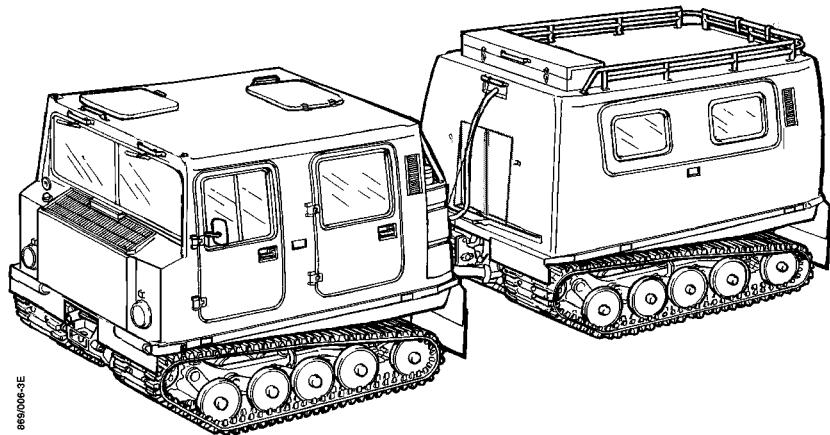




# OPERATORS MANUAL



All Terrain Carrier BV 206

HÄGGLUNDS VEHICLE AB  
S-891 82 ÖRNSKÖLDSVIK  
SWEDEN

ISSUE DATE: NOV 1996

All information, illustrations and specifications in this manual are based on a certain product baseline. Hägglunds Vehicle reserves the right to make model changes at any time or to change specifications or design on this product baseline, without notice and without incurring obligation.

It should be noted that there are certain differences among model versions and market requirements; thus you may find features described and / or pictured in this manual that do not appear on your vehicle

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**—WARNING!**

If the correct operating procedures are not followed, personnel injury or loss of life could result!

---

**—WARNING!**

The safety chain has to be engaged during transportation of troops.

---

**—WARNING!**

Any device used to induce slack into the shoulder belt portion of the three point belt system will have a detrimental effect on the amount of protection available to you in the event of a collision.

---

**—WARNING!**

The blowtorch must not be lit from another blowtorch - high temperature damages the burner.

---

**—WARNING!**

If the blowtorch is not properly heated up, it can behave like a flame throw.

---

**—WARNING!**

Limit curves are representing the static roll over angle 34° and optimum freebord when swimming. Cargo must be properly secured and dynamic forces must be taken into consideration when driving.

---

**—WARNING!**

Accident may occur if the tracks slips from the bridges.

---

**—WARNING!**

Proper ventilation must be provided during loading and unloading operation when the engine is running. Carbon monoxide can be deadly. Exhaust gas are dangerous to personnel

**—WARNING!**

No one except the driver is allowed to be on the trailer or track platform area at any time during loading and unloading operations.

**—WARNING!**

Loading must not be conducted on side lateral slopes exceeding 10 percent or with a tractor to trailer offset greater than 5 °. Also on a sewerage down-grade must be avoided to prevent payload from rolling forward on load area.

**—WARNING!**

Never exceed 5 km/h during loading and unloading operations.

**—WARNING!**

Before starting to tow, ensure that all personnel outside vehicle are far enough away from both vehicles. This distance must be equal to or greater than the length of longest towing rope. If the cable should snap, personnel could be injured.

**—WARNING!**

Before starting to tow, ensure that all personnel outside vehicle are far enough away from both vehicles.

**—WARNING!**

Damage on the steering system impairs driving safety and constitutes serious traffic hazard. Discovered defects should be remedied at once.

**—WARNING!**

Do not use lifting equipment with wrong length of the lifting slings. This affect the lifting forces into the body structure.

---

**—WARNING!**

If entering moving water, the flow of the water must not exceed 1.0 meters per second, otherwise the vehicle may be swept away.

---

**—WARNING!**

Both the front and rear cars must be watertight, otherwise loss of the equipment and injury to personnel could result.

---

**—WARNING!**

Always wear gloves when handling winch cables. Never let cable run through hands. Freyd cables can cut.

---

**—WARNING!**

To prevent injury from a cable breaking during winch operation, clear all personnel from vehicle and from the path of the cable to a distance equal to the length of the cable.

---

**—WARNING!**

To prevent injury from a cable breaking during winch operation, clear all personnel from vehicle and from the path of the cable to a distance equal to the length of the cable.

---

**—WARNING!**

Do not remove expansion cap when engine is hot. Hot engine coolant can cause serious burns.

---

---

**—WARNING!**

---

Damage on steering systems impairs driving safety and constitutes serious traffic hazard. Discovered defects should be remedied at once.

---

---

**—WARNING!**

---

Oil spilled on a hot exhaust pipe constitutes a fire risk.

---

---

**—WARNING!**

---

Damage on brake systems impairs driving safety and constitutes serious traffic hazard. Discovered defects should be remedied at once.

---

---

**—WARNING!**

---

Do not remove the expansion cap when the engine is hot. Hot engine coolant can cause serious burns.

---

---

**—WARNING!**

---

Stop the engine and switch off the master switch on the electrical panel when working in the engine compartment.

---

---

**—WARNING!**

---

Carbon monoxide can be deadly. Exhaust gas leaks are dangerous to personnel.

---

---

**—WARNING!**

---

Damage on brake systems impairs driving safety and constitutes serious traffic hazard.

---

---

**—WARNING!**

---

Stop the engine and switch off master switch on electrical panel when working with shafts.

---

**—WARNING!**

Batteries can be dangerous if not handled properly. When working with batteries, use following guidelines to ensure your safety; Battery acid can cause serious skin burns. Wear rubber gloves and goggles when working with electrolyte. When removing battery cables, remove always ground cable first. When installing battery cables, connect ground cable last. Do not smoke or have open flame nearby while charging batteries. If spilling battery acid on skin or eye wash with cold water immediately and contact a doctor.

---

**—WARNING!**

Stop the engine and switch off the master switch on electrical central when working in engine compartment.

---

**—WARNING!**

Do not touch exhaust manifold when is hot. Hot exhaust manifold can cause serious burns.

---

**—WARNING!**

Do not touch exhaust system when is hot. Hot exhaust system can cause serious burns.

---

**—WARNING!**

Do not smoke or have any open flame in the vicinity of the batteries when changing the batteries. Wear rubber gloves, aprons and goggles.

---

**—WARNING!**

Ensure that personnel never work underneath the vehicle, when the vehicle is not properly supported.

---

**—WARNING!**

---

Always wear heavy gloves when handling winch cables. Never let cables run through hands; frayed cables can cut.

---

**—WARNING!**

---

Do not remove the expansion cap, if the engine is warm, as engine coolant can cause serious burns.

---

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# 1 INTRODUCTION

## 1.1 How to use this manual

Listed below are special features that have been included in this manual to make it easier to locate and use the information you will need.

**WARNINGS**, subject headings, procedural steps, and other types of information are highlighted in bold print as a visual aid.

Words in all capital letters are used to emphasize statements of particular importance.

All measurements in this manual are shown in metric units.

**FOLLOW THESE GUIDELINES WHEN USING THIS MANUAL.**

Read all the **WARNINGS**, **CAUTIONS**, and **NOTEs**.

All operators have to read this manual and become familiar with the contents before attempting to operate the vehicle.

The following definitions are used throughout this manual.

---

**—WARNING!** 

---

If the correct operating procedures are not followed, personnel injury or loss of life could result!

---

**CAUTION!**

If the correct operation procedures are not followed, damage or destruction of the equipment could result!

**NOTE!**

An operation procedure, condition, etc, which is essential to highlight.

## 1.2 General information

### SCOPE

This manual contains operation, maintenance and troubleshooting with options information marked (**OP**) for All Terrain Carrier BV 206.

(**OP**) = Option

### WARRANTY

New vehicles are covered with warranty under respectively contract against any failure or malfunction due to quality of materials, workman-ship, assembly or installation over twelve (12) months or 3 000 km whichever is reached first, effective from the day of acceptance. The warranty does not include consumables such as oil and lubricants and nor any part effected by normal wear and tear.

All warranty claims shall be handled through the Authority point of contact.

### “RUNNING IN” INSTRUCTIONS FOR NEW VEHICLE

The vehicle must undergo a period of running-in. It is important not to overstress the engine and the engine should not be run at full power during the first 500 km of operation, nor should the speed of the vehicle exceed 40 km per hour (approximately 4000 rpm).

### METRIC SYSTEM

Vehicle and systems are metric. All measurement within this manual is given in millimetre (mm) unless otherwise stated. Metric tools are required to perform maintenance.

## 1.3 Contents

### SECTION 1. INTRODUCTION

This section contains a brief explanation of the manuals purpose, scope, arrangement and a section on how to use the manual.

### SECTION 2. DATA

This section contains basic data on the performance characteristics of the BV 206.

### SECTION 3. DESIGN AND FUNCTION

This section contains a brief explanation of the technical principles of the operation of the major components and sub systems.

### SECTION 4. OPERATION

This section contains the basic instructions needed to operate the vehicle properly in all conditions.

### SECTION 5. MAINTENANCE

This section contains how to perform scheduled, including performing checks before operation, during operation and after operation of the vehicle and unscheduled maintenance, troubleshooting, repairs and tests of equipment.

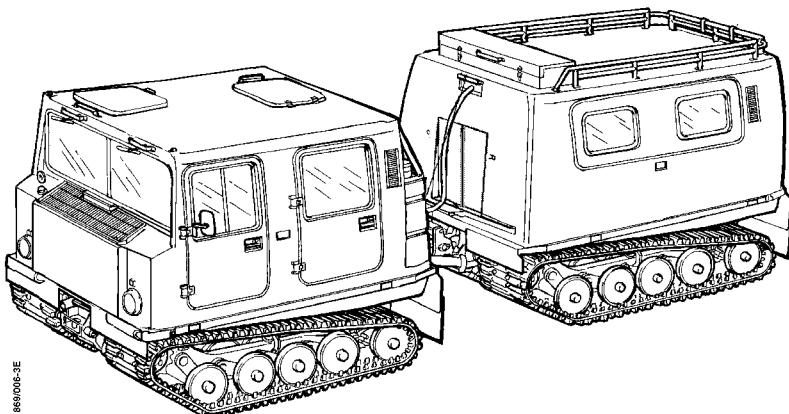
### SECTION 6. LUBRICATION

This section contains how to conduct lubrication of the vehicle.

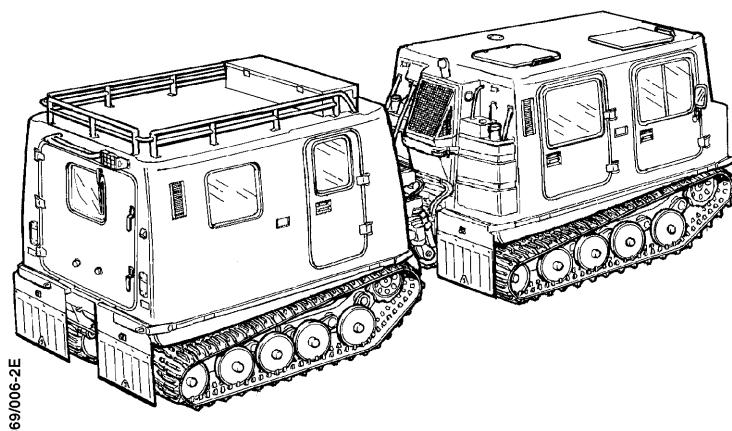
### SECTION 7. ELECTRICAL DIAGRAM

This section contains an electrical wiring diagram and a list of components referenced in the diagram.

## 1.4 Scope

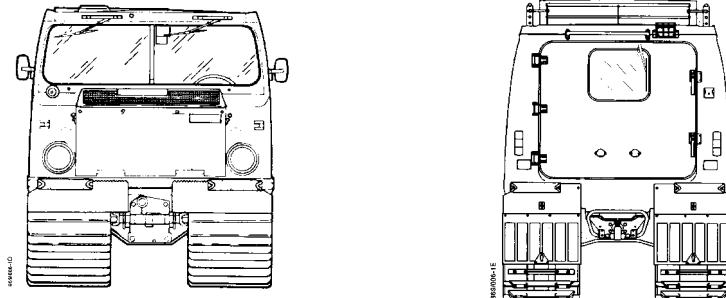


*Fig 1. BV 206, front left hand side view*



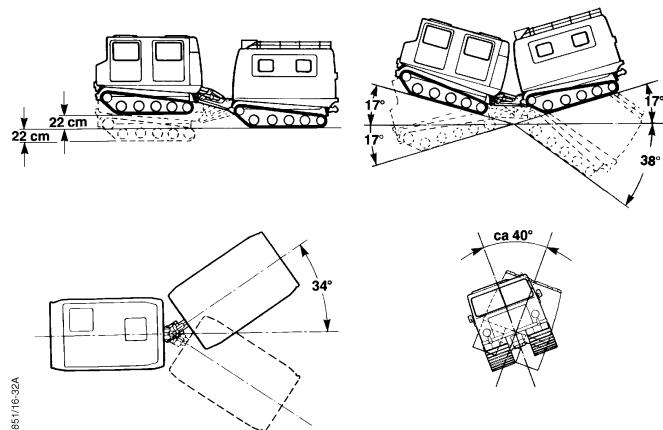
*Fig 2. BV 206, rear right hand side view*

The BV 206 is intended for the transportation of personnel and equipment across all types of terrain. The vehicle consists of two track driven cars with fibreglass reinforced plastic bodies. The front and the rear cars are articulated in relation to each other, horizontally for steering and vertically to follow uneven terrain, by means of an articulated steering unit.



*Fig 3. BV 206, front and rear view*

The front car contains the engine, transmission, transfer gearbox, brake and steering systems. The front car excluding the driver will take four passengers and the rear car will take up to ten passengers. The vehicle is driven by all four tracks and has the capability to swim after preparation according to 4OPERATION "Checks before swimming".



*Fig 4. Handling limitations (maximum)*

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## 2 DATA

### General

Name	All Terrain Carrier BV 206
Manufacture	Hägglunds Vehicle AB
Number of passengers (excluding driver)	5 + 11

### Dimensions

Length	6 900 mm
Width	1 870 mm
Height, front car	2 300 mm
Height, rear car	2 450 mm
Track width	620 mm
Distance between tracks	610 mm
Track gauge	1 230 mm
Ground clearance	350 mm

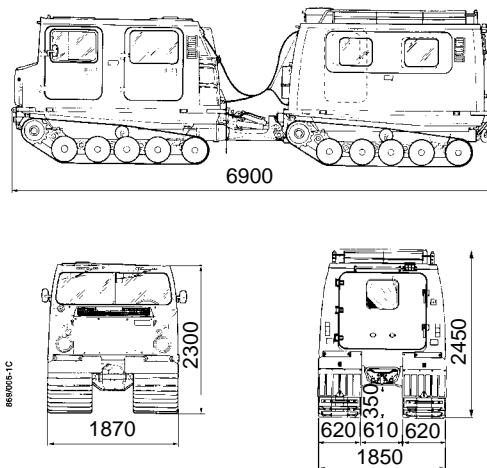
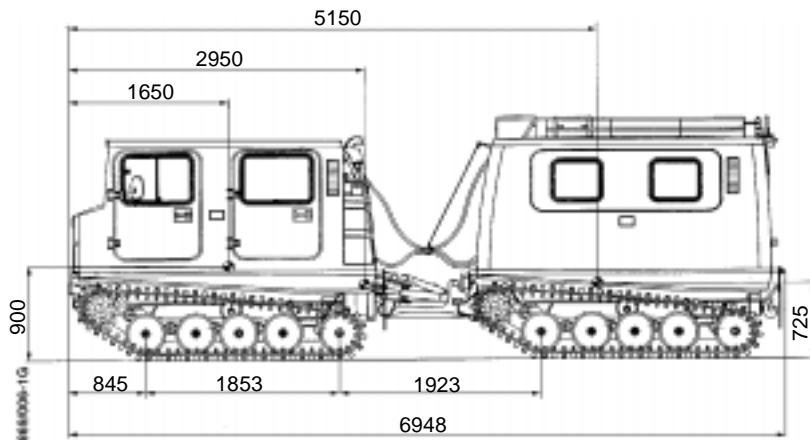
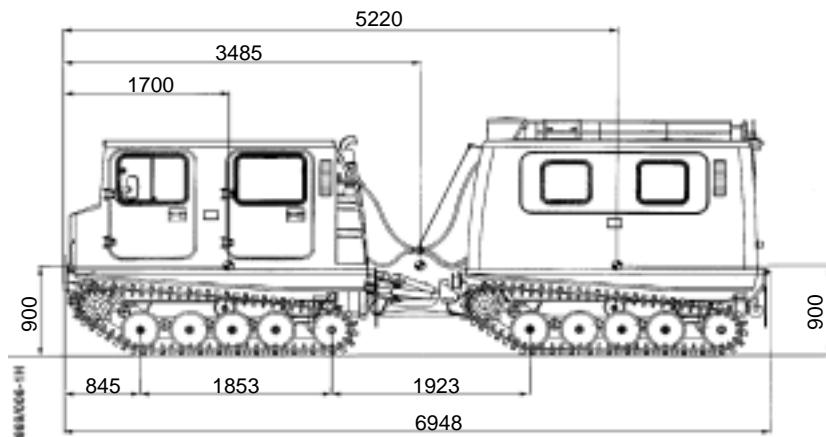


Fig 1. BV 206



*Fig 2. Centre point of gravity, curb weight*



*Fig 3. Centre point of gravity, gross weight*

Doors, front car

width	825 mm
height	1 050 mm

Doors, rear car

side door, width	600 mm
side door, height	1 050 mm
rear door, width	1 250 mm
rear door, height	1 090 mm

---

Cargo space, front car	2 m <sup>3</sup>
Cargo space, rear car	5 m <sup>3</sup>
Winch mount centre height	740 mm
Tow adapter centre height	610 mm
Trailer coupling 212A centre height	500 mm
Trailer coupling FV987958 centre height	500 mm
Trailer coupling FV987958 with adapter centre height	600 mm
Trailer coupling K1D, centre height	700 mm
Turning radius	8.0 m

## Weights

Curb weight, front car	2 740 kg	
Curb weight, rear car	1 760 kg	
Curb weight, total, excluding driver	3370 kg	
Maximum weight, with full load	6 740 kg	
Maximum payload		
Front car	630 kg	
Rear car	1 610 kg (of which a maximum of 200 kg can be secured on the roof)	
Total pay load	2 240 kg	
Maximum weight of towed trailer	2 500 kg	
Specific ground pressure, full load	Front car	Rear car
Soft terrain, (sinking down 200 to 250 mm)	11.8 kPa	13.8 kPa
Hard terrain	14.4 kPa	14.4 kPa
Maximum vertical load on trailer coupling	2 kN (200 kPa)	

## Capacities

Fuel tank, approximately	2x80 litres
Extra fuel, in cans (OP)	2x20 litres
Cooling system change volume	20 litres
Expansion vessel, MAXIMUM to MINIMUM	12 litres
Windscreen washer reservoir	2 litres
	4 litres

## Performance

Maximum road speed	52 km/h
Maximum swimming speed	3,3 km/h
Maximum gradability, hard surface	100 % (45°)
Maximum side slope, static condition <sup>1)</sup>	60 % (31°)

<sup>1)</sup> Side slopes, see page 4-21.

## Engine

Make	Mercedes-Benz
Type	603.950
Operating principle	Four stroke precombustion
chamber Diesel engine, with turbo charger and waste gate pressure regulating valve	
Maximum power rating (DIN), at 4600 rpm	100 kW
Maximum torque rating (DIN), at 2400 rpm	255 Nm
No. of cylinders	6
Cylinder bore	87.0 mm
Stroke	84.0 mm
Cylinder volume	2.996
dm<M^C2,5,0,0,0,0,100>3	
Compression ratio	22.0:1
Fuel filter cartridge	Mercedes-Benz
Injection pump	
Make/Model	Bosch
Governor	
Make/Model	Bosch
Fuel pump	
Make/Model	Bosch
Injectors	
Make/Model	Bosch
Glow plugs	18 V
Supercharger, type	Turbo charger

Injection order	1-5-3-6-2-4
Idling	
Low	875-925 rpm
High	1 000-1 100 rpm
Maximum rpm	5 000-5 200 rpm
Valve system	Overhead camshaft and hydraulic lifters
Cooling system	Closed, with expansion vessel
Normal operating temperature range	75-105 °C
Air filter	Paper cartridge
Air filter cartridge	Mann
Safety cartridge	Mann
Cyclone cleaner (OP)	Mann
Oil cooler controlled	Air cooled, thermostatic
Oil cleaner function	Full flow filter with by pass
Oil filter cartridge	Mercedes-Benz
Fuel Diesel	

## Electrical system

System voltage	24 V
Batteries (lead acid type)	
No. of batteries in series	2
Voltage	12 V
Capacity	105 Ah
Chassis polarity	Negative ground
Alternator	
Make	Bosch
Rating	100 Amps
Starter motor	
Make	Bosch
Rating	3.5 kW

## LIGHTS

	No. of	Rating	Type
Headlight			
high beam/low beam	2	75/70W	H4/P43t
parking light	2	4W	BA9
Working light (OP)	4/2	70W	H3/PK22s
Beacon (OP)	2	70W	H1
Direction indicator			
light, front	2	21W	BA15.s
light, side (OP)	2	21W	BA15.s
Combination tail light			
direction indicator light	2	21W	BA15s
brake light, normal	2	21W	BA15s
tail light, normal	2	5W	BA15s
tail light, blackout	2	2W	BA9
Brake light, blackout (OP)	1	2W	BA9
Licence plate light	2	5W	BA15s
Reverse light	2	21W	BA15s
Cabin light	4	10W	SV8.5
Map reading light	1	5W	SV8.5
Gear selector light	2	2W	BA9
Side marker lamp	4	5W	SV8.5

## INDICATOR AND WARNING LIGHTS

Charging	1	1.2W	W2x4.6d
Parking brake	1	1.2W	W2x4.6d
Service brake	1	1.2W	W2x4.6d
Transmission oil temperature	1	1.2W	W2x4.6d
Engine coolant temperature	1	1.2W	W2x4.6d
Engine oil pressure	1	1.2W	W2x4.6d
Main beam	1	1.2W	W2x4.6d
Preglow	1	1.2W	W2x4.6d
Intercom	1	1.2W	W2x4.6d

## DIRECTION INDICATORS

Front and rear car	2	1.2W	W2x4.6d
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## SWITCH INDICATOR LIGHTS

Test	1	1.2W	W2x4.6d
High idle	1	1.2W	W2x4.6d
Fuel tank selector	1	1.2W	W2x4.6d

Hazard warning	1	1.2W	W2x4.6d
Intercom	1	1.2W	W2x4.6d

## INSTRUMENTS

	No. of	Rating	Type
Fuel gauge	1	2W	BA9
Coolant temperature gauge	1	2W	BA9
Speedometer/odometer	1	4W	BA9
Tachometer	1	2W	BA9
Amperemeter	1	3W	BA7

## FUSES

	No. of	Rating	Mark.
Nature	2	25A	F1-2
Blue	4	15A	F3, 12, 15-16
Red	8	10A	F7-8, 13, 17, 19, 32-33, 34
Brown	17	7.5A	F4-5, 9-11, 14, 20-23, 25-31
Yellow	1	20A	F35
Red	1	50A	F49

## BLOCK HEATER (OP)

Make	Hägglunds
Model	Hägglunds
Power	500W
Voltage	220V with/without coupe' outlet 110V

## POWER TRANSMISSION SYSTEM

Transmission, make	Mercedes-Benz
Type	W4A-040
Gear ratios	
1st	3.871:1 x torque conversion ratio
2nd	2.247:1 x torque conversion ratio
3rd	1.436:1 x torque conversion ratio
4th	1:1 x torque conversion ratio
reverse	5.586:1 x torque conversion ratio
Torque convertortorque multiplication, maximum	1.85:1
Transfer gearbox, make	Hägglunds Vehicle AB
Gear ratio, high	1.28:1

Gear ratio, low	2.11:1
Differential gears, make	Hägglunds Vehicle AB
Gear ratio	4.75:1

## BRAKE SYSTEM

Service brake	Hydraulic disc brake. Two circuit with twin caliper
Parking brake	Mechanical disc brake

## STEERING SYSTEM

Type	Articulated, hydraulic
Hydraulic pump	Bosch
Steering valve	ZF
Pressure filter	Pall
Servo valve	ZF
Steering cylinders	
Make	Bahco Hydraulics
No. of cylinders	2
Damping cylinder	Bahco Hydraulics
Steering wheel turns, left to right	
normal steering approximately	4.5
emergency steering approximately	15
TILT cylinder	Hägglunds

## EXTRA HYDRAULIC SYSTEM, PTO (OP)

Hydraulic power unit	Hägglunds
Valve plate	Hägglunds
Relief valve	Hägglunds
Directional valve	Hägglunds

## ELECTRIC WINCH (OP)

Type	Electric
Voltage	24V DC
Drive	Planetary
Load capacity	2,5 metric tons
Wire rope cable	171-strand with steel core
Diameter	8 mm
Length	30 m

## HYDRAULIC WINCH (OP)

Type	Hydraulic
------	-----------

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Load capacity	3,6 metric ton
Rope speed	13 m/min
Oil pressure, max	150 bar
Oil flow, max	60 l/min
Wire rope cable	
Diameter	10 mm
Length	30 m
Drum diameter	90 mm
Weight	35 kg

## TRACK EQUIPMENT

Tracks, make	Skega
No. of tracks	4
Type	Closed loop
No. of guide horns/track	128
Weight of track	205 kg
Driving sprocket per track assy pairs, no. of	1 pair
No. of teeth on sprocket	12
No. of road wheels, per track assy	10
Support wheels, track assy	1

## EXTRA COOLANT HEATERS (OP)

Manufacturer Volvo Eberspächer

Type-D5W

High power 4,7 kW

Low power -2,3 kW

Fuel consuption, high power 0,6 l/h

Fuel consuption, low power -0,15 l/h

## BODY

Front and rear cars Fibreglass reinforced polyester

## Vehicle identification plates

Please give chassis number when ordering spare parts and in all correspondence or other communications.

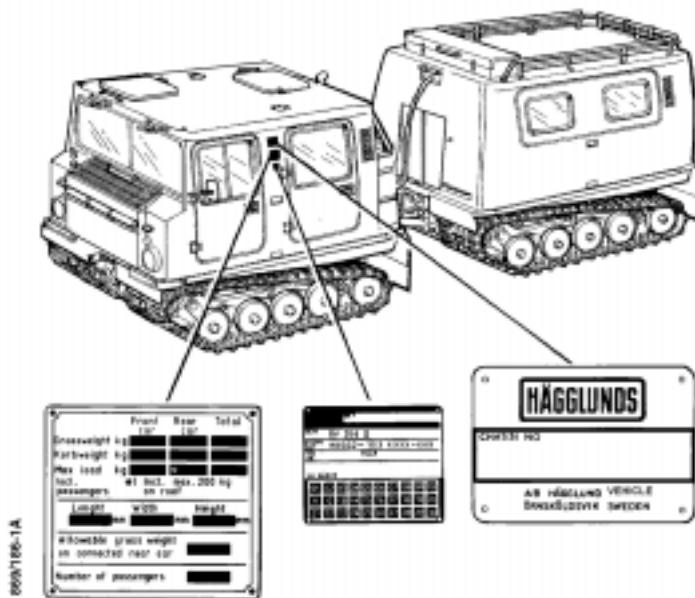
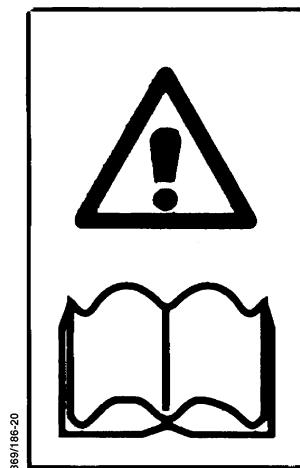


Fig 4. Identification plates



*Fig 5. Note sign*

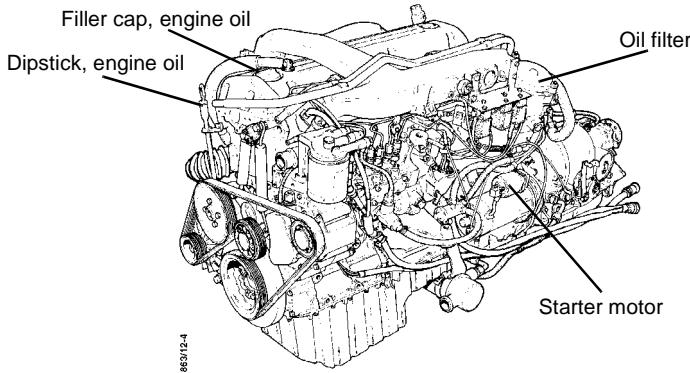
This sign indicates that there are certain procedures to be followed. Read appropriate chapter in this manual for detail instructions.

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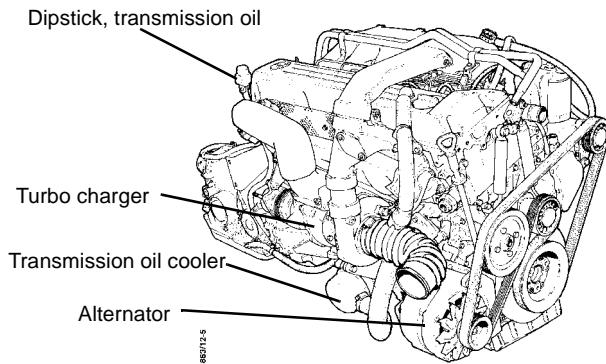
# 3 DESIGN AND FUNCTION

## 3.1 Engine

The engine is a water cooled six in line four stroke diesel engine fitted with a turbo charger and a boost pressure control valve (waste gate valve) to control the charging pressure. The engine has an overhead camshaft (OHC) and hydraulic valve lifters.



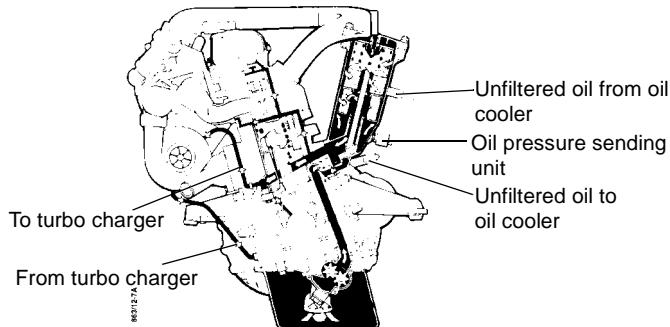
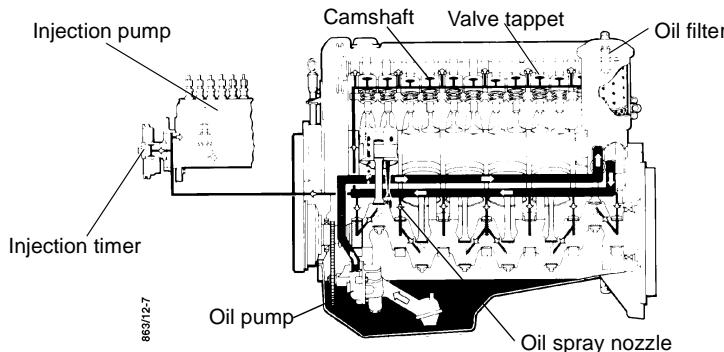
*Fig 1. Engine and transmission, LH view*



*Fig 2. Engine transmission, RH view*

## LUBRICATING SYSTEM

The forced circulation type lubricating system is provided with a thermostat controlled air cooled oil cooler. The thermostat is placed in the lower part of the oil filter housing. The oil lubricates the engine, the turbo charger, the fuel injection pump and the pistons. Nozzles in the engine block spray oil into the pistons.



*Fig 3. Lubricating system*

## FUEL SYSTEM

The fuel system consists of the fuel tanks, water trap with drain plug, fuel tank selector valves, tank shut off valve, thermostat, fuel preheater, fuel pump, fuel filter, fuel injection pump and fuel injectors. The mechanical fuel pump draws fuel from either the left or the right fuel tank, through the tank selector valves, the tank shut off valve, the water trap and the fuel preheater. Fuel is then pressed through the fuel filter to the injection pump which distributes fuel to the injectors. The engine power will be reduced when the engine temperature is below 25°C or above 105°C.

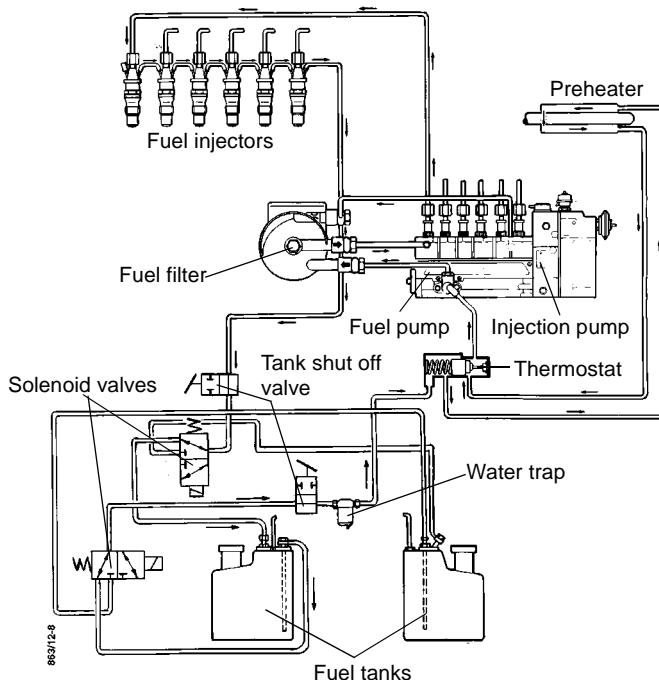
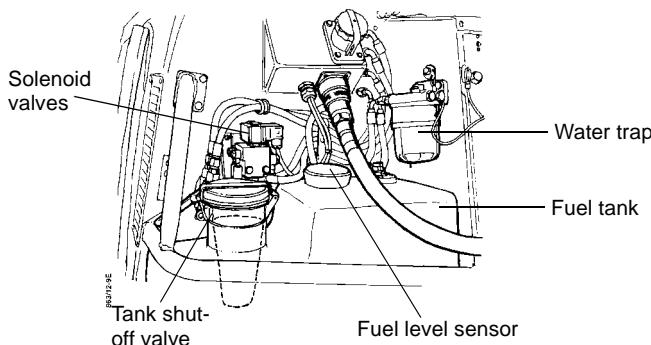


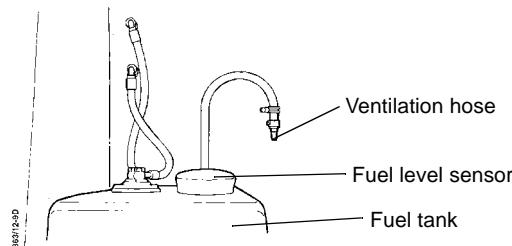
Fig 4. Fuel system

## Fuel tanks

Two fuel tanks are mounted at the rear of the front car and are connected by hoses and piping. Both tanks contain a float type fuel level sensor and connect through the fuel tank selector switch to the single fuel level gauge on the instrument panel. The gauge will only read the level in the tank to which the switch has been set. To read the level in the other tank, the switch position must be changed. The ventilation hoses are fitted with a filter to prevent contamination. The upper part of the fuel tanks can be provided with tank covers.



*Fig 5. Left hand fuel tank*



*Fig 6. Right hand fuel tank*

## Water trap

The water trap is fitted into the fuel pump suction line between the fuel tank selector valve and the fuel preheater. It is located above the left fuel tank.

## Fuel tank selector valve

The fuel tank selector valve consists of a single valve body with two solenoid valves. This electric solenoid valve is controlled by a switch on the instrument panel.

## Mechanical fuel pump

The mechanical fuel pump is driven by the camshaft of the fuel injection pump.

## Tank shut off valve

The tank shut off valve is a manually operated valve which shut off the fuel.

## Fuel preheater

A heat exchanger is installed into the feed line of the heater to preheat the fuel. When the fuel temperature is below +8 °C all the fuel passes through the heat exchanger. When the fuel temperature is between +8 °C and +25 °C a portion of the fuel is passed through the heat exchanger. When the fuel temperature is above +25 °C the fuel bypasses the heat exchanger.

## Fuel filter

The fuel filter is mounted on the front left hand side of the engine, it consists of a filter cartridge and a housing.

## Fuel injection pump

The fuel injection pump is driven by the engine crankshaft and is lubricated by the engine lubricating system. To adjust the quantity of fuel to the varying engine load a pressure compensator (ALDA-cell) is installed on the injection pump. The pressure compensator adjusts the injection quantity to the actual charging pressure with respect to the atmospheric pressure.

Overloading of the engine is prevented by a pressure switch mounted on the intake manifold. This pressure switch controls a solenoid valve in the line between the intake manifold and the pressure compensator. If the pressure of the turbo charger is to high, the connection between the pressure compensator and the charging pressure is closed and the compensator only registers the atmospheric pressure. The pressure compensator will then reduce the fuel quantity supplied to the injectors and the power developed by the engine is reduced. A vacuum shut off valve on the injection pump is used to shut off the engine.

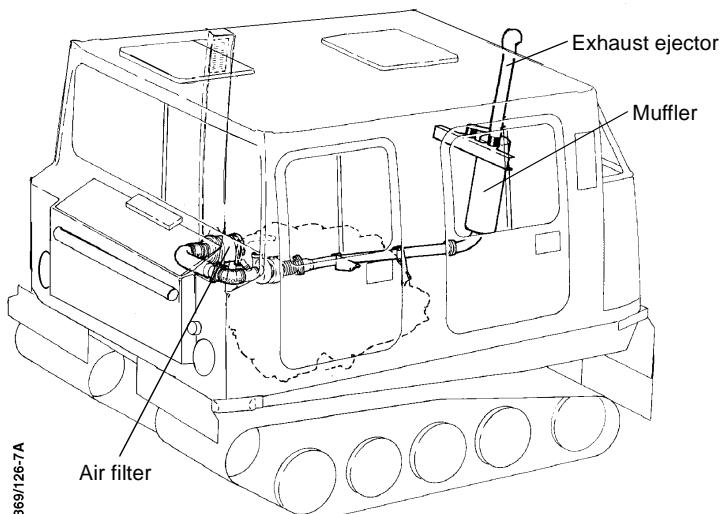
In addition there is also an emergency shut off in the form of a manual shut off lever on the injection pump. A vacuum control valve on the injection pump controls the vacuum to the automatic transmission. The fuel injectors deliver fuel to the cylinders in an atomized fuel spray. Surplus fuel from the injectors and the injection pump is returned to the fuel tanks by a fuel return line.

## Engine power reducing

For protection the engine power is reduced. A temperature sensor, mounted on the left hand rear part of the cylinder head, prevent the charging pressure from turning on when the temperature is below 35°C. A temperature sensor mounted on the left hand front part of the cylinder head, turn off the charging pressure when the temperature is above 105°C.

## INTAKE AND EXHAUST SYSTEM

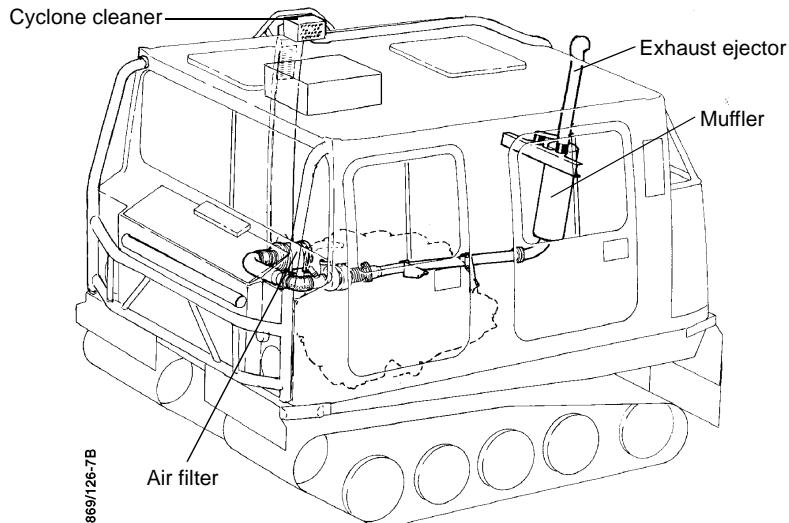
The intake and exhaust system consists of an air filter, a turbo charger, an intake manifold, an exhaust manifold, a muffler and an exhaust ejector. Air is taken in into the engine through to the air filter via an air duct.



*Fig 7. Intake and exhaust system*

## INTAKE AND EXHAUST SYSTEM WITH CYCLONE CLEANER (OP)

The intake and exhaust system consists of a cyclone cleaner, an air filter, a turbo charger, an intake manifold, an exhaust manifold, a muffler and an exhaust ejector. Air is taken in into the engine through the cyclone cleaner to the air filter via an air duct.



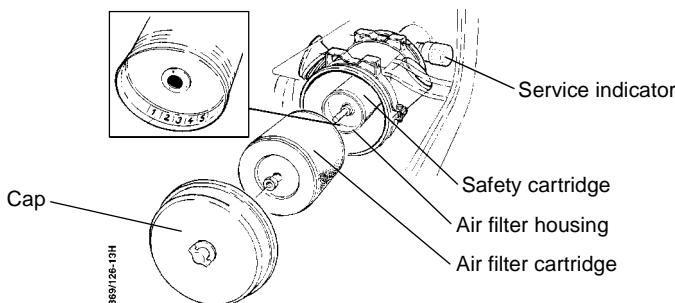
*Fig 8. Intake and exhaust system*

### Cyclone cleaner (OP)

The cyclone cleaner is located on the right hand side of the roof of the vehicle. It consists of a number of tubes placed alongside each other. The cyclone cleaner is designed so that incoming air circulates around the tubes. Particles of debris, such as sand and dust, are rejected by the exhaust ejector and blown out with the exhaust gases.

## Air filter

The air filter is mounted under the front passenger seat. It consists of an air filter housing with a cap, an air filter cartridge and a safety cartridge. The air filter is also equipped with a service indicator.



*Fig 9. Air filter*

## Service indicator

The service indicator is mounted on the front end of the air filter. It measures the pressure drop in the air filter and provides an indication when the air filter cartridge has to be cleaned or exchanged and/or safety cartridge has to be exchanged. When required to be cleaned or exchanged the indicator provides a red indication. Resetting the indicator is made by pressing the button on the top of the indicator.

## Safety cartridge

The safety cartridge prevents dirt from entering into the intake system when the air filter cartridge is being cleaned or exchanged. Make a mark on the label provided on the safety filter cartridge each time you perform a servicing operation ( replacement or cleaning on air filter ).

## Turbo charger

An exhaust gas driven turbo charger is provided in order to increase the power produced by the engine. This turbo charger increases the amount of air admitted to the cylinders allowing the engine to burn the fuel more efficiently which results in more engine power.

## Waste gate valve

In order to limit the air supply to the engine (charging pressure) at high engine speeds, the turbo charger is provided with a waste gate valve, which opens to permit the exhaust gases to bypass the turbine exhaust. As the waste gate valve is controlled by the charging pressure, the speed of the turbo charger will automatically adapt to the load and speed of the engine.

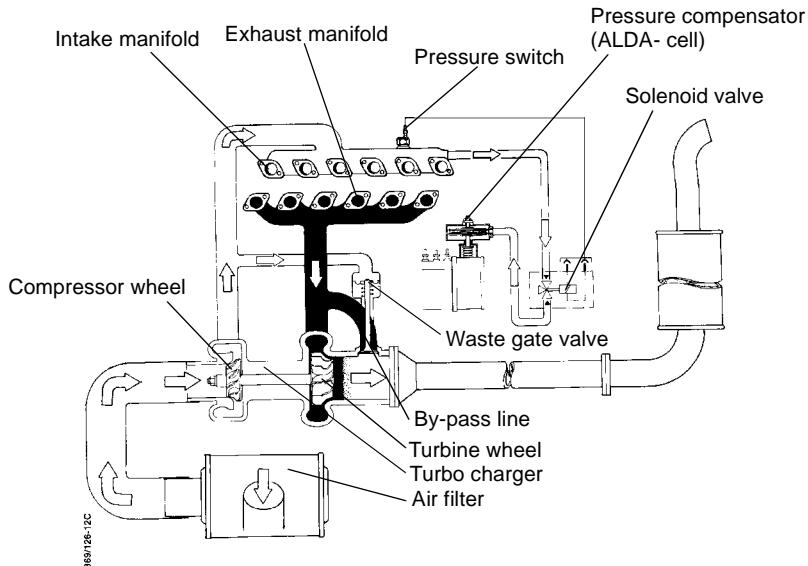


Fig 10. Intake and exhaust system

## Intake manifold

The intake manifold serves as a reservoir for the charge air developed by the turbo charger. The manifold is connected to all the cylinders, when the intake valves open.

## Exhaust manifold

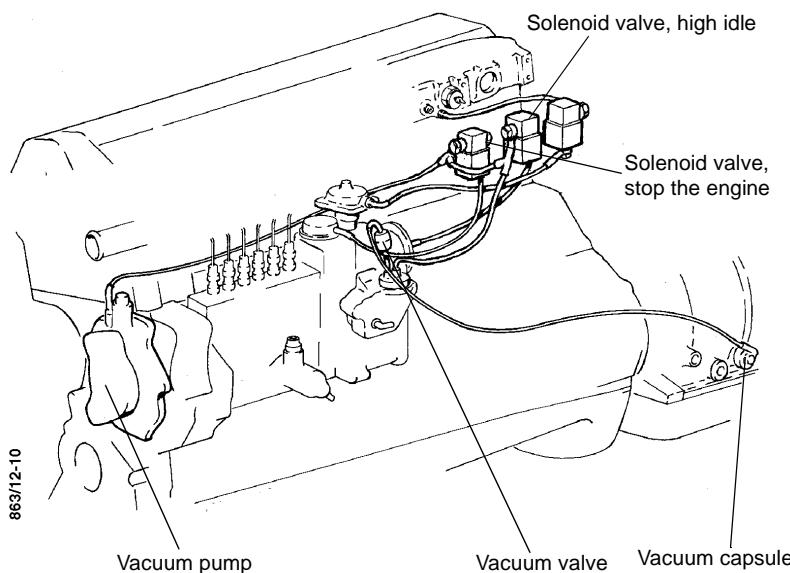
The exhaust manifold channels the exhaust gases through the turbine of the turbo charger to the exhaust pipe, through the silencer, the ejector and finally to the atmosphere.

## VACUUM SYSTEM

The vacuum system consists of a vacuum pump, solenoid valves, a vacuum regulator and two vacuum capsules on the injection pump and a vacuum capsule on the transmission. The vacuum system is used to stop the engine, to allow it to high idle and to regulate the modulating pressure in the transmission.

### Vacuum pump

A double acting piston vacuum pump is attached to the left hand side of the engine. It is driven by the cam of the injection timer. The performance of the vehicle only requires the use of the smaller connection of the vacuum pump. Consequently the larger connection of the vacuum pump is plugged.

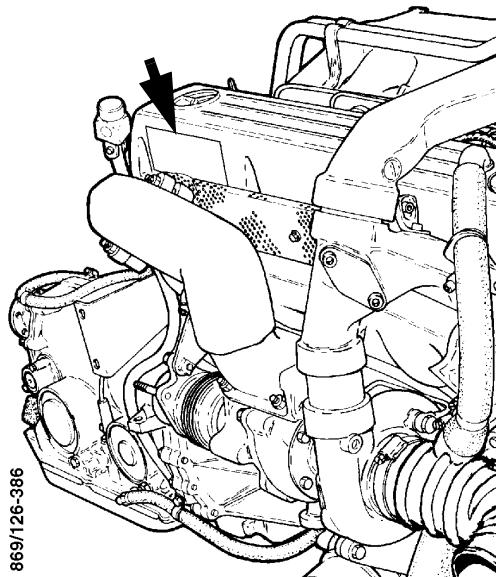


*Fig 11. Vacuum system*

## POSITIVE CRANKCASE VENTILATION

The engine gases are ventilated through the oil separator in the valve cover and via a pressure regulator to the suction side of the turbo charger. The pressure regulator prevents excessive crankcase vacuum, which could result in oil being drawn into the air intake line. The pressure regulator is installed in the rear part of the valve cover.

**CAUTION!** The ventilation hole for the pressure regulator shall always be open. Damage to engine may occur if the ventilation is blocked.



*Fig 12. Pressure regulator ventilation hole*

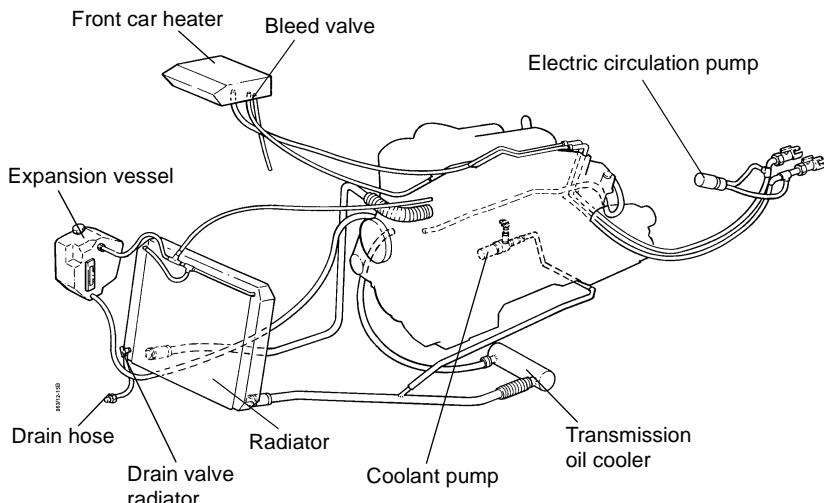
## COOLING SYSTEM

The cooling system comprises of a radiator, an expansion vessel, a transmission oil cooler, a coolant pump, and a thermostat mounted on the engine.

### **CAUTION!**

Do not remove the engine thermostat and operate the vehicle, as damage to the engine may occur.

The cooling system is also used to heat the interior of the vehicle. A fan draws air from the atmosphere through the front air intake and through the radiator, and forces the air through the engine compartment and out through the air exhaust. The expansion vessel controls the amount of fluid in the system, which may change because of the temperature variations within the engine.



*Fig 13. Cooling system*

The electrical circulation pump, located at the right side of the engine, circulates engine coolant, whenever the coolant temperature is above +95 °C. This pump also operates, when the engine is switched off and the coolant temperature is above the specified temperature +95 °C. The circulation pump is controlled by a thermostat located in the cylinder head of the engine. The thermostat stops operation of the pump, when the coolant temperature is below +90 °C.

## 3.2 Electrical system

The electrical system of the vehicle is rated at 24 V negative ground. Dual wire system.

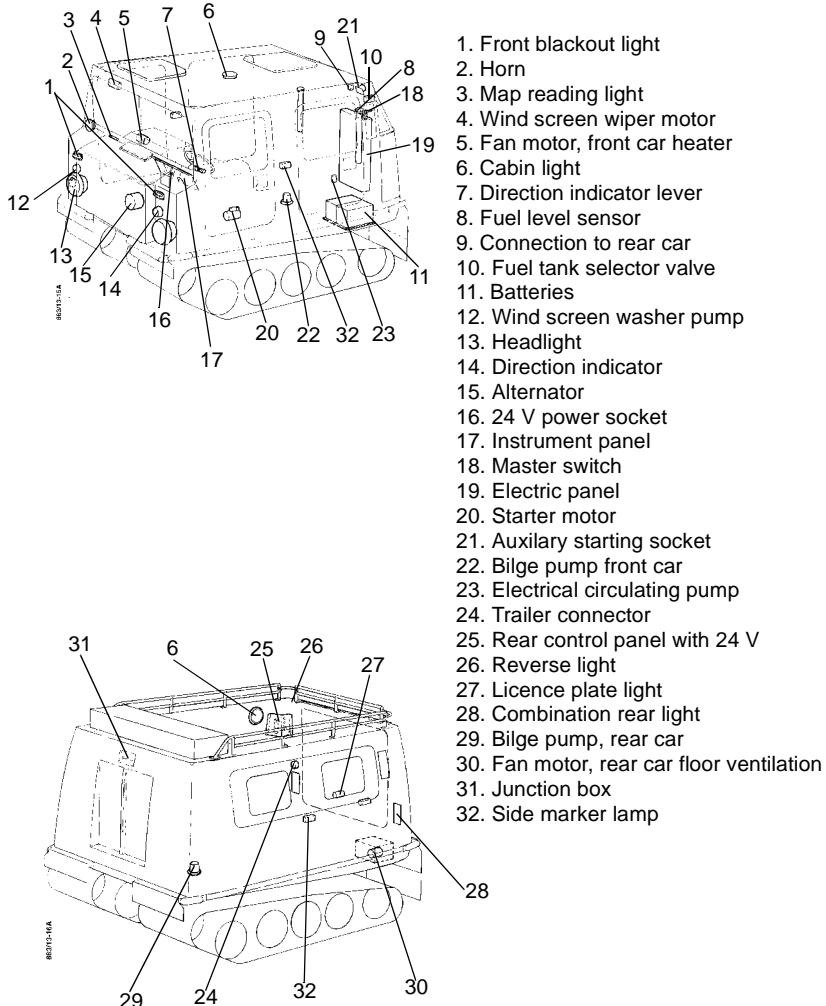
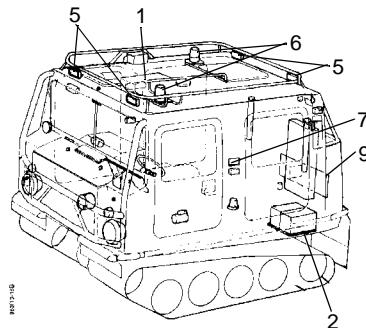
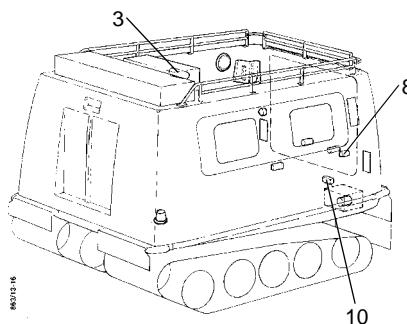
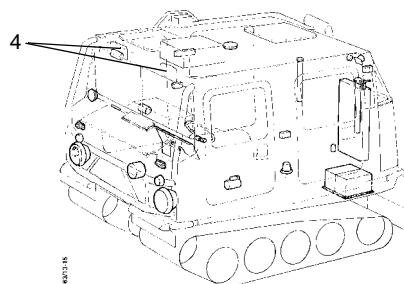


Fig 14. Electrical system

## ELECTRICAL SYSTEM (OP)

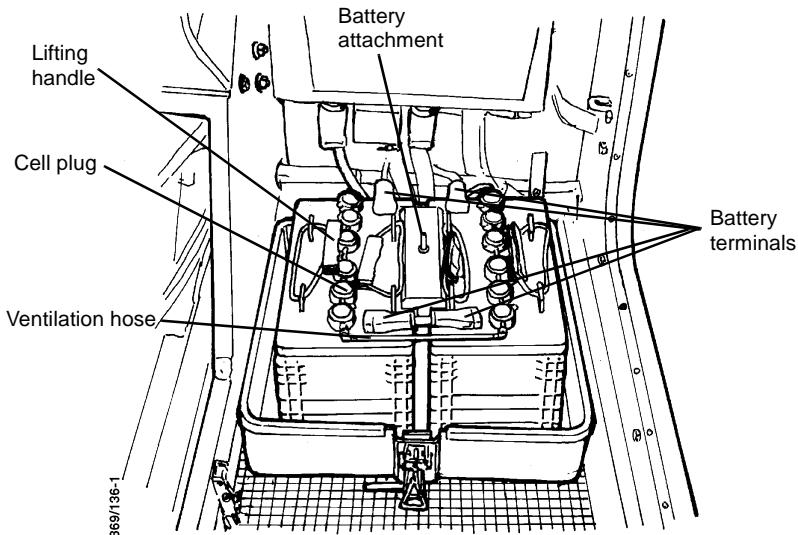


*Fig 15. Electrical system*

## BATTERY

Two 12 V lead acid batteries connected in series are located in a box at the left hand side, rear corner of the front car. The individual cells of the batteries are provided with ventilation covers and hoses for the ventilation of the gases from the batteries.



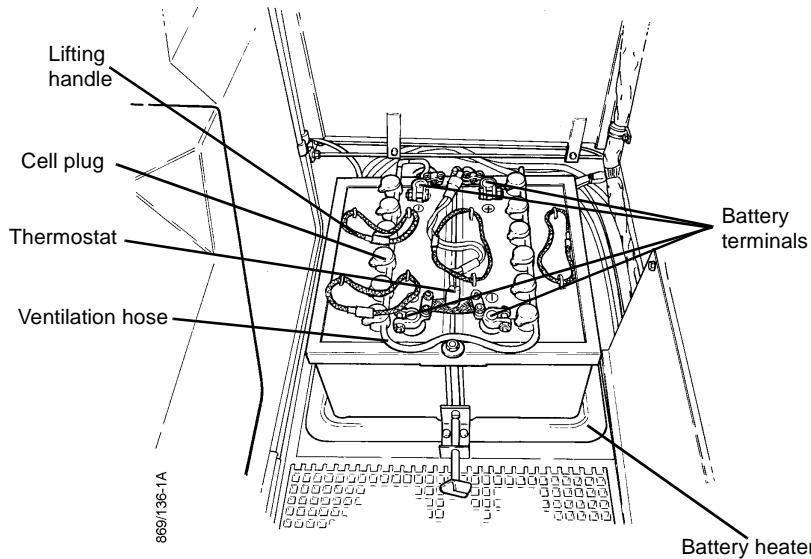
*Fig 16. Batteries*

## Battery cover

The battery cover protects the batteries. The top of this cover is fitted with a cushion, which allows it to serve as a passenger seat.

## Battery heater (OP)

The batteries are placed on a thermostatically controlled heater plate which operates only when the alternator is charging the batteries. The heater current is switched off before the acid in the battery reaches a dangerous temperature. A yellow light with a BATTERY HEATER symbol on the control panel indicates that the battery heater is on.



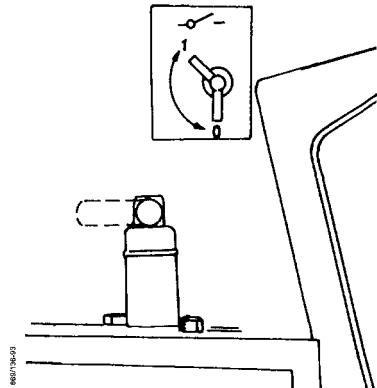
*Fig 17. Batteries with heater*

## MASTER SWITCH

A master switch is located on top of the electric panel. The master switch disconnect and connect the batteries from the electrical system.

The master switch shall always be in “1=ON” position whenever the vehicle is to operated. Position the master switch in “0=OFF” position during overnight parking or any long term parking.

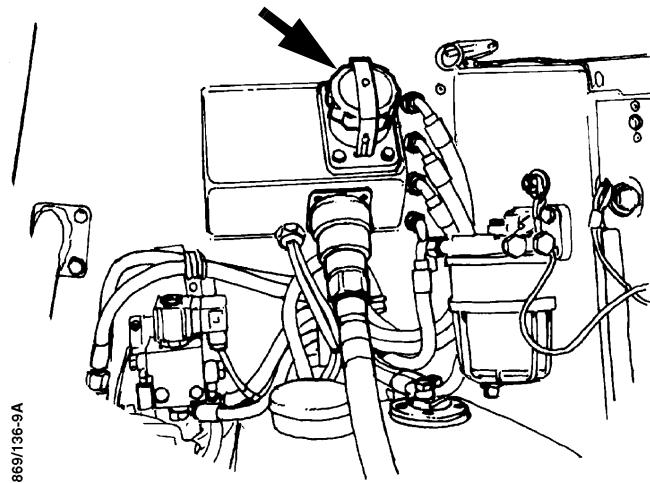
**CAUTION!** Do not position master switch in “OFF” position while the alternator is charging. Damage to alternator occur.



*Fig 18. Master switch*

## AUXILIARY STARTING CABLE CONNECTOR

The connector for the auxiliary starting cable is located externally. This external connection may be used to connect an external 24 V power source to start the engine.



*Fig 19. Auxiliary starting cable connector*

## ALTERNATOR

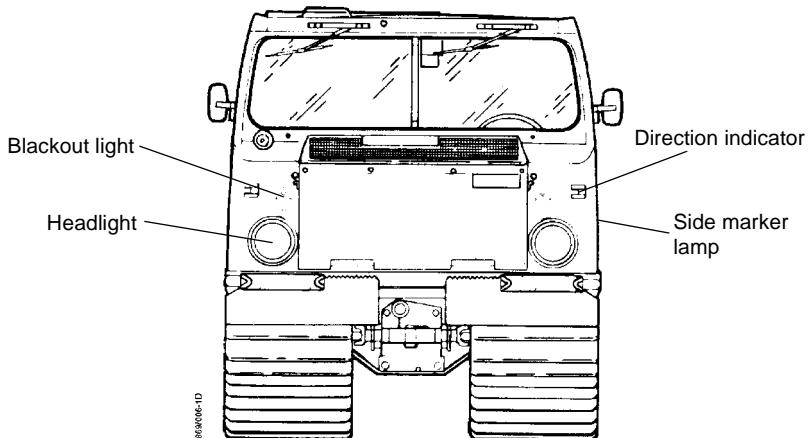
The alternator with built in rectifier and charging current regulator is mounted on the right hand side of the engine. The alternator is driven by a V-belt from the crankshaft pulley.

## STARTER MOTOR

The starter motor is mounted on the flange between the engine and the transmission and is located on the left hand side of the engine. When starting the engine, the gear selector must be in the neutral position "N" as the starter motor will not operate in any other gear selector position.

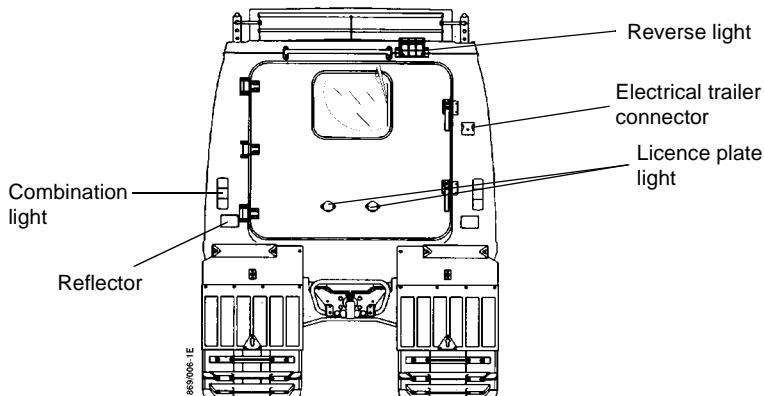
## OUTSIDE LIGHTING AND POWER SOCKETS

The outside lighting equipment on the front car consist of two headlights, with main beam, dipped beam and parking lights, two direction indicators, two blackout lights and two sidemarker lamps. A red reflector are provided inside of each door.

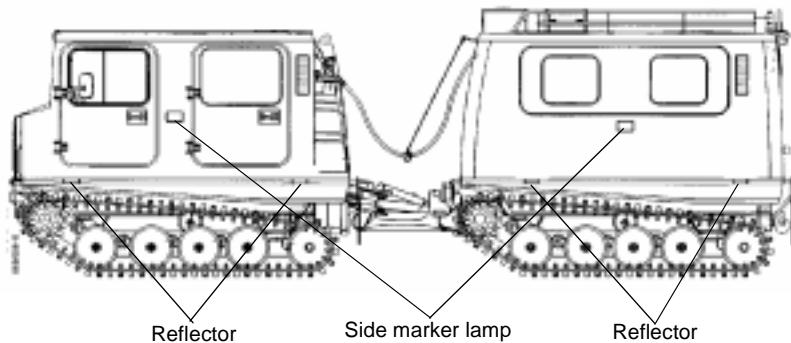


*Fig 20. Lightning equipment, front car*

For the rear car the outside lighting consist of two combination lights, with tail light, brake light, blackout light and direction indicators, a reverse light, two red reflectors, a red reflector on the inside of the side door, a twelve pin socket for electrical connections for a towed trailer, two side marker lamps and two licence plate lights.



*Fig 21. Lightning equipment, rear car*



*Fig 22. Reflectors*

## INTERIOR LIGHTING AND POWER SOCKETS

The interior lighting consist of a map reading light in the front car, cabin lights for both the front and rear cars. The cabin lights are operated by switches mounted on the lights. The map reading light is switched on, when the anti dazzle cover is lifted. In the front car there is a socket located on the instrument panel. In the rear car there is a socket located on the control panel.

## FUSES

The electrical components are protected by fuses. A list located inside the electrical panel cover defines the components, the fuses and the rating of the fuses required. For the bilge pump there is a 6 A circuit breaker built into the switch. The circuit breaker for the bilge pump can be reset by switching OFF and ON again.

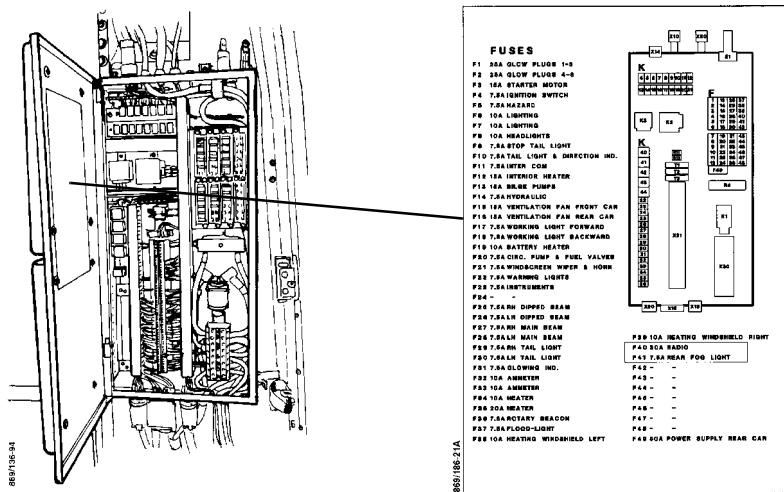


Fig 23. Fuse box and fuse list

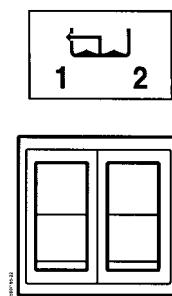


Fig 24. Bilge pump circuit breaker

## RELAYS

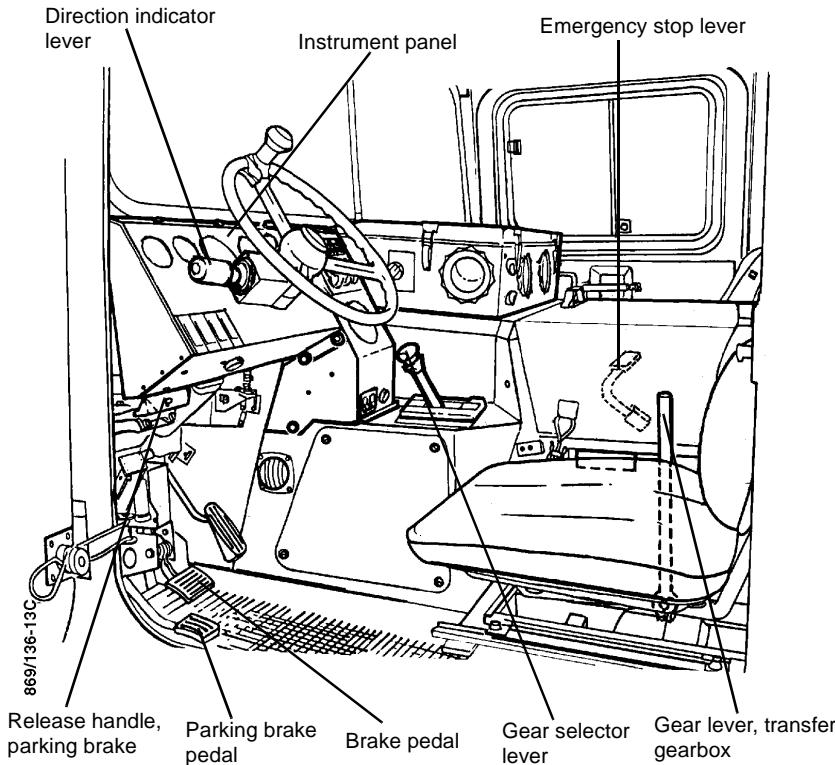
The electrical panel contains relays needed for the electric system function. A list located inside the cover shows the location of the relays, see component list

## INSTRUMENTS, SWITCHES, INDICATOR AND WARNING LIGHTS, CONTROLS

The instruments, switches, warning and indicator lights are located on the instrument panel in the driver's position in the front car.

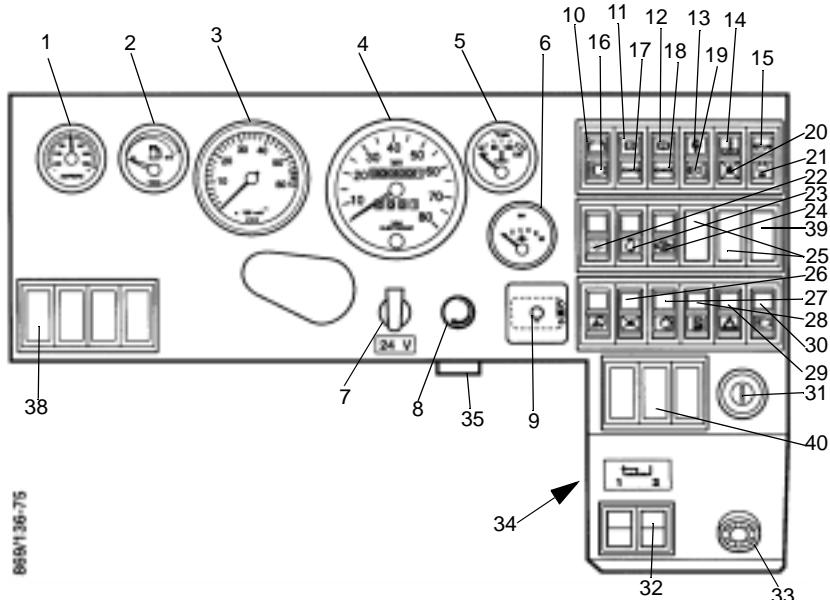
### NOTE!

Descriptive text of the switches refer to the switches in the "ON" positions.



*Fig 25. Driver's controls*

## Instrument panel



*Fig 26. Instrument panel*

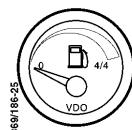
### 1. AMPERE METER (OP)

The ampere meter indicate the electricity to or from the batteries. The gauge registers from - 150 to + 150 Ampere.



### 2. FUEL GAUGE

This gauge indicates the amount of fuel in the right or left tank, provided that the ignition switch is in the "1" position. The gauge registers from O (empty) to 1/1 (full).



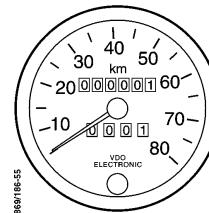
### 3. TACHOMETER

The tachometer indicates the engine speed in revolutions per minute, (rpm).



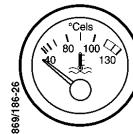
## 4. SPEEDOMETER, ODOMETER AND ODOMETER TRIP

The speedometer indicates the speed of the vehicle in kilometres per hour. The odometer indicates the accumulative total of kilometres travelled. The odometer trip may be set to zero at any point in time, and will register the kilometres travelled, until set to zero.



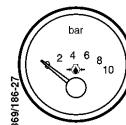
## 5. ENGINE COOLANT TEMPERATURE GAUGE

This gauge indicates the temperature of the engine coolant in degrees Celsius. Normal operating temperature is between +75 and +105 °C. If the temperature rises above +105 °C the engine power will be reduced.



## 6. ENGINE OIL PRESSURE GAUGE (OP)

This gauge indicate the engine oil pressure in bar. The gauge register from 0 to 10 bar.



## 7. 24 V POWER SOCKET

A 24 V power outlet socket is provided and can be used for an extension light etc.



## 8. INSTRUMENT LIGHTS RHEOSTAT

This rheostat is used for adjusting the intensity of the instrument lighting.



## 9. BLACKOUT LIGHTING SWITCH

Upper position:

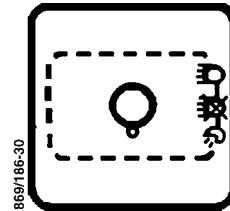
- Blackout lighting switch OFF
- Normal lighting connected

Middle position:

- Blackout lighting switch OFF
- Normal lighting OFF

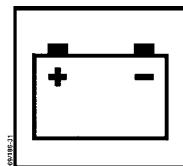
Lower position:

- Blackout lighting ON
- Normal lighting disconnected.



## 10. CHARGING WARNING LIGHT (RED)

This indicator illuminates, when the ignition switch is in position "1", when the engine is running and when the charging system is not working.



## 11. PARKING BRAKE WARNING LIGHT (RED)

This light illuminates, when the parking brake is applied.



## 12. SERVICE BRAKE WARNING LIGHT (RED)

This light illuminates, when one of the brake circuits is non operational.



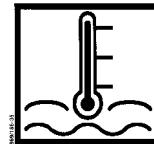
## 13. TRANSMISSION OIL TEMPERATURE,WARNING LIGHT (RED)

This indicator light illuminates when the transmission oil temperature is overheating, +130 3 °C.



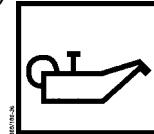
## 14. ENGINE COOLANT TEMPERATURE, WARNING LIGHT (RED)

This indicator light illuminates when the engine coolant temperature is overheating, +110 °C.



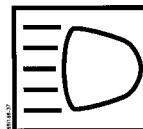
## 15. OIL PRESSURE WARNING LIGHT (RED)

This indicator light illuminates, when the engine oil pressure is below normal operating pressure (0.5 - 0.15 bar).



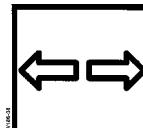
## 16. MAIN BEAM HEADLIGHT INDICATOR (BLUE)

This indicator light illuminates to indicate that the headlight main beams are on.



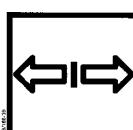
## 17. DIRECTIONAL INDICATOR, VEHICLE, REPEATER LIGHT (GREEN)

This indicator light flashes, when the left/right indicator switch is operated or the hazard warning switch is set.



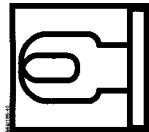
## 18. DIRECTION INDICATOR, TRAILER REPEATER LIGHT (GREEN)

This indicator light flashes, when the vehicle is connected to a trailer and the left/right direction indicator switch is operated.



## 19. PREGLOW INDICATOR LIGHT (GREEN)

This indicator illuminates, when the ignition switch is in the “PREGLOW” position.



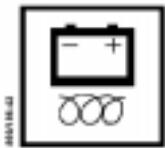
## 20. INTERCOM INDICATOR LIGHT (YELLOW)

This indicator illuminates, when the intercom switch in the front or the rear car is placed in the intercom position.



## 21. BATTERY HEATER INDICATOR SWITCH (OP)

This indicator glows yellow to indicate that the battery heater is operating.

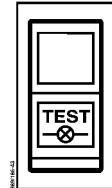


## 22. WARNING LIGHT TEST SWITCH

This switch is to test the function of the warning lights. The following functions are tested by pressing the switch:

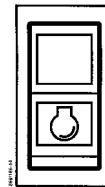
- engine oil pressure warning light.
- engine coolant temperature warning light.
- transmission oil warning light.
- service brake warning light.
- parking brake warning light.

For test of the buzzer, press switch when idling.



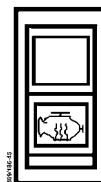
## 23. HIGH IDLE SWITCH

This switch is to set the engine to high idle, about 1100 rpm. High idle is to be used for:  
battery charging from vehicle alternator.  
when increased cooling capacity is needed  
operation of P.T.O.



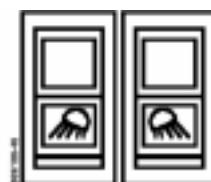
## 24. DIESEL FUELLED HEATER (OP)

A switch for operating diesel fuelled heater.



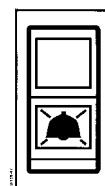
## 25. WORKING LIGHT, FRONT (OP)

A switch for operating the working light, forward and backward.



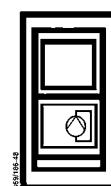
## 26. INTERCOM SWITCH

A switch for operating the intercom to the rear car is provided. When the spring returned switch is held in the intercom position, an indicator light illuminates and a buzzer sounds in the front and the rear car.



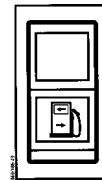
## 27. CIRCULATING PUMP WITH INDICATOR LAMP (YELLOW)

Operates the cooling system circulating pump. The pump is started by pressing the upper part of the switch, and is switched OFF by pressing the lower part. The pump should always be in operation when an external engine heater is used to bring the engine cooling water to operating temperature.



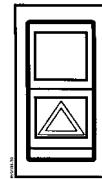
## 28. FUEL TANK SELECTOR SWITCH

This is a two position switch. When the upper part of the switch is pressed, fuel is drawn from the left hand fuel tank and when the lower part is pressed, fuel is drawn from the right hand tank. The switch also connects the fuel gauge to the selected fuel tank and the gauge will register the fuel level of that tank from which the system is currently drawing fuel.



## 29. HAZARD WARNING LIGHT SWITCH

This hazard warning light switch should be used to indicate that the vehicle has become a traffic hazard.



### NOTE!

The ignition switch has to be in position "1" when hazard warning light is to be operated.

## 30. HEADLIGHT SWITCH

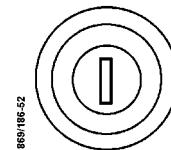
Depressing the switch halfway turns ON the parking light and side marker lights. Depressing the switch all the way adds the headlight main beam or dipped beam, depending in the position of the direction indicator control lever. The MAIN BEAM indicator light on the instrument panel comes ON with the headlight high beam.



## 31. IGNITION SWITCH

This five position switch has the following functions:

- |         |  |
|---------|--|
| STOP    | Shut down the engine<br>(spring return).   |
| 0       | No power is provided to<br>any electrical circuits.  |
| 1       | Provides electrical power<br>to the following circuits:<br><br>Outside and interior lighting,<br>map reading light, chargng,<br>intercom, direction<br>indicators, brake lights,<br>bilge pumps, instruments,<br>indicator and warning lights,<br>front and rear car fans,<br>windscreen wipers,<br>windscreen washer pump,<br>horn, kick down valve,<br>first gear. |
| PREGLOW | Provides power to the glow<br>plugs (spring return).   |



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### **CAUTION!**

Do not hold the switchin PREGLOW position for more than 30 seconds as damage to glow plugs may occur.

- |       |   |
|-------|---|
| START | Operates the engine starter<br>motor (spring return). |
|-------|---|

### **CAUTION!**

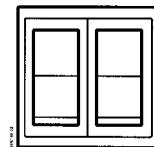
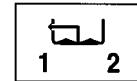
Do not hold the ignition switch in the "START" position for more than 30 seconds as damage to the starter motor may occur. If the engine does not start, wait for 90 seconds before attempting a new start procedure.

**NOTE!**

Upon ignition of the engine release the switch and allow it to return to "1" position.

## 32. BILGE PUMP SWITCHES WITH INDICATOR LIGHT (YELLOW)

These indicators illuminate, when the bilge pumps for the front and rear cars are in operation. The bilge pumps are started by pressing the lower part of the switches and are switched off by pressing the upper part of the switches. The switch include a 6 Amps circuit breaker. To reset the circuit breaker simply press the switch "OFF" and "ON" again.

**NOTE!**

No. 1 switch is for the front car and No. 2 switch is for the rear car.

## 33. INTERCOM BUZZER

This buzzer is an audio indication to the front car, that the rear car passengers wish to communicate with them, and is used in conjunction with the intercom indicator light.

## 34. HOUR METER

This indicator records the time of engine operation in hours.

## 35. WARNING BUZZER

This buzzer will sound, if the engine oil pressure drops below 0.5 0.15 bar, the engine coolant temperature rises above +110 °C, or if the parking brake is engaged while driving. It will also sound when pressing the warning light test switch, when the engine is running.

## 36. DIRECTION INDICATOR LEVER

This lever combines the operation of the direction indicators, control of the headlight beams, the horn, windscreen wipers, and the windscreen washers. Operation of the lever towards the instrument panel brings the main headlight beam into operation.

Returning the lever to the centre position, dips the headlights.

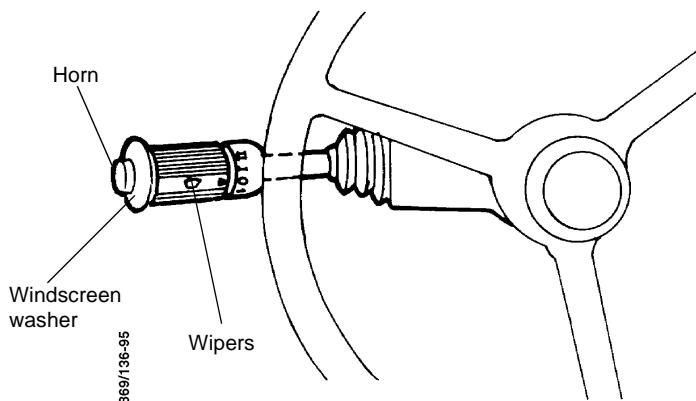
Operation of the lever towards the driver results in the headlights going to the main beam temporarily (flashing).

To operate the direction indicators the lever is moved to the left (down) for a left turn and moved to the right (up) for a right turn.

**NOTE!**

The direction indicator lever does not automatically return to the "OFF" position after a turn and the indicator lights on the instrument panel always flash when the direction indicator is operating.

- To operate the horn, push the button on the end of the lever.
- To operate the windscreen wipers, rotate the knob on the lever to the "I" position (low speed) and to the "II" position (high speed).
- To operate the windscreen washer, press the collar around the horn button at the end of the lever.



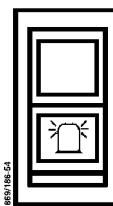
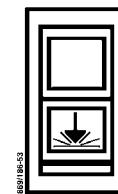
*Fig 27. Direction indicator lever (36)*

## 37. PARKING BRAKE WARNING LIGHT SWITCH

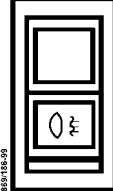
The parking brake warning light switch is activated by depressing the parking brake pedal, which results in the parking brake warning light being illuminated. The parking brake warning light switch is de-activated by releasing the brakes using the parking brake release handle.

**38. PTO ( POWER TAKE OFF ) TOGGLE SWITCH (OP)**

A switch for operating the PTO.

**39. ROTATING BEACONS, TOGGLE SWITCH (OP)**

A switch for operating the beacon.

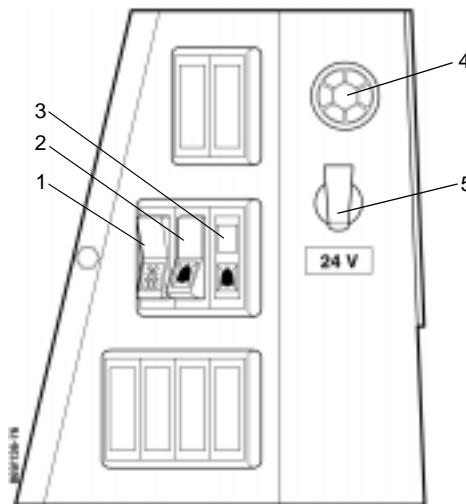
**40. FOG LIGHT SWITCH WITH INDICATOR LAMP (OP)**

A switch for operating the fog light. The indicator indicates that the fog light is on.

## SWITCHES AND INDICATORS, REAR CAR

A control panel complete with outlet socket and control switches is mounted on the right hand side, inside the rear door of the rear car and the control switch for the roof ventilation fan is provided on the air duct in the ceiling.

### Control panel



*Fig 28. Control panel, rear car*

#### 1. FLOOR VENTILATION FAN SWITCH

This three position switch, controls the floor ventilation fan. In its upper position, the fan is "OFF". In the centre position, the fan operates at half speed and in the lower position the fan operates at full speed.

#### 2. INTERCOM SWITCH

A switch for operating the intercom to the front car is provided. When the spring loaded switch is held in the intercom position, an indicator light illuminates and a buzzer sounds in the front and the rear car.

### **3. INTERCOM INDICATOR LIGHT (YELLOW)**

This indicator illuminates, when the intercom switch in the front or the rear car is pressed in the intercom position.

### **4. INTERCOM BUZZER**

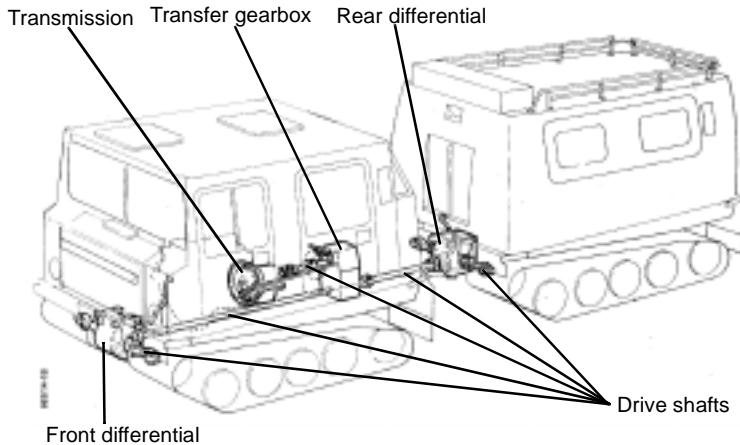
This buzzer is an audio indication to the rear car, that the front car driver wish to communicate with them, and is used in conjunction with the intercom indicator light.

### **5. 24V POWER SOCKET**

A 24 V power outlet socket is provided which can be used for an extension light etc.

### 3.3 Power train

This system comprises of a transmission with a torque converter, a manually operated transfer gearbox, front and rear differentials and drive shafts.



*Fig 29. Power train*

## TRANSMISSION

The transmission is fully automatic. It has four speeds, four forward positions ("D", "3", "2" and "1"), one reverse position ("R") and one neutral position ("N"). The two main components of the transmission are: a hydraulic torque converter and a hydraulically operated planetary gear train.

## GEAR CONTROLS, TRANSMISSION

The positions of the gear selector are marked on the selector cover. To prevent accidental gear shifting a latch mechanism is provided on the selector lever to lock it in positions "R", "N" and "D". When the vehicle is in forward motion, the selector can be moved freely through positions "1", "2", "3" and "D".

When moving the selector in the order of "D", "3", "2" and "1", a latch mechanism must be disengaged by lifting a key located under the selector lever head, when moving from position "2" to "1". See Gear shifting, transmission.

## TRANSFER GEARBOX

The transfer gearbox is located on the chassis beam at the rear of the front car. This non synchronized gearbox has two speeds (high and low) and a neutral position.

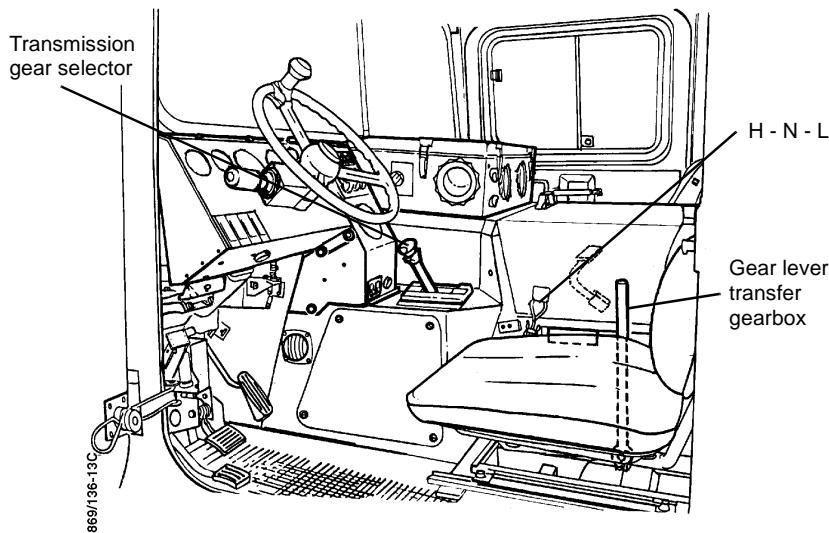
### Gear controls, transfer gearbox

This lever has three positions: "HIGH", "N" (neutral) and "LOW".

The vehicle must be stationary and the automatic transmission in the neutral position, when shifting gears in the transfer gearbox. A gear change in the transfer gearbox between the "HIGH" and "LOW" positions must be made in one continuous, positive movement without pausing in the neutral position. If the change results in the gearbox being in a neutral position, stop the engine and engage the desired gear.

#### **CAUTION!**

The "N" (neutral) position of the transfer gearbox has to be selected when the vehicle is being towed.



*Fig 30. Gear lever and gear selector*

## DIFFERENTIALS

The differentials are located on the frame beams at the front of each car. The differentials are identical and can be interchanged.

## 3.4 Brake system

The vehicle has two independently operated brake systems: a service brake and a parking brake. The service brake is a two circuit hydraulic brake system and the parking brake is a mechanical brake system.

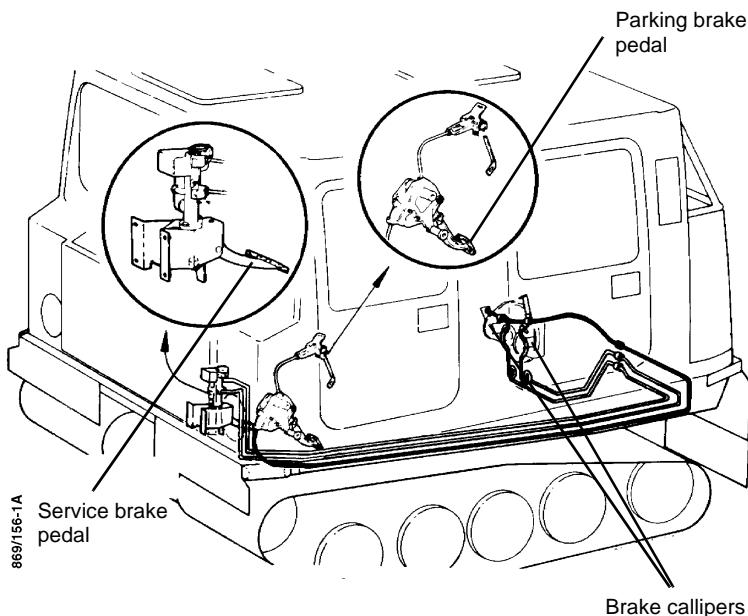


Fig 31. Service and parking brake system

## SERVICE BRAKE

The service brake system consists of a hydraulic disc brake unit with two independent circuits to the left and right brake callipers. Other main components are the master cylinder with pressure differential/warning valve and brake fluid reservoir, the brake lines, and the two brake callipers mounted on the brake unit assembly.

If a pressure differential develops between the two brake circuits, an electrical contact in the warning valve is actuated and the service brake warning indicator is illuminated. When operating the service brake, the brake lights are activated by a hydraulic switch on the brake line.

## PARKING BRAKE

The parking brake is operated by means of a foot pedal. The parking brake pedal and release lever assembly are located in the left front corner of the drivers compartment. The pedal is connected to the right calliper of the service brake via an adjustable cable and mechanical linkage. The right calliper is activated by the parking brake and works on the same brake disc as the service brake, and is adjusted automatically when the service brake is adjusted. The parking brake mechanical linkage must be adjusted separately from the service brake. The parking brake warning indicator is illuminated, when the parking brake is engaged. A warning buzzer will sound, if the parking brake is engaged when setting the gear selector lever to positions "R", "D", "3", "2" and "1".

## 3.5 Steering system

The vehicle is fitted with a hydraulically powered steering system comprising of a hydraulic oil tank, steering valve, servo valve hydraulic pump and steering cylinders. The steering wheel operates the steering valve, which allows oil to pass to the servo valve. This valve opens to allow oil to flow from the hydraulic pump to the steering cylinders. If the hydraulic pump fails, the vehicle may be steered by means of the steering valve, emergency steering. If this occurs, then the steering wheel must be rotated approximately 15 turns for lock to lock steering, instead of 4 1/2 turns for normal power assisted steering.

### NOTE!

More effort is required to turn the steering wheel under emergency steering conditions.

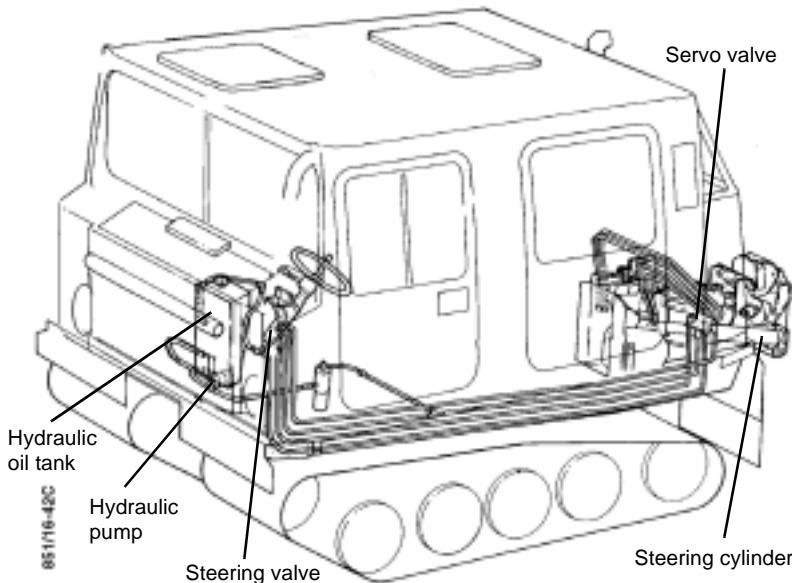


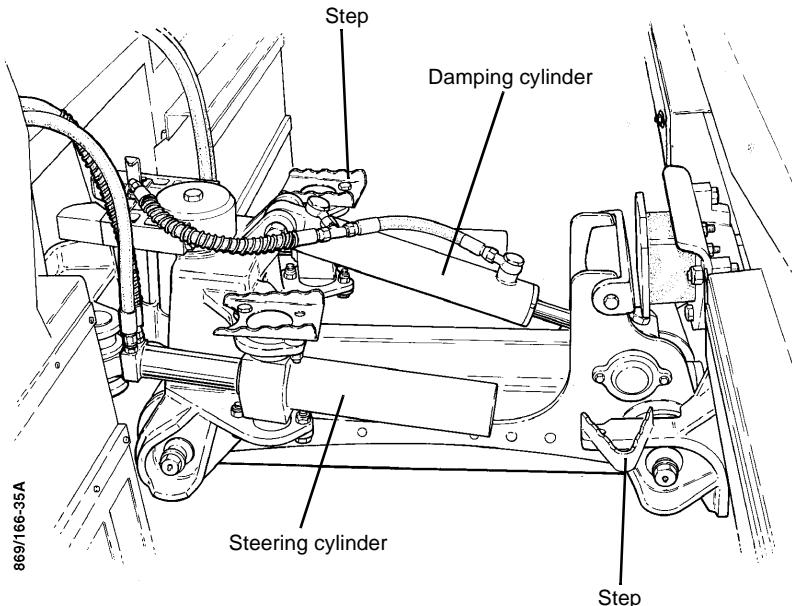
Fig 32. Steering system

## STEERING UNIT

The steering unit between the front and rear car allows the cars to move in relation to each other, horizontally for steering and vertically to follow uneven terrain. A drive shaft passes through the steering unit to transmit power from the front car transfer gearbox to the rear car differential. The steering unit has a damping cylinder to compensate for vibrations during operation of the vehicle.

### NOTE!

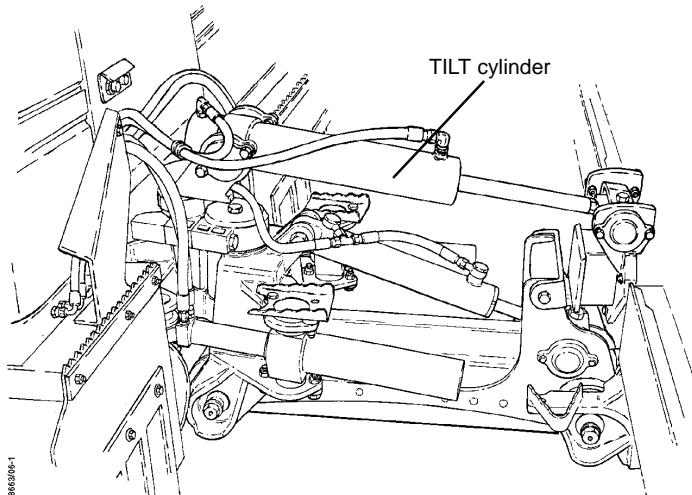
Use the steps when climbing on the steering unit.



*Fig 33. Steering unit*

## STEERING UNIT WITH PITCH CONTROL (OP)

The steering unit between the front and rear car allows the cars to move in relation to each other, horizontally for steering and vertically to follow uneven terrain. A drive shaft passes through the steering unit to transmit power from the front car transfer gearbox to the rear car differential. The steering unit has a damping cylinder to compensate for vibrations during operation of the vehicle and a tilt cylinder that make the front car to change the angle of tilt vertically.



*Fig 34. Steering unit with pitch control*

## PITCH CONTROL (OP)

The tilt cylinder control lever is located under the drivers seat. This lever manually operates a spool valve in the steering / pitch control hydraulic system. When the control lever is in “driving position”, the pitch control cylinder acts as an additional damping cylinder and the steering system functions normally in the “driving position”, the control lever will release the hydraulic pressure on both sides of the pitch cylinder piston, allowing the carrier angle to normalize. With the control lever in either of the pitch control positions ( UP or DOWN ), the pitch control cylinder will extend or retract until it reaches its limit of travel. The limiting angels are  $\pm 7,5^\circ$ .



*Fig 35. Pitch control*

## 3.6 Frame beams, suspensions, wheels and tracks

The frame beams are fitted with leaf springs, at the end of which are fitted the track assemblies. Each of these assemblies consists of a track girder with rubber torsion springs, swing arms, drive sprockets, road wheels, tension wheels, a support wheel, a track tension device and a rubber track. The frame beams also provide the support for the rear mounting of each car body.

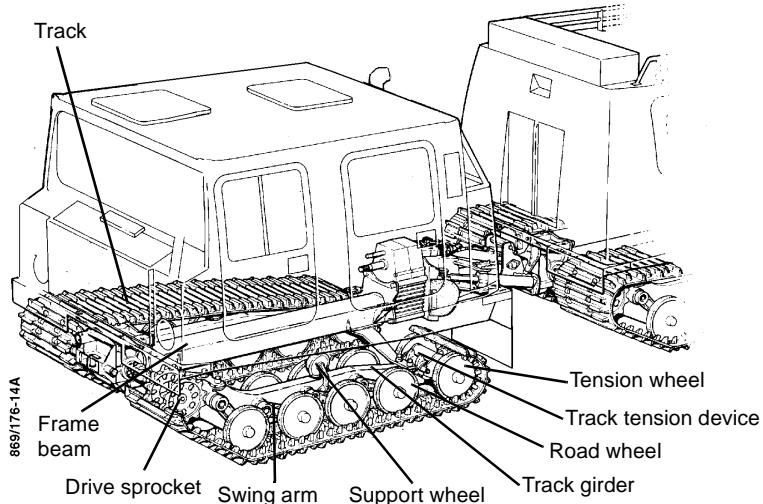


Fig 36. Frame, beam, suspensions, wheels and tracks

## SUSPENSION SYSTEM

The suspension system of both cars is built around a central frame beam from which leaf springs extend sideways to the track girders. Each track girder carries eight swing arms with rubber torsion springs. Road wheels are attached to each swing arm.

## DRIVE SPROCKETS

There are two drive sprockets mounted at the front end of each track girder. Each sprocket consists of a steel disc with a bonded plastic tooth outer rim. The teeth engage the steel cross bars in the track and transmit the propulsion power to the track.

## ROAD WHEELS

The ten (included two tension wheels) road wheels of each track assembly are made from aluminium and are fitted with an outer rim of rubber bonded to the aluminum.

## TENSION DEVICE WITH TENSION WHEELS

Two tension wheels (identical to the road wheels) are fitted to each track assembly and are made from aluminium with an outer rim of rubber bonded to the aluminum. An adjusting screw on the tension mechanism positions the tension wheels longitudinally to achieve the correct track tension. The tension mechanism is cushioned by a rubber torsion spring. The whole track tension device can be compressed to facilitate replacement of the track.

## SUPPORT WHEELS

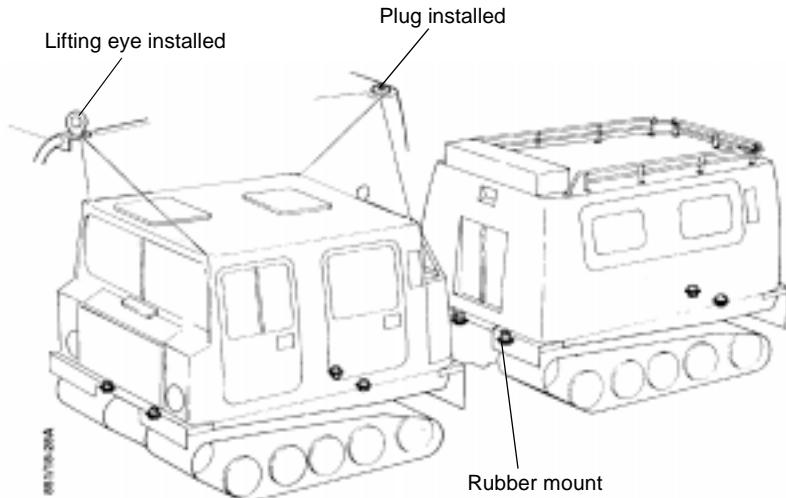
One support wheel is fitted to each track assembly and is made from aluminium with an outer rim of rubber bonded to the aluminum. The wheels are fitted onto a bracket bolted onto the track girder.

## TRACKS

The rubber tracks are reinforced transversely by integral steel cross bars and longitudinally by textile cord. Arrows marked on the edges of the tracks indicate the direction of the track. The track inside surface has guide horns to guide the tracks laterally.

## 3.7 Car bodies

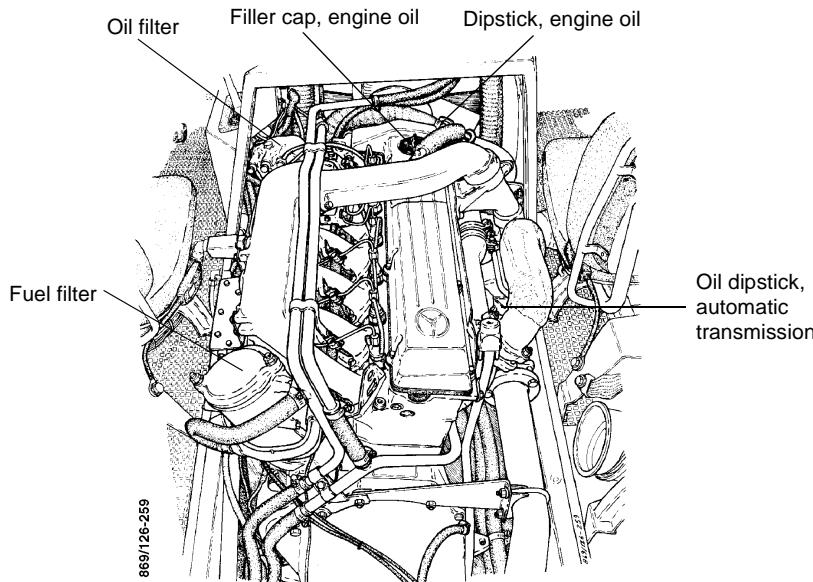
The car bodies are made of self extinguishing polyester fibreglass material in the form of coloured moulded panels. The panels are assembled and each car body is provided as one piece. Each car body is mounted on four rubber mounts onto the chassis, two of these mounts are at the front end and the other two at the rear end. Both bodies are provided with threaded holes for lifting eyes, one in each corner of the roof. The threaded holes are protected by a protection plug when the lifting eyes are not installed. A ground plane for radio antenna is provided by means of a copper mesh, embedded the front car roof.



*Fig 37. Car bodies*

## ENGINE BONNET

The engine bonnet consists of three parts, one upper part and two lower parts. All three parts of the engine bonnet can be removed. The upper bonnet has a net pocket for the map. On the lower bonnet there is an air channel to the air cleaner.



*Fig 38. Engine compartment, bonnet removed*

## DOORS

The four doors of the front car and the side door of the rear car are provided with external handles, which may be locked from the inside with the exception of the drivers door, which is padlocked on the outside.

The side door of the rear car is fitted with a safety chain located on the inside, which should be engaged when transporting personnel.

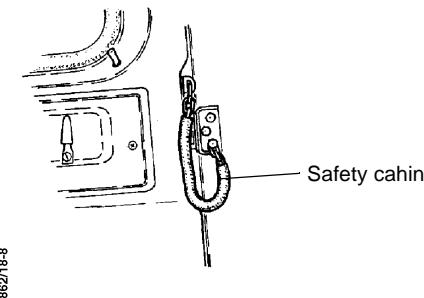
The rear door of the rear car can be opened from inside and outside, and is padlocked on the outside. The front car doors are fitted with net stowages.

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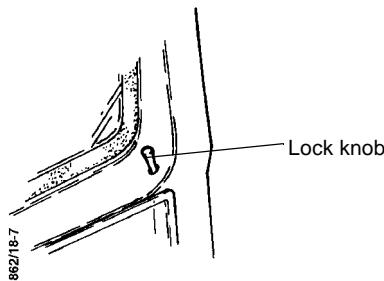
### —WARNING!

The safety chain has to be engaged during transportation of troops.

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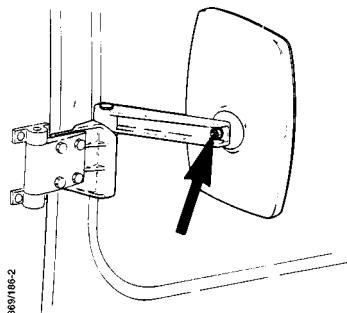
*Fig 39. Door with safety chain*



*Fig 40. Door lock, right hand rear door*

## REAR VIEW MIRRORS

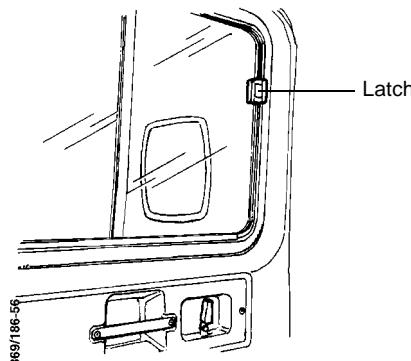
The rear view mirrors are adjustable and can be retracted. When adjusting the mirrors, loosen the nuts on the back of the mirrors, adjust the mirrors and tighten the nuts.



*Fig 41. Rear view mirror*

## WINDOWS

The side windows are manufactured from hardened safety glass. The front front car are a half split design and can be opened by sliding. To open these windows, press the catch and slide the window backwards. The windscreen is made from laminated glass.



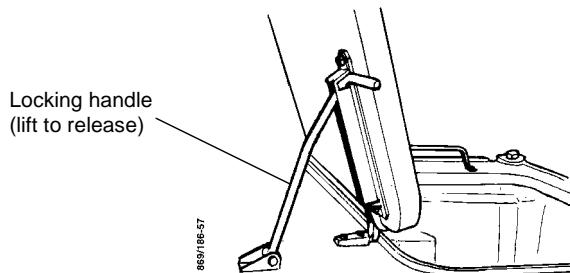
*Fig 42. Window hatch*

## WINDOWS (OP)

The side windows of the front and rear can be half split designed, manufactured from hardened safety glass and can be opened by sliding. To open these windows press the latch and slide the window backwards.

## ROOF HATCHES

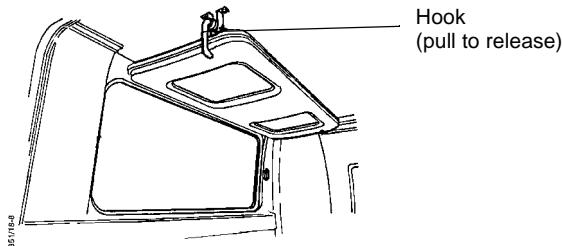
The front car has two roof hatches, which can be opened and closed using the handles and wire operated locks from the inside. The hatches can also be locked in both the open and the closed position from the outside by means of the locking handle.



*Fig 43. Roof hatch*

## REAR CAR SIDE HATCH

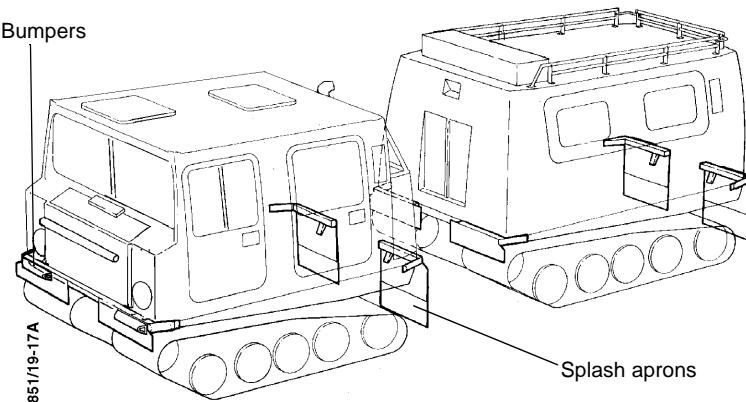
A hatch on the left hand side of the rear car is hinged in the upper edge and opens inward and upward. It is held open by hooks in the roof of the car and can only be opened from the inside of the car.



*Fig 44. Side hatch*

## BUMPERS

Bumpers are mounted on the front and rear end of both cars. Splash aprons are mounted on the bumpers. The front bumper of the front car and the rear bumper of the rear car are fitted with resilient mounts for protection. The splash aprons acts like a water guide during swimming and shall therefore always be mounted on the vehicle.



*Fig 45. Bumpers and splash aprons*

## BRANCH FENDER (OP)

A branch fender is mounted on the front end of the vehicle and is designed to protect the windscreens, headlights and the body from being damaged when driving through high undergrowth. The middle part of the branch fender must be removed when the lifting jack is to be attached to the front end of the vehicle.

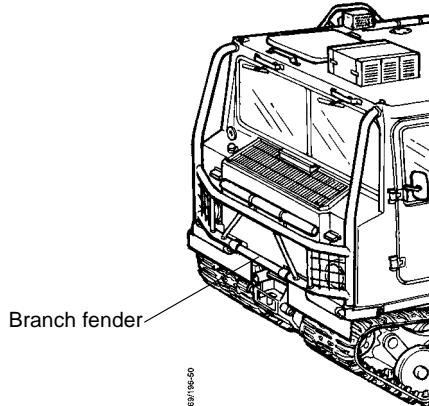


Fig 46. Branch fender

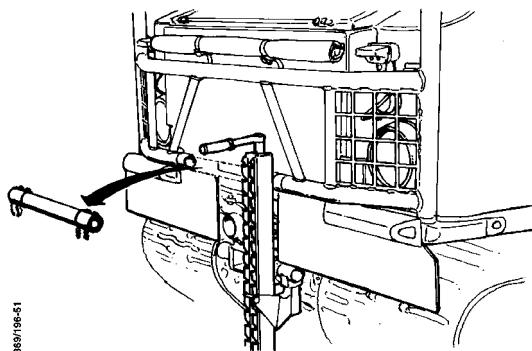


Fig 47. Lifting jack attachment

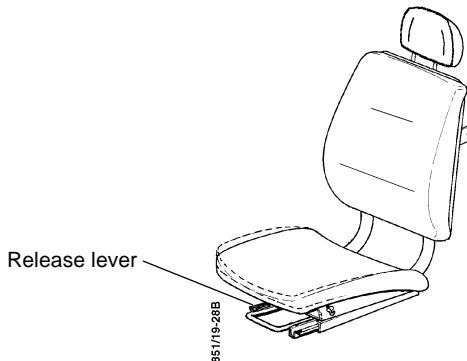
# SEATS

## Front car

### DRIVERS SEAT

The drivers seat consists of a seat, backrest cushion and sliding rails. On the top of the back cushion, a head rest is mounted.

The seat is adjustable in seventeen different positions in a forward/ backward direction, approximately 135 mm. The adjusting lever, located under the seat, is lifted to move the position of the seat. The angle of the seat is adjustable in three positions. This adjustment is made by lifting the front edge of the seat and simultaneously sliding the seat in a forward or backward direction.



*Fig 48. Drivers seat adjustments*

## OTHER SEATS

The co driver seat is of the same design as the drivers seat except that it is not adjustable. All other seats fitted in the front car are fixed seats and are provided with back cushions

### Rear car

The pine wood seats and back rests are provided with soft cushions.

### Rear car (OP)

The pine wood seats and back rests are provided without soft cushions.

#### **CAUTION!**

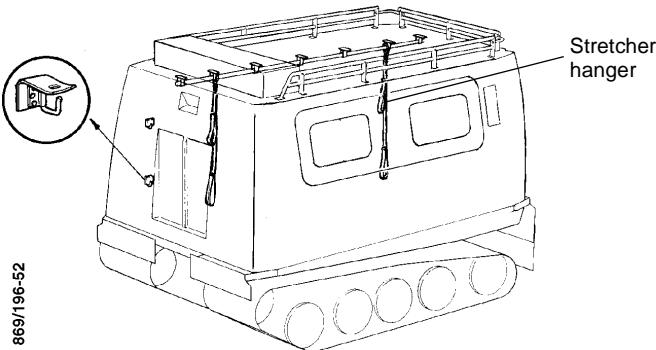
The benches in the rear car is part of the load securing equipment and has to be properly installed when cargo is placed and secured in the rear car.

## DRAIN PLUGS

The vehicle has two drain plugs, one in the front car and one in the rear car. The plugs has to be installed when vehicle is in operation and removed and stored at the drivers station when parked over night this is to prevent from rain water collecting.

## STRETCHER ACCOMMODATION

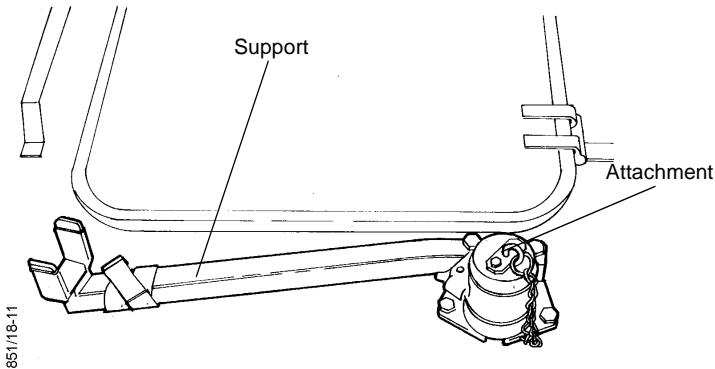
Hangers for four stretchers, two on each side, are provided in the rear car for transportation of four casualties stretchers. The stretchers shall be secured with straps when installed.



*Fig 49. Hooks and stretcher hangers*

## ATTACHMENT KSP58 (OP)

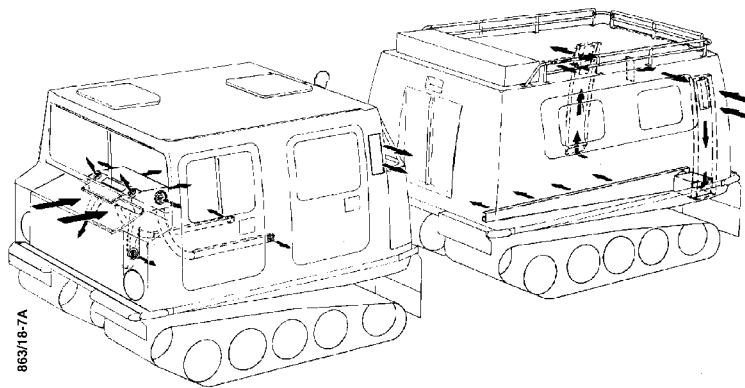
The attachment for the KSP58 is located on the roof of the front car.



*Fig 50. Attachment KSP 58*

## 3.8 Heater and ventilation

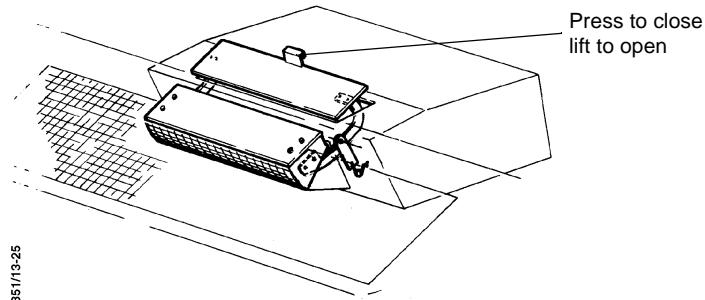
The ventilation system of the vehicle comprises of one air heater fan and one ventilation fan



*Fig 51. Air circulation*

## FRONT CAR

The front car is fitted with a ventilation fan and is incorporated into the front car heater, which is mounted to the right of the driver.



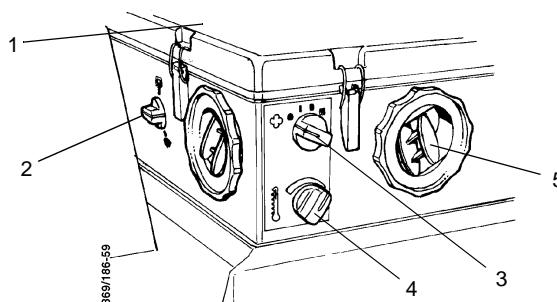
*Fig 52. Air intake flaps*

## Air heater fan

Air is drawn in by the fan and heated by the engine coolant in the heat exchanger. The air intake is located at the front above the engine air intake. The fan is operated by a switch on the heater and the temperature of the air is controlled by means of knobs on the heater. The heated air is then distributed throughout the front car by outlets in the cabin, windscreens and to the floor of the cabin.

## Heater controls

The airflow to the windscreens and the floor area are controlled with knobs on the heater. In addition to these controls, air is let vented at the floor level in the rear of the front car and to the cabin space through adjustable air outlets on the heater. A flap mounted over the air intake is coupled to a flap on the heater. When the flap over the air intake is closed, the flap on the heater is open. The heater will then recirculate the air in the interior of the cabin providing a faster warm-up of the car. The air heater can also be used as a ventilation fan providing fresh outside air.



*Fig 53. Heater controls*

### 1. AIR OUTLET, WINDSCREENS

The air flow for the windscreens are fixed in direction.

### 2. HEATING AIR VALVE CONTROL KNOB

The control knob has two positions according to marking: the entire air flow is directed down towards the floor space, or the entire air flow is directed up to the windscreens for defrosting.

### 3. FAN SWITCH

The fan switch has four operating positions: "0", "I", "II" and "III"

In the "0" position the fan is off. In the "I", "II" and "III" positions the speed of the fan is progressively increased to achieve full speed at position "III"

### 4. AIR TEMPERATURE CONTROL KNOB

This adjusts the temperature of the air coming in to the cabin and is adjustable from maximum (hot) to minimum (cold).

### 5. AIR OUTLET

The air flow can be directed by turning the nozzle and adjusting the air guides angle.

## Ventilation controls (OP)

The front car ventilation fan is mounted in the middle of the roof and has inside a protective cover. The fan blows air into the cabin which is distributed through air ducts to six adjustable air outlets, located in the ceiling. The fan speed is regulated by a switch, which has three positions, "0", "1" and "2".

In the "0" position the fan is off and in the "1" and "2" positions the speed of the fan is adjustable, so that in the "2" position the fan is at full speed.

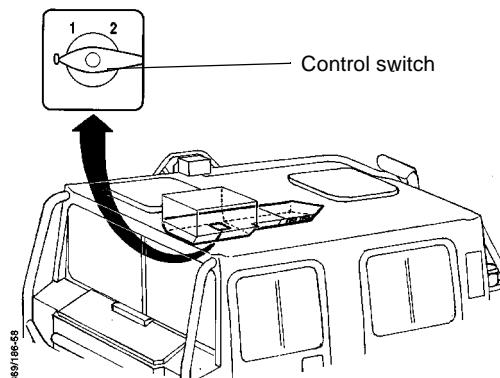
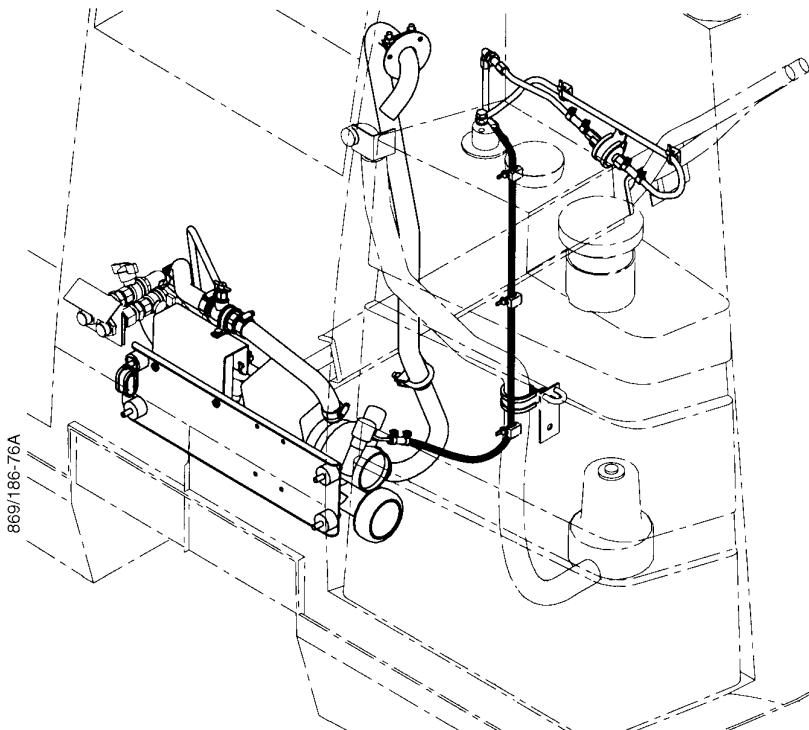


Fig 54. Front car roof ventilation fan

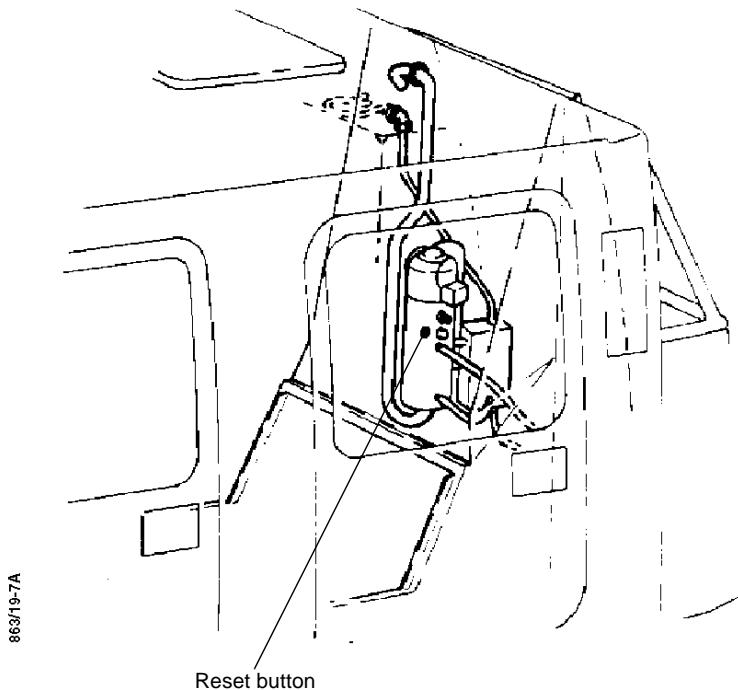
## EXTRA COOLANT HEATERS (OP)

A fuel heater is connected to the cooling system, and is used to heat the coolant when the vehicle engine is not operating. The engine coolant passes through the fuel fired heater at all times, even when the heater is not operating. Heated coolant leaving the fuel fired heater flows through the same lines and heat exchangers as the engine-heated coolant. It is therefore controlled in the same way, using the heater temperature control.

**CAUTION!** Do not use the diesel fuelled coolant heater when the vehicles engine is running.



*Fig 55. Diesel fueled coolant heater, Eberspächer*



*Fig 56. Diesel coolant heater, Volvo*

The heater is mounted in the front car rear air duct and a diesel supply hose is directly connected to the right-hand fuel tank.

The heater is operated from the front car instrument panel.

**CAUTION!**

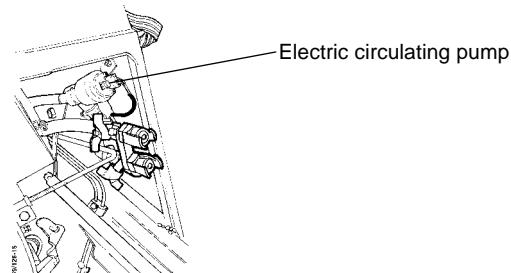
If the Volvo heater overheats during operation a thermostat switches off the combustion. To reset the thermostat depress the reset button when cold.

When heating is stopped the heater fan will continue to run for approx 100 sec to evacuate any combustion gases.

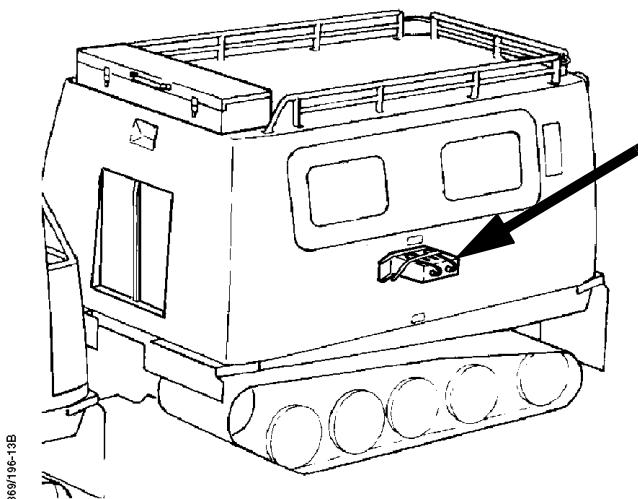
## ENGINE PREHEATER, UWE (OP)

The external UWE heater and blowtorch are to be fastened on the left front bumper of the front car. The heater hoses are to be connected to couplings inside the engine hood, lower back part. The engine and heater couplings are fitted with valves.

An electric circulation pump is mounted at the couplings inside the engine hood, lower back part. The pump is operated with a switch on the instrument panel. With the external engine heater in circuit, the circulation pump must be operating as the coolant will otherwise boil in the connecting hoses. The UWE heater with hoses is placed against the right side wall in the rear car when it is not been used.



*Fig 57. External engine heater connections*



*Fig 58. UWE heater connections*

## ELECTRIC BLOCK COOLANT HEATER (OP)

The block heater is used at low ambient temperatures for heating or maintaining engine temperatures at "ready to start" conditions.

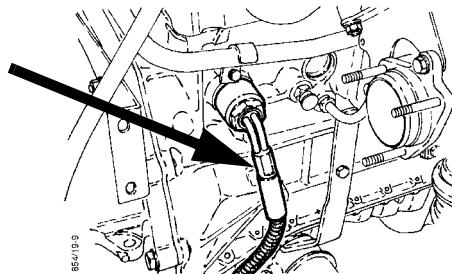
The block heater utilizes preheating of engine / coolant fluid up to a temperature of + 30 ° C.

The coil is inserted into the water jacket RH side and has the power of 500W.

Heating is applied for two hours for starting at -30 ° C to - 46 ° C.

- Following possibilities can be valid :

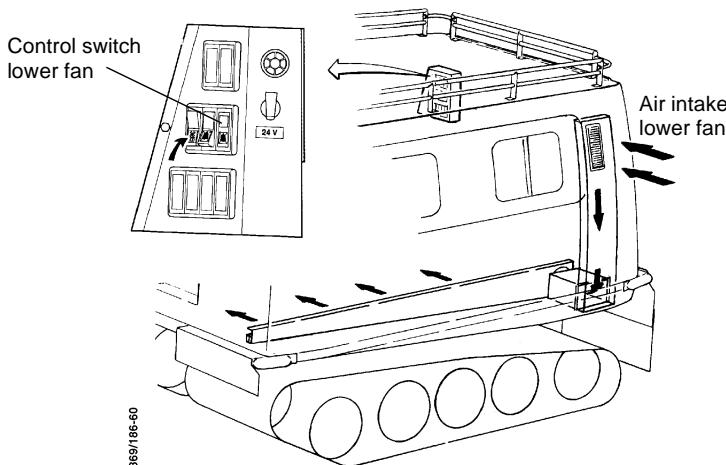
Block heater 220V with or without electrical outlet to the coupe' or a block heater 110V.



*Fig 59. Block heater*

## REAR CAR

The rear car cabin has a ventilation fan located below the left hand side bench. The air intake for the lower ventilation fan is located at the rear left hand side of the car. This fan is operated by means of the fan switch located on the control panel in the rear right hand side of the car and provides air through a distribution duct at floor level on the left hand side of the car.



*Fig 60. Rear car lower ventilation fan*

## Ventilation controls (OP)

The air intake for the upper ventilation fan is located at the front of the roof behind the equipment box No. 2. The upper ventilation fan is located on the roof and has inside a protective cover. The fan blows air into the cabin which is distributed through an air duct, to six adjustable air outlets, located in the ceiling. The fan speed is regulated by a switch, which has three positions, "0", "1" and "2".

In the "0" position the fan is off and in the "1" and "2" positions the speed of the fan is adjustable, so that in the "2" position the fan is at full speed. To prevent overpressure the rear car is provided with an air outlet.

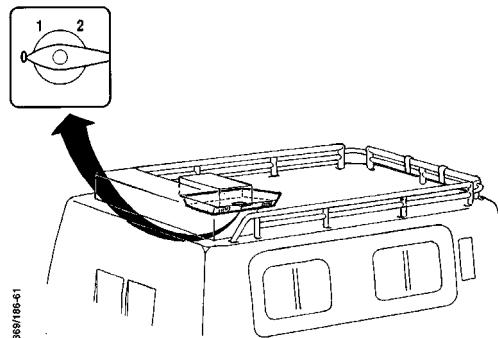


Fig 61. Rear car roof ventilation

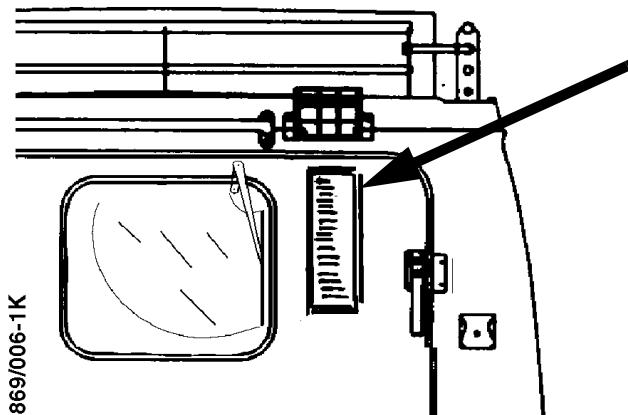


Fig 62. Air outlet

## 3.9 Standard equipment

### SEAT BELTS

The vehicle is fitted with self adjusting lap and shoulder belts for the drivers -, co- drivers seat and for the two front seats with the backs to the front, all other seats have simple lap belts.

---

**WARNING!**

Any device used to induce slack into the shoulder belt portion of the three point belt system will have a detrimental effect on the amount of protection available to you in the event of a collision.

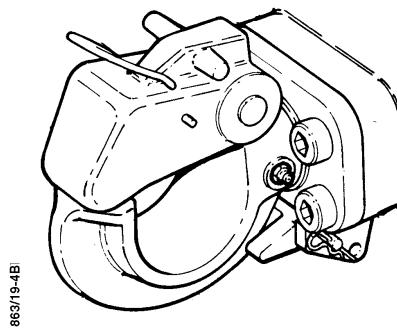
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**NOTE!**

Seat belts should always be worn, when operating the vehicle except when the vehicle is fording and swimming.

### TRAILER COUPLING

A trailer coupling is provided at the rear end of the rear car for towing a trailer. A retractable foot step is provided above the trailer coupling.



*Fig 63. Trailer coupling FV987958 without adapter*

## TRAILER COUPLING (OP)

A trailer coupling is provided at the rear end of the rear car for towing a trailer. A retractable foot step is provided above the trailer coupling.

212A

K1D

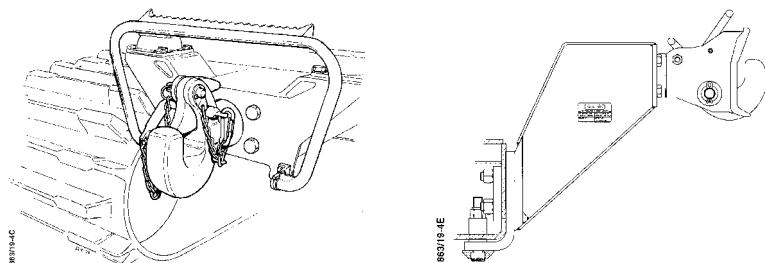


Fig 64. Trailer coupling

## TOWING ADAPTER

The front car is fitted with a towing adapter at the front end for attaching a towing rope or an "A" frame to permit towing of the vehicle.

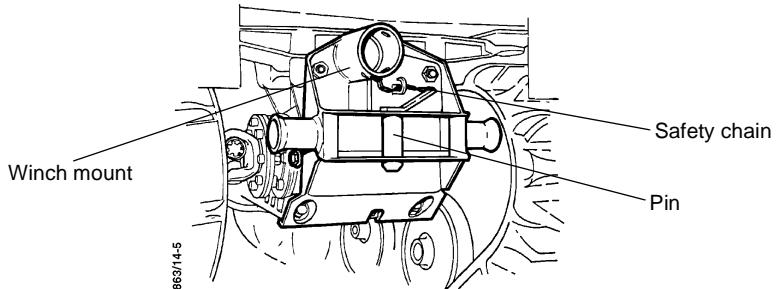


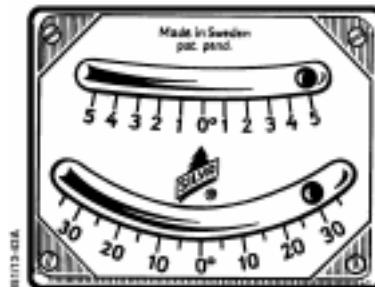
Fig 65. Towing adapter

## WINCH MOUNT

A mounting for a winch is provided on the towing adapter.

## INCLINOMETER

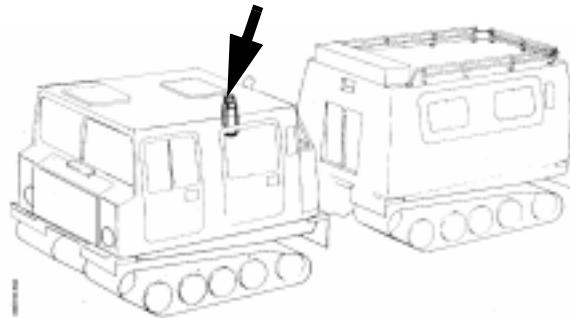
The carrier is equipped with an inclinometer to show the inclination of the carrier when driving in side slopes. The inclinometer is mounted at the ceiling in the front car.



*Fig 66. Inclinometer*

## FIRE EXTINGUISHER

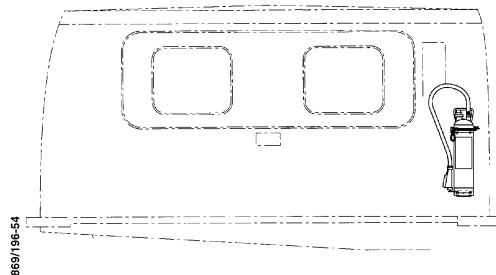
The vehicle is equipped with one fire extinguisher, 3 kg , placed against the rear wall in the front car.



*Fig 67. Fire extinguisher*

## FIRE EXTINGUISHER (OP)

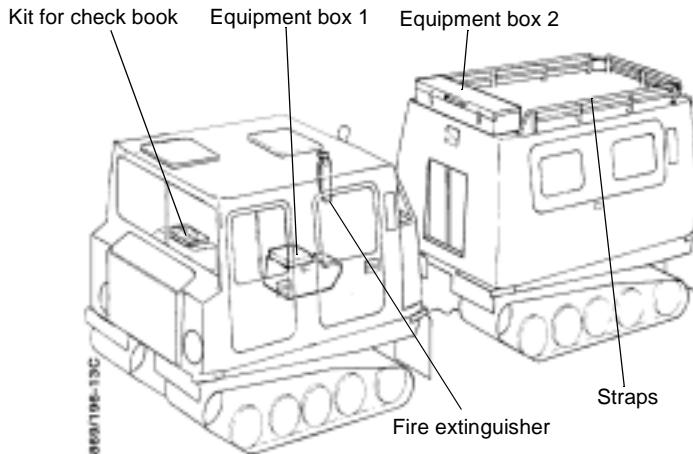
The fire extinguisher , 5 kg, is placed against the right side wall in the rear car.



*Fig 68. Fire extinguisher, rear car*

## 3.10 Accessories

The accessories for the vehicle are stored in the equipment cases, bags and holders.



*Fig 69. Location of accessories*

### **NOTE!**

Without the rear car the equipment box 2 will be located on the front car roof. With PTO the equipment box 1 will be located below the left front seat of the front car.

## No. 1. Equipment Box

1. Rope	1	9. Can hose	1
2. Oilcan	1	10. Steel wire	0.5 kg
3. Strap for stretcher	4	11. inspection lamp	
4. Warning triangle	2	12. Blackout lamp	2(OP)
5. Padlock, with keys	1	13. Light plate	6(OP)
6. Lamp box, Lamps and fuses	1+lamps	14. Blow torch	1(OP)
7. Tool kit	1+contents	15. Oil pump	1
8. Grease gun	1		

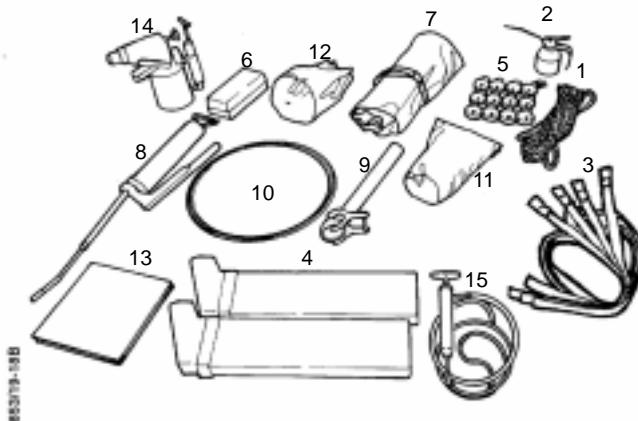


Fig 70. Contents of No. 1 Equipment box

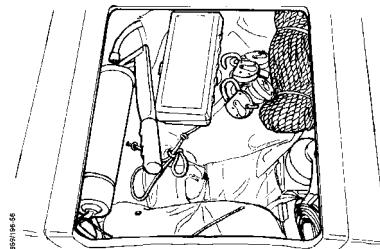


Fig 71. Location of accessories in No. 1 Equipment box

- |                                       |                                   |
|---------------------------------------|-----------------------------------|
| 1. Bag tool                           | 15. Box spanner 13 mm             |
| 2. Feeler                             | 16. Universal pliers              |
| 3. Cotter pin                         | 17. Screwdriver L=100 mm          |
| 4. Sleeve 17 mm                       | 18. Wrench                        |
| 5. Sleeve 19 mm                       | 19. Socket wrench 10 - 11 mm      |
| 6. Sleeve 24 mm                       | 20. Box spanner 17 mm             |
| 7. Sleeve 18 mm                       | 21. Box spanner 16 mm             |
| 8. Sleeve 16 mm                       | 22. Pliers                        |
| 9. Socket wrench $\frac{1}{2}$ " 8 mm | 23. Socket wrench                 |
| 10. Screw driver 3.0 x 75 mm          | 24. Extension rod $\frac{1}{2}$ " |
| 11. Allen wrench 8 mm                 | 25. Screwdriver 8 x 150           |
| 12. Allen wrench 10 mm                | 26. Peen hammer                   |
| 13. Ratchet wrench                    | 27. Handle $\frac{1}{2}$ "        |
| 14. Box spanner $\frac{1}{2}$ "       | 28. Ring spanner 43.4 mm          |

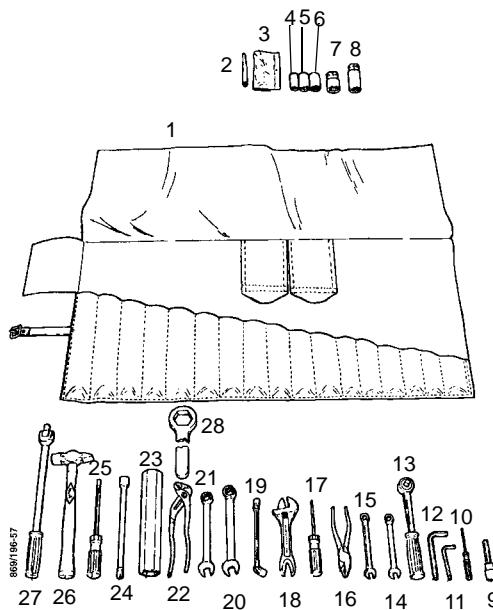


Fig 72. Tool kit

## No. 2. Equipment Box

1. Plate jack	1	7. Axe	1
2. Spade, digging	1	8. Towing line	1
3. Ironbar, with eye	1	9. Spade, snow	1
4. Jack assy	1	10. Steering locking device	2
5. Adapter, jack	1		
6. Lifting eyes	8		

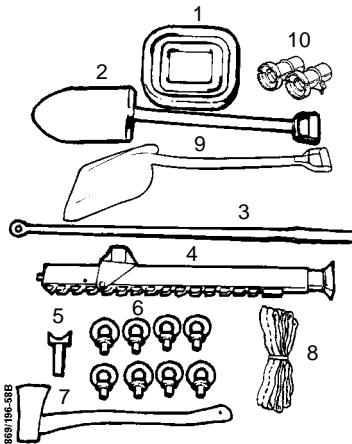


Fig 73. Contents of No. 2 Equipment box

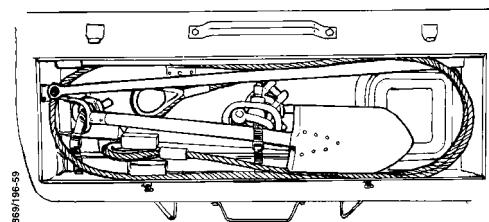


Fig 74. Location of accessories in No. 2 Equipment box

## EXTRA HYDRAULIC SYSTEM, PTO (POWER TAKE OFF ) (OP)

The hydraulic system where winch and crane are examples of connectable applications comprises a double hydraulic pump, a relief valve, a high pressure oil filter, a valve block unit and an oil tank. The applications are connected to the hydraulic system through quick couplings placed under the front grill or at the rear front car. The system has an oil volume of 50 l.

The front part of the hydraulic pump supplies the hydraulic steering system and the rear part supplies the extra hydraulic system with oil.

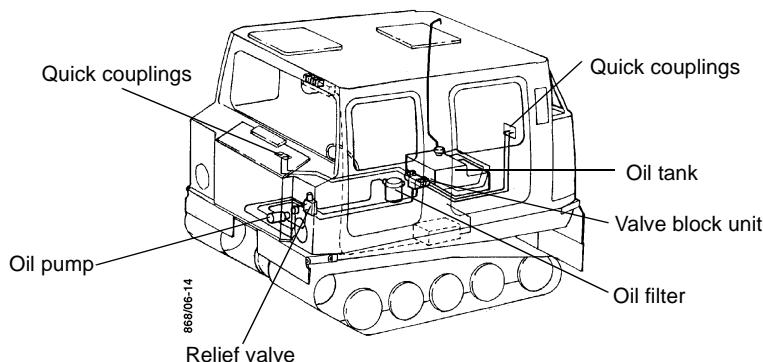
The relief valve is placed on the front left hand side of the engine compartment. It is set on 150 bar. The valve closes when the hydraulic system is being switched on and opens if the pressure in the system exceeds 150 bar.

When the hydraulic system is switched off the valve opens and the oil is being pumped around in the system.

The high pressure oil filter is placed to the right of the gearbox.

The valve block unit is located above the gearbox in the rear part of the engine compartment.

The oil tank is placed at the rear of the front car on the right hand side. The tank is ventilated through a hose in the rear wall. There is a filter in the end of hose.



*Fig 75. Hydraulic PTO*

## ELECTRIC WINCH (OP)

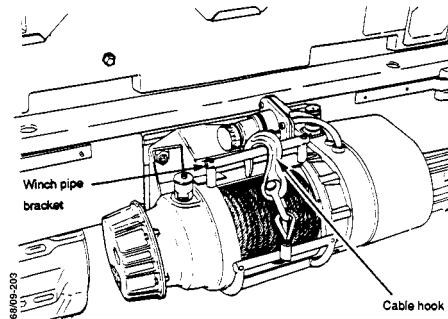
The winch is electrically powered from the carrier battery, 24V. The electric power is supplied to the winch motor by a twin cable. From the winch motor the power is transmitted to the rope from shaft through planetary gearings in series.

The rope drum can be disengaged, so that the wire rope can easily and rapidly be pulled out. The winch is equipped with an overload protection to prevent winching a load more than 2,5 tons.

To avoid overloading, always use a single pulley block. The winch is equipped with a thermal cut out with automatic re set. This means that the electric motor will stop when overheating and resets automatically after cooling. The cooling time varies between 5-30 minutes depending on how warm the winch is and the outside temperature.

An automatically load reaction brake is equipped to the shaft of the electrical motor. This brake starts to work as soon as the load attempts to unwind the winch.

The winch is reversible and is operated by a 5 meters control cable. When toggle switch is neutral position, the winch is automatically braked.



*Fig 76. Electric winch*

## HYDRAULIC WINCH (OP)

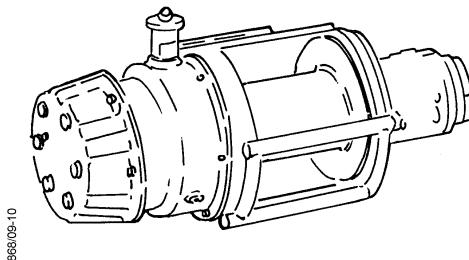
The winch is driven from the vehicle hydraulic system. The hydraulic power is transmitted to the winch motor through hydraulic tubes and hoses. From the hydraulic motor the power is transmitted to the rope drum through planetary gearings in series. The winch is reversible.

The rope drum can be disengaged, so that the wire rope can easily and rapidly be pulled out.

the automatic load reaction brake, which is built in the gear housing, comes into action as soon as a load attempts to unwind the winch. The brake is oil cooled and made of non asbestos brake material.

**CAUTION!** Reaction brake do not work if winch cable is wound on drum from the wrong direction. The cable must be under wound, see service instruction

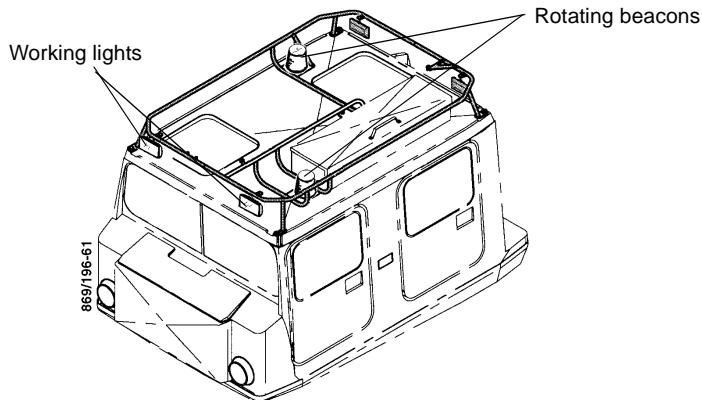
The winch is connected to the hydraulic system of the vehicle. The winch is electrically operated by means of valve block unit placed above the automatic gearbox and a control panel in the front car.



*Fig 77. Hydraulic Winch*

## ROOF RACK (OP)

The front car can be provide with a roof rack with or without working lights, and rotating beacons. The working lights and the rotating beacons operates by pressing the upper part of the switch on the instrument panel .

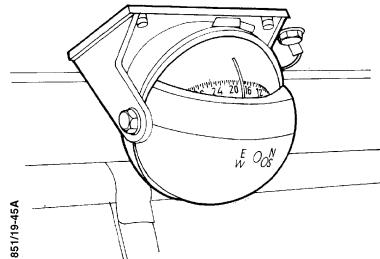


*Fig 78. Roof rack front car*

## COMPASS (OP)

The compass is mounted on the ceiling of the front car.

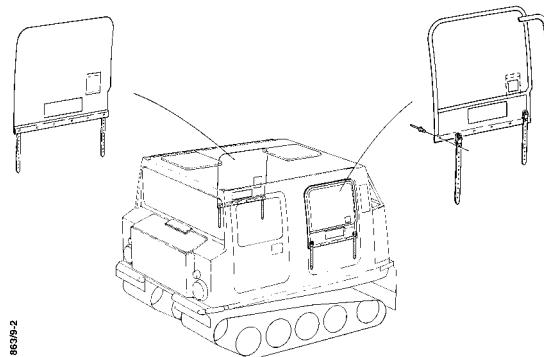
The compass has a scale illumination and provided with a compensator to compensate magnetic disturbances eg. sun visor, windscreens wiper etc. The compass shows the direction in lines. To compensate adjust with the screws N-S and E-W.



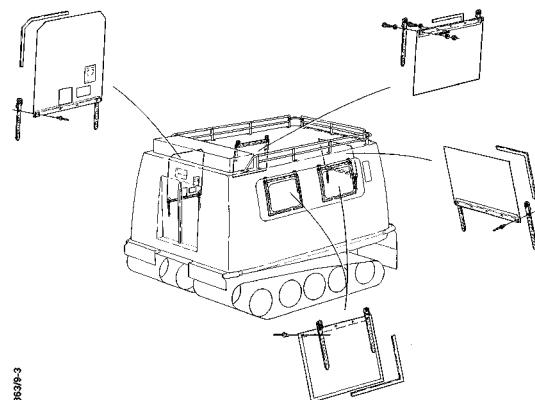
*Fig 79. Compass*

## BLACK OUT CURTAINS (OP)

To black out the front car and the rear car black out curtains is mounted with Velcro tape. At the front car the rear unit can be black out and at the rear car all the windows can be black out. When the rear door is provided with an air grating, it can also be black out. The curtains can be unrolled and mounted with belts at the lower edge / upper edge.



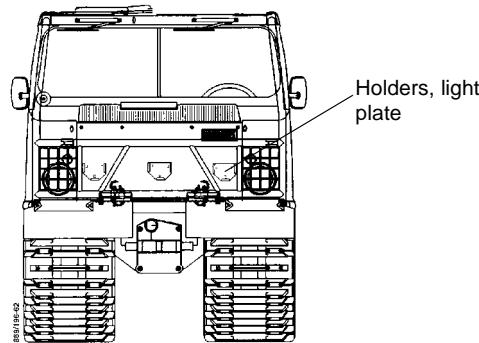
*Fig 80. Black out curtains, front car*



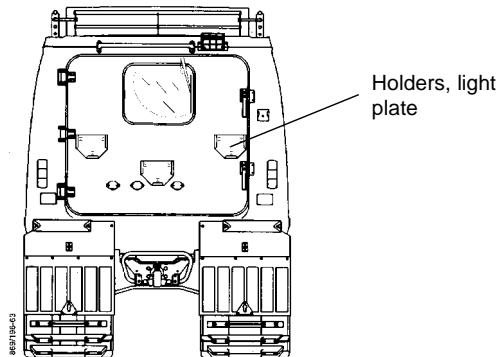
*Fig 81. Black out curtains, rear car*

## HOLDER FOR LIGHT PLATE (OP)

During military practice and war, sign plates are used for force identification and sign during black out night driving. There are six plates mounted on holders, three on the front car and three on the rear car.



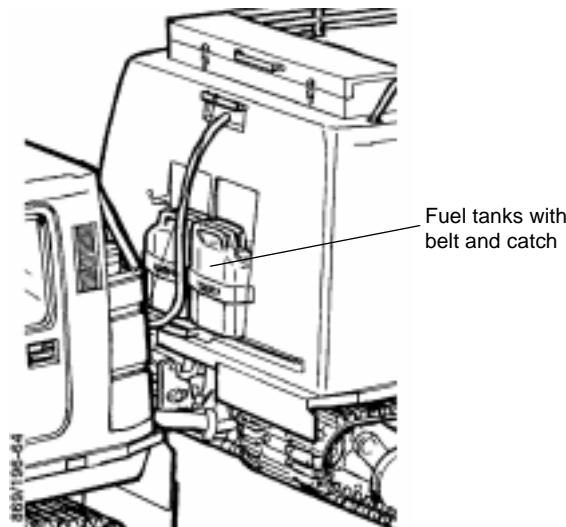
*Fig 82. Holders for light plate, front car*



*Fig 83. Holders for light plate, rear car*

## EXTRA FUEL TANKS (OP)

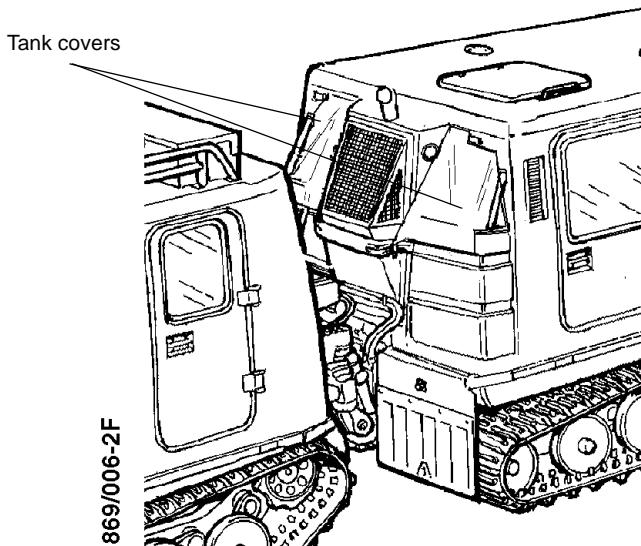
Extra fuel tanks, 20 litres, are installed at the front of the rear car.



*Fig 84. Extra fuel tanks*

## TANK COVER (OP)

Tank covers are mounted with rubber straps over the top of the fuel tanks to protect from snow, dirt, mud etc



*Fig 85. Tank covers*

# 4 OPERATION

## 4.1 System operation

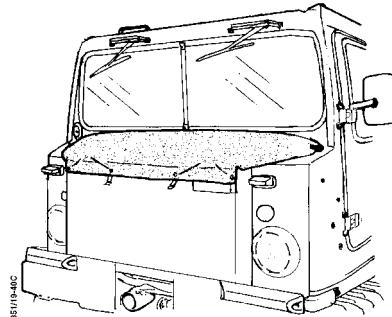
### INTAKE AND EXHAUST COVERS

#### Operating instructions

The cloth covers for the intake and exhaust are mounted on the body and installed over the front and rear air duct when the vehicle is to be parked. The front cover is also used when the vehicle is swimming. See swimming instructions.

##### **CAUTION!**

Operation of the vehicle is not allowed with the front inlet and/or rear outlet covered.



*Fig 1. Front intake cover attached*



*Fig 2. Rear outlet cover attached*

## ENGINE

### Starting and stopping the engine

The starting procedure is dependant upon the ambient air, and the engine temperature.

### Before starting

Perform the “Pre mission check” procedure.

Reference page 5-3.

### Engine cold

1. Ensure that the parking brake is engaged and that the gear selector is in the “N” position (neutral).
2. Turn the ignition switch to the “1” position and ensure that the warning lights for oil pressure, parking brake and charging illuminate.
3. Depress the accelerator pedal half way down.
4. Turn the ignition switch to the “PREGLOW” position. Keep it there for approximately 15 seconds.
5. Turn the ignition switch to “START” position and release the ignition switch when the engine has started. Allow the accelerator pedal to return to its normal position.

#### **CAUTION!**

Do not hold the ignition switch in the “START” position for more than 30 seconds as damage to starter motor may occur. If the engine does not start, wait for 90 seconds before attempting a new start procedure.

6. When the engine has started, ensure that the oil pressure and the charging warning lights goes off.

#### **NOTE!**

Never run the engine at high speed, when it is cold.

## Engine warm

1. Ensure that the parking brake is engaged and that the gear selector is in the “N” position (neutral).
2. Turn the ignition switch to the “1” position and ensure that the warning lights for oil pressure, parking brake and charging illuminate.
3. Depress the accelerator pedal half way down.
4. Turn the ignition switch to the “START” position and release the switch when the engine has started.

### **CAUTION!**

Do not hold the ignition switch in the “START” position for more than 30 seconds as damage to starter motor may occur. If the engine does not start, wait for 90 seconds before attempting a new start procedure.

5. When the engine has started, ensure that the oil pressure and the charging warning lights extinguish.

## Stopping the engine

Allow the engine to idle for at least three minutes before attempting to stop the engine. To stop the engine turn the ignition switch to the “STOP” position.

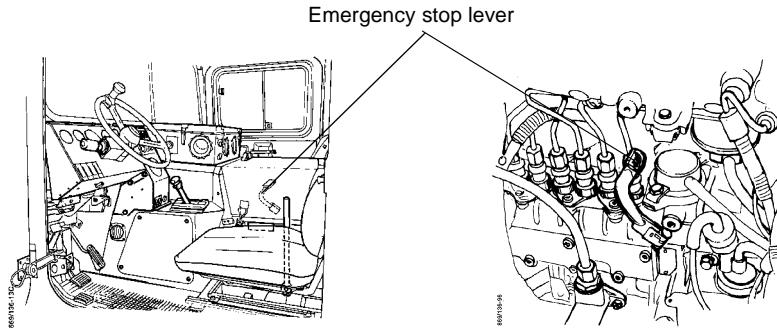
### **CAUTION!**

Failure to follow this procedure may result in damage to the engine.

## Emergency engine shutdown

Should the engine fail to stop, the following procedure may be followed.

1. Open the upper engine bonnet.
2. Locate and press the manual “STOP” lever on the fuel control linkage, located on the upper left hand side of the injection pump.



*Fig 3. Emergency stop lever*

## STARTING THE ENGINE WITH ENGINE PRE HEATER, UWE (OP)

1. Connect the engine heater UWE. The upper hose of the heater is connected to the upper union in the car and the lower hose is connected to the lower union in the car. See fig 4.

### **NOTE!**

Ensure that the heater is filled with coolant.

### **NOTE!**

Though the heater is placed into the rear car this would be performed the evening before usage.

2. Open the four cocks , two on the hoses and two in the front car. The cocks in the car will be opened when the cock handle is pulled in a up motion and turned 1/4 rotation C.C.W.
3. Place the heater on the fastener located at the left front bumpers corner.
4. Start the blow torch.
5. Turn the ignition switch to the “1” position and ensure that the warning lights for oil pressure, parking brake and charging illuminate. Start there-circulating pump by the switch on the instrument panel. Ensure that the pump is working.
6. Open the air venting cock on the heater to check that the water flow is free from air bells.
7. Start up the heating by heating the outside of the heater. Then insert the blow torch step by step into the heater.
8. Depress the accelerator pedal half way down. Turn the ignition switch to the “pre glow” position. Keep it there for approximately 15 seconds. Turn the ignition switch to the “start position” and release the ignition switch when the engine has started. If the engine does not start, go back to point 6 and proceed a new start procedure.

### **NOTE!**

When the engine has started, ensure that the oil pressure and the charging warning lamps extinguish.

9. Let up the accelerator pedal and let the engine rotate 1300 rpm until the engine behave normal.

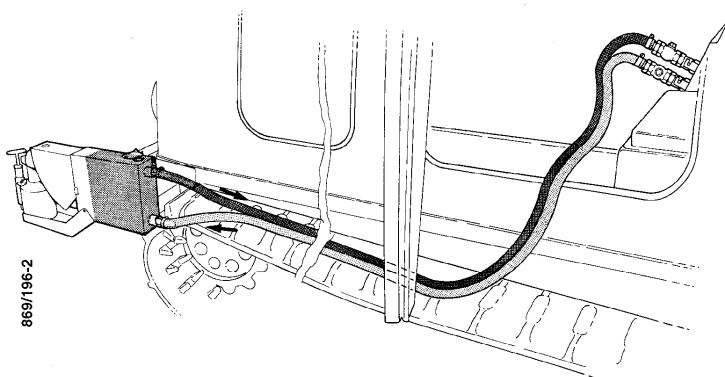
**NOTE!**

If the start failure because of less capacity of the battery, connect the start cables to a car with help start union.

10. Close the four cocks of the heater. The cocks in the car will be closed when the cock handle is pulled in a up motion and turned 1/4 rotations C.W.
11. Turn off the recirculating pump by the switch on the instrument panel.

**CAUTION!**

Never turn off the recirculating pump until the blow torch has been removed.



*Fig 4. Heater connected*

## BLOWTORCH (OP)

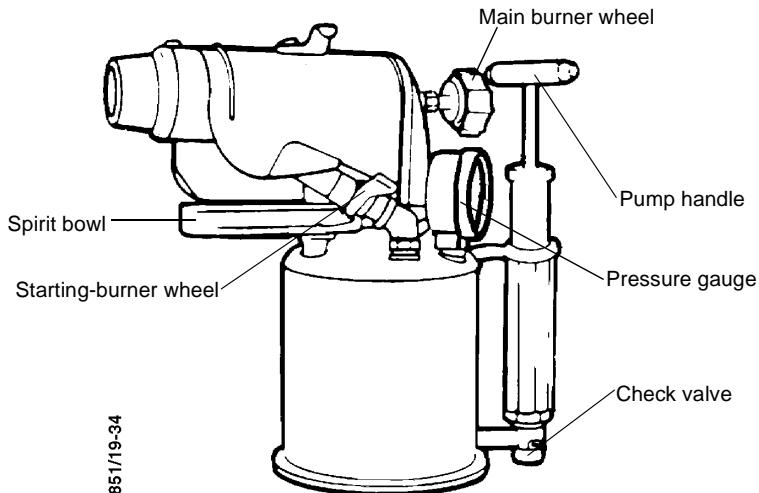


Fig 5. Blowtorch

### Preheating, preparations for igniting blowtorch

The blowtorch is provided with a starting burner and a spirit bowl. In normal cases the starting burner is used, the spirit bowl is used for extra preheating. Both may be used simultaneously.

1. Make sure that the main burner and starting burner knobs are both closed.
2. Pump up a pressure of approx 100 kPa (1.0 bar) in the reservoir.
3. Place the blowtorch on a piece of heat-insulating material, with the main burner down wind or sheltered by the heater hood.
4. Hold a lighted match or a piece of steel wire with a burning wick in front of the starting burner, adjust the starting burner knob to make the flame burn steadily.
5. Check the flame of the starting burner.
6. Pump during warm-up, if necessary.

#### NOTE!

Excessive pressure in the reservoir will blow out the starting burner flame.

## Extra preheating

At low temperatures, using both the starting burner and the spirit bowl for pre-heating is recommended.

Fill the spirit bowl with methanol or ethanol (e.g. carburetter spirit), and light it. Use a safety can for pouring the spirit.

## Igniting the blowtorch

---

**WARNING!**

---

The blowtorch must not be lit from another blowtorch - high temperature damages the burner.

---

---

**WARNING!**

---

If the blowtorch is not properly heated up, it can behave like a flame throw.

---

1. When the starting burner has been going for 5-10 minutes (or longer at very low temperature), and the spirit in the bowl has been all but consumed, open the main burner knob slowly to ignite the blowtorch. Let it burn for 1-2 minutes with a reduced flame, together with the starting burner. If necessary, pump up approx 100 kPa (1.0 bar) pressure. If the flame is spitting or flaring, close the main burner knob and continue preheating.
2. Close the starting burner knob.
3. Pump to approx. 100 kPa (1.0 bar), if required.
4. Open the main burner knob all the way.

**NOTE!**

The blowtorch may flare or blaze if

- the pressure is too high at low torch temperature
  - hard pumping causes the pressure to fluctuate
  - the torch is imprudently handled.
5. After a few minutes, pump up the lamp pressure to max 300 kPa (3.0 bar). When required, clean the main burner jet by closing the main burner knob, this will crush impurities that may have collected in the jet.

## Extinguishing the blowtorch

1. Close the main burner knob until next time of use.
2. Bleed the reservoir pressure by unscrewing the filler cap a few turns.
3. Retighten the cap after a few seconds.
4. When the torch has cooled, top up with fuel to avoid moisture condensation in the reservoir, as for carrier fuel tank filling practice.

## STARTING ENGINE BY COOLANT PREHEATING WITH DIESEL FUELLED HEATER (OP)

1. Start heater by the switch on front car instrument panel.
2. After preheating for 5 min check that front and rear heater valves are closed.
3. After 30 min of preheating depress accelerator pedal firmly. Turn ignition key to position PREGLOW for approx 15 seconds. Turn ignition key to position START. If the engine does not start within approx. 10 seconds, make a new starting attempt starting at item 3. When the engine has started release the accelerator pedal and let the engine run at approx 20 rps (1200 rpm) until it runs properly. Then release the accelerator pedal to idle position.

## STARTING THE ENGINE BY TOWING

### NOTE!

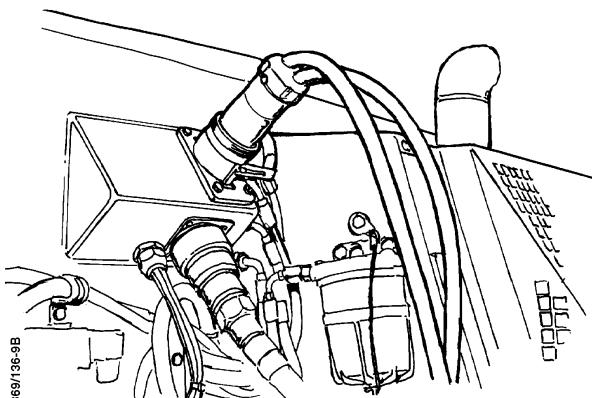
Only when the starter motor has been breaked down. Starting by towing can be done if the temperature is not below -10°C.

1. Connect the A-frame or tow rope to the front towing adapter.
2. Place the automatic transmission gear selector in "N" position and place the transfer gearbox lever in "H" position.
3. Depress the acceleratorpedal half way down.
4. Turn the ignition switch to the "preglow" position. Keep it there and release the parking brake.
5. Tow the vehicle in 15 km/h and let the gear lever be in "N" position for approximately 15 seconds, so the operating pressure in the gearbox can increase.

6. Place the gear lever in position "2". If the engine does not rotate, replace the gear lever in the "N" position and let the pressure in the automatic transmission be build up again.
7. Depress the accelerator pedal carefully when the engine rotate.

## **STARTING THE ENGINE BY USING AUXILIARY STARTING CABLE**

If the battery capacity is low, the auxiliary starting cables may be used to connect the vehicle to an external 24V power source. After connection of the cable, keep the power source vehicle idling on high idling during the start procedure.



*Fig 6. Auxiliary starting cable connected*

When separate 24V power source (two 12V batteries in series) is used, conventional starting cables with battery clamps may be used. When using these starting cables, connect the battery clamps in following order :

1,2,3,4.

Remove the clamps in the reverse order : 4,3,2,1.

### **NOTE!**

Never operate the vehicle without batteries. Damage to alternator occurs.

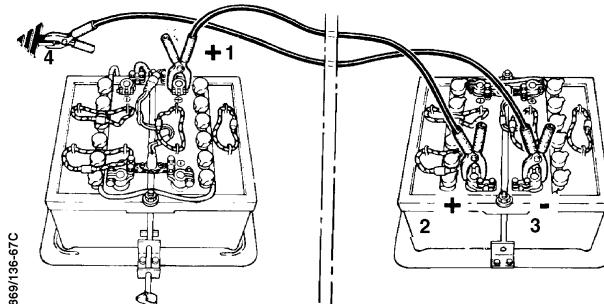


Fig 7. Auxiliary starting cable connections

## USING SEAT BELTS

### Lap and shoulder belts

Seat belts should always be worn, when operating the vehicle except when the vehicle is fording and swimming.

To fasten the seat belt, grip the belt locking tongue and pull the belt slowly across the body and lock the tongue into the seat belt lock. To release the belt, press the red release button on the lock and allow the recoil mechanism to retract the belt.

---

#### —WARNING!

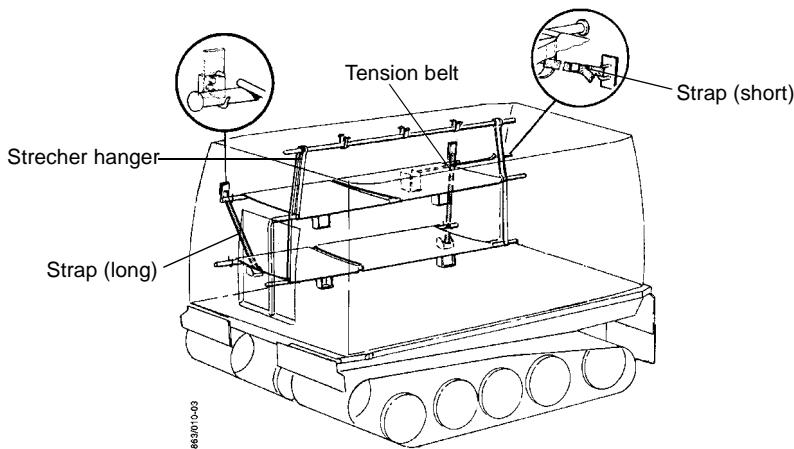
Any device used to induce slack into the shoulder belt portion of the three point belt system will have a detrimental effect on the amount of protection available to you in the event of a collision.

---

# STRETCHERS

## Installing stretchers

For transporting casualties, locate the stretchers onto the hangers provided in the rear car right hand side (a maximum of four stretchers can be installed two on each side). Secure the stretchers at their rear end with straps and within the equipment anchor points aswell as the top stretcher with the long straps vertical at front end rear hanger.



*Fig 8. Stretcher hangers*

# LOAD

## Cargo space

The cargo space of the vehicle is located inside of the front car, inside and on the roof of the rear car.

### CAUTION!

Load on the roof on the front car is not allowed.

When loading the vehicle, place the heavy and rugged cargo at the bottom of the carrier, easy accessible light cargo on top and on the rear carriers roof. On the rear carrier roof the maximum weight is 200 kg.

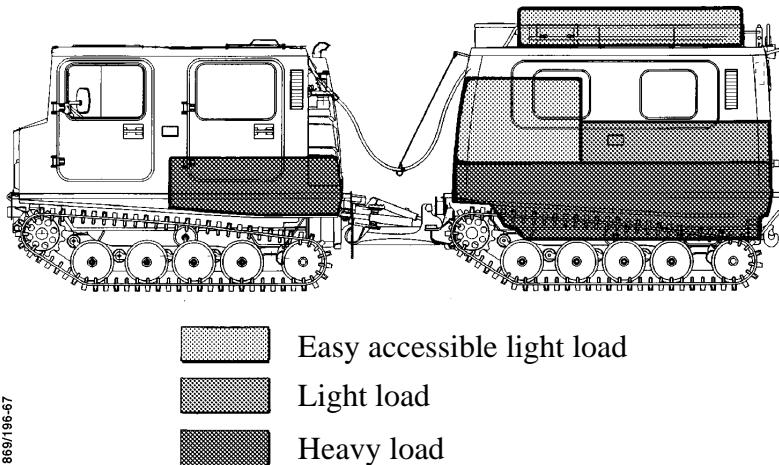
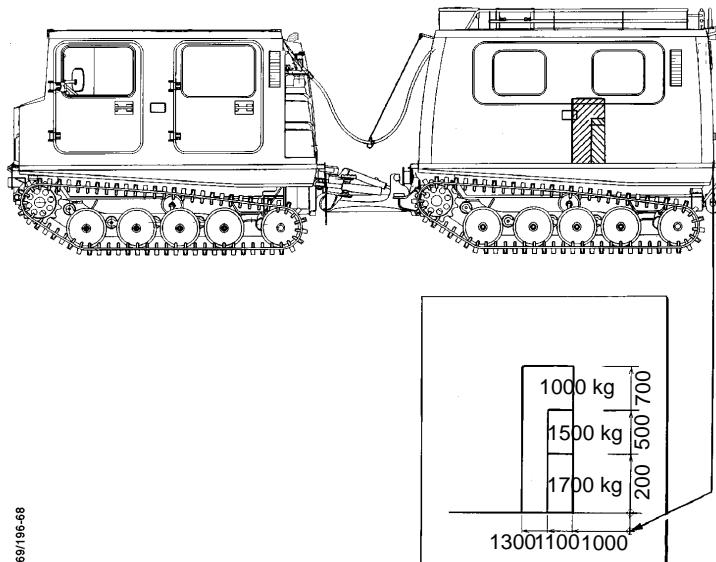


Fig 9. Recommended load distribution

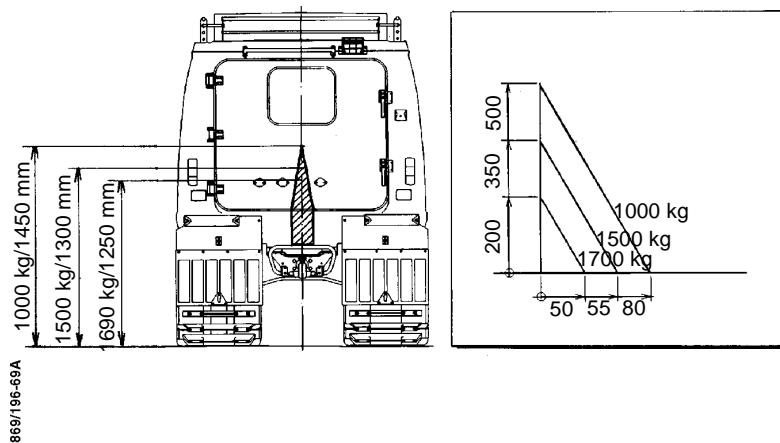
## Allowed centre of gravity location of load

### WARNING!

Limit curves are representing the static roll over angle 34° and optimum freeboard when swimming. Cargo must be properly secured and dynamic forces must be taken into consideration when driving.



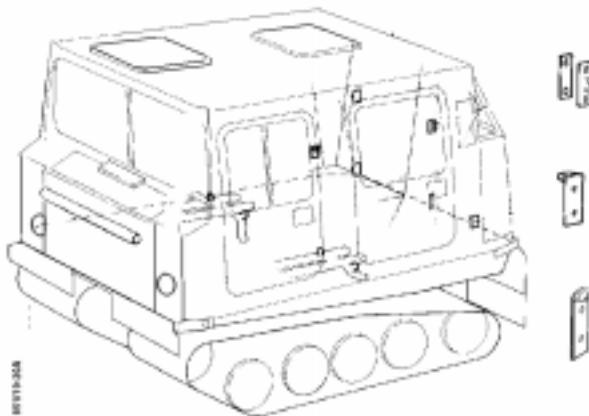
*Fig 10. Maximum load limit, side view*



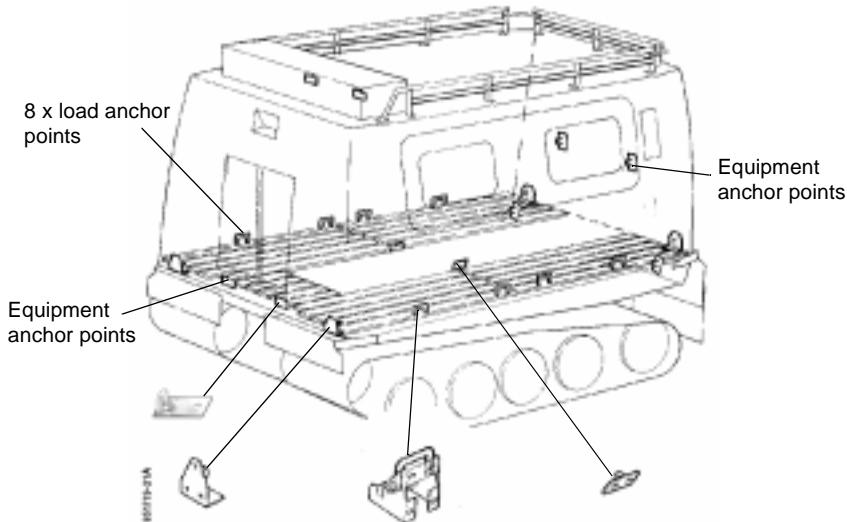
*Fig 11. Maximum load limit, rear view*

## ANCHOR POINTS

The front and rear cars are provided with a number of fittings for securing the load carried in the cars.



*Fig 12. Equipment and load anchor points, front car*



*Fig 13. Equipment and load anchor points, rear car*

### NOTE!

The maximum tie down force on each load anchor point is 1200 kg and on each equipment anchor point 100 kg.

## Security of load

All loads carried in the front and rear cars must be equally divided and secured by using the load anchor points provided in those cars. Do not drive unless the load is well placed and secured. There must be absolutely no risk of load moving while driving.

### **NOTE!**

During operation, the driver is responsible for the safety of the vehicle and the load.

### **NOTE!**

Never attach the lifting eyes in under to secure any load.

## 4.2 Driving

When operating the vehicle keep the seat belts fastened except when fording or swimming and make frequent checks of the instruments and the warning indicator lights. The vehicle should normally be operated with the transmission in "D" or "R" gear and with the transfer gearbox in "H" (high) gear and for heavy duty operation e.g. when the terrain is difficult to traverse, then the "L" (low) gear should be selected. To provide optimum operating conditions for the engine and the transmission, change of gears should be made, so that the engines optimum speed of 3000 to 4000 rpm is maintained, and that the transmission does not continually change between gears. When required, the automatic transmission can be locked in an appropriate gear using the gear selector in combination with the accelerator pedal to maintain the engine speed below 4200 rpm.

### **CAUTION!**

The gear selector must never be moved to the "N" position while driving (neutral), as this may cause transmission failure. The gear selector must never be moved to a lower gear position, when the engine speed exceeds 3300 rpm.

### **NOTE!**

When negotiating narrow passages, a low gear should always be selected and the engine speed kept high in order to permit fast and safe handling. Always steer with a positive, measured movement of the steering wheel as skidding of the vehicle may occur. It should be noted, that a buzzing sound will be heard, when the steering is operated to its maximum position.

### **NOTE!**

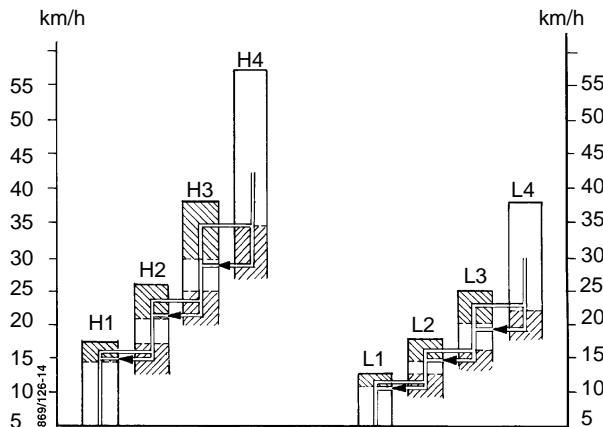
Allow the engine to idle for at least three minutes before attempting to stop the engine.

## **GEAR SHIFTING, TRANSMISSION**

The transmission has four forward gears and one reverse gear.

The gear selector is used to engage these gears. To prevent accidental gear shifting, a latch mechanism is provided on the selector lever to lock it into positions "R", "N" and "D". The gear selector may be moved freely through positions "1", "2", "3" and "D" and in the order "D", "3", "2" and "1", with the exception of positions "2" to "1", when then latch mechanism must be released.

When selecting forward motion, place the gear selector lever in "D" and the vehicle will start in the first gear. When changing from forward motion to reverse motion "R", the gears should always be engaged with the vehicle standing still.



*Fig 14. Gear shifting diagram*

The actual moment of gear engagement may be controlled by means of the accelerator pedal. Depressing the accelerator pedal with the engine at high power results in an earlier shifting to the selected gear. By pressing the accelerator pedal to the floor, engagement of a selected gear is delayed.

## GEAR SHIFTING, TRANSFER GEARBOX

The transfer gearbox lever has three positions: "H" (high) forward, "N" (neutral) and "L" (low) rear. When changing gears, the vehicle must be stationary, and the automatic transmission gear selector must be in the "N" (neutral) position. A gear change between the "H" and "L" positions must be made in one continuous, positive movement without pausing in the "N" (neutral) position. If the change does not occur, stop the engine in order to engage the desired gear.

When the vehicle is being towed, the transfer gearbox must be in the "N" (neutral) position.

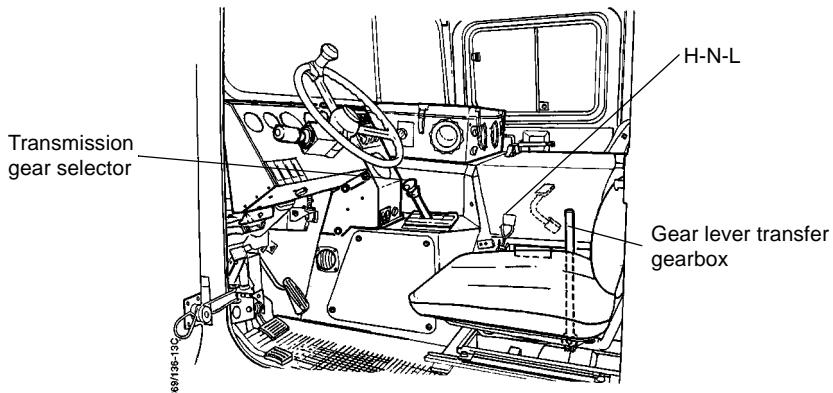


Fig 15. Gear level and gear selector

## CROSS COUNTRY DRIVING

When cross country driving, observe the following precautions:

- Always operate the steering wheel with positive, measured movements. Use the steering knob at low speeds.
- When driving uphill or downhill, preselect the appropriate gear for the slope. For exceptionally steep slopes, lock the transmission in first gear and place the transfer gearbox in "LOW" gear. When operating the vehicle on slopes, avoid situations that can cause slide slipping or skidding of the vehicle.
- Avoid situations where the vehicle has to be turned, and there are obstacles under the vehicle tracks.
- The splash aprons should be suspended during cross-country driving.

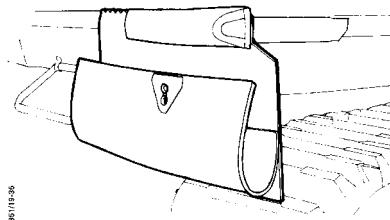
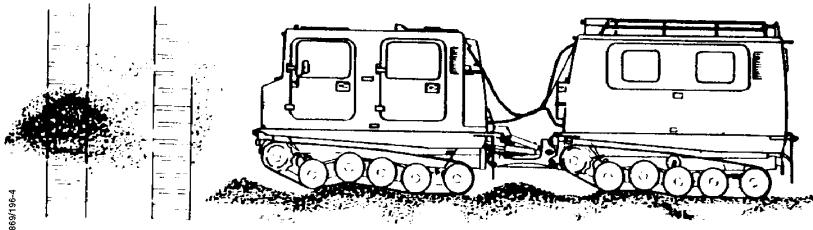


Fig 16. Suspended splash aprons

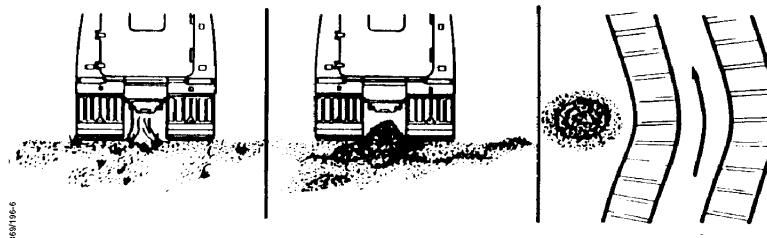
**CAUTION!**

During excessive cross country driving, frequently check that the track units are intact as the tracks can be damaged. See section 5 for track maintenance.

- Never turn when there is an obstacle under the carrier tracks. It is always better to negotiate around an obstacle. This applies to both raised obstacles such as stumps or stones, as well as to depressions such as ditches.



*Fig 17. Do not turn with obstacle under carrier*



*Fig 18. Passing obstacles*

- When driving over soft terrain, avoid driving in same tracks as preceding carriers.

## DRIVING ON SIDE SLOPES

When driving on side slopes the centre of gravity of the vehicle is the major consideration and the operators must take in to account the load carried by the vehicle, especially roof cargo, and conditions of the grounds. Under certain conditions sideways slippage and possible overturning of the vehicle may occur.

## CROSSING FIELD BRIDGES

When crossing a temporary bridge proceed at a low speed, maximum 5 km/h and do not make any sharp steering movements, when traversing the bridge. Two panel bridges can be crossed, provided that the distance between the two panels does not exceed 1050 mm and the bridge curb has no sharp edges. If one track has to go onto the curb, the curb has to be kept within the road wheel station. If the curb is outside the road wheel station damage to the track may occur.

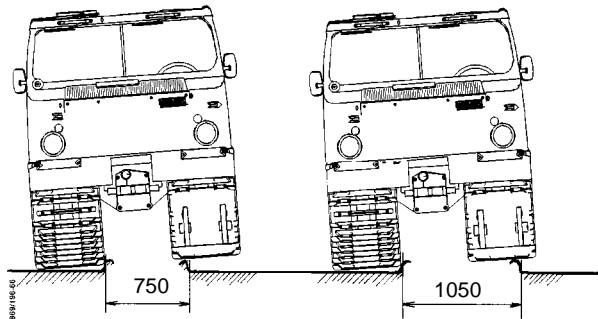
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### —WARNING!

---

Accident may occur if the tracks slips from the bridges.

---



*Fig 19. Field bridge*

## NIGHT DRIVING

1. Always check and clean lights, including blackout lights before night driving.
2. Drive at lower speed than during day light.
3. Check the terrain carefully before driving, use the co-driver as a guide in unknown terrain or whenever it is necessary.
4. Always use the co-driver as guide when driving backwards.
5. Keep distance to other vehicles and be alert to other vehicles signs.
6. Keep out for obstacles such as trees, stones and deep holes.

# SHIPMENT AND TRANSPORTATION

## Safety

- Check and insure that all loose items are properly secured and stowed correctly.
- When reverse the carrier, ensure that a guide is provided and that no personnel or obstacles are in between the cars or behind the carrier.
- Loading and unloading operations shall always be supervised by experienced personnel. The operator shall always drive and operate the carrier whenever he / she is present during loading and unloading operations.
- The personnel responsible for the transportation supplies are also responsible for the tiedown of the carrier.
- When perform lifting operations, ensure that the lifting eyes are screwed all the way in and can not be loosened by hand.
- Movement of the carrier is subject to all safety rules, laws and regulation applicable to commercial carriers. Overseas movement are governed by local regulations and laws.
- Fire extinguishers must be available during loading and unloading operations.
- Vessel equipment and cranes should be inspected and comply with all safety regulations before being used.
- Lifting eyes, shackles and slings should be inspected to ensure that they are complete and not damaged.
- All lifts should have at least two tag lines attached to control the swing of the lift while suspended.
- Personnel should be cautioned not to walk under items being lifted.
- The power lines for electrical driven locomotives shall be disconnected during loading and unloading operations.
- Radio antennas should always be removed during all transport operations on railway.
- The fuel tanks must not be more than three quarter full during air transportation.
- The required numbers of tiedown plus their capacity must be checked and criteria for gravity forces checked to be in accordance with aircraft data.

---

**—WARNING!**

---

Proper ventilation must be provided during loading and unloading operation when the engine is running. Carbone monoxide can be deadly. Exhaust gas are dangerous to personnel

---

**CAUTION!**

Steering cylinders may not be used for tiedown or lift purpose.

**NOTE!**

Lifting eyes shall only be used for carrier lifting operation, not for tiedown purposes.

## Land transport

### PREPARATIONS

Remove all loose equipment from out from outside the carrier and stow the equipment securely inside the cabin. Clean the tracks from mud or other type of environmental effects that can affect the friction between the tracks and the load platform. Make sure that drive ramp used are correct adjusted according to the configurations.

### LOADING

**—WARNING!**

No one except the driver is allowed to be on the trailer or track platform area at any time during loading and unloading operations.

**—WARNING!**

Loading must not be conducted on side lateral slopes exceeding 10 percent or with a tractor to trailer offset greater than 5 °. Also on sewerage down-grade must be avoided to prevent payload from rolling forward on load area.

**—WARNING!**

Never exceed 5 km/h during loading and unloading operations.

Perform as follows:

1. Drive the vehicle up on the platform / Lift the vehicle, see “Lifting with”.
2. Apply the parking brake.
3. Shut off the engine.

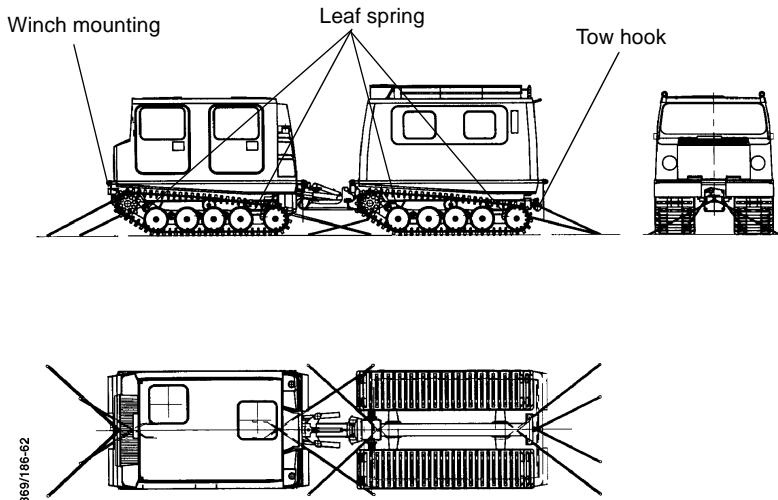
4. Place the gear selector in "N" position (neutral).
5. Switch off the main switch and make sure that all the doors are closed and locked.

## TIEDOWN

Secure the vehicle according to figure 20 ( see the instruction plate inside the front car ceiling ). Correct tie down points during the transport are : leaf spring, winch mounting and tow hook .

### CAUTION!

Tension tiedown evenly.



*Fig 20. Tiedown points*

## UNLOADING

---

**WARNING!**

---

Never exceed 5 km/h during loading and unloading operations.

---

**NOTE!** Make sure that all the tiedown straps are removed before starting the unloading operations.

When unloading the vehicle perform as follow :

1. Start the engine, see page 4-2.
2. Place the gear selector in position reverse “R”.
3. Release the parking brake.
4. Drive the vehicle off / Lifting the vehicle, see “Lifting ”.

## Marine and terminal transport

### PREPARATIONS

Remove all loose equipment from out from outside the carrier and stow the equipment securely inside the cabin. Breakable part should be protected and spare part should be stowed in or near the parent item. Install if required the lifting eyes at the upper four corners on each car , see " Lifting ".

**NOTE!** When the carrier is to be transported on vessel that are adequately ventilated with powerblowers the fuel need not to be drained. Transportation with other types of vessels require that the fuel tanks must be drained and the battery cables disconnected from the batteries and the cable clamps to be taped.

### LOADING

1. Drive the vehicle up on the platform / Lift the vehicle, see "Lifting with crane".
2. Apply the parking brake.
3. Shut off the engine.
4. Place the gear selector in "N" position (neutral).
5. Switch of the main switch and make sure that all the doors are closed and locked.

---

**—WARNING!**

---

Never exceed 5 km/h during loading and unloading operations.

---

## STOWAGE AND TIEDOWN

Secure the vehicle according to figure 20 ( see the instruction plate inside the front car ceiling ). Correct tie down points during the transport are : track girder, winch mounting and tow hook .

Below deck stowage should be provided whenever possible. Place the vehicle with a minimum of space between the outer item and the sweatboards. Secured the vehicle by blocking, bracing and lashing. Blocking shall be done when the vessel or ship are not equipped with permanent fittings in the deck or whenever the situation so require. Blocking shall be done with timbers at the front, rear and on both sides. The bracing timbers shall be force fitted to bulkhead, stanchion or blocking on adjacent vehicle. The vehicle must also be lashed down with turnbuckles and wire rope or lashing straps from vehicle tiedown fitting to be bulkhead, stanchions or deck fittings. On vessels equipped with permanent fittings in the deck patented lashing equipment shall be used.

### **CAUTION!**

Tension tiedown evenly.

## UNLOADING

### **NOTE!**

Make sure that all the tiedown straps are removed before starting the unloading operations.

Perform unloading operation in opposite manner as the loading operation.

# Railway transport

## PREPARATIONS

Remove all loose equipment from out from outside the carrier and stow the equipment securely inside the cabin. Clean the tracks from mud or other type of environmental effects that can affect the friction between the tracks and the load platform.

## LOADING

1. Drive the vehicle up on the platform / Lift the vehicle, see “Lifting with crane”.
2. Apply the parking brake.
3. Shut off the engine.
4. Place the gear selector in “N” position (neutral).
5. Switch of the main switch and make sure that all the doors are closed and locked.

## TIEDOWN

Secure the vehicle according to figure 20 ( see the instruction plate inside the front car ceiling ). Correct tie down points during the transport are : track girder, winch mounting and tow hook .

Tiedown so the load will be adequately restrained against forces encountered at normal speeds an operation.

## UNLOADING

---

**—WARNING!**

---

Never exceed 5 km/h during loading and unloading operations.

---

**NOTE!**

Make sure that all the tiedown straps are removed before starting the unloading operations.

Perform unloading operation in opposite manner as the loading operation.

## Air transport

### PREPARATIONS

Remove all loose equipment from outside the vehicle and stow the equipment securely inside the cabin.

### LOADING

The vehicle may be loaded under its own power.

---

**WARNING!**

---

Never exceed 5 km/h during loading and unloading operations.

---

### TIEDOWN

Secure the vehicle according to figure 20 ( see the instruction plate inside the front car ceiling ). Correct tie down points during the transport are : track girder, winch mounting and tow hook .

Tiedown according to applicable type of aircraft.

### UNLOADING

---

**WARNING!**

---

Never exceed 5 km/h during loading and unloading operations.

---

**NOTE!**

Make sure that all the tiedown straps are removed before starting the unloading operations.

Perform unloading operation in opposite manner as the loading operation.

## Parking

The vehicle can be short term parked without any preparations. However there are a few guidelines that are to be followed, this to minimize the maintenance cost and the maintenance effort. The following guidelines shall be taken in consideration.

- Always try to park the vehicle on hard ground (concrete, asphalt or similar surface) and keep the track free from oil spill and other petrol products.
- Park the vehicle under shelter if possible and always if the periods for parking may be longer than 1 month.
- Maintenance action such as Pre- and Post-mission checks shall be performed.
- Oil and lubrication intervals shall be maintained during the parking period if no special preparation, such as oil change or conservation, has been performed during the parking preparation.
- Touch-up of surface treatment shall be performed before any parking period.
- Front and rear air channels shall be covered with their plastic covers.
- Drain plug shall always be removed if no other regulations are recommended due to local conditions.
- Vehicle parked without any special preparation for storage has to be maintained according to the monthly checks and service schedule.
- Close all windows, hatches and doors during the parking period.
- Always park the vehicle with the fuel tank fully filled with fuel and with drained water separator.
- The vehicle parking area shall be controlled in form of insects or animals who can affect vehicle systems.

## 4.3 Recovery and towing

### RECOVERY OF THE VEHICLE

#### Towing

Whenever the vehicle has to be towed, preferable use the A-frame Part no: 453 7412-080, as towing device.

Using the A-frame there is no need for a driver in the disabled vehicle. It is also possible to tow a vehicle with a damage steering or brake system, as the A-frame give a solid and firm connection between the towing and the disabled vehicle.

#### TOWING THE VEHICLE WITH A TOWING ROPE

When the vehicle is being towed, the transfer gearbox lever must be placed in the "N" position (neutral).

##### **NOTE!**

Exercise caution when towing and drive at low speeds.

##### **NOTE!**

When using emergency steering, the steering wheel has to be turned approx 15 times to obtain full left to right steering.

See Fig 21. Connecting the tow rope.

---

##### **WARNING!**

---

Before starting to tow, ensure that all personnel outside vehicle are far enough away from both vehicles. This distance must be equal to or greater than the length of longest towing rope. If the cable should snap, personnel could be injured.

---

1. Attach the tow rope to the disabled vehicle.
2. Attach the towing rope to the towing vehicle.
3. Put the transmission gear selector of the disabled vehicle in (N) neutral position.
4. Put the transfer shift lever of the disabled vehicle in (N) neutral position. Check for neutral position by rotate transmission propeller shaft by hand.

5. Turn on hazard light.

**CAUTION!**

Transfer gearbox must be in neutral position during towing of vehicle. Damage to transmission may occur if "N" is not selected.

6. If possible, start engine and release the parking brake on disabled vehicle.

**NOTE!**

Exercise caution when towing, drive at low speed. Do not exceed 20 km/h. When using emergency steering the steering wheel must be rotated approx. 15 turns for left to right steering, instead of about 4 1/2 turns at normal steering.

7. In towing vehicle, drive the vehicle slowly forward until tow rope is tight.
8. In disabled vehicle, use steering wheel knob when steering vehicle.



*Fig 21. Connecting the tow rope*

## TOWING THE VEHICLE WITH AN "A" FRAME

When the vehicle is towed the transfer gearbox gear lever must be placed in the "N" position (neutral).

**NOTE!**

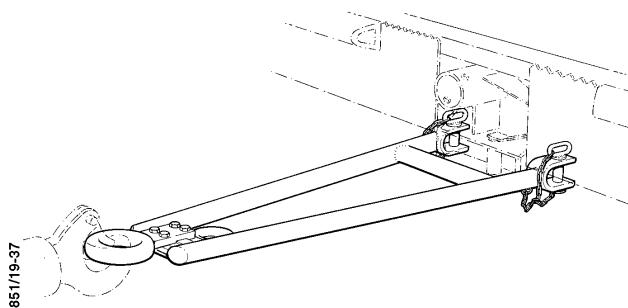
Exercise caution when towing and drive at low speeds.

The vehicle should be towed with an A-frame Part no: 453 7412-080.

**WARNING!**

Before starting to tow, ensure that all personnel outside vehicle are far enough away from both vehicles.

1. Attach the A-frame to the disabled vehicle.
2. Attach the A-frame to the towing vehicle.



*Fig 22. Use of an A-frame*

3. Put transmission gear selector of the disabled vehicle in (N) neutral position.
4. Put the transfer shift lever of the disabled vehicle in (N) neutral position. Check for neutral position by rotate transmission propeller shaft by hand.

**CAUTION!**

Transfer gearbox must be in neutral position during towing of vehicle. Damage to transmission may occur if "N" is not selected.

5. Release the parking brake.

**NOTE!**

Exercise caution when towing, drive at low speed. Do not exceed 20 km/h.

## **Recovery of a vehicle with a broken leaf spring**

If a leaf spring is broken it is recommended that the vehicle should be repaired on site. If the vehicle has to be towed it should be towed backwards, if a front leaf spring is broken and forwards if a rear leaf spring is broken. Towing should be restricted to short distances.

## **Recovery of a vehicle with a damaged differential**

### **DAMAGE TO THE REAR CAR DIFFERENTIAL**

Remove the drive shaft between the cars and the tracks from the rear car. The vehicle can then be driven by the front car only.

#### **NOTE!**

In this condition the brakes only function on the front car.

### **DAMAGE TO THE FRONT CAR DIFFERENTIAL**

Remove the drive shaft between the cars and the tracks from the front car.

#### **NOTE!**

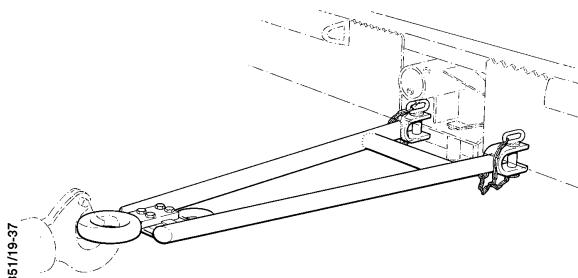
In this condition there are no brake functions, therefor the vehicle must be towed for repair.

## **Recovery of a vehicle with damaged transfer gearbox**

See “Damage to the front car differential”.

## **Recovery of a vehicle with damaged steering system**

When the vehicle has a damaged steering system, the vehicle must be towed by using an A frame.



*Fig 23. Use of an A-frame*

---

**—WARNING!**

---

Damage on the steering system impairs driving safety and constitutes serious traffic hazard. Discovered defects should be remedied at once.

---

## Recovery of a stuck vehicle

Before recovering a stuck vehicle, clear away any debris (stones, stubs trees etc.) from the track assembly. Tow the vehicle in a straight line (backwards or forwards) to avoid damage to the steering unit.

## Recovery of a sunken vehicle

Recovery of a sunken vehicle must be performed, by using a lifting crane or other lifting device.

## LIFTING (OP)

Correct lifting point are located at the upper four corner of each car.

Lifting sling Part no. 353 9972-801 or equivalent equipment shall be used for lifting Bv 206 with two full body variants. Lifting sling 353 9992-801 or equivalent equipment shall be used for lifting Bv 206 in its flatbed variants.

---

**—WARNING!**

---

Do not use lifting equipment with wrong length of the lifting slings. This affect the lifting forces into the body structure.

---

Install, the lifting eyes at the upper four corners on each car (total of eight) as follows:

1. Remove the plastic caps from cabin roof (4x) upper corner on each car. Use 3/4" square wrench.
2. Install lifting eyes. Make sure that the lifting eyes are screwed all the way in (shoulder flush with the roof of the BV 206) and cannot be loosened by hand (torque approx 200 Nm) and align the rings until they are facing diagonally.

**NOTE!**

On versions with equipment permanent attached to the roof, remove the holding screws for the equipment and replace with lifting eyes. Replace to orginal screws after lifting operations (torque 200 Nm).

**NOTE!**

On versions with branch fenders, the lifting eyes are permanent attached to the roof.

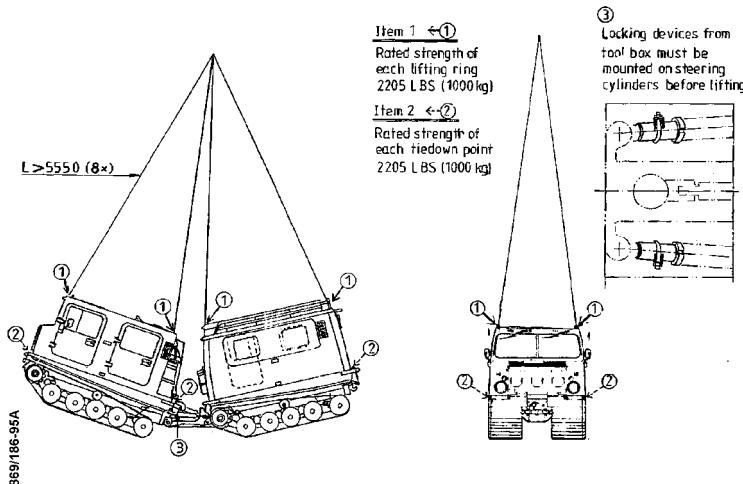
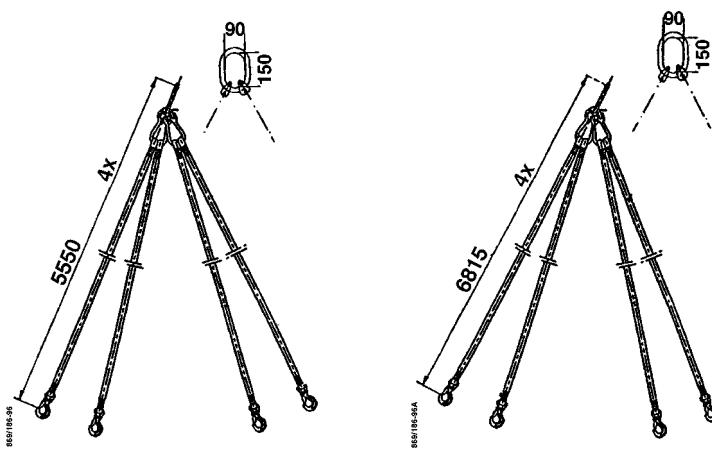
**NOTE!**

Lifting eyes shall only be used for carrier lifting operation, not for tiedown puposes.

**CAUTION!**

Do not use lifting eyes made for versions with branch fenders on versions with flatbed.

3. Position the BV 206 with the centre point of gravity under the lifting hook.
4. Apply the parking brake.
5. Place the gear selector in position "N" and shut off the engine.
6. Switch off the master switch and make sure the all doors all closed and locked.
7. Prepare and attach the lifting slings according to the figure 24 (also found at the instruction plate inside front car ceiling).
8. Perform the lifting operation.  
Remove the lifting eyes and install plastic caps after the operation.

LIFTING AND TIEDOWN POINTS

*Fig 24. Sling lifting with crane*

*Fig 25. Lifting sling length*

## 4.4 Fording and swimming

Before fording or swimming all loads must be equally divided and secured. Heavy loads (point load) must be properly secured in the middle of the cargo space.

---

**—WARNING!** 

---

If entering moving water, the flow of the water must not exceed 1.0 meters per second, otherwise the vehicle may be swept away.

---

### CHECKS BEFORE FORDING

1. Ensure that the bottom plugs of both the front and rear cars are in place.
2. Ensure that the protective glasses for the front headlights are intact.
3. Start the bilge pumps and check their operation.
4. Check the fording depth and the bottom condition.

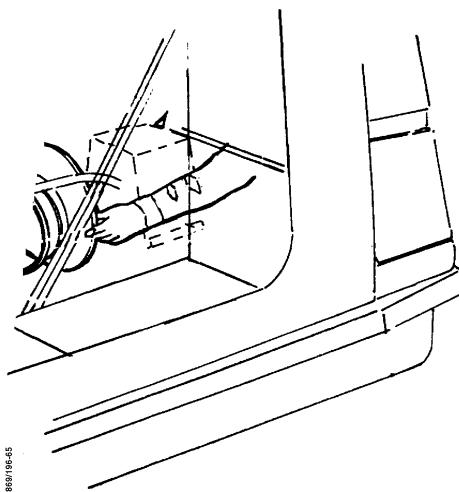
### CHECKS BEFORE SWIMMING

1. Ensure that the bottom plugs in both the front and rear cars are in place.
2. Ensure that the protective glasses for the headlights are intact.
3. Raise, flip up and secure the front air intake grille from the rear and place the plastic protective cover over the intake. See Fig 4:21.
4. Open both roof hatches on the front car.
5. Attach one end of the tow line to the front car towing adapter, and shackle the other end to the handle to the right of the rear roof hatch of the front car. This is for recovery purpose.
6. Wipe the door frames and ensure they are intact and close the doors.
7. Ensure that the rear car side hatch is closed and can be opened in case of emergency.



*Fig 26. Plastic cover on air intake*

8. Start the bilge pumps and check their operation.
9. Ensure that the rubber bellow at the rear of the brake unit, between the brake unit and the body, is intact.



*Fig 27. Inspect of rubber bellow*

10. Ensure that all seat belts are unfastened during the swimming operation.
11. Ensure that load is evenly distributed and strapped down in the cargo compartment. See page 4-13 - 4-14.

12. Ensure that heavy loads are placed in the middle of the cargo compartment and securely strapped down.
13. Ensure that all personnel wear life jackets.
14. Do not drive unless the load is well placed and secured. There must be absolutely no risk of load moving while driving.

---

**WARNING!**

Both the front and rear cars must be watertight, otherwise loss of the equipment and injury to personnel could result.

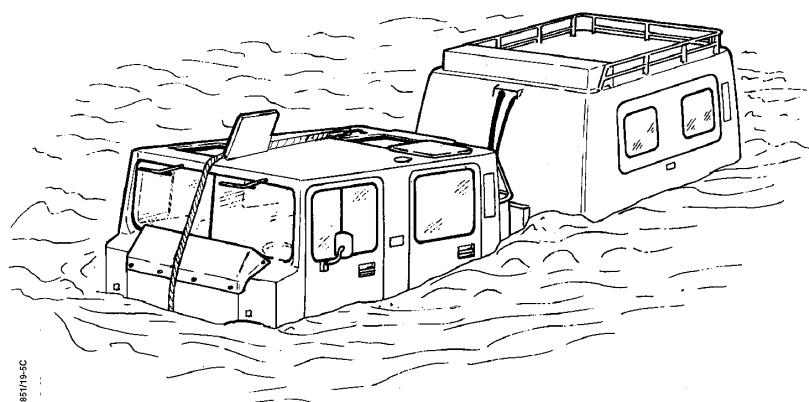
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**NOTE!**

During operation, the driver is responsible for the safety of the vehicle and the load.

## ENTERING THE WATER

Check the conditions of the bottom before entering the water. With the vehicles gear selector in the "D" position, enter the water slowly at right angles to the shoreline. When the front car is completely in the water increase the engine speed and maintain the speed to keep the front end of the vehicle slightly lifted. While the vehicle is in the water, maintain a frequent check of the engine temperature.



*Fig 28. Vehicle swimming*

## LEAVING THE WATER

Before making contact with shore slow down the speed of the vehicle, so that the vehicle leaves the water at a right angle to the shoreline. Upon leaving the water, stop the vehicle and conduct the “Checks and services after swimming”.

## CHECKS AND SERVICES AFTER SWIMMING

1. Switch off the bilge pumps.
2. Close the roof hatches and remove the tow line and shackle.
3. Clean any dirt from the bilge pumps screens.
4. Remove the plastic cover from the air intake.
5. Remove the bottom plugs from the front and rear car and allow any accumulated water to drain out.
6. Reinstall the bottom plugs.
7. Lubricate all external grease points after operation according to the Lubrication Chart.
8. After driving through salt water, wash the complete vehicle with fresh water.

## 4.5 Winch (OP)

### SAFETY

- Check before winching that the direction of rotation of the winch is correct.
- Check before winching that the wire rope is not jammed or frayed and that it is securely mounted.
- The winch must not be used to lift or move people.
- Never touch the wire rope or hook when winching is being done or when the wire rope is under load.
- To prevent injury from a cable breaking during operation, clear all personell from vehicle and from the path of the wire rope to a distance equal to the length of the wire rope.
- Never start winching eith less than 5 turns of wire rope on the drum. if there are less turns on the drum the wire rope might be pulled off.
- The wire rope must be winded on and off according to the sign on the winch.

### PREPARATION

#### Electric winch

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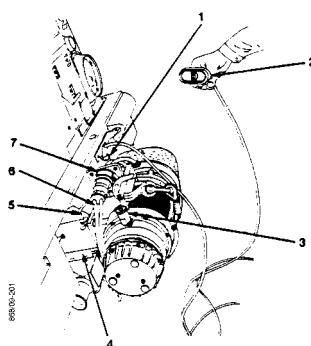
**—WARNING!**

---

Always wear gloves when handling winch cables. Never let cable run through hands. Freyd cables can cut.

---

1. Remove the winch from stowage bracket ( front car ).
2. Position winch on mount at front carrier. Insert winch mounting pin 5.
3. Take power and control cables from stowage location.
4. Plug one end of power cable 6 into carrier axiliary starting connector and other end into power receptacle 7 on winch.
5. Connect remote control cable 2 to remote control receptacle 1.



1. Remote control toggle
2. Remote control toggle switch and cable
3. Drum lock
4. Winch mount
5. Winch mounting pin
6. Power cable
7. Power rectacle

*Fig 29. Winch in operating position*

## Hydraulic winch

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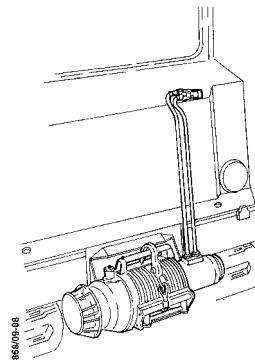
**—WARNING!**

---

Always wear gloves when handling winch cables. Never let cable run through hands. Freyd cables can cut.

---

1. Remove the winch from stowage bracket ( front car ).
2. Place the winch in winch mount on towing adapter on the front car. Lock winch with a locking pin.
3. Connect hydraulic hoses to quick couplings under font grille.



*Fig 30. Winch mounted*

## OPERATION OF WINCH

### Electric winch

#### **CAUTION!**

Do not winch motor to pay out winch cable. Do not pull out winch cable with other vehicle. Damage to winch motor may result.

1. Start engine.
2. Move remote control toggle switch 2 to “wind out” position. Release toggle switch as soon as winch cable has some slack.
3. Pull drum lock 3 and turn it one quarter turn to unlock winch drum.
4. Pull out the required length of cable on the drum. Always leave at least five turns of the winch cable on the drum.

#### **NOTE!**

To avoid overloading use a single pulley block when rigging for winching.

5. Remove single pulley block from stowage.

**CAUTION!**

Rig cable so that a straight pull is maintained on winch. Winching with cable at an angle bigger than 15° in relation to the winch drum can increase wear of winch and winch cable.

6. Attach pulley block with tow cable to another vehicle or permanent fixture.

**—WARNING!**

To prevent injury from a cable breaking during winch operation, clear all personnel from vehicle and from the path of the cable to a distance equal to the length of the cable.

7. Turn drum lock until it falls into the lock position.
8. Move remote control toggle switch to “wind in” position. Release toggle switch to stop winching operation.
9. Move toggle switch to “wind up” position until cable is slack. Disconnect winch cable.

## Hydraulic winch

1. Disengage the winch drum by lifting and turning the disengaging device 1/4 turn. Pull out the required length of the winch cable by hand but leave at least 5 turns of the winch cable on the drum.
2. Start engine. Switch on High idle with switch on control panel.
3. Switch on hydraulic system.
4. Check direction of winch rotation by depressing switch (In and Out) on control panel above driver.

**NOTE!**

To avoid overloading use a single pulley block when rigging for winching.

**NOTE!**

Do not switch on the hydraulic system until the load is attached and the winching is about to start.

5. Remove single pulley block from stowage.

**CAUTION!**

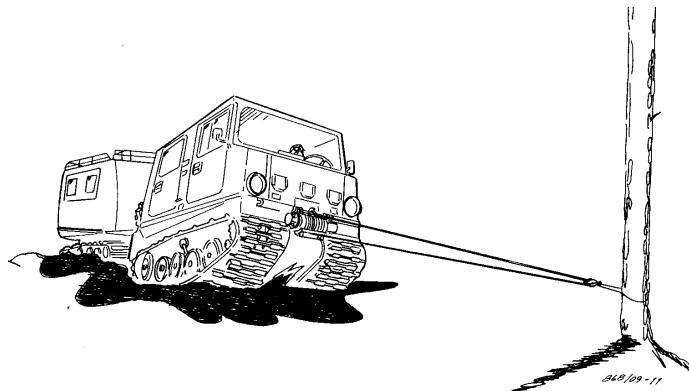
Rig cable so that a straight pull is maintained on winch. Winching with cable at an angle bigger than 15° in relation to the winch drum can increase wear of winch and winch cable.

6. Attach pulley block with tow cable to another vehicle or permanent fixture.

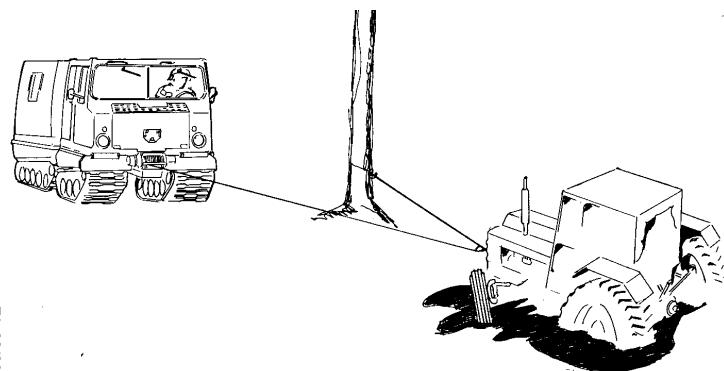
**WARNING!**

To prevent injury from a cable breaking during winch operation, clear all personnel from vehicle and from the path of the cable to a distance equal to the length of the cable.

7. Depress the switch "IN" on control panel.



*Fig 31. Operating winch, recovery of own vehicle*



*Fig 32. Operating winch, recovery of other vehicle*

## STOWAGE

### Electric winch

1. Disconnect pulley block with cable from vehicle or permanent fixture.
2. Remove pulley block from cable and stow pulley block.
3. Maintain tension on cable to ensure that cable winds evenly on drum.
4. Move remote control toggle switch to “wind in” position.
5. Winch in cable until cable hook is near winch. Release toggle switch.
6. Secure cable hook to winch pipe bracket.

**CAUTION!**

Do not wind cable too tightly on drum. Damage to cable or winch can result

7. Move remote control toggle switch “wind up” position until cable is under slight tension. Release toggle switch.
8. Shut off engine.
9. Disconnect and stow remote control cable.
10. Disconnect and stow power cable.
11. Remove and stow winch.

### HYDRAULIC WINCH

1. Disconnect pulley block with cable from vehicle or permanent fixture.
2. Remove pulley block from cable and stow pulley block.
3. Winch in cable until cable hook is near winch.
4. Secure cable hook to winch pipe bracket.

**CAUTION!**

Do not wind cable too tightly on drum. Damage to cable or winch can result

5. Switch off the hydraulic system.
6. Disconnect and plug the hydraulic hoses of the winch. Stow winch.

## 4.6 Compass (OP)

The compass is been for driving in a fixed direction which has been settled from the map by a hand compass or a measuring plate. When necessary take into considiration any deviations.

## NAVIGATING

It is easy to fall away out of course though the nature of the ground are varying and when the car is been pushed and baged then even the compass can swing to and fro. Therefor take a point of sight as far away as possible in the terrain. Do this when the car stands in the right direction. Then drive the best way to that point. Take gradually new points of sight.

## BEARING

The most simply way of bearing is to turn the car. The turn is completed when the front points at the bearing object, after which the compass course is beeing readed.

## 4.7 “Running in” instructions after overhaul

After overhaul, or change of major components, the vehicle must undergo a period of running-in. It is important not to overstress the engine and the engine should not be run at full power during the first 500 km of operation, nor should the speed of the vehicle exceed 40 km per hour (approximately 4000 rpm).

After running-in change oil and replace oil filter cartridge for the engine and change oil for the diffirentials and transfer gearbox.

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# 5 MAINTENANCE

## 5.1 Scheduled maintenance

### GENERAL

Preventive maintenance checks and services is a systematic inspection and service of the equipment to keep it in good condition and to prevent breakdowns in order to guarantee good availability of the vehicle and to reduce maintenance and service costs. For this vehicle, the scheduled maintenance consists of a daily check-out of the vehicle performed before, during and after driving, a pre mission check, while driving checks, post mission checks, a weekly check and a monthly check.

As the vehicle operator, your mission is to;

- a Ensure that scheduled maintenance is performed every time you operate the vehicle. Perform the checks in the same order, so that they become a habit.
- b Do your PRE MISSION CHECKS just before you operate the vehicle. Pay close attention to all WARNINGS, CAUTIONS and NOTES.
- c Do your DRIVING CHECKS as you operate the vehicle. "While driving checks" means to monitor the vehicle and its related components, while it is actually being operated. Pay close attention to all WARNINGS, CAUTIONS and NOTES.
- d Do your POST MISSIONS CHECKS immediately after operating the vehicle. Pay close attention to all WARNINGS, CAUTIONS and NOTES.
- e Do your WEEKLY CHECKS once a week, and do your MONTHLY CHECKS once a month, before driving. Perform WEEKLY CHECKS as well as BEFORE DRIVING CHECKS if;
  - You are the assigned operator but have not operated the vehicle since the last WEEKLY CHECKS, or.
  - You are operating the vehicle for the first time.

# SERVICE AND CHECK PROCEDURES

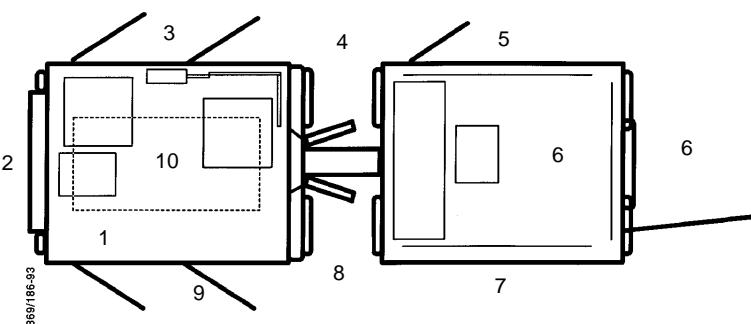
## General

When you do your checks, maintain a supply of cleaning materials for use, when performing the checks. The following checks are common to the entire vehicle;

- a Remove dirt, grease, oil, and debris on a regular basis.
- b Check the metal parts of the vehicle for any sign of rust or corrosion. If there are any signs of bare metal, rust or corrosion, clean and apply a light coat of oil or rust inhibitor until a proper touch up can be performed according to the Workshop Manual BV 206.
- c Check bolts, nuts and screws for any sign of looseness or damage.
- d Check for loose and chipped paint, rust or gaps, where parts are welded together.
- e Check for loose wiring or hoses and any sign of wear or damage.

## DAILY MAINTENANCE

The maintenance checks are arranged in step-by-step order, by following this procedures the entire vehicle will be checked.



*Fig 1. Order of operation*

## Pre-mission checks

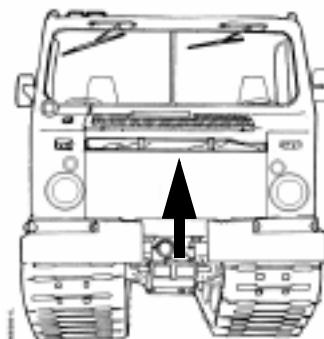
Position the master switch in “ON” position and perform the following actions:

### 1. INSIDE DRIVERS STATION

- a Check that the driver seat is securely mounted, slide easily and has no damage.
- b Check that the driver seat belt is securely mounted and has no damage.
- c Turn the ignition switch to position “1”.
- d Switch on the headlight dipped beam and the RH direction indicator.
- e Place the gear selector level in the R position.
- f Switch on the bilge pumps.
- g Check that the rear view mirrors are undamaged and correctly adjusted.
- h Check that the horn, windscreen wipers and washer are in working order.
- i Check that the tank selector valve operates by pressing tank selector switch.
- j Check brake fluid level.

### 2. FRONT

- a Check that the low beam is in working order.
- b Check that the RH direction indicator is in working order.
- c Check that the headlight glasses are clean and intact.
- d Check that the windscreen panes are undamaged and clean.
- e Check that the windscreens wiper blades are clean and undamaged, and press tightly against the windscreen.
- f Uncover the air inlet and secure the cloth cover. See Fig. 5:2.
- g Clean the front grille and the radiator from leaves and debris.



*Fig 2. Front cloth cover secured*

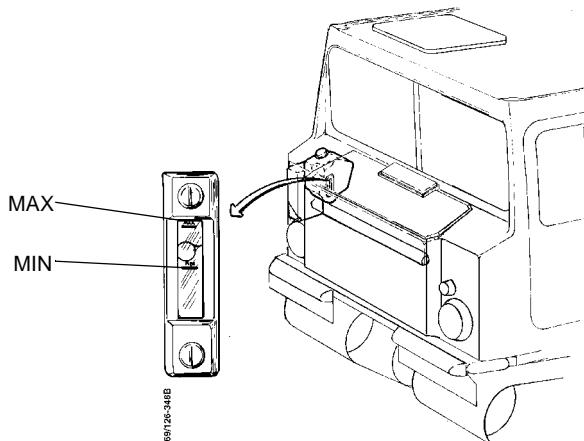
- h Check that the coolant level is between MAX and MIN marks on the expansion vessel. Add coolant if required, according to the Lubrication Chart.

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**—WARNING!**

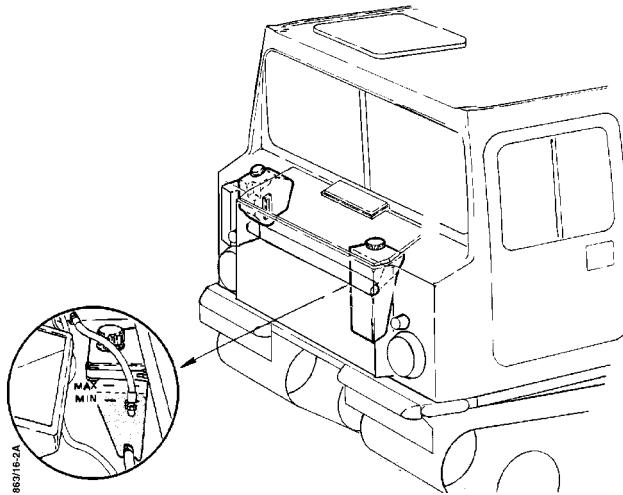
Do not remove expansion cap when engine is hot. Hot engine coolant can cause serious burns.

---



*Fig 3. level glass, expansion vessel*

- i Check that the hydraulic oil level is between MAX and MIN marks on the reservoir. Add hydraulic oil if required, according to Lubrication Chart.



*Fig 4. Hydraulic tank, steering system*

- j Check the front differential for any sign of oil leakage.
- k Check that the towing adapter is securely mounted and in working order.
- l Check that the bumpers and the splash aprons are intact.

### 3. FRONT CAR RIGHT HAND SIDE AND ROOF

- a Check the fluid level in the windscreen reservoir and ensure that it is at least 3/4 full. Add fluid if required.
- b Check that the co driver seat is securely mounted and has no damage.
- c Check that the co driver seat belt is securely mounted and has no damage.
- d Check that the cyclone cleaner air intake area is free from dirt or debris. (OP)
- e Check the cyclone cleaner, the hoses and the exhaust ejector are intact and securely mounted. (OP)
- f Check that the roof hatches and sealings are intact and that the locking device is in correct order.
- g Check that any load in the vehicle is correctly stored and well secured.
- h Check that the glass of the side windows are clean and intact.
- i Check that the door sealings is intact, that the frame is free from dirt and that the locking devices is in working order.
- j Check that the RH side direction light are clean and in working order.
- k Check that the reflectors are undamaged and clean.

## 4. RIGHT BETWEEN CARS

- a Check that the steering unit, transfer gearbox and the rear differential are free from damage and there is no sign of oil leakage.

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**WARNING!**

Damage on steering systems impairs driving safety and constitutes serious traffic hazard. Discovered defects should be remedied at once.

---

- b Check that the brake unit rubber bellow is intact and not damaged.
- c Check that the fuel tank is securely mounted and there are no leaks.
- d Check that the fuel tank filler cans is intact and locked.
- e Check that the fuel hoses are undamaged and no loose fittings.
- f Check the fuel tank ventilation hoses for damage and check that the ventilation filter is not clogged.
- g Check that the splash aprons are intact.
- h Check the function of the TILT cylinder (OP).

## 5. REAR CAR RIGHT HAND SIDE AND ROOF

- a Check that the equipment box is closed and locked.
- b Check that any load on roof is correctly stored and secured.
- c Check that the glass of the side windows are clean and intact.
- d Check that the splash apron is intact.
- e Check that the door sealing is intact, that the frame is free from dirt and that the locking devices is in working order.
- f Check that the RH side direction light are clean and in working order.
- g Check that the reflector are undamaged and clean.

## 6. REAR AND INSIDE

- a Check that the bilge pump is in working order. Clean the surrounding area, this in order not to obstruct the water to enter the bilge pump.
- b Check that the drain plug is installed, if not install the drain plug
- c Check that the cabin lights are undamaged and in working order.
- d Check that the intercom is serviceable. A yellow signal lights and a buzzer comes on when pressing intercom switch, in front and rear car.
- e Check function of ventilation fans by operate the fans in all speeds.
- f Check that the side hatch is closed.
- g Check that any load inside is correctly stored and secured.
- h Check that the rear combination lights are undamaged, clean and in working order.
- i Check that the reverse light are undamaged, clean and in working order.
- j Check that the rear director indicator are undamaged, clean and in working order.
- k Check that the reflectors are undamaged and clean.
- l Check that the footstep are undamaged and in upright position.
- m Check that the trailer coupling are intact and the security chain is in working order.
- n Check that the bumpers and the splash aprons are intact.

With a towed trailer attached.

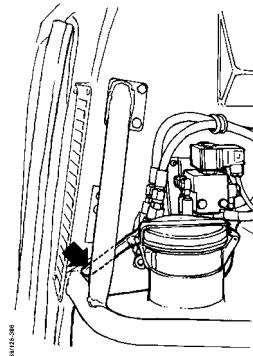
- a Check that the mechanical connections are correctly made.
- b Check that the electrical connection are correctly made and lighting equipment on towed trailer are undamaged, clean and in working order.

## 7. REAR CAR LEFT HAND SIDE

- a Check that the glass of the side windows are clean and intact.
- b Check that the splash apron is intact.
- c Check that the reflector are undamaged and clean.

## 8. LEFT BETWEEN CARS

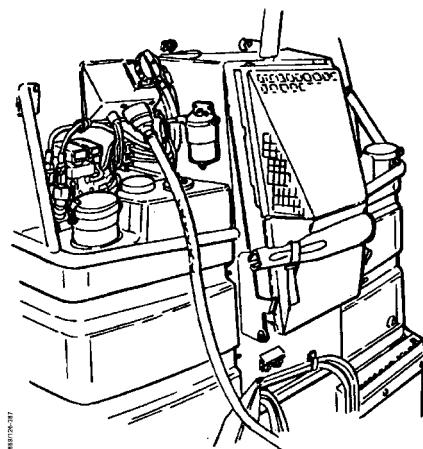
- a Check that the fuel tank filler cap is intact and locked.
- b Check that the cans are filled with diesel fuel.
- c Check that the tank and the cans are closed and locked.
- d Check that the fuel hoses are undamaged and no loose fittings.
- e Check that the fuel tank are securely mounted and there are no leaks.
- f Check the water trap for leakage and loose attachment.
- g Check the fuel tank ventilation hoses for damage and check that the ventilation filter is not clogged.
- h Check that the manual fuel shut off valve is in open position.



*Fig 5. Manual fuel shut off valve (open position)*

- i Uncover the air outlet and secure the plastic cover.

- j Clean the rear grille and the engine oil cooler from leaves and debris.



*Fig 6. Rear plastic cover secured*

- k Check that there are no leakage from the engine oil cooler.
- l Check that the cable between the cars is undamaged and correctly mounted.
- m Check that the cover on the auxiliary starting connection is correctly mounted.
- n Check that the splash aprons are intact.

## 9. FRONT CAR LEFT HAND SIDE

- a Check that the glass of the side windows are clean and intact.
- b Check that the splash apron is intact.
- c Check that the door sealings are intact, that the frames are free from dirt and that the locking devices is in working order.
- d Switch to main headlight, LH direction indicator and place gear selector level in position N.
- e Check that the LH side direction light are clean and in working order.
- f Check that the reflector are undamaged and clean.

## 2. FRONT (LIGHT CHECK)

- a Check that the main beam light is in working order.

- b Check that the LH direction indicator is in working order.

## 6. REAR (LIGHT CHECK)

- a Check that the LH side direction light are clean and in working order.

- b Check that the brake light is in working order by depressing the brake pedal.

- c Check that the rear LH direction indicator is in working order.

- d Check that the license plate light is in working order.

- e Check that the reverse light is off.

## 10. ENGINE COMPARTMENT

- a Check if there is any oil in the bottom of the engine compartment and clean out if necessary.
- b Inspect the engine for any signs of oil leakage.
- c Check oil level with engine off and the vehicle on level ground. If the engine has been running, wait for 1 to 3 minutes before checking the oil level. Check as follows:
  - Remove and clean dipstick.
  - Insert dipstick and wait 10 seconds. Check level. Correct level is between **MAX** and **MIN** marks on the dipstick. Add 0.5 liter of engine oil, at the filler cap in the valve cover, when the oil level is in crosshatched area of the dipstick. Use oil according to Lubrication Chart.

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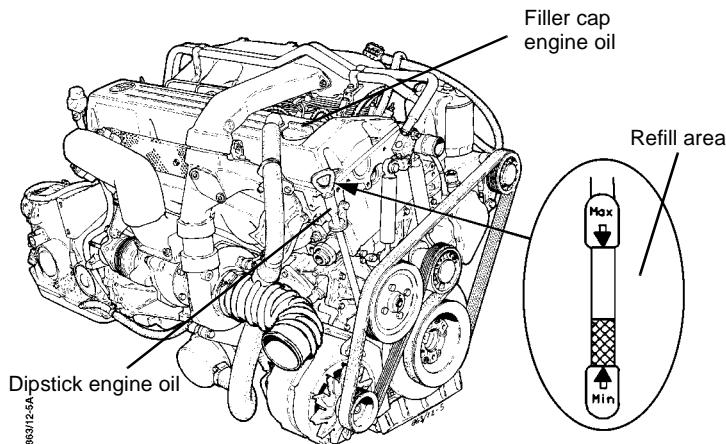
**WARNING!**

Oil spilled on a hot exhaust pipe constitutes a fire risk.

---

**CAUTION!**

Do not overfill the engine. Damage to the engine may occur.



*Fig 7. Oil dipstick and filler cap*

- d Check the fuel filter and injection pump for leakage and loose attachment.
- e Check that the bilge pump is in working order.

- f Check that the drain plug is installed.
- g Check that the parking brake pedal assembly is intact and securely mounted.
- h Check that the parking brake is in order.
- i Start the engine according to section 4 OPERATION , “Engine cold”.
- j Check for unusual noise and vibrations, excessive exhaust smoke or other unusual signals from the engine while idling.
- k Perform warning light test by pressing warning light test switch.

## BRAKE FUNCTION

- a Check that the service brake is in order by driving slowly forward and operate the service brake.
- b Apply the parking brake.

---

**—WARNING!**

Damage on brake systems impairs driving safety and constitutes serious traffic hazard. Discovered defects should be remedied at once.

---

## TRACK ASSEMBLIES

- a Check that there are no through cracks or tears in the tracks.

**NOTE!**

Cracks outside of the wheel contact surfaces are permissible.

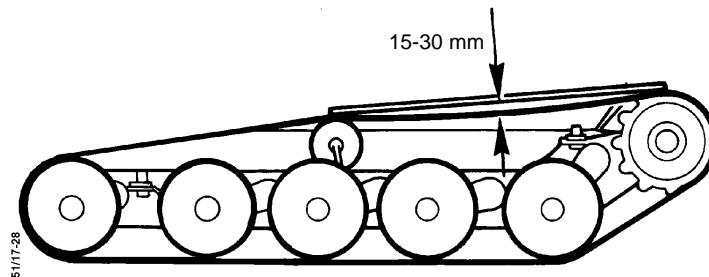
- b Check that the guide horns are intact and firmly secured.
- c Check that the road wheels are intact.
- d Check that the tension wheels are intact.
- e Check that the support wheels are intact.
- f Check that the tension device folding screws are securely mounted.
- g Check that the drive sprockets are intact and firmly attached.

After allowing the vehicle to coast to a stand still and with the vehicle on even ground.

h Measure the slack of the track between the drive sprocket and the supporting wheel. The slack should be between 15-30 mm. Adjust the track tension to 15 mm without payload if required.

**NOTE!**

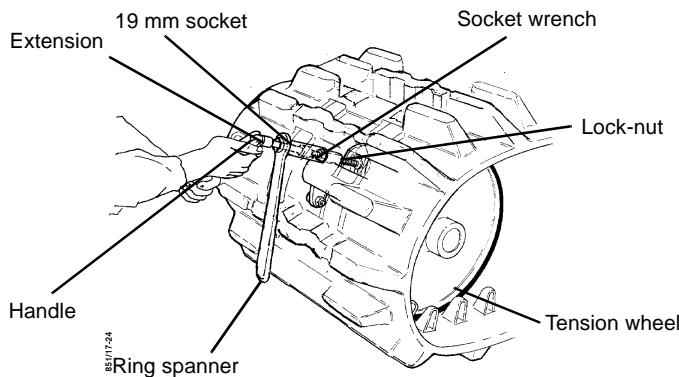
Track tension is depending on the temperature and the load.



*Fig 8. Track tension measurement*

The track tension is adjusted with the tension screw on the tension mechanism. The tension screw is locked with a lock-nut. Use on board tools.

1. Open the lock-nut.
2. Adjust to correct track tension.
3. Tighten the lock-nut.



*Fig 9. Adjust track tension*

- i Clean the track assembly when needed.
- j Check security of internal winch mounting. (OP)
- k Check condition of external winch mount. (OP)

## Checks during operation

- a Observe all instrument continuously during operation and never operate the vehicle if any warning system lights up or any instrument show abnormal readings.
- b Observe fuel gauge reading for time to refill fuel or change fuel tank.
- c Check continually that the coolant temperature is between +75 °C and +105 °C. If temperature gauge enters the red sector, stop the vehicle and let the engine turn over at high idling. If the temperature continue to rise, stop the engine and investigate. If the high temperature remains the same after five minutes, stop the engine and investigate or report to your supervisor.
- d If the warning buzzer comes on during operation check warning lights and instrument, investigate possible causes;
  1. Parking brake is engagd and gear selector is not in “N” position.
  2. Engine coolant temperature to high.
  3. Engine oil pressure to low.
- e If engine coolant warning lights comes on, stop the vehicle and let the engine turn over at high idling for five minutes. Check reading on temperature gauge. If the light remains on, stop engine and investigate.
- f If oil pressure warning light comes on stop vehicle and switch off the engine immediately and investigate.
- g If gearbox oil temp warning lights comes on, reduce engine torque and shift to a lower gear on the gear selector lever. If the light remains on, check transmission oil level at idling and investigate.
- h If charging warning light comes on stop the vehicle and investigate.
- i The ampere meter should read 0 - 100 Amp during normal operation, if not, refer to your supervisor.
- j If the automatic transmission shift indistinctly or has tendency to slip, stop the vehicle, check the transmission oil level at idling and investigate.

- k Observe track system for unnormal noises and damages.
- l Check remote control operation. (OP)
- m Inspect remote control and power cable for damage. (OP)
- n Check winch for leaks and kinked, frayed or damaged cable (OP)

## Post mission checks

- a Clean the vehicle.
- b Check coolant level, engine oil level and fuel level, top up if required.

---

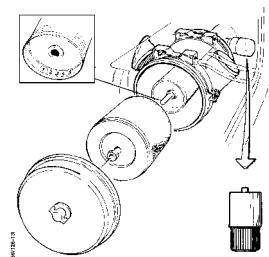
**WARNING!**

---

Do not remove expansion cap when engine is hot. Hot engine coolant can cause serious burns.

---

- c Check the air filter service indicator for signals. If warning (red signal button) perform air filter cleaning, see unscheduled maintenance section.



*Fig 10. Service indicator*

- d Check that no parts of the track unit assembly has been damaged. The track has to be replaced when;
  - More than two cross bars is broken
  - One cross bar section have come off completely
  - The rubber on five consecutive track grouser is peeled off more than 95% average.
- e Check that no parts of the body has been damaged.
- f Check that no parts of the steering unit has been damaged.

---

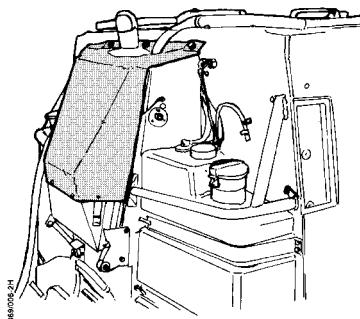
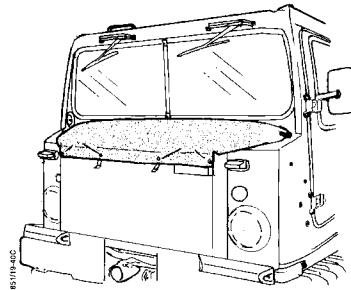
**WARNING!**

---

Damage on the steering system impairs driving safety and constitutes serious traffic hazard. Discovered defects should be remedied at once.

---

- g Lubricate and carry out maintenance required.
- h Perform touch up painting, if required, according to Workshop Manual BV 206. This shall be performed before next operation, long term parking or storage of the vehicle.
- i Clean tools and other equipment after use.
- j Install front and rear cloth covers.



*Fig 11. Covers installed*

**NOTE!**

When the vehicle is to be parked more than 24 hours, remove the drain plugs and place them in a visible position at the drivers station the vehicle. Before the vehicle is used again the drain plugs must be refitted.

- k Set the master switch in “OFF” position.
- l Report to your supervisor all defects that cannot be repaired by you.

## Fuel refilling and checks

The following actions and checks shall be performed whenever the fuel has to be refilled.

- Stop the engine.
- Fill both tanks with fuel. Fill fuel cans with fuel.
- Select right hand tank for fuel use.

### **NOTE!**

Always refuel both fuel tanks at the same time.

Ensure that:

- the fuel tanks and the fuel cans are filled with the correct type of diesel fuel.
- the fuel tanks and fuel cans are closed and locked after refuelling.
- there are no signs of leakage from the fuel tanks and the fuel cans.
- Coolant checks
- Check the coolant level is between the “MAX” and “MIN” marks on the expansion vessel. Add coolant if required using a mixture of water and anti-freeze, according to the Lubrication Chart.

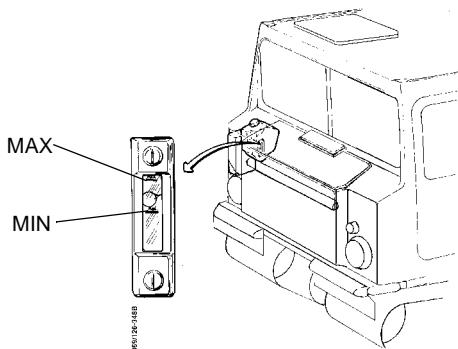
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### **WARNING!**

---

Do not remove the expansion cap when the engine is hot. Hot engine coolant can cause serious burns.

---



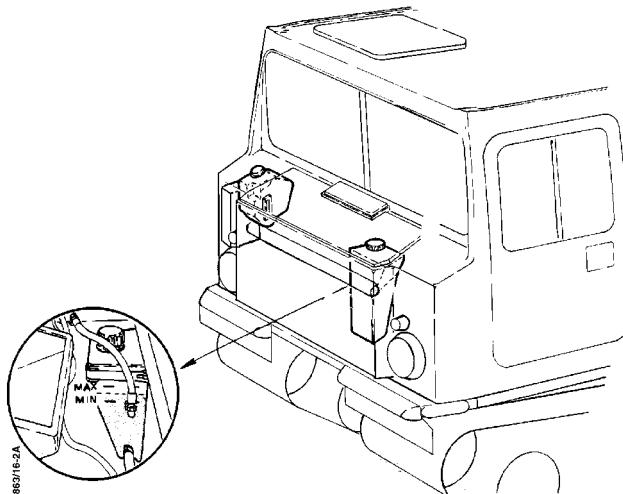
*Fig 12. Level glass, expansion vessel*

- Steering system checks

Check the hydraulic oil level is between **MAX** and **MIN** marks on the reservoir.

Add hydraulic oil if required, according to the Lubrication Chart.

Check that there are no oil leaks in the steering system.



*Fig 13. Hydraulic reservoir*

- Windscreen washer reservoir checks

Check the fluid level in reservoir, which should be approximately three quarters full. Add more fluid as required.

- Engine oil level check

Check if there is any oil in the bottom of the engine compartment and clean out if necessary. Inspect the engine for any signs of oil leakage.

Check oil level with engine off and the vehicle on level ground. If the engine has been running, wait for 1 to 3 minutes before checking the oil level.

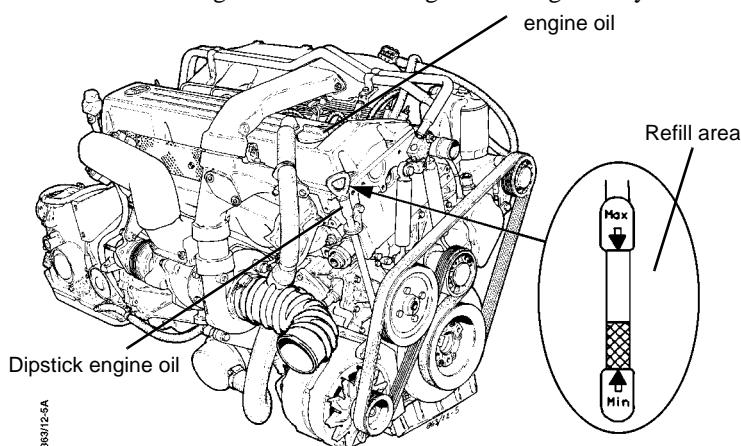
Check as follows:

- Remove and clean dipstick.
- Insert dipstick and wait 10 seconds. Check level. Correct level is between **MAX** and **MIN** marks on the dipstick. Add 0.5 liter of engine oil, at the filler cap in the valve cover, when the oil level is in the crosshatched area of the dipstick. Use oil according to Lubrication Chart.

After performing these checks, start the engine and run it until the oil cooler is warm. Check for any sign of leakage.

**CAUTION!**

Do not overfill the engine with oil. Damage to the engine may occur.



*Fig 14. Oil dipstick and filler cap*

# WEEKLY CHECKS AND SERVICES

## General

Weekly checks and services shall be preformed on equipment used and in operation.

Report any defects or if you find anything wrong immediately to your supervisor.

Remember when in doubt, notify your supervisor.

## Vehicle

a Inspect the vehicle for damage.

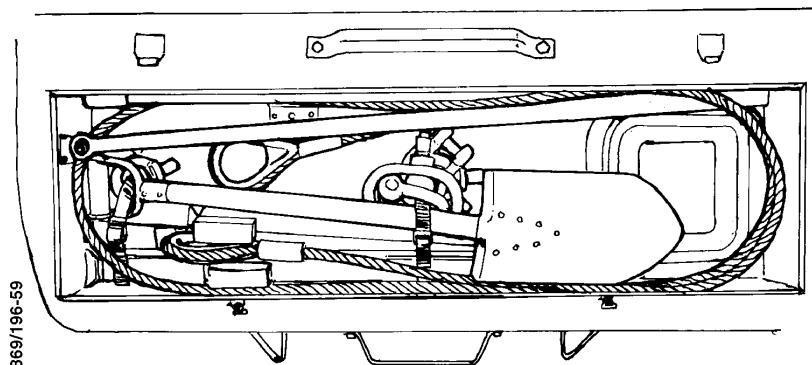
- Make a visual inspection on the vehicle in terms on exterior damage that would impair operation.

b Inspect the equipment boxes as follows:

- Inspect stowage areas for serviceability.
- Stow equipment properly.



*Fig 15. Equipment box No 1. front car*



869/196-55

*Fig 16. Equipment box No 2. rear car*

## Engine compartment

- a Remove the engine bonnets and the both inspection covers.

---

**WARNING!**

---

Stop the engine and switch off the master switch on the electrical panel when working in the engine compartment.

---

- b Inspect and service the belts, see Fig 5:17. as follows:

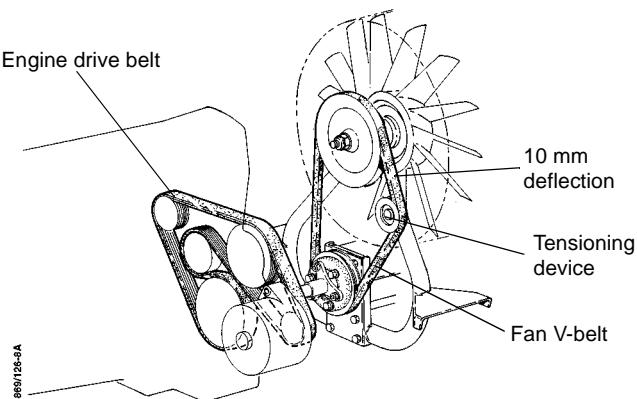
1. Inspect the fan V-belt for cracks and damage.
2. Check tensioning of the fan V-belt, it should be possible to deflect the V-belt approximately 10 mm.
3. Adjust the V-belt tension by moving the tensioning roller outwards.

- c Inspect the engine drive belt.

- Inspect the engine drive belt for cracks and damage.

**NOTE!**

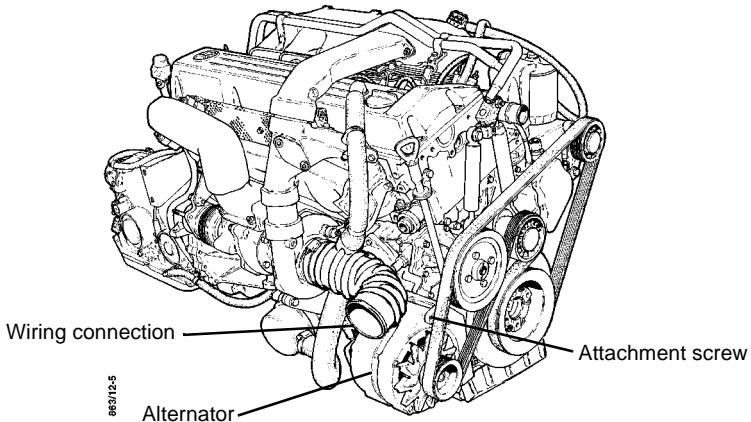
The drive belt tension is automatically adjusted.



*Fig 17. Inspection of belts*

d Inspect the alternator as follows:

1. Inspect the alternator attachment for loose screws.
2. Inspect wiring and connections.

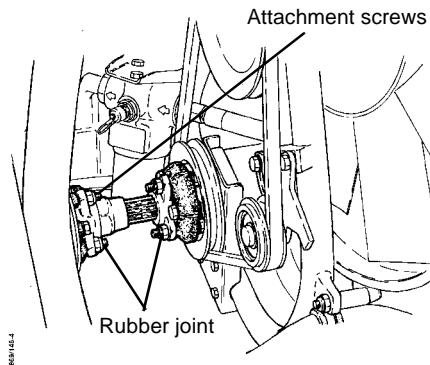


*Fig 18. Alternator*

e Inspect the drive shaft between the engine and the hydraulic pump.

1. Check that the drive shaft is secured mounted.

2. Inspect rubber joint for cracks.



*Fig 19. Drive shaft*

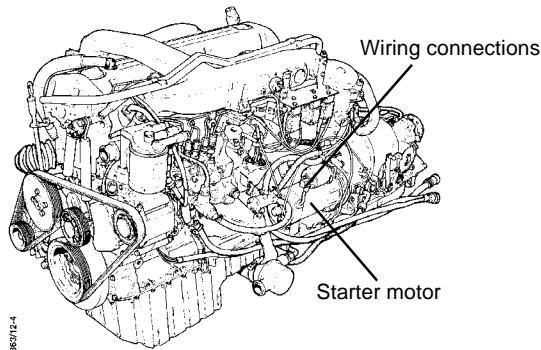
f Inspect the engine throttle controls as follows:

- Examine accelerator pedal and linkage for damage and loose attachments.

g Starter motor.

1. Inspect the starter motor attachment for loose screws.

2. Inspect wiring and connections.



*Fig 20. Starter motor*

h Check the oil level in the transmission as follows:

---

**WARNING!**

---

Carbon monoxide can be deadly. Exhaust gas leaks are dangerous to personnel.

---

1. Check the level after driving and with the vehicle on level ground, the oil level check has to be done at hot automatic transmission temperature.
2. Place the gear selector lever in position N and let the engine run at idling for 1-3 minutes.
3. Remove and clean the dipstick.
4. Insert the dipstick and wait 10 seconds. Check the level. Correct level is between **Hot** marks on the dipstick, with lower level at lower transmission temperature.

---

**WARNING!**

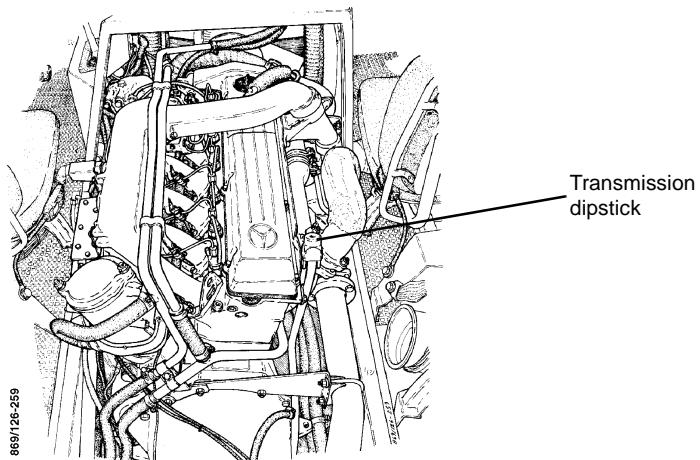
---

Oil spilled on a hot exhaust pipe constitutes a fire risk.

---

**CAUTION!**

Do not overfill transmission. Damage to transmission may occur.



*Fig 21. Transmission dipstick*

5. The **Warm** marks of the dipstick are to be used at low or “hand-warm” temperature after short driving to ensure mission performance.

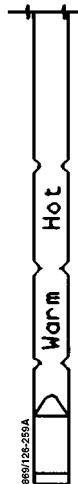
Perform according to step 1-3.

Correct level is between **Warm** marks of the dipstick. If the level is not visible on the dipstick, check for leaks and add oil until level is visible on the dipstick.

**NOTE!**

Unscheduled oil level check, before the engine is started, the oil level shall be visible at the lower part of the dipstick. Unscheduled oil level check shall always be followed by a **Hot** or **Warm** check performed according to above steps.

6. Add oil if necessary through the dipstick pipe. Use automatic transmission oil according to Lubrication Chart.



*Fig 22. Dipstick*

- i Check the brake calipers and pads as follows:

---

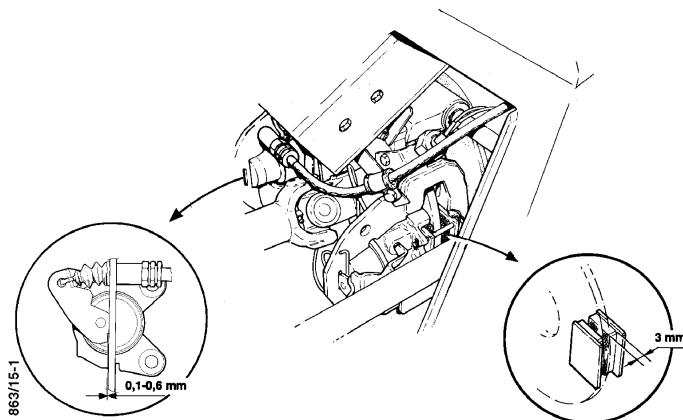
**—WARNING!**

Damage on brake systems impairs driving safety and constitutes serious traffic hazard.

---

Notify your supervisor if any of these cases occurs.

1. Check that the brake pads are not excessively worn, at least 3 mm of friction material must remain.
2. Check that the brake disc has no damage.
3. Check that the brake disc and brake callipers are securely mounted.



*Fig 23. Brake disc and callipers (with wear limits and parking brake adjustment)*

4. Check that the parking brake cable moves easily.
5. Check that there is 0,1-0,6 mm clearance between the parking brake lever and the brake calliper carrier plate.
6. Check that the parking brake lever does not butt against the brake caliper carrier plate, when the parking brake is applied.
7. Check for leakage in brake lines and brake calipers.

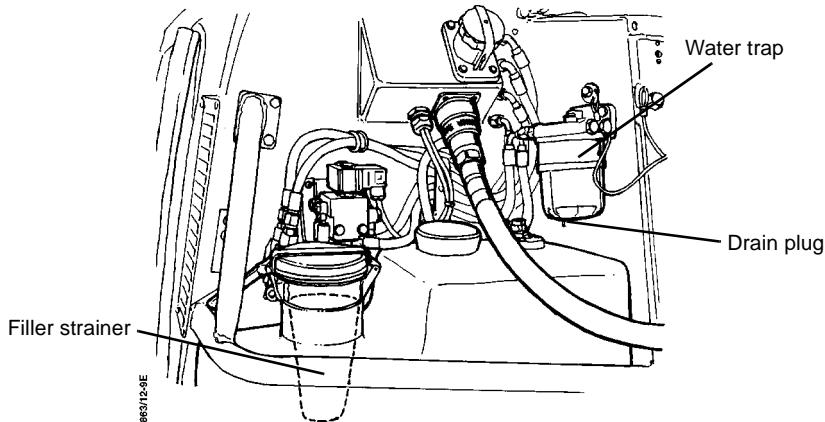
- j Inspect the engine bonnets and inspection covers as follows:

1. Inspect the engine bonnet and inspection covers for damage.

2. Inspect the seals on the engine bonnets and the inspection covers.
3. Install the engine bonnets and the inspection covers.
4. Make sure that the inspection covers fits properly when installed.
5. Make sure that the engine bonnet fits properly when installed, adjust locking device if required.

## Outside and between cars

- a Inspect and service the fuel system as follows:
  1. Check the water trap for leakage and loose attachment.
  2. Check that the fuel hoses are undamaged and no loose fittings.
  3. Open the drain plug on the water trap, drain accumulated water.
  4. Close the drain plug on the water trap.
  5. Check fuel tank filler strainers for availability and clean on both tanks.



*Fig 24. Water trap*

- b Perform and inspect the engine oil cooler as follows:
  1. Remove the lower and upper outlet grille.
  2. Remove the oil cooler attaching screws and fold out the engine oil cooler.
  3. Inspect the oil cooler for clogged and, or damaged radiator elements. Clean if required.

4. Reinstall the oil cooler and the grilles.

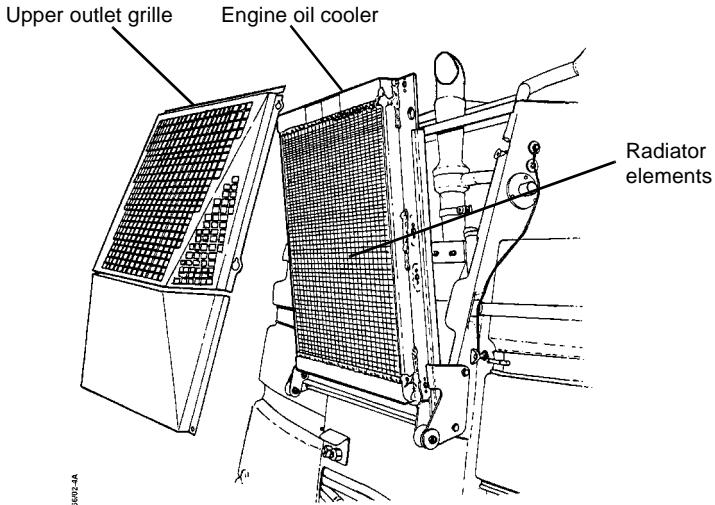


Fig 25. Engine oil cooler

- c Inspect the drive shaft, underneath the steering unit as follows:

---

**—WARNING!**

Stop the engine and switch off master switch on electrical panel when working with shafts.

---

1. Inspect the drive shaft for damage.
2. Inspect the drive shaft for loose attachments screws.
3. Inspect the drive shaft for damage in universal joints.
4. Inspect conditions on the grease nipples.

- d Inspect the hydraulic hoses (outside) as follows.

Inspect the hydraulic hoses and connections for damages, cracks or leakage.

- e Inspect the damping cylinder as follows:

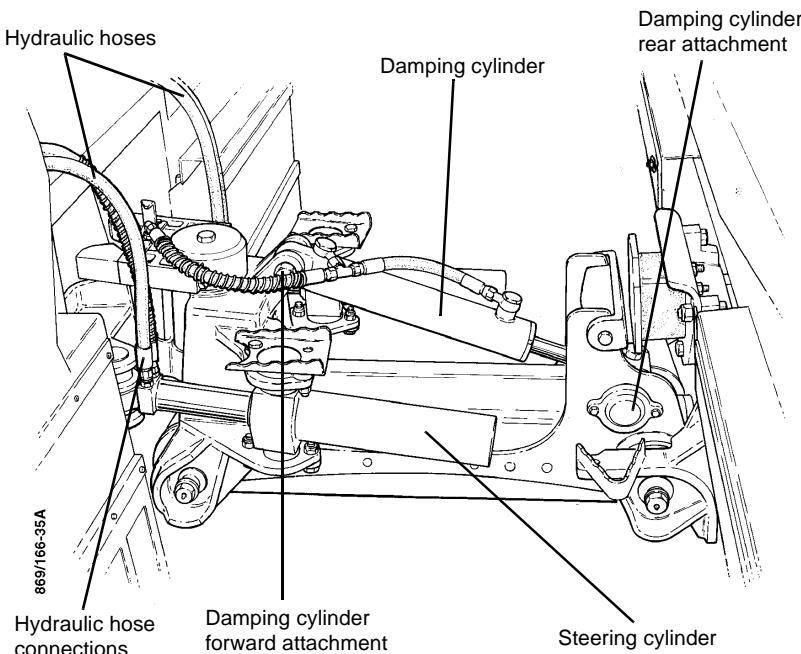
Inspect the damping cylinder assembly for damage, attachment or leakage.

- f Inspect the steering cylinder as follows:

1. Check for leakage.
2. Inspect steering cylinder attachment.

g Inspect steering unit as follows:

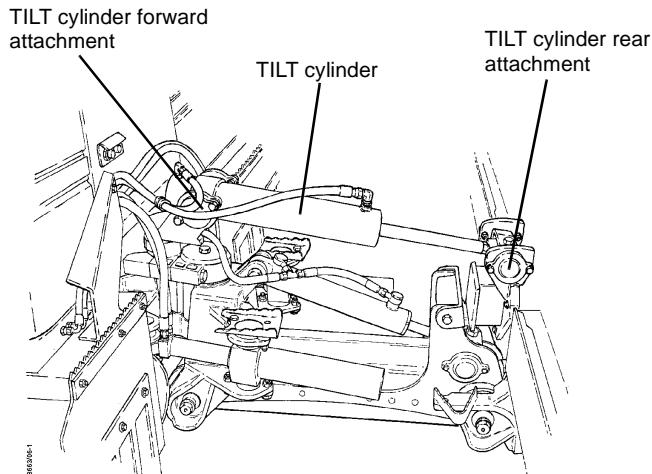
1. Check that there are no cracks, unusual play or other damage on the steering unit.



*Fig 26. Steering cylinder*

h Inspect the TILT cylinder as follows (OP):

1. Check for leakage.
2. Inspect TILT cylinder attachment.



*Fig 27. steering unit with tilt cylinder*

## TRACK ASSEMBLY

- a Inspect the drive shaft between the differential and the drive sprocket (4 pc) as follows:

---

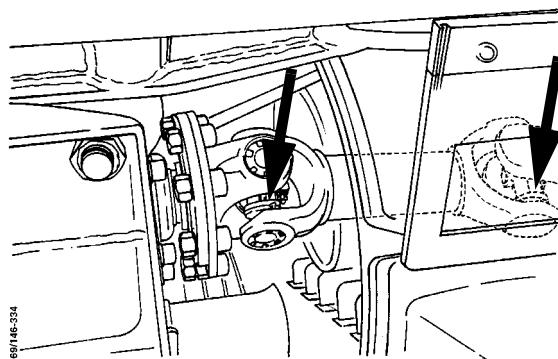
**WARNING!**

---

Stop the engine and switch off master switch on electrical panel when working with shafts.

---

1. Inspect the drive shaft for damage.
2. Inspect the drive shaft for loose attachments screws.
3. Inspect the drive shaft for damage in universal joints.
4. Inspect conditions on the grease nipples.



*Fig 28. Drive shaft*

- b Inspect the chassis beams as follows:

1. Inspect the chassis beams for damage.
2. Clean build-up debris between the chassis beams and the bodies.

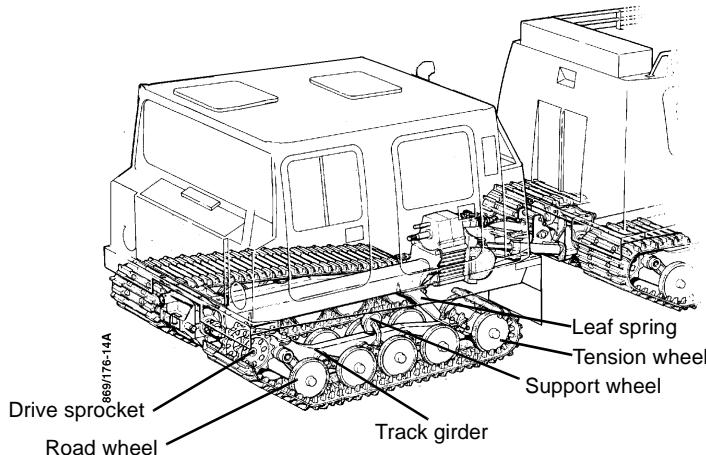
- c Inspect the track girders as follows:

1. Inspect the track girders for damage.
2. Inspect the support wheels bracket for loose screws or damage.

- d Inspect the front and rear leaf spring as follows:

1. Check that the leaf spring is securely mounted.

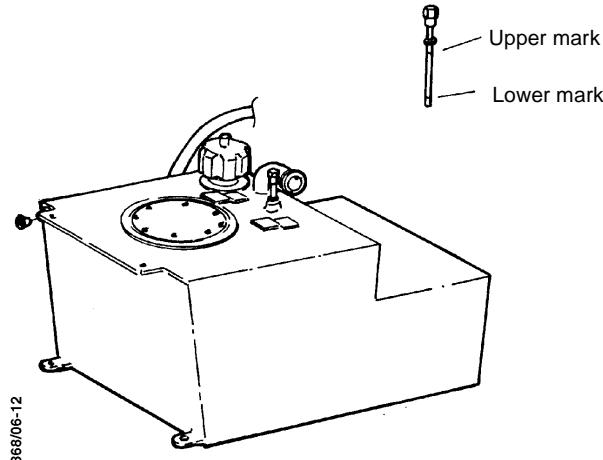
2. Inspect the leaf spring for cracks.
- e Inspect the swing arms (32 pc) as follows:
1. Inspect the swing arm for damage.
  2. Inspect the swing arm for loose attachment screw.



*Fig 29. Suspension system*

## Extra hydraulic system (OP)

Remove and clean dipstick ( wrench grip 22 mm ). Insert dipstick, check level. Correct level when oil is cold , is at lower mark on dipstick. At operating temperature oil level should be upper mark.



*Fig 30. Oil tank with dipstick*

## MONTHLY CHECKS AND SERVICES

Monthly checks and services shall be performed on equipment used and in operation and on equipment parked without any preservation action taken. For equipment prepared and stored under long term conditions, see appropriate document. Report any defects or if you find anything wrong immediately to your supervisor. Remember, when in doubt, notify your supervisor.

### Vehicle general

a Inspect the vehicle for damage as follows:

1. Make a visual inspection on the vehicle in terms of exterior damage that would impair operation.
2. Inspect following items for completeness, security, operation and readability.

Panels.

Equipment box.

Data, Caution and Warning plates.

Steps and brackets.

### INSIDE FRONT CAR

a Inspect the brake master cylinder as follows:

1. Check the brake fluid level. Correct fluid level is between MAX and MIN marks of the reservoir.

Before you add brake fluid. Check that there is no leakage from master brake cylinder, brake lines and brake calipers. Notify your supervisor if any of these cases occurs. Use brake fluid according to the Lubrication Chart.

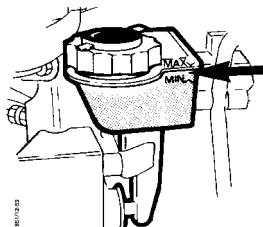


Fig 31. Brake fluid level

2. Inspect that the brake master cylinder and brake pedal assembly is securely mounted and electrical connections are firmly attached.
3. Check that the brake pedal rubber has no damage.

b Inspect the steering column as follows:

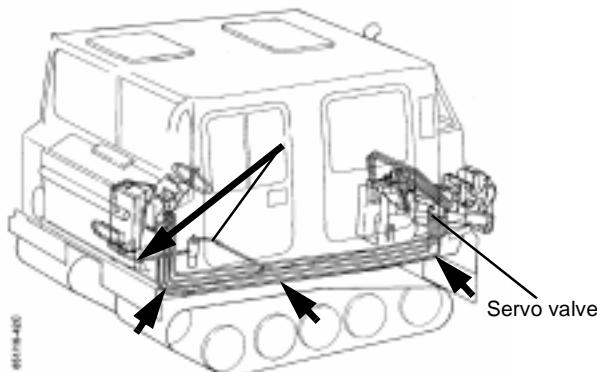
1. Inspect the steering valve for leakage.
2. Check the steering column attachment.

c Inspect the steering servo valve as follows:

1. Remove battery cover.
2. Inspect the steering servo valve for leakage.

d Inspect the hydraulic hoses (inside) as follows:

1. Inspect the hydraulic hoses and connections for damages, cracks or leakage.



*Fig 32. Hydraulic hoses (inside)*

e Inspect the batteries as follows:

1. Check that the state of charge of the battery is satisfactory; if the density of the acid is below 1.22 at +30 °C, the battery should be charged.

2. Check that the electrolyte level, stands 5-10 mm above the top of the electrodes. If necessary re-fill with battery water.

---

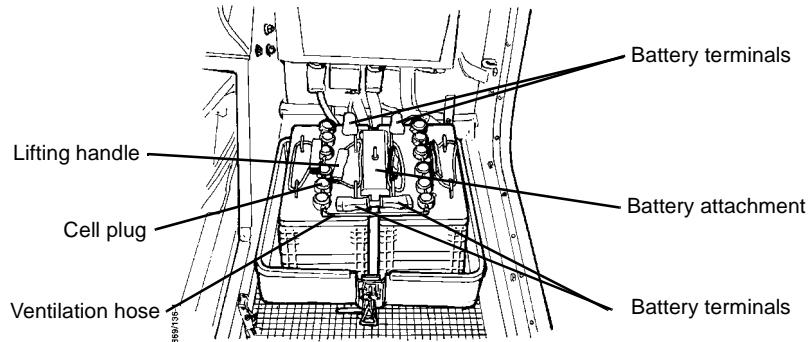
**WARNING!**

Batteries can be dangerous if not handled properly. When working with batteries, use following guidelines to ensure your safety; Battery acid can cause serious skin burns. Wear rubber gloves and goggles when working with electrolyte. When removing battery cables, remove always ground cable first. When installing battery cables, connect ground cable last. Do not smoke or have open flame nearby while charging batteries. If spilling battery acid on skin or eye wash with cold water immediately and contact a doctor.

---

3. Reinstall the cell plugs with air bleed covers and hoses.
4. Check that the ventilation hoses are intact.
5. Check that the batteries are clean, intact, and securely mounted.
6. Check that the connecting cables of the battery are undamaged.
7. Lubricate the battery terminals if necessary.
8. Check that the battery cover is intact.
9. Reinstall the battery cover.

10. Check that the battery heater, thermostat and cables are intact (OP).



*Fig 33. Batteries, checkpoints*

- f Inspect and clean the air filter with housing. See chapter 5.2 Air filter cleaning.

## Engine compartment

- a Remove the engine bonnets and the both inspection covers.

---

**WARNING!**

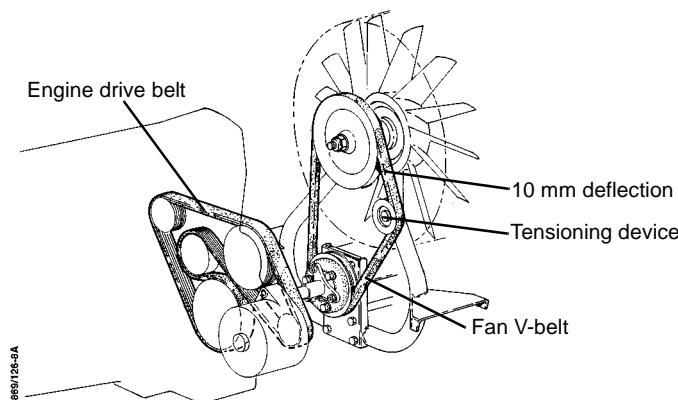
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Stop the engine and switch off the master switch on electrical central when working in engine compartment.

---

- b Inspect the tension on the fan V-belt as follows:

1. Inspect the fan V-belt for cracks and damage.
2. Check tensioning of the fan V-belt, it should be possible to deflect the V-belt approximately 10 mm.
3. Adjust the V-belt tension by moving the tensioning roller outwards.



*Fig 34. Inspection of belts*

- c Inspect the engine drive belt.

Inspect the engine drive belt for cracks and damage.

**NOTE!**

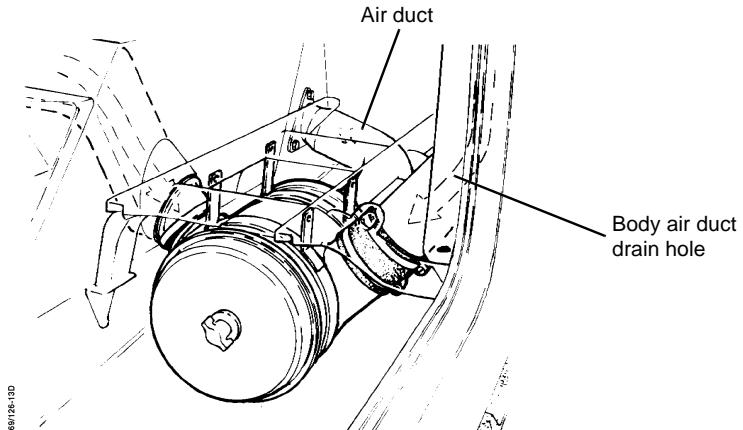
The drive belt tension is automatically adjusted.

- d Inspect the hydraulic steering pump and pressure filter as follows:

1. Inspect the hydraulic pump and the pressure filter for leakage.
2. Check the hydraulic pump attachment.

e Inspect the intake manifold as follows:

1. Inspect the intake manifold for damages, loose parts, pipes and attachments.
2. Inspect the air duct from the air cleaner to the turbo charger for damage and loose attachment.
3. Clean the drain hole within the body air duct.



*Fig 35. Drain hole, hole duct*

f Inspect the exhaust manifold.

- Inspect the exhaust manifold for leakage, loose attachment and damaged heat insulation.

---

**—WARNING!**

Do not touch exhaust manifold when is hot. Hot exhaust manifold can cause serious burns.

---

g Inspect and service the exhaust system as follows:

1. Inspect the exhaust system for leakage, loose attachment and damaged brackets.

---

**—WARNING!**

Carbon monoxide can be deadly. Exhaust gas leaks are dangerous to personnel.

---

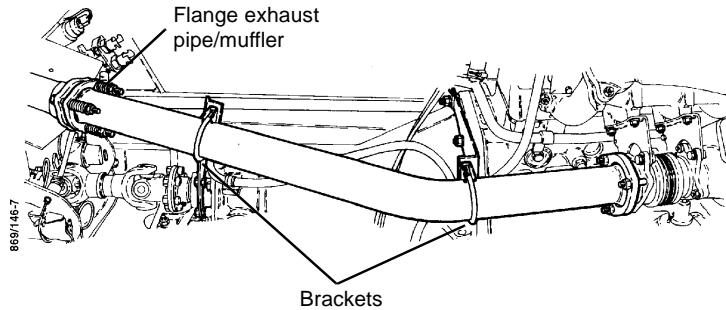
**—WARNING!**

Do not touch exhaust system when is hot. Hot exhaust system can cause serious burns.

2. Inspect the flange mount between the exhaust pipe and the muffler for leakage and attachment.

**NOTE!**

The free length of the springs, shall be 30 mm - 2 mm.



*Fig 36. Exhaust system*

h Inspect the transmission as follows:

1. Inspect the transmission for leakage.
2. Check that the transmission is securely mounted.
3. Check that the ventilation hose are intact.

4. Check that the transmission controls are correctly mounted.

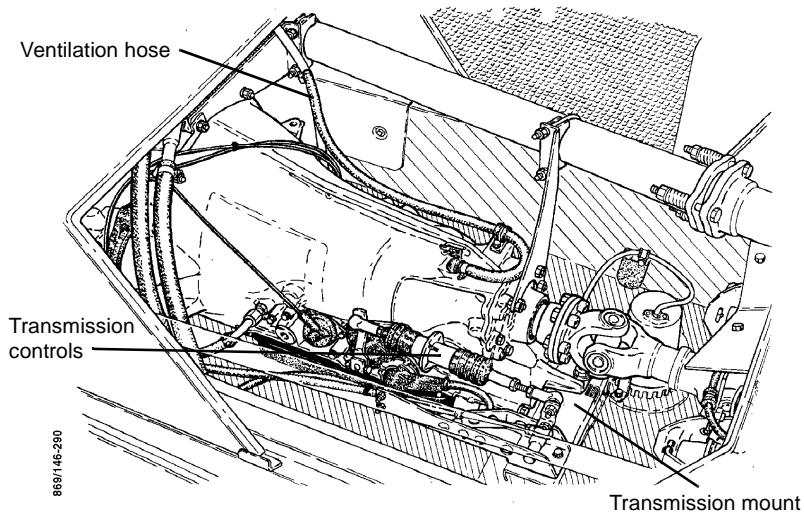


Fig 37. Transmission LH side

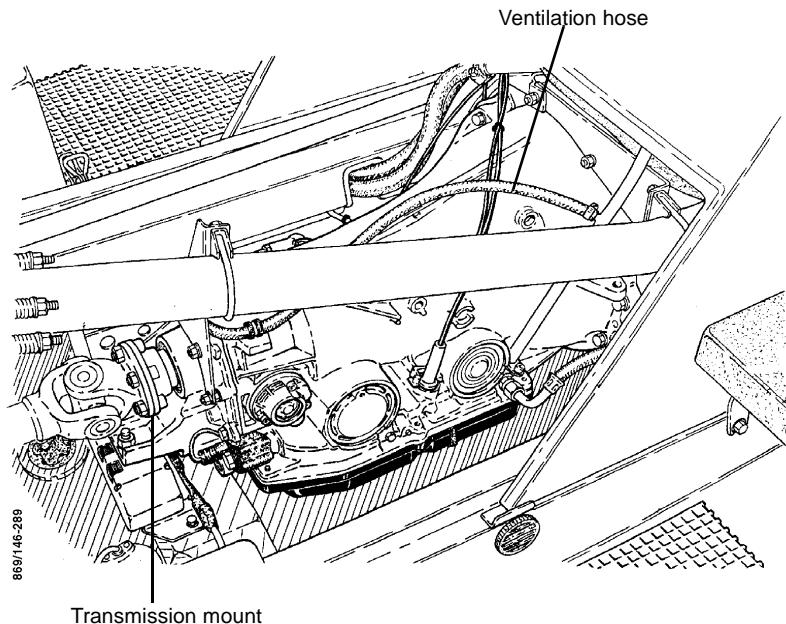
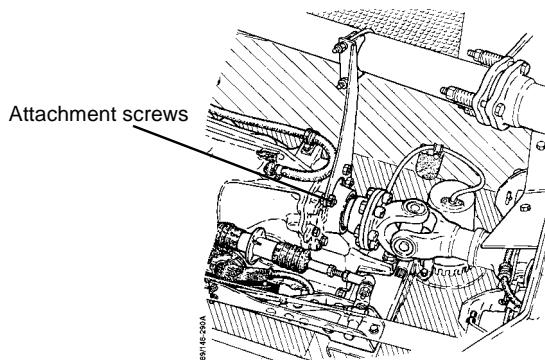


Fig 38. Transmission RH side

## i Inspect the drive shaft transmission - brake unit as follows:

1. Inspect the drive shaft for damage.
2. Inspect the drive shaft for loose attachments screws.
3. Inspect the drive shaft for play in universal joints.
4. Inspect conditions of the grease nipples.



*Fig 39. Drive shaft*

## j Check the brake callipers and pads as follows:

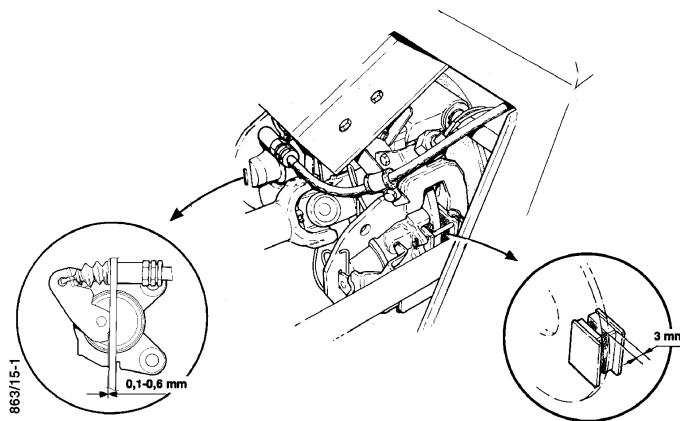
**WARNING!**

Damage on brake systems impairs driving safety and constitutes serious traffic hazard.

Notify your supervisor if any of these cases occurs.

1. Check that the brake pads are not excessively worn, at least 3 mm of friction material must remain.
2. Check that the brake disc has no damage.
3. Check that the brake disc and brake calipers are securely mounted.
4. Check that the parking brake cable moves easily.
5. Check that there is 0.1-0.6 mm clearance between the parking brake lever and the brake calliper carrier plate.
6. Check that the parking brake lever does not butt against the brake caliper carrier plate, when the parking brake is applied.

7. Check for leakage in brake lines and brake callipers.



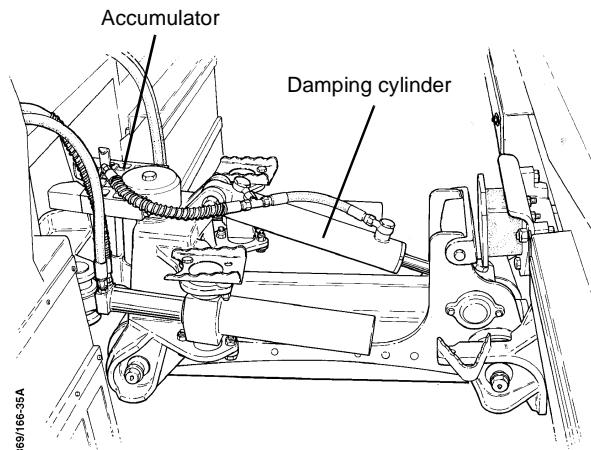
*Fig 40. Brake disc and callipers (with wear limit and parking brake adjustment)*

- k Inspect the engine bonnets and the inspection covers as follows:
  1. Inspect the engine bonnets and the inspection covers for damage.
  2. Inspect the seals on the engine bonnets and the inspection covers.
  3. Install the engine bonnets and the inspection covers.
  4. Make sure that the inspection covers fits properly when installed.
  5. Make sure that the engine bonnets fits properly when installed, adjust locking device if required.

## Outside and between cars

- a Inspect the auxiliary starting connector as follows:
  1. Inspect the socket for loose attachment.
  2. Inspect that the sealing and the threads in the cover are intact.
  3. Inspect that the electrical terminals are undamaged and clean.
  4. Tighten the cover.
- b Position the vehicle at even ground, inspect and service the damping cylinder as follows:

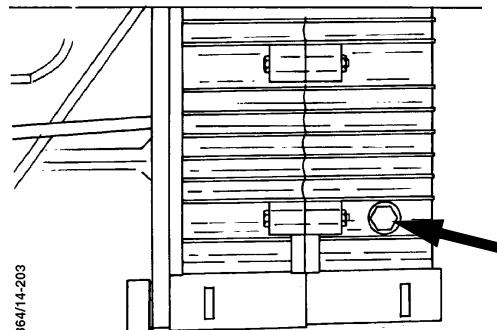
1. Inspect damping cylinder, accumulator and hose for leakage or damage. If no signs of leakage are found, check the pressure in the accumulator, the pressure shall be within 2-7 bar. If required, inflate the accumulator with compressed air to a pressure of seven (7) bar.
2. If signs of leakage are found, go on as follows:
  - check and tighten all hose and nipple connections
  - discharge the air in the accumulator
  - remove the air nipple and check the oil level in the accumulator by inserting a dipstick in the air nipple hole. Correct oil level shall be 70 mm.
  - install the air nipple and inflate the accumulator with compressed air to a pressure of seven (7) bar.
  - check for leakage. If any leakage still occurs, inform your supervisor.



*Fig 41. Damping cylinder and accumulator*

c Inspect and service the transfer gearbox as follows:

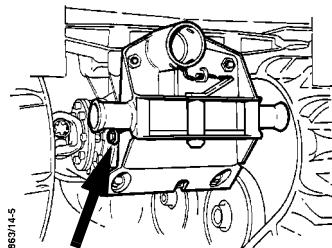
1. Clean and remove the fill plug, oil must appear level with bottom of the fill plug opening.
2. Check oil for water contamination, if water is found in the oil notify your supervisor. Add oil if necessary through filler plug opening until oil begins to overflow. Use oil according to the Lubrication Chart.
3. Clean and install plug.



*Fig 42. Fill and level plug, transfer gearbox*

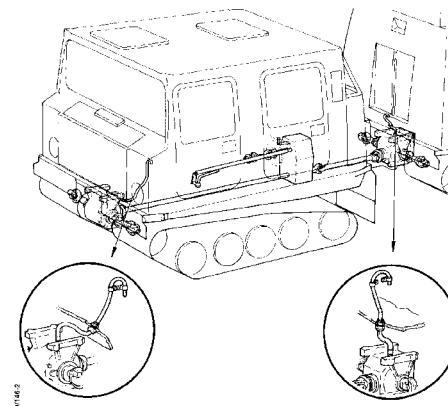
d Inspect and service the differentials as follows:

1. Clean and remove the fill plug, oil must appear level with bottom of the fill plug opening.
2. Check oil for water contamination, if water is found in the oil notify your supervisor. Add oil if necessary through filler plug opening until oil begins to overflow. Use oil according to the Lubrication Chart.
3. Clean and install plug.



*Fig 43. Fill and level plug, front differential*

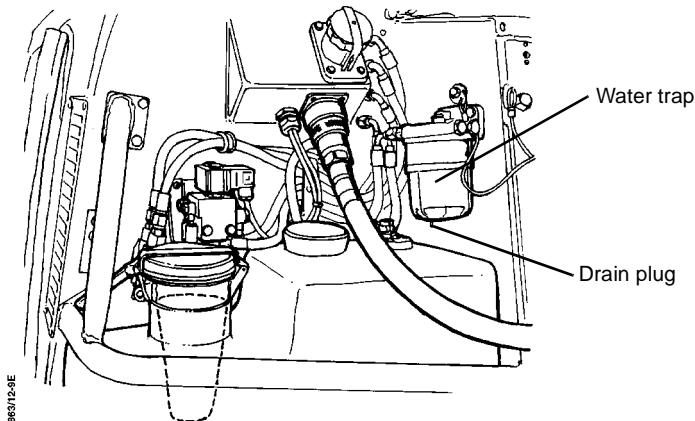
4. Inspect the ventilation hoses for damage and installation. Make sure that the ventilation hose is not clogged.



*Fig 44. Ventilation hoses, differentials*

e Inspect and service the fuel system as follows:

1. Check the water trap for leakage and loose attachment.
2. Check that the fuel hoses are undamaged and no loose fittings.
3. Open the drain plug on the water trap, drain accumulated water.
4. Close the drain plug on the water trap.



*Fig 45. Water trap*

- f Inspect the body attachments as follows:  
a Inspect that the body attachments are intact and securely mounted.

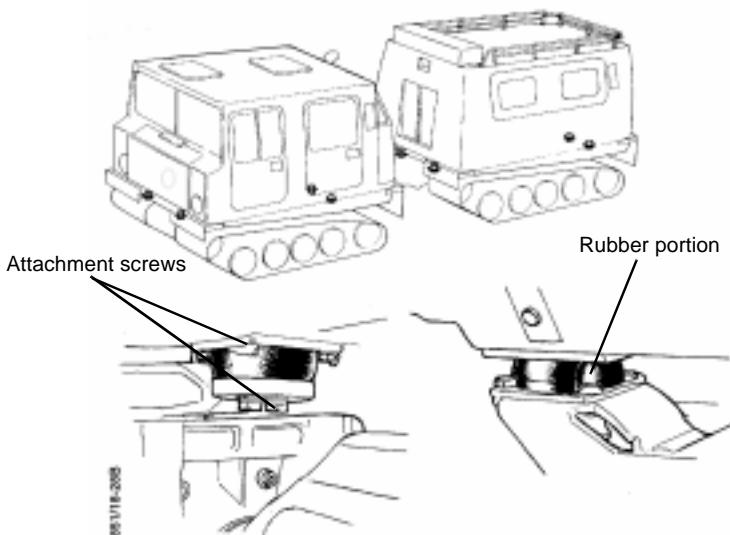


Fig 46. Body attachment

## Track assembly

- a After allowing the vehicle to coast to a stand still and with the vehicle on level ground, inspect and service the track assembly as follows:

### NOTE!

Inspection number 1 shall be performed with the vehicle unloaded.

1. Check that the measurement between the track girder and the track is more than 75 mm.

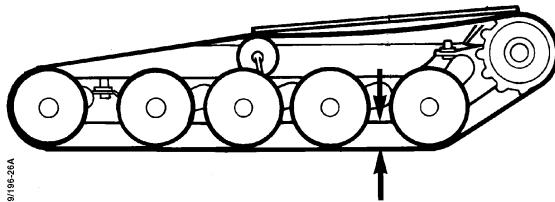


Fig 47. Distance between track girder and track

2. Inspect the tracks for wear cracks or tears.

The tracks shall be replaced when:

- more than three crossbars are broken.
- a crossbar section has come off completely.
- the rubber on five consecutive track grousers is peeled off to more than 95%. I.e. remaining rubber shall have a 5% height left, although exposure of bare metal in some areas is acceptable.

**NOTE!**

The tracks have to have such amount of rubber left that the ongoing or planned missions can be completed.

**NOTE!**

Cracks outside the roadwheel surface are permissible.

3. Inspect guide horn for attachment and damage.
4. Inspect the drive sprockets for attachment and damage.
5. Inspect road wheel, tension wheel and support wheel for damage and attachment.

The wheel shall be replaced when:

- the rim is broken and loose
- the rim is worn down to the structural material of the wheel
- the rim is thinner than 15 mm on the contact surface
- the structure of the wheel is broken.

Notify your supervisor if any of these cases occurs.

## **Electrical winch (OP)**

1. Check remote control operation.
2. Inspect remote control and power cable for damage.

## **Hydraulic winch (OP)**

1. Check that the connections for the winch has plastic plugs.
2. Check the function of the control panel with winch connected.

## **Extra hydraulic system (OP)**

1. Check that there are no leaks in the oil tank and that oil lines are intact and securely mounted.
2. Check that there are no leaks in the oil filter and that the filter is securely mounted.
3. Check the relief valve that there are no leaks and that the valve is securely mounted.
4. Check the valve block unit that there are no leaks and that the valve block unit is securely mounted
5. Check the hydraulic pump that there are no leaks and that the pump is securely mounted.
6. Check that the filter in the ventilating hose is clean, intact and securely mounted.

## **Operation check**

On equipment parked without any preservation action taken, perform the following actions;

- a Static functional test.
  1. Perform pre-mission checks and service.
  2. Start the engine and observe all instruments and;
    - Listen for unusual noises, hesitations and varying idle speed.
    - Be alert for vibration and smell of fuel, oil and exhaust.

- Check engine operation at all speeds.

b Mobile function test.

1. Take the vehicle on a short road test. Observe the following;

- Engine respond for accelerator feed.
- Transmission shifting response and smoothness.
- Vehicle steering respond.
- Vehicle brake system respond.
- Listen for abnormal noise from the track and suspension system.
- Observe the engine controls and the instrument for proper readings.

c Perform post-mission checks.

Check list daily maintenance. See section 5 for detailed instructions.

Pre-mission checks

Location	Action
Inside drivers station	Master switch "ON"
	Check drivers seat and seat belt function
	Rear mirrors adjustment
	Check brake fluid level
	Check ignition switch and light switch function
	Check horn,, windscreens wiper and washers function
	Check fuel level, tank selector switch operation/setting
	Check of instrument and warning light function

Engine compartment	Check for any fluid leakage Engine oil level Check drain plug availability Check bilge pump Check light function
Front of vehicle	Clean windscreen and undamaged windscreen wipers Remove and secure plastic cover Clean grille and radiator Check coolant level Check hydraulic oil level Check for any outside fluid leakage Check attachment of towing adapter, bumpers and splash aprons
RH side front car	Check fluid level windscreen washer reservoir Check cyclone cleaner air intake cleanliness Check hatches and door sealing Check light function
RH side, between cars	Check for any outside fluid leakage Check rubber bellow between brake unit and body
RH side, rear car	Check fuel tank filler cap and ventilation Check light function Check storage of load
Rear and inside rear car	Check door sealing and safety chain Check bilge pump function and attachment Check drain plug availability Check side hatch and rear door Check function of light, intercom and ventilation fans Check trailer coupling, footstep and splash aprons Check storage of load
LH side, rear car	Check light function

**Pre-mission checks****Location**

LH side, between cars

**Action**

Check for any outside fluid leakage

Check fuel tank filler cap and ventilation

Check fuel can attachment

Remove and secure plastic cover

Check and if required clean engine oil cooler

LH side, front cars

Check light function

Check storage of load

Check door sealing

Track assemblies	Check track tension Check road wheels Check support wheels Check track tension devices with tension wheels Check drive sprockets Drive slowly forward and test brake function
Brake function	
Checks during operation	
Location	Action
Instrument panel	Check instrument and warning system
Driving checks	Observe track system for damage and unusual noises
Post-mission checks	
Location	Action
Outside vehicle	Clean and wash the vehicle Check coolant and steering system fluid levels Top up fuel if required Clean and stow used accessories Clean and check steering unit for damage If required, perform touch up painting Install plastic covers

Track assemblies	Inspect for damages on track, road wheels, tension wheels, support wheel and drive sprockets
Inside front car	Check air cleaner
	Clean and stove used accessories
Engine compartment	Master switch "OFF"
	Check for leakage
Inside rear car	Remove drain plug
Miscellaneous	Remove drain plug
	Perform required lubrication and oil changes

#### Fuel refilling check list

See chapter 5 for detailed instructions

Location	Action
Drivers station	Stop engineSelect RH fuel tank
Engine compartment	Check windscreen washer reservoir
Front of vehicle	Check engine oil level
	Check coolant level
Outside	Check hydraulic oil level
	Refill fuel tank
	Refill fuel cans

## 5.2 Unscheduled maintenance

### SERVICES

#### Air filter cleaning

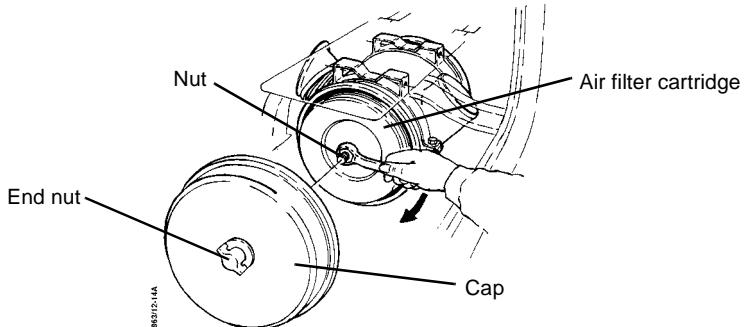
To be performed whenever the red signal occurs at the filter indicator.

The filter cartridge may be cleaned as many as five times. It must be replaced

by a new one at least every second year.

There are two possible techniques for cleaning the cartridge;

- By blowing it clean with dry, compressed air. Blow the cartridge from the clean air side. Air pressure should not exceed 5 bar to avoid rupturing of the cartridge, do not concentrate the air pressure in one spot.
- By tapping (only in emergency case). Use this technique only as a last resort, because the cartridge can be damaged if improperly tapped. Moreover tapping does not clean it properly. Never tap hard objects against the cartridge or the cartridge against hard surfaces. Only tap the palm of your hand against the cartridge end disc.



*Fig 48. Air filter cartridge replacement*

1. Remove the air filter assembly cap.
2. Remove the nut holding the air filter cartridge.
3. Remove the air filter cartridge.
4. Clean the air filter assembly inside with a wet cloth.
5. Make a mark on the label on the safety filter cartridge.
6. Reinstall a new or a cleaned air filter cartridge.
7. Reinstall the nut holding the air filter cartridge.
8. Reinstall the air filter assembly cap.
9. Reset the air filter service indicator.

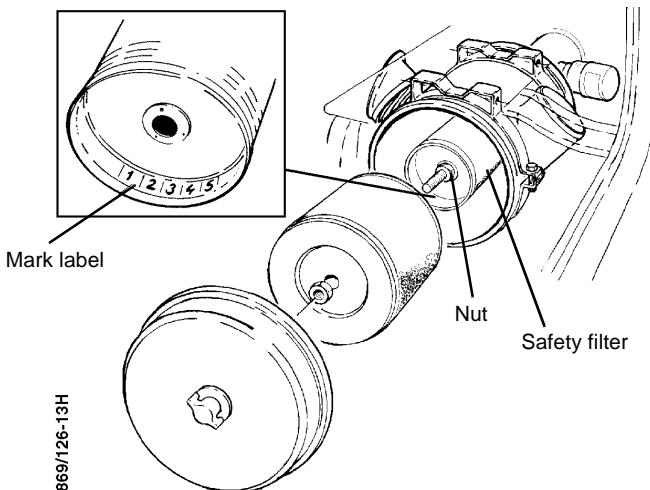
## AIR FILTER INSPECTION

Before installation of the air filter cartridge, check it over for damage on paper folds or rubber seals, dents or signs of crushing on the casing. Hold the air filter cartridge up to the light at an angle or insert a fluorescent hand light to detect any tears or holes in its paper folds. Never use a damage air filter cartridge. In

doubt throw the cartridge away and install a new one.

## SAFETY FILTER CARTRIDGE

While the air filter cartridge is being serviced, the safety filter cartridge must remain in the filter casing.



*Fig 49. safety filter cartridge*

### CAUTION!

Do not operate the engine without the air filter cartridge fitted. Do not clean safety cartridges or re-use them.

The safety filter cartridges must be replaced:

- after the air filter cartridge has been serviced five times. Make a mark on the label provided on the safety filter cartridge each time you perform a servicing operation (replacement or cleaning on air filter).
- at least every second year.
- whenever the service indicator comes right on again although the air filter has been serviced.
- if the air filter cartridge has proved to be defective.

### Safety filter cartridge replace

1. Remove the air filter assembly cap and the air filter cartridge to gain access to safety filter cartridge.
2. Clean the air filter assembly inside with a wet cloth.
3. Open the nut and pull the safety filter cartridge straight out and throw it away.

#### **NOTE!**

Be very careful when taking out the safety filter cartridge so that dust or dirt from the cartridge do not enter the air intake system.

4. Reinstall a new safety filter cartridge and tighten the nut.
5. Install the air filter cartridge and the air filter assembly cap.
6. Reset the air filter service indicator.

## **Compass (OP)**

### CHECK OF THE DEVIATION

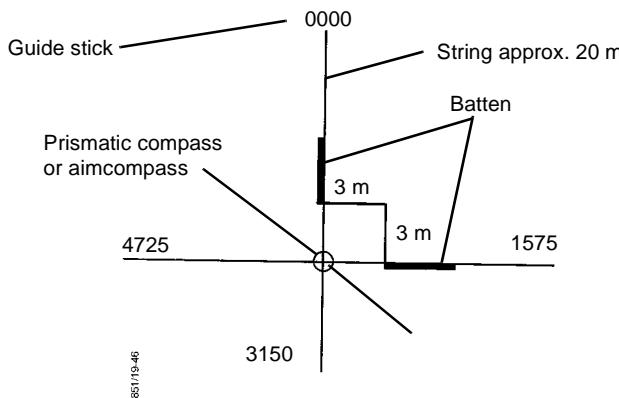
Check with help of a prismatic compass or aimcompass or a rigid training equipment in four directions if there is a risk of a deviation. Compensate if the deviation is estimated more than  $25^\circ$ . The place for compensating must be less than  $2^\circ$  and free from electromagnetic and magnetical disturbances within a radius of 20 m e.g. electrical wires and vehicles. Suitable put the place in order as a rigid training device at which the battens will be replaced by painted lines.

## FACILITIES

1. Prismatic compass or aimcompass
2. Guide stick
3. String approx. 25 m
4. Battens 2 pcs

## PLACE FOR COMPENSATING

1. Place the prismatic compass above the center of the compensating place and mark the ground below the weight.
2. Align the prismatic compass to the north or sight with a aimcompass above the central point.
3. Place a man with a guide stick approxemately 20 m nort of the central point. Direct the stick so the lowest point congruent with north direction of the instrument. Knock down the stick in the ground and strain a string between the guide stick and the central point.
4. Place a 2,5 m batten from the central point parallel with the string and anchor the batton securely.
5. Direct the prismatic compass in a side angle of 1575 and lay a batten similiary in the east-west direction see point 2-4. Make sure that all kinds of objects not can affect the prismatic compass or aimcompass.



*Fig 50. Place for compensating*

## PERFORMING OF COMPENSATION

The engine must run all the time , the sun visors must be hinged up, the wind screen wipers must be off and the lights must be on.

1. Check that the angle between the fixed shell of the compass upper edge and ceiling is  $30^\circ$  , see fig 51. If not, untie the screws on the side, turn the compass to the correct direction and tie the screws.

2. Drive up the car to the north parallel with the batten, the distance from the batten and the track would be approximately 5 m. The N-S screw of the compensator, fig.3.79, will be turned with help by a non-magnetic screw driver so the compass shows 0000. Tap the compass with the fingers before reading. The screw drive is in a plastic bag beside the compass.
3. Direct the car similarly to the east and turn the E-W screw of the compensator so the compass shows 1575.
4. Direct the car to the south. If the compass does not show 3150 turn N-S screw until the error is reduced half as much.

Example:

Compass reading 3200

Error  $3200 - 3150 = 50$

New compensator setting  $3200 - (50/2) = 3175$

5. Direct the car to the west. If the compass does not 4725, turn E-W screw until the error is reduced half as much.
6. Direct the car to the north as point 1 and to the east as point 3 for checking. If the error is more than 25 new adjustments and further checks must be done.
7. Date and sign the label of the compensator and cover the screw hole of the compensator with the label. The label is in a plastic bag beside the compass.

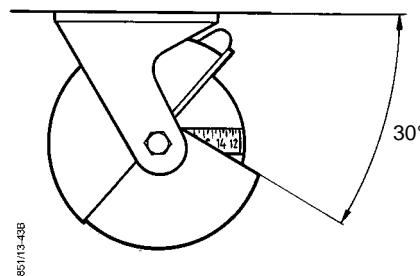


Fig 51. Angle between the compass and the ceiling

## REPAIRS

### Replacing fuses

1. Ensure that the ignition switch is in the "0" position.
2. Open the electrical panel cover.

3. Using the fuse location chart on the cover, locate the blown fuse.
4. Remove the blown fuse.

**NOTE!**

Ensure that the replacement fuse is of the correct rating.

5. Install the new fuse.
6. Check the operation of the electrical circuit for the particular fuse.
7. Should the fuse immediately blow again, or the component does not operate, report the problem.

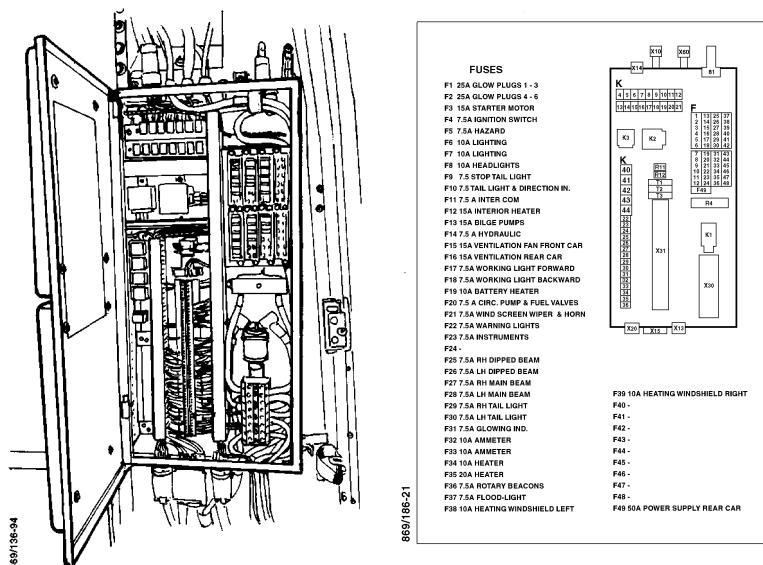
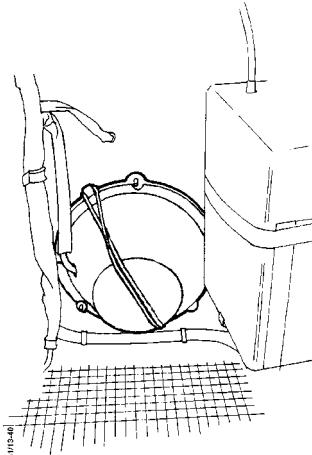


Fig 52. Fuses

## Replacing the headlight bulb

1. Release the elastic cord from the headlight rear housing cover hook, inside the vehicle.

2. Remove the headlight rear housing cover.



*Fig 53. Headlight rear housing cover*

3. Remove the electrical connector and the rubber cap.
4. Release the spring clamp.
5. Remove the bulb.

**NOTE!**

Do not touch the glass bulb with bare fingers. Ensure that the lamp guides enter into the slots, when installing a new lamp.

6. Position a new bulb into the holder in the headlight housing.
7. Replace the spring clamp.
8. Install the rubber cap.
9. Connect the electrical connector to the headlight.
10. Check the operation of the headlight.
11. Install the outer headlight housing cover and replace the elastic cord.

## Replacing the working light bulb

1. Remove the lens screws and plastic lens.

2. Remove the bulb and install a new.
3. Check the operation of the bulb and install the lens.
4. Replace the screws.

## **Replacing the parking light bulb**

1. Release the elastic cord from the headlight rear housing cover hook, inside the vehicle.
2. Remove the headlight rear housing cover.
3. Remove the parking light assembly.
4. Remove the bulb from the socket.
5. Position a new bulb into the socket.
6. Check the operation of the bulb.
7. Install the parking light assembly.
8. Install the headlight rear housing cover and replace the elastic cord.

## **Replacing front, side direction and cabin bulb**

1. Remove the lens screws and plastic lens.
2. Remove the bulb and install a new.
3. Check the operation of the bulb and install the lens.
4. Replace the screws.

## **Replacing rear direction, tail and reverse lights lamp**

1. Remove the plastic lens.
2. Remove the bulb and install a new.
3. Check the operation of the bulb and install the lens.

## Replacing the map reading light

1. Remove the cover.
2. Remove the bulb and install a new.
3. Replace the cover.
4. Check the operation of the bulb.

## Replacing the gear selector light

1. Remove the gear selector cover screws.
2. Lift and turn the cover.
3. Remove the bulb and install a new.
4. Check the operation of the bulb.
5. Turn the cover and install the screws.

## Replacing the rear blackout light

1. Remove the plastic lens.
2. Remove the blackout lens.
3. Remove the bulb and install a new.
4. Check the operation of the bulb and install the blackout lens.
5. Install the plastic lens.

## Replacing the front blackout light

1. Remove the cover screws and the cover.
2. Remove the bulb and install a new.
3. Check the operation of the bulb.
4. Install the cover and install the screws.

## Replacing the parking brake indicator switch

1. Ensure that the vehicle is on level ground and release the parking brake.
2. Disconnect the cables and remove the switch.
3. Install a new switch and connect the cables.
4. Check the operation of the switch.

## Replacing the rear blackout brake and licence plate lights

1. Remove the lens cover.
2. Remove the bulb and install a new.
3. Check the operation of the bulb and install the lens cover.

## Replacing the batteries

1. Switch off the master switch.
2. Unlock the latch mechanism and remove the battery cover and note the position in which the batteries are mounted.
3. Disconnect the battery negative (-) cable.
4. Disconnect the battery positive (+) cable.
5. Disconnect the cable, connecting the two batteries together, the positive (+) end first.
6. Disconnect the thermostat for the battery heater (OP), see fig. 3.16.
7. Disconnect the ventilation tube from the batteries and remove the battery hold down clamps.
8. Remove the batteries.

---

**WARNING!**

Do not smoke or have any open flame in the vicinity of the batteries when changing the batteries. Wear rubber gloves, aprons and goggles.

---

9. Set the batteries in place and install the battery hold down clamps and secure the batteries.
10. Connect the ventilation tubes to the batteries.
11. Connect the positive (+) cable to the battery.
12. Connect the cable, connecting the two batteries together, the positive (+) end first.
13. Connect the negative (-) cable to the battery.
14. Connect the thermostat for the battery heater (OP) see chapter 3 fig 16.
15. Lubricate the battery terminals and switch on the master switch. Check the operation of the battery.

16. Install the battery cover.

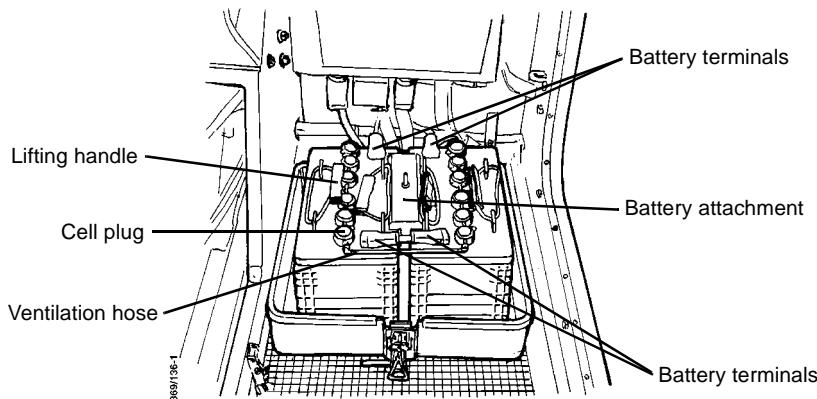


Fig 54. Batteries

## Changing track

To change the track, lift the car using either two lifting jacks or one lifting jack and a suitable support for the car.

---

### **WARNING!**

Ensure that personnel never work underneath the vehicle, when the vehicle is not properly supported.

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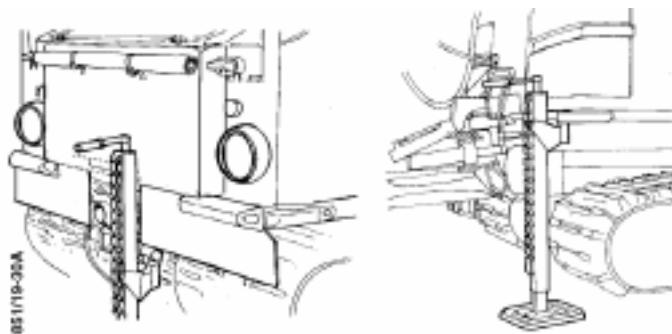
The front car is lifted at the towing adapter and the end of the rear bumper on that side of the car, where the track is to be replaced.

#### **NOTE!**

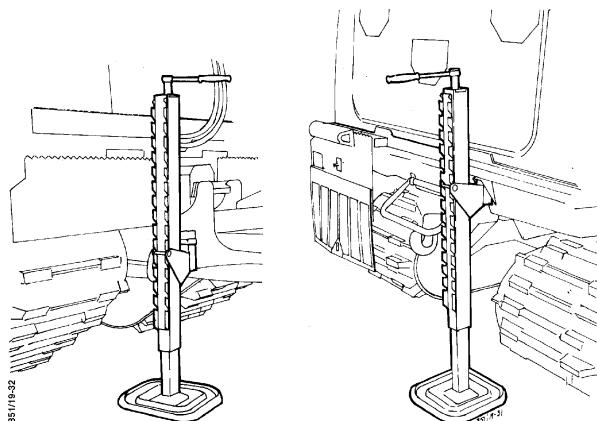
When the lifting jack is to be attached to the towing adapter the middle part of the branch fender must be removed. (OP)

The rear car is lifted at the steering unit jacking support and at the end of the rear bumper on that side of the car, where the track is to be replaced.

The splash aprons must be removed when lifting the car at the front or rear bumper

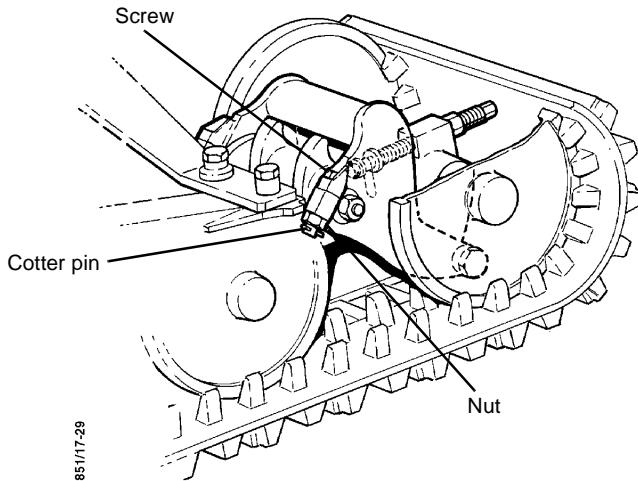


*Fig 55. Lifting front car*



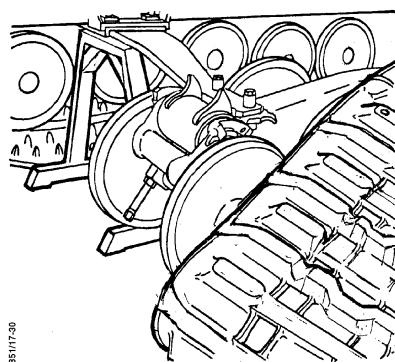
*Fig 56. Lifting rear car*

1. Remove the cotter pin, nut and screw that hold the tension mechanism in a raised position.



*Fig 57. Track tension mechanism*

2. Lift and support the vehicle so that the track passes freely under the road wheels and tension wheels.
3. Remove the track by lifting it free of the tension wheels first and then at the drive sprocket.

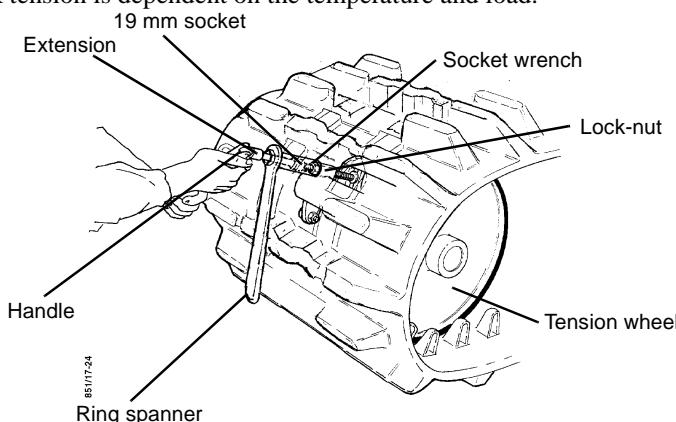


*Fig 58. Track removed*

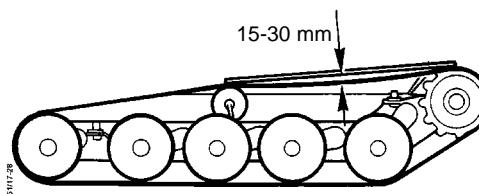
4. Loosen the lock nut on the track tension screw and release the track tension completely.
5. Re-install the track ensuring that the arrows on the track outside edges indicate are pointing in the running direction of the track. The track should be installed by fitting the track at the drive sprockets first and then at the tension wheels.
6. Support the track, under the tension wheels so that the tension wheels are raised to their working position, when the vehicle is lowered. Lower the vehicle.
7. Install the bolt, nut and cotter pin, which hold the tension mechanism in its working position and tighten to a torque of 200 Nm.
8. Drive the vehicle and allow the vehicle to coast to a stand still on even ground. Check that the track tension between the drive sprocket and the supporting wheel is 15 to 30 mm. Adjust the track tension to 15 mm without payload if required.

#### **NOTE!**

Track tension is dependent on the temperature and load.



*Fig 59. Adjusting track tension*



*Fig 60. Checking track tension*

## Replace winch cable (OP)

To remove winch cable, see fig 61 and proceed as follows:

---

**WARNING!**

Always wear heavy gloves when handling winch cables. Never let cables run through hands; frayed cables can cut.

---

1. Pull cable until it is completely extended.
2. Remove screws in winch cable fastener. Remove cable fastener.
3. Position new cable and fastener on winch.
4. Wind winch cable onto winch drum.

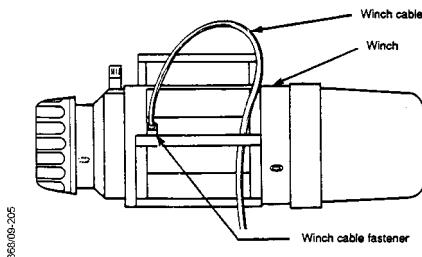


Fig 61. Winch and cable

**NOTE!**

The winch cable must not be paid out from the side of the winch cable ring, because this may result in a kink. Instead the winch cable ring must be rolled along the ground so as to wind off the winch cable. The winch cable must be under wound. The winch cable used must be of good quality and must have a steel core. When the winch cable is wound on it should have a preload of about 500 Nm so that it winds up properly on the drum.

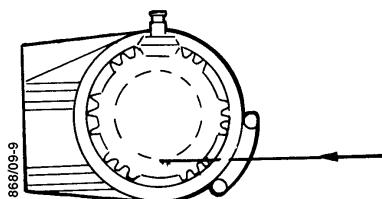


Fig 62. Under wound winch cable

## 5.3 Troubleshooting

### ENGINE FAILS TO CRANK OR CRANKS SLOWLY

1. Ensure that the transmission control level is in the “N” position (neutral).
2. Inspect that the master switch is in on position and inspect the battery cables and clamps for dirt, corrosion, looseness or damage. Clean and tighten the connections as necessary. Replace any defective battery cables.
3. Slave start with auxiliary starting cables from another vehicle if possible.
4. Check the electrolyte level in the batteries and fill the batteries with distilled water to proper level if necessary.
5. If the defects cannot be rectified, notify the supervisor.

### ENGINE CRANKS BUT FAILS TO START

1. Check that the fuel tanks are provided with fuel.
2. Check that the tank shut off valve is opened.
3. Check that the fuel water separator is free from water, drain if necessary.
4. Check the fuel system for any sign of leakage. Tighten any loose connections and replace any damage fuel lines.
5. If the defects cannot be rectified, notify the supervisor

### ENGINE STARTS BUT DOES NOT RUNSMOOTHLY OR MISFIRES

1. Check the fuel lines for any sign of leakage. Tighten any loose connections and replace any damaged fuel lines.
2. Check that the tank shut off valve is fully opened.
3. Check that the fuel water separator is free from water, drain if necessary.
4. Check that the engine idle speed is between 875 to 925 rpm.
5. If the defects cannot be rectified, notify the supervisor.

## ENGINE DOES NOT DEVELOP FULL POWER

1. Check if the service indicator shows if the air filter has to be serviced. Clean or replace if necessary.
2. Check that the tank shut off valve is fully opened.
3. Check that the fuel water separator is free from water, drain if necessary.
4. Check the fuel system for any sign of leakage. Tighten any loose connections and replace any damaged fuel lines.
5. Check that all hoses and connections are attached on the injection pump. Replace if necessary.
6. Check the accelerator linkage and adjust if necessary.
7. If the defects cannot be rectified, notify the supervisor.

## ENGINE CONSUMES TO MUCH OIL

1. Check that the engine oil level is within limits. If the engine oil level is too high, remove engine oil to the correct level.
2. Check the engine for any sign of oil leakage.
3. If the defects cannot be rectified, notify the supervisor.

## ENGINE LOW OIL PRESSURE

1. Check the engine oil level. Add engine oil if necessary.
2. Check that the engine oil pressure sensor electrical connections are clean and tight.
3. Check that the engine oil pressure sensor is free from oil leakage. Replace if necessary.
4. Ensure that the oil pressure gauge is functioning correctly. Replace if necessary.
5. If the defects cannot be rectified, notify the supervisor.

## ENGINE OVERHEATS

1. Check that the plastic grill cover is in place and that it is free from any debris.
2. Check the engine coolant level. Add coolant if necessary.
3. Check the cooling system for any sign of leakage. Tighten any loose connections and replace any leaking components.
4. Check the radiator for debris, which has become lodged in the cooling fins. Clean if necessary.
5. Check that the fan drive belt is free from damage and is tight. Replace or tighten if necessary.
6. Check the coolant reservoir cap for any sign of damage and replace if necessary.
7. Check the engine oil level. Adjust if necessary.
8. If the defects cannot be rectified, notify the supervisor.

## ENGINE SMOKES EXCESSIVELY

1. Check if the service indicator shows if the air filter has to be serviced. Clean or replace if necessary.
2. Check the turbo charger for any sign of damage or leaks.
3. If the defects cannot be rectified, notify the supervisor.

## CHARGING LIGHT ILLUMINATES WHILE ENGINE IS RUNNING

1. Check that the alternator belt is intact. Replace if necessary.
2. If the defects cannot be rectified, notify the supervisor.

## TRANSMISSION INDICATOR LIGHT ILLUMINATES WHILE DRIVING

1. Check the transmission oil level. Correct the oil level if necessary.
2. Allow the engine to run at idle speed for between 3 to 5 minutes. If the light does not go off, notify the supervisor.

## **TRANSMISSION IS IN GEAR, VEHICLE WILL NOT MOVE**

1. Check that the transfer gearbox selection lever is in the high or low gear. If necessary stop the engine and shift into high or low gear.
2. Check that the parking brake is in the “OFF” position.
3. Check that the gear selector lever is in the “DRIVE” position.
4. If the defect cannot be rectified, notify the supervisor.

## **DIFFICULT TO STEER THE VEHICLE**

1. Check the hydraulic steering oil level. Add if necessary.
2. Check the hydraulic pump shaft for any sign of damage.
3. Check the steering unit for any obstruction.
4. If the defect cannot be rectified, notify the supervisor.

## **ELECTRIC WINCH DOES NOT OPERATE (OP)**

1. Check power cable; Connect power cable securely.
2. Check remote control cable; Connect remote control cable securely.

## **ELECTRIC WINCH STOPS DURING WINCHING OPERATION (OP)**

1. Check load; Allow winch to cool; Reduce load.



# 6 LUBRICATION

Lubrication is an important aspect of maintenance. Use only the recommended lubricants defined in the Lubrication Chart and observe the lubricating intervals specified in the Lubrication Chart.

Always clean the grease nipples and the area around the oil filler openings in order to avoid introducing dirt and impurities into the lubricant.

Replace any damaged nipples and plugs. Oil changes should be undertaken, when the engine is hot as the oil will drain off more easily.

To perform oil checks and oil changes, the vehicle should be standing on level ground. Also see the "Running in" instructions.

## 6.1 Lubrication tasks

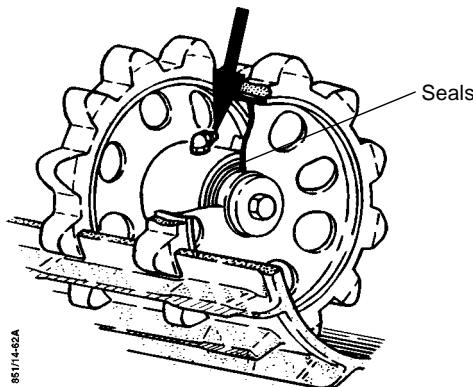
### NOTE!

Item number refers to Lubrication Chart.

### EVERY 500 KM INTERVAL OR AFTER SWIMMING

#### DRIVE SPROCKET BEARINGS (9)

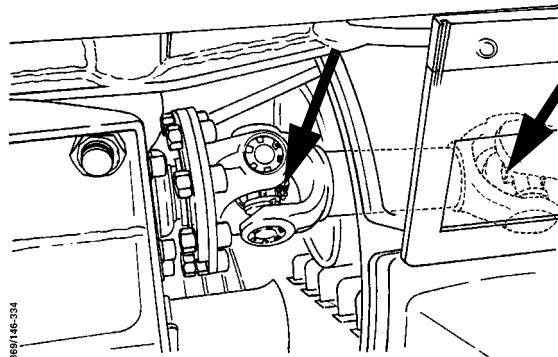
Grease each of the four nipples of the sprocket bearings (one for each bearing), until grease comes out around the seals. Use grease according to the Lubrication Chart.



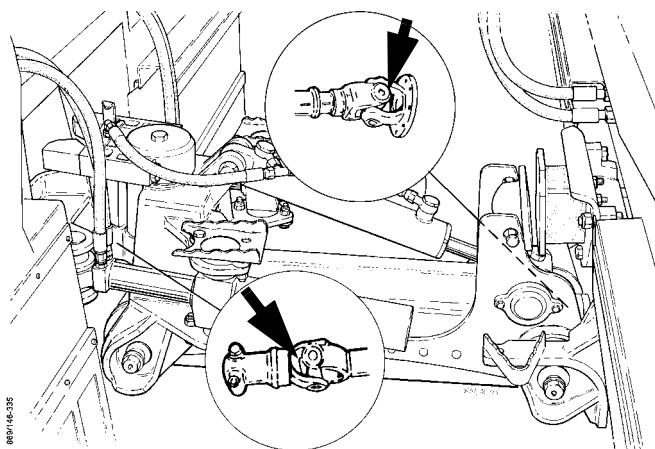
*Fig 1. Drive sprocket bearing*

## UNIVERSAL JOINTS (9)

Grease the ten grease nipples on the four drive shafts (two per shaft) and the steering unit drive shaft (two grease nipples), until grease comes out through the bearing cups, rotate the drive shaft if necessary. Use grease according to the Lubrication Chart.



*Fig 2. Universal joints, drive shafts*

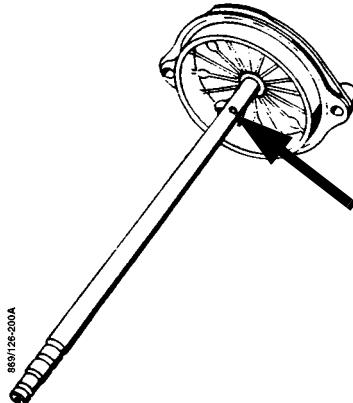


*Fig 3. Universal joints, steering shaft*

## EVERY 2500 KM INTERVAL OR EVERY YEAR

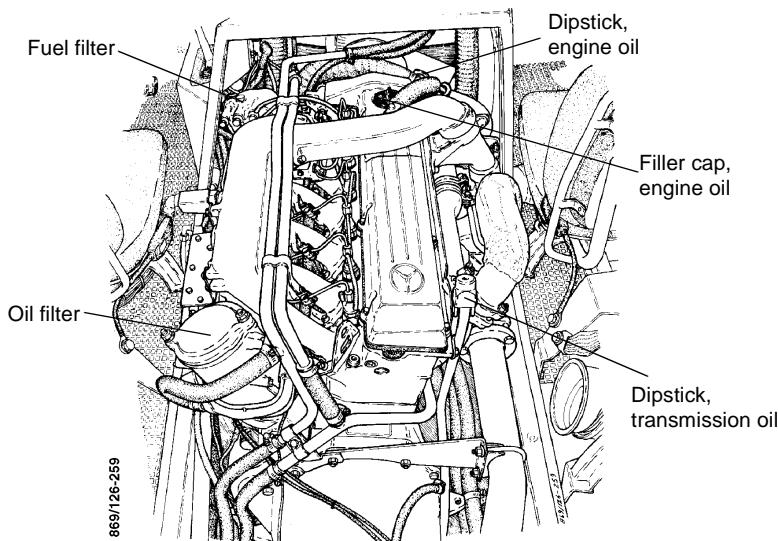
### ENGINE - CHANGE OIL AND REPLACE OIL FILTER CARTRIDGE (10)

1. Start the engine and check for any sign of leakage.
2. Operate the engine until both the oil cooler and hoses are warm.
3. Park the vehicle on even ground and shut off the engine.
4. Clean the filter housing, cover and surrounding area.
5. Remove the cover and let the oil drain into the oil sump. Remove O-ring and oil filter cartridge.
6. Clean the inside of the housing and the cover. During oil change, check throttle bore on oil pipe for foreign bodies (arrow). If the bore is closed, remove foreign body manually. Then blow with compressed air into throttle bore, the air should noticeably come out at oil pipe below. If the throttle bore is not cleared or if no air is coming out, renew oil filter cap with oil pipe.

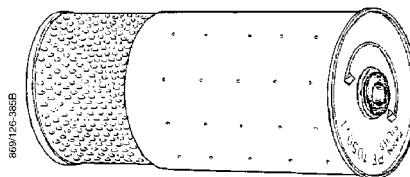


*Fig 4. Throttle bore*

7. Remove the engine oil dipstick and insert the suction hose into the engine dipstick tube.
8. Remove the oil using suction pump 353 7715-801.



*Fig 5. Oil dipstick and filler cap*



*Fig 6. Oil filter cartridge*

9. Remove the suction pump and install a new oil filter cartridge complete with a new O-ring and install the cover.
10. Remove the engine oil filler cap and fill the engine with oil until the level reaches the crosshatched area of the dipstick and then add another 0.5 litre of oil. Use oil according to Lubrication Chart.
11. Install the cap.

12. Press the "STOP" tab of the emergency shutdown lever and turn the engine over using the starter motor, until the oil pressure warning light is switched off.

**CAUTION!**

Do not hold the starter switch in the starter position for more than 30 seconds, or damage to the starter motor may occur.

13. Start the engine and check for any sign of leakage.
14. Operate the engine until both the oil cooler and hoses are warm.
15. Stop the engine and wait for 1 to 3 minutes.
16. Check that the oil level is between **MAX** and **MIN** marks on the dipstick.  
Add 0.5 litre of oil if the level is in the crosshatched area of the dipstick.  
Use oil according to Lubrication Chart.

**CAUTION!**

Do not over fill the engine. Damage to the engine may occur.

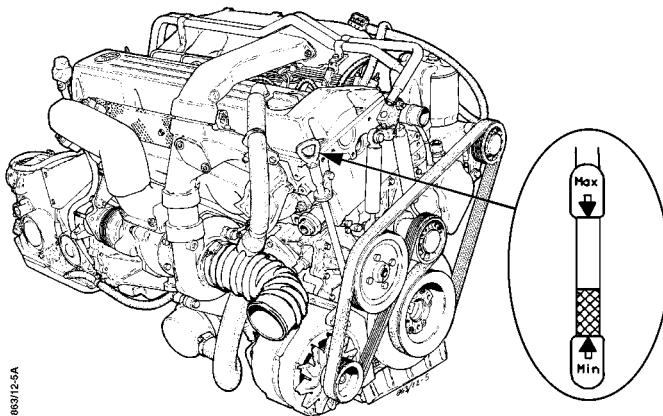
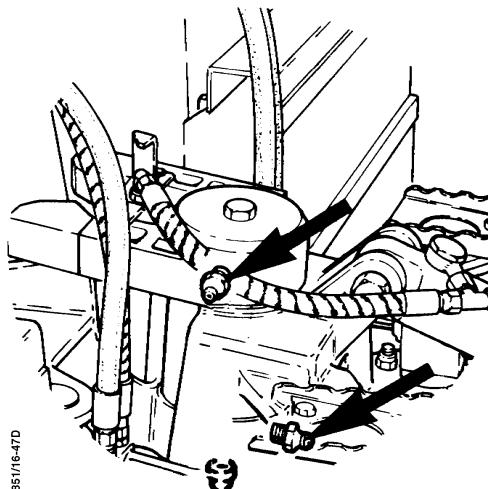


Fig 7. Oil dip stick

## STEERING PIVOT (11)

- Grease the upper nipple until grease comes out from the nipple in the bottom of the steering pivot.

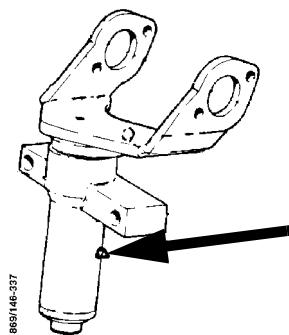
- Grease the lower nipple until grease comes out from the nipple in the bottom of the steering pivot. Use grease according to the Lubrication Chart.



*Fig 8. Steering pivot*

## BEARING HOUSING (11) (OP)

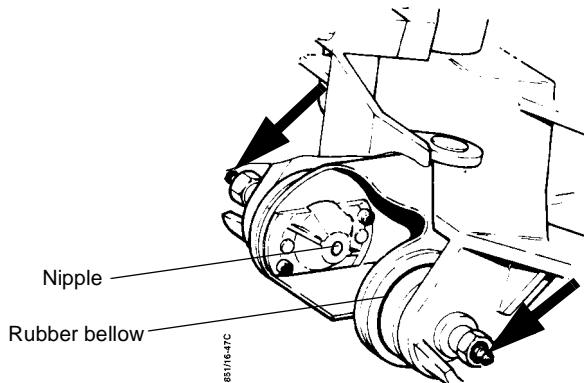
Grease the nipple until grease comes out from the V-type seal. Use grease according to the Lubrication Chart.



*Fig 9. Bearing housing*

## TILT BEARING (11)

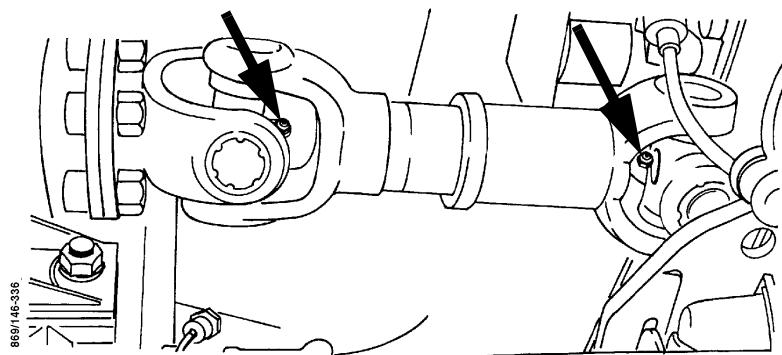
Grease each of the four nipples, until grease comes out from the nipple on the inside of the tilt bearing. Use grease according to the Lubrication Chart.



*Fig 10. Tilt bearing*

## UNIVERSAL JOINTS, DRIVE SHAFT AUTOMATIC TRANSMISSION - BRAKE UNIT (11)

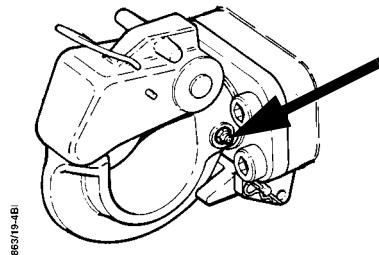
Grease the two nipples of the joints on the shaft between the automatic transmission and the brake unit. Rotate the drive shaft if necessary. Use grease according to the Lubrication Chart.



*Fig 11. Universal joints*

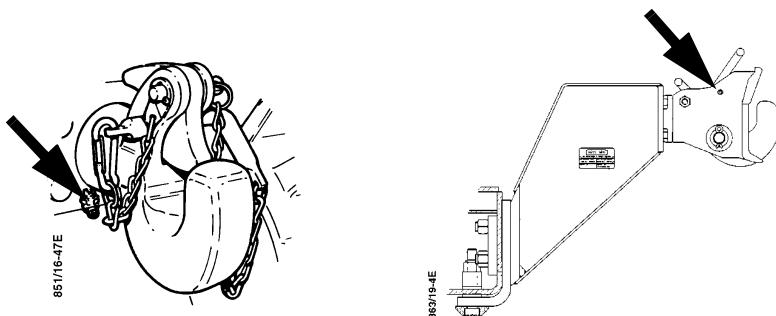
## TRAILER COUPLING (12)

Grease the nipple, until grease comes out. Use grease according to the Lubrication Chart.



*Fig 12. Trailer coupling*

## TRAILER COUPLING (OP) (12)



*Fig 13. Trailer coupling,*

## JOINTS, LINKS, HINGES, LOCKS ETC. (13)

Using engine oil lubricate the following points:

- Windscreen wiper shafts
- Seat adjustment rails
- Accelerator pedal and linkage

- Door hinges and locks
- Mirror arms
- Any accessories
- Trailer coupling

Use oil according to the Lubrication Chart.

## ELECTRICAL WINCH (OP)

### Check the oil level:

1. Place winch into winch mount. Remove fill-drain plugg. Oil must appear level with bottom of fill-drain plug opening. Fill with fluid as through fill-drain plug openings until oil begins to overflow. Clean and install plugs.
2. Lubricate drumlock. Use oil can.

Use oil Gulf Super G5W/20.

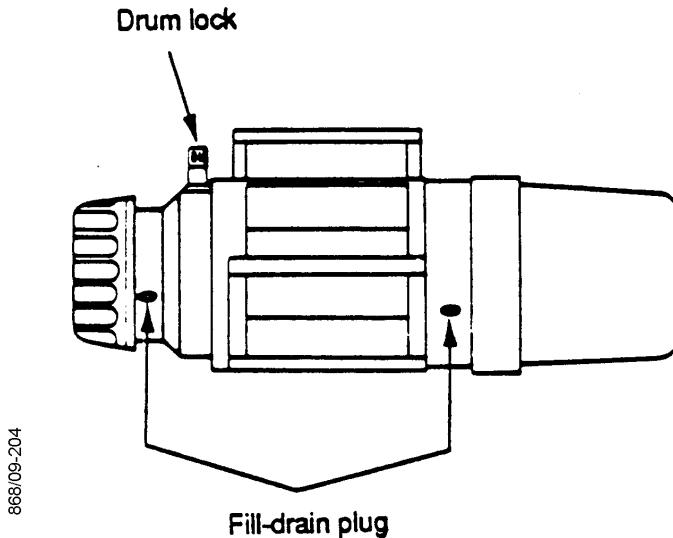


Fig 14. Lubrication points

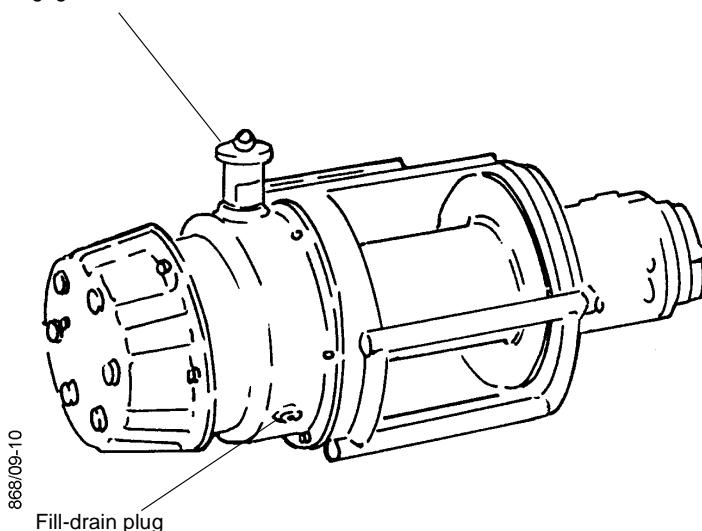
## HYDRAULIC WINCH (OP)

### Check the oil level:

1. Place winch into winch mount. Remove fill-drain plug. Oil must appear level with bottom of fill-drain plug opening. Fill with fluid as through fill-drain plug openings until oil begins to overflow, gear house holds 0,5 litres. Clean and install plugs.
2. Lubricate disengagement device. Use oil can.

Use oil Gulf Super G5W/20.

Disengagement device

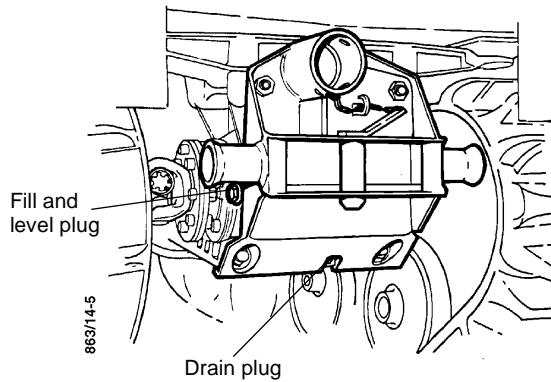


*Fig 15. Lubrication points*

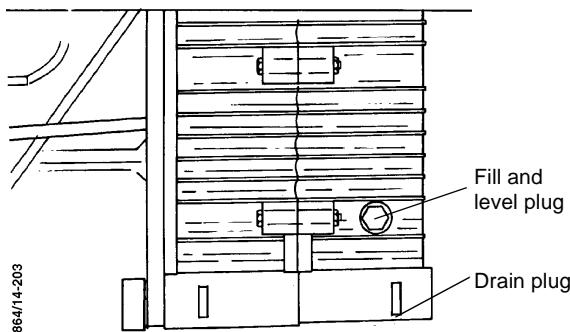
## EVERY 10 000 KM OR EVERY TWO YEARS

### CHANGE OIL. DIFFERENTIALS AND TRANSFER GEAR-BOX (14)

Remove the drain plug and allow the oil to drain out into a suitable container. Clean and replace the drain plug. Remove the filler plug and fill with oil, until the oil begins to overflow. Clean and replace the filler plug. Use oil according to the Lubrication Chart.



*Fig 16. Drain, fill and level plug, front differential*

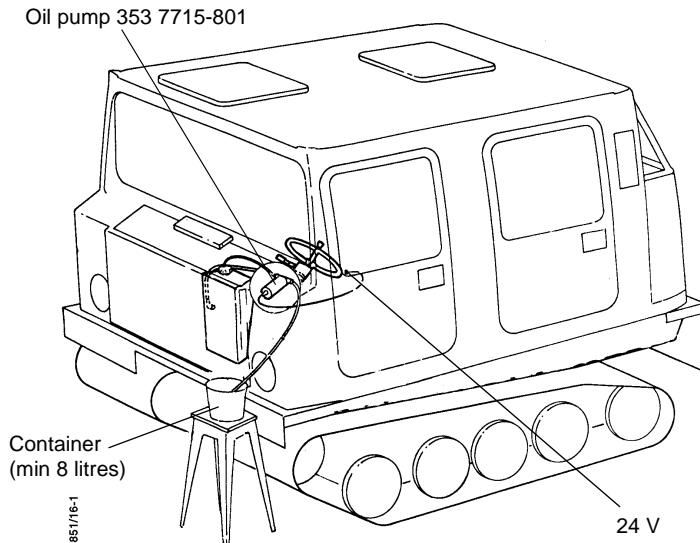


*Fig 17. Drain, fill and level plug, transfer gearbox*

## POWER STEERING SYSTEM - CHANGE OIL AND THE HIGH PRESSURE FILTER CARTRIDGE (15)

Change hydraulic oil as follows:

1. Clean the outside of the hydraulic oil tank.
2. Drain the tank by removing the filler cap assembly and thereafter use oil pump 353 7715-801 to drain the tank.

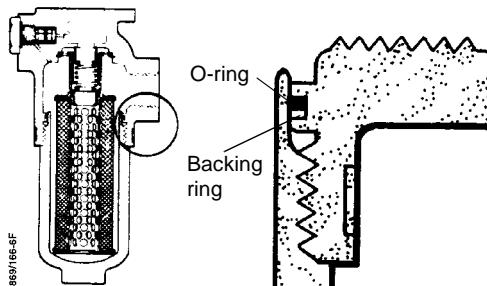


*Fig 18. Drainage of hydraulic tank*

3. Reinstall filler cap assembly.

Change the filter cartridge of the high pressure filter as follows:

1. Clean the pressure filter housing and surrounding area.
2. Screw off the pressure filter housing with filter cartridge.
3. Remove the filter cartridge and drain out oil.
4. Remove the O-ring from the pressure filter housing.
5. Install a new O-ring in the pressure filter housing. The backing ring shall be placed underneath the O-ring.

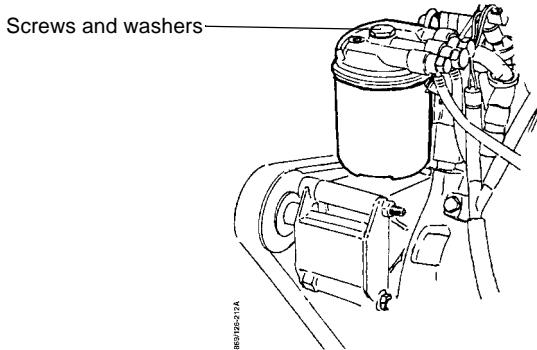


*Fig 19. High pressure oil filter*

6. Break seal of plastic bag, do not take the filter cartridge out of the bag.
7. Grip the plastic bag and press the cartridge into place, remove the bag.
8. Reinstall the pressure filter housing and pull tight.  
Tightening torque: 20 Nm.
9. Fill hydraulic oil according to the Lubrication Chart. Correct level is between "MAX" and "MIN" marks on the reservoir.
10. Turn steering wheel several times to the left and to the right to bleed the system. Check that there are no leaks of oil.

## FUEL SYSTEM - CHANGE THE FUEL FILTER (16)

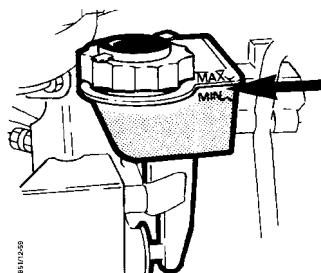
Remove the fuel filter. Smear the seal of the new fuel filter with oil and install the new filter.



*Fig 20. Fuel filter assembly*

## CHANGE BRAKE FLUID (17)

1. Connect a tight fitting compartment plastic hose to the brake callipers bleeding nipples.
2. Place the other end of the hoses into a transparent container for the brake fluid.
3. Loosen the brake bleed nipples and pump the brake pedal, until the brake fluid reservoir is empty.
4. Fill the reservoir with brake fluid until it is half full and pump the brake pedal, until it is empty.



*Fig 21. Brake fluid reservoir*

5. Close the brake callipers bleed nipples.
6. Fill the reservoir with brake fluid to the "MAX" level.
7. Pump the brake pedal 3 to 4 times. Open one of the brake callipers bleed nipples and pump the brake pedal, until the fluid coming from the bleed nipple is free of air. Keep the brake fluid reservoir full of fluid while performing this task.
8. Close the brake calliper bleed nipple.
9. Repeat this operation for the other brake calliper.
10. Check brake function and check for leakage.

## COOLING SYSTEM - CHANGE COOLANT (18)

### —WARNING!

Do not remove the expansion cap, if the engine is warm, as engine coolant can cause serious burns.

### CAUTION!

Do not change or drain the coolant when the engine temperature is hot, damage to the cylinder head can occur.

## Draining

1. Set the temperature control knob in the front car to the "MAXIMUM" heat position.
2. Remove the cap from the expansion vessel.
3. Remove the bottom plug in the front car and place a suitable vessel, capable of holding at least 20 litres, under the car.
4. Connect a hose to the engine drain valve and open the drain valve on the engine.

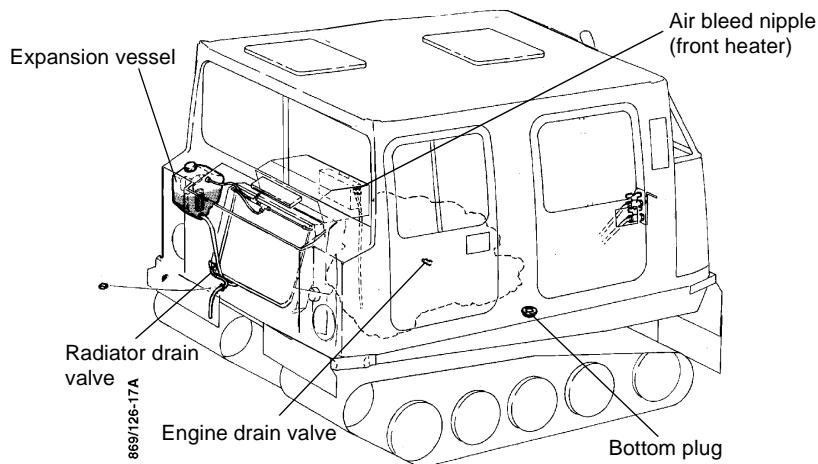
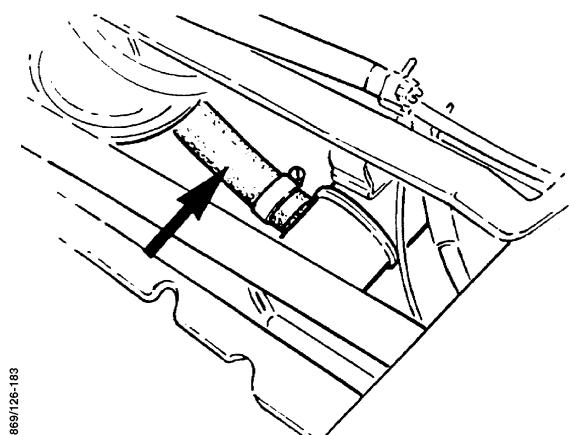


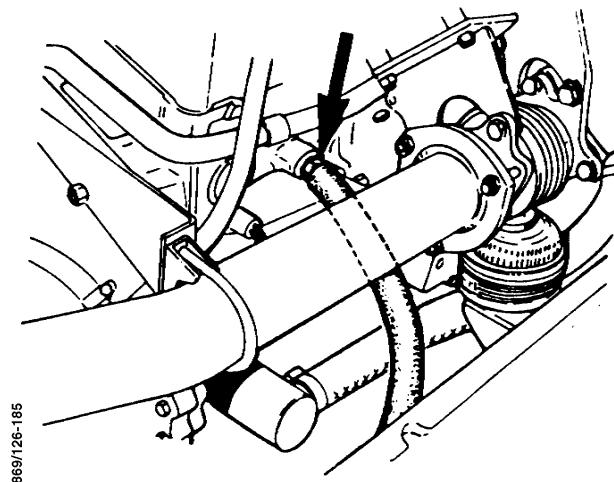
Fig 22. Plugs and valves, cooling system

5. Remove the left hose from the transmission oil cooler.
6. When the coolant is drained, reinstall the hose onto the transmission oil cooler.



*Fig 23. Hose on transmission oil cooler*

7. Close the engine drain plug valve.

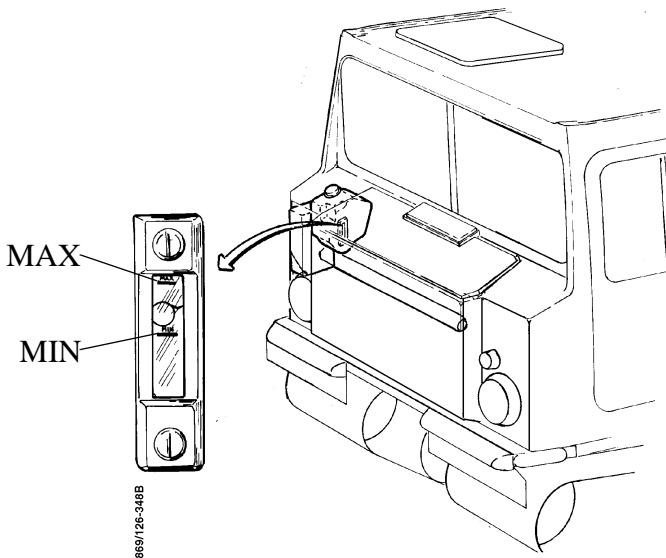


*Fig 24. Engine drain valve*

8. Remove the vessel under the car and install the bottom plug.

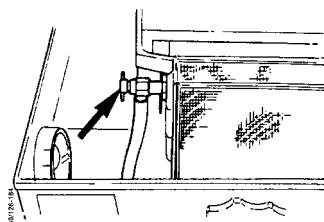
## Filling

1. Check that the temperature control knob in the front car is set to the "MAXIMUM" heat position.
2. Fill the expansion vessel with a mixture of antifreeze and water to the top of the expansion vessel (approximately 10 litres). Use coolant according to the Lubrication Chart.



*Fig 25. Expansion vessel level glass*

3. Allow the fluid level to settle. Start the engine and allow it to run at high idle speed and fill the expansion vessel as necessary.
4. Check that the level in the expansion vessel is at the "MAX" mark.
5. Install the expansion cap.
6. Open the air bleed nipple on the front car heater and allow any air to be discharged. Close the air bleed nipple.



*Fig 26. Air bleed nipple*

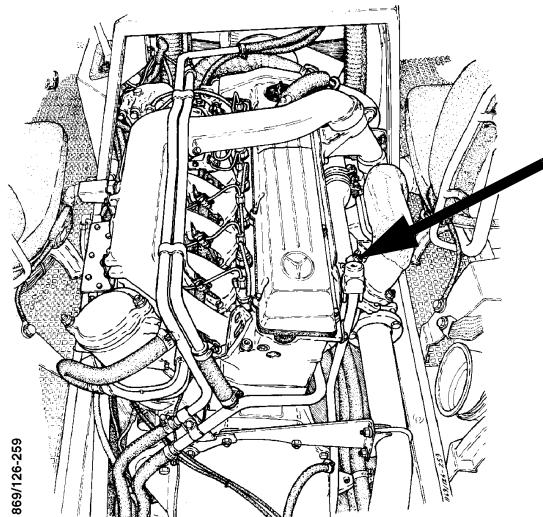
7. Increase the engine speed to 1500 rpm, until the engine thermostat opens.  
(The engine coolant temperature is approximately 80 to 90 °C.)
8. Check that the coolant pipe on the top of the engine is warm. If cold, repeat the air bleeding operation.
9. Check that the coolant level in the expansion vessel is between the "MAX" and "MIN" marks.
10. Check that there is no sign of leakage in the cooling system.

## AUTOMATIC TRANSMISSION - CHANGE OIL(19)

1. Remove the engine bonnets.
2. Remove the transmission oil dipstick.
3. Push the suction line of a suction pump into the transmission dipstick tube and the other end in a suitable vessel, capable of holding at least 5 litres.
4. Connect the suction pump to the 24 V power socket and suck the oil out of the transmission.
5. Fill the transmission with oil, approximately 8.3 litres, and insert the transmission oil dipstick. Use oil according to Lubrication Chart.  
Make sure that the oil level reaches the bottom part of the dipstick.
6. Perform oil level check in the automatic transmission according to the weekly checks.

**CAUTION!**

Do not overfill automatic transmission. Damage to automatic transmission may occur.



*Fig 27. Oil dipstick, automatic transmission*

7. Clean the engine compartment and check for leakage.
8. Install the engine bonnets.

## ELECTRICAL WINCH-CHANGE OIL (OP)

1. To drain place winch on a firm surface. Remove fill-drain plugs, see fig 14, and drain winch. Turn winch so that oil drains from fill-drain holes. Place winch into winch mount. Refill with fluid. Clean and install plugs.
2. Clean the cable by applying GWR to cable.

Use oil Gulf Super G5W/20.

## HYDRAULIC WINCH-CHANGE OIL (OP)

1. To drain place winch on a firm surface. Remove fill-drain plugs, see fig 14, and drain winch. Turn winch so that oil drains from fill-drain holes. Place winch into winch mount. Refill with fluid. Clean and install plugs.
2. Clean the cable by applying GWR to cable.

Use oil Gulf Super G5W/20.

## 6.2 Lubricant recommendation

### STANDARD INITIAL FILLING

The vehicle is initially filled with following lubricants and fuel. The customer performs the first changes after running in.

Chart symbol	Item	Type	Temp range (°C)	Note
	Engine oil	Mineral oil 10W/30	-20 to +35	Change after running in
	Automatic transmission	Dexron II	-40 to +46	
	Hydraulic system	Dexron II	-40 to +46	
	Differentials and Transfer gear	Hypoid 80W/90	-40 to +46	Change after running in
	Brake fluid	SAE J1703 DOT 4	-40 to +46	
	Lubricating grease	NLGI MOS 2	-40 to +46	
	Anti-freeze	50/50 Glycol/water	-40 to +46	
	Fuel	Diesel fuel	-30 to +46	

## RECOMMENDED QUALITIES

### NOTE!

The following recommendation is based on a certain product information.  
Hägglunds Vehicle AB reserves the right to change specification without notice and without incurring obligation

### Engine oils

( symbol in Lubrication chart:        )

#### AMBIENT TEMPERATURE RANGE -35°C TO +35°C

MIL-L-2104E

API SG/CF-4

CCMC D4

BP Vanellus FE 10W/30

Castrol RX Super 10W30

Esso Essolube 2D-3 SAE 10W/30

Gulf Super Fleet Motor oil 10W/30,

Mobil Delvac 1300 10W/30

Quaker State Deluxe 5W/30

Shell Myrina 10W/40

Shell Rimula X 10W/30

Shell Helix Ultra 10W/40

Texaco Ursa Super LA3 10W/30

Q8 T 500 10W/30

#### AMBIENT TEMPERATURE RANGE -20°C TO +49°C

MIL-L-45199B

MIL-L-2104E

API SG/CF-4

Amaco 300 15W/40

BP Vanellus C3 15W/40

Castrol RX Super 15W/40

Esso Essolube 15W/40

Gulf Super Fleet 15W40

Mobil Delvac 1300 15W/40  
Shell Myrina X 15W/40  
Synth Gulf Super G10W/30  
Synth Mobil Delvac SHC 10W/40  
Synth Mobil SHC 15W/40  
Texaco Havoline Motoroil 15W/40  
Texaco Ursa Super Plus 15W/40  
Valvoline All Fleet 15W/40  
Q8 T 500 15W/40

### **AMBIENT TEMPERATURE RANGE -46°C TO +35°C**

MIL-L-2104E  
API SG/CF-4  
NATO O-1178  
CCMC G4/D4 PD-2

BP Visco Coranda 5W/30  
Esso Motor-Oil-S 5W/30  
Q8 Excel 5W/40  
Q8 Super Plus 5W/40  
Mobil Delvac SHC 5W/40 SE/CE  
Shell Helix Ultra 5W/40  
Shell Myrina X 5W/30  
OK Super Synth 5W/40

### **AMBIENT TEMPERATURE RANGE +20°C TO +49°C**

MIL-L-2104E  
API SG/CF-4  
MIL-L-45199B  
CCMC G4/D4

BP Vanellus C3 SAE 40  
Gulf Gulflube SHD SAE 40  
Gulf Super Fleet SAE 40  
Mobil Delvac 1330 SAE 40  
Shell Myrina Oil SAE 40

## Automatic transmission and hydraulic system oils

( symbol in Lubrication chart:        )

ATF Dexron IID

### AMBIENT TEMPERATURE RANGE -35°C TO +49°C

BP Autran DX IID 21520

Caltex Texamatic Fluid Dexron II 21882

Castrol TQ Dexron II 21885

Chevron ATF

Esso ATF Dexron II 21611

Exxon ATF Dexron II 21422

Mobil ATF 220 21685

Pennz Oil Co D21271

Q8 Auto 14 Dexron II 21883

Quaker State Dexron II 21547

Shell ATF Donax TA

Texaco Texamatic 4011 Dexron II 21534

### AMBIENT TEMPERATURE RANGE -50°C TO +40°C

Mobil 1 Synth ATF

Mobil ATF SHC 220

Shell Donax TX

## Differentials and transfer gear oils

( symbol in Lubrication chart:        )

### AMBIENT TEMPERATURE RANGE -35°C TO +35°C

MIL-L-2105D

API GL-5

BP Hypogear 80W/90

Esso Gear Oil GX 80W/90

Gulf MP Gear Lubricant 80W/90

Mobilube HD 80W/90

Shell Spirax HD 80W/90

Texaco Multigear Lubr 80W/90  
Q8 T55 80W/90

### **AMBIENT TEMPERATURE RANGE -50°C TO +40°C**

Synth 75W/90

MIL-L-2105C

API GL-5

Castrol Hypoy S 75W/90  
Esso Gear Oil-S 75W/90  
Geartex SX  
Gulf Trans G 75W/90  
Mobil Mobilube 1 SHC 75W/90  
Shell Trans Axle Oil 75W/90  
Q87 T 65 75W/90

### **AMBIENT TEMPERATURE RANGE -20°C TO +49°C**

SAE 80W/140

MIL-L-2105D

API GL-5

Q8 T 65 75W/140

Castrol Hypoy C 80W/140

Gulf Multipurpose 80W/140

Mobil Mobilube SHC 75W/140

Shell Hypoid Oil HD 80W/140

Texaco Multi Lubr 80W/140

## **Brake fluids**

( symbol in Lubrication chart:        )

SAE-J-1703F DOT 4

BP Disc Brake Fluid DOT 4

Castrol Brake Fluid K 612

Fed Spec VV-H-910 A

Shell Super DOT 4

Wagner Lockheed Brake Fluid

## **Anti-freeze**

( symbol in Lubrication chart: )

Shell Anti-freeze P402

-10°C - +49°C 30/70 Anti-freeze/Water

-35°C - +35°C 50/50 Anti-freeze/Water

-50°C - +35°C 60/40 Anti-freeze/Water

## **Lubricating grease**

( symbol in Lubrication chart: )

NLGI MOS 2 reinforced

AMBIENT TEMPERATURE RANGE -30°C TO +49°C

BP Energearse LA-ED2

Shell SRS 4000

Texaco Multifac EP2

Q8 Rembrant EP2

AMBIENT TEMPERATURE RANGE -50°C TO +49°C

MIL-L-81322 B

Aero Shell Grease 22

Mobil Grease 28

Q8 Rubens LT Synth

## Fuel

**Diesel:** DIN 51601, ASTM D975, BS 28689, W-F-800C

Cetane number more than 45

Sulphur content max 0,05% (0,3% Stationary)

**AMBIENT TEMPERATURE RANGE -20°C TO +49°C**

DF-1 or DF-2

**AMBIENT TEMPERATURE RANGE -49°C TO +20°C**

DF-A or Jet A1

As emergency fuel JP-1 can be used for shorter duration.

### **NOTE!**

HSV reserve the right to change oil change intervals, quality of oil, grease and fluids.

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