

TECHNICAL REPORT

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D3 Tier 4

Approval Name: 3000D



MECHANICAL - SUCTION SWEEPER 3 Yd³

The D3 mechanical-suction sweeper has been produced to the latest design and ergonomic concepts, with a small impact on the environment both for the reduced use of water and for the emission of dusts and noise. The mechanical-suction system is based on the combination of two collection systems, one purely mechanical and one suction by depression.

Collection by means of the mechanical operation is ensured by brushes which convey the waste collected along the path towards the center of the machine. Also, a central roller brush, housed between the rear and front wheels, takes the waste to a vertical conveyor, driven by a belt drive system (Dulevo Patent), which transfers that collected to a watertight 3 Yd³ container made of AISI 304 stainless steel.

Collection through suction takes place thanks to the vacuum created in the collection area by means of a powerful turbine, this ensures the collection of the dust formed during the work stages as well as all light waste (leaves, paper, dust, etc ...) that the machine encounters during the path.

Thus, the collected dust is also conveyed to the waste container, where a fabric filtering system completes the sweeping cycle, ensuring the release of clean air into the environment.

The machine is powered by a Tier4 Final, 74Hp, KOHLER diesel engine.

The engine is installed in a central position to maintain an optimal distribution of the weight and ensure stability in any given situation.

The D3 sweeper uses a hydrostatic transmission system with variable displacement engine connected to the rear axle and allows a maximum speed up to 20 mph and a maximum gradient of 18%. The machine is built on a solid chassis endowed with parabolic leaf springs, both rear and front shock-absorbers, and a hyper-sprung cabin, that makes sweeping operations extremely easy and comfortable and allows reaching a maximum load of 16534lbs. The cabin with large glass surfaces, thanks to its symmetrical construction allows two operators to move comfortably. The main controls, which activate the functions, are located in the central console while the third brush is operated by controls on the side armrest.

CAB

The D3 is equipped with a cabin with an independent suspension system from the chassis and ensures a safe and comfortable working environment. Thanks to the wide side glass surfaces and extended windshield, the operator has seamless visibility in all directions.

The machine has two symmetrical seats with the possibility of driving on the right or left.

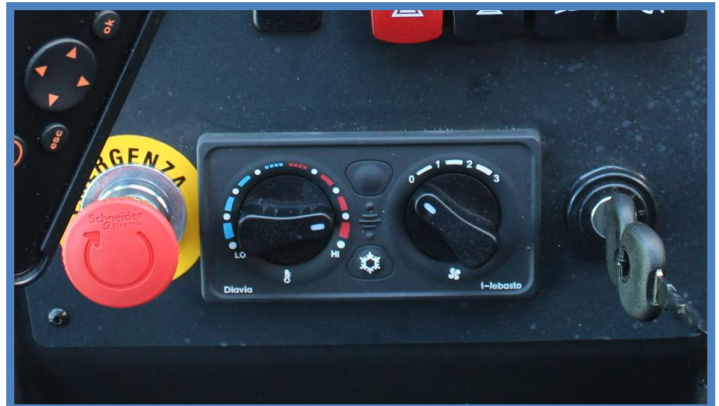
Both seats are adjustable and have shock absorbers; even the steering long nut is adjustable to ensure that all operators can choose the right driving position.

In addition, the pressurisation and inlet air filter ensure a clean and comfortable workplace.



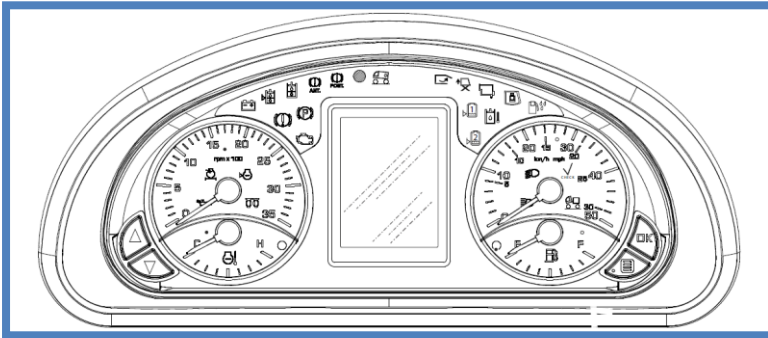
The driving and sweeping controls are simple and intuitive with an ergonomic layout to not tire the operator during long work shifts.

The standard machine equipment includes air conditioning and a rear-view cam in the cabin.



The driver's seat is equipped with a large instrument panel with the following information and warning lights:

- Multifunction display with diagnostics and scheduled maintenance system with can-bus line to the diesel engine.
- Diesel engine water temperature indicator
- Diesel engine speed rpm counter
- Speedometer
- Fuel level indicator



The instrument has a standard page with the information of the engine hour meter, brake pressures for front and rear axle with the option, by pressing the appropriate arrow keys, to display the engine hour meter, work hour meter, partial and total odometer (mph).

Signal warning lights:

- Failed battery charge warning light
- Hydraulic oil level warning light
- Hydraulic oil filter warning light
- Front circuit brakes anomaly warning light
- Rear circuit brakes anomaly warning light
- Braking system anomaly warning light
- Parking brake warning light
- Diesel engine anomaly warning light
- Clogged engine air filter warning light
- Engine cooling water level warning light
- Spark plugs pre-heating warning light
- Engine oil pressure insufficient warning light
- Open dumping door warning light
- Lifted container warning light
- Closed container damper warning light (OPT)
- Container level warning light (OPT)
- Water presence in diesel filter warning light
- Hydraulic oil high temperature warning light
- No clean water warning light (OPT)
- Low beams and position lights warning light
- High beams warning light
- Fuel reserve warning light
- Minimum 2nd Tank level warning light (OPT)

Other light indications are on the steering column.

- Left direction indication warning light
- Right direction indication warning light
- Forward drive warning light
- Reverse drive warning light



From the steering column you can activate:

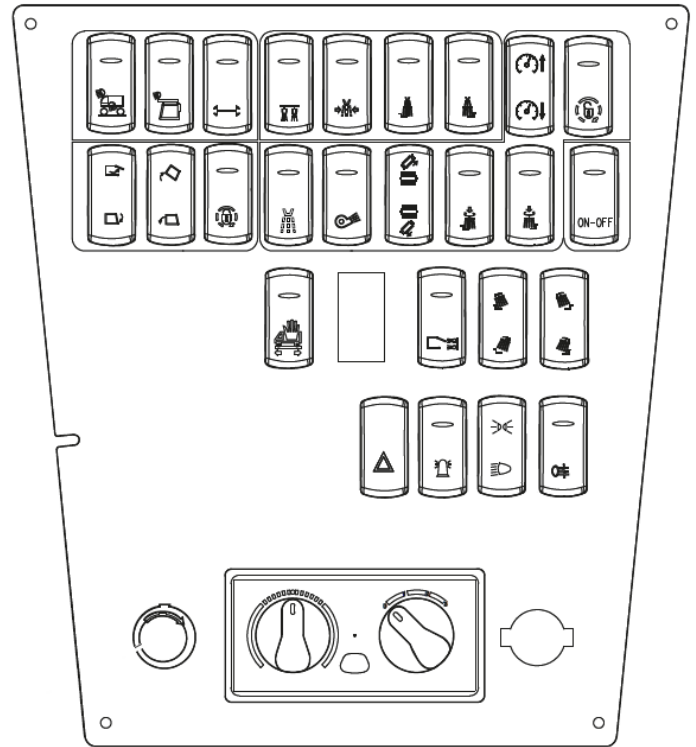
- Drive direction selection lever
- Right and left direction indication
- Central brush extra pressure switch
- Horn
- Flashing and main beam headlights lever
- Windshield washing liquid.
- Intermittent front wipers or at two speed



The various working and switch-on functions of the devices are easily activated by switches on the dashboard and function adjustments from the control panel.

The control dashboard includes (starting from the bottom):

- Starting key
- Air conditioning unit controls for temperature and fan speed adjustment
- Engine stop emergency button
- Hazard lights
- Flashing lights
- Low beams / position lights switch
- Rear fog light switch
- Engine stop ByPass (OPT)
- Descent and rotation of left side brushes
- Descent and rotation of right side brushes
- Conveyor rotation and central brush
- Extraction fan
- Easy Start / Stand-By Switch
- Rear suction pipe water
- Unloading stage
- Container descent / ascent
- Container door opening/closing
- Transfer / work phase switch
- Hand accelerator control
- R.h. brush water
- L.h. side brush water
- High pressure water pump switch (OPT)
- Rear door dust removal (OPT)
- Low pressure bar control (OPT)
- Filter shaker switch
- Facilitator arm beacon (OPT)
- Work lights



EASY Start / Stand-By function

There is an "ON OFF" button on the control dashboard. After activating the working phase, pressing it once automatically activates the central brush, the side brushes, the conveyor and the extractor.

While you are working and want to momentarily interrupt all previously activated functions, e.g. if you stop at a traffic light, you press the button and everything stops.

Previously active functions flash on the panel. Pressing a second time restarts everything as before.



A control panel is located on the dashboard and has two functions:

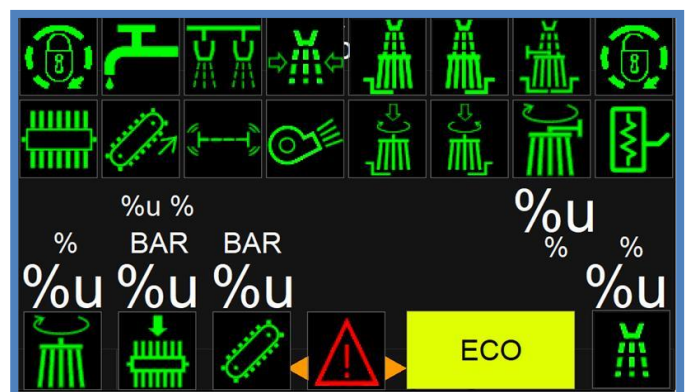
1 - Highlighting controls

Each time a key is pressed, and a function is activated, this action is highlighted on the panel by changing the color of the function icon from white to yellow.

Working pressures, conveyor pressure, central brush ground pressure, brush rotation percentage, water percentage to brushes are indicated.

2 - Adjusting functions

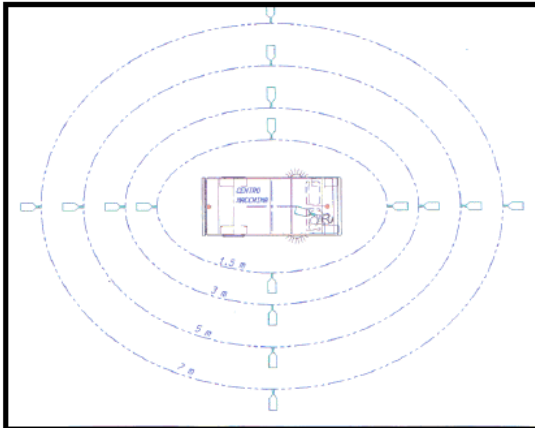
The panel is equipped with 4 switches with a round symbol, a switch with 4 arrows, an OK switch, and an ESC switch.



- By pressing the 4 switches it is possible to select a specific function:
- Side brushes rotation speed
- Central brush pressure to the ground
- ECO / NORMAL / BOOST function (AST - Adaptive Sweeping Technology)
- Water quantity to the brushes

NOISE EMISSION

Particular attention during the development of the cab was given to soundproofing, providing the operator with a comfortable driving position and low noise even during the work phase.
Below are the values that the operator perceives during the work phase.



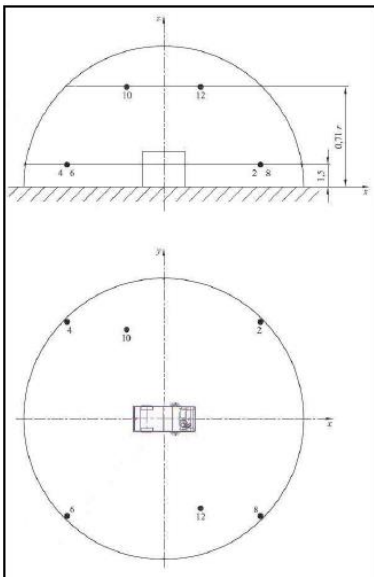
Posto Operatore	Livello Misurato [dB A Leq]	
	Finestr. chiuso	Finestr. aperto
	65.2	66.7

Data only refers to the machine in question.

A corrective coefficient of $K=2$ must be provided for other machines, which is to be added to the data reported. The said coefficient is determined by considering the company's procedures implemented in order to ensure maximum quality distribution and performance for all products in the same series.

SOUND POWER

During the work phase, the sweeper with all functions active and at full working capacity, introduces the following values in the environment:



Punto di Misura	Livello Misurato [dB A Leq]	Potenza Acustica L_{WA} [dB]
2	70.6	100.7
4	73.4	
6	75.5	
8	69.5	
10	73.8	
12	70.0	

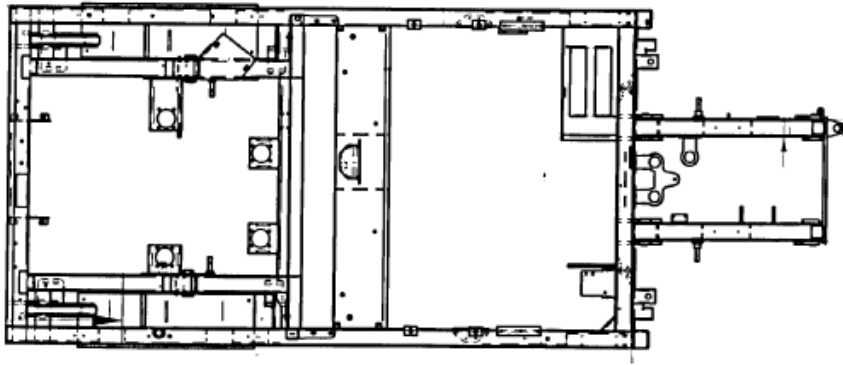
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CHASSIS

The machine is built on a solid S355 steel chassis, in tubular sections of thickness not less than 0,2 In and with anti-corrosion treatment (sanding and cataphoresis) and coating (approx. 90-110 micron). It is fitted with leaf springs, rear and front shock-absorbers.

The sweeper is equipped with a towing device positioned in the front of the vehicle.



TRANSMISSION

The machine is equipped with a Rexroth hydrostatic transmission system in closed circuit with pump and axial piston engine placed on the rear axle, with transfer speed varying from 0 to 20 mph.

Slope not greater than 18%.

The forward and reverse gears are engaged via special control selector located on the steering column in the cabin.

Both directions, chosen with the selector, are signaled by special warning lights.

When engaging the reverse gear, at the same time as the reverse light, an audible alarm is triggered as well as the rear video camera to ensure maximum protection to nearby people.

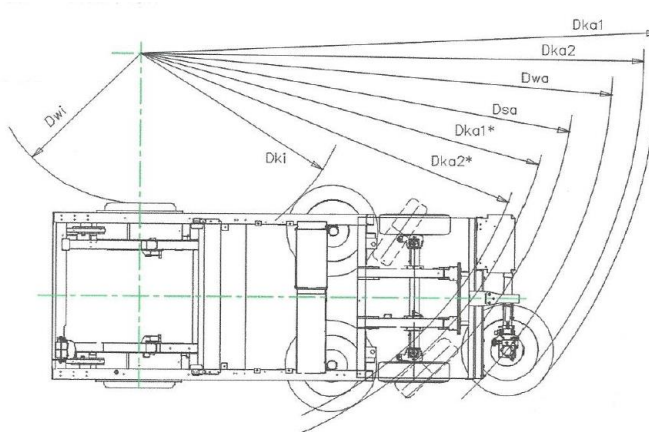
STEERING

The steering is power assisted so that it can be operated without effort even during maneuvering.

It is powered by power steering with built-in safety valve.

The average kerb - kerb curvature diameter is of 27.3 ft

The wall-wall steering radius with the third brush is 15.9 mm



WHEELS

The machine is equipped with four wheels that ensure maximum machine stability both during work and during dumping of the waste container at a height.

Tyre dimensions:

N°2 pneumatic type wheels 7.00- R 12

N°2 pneumatic type rear wheels 250/75 R 12



BRAKING SYSTEM

The differential axles are equipped with drum service brakes on all four wheels with servo-assisted dual independent circuit pedal control.

- The emergency brake is merged with the service one.
- The parking brake is of spring type, retained by hydraulic cylinder acting on the rear axle.



ELECTRICAL SYSTEM

The electrical system is designed to comply with the applicable rules of the highway code and is characterized by a 12 Volt supply voltage.

The system is equipped with 12V 180Ah battery, supported by the alternator of the 120A engine.

In the cabin, near the central dashboard, is a fuse holder that protects the main circuits required for road circulation and the machine functions.

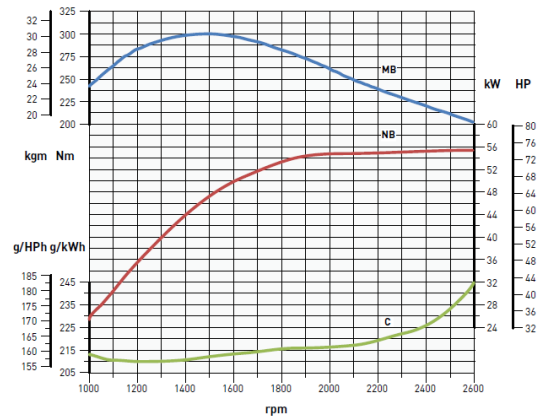
The degree of protection of the system, from IP4X to IP67, varies according to the areas of the machine.

The machine is equipped in standard configuration with the **DULEVO TELEMATIC** remote telemetry system.

ENGINE

The sweeper engines have the following features:

Make: **KHOLER**
 Model: **2504 TIER 4 FINAL**
 Cycle: **DIESEL**
 Cylinders: **4**
 Displacement (in³): **151,5**
 Maximum power: **74 Hp at 2600 rpm**
 Cooling: **water**



The high power of its engine allows to work at low rpm; which results in reduced consumption and lower noise during the working phase.

The engine is equipped with a suitable device for preheating spark plugs aimed at favoring start-up in the winter period.

The engine emission standard is guaranteed without the use of AdBlue.

The machine is standard equipped with a Mann-Hummel engine filter that ensures a very high protection level on three incorporated levels.

- Vortex pre-filter
- Main cartridge
- Secondary safety cartridge



The fuel tank has a total capacity of 21.7 Gal.

HYDRAULIC SYSTEM

The hydraulic system comprises different circuits, supplied by a single tank.

A circuit controls running of the vehicle, while the others provide the hydraulic energy for operating the various services of the sweeper; both systems have a single filter in common positioned in the upper part of the tank which allows replacing the cartridge without oil leakage.

A pressure switch installed on the filter alerts the operator, in real time, of any clogging, through a special warning light.

Also, a float electrically signals in the cabin of the possible decrease in oil level for probable leaks.

The running circuit of the vehicle is powered by a variable displacement pump, operated by the engine and a hydraulic motor installed on the rear differential axle. The advancing speed of the vehicle is adjusted by varying the flow rate of the pump using the feed control pedal. The pump has a "by-pass" valve.

The service system is equipped with three gear pumps that feed the machine's electro-distributors.

The first pump feeds the central brush control distributor-conveyor plus high-pressure pump (OPT)

The second feeds the brakes plus the electric distributor controlling the container, container door and suction fan functions.

The third feeds the power steering plus the electro distributor for the rotation and lifting of the side brushes and downstream the solenoid valve unit for the third brush (OPT).

Power steering is also powered by one of the gear pumps. Power steering is, in turn, connected to the steering movement cylinder.

The fluid tank is provided with: a filler cap with vent device, a drain plug, suction filters and an indicator of the sight level.

All circuits are fitted with safety valve calibrated so as to protect the entire system against possible pressure peaks.

To avoid excessive system heating, the same has been provided with air-oil heat exchanger.

MECHANICAL SUCTION SYSTEM

Mechanical system:

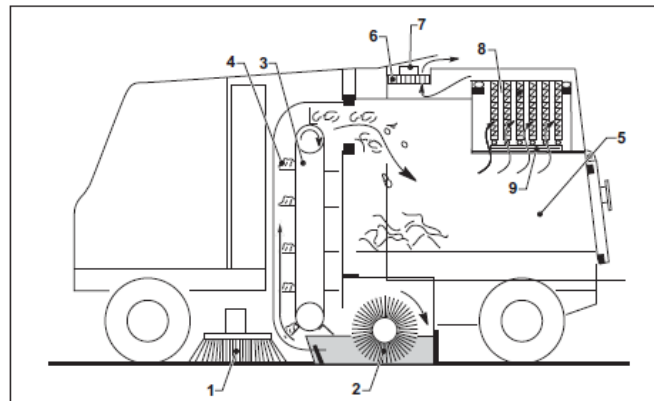
The mechanical system collects waste, and it consists of:

- one or more side brushes (1) that rotate conveying waste to the center of the machine.
- a central brush (2) that conveys the waste on the conveyor (3).
- a conveyor with blades (4) that rotate taking the material up and dumping it inside the container (5).

Suction system:

The suction system sucks dust and light parts into the container and then to the air filtration; the system consists of:

- a turbine (6) activated by a hydraulic motor (7).
- a bag filter (8).
- one filter shaker (9) electrically controlled by the cabin operator.



SWEEPING SYSTEM

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The D3 sweeping system consists of:

1 central roller brush of 20.5 In diameter and 50.4 In, with operating pressure automatically adjusted via hydraulic controls in the cabin.

2 side brushes of 34.5 In diameter (version without brushes cover)

1 third front brush (OPT) of 41.8 In diameter, operating by means of controls in cabin with hydraulic system and adjustment for positioning and rotation.

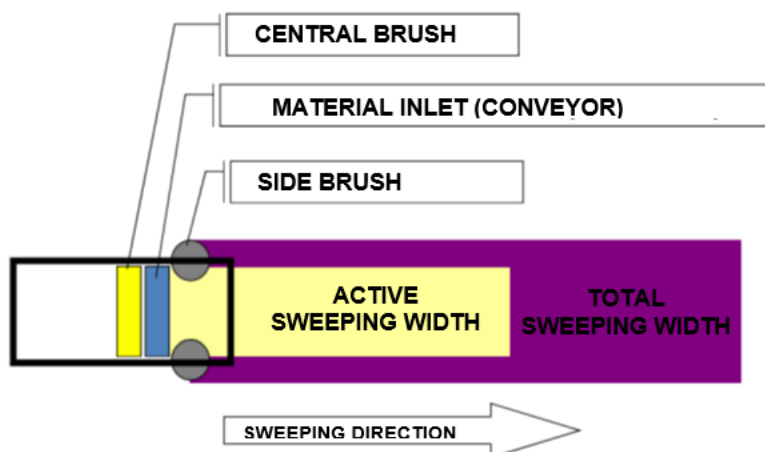
Dust removal system, auxiliary to the suction system, guaranteed by nebulizers placed on the side and front brushes powered by a membrane electric pump.

The flow can be varied by adjusting the pump speed from the control panel in the cabin.

The water tank is made from AISI 304 stainless steel with a capacity of approximately 105.7 Gal.

When the water tank is empty, the pump automatically disconnects alerting the operator in the cabin via special warning light.

A special filter with internal cartridge, positioned in an easily accessible area, allows smooth operation without occlusion of the nebulizers on the side brushes.



SWEEPING WIDTH:

• with central brush	51.2 In	(1300 mm)
• with central brush and one side brush	68 In	(1725 mm)
• with central brush and two side brushes	84.7 In	(2150 mm)
• with central brush, two side brushes and third brush only rh or lh	112.3 In	(2850 mm)
• with central brush, two side brushes and third brush rh/lh	118,2–126 In	3000 mm (3200 Max)

RIGHT AND LEFT FRONT BRUSH (Opt)

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The third front cup-shaped brush is hydraulically controlled in all its functions directly from the operator station.

A brush rotation switch and a swinging switch are located on an adjustable support on the door. There are two joysticks; one to move the unit out and in and the other to control the side inclination and brush incidence.

A water switch enables the dust removal system on the front brush to be activated or deactivated. The rotation speed of the front brush is adjustable via a potentiometer.

By pressing the potentiometer, adjustment of the front brush will be disabled, but adjustment of the side brushes will be possible.



This solution allows an accurate and effective use of the front brush without the operator being distracted from driving the vehicle.

The brush swings 180° to left and right with possibility to return the brush in the stand-by position on both sides.



In the event of a slight impact, the support arm of the third front brush is provided with a hydraulic shock-absorbing system and a mechanical system with cup springs. In the event of more serious impacts, the third front brush is equipped with two safety systems:

- 1) automatic and immediate return of the translation thanks to a sensor that reads the pressures to which the front brush it is subjected in the event of impact.*
- 2) breaking, under a certain load, of a safety bolt (specially worked) that connects the brush arm to the front carriage. Thanks to this safety, the brush arm rotates backward avoiding frontal impact, without breaking the components, with the possibility of immediate restoration by simply replacing the broken safety bolt.*

The front translation carriage connecting the brush arm houses the electro-hydraulic distributor which allows obtaining all the above adjustments. The reason for this choice is to reduce the number of tubes subject to wear on the carriage of the third front brush.

The electro distributor is easily accessible for any maintenance and is provided with suitable external pressure outlet that can be connected without having to remove the protective hood.

FRONT BRUSH ONLY RIGHT OR LEFT (Opt)

It is able to translate sideways in and out and lift and lower thanks to the control of a manipulator located on an adjustable support located on the side of the door.

They house a brush rotation switch and a water control switch.

The brush unit is fitted with multiple safety systems:

- 1) Automatic and immediate return of the translation thanks to a sensor that reads the pressures to which the front brush it is subjected in the event of impact.*
- 2) break of a safety bolt under a certain load*



WASTE CONVEYOR

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The direct launch of debris is directed by the central cylindrical brush on the vertical vane conveyor that allows conveying the debris inside the waste container.

The outside of the conveyor unit is in steel T1 type anti-wear electro welded, cataphoresis treated, while the upper part of the shell is curved to prevent material build-up.

The conveyor consists of a belts system in parallel that rotate on 2 crowns bolted on an upper dragging shaft, hydraulically controlled, and on two free rollers in the lower part.

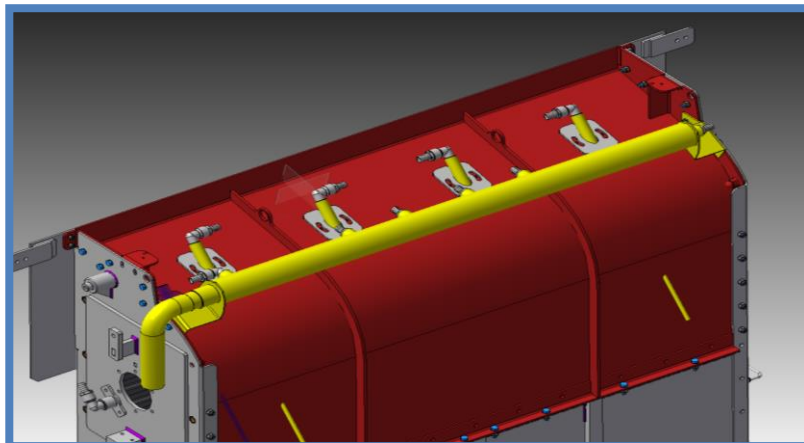
Steel supports along the length of the belts, support special oil-resistant rubberized fabric and iron blades. The belts move by means of a hydraulic motor flanged in the top outer part of the shell and calibrated so as to ensure a number of revolutions synchronized with that of the central brush.

The belts are of a special type as formed from a single piece, without union ring. The material of the belts prevents water aggression or various substances, as well as the wear given by the strong presence of dust. It follows a long life of the belts themselves.

The 2 top crowns are divided into 2 parts so that they can be easily replaced.

In the case of occlusion of the conveyor, a special safety valve installed on the hydraulic system sends the circuit in bypass and an immediate signal in the cabin through an audible alarm. The operator, in order to free the occlusion, will have to reverse the direction of rotation of the conveyor by simply acting on the lever in the cabin. Although unlikely, this will still happen due to the interior dimensions of the conveyor which are 50 In wide by 8.7 In in height, which allow the passage of particularly bulky debris.

The conveyor is also equipped with a system that allows the belts and blades to be washed with a high-water flow rate, in order to remove the greatest possible amount of residue accumulated during sweeping.



DUST REMOVAL SYSTEM

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The combined collection system entrusts the suction phase with the "dry" collection of volatile dusts, in fact the dust and light particles raised by the cylindrical central brush are sucked through a vacuum created in the container itself by two high-speed hydraulically controlled fans and then retained in the bag filter placed in the container.

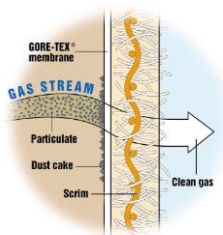
The fabric bag filter has a wide surface of 204.5 ft² that allows long hours of use of the machine without clogging. Its filtering capacity of about 3 microns also allows the re-entry into the environment of clean air only.

The filtering system also includes a shaking system of the filter activated directly from the driving seat. Hydraulically controlled before the dumping phase, it forcefully shakes the filter and ensures the separation of the dust inside the waste container, thus reducing the need for periodic cleaning.



Alternatively, to the standard bag filter, you can use the filter in GORE®, application patented by Dulevo. This type of filter is the highest technology in terms of performance and filter capacity.

- **minimized filter maintenance.** The filtering surface is in fact completely impenetrable by dust particles thus being self-cleaning even in case of an absolute lack of maintenance.
- **total filtration of Pm10 fine particles above 99%.** The Dulevo technology perfects the already exceptional performance of its traditional filters thanks to the application of GORE® filters, reaching filtration standards of particles Pm10, Pm5, Pm2.5 and Pm1 deemed impossible to date.
- **long-lasting filtration quality.** The PTFE maintains the filtering quality of the machine, leaving the particulate matter always outside the membrane and preventing its clogging, even partial, in time.
- **better cleaning quality.** Thanks to an increase of the air flow of your sweeper of 35% which allows a better suction of dust and lighter waste.



The D3 sweeper is EN15429-3 certified for the treatment of fine dust particles PM10 and PM2.5

WASTE CONTAINER

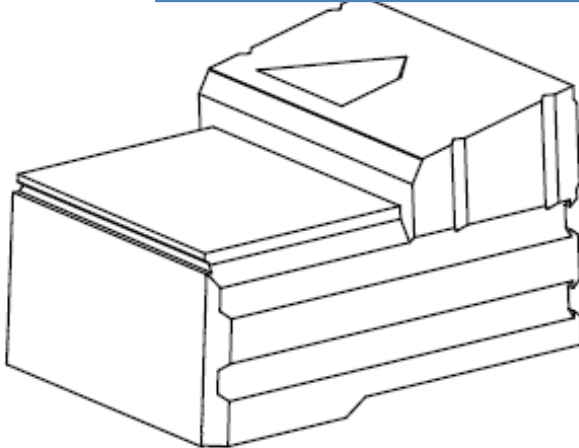
The waste container is made of AISI 304 stainless steel, and the volumetric capacity is 3 cubic yards.

The rear door, also in stainless steel, is kept closed by a hook activated by a hydraulic cylinder. The machine is equipped with a hydraulic door opening and closing system, controlled from the control panel.

The container has an inspection door for easy internal check.

The lifting system consisting of two hydraulic cylinders, allows dumping the waste container at a height of 61.9 / 68.2 In.

A wireless radio control is available as an option, to perform the unloading functions outside the cabin.



DEBRIS SUCTION HOSE (OPT)

The suction system described above allows equipping the machine with a rear debris suction hose able to perform suction operations in wells and storm drains.

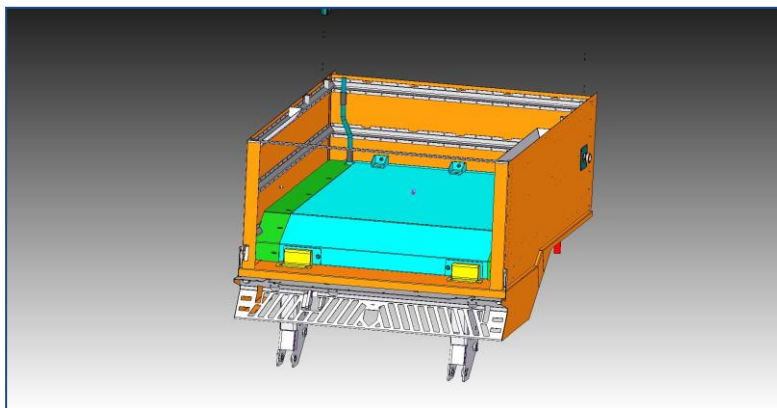
The polyurethane flexible hose has a diameter of 6 In, a length of 177 In, and is equipped with rigid aluminum terminal complete with support handle.

A damper located on the vertical conveyor allows sealing the waste container during the use of the debris suction pipe in order to increase the vacuum. Opening and closing of the damper easily takes place from the ground by simply acting on the rod placed laterally to the vertical conveyor.

The head of the system in operation can reach about 800 mm in H₂O column, while the maximum capacity is about 5828 yd³/h. The hydraulic control motor of the suction device when the damper closes, positions itself at a predetermined speed for use.



ADDITIONAL WATER TANK



On the D3, an additional tank can be installed with a capacity of 87 Gal, which together with the 106 Gal of the main tank provide a water reserve of 193 Gal.

The tank inside the container reduces the internal volume.

The tank and its positioning have been designed to have a perfect compromise between the occupied space and the water reserve available to perform the various functions available on this machine version.

Its shape has been designed to ensure that the material loaded from the conveyor does not accumulate and that the discharge is not obstructed.

The vents are located at the top of the tank near the narrower section, so the tank is practically filled to the limit of its capacity.

WATER SYSTEM

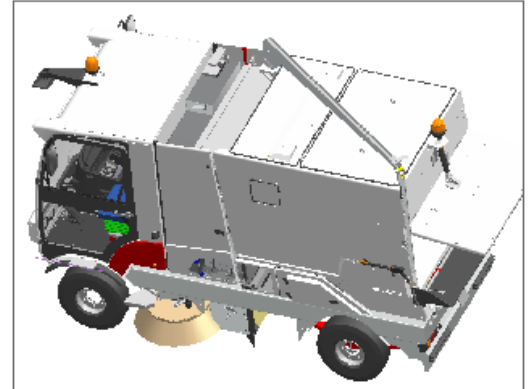
The D3 sweeper configured with the additional tank has a 193 Gal water reserve that can be used to feed all the available water services.

A 3 gal/min nominal electric pump, controlled by a button in the cabin, feeds the low-pressure circuit and the nebulizers placed on the brushes, the flow of which can be adjusted from the cabin.

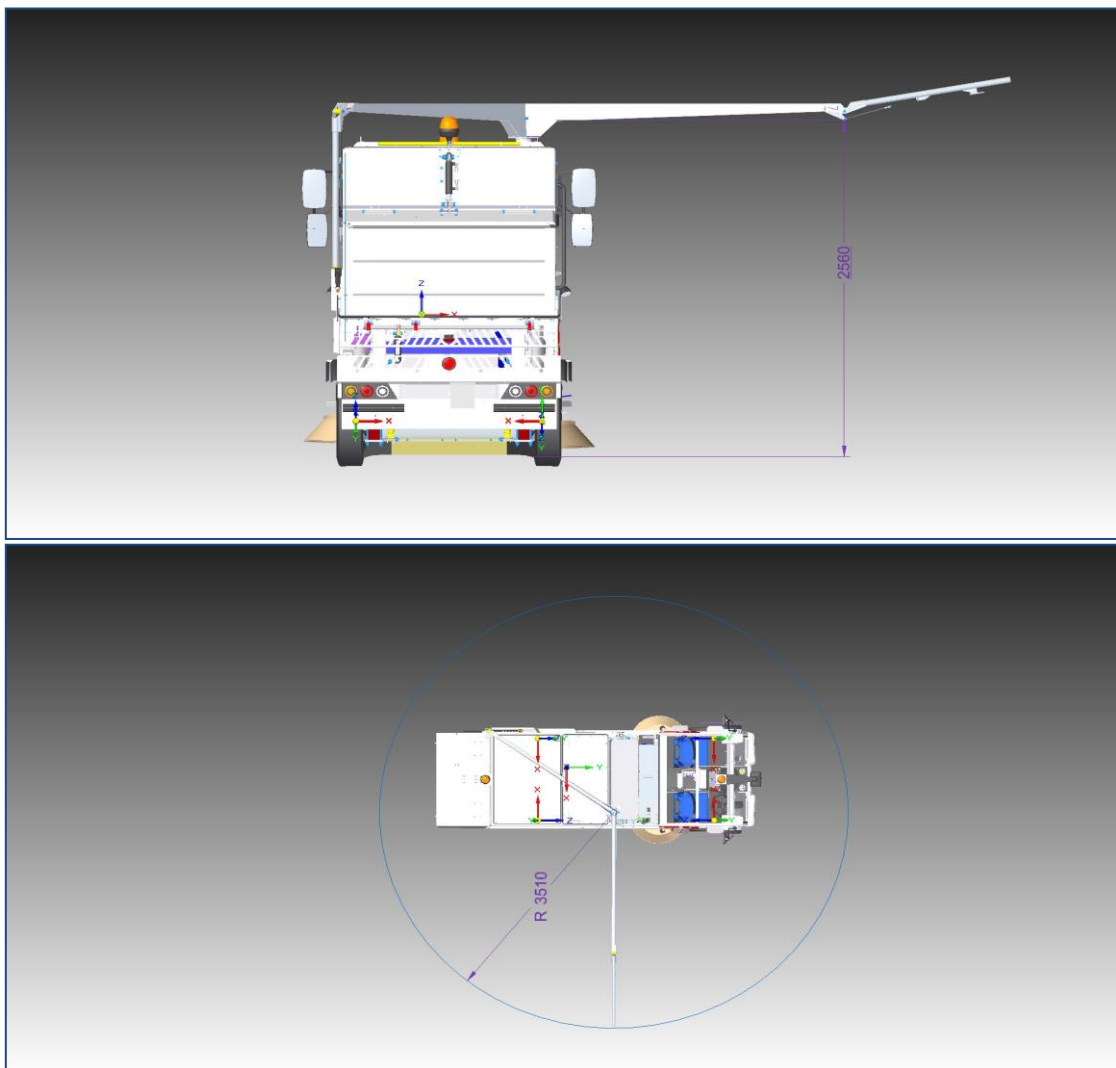
A pump with 2900 Psi nominal pressure and 5.6 gal/min flow rate, activated by a control on the cabin's central console, feeds the high-pressure circuit services, including:

Washing gun. On the rear side of the machine there is an automatic reel hose for the washing gun.

Turning arm for easier washing gun operations, in case it is necessary to bypass obstacles such as parked vehicles.



Turning Arm



SIZE AND WEIGHT

Length	165.4 In	(4200 mm)
Length with third brush	196.9 In	(5000 mm)
Width	81.9 In	(2040 mm)
Max height (to beacon)	105.2 In	(2670 mm)
Maximum height (without beacon)	97.3 In	(2470 mm)
Maximum height with turning arm	109.1 In	(2770 mm)
Wheelbase	103.9 In	(2640 mm)
Empty weight with third brush	11684.4 lbs	(5300 Kg)
Payload	4850.1 lbs	(2200 Kg)
GVW	16534.5 lbs	(7500 Kg)

