

LFO



1 MAIN FEATURES

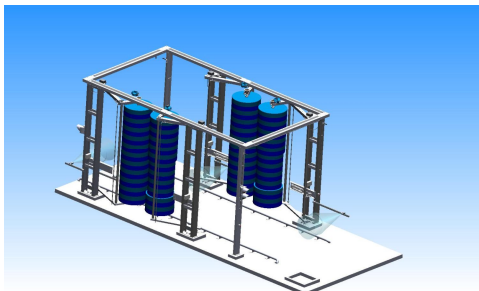
Programmable automatic washing plant, developed to match requirements of high productivity with a high quality standard, containing at the same time the level of the investment. LFO is composed by a steel structure, made up of six/eight flanged columns and anchored to the ground. Columns are connected among them by crossbars; electrical and pneumatic connection run inside of these crossbars. All the structural and hydraulic parts are

treated and protected against corrosion and rust; hot dip galvanizing is optionally associated with another cycle of painting.

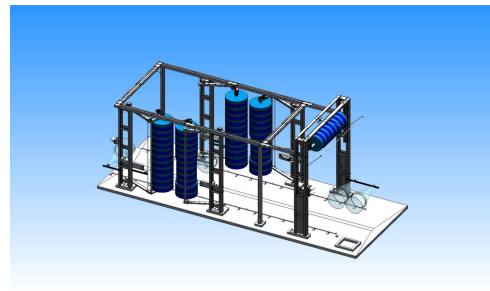
Models

The LFO unit has four basic versions with 4, 5, 6 and 7 brushes realized to allow a maximum working height of 4,50 m. The "4 brushes" version is available in a closed structure as well as in open version for tram wash with pantograph, without the crossbars on the top.

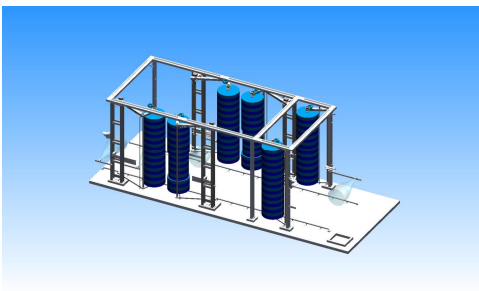
LFO 4 BRUSHES



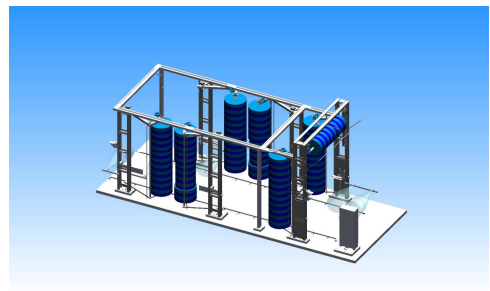
LFO 5 BRUSHES



LFO 6 BRUSHES



LFO 7 BRUSHES



1.1 Main components

Horizontal brush (models 545 and 745)

- Oscillating system fixed at the ends.
- Up-down motion activated by a pneumatic cylinder
- Brush rotation by means of gear motor.
- Pressure applied to the vehicle easy controlled with counterweight.
- Washing cycle control through inductive sensors.

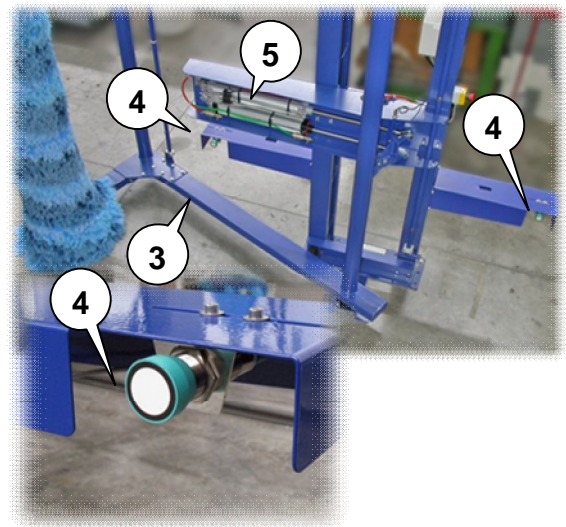


- Handling and sinking control with inclinometer system.

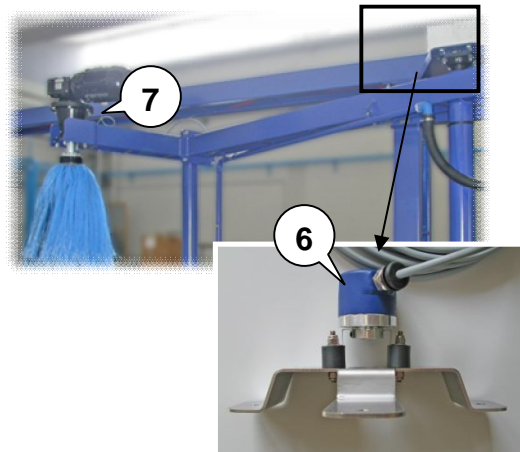


Vertical Brushes

- The elbow shape (3) of the structure allows the brushes to reach the front and rear parts of the bus.
- The activation of the brushes is controlled by ultrasonic sensors (4) that are activated as the bus advances.
- The opening / closing movement is obtained by means of pneumatic cylinders (5)



- The boom position is controlled by an encoder (6) installed on the rotating axis.
- Rotation of the brush is obtained by means of a gear motor (7).



Auxiliary services

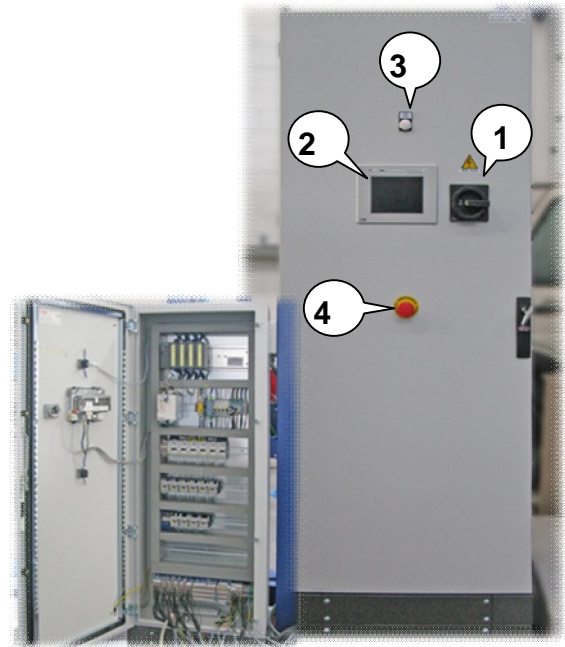
Actuating elements

All the electric actuators are covered and protected in a dedicated metal cabinet.

The following components are installed on the front door:

1. Main switch (1)
2. Colour LCD monitor with touch screen functions
3. Power ON indicator light
4. Emergency push button.

The cabinet can be sited outdoors or inside a technical room



Hydro pneumatic components and chemical products

All the hydro-pneumatic components are covered and protected in a dedicated metal cabinet.

Top section

Box for electrical connections

Pneumatic pump for dosing the chemical product.

Central section

Solenoid valves

Compressed air supply unit.

Bottom section

The tank containing the chemical product (shampoo) is stored at the bottom of the cabinet. When the door is closed, you can check the level of the chemical product in the tank through the viewing window (1).



Entrance traffic lights

Traffic light at the entrance has two led lights:

- red = stop
- green = plant is ready, permission to enter.

Exit Traffic light

Traffic light has only a led yellow light and during washing cycle it interacts with driver of the vehicle through a fixed or double frequency flashing light.



Control devices

The control console is fastened to a support that is anchored to the ground, normally positioned at the bay entrance on the driver's side of the vehicle.

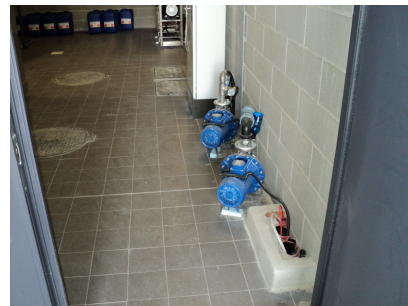
The available functions include:

- energising the machine's auxiliary circuits.
- selection of the wash program
- selection of the operating mode, manual or automatic
- emergency stop
- wash program selection
- launching of the program



Auxiliary systems and services

Two pumps of 4 hp (3 kW), feed areas for washing / rinsing; water supply is different for the front and rear parts (rinsing) The water circuit is also split to allow the use of recycled water or treated; we recommend the recycled water for the front part (entrance washing); clean or softened water is recommended for the rear part (rinsing).



Plant details

Electromechanical parts

Structure and all the steel surfaces of the wash system (optional parts included) are protected against the atmospheric and chemical agents as below:

- steel parts: hot-dip galvanised and hot-dip galvanised plus painted (optional)
- Nozzles and water pipes: stainless steel
- Electric motors: painted (primer + finish)

Electric system

- Electrical wiring installed in compliance with European standards in force.
- Control system with programmable logic (PLC)
- Electric motors are protected individually against power surges and short circuits.

Hydro pneumatic system

- Pneumatic circuit fitted with pressure switch for minimum pressure. If the compressed air pressure is below the minimum or not present, plant will set in emergency status

Chemical dosing system

- Water-Chemical product mixture easy obtained by means of a pneumatic dosing pump.

Waste water

- The waste water is polluted both by the chemicals used for the washing process (prewash) and the substances removed from the washed vehicles (hydrocarbons, grease, oil, dust, dirt, etc...).
- The Manufacturer suggests using recommended chemical products at minimal suitable doses, in order to limit the pollution level.

Winter draining outlet

- On request, an automatic system can be installed for emptying piping through compressed air

Bristles

- Brushes are made of polyethylene. Single elements of different sizes suitable for the type of vehicle to be washed.
- Modules are easy to replace as they are fixed with self-tapping screws.

1.2 Optional

Emollient arch

The arch is composed by a structure supporting the pipe with the nozzles for chemical emollient application to melt dirt on the body. In this way the following washing phase will be easier and efficient.

The system is completed with a pneumatic dosing pump and a submerged or centrifugal pump (3 kW 230-400V-50/60Hz), supply the emollient.

Medium pressure arch (prewashing)

The arch is composed by a structure supporting the pipe with the nozzles for middle pressure water application on the body. This arch, together to an external or submerged pump (7,5 KW230-400V-50/60Hz) is able to remove dirt or emollients present on the vehicle surfaces before its entry in the LFO plant.

Wax Arch

It is installed at the exit of the plant; this arch is used to apply a protective wax on the vehicle. This action is useful to improve drying phase. Wax is supplied by dosing pump and a submerged or centrifugal pump (1,5 kW 230-400V-50/60Hz).

Half vertical brushes

Vertical brushes with height properly sized to wash the surface under the mirrors band of the bus. Water and shampoo are mixed by a dosing pump and centrifugal pump or submersible (3 kW 230-400V-50/60Hz).

Drying arch

It's an independent structure at the exit of the LFO wash system and wax arch (if present). The water that is still present on the vehicle body will be removed by these fans. During the vehicle passage under the arch, the fans, fixed on a galvanized structure, blow air at high speed.

This arch is available with both version at 4 or 6 fans; (each fan 4 kW 230-400V-50/60Hz).

Wheel guide

Wheel guides permit :

- a correct vehicle positioning
- improvement washing phase,
- Avoid improper advancing of the vehicle in the plant; principal cause of accident

Spray protector

Spray protector are made up of plastic micro mesh material and fixed on a hot dip galvanized structure or painted, anchored or to the floor through screws and plugs or directly on the principal structure. These protectors avoid water splashes and limit the working area. Otherwise it is available a different self-porting structure with sandwich panels and with galvanized or painted steel post fixed on the ground.

Chassis wash

The cold water chassis washing system is useful for cleaning the bottom areas of vehicles.

The system is made up of steel pipes crossing the floor; located in a passage obtained from steel section; these protect also the corners of floor.

Piping has rotating nozzles that spray a water blade directly inferior part of vehicle body.

System can be 90° rotated around its axis after washing phase as a "rest" position in order to protect nozzles from possible obstruction

The distribution and concentration of the nozzles makes this the best instrument for intervention in areas underneath the vehicle affected by deposits of mud and others impurities. The system includes a High Pressure pump also (22,5 kW230-400V-50/60Hz).

Water Saver

We suggest our model WS 10B/QC. Water treated range: Max: 7 mc/h- Nominal:140 m3/day.
Water saver unit can be supplied also with reinforced concrete tank with slab and manhole. Cost of relevant civil works activities and additional operations as excavating, laying etc is not included in the scope of supply.

Compressor

If needed, an air compressor group may be supplied for the washing plant and the pneumatic actuation of control valves (both for washing plant and water saver system) and for winter water discharge. The system includes also anti-condensate filters and pressure self-regulators.

Compressor is a belt drive and horizontal version completed of:

Train stop pressure controller;

Drain valve;

Safety valve;

Thermal protection of electrical motor;

Star triangle;

Main feature

Type and model : Ceccato Beltair 270 F5,5V;

Tank capacity : 270 L;

Operational stress: 10 bar /

Power rating: 4 kW (5hp);

Max speed: 1400 rpm;

Air exhausted: 578 l/1' / 20.4 cfm;

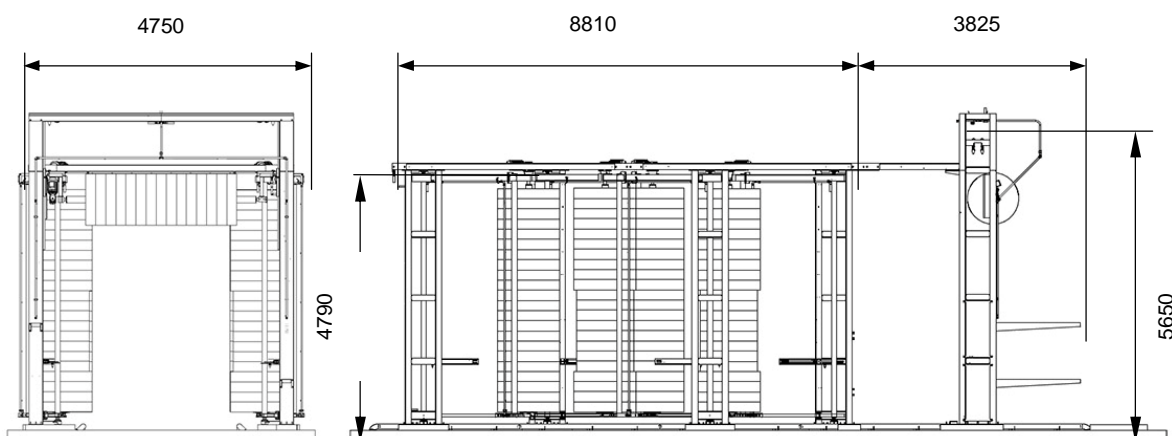
Power: 400V/50Hz/3Ph;

Dimensions 0.82x0.52x1.90 mt;

Weight : 133 Kg.

1.3 Technical specifications

Minimum installation dimensions



LFO 4 and 6
Width 5,50 m height 5,10 m
LFO 5 e 7
Width 5,50 m height 6,00 m

Supplies

Water

Water inlet fitting (each pump) 2 x 1"
Water pressure 2,5 -3,5 bar

Compressed air

Compressed air fitting R 1/4"
Air pressure 5 bar

Electricity

Voltage (3F+N+T) and standard supply frequency = 400 ± 10% V 50 Hz

General information (washing vehicles with 14,00 m length)

Model	UM	LFO 445	LFO 545	LFO 645	LFO 745
Horizontal brush	N°		1		1
Vertical brush	N°	4	4	6	6
Bay length	m	12,90	14,5	14,5	14,5
Bay width	m	5,50	5,50	5,50	5,50
Working height	m	4,80	5,71	4,80	5,71
Maximum vehicle length	m	4,50	4,50	4,50	4,50
Maximum vehicle width	m	2,50 a 2,70	2,50 a 2,70	2,50 a 2,70	2,50 a 2,70
Voltage	V	230/400	230/400	230/400	230/400
Minimum vehicle length	m	4,50	4,50	4,50	4,50
Control voltage	V	24	24	24	24
Power installed	kW(cv)	12 (16)	13,50 (18)	15 (20)	16,50 (22)
Electrical consumption/vehicle	kwh	0,25	0,28	0,31	0,34
Cleansing consumption/vehicle	ml	300/500	300/500	300/500	300/500
Water consumption/vehicle	l	400	400	400	400
Air compressed	bar	5	5	5	5
Cycle timing	min	1,0/2,0	1,0/2,0	1,0/2,0	1,0/2,0

General information (washing vehicles with 14,00 m length)

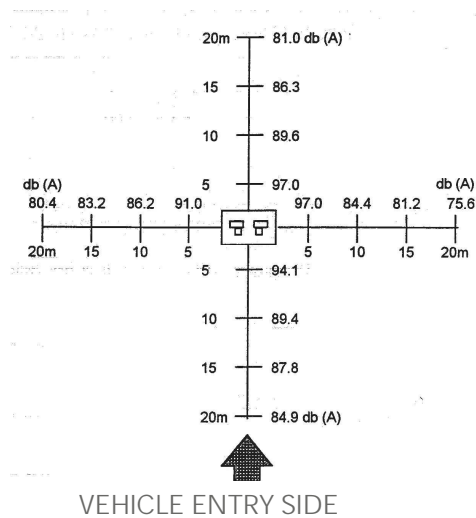
OPTIONS	UM	LFO 445	LFO 545	LFO 645	LFO 745
Emollient arch	N°	1	1	1	1
Supply voltage	V	230/400	230/400	230/400	230/400
Controls voltage	V	24	24	24	24
Rated Power (pump included)	kW(cv)	3 (4)	3 (4)	3 (4)	3 (4)
Electrical consumption/vehicle	kwh	0,06	0,06	0,06	0,06
Chemical consumption /vehicle	ml	150/250	150/250	150/250	150/250
Water consumption/vehicle	l	120	120	120	120
Middle pressure arch	N°	1	1	1	1
Supply voltage	V	230/400	230/400	230/400	230/400
Controls voltage	V	24	24	24	24
Rated Power (pump included)	kW(cv)	7,5 (10)	7,5 (10)	7,5 (10)	7,5 (10)
Electrical consumption/vehicle	kwh	0,15	0,15	0,15	0,15
Water consumption/vehicle	l	230	230	230	230
Wax Arch	N°	1	1	1	1
Supply voltage	V	230/400	230/400	230/400	230/400
Control voltage	V	24	24	24	24
Rated Power (pump included)	kW(cv)	1,5 (2)	1,5 (2)	1,5 (2)	1,5 (2)
Electrical consumption/vehicle	kwh	0,03	0,03	0,03	0,03
Chemical consumption /vehicle	ml	150/250	150/250	150/250	150/250
Water consumption/vehicle	l	120	120	120	120
Half vertical brushes	N°	1	1	1	1
Supply voltage	V	230/400	230/400	230/400	230/400
Controls voltage	V	24	24	24	24
Rated Power (pump included)	kW(cv)	5 (7)	5 (7)	5 (7)	5 (7)
Electrical consumption/vehicle	kwh	0,10	0,10	0,10	0,10
Cleansing consumption /vehicle	ml	150/250	150/250	150/250	150/250
Water consumption/vehicle	l	200	200	200	200
Drying Arch	N°	1	1	1	1
Supply voltage	V	230/400	230/400	230/400	230/400
Control voltage	V	24	24	24	24
Power, 4 fans	kW(cv)	16,5 (22)	16,5 (22)	16,5 (22)	16,5 (22)
Power 6 fans	kW(cv)	24,5 (33)	24,5 (33)	24,5 (33)	24,5 (33)
Electric consumption 4 fans/ vehicle	kwh	0,34	0,34	0,34	0,34
Electric consumption 6 fans/ vehicle	kwh	0,50	0,50	0,50	0,50
Under chassis washer	N°	1	1	1	1
Supply voltage	V	230/400	230/400	230/400	230/400
Controls voltage	V	24	24	24	24
Rated Power (pump included)	kW(cv)	22,5 (30)	22,5 (30)	22,5 (30)	22,5 (30)
Electrical/consumption vehicle	kwh	0,14	0,14	0,14	0,14
Water consumption/vehicle	l	230	230	230	230
Water saver	N°	1	1	1	1
Supply voltage	V	230/400	230/400	230/400	230/400
Control voltage	V	24	24	24	24
Power	kW(cv)	3 (4)	3 (4)	3 (4)	3 (4)
Compressor	N°	1	1	1	1
Supply voltage	V	230/400	230/400	230/400	230/400
Controls supply	V	24	24	24	24
Rated Power	kW(cv)	4 (5)	4 (5)	4 (5)	4 (5)

Noise

The noise level generated by the optional drying arch has been measured under the following conditions:

Free-field measurement of the sound pressure level above a reflecting plane.

Measurements made at 5, 10, 15, 20 meters in line with the source.



The values can vary according to the background noise and the ambient noise of the location. The data provided here are approximate and include a background noise of 73db (A).

1.4 Waste water pollution

The pollution of the discharged water is caused by the chemical products used for the washing (detergents, waxes, etc.), as well as by the substances taken off from the surfaces of the vehicles (hydrocarbons, greases, oils, dust, dirt, etc.). In the following table there are indications on the average pollution level in the waste water discharged by the washing units, after the pre-treatment section (sedimentation and oil separation).

Table:

PH	5 - 10
Sediment solids	10 ml/l
COD	700 mg/l
Mineral oils	50 mg/l
Surface-active agents MBAS	20 mg/l
Fe	2,6 mg/l
Zn	1,2 mg/l
Suspended solids	150 mg/l

These features can change according to the quality and quantity of the chemical products used and to the dirt of the washed vehicles.

In order to limit the pollution level, it is recommended to use chemical products supplied by the Manufacturer of the washing unit and to use minimum amounts.

As for the discharge of waste waters coming from the washing unit, follow the local norms

1.5 Correct use of the plant

"LFO" is a tunnel wash system for buses and utilizes brushes. Only the driver is allowed to remain on board during the wash cycle.

Not allowed:

- Washing of motor vehicles which came in contact with inflammable, aggressive, harmful or explosive powders, gases and liquids, or with any product that may cause dangerous reactions when it is mixed with water
- Use of the machine within an explosive environment (varnish warehouse, classified zones around fuel pumps, etc).
- washing buses with dimensions not matching the plants features:
 - Standard working height is 4,5 m
 - Maximum vehicle width is 2,7 m
 - Minimum vehicle length is 4,5 m
 - Minimum height of the vehicle from the ground for washing purpose is 30 cm.

2 OPERATIONS

2.1 Command and signals – description and position

TRAFFIC LIGHTS

Entry traffic light

Green Light

This light comes on to signal the driver that vehicle can entry and that are no alarms conditions.

Red Light

This light means stop and it works for the following conditions:

- When the front vehicle activates the first sensor at the entrance
- Vehicle washing in progress

When an alarm trips, the red and green lights flash alternately for one minute then if the alarm is still active, the red light remains steady.



Exit traffic light

Yellow light

The switch from off to flashing light at a particular moment of the wash cycle signals the operator, who sees the light in his rear view mirrors, that the last pair of brushes is washing the rear of the vehicle.



Acoustic signals

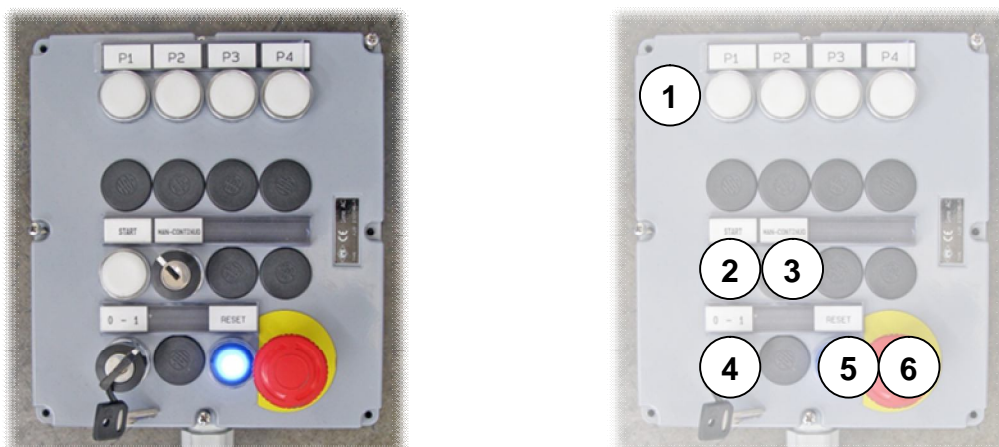
A trumpet alarm siren affixed to one of the plant columns or to the side of the hydro pneumatic cabinet is used, together with the traffic lights, to coordinate the operator's movements.

The siren is activated in the following conditions:

- At the start of the cycle
- At the opening of the first brush on the right to skip over the mirror.
- At the opening of the first brush on the left to skip over the mirror.
- At the end of the cycle.



Control console



The control console is installed on a dedicated, height-adjustable support anchored to the ground. It is located at the edge of the wash bay entrance (driver's side of the vehicle).

1) Programme selection button

Illuminated push buttons for selecting the wash program. An illuminated button indicates that the program has been loaded to the memory.

2) "START" button

In manual operating mode, executes the enabled command button on the touch screen.

In automatic operating mode, it starts the wash cycle that is present in the memory

3) MAN / AUTOMATIC selector.

- Manual mode:

To execute movements in this mode, the operator must enter the manual command menu pages in the operating board and press "start" (2). Enabling is a permanent condition. To disable, press the again "start". It is possible to enabling more options. Passage from Manual to Automatic will loose all the enabling parts.

The screen will show type of function

- Automatic mode:

Enables the automatic operation of the selected wash cycle. Further details in paragraph 6.2

4) POWER ON/OFF key selector

Turn it to "1" to power all the plant's auxiliary circuits.

5) RESET

Reset machine operation after an emergency condition

6) EMERGENCY button

Must be activated whenever an irregularity in the operation of the installation or the washing procedure occurs. When this button is activated all the machine movements come to an immediate stop and all the brushed return to the open position.

2.2 Principles of operations

WASH PROGRAMS

The operation of the machine is based on the execution of a number of instructions that make up the wash program.

There are two activation modes of the washing programme (the selection is configured at the time of plant start-up from the operating board):

- Semi-automatic.
- Automatic.

The washing plant executes the washing programme if the "start" (2) button is pushed [semi-automatic mode] or if the sensor detecting vehicle entrance is activated [automatic mode].

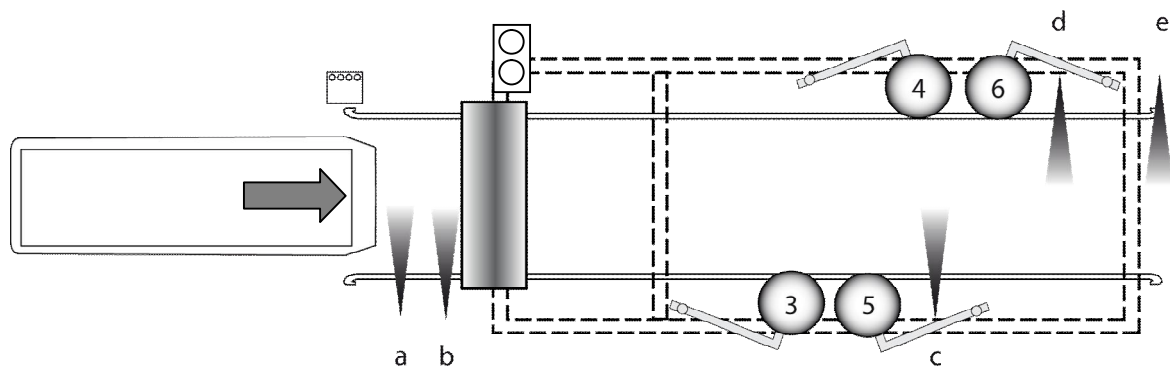
Therefore, selection of a different programme than the one loaded must be executed:

- before moving the vehicle in automatic mode
- with the vehicle stopped on the entrance activation sensor in semi-automatic mode.

Up to 4 different wash programs can be selected through the push button panel located at the bay entrance. The selected programme is signalled by the "programme selection" (1) lamps with steady light. On the other hand, the selectable ones are signalled by the programme selection" (1) lamps with steady light.

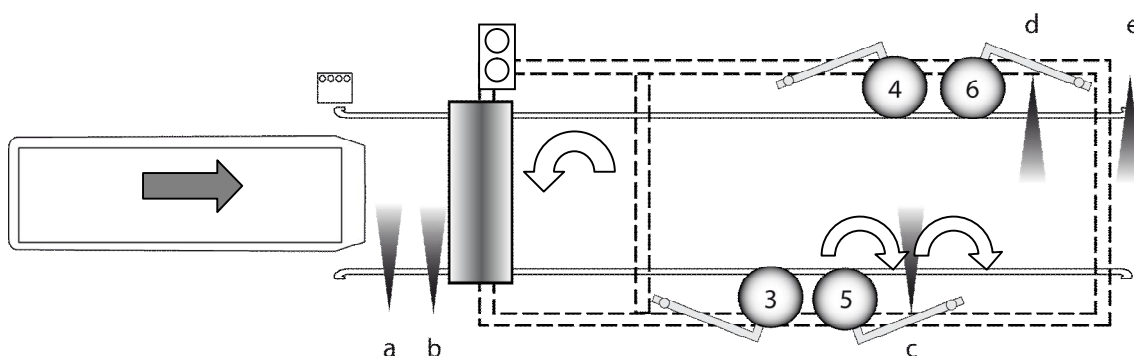
CONVENTION

The definitions left side and right side used in the following descriptions refer to the direction of the arrow which in the figure represents the work flow direction



BRUSH ROTATION

Vertical brush rotations are those highlighted in the illustration.

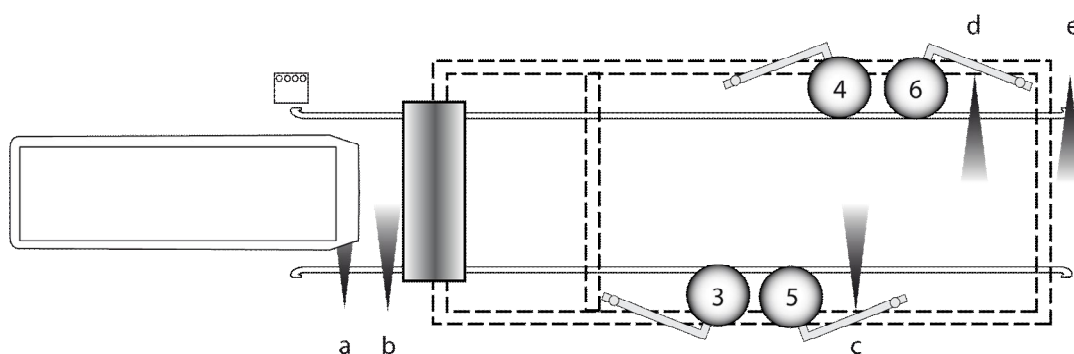


DESCRIPTION OF THE WASH CYCLES

Minimum vehicle length 4,5 m

Sensors are set to detect the presence of the vehicle at a distance of min/max 250/2000mm.

WASH CYCLE START UP MODE



SEMI-AUTOMATIC MODE

The operator enters the bay with the vehicle and when it intercepts the sensor (a) the traffic light switches from green to red.

At this point the operator must stop the vehicle and has the option of selecting the washing programme on the keyboard through the "programme selection" (1) buttons, if different from the one desired, and "start-up" the programme by pressing "START". A horn is sounded signalling the beginning of the washing cycle which lasts 0.5 seconds (time can be set from the operating board).

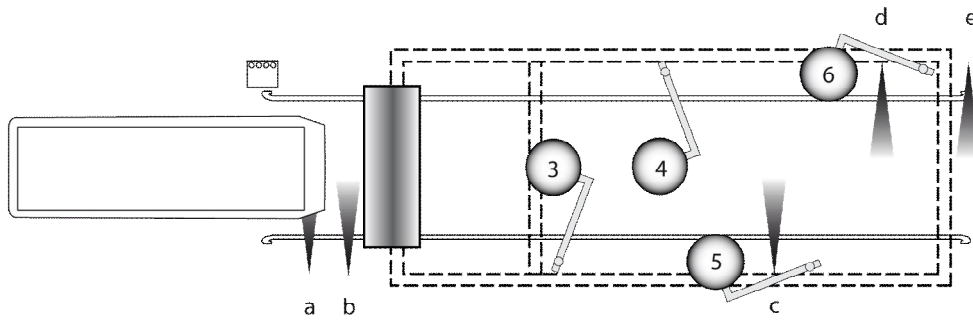
AUTOMATIC MODE

The operator must select the desired programme number, if different from the one pre-selected, through the "programme selection" (1) buttons.

The operator enters the bay with the vehicle and when it intercepts the sensor (a) the traffic light switches from green to red.

At this point the operator must stop the vehicle. A horn is sounded signalling the beginning of the washing cycle which lasts 0.5 seconds (time can be set from the operating board).

WASH CYCLE STEPS



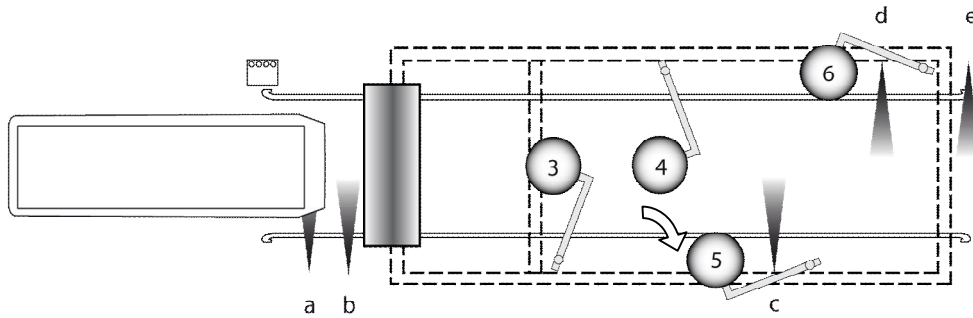
Brushes 3-4 move to the centre of the bay, and then they begin to rotate (if not deactivated and configured in the ongoing washing programme).

The wetting tunnel activates.

The chemical shampoo product is ejected (if present, not deactivated and configured on the ongoing washing programme)

The horizontal brush comes down and begins to rotate (if present, not deactivated and configured on the ongoing washing programme)

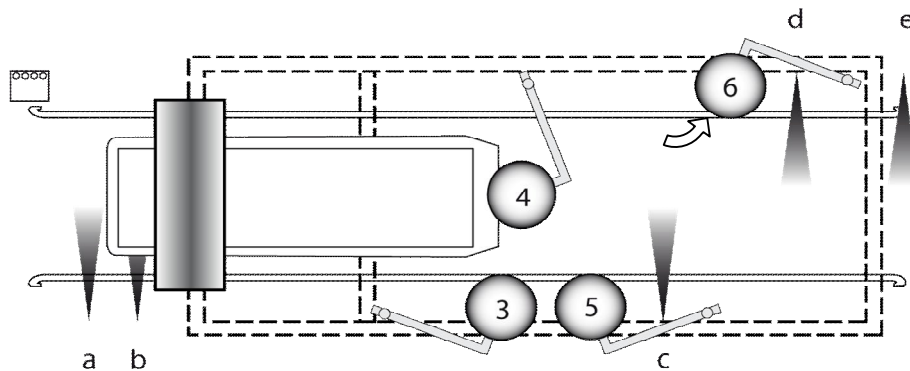
The traffic light turns green and the vehicle may advance



Vehicle advances and makes contact with, brush 3 which then begins to open.

When the brush has reached a certain angle of opening, it opens completely to allow it to skip over the mirror (if configured on the ongoing washing programme). Once reached the open brush end run, the bristle rotation also stops to aid vehicle passage. If the mirror jump is not configured in the ongoing washing cycle, the brush will follow the contour of the vehicle.

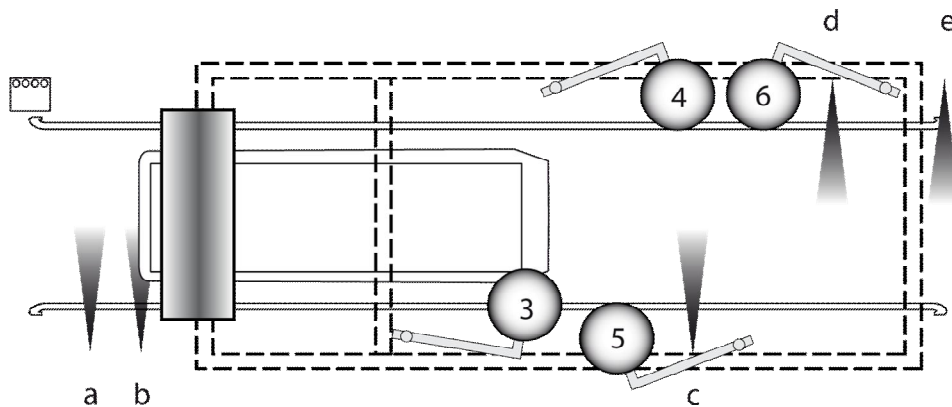
A horn will sound for 0.15 seconds (time can be set from the operating board) until brush 3 reaches the mirror jump opening corner.



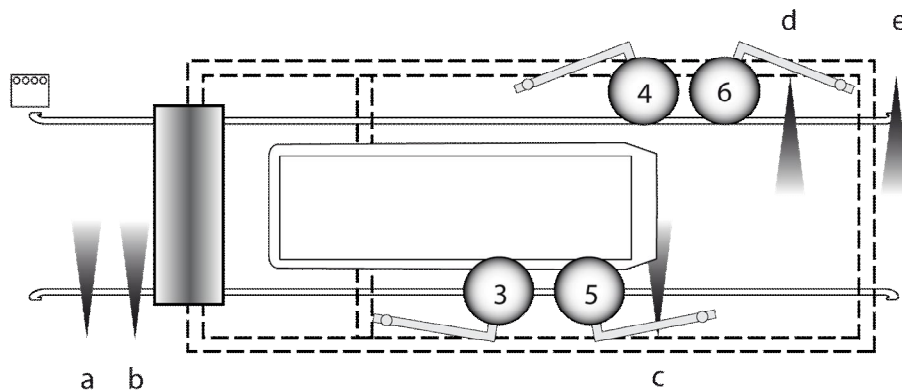
The vehicle advances and makes contact with brush 4 which then begins to open.

When the brush has reached a certain angle of opening, it opens completely to allow it to skip over the mirror (if configured on the ongoing washing programme). Once reached the open brush end run, the bristle rotation also stops to aid vehicle passage. If the mirror jump is not configured in the ongoing washing cycle the brush will follow the contour of the vehicle.

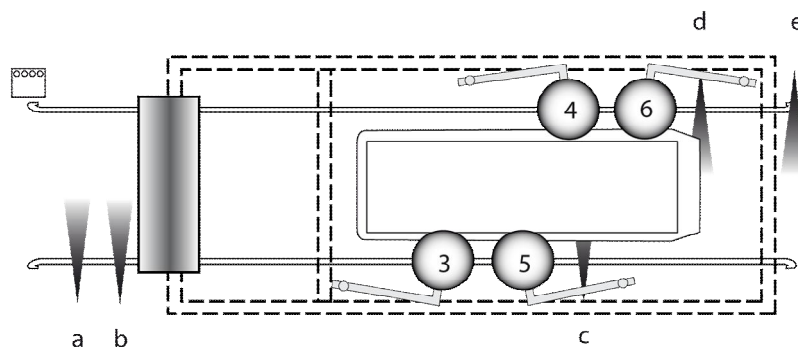
A horn will sound for 0.15 seconds (time can be set from the operating board) until brush 4 reaches the mirror jump opening corner.



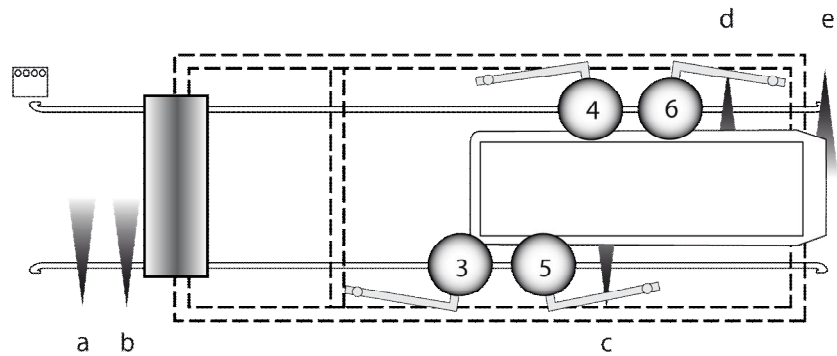
When brush 4 has reached a determined opening corner, brush 3 closes in proximity of the vehicle. If brush 4 is deactivated or is not configured in the ongoing washing programme, brush 3 closes when the vehicle intercepts the sensor (c).



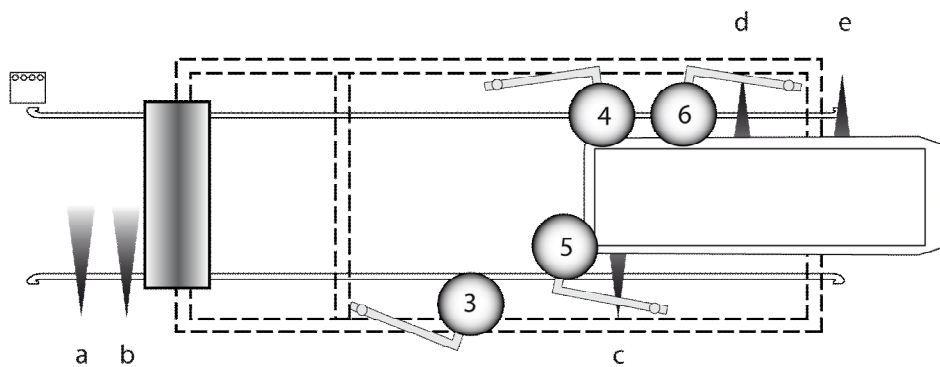
The vehicle releases the sensor (b).
 The horizontal brush rises and stops rotation (if present, not deactivated and configured on the ongoing washing programme).
 The vehicle advances and intercepts the sensor (c).
 Brush 5 closes in proximity to the vehicle (if not deactivated and configured in the ongoing washing programme).



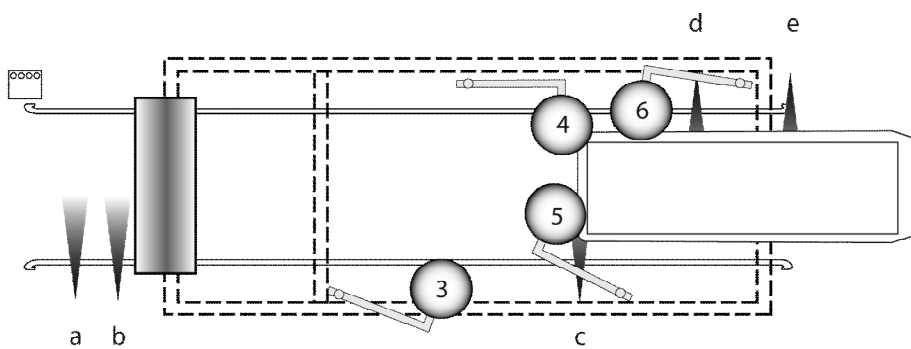
The vehicle advances and intercepts the sensor (d).
 Brushes 4-6 close in proximity to the vehicle (if not deactivated and configured in the ongoing washing programme).



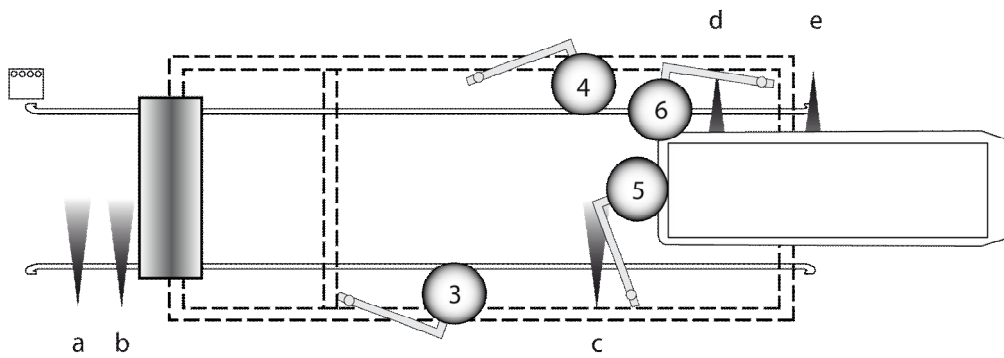
The vehicle advances and intercepts the sensor (e).
 At a certain point brush 3 is positioned up against the rear right corner of the vehicle.
 The position of brush 3 is detected by the control system that commands its opening. (the millimetres of penetration of brush 3 at the end of the corner can be set from the operating board).



The vehicle advances.
 At a certain point brush 5 is positioned up against the rear right corner of the vehicle.
 The washing of the rear of the vehicle begins at this point.
 The yellow exit light begins to flash slowly.
 Brush 5 continues the closing movement following the contour of the vehicle.



The vehicle advances.
 At a certain point brush 4 is positioned up against the rear left corner of the vehicle.
 The position of brush 4 is detected by the control system that commands its (the millimetres of penetration of brush 4 at the end of the corner can be set from the operating board).
 The yellow exit light begins to flash faster (the millimetres of penetration of brush 5 at the end of the corner to regulate the beginning of elevated speed flashing can be set from the operating board).
 Brush 5 continues the closing movement following the contour of the vehicle



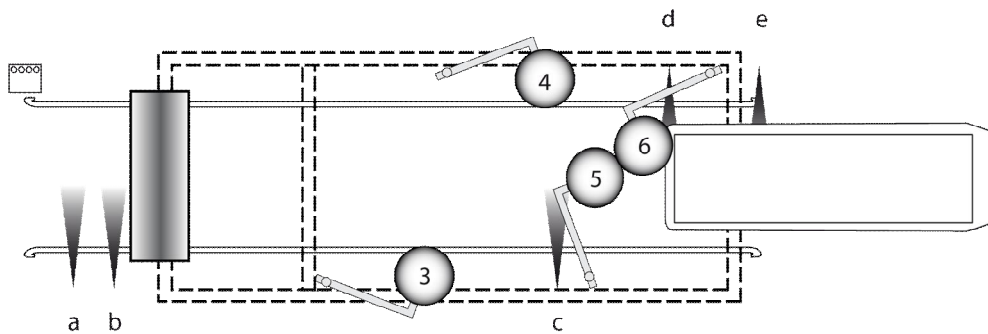
The vehicle advances.

At a certain point brush 6 is positioned up against the rear right corner of the vehicle.

The washing of the rear of the vehicle begins at this point.

The yellow exit light begins to flash slowly.

Brush 6 continues the closing movement following the contour of the vehicle.

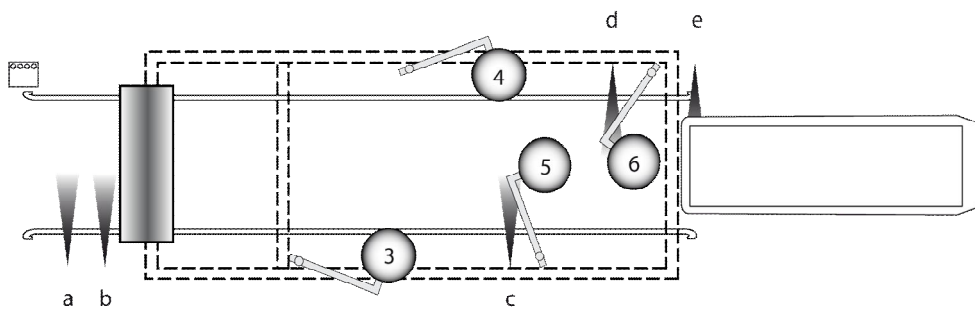


The vehicle advances.

The yellow exit light begins to flash faster (the millimetres of penetration of brush 6 at the end of the corner to regulate the start of flashing at elevated speed can be set from the operating board).

Brush 6 continues the closing movement following the contour of the vehicle.

Vehicle advances and the sensor disengages(d).



Brushes 5-6 open completely

The vehicle advances and the sensor disengages (e). the wash cycle is completed

