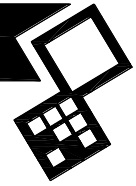
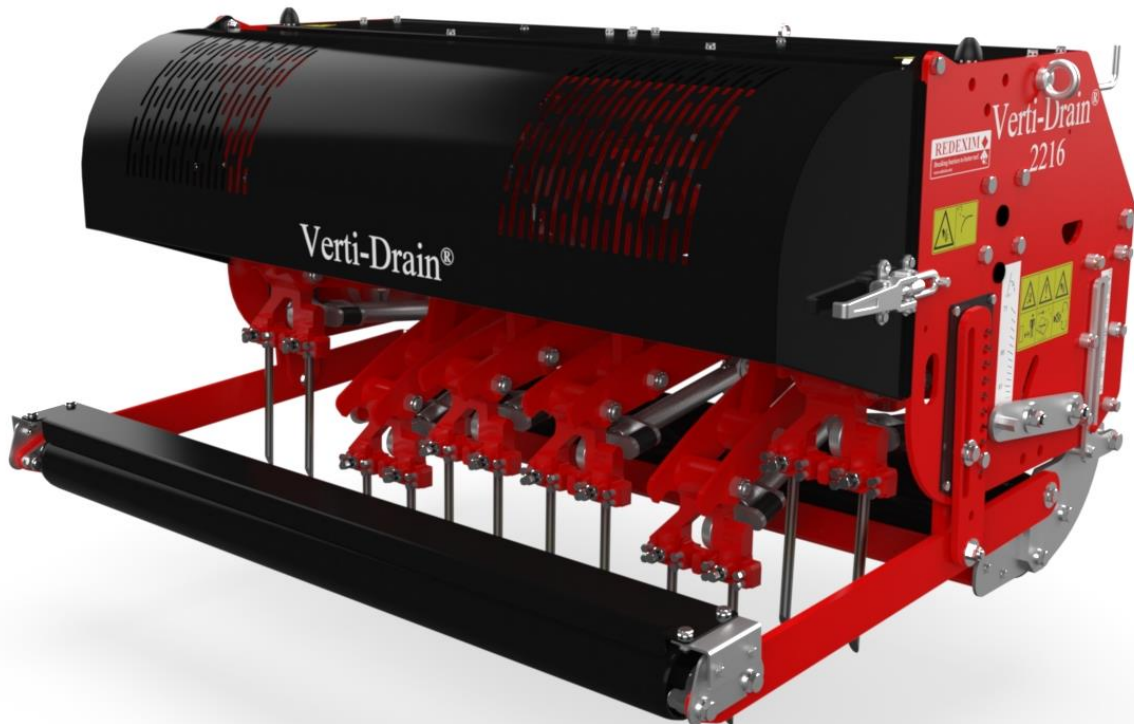


VERTI-DRAIN 2216-2220



Translation of the original user manual



2201 English 911.120.202 EN



Kwekerijweg 8 | 3709JA | Zeist | The Netherlands |
T: +31 (0)306 933 227
E: redexim@redexim.com
W: www.redexim.com

EU – DECLARATION OF CONFORMITY



We,

Redexim Handel- en Exploitatie Maatschappij B.V.
Kwekerijweg 8
3709 JA Zeist, The Netherlands

declare that this “EU - DECLARATION OF CONFORMITY” is issued under our sole responsibility and belongs to the following product:

VERTI-DRAIN® WITH MACHINE NUMBER AS INDICATED ON THE MACHINE AND IN THIS MANUAL,

to which this declaration refers, complies with stipulation of:

2006/42/EC Machinery Directive

and with the standards:

- **ISO 12100-1:2010** Safety of machinery - General principles for design - Risk assessment and risk reduction
- **ISO 13857:2019** Safety of machinery - Safety distances to prevent hazard zones being reached by upper and lower limbs
- **ISO 4254-1:2015** Agricultural machinery - Safety - Part 1: General requirements
- **ISO 4254-5:2018** Agricultural machinery - Safety - Part 5: Power-driven soil-working machines

Zeist, 03-01-2022

A handwritten signature in blue ink, appearing to read 'C.H.G. de Bree', written over a light blue horizontal line.

C.H.G. de Bree

Redexim Handel- en Exploitatie Maatschappij B.V.

UK – DECLARATION OF CONFORMITY



We,

Redexim Handel- en Exploitatie Maatschappij B.V.
Kwekerijweg 8
3709 JA Zeist, The Netherlands

declare that this “UK - DECLARATION OF CONFORMITY” is issued under our sole responsibility and belongs to the following product:

VERTI-DRAIN® WITH MACHINE NUMBER AS INDICATED ON THE MACHINE AND IN THIS MANUAL,

to which this declaration refers, complies with stipulation of:

S.I. 2008 No. 1597 HEALTH AND SAFETY The Supply of Machinery (Safety) Regulations 2008

and with the standards:

- **ISO 12100-1:2010** Safety of machinery - General principles for design - Risk assessment and risk reduction
- **ISO 13857:2019** Safety of machinery - Safety distances to prevent hazard zones being reached by upper and lower limbs
- **ISO 4254-1:2015** Agricultural machinery - Safety - Part 1: General requirements
- **ISO 4254-5:2018** Agricultural machinery - Safety - Part 5: Power-driven soil-working machines

Zeist, 03-01-2022

A handwritten signature in blue ink, appearing to read 'C.H.G. de Bree'.

C.H.G. de Bree

Redexim Handel- en Exploitatie Maatschappij B.V.



FOREWORD

Congratulations on your Verti-Drain® purchase! For safe and long-lasting operation of this Verti-Drain®, it is necessary to read and to understand this user manual. It is impossible to work safely with this machine *without* complete knowledge of its content.

The Verti-Drain® is not a machine that works independently. It is the user's responsibility to use the correct tractor. The user must also check the tractor/Verti-Drain® combination on safety aspects such as noise level, user instructions and risk analysis.

The Verti-Drain® is solely intended for grass fields or areas where grass can grow.

The following pages deal initially with the general safety instructions. Every user should know these safety instructions and apply them. At the end of this page, a registration card is inserted. This registration card should be returned to enable us to deal with potential future claims.

This user manual lists many instructions that are numbered in sequence. You should follow this sequence. A  is an indication of a safety instruction. A  means a tip and/or note.

All information and technical specifications provided at the moment that this document is published are the most recent ones. Design specifications may be changed without prior notice.

This document is a translation of the original operating instructions.

Upon request, the original operating instructions are available in Dutch.

WARRANTY CONDITIONS

WITH DELIVERY THIS VERTI-DRAIN® IS GUARANTEED AGAINST MATERIAL DEFECTS.

THIS WARRANTY IS VALID FOR A PERIOD OF 12 MONTHS FROM THE PURCHASE DATE.

VERTI-DRAIN® WARRANTIES ARE SUBJECT TO THE 'GENERAL CONDITIONS FOR SUPPLY OF PLANT AND MACHINERY FOR EXPORT, NUMBER 188' THAT ARE PUBLISHED UNDER THE AUSPICES OF THE UNITED NATIONS ECONOMIC COMMISSION FOR EUROPE.

REGISTRATION CARD

For your own information, fill in the table below:

Serial number of the machine	
Dealer name	
Date of purchase	
Remarks	

SAFETY INSTRUCTIONS

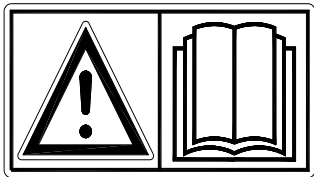


Figure 1

The Verti-Drain® is designed for safe use. This can only be achieved if you completely follow the safety instructions described in this manual. **Read and understand** (Figure 1) the manual *before* you start using the Verti-Drain®. If the machine is not used as described in this manual, this can result in injuries and/or damage to the Verti-Drain®.

1. The Verti-Drain® is solely intended for work on grass fields or areas where grass can grow.
Any other use is improper. The manufacturer will not accept any liability for damage resulting from improper use. All risks occurring with this are entirely at the expense of the user.
Following the use, maintenance and repair instructions prescribed by the manufacturer is also considered proper use of this machine.

Inspect the area to be treated *before* using the Verti-Drain®. Remove loose obstacles and avoid irregularities.

2. The Verti-Drain® is manufactured according to the latest technical understanding and is safe to use.

When unskilled people use, maintain or repair the machine, this could result in injuries to the user *and* to third parties. **This must be avoided!**

Always use the Verti-Drain® in combination with the correct tractor as described in the technical data.

3. All persons assigned to operate, maintain and repair the Verti-Drain® by the owner must completely read and understand the operation manual and in particular the chapter of **Safety Instructions**.

The user is responsible for a **safe Tractor/Verti-Drain® combination**. **This entire combination must be tested** for noise, safety, risk and user friendliness. User instructions should also be drafted.

4. The user is **obliged to check** the Verti-Drain® for **visible damage and defects** before using the Verti-Drain®.
Modifications to the Verti-Drain® (including its operations) that have a negative impact on safety must be rectified immediately.
For safety reasons it is in principle not permitted to make changes or adjustments to the Verti-Drain® (except those approved by the manufacturer).

If **modifications** to the Verti-Rake have been made, then the current CE marking is cancelled. The person that has made these modifications has to apply for a new **CE marking himself**.

Check the Verti-Drain® for loose bolts, nuts and components *before* every operation.

If present, check the hydraulic pipelines regularly and replace these when the hydraulic pipelines are damaged or appear old. The pipelines that are replaced should comply with the technical requirements of the manufacturer.

If a hydraulic installation is present, you should **always** make it pressure-free *before* working on this installation.

NEVER use the Verti-Drain® in the absence of protective guards and safety stickers.

NEVER crawl under the Verti-Drain®.

If necessary, tilt the Verti-Drain®.

NEVER step off the tractor while the motor is running.

In case of maintenance, adjusting and repairs, it is necessary to block the Verti-Drain® in order to prevent sinking away, driving off and/or sliding off.

Always switch off the tractor motor, take the tractor's key out off the ignition and disconnect the Power Take-Off (PTO) in case of maintenance, adjusting and repairs

(Figure 2).



Figure 2

With regards to the safety of the machine and the user, use only original Verti-Drain® parts for maintenance and repairs.

Only authorised technical personnel may carry out repairs to the Verti-Drain®.

Keep a record of the repair activities.

5. The general applicable health & safety (Dutch: ARBO) regulations must also be followed in addition to the instructions in this user manual.

Relevant traffic regulations also apply in case of using public roads.

Transporting persons is not permitted!

Do not use the Verti-Drain® in the dark, in heavy rain/storm or on slopes with an angle larger than 20 degrees.

- All persons that are going to operate the Verti-Drain® must be familiar with all the functions and control elements of the Verti-Drain® *before* starting any work activities.

Attach the **Verti-Drain®** to the towing vehicle according to the regulations. Check whether you have a clear field of vision – both close by and far away – *before* you depart.

Safety stickers with an identical meaning are attached to the sideboard (Figure 4, 5 and 6) and to the rear cover (Figure 3, 4 and 5) of the Verti-Drain®. These safety stickers must always be clearly visible and legible and must be replaced if they have become damaged.

During operation, **NO persons are allowed within the danger zone** of the Verti-Drain®, because there is danger of physical injuries caused by moving components. (Figure 3)

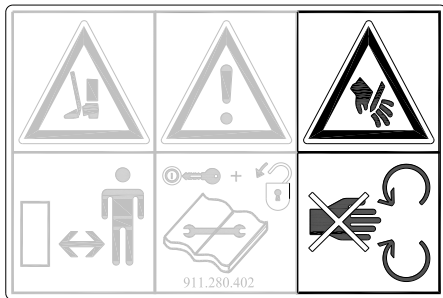


Figure 3



Figure 4

Keep a distance of minimum 4 metres! (Figure 4)

The rear cover must always be closed and undamaged while operating the machine! (Figure 5)

BE CAREFUL not to get any parts of your body jammed! (Figure 6)

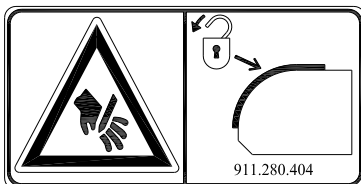


Figure 5



Figure 6

Pay attention to the permitted lifting capacity of the towing vehicle.

Dress appropriately. Wear sturdy shoes with steel toecaps, long trousers and tie up long hair. Do not wear loose clothing.

7. Location of the safety stickers (Figure 7)

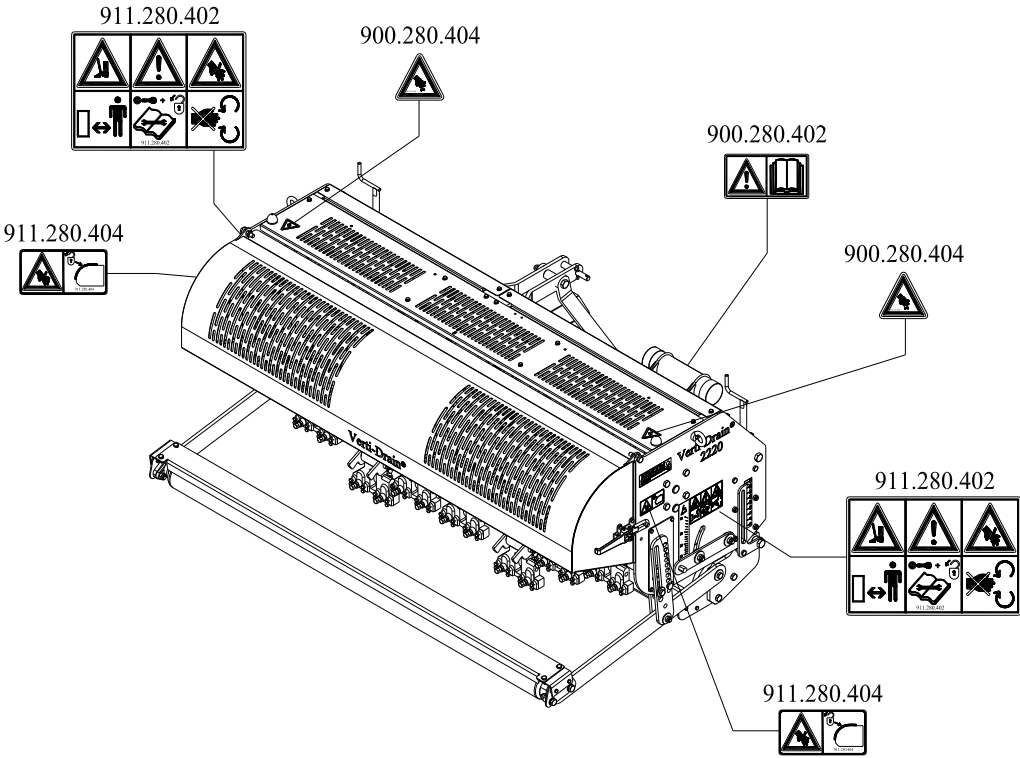


Figure 7

Used oil/grease is harmful to the environment. Dispose of these substances according to the regulations that apply in your location.

TABLE OF CONTENTS

EU – DECLARATION OF CONFORMITY.....	2
UK – DECLARATION OF CONFORMITY	3
FOREWORD	4
REGISTRATION CARD	4
SAFETY INSTRUCTIONS.....	5
1.0 TECHNICAL DATA.....	10
2.0 GENERAL DESCRIPTION.....	11
3.0 FIRST INSTALLATION – TAKING THE MACHINE OFF THE PALLET AND ATTACH TO THE TRACTOR	11
4.0 THE POWER TAKE OFF (PTO).....	12
4.1 LENGTH OF THE PTO.....	12
4.2 USING THE PTO.....	13
5.0 ADJUSTING THE WORKING DEPTH	15
6.0 ADJUSTING THE PIN ANGLE	15
7.0 DRIVING SPEED.....	16
8.0 START PROCEDURE.....	17
9.0 USING THE VERTI-DRAIN®.....	18
10.0 TRANSPORTING THE VERTI-DRAIN®	18
11.0 DETACHING THE VERTI-DRAIN®.....	18
12.0 TROUBLE SHOOTING (PROBLEM ANALYSIS)	19
13.0 MAINTENANCE	20
14.0 TECHNICAL INFORMATION: GREASE POINTS	21
14.1 THE CRANKSHAFT.....	22
14.2 REPLACING A CRANK / CRANK BEARING	22
14.3 REPLACING AN OIL CATCHER	22
14.4 ELIMINATING THE CRANKSHAFT TENSIONS	22
14.5 TIMING AND TIGHTENING MOMENTS	24
15.0 OPTIONS: THE TURF HOLD DOWN KIT.....	25
15.1 OPTIONS: PINS	26
15.2 OPTION: WINDROW KIT.....	27
15.3 OPTION: HYDRAULIC DEPTH ADJUSTMENT	28

1.0 TECHNICAL DATA

Model	2216	2220
Working width	1.60 m (63")	2.08 m (82")
Working depth	Up to 225 mm (9")	Up to 225 mm (9")
Tractor speed measured at 540 rpm on the PTO: Hole distance 65 mm (2.6")	Up to 1.79 km/h (1.1 mph)	
Hole distance 90 mm (3 1/2")	Up to 2.48 km/h (1.5 mph)	
Hole distance 130 mm (5.1")	Up to 3.58 km/h (2.1 mph)	
Max. PTO rpm:	Up to 540 rpm	
Weight	840kg (1851 lbs)	1030kg (2270 lbs)
Hole distance between the pins	65 mm (2.5") for 12 mm (1/2") holes 130 mm (4") for 24/18 mm (1"/3/4") holes	
Hole distance in the driving direction	25-195 mm (1"-7.5")	
Recommended tractor	45 PK with a lifting capacity of minimum 1050 kg (2314 lbs)	50 PK with a lifting capacity of minimum 1300 kg (2866 lbs)
Maximum capacity		
Hole distance 65 mm (2.6")	Up to 2796 m ² /h (30096 ft ² /hr)	Up to 3728 m ² /h (40128 ft ² /hr)
Hole distance 90 mm (3 1/2")	Up to 3871 m ² /h (41672 ft ² /hr)	Up to 5162 m ² /h (55562 ft ² /hr)
Hole distance 130 mm (5.1")	Up to 5592 m ² /h (60193 ft ² /hr)	Up to 7456 m ² /h (80257 ft ² /hr)
Machine dimensions	1210 x 1700 x 900 mm (47.6" x 66.9" x 35.4")	1210 x 2220 x 900 mm (47.6" x 87.4" x 35.4")
Maximum pin dimension	Solid 24 x 225 mm (1"x 9") Hollow 25 x 225 mm (1"x 9")	
Three-point connection	3-point CAT. 1/2	
Gearbox oil	80W90 (5.5Kg)	
Grease	EP 2	
Standard components	<ul style="list-style-type: none"> • Set of solid pins 18x225 (3/4"x 9") • Set of adaptors 24 to 18 mm • Rear roll • Cylinder with tools and user manual • PTO 	

Optional	<ul style="list-style-type: none"> • Solid pins • Hollow pins • Turf hold-down fingers • Windrow kit • Hydraulic front roll adjustment
----------	---

2.0 GENERAL DESCRIPTION

The Verti-Drain[®] is a machine for aerating grass and sport fields. The Verti-Drain[®] is a 3-point machine. You will need a tractor in order to use the Verti-Drain[®].

3.0 FIRST INSTALLATION – TAKING THE MACHINE OFF THE PALLET AND ATTACH TO THE TRACTOR

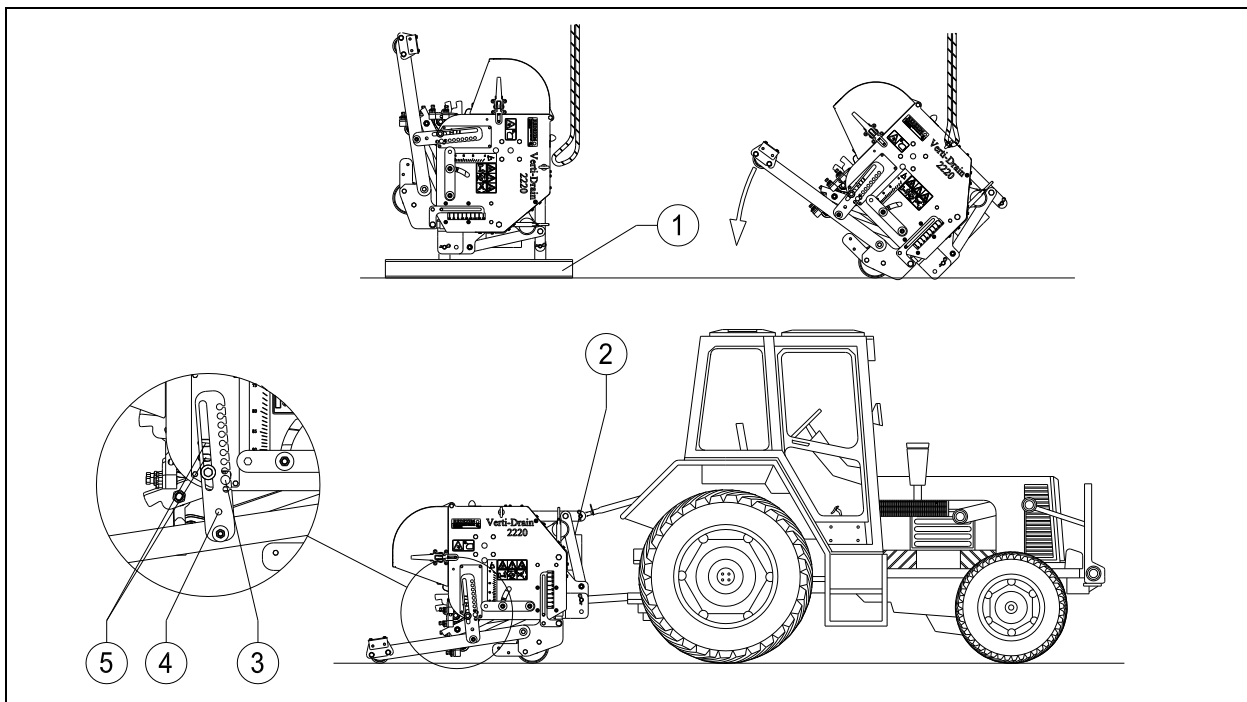


Figure 8

The machine is placed vertically on the pallet. To remove the pallet and to place the machine horizontally on the ground, take the following steps (see Figure 8):

1. Remove the PTO, PTO protective covers and pins from the machine.
2. Attach a cable to the crane hooks.
 - ⚠ **Make sure that the cable/crane/lift can hoist at least 2 times the weight of the machine. (For the weight see chapter 1.0 technical data)**
3. Lift the machine including the pallet of 50 mm (2") off the ground.
 - ⚠ **NEVER crawl under the machine!**
4. Remove the pallet (1).
5. Slowly lower the machine until the 3-point junction plates touch the ground.
6. Slowly lower the machine further so that it can turn on its front roller.
7. Carefully lower the machine further until it stands on its front and rear roller.

8. Assemble the PTO Cover 2 that is included with the supplied items.
9. Attach the machine to a tractor.
- ⚠ **Use the proper tractor (please refer to the specifications).**
10. Attach the hydraulic hoses to the tractor.
11. Lift the machine off the ground.
12. Remove the locking pins of the rear roller (3) and mount these in the appropriate hole (4).
13. Place the machine on the ground and adjust the angle of the machine to 90° by turning the top rod.

👉 **This 90° angle is very important for the proper functioning of the machine.**

14. Set the stabilizer of the tractor to 100 mm lateral stroke.
15. Assemble the pins. Apply some grease to the spindle.
16. Please refer to Section 4.1 for the length of the PTO.
17. When machine is taken of the pallet, remove the upper plug of the gearbox and replace it with the supplied breather.

4.0 THE POWER TAKE OFF (PTO)

The PTO is a very important item. It drives the machine from the tractor and ensures the safe operations when correctly maintained and installed. The PTO shaft has its own CE certification. Read the PTO shaft manual, which is connected to the shaft itself.

For specific adjustments see the details given on the PTO page in the parts book. Do not exceed the given values. This can lead to an unsafe situation and overload the machine, resulting in damage.

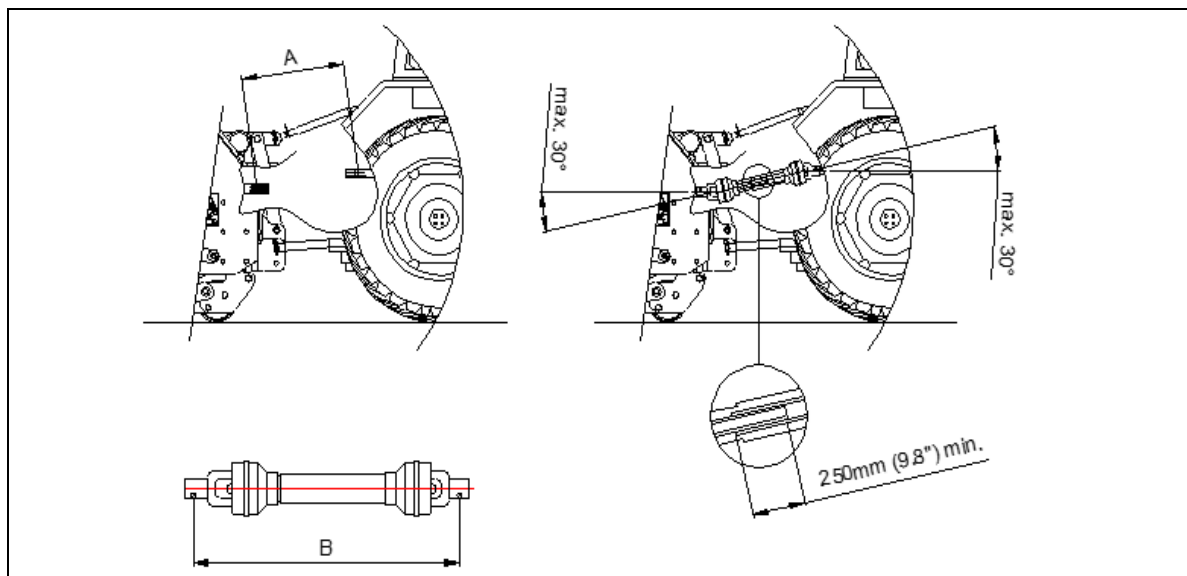


Figure 9

4.1 LENGTH OF THE PTO

The length of the PTO is very important. If it is too long, it can damage the drive of the tractor and/or the Verti-Drain®. If the overlapping length of the cylinders becomes less than 250 mm (9,8") at any time, it can damage the PTO.

⚠ **The length changes when the machine is lifted or when a different tractor is used!**

In order to set the PTO on the correct length, when a new one has been purchased or when a different tractor is used, follow these steps: (see Figure 9)

1. Measure the distance between the PTO's connection to the tractor and to the Verti-Drain, from groove to groove, when the machine is connected to the tractor and positioned on the ground at the right angle.
2. Measure the distance B of the PTO in its shortest position from the locking pin to the locking bolt.
3. Divide the PTO in two parts and remove the protection cap at both ends.
4. The ends of the cylinders and the ends of the protection caps must be made shorter: $(B-A) + 125 \text{ mm}$ (4,9").
5. Smooth off all components, use some grease, and then assemble all components.
6. Mount the PTO on the side of the Verti-Drain.
7. Attach the other end of the PTO to the tractor.
8. Check the overlap of the cylinders.



Never use the machine if it has a damaged PTO protection cap. First remove any damaged parts.

4.2 USING THE PTO

The following items must be checked for correct use of the PTO:

1. While working the angle of the pivot pins may not exceed 30 degrees.
2. The pivot pins must always be aligned.
3. The overlap of the cylinders must always be minimum 250 mm (9,8").
4. Never use the machine if it has a damaged PTO protection cap.
5. For lubrication see section 13.0: Maintenance.

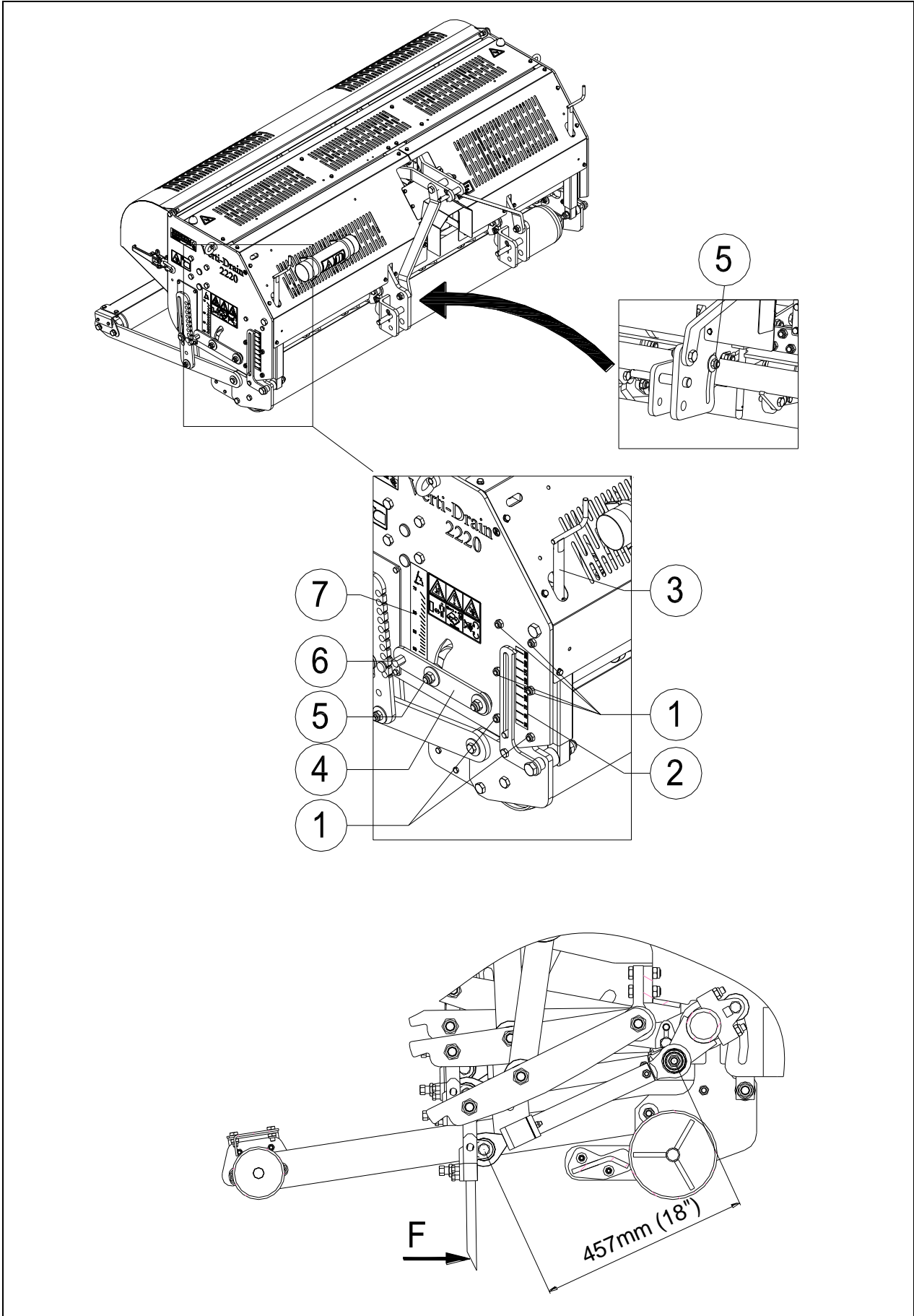


Fig. 10

5.0 ADJUSTING THE WORKING DEPTH

The working depth can be adjusted when the machine is lifted, see Figure 10. Tighten the nuts one by one turn on both sides of the machine. Then turn on or off spindle 3. The sticker 2 on the side of the machine, the depth setting. If the correct working depth is reached, tighten the nuts 1 again.

- ☞ Adjust one side never more than 4 strokes. Compensate the other side first, before continuing.
- ☞ The depth adjustment on the stickers applies only if one uses pins of 225 mm (9"). If shorter pins are used, deduct the difference in length compared to the 225 mm (9") from the values on the sticker.
- ☞ To prevent too much dragging of the rear roller in case of shallow pricking, pushing the protection pin (3) in one of the holes (5) will block the rear roller (see Figure 8).

6.0 ADJUSTING THE PIN ANGLE

All pins can be adjusted simultaneously with the handles (4) at the side of the machine (see Figure 10). Raise the machine above the ground and loosen the check nuts (5) at both sides of the machine. Adjust the angle by putting the supplied ring spanner on the hexagon (6) of the handle (4). The indicator (7) gives the angle. Remove the supplied ring spanner and tighten the check nuts (5).

- ⚠ A 90° angle means hardly any pin movement. A 90° angle is required for hollow pins and is recommended for pins of 8 mm (5/16").
- ⚠ A 90°-70° angle means more pin movement. This is recommended for solid pins and depends on the soil conditions, the pin measurement and the requirements of the client.
- ⚠ In case of 90°, the pins go into the ground perpendicularly only if the machine is correctly installed (see Figure 10). If the machine is incorrectly installed, a force F can occur which damages the machine.
- ⚠ The length of the combined drawbar must be 457 mm (18"). This can be calibrated by means of shims (see Parts page).

7.0 DRIVING SPEED

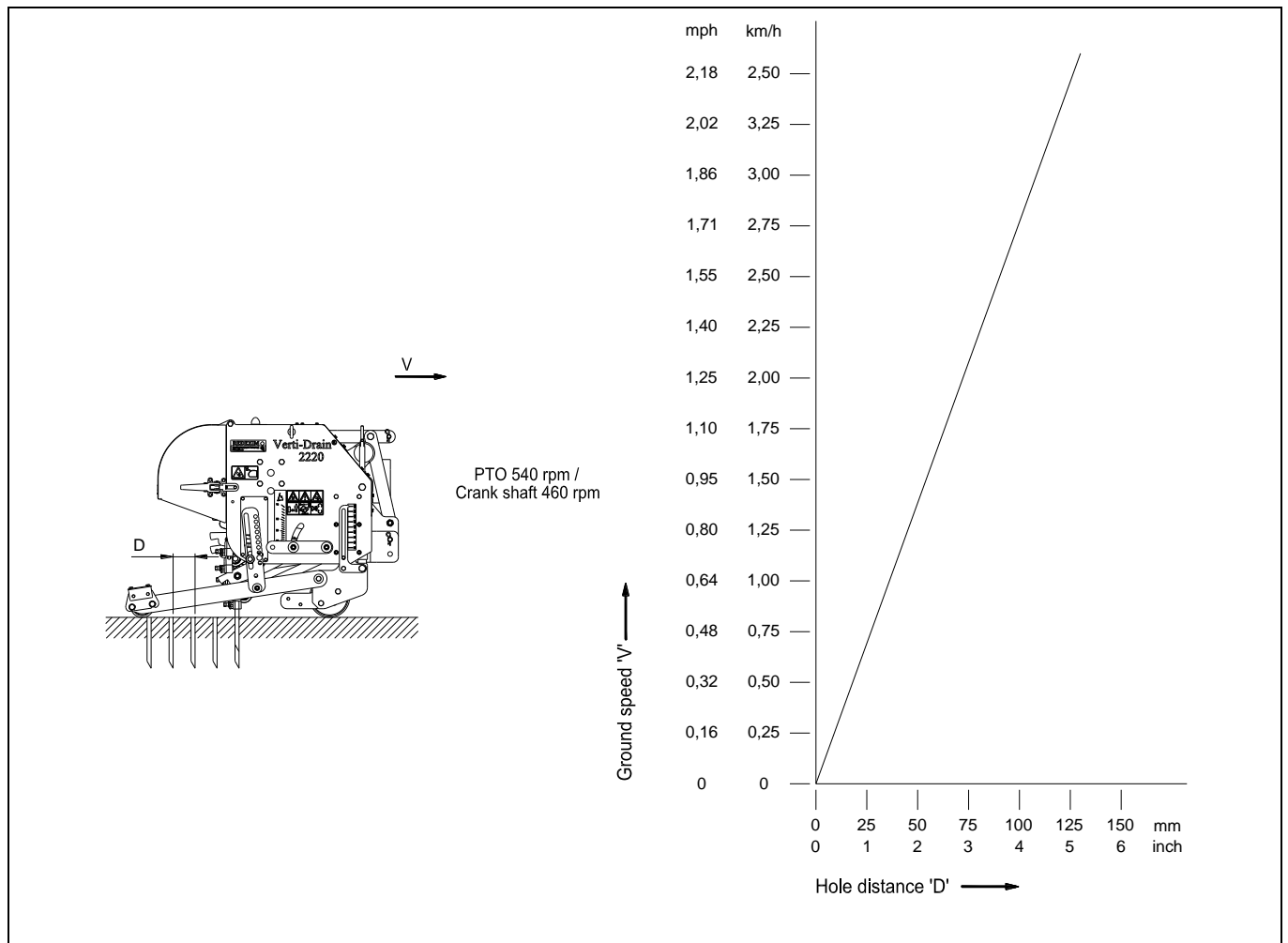


Figure 11

The driving speed determines the distance D between the holes in the driving direction (see Figure 11). If the client requires a smaller distance between the holes, you have to drive slower which depends on the possibility to reduce the tractor speed.

Figure 12 provides a table with the correlation between the driving speed and the distance between the holes. If the driving speed of the tractor at 540 rpm on the PTO is known, the distance between the holes can be determined.

The incoming revolutions of the PTO may be maximum 540 rpm.

- ⚠ **If you expect hard objects, you must reduce the speed.**
- ⚠ **The pin holders can start floating in case of using heavier pins, other applications or maximum pin angle. Reduce the revolutions *before* the pin holders slam upwards.**
- ⚠ **If the Verti-Drain is incorrectly attached to the tractor, the different PTO angles can cause vibrations in the driveline of the machine (see Figure 8). These vibrations can damage the machine and the holes in the ground.**
- ⚠ **If the PTO is shortened incorrectly or if another tractor is used, the gearbox may be overloaded. This can result in damage.**

8.0 START PROCEDURE

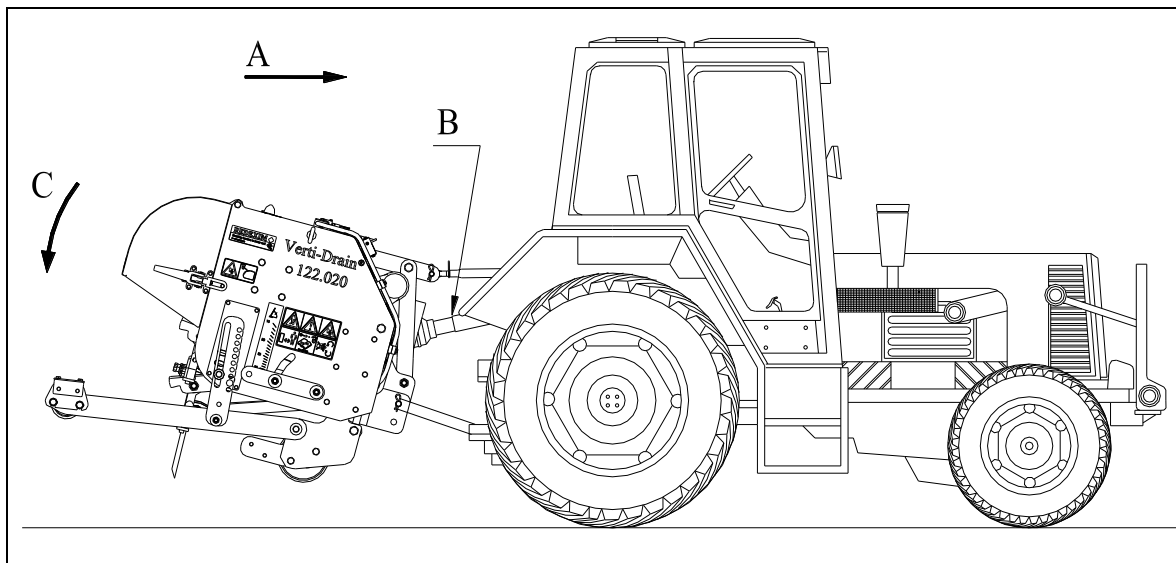


Figure 13

The start procedure is **VERY** important. If this procedure is not executed as described below, it might result in serious damage to the machine. The start procedure is as follows (see Figure 12):

1. Move to the location where you want to start.
2. Lower the machine until the lower pins almost touch the ground.
3. Adjust the tractor engine to around 1200 rpm.
4. Put the tractor in the correct gears and drive forwards (A).
5. Engage the PTO (B).
6. **WHILE IT TURNS**, lower the machine **CAREFULLY** into the ground **DURING** the forward drive (C).
7. Increase the PTO's revolutions to the maximum allowed value.

Stopping occurs as follows:

1. Decrease the engine revs to approx. 1200 rpm.
2. Lift the machine off the ground.
3. Detach the PTO as soon as the pins are out of the ground.
4. Raise the machine further until the pins are minimum 120 mm above the ground.
5. Go to the next location and start again as described above.

⚠ It is absolutely vital to work according to the aforementioned procedures! If the machine is lowered to the ground WITHOUT a turning PTO, the machine can be severely damaged.

⚠ Always lower the machine CAREFULLY.

⚠ Be careful when reversing.

During the work activities, the front roller has to be adjusted to the ground in a stable manner. If the machine is unstable, other pins should be mounted or the working depth has to be adjusted.

⚠ Failing to eliminate the instability will damage the machine. The machine is NOT protected against this continuous overload.

⚠ Never reverse with the pins in the ground or close to the ground.

⚠ Do not use a hydraulic top rod.

9.0 USING THE VERTI-DRAIN®

Before using the Verti-Drain® in a location, you should check the following items:

1. Are there loose objects in the field? First remove these objects.
2. Are there slopes? The maximum slope is 20 degrees for this machine.
3. Always go from top to bottom.
4. Are there cables/pipes buried in the ground? If so, determine their depth and adjust the working depth of the machine to 60% of the depth of the cables/pipes.
5. Are there hard objects in the ground? If so, use the Verti-Drain® with a low PTO speed and adjust the working depth.
6. Is there danger of flying objects (e.g., golf balls) that distract the attention of the driver? If so, the Verti-Drain® CANNOT be used.
7. Is there danger of sinking/sliding away? If so, postpone using the Verti-Drain®.
8. If the soil is frozen or very wet, postpone the activities until conditions improve.
9. If the soil is very compressed, use shorter pins or adjust the working depth.

10.0 TRANSPORTING THE VERTI-DRAIN®

The user is responsible for transporting the Verti-Drain® in back of the tractor over public roads. Verify the national legislation regarding the regulations. On open fields while the machine is raised, the maximum permitted speed is 12 km/h (8 mph) due to the weight of the Verti-Drain®. A higher speed can be dangerous for the driver and/or the public and can even damage the machine.



When the machine is raised off the ground, the front axle of the tractor has to support minimum 20% of its weight.

11.0 DETACHING THE VERTI-DRAIN®

The machine can be detached from the tractor in the following manner:

1. Open the rear cover.
2. Turn the crankshaft until all the pins are in the highest position possible.
3. Place the machine with both rollers in the highest position on a solid underground.
4. Block the guide of the rear roller with the locking pins (3) (see Figure 8).
5. Block the front and rear roller to prevent them from rolling away.
6. Remove the top rod.
7. Loosen the PTO at the side of the tractor.
8. Remove the Verti-Drain's lower arms from the tractor.



Turn the tractor engine OFF if you walk around the machine and block the tractor from moving!

12.0 TROUBLE SHOOTING (PROBLEM ANALYSIS)

Problem	Possible cause	Solution
Machine vibrates.	Crankshaft turns irregularly. Difficult conditions	Machine is not set to 90°. Angles of the PTO's turning points are different. PTO's turning points are not aligned. Adjust the working depth. Use shorter/thinner pins. In case of drought, first sprinkle water.
Solid/hollow pins break and/or bend.	Wrong pin Difficult conditions Rapid wear & tear	Change the pin; use shorter ones. Use solid pins in front of the hollow pins to break the soil open. Adjust the working depth. Use shorter/thinner pins. In case of drought, first sprinkle water. First use solid pins to break up the soil. Adjust the pin angle.
Front roller does not stand stable on the ground.	Wrong pins; too much resistance. Difficult conditions	Change the pin size. Adjust the working depth. Use different pin sizes. First sprinkle water.
PTO breaks.	PTO angles are too large. PTO angles are not the same.	Adjust PTO as described in chapter 4.0
Damage to the drawbars	Bending / breaking	Machine is not set to 90°. Centre bar is bent. Bearing bushes are worn. Pins touch the ground when reversing the machine. Lifting height is incorrect.
Damage to the lawn	Oval holes Soil too wet	Soil is too wet. Change the pin angle setting. Reduce the forward driving speed. Adjust the working depth. Use thinner pins. Postpone operation
Pin is not fixed to the pin holder.	Difficult conditions	Use different pins. Grind a flat part to the pins. Adjust the pin angle.

Problem	Possible cause	Solution
Crankshaft problems	Big-end nuts come undone.	Rectify the vibration (see vibration) Crankshaft bearing is worn. Incorrect assembly after repair. Remove, clean and use Loctite.
Rear roller vibrates.	Locked rear roller. Rear roller is in upward position during pricking with hollow pins. Difficult conditions	Unlock. Change the speed and the PTO revs. Put roller free from the ground. Change the machine settings. (Gearbox in position 1.)

13.0 MAINTENANCE

Time schedule	Check/Grease point	Method
Before every use	Check for loose bolts/nuts. Attach the machine to a tractor and operate the machine for 5 minutes. Check the oil level in the gearbox. It has to reach at least the halfway mark of the gauge. Presence and readability of the safety stickers (Figure 7) Loose hanging parts around the PTO	Tighten loose bolts/nuts with the correct tightening moment. Listen and observe any strange movements/sounds. If necessary, use Lifetime grease EP 00. Replace these if not present or damaged. Tighten the parts so that they cannot reach the PTO.
After the first 20 working hours (new or repaired)	Grease PTO, roller bearings and crankshaft bearings. Check for loose bolts/nuts. Attach the machine to a tractor and operate the machine for 5 minutes. Check the gearbox for oil leaks.	Use EP2 grease 1 shot Tighten loose bolts/nuts with the correct tightening moment. Listen and observe any strange movements/sounds. Replace the seals/sealing paste.

Time schedule	Check/Grease point	Method
After the first 20 working hours (new or repaired)	Loose hanging parts around the PTO	Tighten the parts so that they cannot reach the PTO
After every 50 working hours	Grease PTO, roller bearings and crankshaft bearings. Check for loose bolts/nuts. Attach the machine to a tractor and operate the machine for 5 minutes. Check the gearbox for oil leaks.	Use EP2 grease 1 shot Tighten loose bolts/nuts with the correct tightening moment. Listen and observe any strange movements/sounds. Replace the seals/sealing paste.
After every 500 operating hours.	Replace the oil in the gearbox.	Use 80W90 (5.5 Ltr.)

14.0 TECHNICAL INFORMATION: GREASE POINTS

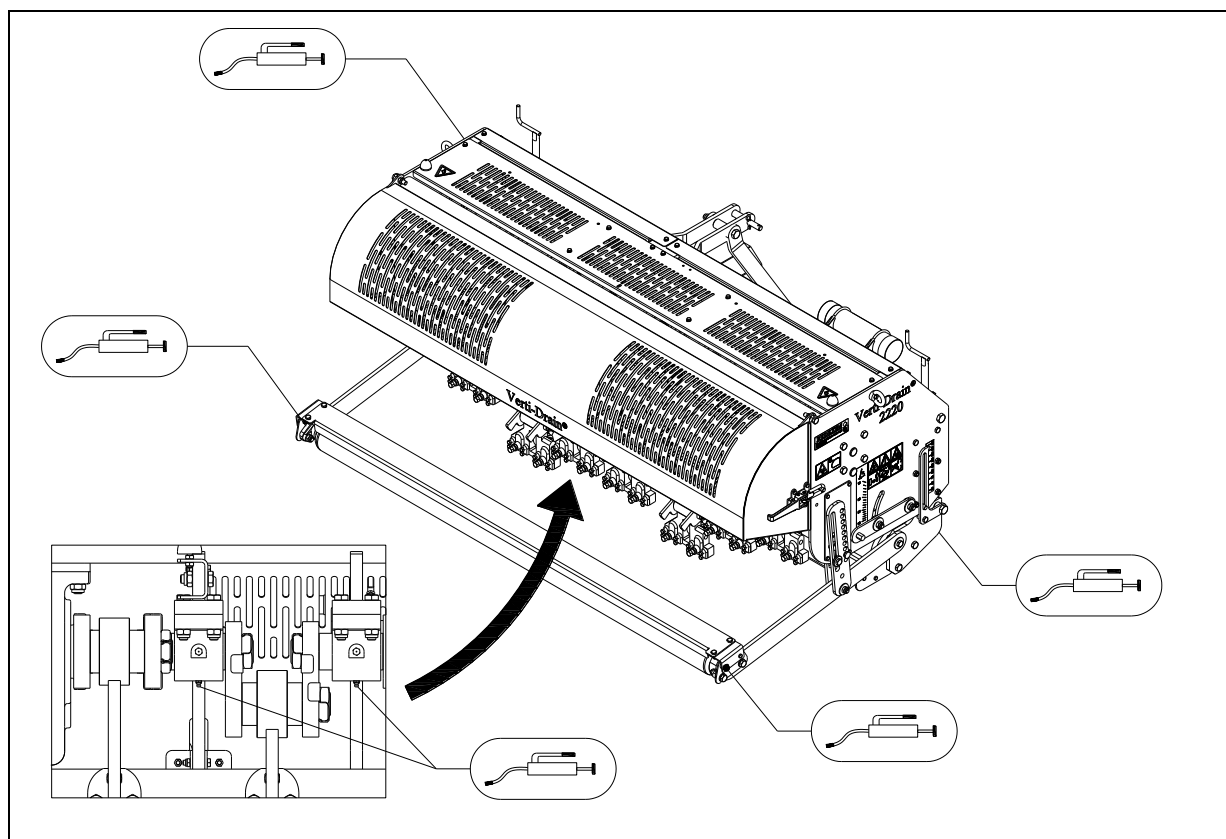


Fig. 13

14.1 THE CRANKSHAFT

Figure 14 illustrates the composition of the crankshaft. Also look at the Parts page for a more detailed drawing. In this machine the angle between the crank cheeks on the gearbox must be 0°.

14.2 REPLACING A CRANK / CRANK BEARING

Replacing a crank is necessary if the crank is cracked or if the big-end nuts come undone regularly. Then the crank bearings or the crank bearing fittings or the big-end pinholes are damaged. To prevent further damage to other parts, as soon as possible replace the crank / bearing as follows (see Figure 14):

1. Remove the big-end nut (1) and the big-end (2).
2. Remove the nuts (3).
3. Remove the combined bearing block (4).
4. Remove the nuts (5) and the profile shaft (6).
5. Remove the seals (7) and bearings (8) from the bearing block (4).
6. Replace the faulty parts and assemble in the reverse order.


 **Use new lock plates (9)**

7. Assemble the elements (10) in the correct manner (see Section 14.5).

- **Use Loctite for the big-end nut (1) and the nuts (3).**

14.3 REPLACING AN OIL CATCHER

Figure 14 provides a view of the crankshaft. Replacing an oil catcher in the gearbox is done as follows:

1. Remove the nut (11) on the second crank element (12) – counted from the gearbox – that might be stuck due to the use of Loctite.
 Heating it may help.
2. Pull the big-end (13) a bit backwards until the element (12) comes loose.
3. Remove the connecting rod (14) by removing the pin (15).
4. Remove the nut (16), lock plate (17) and the crank element (18) from the gearbox. Mark the position of the crank element before removing it!
5. Using a screwdriver, remove the oil catcher (19).
6. Clean the area and remove any oil and grease.
7. Assemble the new oil catcher. Apply some grease on the inside of the oil catcher.
8. Clean the crank element (20) and kit the splines with silicone sealant.
9. Assemble the crank element in the correct position (according to the marking)(See fig.15).
10. Fill the space between the handle and the axle with silicone sealant.
11. Assemble a new lock plate (17) and nut (16). For the nut, use Loctite.
12. Tighten the nut (16) with a torque as indicated in Figure 15.
13. Assemble the other parts in reverse order.

14.4 ELIMINATING THE CRANKSHAFT TENSIONS

If the parts in the crankshaft are replaced, the crankshaft can run heavier. Pre-tension can be the cause. It is necessary to eliminate these tensions as follows (see Figure 14):

1. Loosen the nuts (3) of the bearing blocks (4) a few turns.
2. From the centre of the gearbox, tighten the bearing blocks (4) one by one.
3. After each bearing block (4), check whether the crankshaft runs smoothly and without play.

☞ After repairing the crankshaft, you must regularly check whether nuts come undone.

☞ Assemble the cranks in the correct manner. See the Parts page for the correct order and part numbers.

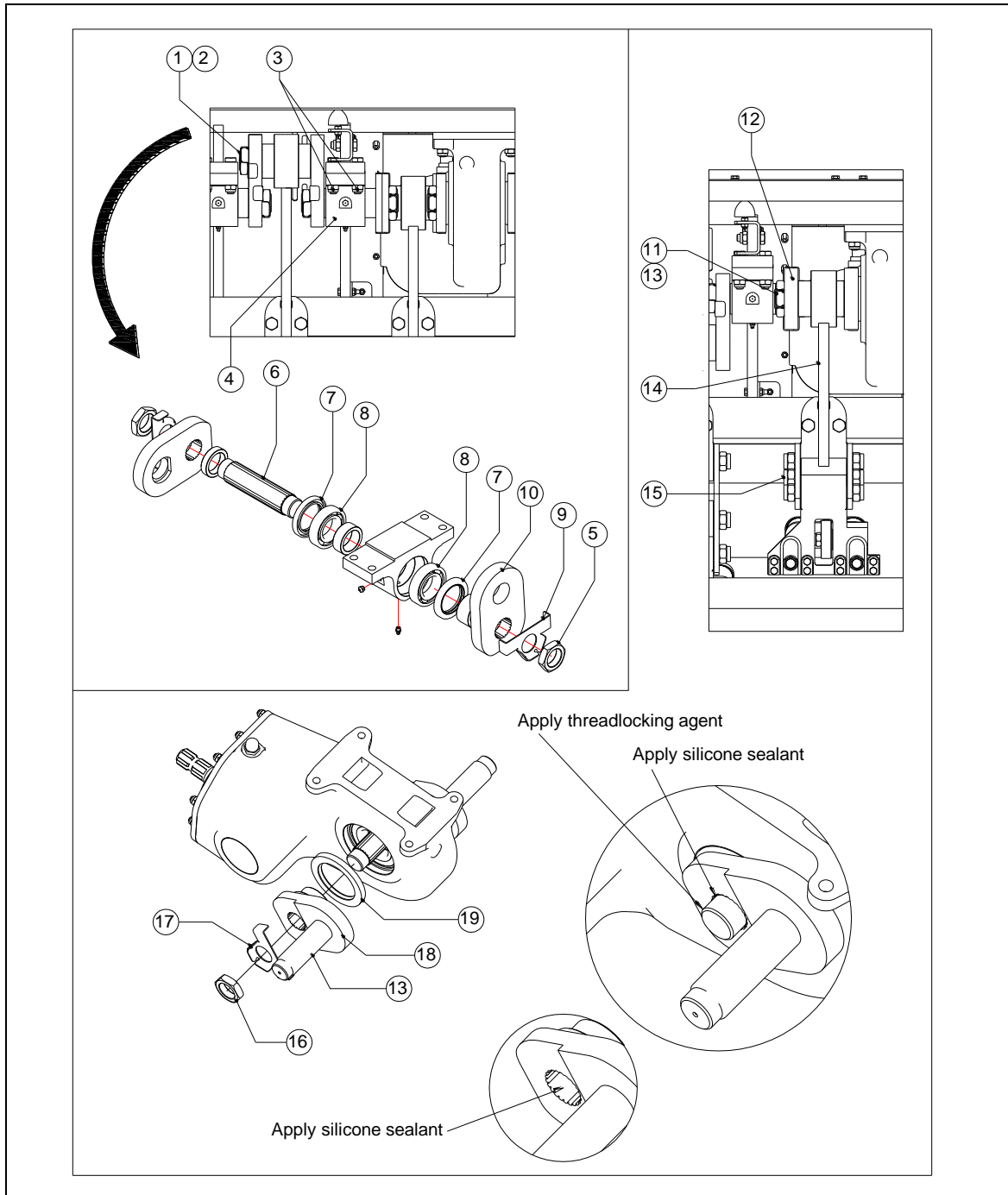


Fig.14

14.5 TIMING AND TIGHTENING MOMENTS

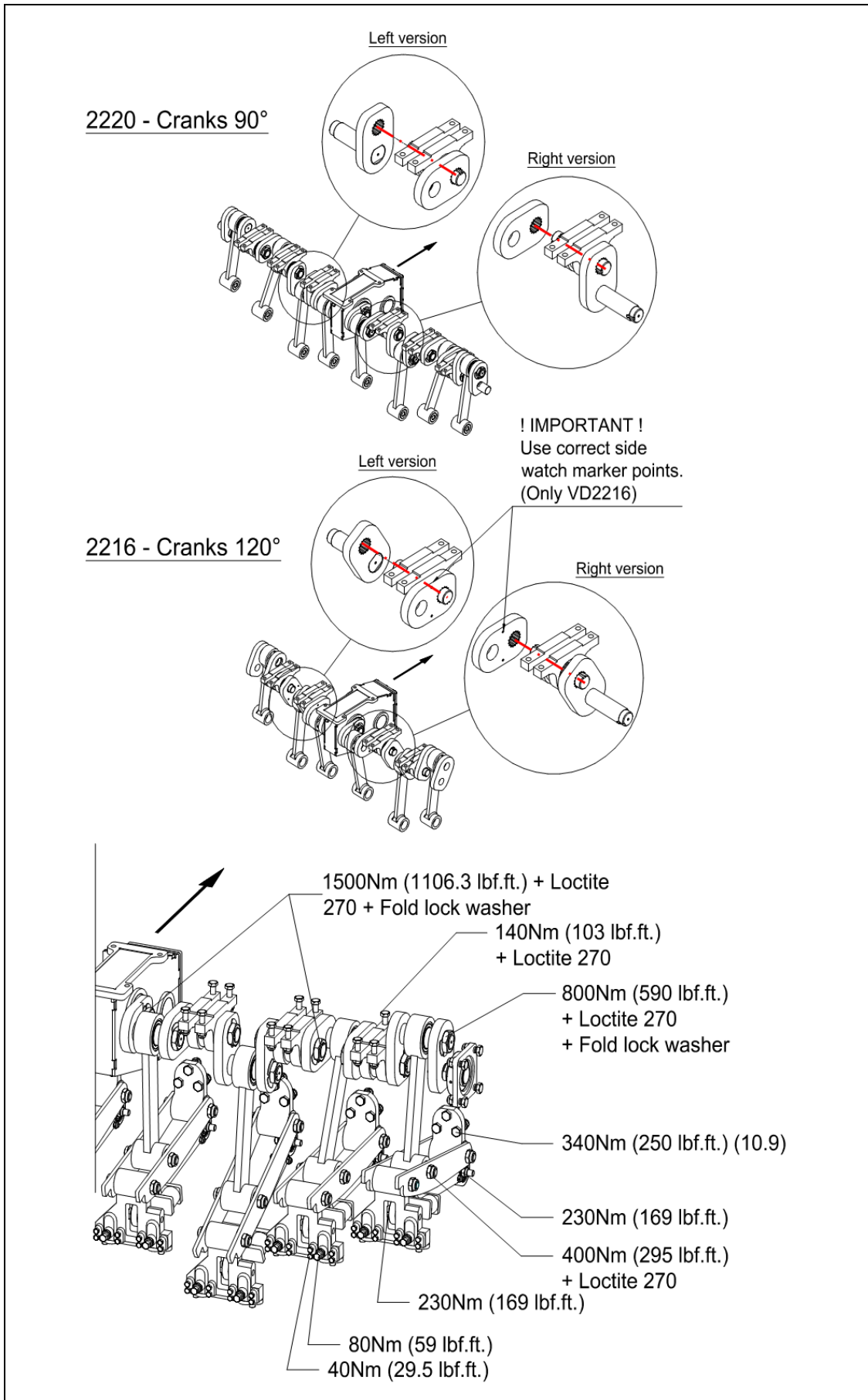


Fig 15.

Figure 15 indicates the tightening moments of the major bolts and nuts. Make sure that the tightening moments of bolts and nuts, which are not listed in Figure 15, are the same as the tightening moments of comparable bolts and nuts. If bolts and nuts come undone, Loctite may be used to tighten them.

15.0 OPTIONS: THE TURF HOLD DOWN KIT

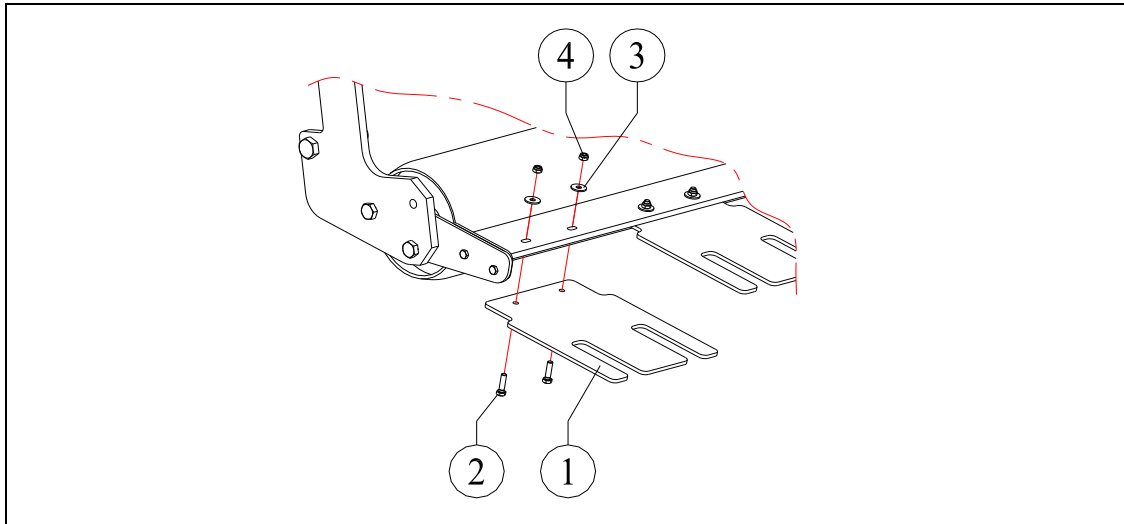


Figure 17

You can use a turf-hold-down kit if a layer of Turf comes loose. The following Turf-Hold-Down Kits are available:

- 2216 for 12mm (1/2") pins, order number: 211.116.004
- 2216 for 24mm (1") pins, order number: 211.116.002
- 2216 for 12mm (1/2") pins, order number: 211.122.004
- 2216 for 24mm (1") pins, order number: 211.122.002

A standard feature of the Verti-Drain 2220 is a pre-mounted main bar to which you can attach the turf-hold-down fingers.

The kit consists of a set of turf-hold-down fingers for 12 mm (1/2") or 24mm (1") pins and the attachment material consisting of a number of bolts and nuts.

ASSEMBLING THE TURF-HOLD-DOWN KIT (see Figure 17):

- Included in the ordered set are the plates (1). Attach the plates to the main bar using bolt (2), ring (3) and nut (4). Align the plates with the pins via the slotted holes in the plates.
- If the plates are bent in one direction after extensive use, you attach them the other way around.

OTHER REMARKS:

- If the pins are no longer in the centre of the machine, they might touch the sides of the slots. Realign the pin locks.
- Check the length of the drawbar if the pins touch the front side of the hole during work activities.



NEVER crawl under the machine! Make sure the machine is firmly blocked!

15.1 OPTIONS: PINS

Pins are vital for the proper functioning of the machine. Different pins are available for this machine. See the Parts page for a complete overview. Generally speaking, the pins can be divided into two categories: solid and hollow pins. We recommend using only original pins, because they are completely adjusted to the machine.

The pin holders have 4 x 12 mm (½") and 2 x 24 mm (1") holes for attaching the pins.

The locking bolt A may be tightened with a torque of 40 Nm/30 lbf.ft. (See Figure 18)

The locking bolt B may be tightened with a torque of 70 Nm/50 lbf.ft. (See Figure 18)

If a pin comes loose from its pin holder, grind a flat part to the assembling side of the pin.

SOLID PINS

Solid pins break open the hard compressed soil. The pin angle setting (see Chapter 6.0) determines the amount of pin movement in the soil. The pin movement becomes larger if the angle is adjusted from 90° to 70°. There is almost no pin movement if the setting is 90°.

If the pins are new, they can damage the lawn – certainly if the roots of the grass are weak. First, clean the pins manually *or* use the machine for 10 minutes on another rough underground.

If the roots of the grass are weak, adjust the working depth in such a manner that the pricking depth is slightly deeper than the length of the roots. This way the roots have a chance to grow deeper. The next time prick deeper. Applying this method will prevent damage to the lawn and ensures a healthy set of roots.

We recommend using solid pins with the sharp point in the direction of the front roller. This method ensures the best pin movement in the soil. On the other hand, we recommend using pins with the sharp point in the direction of the rear of the machine in case of a lawn with weak roots.

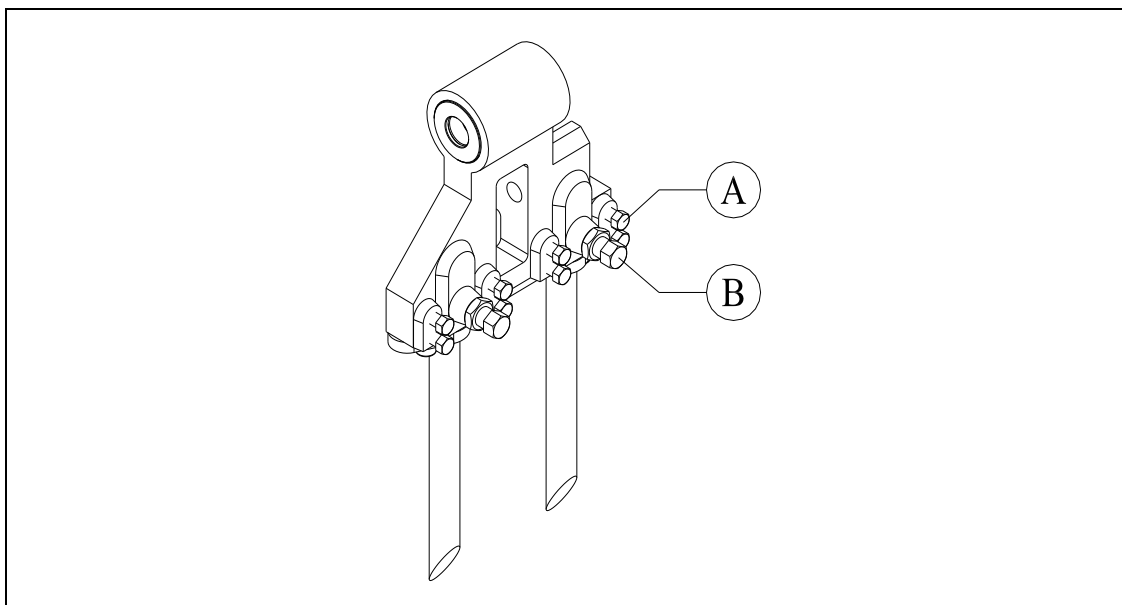


Figure 18

Always use pins of the same thickness and length. Replace a bent pin immediately. If you don't do this, the machine can become unstable. Do NOT use thicker and/or longer pins than the ones we supply.

Shorter (worn) pins can be used if superficial pricking is required. Be aware of the fact that the working depth indicated on the sticker will only be correct if the maximum length of the pin is used.

Oval holes are created if the top layer is weak and the substrate has a hard layer. Use thinner pins or wait until the wet top layer has dried.

If top dressing should be applied, apply this first *before* using the Verti-Drain.

If the soil is hard to prick, sprinkle water on the soil. Afterwards, use thinner and shorter pins or adjust the working depth. If this is not done, the machine will ultimately suffer damage.

HOLLOW PINS

The soil can be mingled with hollow pins. Various sizes are available (see the Parts page). The opening of the pin should be in the direction of the rear of the machine.

In case of using hollow pins, it is important that the pin angle is set to 90°. The pin movement in the soil is minimal and this way you make a nice 'clean' hole. The pin can ultimately break if the pin always moves in the soil under an angle smaller than 90°.

If top dressing should be applied, use the Verti-Drain first, remove the 'cores' and afterwards, scatter the sand.

If a lot of dirt is created during pricking with hollow pins, reduce the revolutions or sprinkle water. Dirt can cause wear & tear to your machine.

If the lawn becomes damaged, use solid pins first in order to create a set of healthy roots or adjust the working depth.

If the pins jam, then the soil is very compressed. First, you should use solid pins to break open the soil and then sprinkle water or adjust the working depth.

15.2 OPTION: WINDROW KIT

If hollow pins are utilized, cores are removed from the substrate.

The Windrow kit ensures that the cores are neatly guided together after the Verti-Drain operation, after which they can easily be removed. The kit can be ordered with number:

- VD2216: 211.116.008
- VD2220: 211.122.008

15.3 OPTION: HYDRAULIC DEPTH ADJUSTMENT

The machine is equipped with a standard mechanical depth adjustment. If desired, the machine can be converted to a hydraulic depth adjustment.

The hydraulic depth adjustment can be ordered as an option with number:

- VD2216: 211.116.006
- VD2220: 211.122.006

The conversion procedure is as follows: (See fig. 19)

For parts, refer to the parts manual.

Left side of the machine looks at the input as being left.

Right side of the machine looks at the input as being right.

1. Position the Verti-drain on a firm underground and secure the Verti-Drain against sinking away.
Take care that the front roll can move freely and that the Verti-Drain is not leaning on this.
2. Remove the covers (1).
3. Turn the front roll (2) downwards so that it is just leans on the ground and the spindles (8) are free of tension.
4. Remove the nuts (3).
5. Remove the plates (4).
6. Install the plates that were included in the kit, # 464.203.400 (5) and 464.043.100 (6).
7. Add bracket 468.031.402 (7) on the left side of the machine and bolt everything together.
8. Repeat steps 4 to 7 on the other side of the machine.
9. Remove spindle (8), together with cylinder (9) on the left side.
10. Mount cylinder 534.252.002 with shaft diameter 25mm (1") (10) with the included cylinders (11) and bolts (12) on the left side of the machine.
Use the existing bolts for attachment to the support (15).
11. Remove spindle (8), together with cylinder (9) on the right side.
12. Mount cylinder 534.252.004 with shaft diameter 30mm (1,2") (10) with the included cylinders (11) and bolts (12) on the right side of the machine.
Use the existing bolts for attachment to the support (15).
13. Mount the hoses to the cylinders and the other hydraulic components as indicated in the parts manual.
14. Mount the covers (1) onto the machine.
15. Attach the hose blocks (13) and the other hydraulic components to the covers (1).
16. Mount the working depth indicator (14) onto the cover (1), feed the cable through the cover (1) and attach the end to the support (15). Use a thread-locking sealant on the bolt to prevent loosening.
17. Adjust the working depth indicator (14) so that it registers the same depth as the indicators (16) on the sides of the machine.
18. Check that all attachments are secure and attach the machine behind a tractor, as described in chapter 3.0.

VENTING THE HYDRAULIC DEPTH ADJUSTMENT:

1. Connect the hydraulic hoses to the tractor.
2. Lift the machine off the ground.
3. Open the faucet (17) located on the right side of the machine by turning it to the left (by using the included key) to vent the hydraulic depth adjustment system.
4. Activate the hydraulic outlet of the tractor and let the front roll move downwards carefully to remove the air from within the system.
5. Close the faucet (17) located on the right side of the machine by turning it to the right (use the included key).

If there is still air in the machine, repeat 3 to 5 until all air is removed. The system is now vented and ready for use.



Ensure that both sides of the machine are moving up and down parallel to each other. If this is not the case, stop the movement immediately to prevent damage to the machine.

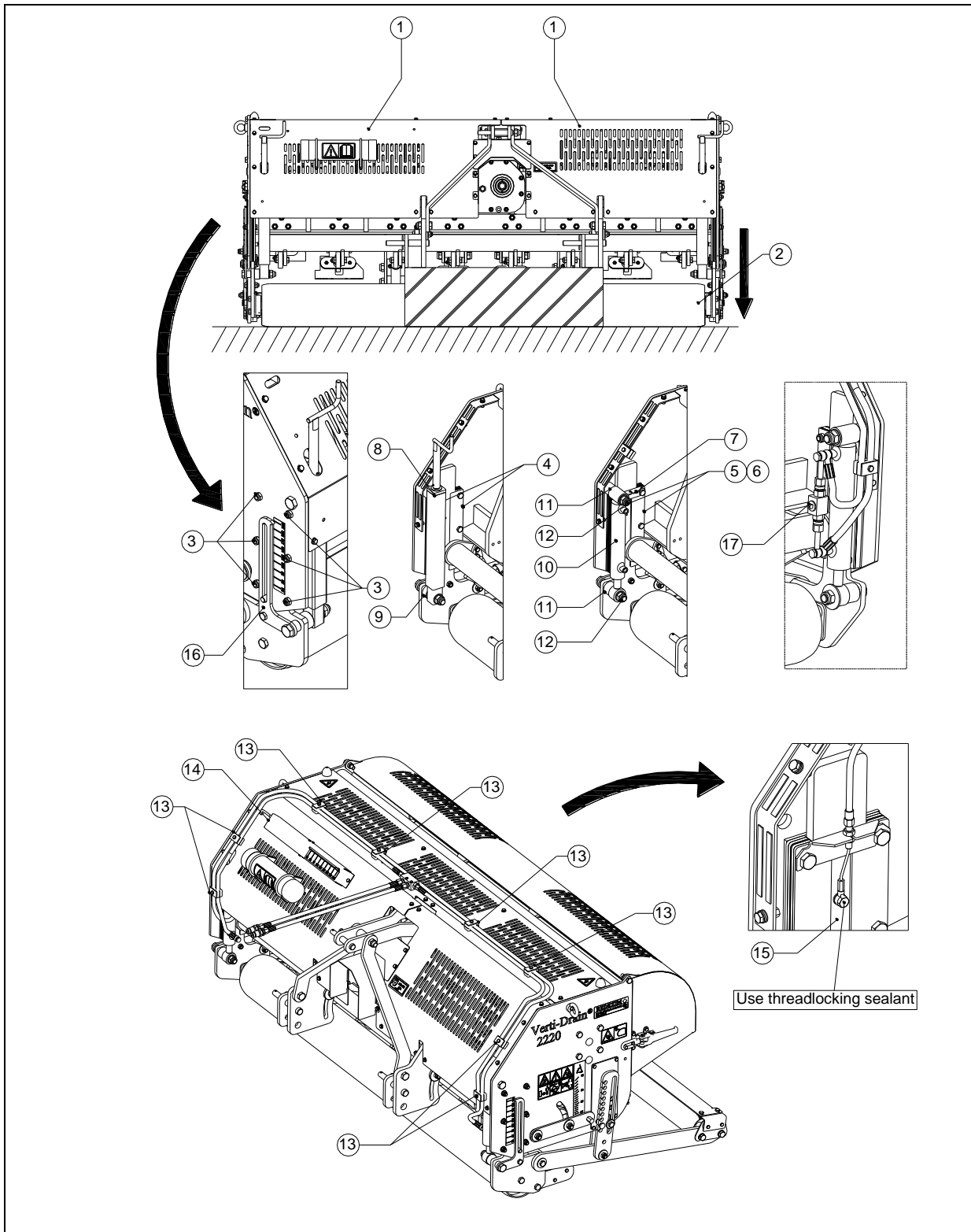


Fig. 19