CE EN

Original Instructions

SP20061_EN REV4 // **December 2025**

Instruction Manual

Battery Cassette Mower

ES-510 / ES-610

DENNIS

Original Instructions in English (UK).
Part number: SP20061_EN.
Models covered: ES-510 (D156) / ES-610 (D157).

Rev.	Date	Description of Changes	Author
4.0	16/DEC/ 2025	Complete redesign of manual	C.B.

For a digital copy of this manual, parts catalogue and other information regarding this product, please scan:

Serial numbers:

Chassis
Battery
Drive Motor
Cassette Motor

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1.1. Introduction

1.1.1. Operator Manual Overview

This operator manual contains important information regarding the safe, proper and efficient operation of the ES-510/ES-610, referred to as 'machine' in this manual. This operator manual must always be available and read by every User of the machine. 'User' is defined as an authorised person tasked with working on or with the machine, typically operators, groundskeepers and maintenance personnel.

Adherence to this operator manual will help to avoid and minimise risk to you as the User and to the machine. It will also lead to a greater quality of cut, lower repair costs and reduce downtimes. Prior to use, every User must ensure they have:

- Fully read and understood these instructions,
- Understood the machine controls,
- Understood the dangers and hazards involved, and methods to mitigate risk.

In the case of any difficulty or if further information is required, call Howardson Group or your Dealer. In the interests of speed and accuracy of information, please quote the serial number of the machine when making enquiries.

Location descriptions (e.g. left/right hand) throughout this manual are observed from the operators view whilst in normal drive position, as per Fig.1.

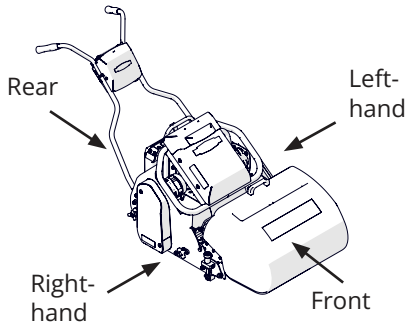


Figure (Fig.) 1 - Viewpoints

1.1.2. Machine Description

The ES-510 and ES-610 are professional electric grass mowers, using a 20" (510mm) or 24” (610mm) cassette respectively. These cassettes are interchangeable, each used for a different application including cutting, brushing, scarifying, verti-cutting and sorrel rolling.

Both machines are powered by a pair of 48V permanent magnet AC motors via an 1.5kWh lithium ion battery, with one motor controlling the rear roller and one motor controlling the cassette.

The rear roller and cassette are controlled independently, operated from the 4.3" colour display screen on the upper handle bar. This display screen also shows battery state of charge (SoC), clip rate and maintenance information.

The design of the machine incorporates a system for quick adjustment of the height of cut and a tubular assembly system for easy service and maintenance of the main components. A mechanical parking brake is fitted which, when applied, disengages drive.

1.2. Safety Instructions

Throughout this manual, potential safety risks are identified with a word and coloured coded box. They denote the following:

DANGER

Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.

WARNING

Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

CAUTION

Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury.

NOTE

Indicates information considered important but not hazard related.

1.2.1. Warning Symbols & Decals

The following symbols and decals are used throughout this Operator Manual and across the machine. Familiarise yourself with them prior to operating the machine. They are located near areas of potential danger or convey further information on machine use.

Warning Signs

General warning sign

Warning; Electricity

Warning; Sharp element

Warning; Toxic material

Warning; Flammable material

Warning; Crushing of hands

Warning; Explosive material

Warning; Battery charging

Prohibition Signs

General prohibition sign

No smoking

No open flame; Fire, open ignition source and smoking prohibited

No metallic articles or watches

Do not touch

No sitting

Do not alter the state of the switch

Not to be serviced by users

Mandatory Signs

General mandatory action sign

Refer to instruction manual/booklet

Wear ear protection

Wear eye protection

Wear a mask

Wear safety footwear

Wear protective gloves

Wear protective clothing

Disconnect before carrying out maintenance or repair

Disconnect mains plug from electrical outlet

Other Signs

Take note

Recycle

Heavy weight

Safe Condition Signs

Emergency stop button

Decals

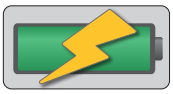
Your machine decals must be replaced when they become worn or damaged. Contact Howardson Group Service department with the part number listed below:

SP18031 - REV0

SP18038 - REV0

SP18026-4 - REV0

SP18026-3 - REV0



SP18026-6 - REV0

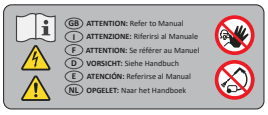
B32903_REV0

SP18032 - REV0

B32902_REV2 (200x50mm)
J20362_REV2 (120x30mm)

SP18026-7 - REV0

SP18051 - REV0



SP18026-2 - REV0

SP18052 - REV0

1.2.2. Important Safety Instructions

DANGER - IMPORTANT SAFETY INSTRUCTIONS

- ***Always*** read this operator manual carefully and understand the controls and safety signs before commencing work. Improper use or care of the machine may result in injury or death.
- This machine is dangerous if not used correctly - take great care and consideration when using it.
- ***Always*** keep hands, feet and any other body part clear of the cassette and rollers. Remember that blades, brushes and rollers can continue to rotate even after the motor has stopped.
- ***Always*** use the correct personal protective equipment (PPE) - see *"1.2.4. Personal Protective Equipment (PPE)" p.9.*
- ***Always*** use the machine with all safety guards correctly fitted. They are supplied for your protection.
- ***Always*** look behind before reversing.
- ***Always*** be alert for pedestrians.
- ***Always*** switch off the power and disconnect the battery before servicing or making repairs.
- ***Always*** keep the machine maintained with the schedule and procedures found in *"4. Maintenance and Servicing" p.44.* Doing so keeps the machine in good condition, thereby reducing accidents and injuries, and maintaining better turf.
- ***Always*** use genuine Dennis parts for servicing and replacements.
- ***Always*** operate standing behind the machine with a hand on each handlebar.
- ***Always*** wait for the cassette to stop rotating before travelling over anything that is not grass.

DANGER - IMPORTANT SAFETY INSTRUCTIONS

- ***Always*** assess the job prior to starting. This includes:
  - Slopes - mitigate use on slopes where possible. Take extra caution and use horizontally across the face of slopes, not up and down.
  - Remove any debris and objects such as stones and branches prior to working in the area. Also observe and avoid anything that can damage the machine such as sudden dips, verges etc
  - Lighting - always operate in daylight or good artificial light.
- ***Never*** use the machine if it is damaged or faulty in any way.
- ***Never*** put any body parts, including limbs, near moving parts of this machine.
- ***Never*** carry out adjustments whilst the machine is running.
- ***Never*** allow any unauthorised person to operate the machine, in any way, at any time.
- ***Never*** operate the machine if you are experiencing any of the following conditions: illness, reduced physical capacity, or under the influence of drugs or alcohol.
- ***Never*** let a child operate the machine or be in the work area when it is being operated.
- ***Never*** open or attempt any work inside the electrical box.
- ***Never*** replace any component with a non-genuine Dennis part.
- ***Never*** attempt to charge the machine from any non-Dennis charger.
- ***Never*** operate the machine if electrical wires are damaged or bare cable is exposed.

DANGER - IMPORTANT SAFETY INSTRUCTIONS

- ***Never*** **lift or carry a machine whilst any parts are moving.**
- ***Never*** **use the machine in adverse weather conditions, particularly in heavy rain, storms or high winds.**
- ***Never*** **use the machine at a speed greater than your walking pace.**

1.2.3. Intended Use and Residual Risks

This machine is designed for the cutting and maintenance (scarify, brush etc) of grass lawns with Dennis, machine specific cassettes. Any use beyond this is outside the scope of this machine and could cause injury or damage to the machine. This includes, but not limited to, riding on the machine, using it to transport goods and using it to cut thick vegetation.

WARNING - INTENDED USE AND RISKS

Personal injury and damage to the machine can result in using the machine for alternative uses. *Never* use the machine for anything else other than its intended use. Risks will always be present and you must be vigilant at all times while operating machine.

You must follow instructions and information found in *"1.2. Safety Instructions" p.6* and *"3.6. Operating Environment" p.41.*

1.2.4. Personal Protective Equipment (PPE)

During use you must adhere to local rules and regulations regarding Personal Protective Equipment (PPE). In addition to this we recommend:

- **Footwear;** heavy duty, slip resistant boots to protect against injury.

- **Eye protection;** to protect from flying debris.

- **Hearing protection;** must be worn at all times when the machine is activated.

- **Clothing;** suitable for the environment you are operating in (hot, cold, wet etc)

- **Hand protection;** to avoid cuts and blisters.

- **Respiratory protection;** for when there are occurrences of high dust and pollen.

1.3. Assembly, Installation and Commissioning

1.3.1. Unpacking and Inspection

The machine will arrive on a wooden pallet base, with either a cardboard or wooden outer frame. Carefully remove this outer packaging. You alternatively may have the machine delivered direct from our factory or your Dealer.

Visually inspect the machine for any signs of damage which may have occurred during transport. Contact Howardson Group or your Dealer as soon as possible should there be damage.

Included with the machine is this operator manual, a warranty registration document and machine parts catalogue.

To remove the machine from the pallet:

1. Remove all tie-down straps.
2. Wherever possible, use a suitably rated ramp to roll the machine off backwards to the ground. Refer to sections ***"3.1. Pre-Start***

Maintenance and Safety Checks" p.27 and *"3.4.2. Adjusting Height of Cut (Cylinder)" p.30* for the relevant procedures.

CAUTION - MACHINE WEIGHT

The machine is very heavy. Machine weight can be found on the serial plate or section *"2.1.2. Specification Table" p.12*. Take care when removing from the wooden pallet - we recommend two people to help with this. Follow all manual handling techniques for your business and region.

3. If a ramp is not available, disengage the parking brake and, while following correct manual handling techniques, ***gently*** lower the rear roller to the floor. Continue to roll backwards, keeping pressure on the handlebar so the front wheels remain in the air. Once clear of the pallet, lower the front to the floor ***gently***.

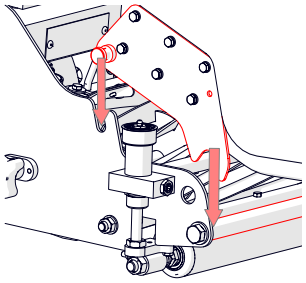
Dispose of all packaging according to local laws - recycle where possible.

1.3.2. Assembly Instructions

Minimal assembly is required to get your machine into a ready state:

1. **Re-connect the battery;** Open the lid of the electrical box, allowing the latch to lock into position to keep the lid open. Locate the electrical connector from the battery and connect to the electrical box. Close the lid. See *"3.5.4. Battery Removal and Insertion" p.37* for more information.
2. **Attach the grass box;** lower the grass box onto the machine, aligning its pin and notch with the corresponding cut-out and tie-bar on the machine (see Fig.2). Remove any plastic wrapping that may be left.
3. **Set handlebar height;** the handlebar may need readjusting to be optimum for your height. See section *"4.3.1. Handlebar Height Adjustment" p.56* for further information.

Fig.2 - Lower grassbox into position.



1.3.3. Installation Requirements

Adjustments will be required to make adequate space for the charging, storage and routine maintenance of the machine:

- See section *"2.1.1. Dimensions" p.11* for minimum space requirements.
- See section *"4.6. Storage" p.61* for correct storage requirements.
- The charger unit will require a mains power outlet source of 110-230V ±10% within 2 m of it. There is a further 2.5 m of lead from the charger unit to the charger plug. For further charger specifications, please consult the charger User Manual supplied.

1.3.4. Commissioning

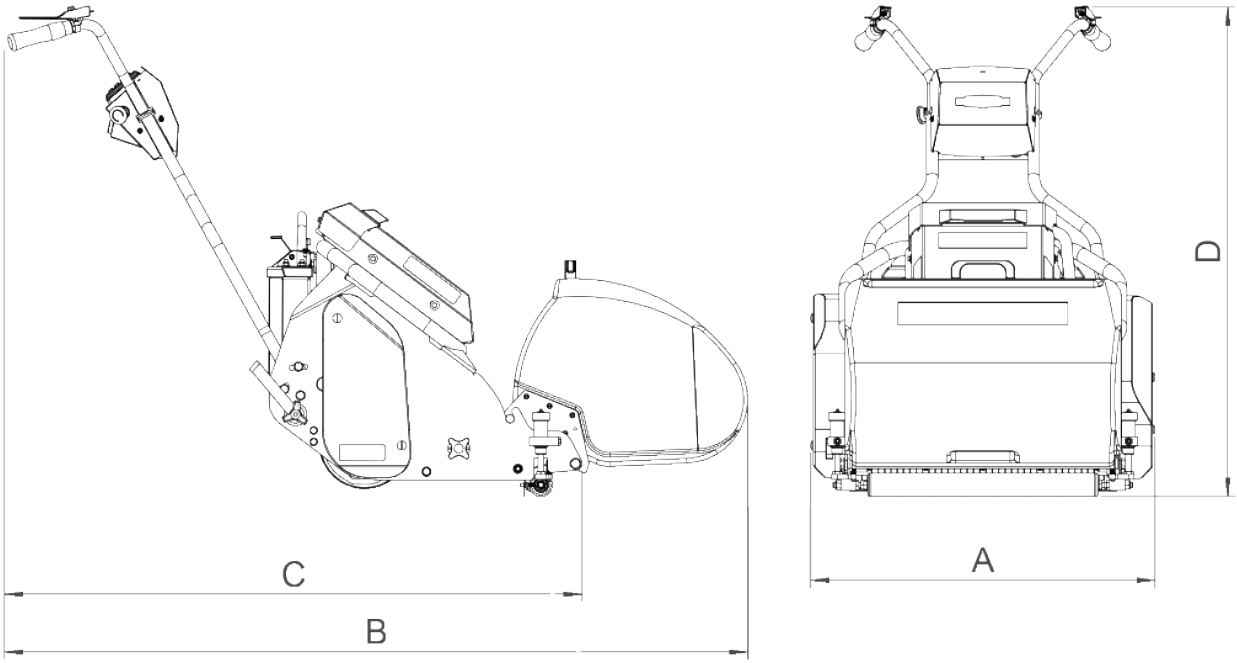
Your Dealer or a Howardson Group representative will be present to commission and set-up your machine. They will walk through the process of basic controls and getting started with your machine.

1.3.5. Calibration

No calibration procedures are required.

2.1. Technical Specifications

2.1.1. Dimensions



View	Model	
	ES-510	ES-610
A	760	860
B	1638	
C	1274	
D	1076	

2.1.2. Specification Table

System			Model	
			ES-510	ES-610
Weight	Machine	Without cassette	106 kg	111 kg
		Cassette only	See *"2.4. Cassettes" p.18*	
	Battery		16 kg	
	Charger		13 kg	
Drive	Drive Motor		630 W	
	Drive System		Timing Belt	
	Cassette Motor		1200 W	
	Cassette Drive System		Multi V Belt	
Electrical	Battery Type		Lithium Ion - Sealed, Fixed	
	Battery Chemistry		Lithium-Ion NMC	
	System Voltage		48 V	
	Battery Capacity		1.5 kWh	
	Self Discharge @ 25ºC		< 2% per month	
	Charger Supply Voltage		115–230 V	
	Charger Frequency		50-60 Hz	
Speed	Forwards		2.0–8.5 (in 0.1 increments) km/h	
	Reverse		1.5 km/h	
Cutting	Blade unit		Cassette - removable	
	Cutting Width		510 mm [20"]	610 mm [24"]
	Number of blades		5, 10	
	Clip-rate range (per metre)		90–130 CPM	
	Height of cut		09–56 mm	
	Grassbox volume		97 L	110 L
Environmental	Operating temperature range		-20 ºC to +40 ºC (+10 ºC to +30 ºC optimal for grass cutting)	
	Charging temperature range		0 ºC to +45 ºC (+15 ºC to +25 ºC optimal)	
	Storage temperature range		- One to three months at -20 ºC to +45 ºC - One year at -20 ºC to +24 ºC For additional information, see section ***"4.6. Storage" p.61***.	

2.1.3. Noise and Vibration

<table>
<tr><th colspan="2" rowspan="2">System</th><th colspan="2">Model</th></tr>
<tr><th>ES-510</th><th>ES-610</th></tr>
<tr><td rowspan="3">Noise</td><td>Measured Sound Power Level</td><td colspan="2">85 dB(A)</td></tr>
<tr><td>Guaranteed Sound Power Level</td><td colspan="2">91 dB(A)</td></tr>
<tr><td colspan="3"> 
WARNING - NOISE LEVELS
Hearing protection must be used when using this machine.</td></tr>
<tr><td>Vibration</td><td>Total value to which the hand-arm system is subjected</td><td colspan="2"><2.5 m/s²</td></tr>
</table>

2.2. Machine Components

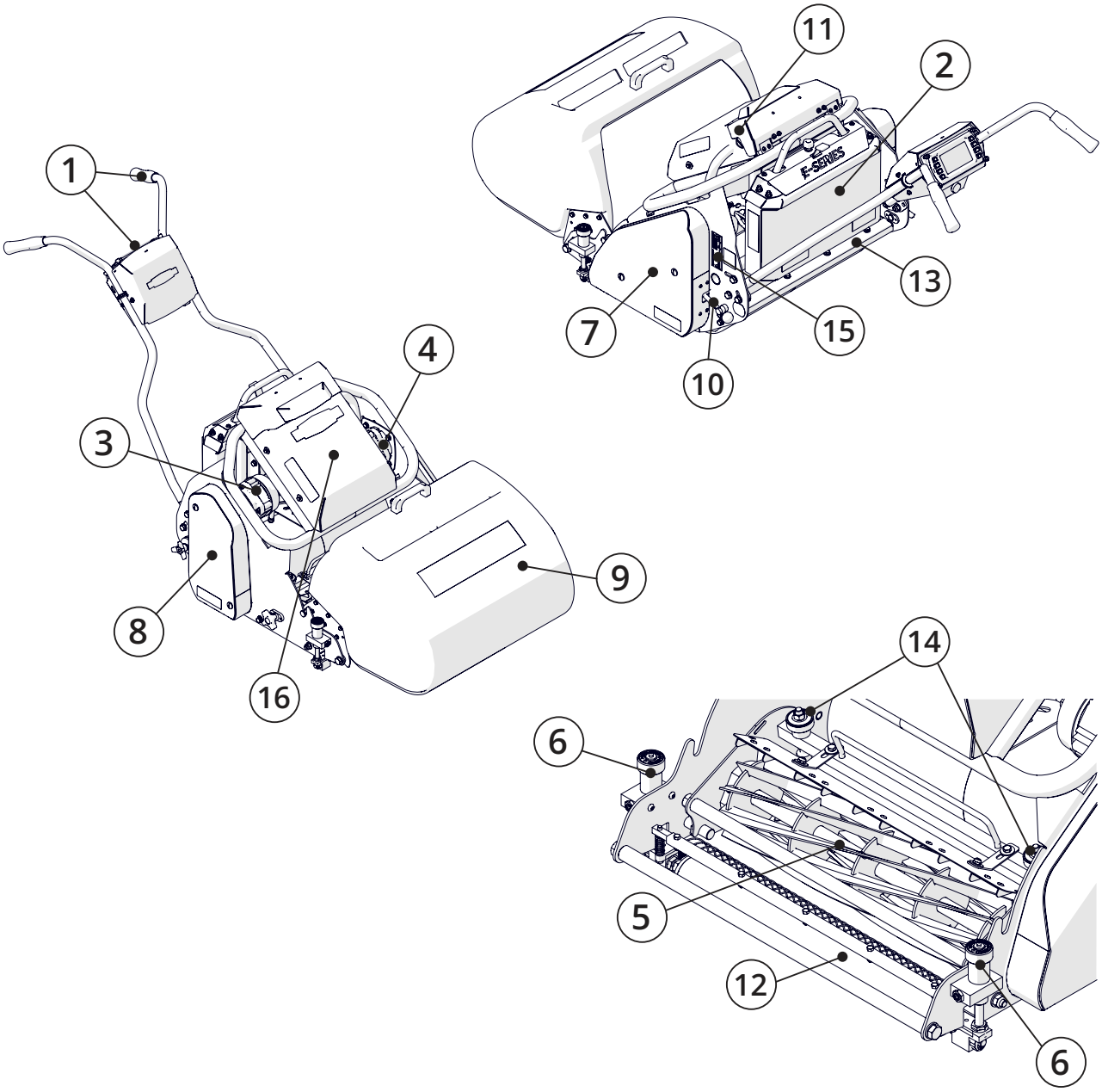


Fig.3 - Machine components overview.

1. Control Components
2. Removable Battery
3. Drive Motor
4. Cassette Motor
5. Cassette; *type depending on order*
6. Cut Height Adjuster
7. LH Belt Guard
8. RH Belt Guard
9. Grass Box
10. Parking Brake
11. Electrical Box Connector
12. Front Roller
13. Rear Roller
14. Shear Blade Adjuster
15. Serial Plate
16. Electrical Box

1. Control Components
See *"2.3. Control Components" p.17.*

2. Removable Battery
The battery is located at the rear of the machine for easy access and removal. It is secured with a latch and clamping knob mechanism, but removable in a matter of seconds. The electrical lead connects to the electrical box connector and must be disconnected before removing the battery.

The battery can be charged 'in-situ' or recharged separately, and can be swapped with another battery to continue working.

3. Drive Motor
This motor powers the rear roller and controls only the drive direction (forwards/backwards) and speed. The motor belt will require periodic checks, adjustment and replacement.

4. Cassette Motor
This motor powers the cassette, spinning the blades/discs towards the front of the machine. It can spin in reverse (i.e. towards the rear of the machine) during the backlapping process. The motor belt will require periodic checks, adjustment and replacement.

5. Cassette
The cassette is an interchangeable piece of equipment which can alter the function of the machine. Using the cassette motor, the machine can use this power to perform different lawn care duties, including cutting, brushing and scarifying - for the full list of cassettes, see ***"2.4. Cassettes" p.18.***

It is designed to be easily swapped, changing the function of the machine in a matter of minutes. Replace worn or damaged cassettes with genuine Dennis replacements.

DANGER - CASSETTE BLADES/DISCS

Worn or damaged blades/discs are dangerous. Incorrect use or maintenance can cause serious injury or death. Inspect before and after every use, as per *"4.1. Maintenance Schedule" p.44*.

***Always* inspect the blades/discs with the machine *off*.**

6. Cut Height Adjuster
Located either side of the machine, cut height is adjusted here - see ***"3.4.2. Adjusting Height of Cut (Cylinder)" p.30.***

7/8. LH & RH Belt Guard
Behind the RH belt guard contains the belt to drive the rear roller. Behind the LH belt guard contains the belt to the cassette and the parking brake mechanism. Both guards protect the operator and machine from injury and damage. They must be kept on and secured at all times.

9. Grass Box
The grass box collects the clippings from the cassette. Maximum volume: ES-510 = 97L, ES-610 = 110L.

10. Parking Brake
The mechanical parking brake physically stops the rotation of the rear roller when engaged.
This stops any unintended rolling and to be used when the machine is off or stationary. To engage, gently lift the brake lever up and around the retainer pin, allowing it to rest on the pin.

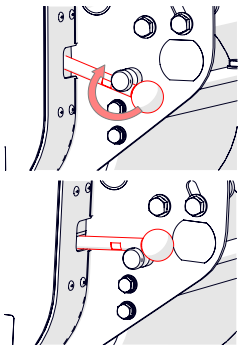


Fig.3A - Parking brake disengaged (top), and engaged (bottom).

When engaged, the display will automatically

display Park (P). The parking brake must be disengaged before the gear selection can be changed.

CAUTION - PARKING BRAKE

- ***Always*** **engage the parking brake when the machine is not in use.**
- **Do *not* use the parking brake to stop the machine while moving. This may result in damage to the braking system. To stop, release the OPC and the machine will slow to a stop.**

11. Electrical Box Connector

The electrical box connector is located under the sprung flap on the electrical box. It connects to the battery to supply power to the machine. Lift the sprung flap to gain access to the connectors and remove/insert accordingly. For further details on charging, see ***"3.5.5. Charging Instructions" p.39.***

12. Front Roller

The front roller maintains stability and guides the machine. As standard a Smooth roller is supplied but a Weile roller is available as an optional extra.

13. Rear Roller

The rear roller also maintains stability like the front roller, but also creates a striping effect behind the machine. It is split into two segments to aid in manoeuvrability.

14. Shear Blade Adjuster

Over time the quality of cut will decrease due to blade wear. Adjustment of the shear blade carrier is required to maintain the cut ***"4.3.3. Shear Blade Adjustment" p.58.***

15. Serial Plate

The serial number can be found on the left-hand side of the machine, above the parking brake. Please make a note of the serial number of your machine and battery in the table found on the inside cover of this manual. Always quote these in any communication with Howardson Group.

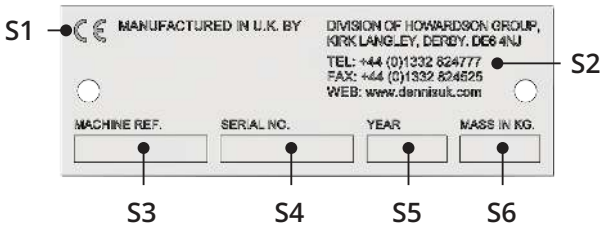


Fig. 3B - Serial plate components overview.

S1. CE marking
S2. Business/manufacturer address and contact details
S3. Machine code designation
S4. Serial number
S5. Year of build
S6. Mass of machine (kg)

16. Electrical Box

This houses many of the machine control components including fuses, contactors and motor controllers.

WARNING - ELECTRICAL BOX ACCESS

Never open or attempt any work inside the electrical box. Doing so will void the warranty.

2.3. Control Components

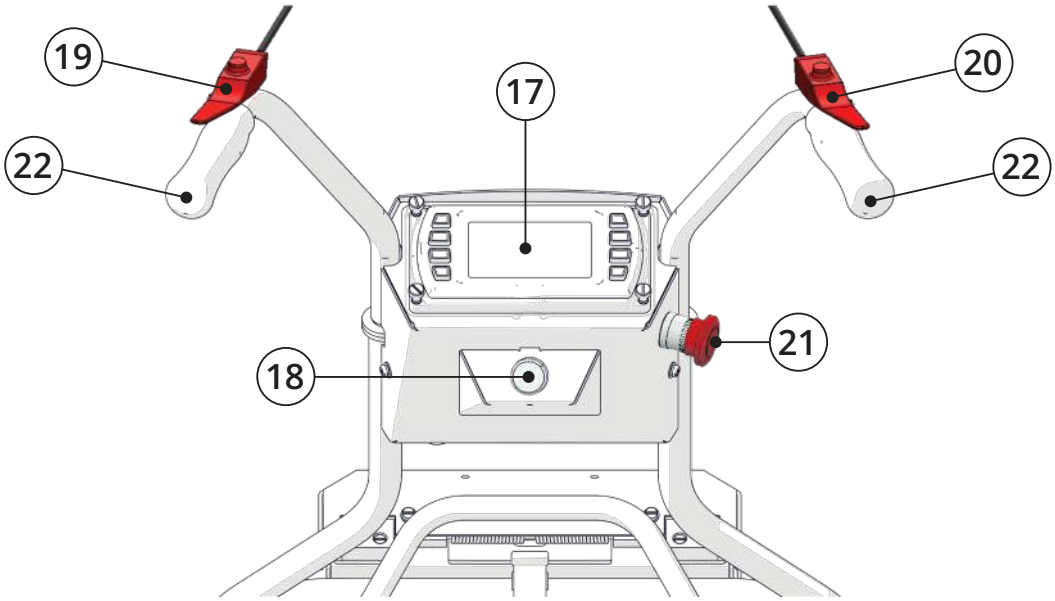


Fig.4 - Control components overview.

17. Display Screen
18. Power Button
19. Operator Presence Control (OPC)
20. Throttle
21. Emergency Stop
22. Handlebar

17. Display Screen

The display screen contains vital information and controls to operate the machine. See ***"2.5. Display Screen" p.22*** for more information.

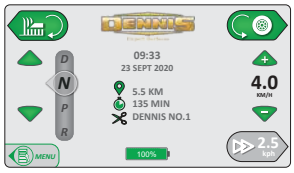


Fig.4A - Display screen

18. Power Button

The power button is only used for powering up and shutting off the machine. It has two position states: on and off. Press to turn the machine on, and press again to turn off.

19. Operator Presence Control (OPC)

This lever mechanism is a safety feature to prevent accidents. It signals to the machine of your control, active or otherwise, and either supplies or stops power to the cassette/drive motors, respectively.

The OPC requires continuous engagement for the cassette or drive to be used. When used with the 'Cutting start/stop' on the display screen it powers the cassette motor.

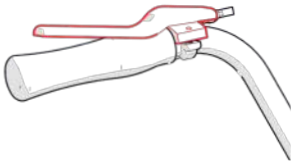


Fig.4B - OPC

When the OPC is released, this indicates you are no longer present or in control. At this, the machine immediately ceases all power to the cassette/drive motors. This minimises risk caused by the machine being able to operate unattended or in unsafe conditions.

DANGER - BYPASSING OPC

Never **interfere or tamper with the OPC in any way. This includes taping, tying up, altering the micro switch etc. Doing so bypasses a key safety mechanism of the machine and puts you and fellow pedestrians at risk.**

NOTE - THROTTLE / DISPLAY CONTROLS

The machine drive motor can be operated from the display control buttons, however throttle controls will override these.

20. Throttle

The throttle, in conjunction with the OPC, is used to power the drive motor. It is a proportional device, therefore speed is determined by the amount of downward pressure on it (up to the desired speed selected on the display screen).

21. Emergency Stop

In case of emergency, press this button to immediately stop all functions and processes of the machine, including to the screen and motors.

Fig.4F - Emergency stop

To reset and resume power to the machine, firstly turn the button head clockwise and then hold the start button.

WARNING - EMERGENCY STOP

- **After using the emergency stop, resolve the issue which caused the fault before continuing to use.**
- **After using the emergency stop, fully assess the machine to ensure all safety functions are working.**
- **This button is for emergencies. Do not use as a regular stop mechanism.**

2.4. Cassettes

Twelve interchangeable cassettes are available for both the ES-510 and ES-610. These are model specific and cannot be used interchangeably (i.e. between the ES-510 and ES-610). Different cassette types are available for various grounds-care work, as outlined in the following table. With exception of the sorrel roller, they are all powered by the cassette motor allowing for easy interchangeability.

For instructions on removing the cassette, see ***"3.4.1. Removing and Inserting a Cassette" p.29.***

On inserting a cassette and before use, you must select the type from the cassette selection menu via the display screen. This selection will be remembered and become the default until it is next changed. After selection of the cassette type, additional information for clip rate/RPM is needed to be chosen:

- Cylinder cassettes will automatically adjust their clip rate based on the speed of the machine. When the speed of the machine changes, the speed of the cylinder adjusts automatically to ensure the clip rate per metre remains the same. For more information on clip rate, see ***"3.4.5. Adjusting Clip Rate" p.35.***
- Other cutter and brushes are set to a RPM of your choice and will remain at that rate regardless of machine speed.
- Sorrel rollers do not need to spin, therefore the motor disengages to allow free roll.

Type		Description and Use	Weight (kg)	
			ES-510	ES-610
Cutting	**5 Bladed Cylinder**			
		Five steel blades in a spiral format. Good general purpose cylinder and ideal for use on longer grass. As standard, no relief grind.	18.7	21.6
	10 Bladed Cylinder			
		Ten steel blades in a spiral format. Higher clip rate compared to 6 bladed cylinder and ideal for medium length grass. As standard, relief ground.	21.3	24.6
Brushing	**Brush- Standard**			
		For moss and debris removal and use as a light scarifier for final pre-cut preparations.	11.0	*TBC*
	Brush Multi-Dense			
		For moss and debris removal and use as a light scarifier for final pre-cut preparations.	11.2	12.8

Type		Description and Use	Weight (kg)	
			ES-510	ES-610
Scarifying	**1mm Scarifier**			
		1mm thick replaceable, wear resistant blades. 12mm spacing for thatch removal throughout the season and autumn/ spring renovation work.	11.5	*TBC*
	2mm Scarifier			
		2mm thick replaceable, wear resistant blades. 12mm spacing for thatch removal throughout the season and autumn/ spring renovation work.	12.8	14.6
	2mm Scarifier Tungsten Tipped			
		2mm thick replaceable, tungsten tipped blades. Designed for heavy duty thatch removal throughout the season and autumn/spring renovation work.	12.7	14.6

Type		Description and Use	Weight (kg)	
			ES-510	ES-610
Verti-Cutters	**Spring Tine Rake**			
		Ideal for lifting lateral growth, helping to stand grasses up, removing dead matter or broken leaves. Helps to break up algae crust or help remove the glutinous slime that can sometimes appear on fine turf.	*TBC*	15.2
	Verti-Cutter			
		1mm thick 10 fingered replaceable discs. Regular use controls, thatch, lateral growth and the ingress of unwanted species such as annual meadow grass. Encourages vertical growth and ground cover. Cuts vertically into plant growth and ***above*** the soil, typically 2–3mm. Do ***not*** use to cut soil or during extended dry spells/drought.	14	*TBC*
	Verti-Cutter Tungsten Tipped			
		1mm thick 10 fingered replaceable discs. Tungsten tip gives extra durability for heavy usage. Regular use controls, thatch, lateral growth and the ingress of unwanted species such as annual meadow grass. Encourages vertical growth and ground cover. Cuts vertically into plant growth and ***above*** the soil, typically 2–3mm. Do ***not*** use to cut soil or during extended dry spells/drought.	16.7	19.4
Non-Powered	**Sorrel Roller**			
		Replaceable spikes relieves surface tension and allows penetration of air, water and fertilizer to the root zone. Good for over seeding and preparing damaged areas for repair.	18.4	*TBC*
	Slitter			
		Helps relieve surface tension and prevents thatch, penetrating deeper than a verti-cutter, into the soil layer.		

2.5. Display Screen

Located directly in front of the handlebar is the display screen. Here is where important machine information and controls are accessed through the display. Additional machine functions and settings are also accessed through the screen via the menu.

On machine start-up it defaults to the Home Page (see Fig.5). From here you can view / action the following:

1. Cutter start / stop
2. Drive start / stop
3. Drive mode (selection)
4. Drive speed
5. Main menu
6. Battery level
7. Transport mode
8. Trip information
9. Time and date

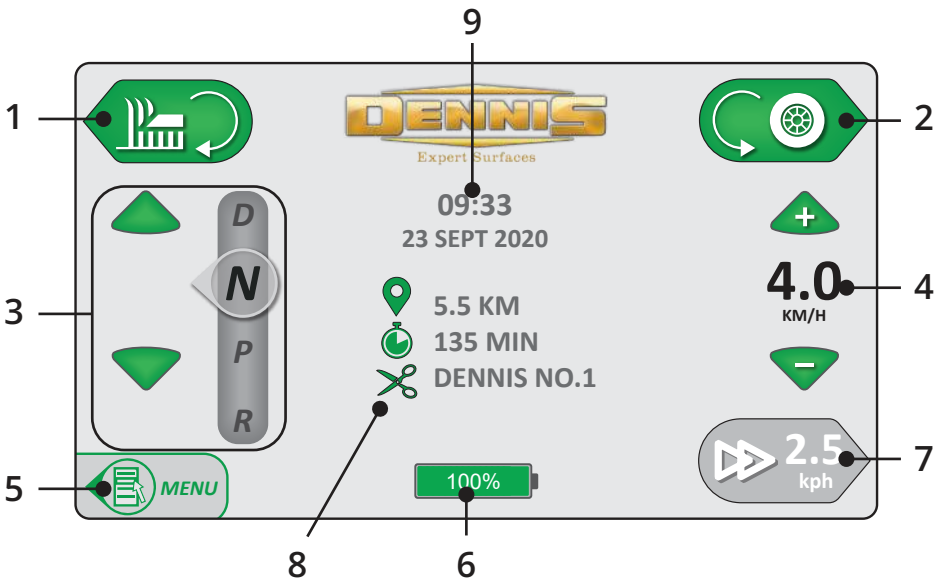


Fig.5 - Home screen overview.

1. Cutter start / stop

This button will illuminate ***green*** to allow the cassette motor to ***start***. This happens only when machine checks have determined this is suitable (i.e. parking brake off, drive mode type etc).

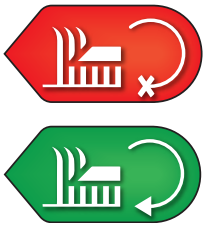


Fig.5A - Cutting start/stop

If it is ***red***, either cutting start is not permitted or the motor is currently in use. If the latter, then pressing this button ***stops*** the cassette motor (releasing the OPC will also achieve this).

2. Drive start / stop

This button will illuminate ***green*** to allow drive (forwards or reverse) to ***start***. This happens only when machine checks have determined this is suitable (i.e. parking brake off, drive mode type etc).

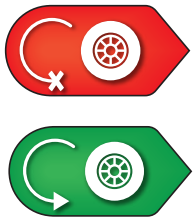


Fig.5B - Drive start/ stop

If it is ***red***, either drive start is not permitted or the motor is currently in use. If the latter, then pressing this button ***stops*** the drive motor (releasing the OPC will also achieve this).

3. Set drive mode

Use the up and down arrows to select drive mode:

- **D - Drive**. Cut start/stop is only available in this mode. There is no motor braking in this mode, therefore it is possible for the machine to 'freewheel' (i.e. without DES use) which allows easier manoeuvrability for cornering or moving between pitches.

- **N - Neutral.** Automatically displays when the parking brake released. Machine will automatically enter Drive when OPC depressed and DES activated. Like Drive mode, there is no motor braking therefore allowing the machine to 'freewheel'. Do not use this mode while transporting off or between work sites - use Transport mode for this.

- **P - Park.** Automatically displays when the mechanical parking brake is set. Machine automatically goes into Neutral when park brake released.

- **R - Reverse**. Select to reverse the machine. Cut start/stop is not available in reverse. Motor braking is active in this mode, therefore trying to move the machine 'freewheel' (i.e. without DES use) is not possible.

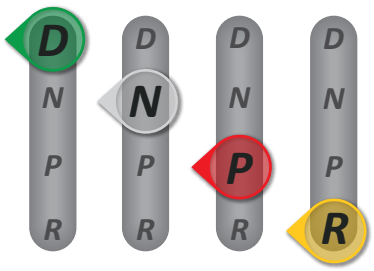


Fig.5C - Drive mode

4. Drive speed

Select the '+' or '-' buttons to alter the top speed of the machine. Single presses change in 0.1 km/h increments, alternatively press and hold to scroll numbers quickly. Acceleration rate remains constant at all speeds.

Fig.5D - Speed icon

Forwards speed: 2.0–8.5km/h.
Reverse speed: 2.0–8.5km/h.
Transport speed: 5.0km/h (default)

Speed units can be changed to either km/h, mph or m/s.
To change units:

Main Menu ▶ *Operations* ▶ *Default speeds*

5. Main menu

Within the Main menu, the following can be viewed/actioned:
(Note - all sub-menu's allow return to the previous page or the Home page.)

Operations:		*Change and view basic operational details*	
	• Default speeds		Edit default turning and forward speed. Modify speed units. This will become default on Home screen.
	• Trip logs		View and reset logs. Distance / time / charge. Resettable trip & lifetime readouts
	• Battery information		Last full charge / total charges / change icon.
	• Edit clip rates		Edit five user defined rates. Edit clips per metre / name / add notes.
Machine Settings:		*Change and view machine settings*	
	• Machine name		Edit machine name
	• Time / date		Edit time / date
	• Screen brightness		Alter screen brightness
	• Lock / unlock		Turn password on / off (stops users editing clip rates)
	• Password		Change password code
	• Download log		Download data to USB stick (additional cable and USB stick required)
Maintenance:		*Select and sign off daily / weekly / yearly checks.*	
	• Daily checks		Gives a list of daily checks. Log as complete once done.
	• Monthly checks		Gives a list of monthly checks. Log as complete once done. Backlapping performed here.
	• Yearly checks		Gives a list of yearly checks. Log as complete once done.
	• Maintenance update		Shows last date checks were completed. Click button to expand log list.

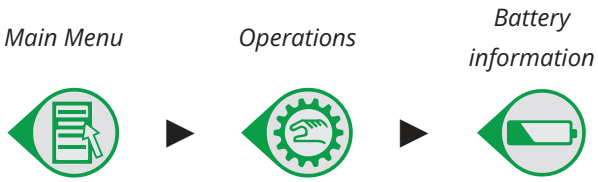
Cassette Selection		*Select the cassette being used. The machine will remember the selection until it is next manually changed.*
• Sorrel roller		Select for machine use with the sorrel roller. Cassette motor disengages to allow free roll. Returns to home screen.
• Cylinder		Select for machine use with a cylinder. Next page requires blade number selection, followed by clip rate.
• Cutter		Select for machine use with a verti-cutter/scarifier. Next page requires RPM selection.
• Brush		Select for machine use with a brush. Next page requires RPM selection.
Rate Selection		*Select your clip rate or RPM dependent on the cassette type you have selected. Clip rate maintained even when speed altered. RPM will remain constant.*
• Factory setting rate		Select as required. Screen returns to Home ready for operation.
• Default rate		Select as required. Screen returns to Home ready for operation.
Information Screen		*View select manual pages, frequently asked questions and Howardson Group contact details. Top page shows machine type, software version, serial number and name.*
• Information		General machine information and pages from Operator Manual.
• FAQ		Frequently Asked Questions.
• Contact Information		Howardson Group contact details.
• Factory Settings (Password protected)		For authorised personnel only - adjustment of various options.
Main Menu		
• Service Icon (Yellow)		Monthly checks not completed and logged (see "4. Maintenance and Servicing" p.44).
• Service Icon (Red)		Annual checks not completed and logged (see "4. Maintenance and Servicing" p.44).

6. Battery state of charge

Battery state of charge is shown either as a percentage, a visual battery indicator or both.

Fig.5E - Battery icon

To toggle the percentage on/off and for further battery information:



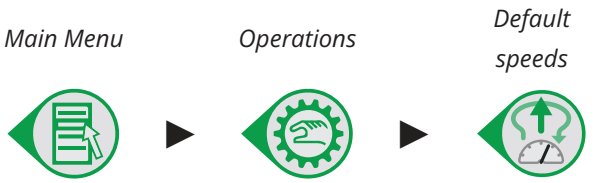
7. Transport mode

Choose this mode when moving the machine from its storage location to work site, loading onto trailers/ramps or moving between work sites. This mode caps the top speed at the value displayed.

Fig.5E - Transport icon

As with the standard drive mode, the OPC requires to be depressed and throttle activated. Forward and reverse can both be used in transport mode, with the speed displayed on the screen.

To change units:



While transport mode is in use, cutting start/stop will not be available.

Motor braking is active in this mode, therefore trying to move the machine 'freewheel' (i.e. without throttle use) is not possible. Therefore it is ideal for when loading into vehicles or moving up ramps.

8 & 9. Trip information / Time & date

Centre of the screen shows the following information:

- Time
- Date (dd/mmmm/yy)
- Trip distance (since key on)
- Trip time run (since key on)
- Clip / RPM information (as applicable - see right)

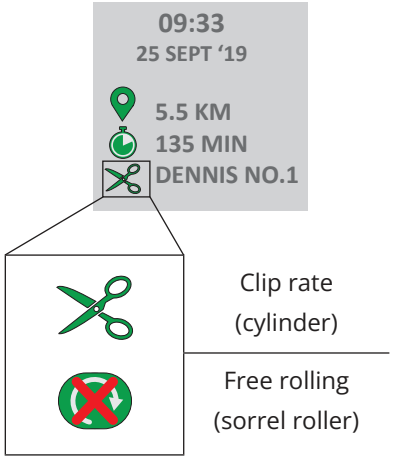


Fig.5E - Trip information

3.1. Pre-Start Maintenance and Safety Checks

Before using the machine, ensure all maintenance checks are complete, as per *"4.1. Maintenance Schedule" p.44.*

3.2. Power On and Shut-Down

WARNING - OPERATING RISKS

Prior to using the machine, ensure you read and understand this Operator Manual carefully. Failure to do so may result in personal injury and damage to the machine.

To turn your machine ***on***:

1. Press the power button (Fig.6A). The display screen will show a start up sequence (Fig.6B) until the home screen appears (Fig.5). If it does not display, check to ensure the emergency stop is not activated.
2. To shut-down the machine, press the power button again.

Fig 6 - Power on procedure

Fig.6A - Start button

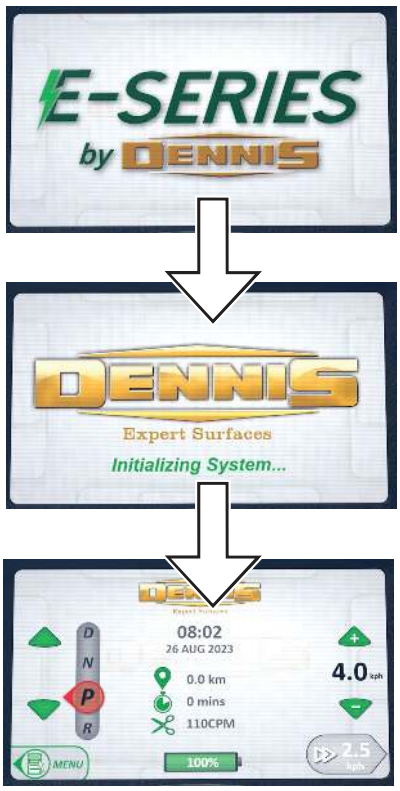


Fig.6B - Start up sequence

3.3. Drive

3.3.1. Selecting Drive Mode and Moving

CAUTION - HANDLEBAR HEIGHT

Prior to moving the machine, set handlebar to the correct height. See *"4.3.1. Handlebar Height Adjustment" p.56*.

1. Release the parking brake (Fig.7A).
2. On the display, select the drive mode required (Drive (D) or Reverse (R)) (Fig.7B). The 'Drive start / stop' changes colour from grey to green.
3. On the display, adjust the maximum speed to your preference.
4. Depress the OPC (Fig.7C).
5. Use the throttle to activate the drive unit. Alternatively select 'Drive start/stop' on the display screen (Fig.7D).
6. To stop, release either the OPC or throttle.

NOTE - DRIVING OVER HARD GROUND

When travelling over surfaces other than grass, tilt the machine backward to elevate the front roller, ensuring it travels solely on its rear roller. This avoids potential damage to the cassette and blades.

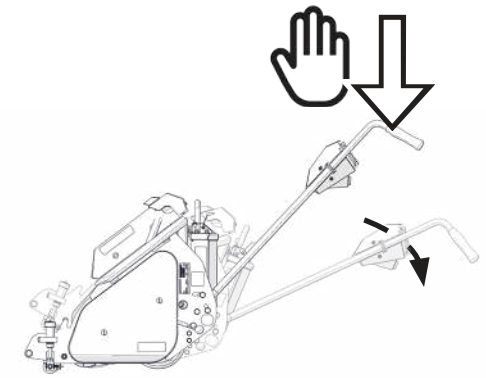


Fig.7 - Driving procedure

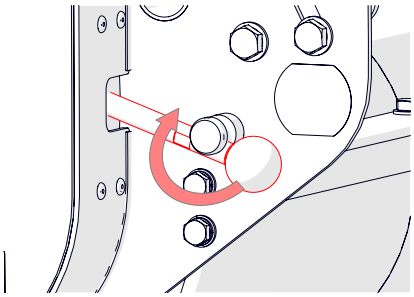


Fig.7A - Parking brake release

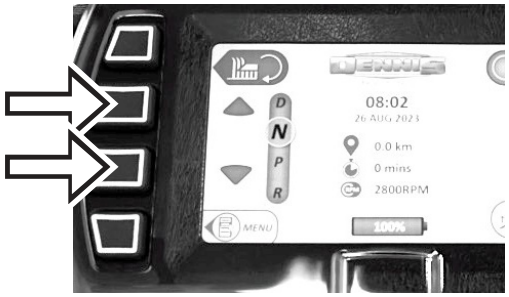


Fig.7B - Setting drive mode

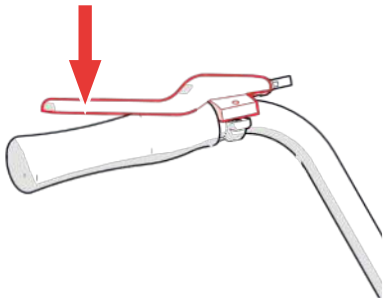
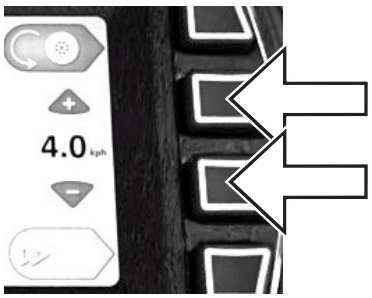


Fig.7C - Depress the OPC

3.3.2. Adjusting Drive Speed

- Adjust the drive speed by locating the speed icons on the right-hand side of the display. Increase (+) or decrease (-) accordingly. Single presses change in 0.1 km/h increments.
- Changing speed can be actioned either prior or during moving.
- Speed units can be changed to either km/h, mph or m/s. Change units by going to: 'Operations > Default speeds'.



3.3.3. Operating on Slopes

WARNING - SLOPES

The machine operates best on flat ground. Follow the safety points below when operating on slopes:

- **Slopes can tip a machine over. Observe extreme caution. Check for obstacles or anything that may lead to instability (e.g. dips, bumps, uneven ground) prior to operating.**
- **There is no maximum operating machine slope angle; use personal judgement, taking into account surrounding environment and weather. If in any doubt, do not use on a slope.**
- **Operate across the face of a slope, never up and down.**
- **Avoid when wet as this can increase the risk of an accident occurring.**
- **Go slow; speed can increase the risk of an accident occurring. Take extra care when turning.**

3.4. Cutting Preparation

WARNING - CASSETTE SAFETY

- ***Always* turn the machine *off* before removing/inserting the cassette. Failure to do so creates a very high risk of cutting or damaging hands. *Always* wear hand protection.**
- **The cassettes are heavy - see *"2.4. Cassettes" p.18 for more information.* We recommend for two people to remove.**

3.4.1. Removing and Inserting a Cassette

No tools are required for removing or inserting a cassette.

1. Turn the machine off.
2. Remove the grassbox and store to the side. Lower the support stand (Fig.8A).
3. Loosen the cassette retaining pin (Fig.8B) until the pip end is inside the nut on the side frame.
4. Slide the cassette along the tie-bars towards the R/H side of the machine. The L/H of the cassette will be clear of the three pins of the drive coupling (~15mm) (Fig.8C).
5. From the front of the machine, hold onto the cassette handle and remove by a lift-and-swing motion, from the back to the front. ⚠ (Fig.8D). We recommend two people to help with this for larger cassettes.
6. To insert a cassette: Lift the cassette using the handle and lower the front slots of the cassette unit onto the front bearing studs (Fig.8E). Slowly lower the back end onto the back tie-bars.
7. Slide the cassette to the L/H of the machine until there is full engagement with the three pins of the drive coupling (Fig.8F). The cylinder may need slight manual rotation to align with the pins. ⚠
8. Tighten the cassette retaining pin (Fig.8G).
9. Normal use can now be resumed.

Fig.8 - Removing and Inserting a Cassette

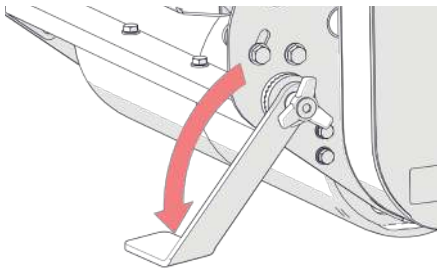


Fig.8A - Lower support stand

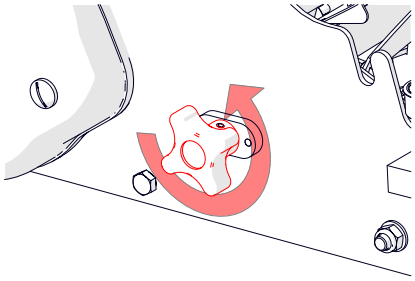


Fig.8B - Unscrew retaining pin.

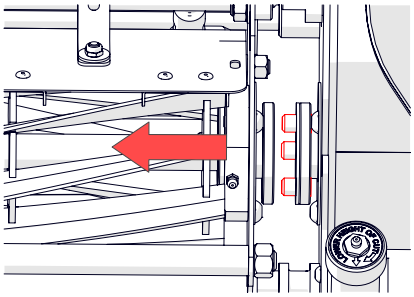


Fig.8C - Slide cassette until pins are visible.

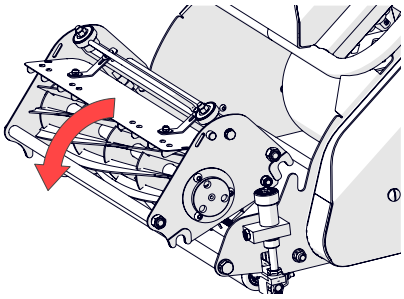


Fig.8D - Lift the cassette out.

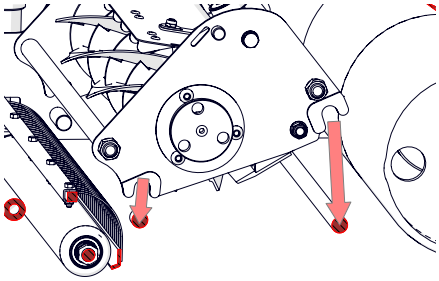


Fig.8E - Lower cassette onto tie-bars (cut-through).

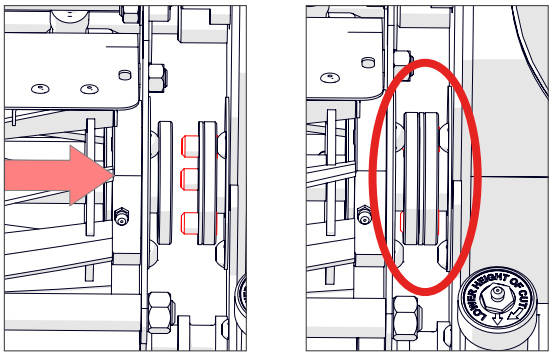


Fig.8F - Lower the new cassette in and slide across, engaging with three pins.

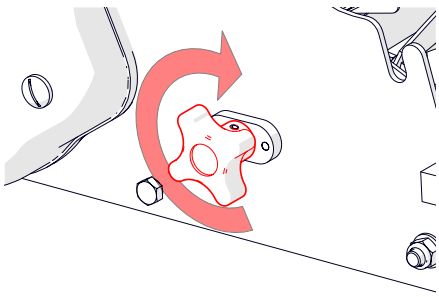


Fig.8G - Secure the cassette retaining pin.

3.4.2. Adjusting Height of Cut (Cylinder)

The following procedure is for adjusting the height of cut for the cylinder cassettes only. For other cassettes, see ***"3.4.3. Adjusting Height of Cut (Scarification, Dethatching and Brushing)" p.32***. Cut height is adjusted using the supplied setting bar and basic tools.

Tools required:

- 19mm spanner
- Rule
- Setting bar

1. Turn the machine off.
2. Remove the grassbox and store to the side.
3. On the setting bar, adjust the bolt against the rule until the distance between the base of the bolt head and rule is that of the desired grass length. Secure with the nut [19mm spanner] (Fig.9A).
4. Tip the machine gently back so it rests on the rear roller and handlebar (Fig.9B).
5. Two positions along the cassette are required to be measured and adjusted to result in an even cut. Choosing either end of the cassette first, lay the setting bar across the front and rear roller. Correct height is achieved when the underside of the bolt head rests, or is level with, the lip of the shear blade (Fig.9C). If it already is, then no further adjustment is needed. If not, then continue with step 6.
6. Manually turn the cut height adjuster to alter the height (Fig.9D). It adjusts in quarter turn 'clicks' of 0.25mm increments. Therefore a full rotation of the adjuster raises or lowers by 1mm.

   Clockwise = reduce height.
   Anti-clockwise = increase height.

   While adjusting the height, position up the setting bar again between the front and rear roller. Stop adjusting when the head rests within the lip of the shear blade (Fig.9F).

7. Repeat step 6 for the second position on the other side of the cassette (Fig.9E).
8. Check the setting bar again for both sides. Adjust if necessary.
9. Lift the machine gently up to rest on its front and rear rollers. Return the grass box.
10. Normal use can now be resumed.

NOTE - HEIGHT OF CUT

- If planning on adjusting the shear blade at the same time, always adjust the shear blade first then adjust the height of cut. Doing the opposite way may result in a different height of cut than planned.
- From the factory, the machine is set to cut mid-height.
- Remember height of cut is affected by moisture of turf, weight of the machine and thatch density. We advise to set the height a little higher than your preference and reduce height by trial.

Fig.9 - Adjusting Height of Cut

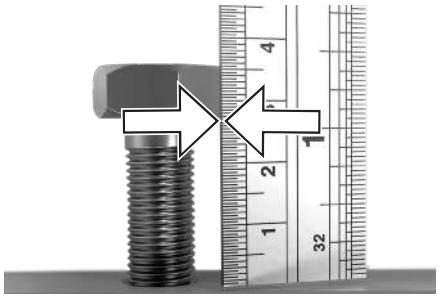


Fig.9A - Adjust bolt to desired cut height and secure nut (above example set for 27mm).

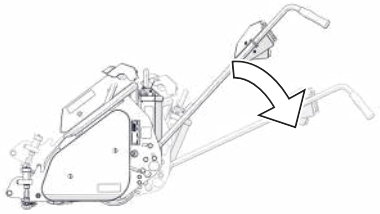


Fig.9B - Gently tip the machine back.

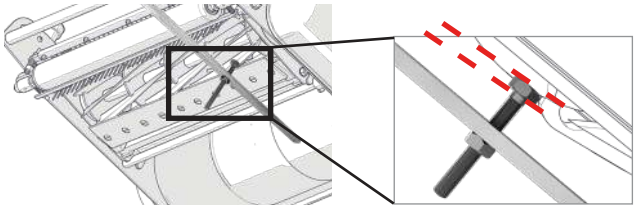


Fig.9C - Position the setting bar and observe distance between the top of the shear blade and bottom on the bolt head. In this example, the bolt head is below the shear blade, indicating the machine cut height is currently too high and therefore needs lowering.

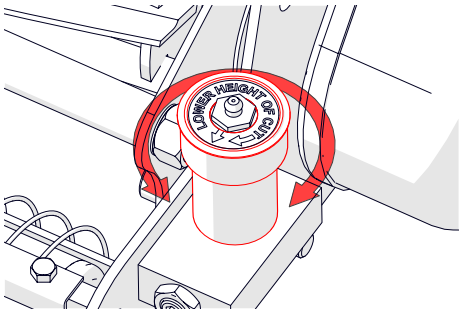


Fig.9D - Adjust the cut height adjuster.

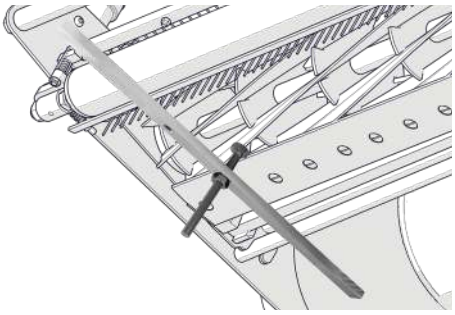


Fig.9E - Repeat process on the other side.

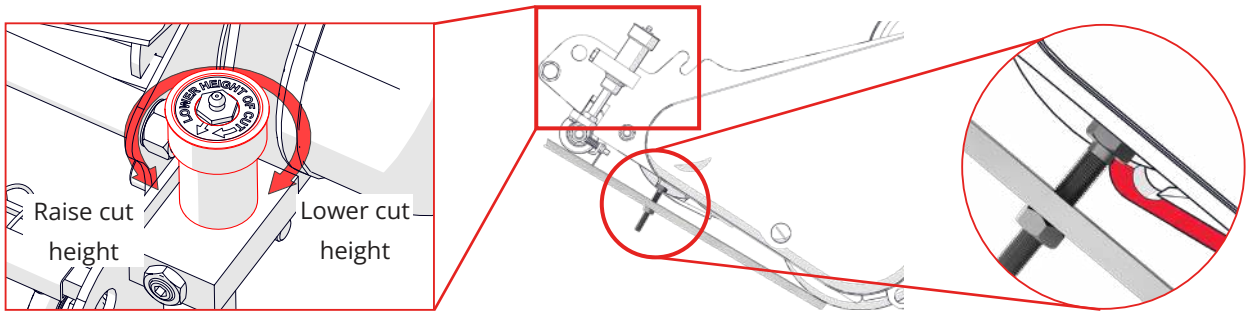


Fig.9F - Rotate the cut height adjuster while offering up the setting bar. Stop when the head rests level/within the shear blade

3.4.3. Adjusting Height of Cut (Scarification, Dethatching and Brushing)

The following procedure is for adjusting the height of cut for the scarifying, dethatching and brushing cassettes. For cylinder cassettes, see ***"3.4.2. Adjusting Height of Cut (Cylinder)" p.30.***

Tools required:

- 19mm spanner
- Rule
- Setting bar

1. Turn the machine off.
2. Remove the grassbox and store to the side.
3. On the setting bar, adjust the bolt against the rule until the distance above or below the setting bar (to the bolt head or bolt end, respectively) is to that desired (Fig.10). To note:

- Brush/Verti-cutter/Spring-tine rake = Measure from top side of setting bar ***up***.
- Scarifier/Sorrel roller = Measure from top side of setting bar ***down***.

Secure the bolt height with the nut [19mm spanner].

4. Tip the machine gently back so it rests on the rear roller and handlebar (Fig.9B).
5. Two positions along the cassette are required to be measured and adjusted to result in an even brush/verti-cut/scarify. Choosing either end of the cassette first, lay the setting bar across the front and rear roller (Fig.9C). Correct height is achieved when either the tips of the brush hairs/verti-cutters are level with the bolt head, or the tips of the scarifier/sorrel roller are level with the bolt end. If it already is, then no further adjustment is needed. If not, then continue with step 6.
6. Manually turn the cut height adjuster to alter the height (Fig.9D). It adjusts in quarter turn 'clicks' of 0.25mm increments. Therefore a full rotation of the adjuster raises or lowers by 1mm.

   Clockwise = reduce height.
   Anti-clockwise = increase height.

   While adjusting the height, position up the setting bar again between the front and rear roller. Stop adjusting when either the tips of the brush hairs/verti-cutters are level with the bolt head, or the tips of the scarifier/sorrel roller are level with the bolt end. (Fig.10).

7. Repeat step 6 for the second position on the other side of the cassette (Fig.9E).
8. Check the setting bar again for both sides. Adjust if necessary.
9. Lift the machine gently up to rest on its front and rear rollers. Return the grass box.
10. Normal use can now be resumed.

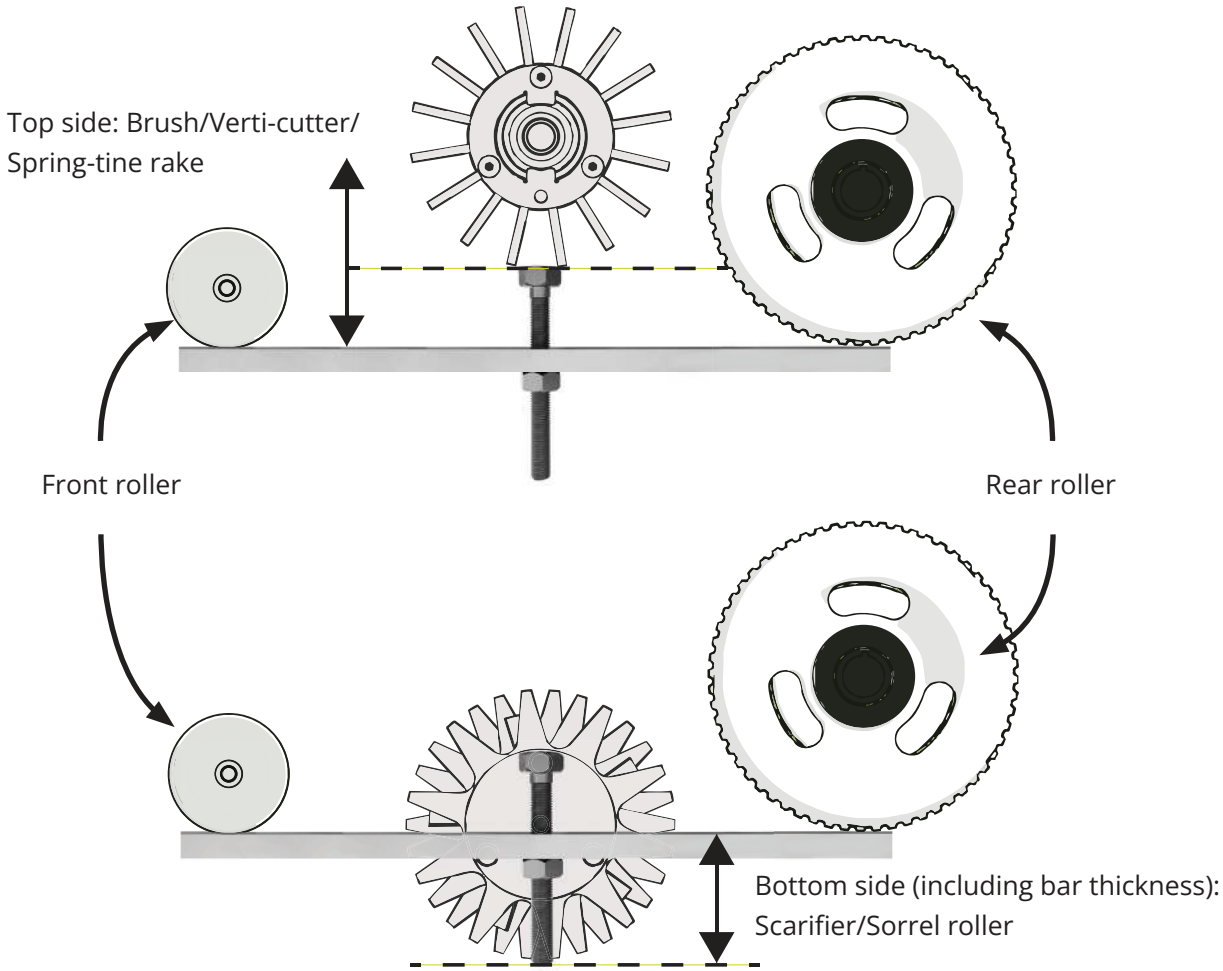


Fig.10 - Setting bar measurement for above/below ground cassettes.

3.4.4. Moving and Cutting

NOTE - HEIGHT OF CUT

Prior to cutting, set the cassette to the correct height. See *"3.4.2. Adjusting Height of Cut (Cylinder)" p.30.*

DANGER - POWER ON

Before turning the cassette unit *on*, you *must* ensure the area is clear of people and obstacles, and all safety guards are present.

Hearing protection must be worn prior and during the cassette unit in use.

1. On the display, set the drive mode to Drive (D) (Fig.11A). The 'Drive start / stop' changes colour from grey to green.
2. On the display, adjust the maximum speed to your preference.
3. Depress the OPC (Fig.11B).
4. Press the 'Cutter start / stop' button to power on the cassette (Fig.11C).
5. Use the throttle to power the drive motor. Alternatively select 'Drive start/stop' on the display screen (Fig.11D).
6. To perform a gentle turn, exert pressure on the opposing side of the handlebar (i.e. LH to steer right, RH to steer left). For harder or 180º turns, tip the machine back slightly and use the throttle gently or ease off completely.
7. To stop the cassette motor, release the OPC or press 'Cutter start / stop'. Releasing the OPC will also stop the drive motor (Fig.11E).
8. Return the throttle to centre position.

Fig.11 - Drive Procedure

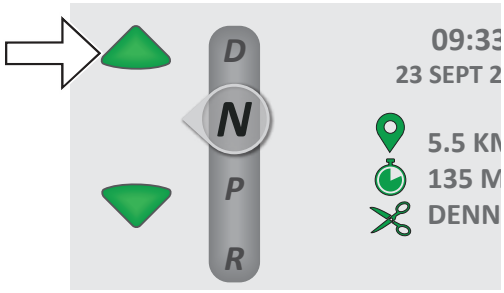


Fig.11A - Setting drive mode.

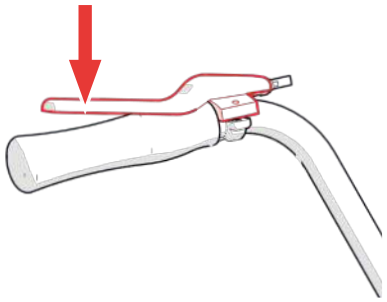


Fig.11B - Depress the OPC.

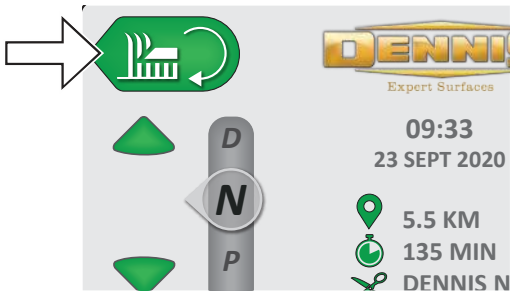


Fig.11C - Power the cassette unit on.

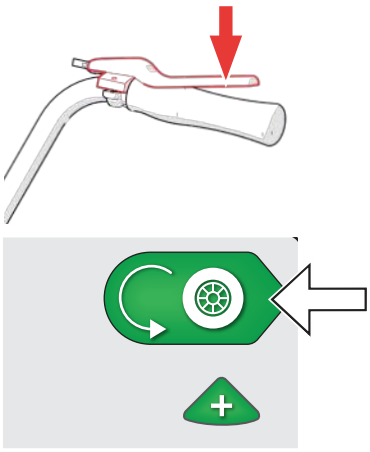


Fig.11D - Activate drive with either the throttle or drive start/stop button

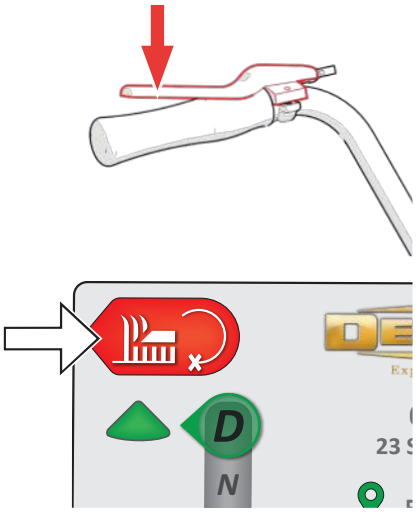


Fig.11E - Stop the cassette motor

3.4.5. Adjusting Clip Rate

Clip rate is the number of cuts made by the cylinder i.e. how often a cylinder blade passes over the shear blade, per metre. It is referred to as 'CPM' (Clips Per Metre) in the machine settings and can be set to several predetermined figures, as shown in the table below. The machine will automatically adjust the cassette motor RPM based on machine speed, ensuring that the selected clip rate is always maintained. This creates an even and uniform cut regardless of the operator or walking speed.

The CPM needs to be adjusted based on various factors, including but not limited to, cylinder blade number, ground conditions (e.g. moisture, slope etc), grass length and grass species - use professional judgement to determine which CPM to use. Incorrect clip rates can lead to poor surface finish and clipping collection.

For non-cylinder cassettes (i.e. brushes and cutters/scarifiers), clip rate is replaced with RPM selection. However, unlike CPM, this does ***not*** take into account the machine speed and will remain constant. RPM selection is based on preference and ground conditions.

CAUTION - SORREL ROLLER

Sorrel rollers must be allowed to free roll and *not* spin. It is very important to select the sorrel roller option before its use. This will disengage the motor and allow free roll.

	Cassette type		
	Cylinder (5 or 10 blade)	Brush	Cutter
CPM options	80, 90, 110, 115, 120, 130	-	-
RPM options	-	1000, 1200, 1400.	1200, 1300, 1400, 1500, 1600, 1800.

To adjust the clip rate/RPM of the cassette, from the display screen, follow either method below:

Method 1:

Main Menu ▶ *Rate Selection* ▶ *Select choice*

Method 2:

Main Menu ▶ *Operations* ▶ *Edit clip rates*

Increase/ Decrease ▶ *Edit display name/ Edit notes* ▶ *Save changes*

Once the clip rate/RPM is set, it will remain fixed until it is manually altered again (even after turning the machine off).

3.4.6. Cutting Technique

There is no set technique for cutting as it will suit individual circumstances. However we recommend the following:

- Mow in straight lines - turning while cutting may damage the turf and produce an inferior quality of cut.
- To perform a turn, press the handlebar down to lift the front of the machine before applying force to the left/right side.
- Mow at a standard walking pace - alter the speed via the display screen to achieve this.
- Do not cut for too long in a single spot or without cutting grass. This can damage the grass and increase blade wear.
- Avoid cutting more than one third of the grass blade. Doing so can increase the risk of disease and stress for the plant.

3.5. Batteries and Charging

3.5.1. Safety Information

Follow the battery and charging guidance below to avoid damage and injury risk:

- ***Always*** **use the charger supplied with the machine. Never attempt to charge the machine from any non-OEM charger.**
- ***Always*** **read the OEM Operator's Manual supplied with the charger. Additional information is supplied in that document which is not included in this manual.**
- ***Always*** **charge the battery in a well ventilated area, away from flammable materials.**
- ***Always*** **inspect the batteries and chargers regularly for signs of damage. If you see any physical damage (such as swelling or leakage), immediately stop using the machine and follow** *"3.7. Emergency Procedures" p.42*. **Replace the battery.**
- ***Never*** **attempt to disassemble, repair or modify either the battery or charger.**
- ***Never*** **immerse the battery or charger in water or allow condensation to occur within the unit.**
- ***Never*** **touch the battery or charger with wet hands.**
- ***Never*** **expose the battery or charger to fire or open flame.**
- ***Never*** **strike or puncture the battery or charger.**
- ***Never*** **expose batteries or chargers to extreme temperatures, direct sunlight or moisture.**
- **Take care handling batteries to avoid damage. Use protective equipment when handling damaged or leaking batteries.**

- **Do not open the unit, puncture, crush, incinerate, immerse in water, short circuit, force discharge or expose to temperatures above the declared operating temperature range of the product. Risk of fire or explosion.**
- **Avoid contacting the batteries and fluid with eyes, skin or clothes. In the event of a spill, flush with water and seek immediate medical help.**
- **Keep children and unauthorised personnel away from this unit.**

3.5.2. Battery Specifications

For battery and charger specification, see ***"2.1.2. Specification Table" p.12*** and on the battery and charger themselves.

3.5.3. Battery Management System

A battery management system (BMS) is integrated into the battery. It is an electronic system that monitors the battery cells and controls several components to ensure a safe and optimised battery. No operator input is required and it runs automatically.

3.5.4. Battery Removal and Insertion

Follow the instruction below for correct battery removal and insertion:

1. Turn the machine ***off*** and lower the support stand.
2. Open the lid of the electrical box, allowing the latch to lock into position to keep the lid open (Fig.12A).
3. Disconnect the electrical box connector from the battery connector (Fig.12B). Bring the battery connector and electrical conduit to the left hand side of the machine. Close the lid.
4. Unscrew the clamping knob of the battery (Fig.12C). Hold the battery handle and lift the latch lever up (Fig.12D) - this disconnects the battery from the machine. Use the battery handle to steady the battery as it falls backwards - it will remain attached to the machine at the bottom of the mount plate so the full weight does not need to be taken.
5. Use the battery handle to lift the battery up slightly and away from the machine. The flat bottom of the battery allows it to stand upright on the floor (Fig.12E).
6. Take the battery to the charger - see ***"3.5.5. Charging Instructions" p.39***.
7. To insert a battery, feed the battery connector and conduit through the chassis on the left hand side, above the cassette motor. Lift the battery and locate the bottom two cut-outs of the mount plate to the lower mount bar of the machine (Fig.12F). The battery will hold itself in this position as per removal.
8. Gently push the battery forwards until the latch makes engagement (Fig.12G & 12H) (the latch may need to lifted to achieve this). Tighten the clamping knob.
9. Open the lid of the electrical box, allowing the latch to lock into position to keep the lid open. Reconnect the electrical box connector to battery connector and then close the lid, taking care not to trap the electrical conduit.
10. Normal use can now resume.

Fig.12 - Battery removal instructions

Fig.12A - Secure the electrical box lid.

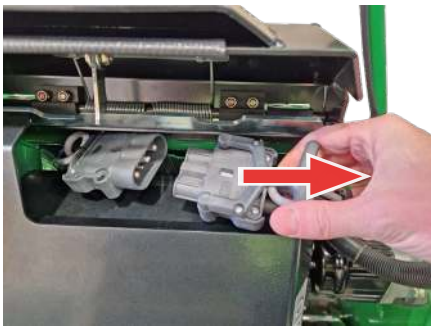


Fig.12B - Disconnect the electrical connector.

Fig.12C - Unscrew the clamping knob.

Fig.12D - Charger indications.

Fig.12E - Battery removed from the machine.

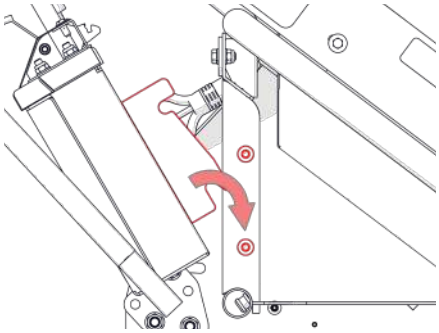


Fig.12F - Cross section view of battery insertion - step 1.

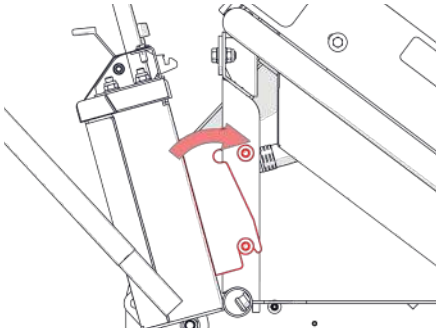


Fig.12G - Cross section view of battery insertion - step 2.

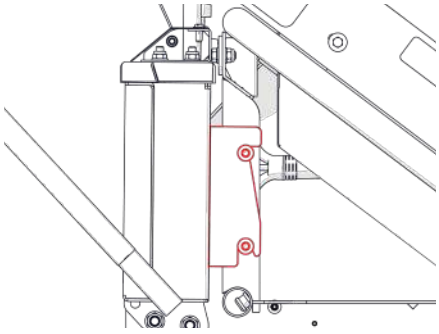


Fig.12H - Cross section view of battery insertion - step 3.

3.5.5. Charging Instructions

Follow the charging instruction below for correct and safe use:

1. If charging the battery separately, follow battery removal steps 1-6 in ***"3.5.4. Battery Removal and Insertion" p.37*** first, then continue to step 3 below. Alternatively, if charging the battery while remaining in the machine (i.e 'in-situ'), continue to step 2 below.
2. Drive the machine within range of the charger - the charger-to-machine lead can extend a maximum of 2m, with an additional 2.5m power lead from the wall outlet to the charger. Engage the parking brake and turn the machine ***off***. Open the lid of the electrical box, allowing the latch to lock into position to keep the lid open (Fig.12A). Disconnect the electrical box connector from the battery connector (Fig.12B). Bring the battery connector and electrical conduit to a position where it can reach the charger.
3. Plug the charger into the power supply. Ensure power is live by checking the charger lights are illuminated (Fig.13A).
4. Connect the charger into the battery connector - this will only connect one-way round (Fig.13B).
5. The charger will show a flashing green battery icon to indicate charging in progress (Fig.13C). The green battery icon will turn solid (two bars) once fully charged (Fig.13D).

NOTE - CHARGE DURATION

The battery does not require to be fully charged and can be safely disconnected from charge at any point of the cycle. See ***"3.5.7. Battery and Charger Tips" p.40***

6. Unplug the charger from the machine. Close the charging cover.
7. Normal use can now resume.

Fig.13 - Charging instructions

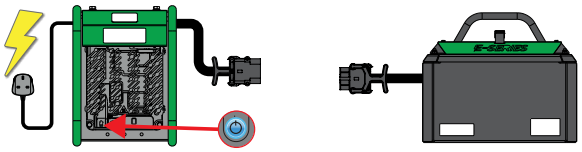


Fig.13A - Plug the charger into the mains socket.

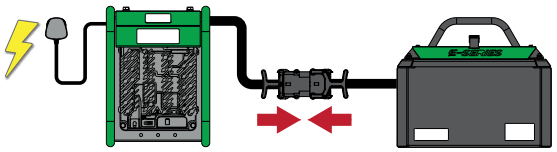


Fig.13B - Plug the charger into the battery.

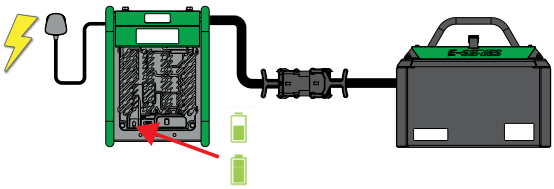


Fig.13C - Charge status location.

Flashing green = Low state of charge
Solid green = High state of charge

Flashing green = High state of charge
Solid green = Charge completed

Fig.13D - Charger indications.

3.5.6. Low Power Mode

We recommend to keep the machine above 20% charge to avoid long term battery degradation. On reaching 3% the machine will enter 'low power mode' whereby the cassette motor will stop and only the drive motor remains. This is shown on the display screen as a low power battery symbol in the position of the cut start/ stop symbol.

At this point you must return to the charging station and charge the battery before

commencing any further.

CAUTION - SEALED BATTERY

The battery is enclosed in a case and must not be accessed except when being serviced by authorised personnel.

3.5.7. Battery and Charger Tips

- Charging to 100% is not necessary; also known as 'opportunity charging', the battery can accept small durations of charge without degradation. It is safe to remove the charger at any point during the charge cycle.
- We recommend to unplug the charger once charging has been completed. Until this point however, the BMS will monitor and regulate the battery to prevent overcharging and to maintain a full battery.
- Store with a battery of approximately 50% charge (if storing for <30 days) or 70% charge (if storing for ≥30 days). Do not store a battery empty.
- Store the machine in a cool, dry place, away from direct sunlight. Extreme heat or cold can degrade battery performance. For further storage guidance, see ***"4.6. Storage" p.61.***

3.5.8. Self-Discharge

Lithium battery packs will self-discharge over extended periods of time without maintenance. Once lithium-ion cells discharge below a certain voltage they become unusable and must not be discharged further (i.e. deep discharge state).

Regular monitoring and maintenance is essential for long storage or idle periods. Howardson Group will not be held responsible for damage due to neglect - see ***"4.9. Warranty Policy" p.62***.

A battery reaching a 'deep discharge' state will not be recoverable and must be replaced.

3.5.9. Electrical Box

The electrical box is located in the middle of the machine and contains sensitive machine control components. Accessing the electrical box will void your warranty and is reserved only for Howardson Group or authorised personnel.

WARNING - RISK OF SHOCK

Opening the electrical box will void the machine warranty. If there must be access, then *always* disconnect the battery before opening due to risk of electrical shock and short circuiting.

3.5.10. Replacement and Disposal

The machine's lithium battery has a limited lifespan and it will gradually lose its capacity to hold charge. This lifespan will depend on the management and maintenance of the battery, and it will ultimately require replacement.

It is recommended to replace the battery when:

- The battery has reached a deep discharge state (typically ≤40V) or does not power the machine on at all despite being charge (i.e. 'dead' battery).
- The battery has visible signs of deterioration, such as leaking, swelling and corrosion.
- The battery gets excessively hot while charging or in use.
- The battery has a noticeably reduced run-time compared to new.
- Charge time increases significantly, or the battery struggles to hold a charge for a sustained duration.

Follow local regulations for the disposal and recycling of batteries. Dispose of at a suitable recycling facility.

Replace batteries with genuine Dennis replacement.

CAUTION - BATTERY PRECAUTIONS

- **Wear suitable PPE including gloves and safety glasses.**
- **Never touch leaked materials, avoiding contact with skin and eyes. Rinse immediately with water and seek medical attention if necessary.**
- **Secure the working area with appropriate warning notices.**

The chemicals in the battery are contained in a sealed package. Exposure to the contents will not occur unless the battery leaks, is exposed to high temperatures or is mechanically, physically, or electrically abused. However, in case of battery leakage:

1. Wear suitable PPE including gloves and safety glasses.
2. Release the parking brake and carefully move the machine (do ***not*** turn the machine ***on***) to a well ventilated area.
3. Remove the battery, taking care to avoid tipping or shaking. Place into a clear plastic bag with sand or vermiculite. Label as hazardous.
4. Use a neutralising solution (such as white vinegar) on a cloth to remove leftover residue.
5. Dry thoroughly and dispose of clothes.
6. Safely dispose of the battery.

3.6. Operating Environment

The machine has been designed to be used on fine turf and meeting the demands of day-to-day use. The following operating conditions shall also be observed:

Temperature:
Use between -20 to +40°C. Usage in the upper and lower limits of this range will affect performance and battery life. It will also have an impact on the quality of cut and subsequent issues*. Operators must take necessary precautions against temperature, such as sun protection and suitable clothing. **The machine can operate beyond the temperature range of the optimum for grass cutting. Grass is best cut between 10-30°C.*
Humidity:
Use between 30–70% RH. High humidity can lead to rust and corrosion on metal parts. It can also lead to fungal diseases on the grass after cutting. Low humidity can lead to wilting and browning of the grass after cutting.
Weather:
Use in dry conditions. This avoids damage to battery components and traction hazards caused from slippery grass. Cutting wet grass leads to poorer cut quality, clumping and reduced collection into the grass bag. This results in additional cleaning of the machine . Compaction of the soil is more likely with wet weather. Operators must take necessary precautions against the weather, such as sun protection and suitable clothing.
Terrain/Slope:
Ensure the ground is firm and preferably dry. Soft or wet ground can cause manoeuvrability problems. There is no maximum slope angle, however use professional judgement when using on slopes (see ***"3.3.3. Operating on Slopes" p.29.*** Free from obstacles and obstructions, including rocks, branches and debris.

Dust and particulate:
Avoid dusty or sandy conditions. Such environments can damage the machine and be hazardous to the operator.
Vibration and Shock:
Keep vibration and shock to a minimum to avoid damage to machine components. This includes, bumps, pot holes and kerbs. Store the machine away from passing traffic and avoid transporting over rough ground - lower gently over kerbs or use alternative routes.
Lighting Conditions:
Use the machine in good lighting conditions, either natural or artificial. This allows for the safe operation of the machine.
Safety Zones:
Other than the operator, all other personnel must keep their distance from the machine during use. This must be maintained by the operator to keep the zone free.

3.7. Emergency Procedures

3.7.1. In the Event of a Breakdown

WARNING - MACHINE BREAKDOWN

- **Take full care and attention while investigating the cause of a fault. Where possible, wear suitable PPE including gloves and safety glasses.**
- **Never touch leaked materials, avoiding contact with skin and eyes. Rinse immediately with water and seek medical attention if necessary.**
- **Secure the working area with appropriate warning notices.**

Regular service and maintenance will prevent the majority of machine breakdowns. The below procedure outlines the immediate actions if the machine fails to function entirely. If the machine is not working as intended and a minor issue, refer to ***"4.8. Troubleshooting & FAQ" p.62.***

In the event of a breakdown:

1. Turn the machine ***off***.
2. If possible, move the machine to a safe area where further investigation can be carried out. If the machine cannot be moved, clearly label it as 'faulty' and cordon around the machine to mitigate unauthorised personnel from accessing the machine.
3. If there are oil leaks, immediately clean up and adsorb with appropriate materials.
4. Once in a safe area or in a serviceable state, open the battery cover and disconnect the battery. Inspect the machine for any obvious defects.

- If the cause is related to the drive roller, check the drive motor for damage or loose connections. Remove both guard covers and inspect the drive belt and parking brake mechanisms. Ensure in good condition.

- If the cause is related to the cassette, check the cassette motor for damage or loose connections. Remove the LH guard cover to inspect the belt and mechanisms for good working order - see ***"4. Maintenance and Servicing" p.44*** for reference.
- Do not attempt repairs beyond basic troubleshooting unless qualified. Full repairs to be carried out by qualified service engineer and documented accordingly.

5. If the source of the breakdown cannot be found, contact your Dealer or Howardson Group for further information.

3.7.2. Hazardous Substances and Fire

No hazardous substances are emitted by the machine during use. However the lithium-ion battery contains hazardous substances which would be toxic if it were to leak or catch fire.

In the event of a fire, use a suitably rated fire extinguisher which can be used on lithium batteries and electronics.

- Lithium battery - use a specialist Lith-Ex fire extinguisher,
- Electrical components - use a suitable electric-safe fire extinguisher, such as CO_2.

Only attempt to extinguish the fire if you are trained and it is safe to do so. Personal safety must always come first.

4.1. Maintenance Schedule

WARNING - CORRECT MAINTENANCE

Following the schedule set out below will prolong the life of your machine and deliver high performance.

Failure to carry out these checks at the specified intervals will result in damage to your machine and possible injury to personnel. If you are unsure of anything, contact Howardson Group or your Dealer.

Not servicing your machine correctly will invalidate your warranty. See *"4.9. Warranty Policy" p.62* for more information.

Always use genuine Dennis parts when servicing and replacement.

The following checks must be actioned as per date, running hours or distance, whichever comes first. Ensure checks are performed in an appropriate area (such as a storage shed), and not on the playing surface due to risk of contaminants/oil. Complete checks with the machine ***off***.

Service kits are available for the machine - see *"Appendix B. Service Kit" p.65.*

Maintenance Check	Daily		Weekly 36hr 30km	6-monthly 860hr 720km	Annually 1,700hrs 1,440km
	Pre-use	Post-use			
Controls					
Check the following for signs of damage and that they operate freely: • Power button • OPC • Throttle • Emergency stop • Parking brake.	•	•	•	•	•
Chassis					
Check all guards are fitted correctly.	•		•	•	•
Visually check all fixings (secure and in place).	•		•	•	•
Visually check condition of cassette blades/ discs.	•		•	•	•
Visually check condition of shear blade.	•		•	•	•
Check the cutting height is set correctly.	•		•	•	•
Check the grass box is fitted correctly.	•		•	•	•

Maintenance Check	Daily		Weekly 36hr 30km	6-monthly 860hr 720km	Annually 1,700hrs 1,440km
	Pre-use	Post-use			
Clean off all grass cuttings from bodywork.		•	•	•	•
⚠ Clean off all grass cuttings from the cassette blade/disc (ensure the machine is turned off first. Use a long handled brush).		•	•	•	•
Remove RH belt guard and visually check condition of roller drive belt. Adjust/change if required.			•	•	•
Remove LH belt guard and visually check condition of cassette drive belt. Adjust/change if required.			•	•	•
Grease[1] the cut height adjuster rods.			•	•	•
Check tyre pressures of wheel kit *(if supplied).*			•	•	•
Lubricate front roller pivot bushes.				•	•
Check condition of rear roller bearings and bushes. Replace if necessary.					•
Renew grease in rear rollers[2]					•
Replace all drive belts.					•
Electrical (inc. battery)					
Check condition of the following for signs of damage: • Drive motor outer casing • Cassette motor outer casing • Battery • Electrical box lid and latch	•	•	•	•	•
Check condition of cabling/harness for signs of damage and fraying.	•	•	•	•	•
Check the battery level has enough charge for the intended session.	•	•	•	•	•
Check the battery voltage reads >42 V. Anything below this indicates possible battery failure and it must be checked by a qualified engineer. Replace any failed batteries with genuine Dennis replacement.			•	•	•
Check no damage to the battery (corrosion etc).			•	•	•
Check no damage to the charger and it powers on correctly.			•	•	•

Maintenance Check	Daily		Weekly 36hr 30km	6-monthly 860hr 720km	Annually 1,700hrs 1,440km
	Pre-use	Post-use			
Cassette ⚠					
Check the blades/discs spin freely, with no grinding or metal-on-metal contact noises (***always*** turn the machine ***off*** first).	•	•	•	•	•
Check for wear or damage (impact, dents, material cracking and excessive thinning).	•	•	•	•	•
Check the retaining nut is tight and secures the cassette.	•	•	•	•	•
Grease[1] cylinder bearings.		•	•	•	•
Check the cassette can be removed and replaced easily.			•	•	•
Check the three pins of the drive coupling engage with the cassette.			•	•	•
Replace worn or damaged blades/discs.				•	•

[1] Use multipurpose lithium EP2 grease, may require a grease gun.

[2] See ***"4.2.5. Changing Rear Roller Grease" p.53.***

4.2. Servicing Instructions

WARNING - SAFETY

- **You *must* turn the machine *off* before service work. Failure to do so may cause major injury.**
- **Always wear suitable PPE for the job at hand.**

CAUTION - SERVICE LOCATION

When servicing the machine, position in a suitable environment for working on (for oil spills etc) and if planning leaving for extended periods.

4.2.1. Drive/Cassette Belt Replacement/ Tensioning

The procedure for changing either the drive or cassette motor belt is very similar and requires minimal tools. Behind the RH cover is the drive motor belt and behind the LH cover is the cassette belt.

Tools required:

- Slotted screwdriver
- 17 mm spanner
- 13 mm spanner x 2
- Replacement belt (*if required, cassette belt p/n J209005, drive belt p/n SP11097)*

1. Turn the machine ***off***.
2. Remove 2 x outer screws of the LH/RH cover [slotted screwdriver] (Fig.14A) and keep the cover to the side.
3. Loosen slightly the 3 x top nuts supporting the motor [2 x 13 mm spanner] - secure from the inside of the machine and loosen from the outside (Fig.14B).
4. Loosen slightly the central nut supporting the tensioner block/motor [2 x 13 mm spanner] - secure from the outside of the machine and loosen from the inside (Fig.14C).
5. While supporting the weight of the motor and belt, loosen fully the tensioner block lock nut [17 mm spanner] below the tensioner block and lower (Fig.14D & Fig.14E).
6. Replace the belt if required (Fig.14F).
7. Slide the entire motor assembly up until the belt is taut. Tighten the tensioner block lock nut [17 mm spanner] (Fig.14G).
8. Check the twist tension of the belt. There must be no more than 90º. Re-adjust the locknut if necessary (Fig.14H).
9. Tighten the nut supporting the tensioner block [2 x 13 mm spanner]- secure from the outside of the machine and tighten from the inside (Fig.14I).
10. Tighten the 3 x top nuts [2 x 13 mm spanner] supporting the motor - secure from the inside of the machine and tighten from the outside (Fig.14J).
11. Double check the twist tension of the belt. There must be no more than 90º.
12. Attach the LH/RH cover [slotted screwdriver].
13. The machine is now ready for use.

Fig.14 - Drive belt replacement / tensioning

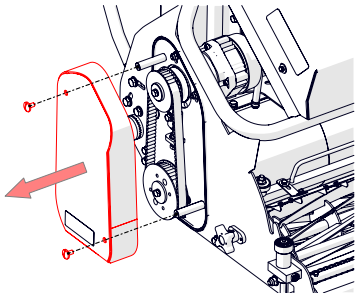


Fig.14A - Remove 3 x outer screws and cover.

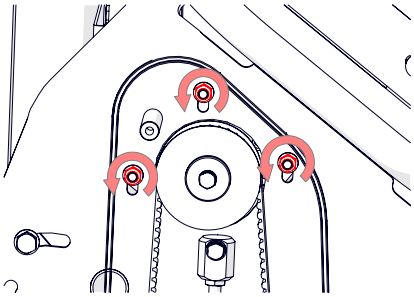


Fig.14B - Loosen slightly the motor 3 x top nuts.

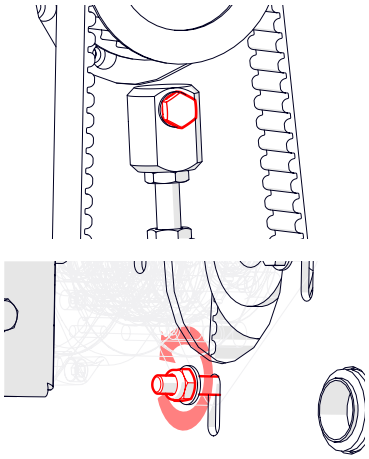


Fig.14C - Loosen slightly the tensioner block/motor nut.

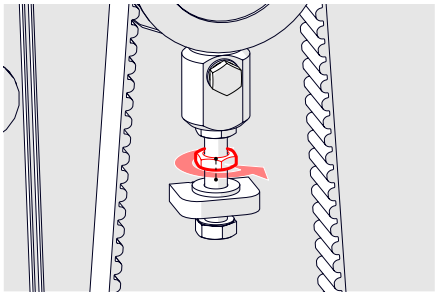


Fig.14D - Loosen fully the tensioner block locking nut.

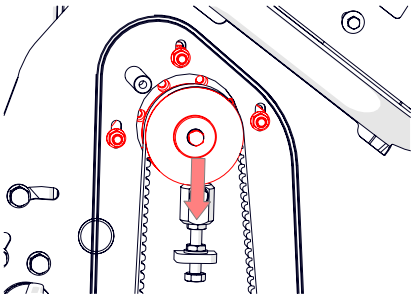


Fig.14E - Support the weight and lower.

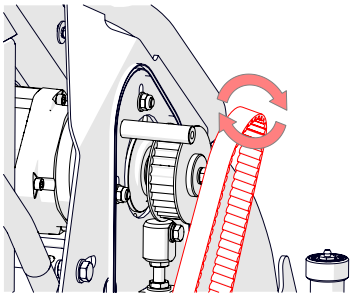


Fig.14F - Replace the belt.

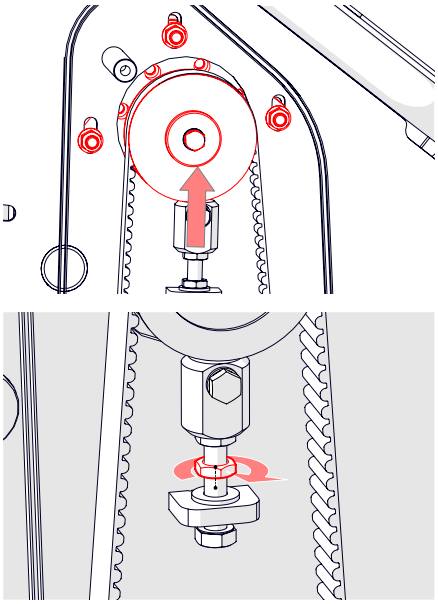


Fig.14G - Tighten the belt and tensioner block locking nut.

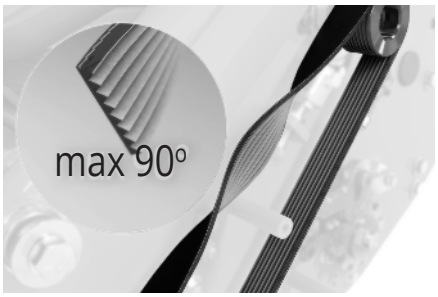


Fig.14H - Check the amount of twist tension.

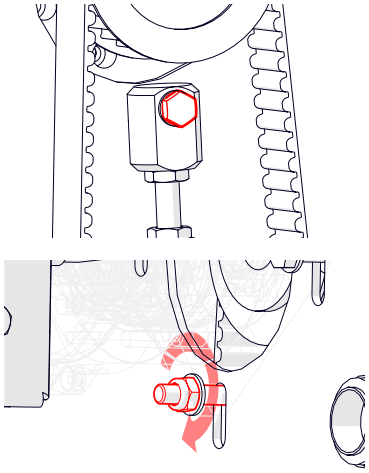


Fig.14I - Tighten the tensioner block/motor nut.

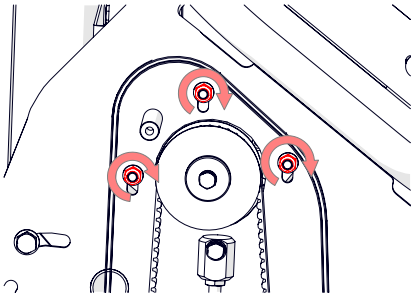


Fig.14J - Tighten the motor 3 x top nuts.

4.2.2. Backlapping

Cutting blades will become blunt over time, producing an inferior quality of cut. Backlapping is the method of sharpening both the cylinder and shear blade simultaneously using a grinding compound while running the drive in reverse. This maintains a temporary sharp edge on the blades to prolong their life, however it is not a substitute for a true grind. Do ***not*** backlap on damage blades or those beyond repair.

There are two methods to achieve backlapping on this machine, further outlined over the following pages:

1. Software - select backlap on the software to run the motor in reverse.
2. Speed brace /drill - use a speed brace or drill to turn the cylinder.

Grinding paste is required to achieve the sharpening of the blades. Three grit types are commonly available (80/120/220 grit) - the type chosen should be based on blade number, wear and expected use.

WARNING - BACKLAPPING

- ***Always*** **wear suitable PPE, including eye protection and gloves.**
- ***Always*** **use a long handled brush. This minimises risk of close contact with the spinning cylinder.**
- **Backlap in a suitable area where the paste can be washed away afterwards. The paste can splatter so ensure a distance is maintained around the machine.**

1) Software

Tools required:

- Long handled brush

- Back lapping paste

1. Turn the machine on.
2. Tip the machine gently back so it rests on the rear roller and handlebar. This will expose the underside of the cylinder, with the shear blade pointing in an upwards direction. Chock the rear roller to stop unintended rolling.
3. Apply a small amount of grinding paste along the whole length of each blade using a long handled brush (Fig.15A).
4. Return to the display screen and navigate to the backlap menu:

Main Menu ▶ *Maintenance* ▶ *Monthly*

Start/stop backlap icon

5. Press the start/stop backlap icon. This will power on the cassette motor in reverse. This should be continued until a sharp lip is achieved on the leading edge of each cylinder blade. This may take a few minutes - stop periodically to check the edge and reapply paste as necessary.
6. When backlaping is complete, all grinding paste must be cleaned off the cylinder. This can be achieved with a low powered hose or a sponge and bucket of water. Failure to clean thoroughly will result in accelerated wear while cutting.
7. Return the cassette to the machine. The machine will now need the shear blade adjusting to account for the change to the cylinder, ***"4.3.3. Shear Blade Adjustment" p.58.***

2) Speed brace

Tools required:

- Long handled brush
- Back lapping paste
- Backlap drive adaptor (p/n 229571)
- Speed brace /drill (1/2" drive)

1. Turn the machine off. Remove the cassette from machine.
2. On a level surface, place the cassette on its back, with the shear blade pointing upwards.
3. Apply a small amount of grinding paste along the whole length of each blade using a long handled brush (Fig.15A).
4. Insert the backlap drive adaptor into the cassette drive coupling.
5. Using a suitable brace or drill, rotate the cylinder clockwise causing a grinding action with the shear blade (Fig.15B). This should be continued until a sharp lip is achieved on the leading edge of each cylinder blade. This may take a few minutes - stop periodically to check the edge and reapply paste as necessary.

   Note: rotating the cylinder clockwise is opposite to the normal operation of the machine. This may cause the drive coupling to become unscrewed. If this occurs, chock the cylinder with a piece of wood or similar, and tighten the drive coupling [Left hand thread].

6. When backlaping is complete, all grinding paste must be cleaned off the cylinder. This can be achieved with a low powered hose or a sponge and bucket of water. Failure to clean thoroughly will result in accelerated wear while cutting.
7. Return the cassette to the machine. The machine will now need the shear blade adjusting to account for the change to the cylinder, ***"4.3.3. Shear Blade Adjustment" p.58.***

Fig.15 - Backlapping

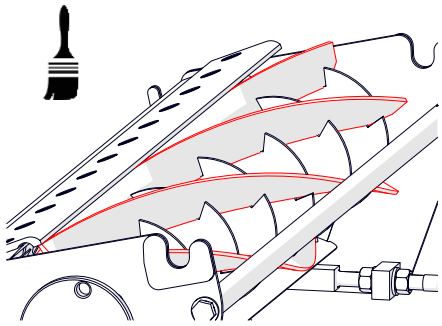


Fig.15A - Apply paste to the blades

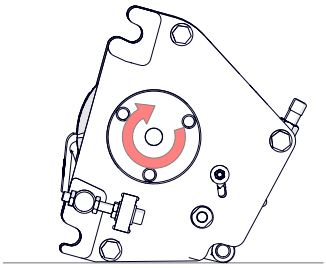


Fig.15B - Rotate the cylinder clockwise

4.2.3. Grinding Cutting Blades

Grinding, as with backlapping, restores the sharp edge of the blades, allowing for a clean, precise cut. Grinding is highly recommended to maintain optimal performance and extend the life of the cutting cassette. However unlike backlapping, this method creates an 'as new' sharp edge, rather than a temporary honed one.

Grinding is recommended when paper does not cut cleanly from the shear blade test (see ***"4.3.3. Shear Blade Adjustment" p.58),*** or when backlapping does not achieve the sharp edge required (usually caused by the edge being rounded too far beyond the capabilities of backlapping). Grinding can also help restore the cylindrical shape of the cylinder, which without, would be seen in poor grass cutting quality and streak marks.

Two grinding methods are performed on our cutting cylinders - spin and relief. As standard, all Dennis cutting cylinders are spun ground, with those of eight blades or more having an additional relief grind. Relief grinding is the process of removing material from the back of each cylinder blade to create a slight angle (i.e. the 'relief').

This relief angle produces a number of benefits:

- Improved cutting quality.
- Increased efficiency: Relief ground cylinders have been shown to reduce the power required to achieve a cut, thereby reducing fuel consumption. This is achieved from less friction between the cylinder and shear blade.
- Less wear between the cylinder and shear blade resulting in:
  i. Longer blade life for both cylinder and shear blades.
  ii. Less cylinder/shear blade adjustments.
  iii. Less backlapping maintenance.
- Longer service life of adjacent moving parts, such as bearings and gears.

Factory standard relief grind is 50% land area at 30 degrees (see Fig.15). It is recommended to grind to these values.

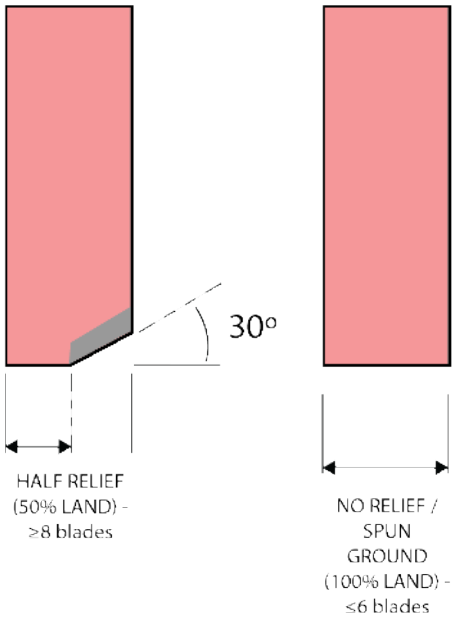


Fig.16 - Recommended cylinder grind angle

Shear blades also need to be ground, ideally

at the same time as the cutting cylinder. It is important to include a relief grind as this helps present the grass at the correct height for cutting. Without this, using a flat or positive front angle can lead to inconsistent cutting heights and an uneven grass surface (see Fig. 17).

Factory standard is a front angle of -10° and top angle of -2°, as shown in Fig.16.

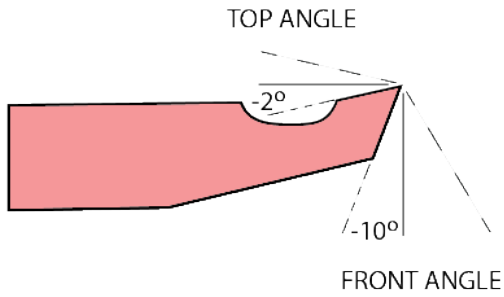
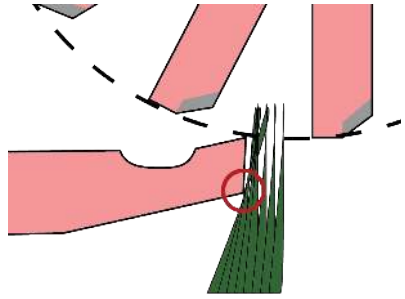
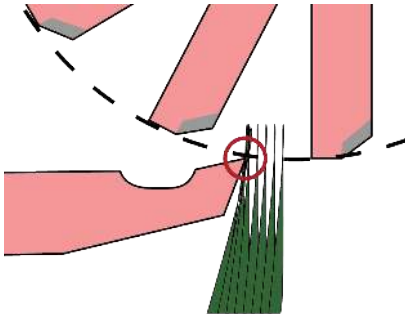


Fig.17 - Recommended shear blade grind angle



Flat front angle



Negative front angle

Fig.18 - Illustration of two different shear blade angles and their grass contact point

For any method of grind, you must use a professional grinding service or dedicated grinding machine. Fail to do this may result in a far inferior cut and increased risk of injury.

4.2.4. Checking Parking Brake

If the display screen shows the parking brake as engaged when it has been disengaged, there could be a problem with the micro-switch or brake disc which requires further investigation:

Tools required:

- Slotted screwdriver

1. Turn the machine ***off***.
2. Chock the front and rear rollers.
3. Remove 3 x outer screws of the LH cover [slotted screwdriver] and keep the cover to the side.
4. Operate the parking brake lever and look to see:

- The cut-out of the brake hammer engages with the cut-outs of the brake disc (Fig.19A).
- The end of the brake hammer presses the micro-switch sufficiently when depressed (Fig.19B).

Fig.19 - Parking Brake Check

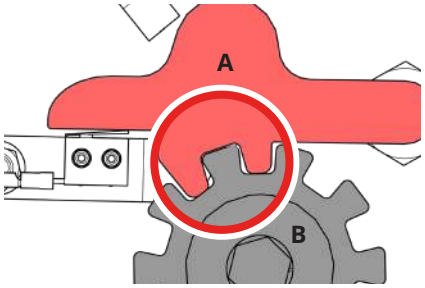


Fig.19A - Brake hammer (A) engaging correctly with the cut-outs of the brake disc (B).

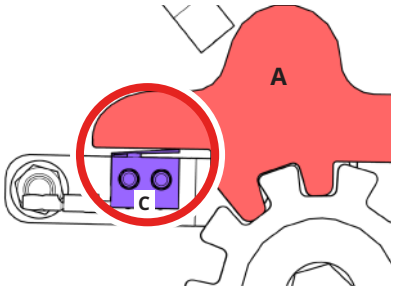


Fig.19B - End of the brake hammer (A) presses the microswitch (C).

4.2.5. Changing Rear Roller Grease

To replace the grease in the rear roller:

Tools required:

- Lifting jack, raised platform or another method to raise the machine
- Wooden chocks
- Slotted screwdriver
- 10 mm spanner
- 13 mm spanner (x2)
- 17 mm spanner
- 4 mm hex key
- M6 cap head screw
- Bearing puller (for bearing Ø 85mm)
- Oil absorbent pads/cleaning cloths
- Grease (multipurpose lithium EP2 grease)
- Loctite 243
- Copper grease
- Scrap metal/wood block with internal hole Ø>25mm
- Rubber-ended hammer

1. Turn the machine ***off*** and chock the front rollers.
2. Lift the rear of the machine by at least 10 cm. Support the rear roller with a lifting jack, blocks of wood or similar.
3. Place oil absorbent pads down under the roller.
4. Remove 2 x outer screws of the RH cover [slotted screwdriver] (Fig.20A) and keep the cover to the side. Repeat on the LH cover.
5. On the RH side, loosen slightly the 3 x top nuts supporting the roller motor [2 x 13 mm spanner] - secure from the inside of the machine and loosen from the outside (Fig. 20B).
6. Loosen slightly the central nut supporting the tensioner block/motor [2 x 13 mm spanner] - secure from the outside of the machine and loosen from the inside (Fig. 20C).
7. While supporting the weight of the motor and belt, loosen fully the tensioner block lock nut [17 mm spanner] below the tensioner block and lower (Fig. 20D & Fig. 20E).
8. Remove the belt and store to the side.
9. Remove the hex screw [13 mm spanner] and washers of the pulley, then remove pulley (Fig.20F).
10. Remove the two hex screws below the pulley [10 mm spanner], attaching the metal cover plate (Fig.20G).
11. On the LH side, locate the castellated parking brake disc. Remove the hex screw securing this [13mm spanner] (Fig. 20H - the shoulder bolt securing the brake may need to be removed prior).
12. Remove the hex screw below the LH bearing [10 mm], attaching the metal cover (Fig.20I).
13. Double check to see if the rear roller is still supported. Remove the 3 x hex screws supporting the LH bearing [13 mm spanner] (Fig.20J).
14. From the RH side, remove the 3 x hex screws supporting the RH bearing [13 mm spanner]. (Fig.20K). Support the rear roller down and away from the machine (Fig.20L).
15. Mark up each side of the roller and shaft (such as numbering or colour) to identify sides when being rebuilt.
16. Choosing one side of the roller, insert a cap head bolt [M8] into the end of the shaft. This protects the shaft when the bearing is being removed.
17. Remove the bearing [bearing puller] (Fig.20M). Check condition of the bearing (wear, smoothness etc) and replace with like-for-like, if required.
18. Remove the 2 x grub screws [4 mm hex key] of the roller lock spacer (Fig.20N).
19. Repeat steps 16-18 for the other side.

20. Rotate each side of the roller and pull slightly. The two halves will come apart.
21. The shaft will be exposed and can be removed from both roller halves. ***Important*** - one or more shims may be added on the shaft, next to the trunnion - take care in locating these and not misplacing, noting number of and side.
22. Remove old grease from the shaft, trunnion and gears with rags/cleaning cloths.
23. Re-pack each roller half with new grease, taking care not to overfill (approximately level with the bevel gear with a light amount the side walls) (Fig. 20O). Grease lightly on the walls of the oilite bushes (x2 for each roller), but keep the top face clean.
24. Insert the shaft the correct way round and rotate to turn the gears, ensuring the new grease is spread evenly (Fig.20P). Repeat for the other half.
25. Assemble the shaft and two roller halves, ensuring the shims are correctly placed (if fitted).
26. Choosing one side of the roller shaft, check the 'lip' from the oilite bush to the shoulder of the shaft. It must be flush (Fig.20Q). If not, remove the roller and shaft, and check the shims (if fitted) are correctly fitted. Repeat assembly until oilite bush and shaft are flush. If this cannot be achieved, please consult Howardson Group or your Dealer.
27. Apply Loctite 243 to the grub screws of the roller lock collar. Then apply copper grease to the inside of the collar.
28. Insert the roller lock collar as far as it can go and tighten the grub screws. Clean up any excess grease.
29. Insert the bearing onto the end of the shaft -ensure it is the correct way round, with the flat face facing outwards. Use a scrap piece of metal or wood suitable to hit the bearing on [rubber-ended hammer]. Stop when it makes contact with the roller lock collar (a change of noise of metal-on-metal contact will signify this).
30. Clean the bearing and surrounds for any grease.
31. Remove the oil absorbent pads and cloths, and dispose of in a responsible manner.
32. Re-assemble the roller into the machine, following steps 1-14 in reverse.

Fig.20 - Rear roller oil

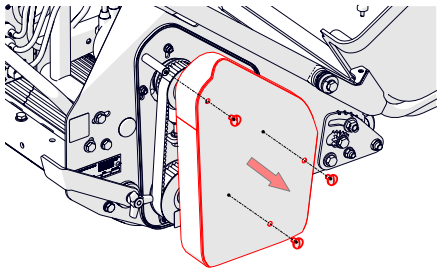


Fig. 20A - Remove 3 x outer screws and cover.

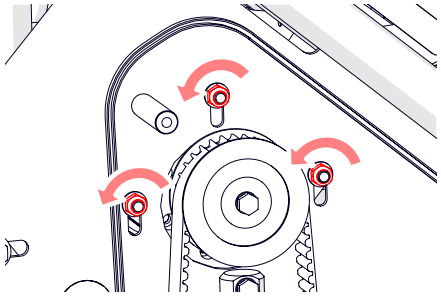


Fig. 20B - Loosen slightly the motor 3 x top nuts.

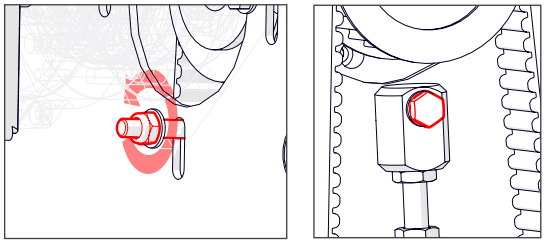


Fig. 20C - Loosen slightly the tensioner block/motor nut.

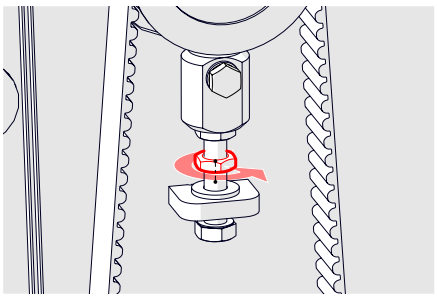


Fig. 20D - Loosen fully the tensioner block locking nut.

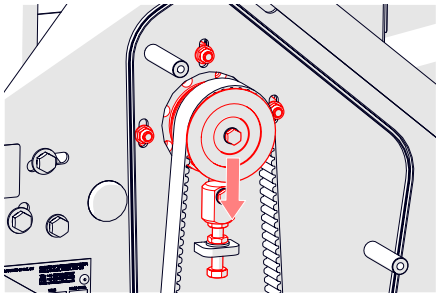


Fig. 20E - Support the weight and lower.

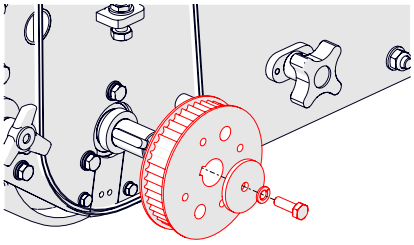


Fig. 20F - Remove roller pulley.

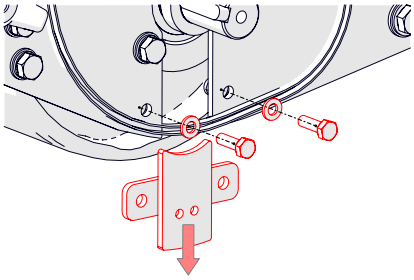


Fig.20G - Remove the RH cover plate.

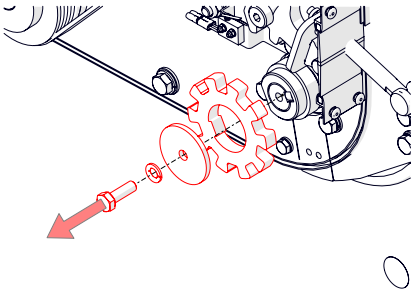


Fig.20H - Remove the castellated parking brake.

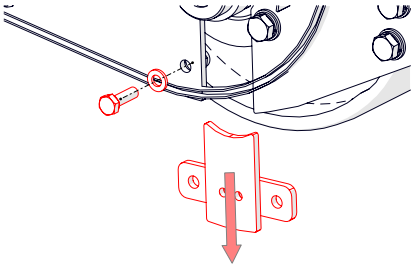


Fig.20I - Remove the LH cover plate.

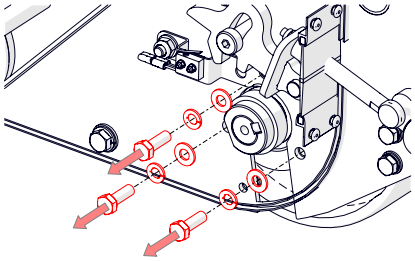


Fig.20J - Remove LH bearing hex screws

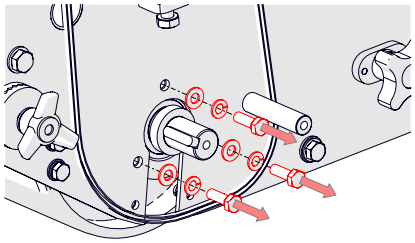


Fig.20K - Remove RH bearing hex screws

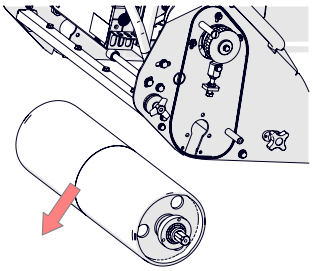


Fig.20L - Remove the rear roller.

Fig.20M - Remove the bearing.

Fig.20N - Remove grub screw

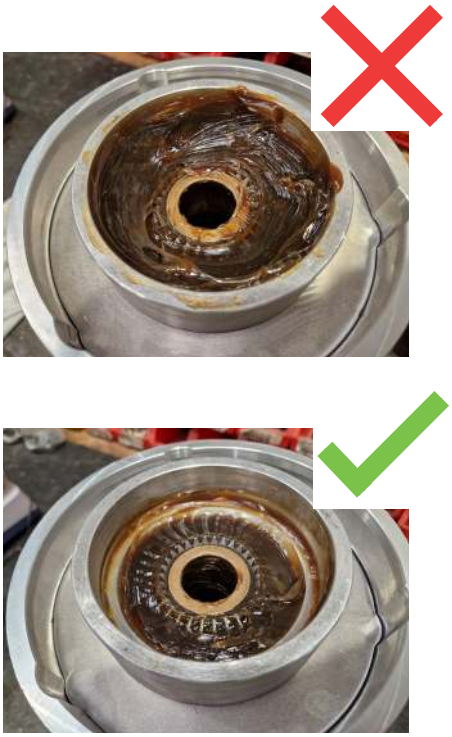


Fig.20O - Correct grease amount.

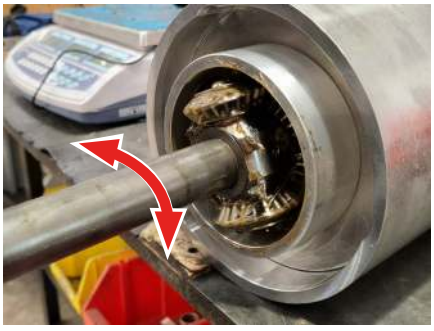


Fig.20P - Rotate shaft to ensure grease is evenly distributed.

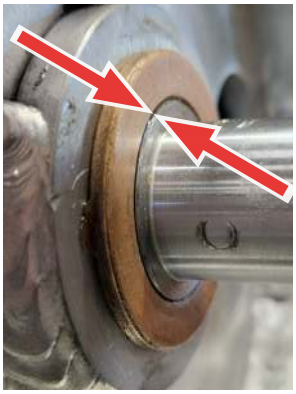


Fig.20Q - Check for no lip between Oilite bush and shaft.

4.3. Adjustments and Settings

4.3.1. Handlebar Height Adjustment

Tools required:

- 2 x 17 mm spanner

1. Turn the machine ***off***.
2. Choosing either side of the machine, locate the three nuts at the bottom of handlebar and loosen [17 mm spanner] (Fig.21A & 21B). Secure the outer bolt head while doing so [17 mm spanner].
3. Repeat with the other side (Fig.21C).
4. Adjust the handlebar to the desired height.
5. When set, tighten the 6 x inner nuts.

Fig.21 - Handlebar adjustment

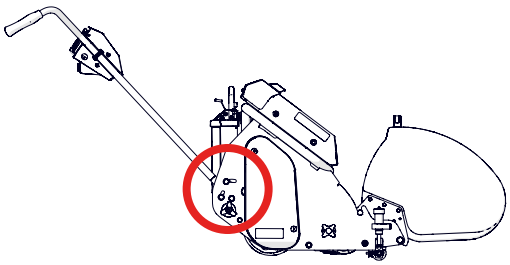


Fig.21A - Securing the bolt head

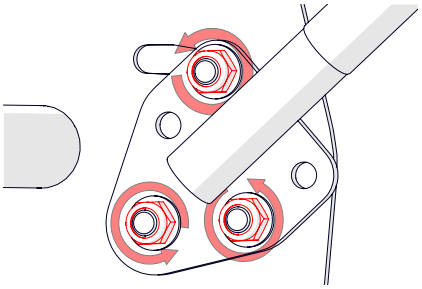


Fig.21B - Loosening the inner nut

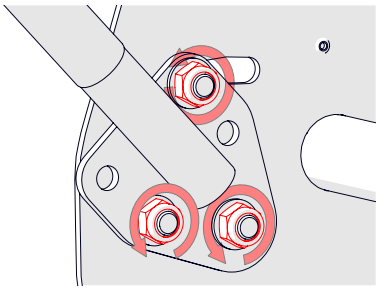


Fig.21C - Repeating adjustment for other side

4.3.2. Handlebar Orientation

Tools required:

- 2 x 13 mm spanners
- Slotted screwdriver

1. Turn the machine ***off***.
2. Locate the top console cover. Remove the 2 x M5 screws from each side [slotted screwdriver] (Fig.22A).
3. Remove the M6 screw at the bottom of the top console cover [slotted screwdriver] (Fig.22B). Remove the cover (Fig.22C).
4. Locate the bottom console cover. Remove the 2 x M5 screws from each side [slotted screwdriver] (Fig.22D). Gently lower the top console cover (with display screen and wiring), and rest using the electrical wiring as support (Fig.22E).
5. Each handlebar is secured with two bolts. For each handlebar, loosen (but not remove) the outer bolt but fully remove the inner bolt [13 mm spanner] (Fig.22F).
6. The handlebar can then pivot - two additional holes are available to orientate the handlebars as desired (Fig.22G). Insert the inner bolt once in position.
7. Secure all the bolts and tighten [13 mm spanner] (Fig.22H).
8. Replace the bottom console cover and secure with 2 x M5 screws [slotted screwdriver].
9. Replace the top console cover and secure with 2 x M5 screws [slotted screwdriver]. Then secure the M6 screw at the bottom.

Fig.22 - Handlebar orientation

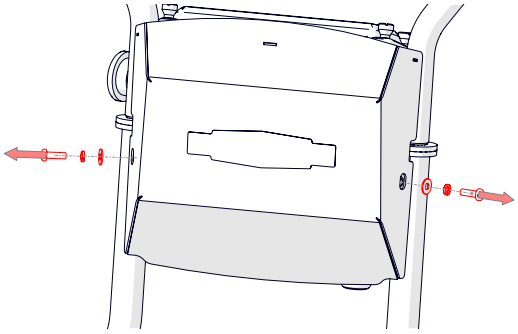


Fig.22A - Remove top console side screws.

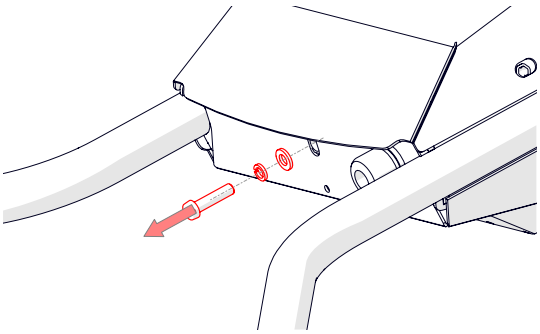


Fig.22B - Remove top console bottom screw.

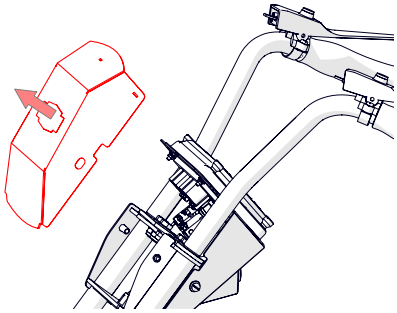


Fig.22C - Remove top console.

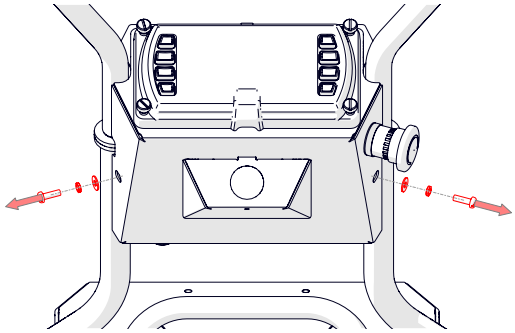


Fig.22D - Remove bottom console screws.

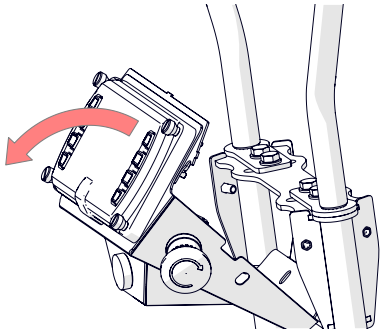


Fig.22E - Gently lower the whole console cover, supported by the electrical wires (wiring not shown).

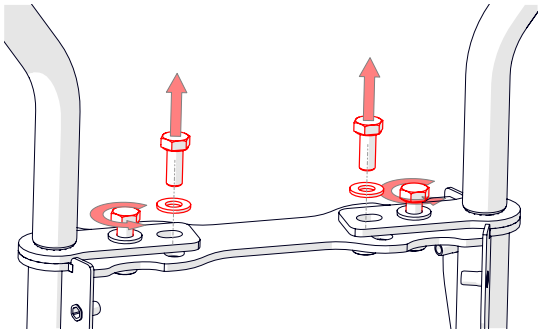


Fig.22F - Loosen outer bolts, remove inner bolts (top console removed for clarity).

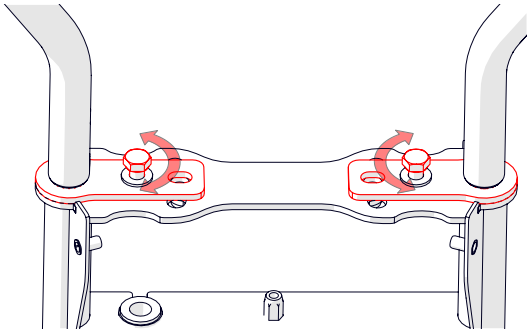


Fig.22G - Rotate handlebars as required (top console removed for clarity).

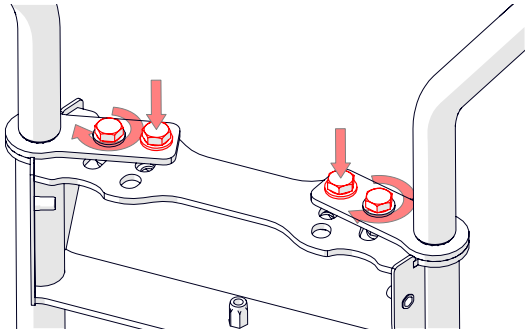


Fig.22H - Insert bolts and tighten (top console removed for clarity).

4.3.3. Shear Blade Adjustment

CAUTION - RISK OF INJURY

- ***Always*** turn the machine ***off*** before commencing this task.
- ***Always*** wear protective gloves to reduce risk of cuts and finger trapping.

NOTE - ORDER OF ADJUSTMENT

If planning on adjusting the height of cut at the same time, always adjust the shear blade first then adjust the height of cut. Doing the opposite way may result in a different height of cut.

NOTE - ADJUSTMENT AFTER BLADE REMOVAL

If replacing the shear blade or cylinder with a new or sharpened version, further adjustment is required to 'square' the blade to the cylinder using the cam located on the right hand side. This must be completed by competent person before following the steps below. Please contact Howardson Group if further guidance is required.

Tools required:

- Scrap paper
- 9/16" spanner

1. Turn the machine ***off***.
2. Remove the grassbox and fold the carry frame up.
3. Tip the machine gently back so it rests on the rear roller and handlebar (Fig.23A). Chock the rear roller to stop unintended rolling.
4. Choosing the left or right hand side of the cassette, test the cut by moving the cassette blade with a gloved hand and using a piece of paper between the cassette and shear blade (Fig.23B). If it does not cut the paper, or does not cut cleanly, then adjustment of

the shear blade is required - see step 5. If it does cut cleanly, repeat test on the other side before proceeding to step 5 if required.

5. Located at each end of a cassette are two shear blade adjusters. On the side being adjusted, loosen the lock nut [9/16" spanner] (Fig.23C).
6. Adjust the gap with the adjustment knob (Fig.23D). Only very small adjustments are required - start with ⅛ of a turn and repeat the paper cut test. Repeat adjustment until the paper cuts cleanly.

NOTE - ADJUSTMENT DIRECTION

A sticker next to the adjuster informs of direction:

- ON = Decrease gap (i.e. cut 'on'),
- OFF = Increase gap (i.e. cut 'off').

7. Secure the lock nut.
8. Repeat step 6 on the opposite side.
9. Repeat the paper cut test on both sides. Adjust where necessary.
10. Lift the machine gently up to rest on its front and rear rollers. Unfold the grass carrier.
11. The machine is now ready for use.

Fig.23 - Shearblade adjustment

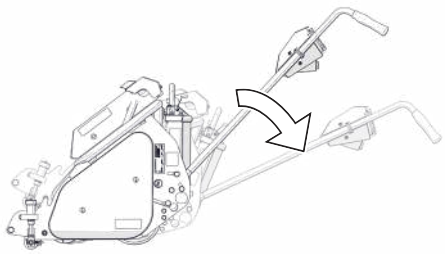


Fig.23A - Tip to rest on the handlebars

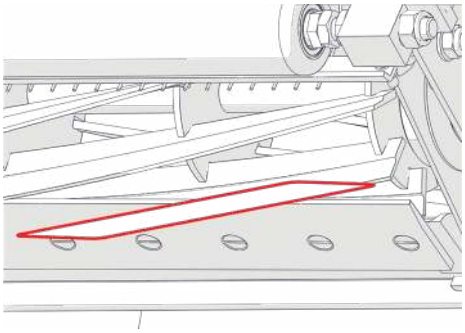


Fig.23B - Repeating adjustment for other side

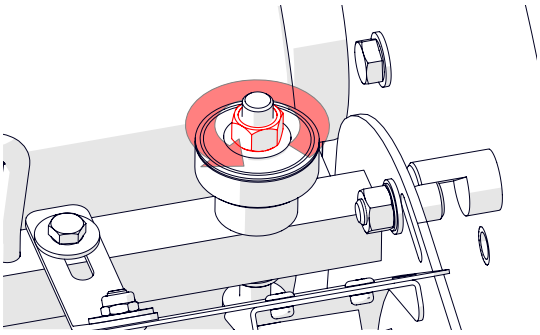


Fig.23C - Loosen the lock nut

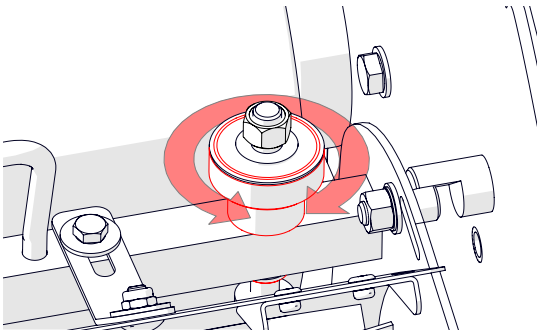


Fig.23D - Tighten/loosen the adjustment nut

4.4. Cleaning

CAUTION - WATER DAMAGE

Do *not* use a pressurised hose to clean your machine. Doing so may cause water ingress, damage and invalidate your warranty.

WARNING - SAFETY

***Never* place your hands inside the cassette area without firstly turning the machine *off*. We recommend to wear safety gloves and to use a long handled brush for cleaning.**

Use a soft brush to remove as much grass and debris as possible. If further cleaning is required:

- **Chassis** - Close and secure the electrical box lid. Remove the grass box and tilt the machine backwards so it rests on the handlebars. Using a ***low pressure*** hose, wash all of the grass from under the machine and around the cassette. Take extra care around the motors and bearings, avoiding direct contact with the hose. Dry thoroughly after use.
- **Grass box** - Use a low pressure hose to rinse the inside of the box. Leave upside down to drip-dry before returning back to the machine.

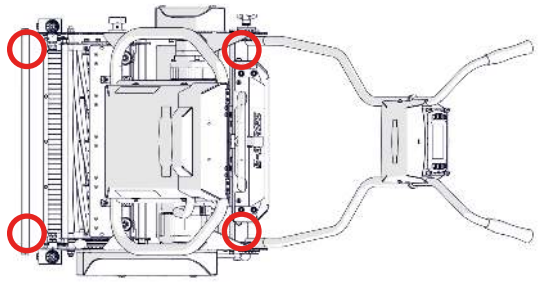


Fig.24 - Anchor points for transport.

4.5. Handling and Transport

WARNING - LIFTING

Do *not* lift the machine as it does *not* have designated lifting points. Lifting the machine may result in injury, damage to the machine, or both.

- Use a ramp to aid the machine onto a vehicle. For the technical specification of the machine, please refer to ***"2.1. Technical Specifications" p.11.*** The weight can also be found on the serial plate.
- Anchor the machine to the floor/pallet using suitably rated tie-down straps. Anchor points shown in Fig.23.
- Transport with sufficient charge levels - see note.
- Turn the machine ***off*** during transport.
- Disconnect battery terminals.

NOTE - SHIPPING LITHIUM BATTERIES

Regulations for the transportation and shipping of lithium batteries differ by country. Ensure compliance with the regulations of both the origin and destination countries.

4.6. Storage

Follow the points below for correct storage of your machine.

- Store in a location away from direct sunlight, flames, heat sources and areas with high shock/vibrations.
- Store in a location maintaining a consistent temperature; for one to three months at -20 to +45°C, for three months to one year at -20 to +24°C. Avoid high fluctuations.
- Store in a location that is dry, preferably with a relative humidity between 30%–70% RH.
- Store with a battery of minimum 50% charge (if storing for < 30 days) or 70% charge (if storing for ≥30 days). Avoid where possible storing with an empty or fully charge battery.
- Disconnect the battery when stored longer than 30 days.
- When stored for > 30 days, check the battery voltage every month to ensure voltage is not approaching deep discharge. Charge if not.
- Thoroughly clean and dry the machine prior to storage.
- Apply a small amount of grease to the cutting edge of the cylinder and shear blade. Use a small brush to achieve this.
- Store on a flat surface with the parking brake ***on***. Chock the front and rear of the machine.
- Cover the machine to protect from damage and dust.

NOTE - INCORRECT STORAGE

Failure to store the machine correctly will cause machine degradation and reduce its operating life.

4.7. Disposal

4.7.1. Machine Disposal

NOTE - DISPOSAL NOTES

Check and comply with all environmental regulations and local disposal guidelines.

Dispose of the product in an environmentally friendly manner. The machine is predominately made up from metal and electronic waste - these can be suitably recycled at a local refuse collection site.

CAUTION - INJURY

Take care when removing components from the machine. If done incorrectly it may cause injury to yourself or damage to the surrounding environment. Wear suitable PPE and dismantle in an appropriate area.

1. Take the machine to a suitable area to allow for the removal of parts. Take into account: access to the machine, tool availability, oil and other contaminants.
2. Wear suitable PPE. This must include safety glasses and gloves as a minimum.
3. Place oil absorbent pads under and around the machine.
4. Disconnect the battery and remove. Remove both motors and electrical box.
5. Safely drain any remaining fluids, such as oil and dispose of them according to local regulations.
6. Clean the machine thoroughly.
7. Detach any removable parts, such as the handlebar, bodywork, rollers and cassette.
8. Separate recyclable parts like metal, plastic and electronic. Recycle at a recycling facility.
9. Dispose of non-recyclable components in accordance with local waste disposal regula-

tions.

10. Document the decommissioning process for record keeping.

4.7.2. Hazardous Materials

The battery contains hazardous components and must be disposed of correctly. Follow local regulations for the disposal and recycling of batteries. Dispose of at a suitable recycling facility.

Other components to note include lubricating grease and roller bearing oil which may contaminate waste during recycling. All oil/ grease should be removed prior to disposal with a suitable solvent or degreaser such as brake cleaner /denatured alcohol and wipes.

4.8. Troubleshooting & FAQ

WARNING - SAFETY

- **You *must* turn the machine *off* before actioning any cause. Failure to do so may cause major injury.**
- **Always wear suitable PPE for the job at hand.**

The most common troubleshooting issues are shown in Appendix C. If your fault is not shown or you are still experiencing problems, please contact Howardson Group directly.

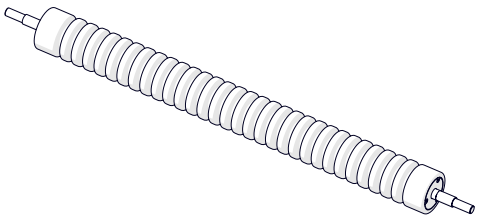
4.9. Warranty Policy

For full warranty terms and conditions, please contact your Dealer or refer to the warranty policy supplied separately.

Appendix A. Optional Items and Attachments

A1. Weile (Grooved) Roller

This option replaces the standard smooth front roller with a weile (grooved) roller. A weile roller has less surface area so the machine sits lower in the turf, allowing for the leaf blades to stand more upright in the grooves prior to being cut. This generally achieves a more consistent height and quality of cut. The grooves also help maintain better traction, so more suited to thicker turf, uneven ground and slopes.



However, a smooth roller distributes the machine weight more evenly provides and is therefore less aggressive on the turf. Use a smooth roller on well maintained level turf, or if your turf is stressed, recently aerated or in soft ground conditions.

To remove and swap the front roller:

1. Fully loosen both LH and RH height adjusters as far as they can go (Fig. 25A). This will allow the front roller, end blocks, comb tine and scraper bar to be removed as one from the machine (Fig.25B).
2. Remove the comb tine and scraper bar [10 mm spanner]. This will allow the end block to be removed (Fig.25C).
3. Assemble the end block and comb tine (if applicable) onto the weile roller.
4. Assemble the end block with weile roller back onto the machine, using the height adjusters to screw back in.
5. Perform cut-height adjustment ***"3.4.2. Adjusting Height of Cut (Cylinder)" on page 30***

Fig.25 - Front roller removal

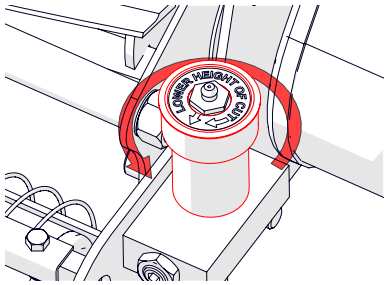


Fig.25A - Loosen height adjusters.

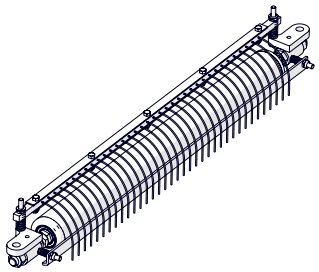


Fig.25B - Whole front roller assembly.

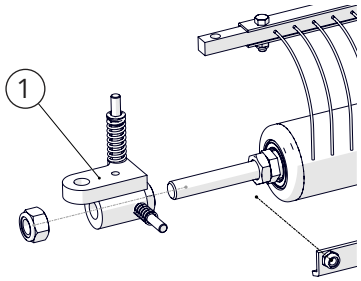


Fig.25C - Remove comb tine and scraper to gain access to end block (1).

A2. Transport Wheel Kit

The transport wheel kit allows the machine to be moved between sites allowing for easier manoeuvring and avoiding damage to the machine.

1. Turn the machine ***off*** and lower the transport stand (Fig.26A).
2. Gently tip the machine backwards until the handlebars rest on the floor. Alternatively, place an object (such as a block of wood or foam) under the central console that houses the display screen (Fig.26B) .
3. Each wheel axle and guard cover is coloured coded (Fig.26C) - match accordingly. Slide the cover to the side and insert the wheel axle (Fig.26D). Rotate the wheel a little until it is fully inserted.
4. Twist and push the sprung handle until it locks in position (Fig.26E).

Fig.26 - Transport wheel insertion

Fig.26A - Lower the transport stand.

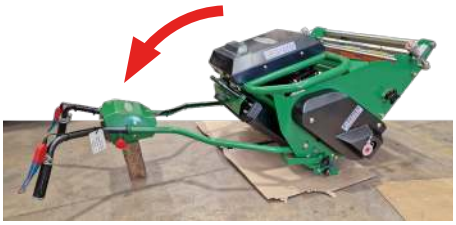


Fig.26B - Loosen the tie-bar bolt.

Fig.26C - Colour match the wheel with the side.

Fig.26D - Insert the wheel axle.

Fig.26E - Insert the wheel axle.

Appendix B. Service Kit

The service kits below are available to be purchased to aid in the servicing of the machine:

Machine	Service area of machine	Kit number	Item description	Item part number	Qty
ES-510 only	(SK06) - Cutter	SK06015	BEARING SELF ALIGNING R16	J20004	2
			20" Shear Blade 0.090" (Standard)	J20030	1
			Blade Screw	J20032	10
			SEAL SINGLE LIP 22 x 40	J20063	2
			GREASE NIPPLE 1/4" UNF	J20064	2
ES-610 only	(SK06) - Cutter	SK06016	BEARING SELF ALIGNING R16	J20004	2
			Blade Screw	J20032	12
			SEAL SINGLE LIP 22 x 40	J20063	2
			GREASE NIPPLE 1/4" UNF	J20064	2
			20" Shear Blade 0.090" (Standard)	J24030	1
ES-510 & ES-610	(SK06) - Cutter	SK06017	CORK BUFFER	J20222	1
			BEARING 5205 - 3205 2RS	J20255	1
			BELT RIBBED 5PK 915	J209005	1
ES-510 & ES-610	(SK05) - Drive / Power	SK05012	BELT RIBBED 5PK 915	J209005	1
			BELT OMEGA 760-8M-20	SP11097	1

*Belt kit - not required with cutter or drive kit

Appendix C. Troubleshooting and FAQ

Issue	Possible Cause	Action
Screen powers on briefly then switches off	1. Start button not pushed in fully. 2. Wiring connection fault. 3. Fully drained battery.	1. Press the ***start*** button and check it stays in the ***on*** position. Screen will power up a few seconds later. 2. Check connections to ***start*** button as per wiring diagram ***"Appendix D. Wiring Diagram (SP19053) - Part 2" on page 61.*** 3. Re-charge the battery.
Screen 'Parking Brake' icon (P) won't disengage	1. Mechanical brake engaged. 2. Parking brake microswitch faulty.	1. Release the parking brake - see ***"2.2. Machine Components" p.14.*** 2. Check the parking brake microswitch is being disengaged from the brake hammer - see ***"4.2.4. Checking Parking Brake" p.52.***
Machine will not switch on	1. If the machine is brand new, battery terminals will be disconnected. 2. Fully drained battery. 3. E-stop activated. 4. Start button not pushed in fully. 5. Harness plug not connected. 6. Damage to battery cables. 7. Wiring connection fault/fuse blown.	1. Connect battery terminals, see ***"1.3.2. Assembly Instructions" p.10.*** 2. Re-charge the battery. 3. Release E-stop button. 4. Press the ***start*** button and check it stays in the ***on*** position. Screen will power up a few seconds later. 5. Open the battery cover and re-connect the harness to the battery. 6. Visually inspect the cabling for damage. **NEVER TOUCH ANY EXPOSED WIRES.** ⚠ 7. Contact your Dealer or Howardson Group Service.
Machine will not operate and displays "PLEASE HOLD DEADMAN HANDLE [OPC]"	1. Check the OPC operates freely and no damage to pivot block. 2. Parking brake microswitch faulty.	1. Service/replace OPC if faulty. 2. Check the parking brake microswitch is being disengaged from the brake hammer - see ***"4.2.4. Checking Parking Brake" p.52.***
OPC will not disengage when released		
Machine will not charge	1. Charger not receiving sufficient power. 2. Not plugged correctly into the machine. 3. E-stop activated.	1. Ensure the mains electrical socket is ***on***. Check lights and screen on the charger are illuminated. 2. Ensure the charger plug is fully inserted and the correct way round. 3. De-activate the E-stop.

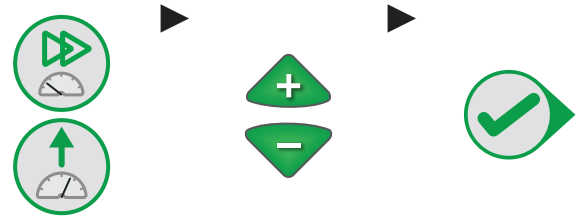
Issue	Possible Cause	Action
Charger lights are not illuminating	1. Charger is not receiving power.	1. Ensure the mains electrical socket is ***on***. 2. Check the condition of the plug fuse - replace if required.
Charger lights are flashing	1. Charger is charging or there is a fault.	1. See ***"3.5.5. Charging Instructions" p.39***
Machine will not show charge (shows as empty)	1. BMS cable is not connected. 2. BMS cable is faulty.	1. Check the BMS cable is connected correctly. 2. Unplug the BMS cable and check the condition of the internal pins. If the pins are bent a replacement cable will be required
"BMS Comms" error showing on screen		
"Motor comms" error showing on screen	1. Faulty motor cable connection.	1. Check for secure connection from the electrical box to the motors 2. Check all three power cables to each motor are connected with the letters matching (U, V and W)

What do the 'Main Menu' icons mean?
*See **"2.5. Display Screen" p.22.***

How do I edit the default Forward and Turning speed?

Main Menu ▶ *Operations* ▶ *Default speeds*

Clip / RPM ▶ *Increase / Decrease* ▶ *Save changes*



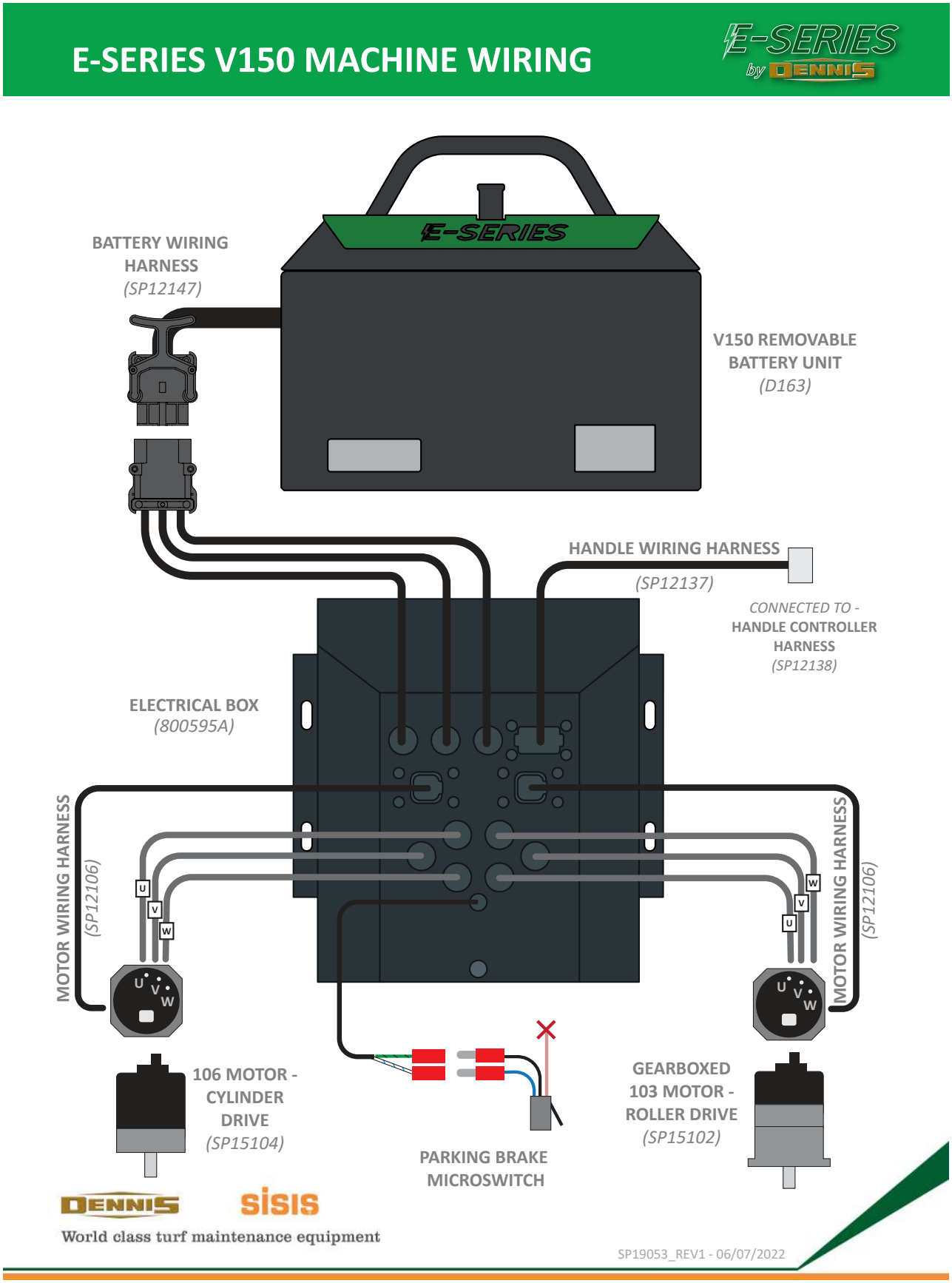
Why does 'Daily Checks' show on start up?
The 'Daily Checks' screen will show on start up each day until the operator confirms they have completed the daily checks required before initial operation.

Once checks have been completed they can be registered as complete (tick icon), which will log the date on the checks register.

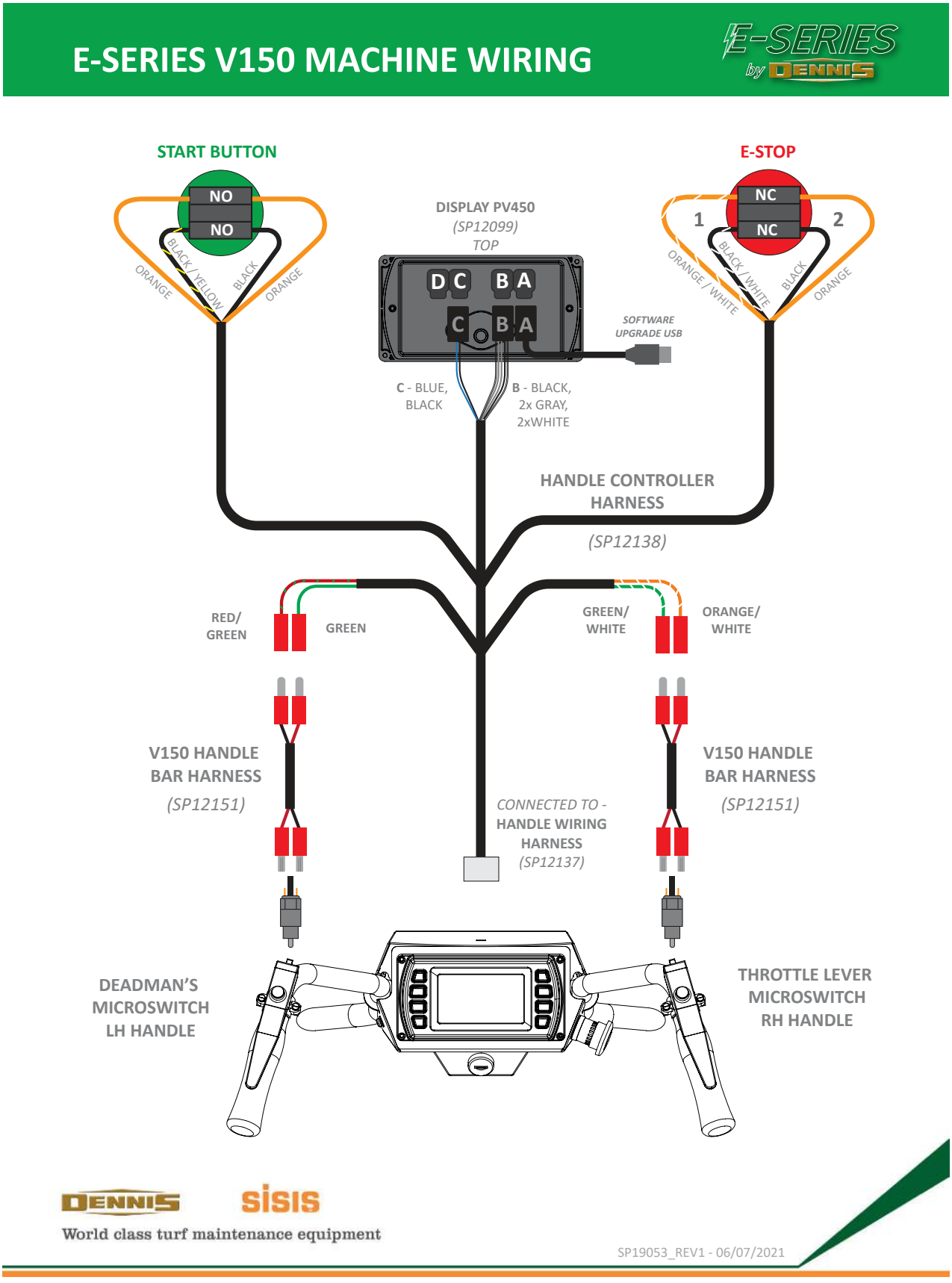
What is the default password?
1111.

Using a password protects your machine from unauthorised modification of values and settings (such as speed) only. It does NOT not lock out other users from using the machine. Contact Howardson Group or your Dealer if you have forgotten your password.

Appendix D. Wiring Diagram (SP19053) - Part 1



Appendix D. Wiring Diagram (SP19053) - Part 2



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