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McCONEl

ROBOCUT / S300E

REMOTE-CONTROLLED COMPACT MOWER

ELECTRIC

Operator Manual



IMPORTANT

VERIFICATION OF WARRANTY REGISTRATION



Dealer Warranty Information & Registration Verification

It is imperative that the selling dealer registers this machine with McConnel Limited before delivery to the end user – failure to do so may affect the validity of the machine warranty.

To register machines; log onto <https://my.mcconnel.com> and select 'Machine Registration' which can be found in the 'Warranty' section of the site. **Confirm to the customer that the machine has been registered by completing the verification form below.**

Registration Verification	Serial No. <input type="text"/>
Dealer Name:	
Dealer Address:	
Customer Name:	
Date of Warranty Registration:/...../..... Dealer Signature:	

Note to Customer / Owner

Please ensure the section above has been completed and signed by the dealer to verify your machine has been registered with McConnel Limited.

IMPORTANT: During the initial 'bedding in' period of a new machine it is the customer's responsibility to regularly inspect all nuts, bolts and hose connections for tightness and re-tighten if required. New hydraulic connections occasionally weep small amounts of oil as the seals and joints settle in – where this occurs it can be cured by re-tightening the connection – *refer to torque settings chart below*. The tasks stated above should be performed on an hourly basis during the first day of work and at least daily thereafter as part of the machine's general maintenance procedure.

CAUTION: DO NOT OVER TORQUE HYDRAULIC FITTINGS AND HOSES

Torque Settings for Hydraulic Fittings

Hydraulic Hose Ends		
BSP	Setting	Metric
1/4"	18 Nm	19 mm
3/8"	31 Nm	22 mm
1/2"	49 Nm	27 mm
5/8"	60 Nm	30 mm
3/4"	80 Nm	32 mm
1"	125 Nm	41 mm
1.1/4"	190 Nm	50 mm
1.1/2"	250 Nm	55 mm
2"	420 Nm	70 mm

Port Adaptors with Bonded Seals		
BSP	Setting	Metric
1/4"	34 Nm	19 mm
3/8"	47 Nm	22 mm
1/2"	102 Nm	27 mm
5/8"	122 Nm	30 mm
3/4"	149 Nm	32 mm
1"	203 Nm	41 mm
1.1/4"	305 Nm	50 mm
1.1/2"	305 Nm	55 mm
2"	400 Nm	70 mm

WARRANTY POLICY

WARRANTY REGISTRATION

All machines must be registered, by the selling dealer with McConnel Ltd, before delivery to the end user. On receipt of the goods it is the buyer's responsibility to check that the Verification of Warranty Registration in the Operator's Manual has been completed by the selling dealer.

1. LIMITED WARRANTIES

- 1.01. *All mounted machines supplied by McConnel Ltd are warranted to be free from defects in material and workmanship from the date of sale to the original purchaser for a period of 12 months, unless a different period is specified.
All Self Propelled Machines supplied by McConnel Ltd are warranted to be free from defects in material and workmanship from the date of sale to the original purchaser for a period of 12 months or 1500 hours. Engine warranty will be specific to the Manufacturer of that unit.*
- 1.02. *All spare parts supplied by McConnel Ltd and purchased by the end user are warranted to be free from defects in material and workmanship from the date of sale to the original purchaser for a period of 6 months. All parts warranty claims must be supported by a copy of the failed part invoice to the end user. We cannot consider claims for which sales invoices are not available.*
- 1.03. *The warranty offered by McConnel Ltd is limited to the making good by repair or replacement for the purchaser any part or parts found, upon examination at its factory, to be defective under normal use and service due to defects in material or workmanship. Returned parts must be complete and unexamined. Pack the component(s) carefully so that any transit damage is avoided. All ports on hydraulic items should be drained of oil and securely plugged to prevent seepage and foreign body ingress. Certain other components, electrical items for example, may require particular care when packing to avoid damage in transit.*
- 1.04. *This warranty does not extend to any product from which McConnel Ltd's serial number plate has been removed or altered.*
- 1.05. *The warranty policy is valid for machines registered in line with the terms and conditions detailed and on the basis that the machines do not extend a period of 24 months or greater since their original purchase date, that is the original invoice date from McConnel Limited.
Machines that are held in stock for more than 24 months cannot be registered for warranty.*
- 1.06. *This warranty does not apply to any part of the goods, which has been subjected to improper or abnormal use, negligence, alteration, modification, fitment of non-genuine parts, accident damage, or damage resulting from contact with overhead power lines, damage caused by foreign objects (e.g. stones, iron, material other than vegetation), failure due to lack of maintenance, use of incorrect oil or lubricants, contamination of the oil, or which has served its normal life. This warranty does not apply to any expendable items such as blades, belts, clutch linings, filter elements, flails, flap kits, skids, soil engaging parts, shields, guards, wear pads, pneumatic tyres or tracks.*
- 1.07. *Temporary repairs and consequential loss - i.e. oil, downtime and associated parts are specifically excluded from the warranty.*
- 1.08. *Warranty on hoses is limited to 12 months and does not include hoses which have suffered external damage. Only complete hoses may be returned under warranty, any which have been cut or repaired will be rejected.*
- 1.09. *Machines must be repaired immediately a problem arises. Continued use of the machine after a problem has occurred can result in further component failures, for which McConnel Ltd cannot be held liable, and may have safety implications.*
- 1.10. *If in exceptional circumstances a non McConnel Ltd part is used to effect a repair, warranty reimbursement will be at no more than McConnel Ltd's standard dealer cost for the genuine part.*

- 1.11. *Except as provided herein, no employee, agent, dealer or other person is authorised to give any warranties of any nature on behalf of McConnell Ltd.*
- 1.12. *For machine warranty periods in excess of 12 months the following additional exclusions shall apply:*
 - 1.12.1. *Hoses, exposed pipes and hydraulic tank breathers.*
 - 1.12.2. *Filters.*
 - 1.12.3. *Rubber mountings.*
 - 1.12.4. *External electric wiring.*
 - 1.12.5. *Bearings and seals*
 - 1.12.6. *External Cables, Linkages*
 - 1.12.7. *Loose/Corroded Connections, Light Units, LED's*
 - 1.12.8. *Comfort items such as Operator Seat, Ventilation, Audio Equipment*
- 1.13. *All service work, particularly filter changes, must be carried out in accordance with the manufacturer's service schedule. Failure to comply will invalidate the warranty. In the event of a claim, proof of the service work being carried out may be required.*
- 1.14. *Repeat or additional repairs resulting from incorrect diagnosis or poor quality previous repair work are excluded from warranty.*

NB Warranty cover will be invalid if any non-genuine parts have been fitted or used. Use of non-genuine parts may seriously affect the machine's performance and safety. McConnell Ltd cannot be held responsible for any failures or safety implications that arise due to the use of non-genuine parts.

2. REMEDIES AND PROCEDURES

- 2.01. *The warranty is not effective unless the Selling Dealer registers the machine, via the McConnell web site and confirms the registration to the purchaser by completing the confirmation form in the operator's manual.*
- 2.02. *Any fault must be reported to an authorised McConnell Ltd dealer as soon as it occurs. Continued use of a machine, after a fault has occurred, can result in further component failure for which McConnell Ltd cannot be held liable.*
- 2.03. *Repairs should be undertaken within two days of the failure. Claims submitted for repairs undertaken more than 2 weeks after a failure has occurred, or 2 days after the parts were supplied will be rejected, unless the delay has been authorised by McConnell Ltd. Please note that failure by the customer to release the machine for repair will not be accepted as a reason for delay in repair or submitting warranty claims.*
- 2.04. *All claims must be submitted, by an authorised McConnell Ltd Service Dealer, within 30 days of the date of repair.*
- 2.05. *Following examination of the claim and parts, McConnell Ltd will pay, at their discretion, for any valid claim the invoiced cost of any parts supplied by McConnell Ltd and appropriate labour and mileage allowances if applicable.*
- 2.06. *The submission of a claim is not a guarantee of payment.*
- 2.07. *Any decision reached by McConnell Ltd. is final.*

3. LIMITATION OF LIABILITY

- 3.01. *McConnell Ltd disclaims any express (except as set forth herein) and implied warranties with respect to the goods including, but not limited to, merchantability and fitness for a particular purpose.*
- 3.02. *McConnell Ltd makes no warranty as to the design, capability, capacity or suitability for use of the goods.*
- 3.03. *Except as provided herein, McConnell Ltd shall have no liability or responsibility to the purchaser or any other person or entity with respect to any liability, loss, or damage caused or alleged to be caused directly or indirectly by the goods including, but not limited to, any indirect, special, consequential, or incidental damages resulting from the use or operation of the goods or any breach of this warranty. Notwithstanding the above limitations and warranties, the manufacturer's liability hereunder for damages incurred by the purchaser or others shall not exceed the price of the goods.*
- 3.04. *No action arising out of any claimed breach of this warranty or transactions under this warranty may be brought more than one (1) year after the cause of the action has occurred.*

4. MISCELLANEOUS

- 4.01. McConnel Ltd may waive compliance with any of the terms of this limited warranty, but no waiver of any terms shall be deemed to be a waiver of any other term.*
- 4.02. If any provision of this limited warranty shall violate any applicable law and is held to be unenforceable, then the invalidity of such provision shall not invalidate any other provisions herein.*
- 4.03. Applicable law may provide rights and benefits to the purchaser in addition to those provided herein.*

McConnel Limited



For Safety and Performance...

ALWAYS READ THE BOOK FIRST



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To access manuals use the QR code opposite or the web address below;

<https://my.mcconel.com/service/pdf-manuals/pdf-operator-manuals/remote-control-technology-manuals/>

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GENERAL INFORMATION

Read this manual before fitting or operating the machine or accessory. Whenever any doubt exists contact your local dealer or the McConnell Service Department for assistance.

Only use 'Genuine McConnell Parts' on McConnell machinery and equipment.

DEFINITIONS: *The following definitions apply throughout this manual;*

⚠ DANGER

DANGER: Alerts to a hazardous situation which will result in death or serious injury if not observed carefully.

⚠ WARNING

WARNING: Alerts to a hazardous situation which could result in death or serious injury if not observed carefully.

⚠ CAUTION

CAUTION: Alerts to a hazardous situation which could result in damage to the machine and/or equipment if not observed carefully.

NOTICE

NOTICE: Specific or general information considered important or useful to emphasise.

LEFT HAND (LH) & RIGHT HAND (RH): *These terms are applicable to the machine when fitted to the tractor and viewed from the rear; these terms also apply to tractor references.*

SERIAL PLATE

All machines are equipped with a serial number plate containing important information relating to the machine including a unique serial number used for identification purposes.

Note: Images in this manual are provided for instruction and informational purposes only and may not show components in their entirety. In certain instances images may appear different to the actual machine; where this occurs the general procedure will be basically the same. E&OE.

NOISE LEVEL

L_{pA}
80

L_{pA} = the value indicates the maximum sound level perceived by the operator at a distance of 1m from the machine.

L_{wA}
86

L_{wA} = the value indicates the sound level outside the machine and refers to the noise perceived by those who are in the vicinity of the work area.

MACHINE DESCRIPTION

McConnel Robocut S300E electric powered machines are compact, all-terrain, remote-controlled mowers with bi-directional cutting capability for high performance efficient mowing/mulching of grass and herbaceous vegetation.

Machines are powered by two 7kWh Vanguard Lithium batteries delivering smooth progressive power for operation on all types of terrain including slopes of up to 55°.

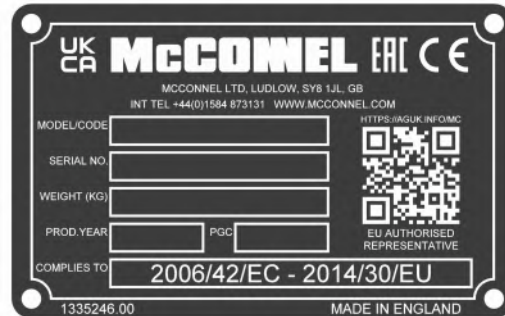
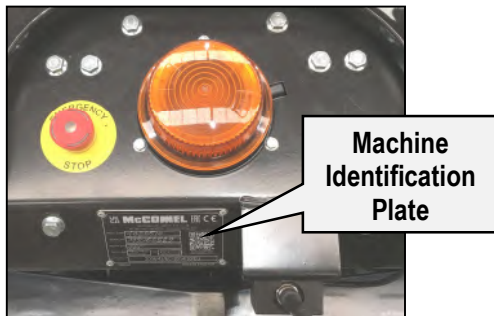
The S300E is controlled via a precision digital remote-control unit giving users freedom to operate the machine in difficult or dangerous areas at distances of up to 150m.

This machine must only be used to perform tasks for which it was designed, use for any other purpose could be dangerous to persons and damaging to the machine.

MACHINE IDENTIFICATION

An identification plate is fitted to the rear of the machine in the location shown below.

It is advisable that owners keep a record of the serial number as stated on the identification plate and always quote the serial number when ordering replacement parts or when seeking service information or advice.

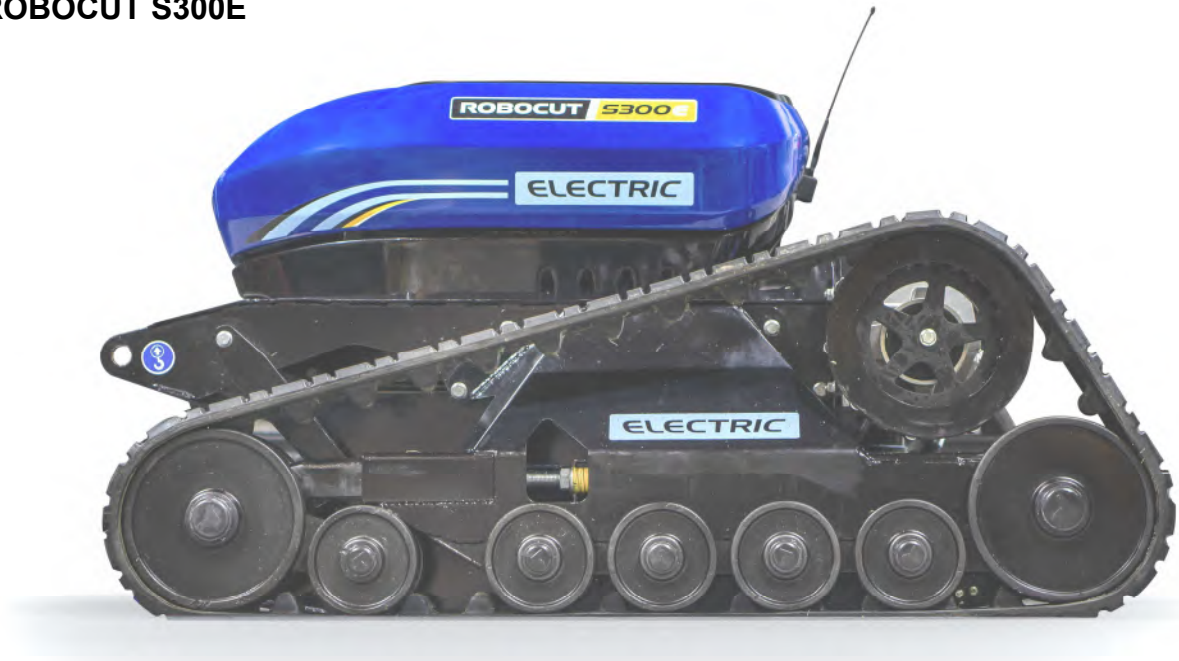


MACHINE & DEALER INFORMATION

Record serial numbers and dealer contact information here. Always quote serial numbers when ordering replacement parts or seeking service information and/or advice.	
Machine Serial Number:	Machine Installation Date:
Battery Serial Numbers:	/
Machine Model Details:	
Dealer Name & Branch:	
Dealer Address:	
Dealer Telephone No:	
Dealer Email Address:	

FEATURES & SPECIFICATIONS

ROBOCUT S300E



- 2x 7kWh Vanguard Lithium batteries.
- Fully enclosed body panels.
- Tracked carriage.
- Electric motor driven tracks.
- Ability to operate on slopes up to 55°.
- Remote-controlled cutting height adjustment 25mm (1") to 150mm (6").
- Automatic height pre-set.
- Twin 'fast stop' rotors.
- Track tensioning system.
- Remote operation up to 150m.
- Fully proportional remote-control.
- Speed limiter.
- 50/50 weight distribution.
- User screen.
- GPS compatible.

TECHNICAL SPECIFICATIONS

Power	Battery 14kWh (2x 7kWh)
Track power	Electric motors
Travel speed	8kph / 5mph
Brakes	Short-circuit brake system
Ground pressure	2800 kg/m ² (6173 lbs/m ²)
Rotor No.	2
Rotor shaft speed	3114 rpm
Cutting blades per rotor	2 updraft blades & 2 top cut blades
Area capacity (<i>approx.</i>)	5000 m ² /h @ 3 mph
Controls	Twin joystick remote-control
Control range	150m / 490 ft.
Ambient working temperature	-5 to +40 °C
Noise output level	LWA = 86 dB
Bearing lubrication	Sealed bearing
Weight	566kg (1248 lbs.)
Cutting height	Min. 25mm (1") / Max. 150mm (6")
Cutting width	1120mm / 44"
Working angle	0 to 55° (<i>conditions permitting</i>)
Operating time (full charge)	Up to 4 hours (*)

(*) Optimum operating time.

Figure will vary depending on factors such as work/ground conditions, terrain, temperature etc.

SAFETY INFORMATION



Read the manual before using the machine

This machine has the potential to be extremely dangerous - in the wrong hands it can kill or maim; It is therefore imperative that both owner and operator of the machine reads the following section to ensure they are fully aware of the dangers that do, or may exist, and fully understand their responsibilities surrounding use and operation of this machinery.

The operator of this machine is responsible not only for their own safety but equally for the safety of all others who may come into the close proximity of the machine, as the owner you are responsible for both.

When the machine is not in use it should be parked in a safe location on a firm level site with power turned off.

In the event of any fault being detected with the machine's operation it must be stopped immediately and not used again until the fault has been corrected by a qualified technician.

- ⚠** *Before starting the machine, the operator must read and understand all aspects of use and maintenance of the machine as stated in this manual.*
- ⚠** *The machine must only be used by a responsible adult who is familiar with all aspects relating to safe operation.*
- ⚠** *Do not operate the machine while under the influence of alcohol or drugs.*
- ⚠** *The machine must not be operated by children or non-authorized persons.*
- ⚠** *Operators must know the meaning of all operation and safety decals on both the machine and the remote-control unit.*
- ⚠** *Operators must know the procedure for switching the machine off normally and the correct procedure for using the Emergency Stop.*
- ⚠** *Do not attempt to use the machine if the Emergency Stop switch is damaged or malfunctioning.*
- ⚠** *Never use the machine with safety guarding removed or defective.*
- ⚠** *Operators should practice operation on flat open ground to familiarise themselves with driving and manoeuvring the machine before attempting to use it on sloping ground.*
- ⚠** *Operators should practice manoeuvring the machine around obstacles, without the rotors running, before using the machine for work purposes.*
- ⚠** *Never operate the machine if your vision is blocked or obscured by obstacles such as vehicles, buildings, hedges, fences etc.; move to a safe position where you have a clear, un-interrupted view of the entire machine.*
- ⚠** *Never operate the machine when standing directly in the line of travel.*
- ⚠** *Do not use the machine on sand piles, gravel, or other similar loose materials.*

- ⚠ Only operate the machine in good light conditions.*
- ⚠ Never start or run the machine in an enclosed area or building.*
- ⚠ Keep the machine clean to avoid build ups of dry materials that could ignite on hot components.*
- ⚠ Never stand directly below a machine that is working or parked on a slope.*
- ⚠ Always operate the joystick control slowly; rapid or jerky movements could cause the machine to 'rear up' causing loss of control.*
- ⚠ When operating the machine with the rotors running the operator must remain in a safe position at least 30 ft. (9.15m) away from the machine; always switch the rotors off before approaching the machinery.*
- ⚠ When using the machine, the operator should place themselves in a position that provides optimum visibility over the entire work area.*
- ⚠ Never leave a running machine unattended; always shut-off main power.*
- ⚠ Always stop and switch the machine off if persons or animals enter the work area; do not restart the machine until they are at a safe distance.*
- ⚠ Never use the machine to perform tasks it was not designed for.*
- ⚠ Never ride or allow others to ride on the machine.*
- ⚠ Keep children away from a working or running machine at all times; stop the machine immediately if children are in the close vicinity.*
- ⚠ Never allow children to play on or near a machine even when it is parked up.*
- ⚠ Always inspect the work area prior to operation and remove stones, glass, metal, wire or any other foreign objects that are hazardous. Immovable hazards should be suitably 'marked' so they can be easily avoided.*
- ⚠ Take extra care when operating the machine on slopes or uneven ground; there is increased risk of objects being thrown from rotating equipment when working in these conditions.*
- ⚠ The machine can be used on slopes up to a maximum of 55° providing the surface is dry and firm.*
- ⚠ Should a machine overturn, a suitable crane or winch should be used to recover it; keep all persons at a safe distance before and during recovery.*
- ⚠ Do not operate the machine in foggy or frosty conditions as there is increased risk of accidents.*
- ⚠ Take extra care when working in close proximity to electrical cables; in some circumstances, operating the machine under overhead power lines can result in loss of radio signal causing the engine to be deactivated.*
- ⚠ Do not operate the machine close to vehicles or properties where there is risk of damage by objects accidentally ejected from the cutting unit.*
- ⚠ It is the user's responsibility to protect persons in or near the work zone.*
- ⚠ When servicing or maintaining the machinery no-one should be allowed beneath it when it is raised unless it is securely supported on suitable ramps or stands.*
- ⚠ Never attempt to service or maintain the machine whilst powered on; always turn isolator switch off and remove the remote-control switch key.*
- ⚠ When transporting the machine on another vehicle or trailer the power must be switched off and the machine chocked and secured with suitable ropes or chains.*
- ⚠ Check the condition of cutting blades and their fixings on a regular basis; never use a machine with damaged or missing blades or loose fixings.*
- ⚠ Always clean the machine after use; if machine components are hot, allow them to cool to a safe temperature before cleaning. Never use solvent based chemicals for cleaning.*

- ⚠ *When operating in excessively dusty conditions work may need to be interrupted on a regular basis to remove any build ups of dust on components that could cause overheating.*
- ⚠ *Test the Emergency Stop switch before each period of work to ensure it functions correctly.*
- ⚠ *Never leave machine and control unit unattended in one place; the machine could be started and used by un-authorized persons.*
- ⚠ *Any inspection, service or maintenance of the machine must only be performed with machine switched off and control unit switch key removed.*
- ⚠ *Always wear suitable safety gear at all times when performing service or maintenance work on the machine.*
- ⚠ *Rotors must always be switched off when manoeuvring outside of the work zone.*

Personal Protective Equipment (PPE)

We recommend that the following personal protective equipment is worn during operation and/or maintenance of this machinery; overalls, safety shoes, safety goggles, ear protection, safety helmet, protective gloves, respiratory protection, shin/knee protection.



Although the information stated here covers a wide range of safety subjects, it is impossible to predict every eventuality that can occur under differing circumstances whilst operating this machine. No advice given here can replace 'good common sense' and 'total awareness' at all times, but it will go a long way towards the safe use of your McConnel machine.



Operating, servicing and maintaining this equipment can expose you to chemicals including gasoline, diesel fuel, lubricants, petroleum products, engine exhaust, carbon monoxide, and phthalates, which are known to the State of California to cause cancer and birth defects or other reproductive harm. To minimize exposure, avoid breathing exhaust, do not idle the engine except as necessary, service your vehicle in a well-ventilated area and wear gloves or wash your hands frequently when servicing your vehicle. Battery posts, terminals and related accessories contain lead and lead compounds, chemicals known to the state of California to cause cancer, birth defects or other reproductive harm. For more information go to www.P65Warnings.ca.gov. This website, operated by California's Office of Environmental Health Hazard Assessment, provides information about these chemicals and how individuals may be exposed to them.

MACHINE DELIVERY

Robocut S300E machines are delivered ready for use. Before use, all delivery packaging should be removed and the machine fully inspected; if there are any signs of damage or missing components it must be reported to your supplier/dealer immediately.

Standard items supplied;

- Machine with mounted receiver.
- Remote-control Transmitter Unit c/w Battery Pack.
- Reserve Battery Pack.
- Battery Charger.
- Belt for Remote-control Unit.
- User Manual.

Machine Handling

The machine is equipped with 4 lifting points for raising the machine with overhead lifting gear. Ensure the equipment used does not foul or come into contact with the machines body panels during the lifting procedure; use spreader beams if required. The deck must be placed into the fully lowered position when lifting the machine with overhead lifting gear.

Lifting Point Locations



Lifting Equipment

Suitable overhead lifting equipment with a minimum Safe Working Load (SWL) in excess of 600kg should be used for handling the machine.

Ensure the machine is kept balanced and level at all times during the lifting procedure.

All operatives and bystanders must remain at a safe distance from the raised machine.

⚠ DANGER

Keep all persons at a safe distance from the raised machine.

⚠ DANGER

Lifting of the machine should only be performed on a firm level site.

Machine Transportation

The lifting points on the machine can also be used as lash points; all 4 positions should be used to secure the machine for transportation on flatbed vehicles or trailers.

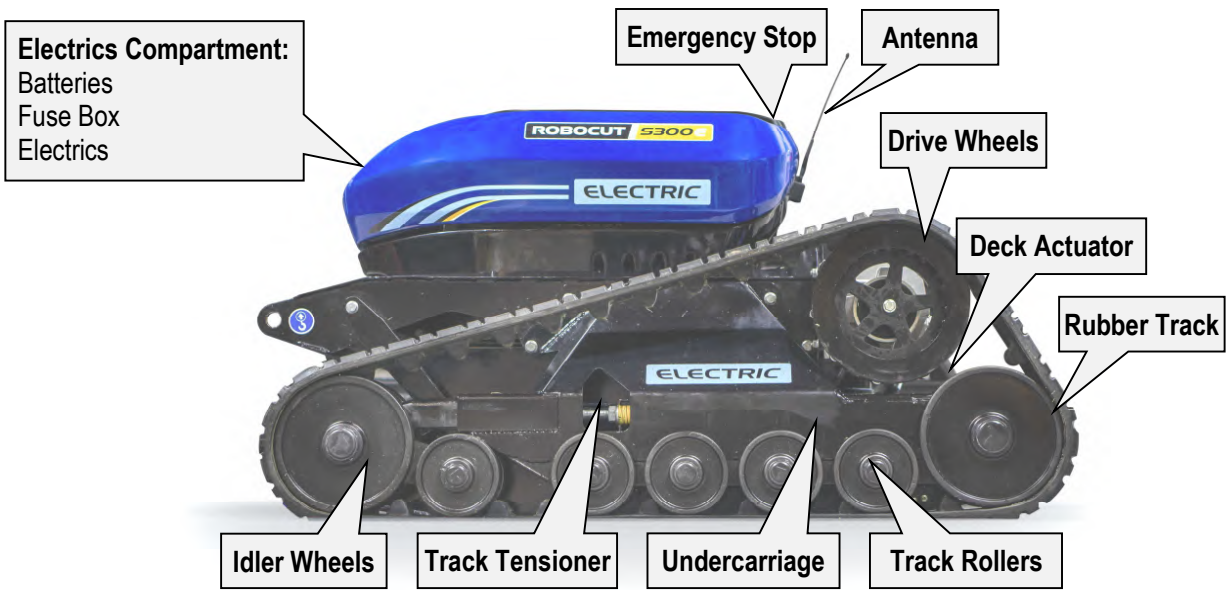
⚠ CAUTION

Machine must be fully secured at all times when transporting on a vehicle.

⚠ CAUTION

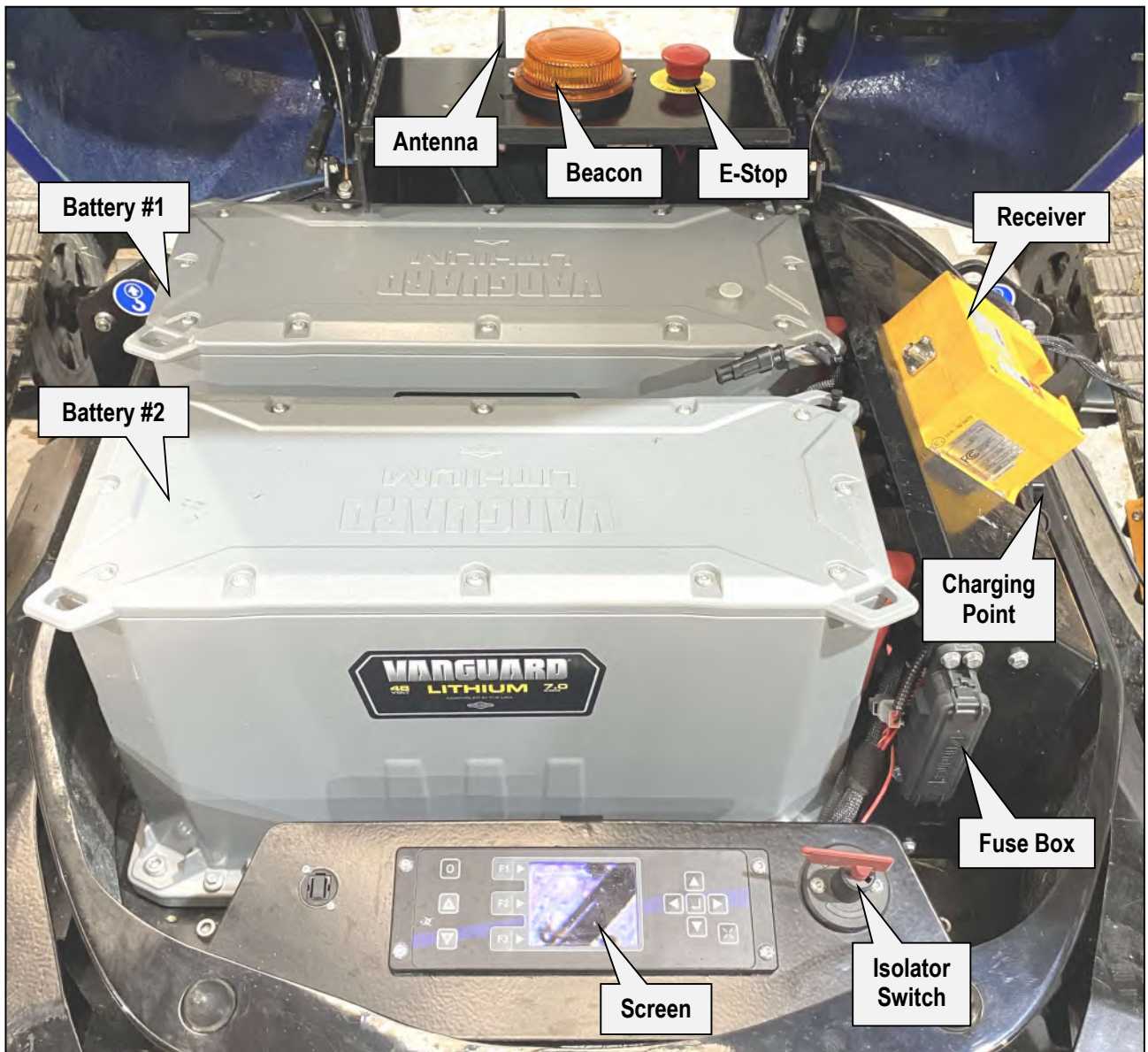
Ensure E-Stop is DOWN (Activated) and Isolator Switch is in OFF position.

MACHINE OVERVIEW



ELECTRICS COMPARTMENT

Component Identification



EMERGENCY STOP BUTTONS (E-STOP)

Location of Emergency Stop Buttons

E-Stop buttons are located on top of the machine at the rear of the electrics compartment and on the remote-control unit.

The E-Stop button on the machine also acts as the main power ON/OFF button for the machine.



Main Power ON/OFF

It is important that the machine E-Stop button (Power ON/OFF button) is always switched OFF (E-Stop activated) when the machine is not being used; this is for both safety reasons and to preserve battery power.



⚠ IMPORTANT

ALWAYS activate the E-Stop to shut-off power to the machine when it is not being used.

SAFETY DEVICES & EMERGENCY STOP (E-Stop)

Automatic Emergency Safety Features

As the machine is operated by remote-control and the user is not 'physically' controlling the machine, specific safety features have been built in to protect the operator, third party persons, and the machine itself; these are as follows;

DANGER / RISK SITUATION	AUTOMATIC SAFETY FEATURE
Machine beyond signal reception area or radio signal blocked	EMERGENCY STOP will activate
Radio signal failure	EMERGENCY STOP will activate
Another machine on same frequency operating in the area	EMERGENCY STOP will activate

Manual Emergency Safety Feature

In addition to the automatic safety features stated above **the operator can immediately stop all machine movements and shut off the power by pressing an E-Stop button;** these are located on the remote-control unit and on the top of the machine.

In all instances above the following actions will occur;

- **Machine movement / operations and functions will be halted (*).**
- **Power will be immediately switched off.**

(* **NOTE:** *When an E-Stop is activated the rotors will continue to 'freewheel' under their own momentum for a short period of time before coming to a complete standstill, **do not approach the machine until all movement has ceased.***

After using an E-Stop the machine will cease to function completely; to regain functions and continue operating, the E-Stop button must be reset and a normal re-start performed.

In the unlikely event of movement malfunction

If machine movements perform in an unexpected and/or incorrect manner follow the instructions below;

- 1) Release the forwards/backwards movement joystick.
The control is equipped with automatic zero position; on release it will automatically return to the central (stop) position, this action will halt track motion.
- 2) Press E-Stop button on the control unit.

 DANGER Do not approach the machine if it is moving.

- 3) Press machine's E-Stop button.
- 4) Turn control unit power switch to the OFF position (*anti-clockwise*) and remove the key.

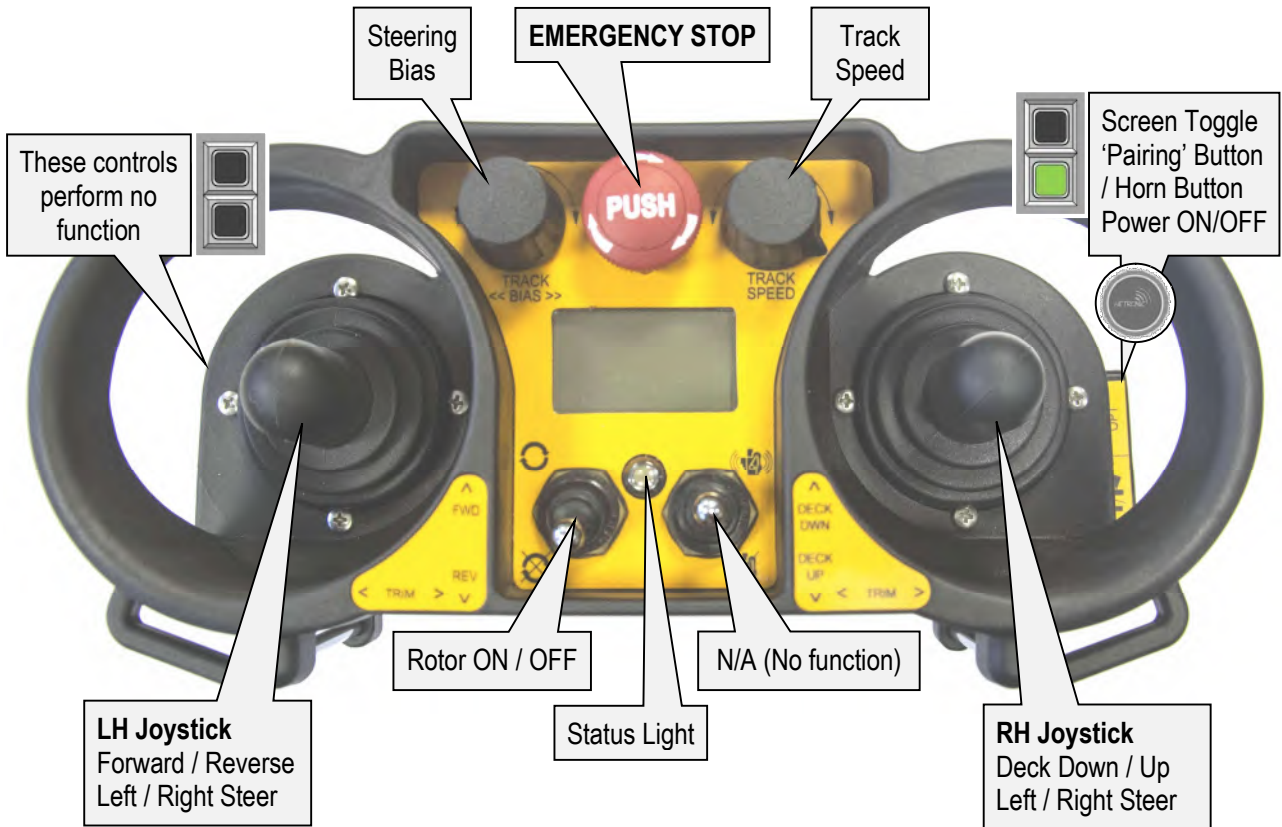
If movement malfunction is experienced contact your Authorised Dealer or McConnel Service; DO NOT attempt to use or operate the machine until advice has been sought.

REMOTE-CONTROL UNIT

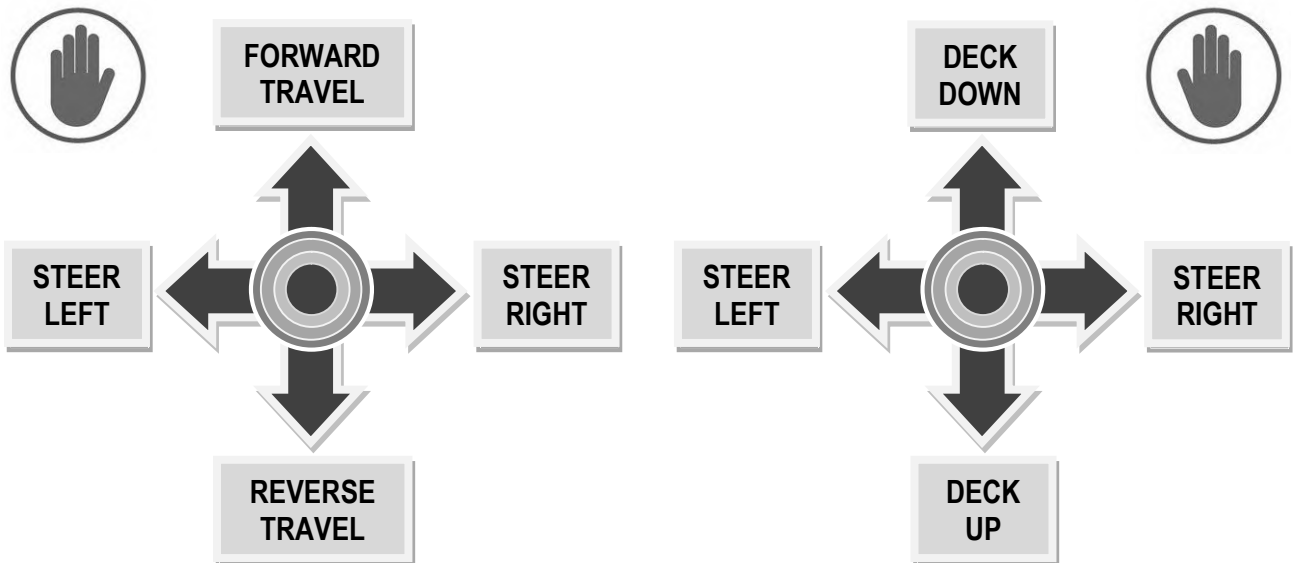
⚠ DANGER

Operators must wear personal safety gear at all times whilst operating the machine and stand in a safe operating position with a clear view of the machinery and the work area.

Controls Identification



Joystick Controls

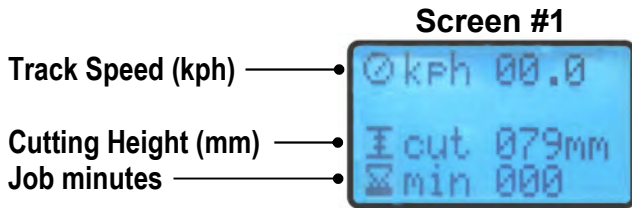


NOTE: Steering can be controlled using either the LH or the RH joystick; if joysticks are operated in opposing directions simultaneously the RH joystick will take priority to avoid conflicting commands.

Control Unit – Function Operation

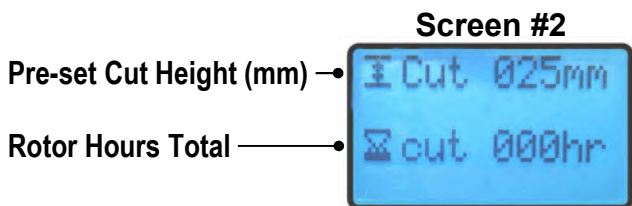
LCD Display

Reports the following information;



Job minutes records current rotor engaged time until the job timer is manually reset – refer to ‘Job Timer Reset’ procedure.

Press **OPT** button  to ‘toggle’ screens



*Pre-set cut height can be set to user’s own preference; this setting is then the height the deck will automatically move to when **OPT** button is pressed for >3 seconds. Continue to operate the joystick if you want to power the deck past the pre-set cut height.*

When altering height, screen will display the new cutting height after approximately 3 seconds.

Refer to cutting height section for details of setting the cutting height pre-set.

Status Light

Indicates the status of the Remote-control Unit;

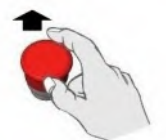
Illuminated **GREEN** = ‘**CORRECT**’ Status.

Illuminated **RED** = ‘**PROBLEM**’ Status.

Emergency Stop Button



PUSH button down to **activate** ‘**EMERGENCY STOP**’.



PULL button out to **deactivate** ‘**EMERGENCY STOP**’ (on machine).

ROTATE button to **deactivate** ‘**EMERGENCY STOP**’ (on control unit).



Steering Bias Dial

Control for setting steering angle bias when operating on sloped ground.



Left Steering Bias: Turn control dial to the left to select desired LH bias.

No Steering Bias: Place control dial into the central position.

Right Steering Bias: Turn control dial to the right to select desired RH bias.

Track Speed (Governor)

Sets maximum top speed limit.



Increase Maximum Speed Limit: Rotate control dial clockwise.

Decrease Maximum Speed Limit: Rotate control dial anti-clockwise.

NOTE: *lower maximum speed settings will provide proportionally ‘finer’ speed control.*

Rotor Control Switch

Rotor ON and OFF control.



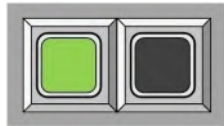
ON : Place switch in 'UP' position to start the rotor.





OFF: Place switch in the DOWN position to 'STOP' rotor.

With MACHINE & REMOTE-CONTROL UNIT UNSYNCHRONISED

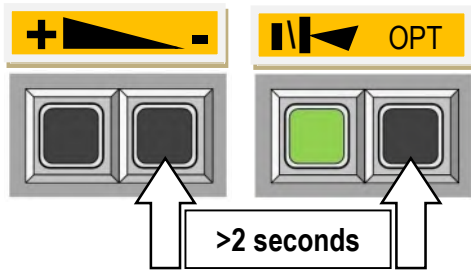
Pair Button & Screen 1 ◀▶ 2 Swap (Synchronisation mode)



Press  Button: Will 'Pair' machine with remote-control unit. Horn will sound to confirm, and software version will be displayed.

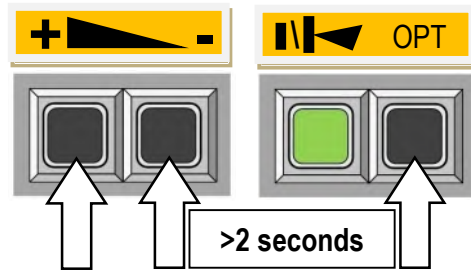
Press  Button: Toggles between Screen 1 & Screen 2.

1) Toggle Metric & Imperial Units



1) Press and hold the Speed (+) & Option button for >2 seconds to toggle between metric and imperial units.

2) Job Timer Reset





2) Press and hold Speed (+), Speed (-) & Option button together for >2 seconds to reset the job timer, *job minutes are displayed at the bottom of screen 1.*

With MACHINE & REMOTE-CONTROL UNIT SYNCHRONISED

Horn Button & Actuate Pre-set Cutting Height (Operation mode)



Press  Button: Sounds the horn (Operator controlled warning).

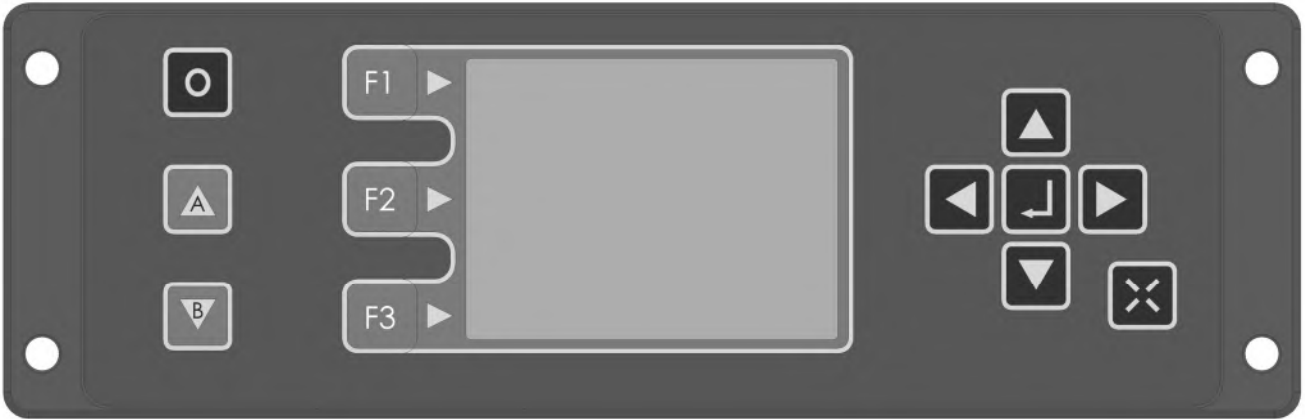
Press  Button: Hold for > 3 seconds to move deck actuator to the pre-set cut height.

MACHINE CONTROL PANEL

The machine control panel is located in front of the batteries in the electrics compartment.








⚠️ WARNING Screen features are live and changes to some settings on the screen will cause machine movement.

Control Panel



Control Panel Buttons

To access system menus and functions use the control panel buttons identified below;

 <p>Control Panel ON/OFF</p>  <p>Page Scroll (Back)</p>  <p>Page Scroll (Forward)</p>	 <p>F1 Strobe Settings Access</p>  <p>F2 N/A</p>  <p>F3 N/A</p>	<p>Screen Navigation</p>  <p>Home Button</p>
---	---	--

Control Panel Activation

NOTE: Machine isolator switch must be in the ON position and E-Stop button deactivated (in its out position) to allow control panel to be powered on.

 **Press and hold control panel ON/OFF button** until the screen switches on.

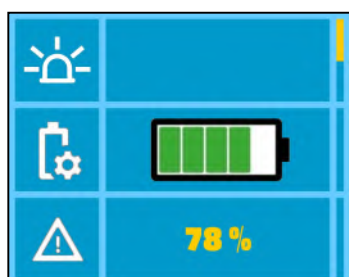


Initial Boot Screen

Initial screen will appear with 'signal status' symbol displayed to indicate machine and remote-control unit are **not 'paired'**. Horn will 'beep' continuously until machine and control unit have been 'paired'. Refer to following page for 'pairing' procedure.



Signal Status Symbol (not paired)



When machine and remote-control unit are paired the screen will be displayed as shown here.

◀ **Battery Power Visual Indicator**

◀ **Battery Power Level % Figure**

MACHINE & REMOTE-CONTROL UNIT SYNCHRONISATION (Pairing)

Machine and Remote-Control Synchronisation



To allow machine and remote-control synchronisation;

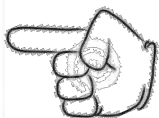
- **Isolator switch** must be in the **ON** position.
- **E-Stops** must be **de-activated** (out position).



Pairing Procedure



Switch remote-control unit ON by turning the power switch clockwise; control unit will emit a series of 'buzzing' sounds and screen will display the 'unsynchronised' symbol.



Remote Control Unit ON/OFF Switch



Unsynchronised Status



Press GREEN button on right-hand side of remote-control unit to 'pair' the remote-control with the machine.

When synchronised the remote-control unit screen will display screen #1 information.



Synchronised Status

Machine is ready for use when remote-control displays the synchronisation status screen.

PRE-OPERATION CHECKS

WARNING

Checks and inspections of the machine should be performed with machine parked on firm level ground with E-Stop activated and Isolator Switch in the OFF position

The following checks should be made daily before using the machine;

- Check all safety guarding is in good condition and fitted correctly.
- Check nuts and bolts for tightness, retighten if required.
- Check rotors for damaged or missing blades, replace if required before use.
- Check machine is free from debris.

EMERGENCY STOPPING (E-STOP)



In emergency situations, all machine functions can be immediately stopped by pressing an E-Stop button.

E-Stop buttons are located on the remote-control unit and on the top of the machine to the rear electrical compartment.

When an E-Stop button is pressed (activated), all machine movements and functions will cease immediately. When an E-Stop button is activated, that button must be reset before the machine can be used.

DRIVING & MANOUEVERING

⚠ WARNING

Operation of the machine must only be performed by a responsible person who has read the manual and is familiar with the machine's controls and all aspects relating to the safe use of this equipment.

⚠ CAUTION

It is advisable that all new operators practice using the machine, without the rotors running, in a safe open area to familiarise themselves with the controls and movements of the machine.

Forwards & Backwards Travel

Operation of the machine's forward and backwards movements are controlled by the **left-hand joystick** on the remote controls;

Push the lever forwards to move the machine forwards.

Pull the lever backwards to move the machine backwards.

The joystick operates proportionally; the further the lever is moved the faster the machine travels.

The maximum speed available will be determined by the particular position of the track speed dial.



Turn dial anti-clockwise = reduces top speed limit
Turn dial clockwise = increases top speed limit



**FORWARD
TRAVEL**



**REVERSE
TRAVEL**

Steering Direction

Operation of the machine's left and right movements can be controlled using either the **left-hand** or **right-hand joystick** on the remote controls;

Move left-hand OR right-hand lever to the left to steer left.

Move left-hand OR right-hand lever to the right to steer right.



NOTE: if joysticks are operated in opposing directions simultaneously the RH joystick will take priority.

Steering Bias

The steering bias feature allows the operator to set a 'degree of steer' for manoeuvring the machine across slopes, setting and adjustment is performed using the steering bias dial;



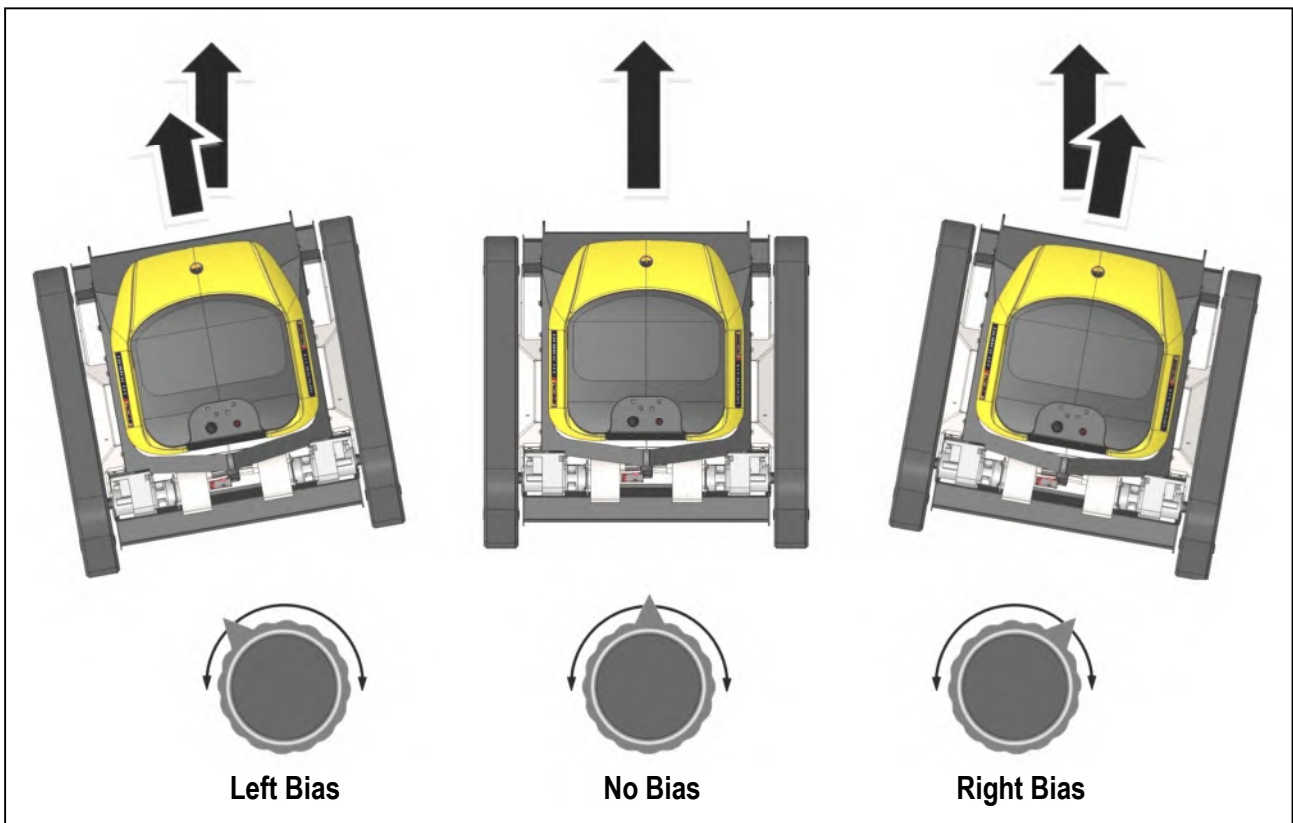
- Turn control dial to the left to select a desired degree of left steering bias.
- Turn control dial to the right to select a desired degree of right steering bias.
- Place control dial into the central position to de-select steering bias.

The further the dial is rotated in each direction the greater the degree of bias.

Operating with Bias

Steering must still be monitored and controlled by the operator in the normal manner, but steering corrections required to guide the machine will be greatly reduced.

Bias Control



Cutting Height Control

The deck height is controlled by forward and backwards operation of the **right-hand joystick**;



- Move joystick forwards to lower the cutting height.
- Move joystick backwards to raise the cutting height.

Providing it is safe to do so, the cutting height may be adjusted whilst the machine is in motion.



CUTTING DECK

Cutting Height

The machine can be set to cut at any height between 25mm (1") and 150mm (6").


The cutting height selected should be one that offers the desired finish. If the material being cut is particularly tall or thick or causes the machine to 'labour' whilst working, it is advisable to begin cutting at a high setting and progressively reduce the height until the required finish is achieved. In these conditions reducing the forward travel speed is advisable.

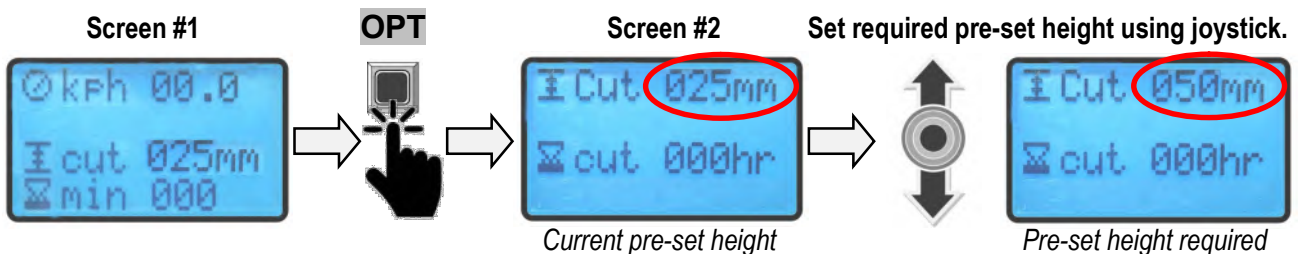
Cutting Height Pre-set


The controls feature a 'pre-set' height setting allowing the user to set a default cutting height that the machine automatically returns to when the **OPT** button is pressed and held for >3 seconds.

Setting the Pre-set Cutting Height

The procedure for setting the pre-set cutting height is as follows:


With machine running, press  **OPT** button on control unit to display screen #2.



When required pre-set height is displayed, press  **OPT** button to return to screen #1.

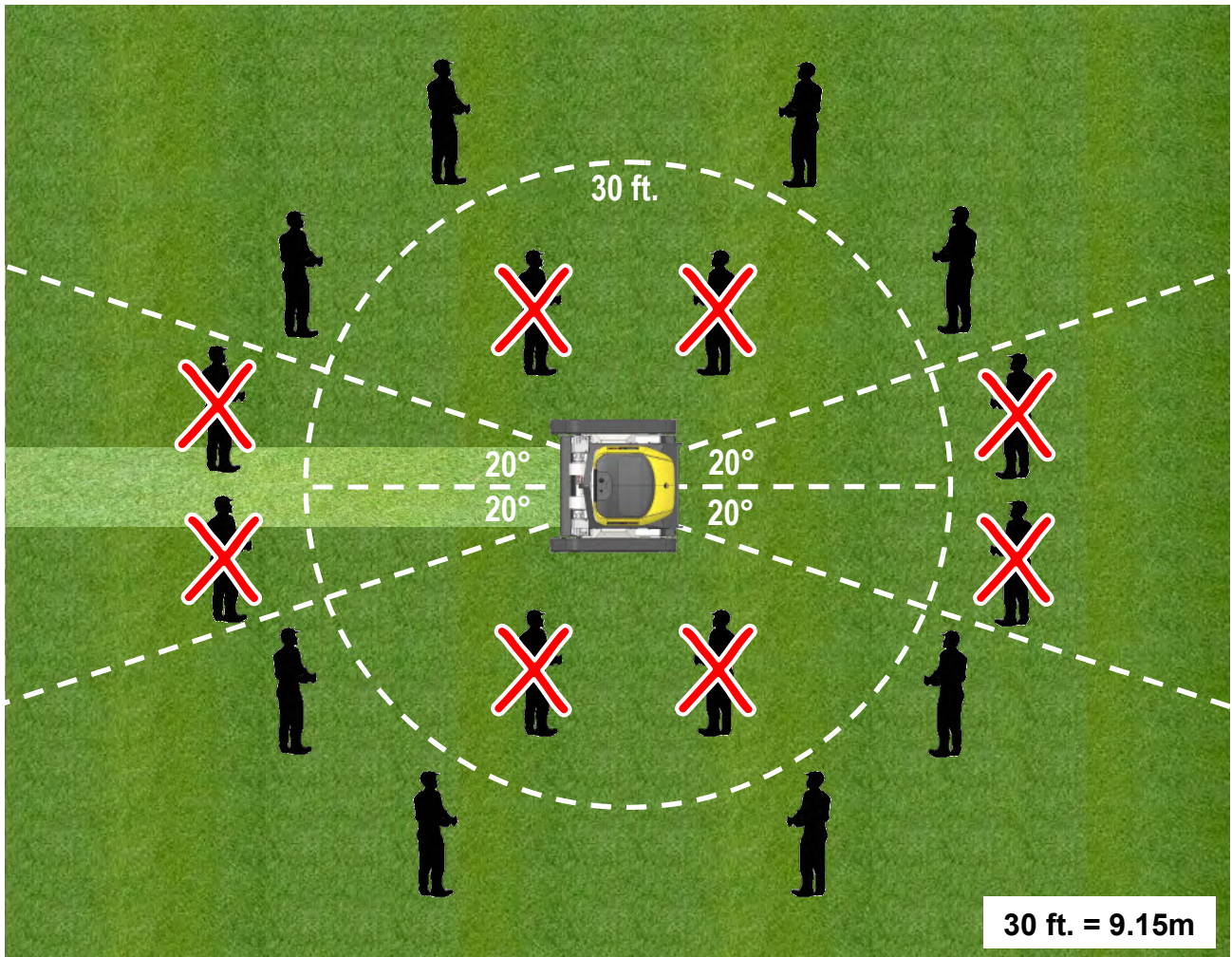
The pre-set cutting height has now been set at your chosen height and will remain as that setting unless subsequently changed.

Activating Pre-set Cutting Height

To move the deck to its pre-set cutting height, press and hold the  **OPT** button for >3 seconds; the deck will automatically move to the pre-set height.

OPERATING POSITION & DISTANCE

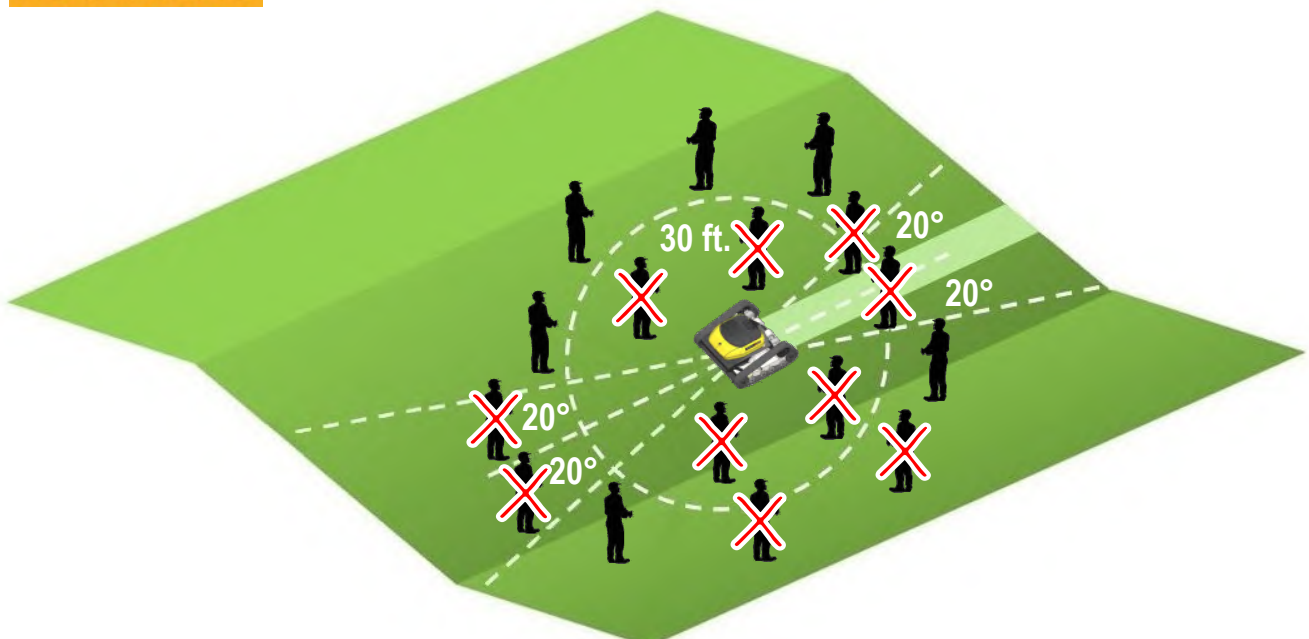
Only operate the machine from a safe distance and position that provides an unobstructed view of the machine and work area. When operating this machinery you are responsible for your own safety and the safety of all others who enter the work area.



Working on Slopes

When working on slopes do not operate from any position directly below the machine, where possible it is safer to stand in a suitable location above the machine.

⚠ WARNING Do not operate the machine on ground or surfaces that are slippery underfoot.

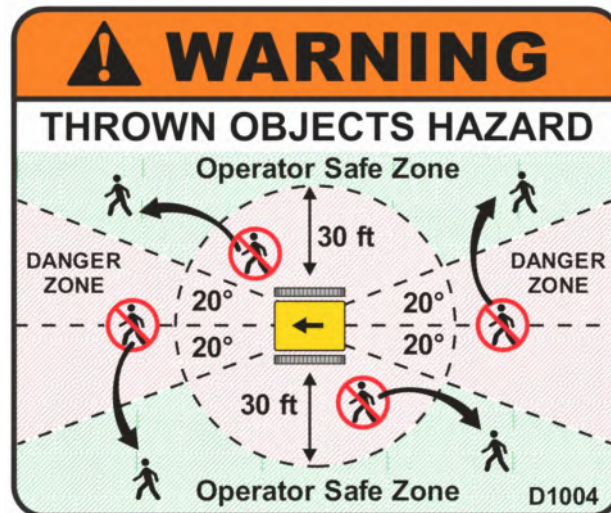


WORK AREA PRECAUTIONS

⚠️ WARNING Work and Work Area Precautions

The following checks should be made prior to operation in the work area;

- Inspect the work area prior to operations; check for and remove foreign bodies such as large stones, metal items, wire, glass etc. which could damage the machinery or may be ejected by the equipment being used. Any immovable objects should be visually marked or avoided.
- Ensure the work zone is clear of animals and persons. Never manoeuvre the machine into an area where you can no longer clearly see it working.
- Only work machinery in materials and conditions that are within their designed capability; attempting to work a machine for the wrong task, or beyond its capability, is highly dangerous and risks damage to machine components.
- When working on slopes always start at the bottom and work upwards.
- Never drive the machine down a slope that is in excess of its capability.
- Never operate the machine on slopes or terrain where there is a risk of overturn.
- Review the site and plan the work to abide with safe operating positions.



OPERATION

Personal Protection Equipment (PPE)

Operators must wear suitable safety gear when operating and/or maintaining this machine.



Recommended Safety Gear

- Safety Gloves
- Safety Boots
- Eye Protection
- Protective Overalls
- Safety Helmet
- Ear Defenders
- Dust Mask
- Shin/Knee Protection

Work Lighting Conditions



WARNING

Never operate the machine in poor lighting conditions.

Only work in good lighting conditions; you must have a clear view of the machine and the entire work area at all times. If necessary use suitable artificial lighting that complies with local rules and regulations.

Fire Hazard



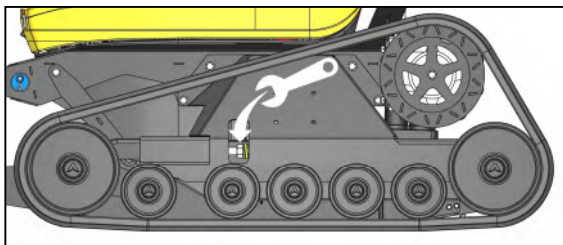
WARNING

Do not smoke near the machine.

Fuels, oils and lubricants are flammable; keep naked flames away from the machine at all times.

Track Protection

In certain driving conditions or circumstances the machine is at an increased risk of track damage and/or losing a track during manoeuvres; the following advice should be observed to avoid or reduce this risk.



Keep tracks correctly tensioned at all times.

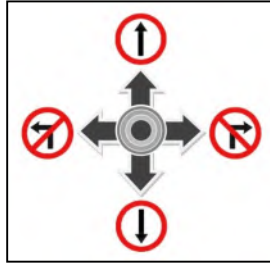
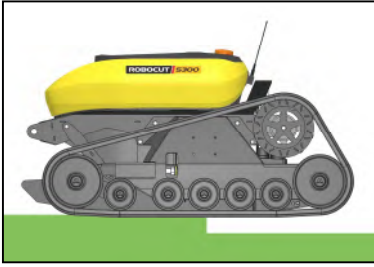
Incorrect track tension increases the risk of track damage or losing a track.



CAUTION

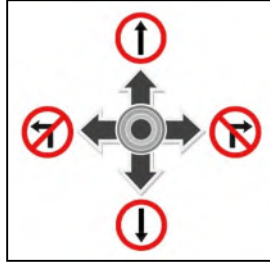
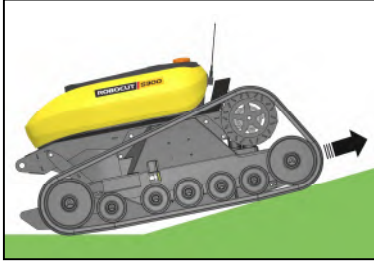
Do not move along the edge of a slope, or on uneven ground, with one track in the horizontal position and the other inclined or partially raised when machine is inclined in excess of 10°.

To avoid risk of track damage, always proceed with both tracks travelling on the same horizontal plane.



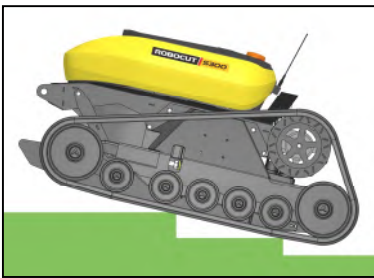
⚠ CAUTION

Do not change direction whilst moving on kerbs, rocks, or surfaces with considerable differences in height (*more than 20cm*); in these instances move perpendicular to the obstacles.



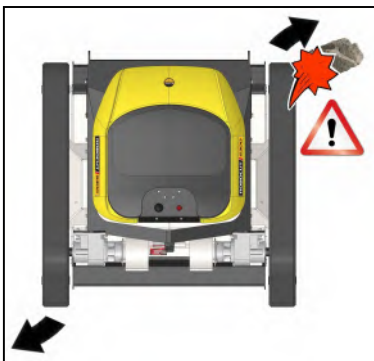
⚠ CAUTION

When reversing uphill, do not steer when transferring from the level surface to the slope; if unavoidable turning manoeuvres should be performed gradually.



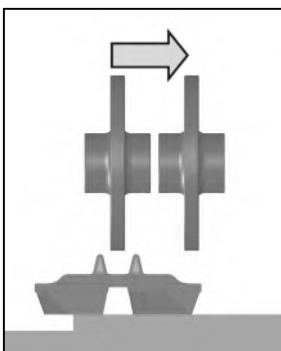
⚠ CAUTION

When the machine manoeuvres over an obstacle, a space is created between the bearing rollers and the track - this can cause the track to come off its seat. The same situation can occur in reverse when a space is created between bearing roller, idler roller, and track.



⚠ CAUTION

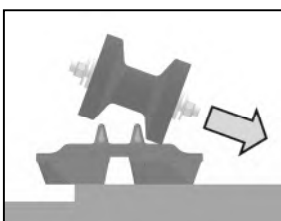
If the machines changes direction, and the track cannot move sideways due to the presence of an obstacle, there is a risk that the track can be damaged or come of its seat; wherever possible avoid turning the machine if it is against an obstacle, if unavoidable, make manoeuvres slowly and gradually until the machine is clear of the object.



⚠ CAUTION

If the machine moves in reverse in these conditions there is risk of the track coming off its seat.

Generic image used for example purpose.



⚠ CAUTION

If the machine is steered in these conditions the track will come off its seat

Generic image used for example purpose.

BRAKES

Machine movement is controlled by electric track motors which drive the machine when they receive electrical power from the battery, motion is stopped by 'short-circuiting' the motors which generates a braking effect to halt the machine.

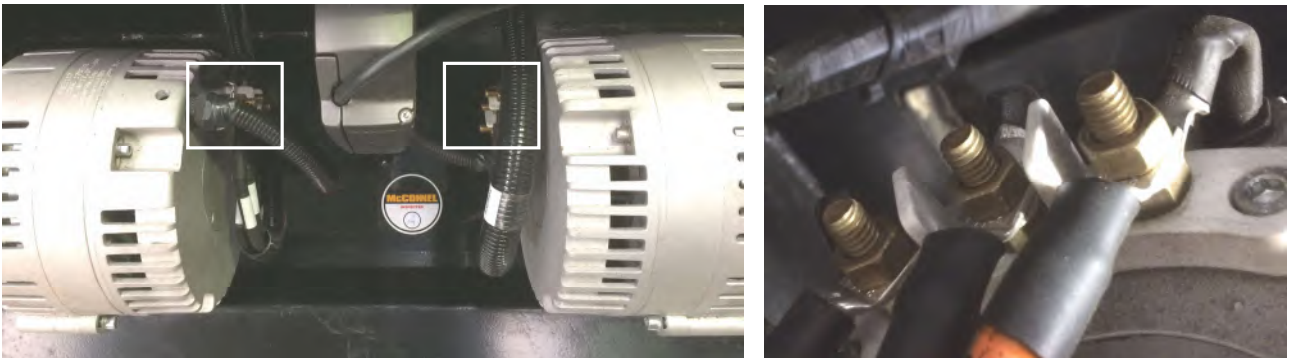
If the machine is switched off, or cuts-out for any reason, the motors 'lock-out' to hold the machine; if the machine is facing up or down a slope it may not bring the machine to a complete standstill, but it will greatly reduce roll-away speed allowing the machine to 'creep' safely to the bottom of the gradient.

It is important that the machine is never parked-up or left unattended a slope, if the machine needs to be stopped on a slope for any reason it should be positioned across the gradient, and if necessary chocked front and rear to ensure it cannot move under its own weight. Chock Kits (Part No. 4009362) are available as an optional extra if required.

⚠ WARNING Never stand, or allow others to stand, downhill of the machine when it is located on a slope.

Emergency Towing

In a recovery situation that necessitates the machine being towed by another vehicle, the three power cables to each track motor must first be disconnected.



Location of track motor power cables: the 3 power cables on each motor must be disconnected for towing.

Towing of the machine should only be performed in an emergency situation. A rigid towing bar or frame should be used connected to lift point(s) on the front of the machine; never attempt to use chains or ropes to tow the machine.

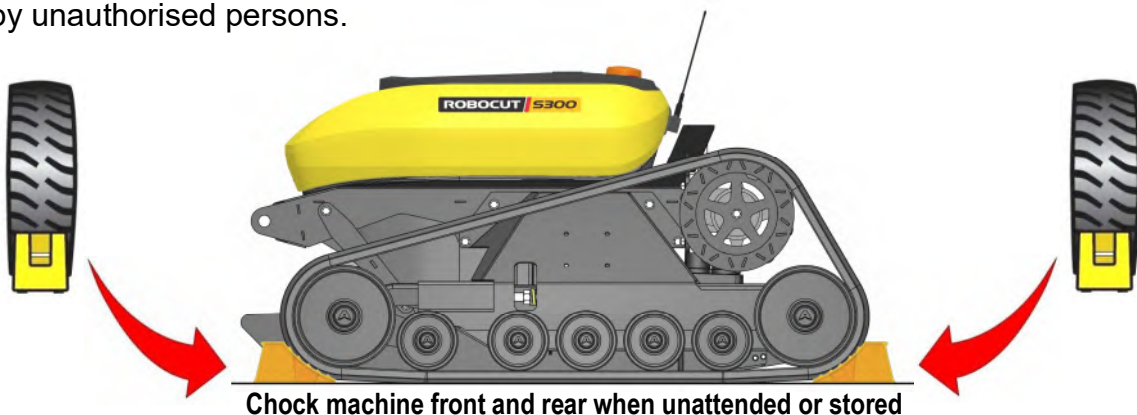
If it is deemed necessary to tow the machine, distance towed and towing speed should be kept to an absolute minimum.

⚠ CAUTION Never run the machine with track motor power cables disconnected.

Parking the Machine

When not in use the machine must always be parked on a firm level site with the main power switched off. When leaving the machine unattended or for long-term storage the machine should be 'chocked' front and rear to avoid risk of accidental movement.

The remote-control unit should be stored in a different location to protect the machine from use by unauthorised persons.



MAINTENANCE

⚠ WARNING

Checks, maintenance, and service tasks must only be performed with the machine parked on a firm level site.

⚠ WARNING

Never attempt to work on any machine that is not safely supported and chocked. Only use suitable equipment for the task that is fully capable of supporting the machine's entire weight.

⚠ WARNING

Never attempt to work under a machine that is suspended on lifting equipment; the machine must be in a fixed position and safely supported from below at all times.

⚠ WARNING

Machine isolator switch must be in OFF position and the remote-control starter key removed before attempting to inspect or work on any components of the machine.

⚠ WARNING

Electrical maintenance and repairs must only be performed by qualified Electrical Technicians.

CHARGING REMOTE-CONTROL BATTERY

The machine's remote-control unit is supplied with a spare battery for use as a reserve. A charging station for the control unit reserve battery is built-in to the receiver unit located within the electrics compartment.

For uninterrupted operation, the reserve battery can be stored in the charging station; this will ensure it remains fully charged and ready for use.



The charging station only provides power to the spare battery when the Receiver is being powered by the machine's lithium batteries.

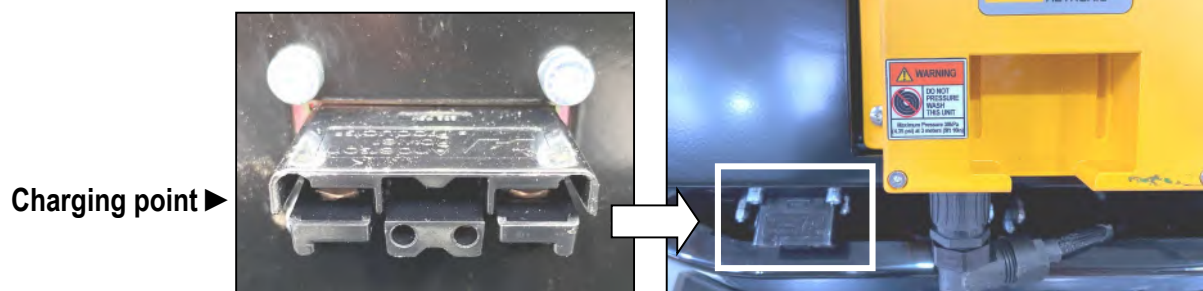
CHARGING MACHINE BATTERIES

Preparation for recharging should be made before battery power reaches a critical charge level to allow sufficient power reserve for driving the machine to the transportation vehicle. When the power level drops to approximately 10% the system will cut-off power to the blade motors and remaining power will be solely used for driving the track motors; at this point the machine should be returned to the transportation vehicle.

Plan your work in such a way that the machine is in close proximity to the transportation vehicle when the charge level is becoming low.

Charging the machine should be performed on a firm level site in a safe location close to a mains power supply. Ensure all leads are routed safely between the mains power supply and the machine and do not allow unauthorised persons near the machine whilst charging.

The charge point for the lithium batteries is located in the electrical compartment on the left-hand side of the machine adjacent to the Receiver Unit.



When connecting the charger it should be plugged into the machines charge point first and plugged into a suitable mains socket second. A full charge will take approximately 8 hours. Removal of the charger is a reversal of the connection procedure.

Battery Charger Operation

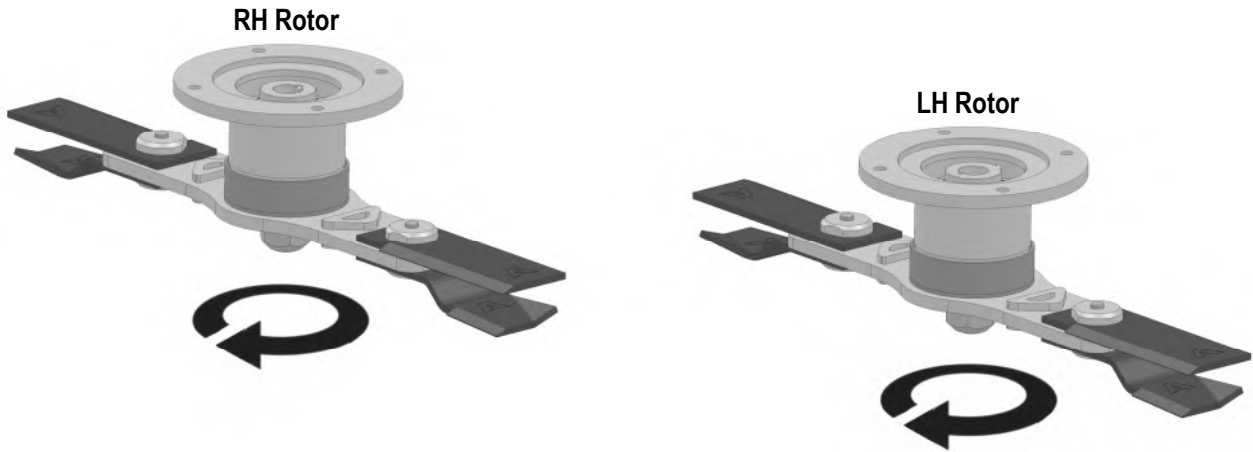
1. With the charger DC output connector/plug disconnected from the battery connector, connect the charger AC power cable to an appropriate AC outlet; blue 'AC PRESENT' LED will turn ON.
2. Connect the charger DC output connector/plug to the battery connector; when the charger starts it is indicated by the yellow 'CHARGE STATUS' LED beginning to 'blink' slowly.
3. If the charger must be disconnected from the battery while a charge cycle is in progress, first disconnect the AC power cord from the AC outlet. Do not disconnect the charger DC output connector/plug from the battery while a charge cycle is in progress.
4. The charge cycle terminates when a battery reaches full charge; yellow LED will switch OFF. The required charge time is affected by numerous factors, including battery amp-hour capacity, depth of discharge, battery temperature, and battery age/usage.
5. Before operating machine, disconnect the charger DC output plug from the machine connection point by firmly grasping the DC output plug and pull the plug straight out of the connection point.

No maintenance tasks are required for the lithium batteries or battery charger, if problems occur and you suspect a fault or issue with either of these components contact your local McConnell dealer for advice. Do not attempt to repair or interfere with these components.

ROTORS & BLADES

Machine features two rotors equipped with sets of opposing blades mounted on a blade carrier; blade sets comprises of an updraft blade and a top cut blade. The 'fast-stop' rotors, are mounted on the machine in a staggered configuration to provide overlapped cutting.

Rotors



Blades

⚠ WARNING Activate E-Stops, turn Isolator Switch to OFF and remove remote-control starter key before inspecting or working under the machine.

⚠ WARNING Protective gloves must be worn when inspecting rotors and blades.

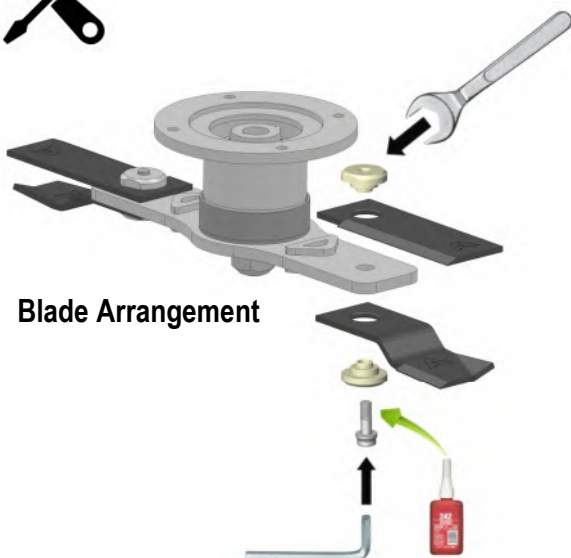
Rotors and blades should be inspected on a daily basis for signs of wear or damage; excessively worn or damaged blades must be replaced before using the machine.

Blade Replacement

When fitting new blades they must be replaced in opposing matched pairs to ensure the rotor remains balanced. Blades must only be mounted as shown in arrangement below. When replacing blades new blade screws should also be fitted and secured with a thread-locking adhesive (Loctite 242 or equivalent).



Tools required; 8mm hex key, 36mm spanner.



Blade Arrangement

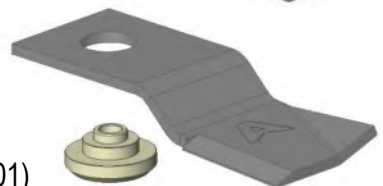
Spacer Nut
(Part No. 4009114.02)



Top Cut Blade
(Part No. 4009026)



Updraft Blade
(Part No. 4009029)



Spacer Ring
(Part No. 4009114.01)



Hex Socket Screw
(Part No. 94431030)



⚠ CAUTION Blades must only be mounted as shown in the arrangement above.

TRACKS

Track Replacement

Tracks must be replaced when the treads are excessively worn, or sooner if there are large cuts, cracks, or damage that could affect their safe use.

⚠ WARNING

Never attempt to work on any machine that is not safely supported and chocked. Only use suitable equipment for the task that is fully capable of supporting the machine's entire weight.

⚠ WARNING

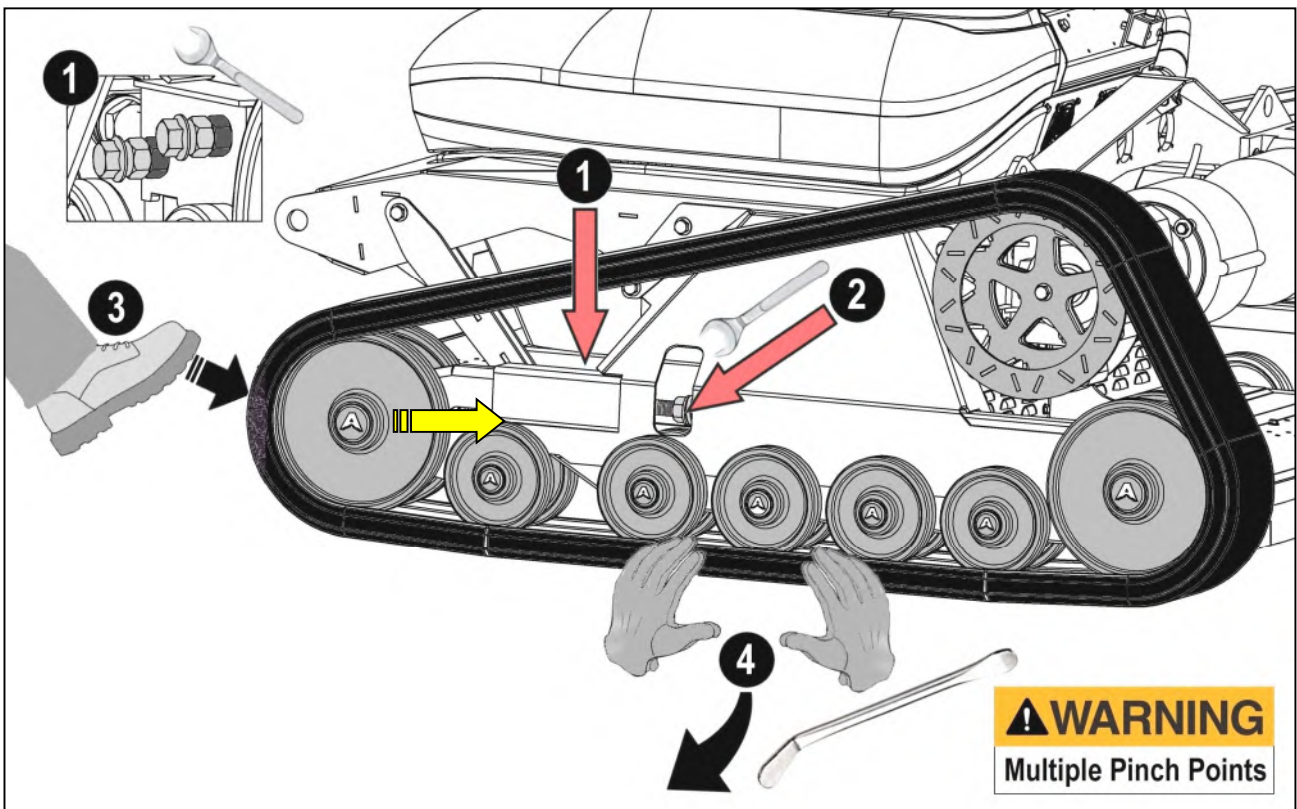
Ensure suitable safety gear is worn at all times when performing maintenance tasks. Beware, there is 'pinch risk' when working on track components – *keep hands clear of risk areas*.



Tools required; 22mm, 24mm & 36mm spanners, pry bar.

Track Removal Procedure

Raise machine off the ground to a height of approximately 30-40cm; *ensure the machine is stable and suitably supported*. Clean undercarriage components and surrounding areas of the machine before removing tracks.



- 1) Slacken off the 24mm clamping bolts (x2) located on the inner face of the landing gear.
- 2) Slacken off the 36mm track tensioner nut to fully release tension.
- 3) Compress tension unit; this can be done by using your foot to push track and idler roller rearwards.
- 4) Draw the track downwards and outwards at its mid-point position on the lower run to pull it off its seating, carefully lever between the track and the idler roller until track is free enough to be removed. Keep hands and fingers clear of the rollers to avoid injury!!

Tracks are heavy items; keep clear of the track as it falls to the ground.

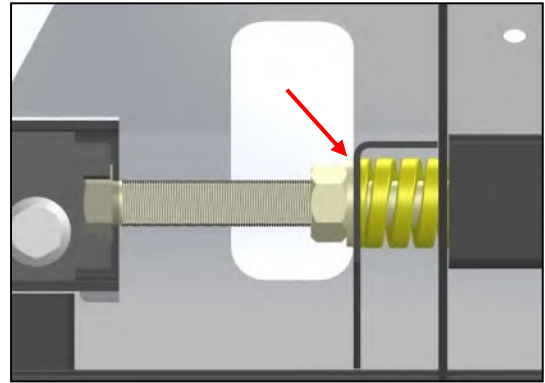
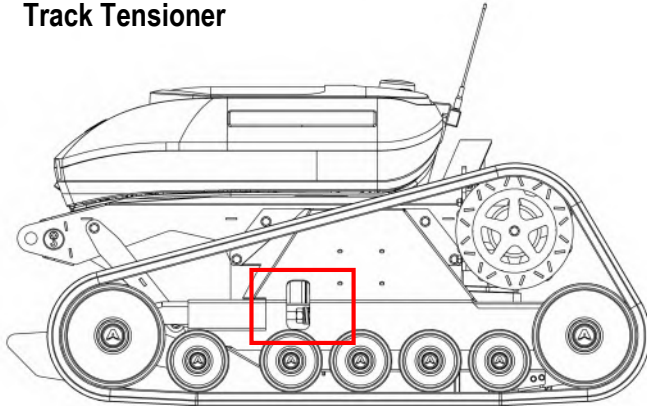
Track Fitting Procedure

Installation of a track is basically a reversal of the removal procedure previously described. When the track has been installed it must be correctly tensioned to the specific setting detailed below; when the tension has been set, secure the tensioner by re-tighten the 24mm clamping bolts (x2) located on the inner landing gear.

Track Tension Setting

Track tension is set using heavy-duty compression springs. To ensure correct tension is applied, slacken off the clamping bolts and locking nuts before turning tensioning nut to compress the spring; correct tension is achieved when tensioner washer is in contact with the folded steel plate that houses the spring (*refer to the image below*). When track tension has been correctly set, re-tighten clamping bolts and locking nuts.

Track Tensioner



Tighten tensioner nut until washer is in direct contact with the spring housing plate.

NOTE: Tensioner spring is not visible externally, the spring housing plate is located directly in line with the rear edge of the access hole.

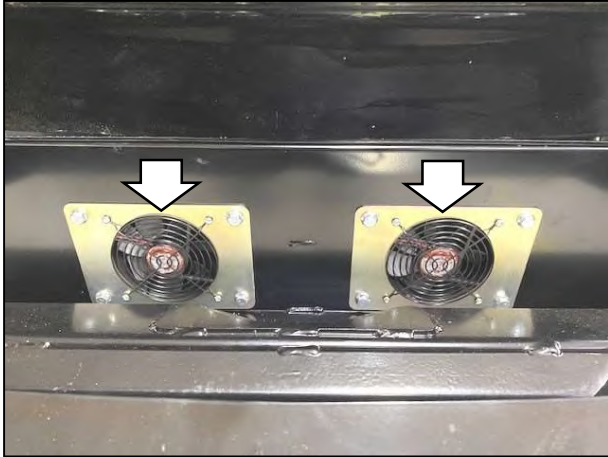
Track Tension Check

Tracks should be re-tensioned after an initial 2 hours work with a new machine and on an annual basis thereafter.

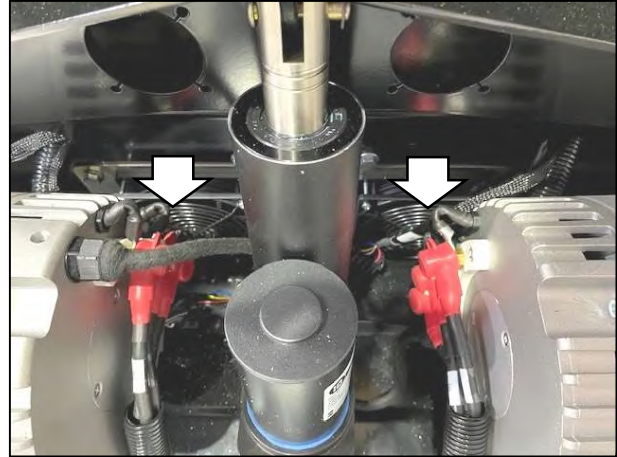
If the machine is placed into long-term storage it is suggested that the tensioners be 'slackened off' to relax the rubber tracks; tracks must be re-tensioned before next use.

INVERTER COOLING FANS

Machines are equipped with 4 cooling fans located at the front and rear of the machine; the function of the fans is to provide additional cooling to the heatsinks for track inverters and rotor motors/inverters by drawing air into the machine.



Front Inverter Fans



Rear Inverter Fans

During normal operations, the area between the fan mounting plate and the heatsink can accumulate a build-up of cutting debris and dust that can reduce the effectiveness of the fans, or in extreme cases block air flow. To ensure maximum cooling, this area should be cleaned on a monthly basis as part of a regular maintenance procedure or sooner if inverter overheating is experienced. Inspect fans on a regular basis and clean if required.

Cooling Fan Cleaning



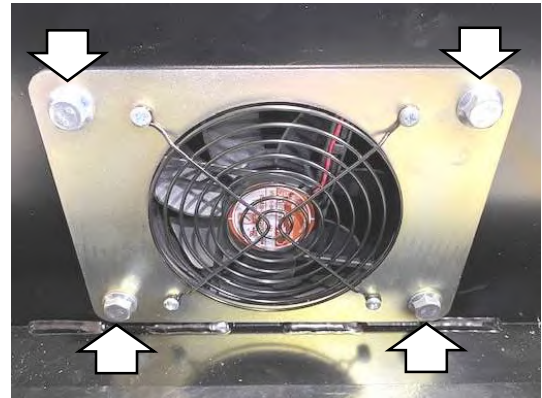
Tools Required: 13mm spanner or socket, soft brush.

Cleaning Procedure

Remove M8 bolts (x4) that secure the fan mounting plate to the chassis and remove the unit carefully to avoid damaging the fan wiring looms.

With the mounting plate clear of the chassis the area behind the fans will be exposed allowing access to remove any build-up of debris. The fans should be carefully cleaned whilst exposed using a soft bristle brush to remove any build-up of dust.

When all areas have been thoroughly cleaned the fans can be replaced and secured with the 4 bolts previously removed.



FUSES

Fuse Box Location



Fuse Identification

- 40A MAIN SUPPLY
- 30A GEN 4
- 1A FANS
- 15A DECK HEIGHT
- 10A PLC OUTPUT
- 2A PLC SUPPLY
- 5A AUTOTRIM
- 2A INCLINOMETER
- 2A RECEIVER
- SPARE

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SERVICE SCHEDULE

Standard Maintenance Schedule

Maintenance Task / Frequency	10 Hours (Daily)	25 Hours	100 Hour	500 Hour (Annual)	1500 Hour
Check blade condition	•				
Check track condition	•				
Check blade bolts are tight	•				
Remove cutting debris build-ups	•				
Check and/or adjust track tension		•			
Inspect and clean inverter fans		•			

CLEANING & STORAGE

Cleaning the Machine

It is recommended that the machine is cleaned on a daily basis using an air hose and/or soft brush to remove dust and debris. If necessary, carefully wipe down external surfaces using a damp cloth. Do not allow water to come into contact with electrical components.



DO NOT use a pressure washer or hose pipe to clean the machine.

Machine Storage

Store the machine in a safe clean environment where it is protected from the elements. The remote-control unit should be kept in a separate secure location to avoid risk of unauthorised use. Ensure E-Stops are activated and Isolator Switch is in the OFF position during storage.

TROUBLESHOOTING

PROBLEM	CAUSE	REMEDY
Rotors not turning	Blade blocked	Clear blockage
Tracks do not operate	Tracks blocked Track motor wiring defective Track motor brushes worn Overheated track inverter(s)	Clear track blockage Check wiring to motors Check / replace brushes Remove any debris behind heatsink fans Replace faulty heatsink fan
Tracks running too slow	Tracks hampered by residue or foreign objects Track motor brushes worn	Remove residue or foreign objects from tracks Check / replace brushes
Deck will not raise / lower	Foreign object on / under deck Linear actuator wiring fault Linear actuator defective Remote switch defective Deck actuator defective	Remove foreign objects Check / replace wiring Repair or replace actuator Test and replace if defective Test and replace if defective
Radio signal loss	Excessive distance between remote-control and machine Signal interference caused by powerlines or electric sources Antenna damaged or defective Antenna wiring damaged/faulty	Reduce operating distance - operate in machine range Avoid operating near sources of electrical interference Replace antenna Replace antenna wiring
Excessive vibration	Fixings loose or missing Rotor imbalance due to damage or missing blades Worn or damaged bearing	Tighten / replace fixings Check rotors for damaged components or missing blades Replace defective bearing



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