluid	Servo Transmission Fluid A	Veedol Multigear SM Oil	Chemoleums TQA Gear oil	TATA BP Autran GM-MP	

Regular Maintenance

The maintenance schedule given in this book is meant for vehicles operating under normal conditions. For severe operating conditions (tipper / off the road / short route / city applications) certain operations (e.g. maintenance of air filter, replacing engine oil & oil filter and clutch & brake system maintenance & adjustment etc.) may have to be carried out more frequently and certain other operations may have to be introduced based on your own experience.

In severe operating conditions, the engine is in operation ever when the vehicle is stationery (e. g. tipper) As such the 9,000 km regular service is to be carried out at every 250 operational hours or 9,000 km whichever is earlier.

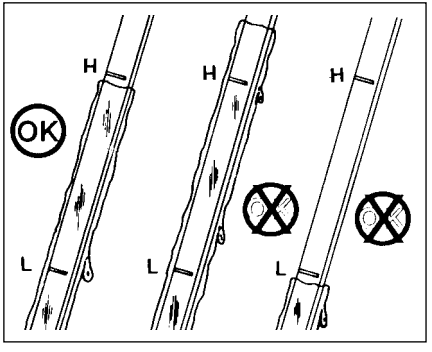
The maintenance work to be performed during these services (listed in the enclosed service scheduled chart) are to be carried out at any one of Tata Motors authorised workshops / service stations at the prescribed km. / hours

The details of operations (listed in the enclosed service scheduled chart) to be carried out daily and after every 1,000 km or prior to a long trip are to be attended by the driver / operator.

Engine oil level

Engine oil level

Before starting or at least 5 minute after the engine is shut down, check the oil level and top up if necessary. Never operate the engine with the oil level below the low mark or above the high mark.



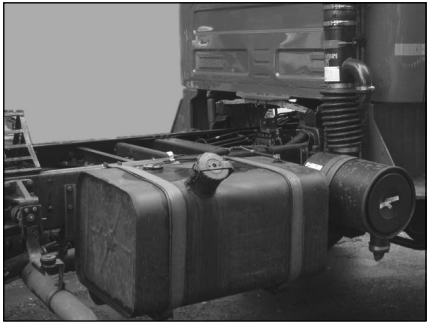
Markings on dipstick

Markings on dipstick

Low mark to high : 2 litres mark capacity

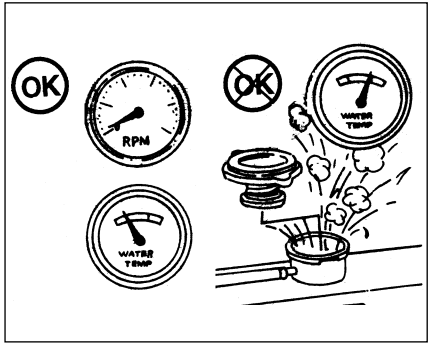
Fuel level

Check fuel level in the tank through fuel gauge with ignition key "ON" OR through dipstick provided on the fuel tank. Top up, if necessary and secure the cap.

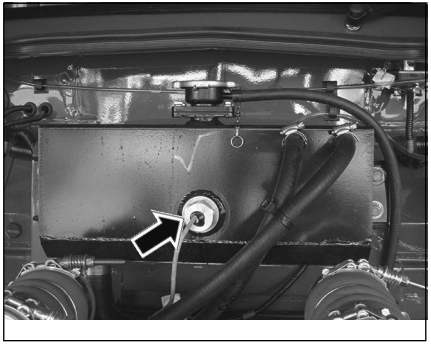


Fuel tank (SAK & SA 1212 TC/32)

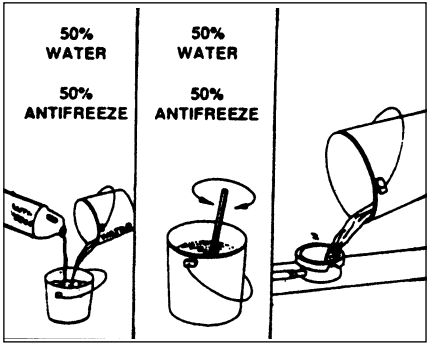
Fuel tank (SA 1212C/42)



Removing radiator cap



Coolant level sensor



Coolant mixture

Coolant level

Remove the radiator cap when the coolant is cold (below 50 ^{0}C). Failure to do so can result in personal injury. Check coolant level. Top up, if necessary.

Coolant level indicator

Electrically connected float unit is fitted on auxiliary tank. Spring loaded piano switch is fitted on the instrument panel also an indicator lamp is incorporated in the panel along with other warning indicators. With the ignition "ON" by pressing the coolant level switch, the indicator lamp glows, which denotes the electrical circuit is complete. Whenever the coolant level falls below the safe level (MIN) the float inside the tank goes down closing the electrical circuit and also coolant level indicator glows.

NOTE: If the coolant level indicator glows while driving stop the vehicle check for the leakage and take it to the nearest dealer point for rectification.

Coolant mixture

Coolant 50% Water
50 % Ethylene glycol (anti freeze)

Note : *Percentage of water and antifreeze varies with range of ambient temperature.*

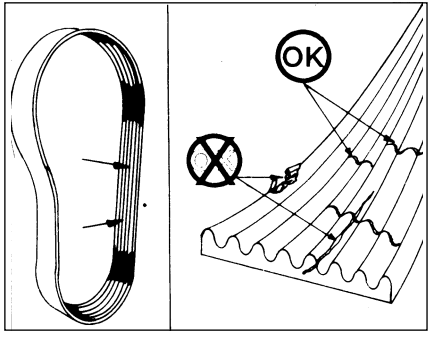
Fill slowly to prevent air lock.

Viscous Fan

Fan

Rotate the crankshaft and visually inspect the fan for

- Cracks
- Proper mounting



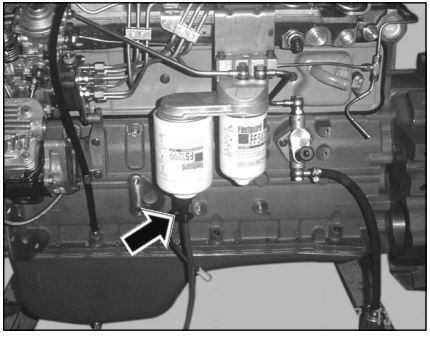
Drive belt

Drive belt

Replace fan if damaged.

Visually inspect the belt.

Replace the belt, if it is frayed or pieces of material missing or longitudinal cracks intersect with transverse cracks.



Water separator

Open the drain valve by 1.5 to 2 turns, and drain the water until clear fuel is visible. Close the drain valve. Do not over tighten.

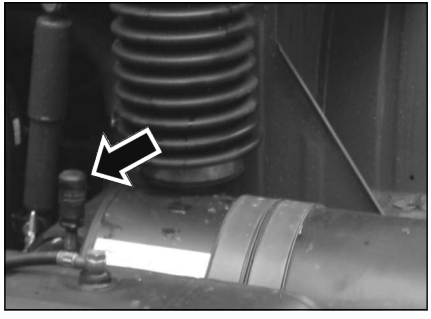
Caution : Excessive draining will introduce air into system causing the engine hard starting.

Air intake system

Air intake system

Inspect inter-cooler, intake piping, hoses for cracks & damage.

Check tightness of all hoses and pipe clamps.



Service indicator check

Replace damaged hoses and tighten the loose clamps.

Never operate the engine without an air cleaner or with damaged intake hoses or clamps in loose condition.

Service indicator

Check the air cleaner service indicator.

Reset the red band, if it is in raised position. Operate the engine at max rpm / load to check if the red band raises again in the window which indicates intake restriction.

Air filter change

Change the primary filter element when the red flag in the service indicator raises again in the window because of the intake resistance.

Note : *The secondary filter is to be changed after replacement of primary filter thrice.*

Charge air cooler

Inspection

If the engine experience a turbocharger failure or any other occasion where oil or debris is put into the CAC the CAC must be cleaned.

Remove the CAC from the vehicle.

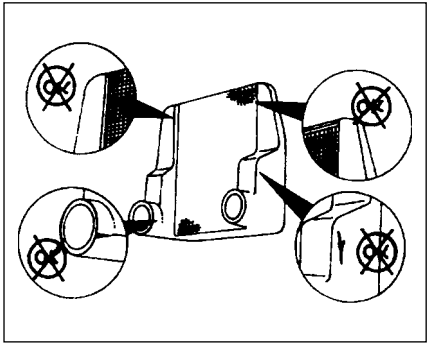
Visually inspect the CAC for cracks, holes or damage.

Inspect the tubes, fins and welds for tears, breaks or other damage.

Cleaning

Flush the CAC internally with solvent in the opposite direction of normal air flow. Shake the CAC and lightly tap on the end tanks with a rubber mallet to dislodge trapped debris. Continue flushing until all debris or oil is removed.

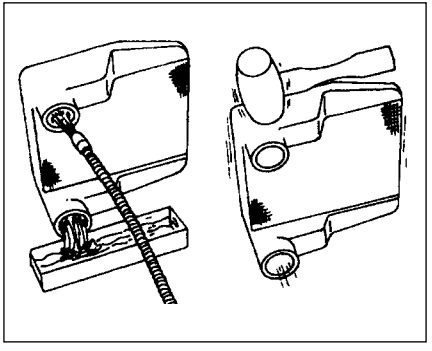
Caution : *Do not use caustic cleaners to clean the CAC. Damage to the CAC will result.*



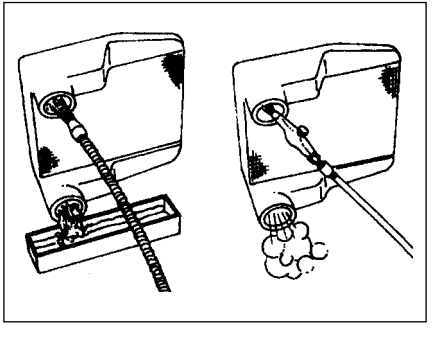
Charge Air Cooler

After the CAC has been thoroughly cleaned of all oil and debris with solvent, wash the CAC internally with hot soapy water to remove the remaining solvent. Rinse thoroughly with clean water.

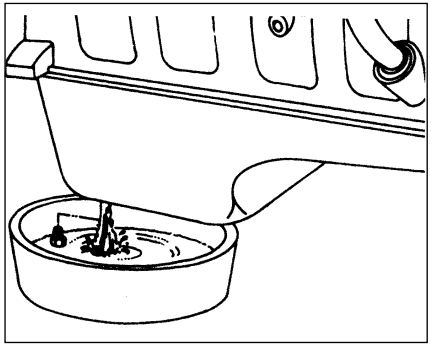
Blow compressed air into the CAC in the opposite direction of normal air flow until the CAC is dry internally.



Cleaning with solvent



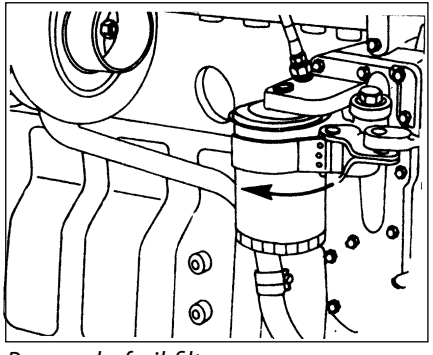
Cleaning with hot water/compress air



Oil drain

Engine oil & filter change

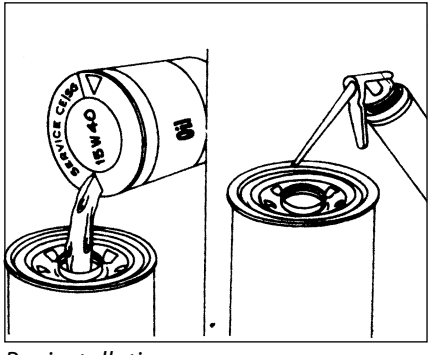
Warm up the engine. Remove the drain plug and allow the oil to drain. A drain pan with a capacity of 20 litres will be adequate.



Removal of oil filter

Removal of oil filter

Clean around the filter head, remove the oil filter and clean the gasket surface.

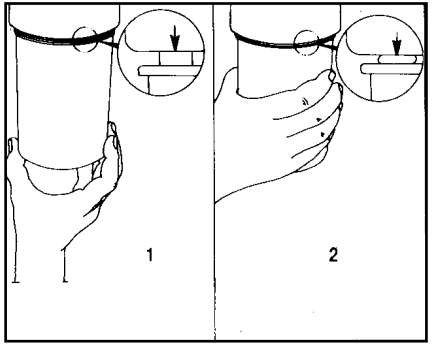


Pre installation

Pre installation

Fill the new filter with clean lubricating oil.

Apply a light film of lubricating oil to the gasket sealing surface before installing the filters.

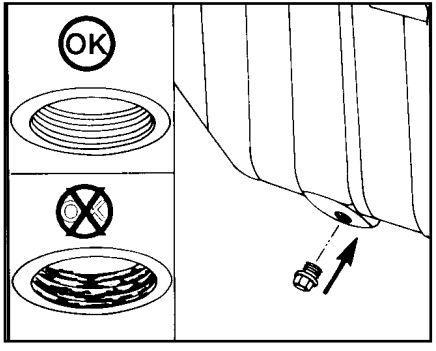


Installation of oil filter

Installation of oil filter

Install the filter and tighten it 1/2 turn after its seal contacts the seal head.

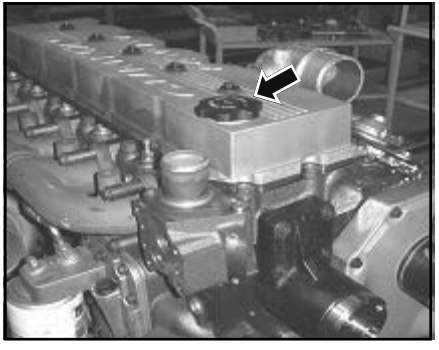
Caution : Mechanical over-tightening may distort the threads or damage the filter element seal.



Oil drain plug

Oil drain plug

Install the oil drain plug and **tighten to 8 mkg.**



Engine oil filler cap

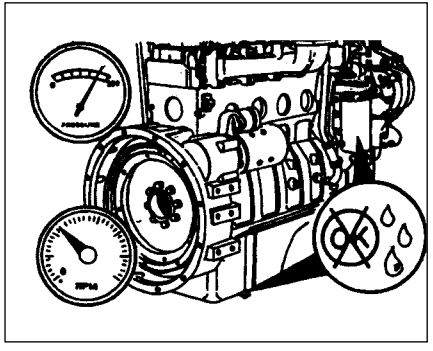
Filling the engine oil

Fill the engine with the clean oil to the proper level.

Sump capacity : 15.3 litres (Max)
13.3 litres (Min)

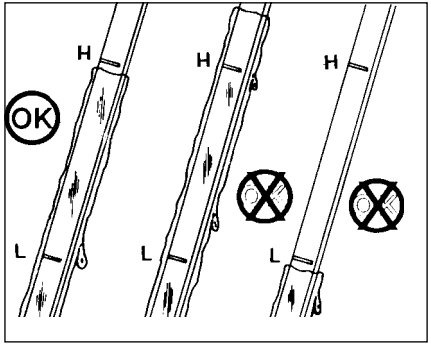
Recommended oil

For ambient temperature upto -10^{O}C and above use SAE 15W40 oil conforming API CF4+ and MB 228.1 specifications.



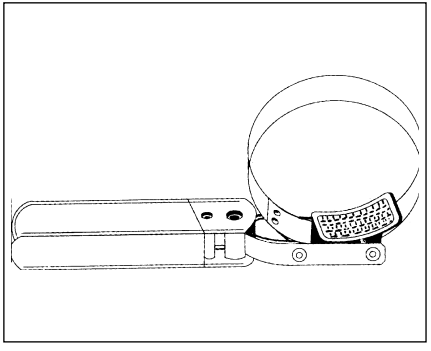
Inspection

Operate the engine at idle and inspect for leaks at the filter and drain plug.



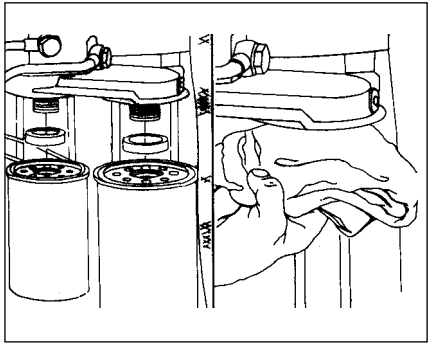
Checking engine oil level

Shut the engine off and check the oil level with the dipstick. Allow 5 minutes for oil to drain into oil sump before checking.



Filter wrench

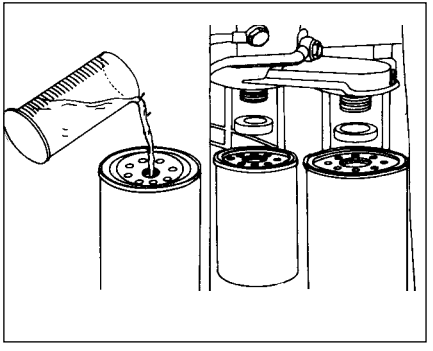
Note: *For removal and installation of engine oil filters / fuel filters use filter wrench part No. 2751 5890 18 05 N.*



Removal

Replacing fuel filters

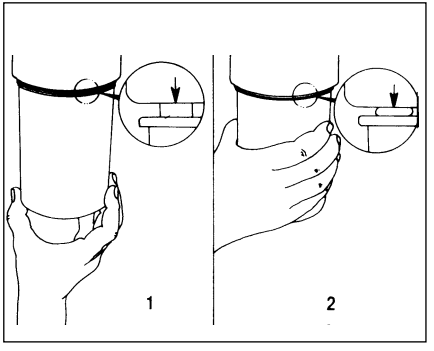
Remove the two filters from the dual filter adapter. Clean the gasket surface of the filter head. Replace the 'O' ring.



Pre-installation

Fill the new filters with clean fuel. Lubricate the 'O' ring seal with clean lubricating oil.

Install the filters and tighten them 1/2 turn further after its seal contacts the filter head.



Installation

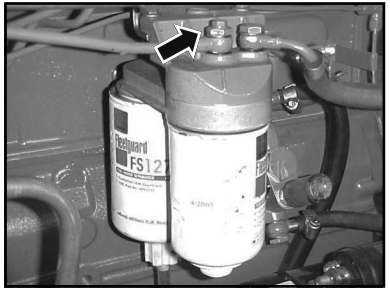
Caution : *Over-tightening may distort threads or damage the filter element seal.*

Bleeding Fuel System

Controlled venting is provided at the injection pump through the fuel drain manifold. Small amounts of air introduced by changing the filters or injection pump supply line will be vented automatically. If the fuel filter is changed in accordance with the instructions, no manual bleeding of fuel lines is required.

Note : Manual bleeding is required if

- *The fuel filter is not filled prior to installation.*
- *Injection pump is replaced*
- *High pressure fuel line connection are loosened or lines replaced.*
- *Initial engine start up or start up after an extended period of no engine operation.*
- *Vehicle fuel tank has run empty.*



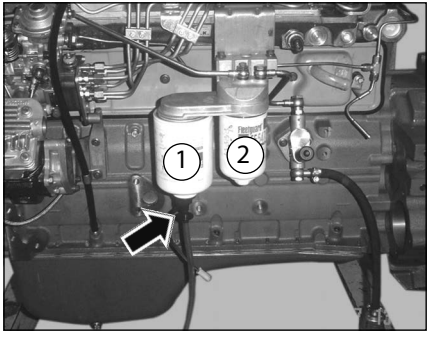
Fuel bleeding screw on fuel filter

Bleeding the fuel system

Fuel system need bleeding after replacement of filters during maintenance/repair or when the tank run dry.

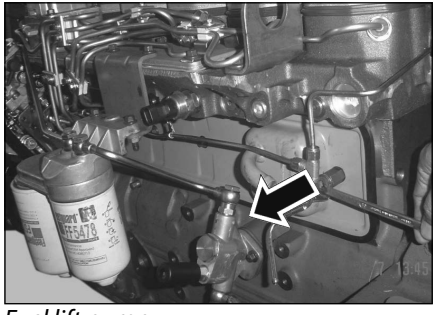
Procedure to bleed the system :

Operate the feed pump plunger "B" till fuel pressure is felt. Slightly open the bleeding screw "A" on the fuel

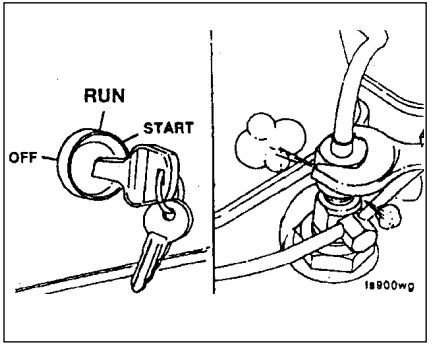


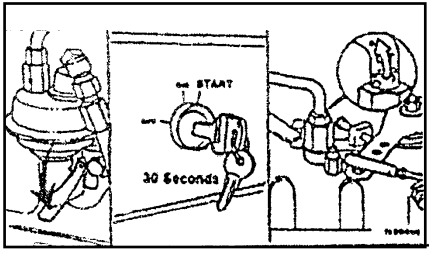
1 Primary fuel filter with water separator
2 Secondary fuel filter

filter head. Continue to operate the feed pump priming plunger till clean fuel free from air bubbles flows from the bleeding screw. Then, tighten the bleeding screw. Torque value = 0.8mkg If air bubbles start appearing on the bleeding screw or if air bubbles continue, either there is less fuel in the tank or there is leakage in the suction line (from tank to feed pump).



Fuel lift pump





I. Injection pump venting

Loosen the drain line outlet from the pump.

Operate the plunger, on the lift pump until the flowing from the fitting is free of air. Move the lever to the locked upward position.

II. High Pressure Line Venting

Warning : The pressure of the fuel HP line is sufficient to penetrate the skin and cause serious physical injury.

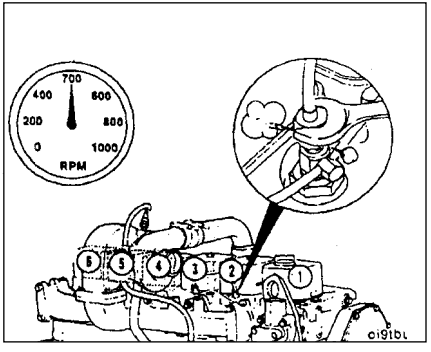
Venting is accomplished by loosening one fitting at a time at the injectors and cranking the engine to allow entrapped air to bleed from the lines.

The Cranking can be achieved by :

a) Using the starting motor

Caution : When using the starting motor to vent the system do not engage it for more than 30 seconds at a time: 2 minutes between engagements.

Warning: It is necessary to put the engine in "OFF" position. Because the engine can start, be sure to follow all the safety precautions. Use the normal engine starting procedure.



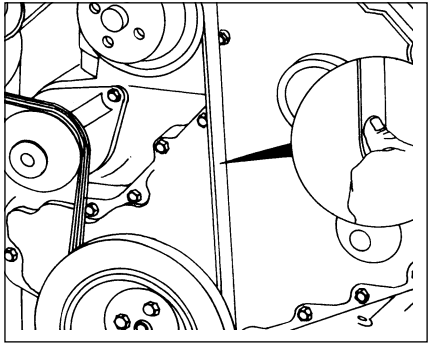
or (b) by starting the engine :

Warning : Do not bleed a hot engine as this could cause fuel to spill onto a hot exhaust manifold creating a danger of fire.

Start the engine and vent one line at the same time until the engine runs smoothly.

Re-tighten line fittings.

Torque Value = 2.4 mkg.



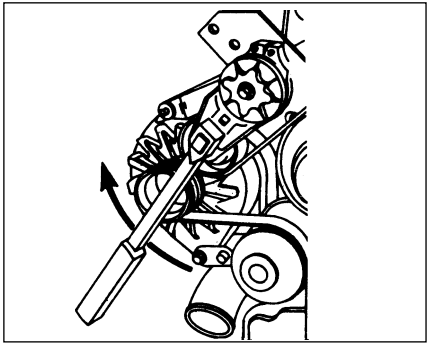
Drive belt tension

Drive belt tension

Measure the belt deflection with thumb pressure at the longest span of the belt.

Maximum deflection : 9.5 to 12.7 mm.

If the deflection exceeds the max limit, replace the belt.

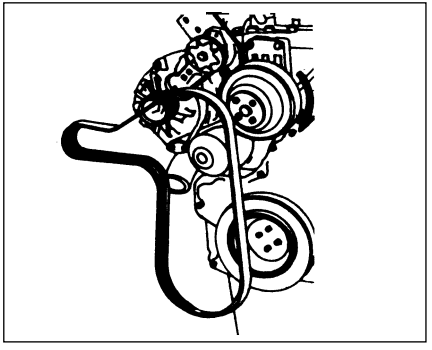


Tensioner bearing

Tensioner bearing

Pivot the belt tensioner away from the drive belt and remove the drive belt.

The tensioner pulley bearing should spin freely with no rough spots detected under hand pressure.

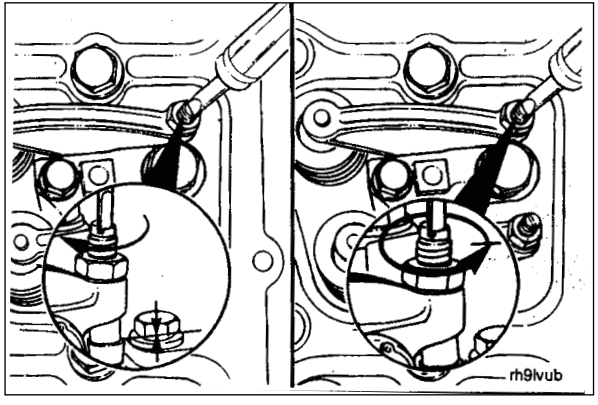


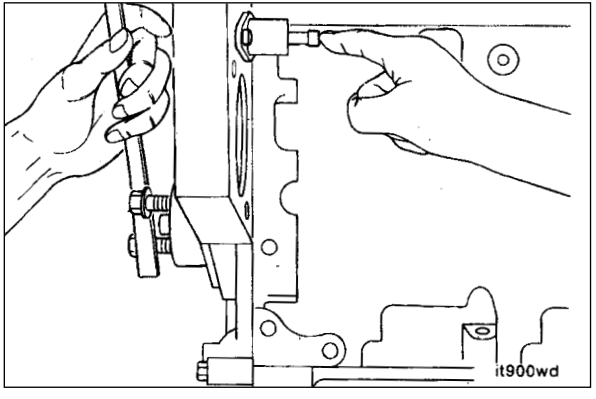
Fan hub

Fan hub

The fan hub should spin without excessive end play.

Install the drive belt. Lift the tensioner arm and pulley to install the drive belt.

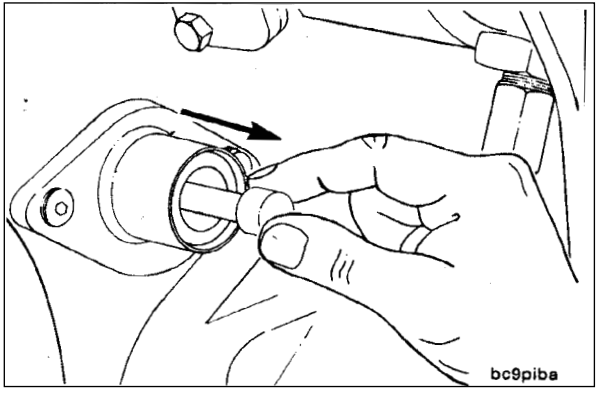




Valve Clearance - Adjustment

Turn the valve adjustment screws in until they touch the push rod sockets. Loosen them one full turn.
Locate TDC for Cylinder Number 1.

Disengage the timing pin.



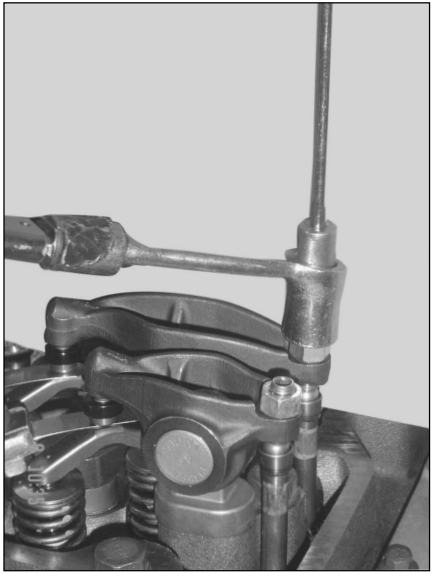
Valve Stem to Rocker Lever Clearance

Intake Valve	Exhaust Valve
0.254 mm	0.508

The clearance is correct when some resistance can be “felt” when the feeler gauge is pulled through the space between the valve stem and rocker lever.
Adjust the valves as indicated in the following illustrations. Tighten the lock-nuts and check the clearance again.

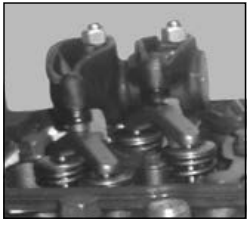
Torque Value : 24 N•m

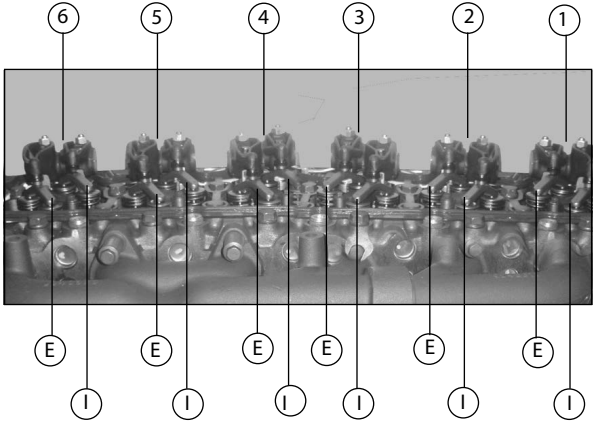
Caution : Perform step A of the valve set procedure with Cylinder No. 1 at TDC compression stroke (timing pin will engage).



Step A - Six Cylinder

	Valve	
Cylinder	**I = Intake**	**E = Exhaust**
1	*	*
2	*	#
3	#	*
4	*	#
5	#	*
6	#	#



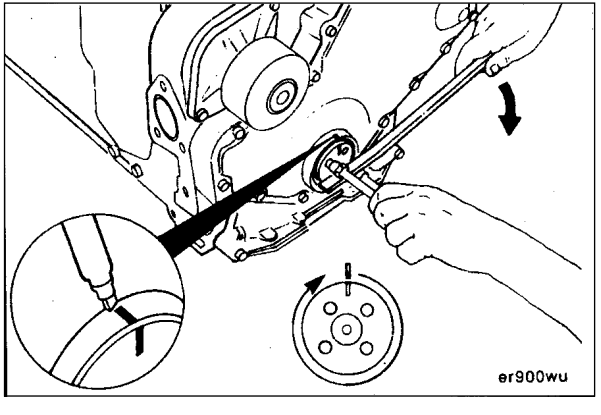


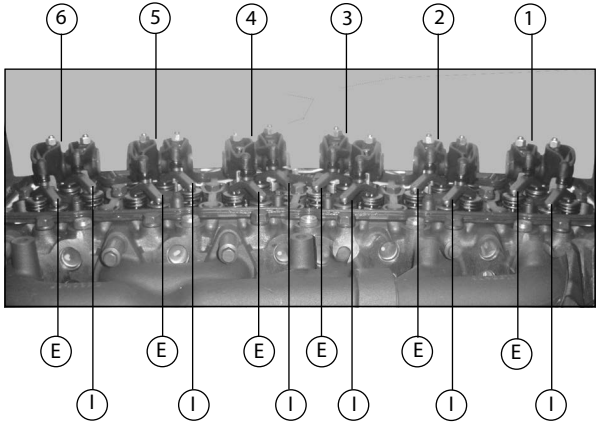
* = Set

\# = Do not Set

Perform Step B of the valve set procedure with Cylinder Number 1 at TDC plus 360 degrees (timing pin will not engage).

Mark the crankshaft and front cover. Rotate the Crankshaft one full turn.

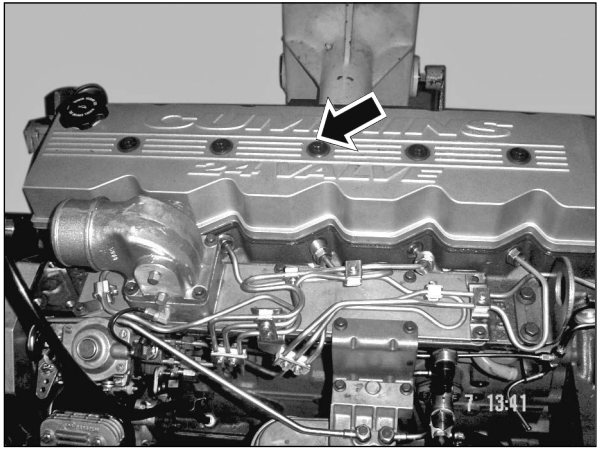




Step B - Six Cylinder Valve

Cylinder	I = Intake	E = Exhaust
1	#	#
2	#	*
3	*	#
4	#	*
5	*	#
6	*	*

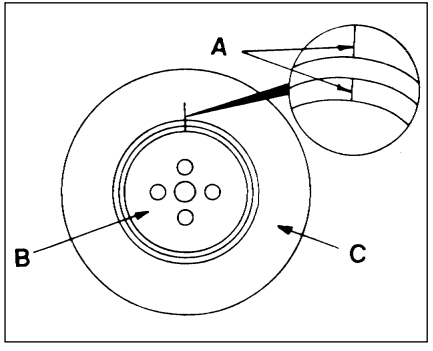
* = Set
# = Do not Set



Valve Covers - Installation

16 mm

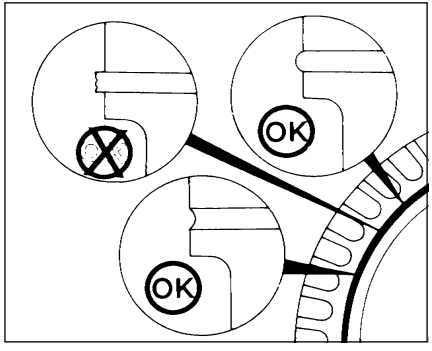
Assemble the gaskets, valve covers, Isolator vibration, Plain washer and special, cap-screws.



Vibration damper

Vibration damper

Check the index lines (A) on the damper hub (B) and the inertia member (C). If the lines are more than 1.59 mm out of alignment, replace the damper.



Inspecting rubber member

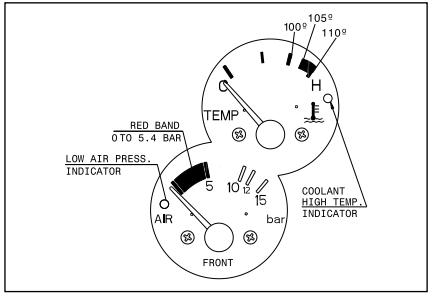
Inspecting rubber member

Inspect the rubber member for deterioration. If pieces of rubber are missing or if the elastic member is more than 3.18 mm below the metal surface, replace the damper.

Also look for forward movement of the damper ring on the hub. Replace the damper if any movement is detected.

Battery

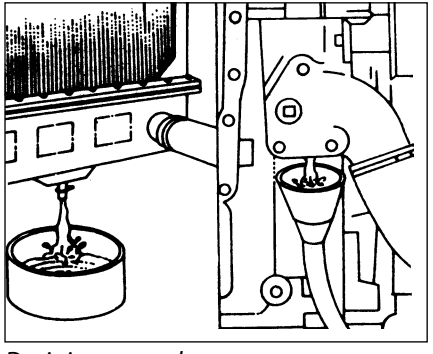
Check battery cells with cell tester. Also check specific gravity of electrolyte and if necessary, attend to it.



Coolant draining

Cleaning of Cooling system

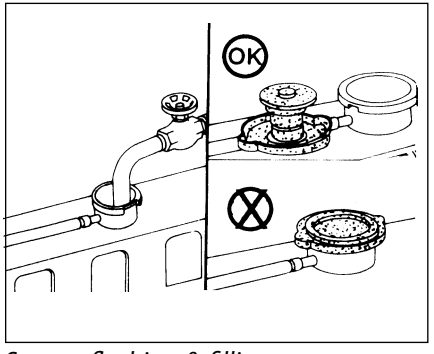
Wait until the temperature falls below 50^{O}C before draining.



Draining procedure

Draining procedure

Drain the cooling system by opening the drain valve on the radiator and removing the plug at the inlet to water pump. Use a drain pan with a capacity of 30 litres.



System flushing & filling

System flushing & filling

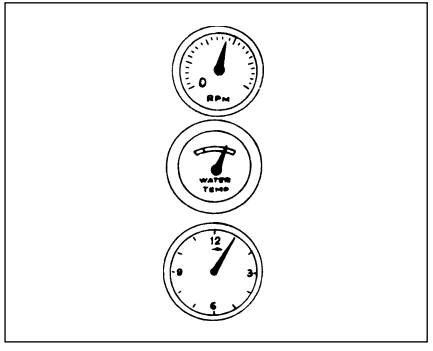
Prolonged and repeated contact with used antifreeze can cause skin disorders or other body injury.

Mix 0.5 kg of sodium carbonate with water for preparing flushing mixture.

Fill the system slowly.

Wait 2 or 3 minutes to allow air to be vented and add mixture to bring the level to the top.

Do not install the radiator cap.

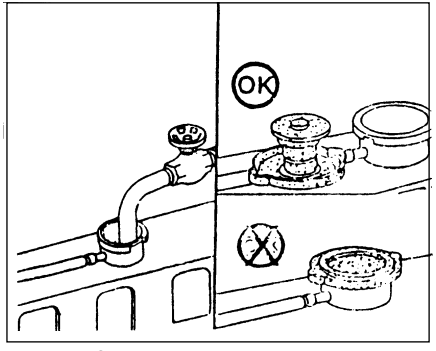


Operating procedure

Operating procedure

Operate the engine for 5 minutes with the flushing mixture temperature above 80°C.

Shut the engine off and drain the cooling system.

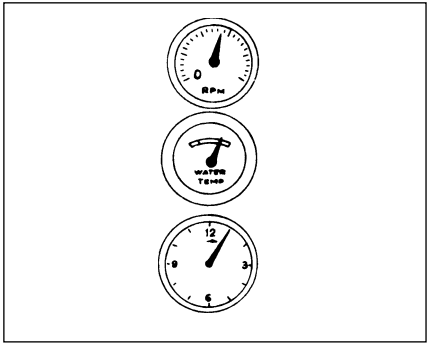


System filling

System filling

Fill the cooling system with clean water. Be sure to vent the engine for complete filling.

Do not install the radiator cap.



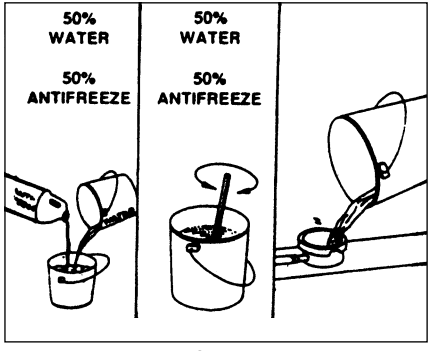
Operating procedure

Operating procedure

Again operate the engine for 5 minutes with the water temperature above 80°C.

Shut the engine and drain the cooling system.

If the water drained is still dirty, the system must be flushed again until the drained water is clean.



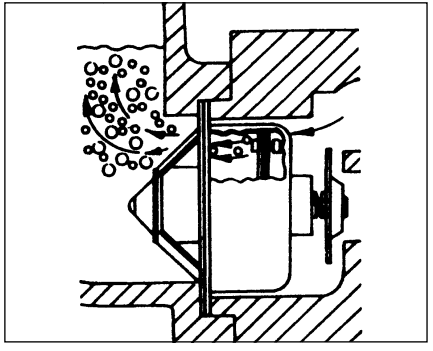
Coolant mixture filling

Coolant mixture filling

Use a mixture of 50% water and 50% Ethylene Glycol antifreeze to fill the cooling system.

Total system capacity : 22 litres

Engine capacity : 9 litres



Filling & venting

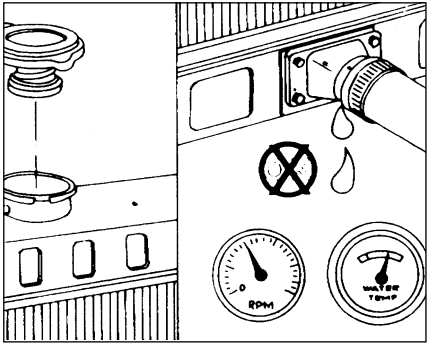
Filling & venting

Fill the system slowly to prevent air locks. During filling air must be vented from the engine and coolant.

Maximum fill rate : 19 litres / min

Do not exceed this fill rate.

Wait for 2 to 3 minutes to allow the air to be vented and then add mixture to bring the level to the top.

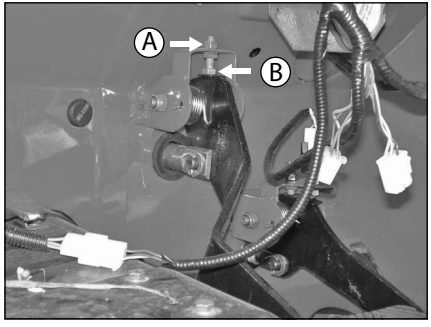


System check

System check

Install the pressure cap. Operate the engine until it reaches a temperature of 80^{O}C, and check for coolant leaks.

Wait until the coolant temperature is below 50^{O}C and check the coolant level again to make sure the system is full of coolant.



Clutch pedal free play adjustment

Clutch pedal free play adjustment

Clutch pedal free play is due to play between plunger and push rod of master cylinder in installed condition. This should be between 5 to 10 mm, if not adjust as follows.

- Loosen the lock nut "A" .
- Hold the nut "A" and turn screw (anti-clockwise to reduce the pedal free play) till the specified play of 5 to 10 mm is achieved . Tighten the lock nut "A" firmly.

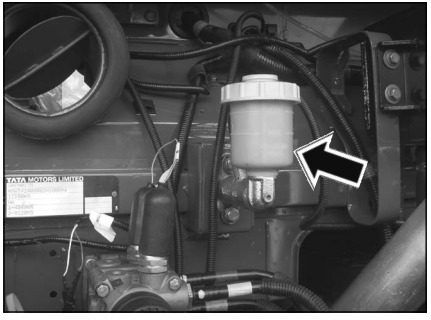
Unlike mechanical clutch actuation, adjustment of clutch pedal free play for compensating clutch disc wear is not required in hydraulic clutch actuation. Level of clutch fluid in container should be checked from time to time and topped up if necessary. Only recommended fluid should be used for dependable operation under all operating conditions.

Press clutch pedal fully and check for clutch fluid leakages at pipe connections and bleeding screw. Rectify leakages if any.

Bleeding

1. Ensure that fluid level in clutch fluid container is up to 'MAX' mark and not above it.
2. Clean area around bleed screw. Remove dust cap from slave cylinder bleed screw. Attach bleeding tube to bleeding screw and place other end of tube in a clean glass jar containing sufficient clutch fluid to submerge tube end.
3. Press clutch pedal two or three times slowly through out its stroke. Hold clutch pedal in fully pressed condition and loosen bleed screw on slave cylinder. Watch for air bubbles in glass jar. Tighten bleed screw on slave cylinder. Repeat above procedure until air bubbles cease to appear at bleeding tube end in glass jar.
4. After completing bleeding operation ensure that bleeding screw on slave cylinder is tightened fully. Install dust cap on slave cylinder bleeding screw.

Note : During bleeding operation keep a watch on clutch fluid level in container and top up if level falls down to 'MIN' mark.



Clutch fluid container

'S' Cam Full Air Brakes

S-cam brakes are fully air operated brakes. Brake actuators at front and rear axles are externally mounted outside the foundation brake assemblies.

Air is fed to brake actuators through dual brake valve (Operated by brake pedal), proportional to braking requirements.

Push-rods of brake actuators act on slack adjusters, which convert linear motion into circular motion of cam shaft. S-shaped cam portion of shaft expands brake shoes against drums, thus applying brakes.

S-cam is of equal displacement design, resulting in equal wear of leading and trailing shoes.

In addition wider, thicker and tapered lining result in high brake lining life.

The brake system provides safe and reliable braking. The brake circuit consisting of various pneumatic components is shown in schematic layout.

Service brakes consist of two separate circuits. One for front wheels and the other for rear wheels.

In the unlikely event of failure of any one circuit, other circuit remains still operative and guarantees a certain degree of braking for the vehicle.

One of the auxiliary outlet of system protection valve is connected through a graduated hand brake valve to spring brake chamber portion, integral with rear brake actuator.

During normal running, inside springs are kept in compressed condition by air pressure, thus releasing parking brake. For parking / emergency braking, hand brake valve is operated for depleting air to atmosphere, thus applying parking brakes.

Second auxiliary outlet of system protection valve is connected to exhaust brake air cylinder through exhaust brake solenoid valve which is coupled with service brake pedal operation through stop light switch.

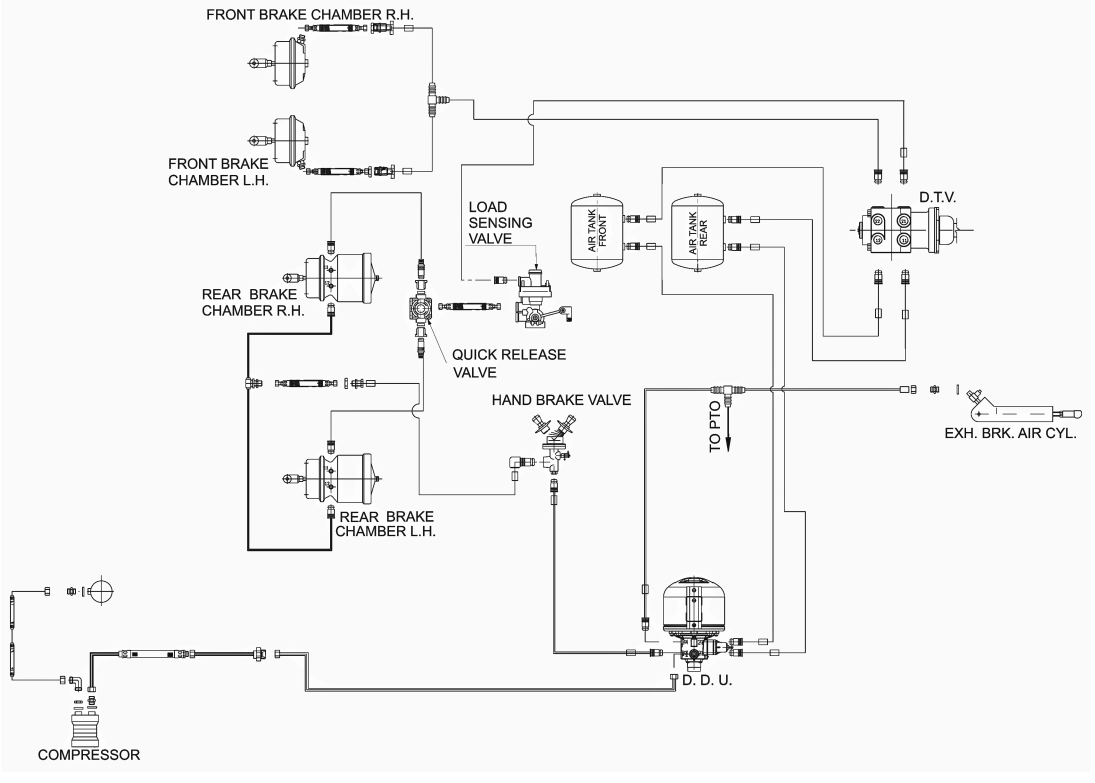
Exhaust brake isolator switch is provided on instrument panel which can be used to cut off exhaust brake, isolating exhaust brake whenever required e.g. while starting the vehicle on steep up gradient.

DDU is single unit consisting of air dryer, unloader valve, tyre inflator, system protection valve and purge tank. DDU ensures clean and dry air in the brake system, resulting in enhanced life of brake valves.

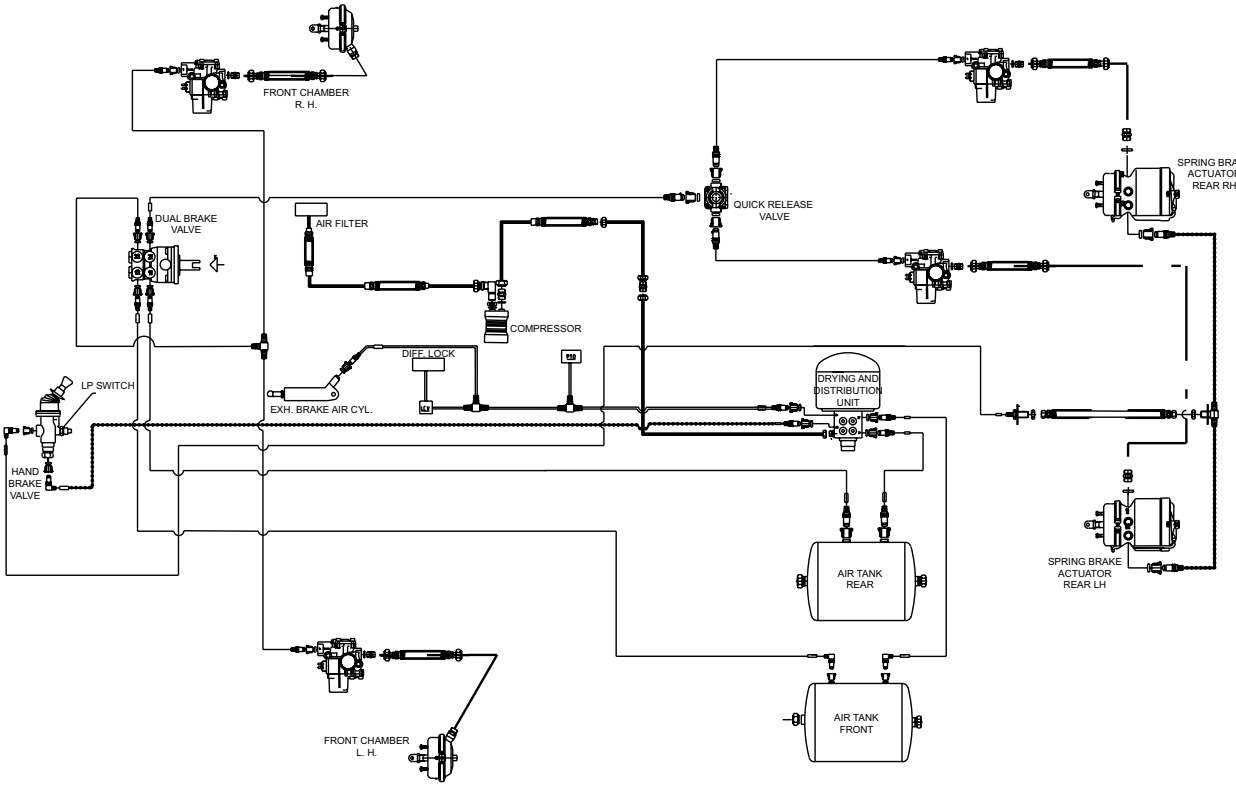
Note :

Do not attempt to clean DDU desiccant cartridge and filter.

Replace desiccant cartridge and filter after every 2 years.



BRAKE CIRCUIT SCHEMATIC SAK 1212C/32 & SA 1212C/32



BRAKE CIRCUIT SCHEMATIC SA 1212 C with ABS

Brake System
Brake System checking

1. Tighten brake torque plate mounting bolts to specified torque.
2. Check for travel of brake chambers push rod. The brakes have to be adjusted before it reaches 45 mm. Check brake lining wear and clearance with the drum (0.5 to 1 mm). Adjust service brakes if necessary.
3. Exhaust brake linkages.

a. A few drops of oil should be applied to the ball pins of outer linkages and friction surface.

b. The butterfly valve shaft, which is made of heat resistant material, **should not be lubricated** since the lube oil would cause seizure of the valve in the exhaust manifold.

c. Check for proper functioning of exhaust brake. Check and tighten mounting bolts of exhaust brake assembly and air cylinder.

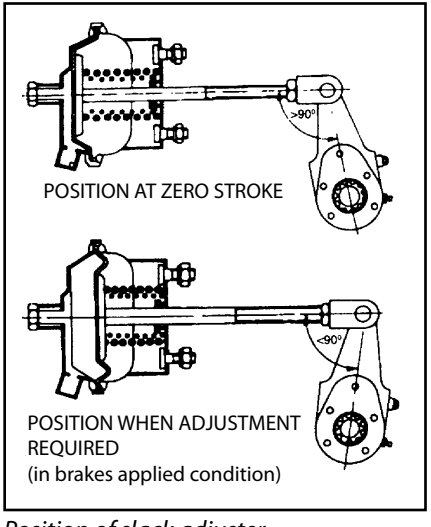
d. With brake pedal fully released, there should not be exhaust brake application.

Exhaust brake application can be made out from the distinct change in engine noise.

Adjustment of service brakes/ slack adjusters

This vehicle is fitted with automatic slack adjusters for front and rear brakes.

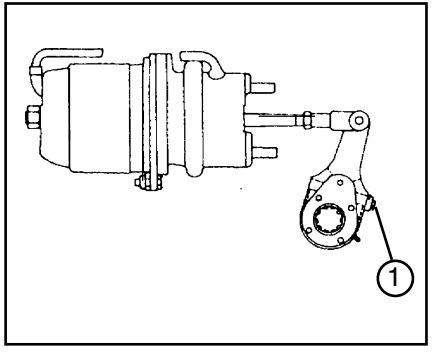
1. The automatic slack adjuster automatically adjusts the clearance between brake drum to brake lining. This ensures brake chamber stroke within safe operating limit automatically till the lining is worn out.
2. Brake lining thickness to be monitored with regular interval so as to identify worn out linings and replace it before rivets start rubbing with the drum.



Position of slack adjuster

Procedure for adjusting automatic slack adjuster when new brake lining is fitted (front / rear brakes)

1. Gently rotate the adjusting hex head clockwise to expand the shoes just until the hex head stops rotating. Then rotate the adjusting hex head anticlockwise for 3/4



1. Adjuster screw

of a turn to collapse the shoes. Anticlockwise rotation produces click sound and requires minimum 1.9 kgm torque.

2. Push the slack adjuster arm away from the brake chamber by a tommy bar so as to apply approx. 50 kg. force on the slack adjuster arm. Measure the distance by which the brake chamber push rod had come out. This is called free stroke.
3. If the free stroke is not between 18 mm and 30 mm, rotate the adjusting hex head clockwise or anticlockwise to reduce or increase the free stroke respectively to bring it within this limit.
4. Install the split pin at the end of clevis in brake chamber fork.
5. Ensure that the brake drum is rotating freely.

Procedure for checking functioning of automatic slack adjuster with full bedded in linings (front / rear brakes)

1. Ensure that the free stroke is between 15 to24 mm and full stroke is between 28 to 45 mm.
2. Ensure that the wheels are rotating freely after jacking up.

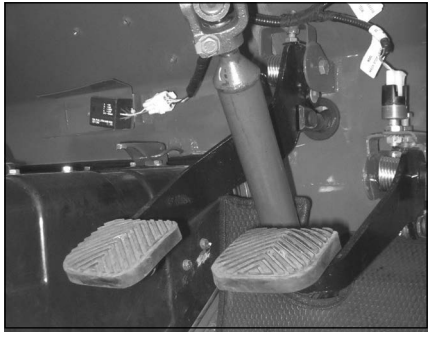
Operational Check of Automatic Brake Adjuster

Operational check of the brake adjuster can be performed on the vehicle by using the procedure given below:

- Block wheels to prevent vehicle from rolling
- Ensure tank pressure is above 7 bar.
- Check that the push rod is fully retracted, apply air pressure to release spring brake. If air is not available spring brake must be manually caged back.
- Manually de-adjust brakes to increase lining clearance. Turn adjustment hex counter clockwise one full turn to create an excessive drum to lining clearance condition (A ratcheting sound should occur. This ratcheting sound indicates healthy condition of the clutch mechanism).
- Apply the service brake for 10 to 15 times. On release allow sufficient time for brake to fully retract.
- During the brake release, Observe rotation of the adjustment hex (Scribing the hex will make this rotation easier to observe).

- This rotation indicates that an excessive clearance condition has been sensed by the brake adjuster, and it is making an adjustment to compensate. On each subsequent brake release, the amount of adjustment and the push rod travel will be reduced until desired clearance is achieved.
- If rotation of the adjustment hex. is not observed, refer to the Foundation Brake operational Check and trouble shooting procedures. If foundation brake assembly checks out to be OK and hex still does not turn, replace the adjuster.

Since with auto brake adjusters there will be no need for periodical brake setting and hence the condition of brake lining wear has to be checked periodically to avoid consequential damage to brake drum in case lining are excessively worn out. Hence check the brake liner wear condition during routine services and get it replaced at authorized workshop if necessary.



Brake pedal free adjustment
A. Lock nut

Brake pedal free play adjustment (Floor mounted DBV)

Recommended brake pedal free play is 5 to 10 mm.

Build air pressure above 6.9 bar (cut in pressure).

Loosen lock nut A and rotate adjusting screw B with help of DE spanner.

Increasing the height of adjusting screw will reduce the pedal free play and vice versa.

Feel pedal free play by thumb push.

After obtaining desired free play, tighten lock nut without disturbing the position of adjusting screw.

Re-check pedal free play and check for proper functioning of brakes by road test.

Hand brake adjustment

No separate adjustment is required. The same service brake adjustment holds good for hand brake also.

Note : *For City/Hilly/cross country applications perform the following at every 4500 kms.*

i) Check travel of brake chamber's push rod.

ii) Check brake lining wear and clearance with drum.

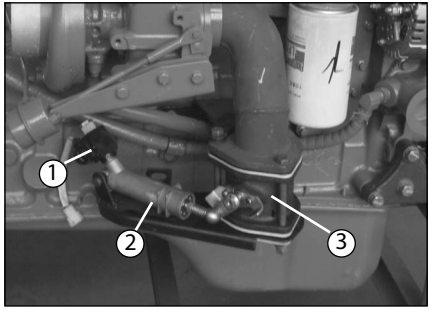
iii) Adjust service brakes if necessary.

Improper brake adjustment can cause brake grabbing, more air consumption or lower brake efficiency.

Releasing hand brake mechanically

If there is air leakage in hand brake circuit, parking brake gets applied automatically, Air leakage in any other circuit (front, rear and exhaust brake) does not effect parking brake due to the action of system protection valve. A mechanical 'wind off' screw (M 16 x 1.5) is provided at the top of spring brake actuator to release automatically applied hand brake due to any reason. To release, rotate wind off screw up with a spanner against the tension of spring (inside spring brake chamber) till brakes are completely released.

The wind off screw has to be turned down into original position, soon after mechanical wind off requirement is over and before vehicle is put on the road again.



1. *Exhaust brake solenoid switch*
2. *Exhaust brake air cylinder*
3. *Butterfly valve housing*

Adjustment of exhaust brake

There is no separate exhaust brake valve adjustment. Stop light switch serves the function of providing signals both for rear tail brake lamps as well as for exhaust brake solenoid valve.

In case exhaust brake is ON without exerting force on brake pedal, stop light switch needs to be adjusted as given below :

Check for proper functioning of exhaust brake at PDI and every 9,000 Km.

Exhaust Brake

Check for proper functioning of exhaust brake at PDI and after every 9000 kms. With brake pedal fully released, there should be no exhaust brake application. Exhaust brake application can be made out from the distinct change in engine noise.

Lubricating exhaust brake linkages.

1. Every 9,000 kms. a few drops of oil should be applied to ball pins of outer linkages and friction surface.
2. Butterfly valve shaft, which is made of heat resistant material, **should not be lubricated,** since the lube oil would cause seizing of the butterfly valve in its housing.

Foundation Brake overhaul

Remove brake drum. Inspect brake linings, brake drums etc., rectify any defects.

Replace lining if worn upto indicator slot or 1 mm over the rivets. Grease fulcrum pin bushes and roller ends.

Two makes of foundation brakes are used in selection. Please note that, same make of brake assemblies, brake linings and brake actuators should be used on the same axle. Brake drum diameters are recommended up to repair size II of 414 mm. Drums should not be used beyond 416 mm, as there will be no servicing brake or parking brake left due to cam roll over. Before that the drums should be discarded.

Brake system overhaul

Dismantle pneumatic aggregates of 'S' cam brake system. Clean, inspect and replace parts if necessary. Apply grease to components while reassembling . The foundation brakes should also be overhauled for every second brake shoe relining or as required.

Tightening torques

Torque plate mounting bolts

Front : 18 mkg

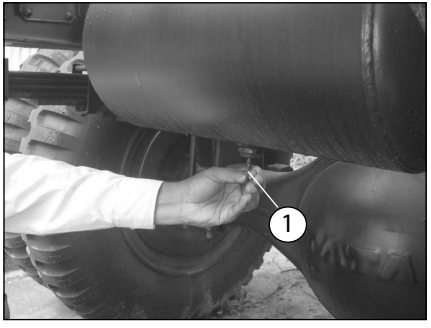
Rear : 20 mkg

Air brake chamber / spring brake actuator mounting bolts : 10 - 13 mkg

Spring brake actuator mounting bracket to rear axle : 8 mkg

Cam Shaft bearing block to rear axle : 5 mkg

Brake chamber mounting bracket to front torque plate : 10 - 11mkg



1. Air tank drain valves

Draining of condensed water

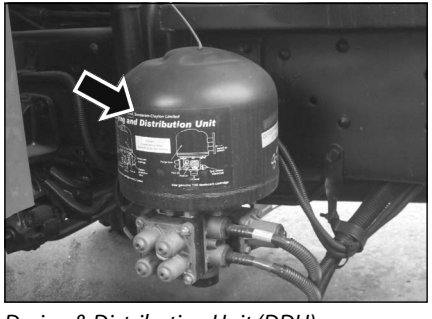
Drain off condensed water from all air tanks by operating tilt type drain valves.

Drying & Distribution Unit (DDU)

DDU is single unit consisting of air dryer, unloader valve, tyre inflator, system protection valve and purge tank.

Ensure cut-out takes place at system set pressure 8.1±0.2 bar. The difference between cut-in and cut-out pressure should not exceed 1.3 bar.

Check for leakage in the air pressure pipelines and adapter joints every service.



Drying & Distribution Unit (DDU)

Overhaul the unit once in two years with recommended kit and replace desiccant cartridge.

When the desiccant is renewed, the coalescent filter and the rubber components in the unloader, QSPV and tyre inflator portions also should be replaced.

If residual oil vapours carried over beyond the pre-filter, contaminate the desiccant prematurely and lower its air drying efficiency thus oil carry over of the compressor being high, more frequent replacement of the desiccant is warranted.

Inflating tyres with air from DDU (with unloader valve cum tyre inflator)

The outlet pipe from compressor leads to the DDU (with unloader valve cum tyre inflator). The air from the tyre inflator on DDU can be used to inflate the tyres during emergency. For inflating the tyres, remove rubber cap on tyre inflator and start the engine. After the condensed water and oil that may be present in the system has been completely expelled, connect the tyre inflating valve and nipple of the hose. Connect the hose to the tyre tube nozzle and run the engine at fast idling speed. Disconnect inflating hose and check tyre pressure.

Brake System Routine Checks

It is very essential that brake system is kept trim at all times and periodic checks are conducted so that vehicles with brake system defects are not run on road.

The following procedure is recommended for a general check once in 36000 Km or after each brake overhaul. For maintenance data, refer to specifications.

1. Place chocks on both front and rear wheels.
2. Remove drain plugs and exhaust all air tanks. If water is found in the air tanks, check whether purging cycle of air-dryer is occurring after every cut-out. If purging cycle is taking place after every cut-out, than the air-dryer cartridge needs to be replaced. If purging cycle is not taking place , overhaul the DDU/ Air Dryer. Deplete air in spring brakes by applying, releasing hand brake valve. Keep hand brake in 'OFF' position.
3. Turn vehicle ignition to 'ON'. The low air pressure and hand brake indicators should operate immediately. The pressure gauges should read zero. If not, rectify.
4. Run the engine at full speed to charge the system. The air pressure in one of the service tanks (the circuit having slightly lesser opening pressure in the system protection valve) will rise at first to a certain limit. then other circuit will follow and both will rise together.
5. The low air pressure indicators should cease to operate at the specified value. If not, rectify.
6. Continue to charge the system till 'cut-out' pressure. The unloader valve should cut out (identified by a hissing noise).
7. Stop engine. The time taken from zero to cut out pressure should not exceed specified pump up time. If it takes more, check for leakages in brake system and rectify. Also open compressor head, check for defects and rectify.
8. After pressure in the system stabilizes, the drop in air pressure (due to leakage if any) with brakes 'OFF' should not exceed specified value. Otherwise, rectify.
9. Make a few brake applications to bring down air pressure. when 'cut in' pressure is reached, the compressor charges the system again till 'cut out'. Put off the engine.
10. Apply hand brake/ Hand brake indicator and audio beeper signals come together. Release hand brake. There will be a small pressure drop in both the reservoirs. Now hand brake warning signals should be off.
11. Apply service brakes and check that rear tail lamps glow.

12. Take road test for

i) Efficient braking

ii) Absence of grabbing/pulling to one side

iii) Absence of brake squealing and rectify defects, if any.

iv) Check that hand brake and exhaust brake are also functioning properly.

13. Check for system protection valve (SPV)

A) Opening pressures

a) Fail one service brake circuit say rear circuit (port 21) by opening any pipe joint.

b) Drain the healthy reservoir (front) below 4 bar and charge air at max. engine speed.

c) Note max. pressure in the gauge of healthy circuit. this is the opening pressure of SPV port 21, connected to failed rear circuit.

d) Repeat (b) and (c) for other circuit (port 22).

e) With all circuits healthy, build up air pressure till cut out. Open connector at SPV port 23 to atmosphere. Pressure in the service tanks will fall to around 4 bar. Run engine at max. speed and note the stabilized gauge pressure (either front or rear gauge).

This is the opening pressure of SPV port 23.

f) Repeat (e) for SPV port 24.

B) Closing pressures

a) With full pressure in the air tanks, slowly leak out any circuit, say rear (port 21) to zero. The pressure in the other circuit (port 22) falls to a certain value and stabilizes. This is the closing pressure of SPV port 22.

b) Repeat (a) for closing pressure of port 21.

c) For checking closing pressures of port 23, 24 pressure gauges should be connected in their circuits. Leak out air in either front (22) or rear tanks (2~). Note down closing pressure of SPV port 23 and 24 after pressure gets stabilized.

d) Note down closing pressures of SPV port 21/22 with air leaked out to zero in hand brake circuit (port 23). These closing pressures will be different from those at (a) and (b).

e) Repeat (d) with air leaked out to zero in exhaust brake circuit (24).

14 Check for dual brake valve (DBV)

a) With full pressure in air tanks, check for leakage from exhaust port of DBV with :

i) Brakes in released condition;

ii) Full braking.

b) Open the outlet pipes 21 and 22 and check for leakage in brake 'OFF' condition.

15 Check for Brakes chambers & spring actuation

a) With brakes applied at full pressure, check for leakages in front nd rear brake chambers.

c) Check that "mechanical wind off" is functional in spring brake actuator.

d) Check for any hole elongation and wear on push rod fork and pin.

16 Check for slack adjusters

a) For manual slack adjuster, Check that slack adjusters stroke is between the specified limit and adjustment is possible without sticking.

b) Check for any hole elongation and wear in bushes.

c) For Automatic slack adjuster, check that the adjuster stroke at full brake application in static condition is within the specified limit.

d) Jack up all the wheels one by one and check for free rotation of wheels

e) Check that at least two mm of lining is left above the lining wear indicator groove visible from the hole provided for lining inspection in the dust cover.

17 Check for graduated hand brake valve

a) Check leakage from exhaust port in brake 'ON' and 'OFF' condition.

b) Check lever for proper locking, in brakes 'ON' and 'OFF' conditions.

Anti-lock Braking System (ABS) (If fitted)

Anti-lock braking system (ABS) is an electronic system added to the conventional brake system. The purpose of the antilock braking system (ABS) is to prevent the wheels from locking and skidding when braking, thereby enabling the driver to retain steering control of the vehicle. The ABS modulates the air pressure in the brake chamber to prevent the wheel lockup and provide precise vehicle control during over-braking.

Under normal braking conditions (where sufficient road surface friction exists to reliably bring the vehicle to a stop without the wheels locking), ABS will not be activated. However, if the braking force exceeds the available adhesion between the tyres and the road surface causing the wheels to lock (for example, on slippery roads) then ABS will automatically get activated.

Role of ABS during emergency braking

In an emergency situation, the driver should apply full braking effort even when the road surface is slippery. The ABS will constantly monitor the rotational speed of the wheels and will vary the braking pressure to each wheel according to the amount of traction available. This will ensure that the wheels do not lock and the vehicle is brought to a stop in the shortest possible distance for the prevailing road surface conditions

Benefits of ABS

- Improved stability – Prevent vehicle pulling by avoiding wheel lock.
- Steer wheel brake – Helps driver to steer around obstacles during panic braking even on slippery roads.
- Shorter stopping distance on wet or slippery roads
- Automatic Control of ABS gets initiated during a wheel about to lock situation and the control cycle gets terminated after brake is released or the vehicle has come to a very low speed.
- Fail-safe philosophy- In the event of electrical failure of any one or more assemblies or components of ABS, the system switches over to normal braking mode automatically.

NOTE:

When ABS is active, the driver will feel the brake pedal pulsating, which is normal.

WARNING:

ABS cannot overcome the physical limitations of stopping the vehicle in too short distance, cornering at too high speed, or the danger of aquaplaning, i.e. when a layer of water prevents adequate contact of the tyres and the road surface. The fact that a vehicle is fitted with ABS must never tempt the driver into taking risks that could affect his/her safety or that of other road users. In all cases, it remains the driver's responsibility to drive within normal safety margins, having due consideration for prevailing weather and traffic conditions.

CAUTION:

DO NOT pump the brake pedal when driving. This will interrupt operation of the ABS and may increase the braking distance. No matter how hard you brake, you should be able to continue steering the vehicle as NORMAL. However, always remember that the ABS operates only AFTER the driver has already lost control. ABS cannot reliably compensate for driver error or inexperience.

ABS ON/OFF switch :

This switch is used to engage / disengage the ABS system. Normally this switch keeps in 'ON' condition. Only while using 4x4 mode this switch keeps in 'OFF' condition.

ABS malfunction indicator (If applicable) on instrument cluster

When the ignition is switched ON, the lamp glows for a few seconds and then goes "OFF". If the warning light fails to go OFF or comes ON when driving, a fault has been detected by the self-monitoring system and complete ABS control may not be available. If this occurs, get your vehicle checked by a TATA Authorized service center.

NOTE:

If the ABS warning lamp is ON while driving, then there is a malfunction in the ABS system (the standard braking system will however function) and the vehicle should be driven cautiously to the nearest TATA MOTORS Authorized Service Centre.

ABS Diagnostic switch (If fitted)

This switch is used during diagnostic checkup, pressing ABS diagnostic switch will give us information (blink codes) about faults of the ABS system.

NOTE: *Not to be used by operator. This is provided for diagnostic to be carried out by authorized workshop only.*

Do's and Don'ts – For Drivers:

- Never switch off the ignition while driving as this will also switch off the ABS.
- After switching on the Ignition, check if the Warning Lamp blinks once for a few seconds and then goes OFF.
- Do not assume that with ABS fitted to a vehicle, it is safe to drive faster or more aggressively.
- ABS may not shorten stopping distances in all situations.
- If the ABS warning lamp comes on and stays on, there is no need to panic, since normal braking will still be available but without the ABS function.
- The ABS system must be checked as soon as possible, so that we get maximum benefit from it.
- Do not attempt to "pump" the brakes during a wheel lock situation. The ABS can apply and release the required brakes much

quicker than a driver. In addition, any "pumping" could upset the operation of the ABS

- Ensure that the tyres are correctly inflated at all times.
- Never go for over speeding. Even the best braking system cannot prevent accident caused by negligent driving
- If the ABS is disabled due to a fault, the driver still has full use of the conventional Brake. All work performed on the ABS is to be carried out only by authorized personnel.

Safety Instructions – For Drivers:

- Efficient operation of the ABS relies upon the efficient operation of the braking system. Hence carry out preventive maintenance regularly.
- Use same size of tyres on all wheels as per recommendation. Ensure that the tyres are correctly inflated at all times.
- Ensure wheel bearings are adjusted appropriately to ensure that the run-out of the pole wheel is within acceptable limits. Always ensure that the wheel run-out is within the specification.

Caution :

In 4x4 mode ABS switch to be off. ABS 'ON/OFF' switch located in the switch bank.

Care of propeller shaft

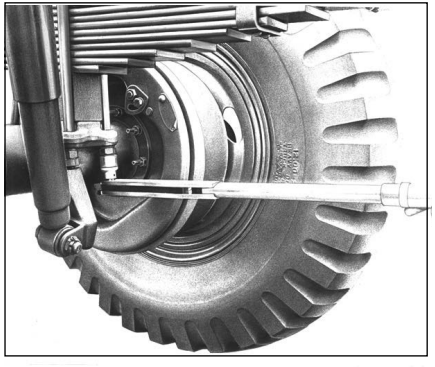
The propeller shaft centre bearings. 'U'-joint cross bearings and the sliding yoke should be regularly lubricated.

Failure to do so may result in rapid wear and tear of the bearings and the centre bearing mountings.

When disconnecting rear propeller shaft, care must be taken to ensure that the arrow marks on the propeller shaft and the sliding yoke are in line at the time of reassembly. Fit new lock plates and tighten the coupling flange bolts to the specified torque and lock with lock plates.

Springs

The spring U-bolt nuts and check nuts of the front and rear springs should be regularly tightened with a torque wrench or with a socket wrench and a handle of atleast 60 cm. length.



Tightening 'U' bolts

The spring shackle pins and helper spring brackets should be regularly lubricated. The springs should be kept clean and regularly greased. For this remove springs from chassis and open the spring clamps and centre bolts. Clean each leaf and apply graphite grease and reassemble springs.

Care of wheels and tyres

Tyres can give satisfactory service only if the load carried by each tyre is within the specified limit and specified tyre pressure is maintained.

For this reason the maximum G.V.W. given in this booklet must never be exceeded. Otherwise the life of the tyre will be adversely affected.

Under inflation and over inflation are both injurious to the life of the tyres. Therefore, correct tyre pressure must be maintained at all times.

It is possible that after the initial inflation of the tyres in cold condition, there is a rise in the pressure after the vehicle has travelled some distance and the tyres get hot. The tyres pressure should not checked under these conditions because if the tyres pressure were to be corrected, at this stage, it will result in under inflation, when the tyres cool down.

It is good practice to have the best tyres on the front axle for the operational safety of the vehicle.

Power steering

In case of excessive free play, check steering linkages for looseness and get the defect rectified immediately. Periodical inspection of the steering linkages is essential for driving safety.

Filling oil in steering system

The steering gear and the pump are filled through filler neck on oil tank. For initial filling and for oil changes, it will be of advantage to remove the tank cover and to add hydraulic oil upto edge of tank.

The engine can then be cranked with starting motor for a few moments (Not more than 10 second at a stretch) to fill the entire hydraulic system with oil. Since the oil level in the tank will drop rapidly, keep adding oil so that the pump cannot suck air.

Bleeding the steering system

When the steering gear is filled to the extent that short cranking of engine will not cause oil level to drop below top mark on oil dipstick, the engine can be started.

Jack up the front axle, start the engine, run at idle speed.

Then turn steering wheel several times from lock to lock so that the air escapes from the cylinders. Keep watching oil level. Add oil immediately the moment oil level drops.

Keep adding oil until oil level remains at upper mark of oil dipstick and air bubbles are no longer rising in oil tank when steering wheel is turned.

If the above instructions are observed, the oil level in the oil tank should not rise by more than approx. 1-2 cm when the engine is shut off.

Shut off engine and lower front axle.

Oil level checkup with engine stopped

To make sure that no air is sucked up when the engine is started, check for oil losses first with the engine stopped. Add just enough oil into tank until oil level is approx. 1-2 cm above top mark of oil dipstick.

Oil level checkup with the engine running

When the engine is running, the oil level will drop slightly, since the oil requires a pressure of approx. 2-4 bar to overcome the flow resistance when flowing through steering gear. Add enough oil to keep oil at top mark constant. Then stop engine again. Oil level should not rise more than max. 1-2 cm. A higher oil level indicated that there is air in the system.

Filter change

(a) Unscrew closing plug from cover of oil tank and remove tank cover.

(b) Pull used filter cartridge out on metal collar. When pulling out, keep bore of filter cartridge closed so that no dirty oil will flow back into tank.

(c) Lubricate filter carrier and insert new filter cartridge with metal collar in upward direction.

(d) Fill reservoir upto edge with oil.

(e) Crank engine for a short moment with the starter motor, so that oil level will drop. Then bleed steering system.

Replace filter element after every 72,000 km. The oil level in steering gear box, oil tank should be checked periodically.

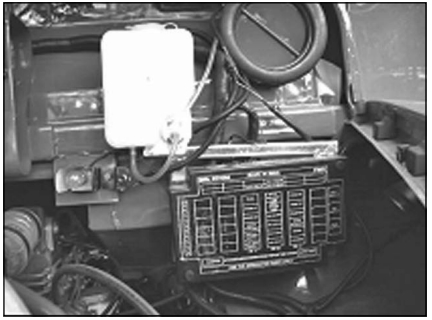
Fuses and Relay cluster

In order to protect the cable harness from damage in case of short circuit and overloads, -blade type fuses as per IS 2577 are provided in the fuse box.

The fuse box are located in the engine compartment on the firewall, which incorporate fuse and for black out equipment & blower etc.

In case of a fault in the electrical system check the respective fuse. The particulars of the consumers served by each fuse are printed on the fuse box cover. While fitting fuse box cover ensure that cover knob rests in the slot provided inside fuse box.

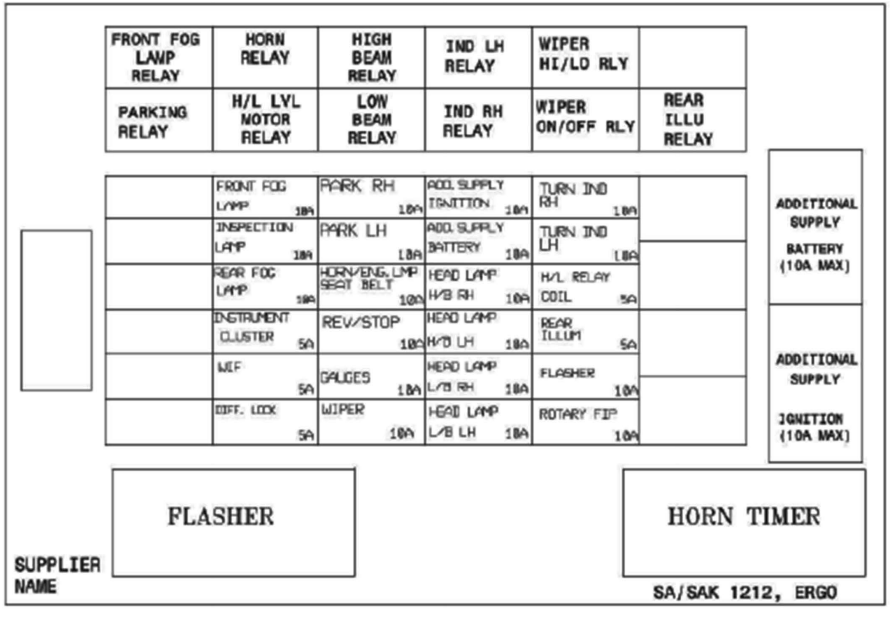
The consumers served by each fuse are printed on the transparent cover of the fuse box.



Fuse box

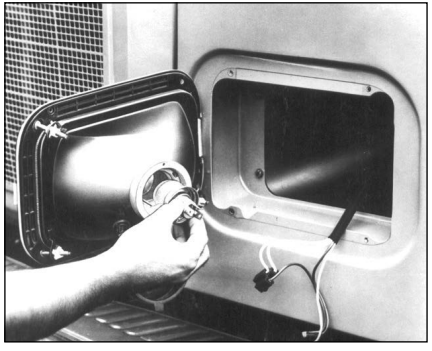
SA / SAK 1212 C FUSE BOX

STICKER VIEW FOR FUSE BOX & RELAY COVER

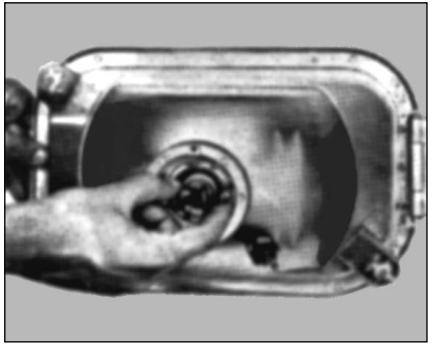


VIEW SHOWN FROM TOP SIDE

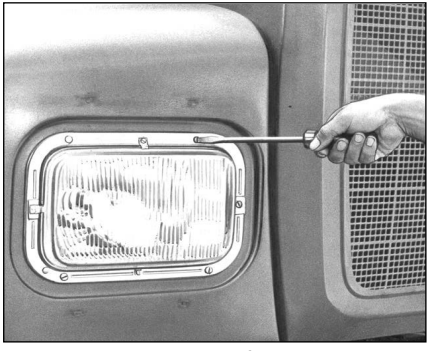
STICKER SHOWING FROM TOP OF THE COVER



Replacing head lamp bulb



Locking the head lamp bulb with lock ring



Adjusting head lamp focus

Head lamps

The head lamp system provides two types of light beams; a main beam to give Maximum light well ahead of the vehicle, and a dipped beam which is shorter and lower so that it will not dazzle on on-coming drivers, and can be used in low visibility area.

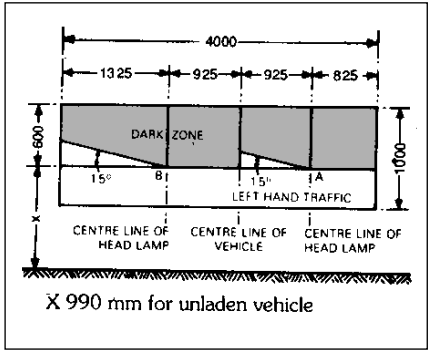
Separate filaments in a single bulb in each headlamp provide the main and dipped beams.

Bulbs are made with accurately located filaments and a locating flange, so that when fitted into reflector, which is permanently bonded together with lens, the bulb is always at focus. The design ensures that bulb can be fitted only in the correct position. It cannot be fitted

With filaments reversed. The head lamp also has a parking lamp.

Bulb Replacement

Remove rubber cap from rear of head lamp. Push out cable socket with bulb and remove locking ring. Replace with new bulb taking care for proper fitment and lock the hub with lock ring. Refit cable socket with bulb on the head lamp and press it in position. Seat the rubber cap in position.



Note: -

Do not clean the reflector, as it will cause damage to mirror finished surface. Do not replace bulb with dirty or oily hands since oil will evaporate due to the bulb heat and strain the reflector.

After replacing bulb check head lamp alignment.

Head Lamps Alignment

The head lights must be properly aligned in order to obtain maximum road safety as regards proper road illumination and to reduce the glare on the oncoming traffic.

It is recommended to check the alignment of head lights periodically and whenever bulbs are replaced, by means of screen as shown in figure.

The head lamp alignment in this type, asymmetrical dipped beams, is done only by adjusting the dipped beams unlike other head lamps where main beams are adjusted.

The vehicle should be parked 10 m away from the screen, with its center in line with the central vertical line on the screen and the screen at right angles to longitudinal axis of vehicle. The vehicle should be in unladen condition with no sag in suspension springs and all tyres equally inflated.

On the market up screen as shown in figure, the area above the horizontal and inclined lines (shaded) is called 'The Dark Zone', and the area below it is called 'The Illuminated Zone'.

Each lamp is aligned individually by masking the other lamp. The head lamp is first adjusted for the proper height of the dipped beam by the adjusting screw at its top. The light from dipped beam should fall below the horizontal and inclined lines i.e. in the 'The Dark Zone'. Thereafter the lateral adjustment is done by the adjusting screw at the bottom so that contour of the dipped beam coincides with contour formed by horizontal and inclined lines below 'The Dark Zone'. When properly aligned the most illuminated area will be just below the intersection (Point A) of the two lines.

The second head lamp is adjusted in a similar manner without disturbing the position of the vehicle and the screen. Now Switch "ON" Main beam lights. They will be symmetrical above the points of intersection (Point A and B) of the vertical lines and the horizontal line. It is possible that the main beams may not be exactly symmetrical but for this reason the head lamps should not be realigned.

Preferably, alignment should be done in the dark.

INDEX

SHEET NO.	CIRCUIT DESCRIPTION
1	INDEX AND SYMBOLS
2	BATTERY, ALTERNATOR, STARTER
	MOTOR WITH INTERMEDIATE RELAY,
	ST.LOCK CUM IGN SWITCH,FIP SOL
	WITH AIR PRESSURE SENSOR
	& MAXIFUSE.
3	H/L RELAYS, H/L, PARKING LAMPS
	FOG LAMP RELAYS, SWS & LAMPS
4	BLINKER, REVERSE LIGHT, STOP
	LIGHT, SIDE IND. LAMP, READING
	LAMP, TOP MARKER LAMP, CAB
	LAMP, EXHAUST BRAKE CKT,
	REAR ILLUMINATION LAMP
5	HORN,AIR PRESSURE SENSOR,
	HAND BRAKE BEEPER,OIL PR SW,
	LO AIR PR SW,FUEL TANK,
	TEMP TRANSDUCR,RPM METER,
	COOLANT LEVEL SENSOR,
	INSPECTION LAMP SOCKET
6	2 SPEED WIPER & WASHER
7	FRONT & REAR FOG LAMP CKTS
	ALONG WITH REAR FOG LAMP
	CONTROLLER.
8	POWER SUPPLY DISTRIBUTION &
	FUSE LAY OUT.
9	ABS (WABCO) RELATED
	COMPONENTS.
10	VEHICLE SPEED SENSOR CKTS

SYMBOLS

SYMBOL	DESCRIPTION
	GROUND /EARTH
	DIODE
	SINGLE WAY SW
	FUSE
	CABLE JOINT
	CROSS OVER WITH JOINT
	CROSS OVER WITH OUT JOINT
	LAMP/BULB
	FEMALE CONN
	MALE CONN
B T H	HI TEMP BUZZER
	SOLENOID VALVE
1 M 2	MOTOR
1 4 3 5	RELAY
1 2 3 M	HEAD LAMP LEVELLING MOTOR

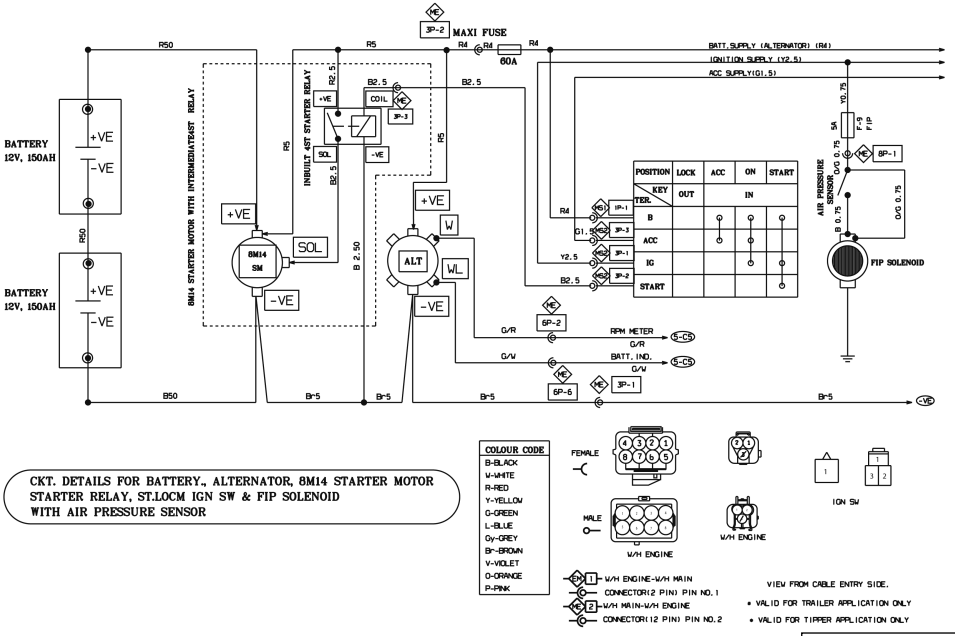
SYMBOLS

SYMBOL	DESCRIPTION
+VE W ALT WL -VE	ALTERNATOR.
+VE SOL SM -VE	STARTER MOTOR
	PIANO SW SPRING LOADED
	TRANSDUCER
	GAUGE/METER

SYMBOLS

SYMBOL	DESCRIPTION
B L E ELECTRONIC FLASHER	ELECTRONIC FLASHER
R0 R1 R2	HEAD LAMP LEVELLING SWITCH
1 5 3 4	MICRO RELAY NC

Part No. : 2097 5400 00 03
SA/SAK 1212 TC BS-III
Ergo Pack Circuit Schematic
Sheet 1 of 10



CKT. DETAILS FOR BATTERY., ALTERNATOR, 8M14 STARTER MOTOR STARTER RELAY, ST.LOCM IGN SW & FIP SOLENOID WITH AIR PRESSURE SENSOR

COLOUR CODE
B-BLACK
W-WHITE
R-RED
Y-YELLOW
G-GREEN
L-BLUE
Gy-GREY
Br-BROWN
V-VIOLET
O-ORANGE
P-PINK

W/H ENGINE-W/H MAIN CONNECTOR(2 PIN) PIN NO.1
W/H MAIN-W/H ENGINE CONNECTOR(12 PIN) PIN NO.2

Part No. : 2097 5400 00 03
SA/SAK 1212 TC BS-III
Ergo Pack Circuit Schematic
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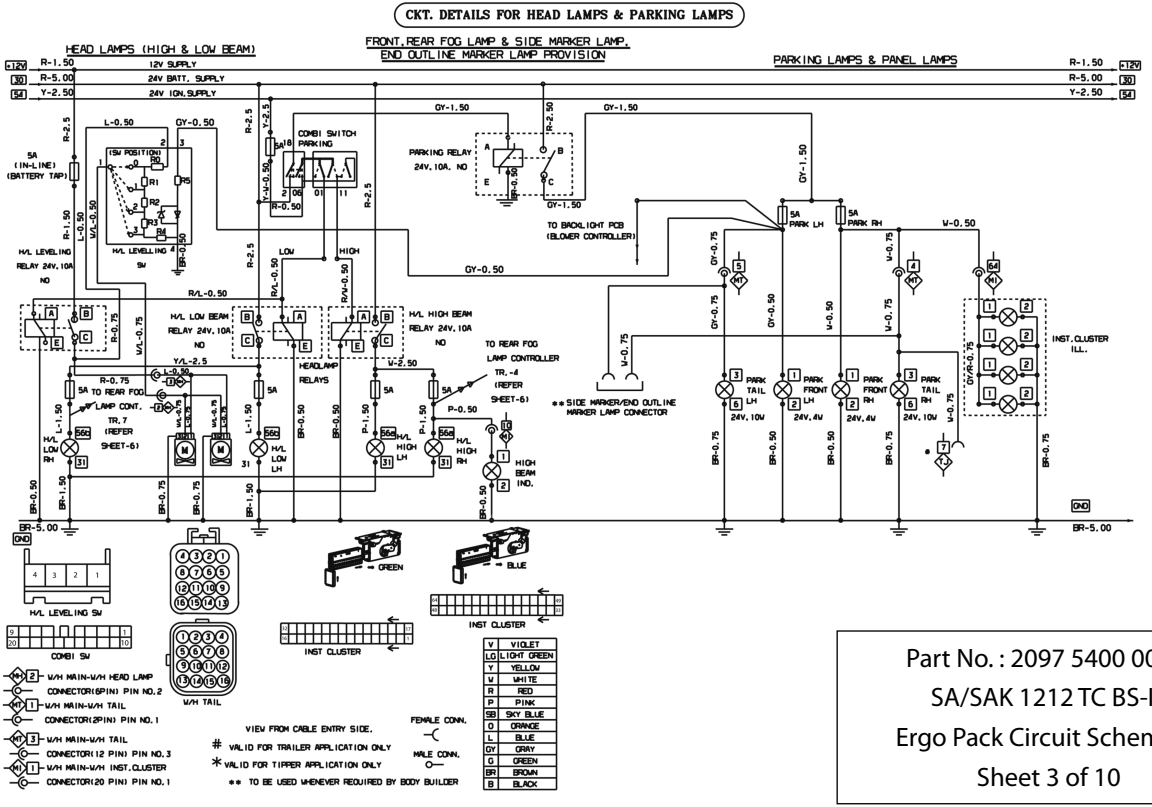

Part No. : 2097 5400 00 03
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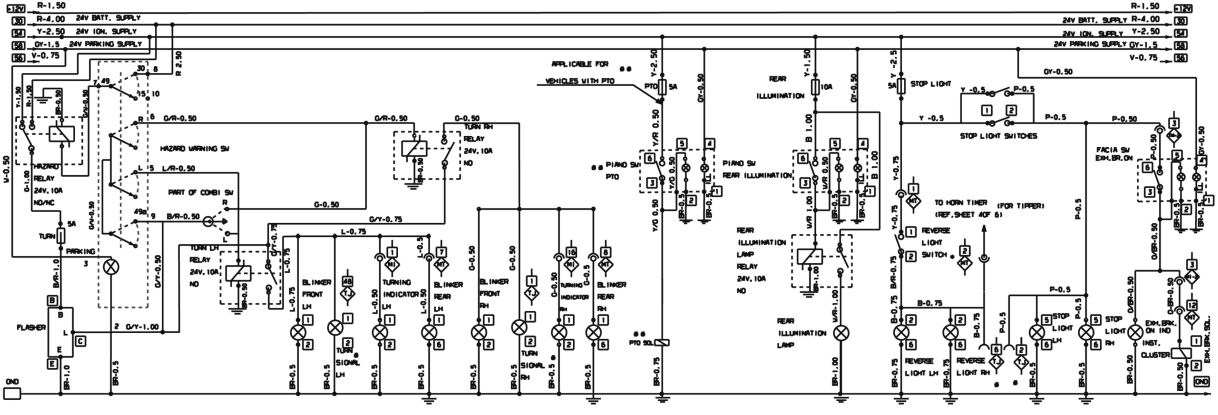
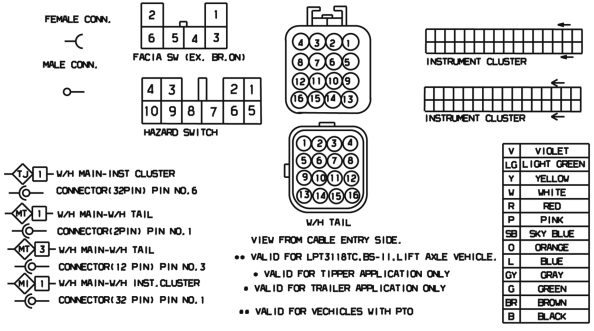
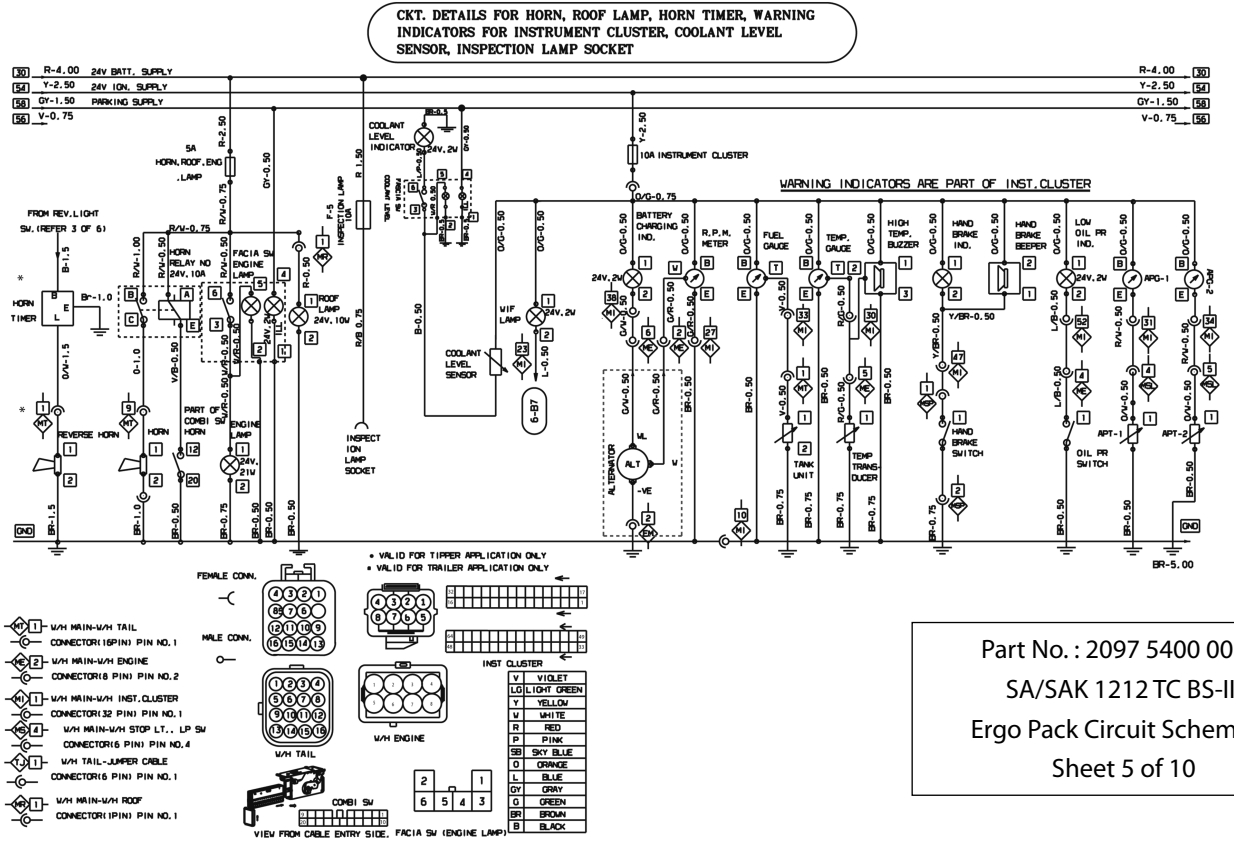
CKT. DETAILS FOR BLINKERS,
TURNING IND., HAZARD WARNING
LAMPS,REVERSE LIGHTS, STOP LIGHTS, EXH BRAKE
SOLENOID, REAR ILLUMINATION LAMP





V	VIOLET
LG	LIGHT GREEN
Y	YELLOW
W	WHITE
R	RED
P	PINK
SB	SKY BLUE
O	ORANGE
L	BLUE
GY	GRAY
G	GREEN
BR	BROWN
B	BLACK

Part No. : 2097 5400 00 03
SA/SAK 1212 TC BS-III
Ergo Pack Circuit Schematic
Sheet 4 of 10



Part No. : 2097 5400 00 03
SA/SAK 1212 TC BS-III
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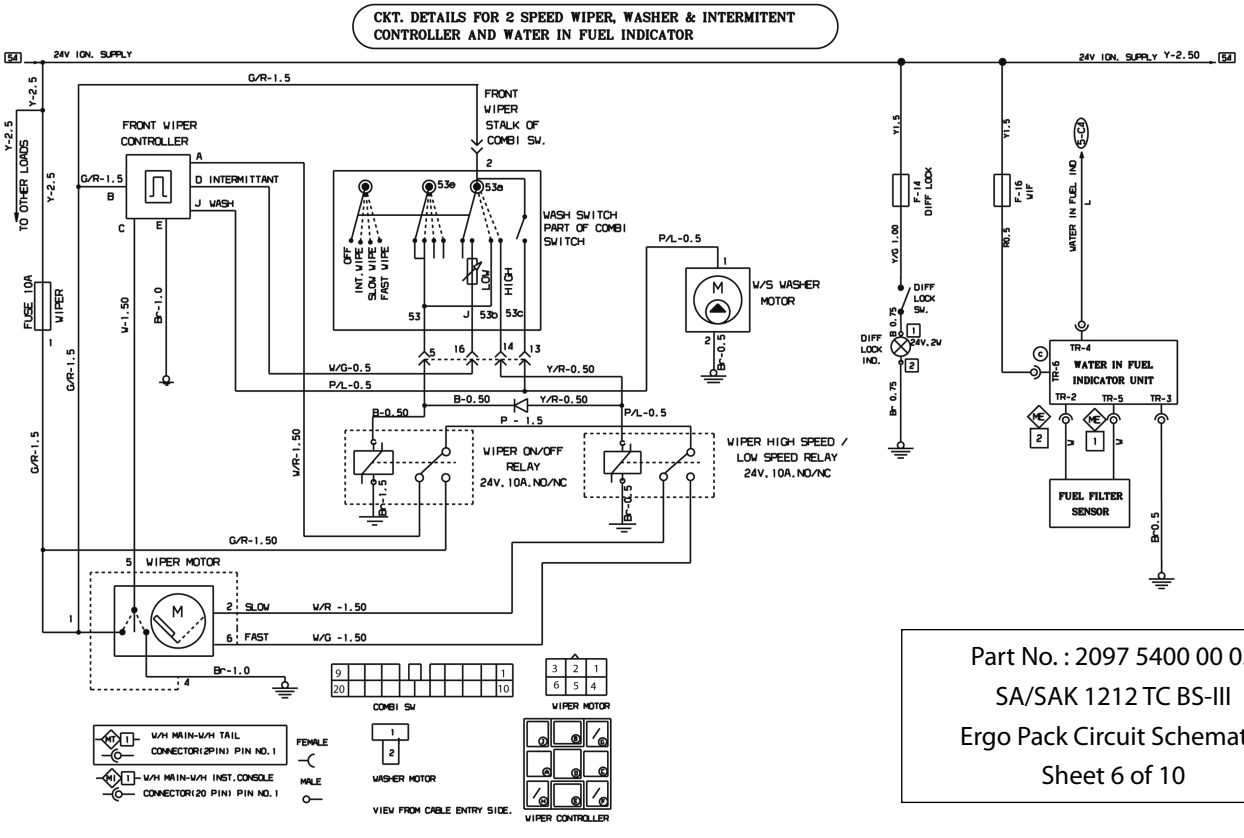

Part No. : 2097 5400 00 03
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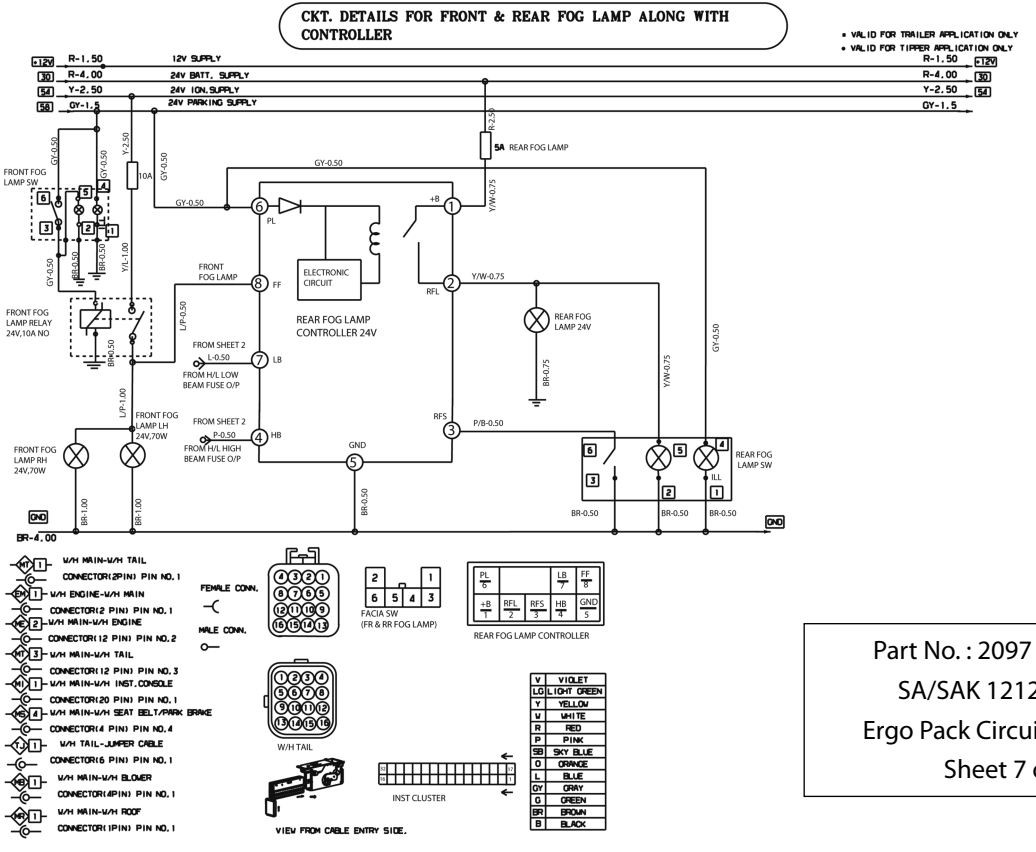

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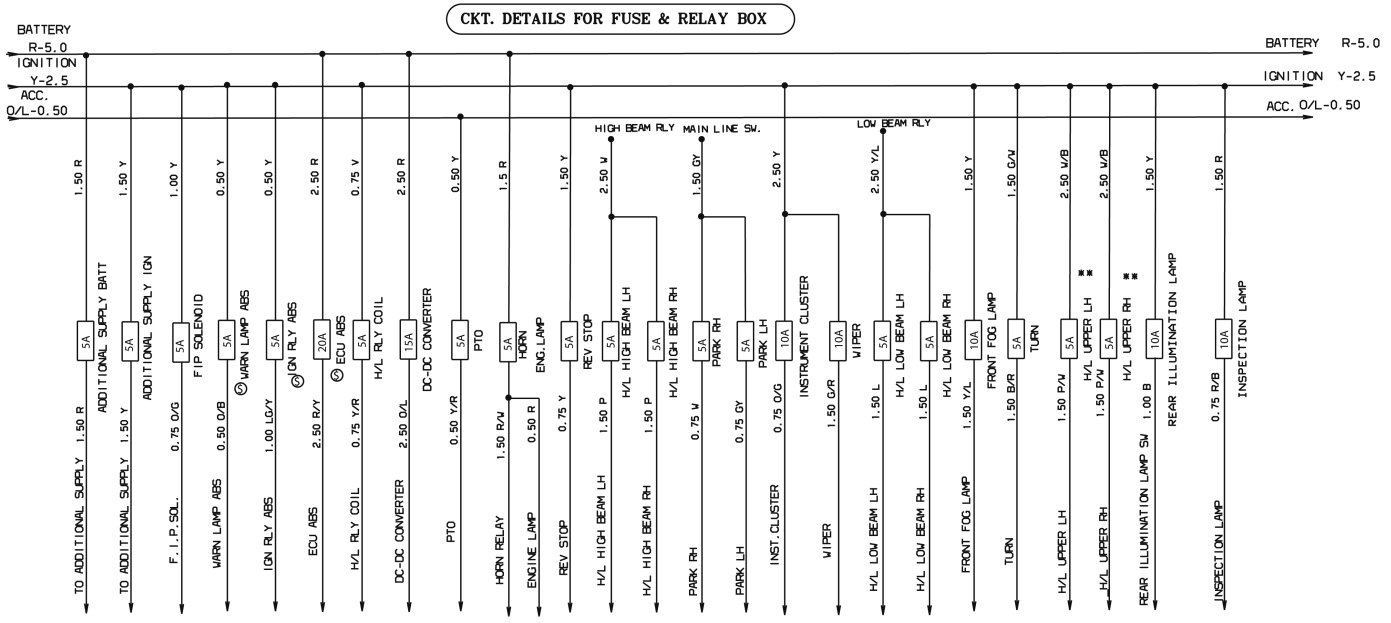

Part No. : 2097 5400 00 03
SA/SAK 1212 TC BS-III
Ergo Pack Circuit Schematic
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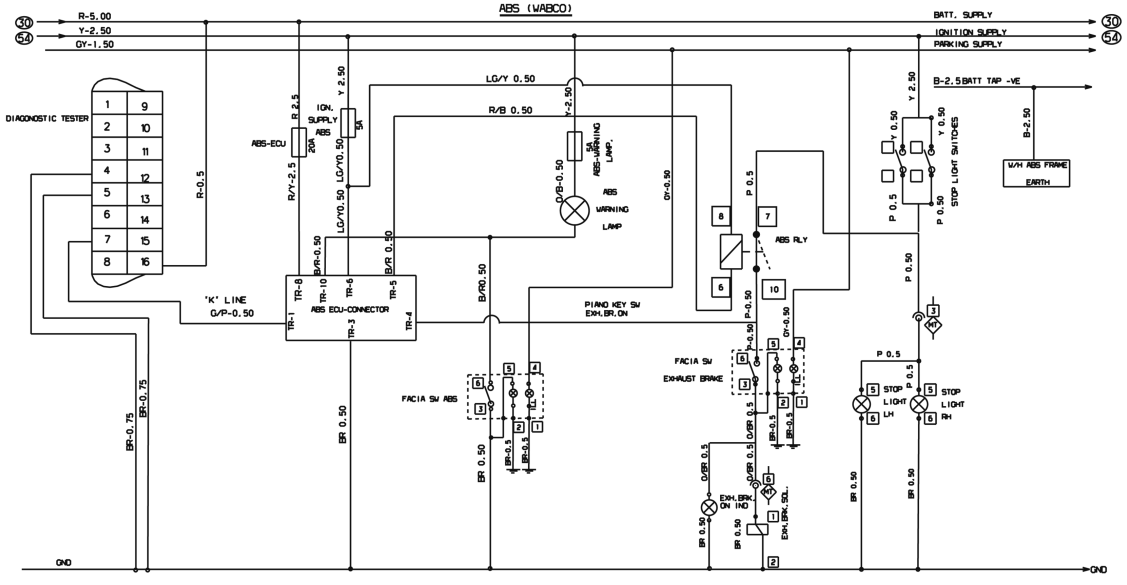
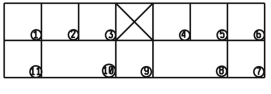
CKT. DETAILS FOR ABS (WABCO) SYSTEM

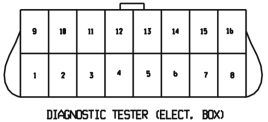


FACIA SW

ABS SHEET IS OPTIONAL



ABS ECU



DIAGNOSTIC TESTER (ELECT. BOX)

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Ergo Pack Circuit Schematic
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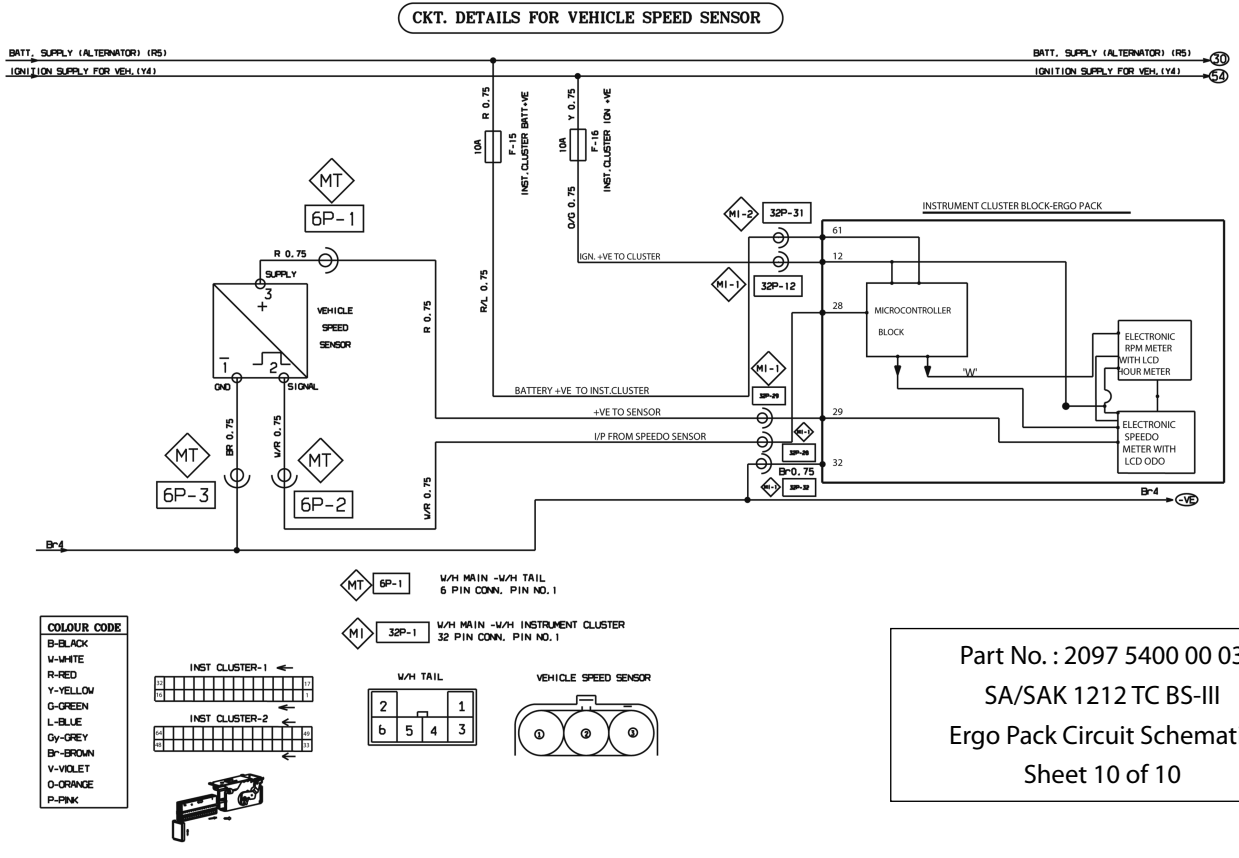

Part No. : 2097 5400 00 03
SA/SAK 1212 TC BS-III
Ergo Pack Circuit Schematic
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DO 'S

a. Load the tipper body uniformly.

b. Apply handbrake while tipping.

c. Position tipper on level ground during loading and unloading.

d. Observe that there are no obstructions in the dumping place.

e. Always depress the clutch fully and engage PTO properly.

f. Check the oil level in the hydraulic tank regularly.

g. Greasing as per greasing chart is important.

h. Check and tighten hydraulic fittings and other nuts and bolts regularly.

i. Check the hydraulic oil for contamination and change if required. Change the hydraulic oil completely every six months.

j. Check the filter element and change, if necessary.

k. Use recommended grade of hydraulic oil only.

l. Maintain the gearbox oil level to ensure proper lubrication of PTO.

m. Apply grease on extended piston rod, if any welding is being carried out near the cylinder. This is to avoid welding spatters from getting stuck on piston rod surface. Wipe off the grease after welding is completed.

n. Place all hydraulic components on a rubber mat in a dust free atmosphere while servicing.

o. Adjust the limiter valve in such a way that the cylinder does not extend fully in the tipped condition i.e. 50 to 100 mm of the smallest ram must stay inside even when the body is fully tipped.

DON'TS

a. Do not overload the tipper beyond the specified limit.

b. Do not park your tipper for tipping on uneven or soft ground.

c. Do not operate the PTO when the vehicle is in motion.

d. Do not drive with PTO engaged.

e. Do not drive with valve in closed position.

f. Do not race the engine fully. It is not necessary.

g. Do not drive away till body rests down completely on the subframe.

h. Do not work under an unsupported body.

i. Do not use the cylinder as welding conductor i.e. earthing should not be given on chassis while welding on the body and vice-versa.

j. Do not paint on the extended portion of the piston rod.

k. Do not change the relief valve setting on the control valve.

HOW TO OPERATE THE TIPPER

1. Position the tipper on a level ground to avoid toppling .
2. Apply hand brake and bring the gear lever to neutral position.

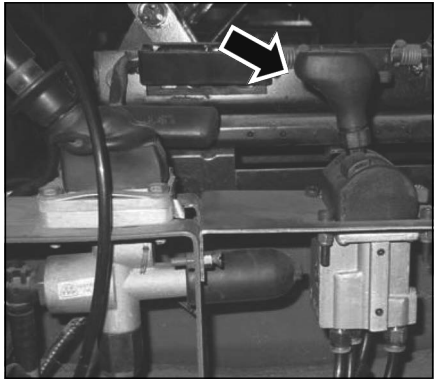
   Before tipping ensure the following :

   The site for unloading is clear of obstructions and people.

   The body in the tipped condition dose not come into contact with overhead electric wires.
3. Engage the power take off (PTO) by depressing the clutch pedal completely and PTO is operated electro- pneumatically by pushing the "PTO" switch to "ON" position. Now the PTO indicator will glow.
4. To start tipping, close the control valve by rotating the knob in UP direction.

   The rate of tipping, can be finely controlled by the valve opening and can be increased by fully closing the valve and also by increasing the engine speed (RPM) by accelerating.

   At the end of stroke, the oil supply in to the cylinder is cut off by the limiter valve and will not damage the system.



Tipper Control Valve cum PTO Lever

5. The body can be lowered by opening the valve by rotating the valve knob in DOWN direction. The rate of lowering can also be controlled by the valve opening. The body can be made to stop at any intermediate position by closing the valve completely and with the engine stopped or PTO disengaged.
6. Do not race the engine while lowering the body.
7. Do not move the tipper till the body is fully lowered and is fully resting on the sub frame.
8. PTO must be disengaged by depressing the clutch and by pushing "PTO" switch to "OFF" position. Now the PTO indicator will go "OFF" the tipper is not in use. Otherwise the pump will run continuously. This pump is for intermittent duty only and will get damaged if it is running continuously.

   The tipper is now ready to proceed.

Before you start using

The tipper for first time

1. If you are using the system for the first time or after the maintenance of cylinder, pump, valve or hose replacement etc,. then

   a. Bleed the air out of the system by opening the air bleed screw on the control valve and on the pump.

2. Before you start the vehicle, check:

   a. Oil level in the hydraulic tank using oil sight glass

   b. Ensure that proper grade of hydraulic oil is used Recommended standard brands and grades are as under:

Bharat petroleum	-	Hydrol 68
Indian Oil	-	Servo system 68
Hindustan petroleum	-	Enklo 68
Indrol	-	Mgna BD 68

   c. Check that all U-bolts are properly torqued and are in place and must have 5 or 6 U-bolts on each side of sub- frame. Tipper must have 2/3 bolts on each side of sub frame end connecting the sub frame with chassis properly torqued.

3. Operate and check whether the PTO is engaging properly and lever operation is smooth.

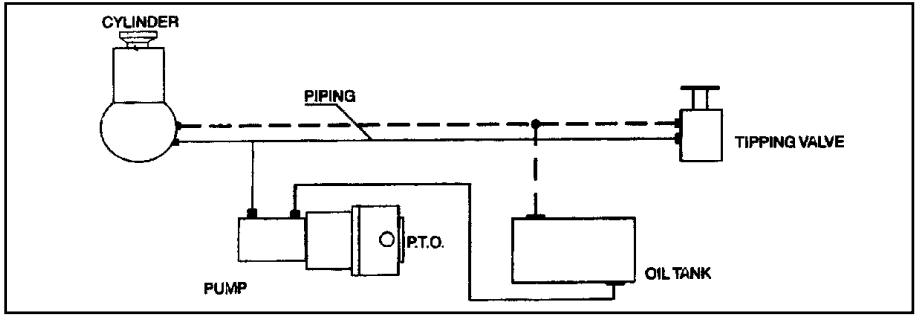
4. Operate and check whether the valve can be operated easily by rotating the knob.

5. Once these above checks are carried out, do the tipping operations a few times without any load. When you are totally convinced that he tipping is smooth, with the body in the tipped condition, and the body supporting props in place, check whether the greasing points have been greased properly as shown in the in this book.

6. Check tightness of all the hydraulic fittings, assembly bolts, tank mounting, cylinder mounting, pump mounting and valve mounting.

7. Now tipper is ready for use.

NOTE : After using the tipper initially for about 50-60 trips, change the oil and hydraulic filter. This will increase life of the hydraulic system.



Tipping system

1. Cylinders

Type	Telescopic, Two stroke
No. of stages	2
Ram diameter	89 mm (min.) 120 mm (max.)
Stroke	1034 mm
Closed length	847 mm
Working pressure	170 Bar
Volume	9 litre

2. Pump

Type	Axial piston pump
No. of pistons	9
Working pressure	180 Bar
Speed	1400 rpm (max.)
Displacement	63 cu. cm/rev
Direction of rotation	Bidirectional

3. Tipping valve

Type	Pneumatically operated control valve.
Flow	70 litres per minute (maximum)
Relief pressure	180 Bar

4. Oil Tank

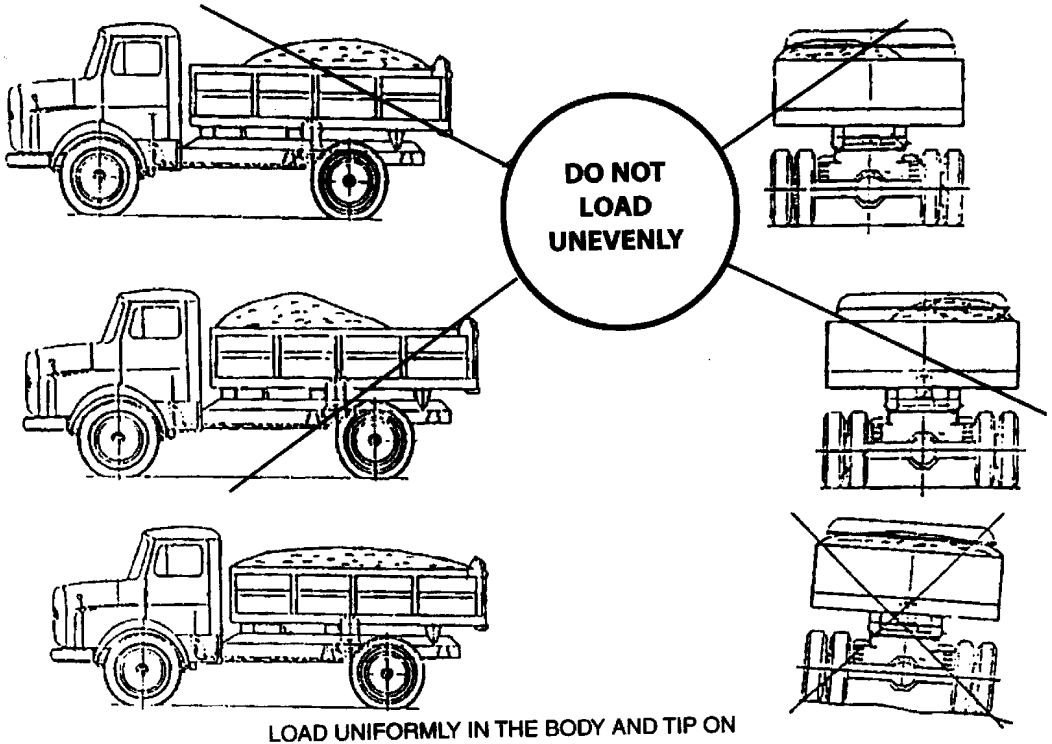
Oil capacity	37.5 litres with breather and return line filter

5. PTO pump — This pump is driven through a drive unit fitted on side PTO of G-600

6. Piping — Metallic pipes with standard fittings and flexible hoses.

7. Hinge shaft — Front stability shaft. Rear stability shaft, Selector pin.

8. Accessories — Mechanical jack (prop), Safety wire rope arrangement



LOAD UNIFORMLY IN THE BODY AND TIP ON
EVEN GROUND

Trouble	Probable cause	Remedy
1. Cylinder not lifting load.	power take off not engaged properly Overloading Too much load in front Leakage in cylinder Less oil in tank Cylinder not receiving hydraulic oil at sufficient pressure Defective relief valve	Engage properly Reduce load Shift load to the back of body Change cylinder seals Fill oil to required level Check pump - repair or replace.
	Pressure setting incorrect/ Air lock	Replace valve or contact supplier.
	Limiter valve spool stuck inside	Bleed through pump/valve Replace spool and spring
2. Lifting slow even when engine rpm increased	Flow restriction in suction/ pressure line	Check and clean hoses and pipes Replace if needed.
	Cylinder not receiving sufficient flow	Check pump, repair or replace. Tighten connections- repair or replace

Trouble	Probable cause	Remedy
	Oil insufficient in tank Control valve clogged	Fill to required level Clean valve thoroughly.
3. Leakage in seals	Cylinder / pump / valve leakage	Replace worn-out seal
4. Erratic movement	Air Lock in system	Tighten the joints- Replace if needed Bleed through pump, valve
5. Pump not delivering oil		Check air breather
	Less oil in tank Oil intake hose / filter clogged	Fill oil to required level Remove and clean lines and filter
	Pump shaft speed low Oil viscosity too high	Increase engine speed Use recommended oil only
6. Pump not working to rated pressure	No delivery	Bleed the pump
	Internal leakage in pump/valve	Detect leakage and replace seals or plunger seal
	Free circulation of oil to tank	Check valve operation
	Damaged seal or check valves in pump	Replace seals and check valves

Trouble	Probable cause	Remedy
7. Excessive noise	Partially clogged line or filter Air drawn through suction line Damaged seals on pump Damage plunger seals Damaged bearing Damaged plunger springs Foreign material in pump Damaged check valve on pump	Clean filter & suction line thoroughly Tighten the 4 nos. Jubilee clips Replace seals Replace plunger seals Replace bearing Replace plunger springs Clean pump thoroughly Replace defective check valve
8. Oil leakage	Damaged 'O' ring and wiper Excessive leakage in valve Oil leakage from cylinder port pipe and sub assy.	Change 'O' ring and wiper Replace valve Replace quad rings
9. Load not holding	Needle valve damaged Leakage in cylinder leakage between ports of the cylinder	Replace needle valve Replace seals Change clamping ring

MAINTENANCE SCHEDULE

1. Daily

   a. Tip the body and rest the body on the prop (mechanical jack)

   Never work under the body without body supporting prop in place.

   b. Lubricate wit grease gun-

   i Spherical ball joints of the top and bottom of the cylinder.

   ii Visually check for any oil leak and rectify if necessary.

2. Weekly (in addition to daily)

   a. Check tightness of fasteners on subframe, etc.

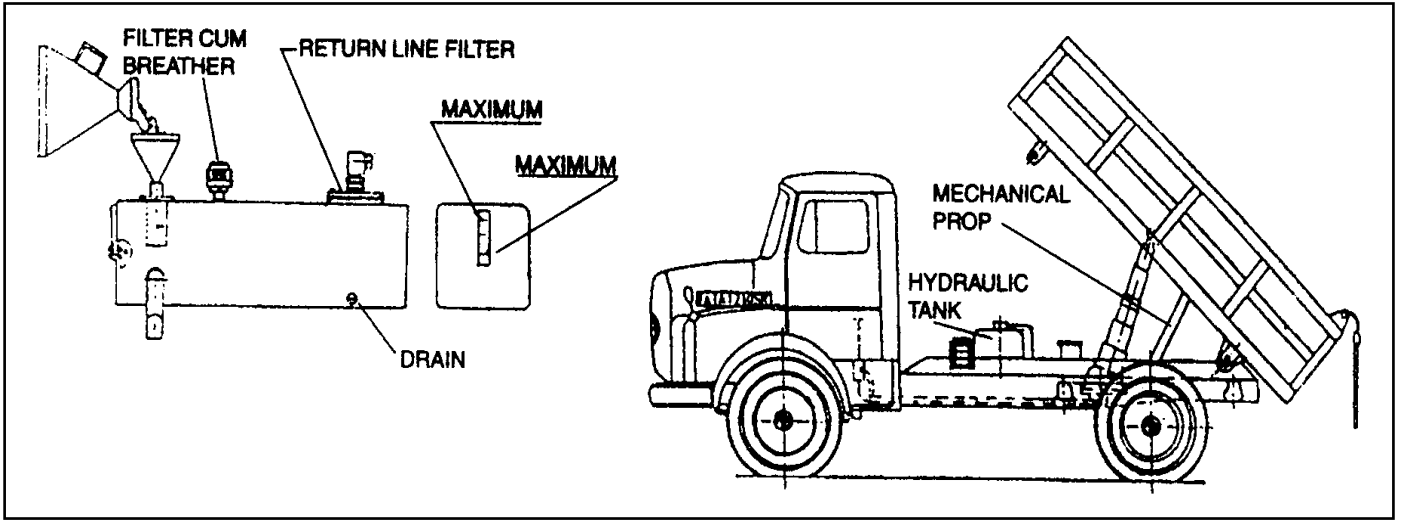
   b. Check hose nuts hydraulic fittings etc.

   c. Clean air breather filter with kerosene.

   d. The oil level must be topped up to the given mark on the oil tank level indicator. Topping up above this might result in spillage. Replace the cap on the filter and tighten to avoid the same from falling down while the tipper is in motion.

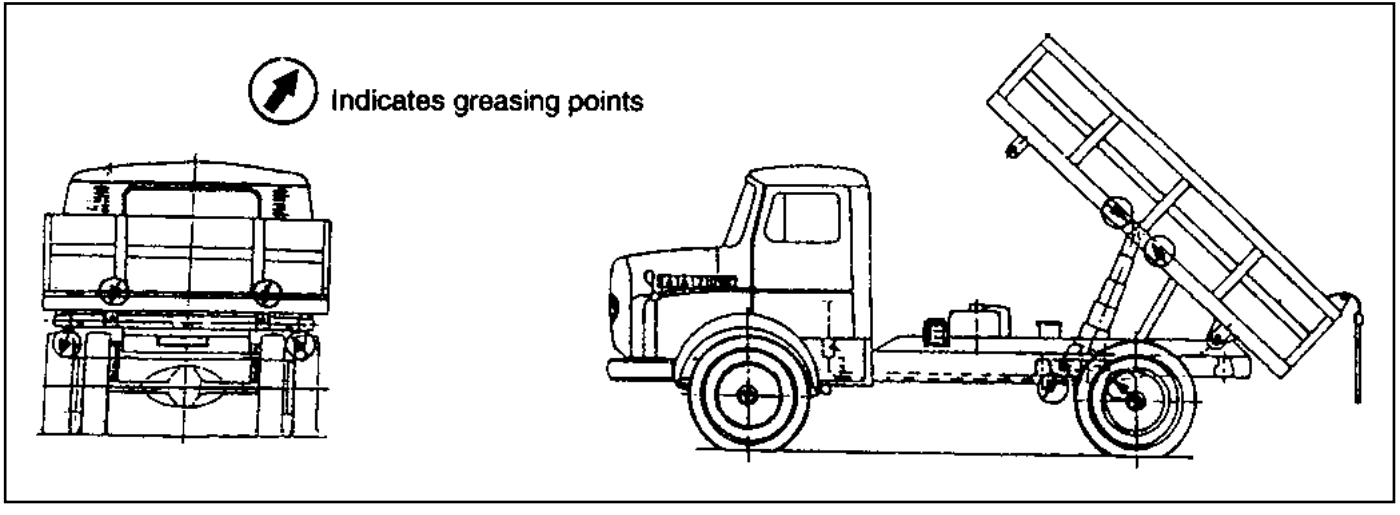
3. Monthly (in addition to daily and weekly)

   a. Return line filter on the tank should be cleaned atleast once in a month. If it is damaged, must be replaced with genuine return line filter element supplied by Tata Motors or Wipro. It is advisable to change the return line filter once in six months or earlier depending on the contamination and filter condition.

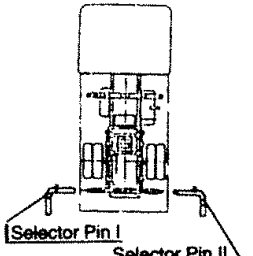


Oil level maintenance

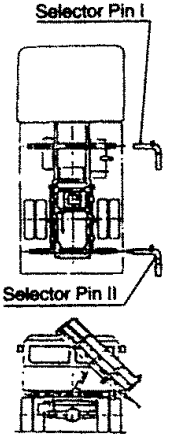
1. Oil level should be at maximum level when body is resting on subframe.
2. Oil level should be at middle mark when body is lifted by two stage of cylinder.
3. Tip the body and support the using mechanical prop for oil filling.
4. Through filler breather fill the oil to the required marked level using cleaned funnel.



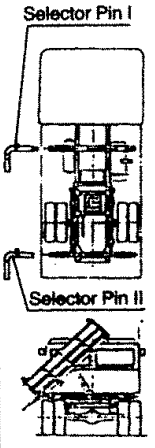
Greasing points



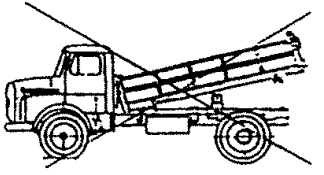
Rear Tipping



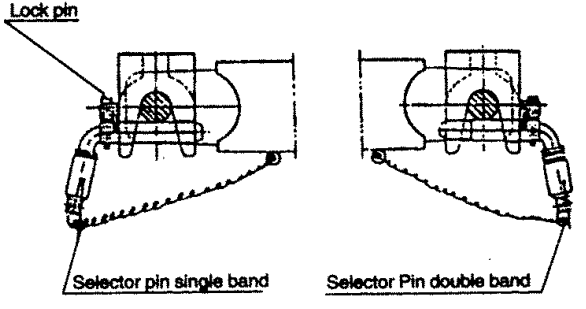
Rightside Tipping



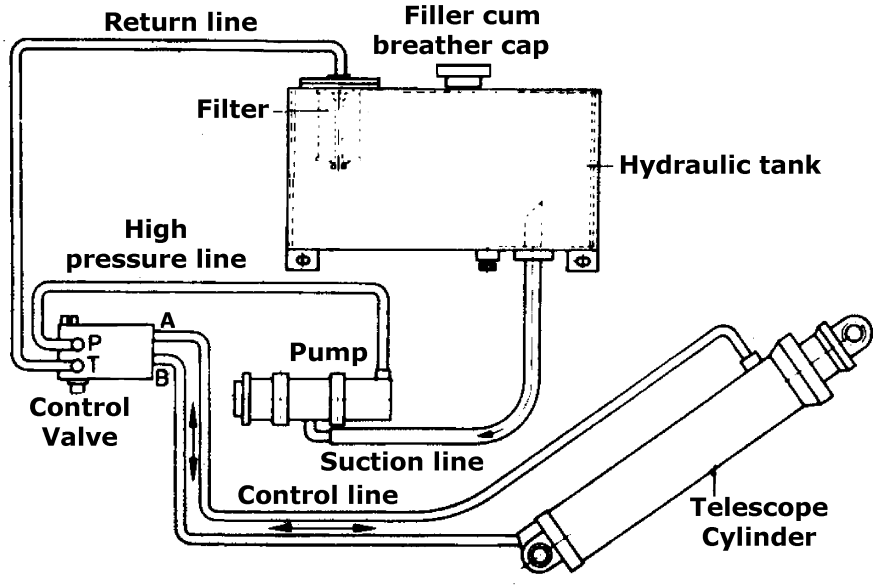
Leftside Tipping



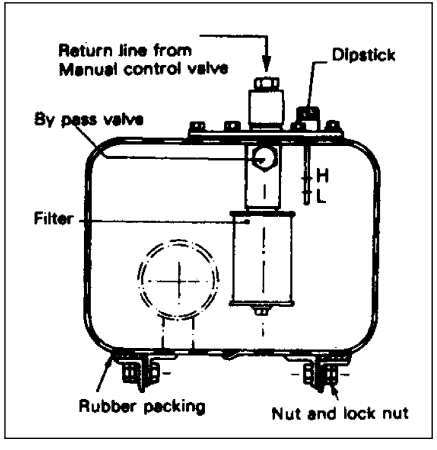
Dont tip the body front to avoid damaging the cabin



Selector pin - Body hinge Assembly



Schematic circuit - Tipper Hydraulic System - Single hydraulic cylinder (Tipper)



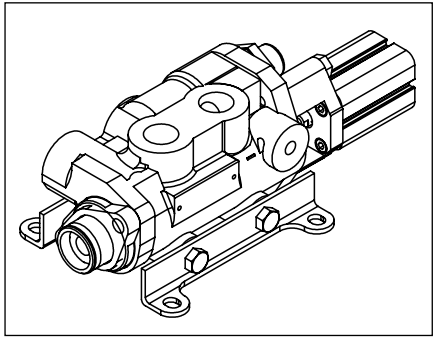
Hydraulic Tank

Hydraulic system Hydraulic Tank

The hydraulic tank is a rectangular tank mounted with resilient rubber packing, on the frame, between the long member, The tank is provided with a cap and a dip stick with markings. H and L show high and low levels. The oil level should always be between these two markings. The dip stick also incorporates the breathing arrangement to ensure adequate venting of the hydraulic tank. Inside the tank is a hydraulic oil filter (Throw away type) on the return line.

Hydraulic oil filling :- The following procedure is to be adopted when the system is to be filled with hydraulic oil.

1. Open the filler cap and add the hydraulic oil to be filled with hydraulic oil.
2. The pump should be stared and manual control valve operated a couple of times so that the oil enters the either side of cylinder, at the same time bleeding it. The cylinder has to be bled by slightly loosening the banjo connection of hydraulic cylinder and tightening it after all the trapped air is driven out and only oil starts coming out.
3. This ensure that the system is filled with hydraulic oil.
4. Again fill up the tank oil tank so that the oil level lines in between the H and L marks on the dip stick.

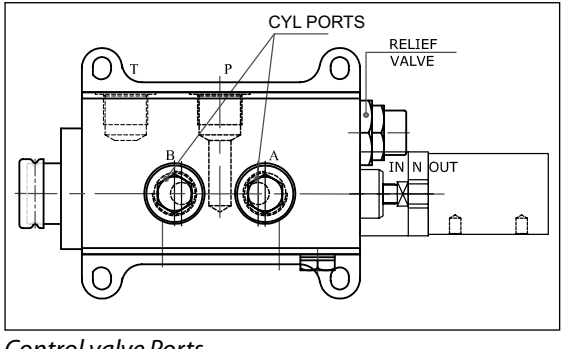


Control valve Schematic

SPECIFICATIONS

DIMENSION	
PORT	SIZE
A	M 22 X 1.5
B	M 22 X 1.5
P	M 22 X 1.5
T	M 22 X 1.5

OTHER SPECIFICATION	
RELIEF SETTING	180 BAR
MAX. FLOW	70 LPM
NO. OF SPOOL POSITION	3
ACTUATION METHOD	MANUAL

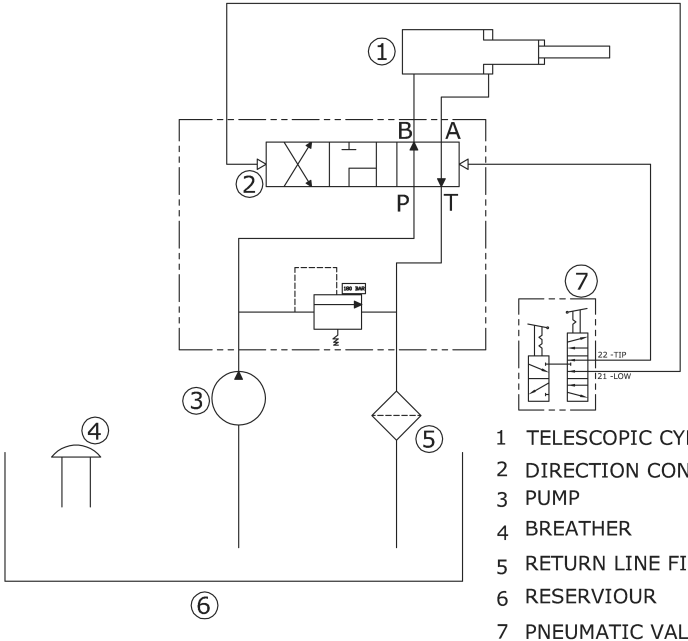


Control valve Ports

Control Valve

A single spool, directional type, manually operated, control valve manufactured by Tata Motors is used to operate telescopic cylinder. This control valve has one inlet port, a tank port and two cylinder ports. The inlet port marked as 'P' is connected to pump outlet. The two cylinder ports are connected to the fixed end and piston rod of the telescopic cylinder. The tank port of the control Valve, marked 'T', is connected to the tank. "B" is connected jack bottom. "A" is connected to jack top. The control valve incorporates an integral pressure relief valve correctly set at Tata Motors. The control valve is mounted under the cab. The operating lever is so located as to facilitate easy operation by the driver.

The control lever has three positions, raise neutral and lower. The control valve fitted on tipper is called MCV-90. Lever will return to neutral position from raise position automatically when released.



1 TELESCOPIC CYLINDER
2 DIRECTION CONTROL VALVE
3 PUMP
4 BREATHER
5 RETURN LINE FILTER
6 RESERVIOUR
7 PNEUMATIC VALVE

Neutral Position

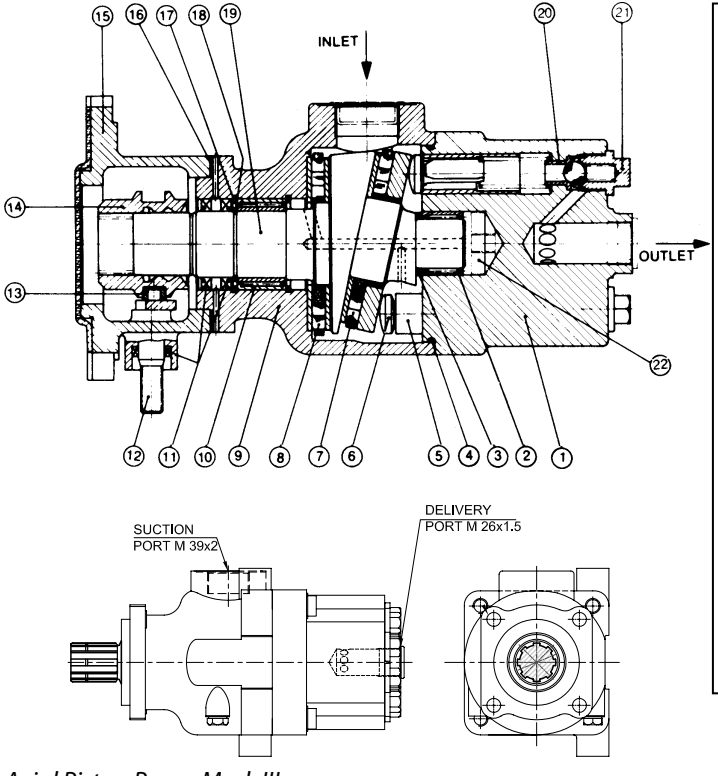
The centring spring at the end of speed holds the spool in neutral position. The pump delivery is routed through port 'A' to the outlet port in this position. Port 'B' is blocked in this position preventing the cylinder movement.

Tipping (Raising) the body

When the spool is pulled out by operating the lever, the pump delivery is directed to port 'B' is and port 'A' gets connected to tank, the cylinder extends thus raising the body.

Lowering the body

When the control lever is pushed in and the port 'A' gets connected to pump, the port 'B' is connected to tank the cylinder retracts thus lowering the body.



1 Plunger Housing
2 Needle Bush
3 Spacer
4 'O' Ring
5 Plunger Sleeve
6 Poppet
7 Thrust Bearing
8 Thrust Bearing
9 Seal Housing
10 Needle Bearing
11 Oil Seals
12 Shifter Shaft
13 Shifter Piece
14 Coupler Sleeve
15 Shifter Housing
16 Gasket
17 Circlip
18 Snap Ring
19 Shaft
20 Ball Seat
21 Delivery Valve
22 Bush Removal Piece

Axial Piston Pump Mark III

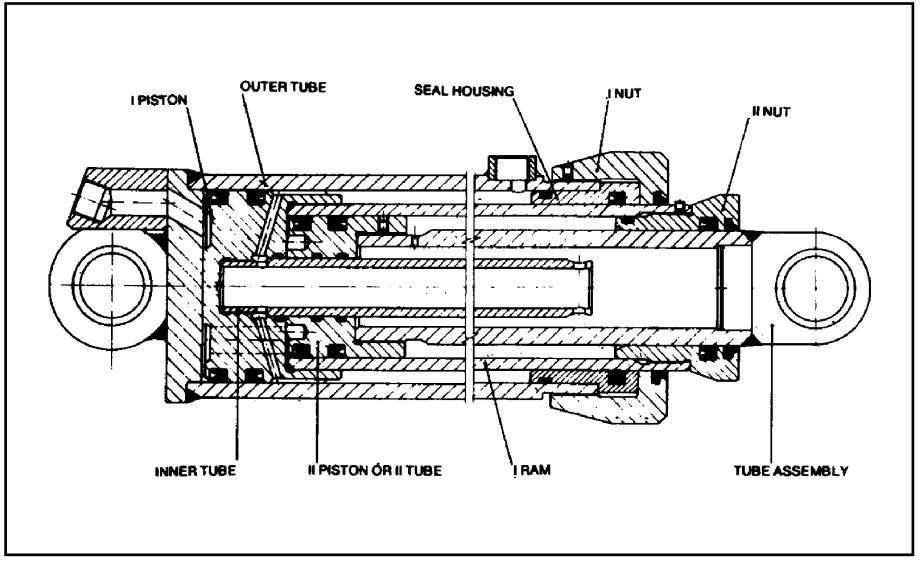
Pump

This pump is an axial piston pump and is known as Mark III Axial piston pump. The pump has 9 number of plungers and a delivery of 70 lit/min at max, engine speed at a pressure of 180 kg/cm^2. The pump is driven through a drive unit fitted on side PTO of G600.

The pump should never run dry

Filter

A full flow oil filter with throw away type insert is incorporated in the hydraulic system to ensure supply of clean oil to the system. The filter is located inside the hydraulic tank in the return passage of the hydraulic circuit. The filter cartridge is always immersed in oil. The filter has a by pass valve which allows the oil to return in case filter gets clogged.



Hydraulic Cylinder

This is two stage telescopic double acting hydraulic cylinder. The cylinder is manufactured by Tata Motors. The fixed end of hydraulic cylinder is pivoted on the sub frame and the piston rod end on the body frame.

Guidelines for servicing of hydraulic elements

1. Hydraulic system is designed to maintain low contamination level by providing return line filter for positive filtration. However, outside dust in the field working condition can lead to problem if the elements are not dismantled and assembled properly, Hence, any elements like cylinder, pump or valve etc. removed from tipper must be cleaned thoroughly before dismantling.
2. Ensure clean, preferably dust free area for servicing of elements.
3. Thoroughly remove dust and dirt from oil and components using flushing oil.
4. Use soft lint-free cloth. Never use cotton waste as lint may contain metal chips which will damage working surface of components.
5. After dismantling, inspect every component and assess the damage and replace wherever necessary.
6. It is advisable to change seals and 'O' rings once removed from housing.
7. Before fitting the new rubber components like 'O' rings and seals, immerse in hydraulic oil.

Vehicle storage

The following protective treatment would be required for the vehicle in case the body building is deferred or the vehicle would be put in operation after considerable storage or the body building time would be fairly long.

The vehicle should be thoroughly washed and lubricated. Check all painted parts of the vehicle for damage and touch up, if necessary. Apply chromium protective paste on the chromium plated parts. Check the chassis to see whether the paint has peeled off and touch up wherever necessary. Grease all unpainted parts including springs and spring suspensions with anti-corrosive grease.

If the vehicle is to be laid up for more than 6 months, drain off transmission and rear axle oils when hot, after the vehicle has been driven for sometime and replace by anti corrosive oil.

Depress clutch pedal and wedge it in depressed position to prevent the clutch disc sticking to the pressure plate or the flywheel.

Batteries which are not used, should be serviced at regular intervals to keep them in good condition. Batteries should be stored in a cool and dry room. Check battery condition every fortnight. If necessary, recharge.

The vehicle should be jacked up to relieve the load on tyres. The tyres including the spare wheel should have a pressure of approximately 0.5 to 1 kg/cm^2. Check the tyre pressure from time to time.

The paint needs no special maintenance if the vehicle has been thoroughly cleaned before laying it up.

Caution : *Grease nipples must be carefully cleaned prior to greasing and the same applies to grease cups / screw plugs before they are unscrewed.*

Engine storage (Short term)

Note : *This procedure describes the correct method of preparing an engine for short term (1 to 6 months) storage.*

Operate the engine at high idle until the coolant temperature reaches 70^0 C. Shut off the engine.

Remove the fuel tube to the engine fuel filter and the injector return tube.

Note : *Fuel system preservative oil must meet Federal specification V V-L-800C.*

Fill two containers, one with diesel fuel and the other with the preservative oil. Put both fuel tubes into the container of diesel fuel.

Start the engine. When it is operating smoothly, put the fuel supply tube into container of preservative oil. Remove the injector return tube from the diesel fuel container. When preservative oil flows from the tube, shut off the engine.

Install the fuel supply tube to the fuel filter, and put a cap on all other fuel tubes.

Drain the lubricating pan, the oil filter, and the fuel filters. Install the drain plug into the oil pan and install the filter cans. Tighten according to specifications.

Note : *Do not drain the coolant from the cooling system.*

Inspect the engine closely, and cover all openings with tape to prevent dirt and moisture from entering. Install a warning tag which alerts others of **no oil** in the engine and that it **must not be started.**

Store the engine / vehicle in a dry area of even temperature.

Rotate the crankshaft two or three revolutions every 3 to 4 weeks using the barring gear .

Preparing the engine after short term storage.

Remove the tapes from all openings, and remove the warning tag. Refill the oil filter with clean 15W-40 oil, and fill the oil pan to the high mark on the dipstick. Prime the lubrication system.

Use the starter to crank the engine for a **maximum of 30 seconds with 2 minute intervals** until oil pressure registers on the oil pressure gauge.

Use clean diesel fuel to flush the preservative oil from the fuel system, and fill the fuel filters again. Prime and vent the fuel system.

Engine storage (Long term)

This procedure describes the correct method of preparing an engine for long term (6 to 24 months) storage.

Note : *If the engine has been stored for 24 months, the cooling system must be flushed with a solvent. Repeat the flushing procedure a second time.*

Operate the engine at the idle throttle position until the coolant temperature reaches 70^0 C.

Shut off the engine.

Drain the lubricating oil pan. Install the drain plug and fill the oil pan to the high level mark on the dipstick with preservative oil.

Note : *Lubricating system preservative oil must meet Military Specification MIL -L- 21260 Type PE 30 I SAE 30.*

Disconnect the fuel supply tube at the fuel filter and keep the injector return tube at a convenient place.

Note : *Fuel system preservative oil must meet Federal Specifications V V-L-800C,*

Fill two containers, one with diesel fuel and the other with preservative oil. Put both fuel tubes into the container of diesel fuel.

Start the engine and, when operating smoothly, put the fuel supply tube into the container of preservative oil.

Remove the injector return tube from the diesel fuel container, when the preservative oil flows from the tube. Shut off the engine.

Connect the fuel supply tube to the filter and put a cap on the ends of all the other fuel tubes.

Drain the preservative oil from the lubricating oil pan and the oil filter. Install the drain plug.

Drain and flush the cooling system, using a water-soluble rust inhibitor.

Spray preservative oil into the intake and the exhaust ports of the cylinder head housing and the exhaust manifold.

Install the exhaust manifold.

Remove the rocker housing covers, and spray the rocker levers, valve springs, valve stems, valve guides, and the push rods with preservative oil. Install the rocker housing cover.

Spray preservative oil into the intake port of the air compressor and on all exposed metal surfaces that are not painted.

Note : *Use a preservative compound that meets Military Specification MIL-C-16137 C type P-2 Grade 1 or 2.*

Cover all openings with heavy paper and tape to prevent entrance of dirt and moisture.

Put a warning tag on the engine which contains the following information :

Date the engine was prepared for storage.

Crankshaft must not be rotated.

Coolant has been drained.

Engine must not be operated.

Store the engine / vehicle in a dry area of even temperature.

Preparing the engine after Long term storage

Remove the paper and the tape from all openings. Remove the warning tag.

Flush the fuel system with clean diesel fuel to remove preservative oil.

Rotate the water pump to make sure that it hasn't rusted.

Rotate the crankshaft two complete revolutions to make sure the piston rings are free and no foreign objects are in the engine.

Remove the intake manifold cover and visually inspect the lower valve stem area for presence of rust. An accumulation of rust requires disassembly and rebuild of the cylinder head.

Install the drive belt.

Remove a plug from the main oil rifle drilling and flush the preservative oil from the engine by pumping 4 litres of light mineral oil into the oil rifle. Rotate the crankshaft three or four revolutions as the engines is flushed. Install the plug.

Remove the oil drain plug and allow the mineral oil to drain from the engine.

Remove the lubricating oil filter. Install a new filter.

Pressure fill the engine with 15W40 lubricating oil through the 1.8 inch pipe tap on the side of the oil filter housing directly below the turbocharger oil supply connection. Use 2.07 bar to pressure fill the system with a minimum of 3.6 Litres.

Fill the oil pan to the high mark on the dipstick.

Fill the cooling system with a mixture of 50% water and 50% ethylene-glycol type antifreeze. Adjust the valve clearance.

Tighten all cap-screws, plugs and fittings as necessary.

Caution : *Make sure that the engine does not start when you crank the engine.*

Use the starter to crank the engine for a **maximum of 30 seconds with two minute intervals,** until oil pressure registers on the lubricating oil gauge.

When choosing torque wrench, remember that it should not be subjected to torque exceeding three-fourth of its capacity. Before tightening, clean the threads and apply a little oil.

Sl. No.	Description	Torque
	ENGINE	
1	Cyl. Head Mtg. Cap Screw. (Follow the sequence)	
	Step 1 (ALL Cap Screws.)	9.0 mkg.
	Step 2 Recheck (All Cap Screws.)	9.0 mkg
	Step 3 (Long Cap Screws Only.)	12.0 mkg
	Step 4 Recheck (Long Cap Screws Only)	12.0 mkg
	Step 5 (All Cap Screws)	Rotate by 90 degrees
2.	Rocker support bolts	2.4 mkg
3	Valve lash adjusting screws nut	2.4 mkg
4	Main bearing cap screws Step 1	8.0 mkg
	Main bearing cap screws Step 2	Rotate by 60 degrees
5	Con. rod cap screws Step 1	6.0 mkg
	Con. rod cap screws Step 2	Rotate by 60 degrees
6	Fly wheel housing mtg. screws	7.7 mkg
7	Fly wheel mtg. screws	13.5 mkg
8	Vibration damper mtg. screws	12.5 mkg

Sl. No.	Description	Torque
9	Crank shaft rear oil seal mtg. screws	0.9 mkg
10	Timing gear housing cover mtg. screws	2.4 mkg
11	Timing gear housing mtg. screws	2.4 mkg
12	Cam shaft thrust plate	2.4 mkg
13	Cam shaft drive gear (Inline Pump “P” type)	2.7 mkg Rotate by 60 degrees.
14	Water pump	2.4 mkg
15	Belt Tensioner	4.3 mkg
16	Push rod, cover cap screws	2.4 mkg
17	Oil cooler mtg. screws	2.4 mkg
18	Oil pump mtg. screws	2.4 mkg
19	Oil suction tube mtg. screws	2.4 mkg
20	Oil pan mtg. screws	2.4 mkg
21	Valve cover screws	2.4 mkg
22	Intake manifold cover screws	2.4 mkg
23	Oil filler tube	4.5 mkg
24	Oil filter	3/4 turn after contact
25	Oil drain plug	6.0 mkg
26	Oil pressure regulator retainer plug	8.0 mkg

Sl. No.	Description	Torque	
27	FIP drive gear nut initial Torque (ROTARY TYPE)	2.0	mkg
28	FIP drive gear nut Final Torque (ROTARY TYPE)	6.5	mkg
29	FIP mounting nuts	2.4	mkg
30	FIP brace cap screw (ROTARY)	2.4	mkg
31	Fuel lift pump mtg. screws (Diaphragm type)	2.4	mkg
32	Fuel Lift Pump Mtg. Screws (Plunger type)	3.2	mkg
33	Fuel filter adopter nut	2.4	mkg
34	Fuel High Pressure pipes	2.4	mkg
35	Injector Holding nut	6.0	mkg
36	Fuel filter bracket mtg. screws. (Inline Pump)	2.4	mkg
37	Turbo Oil drain tube screws	2.4	mkg
38	Turbo Oil drain tube clamps	2.4	mkg
39	Turbo mtg. nuts	4.3	mkg
40	Turbo charger hose clamps	0.5	mkg
41	Turbo turbine housing screws	2.0	mkg
42	Exhaust manifold mtg. screws	4.3	mkg
43	Fan clutch bkt. mtg. screws (bkt. to eng. block)	2.4	mkg
44	Fan clutch mtg. screw	27	mkg

Sl. No.	Description	Torque	
45	Fan mtg. screws	5.0	mkg
46	Air compressor drive gear nut	12.5	mkg
47	Air compressor mtg. nuts	7.7	mkg
48	Starter mtg. screws	4.3	mkg
49	Alternator mtg. nut	5.5	mkg
50	Clutch pressure plate mtg. screws	6.0	mkg
51	Transmission housing mtgs. screws	9.5	mkg
52	Rear engine mtg. {All bolts (8) and nuts (8)}	8.0	mkg
53	Engine front mounting centre bolt	32 to 35	mkg
54	Engine front mounting bracket to cross member	5 to 6	mkg
55	Engine front support mtg. screws	7.7	mkg
	TRANSMISSION (G-600)		
1.	Main Shaft Coupling Flange Nut (M32 Threads)	36-40	mkg
2.	Coupling Flange / Propeller Shaft Nuts / Bolts	7	mkg
3.	Centre Bearing Bracket mounting Bolts	5	mkg
4.	Gear Shift Lever Bracket mounting bolts	3	mkg
5.	Turning Tube / Connecting Flange mounting nuts / Bolts	3	mkg

Sl. No.	Description	Torque	
6.	Housing Interface Bolts	6	mkg
7.	Top Cover bolts/screws	2.5	mkg
8.	Front Cover bolts/screws	2.5	mkg
9.	Rear cover bolts/screws	2.5	mkg
10.	Rear cover lower (inner) bolts/screws	6	mkg
11.	Reverse Idler Cover bolts/screws	1.5	mkg
12.	Filler plug	1.5	mkg
13.	Drain plug	6	mkg
	POWER STEERING AND CHASSIS		
1	Steering intermediate cover screw M 10	3	mkg
2	Steering intermediate cover screw M 12 x 1.5	5.6	mkg
3	Steering intermediate cover screw M 14 x 1.5	9.2	mkg
4	Sealing nut	4.3	mkg
5	Oil drain plug	2.1	mkg
6	Counter nut	1.7	mkg
7	Ball joint of Pitman arm and drag link	13 to 17	mkg
8	Pitman arm to cross shaft	40 to 45	mkg

Sl. No.	Description		Torque	
9	Shock absorber mounting bolts		10	mkg
10	Brake anchor plate mounting bolts		12	mkg
11	'U' bolt nuts	Front axle	22	mkg
		Rear axle	22	mkg
12	'U' bolt check nuts	Front axle	15	mkg
		Rear axle	15	mkg
13	Wheel nuts		50 to 60	mkg
14	Bolts holding steering mounting bracket to long member		10	mkg
15	Bolts holding steering gearbox to mounting bracket		10	mkg
16	Steering arm mounting bolt / nut		20	mkg
17	Rear spring hanger mounting bolts		12	mkg
18	Tie rod end		13 to 17	mkg
19	Drag link ends nuts on adjusting clamp		13 to 17	mkg

Technical Specification

ENGINE	
Model	Cummins B5.9 130 31
Type	Water cooled, Turbocharged, after cooled Diesel Engine
No. of Cylinders	6 Inline
Bore / Stroke	102mm x 120mm
Capacity	5883 CC
Max. engine output	130 BHP (101.5 Kw) at 2500 rpm as per ECE R 24 and CMVR 115 (9)
Max. torque	490 Nm at 1500 rpm as per ECE R 24 and CMVR 115 (9)
Compression ratio	18:1
Firing order	1-5-3-6-2-4
Air filter	Dry type remote mounted
Oil filter	Spin-on full flow paper type
Fuel filters	Two stage Pre & fine filtration with water separator
Fuel injection pump	For SA 1212 C/42 BOSCH Rotary VE 14/ VP 14 For SAK 1212 C/32 & SA 1212C/32 BOSCH Rotary VE 6 /VP 14
Governor	All speed, Mechanical
Turbocharger	HOLSET HX 35W SA 1212C/42 HOLSET HE 250W SAK & SA 1212C/32
Capacity of cooling system	22 liters (Total)
Coolant	Water & Ethylene glycol, Ratio 1:1 premixed
Crankcase oil capacity	Max. 15.3 Litres, Min. 13.3 Litres
Weight of engine	413 kg (Dry) with flywheel and alternator but without starter and air compressor
Radiator frontal area	3007 sq.cm.
CLUTCH	
Model	Single plate,Coil type with ceramic Lining (dry friction type)
Outside diameter of clutch lining	352 mm
Type	Pull Type
Friction area	464 sq. cm (approx.)

GEAR BOX	
Model	TATA G-600 with PTO for APP- MK III (for SAK 1212 C/32 & SA 1212C/32) TATA G-600 with PTO provision (for SA 1212C/42)
Type	Synchromesh on all forward gears and constant mesh on reverse gear
No. of gears	6 Forward 1 Reverse
Gear Ratios (G-600)	1st - 8.47 2nd - 4.87 3rd - 2.95 4th - 1.92 5th - 1.29 6th - 1.00 Rev - 7.28
AUXILIARY GEAR BOX (Transfer Case)	
Type	Constant mesh helical gear
Ratios	High 1.05:1 for 4x2 drive Low 1.60:1 for 4x4 drive
REAR AXLE	
	Single reduction hypoid gears, heavy duty fully floating axle shafts
Type	TATA RA - 108RR
Ratio	5.857 : 1 (41/7)
FRONT AXLE	
Model	FA 104
Ratio	5.857:1 (41/7)

STEERING	
Type	Fixed column type with Nacelles and steering lock cum ignition switch
Steering Wheel Dia	470 Dia, 2 Spokes and Nacelles
Ratio	20.2:1
BRAKES	
Service brakes	Full air S-cam brake
Brake drum diameter	Front - 410 mm., Rear - 410 mm
Lining area	Front - 2180 sq. cm., Rear - 2470 sq. cm., Total - 4650 sq. cm.
Parking brake type	Graduated valve controlled spring brake chamber integral with rear brake
Engine exhaust brake	Pneumatically operated butterfly valve Type exhaust Brake
FRAME	
Type	Ladder type heavy duty frame with riveted / bolted cross members. Side members are of channel section. Depth : 223 mm (max.) Width : 60 mm
SUSPENSION	
Type	Semi elliptical leaf spring at front and rear

Spring span	Front - 1450 mm Rear - 1600 mm (Main) 1100 mm (Auxiliary)
Leaf width	Front - 70 mm Rear - 80 mm
Shock absorbers	Hydraulic double acting telescopic type at front, optional at rear.
WHEELS & TYRES	
Tyres	10.00-20,16PR RIB type (front), 10.00-20,16PR LUG type (Rear)
Wheel rims	7.00 x 20
No. of wheels	Front - 2, Rear - 4, Spare - 1
FUEL TANK	
Capacity	150 litres Rectangular tank for 32 WB (SAK 1212 C & SA 1212C) 225 litres Circular tank for 42 WB (SA 1212TC)
CAB/COWL	
Type	All steel semi forward control Driver's cab or cowl
ELECTRICAL SYSTEM	
System Voltage	24 Volts
Alternator Capacity	55 Amps
as per DIN:72311 & BS:3911	12 Volts,150 Ah capacity (2 Nos)

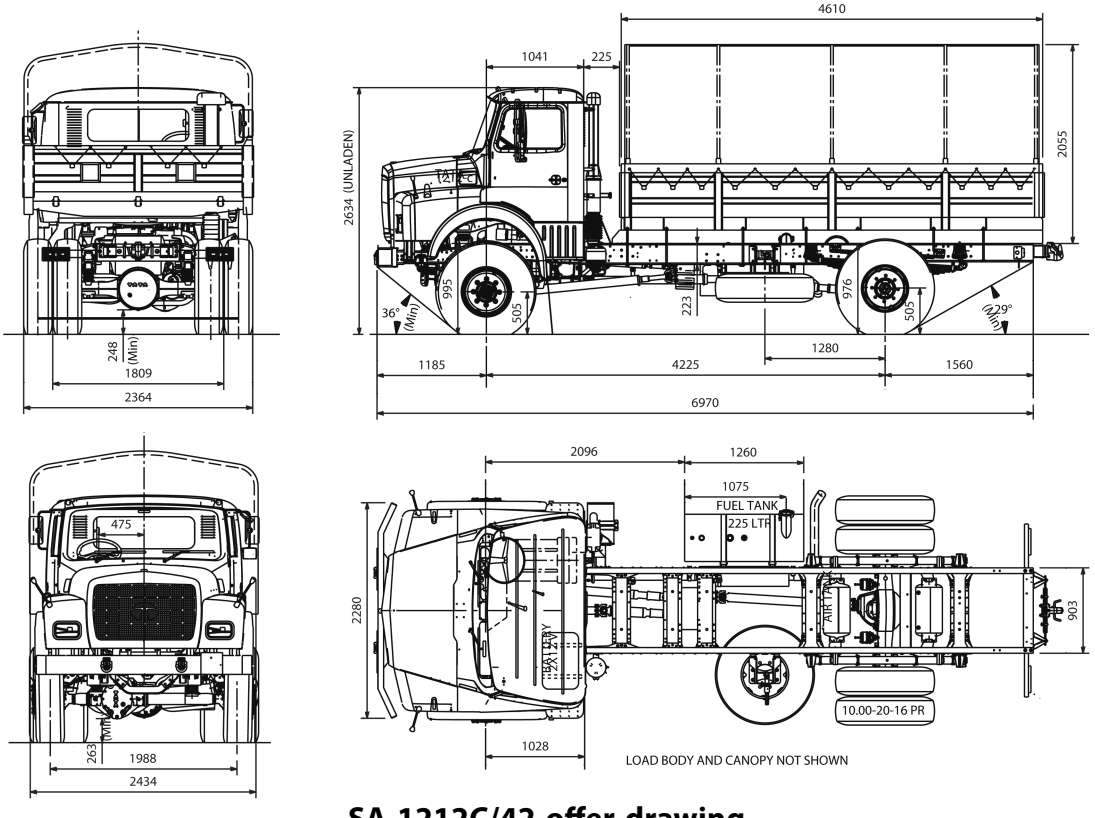
TIPPING GEAR	Under-body tipping gear pivoted to the subframe at rear with heavy duty steel body. Tipper is provided with tail gate.
Struck capacity in Cu.Mtrs.	4.5(Box Tipper)
PERFORMANCE	
Maximum recommended speed kmph	72 kmph in 4x2 on hard paved roads
Gradability on hard paved roads at sea level	10 deg for 4X2 & 23 Deg for 4X4 Mode on hard paved roads in 4x4 mode (limited by slip)
Wheel Base, mm	3225 (For SAK & SA 1212C/32), 4225 (For SA 1212C/42)
Minimum Turning Circle Dia. in mm as per IS: 9435 (For SAK & SA 1212C/32)	14900
Minimum Turning Circle Dia. in mm as per IS: 9435 (SA 1212C/42)	17600

Minimum Turning Clearance Circle Dia. in mm as per IS:9435 (For SAK & SA 1212C/32)	16400
Minimum Turning Clearance Circle Dia. in mm as per IS:9435 (For SA 1212C/42)	19100
MAIN CHASSIS DIMENSIONS AS PER IS 9435 IN mm	
Wheel base	3225 (For SAK & SA 1212C/32), 4225 (For SA 1212C/42)
Track front	1988
Track Rear	1809
Max. Width	2434
Front Overhang	1185 (For SAK & SA 1212C/32), 1185 (For SA 1212C/42)
Frame Overhang rear	960 (For SAK & SA 1212C/32), 1560 (For SA 1212C/42)
Overall Length	5370 (For SAK), 6970(For SA 1212C/42) 5370 (For SA 1212C/32 without toeing hook)

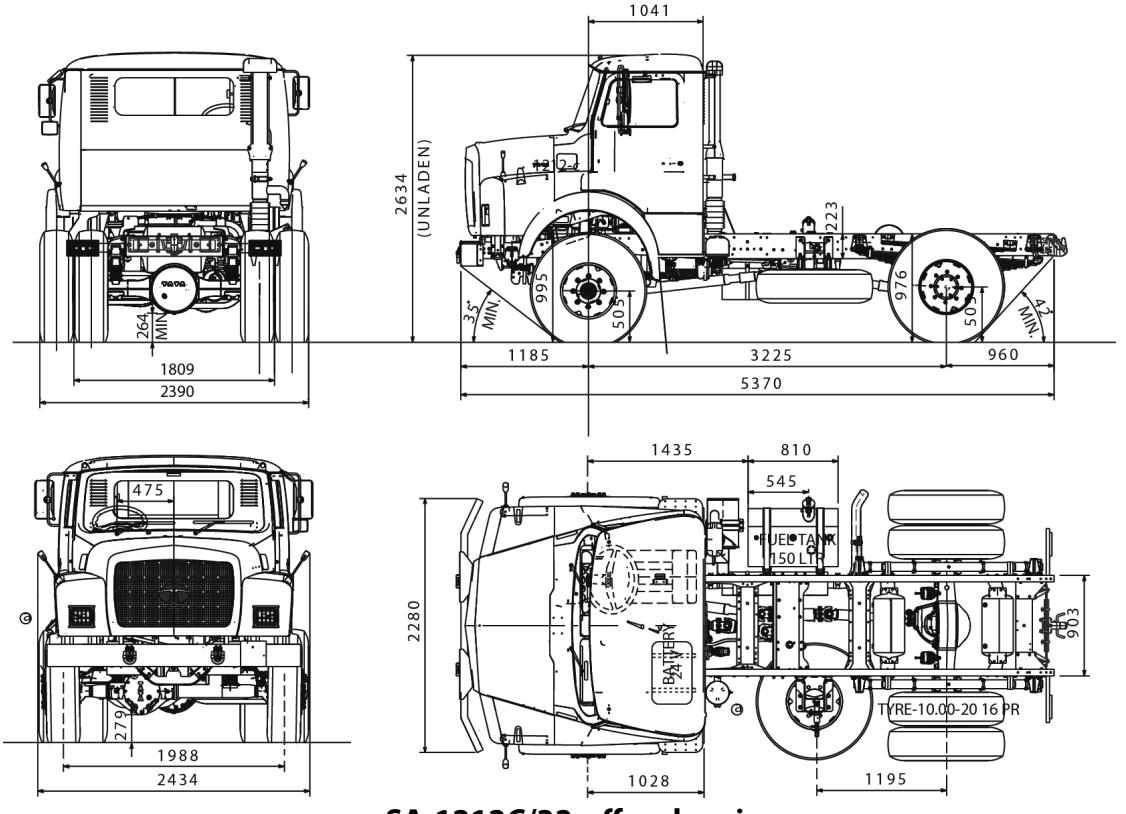
WEIGHTS (kg) (Tolerance as per INTER EUROPE StVZ0)	
Complete chassis kerb weight with cab without loadbody (With spare wheels and tools) as per IS 9211	4670 (For SAK & SA 1212C/32) 4890 (For SA 1212C/42)
Bare chassis kerb weight with Cowl (With spare wheel and tools) as per IS 9211	4440 (For SAK & SA 1212C/32) 4700 (For SA 1212C/42)
Max. permissible FAW	4060 kg
Max. permissible RAW	8120 kg
Max. permissible GVW	12180 kg

OPTIONAL ADDITIONAL FITMENTS (SA/SAK 1212TC)

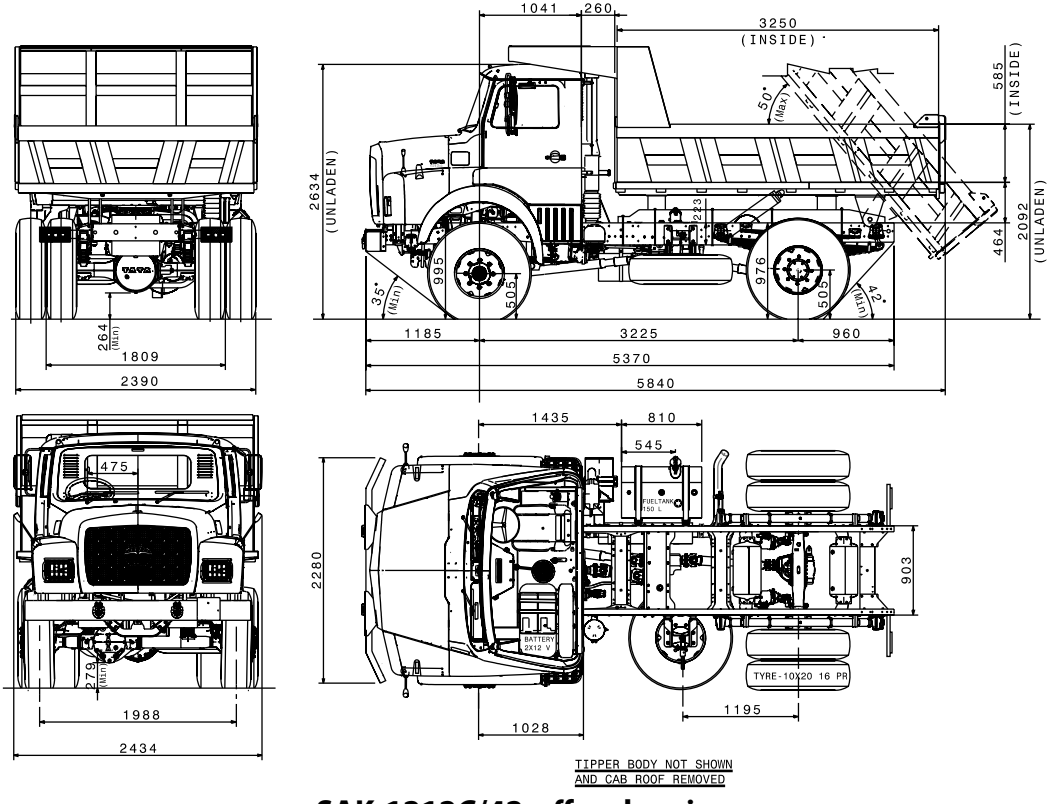
1. Army Type Straight Bumper
2. Inspection Lamp
3. Rear Towing Hook
4. Dandamen Seat
5. Foldable troop seats - 2 Nos.
6. Bracket for shovel - 1No.
7. Bracket for pick axe and helve -1 No.
8. Lockable tool box -1.
9. Jerrican carrier for 3 jerrican of 20 litres.
10. Oil can carrier for 1 can of 5 litres
11. 55 Litre water tanks- 2 Nos.
12. Ladder at rear on both sides.
13. Buzzer switch for dandaman.
14. Light in loadbody - 1 No.
15. Blackout equipment with NATO pattern12 pole socket.
16. Draw bar type rear tow hook-1 No.
17. 2-Nos D-shackle on front bumper & 1 No central tow hook.
18. Winch type spare wheel carrier fitted below load body on Left hand side frame.
19. Hook (for tieing up with lifting platform.)
20. Brackets for camouflage poles.
21. Cab heating device.



SA 1212C/42 offer drawing



SA 1212C/32 offer drawing



SAK 1212C/42 offer drawing

FILLING CAPACITIES OF AGGREGATES

Engine oil sump	Max.15.3 ltr. Min.13.3 ltr.
Gear box G-600	7.5ltr + 300 ml for PTO
Rear axle RA - 108RR	8.6 ltr.
Power Steering System	3.0 ltr.
Fuel tank (SAK 1212C/32 & SA 1212C/32)	150 ltr.
Fuel tank (SA 1212 C/42)	225 ltr.
Cooling system	22 ltr.
Front hub grease per hub	450 gm
Rear hub grease per hub	650 gm
Hydraulic oil tank Tipper	28 ltr.

Regular Maintenance

The maintenance schedule given in this book is meant for vehicles operating under normal conditions. For severe operating conditions (off the road / short route / city applications) certain operations (e.g. maintenance of air filter, replacing engine oil & oil filter cartridge with 'O' ring and clutch & brake system maintenance & adjustment etc.) may have to be carried out more frequently and certain other operations may have to be introduced based on your own experience.

In severe operating conditions, the engine is in operation even when the vehicle is stationery (e.g. tipper). As such the 10,000 km regular service is to be carried out at every 250 operational hours or 9,000 km whichever is earlier.

The maintenance plan recommended is as follows :

PDI : Service to be performed once only at the time of delivery of vehicle.

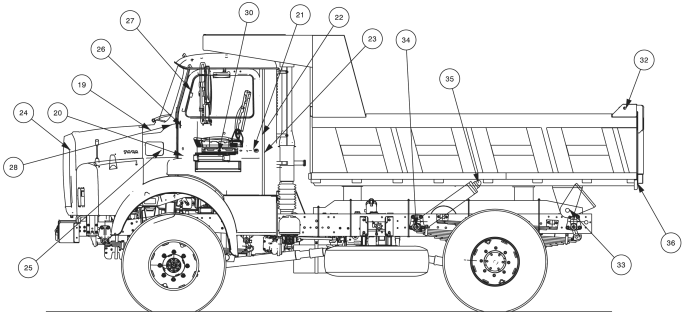
Note : Vehicles directly sold to Defence and State Transport Undertakings are eligible only for PDI service.

1. The Tata Diesel Vehicle has been built to give you thousands and thousands of km. of economical and trouble free performance. This is, however, possible only if the vehicle is systematically maintained and operated strictly according to the instructions contained in this book.
2. This book contains a Service Schedule Chart detailing.
3. IT IS AN IMPORTANT CONDITION OF OUR SALES POLICY THAT NO WARRANTY CLAIMS WILL BE ENTERTAINED BY US UNLESS ALL SERVICES UPTO THE TIME OF THE CLAIM ARISING HAVE BEEN PERFORMED ON THE VEHICLE BY ONE OF OUR AUTHORISED DEALERS' WORKSHOPS.

   Failure to carry out the services listed in this booklet can cause considerable damage to the vehicle and inconvenience to you. It is therefore, in your own interest to maintain your vehicle as per instructions given in this book
4. During the first 2,000 km of operation, which is the most critical period influencing the life and economy of operation of vehicle, it should be driven very carefully, and the GVW and speed should not be more than 2/3 of maximum permissible.
5. For any technical advice concerning your vehicle, please contact our nearest authorised dealer, area service officer, TASS or Write to :

   Tata Motors Limited,
   Customer Service Commercial Vehicle
   Spare parts building
   2nd Floor
   Jamshedpur - 831 010. (Jharkhand)
   Telephone : (0657) 2268892, 2286481
   Extn. : 4282, 4682, 4477

LUBRICATING POINTS



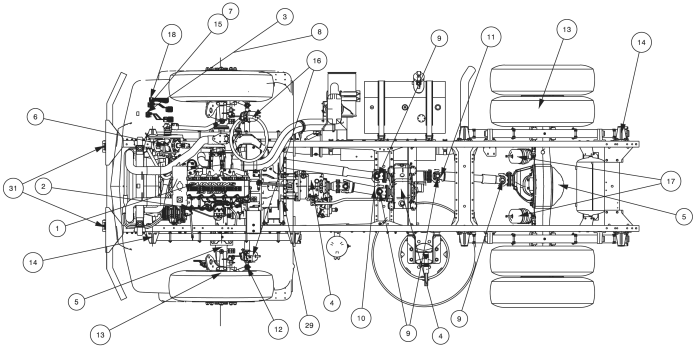


TABLE I OIL LUBRICATING POINT CHART

1.ENGINE OIL FILLING	OIL LEVEL
2 CONTROLS TO INJECTION PUMP	2
3 CLUTCH LINKAGE AND RELEASE BEARING	2
4 GEAR BOX,TRANSFER CASE	OIL LEVEL
5 REAR AXLE, FRONT AXLE	OIL LEVEL
6 STEERING GEAR BOX	OIL LEVEL
7 PINS FOR FOOT AND HAND BRAKE LINKAGES	8
18 ACCELERATOR PEDAL LINKAGES	5
19 BONNET HINGES	4
20 DOOR HINGES	4
21 OUTER DOOR HANDLES	2
22 DOOR LATCHES	2
23 DOOR DOVETAIL AND STRIKER PLATES	4
24 BONNET STAY ROD PIVOT PIN	2
25 SIDE FLAP HINGES	2
26 GLOVE BOX,INSTRUMENT PANEL AND WIPER MOTOR COVER HINGES	5
27 PIVOT OF QUARTER WINDOW	4
28 AIR VENTILATOR CABLE	2
31 HOOK	

TABLE II GREASE LUBRIACATING CHART

8 CLUTCH PEDAL BUSHING	1
9 PROPELLER SHAFT UNIVERSAL JOINT	6
10 FRONT PROPELLER SHAFT YOKES	2
11 REAR PROPELLER SHAFT YOKES	1
12 KING PIN (4),STEERING KNUCKLE JOINTS (4),DRAG LINK ENDS (2),TIE ROD ENDS (2)	12
13 FRONT AND REAR HUB	4
14 FRONT AND REAR SPRING PINS, SHACKLE PINS	12
15 BRAKE PEDAL BUSHING	-
16 FRONT BRAKE SLACK ADJUSTER (S-CAM BRAKE) LH/RH 2 NO.	2
17 REAR BRAKE SLACK ADJUSTER (S-CAM BRAKE) LH/RH 2 NO.	2
29 SLIDING END OF CAB SPRING BKT	1
30 SLIDING RAILS OF DRIVER SEAT	-
32 TAIL DOOR HINGE PIN	
33 LOAD BODY MOUNTING REAR HINGE PIN	
34 CYLINDER MOUNTING BRACKETS	
35 BODY LIFTING BRACKET	
36 TAIL DOOR LOCKING CROSS BAR	

P :	Service to be performed once only at the time of delivery of vehicle (PDI)	W :	Service to be performed weekly or at every 2000 kms whichever is earlier by driver / operator.
D :	Daily service to be performed by the driver / operator	T :	Service to be performed once only at 3000-3500 kms *Note : This service is not applicable for Tippers.*
O :	Service to be performed at every 1000 kms by the driver / operator	• :	Service to be performed regularly as per frequency given in the chart

SR. NO.	OPERATION	FREQUENCY IN km	PDI	DAILY	Every 1000 km	3000-3500	9000-9500	18000-18500	27000-27500	36000-36500	45000-45500	54000-54500	63000-63500	72000-72500
	GENERAL													
1.	Wash the Vehicle	9,000	P			T	•	•	•	•	•	•	•	•
2.	Road Test and Check Brake : i. Foot brake, ii. Hand brake. Steering, Clutch. Transmission and P.T.O (If fitted) for Gear shift and Noise. Rear axle for differential noise. Speedometer. Squeaks and rattles. For tippers : Check operation of tipping gear.	PDI only	P											
3.	Start engine and check - Engine idling and running (watch for any unusual noise). Alternator operation (watch charging control lamp) Oil pressure at : a) Idling speed & maximum speed. Water temperature, compressed air pressure and operation of engine exhaust brake.	PDI only	P											
	ENGINE													
1.	Check water trap in water separator.	DAILY	P	D		T	•	•	•	•	•	•	•	•
2.	Check fan and fan belt visually and replace, if damaged.	DAILY	P	D		T	•	•	•	•	•	•	•	•

SR. NO.	OPERATION	FREQUENCY IN km	PDI	DAILY	Every 1000 km	3000-3500	9000-9500	18000-18500	27000-27500	36000-36500	45000-45500	54000-54500	63000-63500	72000-72500
3.	Check coolant level in radiator and top up, if necessary. Check coolant leakages and rectify, if any	DAILY	P	D		T	•	•	•	•	•	•	•	•
4.	Check air intake piping, hoses, clamps. Replace damaged hoses	9,000	P				•	•	•	•	•	•	•	•
5.	Check service indicator. Change primary filter, if red band is in raised position	9,000	P				•	•	•	•	•	•	•	•
6.	Check oil level in the sump and top up, if necessary. Check oil leaks and rectify, if any	9,000	P	D		T	•	•	•	•	•	•	•	•
7.	Lubricate with oil can : Controls to fuel injection pump and exhaust brake linkage ball joints	9,000	P		O	T	•	•	•	•	•	•	•	•
8.	Check distance between release bearings and clutch; adjust if necessary	9,000					•	•	•	•	•	•	•	•
9.	Check and if necessary, tighten the following :- (a) Injector pressure lines, (b) Leak off fuel line banjo bolts. (c) Heat exchanger bolts. (d) Oil sump screws. (e) Oil pressure transducer at heat exchanger (f) Exhaust manifold mounting bolt. (g) Turbocharger mounting fasteners. (h) Flywheel housing mounting bolts. (i) Air cleaner mounting bolts. (k) Muffler assembly bolt.	9,000	P		O	T	•	•	•	•	•	•	•	•

SR. NO.	OPERATION	FREQUENCY IN km	PDI	DAILY	Every 1000 km	3000-3500	9000-9500	18000-18500	27000-27500	36000-36500	45000-45500	54000-54500	63000-63500	72000-72500
10.	Check and tighten, if necessary the following :- (a) Push rod chamber cover. (b) Timing gear cover (c) Cylinder head cover (d) Radiator mountings (e) Radiator hose connections, (f) Fuel tank brackets. (g) Fuel filter bracket, (h) Fuel filter mounting bolts. (i) Air ducting hose connections, (j) Engine mounting bolts (k) Engine breather rubber hose clamp	9,000	P			T	•	•	•	•	•	•	•	•
11.	Change oil in sump. Drain off while hot. Clean drain plug. Change oil filter. (For city service, tippers & short route operation the filter & oil should be changed at 9000 kms. or 250 hrs., whichever is earlier.)	18,000						•		•		•		•
12.	Check anti-freeze concentration	18,000						•		•		•		•
13.	Change two fuel filters and 'O' rings. Bleed the fuel system.	18,000						•		•		•		•
14	Grease with grease gun : clutch release bearing	18,000						•		•		•		•
15.	Remove strainer in fuel tank, clean and refit.	36,000								•				•
16.	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 kms or 2 years whichever is earlier												
17.	Check drive belt tension and replace belt , if necessary.	36,000								•				•
18.	Check fan hub and drive belt tensioner bearing	36,000								•				•

SR. NO.	OPERATION	FREQUENCY IN km	PDI	DAILY	Every 1000 km	3000-3500	9000-9500	18000-18500	27000-27500	36000-36500	45000-45500	54000-54500	63000-63500	72000-72500
19.	Check valve clearance and adjust, if necessary.	36,000	P							•				•
20.	Remove and clean exhaust outlet elbow, exhaust valve, shaft and refit. (Do not lubricate)	72,000												•
21.	Check end play of turbocharger shaft and radial clearance between turbine wheel & housing	72,000												•
22.	Check vibration damper and replace, if necessary	72,000												•
23.	Remove FIP injectors, check and reset the pressure	72,000												•
	CLUTCH AND TRANSMISSION													
1.	Check oil level in gear box and top up, if necessary	9,000	P		O	T	•	•	•	•	•	•	•	•
2.	Check clutch fluid level and top up, if necessary	9,000	P		O	T	•	•	•	•	•	•	•	•
3.	Check clutch pedal free play and adjust if necessary. (For off highway operation vehicles this check to be done more often)	9,000	P		O	T	•	•	•	•	•	•	•	•
4.	Grease with grease gun : (i) Accelerator pedal bush -LP (ii) Clutch pedal bushing, (iii) Remote gear shifting linkage where fitted, (v) Propeller shaft U joints, sliding yoke, & centre bearing where fitted.	9,000	P		O	T	•	•	•	•	•	•	•	•
5.	Remove grease cup for lubricating clutch release bearing. Repack 3/4 the full with grease and tighten by a few turns.	9,000	P				•	•	•	•	•	•	•	•

SR. NO.	OPERATION	FREQUENCY IN km	PDI	DAILY	Every 1000 km	3000-3500	9000-9500	18000-18500	27000-27500	36000-36500	45000-45500	54000-54500	63000-63500	72000-72500
6.	Lubricate with oil can : Clutch linkages & felt pad of clutch release bearing sleeve. (few drops only)	9,000	P		O	T	•	•	•	•	•	•	•	•
7.	Change oil in gear box and transfer case. Drain while hot. Clean drain plug. (At first 3000 km also)	36,000*				T				•				•
8.	Check and tighten, if necessary : (a) Gear box mounting bolts, (b) Propeller shaft coupling flange bolts, (c) Propeller shaft centre bearing support bracket bolts.	18,000	P					•		•		•		•
9.	Clean breather on gear box	72,000												•
10.	Overhaul clutch master and slave cylinder	72,000												•
	FRONT AXLE AND REAR AXLE													
1.	Grease with grease gun : (a) Kingpins, (b) Tie rod ends, (c) Drag link ends	9,000	P		O	T	•	•	•	•	•	•	•	•
2.	Check oil level in front live axle and rear axle and top up, if necessary	9,000	P		O	T	•	•	•	•	•	•	•	•
3.	Change oil in front live axle and rear axle, drain while hot, clean drain plug and breather (At first 3000 km also)	36,000 *				T				•				•
4.	Check crown wheel thrust pad clearance and adjust, if necessary	18,000	P			T		•		•		•		•

SR. NO.	OPERATION	FREQUENCY IN km	PDI	DAILY	Every 1000 km	3000-3500	9000-9500	18000-18500	27000-27500	36000-36500	45000-45500	54000-54500	63000-63500	72000-72500
5.	Check and tighten, if necessary, carrier and rear cover mounting nuts. Also tighten axle shaft cover mounting bolts, rear axle (Banjo type) carrier mounting studs	18,000	P			T		•		•		•		•
6.	Remove front hub cap, fill 3/4 the full with wheel bearing grease and refit	18,000	P					•		•		•		•
7.	Check front and rear wheel bearing adjustment and correct, if necessary		P			T								
8.	Check wheel alignment and if necessary, adjust	18,000	P					•		•		•		•
9.	Remove front and rear wheel hubs. Dismantle and clean bearing and other components. Replace damaged/worn-out parts. Repack with fresh wheel bearing grease, and refit, Adjust Wheel hub bearing play.	36,000								•				•
	STEERING AND SUSPENSION													
1.	Check steering wheel free play. Adjust if necessary	9,000	P				•	•	•	•	•	•	•	•
2.	Check oil level in steering gear housing (where fitted). Top up, if necessary	9,000	P			T	•	•	•	•	•	•	•	•
3.	Check oil level in power steering hydraulic tank and top up, if necessary, Check hydraulic piping connections for leakages and rectify, if any.	9,000	P				•	•	•	•	•	•	•	•

SR. NO.	OPERATION	FREQUENCY IN km	PDI	DAILY	Every 1000 km	3000-3500	9000-9500	18000-18500	27000-27500	36000-36500	45000-45500	54000-54500	63000-63500	72000-72500
4.	Grease with grease gun : (a) Front spring pins, (b) Rear spring pins. Apply grease on helper spring brackets and free end of cab spring.	9,000	P		O	T	•	•	•	•	•	•	•	•
5.	Check and tighten, if necessary : (a) U bolts of front and rear springs, (b) Nuts of spring pin wedge bolts, box mounting bracket bolts and , (c) Anti roll bar bracket mounting bolts, Spare wheel carrier.	9,000	P		O	T	•	•	•	•	•	•	•	•
6.	Check and tighten, if necessary : (a) Pitman arm, (b) Drag link rod, (c) Tie rod, (d) Steering gear box mounting bracket bolts and , (e) Steering gear box mounting bolts.	9,000	P			T	•	•	•	•	•	•	•	•
7.	Check and tighten, if necessary, mounting of shock absorber	9,000	P			T	•	•	•	•	•	•	•	•
8.	Check mountings of spare wheel carrier and tighten, if necessary	18,000				T		•		•		•		•
9.	Check condition of shock absorber rubber bushes and replace, if necessary	18,000						•		•		•		•
10.	Dismantle front and rear springs and cab mounting spring. Clean and inspect leaves. Check and replace eye bushes, if necessary. Apply graphite grease on leaves and reassemble.	72,000												•
11.	Drain off hydraulic oil of power steering. Replace filter cartridge & fill in fresh oil. Test the system with test equipment	72,000												•
	BRAKES ('S' CAM)													
1.	Check for effective operation of brakes.	9000				T	•	•	•	•	•	•	•	•

SR. NO.	OPERATION	FREQUENCY IN km	PDI	DAILY	Every 1000 km	3000-3500	9000-9500	18000-18500	27000-27500	36000-36500	45000-45500	54000-54500	63000-63500	72000-72500
2.	Check for condensed water in air tanks. If water found, replace air dryer cartridge.	18000						•		•		•		•
3.	Check and if necessary, tighten : (1) Mounting of air tanks, (2) Air line clamps.	54,000										•		
4.	Check brake system for leaks and rectify, if necessary.	9000			O	T	•	•	•	•	•	•	•	•
5.	Check for proper functioning of engine exhaust brake, free movement of plunger of exhaust brake valve, mounting bolts for loosening and slackness in linkages.	9000				T	•	•	•	•	•	•	•	•
6.	Check brake rubber hoses / air pipes for damages / leaks and replace if necessary.	18000				T		•		•		•		•
7.	Dismantle pneumatic aggregates of brake system, clean, inspect and replace parts if necessary.	2,00,000 km or 2 years whichever is earlier												
8.	Grease with grease gun - brake lever, and camshaft bushes (AAL).	9000			O	T	•	•	•	•	•	•	•	•
9.	Lubricate with oil can : brake chamber fork & pin, linkages of foot brake, ball joints of exhaust brake linkages - hand & foot brake linkages.	18000					•		•		•		•	
10.	For manual slack adjuster, check travel of brake chamber's push rod/brake lining wear and clearance with drum. Adjust service brakes, if necessary. Change lining when worn up to indicator slot. a. Long route operation. b. City/Hill/Cross country application.	 9,000 4,500				 T T	 • •	 • •	 • •	 • •	 • •	 • •	 • •	 • •

SR. NO.	OPERATION	FREQUENCY IN km	PDI	DAILY	Every 1000 km	3000-3500	9000-9500	18000-18500	27000-27500	36000-36500	45000-45500	54000-54500	63000-63500	72000-72500
11.	For automatic slack adjuster, check lining thickness. Change lining if worn up to 1 mm above indicator slot. a. Long route operation. b. City/Hill/Cross country application.	 9,000 4,500				T T	• •	• •	• •	• •	• •	• •	• •	• •
12.	Overhaul the automatic slack adjuster	3,00,000 km or 3 years whichever is earlier												
13.	Check brake torque plate mounting bolts and tighten if necessary.	At every lining change												
14.	Check condition of gaiter in different brake valves, exhaust flap in dual brake valve, exhaust check diaphragm in valve, nylon breather tube and inspect spring brake actuator for external damage. Replace if found damaged.	36,000								•				•
15.	Check mounting bolts of brake chambers, different valve mountings, air tank mounting, air cylinders mounting, master cylinders mountings, air line clamps hydraulic pipes & tighten if necessary.	54,000										•		
16.	Conduct brake system routine checks	36000								•			•	
17.	Remove brake drums, inspect brake drums. Rectify defects if any.	At every lining change												
18.	Grease fulcrum pin bushes and roller ends of S-Cam Brake.	At every lining change												
19.	Overhaul foundation brakes. Remove brake drum. Inspect brake drums camshaft etc. Rectify defect, if any.	Every second brake shoe relining or as required												

SR. NO.	OPERATION	FREQUENCY IN km	PDI	DAILY	Every 1000 km	3000-3500	9000-9500	18000-18500	27000-27500	36000-36500	45000-45500	54000-54500	63000-63500	72000-72500
20.	Replace desiccant cartridge and filter of Air Dryer / DDU.	Every two years												
21.	Check for excessive play of hand brake shaft in bushes. Replace bushes, if necessary.	18000						•		•		•		•
	ELECTRICALS													
1.	Check lights, switches, gauges, blinkers, wiper motor, horn, speedometer for proper functioning and if necessary rectify.	DAILY	P	D		T	•	•	•	•	•	•	•	•
2.	(a) Check battery mountings, (b) Clean battery posts and terminals. Tighten terminals & smear vaseline/petroleum jelly.	9,000	P		O	T	•	•	•	•	•	•	•	•
3.	Check electrolyte level in battery and if necessary, add distilled water.	9,000	P		O	T	•	•	•	•	•	•	•	•
4.	Check head lamp focusing. Adjust if necessary. (this should be done after every bulb change)	9,000	P			T	•	•	•	•	•	•	•	•
5.	Check and if necessary tighten connections of (a) Starter motor, (b) Alternator (c) Switches and gauges, (d) Tail lamp, (e) Head lamp, (f) Blinker lamp. Check speedometer cable for proper clamping	9,000	P			T	•	•	•	•	•	•	•	•
6.	Check mountings of (a) Alternator, (b) Starter motor and tighten, if necessary,	18,000	P			T		•		•		•		•
7.	Lubricate with oil can (a) Pinion bushing of starter motor an (b) Wiper motor linkages.	18,000						•		•		•		•

SR. NO.	OPERATION	FREQUENCY IN km	PDI	DAILY	Every 1000 km	3000-3500	9000-9500	18000-18500	27000-27500	36000-36500	45000-45500	54000-54500	63000-63500	72000-72500
8.	Check battery cells with cell tester. Also check specific gravity of electrolyte & if necessary attend to it	18,000	P					•		•		•		•
9.	Check alternator carbon brushes and if necessary replace.	36,000								•				•
10.	ABS wheel sensors & connectors check for fitment	At every Wheel change												
11.	Check all sensors & connectors for cleanliness & secure fitment.	At every wash												
	CAB AND BODY													
1.	Grease with grease gun : (1) trailer coupling where fitted, (2) free end of cab spring, (3) sliding rails of driving seat.	9,000	P		O	T	•	•	•	•	•	•	•	•
2.	Check condition of driver seat, rubber stops, buffers, shock absorbers & bushes, replace if necessary	9,000					•	•	•	•	•	•	•	•
3.	Lubricate with oil can : Door hinges, door handle, outer door latches, dove tails & striker plates hinges & locking levers of drop side bodies, hinges, bonnet stay rod, pivot pins & cables of air scoop flap, side flap hinges (if provided), hinges on glove boxes, instrument panel, wiper motor cover & quarter window pivot.	9,000	P				•	•	•	•	•	•	•	•
4.	Lubricate with oil can : Pivot of driver's seat	9,000	P				•	•	•	•	•	•	•	•

SR. NO.	OPERATION	FREQUENCY IN km	PDI	DAILY	Every 1000 km	3000-3500	9000-9500	18000-18500	27000-27500	36000-36500	45000-45500	54000-54500	63000-63500	72000-72500
5.	Check and if necessary tighten mounting of driver's cab, load body and spare wheel carrier, bonnet, hinges, tie member mounting, dove tail bottom, dove tail bracket stop, door hinges, door locks, dove tail striker plates, mounting of driver seat, wiper motor & front bumper.	9,000	P				•	•	•	•	•	•	•	•
	WHEELS & TYRES													
1.	Check tyre pressure	DAILY	P	D		T	•	•	•	•	•	•	•	•
2.	Check and tighten wheel nuts, if necessary (Wheel nuts to be checked 100 km after every wheel change)	9,000	P		O	T	•	•	•	•	•	•	•	•

Record of services performed

Chassis No.....

Recommended Service		Date	Odometer reading Km.	Repair Order No.	Servicing Dealer's Signature and Stamp
At Km.	Type				
PDI	PDI				
3,000	1				
9,000	2				
18,000	3				
27,000	2				
36,000	4				
45,000	2				
54,000	3				
63,000	2				
72,000	5				

Recommended Service		Date	Odometer reading Km.	Repair Order No.	Servicing Dealer's Signature and Stamp
At Km.	Type				
81,000	2				
90,000	3				
99,000	2				
1,08,000	4				
1,17,000	2				
1,26,000	3				
1,35,000	2				
1,44,000	5				
1,53,000	2				
1,62,000	3				

Recommended Service		Date	Odometer reading Km.	Repair Order No.	Servicing Dealer's Signature and Stamp
At Km.	Type				
1,71,000	2				
1,80,000	4				
1,89,000	2				
1,98,000	3				
2,07,000	2				
2,16,000	5				
2,25,000	2				
2,34,000	3				
2,43,000	2				
2,52,000	4				

Recommended Service		Date	Odometer reading Km.	Repair Order No.	Servicing Dealer's Signature and Stamp
At Km.	Type				
2,61,000	2				
2,70,000	3				
2,79,000	2				
2,88,000	5				
2,97,000	2				
3,06,000	3				
3,15,000	2				
3,24,000	4				
3,33,000	2				
3,42,000	3				

Record of repairs carried out

Chassis No.....

Date	Odometer reading (km)	Repair Order No.	Particulars of Repair	Servicing Dealer's Signature & Stamp

Record of repairs carried out

Chassis No.....

Date	Odometer reading (km)	Repair Order No.	Particulars of Repair	Servicing Dealer's Signature & Stamp