# CMAR 600 RR

## TRAM RAIL SWEEPER AND CLEANER
## ROAD-RAIL VEHICLE

# TECHNICAL DESCRIPTION

Durtal,

# CONTENTS


1- MAIN SWEEPER SPECIFICATIONS ..... 4

1.1 - MAIN SPECIFICATIONS: ..... 4

1.2 - PERFORMANCES: ..... 5

1.2.1 General performances ..... 5

1.2.2 RMAS performances ..... 5

1.3 - TECHNICAL DESCRIPTION: ..... 6

2- RAIL GUIDING SYSTEM ..... 9

3- CLEANING TROLLEYS ..... 10

3.1. Suction openings and guiding trolleys ..... 11

3.2. Rail scouring nozzles ..... 11

3.3. Scraping system ..... 11

3.4. Brushing system ..... 11

4- HIGH PRESSURE EQUIPMENT ..... 12

4.1. High pressure pump ..... 12

4.2. Reel ..... 12

5- ELECTRIC EQUIPMENT ..... 12

5.1. Control and monitoring console ..... 12

5.2. Emergency stops ..... 12

5.3. Electric cabinet ..... 13

5.4. Cameras ..... 13

6- MISCELLANEOUS EQUIPMENT ..... 13

7- SIGNAGE ..... 14

8- FIRE SAFETY ..... 14

9- PAINT ..... 14

10- ADDITIONAL OPTIONAL EQUIPMENT ..... 14

10.1 - RADIO EQUIPMENT FOR COMMUNICATIONS WITH THE CENTRAL CONTROL STATION ..... 14

10.2 - PRIORITY PASSAGE EQUIPMENT AT CROSSROAD TRAFFIC LIGHTS ..... 14

10.3 – SWITCH POINT REMOTE CONTROL ..... 14

10.4 – SWITCH POINTS ROD ..... 15

11- TRAINING ..... 15

11.1 - User training. Duration: 2 days ..... 15

11.1.1 Road mode ..... 15

11.1.2 Rail mode ..... 15
11.1.3 Offloading operations ..... 15
11.1.4 Cleaning using the high pressure lance ..... 15
11.1.5 Backup mode ..... 15
11.1.6 Routine servicing ..... 15
**11.2 - Maintenance training. Duration: 1.5 days ..... 15**
11.2.1 Carrier ..... 16
11.2.2 Sweeper ..... 16
11.2.3 Rail cleaning tools ..... 16
11.2.4 Lubrication circuit ..... 16
**12- WARRANTY ..... 16**
**12.1 Use of vehicles by trained staff: ..... 16**
**12.2 Consumables and spare parts: ..... 16**
**12.3 Servicing: ..... 16**
**12.4 Fuel: ..... 17**
**12.5 Ad Blue additive: ..... 17**
**13- ENVIRONMENT ..... 17**
**14- VEHICLE CONSUMPTION ASSESSMENT ..... 17**
**14.1. In travel mode ..... 17**
**14.2 In sweeper mode ..... 17**
**14.3. In rail cleaning mode ..... 17**
**15- SPARE PARTS ..... 17**
**16- ROUTINE MAINTENANCE ..... 18**

# 1- MAIN SWEEPER SPECIFICATIONS

*Thanks to its size, the CMAR 600 RR compact sweeper has a wide range of uses.*

*It has a very high suction power over a sweeping width in excess of 3m.*
*It is also designed to clean the rail grooves and their surfaces using a high pressure water spray followed by brushing and waste suction. In this way, the machine guarantees the aesthetic appearance of the rails, but above all the driveability and braking capacities of the rolling stock, as well as its correct electricity supply.*

*The power of the motor and the hydraulic system make it possible for the machine to fulfil its missions separately, without requiring an auxiliary motor and keeping it compact.*

## 1.1 - MAIN SPECIFICATIONS:

- Length with front brush: 6900 mm
- Width: 1800 mm
- Height: 2900 mm
- Total weight: 12100 kg
- Working load: 3500 kg
  *(road-rail and front brush fitted sweeper)*
- Waste tank capacity: 2.7 $m^3$
- Clean water tank capacity: 1800 litres (HDPE and aluminium)


## 1.2 - PERFORMANCES:

### 1.2.1 General performances

- Driving speed: 25 km/h or 50 km/h depending on local regulations.
- In sweeping mode, the speed is between 5 and 15 km/h depending on the quantity of waste to collect.
- In rail cleaning mode, the speed is between 5 and 10 km/h depending on how dirty the grooves and rail surfaces are.
- The vehicle is put on and removed from the rails in locations in which the rails are embedded in a stable, load-bearing covering.
- It takes no more than a minute to put it on the rails and less than 30 seconds to take it off the rails, making it possible for the vehicle to work while passenger services are running.
- Minimum track curve radius: 20 m.
- The vehicle can sweep grass zones without damaging them.
- The vehicle can move, work, brake and remain stationary on the steepest network slopes, whatever the rail condition except for ice and snow.
- The fully loaded vehicle (12.100t GVWR) moving on a level section on dry rails at a speed of 25 km/h will stop in under 6 m.

### 1.2.2 RMAS performances

- The vehicle service life expectancy is 10 years.
- The vehicle can carry out its intended functions outside preventive maintenance and servicing without any other requirements than to keep it fuelled and lubricated.
- Average number of breakdowns on all the vehicles in service (about 30 vehicles): 2 breakdowns / year and per vehicle.
- Supported by this experience, we commit to a MTBF of 800 hours.
- MTTR: < 3 hours in 95 % of cases.
- Annual availability: >0.96.
  TBF: 83.75 days
  TICE: 3 days
  TID: 4 days
  TIM: 0.25 days

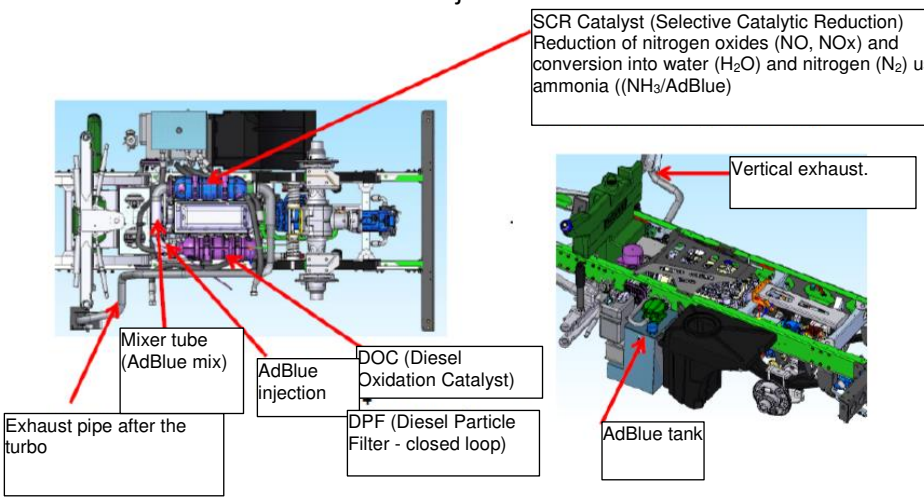
  D(t)=((84-0.25)+3)/(84-0.25)+4+0.25) = 98.5%

  *Note: The following conditions of use, servicing and maintenance must be strictly followed:*
- *The vehicle must be operated in compliance with the supplied indications and user manuals.*
- *Keep the equipment clean.*
- *Altering the equipment without permission from CMAR is strictly prohibited.*
- *Users must be trained and accredited.*
- *Have cleaning, servicing and preventive maintenance carried out by qualified staff according to the recommendations in terms of frequency, tasks and quality.*

## 1.3 - TECHNICAL DESCRIPTION:

***1.3.1 ENGINE***

Detroit Diesel VM756R turbo diesel with air cooled turbo, Common rail, 6 in line cylinders EURO VI, 162 HP (120 kW) at 2300 rpm. Ad Blue additive injection. Vertical exhaust.




***1.3.2 TRANSMISSION***

Hydrostatic drive transmission on the rear wheels.

***1.3.3 CABIN***

Suspended, pressurised and air conditioned. 2 seats with panoramic windscreen and ergonomic control console. Adjustable seat and steering column for added comfort. Floor and doors with sliding glazing.

***1.3.4 TYRES*** 215/75 R 17.5**.** Twinned wheels at the rear.

***1.3.5 ELECTRICITY*** 12 V 90 Ah battery, 2 FRONT floodlights, FRONT and REAR directional indicators, REAR tail lights, REAR brake lights, REAR reflectors, 2 rotating lights (1 FRONT over the cabin and 1 REAR over the casing), cabin interior ceiling light. Battery cut-off.

***1.3.6 SUCTION*** Suction through a 700 mm wide opening placed under the cabin (the driver has a direct view through the glazed cabin floor). Suction diameter: Ø 250 mm.

ARDOX® abrasion-proof steel turbine. Rotating speed 3200 rpm max. Flow rate 18000 m³/h. Soundproofing using a stainless steel filter on the turbine air discharge. PM10 certified.
The tank is fitted with a suction arm for occasional use.

EUnited Municipal Equipment
PM 10
FOR A CLEAN ENVIRONMENT
★★★
CERTIFIED

***1.3.7 SWEEPING***

Sweeping width: 2400 mm
Sweeping width with optional front brush: up to 3100 mm
2 sweeping levels for work on narrow side-walks.
Dampening pump 17 l/min - 10 bars



***1.3.8 WASTE TANK***

made in aluminium
Net capacity: 3500 litres
Tipping height: 1150 mm
Remotely controlled emptying
Manual suction pipe for accumulations of dead leaves, drain inlets, etc.
Settling valve to empty the liquid phase without tipping.

***1.3.9 DASHBOARD DISPLAY***


Very complete, the system displays the machine's parameters:
Operating hours
Travel hours
Swept mileage
Travel mileage
Engine and turbine speeds
Fluid level displays (water, fuel)
Travelling speed.

**Maintenance mode display:**
Alarm and malfunction history
Information menus
Troubleshooting for electric components.



***1.3.10 NOISE LEVELS***

| | |
|---|---|
| ***ACOUSTIC LEVEL*** | LwA =106 dB (A) |
| ***ACOUSTIC PRESSURE*** | Exterior: 77.2 dB(A) at 1450 rpm at 7.50 m<br>In the driver's cabin with the windows open: 65.4 dB(A) at 1450rpm |

## 2- RAIL GUIDING SYSTEM

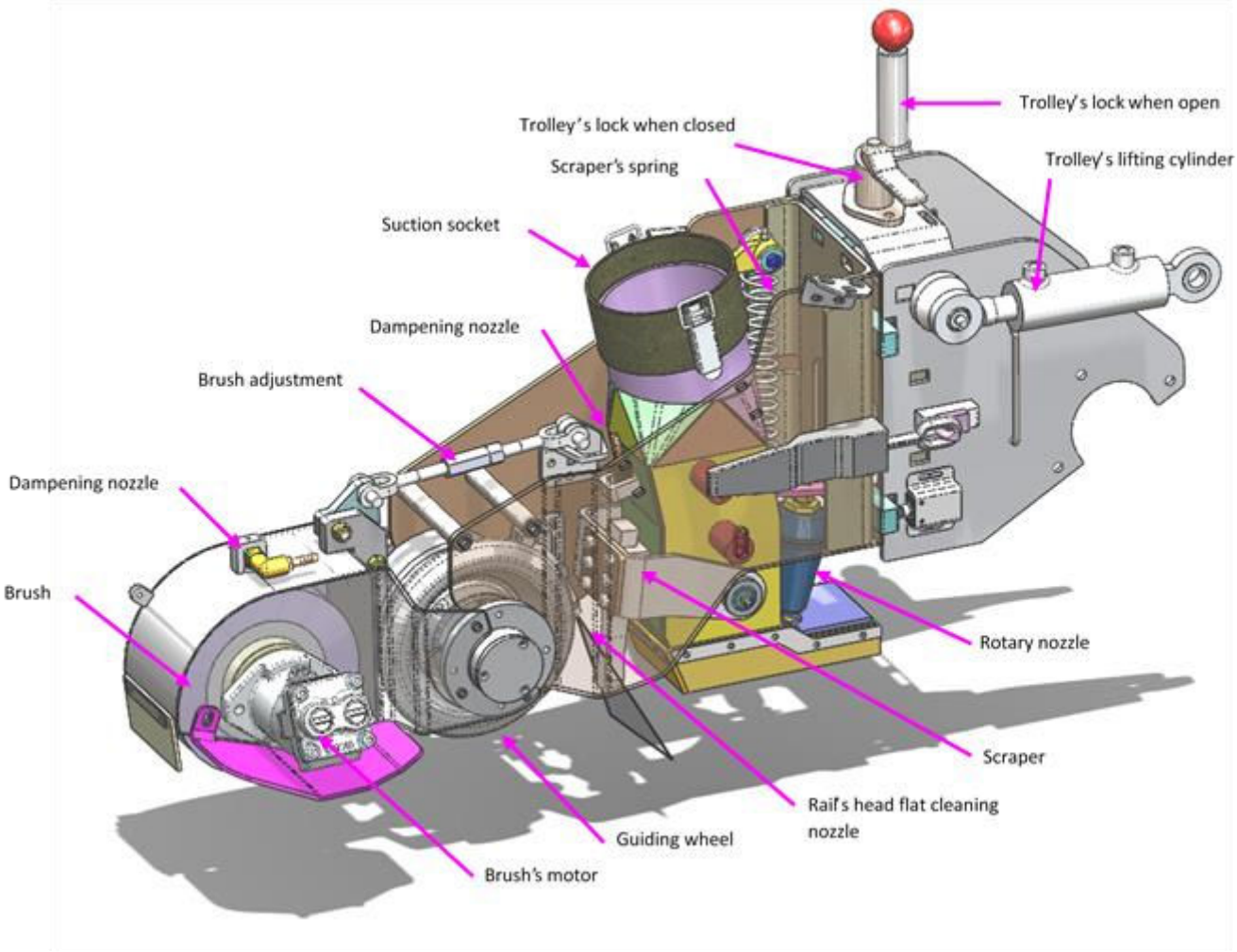

Guiding is provided by two guiding axles with two Ø 400 mm wheels at the rear and two Ø 300mm wheels at the front.

The guiding wheels have a profile defined according to the profile of the elastic wheels commonly used on trams, the flange profile is adapted to use on grooved rails.
Each wheel is guided by two conical bearings mounted sealed, with external lubrication.
The guiding axle is fixed using clamps to an articulated bed located close to the axle in the FRONT and REAR overhang.

The vertically floating assembly makes an even spread of the pressure of the guiding wheels on the rail possible. These axles are raised and lowered using double acting hydraulic cylinders controlled via a hydraulic block from the driver's cabin.
A manual backup control can be used for operations to put the vehicle on or take it off the rails.
Movement is provided by the tyres in contact with the rails. The vehicle wheel route preserves the urban environment during use on rails (lawn, paving, etc.). Nevertheless, due to the relative sagging of the tyres, the substrate in grassed areas should be kept at about 30 mm under the level of the rails.
FERRAZ contact shoes are installed at the end of the journals on the front axle in order to achieve electric continuity with a resistance of less than 1.5mΩ.

The steering wheel can be locked with the wheels in the straight position when the vehicle is on rails. The operator carries out this operation.

## 3- CLEANING TROLLEYS




**3.1. Suction openings and guiding trolleys**

- 2 cleaning trolleys placed behind the guiding wheels.
- 2 side suctions of Ø 130mm on each side of the casing.
- In the transport position, the trolleys are hydraulically raised.

**3.2. Rail scouring nozzles**

- 2 high pressure tools of 200 bars max. (adjustable pressure) used to scour:
    - either the rail surface (1 flat spray) + the rail groove (1 rotating nozzle)
    - or just the groove (1 rotating nozzle)

**3.3. Scraping system**

- 2 scrapers are fitted behind the suction openings.

**3.4. Brushing system**

- 2 brushes are fitted on the rear of the trolleys.
- A "no forward movement" safety stops the brush rotation when the speed drops below 3 km/h.

# 4- HIGH PRESSURE EQUIPMENT

## 4.1. High pressure p

ump

- Type WS 203
- Max flow rate: 30 l/min
- Max pressure: 200 bars
- Pump driven by a hydraulic motor
- Manual pressure regulator with automatic by-pass
- Suction water filter with stainless steel quickly-removable mesh

## 4.2. Reel

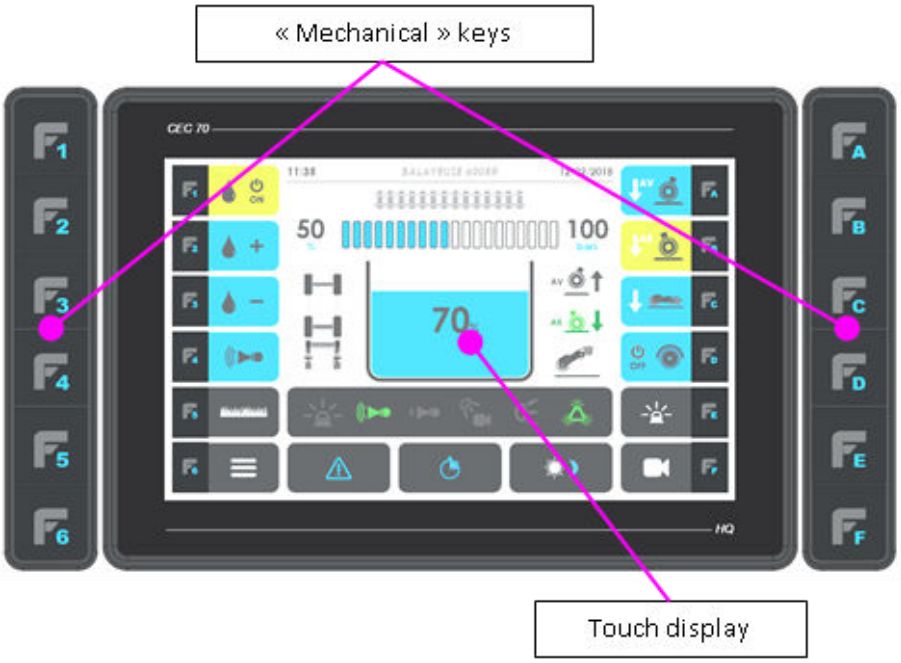
- Automatic type reel, fitted with 13 m of high pressure hose.
- Manual isolation valve
- 1 high pressure cleaning gun, double lance with adjustable flow.
- Optional Venturi ejector detergent suction system

# 5- ELECTRIC EQUIPMENT

## 5.1. Control and monitoring console

It is located inside the cabin and unables mainly to operate and stop the following functions by means of a touch display:

- Putting the vehicle on and off the rails
- Operation of the cleaning trolleys
- Operation of the High Pressure cleaning
- Operation of the scrubbing brushes




## 5.2. Emergency stops

2 at the front (right and left)
2 at the rear (right and left)
1 in the cabin

### 5.3. Electric cabinet

There is an electric cabinet in the cabin that houses:
the connections
the automation relays
the power relays
a buzzer connected to the reverse that is not inhibited by the tail lights. This buzzer can be inhibited using a switch when the vehicle is not in a working configuration, in compliance with applicable regulations for road vehicles.

### 5.4. Cameras

There are 2 colour cameras located at the front and rear to facilitate operations to put the vehicle on the rails.
1 reverse camera with sound
1 7″ colour monitor inside the cabin

## 6- MISCELLANEOUS EQUIPMENT

- A centralised lubrication system is connected to the vehicle's main lubrication points.
- Battery cut-off on the back of the cabin.
- Manual backup pump.
- Spare wheel not carried on the vehicle.
- Jack and indicator triangle
- Radio-CD player.
- Pre-wiring for priority beacons at intersections and points controls and beacon fixing supports under the chassis. 12V power supply with protection included.
- 12 V cigarette lighter socket in the cabin.
- 2 LED work flood lights at the rear of the vehicle.
- Plastic storage locker containing:
    - 5 m filling pipe with claw coupling connector
    - DN 65/40 hose coupling
    - Spanner wrench
    - Ratchet wrench
    - Grease pumps
    - Pressure gauge

## 7- SIGNAGE

Additional signage using high visibility reflector strips.
1 rotating light on the cabin roof + 1 rotating light at the rear on the waste tank.


1 LED work light at the rear of the vehicle
2 extra FRONT + REAR lights level with the cameras.
1 AK5 tri-flash panel at the rear.
1 audible reverse warning that can be inhibited using a switch in the cabin.

## 8- FIRE SAFETY

2 kg, ABC fire extinguisher in the cabin.

## 9- PAINT

Equipment + carrier painted in the RAL colour to be defined when the order is launched. By default, the carrier is painted RAL 9016 white.

## 10- ADDITIONAL OPTIONAL EQUIPMENT

### 10.1 - RADIO EQUIPMENT FOR COMMUNICATIONS WITH THE CENTRAL CONTROL STATION

Installation of a static radio and antenna in the cabin (supply not included in the contract).
The power supply cable and the antenna cable are supplied and installed by us as per client recommendations.

### 10.2 - PRIORITY PASSAGE EQUIPMENT AT CROSSROAD TRAFFIC LIGHTS

Pre-wiring and reservations required to fit an onboard cross-roads priority request device.
24 V power supply with protection and the control push button on the vehicle console are supplied and installed by us.

### 10.3 – SWITCH POINT REMOTE CONTROL

Installation of a mechanical interface under the vehicle and a connection cable to the cabin for the installation of a remote switch point control device (supply not included).
24 V power supply with protection and 2 control push buttons on the Unimog dashboard supplied and installed by us.

### 10.4 – SWITCH POINTS ROD

1 switch points rod placed in the cabin.

## 11- TRAINING

### 11.1 - User training. Duration: 2 days

Training of a maximum of 4 people on how to use the vehicle in different configurations. The training will be provided on site when the vehicle is delivered.

#### 11.1.1 Road mode

- Starting up
- Driving the vehicle in road mode
- Movement - acceleration - braking
- Switching to stand-by
- Signage and accessory controls

#### 11.1.2 Rail mode

- Operations to put the vehicle on and remove the vehicle from rails (cameras, steering wheel locking)

##### 11.1.2.1 Use in sweeper mode

- Use of the twin brushes
- Use of the front brush
- Wetting and rotation adjustment
- Use of the vacuuming arm

##### 11.1.2.2 Use in rail cleaning mode

- Use of the high pressure nozzles
- Use of the scraper fingers
- Use of the finishing brush

#### 11.1.3 Offloading operations

- Opening the cleaners
- Emptying the waste tank

#### 11.1.4 Cleaning using the high pressure lance

#### 11.1.5 Backup mode

- Manual hydraulic pump
- Towing

#### 11.1.6 Routine servicing

- Greasing
- Cleaning
- Freezing temperature protection

### 11.2 - Maintenance training. Duration: 1.5 days

Training of a maximum of 4 people in how to maintain the vehicle. The training will be provided on site when the vehicle is delivered.

**11.2.1 Carrier**

- Engine (oil, etc.)
- Advance
- Hydraulic distribution
- Suspension
- Tyres
- Electric circuit (autotests, protection)
- Air-conditioning

**11.2.2 Sweeper**

- Brush hydraulic circuit
- Brush replacement
- Filter maintenance
- Dampening water circuit
- Electric circuit (protection)

**11.2.3 Rail cleaning tools**

- Nozzle replacement
- Scraper finger adjustment
- Hydraulic circuit
- Pneumatic circuit
- Brush replacement
- High pressure pump (valves)
- Electric circuit (protection)

**11.2.4 Lubrication circuit**

- Filling
- Injector inspection
- Injector replacement

## 12- WARRANTY

The vehicle and its equipment have a one year warranty for parts and labour.
Work resulting from the incorrect use or the damage of the equipment will not be covered.
The oil changes and regular inspections, and the wear parts are not covered by the warranty. These parts and ingredients will be listed in the spare parts list required for maintenance during the warranty period.

**12.1 Use of vehicles by trained staff:**

A training report is drawn up when the equipment is delivered. If a driver or drivers are replaced, they must be trained at the customer's expense.

**12.2 Consumables and spare parts:**

During the warranty period it is MANDATORY to use genuine manufacturer filter parts. The warranty cannot cover the use of "compatible " filters.

**12.3 Servicing:**

During the warranty period, servicing must be carried out at the scheduled dates by a CMAR-trained technician.

If the customer carries out the servicing, he must have been trained by CMAR and update the servicing log.
If the technician is replaced, the new technician must be trained by CMAR at the customer's expense.

**12.4 Fuel:**
Unless otherwise agreed, the fuel used in the vehicles must be top quality diesel fuel.

**12.5 Ad Blue additive:**
This vehicle is compliant with the Euro VI pollution standard. As a result, an additive is automatically injected into the exhaust line (urea). The consumption is in the order of 3% of diesel consumption. The Ad Blue supply must be guaranteed so that the vehicle never runs without this additive to prevent any damage to the exhaust line, and in particular the particle filter

## 13- ENVIRONMENT

Special precautions are essential to prevent freezing in the piping, pumps, tanks, etc. during freezing weather. The circuit should be completely drained.
Attention must be drawn to the fact that, in general, sweepers are not used in washing or in sweeping modes with dampening in freezing temperatures.
In those conditions the vehicle can be used in sweeping and vacuum mode without the addition of water.

## 14- VEHICLE CONSUMPTION ASSESSMENT

**14.1. In travel mode**
The average consumption in travel mode is 8 litres of fuel per hour. This consumption may vary by plus or minus 10% depending on the driving mode.

**14.2 In sweeper mode**
At the rated engine speed of 1500 rpm, the average consumption is 10 litres of fuel per hour.

**14.3. In rail cleaning mode**
At the rated engine speed of 1500 rpm, the average consumption is 10 litres of fuel per hour.

## 15- SPARE PARTS

A set of spare parts (consumable and asset parts) can be supplied for an operating period of one or two years.

## 16- ROUTINE MAINTENANCE

Routine maintenance is essentially the systematic cleaning of the vehicle after use, a fluid level check and the lubrication of sensitive spots. As the vehicle is fitted with an automatic lubrication system, the vast majority of these sensitive spots are lubricated without any staff intervention. The following table indicates the operations to be carried out by operating staff.

| ROUTINE MAINTENANCE SCHEDULE | | | | | |
|---|---|---|---|---|---|
| | Every day before starting up | Every day after use | Every week | Every month | Every 50 hours |
| **Operating time in hours** | 0.5 | 1 | 0.5 | 0.5 | 4 |
| Check the engine oil level | ■ | | | | |
| Check the coolant level | ■ | | | | |
| Check the hydraulic oil level | ■ | | | | |
| Check the fuel level | ■ | | | | |
| Check the water level | ■ | | | | |
| Check the brush and suction opening position | ■ | | | | |
| Clean the machine | | ■ | | | |
| Check the vacuum duct/waste tank junction | | ■ | | | |
| Check the leaf mesh and the inside surfaces | | ■ | | | |
| Rinse the suction openings for 2-3 minutes while running | | ■ | | | |
| Clean the water filter | | ■ | | | |
| Empty the water tank if there is a risk of freezing weather | | ■ | | | |
| Drain the ducts in the event of freezing weather | | ■ | | | |
| Grease the cleaning trolley locks | | | ■ | | |
| Grease the guiding wheels | | | | ■ | |
| Check bolt tightening | | | | ■ | |
| Check the grease level in the automatic lubricating system | | | | | ■ |
| Check tyre pressure | | | | | ■ |
| Check the journal bolt tightening | | | | | ■ |
| Check the battery electrolyte level | | | | | ■ |
| Clean the air filter | | | | | ■ |
| Clean the heating filter | | | | | ■ |