CE EN

Original Instructions

SP20084_EN REVO // **March 2026**

Operator Manual

Battery Dedicated Mower

ES-34SL

DENNIS

Original Instructions in English (UK).
Part number: SP20084_EN.
Models covered: ES-34SL (D177)

Rev.	Date	Description of Changes	Author
0.0	30/MAR/2026	New	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
Cylinder Motor

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1.1. Operator Manual Overview

This operator manual contains important information regarding the safe, proper and efficient operation of the ES-34SL, 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.

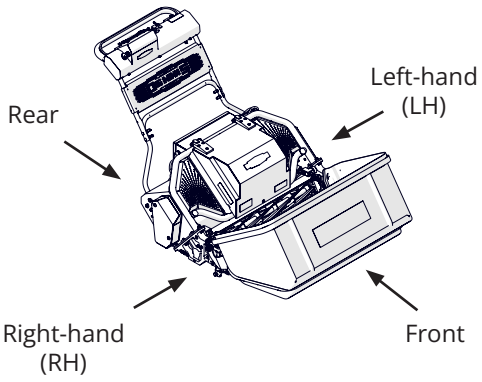


Figure (Fig.) 1 - Viewpoints

1.2. Machine Description

The ES-34SL (Superlight) is a professional electric grass mower, using a 34" (860 mm) dedicated cylinder. This cylinder is designed for the cutting of grass only.

It is powered by a pair of 48V permanent magnet AC motors via an 5.8 kWh lithium ion battery, with one motor controlling the rear roller and one motor controlling the cylinder.

The rear roller and cylinder 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 quick 'click adjust' system for the easy height adjustment of the front roller and grooming brush. These are adjusted independently to suit personal preferences.

A tubular assembly system allows for the easy service and maintenance of the main components. A mechanical parking brake is fitted which, when applied, disengages drive.

2.1. Safety Statements

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.

2.2. Warning Symbols

The following warning symbols 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

Prohibition Signs

General prohibition sign

Mandatory Signs

General mandatory action sign

Refer to instruction manual/booklet

Wear ear protection

Wear eye protection

Wear protective gloves

Wear safety footwear

Other Signs

Take note

Heavy weight

2.3. Safety Instructions

DANGER - SAFETY INSTRUCTIONS

This machine can cause serious injury if it is not used correctly. Before use, carefully read all following safety instructions and the potential hazards that could occur. It is essential they are adhered to.

Failure to follow the safety information and correct operating procedures may result in serious injury or death.

2.3.1. General Safety Instructions

WARNING - GENERAL SAFETY INSTRUCTIONS

This machine contains mechanical, electrical and battery-related hazards. *Always* read this operator manual carefully, taking care to understand all safety instructions.

Training and Access

- Read and understand all instructions and machine hazards before use.
- Only trained and authorised personnel may operate the machine.
- The machine owner must ensure the manual is accessible to all users at all times.

Area Safety and Exclusion

- Never allow children to operate the machine, enter the work area or access the machine while in storage.
- Maintain a safe distance from pedestrians and remain alert to your surroundings.
- Prevent any unauthorised person from interacting with the machine under any circumstances.

Safe Operation

- Always keep both hands on the handlebar.
- Never exceed a standard walking pace.
- Operate only within the specific environmental conditions defined in ***"5.7. Operating Environment" p.40.***

Fitness for Work

Do **not** operate the machine if your judgment or physical ability is impaired by:

- Illness or fatigue.
- Reduced physical capacity.
- The influence of drugs or alcohol.

2.3.2. Electrical and Battery Safety Instructions

DANGER - ELECTRICAL AND BATTERY SAFETY INSTRUCTIONS

This machine contains and uses high-voltage components. Improper handling poses a significant risk of electric shock, fire, or severe injury. Always follow the guidance shown.

Operational Requirements

- Only use the battery, charger and cables supplied with the machine.
- Strictly follow all procedures in this document for charging, handling, servicing and storage of the electrical components.
- Always read the OEM Operator's Manual provided with the charger for specific instructions not covered in this manual.

Maintenance and Inspection

- Before every use, inspect the battery, charger and all wiring. If you observe any damage, stop using the machine immediately.
- Keep all electrical components clean, dry, and free from debris or physical damage.

Prohibitions

- **DANGER: DO NOT ATTEMPT REPAIRS.** Never open, modify, or attempt to repair electrical or battery components. Internal parts store energy even when the power is disconnected and can cause a lethal discharge.

2.3.3. Mechanical Safety Instructions

WARNING - MECHANICAL SAFETY INSTRUCTIONS

This machine contains sharp, fast-moving parts. Improper use can result in serious injury. Always keep all body parts away from rotating components, which may continue to move after power-off. Never operate without protective guards or bypass safety devices.

Vigilance

- Components such as blades, brushes and rollers may continue to rotate for a short period after the machine is switched off; maintain full attention until all motion has completely ceased.
- If any component is damaged, loose or excessively worn, **stop using the machine immediately**.

Maintenance and Inspection

- Carry out maintenance checks as shown in ***"6.1. Maintenance Schedule" p.43*** to ensure safe and reliable operation.
- All servicing and repair must be carried out by a suitably qualified person using genuine parts.

2.3.4. Noise and Vibration Safety Instructions

WARNING - NOISE AND VIBRATION SAFETY INSTRUCTIONS

This machine generates noise and low levels of mechanical vibration during normal use. Always use hearing protection to allow safe, extended operation and prevent long-term health risks associated with noise exposure.

Consult local regulations for vibration exposure limits. Do not exceed the maximum allowable duration for machine operation.

- If abnormal noise or vibration is detected, stop using the machine immediately and inspect it for damage or wear.
- Ensure all maintenance is carried out as specified to keep noise and vibration levels within their intended limits.

2.3.5. 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 to wear:

- **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.

2.3.6. Intended Use and Residual Risks

WARNING - INTENDED USE AND RISK

This machine is designed solely for cutting fine grass surfaces. Never use the machine for anything else other than this purpose. Personal injury and damage to the machine can result in using the machine for alternative uses.

Limitations

- Do not use the machine to cut grass above the maximum specified cutting height, or to

cut thick, coarse vegetation expected for the use of different equipment (e.g. brushcutters or strimmers).

Prohibited Operations

- Do not ride on the machine, tow it or use it to carry loads or transport goods.
- Do not use the machine as a general-purpose tool for any task other than fine grass cutting.
- Do not modify the machine or fit non-approved attachments.

Surfaces

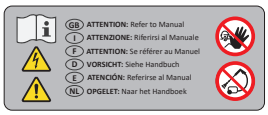
- Do not operate the machine on surfaces other than grass (e.g. gravel, bare soil, hard surfaces). Operating on other terrain may cause damage or create hazards (such as flying debris).

2.3.7. Machine Decals

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

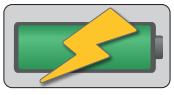
SP18066 - REV0
Machine Model Decal

SP18026-3 - REV0
'E-Series' Machine Decal



SP18026-2 - REV0
Attention: Refer to Manual

SP18032 - REV0
Noise Decal



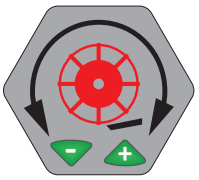
SP18026-6 - REV0
Charging icon

SP18026-7 - REV0
Parking brake

SP18051 - REV0
Do not pressure wash the machine

B32903_REV0
United Kingdom Flag

SP18052 - REV0
Do not pressure wash the machine



SP18034 - REV0
Shear blade adjustment

B32902_REV2
(200x50mm)
J20362_REV2 (120x30mm)
Dennis Logo Decal

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 and a warranty registration document.

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 ***"5.3. Power On and Shut-Down" p.30*** and ***"5.4. Drive" p.31*** for the relevant procedures.

CAUTION - MACHINE WEIGHT

The machine is heavy. The exact weight is shown on the serial plate and in section *"4.1.2. Specification Table" p.13*.

Take care when removing the machine from the wooden pallet; two people are recommended for this task. Follow all manual handling procedures applicable to your workplace 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.

3.2. Assembly Instructions

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

1. **Re-connect the battery terminals;** use a 5 mm hex key to open the battery cover and locate the two terminals. Insert positive to positive and negative to negative (Fig.2A). An audible 'click' will be heard to indicate a secure connection. Secure the battery cover.
2. **Attach the grass box;** lower the grass box frame towards the front of the machine. Lift the grass box onto this frame (Fig.2B), removing any plastic wrapping that may be left.
3. **Set handlebar height;** the handlebar may need readjusting to be optimum for your height. See section ***"5.2.3. Handlebar Height Adjustment" p.28*** for further information.

Fig. 2 - Assembly Instructions

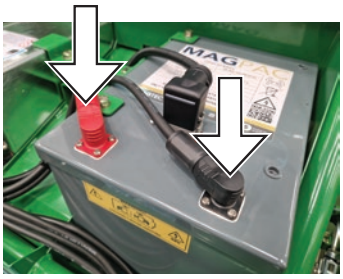


Fig.2A - Battery terminal re-connection

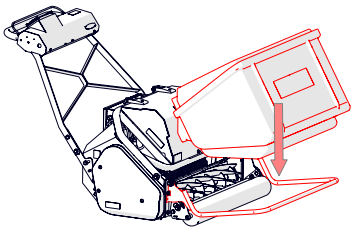


Fig.2B - Grass box fitment

3.3. Installation Requirements

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

- See section ***"4.1.1. Dimensions" p.12*** for minimum space requirements.
- See section ***"6.5. Storage" p.56*** 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, consult the OEM charger User Manual supplied.

3.4. Commissioning

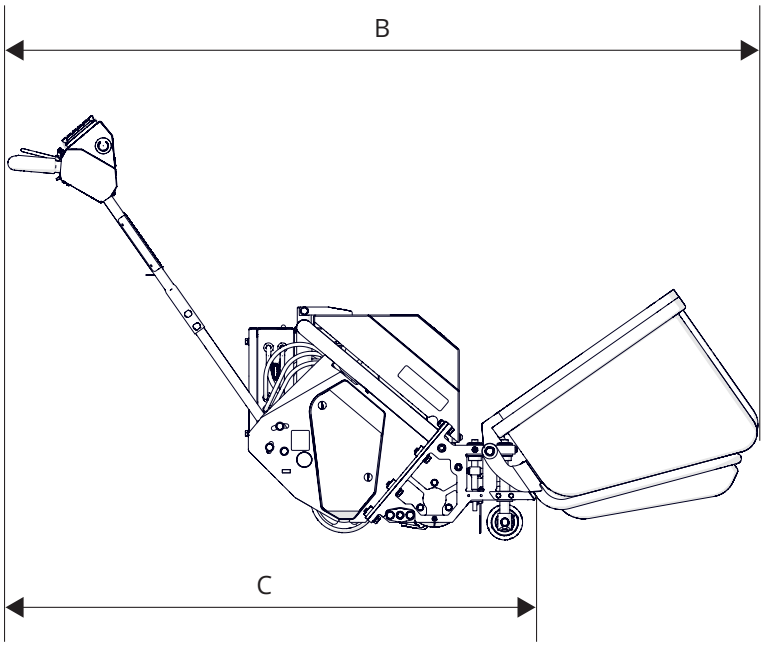
Your Dealer or a Howardson Group representative will be present to commission and set-up your machine. They will walk through the process of basic controls and getting started with your machine.

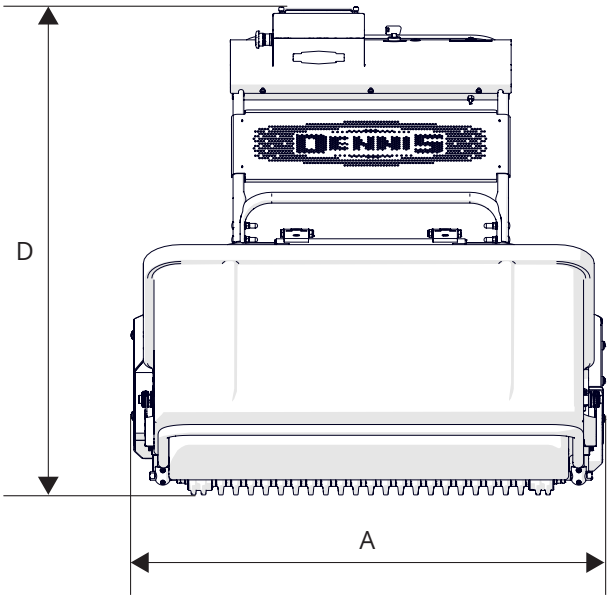
3.5. Calibration

No calibration procedures are required.

4.1. Technical Specifications

4.1.1. Dimensions





View	Dimensions
A	1114 mm
B	1878 mm
C	1324 mm
D	1062 mm

4.1.2. Specification Table

System		
Weight	Machine	187 kg (w/o grassbox)
	Charger	13 kg
Drive	Drive Motor	630 W
	Drive System	Timing Chain
	Cylinder Motor	1200 W
	Cylinder Drive System	Multi V Belt
	Rear Roller Diameter	168 mm
	Front Roller Diameter	89 mm
Electrical	Battery Type	Lithium Ion - Sealed, Removable
	Battery Chemistry	Lithium-Ion NMC
	Battery Capacity	5.8 kWh
	System Voltage	48 V
	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	Cylinder, fixed
	Cutting Width	34" [860 mm]
	Cylinder Diameter	140 mm
	Number of blades	8
	Clip-rate range (per metre)	85–140 cpm
	Height of cut	09–35 mm
	Grassbox volume	200 L
Environmental	Operating temperature range	-20ºC to +40ºC *(+10ºC to +30ºC optimal)*
	Charging temperature range	0ºC to +45ºC *(+10ºC to +40ºC optimal)*
	Storage temperature range	-20ºC to +35ºC (machine) +10ºC to +30ºC (battery) For additional information, see section ***"6.5. Storage" p.56***.

4.1.3. Noise and Vibration

WARNING - NOISE AND VIBRATION LEVELS

This machine generates noise and low levels of mechanical vibration during normal use. Always use hearing protection to allow safe, extended operation and prevent long-term health risks associated with noise exposure.

System		
Noise	Measured Sound Power Level	84 dB(A)
	Guaranteed Sound Power Level	91 dB(A)
Vibration	Total value to which the hand-arm system is subjected	<2.5 m/s^2

4.2. Machine Components

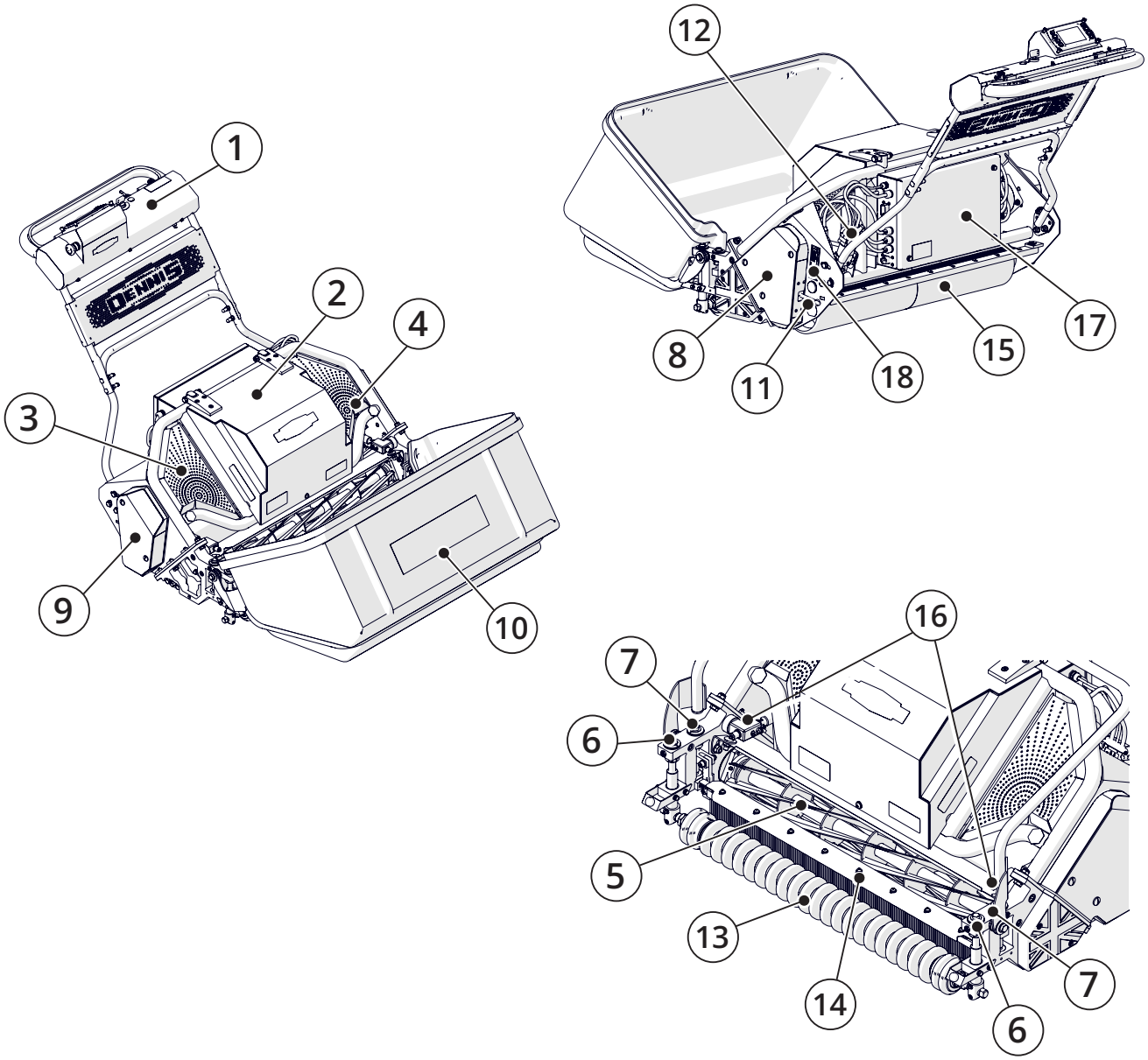


Fig. 3 - Machine components overview

1. Control Components - see ***"4.3. Control Components" p.18***
2. Battery Cover and Battery *(hidden)*
3. Drive Motor *(hidden)*
4. Cylinder Motor *(hidden)*
5. Cutting Cylinder
6. Cut Height Adjuster
7. Grooming Brush Height Adjuster
8. LH Belt Guard
9. RH Chain Guard
10. Grass Box
11. Parking Brake
12. Machine Charging Connector
13. Front Weile Roller
14. Grooming Brush
15. Rear Roller
16. Shear Blade Adjuster
17. Electrical Box
18. Serial Plate

1. Control Components
See *"4.3. Control Components" p.18.*

2. Battery Cover and Battery
Secured with a button head bolt, the battery is protected by this cover. This must remain closed and only accessed for initial battery assembly and service purposes.

3. Drive Motor
This motor powers the rear roller and controls only the drive direction (forwards/backwards) and speed. The timing chain behind RH chain guard (9) will require periodic checks, adjustment and replacement.

4. Cylinder Motor
This motor powers the cylinder, 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 behind LH belt guard (8) will require periodic checks, adjustment and replacement.

5. Cutting Cylinder
The cylinder is the cutting unit of the machine. It is a dedicated (i.e. non-removable) unit in operational use, but can removed for re-grinding and replacement.

Replace a worn or damaged cylinder with genuine Dennis replacement.

DANGER - CYLINDER BLADES

Worn or damaged blades are dangerous. Incorrect use or maintenance can cause serious injury or death. Inspect before and after every use, as per *"6.1. Maintenance Schedule" p.43*.

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

6/7. Cut Height Adjuster & Grooming Brush Height Adjuster
Located either side of the machine, cut and brush height is adjusted here - see ***"5.2.1. Adjust Height of Cut" p.25 and "5.2.2. Adjust Grooming Brush Height" p.27.***

8/9. LH & RH Guards
Behind the RH guard contains the chain to drive the rear roller. Behind the LH guard contains the belt to the cylinder 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.

10. Grass Box
The grass box collects the clippings from the cylinder. Maximum volume 200 L.

11. 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.

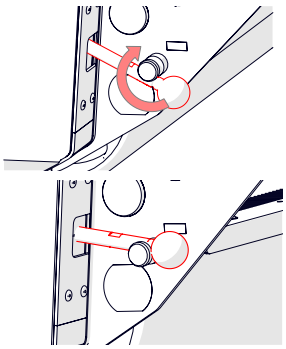


Fig.3A - Parking brake disengaged (above pin), and engaged (below pin).

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.**

12. Machine Charging Connector

The machine charging connector is located at the rear of the machine. It must be removed from its dock before being plugged into the charger. For further details on charging, see ***"5.6.4. Charging Instructions" p.36.***

13. Front Weile Roller

The front weile (grooved) roller provides less turf contact area than a smooth roller, therefore allowing the machine to sit lower. This helps the grass blades stand more upright within the grooves just before cutting, resulting in a more consistent height and improved quality of cut. For details on adjusting height of cut, see ***"5.2.1. Adjust Height of Cut" p.25***

14. Grooming Brush

The grooming brush stands the grass blades upright so they enter the cylinder at a uniform height. This leads to a cleaner and more consistent height of cut. They can also enhance the striping effect left behind.
Adjust height to suit preference. For details on adjusting brush height, see ***"5.2.2. Adjust Grooming Brush Height" p.27***

15. Rear Roller

The powered rear roller drives the lawnmower and supports the machine during operation. It provides stable traction through consistent ground contact, improves straight-line control and lightly compresses the turf, producing a clean, striped finish on the lawn.

16. 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 ***"5.2.4. Shear Blade Adjustment" p.29.***

17. 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.

18. Serial Plate

The serial plate can be found above the parking brake. 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.

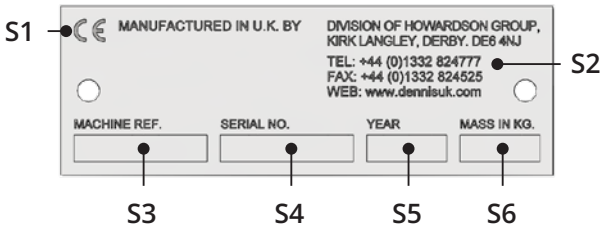


Fig. 3B - Serial plate components overview.

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)

4.3. Control Components

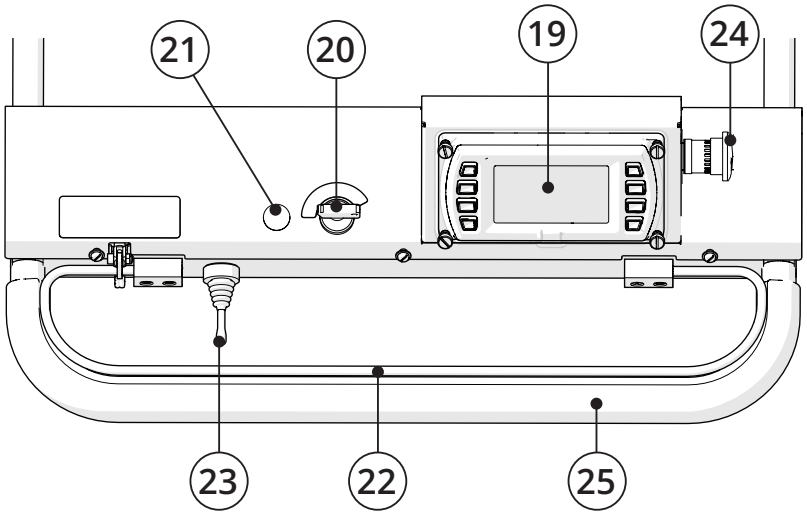


Fig. 4 - Control components overview

19. Display Screen
20. Key Switch
21. Start Button
22. Operator Presence Control (OPC)
23. Drive Toggle Switch
24. Emergency Stop
25. Handlebar

19. Display Screen

The display screen contains vital information and controls to operate the machine. See ***"4.5. Display Screen" p.20*** for more information.

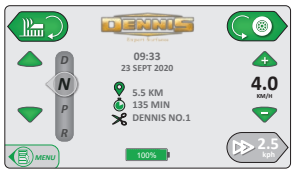


Fig. 4A - Display screen

20. Key Switch

The key switch is used only to power up the machine prior to start button activation. Turning to the ***off*** position will turn all electronics and functions off.
Two keys are supplied with your machine. Spares can be ordered from Howardson Group Spares.

21. Start Button

The start button is used only to power up the machine following key switch activation. After turning the key switch to the ***on*** position, press and hold for approximately three seconds (until a 'click' is heard) to turn the machine ***on***.

22. 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 motors, respectively.

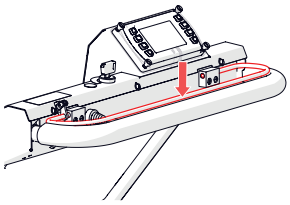


Fig. 4B - OPC

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

When the OPC is released, this indicates you are no longer present or in control. At this, the machine automatically and immediately ceases all power to the motors, regardless of drive switch position or cutter/drive activation via display screen. 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.**

23. Drive Toggle Switch

The Drive Toggle Switch (referred to as the 'Drive Switch' in this document) works with the OPC to power the drive motor of the rear roller. The drive switch position provides different drive functions:

- Neutral (drive switch in the middle) - no power is delivered to the motors. Leave in this position whenever the machine is being switch off or not actively used.
- 'Nudge' (drive switch moved to the right) - requires continuous compression to be used and self-centres on release. Used when a finer degree of movement is required, such as turning or moving around obstacles.
- 'Latched' (drive switch moved to the left) - used when long continuous operation is expected. It will 'lock' into position and not return to centre until manually moved back.

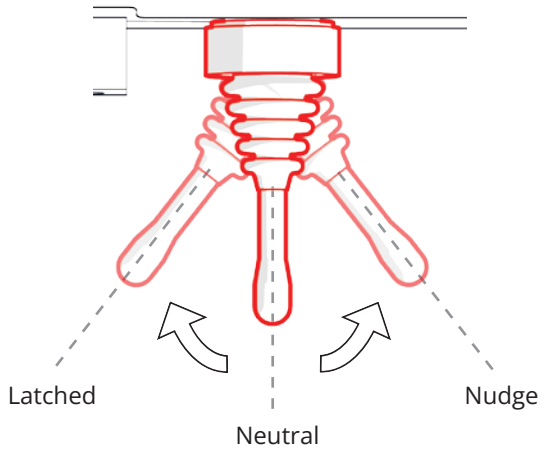


Fig. 4C - Drive Toggle Switch

NOTE - DRIVE SWITCH / DISPLAY CONTROLS

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

24. 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. 4D - 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.**

4.4. Cylinder

The machine is supplied with an eight blade dedicated cylinder. Unlike cassettes, it is fixed and remains in the machine at all times, only to be removed for servicing and grinding.

Cylinder clip rates can be changed via the display screen. Clip rates will automatically adjust based on the speed of the machine, ensuring the clip rate per metre remains the same. For more information on clip rate, see ***"5.5.2. Adjusting Clip Rate" p.34.***

4.5. 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 the display screen 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

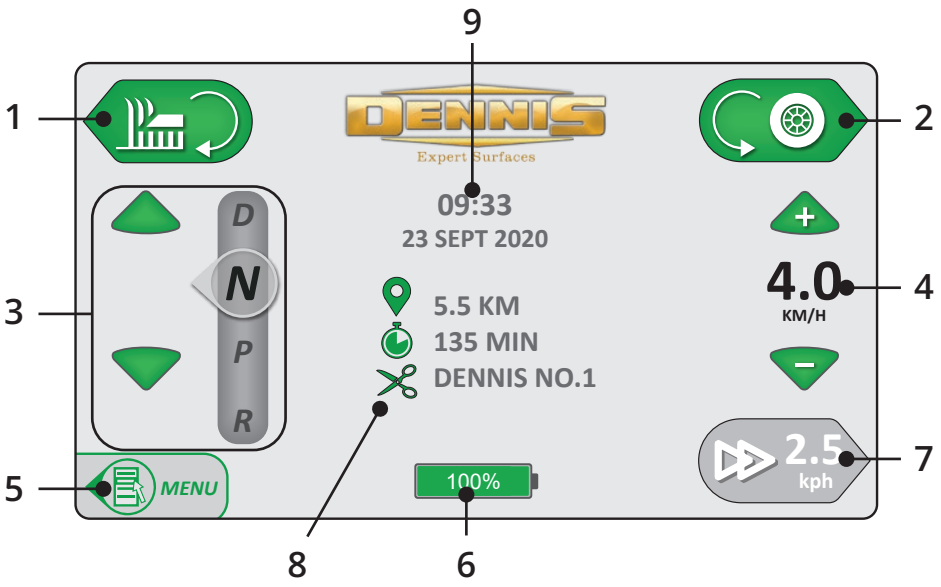


Fig. 5 - Home screen overview

1. Cutter start / stop

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

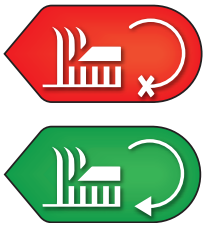


Fig. 5A - Cutting start/stop

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 cylinder 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).

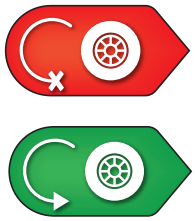


Fig. 5B - Drive start/ stop

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**. Select to go forward. 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 drive switch use) which allows easier manoeuvrability for cornering or moving between pitches.

- **N - Neutral.** Automatically displays when the parking brake is released. Machine will automatically enter Drive (D) when both OPC and drive switch are 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 (see No.7).

- **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 drive switch use) is not possible.

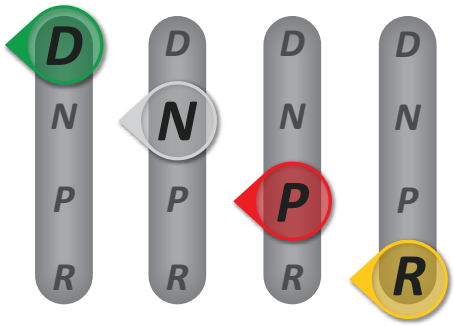


Fig. 5C - Drive mode

4. Drive speed

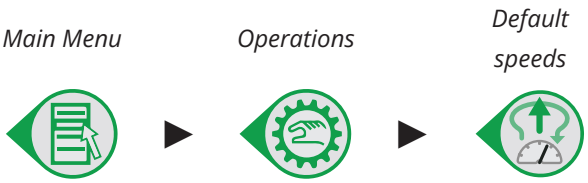
Select the '+' or '-' buttons to alter the top speed of the machine. Single presses change in 0.1 km/h increments, alternatively press and hold to scroll numbers quickly. Acceleration rate remains constant at all speeds.

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 speed units:



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.

Rate Selection		*Select your clip rate. Clip rate maintained even when speed altered.*	
	• 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 ***"6. Maintenance and Servicing" p.43***).
	• Service Icon (Red)		Annual checks not completed and logged (see ***"6. Maintenance and Servicing" p.43***).

6. Battery state of charge

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

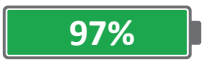
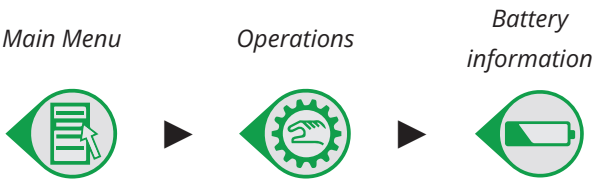


Fig. 5E - Battery icon

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



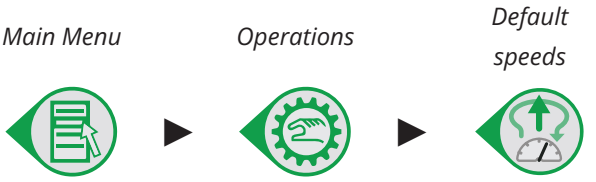
7. Transport mode

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. 5F - 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:

1. Time
2. Date (dd/mmmm/yy)
3. Trip distance (since key on)
4. Trip time run (since key on)
5. Clip information (as applicable)

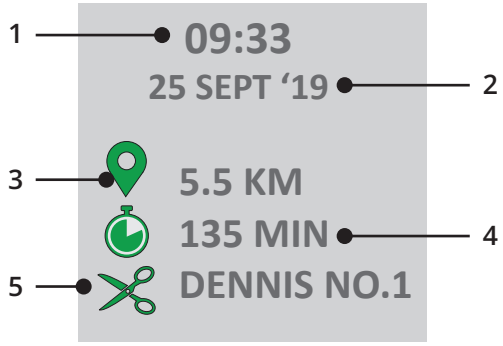


Fig. 5G - Trip information

5.1. Pre-Start and Safety Checks

DANGER - OPERATING RISKS

- Prior to using the machine, ensure you read and understand this Operator Manual carefully. Failure to do so may result in injury and damage to the machine.
- Moving parts can cause serious injury. Keep hands, feet and clothing clear of moving components, particularly the cylinder and rollers. Contact with moving parts will cause severe personal injury or amputation.
- Before turning the machine 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 use.

WARNING - ROTATING BLADES AND MOVING PARTS

- Blades, brushes and rollers can continue to rotate even after the motor has stopped.
- *Never* lift or carry a machine whilst any parts are moving.
- *Always* wait for the cylinder to stop rotating before travelling over anything that is not grass.
- *Never* carry out adjustments whilst the machine is running.

WARNING - MAINTENANCE CHECKS

Before using the machine, ensure all maintenance checks are complete, as per *"6.1. Maintenance Schedule" p.43*.

WARNING - SAFE OPERATING ENVIRONMENT

Always assess the job prior to starting. See *"5.7. Operating Environment" p.40* for further information.

5.2. Cutting Preparation

WARNING - CYLINDER SAFETY

Always turn the machine *off* before adjusting any part of the cylinder or grooming brush. Failure to do so creates a very high risk of cutting or amputation. *Always* wear hand protection.

5.2.1. Adjust Height of Cut

Cut height is adjusted using the supplied setting bar and basic tools.

NOTE - HEIGHT OF CUT

- When adjusting both the height of cut and the shear blade setting, always set the shear blade **first** before modifying the height of cut. Doing the opposite way may result in a different height of cut than planned.
- Remember height of cut is affected by moisture of turf, weight of the machine and thatch density. It is advised to set the height a little higher than your preference and reduce height by trial.

NOTE - SETTING BAR

The setting bar is supplied with two bolts. Use the coach bolt for adjusting cut height and keep in the hole position supplied from the factory.

Tools required:

- Spanners: 13 mm and 15 mm
- Rule

- Setting bar

1. Turn the machine ***off*** and remove the key.
2. Remove the grassbox and fold the carry frame up.
3. On the setting bar, adjust the coach bolt against the rule until the distance between the underside of the bolt head and top of setting bar is that of the desired grass length. Secure with the nut [13 mm spanner] (Fig. 6A).
4. Tip the machine gently back so it rests on the rear roller and handlebar.
5. Two positions along the cylinder are required to be measured and adjusted to result in an even cut. Choosing either end of the cylinder 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. 6B). If it is already, then skip to step 7. If not, then continue to step 6.
6. With the setting bar still in position, locate the cut height adjuster on the same side as being adjusted. Rotate the height adjuster to raise or lower the front roller [15 mm spanner]. Stop adjusting when the head rests within the lip of the shear blade (Fig. 6C).

NOTE - ROLLER HEIGHT ADJUSTMENT

- Clockwise = Decrease height.
- Anti-clockwise = Increase height.
- One full revolution equals 12 clicks. Each click of the adjuster raises/lowers the front roller 0.1 mm.

7. Repeat step 6 for the second position on the other side of the cylinder (Fig. 6D).
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. Unfold the grass box carry frame and return the grass box.
10. Normal use can now be resumed.

Fig. 6 - Adjusting Height of Cut

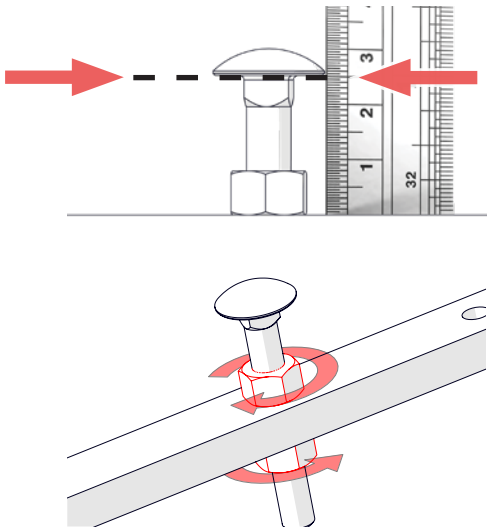


Fig. 6A - Adjust bolt to desired cut height and secure nuts (above example set for 35 mm)

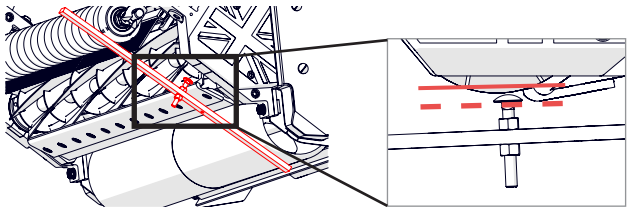


Fig. 6B - Position the setting bar and observe distance between the top of the shear blade and bottom on the bolt head. In this example, the underside of the bolt head (dashed line) is below the shear blade (solid line), indicating the machine cut height is currently too high and therefore needs lowering.

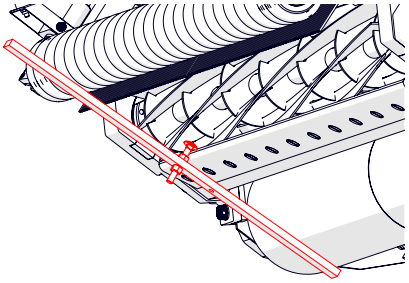


Fig. 6D - Repeat process on the other side

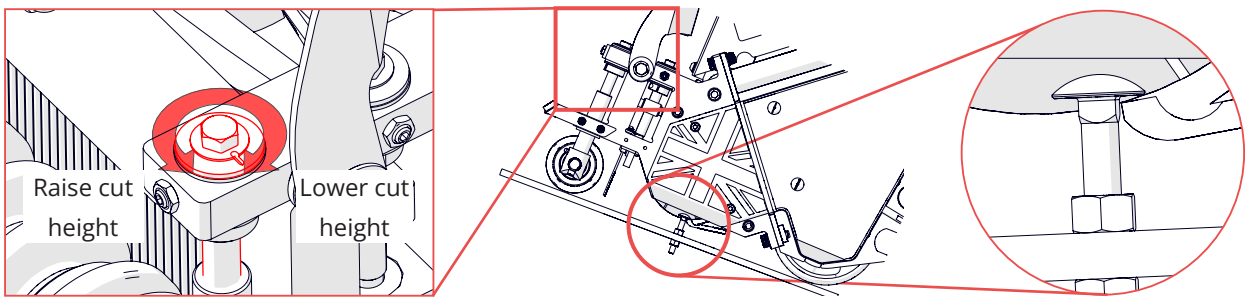


Fig. 6C - Rotate the toothed gear while offering up the setting bar. Stop when the head rests level/within the shear blade

5.2.2. Adjust Grooming Brush Height

Brush height is adjusted using the supplied setting bar and basic tools.

NOTE - SETTING BAR

The setting bar is supplied with two bolts. Use the hex bolt for adjusting brush height and keep in the hole position supplied from the factory.

Tools required:

- Spanners: 13 mm and 15 mm
- Rule
- Setting bar

1. Turn the machine ***off*** and remove the key.
2. Remove the grassbox and fold the carry frame up.
3. On the setting bar, adjust the hex bolt against the rule until the distance between the topside of the bolt head and top of the setting bar is that required. Secure with the nut [13 mm spanner] (Fig. 7A).
4. Tip the machine gently back so it rests on the rear roller and handlebar.
5. Two positions along the groomer brush are required to be measured and adjusted to result in an even brush. Choosing either end first, lay the setting bar across the front and rear roller. Correct height is achieved when the topside of the bolt head is level with the bottom of the bristles (Fig. 7B). If it is already, then skip to step 7. If not, then continue to step 6.
6. With the setting bar still in position, locate the grooming brush height adjuster on the same side as being adjusted. Rotate the height adjuster to raise or lower the groomer brush mechanism [15 mm spanner] (Fig. 7C). Stop adjusting when the head is level with the bottom of the bristles.

NOTE - BRUSH HEIGHT ADJUSTMENT

- Clockwise = Decrease height.
- Anti-clockwise = Increase height.
- One full revolution equals 4 clicks. Each click of the adjuster raises/lowers the brush 0.5 mm.

7. Repeat step 6 for the second position on the other side of the cylinder.
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. Unfold the grass box carry frame and return the grass box.
10. Normal use can now be resumed.

Fig. 7 - Adjusting Grooming Brush Height

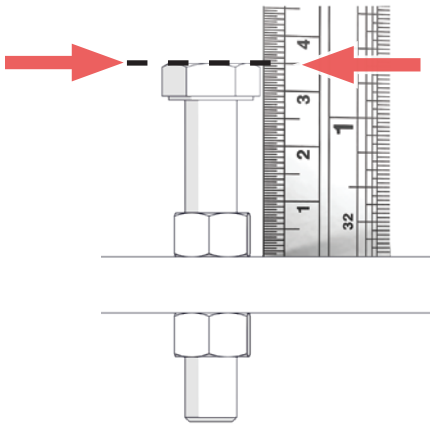


Fig. 7A - Adjust bolt to desired brush height and secure nuts (above example set for 35 mm)

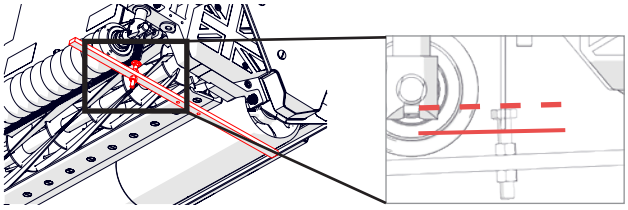


Fig. 7B - Position the setting bar and observe distance between the bottom of the groomer bristles and top on the bolt head. In this example, the topside of the bolt head (dashed line) is above the bristles (solid line), indicating the brush height is currently too low and therefore needs raising.

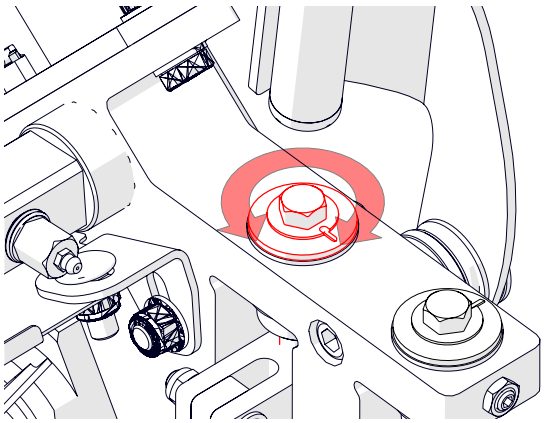


Fig. 7C - Grooming brush height adjustment

5.2.3. 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. 8A & 8B). Secure the outer bolt head while doing so [17 mm spanner].
3. Repeat with the other side.
4. Adjust the handlebar to the desired height (Fig. 8C).
5. When set, tighten the 6 x inner nuts.

Fig. 8 - Handlebar adjustment

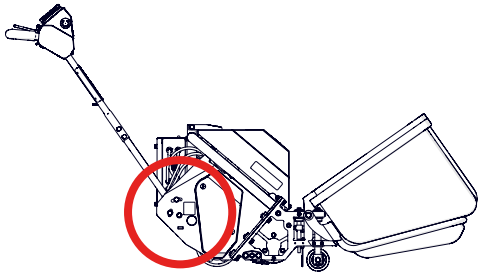


Fig. 8A - Securing the bolt head

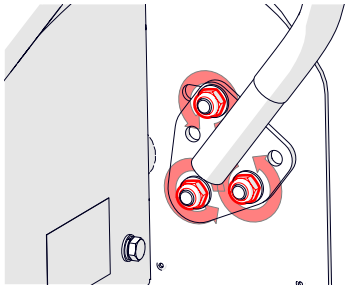


Fig. 8B - Loosening the inner nut

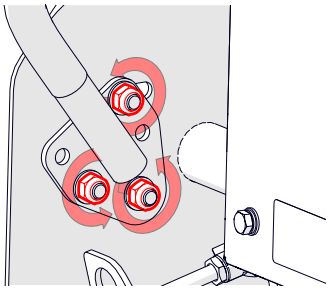


Fig. 8C - Repeating adjustment for other side

5.2.4. Shear Blade Adjustment

CAUTION - RISK OF INJURY

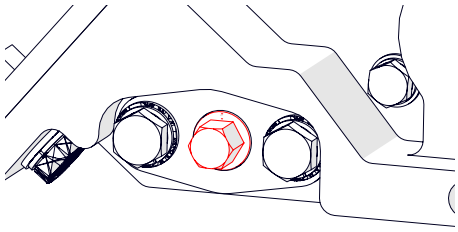
- ***Always*** **turn the machine *off* before commencing this task.**
- ***Always*** **wear protective gloves to reduce risk of cuts and finger trapping.**

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
- 15 mm 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. 9A). Chock the rear roller to stop unintended rolling.
4. Choosing the left or right hand side of the cylinder, test the cut by moving the cylinder blade with a gloved hand and using a piece of paper between the cylinder and shear blade (Fig. 9B). 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 above the cylinder are two shear blade adjusters. On the side being adjusted, rotate the brass hex bolt of the adjuster [15 mm spanner] (Fig. 9C). Only very small adjustments are required - see note below. Start with one click and repeat the paper cut test. Repeat adjustment until the paper cuts cleanly.

NOTE - CLICK ADJUSTMENT

- Clockwise = Decrease gap (i.e. cut 'on').
- Anti-clockwise = Increase gap (i.e. cut 'off').
- Each click of the adjuster moves the shear blade 0.003 mm (3 microns). One full revolution moves the shear blade 0.1 mm.
- One full revolution equals 30 clicks.

6. Repeat step 5 on the opposite side.
7. Repeat the paper cut test on both sides. Adjust where necessary.
8. Lift the machine gently up to rest on its front and rear rollers. Unfold the grass carrier.
9. The machine is now ready for use.

Fig. 9 - Shearblade adjustment

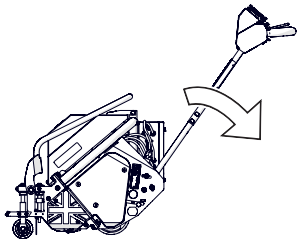


Fig. 9A - Tip to rest of handlebars

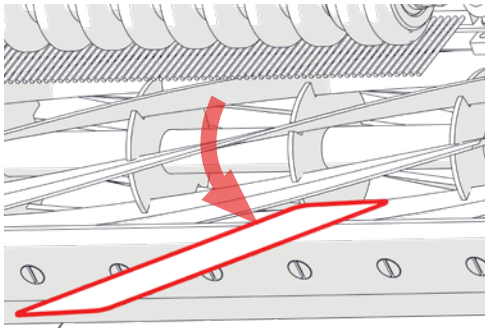


Fig. 9B - Test the cut with a piece of paper.

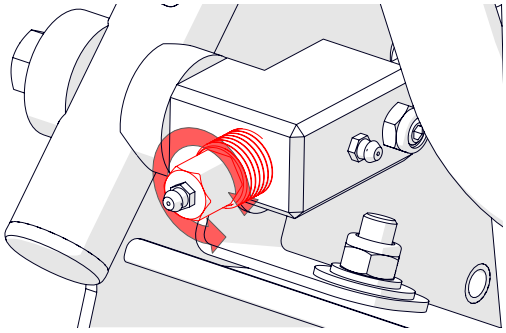


Fig. 9C - Fine-tune the cut by rotating the adjuster clockwise or anti-clockwise.

5.3. Power On and Shut-Down

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

1. Insert the key into the barrel and turn to the ***on*** position (Fig. 10A).
2. Press and hold the start button (Fig. 10B) until an audible 'click' is heard (approximately three seconds). Release the button.
3. The display screen will show a start up sequence (Fig. 10C) until the home screen appears (Fig. 5).
4. To shut-down the machine, turn the key switch to off (Fig. 10D) and remove the key.

Fig. 10 - Power on procedure

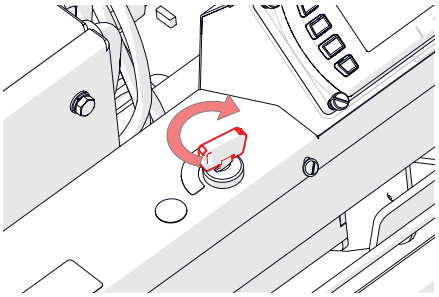


Fig. 10A - Key switch to on

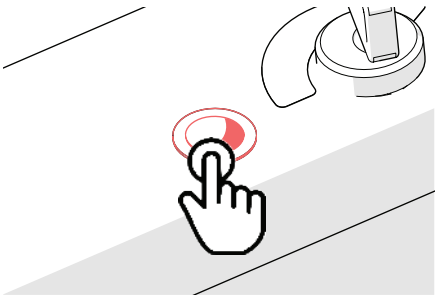


Fig. 10B - Start button

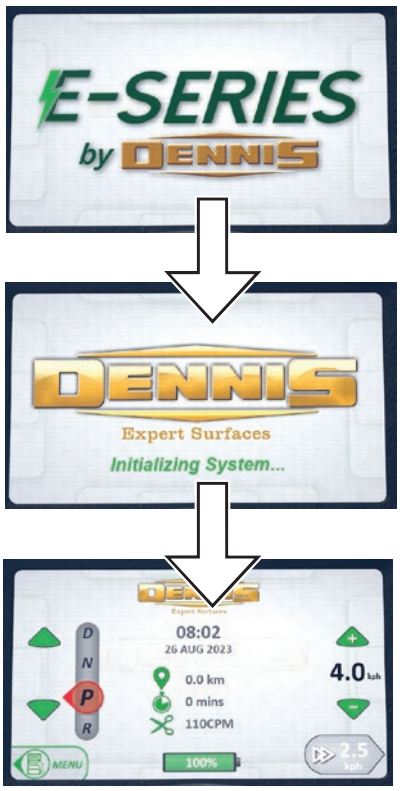


Fig. 10C - Start up sequence

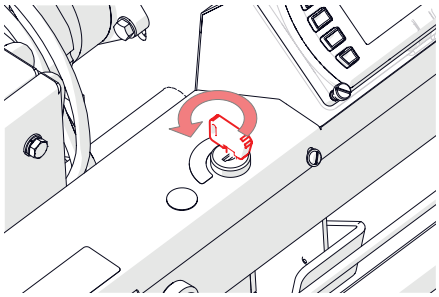


Fig. 10D - Key switch to off

5.4. Drive

5.4.1. Selecting Drive Mode and Moving

CAUTION - HANDLEBAR HEIGHT

Prior to moving the machine, set handlebar to the correct height. See *"5.2.3. Handlebar Height Adjustment" p.28*.

1. Turn the machine ***on*** (see ***"5.3. Power On and Shut-Down" p.30).***
2. Release the parking brake (Fig. 11A).
3. On the display, select the drive mode required (Drive (D) or Reverse (R)) (Fig. 11B). The 'Drive start / stop' icon changes colour from grey to green.
4. Depress the OPC (Fig. 11C).
5. Use the drive switch to activate the drive motor (Fig. 11D). Alternatively select 'Drive start/stop' on the display screen.
6. To stop, release the OPC or return the drive switch to centre neutral position.
7. Apply the parking brake (Fig. 11E) and if required, turn the machine ***off.***

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 cylinder and blades.

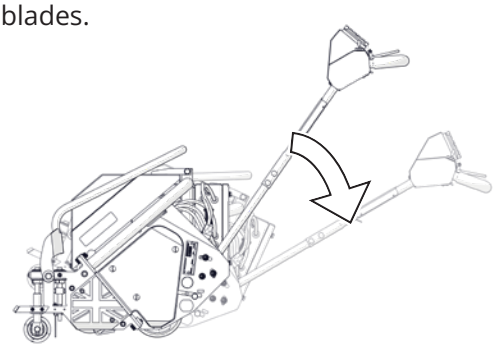


Fig. 11 - Driving procedure

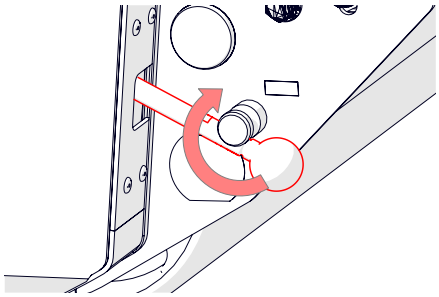


Fig. 11A - Parking brake release

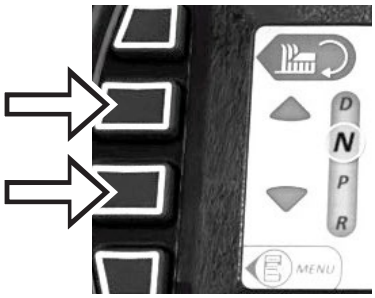


Fig. 11B - Setting drive mode

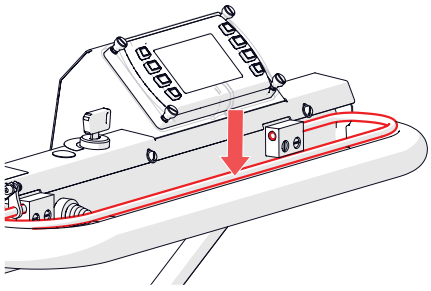


Fig. 11C - Depress the OPC

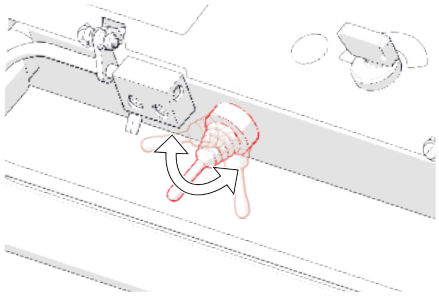


Fig. 11D - Using the drive switch to select drive type (i.e. nudge or latched)

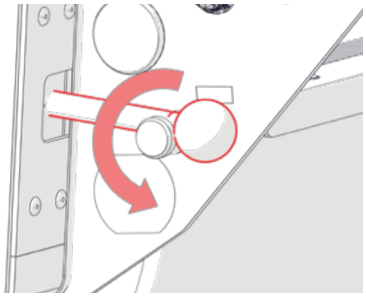


Fig. 11E - Parking brake engage

5.4.2. 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 slopes 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.**

5.5. Cutting

5.5.1. Moving and Cutting

DANGER - OPERATING RISKS

- **Ensure all 'Pre-use' checks have been completed and the surrounding area is safe.**
- **Moving parts can cause serious injury. Keep hands, feet and clothing clear of moving components, particularly the cylinder and rollers. Contact with moving parts will cause severe personal injury or amputation.**

WARNING - ADJUSTMENTS

***Never* carry out adjustments whilst the machine is running.**

NOTE - HEIGHT OF CUT

Prior to cutting, set the cylinder to the correct cut height. See ***"5.2.1. Adjust Height of Cut" p.25.***

1. Turn the machine ***on*** (see ***"5.3. Power On and Shut-Down" p.30).***
2. Release the parking brake (Fig. 11A).
3. On the display, set the drive mode to Drive (D) (Fig. 12A). The 'Drive start / stop' icon changes colour from grey to green.
4. Depress the OPC (Fig. 12B).
5. Press the 'Cutter start / stop' button to power on the cylinder (Fig. 12C).
6. Use the drive switch to power the drive motor. Alternatively select 'Drive start/stop' on the display screen (Fig. 12D).
7. 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 180° turns, tip the machine back slightly and use the drive switch on 'nudge'.
8. To stop the cylinder motor, release the OPC or press 'Cylinder start / stop'. Releasing the OPC will also stop the drive motor (Fig. 12E).
9. Return the drive switch to centre position.

Fig. 12 - Drive Procedure

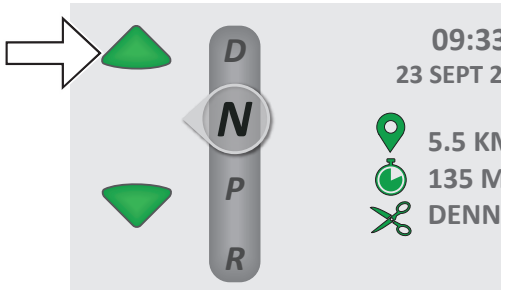


Fig. 12A - Setting drive mode

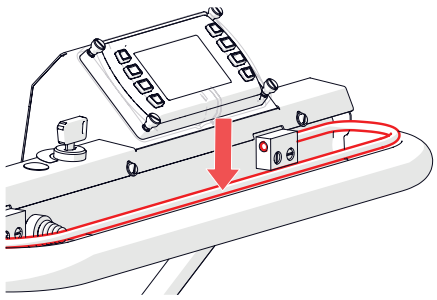


Fig. 12B - Depress the OPC

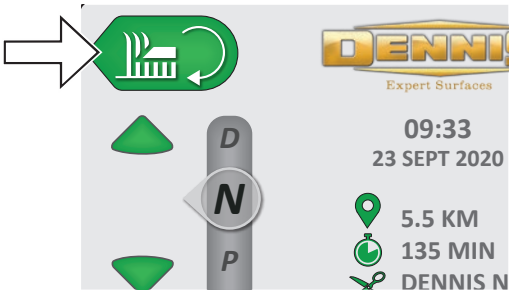


Fig. 12C - Power the cylinder unit on

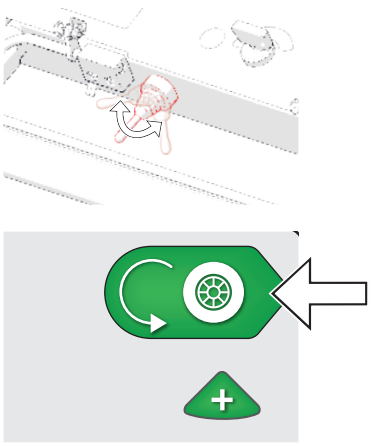


Fig. 12D - Activate drive with either the drive switch or drive start/stop button

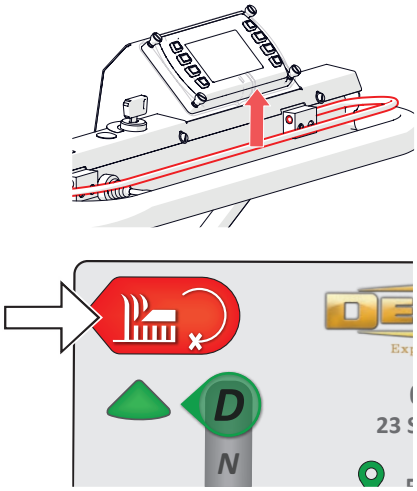


Fig. 12E - Stop the cylinder motor

5.5.2. 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 cylinder 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.

	Cylinder (8 blade)
CPM options	85, 90, 95, 100, 105, 110

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.

To adjust the clip rate of the cylinder, 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).

5.5.3. 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'.

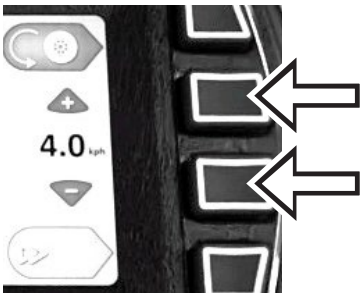


Fig. 13 - Adjusting Drive Speed

5.5.4. 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 along with drive switch 'nudge'.
- 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 operate the cylinder blade without cutting grass. This can 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.

5.6. Batteries and Charging

5.6.1. Battery Specifications

For battery and charger specification, see *"4.1.2. Specification Table" p.13* and on the battery and charger themselves.

5.6.2. Battery Handling

WARNING - BATTERY HANDLING AND DAMAGE

- ***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 in this manual. 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.**
- ***Never*** **attempt to disassemble, repair or modify either the battery or charger.**

WARNING - WATER INGRESS AND MOISTURE HAZARDS

- ***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.**

CAUTION - BATTERY ACCESS

The battery is located under the battery cover and for most day-to-day operations, does not require access or removal. It must only be accessed or removed when being serviced by authorised personnel.

5.6.3. 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. This prevents against problems such as over/undercharging, reduced capacity and overheating.

No operator input is required and it runs automatically.

5.6.4. Charging Instructions

WARNING - CHARGING AND CHARGER USE

- ***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** *"5.8. Emergency Procedures" p.41***. Replace the battery.**

Follow the charging instruction below for correct and safe use:

1. Plug the charger into the power supply.

Ensure power is live by checking the charger lights are illuminated (Fig. 14A).

2. Position the machine within range of the charger - the charger-to-machine lead can extend a maximum of 2 m, with an additional 1.5 m power lead from the wall outlet to the charger. Engage the parking brake and keep the machine ***on*** (Fig. 14B).
3. Remove the machine charging connector from its holder. Connect this to the charger-to-machine lead - it will only connect one-way round (Fig. 14C).
4. The machine display screen will now show the machine is in charge mode (Fig. 14D). The charger will also show a solid red light to indicate charging in progress (Fig. 14E).
5. Once the battery reaches 100%, the red light on the charger will be replaced by a green light (Fig. 14F).
6. Unplug the charger-to-machine lead from the machine. Return the machine charging connector to its holder.
7. Normal use can now resume.

Fig. 14 - Charging instructions

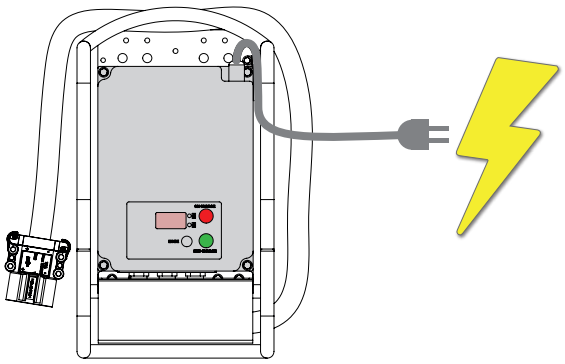


Fig. 14A - Plug the charger into the mains socket

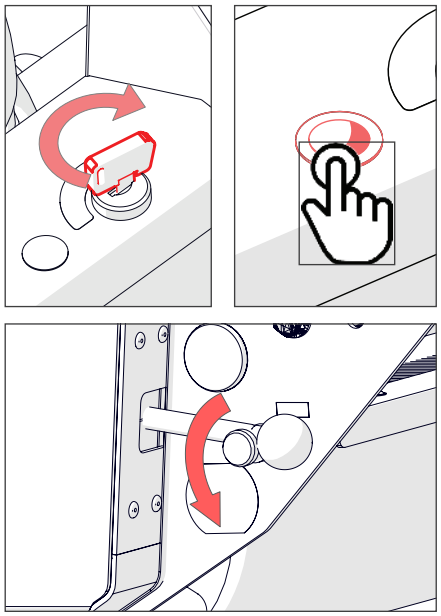


Fig. 14B - Engage parking brake. Keep power on

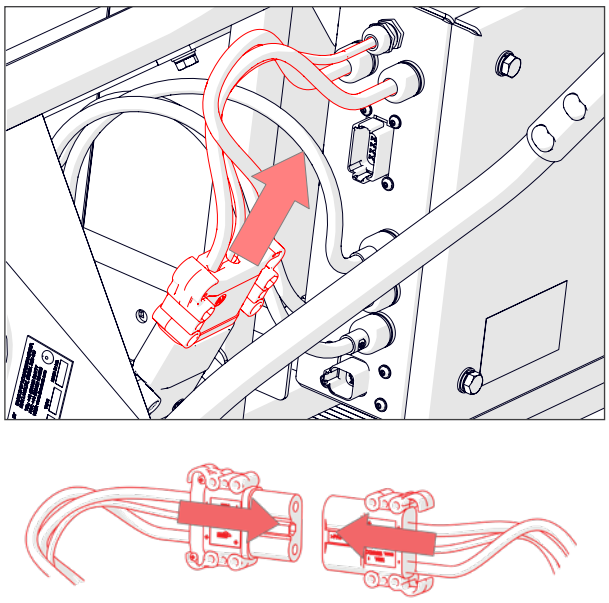


Fig. 14C - Remove the machine charging connector and plug into the charger

Fig. 14D - Charging progress indicator

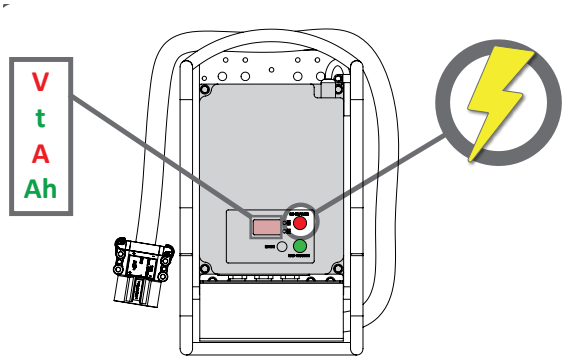


Fig. 14E - Check the charger indications

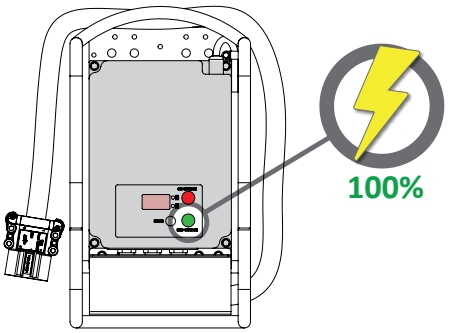


Fig. 14F - Wait until fully charged

5.6.5. Low Power Mode

On reaching 3% SoC, the machine will enter 'low power mode' whereby the cylinder 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 - BATTERY DEGRADATION

We recommend to keep the machine above 20% charge to avoid long term battery degradation.

5.6.6. 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 SoC between 40–60%, in temperatures between +5°C to +25°C. For further storage guidance, see ***"6.5. Storage" p.56.***

5.6.7. Self-Discharge

Lithium battery packs will self-discharge over extended periods of time without maintenance. Regular monitoring and maintenance is essential for long storage or idle periods - see ***"6.5. Storage" p.56***.

Once lithium-ion cells discharge below a certain voltage they become unusable (i.e. deep discharge state) at which point they will not be recoverable and must be replaced. Howardson Group will not be held responsible for damage due to neglect.

5.6.8. Battery Disconnection

WARNING - RISK OF SHOCK

The battery remains energised even with the machine switched OFF. Disconnect only using the designated connector and wear electrically insulating gloves. Do not touch live terminals or bring metal tools near the battery during connector removal.

To disconnect the battery:

1. Turn the machine ***off*** and remove the key.
2. Open the battery cover using a 5 mm hex

key.

3. Locate the positive and negative battery terminals. Press the release button located on the side of the terminal head and pull upwards. Stow the cables safely away.
4. On reconnection, insert positive to positive and negative to negative leads. An audible 'click' will be heard to indicate a secure connection. Secure the battery cover.

5.6.9. Electrical Box

WARNING - RISK OF SHOCK

Opening the electrical box will void the machine warranty. However, if there must be access, then *always* disconnect the battery and wait several minutes before opening or touching internal parts. This is due to a risk of electrical shock, short circuiting and stored electrical energy.

The electrical box is located at the rear 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.

5.6.10. Replacement and Disposal

CAUTION - BATTERY PRECAUTIONS

- **Wear suitable PPE including gloves and safety glasses.**
- **The battery is heavy and it is recommended for two people to remove from the machine.**
- **Replace batteries with genuine Dennis replacement.**

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.

To remove a battery:

1. Turn the machine ***off*** and remove the key.
2. Open the battery cover and disconnect the battery following the procedure in ***"5.6.8. Battery Disconnection" p.38***.
3. With two people, support and lift the battery from the chassis to the floor.

5.7. Operating Environment

CAUTION - ENVIRONMENTAL CONDITIONS

Failure to observe the conditions listed below may result in a risk to the operator and damage to the machine.

Temperature:

- Use between -20 to +40°C*. However usage in the upper and lower limits of this range will affect performance and battery life.
- Operators must take necessary precautions against temperature, such as sun protection and suitable clothing.

**The machine can operate beyond the temperature range optimum for grass cutting. Grass is best cut between 10-30°C.*

Weather:

- Use in dry conditions wherever possible. Do not use on excessively wet or frozen ground. This avoids damage to motor 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.
- Do not use in adverse weather conditions (e.g. storms, high wind, risk of lightning etc).
- 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 *"5.4.2. Operating on Slopes" p.32.)*
- Before use, check to ensure the terrain is free from obstacles and obstructions, including rocks, branches and debris.

Humidity:

- Use between 30–70% RH. High humidity can lead to rust and corrosion on metal parts, and to fungal diseases on the grass after cutting.
- Low humidity can lead to wilting and browning of the grass after cutting.

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.

5.8. Emergency Procedures

5.8.1. In the Event of a Breakdown

WARNING - MACHINE BREAKDOWN

- **Take full care and attention while investigating the cause of a fault. 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 ***"6.7. Troubleshooting & FAQ" p.57.***

In the event of a breakdown:

1. Turn the machine ***off*** and remove the key.
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 chain and parking brake mechanisms. Ensure in good condition.
   - If the cause is related to the cylinder, check the cylinder motor for damage or loose connections. Remove the LH guard cover to inspect the belt and mechanisms for good working order - see ***"6.2.1. Belt/Chain Replacement and Tensioning" p.46*** 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.

5.8.2. 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.

5.8.3. Battery Leakage

CAUTION - BATTERY LEAKAGE

- **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.**
- **The battery is heavy and it is recommended for two people to remove from the machine.**

The chemicals inside the battery are contained within a sealed unit. Exposure to these contents is only possible if the battery leaks, is subjected to high temperatures, or is physically or electrically mishandled. 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 to a well ventilated area (do ***not*** turn the machine ***on***).
3. Open the battery cover using a 5 mm hex key and disconnect the battery following the procedure in ***"5.6.8. Battery Disconnection" p.38***.
4. Remove the battery, taking care to avoid tipping or shaking. Place into a clear plastic bag with sand or vermiculite. Label as hazardous.
5. Use a neutralising solution (such as white vinegar) on a cloth to remove leftover residue.
6. Dry thoroughly and dispose of cloths.
7. Safely dispose of the battery.

6.1. Maintenance Schedule

WARNING - MAINTENANCE

- ***Always*** **keep the machine maintained with the schedule and procedures outlined below.**
- **Failure to carry out these checks at the specified intervals will result in damage to your machine, poor machine performance and possible injury to personnel.**
- **Not servicing your machine correctly will invalidate your warranty.**
- ***Always*** **use genuine Dennis parts for servicing and replacements.**
- ***Never*** **use the machine if it is damaged or faulty in any way.**

The following checks must be actioned as per date or running hours, 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 containments/oil. Complete checks with the machine ***off***.

Maintenance Check	Daily		Weekly 25hr	Monthly 100hr	6-monthly 600hr	Annually 1,200hrs
	Pre-use	Post-use				
Electrical (inc. battery)						
Check condition of the following for signs of damage: • Drive motor outer casing • Cylinder motor outer casing • Battery • Charge port cover and latch • Display screen	•	•				
Check condition of cabling/harness for signs of damage and fraying.	•	•				
Check the battery level has enough charge for the intended session. Always keep the battery above 5% (47.6 V)	•	•				
Check no damage to the battery (corrosion etc).			•			
Check the machine charger holder secures the machine charger connector and damage free.			•			
Check no damage to the charger and it powers on correctly.			•			

Maintenance Check	Daily		Weekly 25hr	Monthly 100hr	6-monthly 600hr	Annually 1,200hrs
	Pre-use	Post-use				
Cylinder ⚠						
Check cylinder and shear blade for wear or damage (impact, dents, material cracking and excessive thinning). Replace or re-grind worn blades. **Replace damaged blades.**	•	•				
Check the blades spin freely, with no grinding or metal-on-metal contact noises (***always*** turn the machine ***off*** first).	•	•				
Check the quality of cut. Adjust the shear blade if required.	•	•				
Grease cylinder bearings, shear blade adjuster block and weile roller[1].			•			
Adjust the metal deflector.	*As required*					
Chassis						
Check all guards are fitted correctly.	•					
Visually check all fixings (secure and in place).	•					
Check the cutting height is set correctly.	•					
Check the grass box is fitted correctly.	•					
Clean off all grass cuttings from bodywork.		•				
⚠ Clean off all grass cuttings from the cylinder blade (ensure the machine is turned off first. Use a long handled brush).		•				
Check front roller bushes and bearings for wear. Replace if necessary.			•			
Grease LH & RH rear roller collars[1].			•			
Remove both guards and visually check condition of drive chain/belt. Adjust/ replace if required *(check within first 20hrs and after replacement).*				•		
Check condition of rear roller bearings and bushes. Replace if necessary.					•	
Replace internal grease for rear rollers.						•

Maintenance Check	Daily		Weekly 25hr	Monthly 100hr	6-monthly 600hr	Annually 1,200hrs
	Pre-use	Post-use				
Controls						
Check the following for signs of damage and that they operate freely: • Key switch • OPC • Emergency stop • Parking brake.	•	•				
Check the drive switch works in both nudge and latch positions.	•	•				

[1] See section ***"6.2.6. Greasing points" p.53***

6.2. Servicing Instructions

WARNING - SAFETY

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

WARNING - ELECTRICAL COMPONENT ACCESS

- ***Always*** switch off the power and disconnect the battery before servicing or making repairs.
- ***Never*** open or attempt any work inside the electrical box.
- ***Never*** operate the machine if electrical wires are damaged or bare cable is exposed

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.

6.2.1. Belt/Chain Replacement and Tensioning

The procedure and illustrations below describe the removal of the drive chain, however the cylinder belt is removed using the same method and tools. Behind the RH cover is the drive motor chain and behind the LH cover is the cylinder belt.

Tools required:

- Slotted screwdriver
- Spanners: 13 mm (x2) and 17 mm
- Replacement belt/chain (*if required, cylinder belt p/n SP11086, drive chain p/n SP11148)*

1. Turn the machine ***off*** and remove the key.
2. Remove the outer screws of the LH/RH cover [slotted screwdriver] (Fig. 15A) and keep the cover to the side.
3. Loosen slightly the 3 x top nuts supporting the motor [2 x 13 mm spanner] (Fig. 15B).
4. Loosen slightly the central nut supporting the tensioner block/motor [2 x 13 mm spanner] (Fig. 15C).
5. While supporting the weight of the motor and chain/belt, loosen fully the tensioner block lock nut [17 mm spanner] below the tensioner block and lower (Fig. 15D & Fig. 15E).
6. Replace the chain/belt, if required (Fig. 15F).
7. Slide the entire motor assembly up until the chain/belt is taut. Tighten the tensioner block lock nut [17 mm spanner] (Fig. 15G).
8. Check the tension of the chain/belt. There must be no more than 10 mm deflection (chain) or 90° twist (belt) (Fig. 15H). Re-adjust the locknut if necessary.
9. Tighten the nut supporting the tensioner block [2 x 13 mm spanner] (Fig. 15I).
10. Tighten the 3 x top nuts [2 x 13 mm spanner] supporting the motor (Fig. 15J).
11. Double check the deflection/twist tension of the belt. There must be no more than 10 mm (chain) or 90° (belt).
12. Attach the LH/RH cover [slotted screwdriver].
13. The machine is now ready for use.

Fig. 15 - Drive chain replacement / tensioning

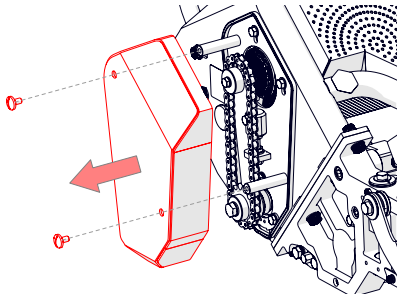


Fig. 15A - Remove 3 x outer screws and cover.

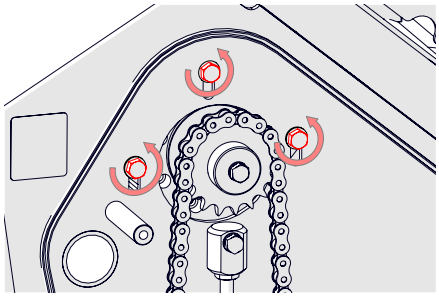


Fig. 15B - Loosen slightly the motor 3 x top nuts.

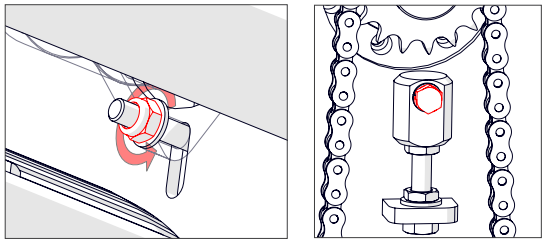


Fig. 15C - Loosen slightly the tensioner block/motor nut.

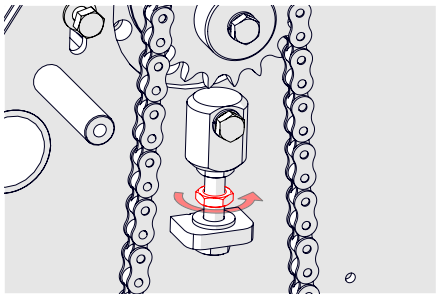


Fig. 15D - Loosen fully the tensioner block locking nut.

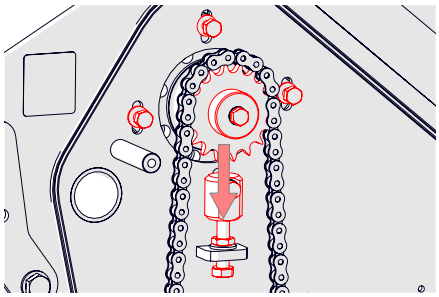


Fig. 15E - Support the weight and lower.

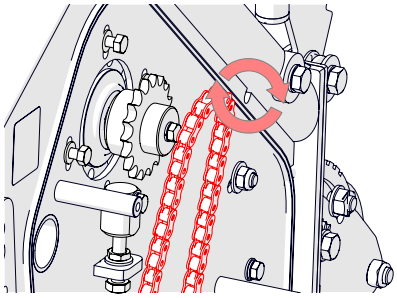
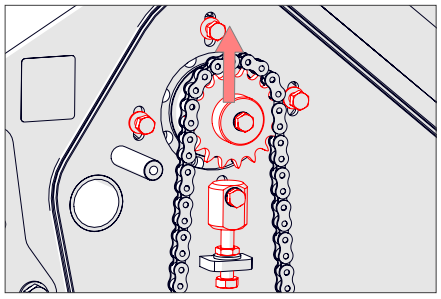


Fig. 15F - Replace the chain.



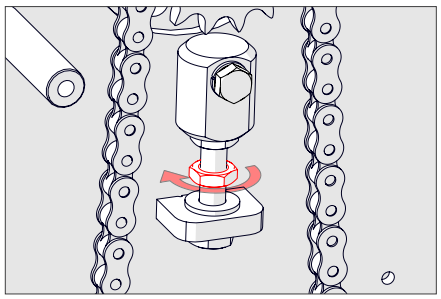
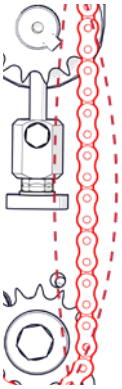


Fig. 15G - Tighten the belt and tensioner block locking nut.



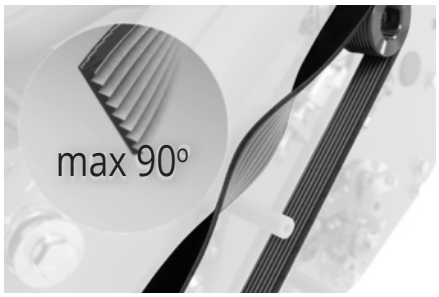
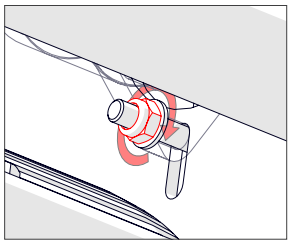


Fig. 15H - Check the amount of deflection in the chain (8-10 mm) / belt twist tension



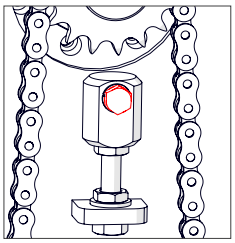


Fig. 15I - Tighten the tensioner block/motor nut.

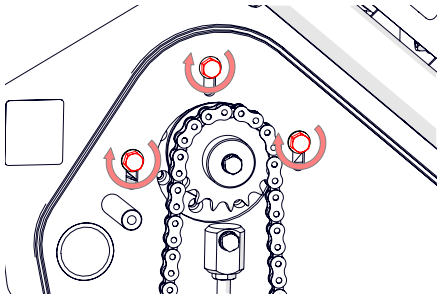


Fig. 15J - Tighten the motor 3 x top nuts.

6.2.2. Removing the Cylinder

The cylinder will need removing for replacement or for re-grinding, but for most of its working life it will remain fixed in the machine.

WARNING - SAFETY

- **You *must* turn the machine *off* before service work. Failure to do so may cause major injury.**
- **Always wear safety gloves when carrying out work on the cylinder.**

Tools required:

- Slotted screwdriver
- Spanners: 13 mm (x2), 17 mm and 19 mm
- Hex key: 5 mm, 6 mm, 8 mm and 10 mm

1. Remove the cylinder drive belt, following steps 1-6 in ***"6.2.1. Belt/Chain Replacement and Tensioning" p.46.***
2. Remove the LH side plate guard [6 mm hex key] (Fig. 16A).
3. Remove the cylinder drive pulley [19 mm spanner] (Fig. 16B).
4. Remove the pulley spacer and keyway (Fig. 16C).
5. Remove the 2 x M10 cap head bolts from each side of the machine securing the deflector plate [8 mm hex key] (Fig. 16D). Remove the two bolts and slide the deflector out from the top (Fig. 16E).
6. Remove the R-clip from the clevis pin securing the shear blade adjuster from each side of the machine (Fig. 16F).
7. Remove the 2 x M12 cap head bolts [10 mm hex key] from both sides of the machine securing the shear blade adjuster block (Fig. 16G).
8. For both sides, remove the clevis pin from where the R-clip was removed. Remove both pivot blocks and adjusters away from the machine (Fig. 16H).
9. Support the shear blade carrier and remove the 2 x M10 cap head bolts of the left hand shear blade carrier [8 mm hex key] (Fig. 16I). Lower that side to the floor gently.
10. Support the shear blade carrier and remove the 2 x M10 bolts of the right hand shear blade carrier [17 mm spanner] (Fig. 16J). Remove the plate and cam bolt. Lower the whole carrier to the floor gently.
11. Tip the machine back to gain access to the underside. Remove the shear blade carrier (Fig. 16K).
12. Tip the machine forwards onto both rollers.
13. Remove the 3 x M8 bolts supporting the left hand cylinder bearing [13 mm spanner] and M6 bolt supporting the side plate [10 mm spanner] (Fig. 16L).
14. Insert a piece of wood or similar though the cylinder and wedge it against the front roller to stop it rotating. Remove the 3 x M8 bolts supporting the right hand cylinder bearing [13 mm spanner], and M6 cap head bolt supporting the side plate [5 mm hex key] (Fig. 16M). Support the cylinder and lower to the floor.
15. Tip the machine back to gain access to the underside. Remove the cylinder (Fig. 16N). It is now free to be replace/re-ground.
16. When inserting a cylinder, refer to ***"6.2.1. Belt/Chain Replacement and Tensioning" p.46.*** to aid in reapplying the belt and tensioning.

Fig. 16 - Cylinder Removal

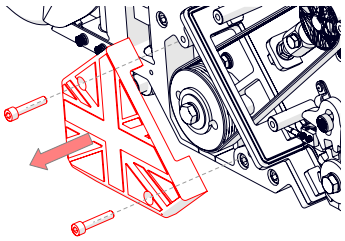


Fig. 16A - Remove the side plate guard

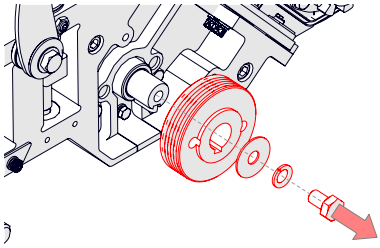


Fig. 16B - Remove the cylinder drive pulley

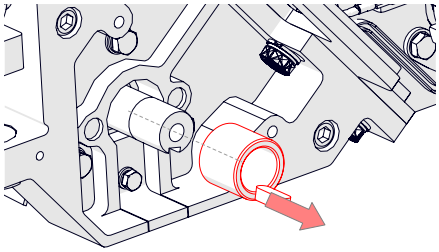


Fig. 16C - Remove the pulley spacer and keyway

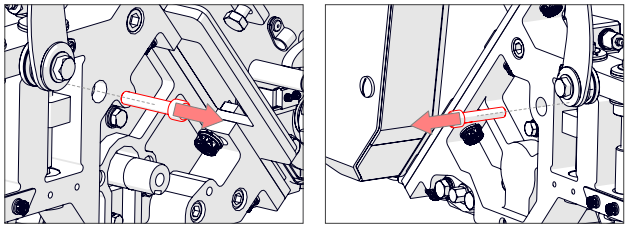


Fig. 16D - Remove the deflector plate bolts

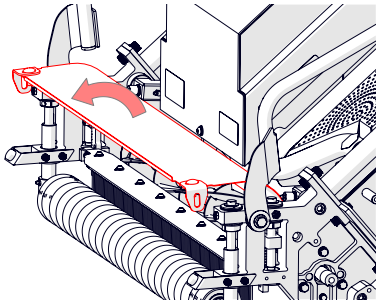


Fig. 16E - Slide the deflector plate out

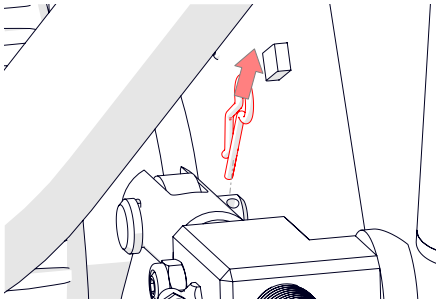


Fig. 16F - Remove the shear blade R-clip

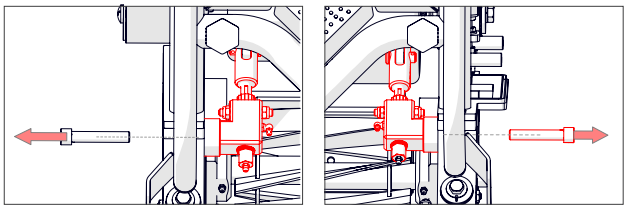


Fig. 16G - Remove the shear blade top bolt and saddle washer

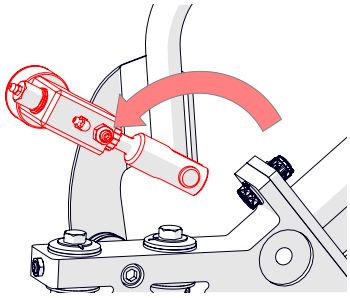


Fig. 16H - Remove the pivot block and adjuster

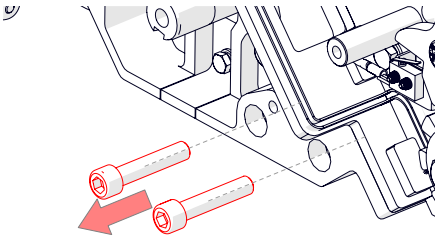


Fig. 16I - Remove the LH 2 x shear blade bolts

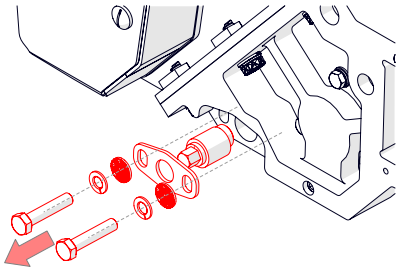


Fig. 16J - Remove the RH 2 x shear blade bolts and cam

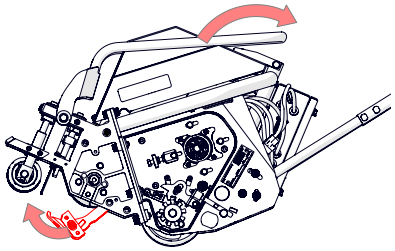


Fig. 16K - Remove shear blade assembly

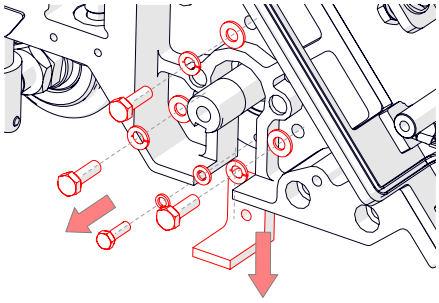


Fig. 16L - Remove bolts from LH cylinder bearing

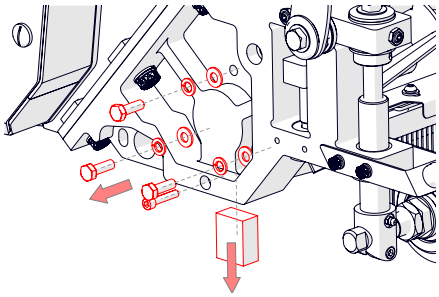


Fig. 16M - Remove bolts from RH cylinder bearing, and central shaft

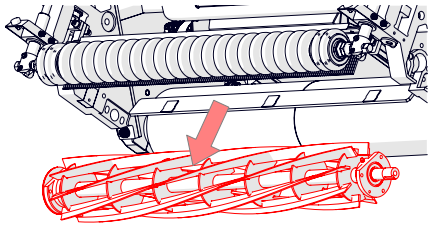


Fig. 16N - Remove the entire cylinder and bearings from the machine

6.2.3. 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.

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.**

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.

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 visually 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. Tip the machine gently back upright. The machine will now need the shear blade adjusting to account for the change to the cylinder, ***"5.2.4. Shear Blade Adjustment" p.29.***

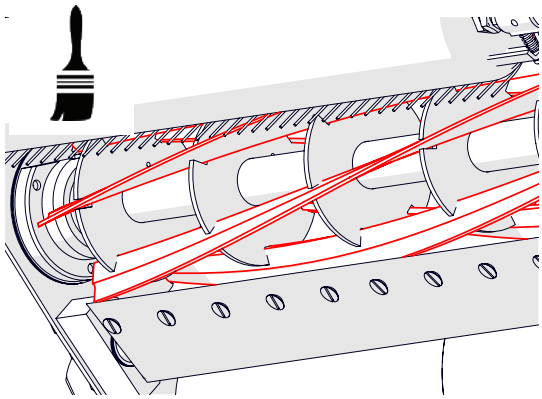


Fig. 17 - Backlapping

6.2.4. 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, 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 energy 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. 18). It is recommended to grind to these values.

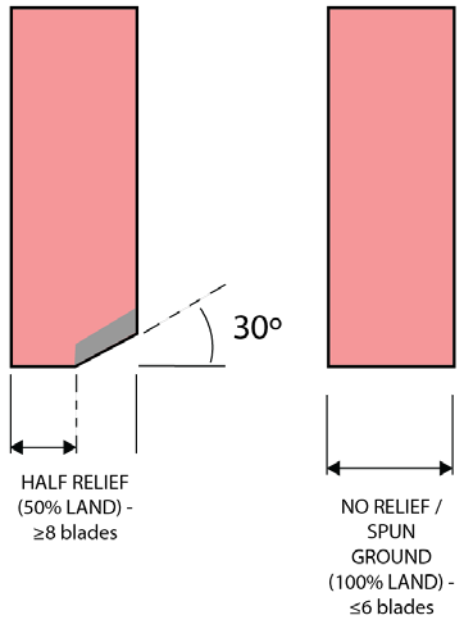


Fig. 18 - Recommended cylinder grind angle

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. 20).

Factory standard is a front angle of -10° and top angle of -8°, as shown in Fig. 19.

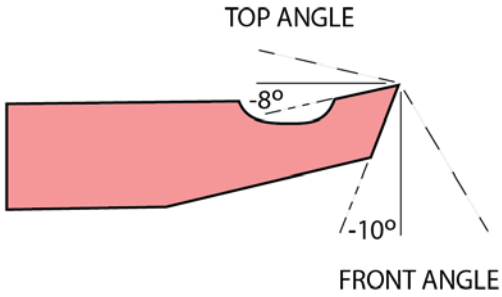
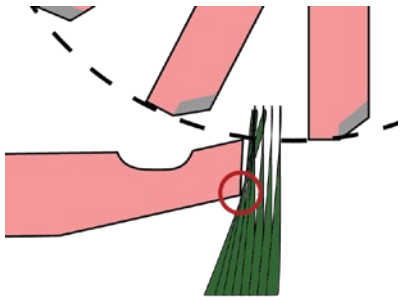
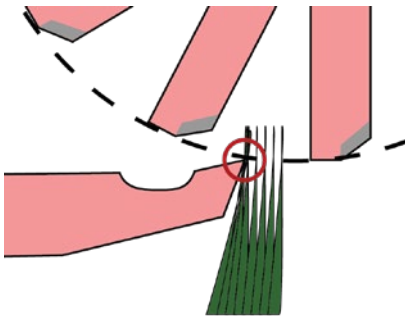


Fig. 19 - Recommended shear blade grind angle



Flat front angle - incorrect cutting contact point (below the cylinder blade cutting arc)



Negative front angle - correct cutting contact point (at the intercept of the cylinder blade cutitng arc)

Fig. 20 - 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.

6.2.5. 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*** and remove the key.
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. 21A).
- The end of the brake hammer presses the micro-switch sufficiently when depressed (Fig. 21B).

If either of the above are not happening, further adjustments of the components will be required.

Fig. 21 - Parking Brake Check

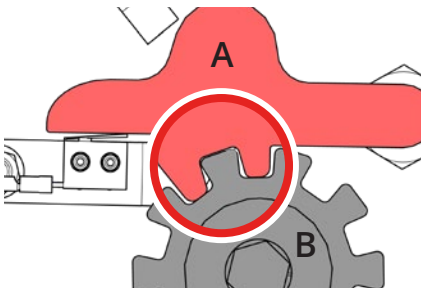


Fig. 21A - Brake hammer (A) engaging correctly with the cut-outs of the brake disc (B).

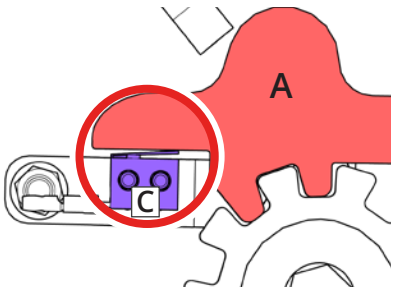
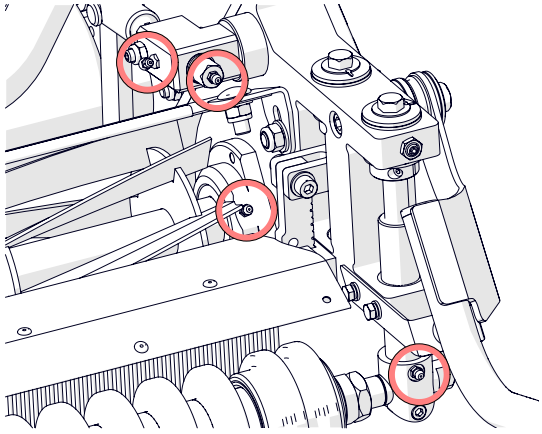
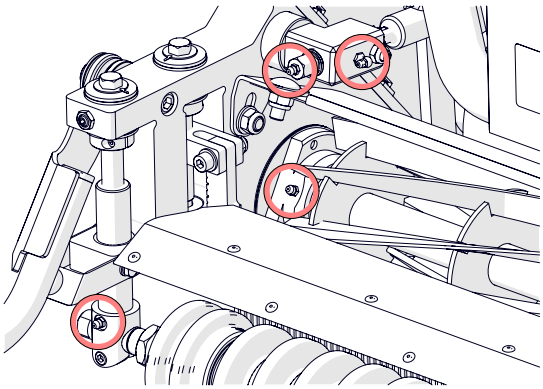
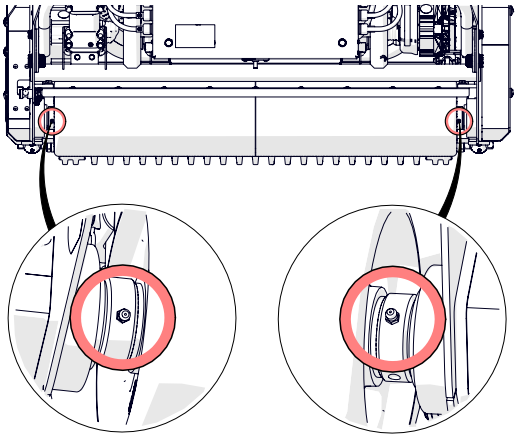


Fig. 21B - End of the brake hammer (A) presses the microswitch (C).

6.2.6. Greasing points

Grease the following locations at the intervals stated. We recommend to use a grease gun with a multipurpose lithium EP2 grease.

Location	Frequency
Left hand side: • Cylinder bearing • Shear blade adjuster brass hex bolt • Adjuster pivot block • Weile roller click mechanism 	Weekly or 25hrs
Right hand side: • Cylinder bearing • Shear blade adjuster brass hex bolt • Adjuster pivot block • Weile roller click mechanism 	

Location	Frequency
Rear roller - LH and RH roller collars 	Weekly or 25hrs

6.3. Cleaning

WARNING - SAFETY

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

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

- Chassis - Ensure the battery cover is closed and secure. 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.

6.4. 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 and damage to the machine.

- Use a ramp to aid the machine onto a vehicle. For the technical specification of the machine, refer to ***"4.1. Technical Specifications" p.12.*** The weight can also be found on the serial number plate.
- Anchor the machine to the floor/pallet using suitably rated tie-down straps. Anchor points shown in Fig. 22.
- Transport with sufficient charge levels - see note.
- Turn the machine ***off*** during transport.
- Disconnect battery terminals.

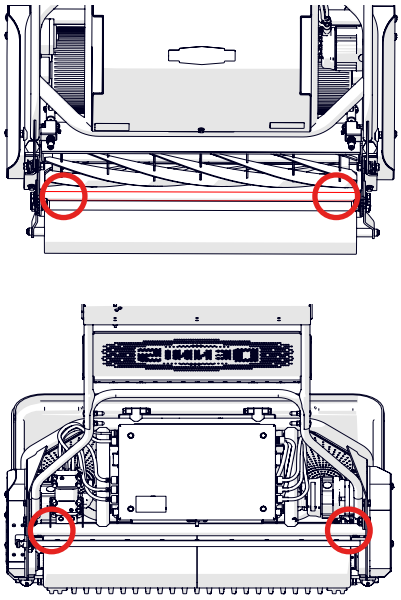


Fig. 22 - Anchor points for transport.

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.

6.5. Storage

6.5.1. Machine

CAUTION - INCORRECT STORAGE

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

Follow the points below for correct storage of your machine. See section '6.5.2. Battery' for battery specific storage.

- 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 between -20 to +35°C. Avoid high fluctuations. Note, if the battery is to remain in the machine, its storage temperatures will differ (see ***4.6.2. Battery'***).
- Store in a location that is dry, preferably with a relative humidity between 30%–70% RH.
- 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.
- Remove the key and keep safe.
- Cover the machine to protect from damage and dust.

6.5.2. Battery

CAUTION - BATTERY STORAGE

Batteries have additional requirements beyond those of the machine. Following the guidelines below will help maintain battery health and extend its long-term life. Failure to do so may significantly reduce battery lifespan.

- Store with a battery State of Charge (SoC) between 40–60%. Never store the battery fully discharged or fully charged as this can shorten the long-term life of the batteries.
- Disconnect the battery terminals when storing for >2 weeks.
- Store in an environment between +5°C–+25°C. Avoid storing below 0°C and above 30°C (storage at the extreme ends of the ***machine*** storage temperature range will shorten the long-term life of the battery).
- Store in a location with relative humidity between 30–70% RH.
- Every three months, check the battery SoC is between 40–60% — charge if it is below this value. Voltage can be measured to determine battery SoC if it is disconnected, see table below:

Battery SoC	Typical Voltage
100%	57.8 V
60%	53.3 V
50%	52.4 V
40%	51.5 V
25%	50.1 V
5%	47.6 V
2%	46.2 V
0%	44.1 V
DEEP DISCHARGE	39.2 V

6.6. Disposal

6.6.1. Machine Disposal

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.

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.

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 all 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 regulations.
10. Document the decommissioning process for record keeping.

6.6.2. 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.

6.7. Troubleshooting & FAQ

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

6.8. Warranty Policy

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

Appendix A. Troubleshooting and 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.**

Issue	Possible Cause	Action
Screen powers on briefly then switches off	1. Start button not held for long enough. 2. Wiring connection fault. 3. Battery BMS connection issue.	1. Ensure the ***start*** button is held for >3 seconds. 2. Check connections to ***start*** button. C (Common) and NO (Normally Open) terminals to be connected. 3. Check BMS cable connection.
Screen 'Parking Brake' icon (P) won't disengage	1. Mechanical brake engaged. 2. Parking brake microswitch faulty.	1. Release the parking brake. 2. a) Check the parking brake microswitch is being disengaged from the brake hammer. b) Test micro-switch continuity.
Machine will not charge	1. Charger not receiving sufficient power. 2. Charger not plugged correctly into the machine. 3. Machine not switched on.	1. Ensure the mains electrical socket is ***on***. Check lights and screen on the charger are illuminated - they will cycle through volts/time/ current/amp hours to indicate the machine is charging. If not, see below Issue. 2. Ensure the charger plug is fully inserted and the correct way round. 3. Power the machine on, then plug in charger. De-activate the E-stop.
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. a) Check the parking brake microswitch is being dis-engaged from the brake hammer - see ***"6.2.4. Grinding Cutting Blades" p.51*** b) Test micro-switch continuity.
OPC will not disengage when released		
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 Charging section ***"5.6.4. Charging Instructions" p.36***

Issue	Possible Cause	Action
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 being held long enough or faulty. 5. Harness plug not connected. 6. Damage to battery cables. 7. Wiring connection fault/fuse blown.	1. Connect battery terminals, see *"3.2. Assembly Instructions" p.11* 2. Re-charge the battery. 3. Release E-stop button. 4. Ensure the ***start*** button is held for >3 seconds. Check continuity of button. 5. Check BMS harness, handle bar harness connection and charger plug pins for signs of damage. 6. Visually inspect the cabling for damage. ⚠ **NEVER TOUCH ANY EXPOSED WIRES.** 7. Contact your Dealer or Howardson Group Service.
Machine will not show charge (shows as empty) "BMS Comms" error showing on screen	1. BMS cable is not connected. 2. BMS cable is faulty. 3. Wrong battery type selected.	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. 3. Contact your local dealer to change factory settings.
"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 **"4.5. Display Screen" p.20.***

How do I edit the default Forward and Turning speed?

Main Menu ▶ *Operations* ▶ *Default speeds*

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.

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