



POWAVATOR 400HS

(high speed gearbox)

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EU & UKCA Declaration of Conformity

According to the Machinery Directive 2006 / 42 / EC
& The Supply of Machinery (Safety) Regulations 2008

Manufacturer:	Standen Engineering Limited Station Road, ELY Cambridgeshire CB7 4BP England
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We declare that the product, described below, meets the requirements of the above mentioned directive and has been assessed against and complies with the essential safety requirements application as specified in the Standards listed here.

Model	Powavator 400
Serial No.	PV400.....

British Standards used in the implementation of this certificate

BS EN ISO 12100-1
BS EN ISO 12100-2
BS EN ISO 4254

Place of Issue: Standen Engineering Limited, Station Road, Ely,
Cambridgeshire, UK



M R Gammon - Technical Manager
For Standen Engineering Limited

IMPORTANT

- This operator's handbook should be regarded as part of the machine. Suppliers of both new and second-hand machines are advised to retain documentary evidence that this handbook was supplied along with the machine.
- On installation of the machine (i.e. starting off in the field), the New Machine Installation Record Card should be completed by the dealer/distributor and be countersigned by the customer. The document is proof that the correct procedures have been followed.
- The New Machine Installation Record Card should be returned to Standen Engineering Limited within 7 days of installation. Failure to do so may invalidate the machine warranty.

On delivery check that the machine is as ordered and has not been damaged in transit. Please report any shortfall to your Standen dealer.

The contents of this handbook, although correct at the time of publication, may be subject to alteration by the manufacturers without prior notice.

Standen Engineering Limited operates a policy of continual product development. Therefore, some illustrations and/or text within this publication may differ from your machine.

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Introduction to the Handbook

This handbook provides the information for the operation, adjustment and maintenance of your Standen POWAVATOR 400. To enable you to achieve the best results from the machine, the manufacturer recommends that you read the handbook thoroughly prior to using the machine for the first time.

Record below the details of your machine.

Dealers name.....

Address.....

.....

Telephone number.....

Machine serial number.....

Date purchased.....

Date started work.....



This symbol indicates important safety messages within this handbook. When you see this symbol, be alert to the possibility of injury to yourself or others and/or damage to the machine and carefully read the message that follows.

Throughout this handbook the terms 'front', 'rear', 'left-hand' (LH) and 'right-hand' (RH) are derived from the tractor driver's position facing forward in the normal direction of travel.

Adjustments to the machine may have to be made singly or in combination according soil conditions. Always allow the machine to settle to a new setting before making further adjustments.

Recommended lubrication and maintenance instructions are included in this handbook and if followed will help to keep the machine in a safe working condition.

Warranty

Should the machine suffer any faults or defects within the warranty period, please contact your dealer. The warranty shall be effective only if the dealer is informed of any such defect as soon as practicable upon discovery. Please note that some components deemed as wearing parts are not covered for replacement under warranty.

The Powavator is designed solely for cultivation operations. (INTENDED USE). Use in any other way is considered as contrary to the intended use. Standen Engineering Limited accepts no liability for damage, and or injury resulting from this misuse, and these risks must be borne solely by the user. Compliance with, and strict adherence to the conditions of operation, service, and repair as specified by Standen Eng. Ltd also constitute essential elements for the intended use.

READ THIS MANUAL BEFORE ATTEMPTING TO OPERATE THE MACHINE. Learn how to operate and service your Powavator correctly. Incorrect use could result in personal injury, or damage to the machine and surroundings. Operation, Servicing, and Repairs should only be carried out by persons trained and familiar with the POWAVATOR 400, and acquainted with the relevant safety rules (accident prevention). The accident prevention regulations, all generally recognized regulations on safety, and occupational medicine and road traffic regulations must be observed at all times.

Any modifications, other than correctly installed manufacturer supplied parts, will relieve the manufacturer of all liability for any resulting damage or injury, and invalidate the warranty.

Replacement Parts

Recommended replacement parts are designed for your machine and have the full backing of the warranty. Only when recommended parts are used can responsibility be considered under the terms of the warranty.

Section 2 of this handbook contains a list of spare parts available through your Standen Agents. Each illustration shows a complete unit or assembly in exploded form. Standen's policy of continual product development means that components or even complete assemblies are redesigned from time to time. Where possible the modifications are shown in the remarks column.

The first printing of each page in the spare parts section is identified as issue 1 at the foot of the page. When a complete unit or assembly has been redesigned the appropriate pages are revised and printed as issue 2. The revised pages are filed behind the existing issue so that a complete modification history is gradually built up. When using an illustration and parts list it is essential that both are of the same issue.

Always quote the full serial number of your machine when ordering spare parts.

Safety

The Standen POWAVATOR 400 has been designed to comply with current Safety Regulations. However, as with all machinery there will be inherent dangers whilst operating and carrying out maintenance on the machine. The following list of precautions should therefore be brought to the attention of all persons operating and working on the machine. The list is not exhaustive. All machinery is potentially dangerous and great care must be exercised by the operators at all times. Standen Engineering Limited will not accept liability for damage or injury caused by their products except when such liability is specifically imposed by English statute.



Safety is the responsibility of the persons working with this machine. Think "safety" at all times. Read and remember the contents of this handbook.

The machine must never be operated by untrained personnel or children.

Always check that the machine has been correctly mounted to the tractor before setting off on operations.

Never set the machine in motion before ensuring that every one in the vicinity is aware of your intentions.

The working area should be kept clear and free of obstructions at all times.

Never allow children or animals in the area when the machine is working. Stop if anyone enters the area.

Be alert for hidden obstructions. Should the machine hit an obstruction stop and check for damage before proceeding. Make appropriate repairs before restarting operation.

The operator must not leave the tractor seat with the machine running. Stop the machine, lower the Powavator, and apply the parking brake before leaving the machine.

Normal safe working procedures should be adopted at all times. Reduce speed when transporting the machine on sloping ground. Do not work on ground where there is a possibility of overturning, or across steep slopes.

Carry out repairs before starting operation. The machine must be properly maintained, and in good working order. Never operate the machine in a state of disrepair.

Always use mechanical or additional help when lifting heavy objects. Do not lift the machine unassisted.



ROTATING BLADES ARE DANGEROUS!

Deep bed cultivation guards must not be used for general cultivation. Always fit the correct front guards.

Keep hands and feet away from rotating parts. Rotating blades do not differentiate between fingers, toes, and soils. Stop the machine when not working.

Stop the machine, and stop the tractor before attempting to clear any blockage.

Shut off the P.T.O. and raise the Powavator before reversing. Do not attempt to work in reverse.



ALWAYS WEAR APPROPRIATE CLOTHING

Wear close fitting clothing and safety equipment. Wear substantial or proper safety footwear.

Distraction is dangerous. Do not operate the machine wearing radio or personal music headphones.

Loud noise can cause loss of hearing, or impaired hearing. Wear suitable ear protection such as ear plugs, or ear defenders when operating the Powavator.

In dry, dusty conditions, a closed cab, or a facemask may be required.



CHILDREN

Do not let children near the machine when operating.

Children move very quickly, never assume they will remain where you last saw them. Stay alert to their movements.

Keep children away from the working area; stop the machine if they enter the area.

Be extra vigilant when operating in areas of restricted vision. Shrubs, trees, objects and blind corners can hide a child from your view.

Do not carry or let children ride on any attachment even when the machine is not running.

**PRACTICE SAFE MAINTENANCE**

Do not attempt to carry out repairs beyond your capability.

Understand service procedures before doing work. Keep work area clean and dry.

Never carry out any adjustment, service work or lubrication with the machine running.

Keep guards in place when running the machine.

Before carrying out any work on the machine, lower the machine to the ground, switch off the tractor engine, apply the parking brake, remove the ignition key, and disconnect the PTO shaft.

Never work under the machine when it is raised on the tractor hydraulics. Always lower the machine onto solid supports to prevent the machine dropping suddenly.

Wear gloves when handling sharp blades.

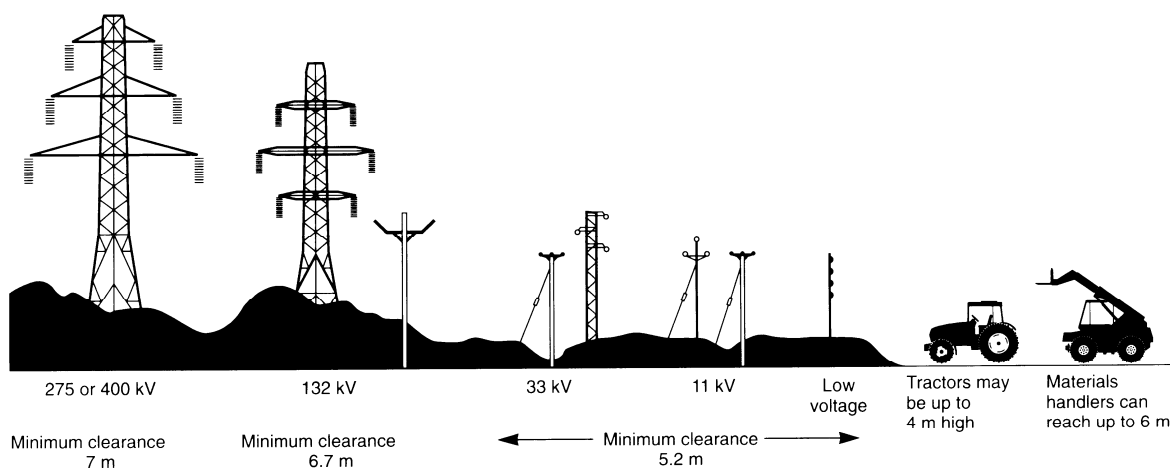
Take care that the blades cannot rotate onto you when working in their vicinity.

Regularly lubricate the machine as per the service schedule in the operator's handbook. Check all nuts and bolts for tightness especially those securing the blades.

HSE information sheet

Working safely near overhead power lines

Agriculture Information Sheet No 8 (rev)



Be aware of line heights

Introduction

About five people are killed every year in accidents involving overhead power lines during agricultural work. Machinery (eg combines, tipping trailers and loaders); equipment (eg irrigation pipes and ladders); and activities (eg stacking) are often involved. Contact with the lines does not need to be made. Electricity can flash over when machinery or equipment gets close to overhead lines.

Most incidents involve high-voltage lines supported on wooden poles, but the dangers of other power lines cannot be ignored.

This information sheet outlines the steps you can take to reduce the risks when working near overhead power lines. Remember the Electricity at Work Regulations 1989 apply to work activities carried out near power lines.

Planning precautions

Consult your local electricity company. They will provide free information and advice about precautions and safe working procedures which can be followed near power lines.

Find out the maximum height and maximum vertical reach of your machines and those used by contractors.

Find out the routes of **all** overhead lines on your land or near your boundaries. Mark them on the farm map. The electricity company will give you this information.

Make sure you have information about all the lines on your land - if not, contact the owners of those lines.

The farm map can be used as a reference when planning cropping or other work, instructing machine operators and contractors, or buying new equipment.

In cases where there is a significant risk area, it is sensible to discuss the following measures with the electricity company:

- **access:** creating alternative access points and routes - this is often the cheapest option;
- **divert lines:** benefits can arise from burying lines or changing routes - an option particularly suited to farmyards;
- **barriers and goal posts:** by erecting goal posts and barriers, machines which have to pass beneath lines can be limited to a safe height - an option especially suited to gateways and tracks.

Working safely

Key elements of safe systems of work are:

Training

Everybody who works near overhead power lines with a machine or equipment needs to know what the dangers of overhead lines are and the precautions to follow.

Visitors

Contractors are at risk when they work on farms where overhead lines are present. Make sure they know where the lines are and tell them the precautions they need to take. Routes can be marked with safety signs to warn all visitors of the dangers.

Use of machinery

Accidents can be avoided if the following operations are **not** carried out within a horizontal distance of at least 9 m from power lines on wooden poles or at least 15 m of lines on metal towers:

- stacking bales or potato boxes;
- folding sprayer booms;
- tipping trailers or lorries;
- operating materials handlers;
- working on top of combines or other high machinery.

Risks can be reduced by:

- using sprayers with horizontally folding booms;
- taking care not to damage poles and stays;
- making sure machinery can operate safely near any overhead lines;
- fitting shorter radio aerials to high machines so they cannot cause danger;
- carrying irrigation pipes horizontally using two people and not storing pipes near power lines.

EMERGENCY ACTION IN THE EVENT OF AN ACCIDENT

- **Never touch an overhead line - even if it has been brought down by machinery, or has fallen. Never assume lines are dead.**
- **When a machine is in contact with an overhead line, electrocution is possible if anyone touches both the machine and the ground.**
- **If you need to get out to summon help or because of fire, jump out without touching any wires or the machine. Keep away.**
- **Get the electricity company to disconnect the supply. Even if the line appears dead, do not touch it - automatic switching may reconnect the power.**

Further advice

For further advice and information contact your local electricity supply company. You can also get advice from the Farm Energy Centre, National Agricultural Centre, Stoneleigh Park, Warwickshire CV8 2LS (Tel: 01203 696512). To obtain the latest edition of their handbook *Safe use of electricity in farming and horticulture* (FEC 2100: 3rd edition 1992), send them a cheque for £2.50 made payable to Farm Energy Centre.

Further reading

Avoidance of danger from overhead electrical lines
GS 6 (rev) HSE Books 1991 ISBN 0 11 885668 5

Farm Electric *The safe use of irrigators and slurry guns near overhead electric power lines* Electricity Association Technology Ltd. Available free from the Farm Energy Centre, National Agricultural Centre, Stoneleigh Park, Warwickshire CV8 2LS

Memorandum of guidance on the Electricity at Work Regulations 1989 HSE Books 1989 ISBN 0 11 883963 2

Management of health and safety at work. Management of Health and Safety at Work Regulations 1992. Approved Code of Practice HSE Books 1992 ISBN 0 7176 0412 8

An HSE video called *Shock horror* is available for purchase or hire from CFL Vision, PO Box 35, Wetherby LS23 7EX (Tel: 01937 541010).

HSE priced and free publications are available by mail order from HSE Books, PO Box 1999, Sudbury, Suffolk CO10 6FS. Tel: 01787 881165 Fax: 01787 313995.

HSE priced publications are also available from good booksellers.

For other enquiries ring HSE's InfoLine Tel: 0541 545500, or write to HSE's Information Centre, Broad Lane, Sheffield S3 7HQ.

HSE home page on the World Wide Web:
<http://www.open.gov.uk/hse/hsehome.htm>

This leaflet contains notes on good practice which are not compulsory but which you may find helpful in considering what you need to do.

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Machine Description

The POWAVATOR 400 series rotavator is designed for either primary or secondary cultivations and will produce seedbeds, control weeds, incorporate chemicals, trash and sterilizing agents. Fitted with the optional ridger units, the machine can be used to produce raised beds from ploughed land, or for cultivating and reforming existing beds ready for planting.

The machine is suitable for category 2 or 3 linkage rear mounting. The centre linkage unit is fitted with a heavy-duty gearbox. Carried on the centre section are a pair of hydraulically folded wing mounted Powavator units which are shaft driven from the central gearbox, and protected by preset clutches in the drive shafts. The heavy-duty rotor gear drives are oil bath lubricated for maximum continuous power transmission. Depending on build specification, the machine can be fitted with rear mounted ridger units, steel or rubber side depth wheels, or a rear mounted packer roller. Wheel or centre line markers are available for bed forming work on ploughed land. Soil opening disc assemblies can be fitted to run in front of the outer gear cases.

Tractor Suitability

The POWAVATOR 400 is designed to be mounted on the three point linkage of tractors of a minimum power of 168 kW (225 HP). The tractor must be capable of handling and lifting the implement safely, and may need to be ballasted accordingly. The wheel equipment must also be capable of carrying the combined weight of tractor and implement. Tyre pressures should be checked to the manufacturers recommendation and both side tyres should be identical type, and in approximately the same state of wear.

Attaching the Powavator to the Tractor



Before attaching the Powavator, apply the tractor handbrake and switch off the engine.

Position the tractor lift arms so that the mounting pins (item 1, fig. 1) can be inserted through the lower hitch arms, and the tractor link ball ends. Fit the mounting pins, and secure using the clip pins. Adjust the top link length, and fit to the machine top hitch arm using the mounting pin (item 2, fig. 1). Secure using the clip pin. To keep the PTO shaft working angle as shallow as possible the top and bottom hitch arms may have to be adjusted in or out. To do this remove the locking bolts and spacers (item 3, fig. 1) and slide the hitch arms to the new position and re-secure.

Adjust linkage stabilisers to suit the operation, up to a maximum of 50mm (2") sideways movement.

Fit the PTO drive shaft to the tractor PTO, ensuring that the yoke quick release mechanism locates fully in the tractor PTO groove. Anchor the guard safety check chain to the tractor master shield. Ensure that the chain does not wrap around the plastic guard, as this can cause premature failure of the guard.

If fitting the PTO shaft to a tractor for the first time, check that the open, and closed length of the shaft is correct for the tractor / machine combination in the raised, and lowered positions. A minimum 1/3rd overlap must be maintained when extended.

Lift the machine and remove the parking stands (item 1, fig. 2). Refit the stands in the inverted position for storage.



WARNING:

Never run the machine when in the raised position.

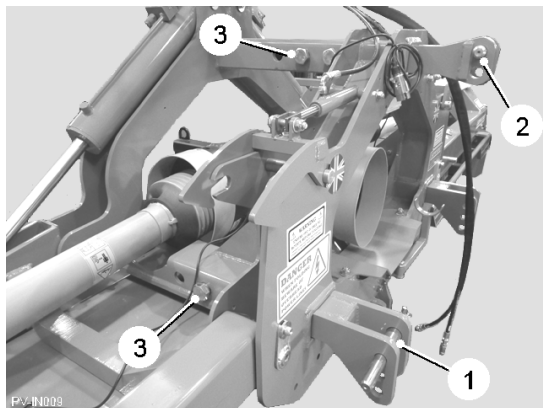


Fig. 1

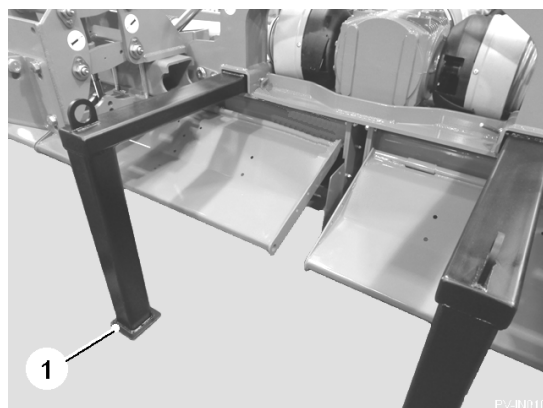


Fig. 2

Opening the Machine for Work



Do not attempt to fold or unfold the machine unless it is coupled to the tractor linkage. Ensure the PTO is free to rotate, or is disconnected from the tractor. Always fully raise the wings prior to lowering them.

1. With the machine on level ground, stop the tractor and apply the handbrake.
2. Open the hydraulic shut-off valve (item 1, fig. 3) (handle in line with the pipes).
3. Raise the machine at least 300mm to allow ground clearance when the wings rotate.
4. Fully raise the wings. This will ensure the latch hooks (item 1, fig. 4) are unloaded and are free to rotate away from the latch pins.
5. Lower the wings. The transport latches (item 1, fig. 4) will automatically open releasing the wings.
6. Lower the wings fully (they may not move together).

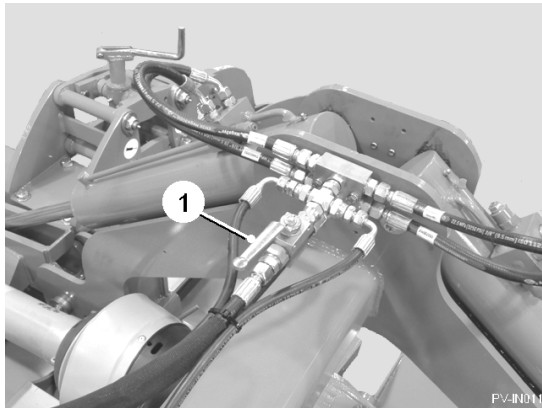


Fig. 3

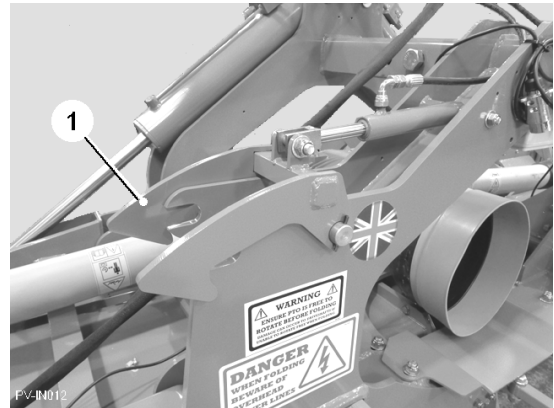


Fig. 4

Folding the Machine for Transport



Ensure the PTO is free to rotate, or is disconnected from the tractor. Ensure that you are clear of power lines or any overhead obstructions.

1. With the machine on level ground, stop the tractor and apply the handbrake.
2. Open the hydraulic shut-off valve (item 1, fig. 3) (handle in line with the pipes).
3. Raise the machine at least 300mm to allow ground clearance when the wings rotate.
4. Operate the hydraulic service to raise the wings fully (they may not move together).

5. Ensure transport latches (item 1, fig. 4) locate correctly to lock the wings into the vertical transport position.
6. Close the hydraulic shut-off valve (item 1, fig. 3) (handle 90° to the pipes).

Removing the Powavator from the Tractor

1. Lift the machine and rotate the stands (item 1, fig. 2) into the parking position.
2. Lower the machine carefully onto the parking stands.
3. Disconnect the PTO drive shaft from the tractor PTO. Support the drive shaft on the PTO rest (item 1, fig. 5).
4. Disconnect the top link and lower links from the machine.

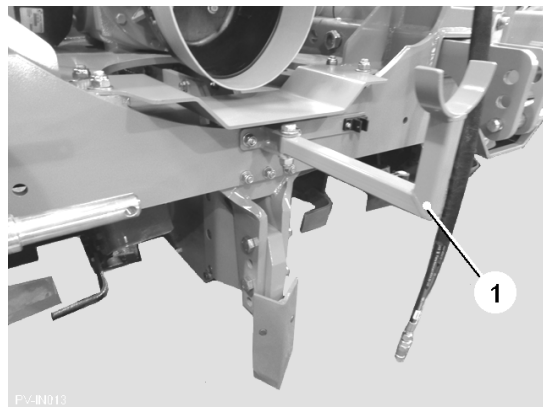


Fig. 5

Side Drive Shafts

The LH and RH drive shafts are each fitted with a torque limiting clutch (item 1, fig. 6). The clutch is preset and has no user adjustment. If the clutch repeatedly trips then it may be necessary to revise the method of working, i.e. shallower first pass, or slower forward speed to prevent overloading the machine.



WARNING:

If for any reason the LH or RH drive shafts are disconnected from the central gearbox, they must be refitted with the LH and RH shaft yokes exactly in line. This is necessary to allow the shaft joints to fold. Failure to do this will result in breakage of the yokes and/or gearbox output shafts.

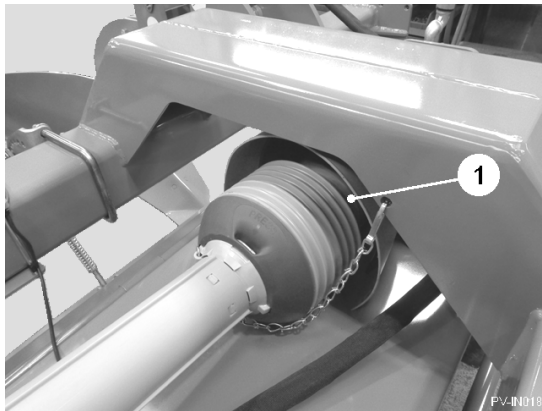


Fig. 6

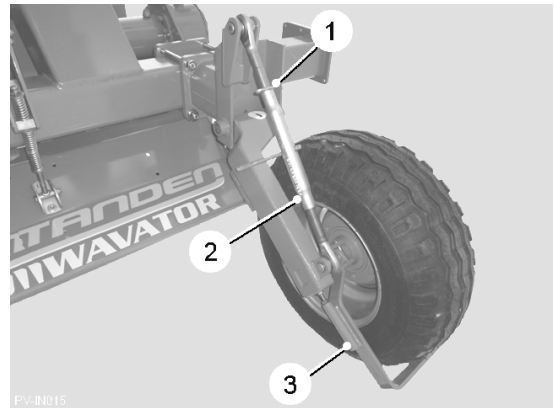


Fig. 7

Cultivation Depth Control

The depth of cultivation is controlled down to a maximum of 200mm (8") by either depth wheels or, when ridgers are fitted, by the setting of the ridgers and the tractor position control.

On machines with depth wheels, loosen the adjustable link locking tab (item 1, fig. 7) and turn the link bar (item 2, fig. 7). Adjust both depth wheels evenly. The wheel scraper (item 3, fig. 7) should be set as close to the surface of the tyre as possible without fouling it.

Rigid or Floating Operation

The Powavator 400 can be operated either with the wings locked rigid or with the wings allowed to float to follow the ground surface. When working to produce ridges, the wings should be locked horizontal by closing the ram shut-off valves (item 1, fig. 3). For general rotavation and incorporation, the wings should be allowed to float. This is achieved by leaving the ram shut off valve (item 1, fig. 3) in the open position and the tractor service in float. The wings are then able to move upwards if too much pressure is placed on the powavator.

Centre Divider Tine

The centre divider (item 1, fig. 8) is designed to split the soil making it flow through the rotors and not between the inner side plates. The tine mounting is adjustable for depth by resetting the bolts (item 2, fig. 8). The tine point should be set level with the bottom of the rotor blades. Operating with the divider tine removed will result in premature wear of the side plates and to soil in the centre not being properly cultivated.

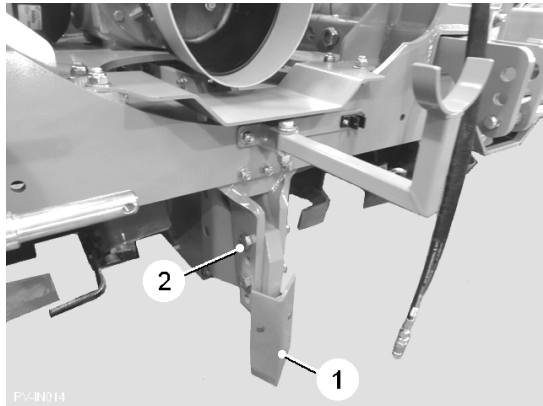


Fig. 8

Track eradicator tines

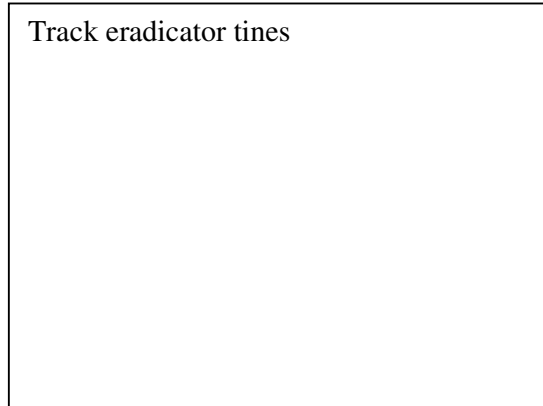


Fig. 9

Track Eradicator Tines

The track eradicator kit is designed to break up the compacted soil created under the tractor wheels. Two pairs of tines (item 1, fig. 9) mounted to the powavator centre frame are positioned directly behind the tractor wheels. Adjustment is provided for different track widths and the point depth is set using the locking pins (item 2, fig. 9).

Trailing Boards

The spring-loaded trailing boards (item 1, fig. 10) help control the type of tilth produced. With the boards lowered, the cultivated soil strikes them and clods are broken on impact producing a finer tilth. Trash is held and buried while the board levels and consolidates the top of the bed. With the boards raised, the soil is thrown out unrestricted producing a coarse tilth. Trash and weeds are left on the surface to weather.



Assistance will be required to lift the trailing boards.

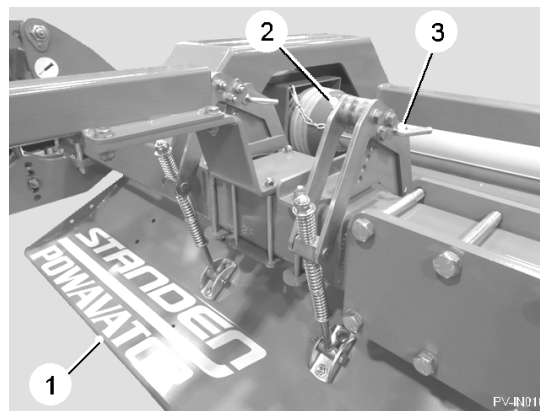


Fig. 10

To adjust the height of the trailing boards (item 1, fig. 10):

1. Remove the 'R' clips (item 2, fig. 10).
2. While taking the weight of the trailing boards, remove the securing pins (item 3, fig 10).
3. Reposition the trailing board as required and replace the securing pins (item 3, fig 10).
4. Finally, refit the 'R' clips (item 2, fig 10).

Bedformer Kit

The bedformer kit comprises of four individual parallel linkage ridger units. Each ridger can be adjusted for depth.

The working depth of the centre ridgers (item 1, fig. 11) is set by the parallel linkage adjuster screw (item 2, fig 11). This gives the basic depth. Moving the bottom pin (item 3, fig. 11) into a higher hole will raise the ridger body, reducing the overall working depth.

The two outer ridger units can be fitted with an optional hydraulic ram. The ram allows the units to be used in a fully down position or in a half raised position. This promotes equal pulling forces across the machine, making the tractor more controllable and easier to drive in a straight line. Operation is fully automatic, activated by the driver at the end of the field. On machines with dual operation, a hydraulic shut-off valve is fitted to the top of each ram allowing the ridger to be locked in position.

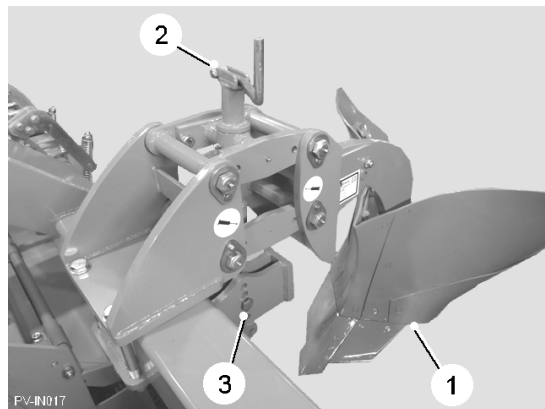


Fig. 11

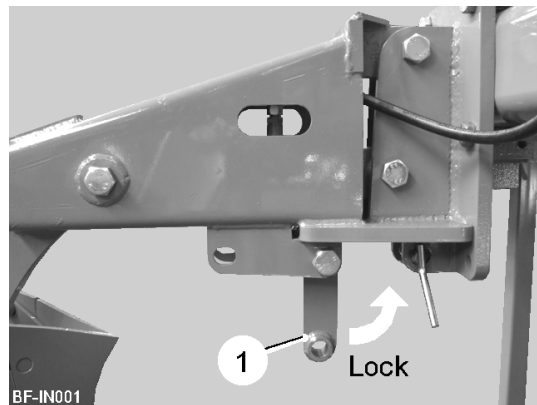


Fig. 12



If auto-reset legs are fitted, the leg locking arms (item 1, fig. 12) will need to be set into the working position. When disconnecting from the tractor, ensure the locking arms are locked to support the machine.

Ridger Bodies

The ridgers bodies are protected by either a shearbolt device or an auto-reset device. Both devices prevent damage to the machine by allowing the ridger body to pivot backwards when hitting an obstruction. With the shearbolt device, as the name suggests, the grooved shearbolt (item 1, fig 13) breaks allowing the ridger to pivot up over the obstruction. Once the obstruction is clear the shearbolt must be replaced. With the auto-reset device the ridger body will pivot up and then automatically return to its working position once the obstruction has cleared.

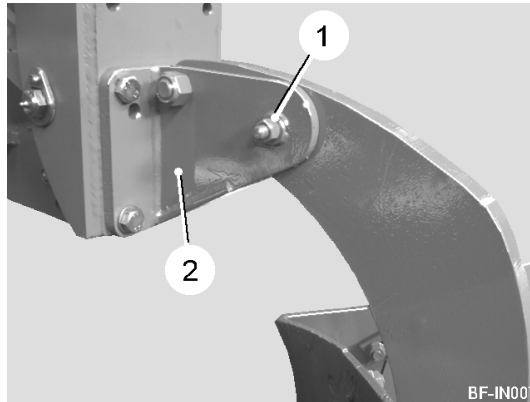


Fig 13



Always replace a broken shearbolt with a genuine Standen replacement. When fitting the new shearbolt, for it to function correctly, the nyloc nut must be on the 'spacer side' of the leg mounting bracket (item 2, fig 13). Failure to observe the above precautions may cause damage to the machine.

Auto-Reset Leg Hydraulic Pressure

There are two hydraulic systems within the auto-reset leg circuit. One system sets the pressure at which the ridger bodies release (break-back pressure) and the other sets the accumulator pressure which re-sets the ridging bodies once the obstruction has cleared (accumulator gas pressure). The pressures can be set to suit various field conditions using the table below. Setting the gas and break-back pressures is easily done using the tractor hydraulics. No special tools are required.



WARNING: *The accumulator manifold unit (item 1, fig 13) contains gas at extremely high pressures and should not be tampered with. Never attempt to service or remove any manifold fittings including the pressure gauge. For service contact your Standen Dealer.*

Setting the accumulator unit gas pressure:

The accumulator gas pressure must be set before the break-back pressure. The standard accumulator unit supplied with the machine is pre-set at 85 bar, therefore the minimum gas pressure possible will be 85 bar (see table below). If a lower gas pressure is required, additional accumulator manifold units are available through your Standen Dealer.

Before setting the gas pressure, the pressure within the break-back circuit must be released. To do this:

1. Ensure the flow valve (item 2, fig 14) is fully closed and then connect the hose (item 3, fig 14) to the tractor spool valve.
2. Set the spool valve to 'lower' to allow a return flow (if using a tractor switch off the engine).
3. The pressure gauge (item 4, fig 14) indicates the pressure within the break-back circuit. Dump the pressure by opening the flow valve (item 2, fig 14) until the gauge reads '0 bar' then disconnect the hose (item 3, fig 14).

The accumulator gas pressure can now be set as follows:

4. Ensure the flow valve (item 5, fig 14) is fully closed and then connect the hose (item 6, fig 14) to the spool valve. Accumulator unit gas pressure is indicated on the gauge (item 7, fig 14). With no hydraulic pressure within the break-back circuit the indicated pressure is the pre-set pressure of the accumulator unit.
5. To increase the gas pressure, set the spool valve to 'neutral' and open the flow valve (item 5, fig 14). Operate the spool valve and pressurise the system until the gas pressure gauge (item 7, fig 14) reads 10 bar above the required setting and then close the flow valve (item 5, fig 14).
6. Set the spool valve to 'lower' to allow a return flow (if using a tractor switch off the engine).
7. Slowly reduce the gas pressure to the required setting (e.g. 95 bar) by fractionally opening the flow valve (item 5, fig 14). Tightly close the flow valve when reached.
8. Disconnect the hose (item 6, fig 14) from the spool valve.

The break-back pressure can now be set.

Setting the break-back pressure:

For the auto-reset break-back system to function correctly, the hydraulic pressure within the break-back circuit must be matched to the gas pressure within the accumulator unit (item 1, fig 14).

1. Connect the hose (item 3, fig 14) to the spool valve and open the flow valve (item 2, fig 14).
2. Operate the tractor spool valve and pressurise the system until the gauge (item 4, fig 14) reads approximately 10 bar above the required operating pressure and then close the flow valve (item 2, fig 14).

Note: The accumulator pressure gauge will also rise to equal the break-back pressure.

3. Set the spool valve to 'lower' to allow a return flow (if using a tractor switch off the engine).
4. Slowly reduce the system pressure to the required setting (e.g. 114 bar) by fractionally opening the flow valve (item 2, fig 14). Tightly close the flow valve when reached.

Finally, disconnect the hose (item 3, fig 14) from the spool valve.

Accumulator gas pressure (set with no break-back pressure)	Break-back oil pressure (set after gas pressure)
70 bar	84 bar
75 bar	90 bar
80 bar	96 bar
85 bar	102 bar
90 bar	108 bar
95 bar	114 bar
100 bar	120 bar
105 bar	126 bar
110 bar	132 bar

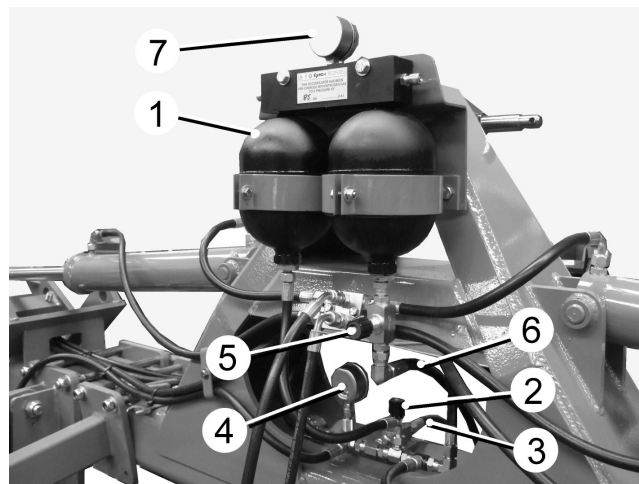
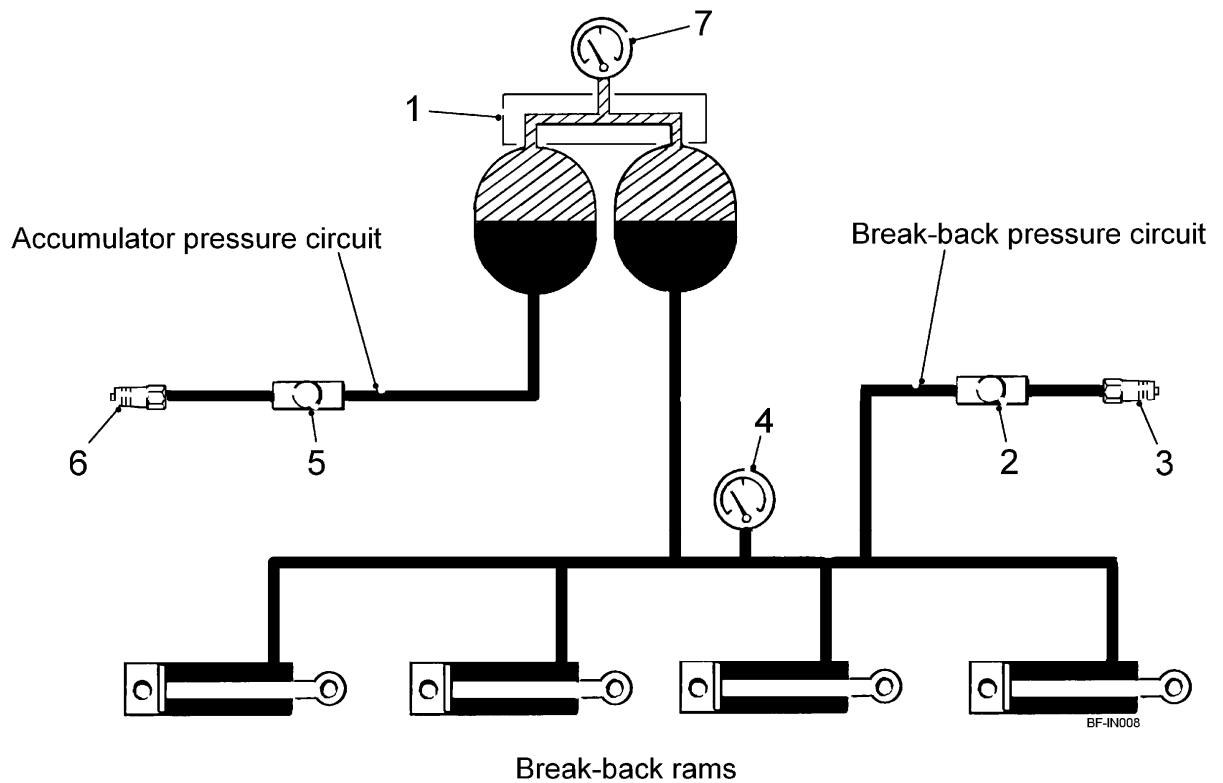


Fig 14



Checks Before Operation

Check that the machine is correctly connected to the 3-point linkage, and that the pins are correctly retained.

Check that the PTO drive shaft is correctly locked into the retaining groove.

Check that the PTO guard is intact and the safety chains correctly anchored.

Check that all blades / spikes fixings are tight.

Ensure that all frame fixings are tight.

Ensure that the side drive and rotor stub wear skids are in position.

Ensure all guards are in place and secure.

Ensure that all safety precautions have been observed and that preliminary maintenance has been carried out as detailed in the Lubrication and maintenance section of this publication.

If the tractor is equipped with dual hydraulics, ensure that the system is selected for 'position control', not for 'draft control'.

Working Instructions

Unfold the machine and remove any transport pins to their stowage positions.

Check that all guards are in position.

With the machine clear of the ground, engage the PTO drive and bring it up to speed (1000rpm).

DO NOT LOWER THE MACHINE ONTO THE GROUND RUNNING WITH THE TRACTOR IN NEUTRAL.

Lower the machine to the ground and drive forward at a speed suitable for the prevailing conditions. Work a short distance then stop the tractor, disengage the PTO and stop the engine. Check that the tilth being produced is satisfactory and that the working depth is correct across the full width of the machine. Adjust any setting as necessary before restarting.

It may not be possible to achieve the full cultivated depth in one pass. Start at a shallower depth, and work deeper on subsequent passes.

Lift the machine clear of the ground and disengage the PTO when turning at the headlands. If the tractor is fitted with a PTO brake, reduce the engine speed before disengaging the PTO to reduce the shock in the driveline.

If the machine fails to operate as expected, stop the machine, lower to the ground, and switch off the tractor. Investigate the fault. Use the Operators Check List as a guide.

Setting to Produce the Tilth

The type of tilth (fine or coarse) produced by the Powavator is controlled by the following factors:

THE EFFECT OF SOIL TYPE.

Soil type heavy to light.

The amount of clay present in heavier soils gives them cohesion and a greater variation of tilth is therefore possible. Lighter soils usually contain insufficient clay to give cohesion and a finer tilth is usually produced.

THE EFFECT OF ROTOR SPEED.

Rotor speed high – medium – low.

At a constant forward travel speed, the rotor speed controls the size of the slice cut in the soil. A 2-blade rotor at a slow speed will produce a large cut leaving a rough cloddy finish. A 3-blade rotor at a fast speed reduces the cut size giving a finer tilth. The 3-blade configuration is suitable for general use, but the 2-blade configuration has the following advantages.

Less tendency to clog in wet or sticky conditions.

The rotor is more self-cleaning in trash, allowing deeper working depth and better incorporation.

The finished cloddy surface is better for 'autumn' weathering.

THE EFFECT OF FORWARD TRAVEL SPEED.

Forward speed fast – slow.

The size of the soil slice can also be varied by use of the tractor gears. A low gear and slow forward speed will produce a fine tilth. Higher gears and a faster forward speed will produce progressively larger slices, and a rougher finish. Higher forward speeds in conjunction with a high rotor speed can be used to maintain the tilth in previously rotavated ground.

THE EFFECT OF THE TRAILING BOARD.

Trailing board position raised – lowered, fixed – floating.

With the trailing board lowered, the clods tend to be broken on impact, a finer tilth is produced, trash is buried, and the trailing board levels the surface.

Working with the trailing board raised allows a coarse tilth to be produced with larger particles, and trash to be left on the surface,

If the trailing board is locked down on its springs, the effect will be to compact the top of the seedbed. Allowing the board to float will produce a looser surface.

THE EFFECT OF SOIL MOISTURE CONTENT.

The moisture content of the soil affects the suitability for tillage. If the soil has a high moisture content it will be more inclined to 'ball' and smear. Dry soil will create a large amount of dust, and also lead to exaggerated blade wear. If soil conditions are too wet, damage to the structure may occur.

Operator's Check List

If the Powavator fails to operate as expected, the following points highlight common problems that can occur. Make adjustments one at a time, and check the effect before making further alterations.

ROTOR WILL NOT TURN.

PTO not engaged on tractor.
Overload clutch working.

ROTOR TURNS ERRATICALLY.

Overload clutch operating.
Blades or spikes missing or incorrectly fitted.
PTO drive shaft angle too steep.
Blockage or obstruction of rotors.

INSUFFICIENT DEPTH OF WORK

Machine carried on tractor hydraulics.
Insufficient power.
Depth control wheel set too low.
Worn, bent, or missing blades / spikes
Rotor speed too slow.
Obstruction in rotor.

TILTH TOO COARSE

Trailing board too high.
Rotor speed too slow.
Forward speed too fast.
2-blade formation.
Soil too wet.

TILTH TOO FINE.

Trailing board too low
Rotor speed too fast.
Forward speed too slow.
3-blade formation.
Soil too dry.

ROTOR CLOGGING.

Soil too wet
Worn, bent, or missing blades / spikes.
Rotor speed too slow.
Obstruction in rotor.

Lubrication

Correct lubrication should be used to ensure the full life of working parts and efficient operation of the machine. Shafts and bearings fitted with grease nipples should be lubricated using a good quality general-purpose grease. Bearings must not be allowed to run dry. When greasing it is better to give a little frequently than a lot at long intervals.

LUBRICANTS

CENTRAL GEARBOX SAE90/140 (CASTROL EPW85X/140) 10 litres

RH SIDE DRIVE SAE90/140 (CASTROL EPW85X/140) 3 litres

LH SIDE DRIVE SAE90/140 (CASTROL EPW85X/140) 3 litres

GREASE POINTS (Including U/J Bearings) Lithium based grease

PTO DRIVE SHAFT Graphite or Molybdenum Di-sulphide grease

OIL POINTS General-purpose machine oil

CENTRAL GEARBOX OIL LEVEL

The gearbox oil level is checked by removing the level plug (item 1, fig. 14). Oil level should be to the bottom of the hole with the machine level.

SIDE DRIVE CASE OIL LEVEL

The side drive case oil levels are checked by removing the level plugs (item 1, fig. 16). Oil level should be to the bottom of the hole with the machine level.

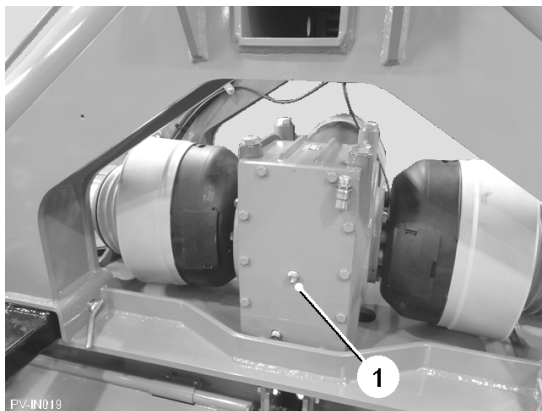


Fig. 15

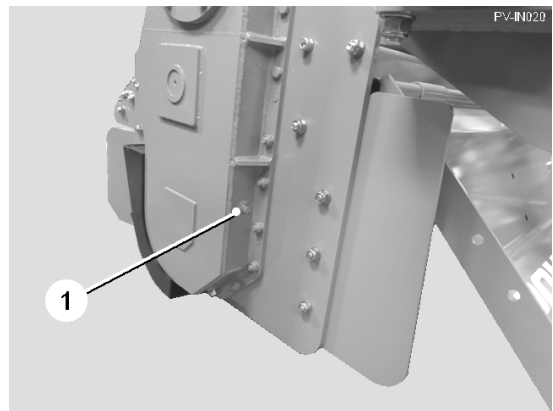


Fig. 16

Service Intervals**On delivery and after the first day:**

Check all fixings for tightness.
Check oil levels.
Lubricate drive shaft.
Check all blade / spikes fixings.

Every 10 hours (daily):

Lubricate drive shafts.
Check all fixings for tightness.
Check oil levels.
Lubricate trailing board hinges.
Check all blade / spikes fixings.
Check all blade / spikes for damage.
Replace wearing parts as necessary to prevent damage.

Every 500 hours (three monthly):

Drain, flush, and refill gearbox and side drives.
Check for excessive play on all drive shafts.
Replace any wearing parts as necessary.
Lubricate drive shafts
Check all fixings for tightness.
Check oil levels.
Lubricate trailing board hinges.
Check all blade / spikes fixings
Check all blade / spikes for damage.

End of season:

Before storing the machine;
Wash down the machine and clean all soil from working parts.
Coat bare metal with a rust preventative.
Carry out a full service on the machine.
Check the condition of the hydraulic hoses.
Touch up any damaged paintwork.
Grease any adjustable parts such as discs, marker arms, or ridgers to prevent them seizing / rusting.
Replace any wearing parts as necessary.

Wear Plates

The replaceable wear strips (item 1, fig. 17) and (item 1, fig. 18) are fitted to protect the front and bottom edges of the side plates. These should be replaced when worn as they help to prevent damage to the main rotor bearing housings.

The wear plates (item 2, fig. 18) are fitted to protect the side drive gear cases. Failure to keep these in place and in good condition will result in major damage to the drive assembly.

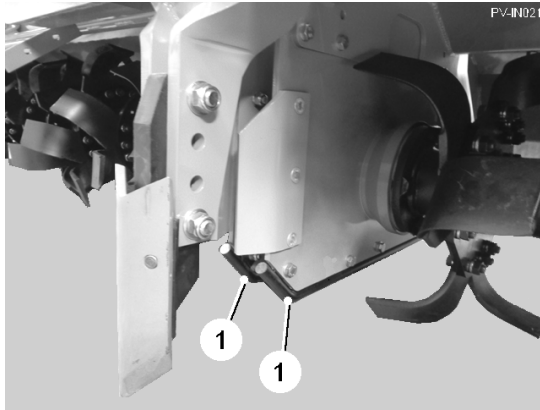


Fig. 17

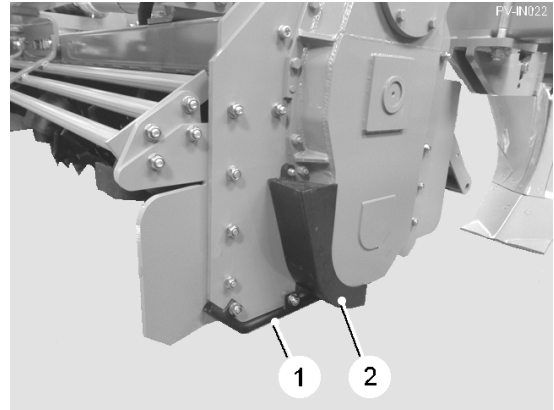


Fig. 18

Rotor Blades

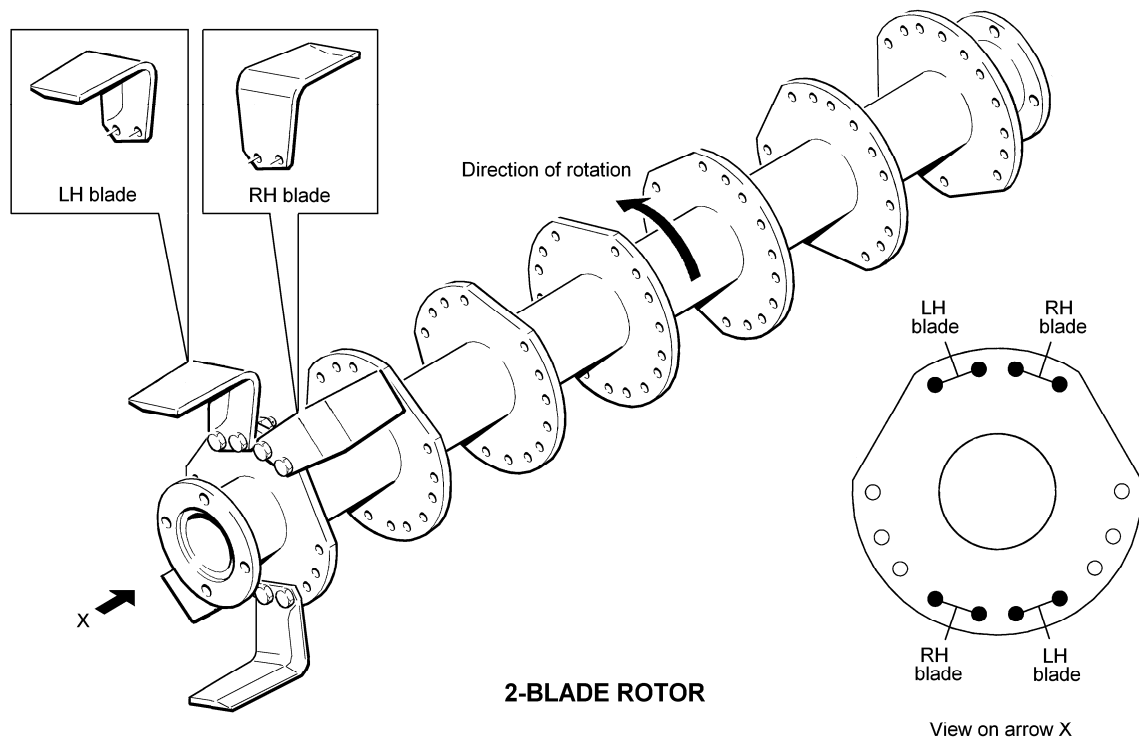


Rotor blades are sharp. Wear stout gloves when working on the rotor blades.

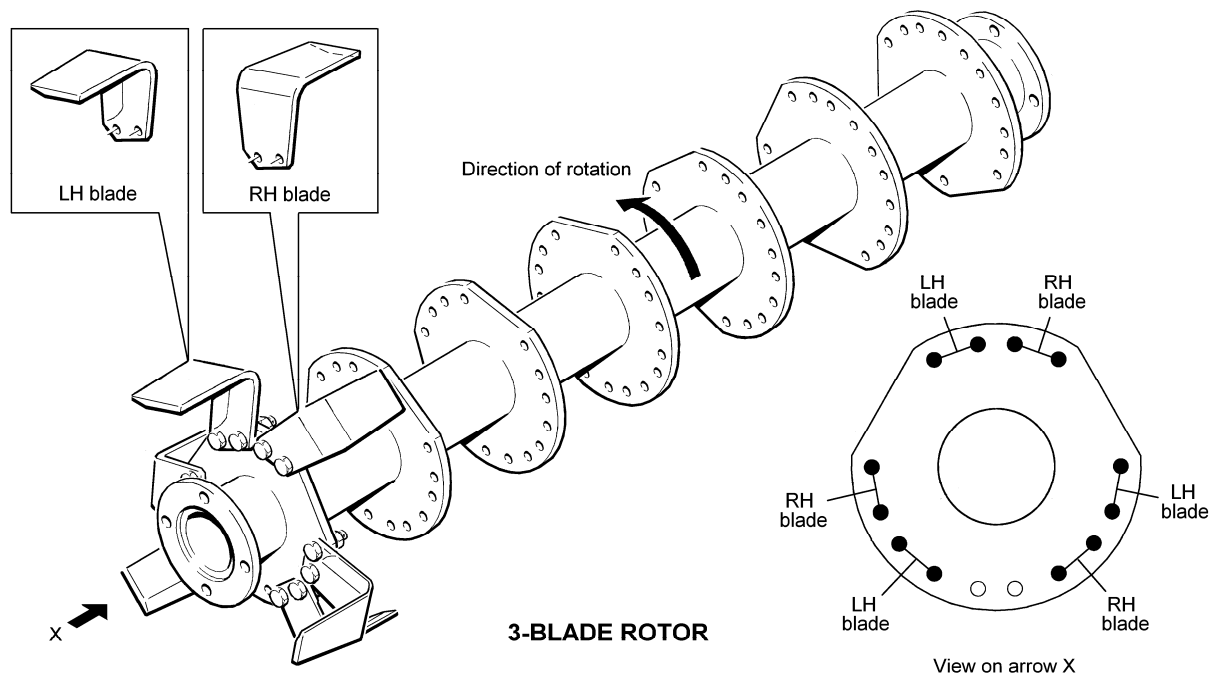
Note that each flange plate is rotated slightly from the previous one creating a scroll pattern along the rotor shaft. This ensures that the blades enter the soil at regular intervals to even out the load on the machine transmission. When replacing worn blades remove one blade at a time and fit a replacement before proceeding to the next. This will ensure that the 'scroll' pattern is maintained.

When fitting new blades use only genuine 'STANDEN' blades and blade bolts. Genuine blade bolts will have the correct shank length and tensile strength. Fit the bolt head against the blade with the spring washer and nut against the flange. Tighten the nuts to 35kgsM (250lbs/ft).

To help provide alternative tilths the rotor flanges are drilled to accept either 2-blade or 3-blade configurations.



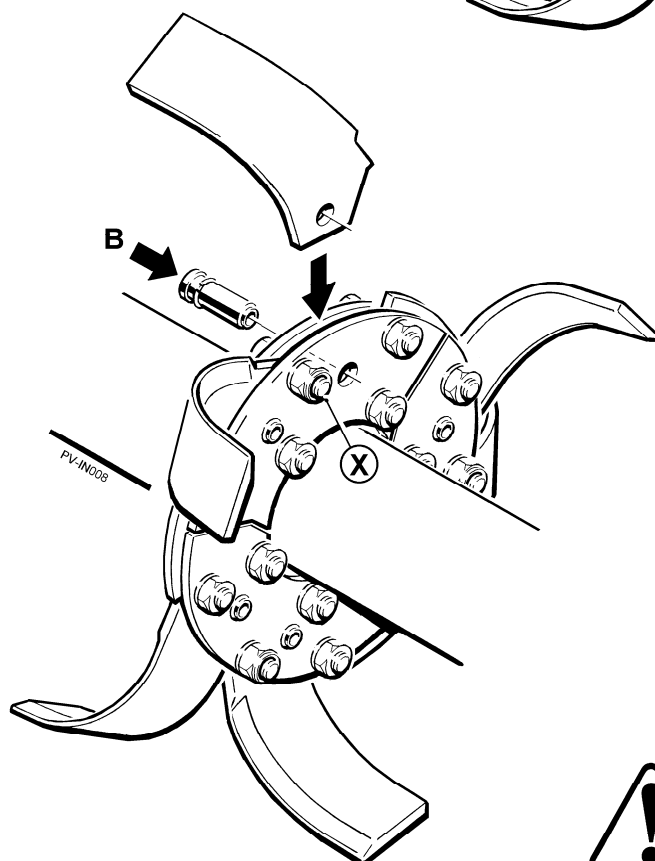
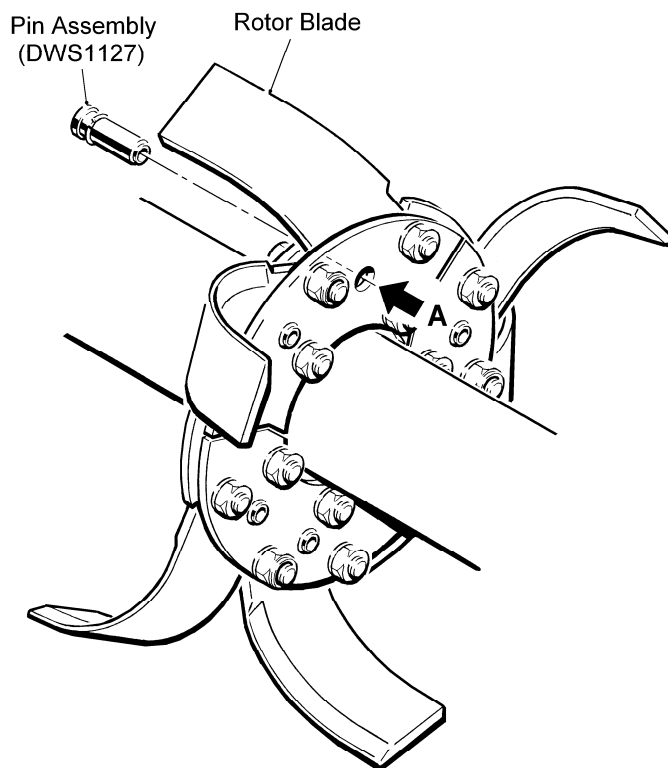
PV SP107



Quick Release Rotor Blade Changing Instructions

To remove a rotor blade:

1. Remove the pin assembly with a firm hammer blow at 'A'.
2. Remove the rotor blade.



To fit a rotor blade:

1. Fit the new rotor blade between the plates.
2. Align the holes and fit a new pin assembly.
3. Drive the pin fully home using a firm hammer blow at 'B'.
4. If necessary, tighten bolt (X) to set blade space between flange plates.

Note: All other bolts should be torque set to 345 Nm (255 lb/ft).



Standen Eng. Ltd. recommend that a new pin assembly (Part No. DWS1127) is used when replacing blades.

Spike Removal / Fitting



The retaining pin is a very tight fit and considerable effort will be required to remove it. Take care that when it comes out it cannot hit you.

To remove a worn or damaged spike:

Hammer out the retaining pin using a properly fitting punch. If the spike is free, hammer it out of its socket. If after removing the pin the spike will not easily come out of the rotor, it may be because it is bent. Follow the procedure below to remove the spike.

Hammer the end of the spike to drive it in and out of the rotor both ways until it becomes loose. **DO NOT HIT THE SPIKE SIDEWAYS**, this may damage the retaining block and make the new spike loose when fitted. Cut through the spike as close to the retaining block as possible without damaging the block. Deburr the cut end and, using a suitable punch, drift the spike through the tube from the cut end.

To fit a new spike:

Clean any rust from the retaining block and rotor holes. Insert the new spike through the rotor tube so that the machined groove aligns with the pinhole in the retaining block. Insert a new retaining pin with the seam away from the spike, and hammer it in flush with the block.

Dimensions

Length	1.55 m
Length with ridgers	2.80 m
Width in transport	2.90 m
Width in work	6.50 m
Height	1.95 m
Height in transport	3.30 m

Weight

Weight with ridgers	4350 kg
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Technical Data

Cultivating width	5.38 m (2 x 100")
Power requirement	168 kW (225 HP)
PTO input	1000 rpm