



## Safety, Operation & Service Manual

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### DIABLINE



WARNING: If incorrectly used this machine can cause severe injury. Those who use and maintain this machine should be trained in its proper use, warned of its dangers and should read the entire manual before attempting to set up, operate, adjust or service the machine.



English

RJL 100 June 2009

 **WARNING** 

**DO NOT USE THIS VEHICLE  
UNLESS YOU HAVE BEEN  
TRAINED IN ITS USE AND SAFETY.  
TRAINING CONSISTS OF  
KNOWLEDGE OF THE WORK  
REGULATIONS OF YOUR  
EMPLOYER, INSTRUCTIONS IN  
THIS MANUAL AND THE CURRENT  
REGULATIONS FOR THIS TYPE  
OF MACHINE.  
A NON-QUALIFIED OPERATOR  
IS EXPOSED TO AND EXPOSES  
OTHERS TO THE RISK OF  
SERIOUS INJURY.**

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## **NEW PRODUCT WARRANTY**

The seller guarantees each new product against all material or manufacturing fault, without obligation, his responsibility being limited under this guarantee to the repair or replacement of each part recognised as being defective in use or normal maintenance, and the reasonable cost of repair and or replacement of the said parts during the twelve months from the initial date of purchase, hire purchase or rental, on the understanding that the taking into service of the equipment has been registered with the seller. In the case that the equipment has not been registered with the seller, the initial date of sale, of hire purchase or of rental will be the date of despatch from the factory. This warranty replaces all other guarantees explicit or implicit and the responsibility of the seller under this guarantee excludes the cost of transport or others or all responsibility for damage, direct or indirect or consecutive such as all delays due to possible faults. The warranty will be null and void in the case of use over capacity or in conditions not foreseen by the seller or in the case of use of parts not recognised by the said seller.

### **NOTES**

To obtain a copy of the terms and conditions of the application of the warranty, call or write to Ransomes Jacobsen Limited.

The use of parts not originating from Ransomes Jacobsen Limited can result in the cancellation of this warranty.

The charging of the batteries by a means other than the fitted charger will result in the cancellation of the warranty.

### **FOR THE ATTENTION OF THE CLIENT / USER**

If this vehicle is involved in an accident, please contact your distributor immediately and provide him with all the details of the accident in order that he may notify the firm.

If the distributor is unknown or cannot be notified, please contact:

#### **Ransomes Jacobsen Limited**

West Road, Ransomes Europark,  
Ipswich IP3 9TT, England  
Tel: +44 (0) 1473 270000  
Fax: +44 (0) 1473 276300  
[www.ransomesjacobsen.com](http://www.ransomesjacobsen.com)

## **FOREWORD**

This manual has been prepared in order to allow you to correctly use and service your electric vehicle.

Before putting the vehicle into service, take the time to carefully read and familiarise yourself with the contents of this manual. After having read and understood all the sections, keep the manual in its place.

This vehicle has been designed to offer maximum performance with minimum servicing. The proper employment of the servicing operations ensures years of use without problems.

With our policy of continuous improvement of our products, we reserve the right to make changes without warning to the specifications and equipment.

The servicing procedures and routines are given in this manual with each machine and must be consulted for detailed information.

Information in this manual in no case replaces internal regulations, advice or insurance policy clauses.

This manual consists of the following main parts:

**Section A:** SAFETY AND USE

This part covers the safety of personnel in relation to:

- conditions of use of the vehicle
- the functioning of the vehicle
- the vehicle itself

**Section B:** GENERAL MAINTENANCE AND UPKEEP

This part aims to assist you to keep to the basic rules of , to maintain your vehicle and to detect possible breakdowns.

The definitions **DANGER**, **ATTENTION**, and **NOTE** in this manual are the following:

**DANGER** - Indicates an imminently hazardous situation which, if not avoided, **WILL** result in death or serious injury.

**WARNING** - Indicates a potentially hazardous situation which, if not avoided, **COULD** result in death or serious injury.

**CAUTION** - Indicates a potentially hazardous situation which, if not avoided, **MAY** result in minor or moderate injury and property damage. It may also be used to alert against unsafe practices.

## Section A

### SAFETY AND USE





## **A.1 INTRODUCTION**

This manual contains all-important information relative to the functions and maintenance of the **Ransomes** Diabline model electric vehicles.

This vehicle is an automotive type with a chassis in steel and aluminium. Power is by electric motor situated on the rear axle. Batteries provide electric power. The driving position is on the front left of the vehicle.

The nominal capacity of the machine is indicated on the plate displaying the permissible loads situated on left of the driver seat. This stipulated load must not be exceeded.

### **ON DELIVERY...**

You must immediately check your vehicle on delivery in order to ensure that nothing has been forgotten or appears to have deteriorated.

#### **Checking of the vehicle**

Examine the vehicle such as the accessories delivered separately. Ensure that all that you have ordered has been delivered. Nothing must appear damaged or deteriorated.

**Check the function of controls**

Carry out each of the following checks :

- Accelerator pedal
- Brake pedal
- Forward/reverse switch
- Brakes
- Steering
- Audible alarm
- Lighting and indicators

**If you find a problem...**

Immediately draw up a list and send it to:

**Ransomes Jacobsen Limited**

West Road, Ransomes Europark,  
Ipswich IP3 9TT, England

 **WARNING** 

**DO NOT REPAIR, MODIFY  
OR ADJUST A PART OF THE  
VEHICLE WITHOUT THE WRITTEN  
AGREEMENT OF RANSOMES  
JACOBSEN LIMITED, THIS WILL  
RESULT IN THE CANCELLATION  
OF THE WARRANTY. FURTHER  
AN INCORRECT REPAIR CAN  
CAUSE SERIOUS INJURY.**

A.2 GENERAL DESCRIPTION

A.2.1 Description of the vehicle

Driving Position

Passanger Cabin



Batteries

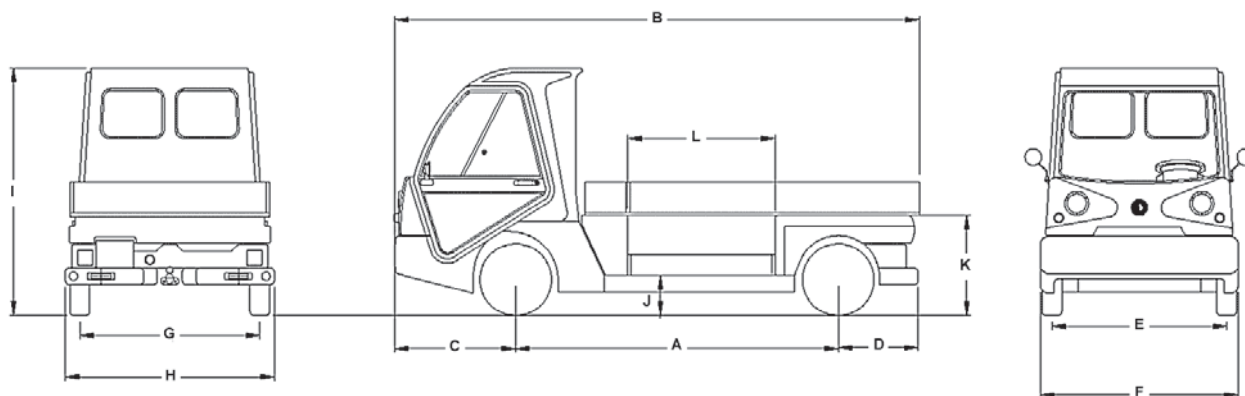
Steering Wheels

Motor / Reducer

Drive Wheels



A.2.2 Dimensions and technical characteristics



Diabline side (mm)		
<b>A</b>	<b>Wheelbase</b>	<b>2345</b>
<b>B</b>	<b>Length</b>	<b>3790</b>
<b>C</b>	<b>Front overhang</b>	<b>880</b>
<b>D</b>	<b>Rear overhang</b>	<b>635</b>
<b>E</b>	<b>Front track</b>	<b>1270</b>
<b>F</b>	<b>Front width</b>	<b>1440</b>
<b>G</b>	<b>Rear track</b>	<b>1310</b>
<b>H</b>	<b>Rear width</b>	<b>1520</b>
<b>I</b>	<b>Drivers Cabin height</b>	<b>1800</b>
	<b>Passenger Cabin Height</b>	<b>2200</b>
<b>J</b>	<b>Load deck sill height</b>	<b>290</b>
<b>K</b>	<b>Modular Main deck height</b>	<b>750</b>
<b>L</b>	<b>Lower deck length</b>	<b>1070</b>

# RANSOMES DIABLINE SAFETY AND OPERATORS MANUAL

Motor	Electric	Volt	48					
Wheels	Number of driving wheels		2 AR					
Rear deck	length x width	mm	2320 x 1450					
Deck height	height empty	mm	750					
Dimensions	length	mm	3790					
	width	mm	1520					
	seat height	mm	760					
	height with cabin	mm	1800					
Turning circle	minimum between walls	m	4,25					
Road width	for a turn of 90°	mm	2700					
Tow hook height	centre in relation to ground	mm	350					
Weight	empty without batteries	kg	545					
Tyres	dimensions front		145/70/R13					
	dimensions rear		145/70/R13					
Wheelbase		mm	2345					
Track	from centre of tyre Front/rear	mm	1270 / 1310					
Height in relation to ground	without load at the lowest point	mm	150					
	without load at centre of wheelbase	mm	165					
Brakes	Front + Rear		hydraulic discs					
Brake assistance	Rear		electric					
Parking brake			mechanical					
Suspension	4 wheel independent		oleo pneumatici					
Electric motor	power	kW	6					
Electronic speed control	Maximum power	Amp	400					
Batteries	gel or lead/acid		monobloc or cells					
	nominal voltage	V	48					
Tow bar	patented system		multi-arm					
Batteries	capacity (C/5)	Amp	205	275				
Batteries	weight	kg	250	380				
Range	in realistic usage when empty	km	40-60	55-80				
Consumption	average when empty	Wh/km	160	160				
Charger 220V fitted	power on charge	Amp	20	50				
Useable load	in standard platform version	kg	625	495				
Transmission	mechanical by differential reduction	ratios	7	10	15	7	10	15
Effort to the hook	continuous service : 60' on flat ground	kg	-	100	150	-	100	150
	Max : 5' on flat ground	kg	-	190	280	-	190	280
Admissible slope	empty / loaded	%	15/7	17/9	18/10	15/7	17/9	18/10
maximum speed	empty	km/h	58	48	35	58	48	35

### A.3 SAFETY ADVICE

#### A.3.1 General

It is impossible to establish a complete list of safety advice covering all situations. In the meantime, a certain number of basic rules **MUST** be followed in the course of the daily use of the vehicle. Safety is your **FIRST RESPONSIBILITY**, because the vehicle can only be **PERFECTLY MASTERED** by the user.



##### A.3.1.1 Information FOR THE DRIVER

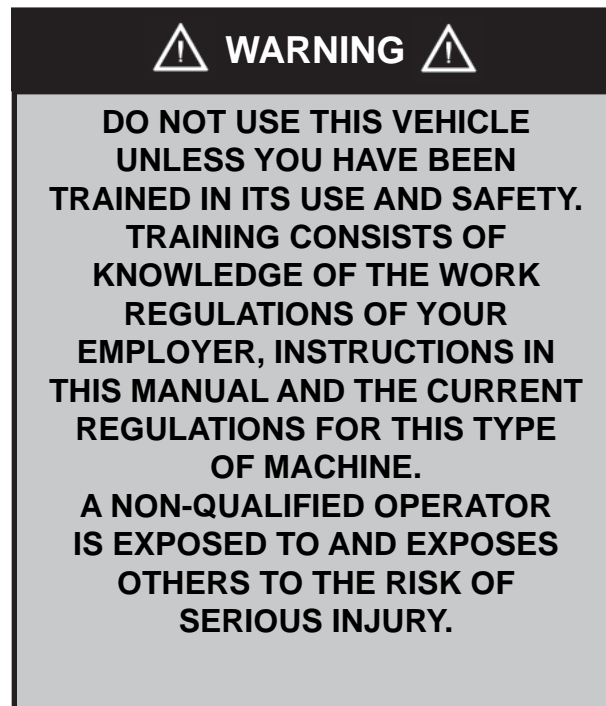
You must **READ** and **ASSIMILATE** the **MANUAL FOR THE SAFETY OPERATOR** before using the vehicle. This manual must be readily available at all times

Ensure that all persons in the vehicle perfectly understand the safety procedures and apply them.

You must know exactly the position of and the signs that appear on all the plates and stickers on the vehicle.

You must know the regulations and standards applying to industrial vehicles and their use. Works practices can vary slightly according to national regulations, industry norms and employer regulations. It is for this reason that all the different norms must be well understood.

### A.3.1.2 Qualifications OF THE DRIVER



Do not try to use the vehicle if you do not have the training and the knowledge necessary for all the functions of the vehicle.

The controls, characteristics and procedures may vary from one vehicle to another, this is why it is **VITAL** that the operator receives appropriate training and that it is given by competent and authorised personnel.

You must be in perfect physical and mental health to use the vehicle and must not be under the influence of medicines, narcotics or alcohol. **ALL** types of drugs can reduce reactions and physical abilities, visual and mental.

A qualified driver must be able to:

- Master each vehicle control
- Understand and abide by all the advice in this manual
- Know how to correctly load and unload material
- Know how to correctly park the vehicle
- Recognise a badly serviced vehicle
- Be able to control the vehicle in all situations

### **A.3.2 Basic rules**

Never put your safety at risk and that of others in trying to use a machine for something for which you have not been trained. It is **VITAL** that the operator has received adequate training and knows perfectly the regulations for the use of the vehicle:

- Stay inside the vehicle during its movement. Do not leave an arm, a leg or the head outside the vehicle
- Drive carefully
- Do not turn the steering wheel violently when moving at high speed
- Drive preferably on a flat surface or, if you have no other choice, on a surface with a slope that does not exceed 15%
- Do not take the vehicle over holes or bumps or objects on the ground
- Observe all the driving regulations and speed restrictions (60 km/h max)
- Keep a safe distance between the vehicle and possible obstacles
- Always keep full control of the vehicle
- Warn personnel, by using the horn, when you approach a crossing or a corner of a wall behind which people or another vehicle may be approaching
- Give priority to pedestrians, ambulances, firemen or all other emergency vehicles
- Always keep an eye on others; anticipate their manoeuvres or their movements



### A.3.3 Servicing



Always keep the vehicle clean. Eliminate all traces of mud, dirt or grease. Dirty equipment wears more and makes servicing difficult. Use only appropriate and nonflammable cleaning products. Avoid spraying directly on electrical components.

Routine servicing and inspection of this vehicle must be carried out by a qualified person and according to the recommendations contained in the chapter «General maintenance and servicing». For all questions concerning procedures and specifications, speak to your **Ransomes** distributor.

Except with the written authorisation and agreement of **Ransomes Jacobsen Limited**, no modification affecting the original design may be made to the vehicle.

Such modifications render invalid the warranty and render the owner and/or user liable in the case of an accident.

Before carrying out servicing or a repair on the vehicle:

1. The vehicle must be parked in a clean state and disengaged. The emergency stop button must be pressed, the parking brake locked and the forward-reverse switch in the **neutral** position.
2. The batteries must be disconnected, also the charger plug and the starter key removed

After having carried out servicing or repair operations:

1. Replace all covers that have been removed
2. Reconnect the batteries
3. Remove all chocks and or supports
4. Carry out a functional test on all controls in order to ensure their proper functioning. If the brake parts have been removed, test the brakes before refilling with hydraulic fluid. Purge the circuit if necessary and check the level. Carry out the checks once more

#### **A.3.3.1 Lubrication**


The vehicle must be lubricated and greased according to the constructor's recommendation concerning the lubrication points, periods and types of products to be used.

If your vehicle is not correctly greased, there is a risk of overheating of the mechanical parts, which can result in their deterioration.

#### **A.3.3.2 Batteries**

The battery electrolyte must never be brought into contact with the skin or the eyes. In case of accidental splashing, immediately and copiously wash the effected part with cold water and consult a doctor.

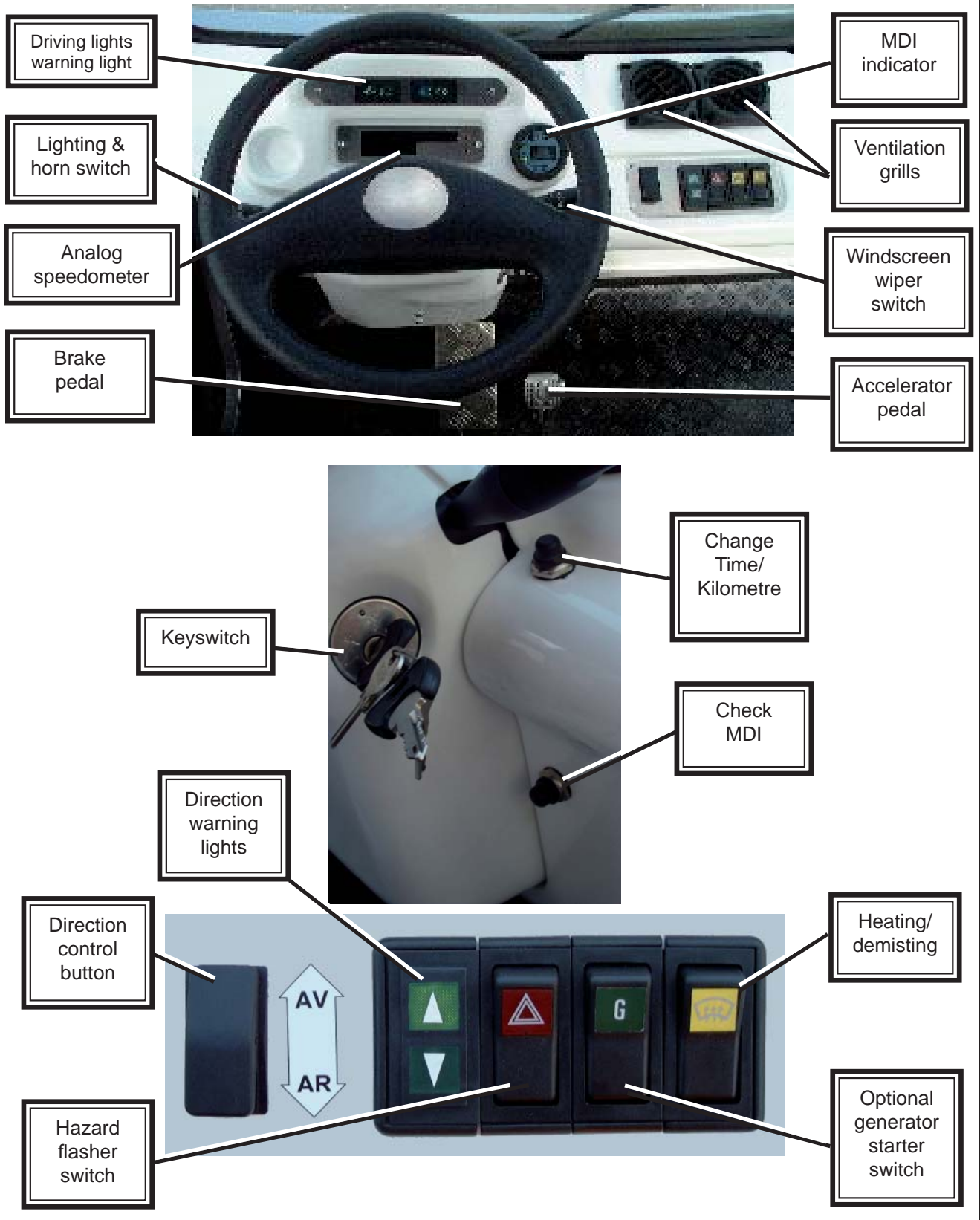
During inspection and maintenance of the battery, abide by the precautions and procedures below:

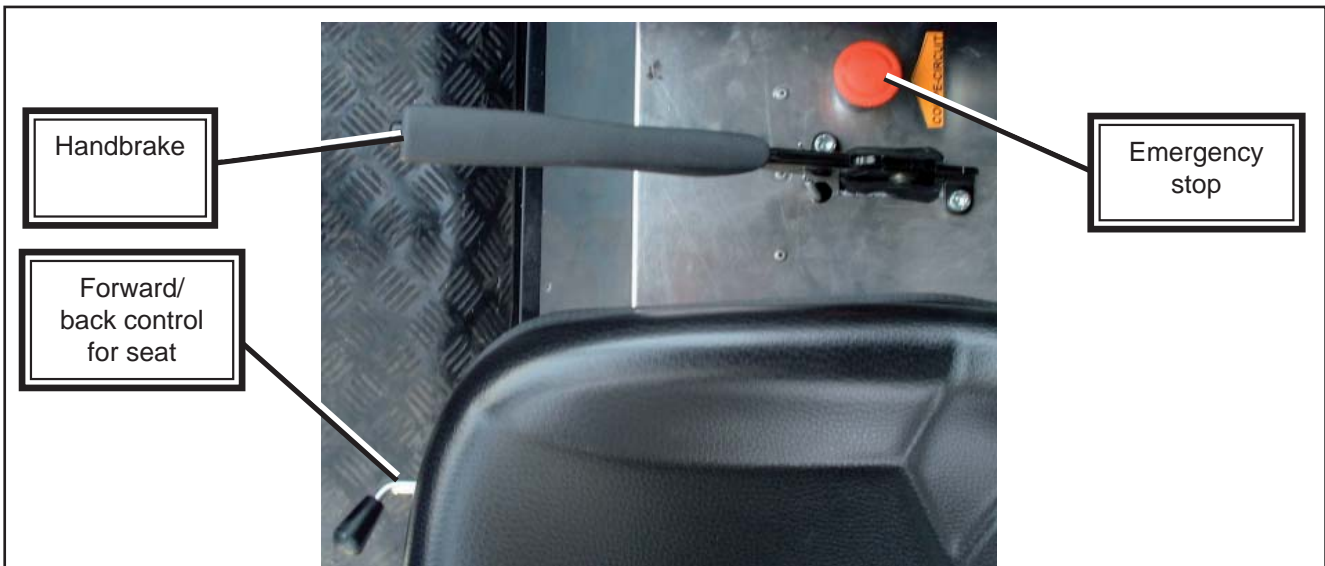
- Never check the state of charge of a battery by short-circuiting the connections. The sparks or flames can produce an explosion of the battery
- Check the level of the electrolyte in the battery using the floats, generally green, in the centre of each refill cap. If the batteries are not equipped with this type of device, check that the level of water totally covers the plates.
- Wear safety glasses for all work on the batteries
-  Never disconnect the positive cable of the battery first. On the contrary, disconnect the negative cable first. This must be reconnected last when replacing the battery.

## A.4 VEHICLE CONTROLS

### A.4.1 Driving position

This section describes the function and position of each control. It is vital that the driver familiarises himself with the use of the controls before using the vehicle (details follow):





#### A.4.2 Starter key

The Neiman anti theft/starter key is situated on the right hand side of the dashboard and activates the electrical functions of the vehicle.

Turn the key in a **clockwise direction** to switch on the vehicle (I), turn the key in an **anticlockwise direction** to turn off the electricity (0).



**WARNING**

**THE STARTER KEY MUST BE IN THE 0 POSITION EACH TIME THE DRIVER LEAVES THE VEHICLE**

**NOTE**

**THE STARTER KEY CAN ONLY BE WITHDRAWN WHEN IT IS IN THE 0 POSITION.**

**NOTE**

**CERTAIN CONTROLS ARE OPTIONAL.**

#### A.4.3 Forward-Reverse control

This is a 3-position switch. It is situated to the right of the dashboard and establishes the direction of travel of the vehicle.

#### A.4.4 Steering wheel

The steering wheel is attached to a column of the same type as a touring car. **Turn the wheel to the right** to direct the wheels to the right and **turn the wheel to the left** to direct the wheels to the left.

#### A.4.5 Brake pedal

The brake pedal is situated to the right of the steering column. It must be operated only with the right foot.

This pedal works, by fluid, on pistons that push the brake pads onto a steel disc. **The more you push** on the pedal, **the more you brake** the vehicle.

**NOTE**

**WHEN THE PEDAL IS ACTIVATED SO ARE THE BRAKE LIGHTS ON THE BACK OF THE VEHICLE.**

#### A.4.6 Accelerator pedal

The accelerator pedal is situated to the right of the brake pedal. It must be operated only with the right foot. This pedal controls the speed of the vehicle using a potentiometer. **The more you push** on the pedal, **the more you accelerate** the vehicle. When the accelerator pedal is fully raised a regenerative braking system slows the vehicle

**NOTE**  
**THE BRAKE PEDAL MUST BE USED TO**  
**EFFICIENTLY BRAKE THE VEHICLE.**

#### A.4.7 Parking brake

The parking brake lever is situated between the two seats.

**NOTE**  
**THE PARKING BRAKE MUST ALWAYS BE**  
**PROPERLY ADJUSTED.**

#### A.4.8 Emergency stop

The emergency stop button, usually coloured red, is situated between the driver and the passenger seats. In case of emergency, this cuts off the electrical power. **Push** on the button to **cut** the supply and **pull** the button to **re-establish** power.

#### **A.4.9 Audible alarm (Horn)**

It is situated at the end of the left control lever, on the left side of the steering column. **Push** on the button to **warn** then release. An audible safety-warning signal sounds when the vehicle moves in reverse. When reverse is engaged, the buzzer sounds to warn personnel that the vehicle is reversing.

#### **A.4.10 Lighting**

The lighting switch is situated on the left control lever. When it is actuated the headlights on the front of the vehicle are switched on as well as the rear lights. **Turn** the switch **one click** to **switch on the sidelights**, and **turn two clicks** to **switch on the main lights**. **Pull** the lever **upward** for Full beam. Turn the switch to **position 0** to **switch everything off**.

#### **A.4.11 Indicators**

Please signal all changes of direction, left and right, using the left switch lever.

**Push** the lever forwards to indicate a change of direction to the right and **pull** the lever towards the rear to signal a change to the **left**.

#### **A.4.12 Windscreen wiper**

This is the right hand switch lever. **Pull** the lever **towards the rear** to **activate** the wiper blade **in single sweeps**. **Push** the lever **towards the front one click** to **activate** the wiper blade with **interrupted sweeps**, and **push** two or three **clicks** to activate in **slow and rapid continuous sweeps**.

#### **A.4.13 Windscreen washer**

This is the windscreen wiper switch. **Pull** the lever **upward** to **activate** the washer by **impulse**, **keep in this position** to have a **continuous function**. Release the lever to **stop** the windscreen washer.

The washer reservoir is situated to the right of the battery compartment.

#### **A.4.14 Windscreen de-icer / heater**

This is a switch situated in the centre of the dashboard.

### A.4.15 M.D.I. indicator

This is an indicator, in the form of luminous warning lights and a liquid crystal display, situated on the dashboard. The MDI indicator provides information on:

CODES	DESIGNATION	SIGNIFICANCE
AL02		Problem with the dialogue between the speed control and the MDI
AL10 to AL12	EEPROM KO	Problem with the eeprom
AL13	EEPROM KO	Problem with the configuration of the eeprom
AL15 to AL19	LOGIC FAILURE #1	Automatic test carried out at start up that has a problem with the speed control level
AL32	VMN NOT OK	Problem with the measure of the voltage between the speed control and the voltage relayed to the battery : Erroneous motor connection Motor shorting to earth Power unit fault
AL49	I=0 EVER	Automatic test during travel verifies that the current would not be more than the minimum threshold value(possibly related to AL53)
AL53	STBY I HIGH	Automatic test check of current signal: Defective current collector Defect in retroactive circuit Defect in the power logic
AL57 to AL58	HIGH / NO FIELD CURR	Anomaly in the current field: Anomaly in the current collector Field cables not connected Defect in the field current unit
AL61		Temperature of speed control too high
AL62	TH PROTECTION	The temperature of the speed control is greater than 77° and the current is reduced in proportion to this rise. The speed control stops at 92°. The temperature of the speed control is less than -10°C; the maximum current is reduced to 80%. The speed control is at normal temperature (ambient), idem AL65
AL65	MOTOR TEMPERATURE	The motor temperature is greater than the intervention threshold of the sensor (the speed of the motor is reduced) If the alarm goes off motor cold: Defect with sensor Problem of connection of sensor
AL66	BATTERY LOW	The battery is below 50% of the nominal value
AL75tot AL76	CONTACTOR DRIVER or COIL SHORTED	Circuit defect in general contact control circuit: The contact winding is short circuiting or not connected
AL78	HANDBRAKE or VACC NOT OK	The direction of travel is not selected or the hand brake is on, or one or more safety(ies) annexe(s) –special option(s)- is/are activated The following test gives confirmation : keep the button "check MDI" down (page 22) and give a slight push on the accelerator, if the vehicle moves forward one of the following is the likely cause A wire in the potentiometer is broken Defective potentiometer
AL79	INCORRECTSTART	Erroneous starting sequence : Problem with the connection between the accelerator pedal and the corresponding entry into the speed control Wiring error
AL80	FORW+BACK	Forward and reverse demanded at the same time: Problem with the connection between the accelerator pedal and the corresponding entry into the speed control Wiring error
AL86	PEDALWIRE KO	Defect of the potentiometer and the accelerator pedal: Wiring defect Wire broken

**NOTE**  
IT IS POSSIBLE THAT AN UNKNOWN CODE IS  
DISPLAYED. IN THIS CASE, NOTE THE CODE  
BEFORE CALLING AFTER SALES SERVICE  
THAT WILL BE ABLE TO DIAGNOSE THE  
PROBLEM.

- **Battery charging**

The warning lights indicate the state of battery charge

 **WARNING** 

**DO NOT CONTINUE TO RUN  
WHEN THE RED LIGHT SHOWS,  
PUT THE VEHICLE ON CHARGE.**

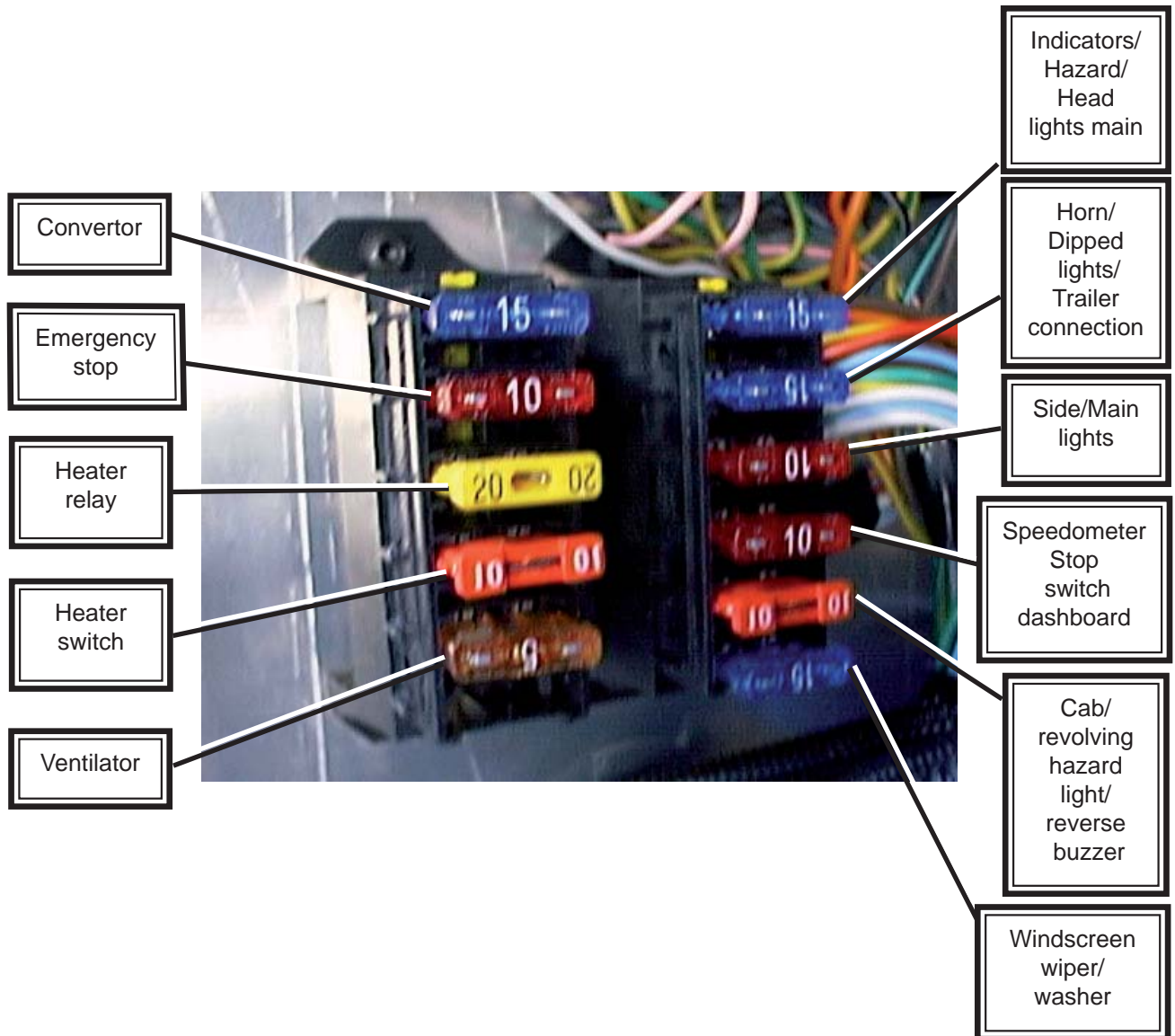
- **THE HOURS OF USE RECORDER**

Indicates the number of hours of use of the vehicle.



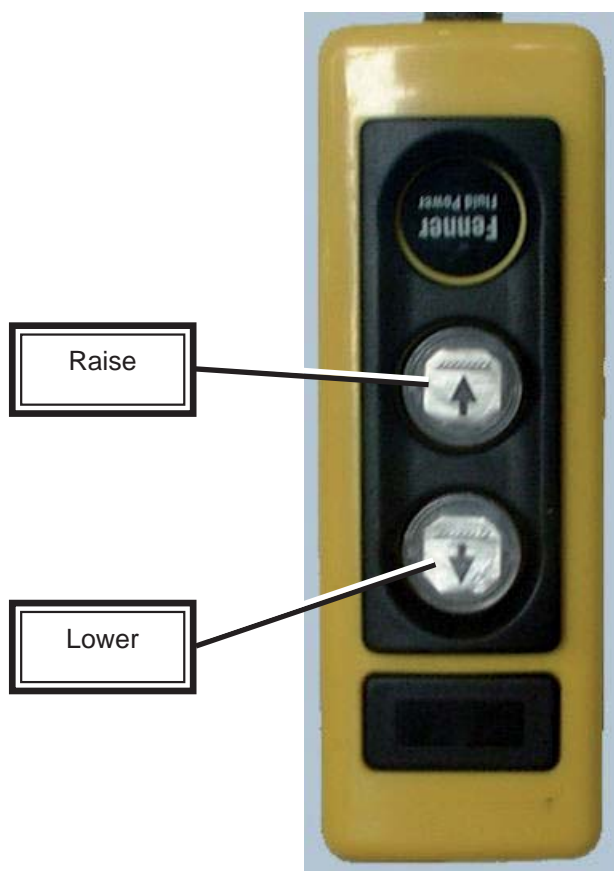
### A.4.16 Fuses

To check and/or change one or more fuses, open the lid situated under the passenger/driver seats:



#### A.4.17 Hydraulic dump truck control (D24)

This box is situated in the cabin behind the driver :



#### ⚠ WARNING ⚠

WHEN THE DUMP TRUCK IS IN  
USE OR DURING MAINTENANCE  
OF THE HYDRAULIC SYSTEM,  
ENSURE THAT THE SYSTEM IS  
SECURED AND THAT NO ONE  
RISKS BEING INJURED.

#### A.4.18 Special operations

For all questions relating to vehicles fitted with special equipment , please consult the technical service department of Ransomes Jacobsen Limited.

## **A.5 PROCEDURES FOR USE**

### **A.5.1 Checks before use**

Carry out a complete systematic inspection of the vehicle before use:

Look for possible non-operational equipment, leaks or other defects, which necessitate immediate action to make the vehicle safe to use. The non-exhaustive list of checks that follows has been provided in order that the user can carry out all the checks before taking the vehicle into use.

Check the state of charge of the battery, ensure that the connections and cables are correctly fastened and show no signs of corrosion.

#### **A.5.1.1 CONTROLS**

Check the functioning of all the vehicle controls. Carry out a detailed check of the brake system.

#### **A.5.1.2 SAFETY EQUIPMENT**

Make sure that all the safety equipment functions correctly

#### **A.5.1.3 LIGHTING AND SIGNALLING**

Ensure that all the lights function correctly, especially if you are working at night.

Equally, check indicators and the flashing light if you are to go on a public road.

### **A.5.2 Advice on use**

#### **A.5.2.1 DRIVING**

- Slow down when you approach a crossing or a traffic zone
- Do not drive in a dangerous or carefree manner
- Do not drive in a dangerous area unless the vehicle has been authorised for that area
- In the case of any accident or problem, contact your superior

#### **A.5.2.2 LOADING AND UNLOADING**

- Do not load an object if there is a risk that it can fall from the vehicle
- Do not exceed the maximum load stated by the manufacturer
- Be extremely careful when the load exceeds the height, length or width of the vehicle
- Make sure that the load is correctly distributed and fastened during transportation
- Do not carry more than the authorised number of persons in the vehicle

#### **A.5.2.3 STARTING PROCEDURE**

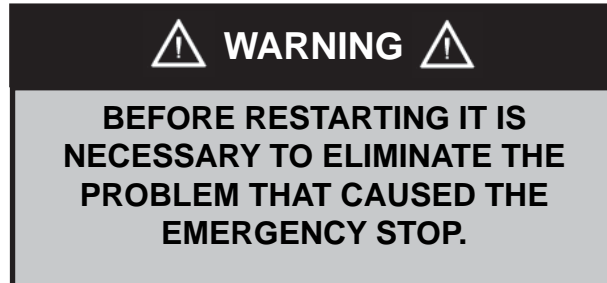
- Check that the emergency stop is out
- Place the starter key in position **I**
- Put the Forward/Reverse button in the required position
- Release the parking brake
- Push gently on the accelerator pedal

#### **A.5.2.4 STOP PROCEDURE**

- Pull on the parking brake
- Place the start key in position **0**
- Put the Forward/Reverse button in neutral position
- Remove the start key
- If necessary, place chocks under the wheels

### A.5.2.5 EMERGENCY STOP

Pull the emergency stop switch to establish electrical supply to the vehicle



A.5.2.6 TOWING

**⚠ WARNING ⚠**

**COMPLETELY UNLOAD THE VEHICLE BEFORE BEING TOWED.**

**⚠ WARNING ⚠**

**TOWING IS LIMITED TO EXTREMELY SHORT DISTANCES AND TO A SPEED NOT EXCEEDING 8KM/H, AS IT CAN CAUSE SERIOUS DAMAGE TO THE DRIVE SYSTEM.**

**⚠ WARNING ⚠**

**IF THE VEHICLE BECOMES STUCK, USE AN APPROPRIATE TRACTOR TO RETRIEVE IT. DO NOT TRY TO MOVE IT UNDER IT'S OWN POWER AS THIS WILL DAMAGE THE DRIVE SHAFT.**

**NOTE**

**The parking brake must be released when the vehicle is being towed.**

The tow hook is found behind the passenger seat and screws to the base of the mounting on the bumpers: the emergency stop button must be pressed in when you do this to eliminate damage to the controller.



### A.5.2.7 CHARGE OF BATTERIES

During the charge:

- Open the cover of the electronic box (under the front seats) during the charge for ventilation to gives the charger optimal performance.
- Let open the panel above the batteries to avoid risks of explosion.

Battery charging must be carried out in an open and well-ventilated area. Never smoke or bring a naked flame near to or produce sparks in the proximity of a charging battery.

 **WARNING** 

**TURN OFF THE VEHICLE BEFORE CHARGING TO AVOID DAMAGES ON THE ELECTRONIC SYSTEM.**

 **WARNING** 

**ONLY CHECK THE LEVEL OF ELECTROLYTE AND REFILL AFTER CHARGING HAS BEEN CARRIED OUT.**

 **WARNING** 

**NEVER USE A CHARGER OTHER THAN THAT FITTED TO THE VEHICLE.**

 **DANGER** 

**THE BATTERIES MUST ONLY BE PUT ON CHARGE IN A PROPERLY VENTILATED ENVIRONMENT. DO NOT CHARGE IN THE PROXIMITY OF FIRE, FLAME OR OTHER SOURCE OF HEAT. DURING CHARGING THE BATTERIES DISCHARGE HYDROGEN WHICH IS HIGHLY EXPLOSIVE.**

 **WARNING** 

**NEW BATTERIES ARE ONLY AT THEIR FULL CAPACITY AFTER HAVING BEEN CHARGED/ DISCHARGED THROUGH ABOUT 30 CYCLES. NEVERTHELESS, TO OBTAIN THE MAXIMUM LIFE FROM THE BATTERIES, DO NOT DISCHARGE THEM MORE THAN 80%.**

 **WARNING** 

**THE USE OF THE VEHICLE WITH INSUFFICIENTLY CHARGED BATTERIES CAN DEGRADE THE BATTERIES AND THE ELECTRONIC MOTOR.**

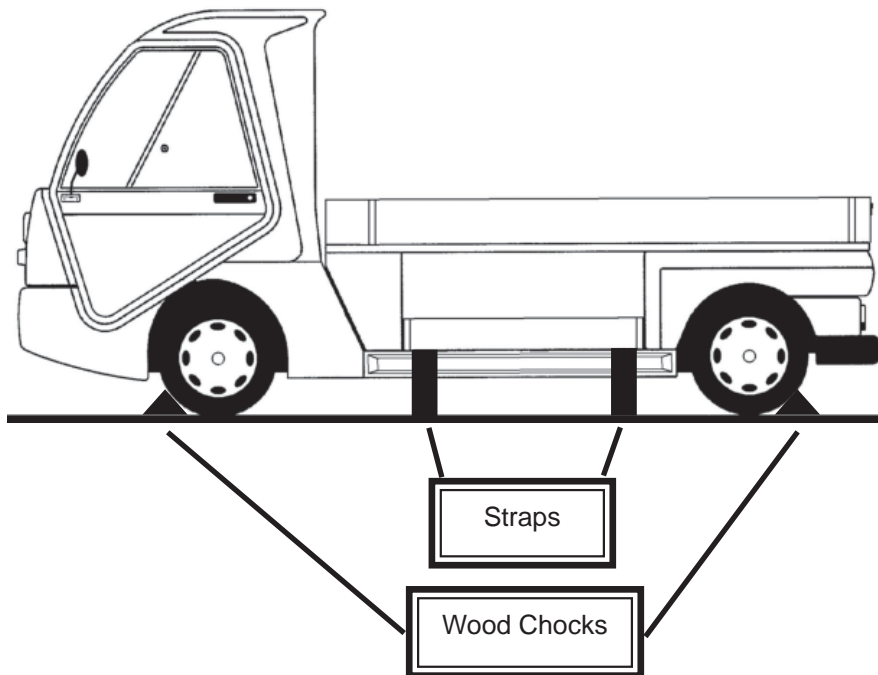
 **DANGER** 

**THE BATTERY ELECTROLYTE CAN PRODUCE CHEMICAL BURNS WHEN IN CONTACT WITH THE SKIN. PROCEED WITH EXTREME CAUTION WHEN FILLING UP THE ELECTROLYTE OR WHEN CHECKING THE LEVEL OR THE LEVEL OF CHARGE OF THE BATTERY.**

### **A.6 INSTRUCTIONS FOR TRANSPORTING**

To tie down the vehicle:

- Pull on the hand brake
- It is essential to block the vehicle wheels ensuring that the chocks are correctly fixed to the bed of the transport vehicle
- Chock the chassis of the vehicle to ensure that the suspension does not pitch or roll during transport
- Strap down the vehicle to avoid all risk of bouncing during transport



**A.7 TYRES**

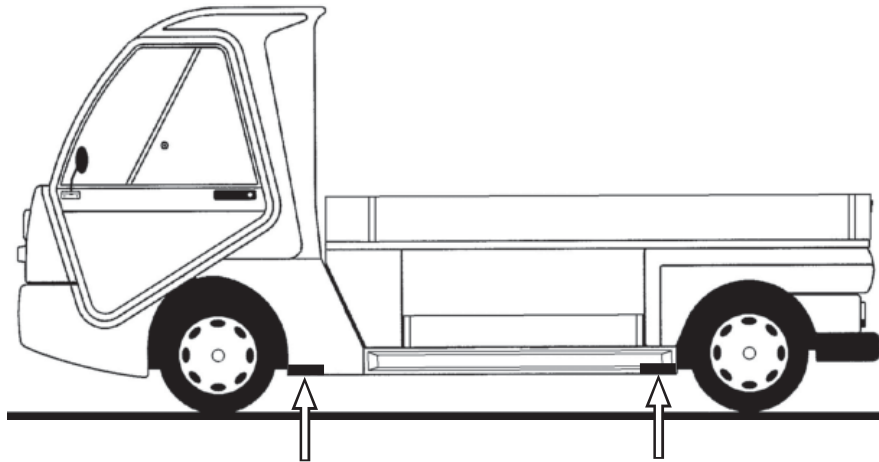
- Check that the tyres are correctly inflated (sticker on the left of the driver).
- Check for cuts or embedded foreign bodies in the treads.
- Ensure that the wheel nuts are properly tightened

**IN CASE OF A FLAT TYRE:**

Use the aerosol provided for this eventuality. It is situated in the electrical compartment under the seats.

The jack is situated behind the passenger seat.

**NOTE**  
The jack must be placed only in the following positions:



**NOTE**  
Use only the jack delivered with the vehicle,  
otherwise there is some risks to damage the  
chassis.



## Section B

### GENERAL MAINTENANCE AND SERVICING



## **B.1 GENERAL MAINTENANCE**

### **B.1.1 General**

This section comprises information relative to the maintenance and general procedures.

Qualified personnel must carry out maintenance operations and/or repairs carried out on your vehicle. To find the frequency of maintenance, study the table of scheduled maintenance.

The following procedure aims to help you diagnose a break down and possibly to resolve the problem:

1. To determine the problem
2. To establish the list of possible causes
3. To make the functional checks
4. To make the checks in a logical sequence to determine the cause/causes
5. To consider the life remaining in a part against the cost of replacement and labour
6. To make the necessary repairs
7. To check again to make sure nothing has been forgotten
8. To make a functional test of the replaced part in it's system

### **B.1.2 Cleanliness**

In order to preserve the life of your vehicle, it is important that spare parts are always kept clean. Each time some oil or lubricant escapes from disconnected pipes or sections, it is important that the joints are cleaned, to prevent foreign bodies getting into the pipe work. The same conditions apply to the cleanliness of mechanical parts

Clean and inspect all the parts. Ensure that the openings are not blocked. Cover them to protect them from dust or liquids. Ensure that the parts to be changed are clean before installing them. Remove all traces of corrosion from the parts that are to be fitted with new components.

### **B.1.3 Removal and refitting**

While servicing your vehicle, do not try to manually lever heavy parts when a method of mechanical leverage can be used. Do not place and never leave heavy parts in an unstable position. When lifting a part of the vehicle or the whole vehicle, ensure that it is well wedged and that its weight is supported by wedges rather than by a lifting system

If you encounter difficulties during the removal of a part, check that all the screws and nuts have been removed and that an adjacent part is not jamming. When assembling or removing a component or a system, carry out each stage turn by turn. Do not partly assemble a component and then start to assemble another. Carry out all the necessary adjustments. Always check the work done after having finished to ensure that nothing has been forgotten. Check again the various adjustments concerning the functioning of the vehicle before putting it back into service.

### **B.1.4 Procedure**

- Place the vehicle in an authorised, clean and clear environment
- Before working on the vehicle make sure the proper shut down procedures have been carried out
- Block the vehicle according to the type of work
- Disconnect the batteries before starting work
- Provide a fire extinguisher

Before putting the vehicle back in service, follow the safety guidelines

- Carry out the functional checks in a clear and authorised area

### **B.1.5 Batteries**

Remove batteries from vehicle before cleaning with a brush using a bicarbonate of soda solution. Rinse with clear water. After cleaning, dry the batteries and cover the leads and terminals with an anti-corrosive or grease.

If the vehicle remains unused during a long period of time, the batteries must be removed. They must be stored in a dry and temperate environment, preferably on wood blocks. Never store on concrete. A small



### B.1.6 Batteries central filling

Thanks to this system, you can easily make the batteries water level :

- Connect the removable tank to the mouth located on the right of the batteries compartment and keep it higher than it.
- Open the tap and wait until the red roller stop



- Close the tap and disconnect the can.

#### NOTE

**We recommend checking the electrolyte levels every 15 days (hot weather) or every 3 weeks (regular use).**

**If the check point gauges on top of the caps are red the level is full, if they are half or not visible they need topping up.**

**B.1.7 Simple Steps For Longer Battery Life**

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**Equipment:**

Trojan recommends the following equipment for use in battery care and maintenance:

- Wrench
- Distilled Water
- Voltmeter
- Hydrometer
- Post Cleaner
- Baking Soda
- Petroleum Jelly
- Goggles & Gloves

**CAUTION: Always wear protective clothing, gloves, and goggles when handling**



**batteries and electrolyte.  
Inspection**

1. Examine the outside appearance of the battery.
  - Look for cracks in the container.
  - The top of the battery, posts and connections should be free of dirt, fluids and corrosion. (If batteries are dirty, see Cleaning section.)
  - Replace any damaged batteries.
2. Any fluids on or around the battery may indicate that electrolyte is spilling, leaching or leaking out.
  - Leaking batteries must be replaced.
3. Check all battery cables and connections.
  - Look closely for loose or damaged parts.
  - Replace any cable that is broken or frayed.
4. Tighten all wiring connections to the proper specification (following page.) Be sure there is good contact with the terminals.

**WARNING: Do not smoke near batteries.**

**WARNING: Do not over-tighten terminals. Over-tightening can result in post breakage, post melt-down or fire.**

**Proper Torque Values for Connection Hardware**

- Flooded
- Automotive: 50-70 in-lbs
  - Side: 70-90 in-lbs
  - Wingnut: 95-105 in-lbs
  - LPT: 95-105 in-lbs
  - LT: 100-120 in-lbs

- Gel
- Button: 90-110 in-lbs
  - LT: 100-120 in-lbs

**Specific Gravity Testing**

(Flooded batteries only)

1. Do not add water prior to testing.
2. Fill and drain the hydrometer 2-4 times before drawing a sample from the battery.
3. Have enough sample electrolyte in the hydrometer to completely support the float.
4. Take a reading, record it and return the electrolyte to the cell.
5. Check all cells in the battery, repeating the steps above.
6. Replace vent caps and wipe off any electrolyte that might have been spilled.
7. Correct the readings to 80°F:
  - Add .004 to readings for every 10° above 80°F.
  - Subtract .004 for every 10° below 80°F.
8. Check the state of charge using the table on the next page.

The readings should be within the factory specification of 1.277 +/- .007. If any specific gravity reading registers low, follow these steps:

1. Check and record voltage level(s).
2. Put batteries on a complete charge.
3. Take specific gravity readings again.

If any specific gravity reading still registers low, follow these steps:

1. Check voltage level(s).
2. Perform equalization charge. (See Equalizing).

If any specific gravity reading still registers lower than the factory specification, one or more of these conditions may exist:

1. The battery is old and nearing end of life.
2. The battery was left discharged too long.
3. Electrolyte was lost due to spillage.
4. A weak or bad cell is developing.
5. The battery was over-watered prior to testing.

Batteries in conditions 1-4 should be taken to a specialist for further evaluation or retired from service.

### Open-Circuit Voltage Testing

For accurate voltage readings, batteries must remain idle (no charging, no discharging) for at least 6 hours, and preferably 24 hours.

1. Disconnect all loads from the batteries.
2. Measure the voltage with a DC voltmeter.
3. Check the state of charge with the table below.
4. Charge the battery if it registers 0-70% charged.

If battery registers below table values, these conditions may exist:

1. The battery was left discharged too long.
2. The battery has a bad cell.

Batteries in these conditions should be taken to a specialist for further evaluation, or retired from service.

% STATE OF CHARGE	SPECIFIC GRAVITY CORRECTED TO 80° F	OPEN-CIRCUIT VOLTAGE		
		6 VOLT	8 VOLT	12 VOLT
100	1.277	6.37	8.49	12.73
90	1.258	6.31	8.41	12.62
80	1.238	6.25	8.33	12.50
70	1.217	6.19	8.25	12.37
60	1.195	6.12	8.16	12.24
50	1.172	6.05	8.07	12.10
40	1.148	5.98	7.97	11.96
30	1.124	5.91	7.88	11.81
20	1.098	5.83	7.77	11.66
10	1.073	5.75	7.67	11.51

State of charge as related to specific gravity and open-circuit voltage

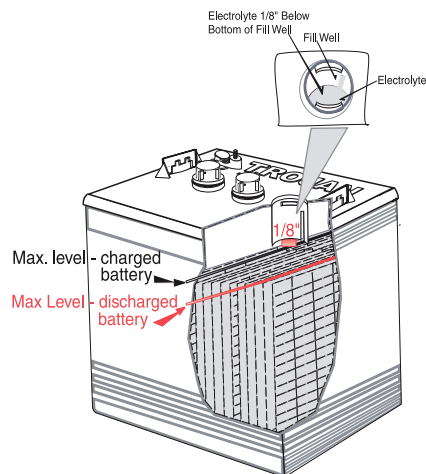
### Watering (Flooded batteries only)

Water should only be added after fully charging the battery. Prior to charging, there should be enough water to cover the plates. If the battery has been discharged (partially or fully), the water level should also be above the plates.

Important things to remember:

1. Do not allow plates to be exposed to air.
2. Do not fill the water all the way up to the cap.
3. Do not use water with a high mineral content.
4. Use only distilled or deionized water.

**CAUTION: The electrolyte is a solution of acid and water, so skin contact should be avoided.**



Procedure:

1. Remove the vent caps and check the electrolyte level; the minimum level is to the top of the plates.
2. If there is no electrolyte visible, add just enough water to cover the plates.
3. Replace and tighten all water vent caps.
4. Put batteries on a complete charge before adding any more water. (See Charging section.)
5. Once charging is completed, remove the vent caps and check the electrolyte level.

6. Add water until the electrolyte level is 1/8" below the bottom of the fill well.
7. Clean, replace and tighten all vent caps

**WARNING: Never add acid to a battery.**

**Cleaning**

1. Check that all vent caps are tight.
2. Clean the battery top with a cloth or brush and a solution of baking soda and water.
- Do not allow any cleaning solution or other foreign matter to get inside the battery.
3. Rinse with water and dry with a clean cloth.
4. Clean battery terminals and the inside of cable clamps with a post and clamp cleaner.
5. Reconnect the clamps to the terminals and thinly coat them with petroleum jelly.
6. Keep the area around batteries clean and dry.

**Storage**

Important things to avoid:

1. Freezing - Avoid locations where freezing temperatures are expected. Keeping batteries at a high state of charge also prevents freezing. (See table next page.)
2. Heat - Avoid direct exposure to heat sources, such as radiators or space heaters. Temperatures above 80° F accelerate the battery's self-discharge characteristics.

Procedure:

1. Completely charge the battery before storing.
2. Store the battery in a cool, dry location, protected from the elements.
3. During storage, monitor the specific gravity (flooded batteries) or voltage.
- Stored batteries should be given a boost charge when they show a 70% state of charge or less. (See table previous page.)
4. Completely charge the battery before re-activating.
5. For optimum performance, equalize the batteries (flooded) before putting them back into service. (See Equalizing

section.)  
**Electrolyte Freezing Point at Various**

SPECIFIC GRAVITY	%STATE OF CHARGE	FREEZING TEMPERATURE
1.280	100	-92.0°F
1.265	92	-71.3°F
1.250	85	-62.0°F
1.200	62	-16.0°F
1.150	40	+5.0°F
1.100	20	+19.0°F

\*Source: BCI Battery Service Manual 1995

**States of Charge\*  
Charging**

Correctly charging batteries requires administering the right amount of current at the right voltage.

Most charging equipment automatically regulates these values. Some chargers allow the user to set these values. For proper charging, refer to the instructions

that came with your charging equipment. Important things to remember:

1. Become familiar with, and follow the instructions from, the charger manufacturer.
2. Batteries should be charged after each period of use.
3. Lead-acid batteries do not develop a memory and need not be fully discharged before recharging.
4. Charge only in well-ventilated areas. Keep sparks or flames away from a charging battery.
5. Verify charger voltage settings are correct.
6. Check electrolyte level. (See Watering section.)
7. Tighten all vent caps before charging.
8. Do not overcharge or undercharge the

### **Equalizing**

(Flooded batteries only)

**WARNING: Do not equalize Gel  
or AGM batteries.**

Equalizing is an overcharge performed on flooded lead-acid batteries after they have been fully charged. It helps eliminate stratification and sulfation, two conditions that can reduce the overall performance of a battery.

Trojan recommends equalizing only when low or wide ranging specific gravity (+/- .015) is detected after fully charging a battery.

Procedure:

1. Verify that batteries are the flooded type.
2. Remove all loads from the batteries.
3. Connect battery charger.
4. Set charger to equalizing mode.
5. Start charging batteries.
6. Batteries will begin gassing and bubbling vigorously.
7. Take specific gravity readings every hour.
8. Equalization is complete when specific gravity values no longer rise during the gassing stage.

NOTE: Many chargers do not have an equalization setting, so this procedure cannot be used.



**B.1.8 Electric wires and cables**

The batteries must always be disconnected before working on the electrical system. Before removing or disconnecting a bundle of wires or cables, mark each one of them to ensure that you can correctly reconnect them. Make sure that each connection is clean to avoid bad contacts.

**NOTE**  
**Open the lid under the seats to give access to the fuses.**

**B.1.9 Electric Motor**

Traction Motor Brush



The motor brushes should be checked on a six monthly basis (check wear line).

To ensure the cooling air flow is maintained across the motor, the rear motor cover should be checked for correct fitting when removed.



Plate fitted incorrectly (wrong way round)



Plate fitted correctly

**B.1.10 Bearings**

Once a bearing is removed, cover it to keep out dirt and abrasive matter. Clean the bearings in a solvent and leave them to dry. The bearings can be dried with compressed air but avoid turning them too fast.

Dispose of the bearings if they show any sign of discoloration, marking, deformation or overheating. If the bearing is usable, smear it with oil or grease and cover it with clean waxed paper. Do not unpack a bearing until just before its use. The life of a bearing is considerably reduced if it is not correctly lubricated. Dirt in a bearing can stop it turning on its axle. The track of the bearing can become the axle or the housing, which can result in a lot of repair work.

Do not fit bearing with a hammer. Where possible use a press and ensure that the pressure is applied directly on the ring, which must be fixed in relation to its housing. If you use a hammer, equip yourself with a tube of the same diameter as the ring to be set up and ensure that the bearing does not go askew.

**B.1.11 Nuts and Bolts**

Lock washers, lock plates and pins are used to lock the nuts and bolts. Always use new nuts and bolts on parts with movable parts. When fitting lock washers on aluminium, use a flat washer between the lock washer and the part

**B.1.12 Waterproofing**

Ensure that joints are fitted with the appropriate gaskets or seals for the lubricants used. If it is necessary to fabricate a seal, select an appropriate material of a good thickness. Make a hole in the correct place. An unsuitable seal can cause serious damage.

**B.2 SERVICING**

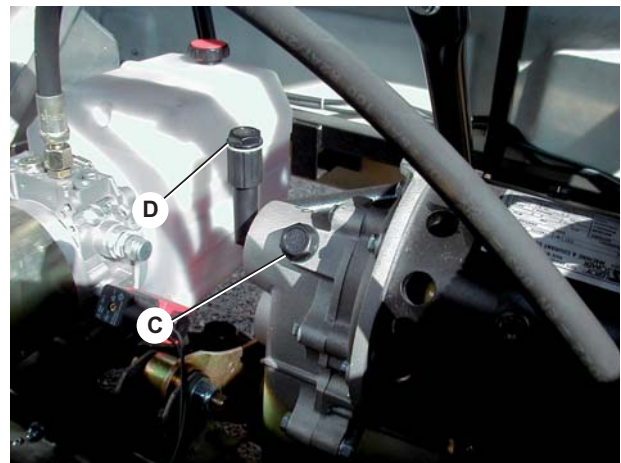
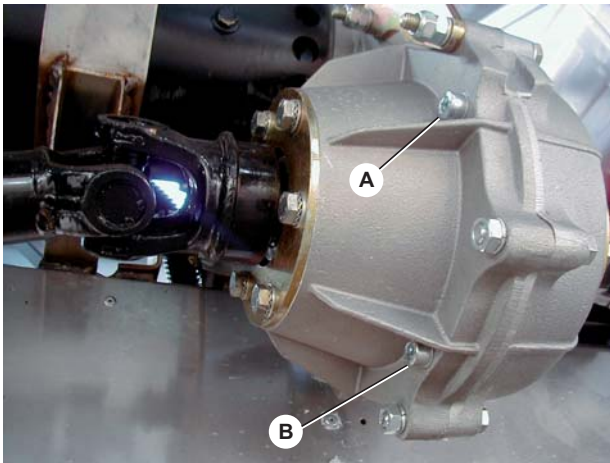
**B.2.1 Washing the vehicle**

Whatever is the version of the vehicle, if you wash it by water jet don't aim at the batteries area (see below) because there is risk of acid splashes.



**B.2.2 Lubrication points**

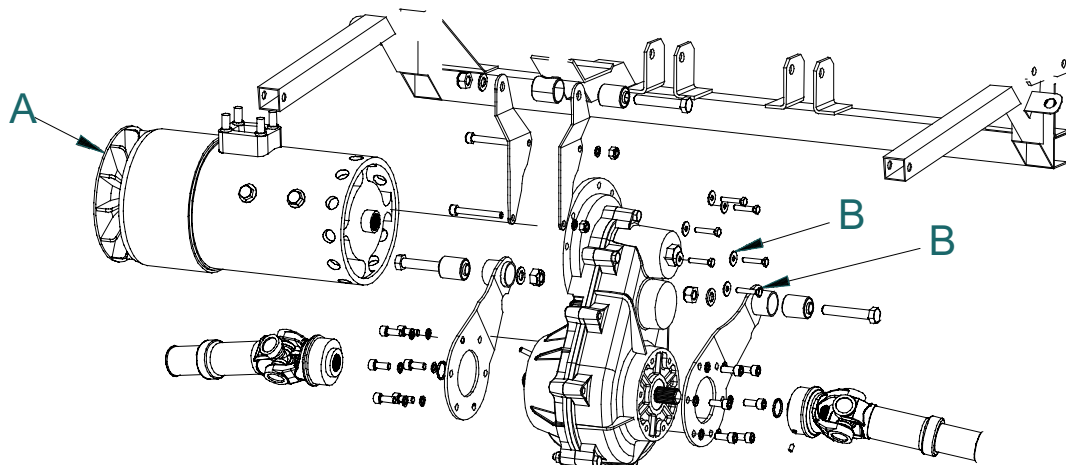
REP.	DESCRIPTION	TYPE OF LUBRICANT
1	Filling of axle/reduction gear	SAE 90
2	Axle/reduction Oil level	SAE 90
3	Oil change axle/reduction	



A Level Plug  
B Drain Plug

C Filler Plug  
D Breather

The axle oil be checked ever 6 months and replaced annually using SAE90 gear oil.



A 1/4 Turn on motor shaft  
B Motor retaining bolts

Check drive shaft back-lash via motor fan. If excessive movement U-joints are worn out (1/4 turn).

Every 6 months release the six motor retaining bolts and lubricate motor and gearbox shaft with HP grease.



Lubricate the PTO U joint, using the 30 degree grease nipple.

### B.2.3 Suspension pressure

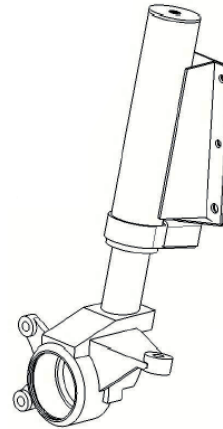
The standard pressures are:

- Front: 13 bars
- Rear: 12 bars

#### To service suspension system

use the following process:

1. Remove the suspension arm from the vehicle
2. Release compressed air from the ram using the Schroeder valve on the top
3. Compress the ram whilst releasing the air from the ram
4. Using a C-spanner or punch, remove the collar from the body (this is Loctited) Pull shaft from body. Warning – Oil is held within assembly



Inspection – Ram shaft can get rusty, check thoroughly for damage to shaft.

Assembly is in reverse to the above.

Once assembled, remove the Schroeder valve and purge the oil from the ram. Position the piston 1.5 cm from the top and fill with 180ml of oil. Allow oil to settle and after one hour refit Schroeder valve and fill with air to pressures shown above.

#### How to inflate:

This operation is done wheel by wheel, with an air pump capable of achieving a pressure of 12 bars.

- Raise up the vehicle with the jack supplied or electric lift (distribute the efforts under the chassis)
- Be sure the wheel does not touch the ground by spinning it
- Bring forward the front seats for valves (standard) access.
- Remove the cap and connect the pump.
- Inflate until the correct pressure is achieved.
- Disconnect the pump with a quick and precise hand move to doesn't lose pressure
- Put on the cap
- Lower the vehicle to the ground

### ⚠ WARNING ⚠

**SUSPENSION PRESSURE CAN'T BE CHECKED WHEN THE VEHICLE IS IN THE DRIVING POSITION.**

**IF DOUBTS ABOUT INCORRECT PRESSURE, YOU CAN DO A VISUAL ESTIMATION WITH HEIGHT (PUSH THE VEHICLE FOR SEVERAL METERS TO RELEASE THE SUSPENSION).**

**CHECKING PRESSURE MUST BE DONE WITH THE VEHICLE LIFTED OFF THE GROUND TO HAVE SUSPENSION POSITION DOWN.**

### ⚠ WARNING ⚠

**NEVER REMOVE CAPS OR CONNECT AIR PUMP WHEN THE VEHICLE IS ON THE GROUND.**

**DON'T EXCEED 15 BAR IN SUSPENSION.**

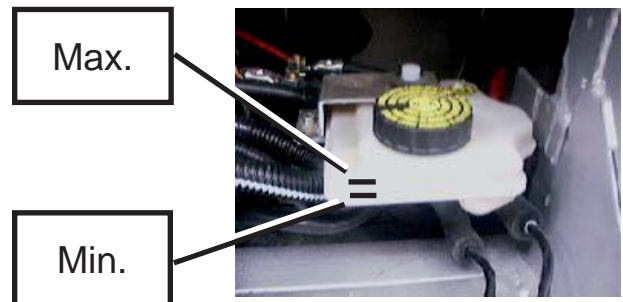
### B.2.4 Steering

If any play is felt in the steering wheel, contact your dealer.

### B.2.5 Brake fluid

The **brake fluid level** must be **checked** every **two weeks**. To do this **open the lid** situated under the **passenger and driver seats**.

Only use the fluid recommended by the manufacturer: DOT 4 specification.



**B.2.6 Charger**

**B.2.6.1 Charger - NG1**

Two chargers are available:     Standard charger  
13A (7-8 hours)  
Fast charger 16A

When charging:

0-5 hours    Red    }  
5-8 hours    Amber}     lights on charger  
10-15 hours    Green}     60-70%

When fan switches off battery is fully charged -  
62/63V peak battery voltage

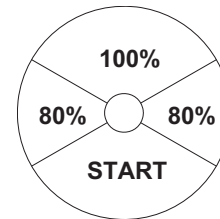
If disconnected during charge cycle a warning beep  
can be heard.

Note: If the battery pack goes below 20% charge then the charger fitted to the machine cannot detect the pack and will not switch on. If this occurs a remote charger will be required to boost the charge to allow the on board charger to be used

Note: Machine should be charged every day if it has been used whether for 1 hour or 12 hours.

**B.2.6.2 Charger - NG3**

RED LED                    shows that the battery is in the initial charging phase.  
YELLOW LED                shows that the battery charger has reached 80% of charge.  
GREEN LED                 shows that the battery has reached 100% of charge.



**ALARMS**

An two-tone audible message and the flashing LED shows that an Alarm situation has occurred:

LED State	Alarm Type	Description (Action)
RED flash	Battery Presence	Battery disconnected or not in conformity. (Verify the connection and the nominal voltage).
YELLOW flash	Thermal Sensor	The thermal sensor is disconnected during the recharge or it is out working range. (Verify the connection of the sensor and measure the temperature of the battery).
GREEN flash	Timeout	Phase 1 and/or Phase 2 have a duration in excess of the maximal allowed. (Verify the battery capacity).
RED-YELLOW flash	Battery Current	Loss of output Current control. (Failure of the control logic).
RED-GREEN flash	Battery Voltage	Loss of output Voltage control. (Battery disconnected or failure of the control logic).
RED-YELLOW-GREEN flash	Thermal	Overheating of semiconductors. (Verify the fan operation)

When there is an alarm the battery charger stops supplying current.



### B.2.7 Maintenance schedule

The following table gives a resume of the maintenance periods in normal conditions of use.

TASKS TO BE CARRIED OUT	DAILY. 20 HOURS	HALF MONTHLY 40 HOURS	MONTHLY 80 HOURS	4 MONTH 250 HOURS	6 MONTHS 500 HOURS	ANNUALLY 1000 HOURS
Check the electrolyte level in the batteries and fill if necessary (distilled water)	●	●				
Check brake fluid level. Top up if necessary		●				
Check tyre pressure (3.5 bars max)	●					
Check brake cables			●			
Check for play in steering. Adjust if necessary.			●			
Check the steering column and rack.			●			
Cleaning and tightening of all connections (cables and wires) and lubricate connections				●		
Check flexible pipes and lines on brake system (wear, cracking and breaks)					●	
Check front wheel bearings					●	
Check axle oil level					●	
Check tightness of all nuts and bolts of motor, axle and bodywork						●
Check motor brushes					●	
Lubricate motor shaft					●	
Change rear axle oil						●

### B.3 CIRCUIT ELECTRIQUE

#### B.2.8 Breakdown guide

#### B.3.1 Circuit standard

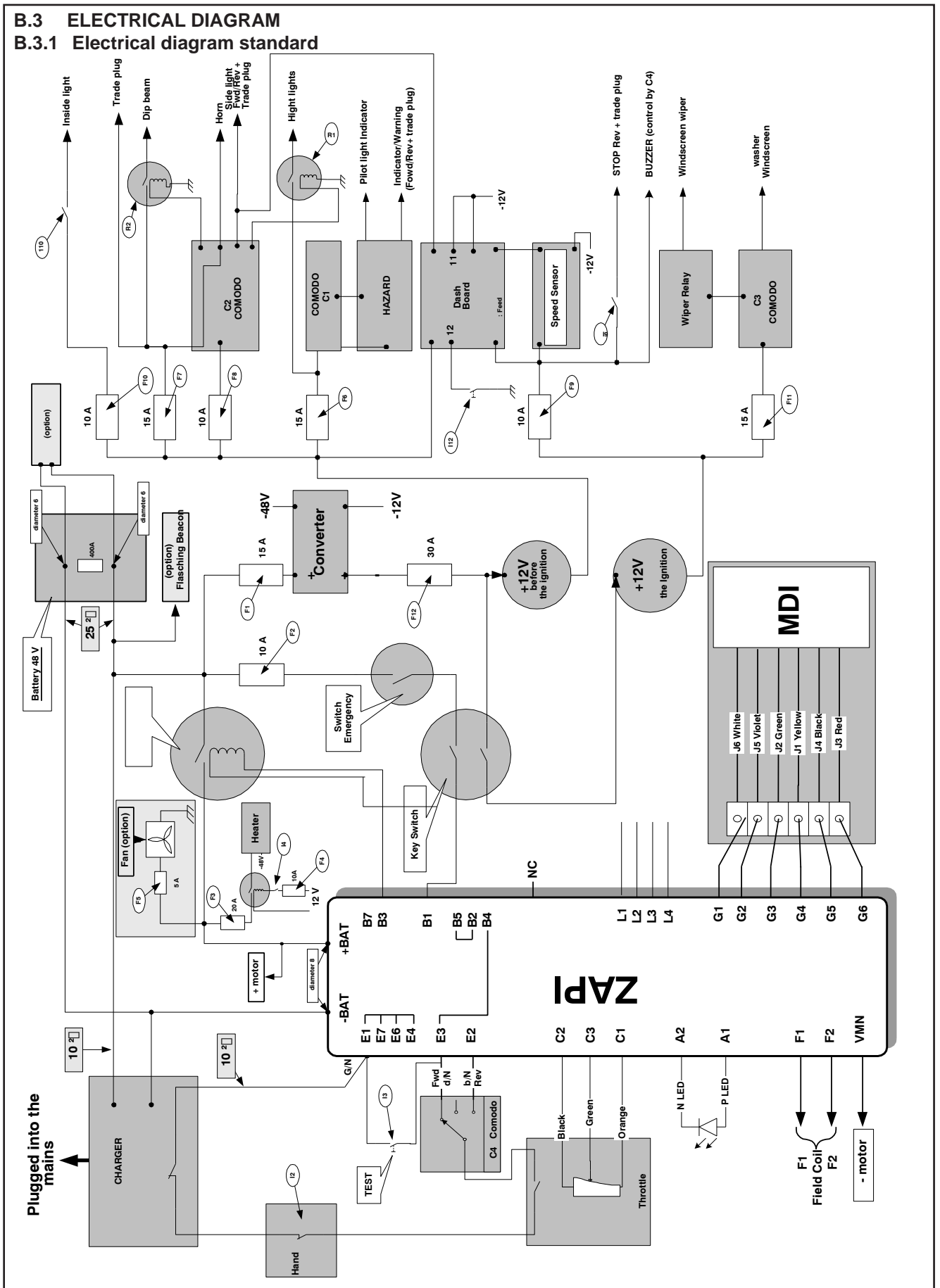
SYMPTOM	PROBABLE CAUSE
Steering « pulls » to right or left	Unequal tyre pressure
	Misalignment of front axle in relation to rear
	Problem with stub axle (shock or bar badly refitted)
Difficult steering	Insufficient tyre pressure
	Damaged steering ball and socket(s)
	Steering rack damaged
	Misaligned steering column (shock)
Excessive steering play	Worn steering ball and socket joints)
	Worn splines on steering rack
	Steering rack weak
	Loss of a connection
Lack of power or speed abnormally slow	Brake callipers not properly disengaging
	Badly adjusted parking brake
	Back axle working badly
	Misalignment of front axle in relation to rear, defective battery
	Speed variator defective or badly adjusted
Abnormal noise	Bearings and/or back axle pinions damaged
	Bearings front wheel boss bearings damaged
	Bearings of electric motor damaged
Oil leak	(On the rear axle) the seals are defective or casing loose
	Axle over-full
	Brake system connectors or bleed screws not properly tightened
Brake pedal spongy	Air in the brake circuit
Too much travel in the brake pedal	Fluid level too low
	Brake linings too worn
Braking too slow (bad braking)	Air in the brake circuits
	Linings too worn
	Linings impregnated with liquid/fluid
	Bad brake pedal movement
	Weak master cylinder
No response from accelerator pedala	Hand brake on
	The vehicle is on charge (i.e. connected to the mains)
The MDI indicator does not light up	Not switched on or the emergency stop is pushed in

#### NOTE

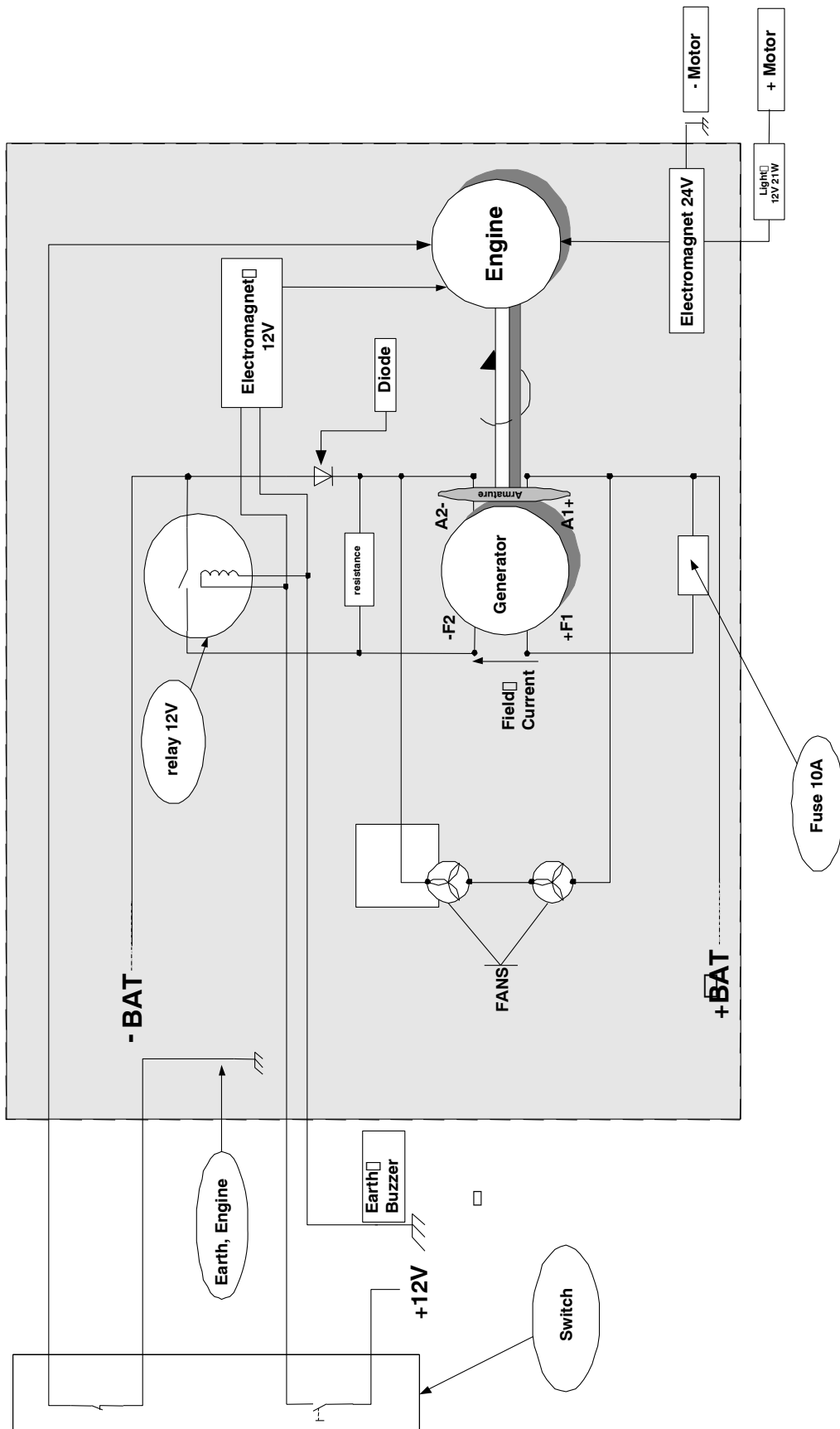
**The table gives a non-exhaustive summary of the causes of breakdown. It is only an aid and in no way summarises all the possible causes for a given problem.**

**B.3 ELECTRICAL DIAGRAM**

**B.3.1 Electrical diagram standard**



B.3.2 Electrical diagram with gas generator







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