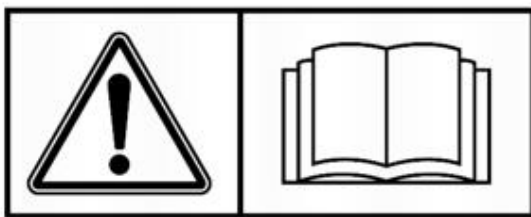
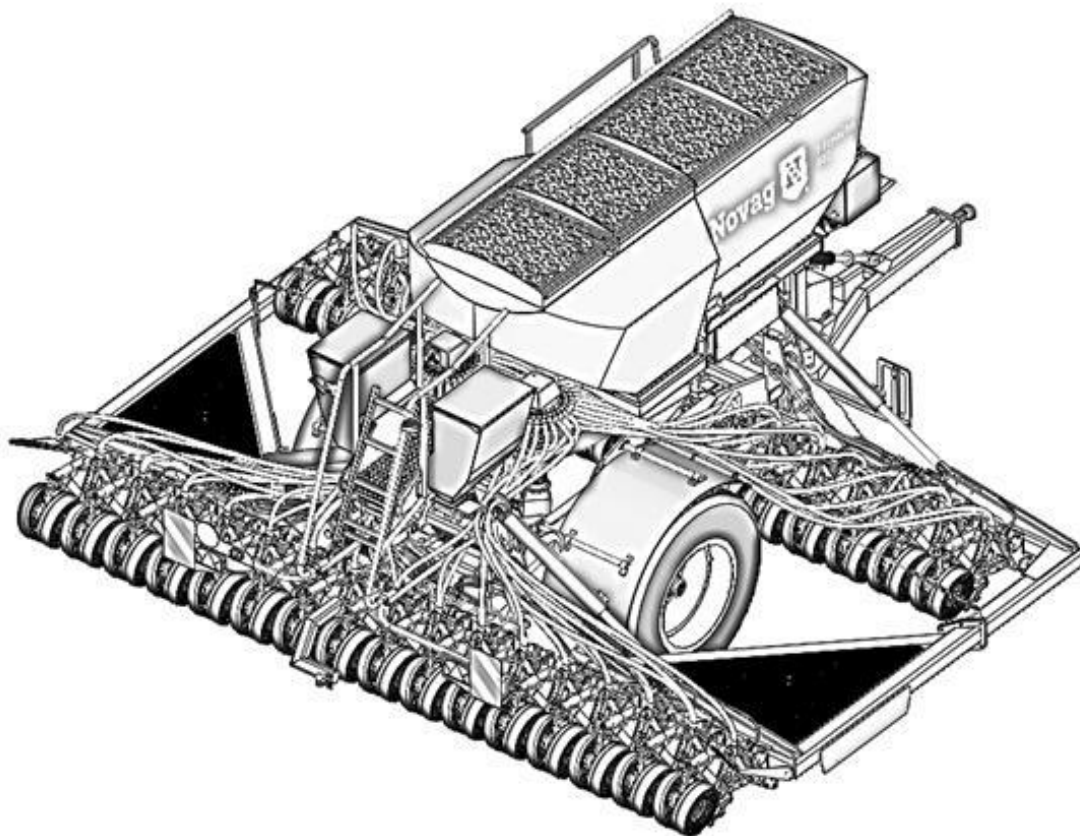




Next Generation
Farming

USER MANUAL

T-FORCEPLUS® SERIES 6M FOLDING DRILLS



**READ CAREFULLY BEFORE USING
THE MACHINE**

MESSAGE TO THE USER

You have just purchased a NOVAG product. We would like to thank you for the trust you place in our company with your choice.

Years of studies, design engineering and repeated upgrades from field use have allowed the manufacturing of your machine.

This machine is very reliable. Its functioning throughout its life will depend of your care and proper maintenance.

You will find in this user manual all the information required for optimum use of your implement. We strongly recommend that you carefully read this manual and you follow all the instructions.

This implement is of simple design. But, even if they are generally visible, the reasons of its improper functioning would often be neglected.

YOU WILL NOT BE ABLE TO CORRECTLY MAINTAIN AND USE YOUR PRODUCT, if you have not read this user manual

ALWAYS KEEP IT AT HAND.

Your NOVAG dealer will explain to you how to successfully use your implement. His role is to allow you to get the most from it.

Your NOVAG dealer also keeps in stock a full range of NOVAG genuine spare parts.

Meticulously checked, these spare parts are strictly identical to the ones that were fitted on your machine at the factory.

UPGRADES

Constantly improving our products is a major concern for our technicians. Therefore, we reserve the right to apply without notice any modification or upgrades that seems necessary to us, without being compelled to apply them to previously sold machines.

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1 Safety Prescriptions



This symbol is used in the manual every time recommendations are written, relating to your safety or the safety of others, or the proper functioning of the machine.

You must make these recommendations to any operator that will use the machine.

CORRECT USE OF THE MACHINE

T-FORCEPLUS drills must only be used for the work they have been designed for: drilling of cereals, peas, forage/cover crops and grasses.

In case of damage related to the use of the machine, occurring out of the field specified by the manufacturer, his responsibility will be fully excluded.

The correct use of the machinery also implies:

- Following of the prescription of use and maintenance specified by the manufacturer.
- Exclusive use of spare parts, equipment and accessories preconized by the manufacturer
- **T-FORCEPLUS** drills must only be used, serviced or repaired by skilled personnel, familiar with their specifications and their use. These personnel must be informed of the danger they might be exposed to.

The user must scrupulously comply with regulations in terms of:

- Injury prevention
- Work safety
- Road regulations

He/she must strictly observe the warning signs marked on the machine.

Any modification of the machinery made by the user him/herself or any other person, without written approval from the manufacturer will clear the manufacturer's responsibility for any damage that might result from this.

1.1 General Safety Prescriptions

Before any use of the tractor-implement machinery, its compliance with work safety and road regulations must be checked.

1.1.1 GENERAL PRESCRIPTIONS

1. The warning signs and stickers on the machinery give indications on the safety measures to observe and help to avoid injuries.
2. While driving on public roads, keep in accordance with road regulations.
3. Before starting working with the machine, the user must be familiar with the control panels and operating the machinery. During the work, it will be too late to do so.
4. The user must avoid wearing clothing that could be caught by moving elements.
5. Use a tractor equipped with a safety cab. Leave the windows closed while working with the machine.
6. Before starting work with the machines, check the surroundings (children!).
Make sure to have enough visibility!
Keep people or animals away from the danger zone of the machine (projection!).
7. Transportation of animals or people on the machine while driving or working is strictly forbidden.
8. The machine coupling with the tractor must only be made on towing hitches adapted for this use.
9. Keep caution during the coupling of the machine to the tractor.
10. Keep the machine weight under the maximum total load allowed on the machine and over the axles.
11. Comply with the maximum allowed dimensions of the machine on the road.
12. Before driving on public roads, make sure the road lights are fully working and that the panels required by the law are in place.
13. Before driving on public roads, fold the machine in transport position, according to the manufacturer's instructions.
14. Never leave the driving post while the machine is running.
15. Speed and driving must always be adapted to terrain, roads and tracks. In all circumstances, avoid any sudden direction changes.
16. Be very cautious while turning, taking in account the length, the wheelbase, the height and the weight of the machine or trailer.
17. Before any use of the machine, make sure every protection component is in place and not damaged. Any damaged component protection must be immediately replaced.

18. Before any use of the machine, check the tightening of screws and nuts, the ones that hold the ground engaging parts in particular. Tighten them if necessary.
19. Do not stay in the operating zone of the machine.
20. Careful! Pinching zones may exist between moving parts of the machine, especially the ones controlled by hydraulics, pneumatics, or electrics.
21. Before getting out of the tractor, or before any intervention on the machine, turn the engine off, pull out the contact key, and wait for the complete stop of all moving parts.
22. Do not stand between the tractor and the machine without first setting the parking brakes and/or placing chocks under the wheels.
23. Before any intervention on the machine, make sure it cannot be turned on accidentally.

1.1.2 HYDRAULIC CIRCUIT

1. Careful! The hydraulic circuit is under pressure.
2. When mounting cylinders or hydraulic motors, make sure the wiring is correct, according to the instructions made by the manufacturer.
3. Before plugging any hose to the tractor, make sure that neither the tractor circuit nor the machine circuit are under pressure.
4. It is highly advised to the machine user to install identification marks on the hydraulic couplers between the tractor and the machine to prevent any connection error.
5. Careful! Some functions may be inverted. For example: fold/unfold.
6. Regularly check the hydraulic hoses! Damaged or worn hoses must be immediately replaced.
7. For hydraulic hose replacement, make sure you only use hoses of the same specifications and quality to the ones specified by the machine manufacturer.
8. If a leakage is found, accidents must be prevented by all means.
9. Any pressurized liquid, notably hydraulic oil, can perforate the skin and occasion serious injuries. In case of injury, immediately consult a doctor! There is a risk of infection!
10. Before any intervention on the hydraulic circuit, lower the openers, discharge oil pressure from the hydraulic circuit, turn off the tractor engine and remove the contact key.

1.1.3 MAINTAINANCE

1. Before any maintenance or repair work, and before looking for causes of a break down, the PTO must be unclutched, the motor must be turned off and the contact key removed.
2. Regularly inspect bolts and nut tightening. Tighten them if necessary!

3. Before working on a machine in raised mode, put an appropriate mechanical prop in position.
4. Before replacing any ground engaging part, wear protection gloves and only use correct tooling.
5. To protect the environment, it is forbidden to throw or spill oils, greases and any kind of filters. Give them to companies specialized in their treatment.
6. Before any work on the electric circuit, disconnect the power source.
7. Protection devices subjected to wear must be checked regularly. Immediately replace them if they are damaged.
8. Spare parts must be in conformity with the specifications and norms defined by the manufacturer. Only use genuine NOVAG spare parts!
9. Before undertaking electric welding on the tractor or the machine, disconnect the battery and alternator cables.
10. Repairs of any preloaded device (springs, accumulators...) requires particular skills and involves mandatory tooling. Thus, they may only be performed by qualified workers.

1.2 Special Safety Measures

1. Keep people away from the metering units' gears and wheels.
2. Slowly clutch in the tractor PTO.
3. Never leave any object in the hoppers.
4. Do not move your fingers close to the metering roller.

2 Technical Specifications

2.1 Main features

Model	T-ForcePlus 650		
Work Width	6m		
Road Width	3m		
Empty weight	11000kg (TF+ 650.24)		
Row configuration	No. of Rows	Row Spacing	Power requirement
	24	25cm	>280 hp
	32	18,75cm	>330 hp
	36	16.66	>360 hp
Total hopper capacity	5 400l (2600l – 2900l or 1800l – 3600l)		

2.2 General views





3 Coupling to tractor

3.1 Coupling procedure

3.1.1 USE OF DRAWBAR CYLINDER

1. Plug the two hoses coming from the drawbar cylinder to a double acting spool valve on the tractor. The hoses can be recognized by their blue caps.

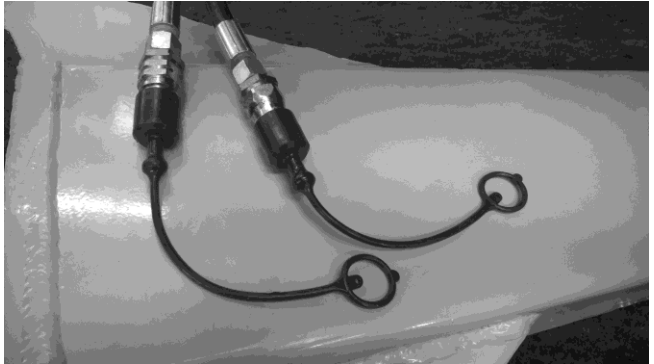


Fig. 1 : Drawbar hoses

2. Set the oil flow from the tractor to a low value to avoid sudden movement.
3. To connect the drill, raise or lower the drawbar to correct position.
4. Put the tractor in place.
5. When the tractor is attached, lower the drawbar to transfer the weight on the tractor hitch.



Only use certified tow couplings provided by NOVAG.

Two configurations are possible:

- Ball joint type « K80 ». Maximum permitted vertical load 3000kg.
- Tow eye. Maximum permitted vertical load 3000kg.

3.1.2 CRUTCH FOLDING

- A. Raise the front of the drill, using the drawbar cylinder.
- B. Remove the lower pin (1) and push the telescopic crutch (2).
- C. Lock the crutch in short position with the same pin (3).

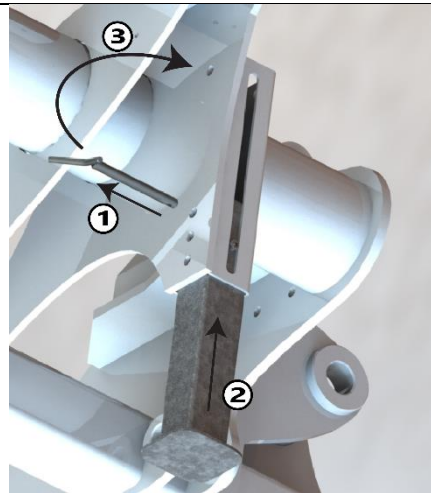


Fig. 2 : Folding the crutch

3.2 Clip and angle setting

Once the drill is attached to the tractor, the drawbar cylinder is used for adjusting the frame angle with the ground. The drill is designed to work at a perfectly horizontal angle. It is best to adjust the drill frame to horizontal when the drill is working.

Clip blocks for the cylinder rod are supplied with the drill. Use them in association with the angle settings.



Always set the angle on horizontal for road transport, in order to have the most clearance under all discs.



Always mount the clip blocks when travelling on the road.



Fig. 3 : Clip kit for mounted on the cylinder

4 Road driving and brakes



Before going on the road, always check that the drill configuration complies with road regulations.



Make sure that the openers are fully raised.



Make sure the folding frame parts are completely folded and that the safety hooks are in correct position.

4.1 Maximum speed

The drill is certified for a maximum road speed of 25km/h.

4.2 Tires

4.2.1 AUTHORIZED TIRE DIMENSIONS

Any tire matching the following specifications:

- 710/50 x 26.5
- 750/45 x 26.5
- 800/45 x 26.5
- 710/50 x 30.5
- 800/45 x 30.5

4.2.2 INFLATION PRESSURE.

- Comply with the inflation pressures specified on the rim. If they are not mentioned, never go under 1.7bar for road travel at 25km/h.
- On difficult land, increase the minimum pressures by 20%.
- For intensive use on the road, double the minimum pressure to maximize tire life.



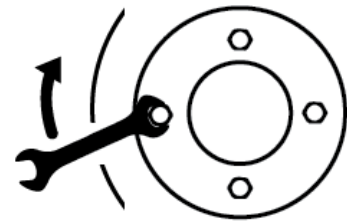
With any tire, never inflate at a pressure lower than 1bar or higher than 3.5bar.

4.2.3 WHEEL NUT TIGHTENING



Always check the wheel nut tightening before any use of the drill.

The required torque for the wheel nut is 450Nm (nut size M22x1.5).



**M 22 X 1,5
450 Nm**

**Toujours contrôler le serrage
des roues avant utilisation.**

Fig. 4 : Sicker on the rim

4.3 Lightning

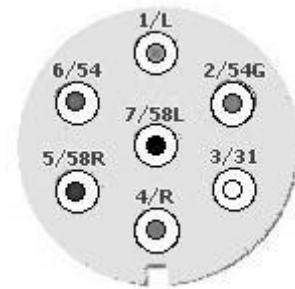
4.3.1 ROTATING BEACON

The drill is fitted with a 12V rotating beacon. The beacon is independent from the road lights system and must be activated and deactivated from the main power cabinet on the drill. The drill has to be connected to the tractor battery (See section (5.1.1)).

4.3.2 REAR LIGHTS

Connect the 7-pin plug to the tractor socket.

Pin	Code	Wire colors	Circuit
1	L	YELLOW	L. Indicator
2	54G	BLUE	Fog light
3	31	WHITE	GND
4	R	GREEN	R. Indicator
5	58R	BROWN	D. Sidelight
6	54	RED	Stop Light
7	58L	BLACK	G Sidelight



*Fig. 5 : 7 pin plug wiring
schematics*



In case of malfunction of only one sidelight, check the tractor fuses.



Do not drive on any road without connecting this plug first, or in case of malfunction. Make sure the bulbs are working.

4.4 Brakes

4.4.1 HYDRAULIC BRAKE

Before any use on the road:

Plug the special coupling of the drill to the tractor brake valve.

If coupling is not possible:

- Check the compatibility between the couplers.
- The hydraulic brake circuit may be under pressure, due to the emergency brake accumulator. Use the decompression push button described in 4.4.2.



Remove the coupler if necessary, taking all safety precautions.



Fig. 6 : Brake hose with special coupler



Always use the coupler that was factory fitted on the drill. The coupler must be in accordance with ISO 5576.1983.



Never use the drill without connecting the brake system to the tractor.

4.4.2 EMERGENCY BRAKE

Using a chain or rope, connect the pin to a static point at the back of the tractor.

1/ Trigger pin.

If, while on the road, the drawbar connection breaks, the chain will pull the trigger out and will activate the emergency brakes.

2/ Decompression pushbutton

This button can be used to relieve the pressure in the brake hose after a long period without being used.

3/ Brake accumulator

This accumulator charges itself when the driver uses the tractor brakes. It will send the oil flow back to the drill brakes when the trigger pin is activated.

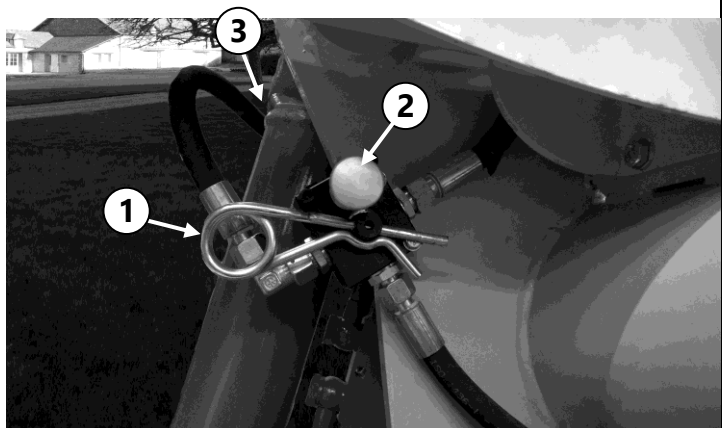


Fig. 7 : Brake valve in braking position)

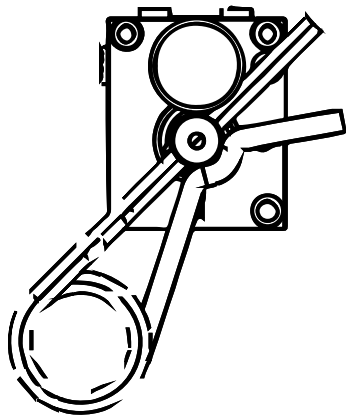


Fig. 8 : Brake valve in free position

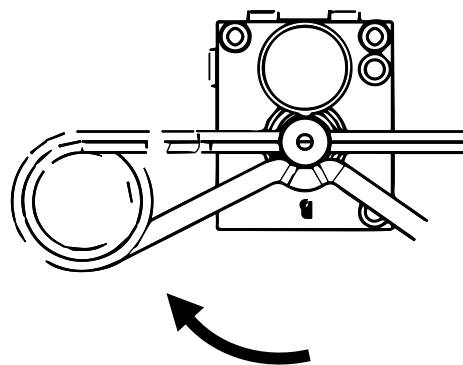


Fig. 9 : Brake valve activated



This system is an emergency brake only and it is not designed to be used as a parking brake.



Make sure that the trigger is deactivated before moving the drill on the road as well as on the fields.

4.4.3 PNEUMATIC BRAKE SYSTEM

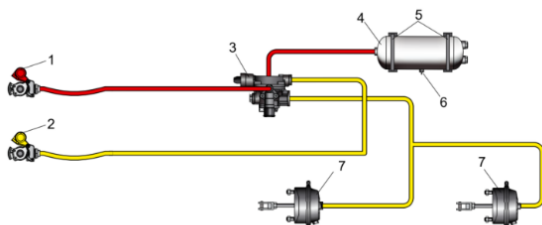


Figure 10: Schematic pneumat. system

1. Pneumat. brake hose *pressure* – red
2. Pneumat. brake hose *brake* – yellow
3. Brake force regulator
4. Air reservoir
5. Brackets for air reservoir
6. Drain valve
7. Wheel cylinder

Hitching-Up:

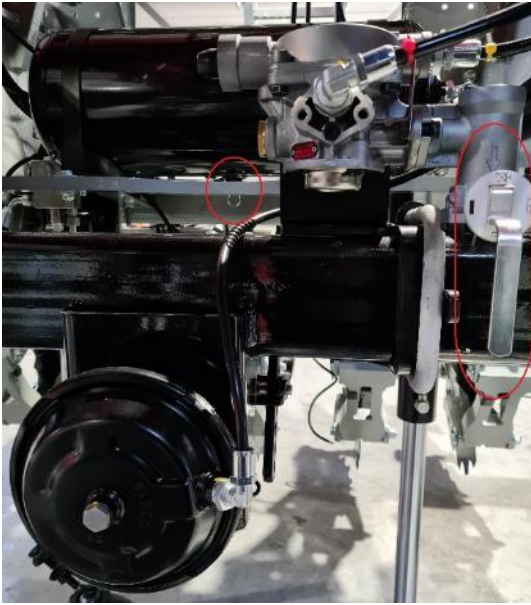
1. Brake coupling – yellow
2. Pressure coupling - red
3. Release the parking brake

When unhooking, proceed in reverse order.

Unhitching:

1. Apply parking brake
2. Disconnect provision coupling - red
3. Disconnect brake coupling - yellow

4.4.4 AIR PRESSURE RESERVOIR



- Drain the air reservoir at frequent intervals using the drain valve.
- Brake force regulator must be adjusted according to the loading condition of the seed drill.

4.4.5 PARKING BRAKE

The parking brake is immobilize to fix the drill in its position. Uncontrolled rolling away of the machine can cause serious injuries due to crushing or rolling over.

- Park the machine only horizontally and on a stable surface.
- Before loosening the brake, secure the machine against rolling away.
- Before parking the machine, always apply the parking brake and secure the machine against rolling away.
- Always release the parking brake before transport and empty runs.
- When hitching up the machine, check the function of the parking brake. If necessary, readjust the cable.



Figure 11: Park Brake



Make sure the parking brakes are untightened before moving the drill. A permanent braking load, even light, will induce heat and wear on the brake components and the axle.

4.5 Manufacturer identification plate

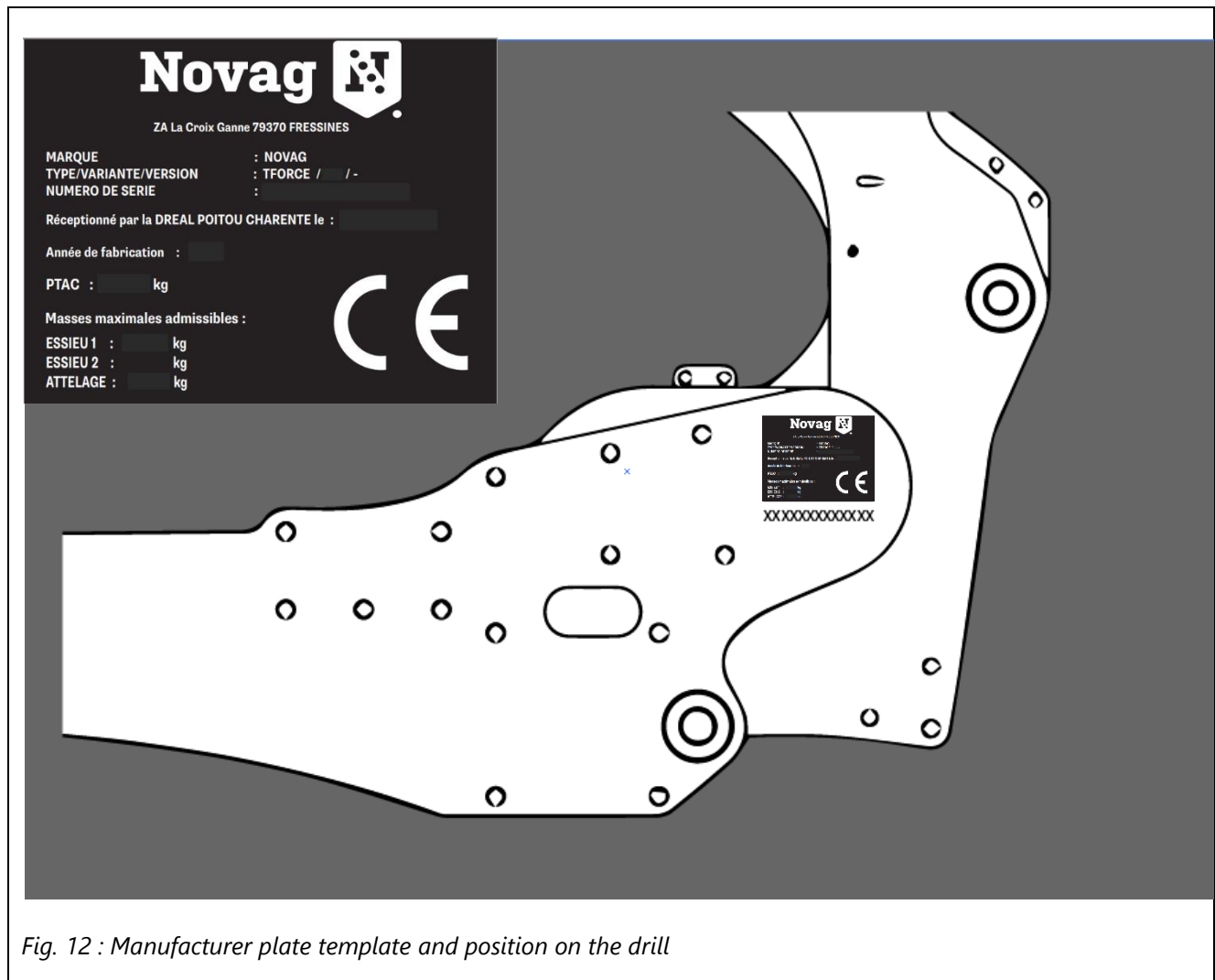


Fig. 12 : Manufacturer plate template and position on the drill

5 Drill Set Up

5.1 Battery cable mounting

1. Crimp contacts adapted to the tractor battery on the power wires.
2. Install the power wire along the tractor's frame, and secure it cautiously. In particular, keep it away from the tractor wheels and moving parts.
3. Bolt tightly the crimp contacts to the tractor battery, following its polarity.

Wire color	Polarity
RED	(+)
BLACK	(-)

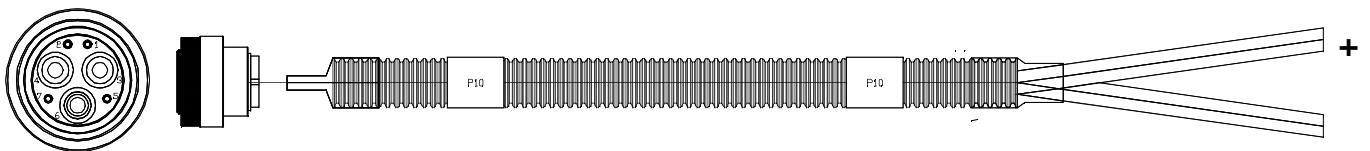


Fig. 13 : Tractor power cable.



Always connect the power cable directly to a 12V battery. And never use a tractor cab socket, isobus socket or external implement socket. Minimum required intensity is 70A.

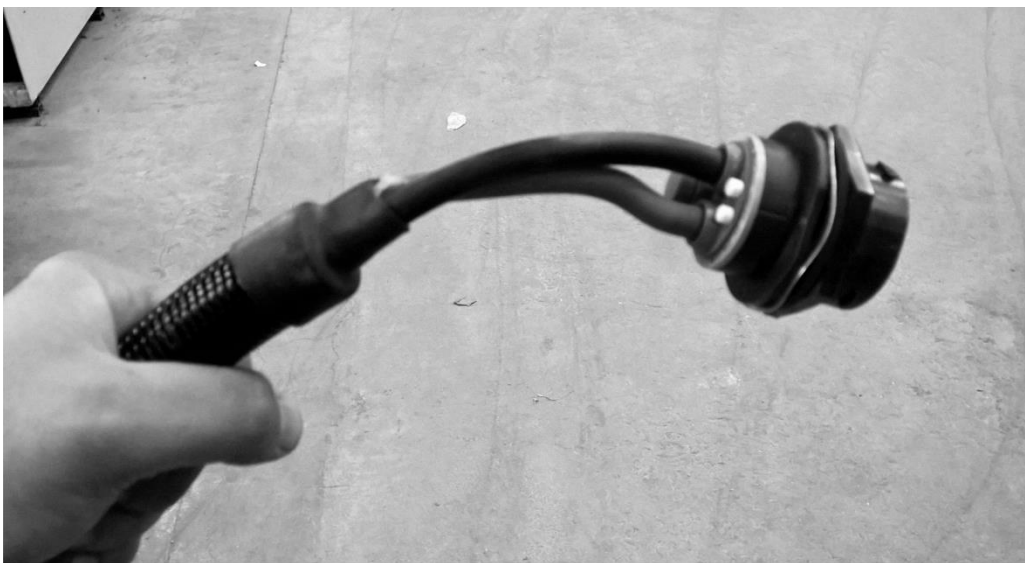


Fig. 14 : Drill power cable

5.2 Monitor Installation and setup

5.2.1 DESCRIPTION OF THE BOX







Fig. 15 : Monitor and main socket

- 1/ Aluminum mount
- 2/ HMI
- 3/ Joystick 1, 2 or 3 push button depending on options
- 4/ USB socket for software upgrades
- 5/ Joystick socket
- 6/ Joystick cable
- 7/ Drill main socket
- 8/ 3 position switch. From bottom to top: OFF/ Monitor only ON / Monitor + Drill ON



Fig. 16 : RAM ball arm

- 
Do not hang the monitor assembly using the joystick cable.
- 
Firmly fasten the monitor assembly in the tractor cab using the RAM system provided, or any other appropriate system
- 
Handle the monitor with caution to avoid scratches.
- 
Do not attempt welding on the aluminum mount.

5.2.2 CONNECTION TO THE DRILL CABLE

1. When the monitor assembly is mounted, connect it to the drill cable using the elbow connector.
2. Secure the drill cable at the back of the tractor to prevent it being caught during turns and maneuvers.



Fig. 17 : Elbow connector on the drill cable

5.2.3 ELECTRIC START UP

The electrics are switched on by the cab switch. This switch has 3 positions.

OFF position	Monitor and controllers are OFF
Intermediate position	Only the monitor is activated. This position is used to upgrade the software.
ON position	<p>The drill is fully activated.</p> <ul style="list-style-type: none"> ▪ The monitor is turned on ▪ The sensors are powered ▪ The drill controllers are powered

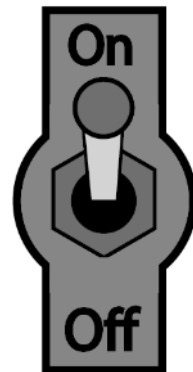


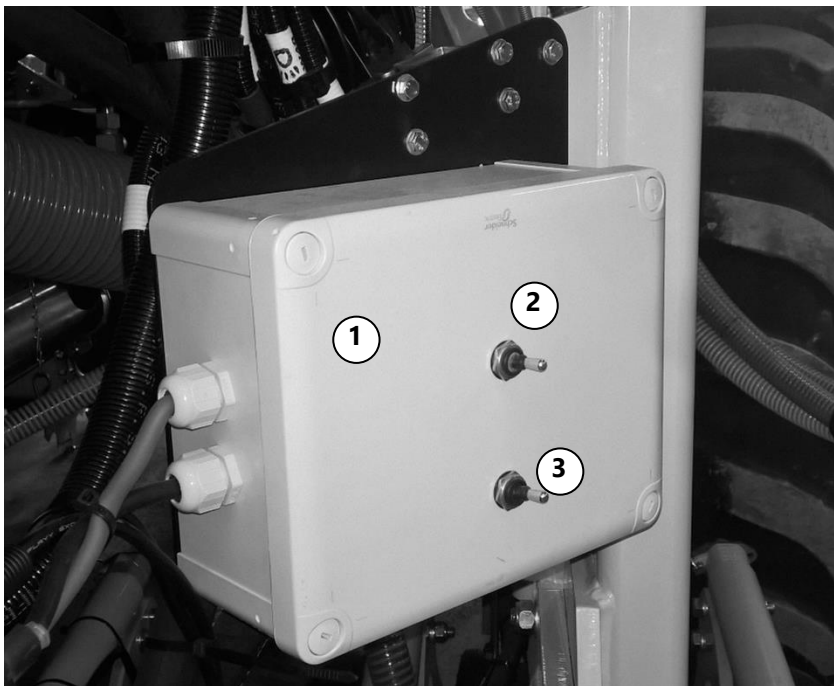
Fig. 18 : Cab switch positions



The drill will not work if the switch is not pushed to 3rd position, (top of its travel).



The rotating beacon and the road lights are independent from this switch and must be activated/deactivated on the main power cabinet.



1/ Power cabinet

2/ Rotation beacon switch

3/ Hopper LED switch

Fig. 19 : Main power box on the drill

5.3 Hydraulic hoses coupling

5.3.1 4-SPOOL VALVE SETUP

Hose designation	Tractor coupling	Hose size	Color	Coupler type
Drawbar coupling	2 hoses on double acting spool valve	2 hoses 1/4' (DN06)	Blue cap	Male coupler 1/2"
Fan hose	1 hose on 1 spool valve	1 hose 1/2 (DN13)	Orange or green cap	Male coupler 1/2"
Fan return hose	1 hose on other side of fan spool	1 hose 1/2 (DN13)	Black cap	Male coupler 1/2"
Folding cylinders	2 hoses on double acting spool valve	2 hoses 3/8 (DN10)	Yellow cap	Male coupler 1/2"
Main circuit hose	1 hose on 1 spool valve	1 hose 1/2 (DN13)	Red cap	Male coupler 1/2"
Load Sense hose	1 hose on LS spool	1 hose 1/4" (DN06)	Blue cap	Male coupler 1/4"
Tank hose	Direct return to tank	1 fabric hose 3/4 (DN20)	Black cap	Male or female coupler 3/4"

*Depending on tractors

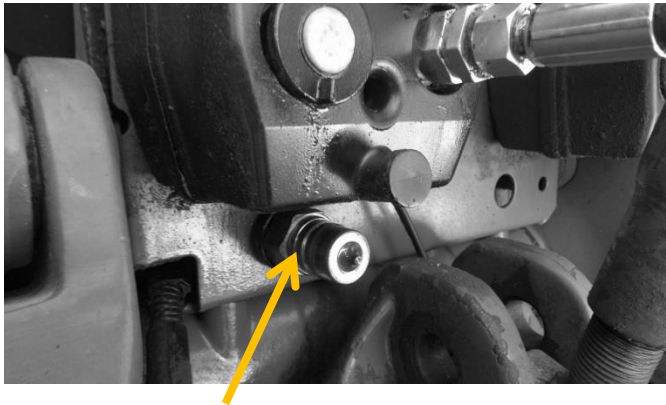


Fig. 20 : Example of return plug on tractor



Fig. 21: Return hose on the drill



The tractor must be fitted with a tank coupler.



Always plug the return hose first and unplug it last, to avoid any pressure blockage.

5.4 Oil flow set up

In case of a drill without embarked pump.

5.4.1 RECOMMENDED OIL FLOW

Oil flows are set from the tractor hydraulic system.



Stay in accordance with the following specifications. An overly low flow will cause irregularity and an overly high one will induce overheating and power loss.

Functions	Minimum flow	Maximum flow
Drawbar cylinder	/	15l/min
Main circuit	25l/min	60l/min (using aux. bins)
Fan	240l/min	60l/min



Oil flow output values from the tractor can depend on 2 parameters:

- Engine revolutions: Maximum oil flow is not generally reached under 1500-1700 rpm, even with a load sensing pump. For lower motor speed, the tractor pump cannot deliver enough flow. This can be seen with the fan speed.
- Temperature: On especially older tractors, the hotter the oil is, the higher is the oil flow. This parameter must be taken in account for manual spool valve adjustments.

5.4.2 SPOOL VALVE FOR « MAIN CIRCUIT »

This distributor sends oil for:

- Raise and lower functions of the openers.
- Metering unit's rotation.
- Opener Downforce control.

The oil flow has to be adjusted taking in account the number of rows, because the raising and lowering speed of the openers is directly proportional to this value.

Also, 10l/min has to be allowed for each activated hopper.

The IntelliForce® system only occasionally uses the tractor oil flow.

5.4.3 FAN SPOOL VALVES

Detailed fan adjusting procedure will be presented in section 8.

5.4.4 LOAD SENSING OPTION

With this option, the drill can be connected directly to the load-sensing system of the tractor. If the tractor is equipped with a load-sensing pump, the main line (P) can be connected directly to the pump outlet of the tractor. For LS operation, the LS valve must be adjusted. To do this, loosen the union nut (size 13 spanner) and screw the threaded shaft down using an Allen key (size 4). Then secure the union nut.

If the drill is operated via the normal control units (scv), make sure that the threaded shaft is completely screwed out.

This pilot hose will send information to the tractor pump which will adapt its flow for:

- Adjusting the opener downforce.
- Making the metering unit(s) turn at the right speed.
- Raise and lower the openers.

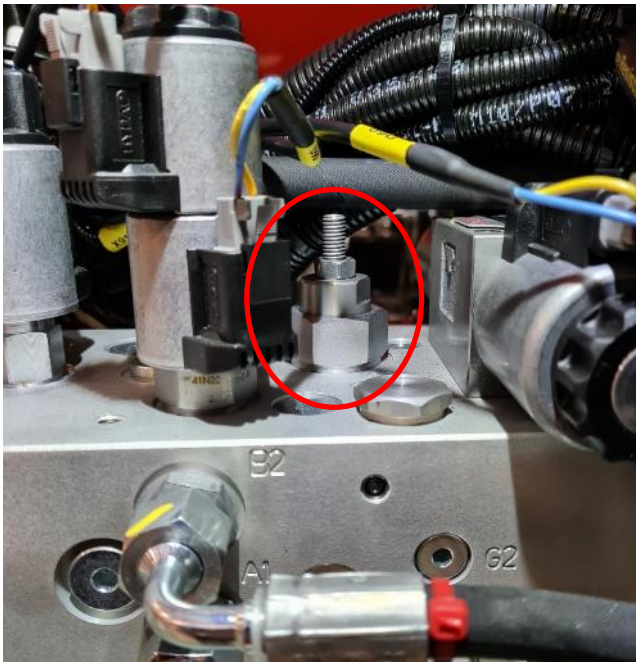


Figure 22: Hydraulic block Principal

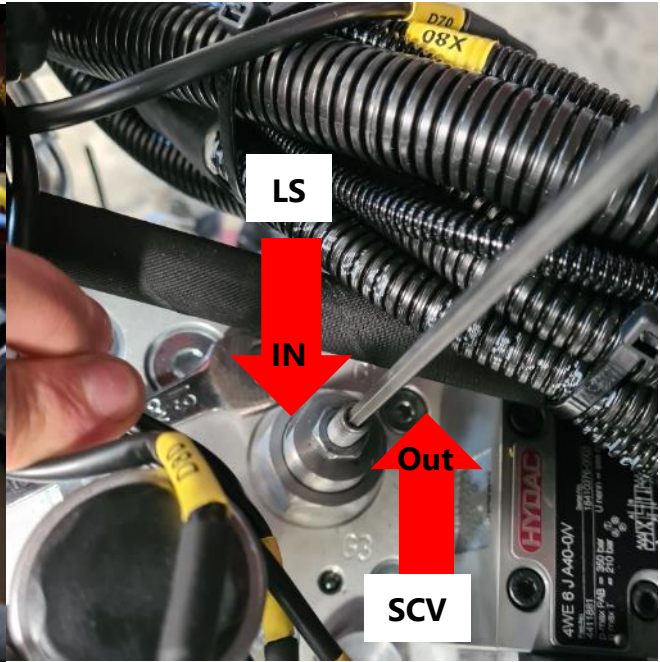


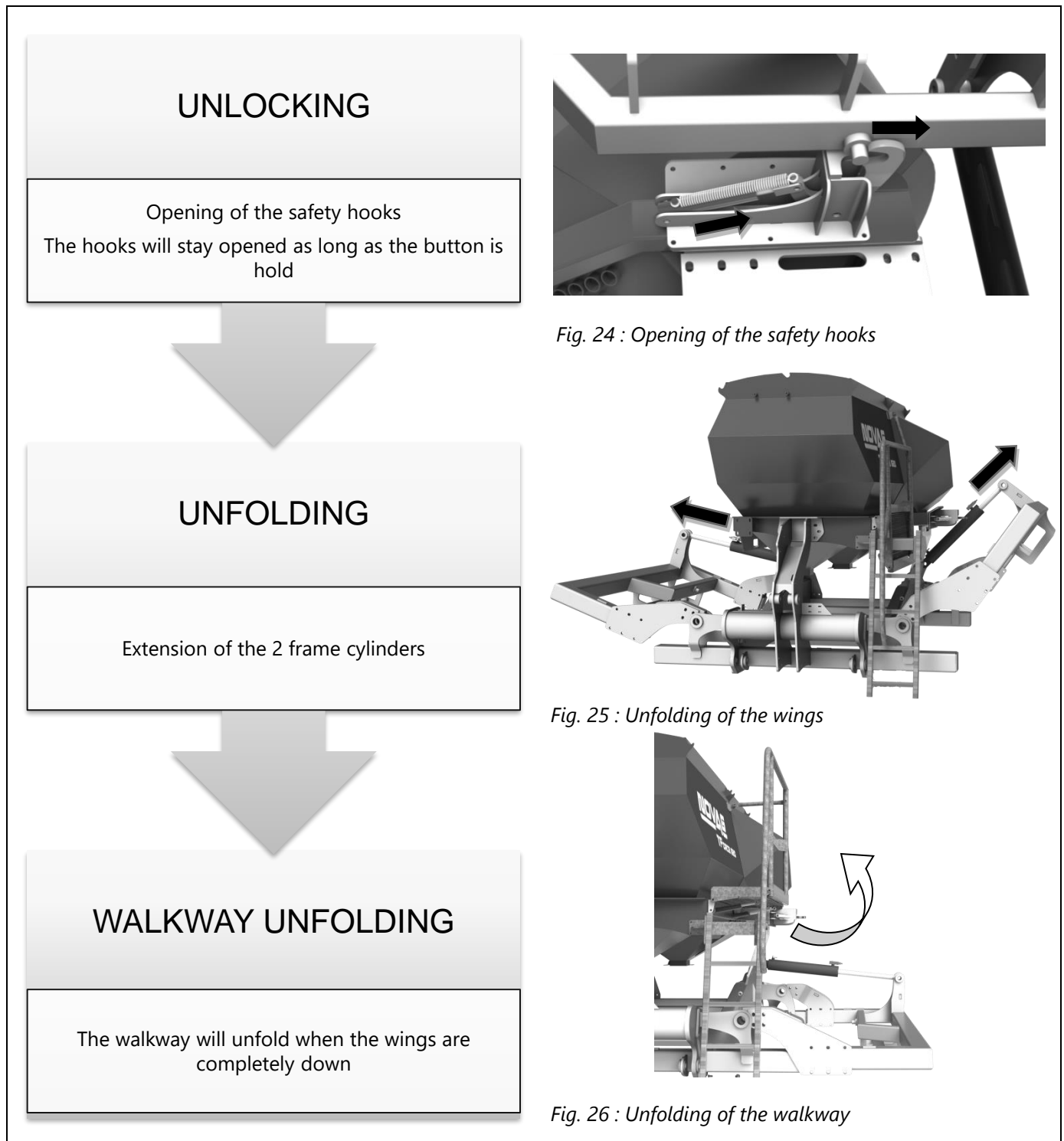
Figure 23: LS-Valve

5.5 Folding / Unfolding

For 6m drills

5.5.1 ACTUATION OF FOLDING OR UNFOLDING

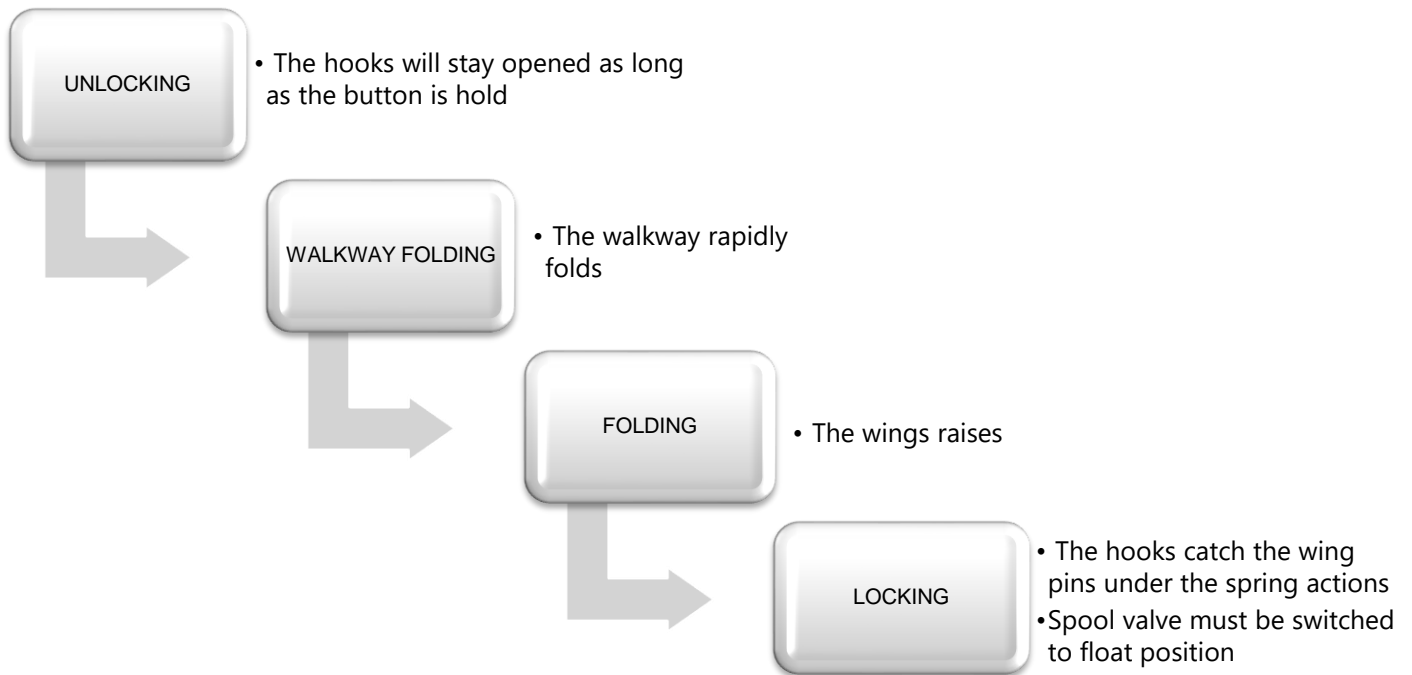
Use the tractor spool valve control to send oil to the frame cylinders. Unfolding sequence



5.5.1 FOLDING SEQUENCE



After a while, internal hydraulic leakage can cause a slight unfolding. The hooks are under heavy load and cannot open. Before unfolding the drill, fold the frame completely to release the hooks.



Make sure that nobody stands close to the side walkway before unfolding.



When folding sequence is completed, switch the tractor spool valve to float position to free the locking hooks and secure the wings in position.



Make sure the hooks are in place before attempting to move the drill in folded position.

5.6 Raising and lowering the openers

5.6.1 JOYSTICKUOI

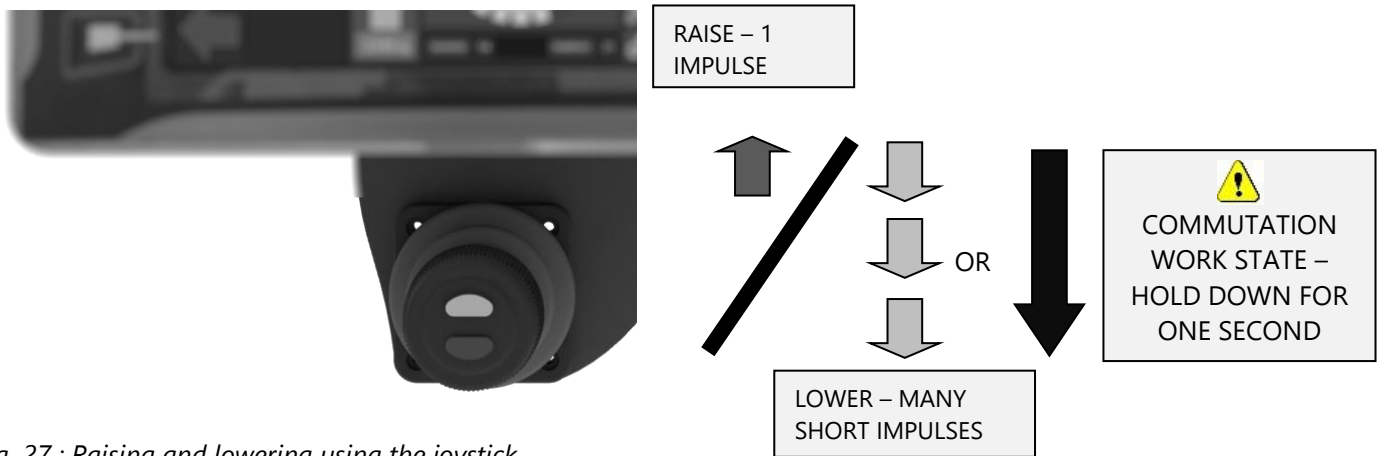


Fig. 27 : Raising and lowering using the joystick



Always checks the surroundings first. In particular, make sure that nobody stands close to the opener prior to any action.

1. Active the main tractor spool valve.
2. Raise: Raising is triggered after a brief impulse on the top arrow button. The openers will raise to their maximum. To stop the raising, a brief impulse on the down arrow button is enough.
3. Lower: Lowering can be controlled:
 - Either, by short and repeated impulse on the down arrow button. The openers stay in place and are moving down every time an impulse is made. Or, by holding approximately 1s the down arrow button. In this case, the drill goes into work state and the **openers immediately fall**. If IForce pressure control is in automatic mode, the hydraulic pressure in the opener cylinder will raise until the openers penetrate the ground. (On a concrete floor, the pressure will raise to its maximum).



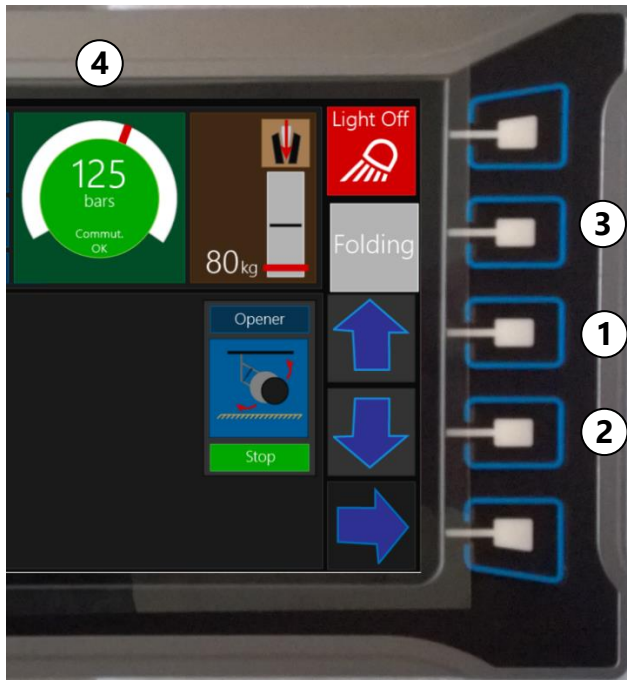
When the drill is put into work state, the openers fall under their own weight even if the tractor hydraulics are not activated.

- To deactivate IForce, press the blue button on the joystick or use the monitor (section 13).
- When the drill has gone into work state, it is no longer possible to lower them more with the joystick.

5.6.2 MONITOR

As a second option, the opener raise and lower function can be commanded from the monitor. See section 13. Monitor for more details.

Fig. 28 : Opener raise/lower options on the monitor



1/ Raise button

2/ Lower button

3/ Choose between

- Opener raise/lower
- Folding/Unfolding
- Tramline counter (if option is activated)

4/ Opener pressure gauge

A green background means that the drill is in work mode. The openers cannot be lowered anymore. To avoid this work mode, use repeated short impulses on the lower button.

5.7 Disc adjustments

5.7.1 PURPOSE OF ADJUSTMENT

The openers feature 3 holes for disc mounting.

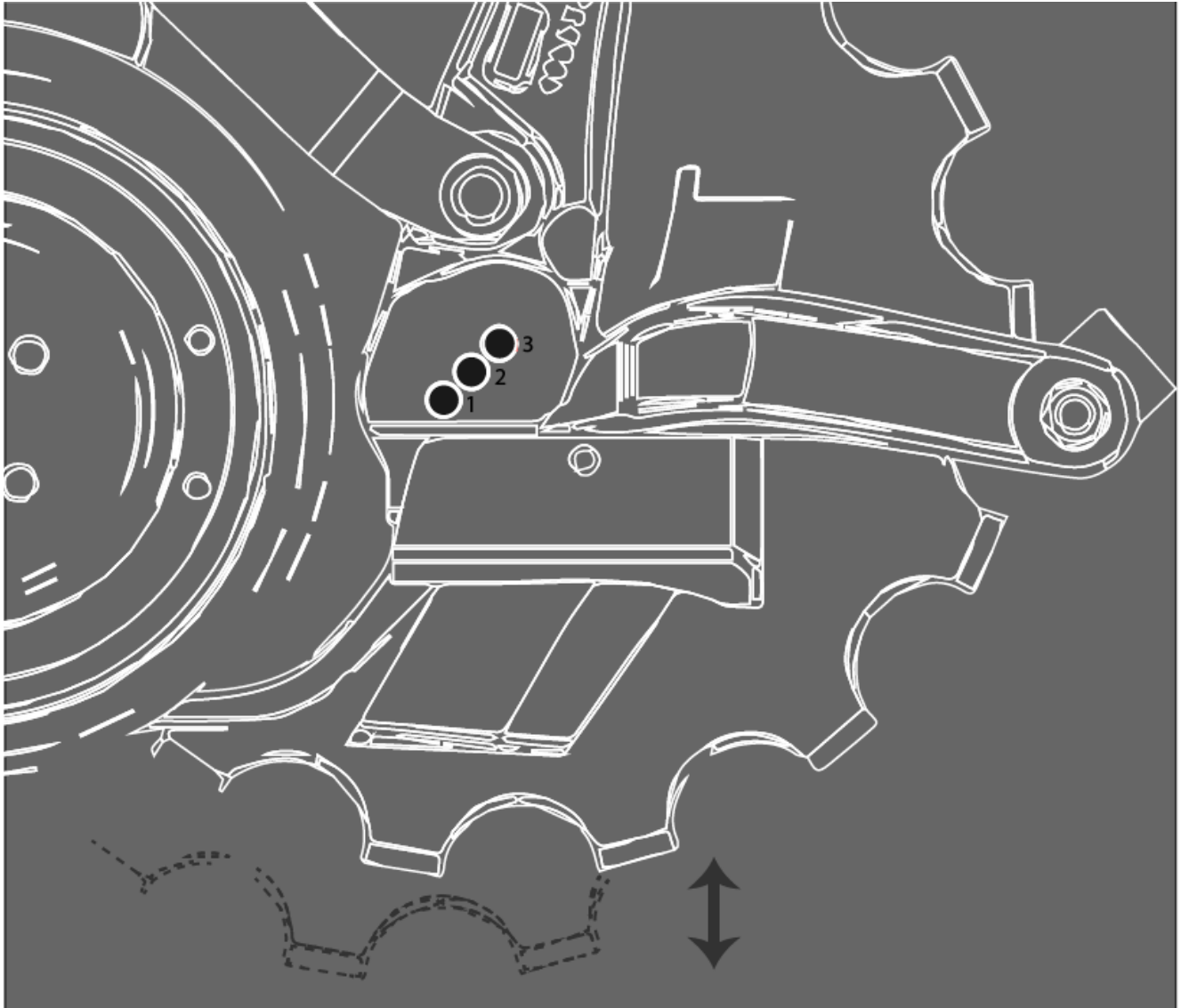


Fig. 29 : Disc mounting holes

Reasons frequently causing change of disc setting mounting positions are the following:

- Compensation for disc wear: with wear, the disc diameter decreases and it is important to mount it to a lower hole to avoid the lower part of the blades being below from the notches (see fig. 32 – Page 39).
- Improvement of disc rotation: In wet or very soft soil, moving the disc down gives it more grip.
- Lowering the required downforce: In hard soils, raising the disc to a top hole helps reduce the required weight on the drill.

5.7.2 ADJUSTMENT

Handle the discs with care because they are very sharp. Wear gloves, long clothing and safety shoes to prevent cuts and injuries.

1. Untighten the 2 Spring Plate screws (Fig.29) to relieve the pressure applied by the blades and the scrapers.
2. Untighten the hub bolt.
3. Remove the hub bolt.
4. The disc hub is now freed and it can be moved to the next hole.
5. Place the hub hole exactly in alignment with the mounting holes.
6. Insert the hub bolt screw and tighten it.
7. Use of a Nylock nut or spring washer is essential to prevent the bolt becoming loose, which would otherwise.
8. cause wearing of the bolt and the hub.



Always check the correct rotation of the disc. The disc must easily be turned by foot, in forward direction (at the base of the disc, push from front to rear).

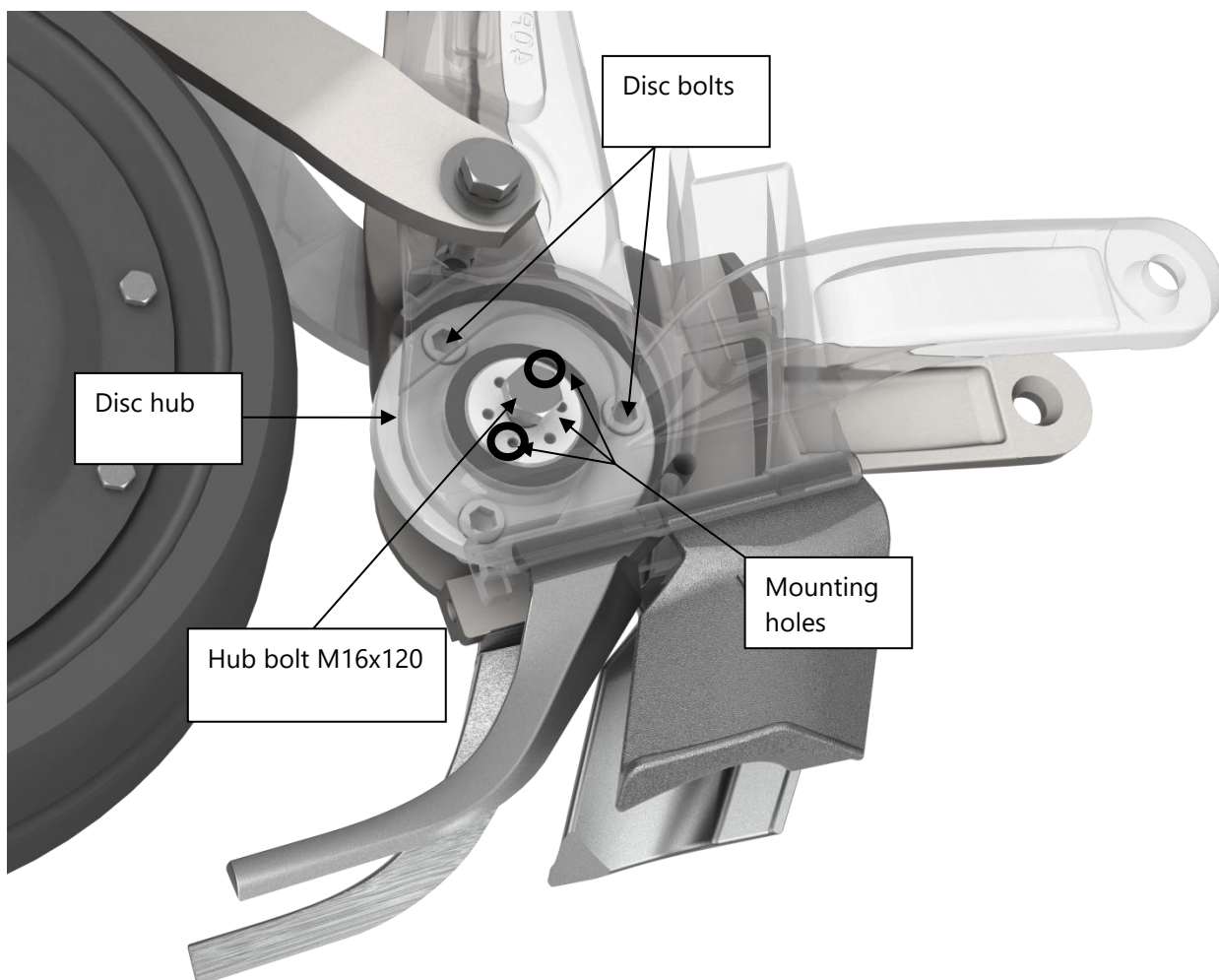


Fig. 30 : Mounting of disc hub in the opener, disc not shown

5.7.3 DISC REMOVAL AND REPLACEMENT

The principle is similar to the one for changing holes, but, in addition:

1. First, raise the press wheels to maximum height to give more clearance for disc removal.
2. Using the drawbar cylinder, raise the front or rear toolbar by changing the frame angle.
3. Once the hub bolt is removed, pull the disc from under the opener.
4. Remove the 3 x disc stud bolts.
5. Fit a new disc and refit the disc stud bolts.
6. Replace the disc and mount the hub in place in the opener.

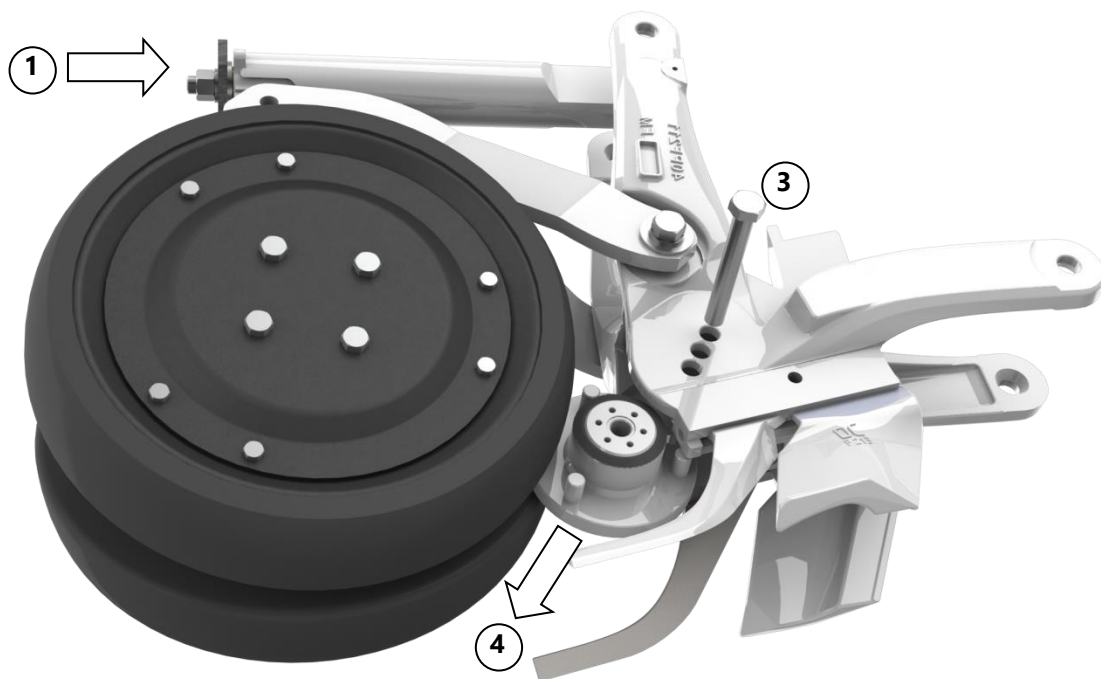

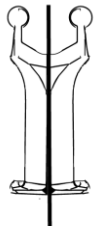
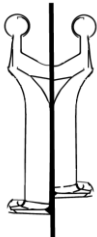


Fig. 31 : Disc hub removal

5.8 Blade and scraper mounting

5.8.1 POSSIBLE CONFIGURATIONS

Configuration	Drawing	Advantages
1x Blade on one side		Low soil disturbance Low traction power required
2x Blades of equal length		Moderate soil disturbance Allows horizontal separation of seeds and fertilizer
2x Blades of unequal length		Moderate soil disturbance Allows diagonal separation of seeds and fertilizer Allow drilling two different seeds at different depths.

5.8.2 MARKING

Blades and Scraper are casted with inscriptions that make their identification easy:

Part	Mark
Long Right hand blade	DL F214
Long Left hand blade	GL F215
Right hand scraper	D
Left hand scraper	G

5.8.3 MOUNTING / DISMOUNTING

1. Remove the spring plate screw and remove the spring plate.
2. Slide away the blades, in a forward direction in their keyhole.
3. Remove the scraper after the blade using the same method.



In case of blockage (caused by soil, wear, rust...), a hole is drilled at the back of the key hole. A pin can be inserted through this hole to remove the blade and scraper.

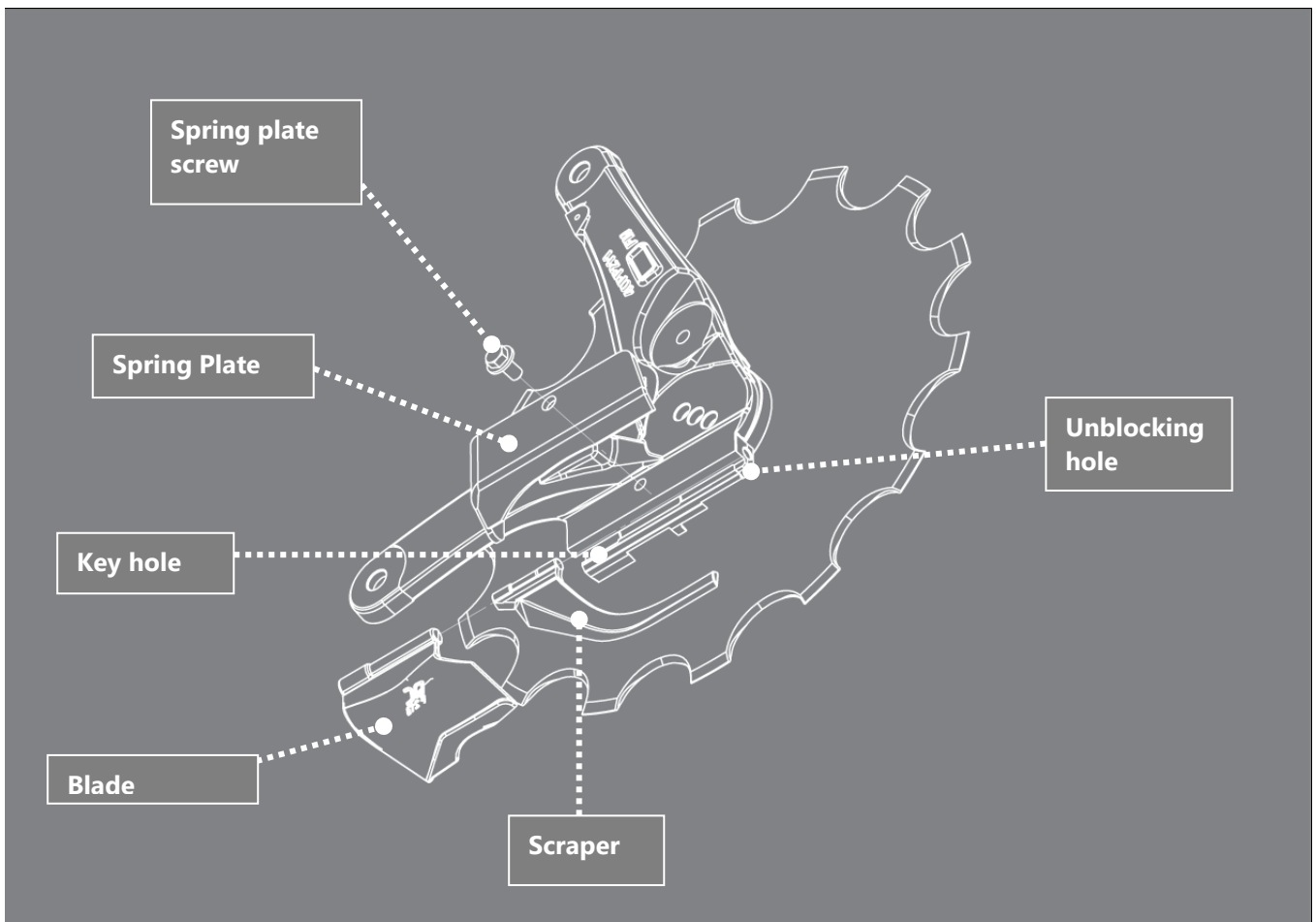


Fig. 32 : Blade and scraper mounting


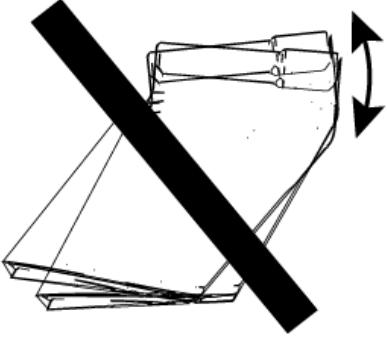
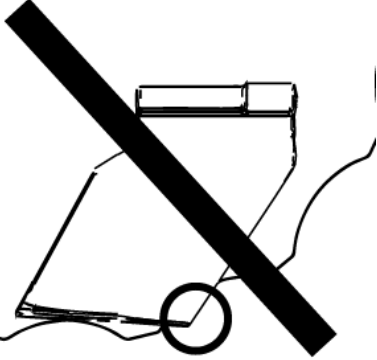
1. Remount in the opposite order.
2. When tightened, the spring plate will retain the blade and the scraper.



In normal working conditions, scrapers can become razor sharp. Always handle them with caution.

5.8.4 IMPORTANT CHECKS

A correct mounting must not display the following problems:

<p>Bad contact</p> <p>The blade is not in contact with the disc at the bottom of its leading edge.</p> <p><u>Possible cause:</u></p> <ul style="list-style-type: none"> - Blade wear - Spring plate wear - Excessive friction in the key hole - Warped disc or abnormal play in the disc hub  <p><i>Fig. 33 : Bad contact with disc</i></p>	<p>Excessive play before mounting the spring plate</p> <p><u>Possible cause:</u></p> <ul style="list-style-type: none"> - Blade wear - Key hole wear  <p><i>Fig. 34 : Excessive play</i></p>	<p>The blade sticks out of the disc notches</p> <p>The leading edge tip is lower (goes deeper) than the disc notches.</p> <p><u>Possible cause:</u></p> <ul style="list-style-type: none"> - Worn out disc. Replace it or change mounting hole  <p><i>Fig. 35 : Disc wear</i></p>
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5.8.5 CLEANING

Always make sure the path for seed is clear between the disc and the blade. Residues or dirt can cause blockage of the row.

Blockage of the seed path can occur in case of bad contact (fig. 30), driving rearwards while the openers are in the ground, excessive tractor wheel slippage, or, in general cases, if the soil is too wet to drill. If a blade is blocked, unmount it and clean it.

5.9 Hopper low level sensors

Low level sensors make the driver aware of an empty hopper. If necessary, height adjustments are possible.

5.9.1 SENSOR ADJUSTMENT

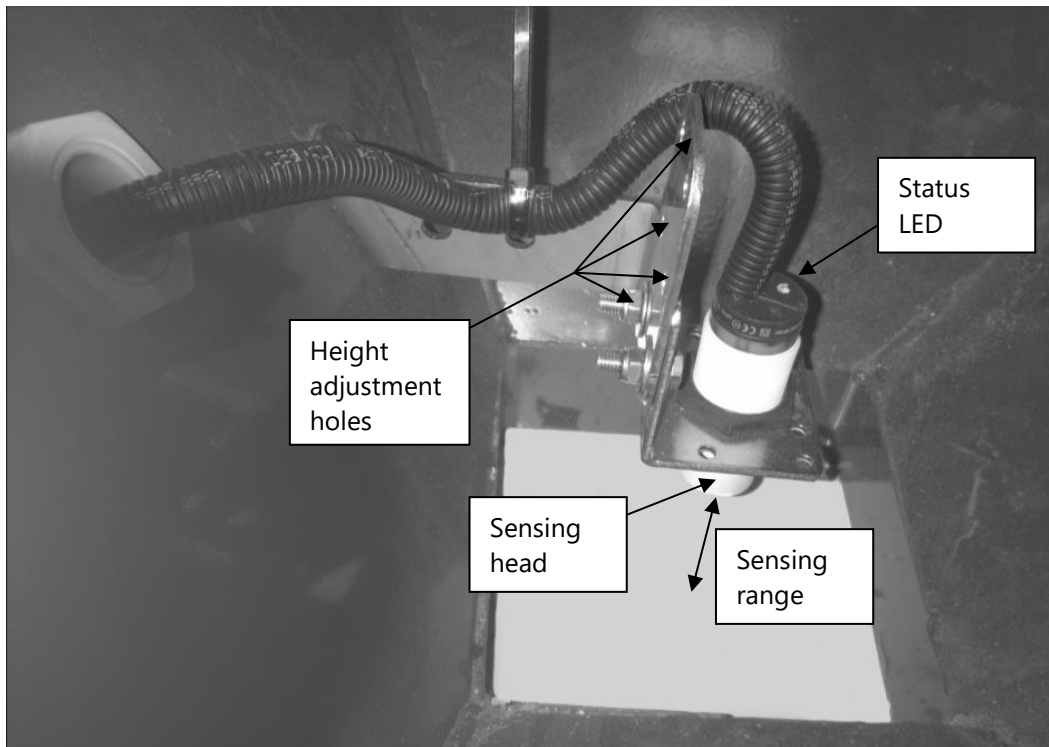


Fig. 36 : Low level capacitive sensor

The sensor must be oriented upside down, looking at the hopper outlet.

Nominal sensing range is 1 to 3cm.

Remove the stainless steel bolts and set the desired position of the sensing head. The higher it is, the sooner the low level alert will trigger prior to the hopper emptying.

5.9.2 GOOD FUNCTIONNING CHECK

This must be performed when the hopper is empty.

1. Activate the electrical system using the cab switch behind the monitor.
2. If the hopper is empty, check the status LEDs. Both of them must be turned on. If only one is on, then the sensor detects the hopper wall or any object in the range, and must be adjusted.
3. If something is placed under the sensor, one LED must switch off.
4. If both LED's are off, check the wiring.

5.10 Seed sensors

As an option, NOVAG electronics can interface with the blockage monitoring system AGTRON[®]

The option features:

- Optical seed sensors, mounted around one or both distributor head.
- An ISOBUS[®] compatible controller, able to interpret the blockage data from the sensors. This controller can manage the two main hoppers.

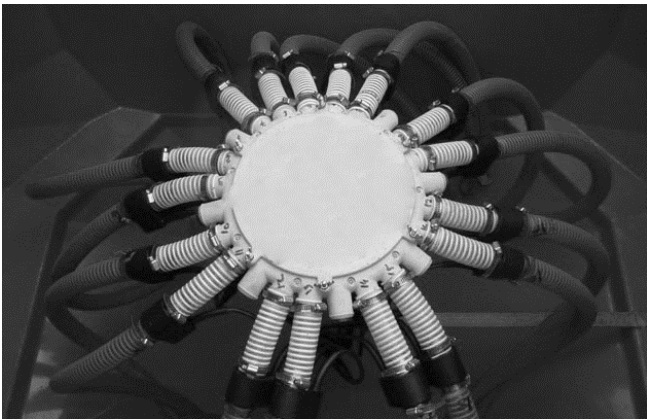
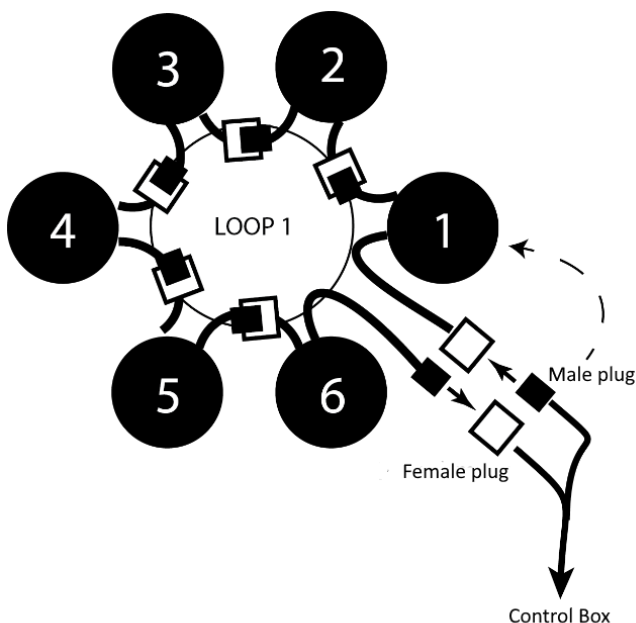


Fig. 37 : Sensors installed around the distribution head.



Fig. 38 : ISOBUS controller inside the main electrical box



The wiring around the head must be checked on occasions.

The sensors are wired in serial, and they form a loop. There is 1 loop per hopper.

Sensor auto-numbering is a factor of its position in the loop.

The male plug from the drill main cable system must be connected to sensor n°1 (see section 6.1.3).

5.11 Fan

5.11.1 DESCRIPTION OF FAN ASSEMBLY

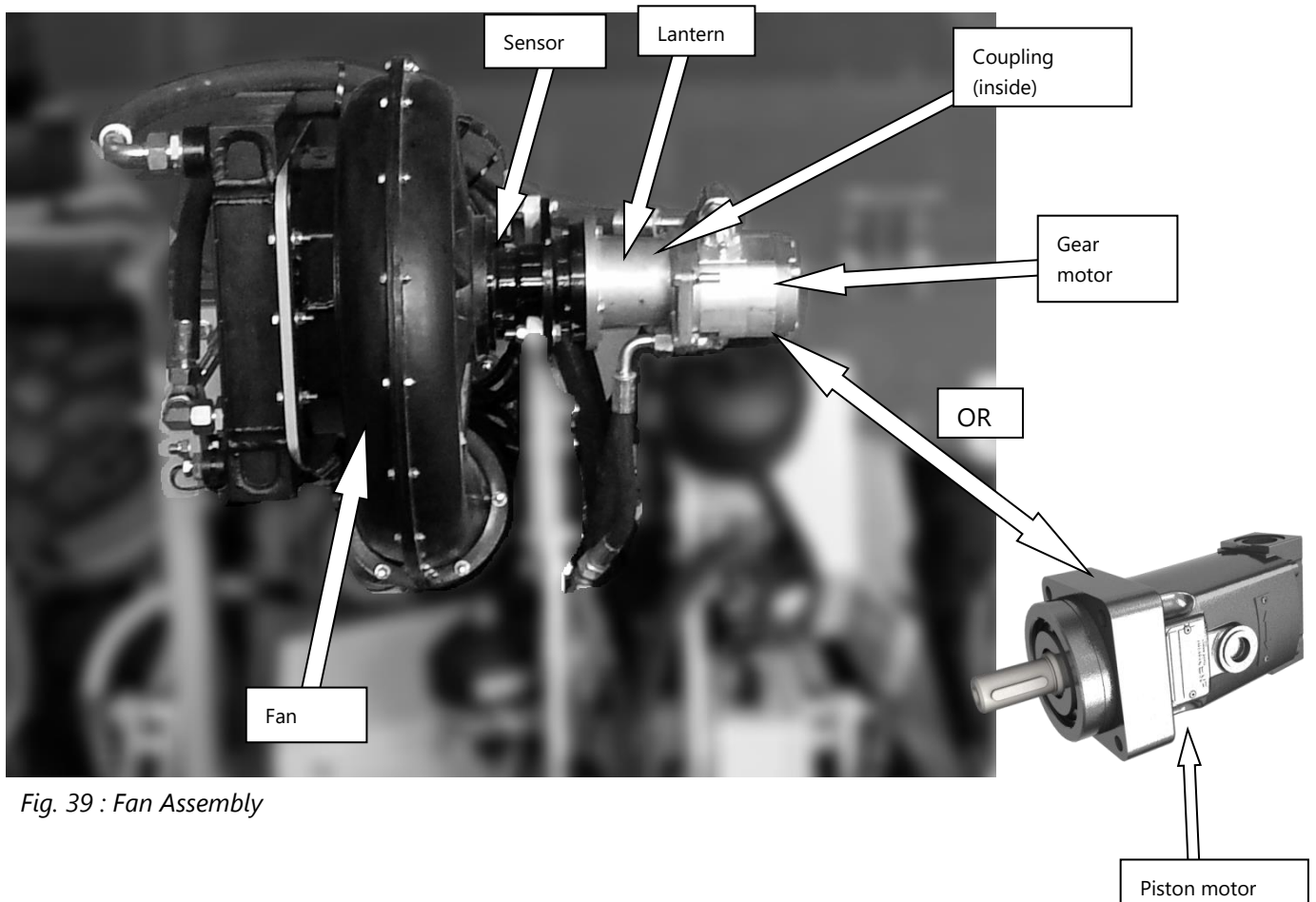


Fig. 39 : Fan Assembly

5.11.1 SENSOR

Check the fan sensor. If the drill is powered, the sensor LED will switch on twice per turn of the fan impeller. To do the verification, make the impeller turn using the access hole under the lantern.



The sensor must be set at 1mm from the fan shaft.

The sensor must be tightened until its head makes contact with the shaft, then it must be unscrewed $\frac{1}{2}$ of a turn. The counter nut must imperatively be tightened. Check the correct rotation of the shaft after this. The sensor head must not rub against the shaft.

5.12 Filling

5.12.1 CAPACITIES

Hopper	Use	Volume	Maximum weight of product
Front hopper	Grain, small seeds, big seeds, fertilizer	2200l	1500kg
Rear hopper	Grain, big seeds, fertilizer	2000l	1500kg
Aux. Bin	Slug bait, small seeds starter fertilizer	120l	100kg

5.13 Ballast

For hard soils, 2 places are designed to host ballast weight on 6m drills. Ballast of 650kg each can be bolted on the frame wings. These ballast are available from NOVAG as options. Maximum number of ballast permitted on the drill is 4, equivalent to 1600kg.



Fig. 40 : Ballast location on 6m drill



Never overload the drill over this specification. Wings could suddenly unfold under the dynamic load on the road or on the field.



When ballast weights are fitted, take extra caution on slopes and turns.



Never drive on public roads if the drill weight is over the maximum permitted weight written on the manufacturer plate.

6 Seeding rate – Calibration

6.1 Main hoppers

6.1.1 AIR SYSTEM SCHEMATICS

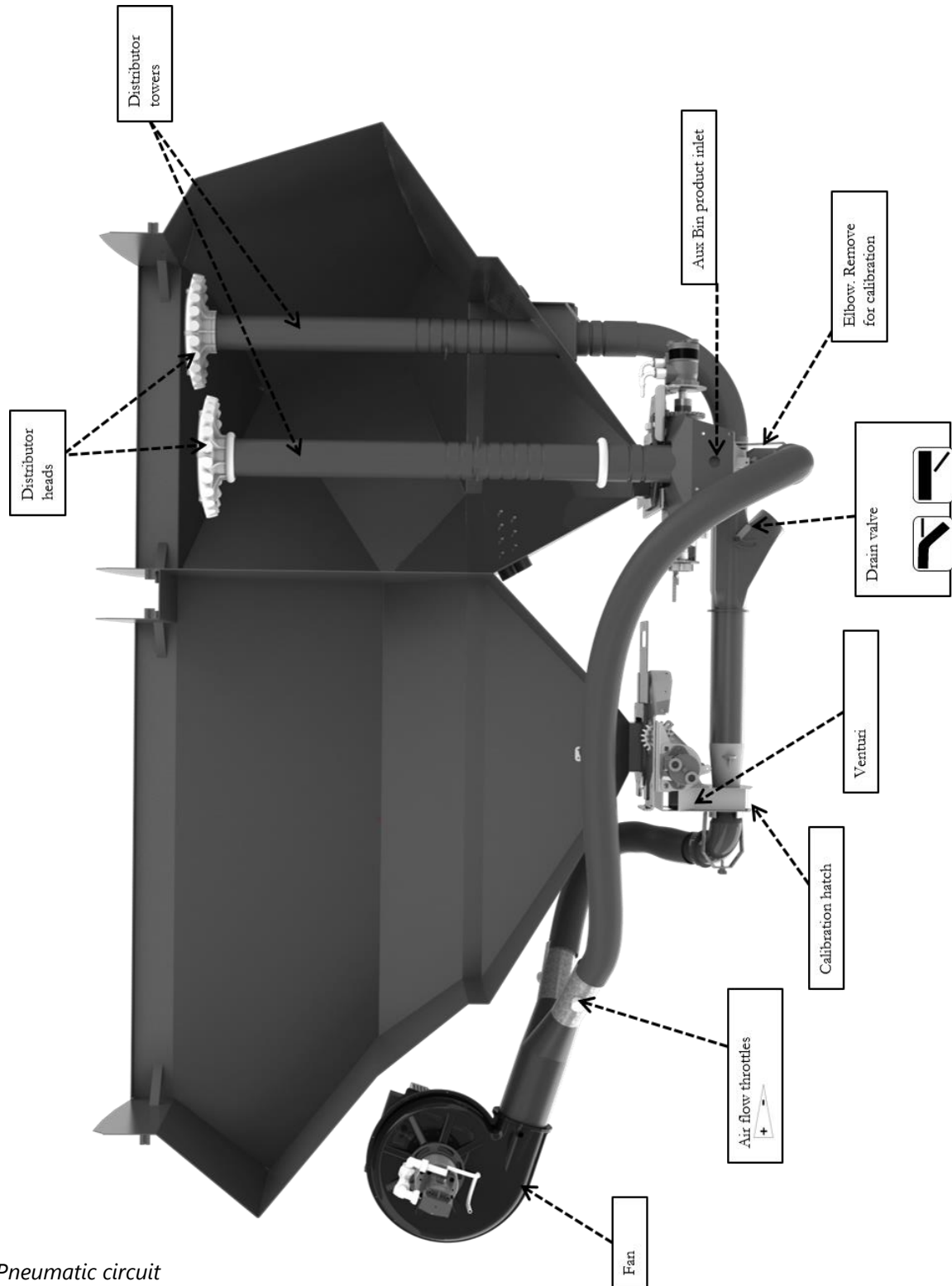


Fig. 41 : Pneumatic circuit

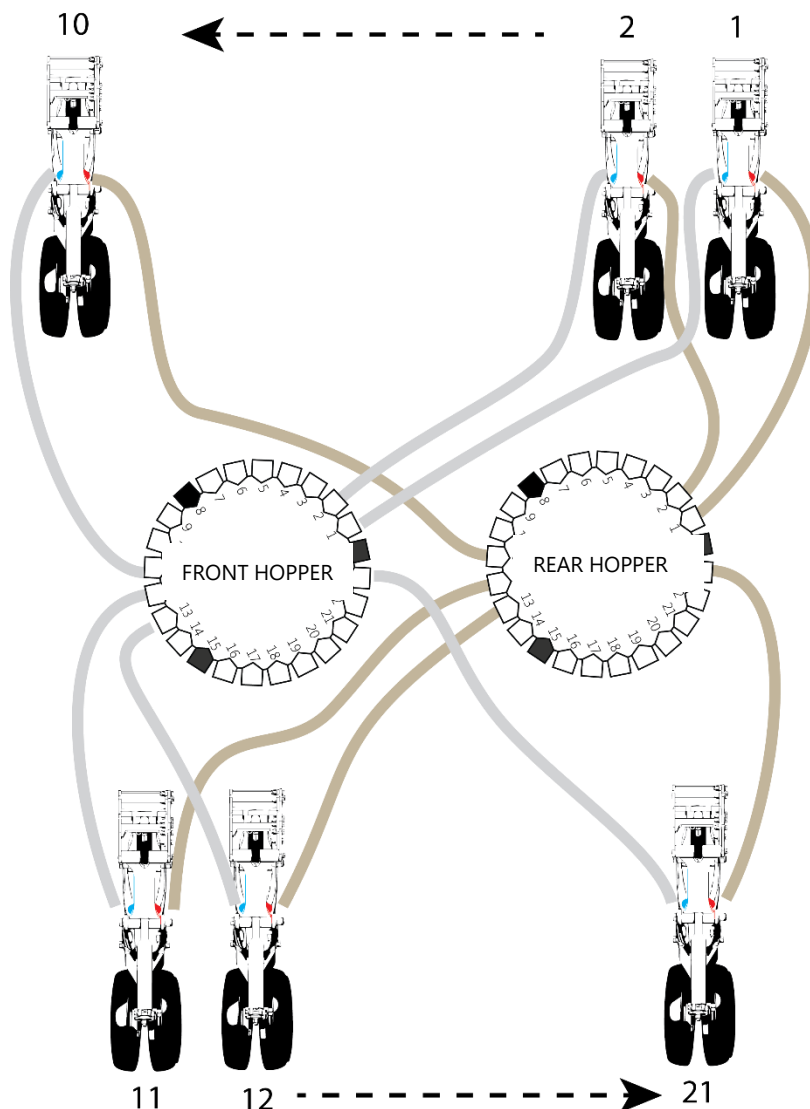
6.1.2 PRINCIPLES

1. Airflow from the fan is separated in two with the provision to independently adjust the flow in each branch by throttle valves.
2. Each flow is conducted to a suction venturi located at the output of the metering unit, below each hopper.
3. Seeds/fertilizer are blown until they reach the distributor heads at the top of the towers, located inside the rear hopper. The flow coming out the front hopper can be diverted out through a drain valve.
4. Distributor heads at the top of the towers divide the flow into as many pipes as there are seeding rows.
5. Each distributor head is connected to all the openers, on both toolbars. Thus, the front hopper supplies the right side of the front openers, and the left side of the rear openers. The rear hopper supplies the left side of the front openers, and the right side of the rear openers.
6. The auxiliary bins deliver their products at the base of the rear tower, so the products are mixed with the rear hopper product inside the slot.

6.1.3 ROW NUMBERING

Distributor heads come with a standard of 24 outputs. They are designed to be mounted on maximum 24 row drills. In the example case of a TForce Drill 21 rows, 3 rows are factory closed.

Numbering follows the order of the drawing below:



6.1.4 METERING UNIT ADJUSTMENT

Main hoppers are equipped with a changeable rotor metering unit. They use a HVRC system (Hydraulic Variable Rate from the Cab system)

The metering device is controlled by the NOVAG software. Information about adjustments made to the metering device is displayed on the terminal.

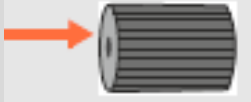
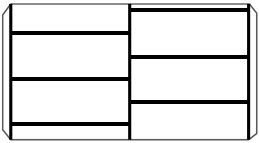
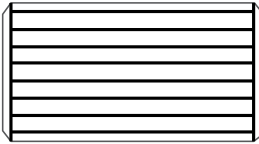
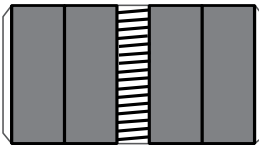
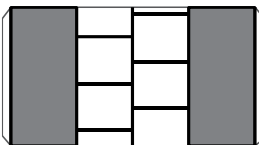
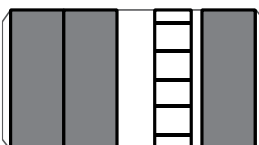
When starting a new calibration test:

- ◆ Place a catch pan under the metering device
- ◆ Open the flap
- ◆ Fold out the machine
- ◆ Secure the tractor against rolling away and the being restarted without authorization
- ◆ Close the siding cover on the metering device. No more seed can flow from the seed hopper into the metering device.
- ◆ Fill the seed hopper with enough seed for the calibration test. Make sure the seed is evenly distributed on both metering devices.

6.1.5 DOSING HEART SELECTION AND MOUNTING

The dosing hearts have different shapes and functions. Guide pins installed in dosing hearts 3 and 4 needs to be into a guide groove in the metering housing.

Number of the dosing can be found on the side of the dosing heart

Number		Main use	Common Rates
1		Large seeds, fertilizer, general seeds at high rates	100-330kg
2		Grass	20-120kg
3		OSR, canola, sorghum	1-10kg
4		Wheat, Barley, oats at medium and small rates, fertilizer	30-200kg
5		Corn, sunflower, sorghum	5-40kg

1. Close the sliding cover the metering device. No more seed can flow from the seed hopper into the metering device.
2. Loosen the wing nut and fold it upwards.
3. Open the emptying flap.

4. Loosen the knurled screws.
5. Remove the cover. The cover is secured by means of a cable.

6. If necessary, turn the dosing heart slightly and remove it.

7. Select the dosing heart with the correct number.
8. Carefully slide the dosing heart onto the hexagonal shaft by turning it slightly.

Guide pins installed in dosing hearts 3 and 4 needs to be inserted into a guide groove in the metering housing.

If dosing heart 3 or 4 needs to be installed:

Carefully slide the dosing heart into the guide groove and onto the hexagonal shaft.

9. Re-attach the cover and secure it using knurled screws.
10. Close the emptying flap and secure it with the wing nut.

6.1.6 AUXILIARY PLATE

The auxiliary plate is located the metering housing. It cannot be seen from the outside.

Depending on the seed, it may be necessary to fit the auxiliary plate. The auxiliary plate prevents the drive motor from being overloaded.



The auxiliary plate can only be removed or mounted once the dosing heart has been taken out.

REMOVAL

1. Remove the split pin. The auxiliary plate is released.
2. Remove the auxiliary plate.
3. Re-insert the split pin.
4. Close the emptying flap.

MOUNTING

1. Open the emptying flap.
2. Remove split pin.
3. Guide the auxiliary plate through the opening and secure it.
4. Insert the dosing heart.
5. Re-attach the cover and secure it using knurled screws.

Grooves in the metering housing help with installing the auxiliary plate correctly.

6.1.7 MAINTAINANCE AND CHECKRotor

Make sure the splines are clean from dust before any use. Fertilizer, in particular, may progressively fill the splines if exposed to humidity.

The spline can be easily checked before filling the hopper.

If the hopper is full, use the stainless shutter plate located between the metering unit and the hopper outlet.

Venturi

For the same reasons as the splines, venturis must be regularly checked and cleaned.

Distributor head

Remove the cover after unscrewing the winged nuts. Check every pipe entrance.

Encoders

Sensor heads must be set at 1mm from the wheel teeth. If the drill is powered, the sensor's LED switches on in front of a tooth, and stays off in front of a hole.

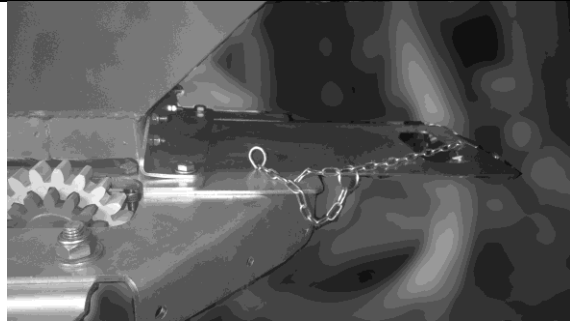


Fig. 42 : Stainless shutter plate

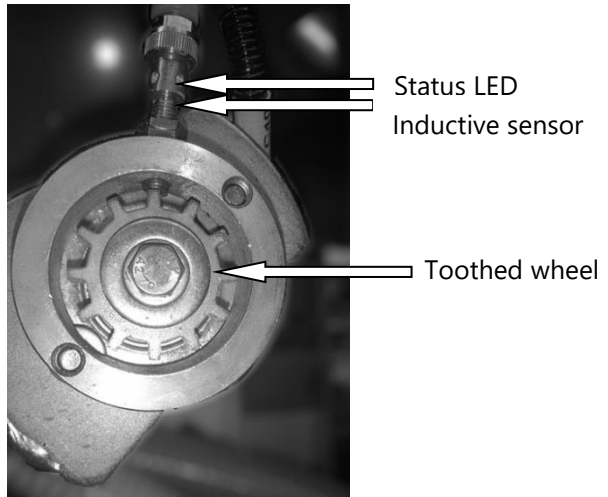
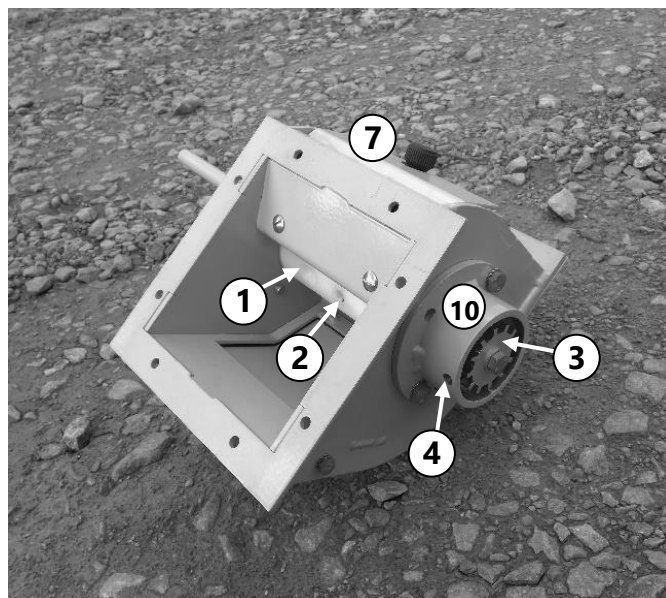
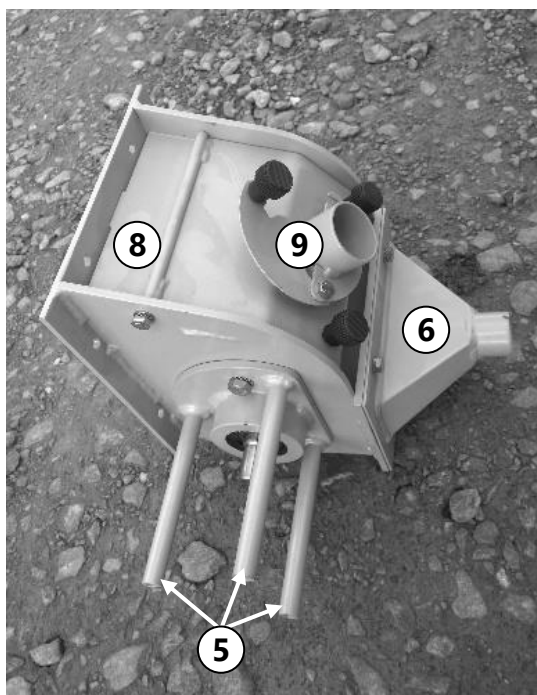


Fig. 43 : Encoder

6.2 Auxiliary bin

6.2.1 METERING UNITS

Auxiliary bins mounted as options on NOVAG Drills are fitted with SEPEBA POLYDOSER® metering units. They are well suited to metering of slug bait, micro-granular fertilizer, and small cover crop seeds. Products are placed in the slot. The bins have a capacity of 120L.



- 1/ Rotor
- 2/ Unlocking screw
- 3/ Encoder
- 4/ Sensor hole
- 5/ Motor bracket
- 6/ Product outlet
- 7/ Inspection flap
- 8/ Full drain flap
- 9/ Drain cover
- 10/ Removable hub

6.2.2 PRINCIPLE

Metering makes use of a HVRC system (Hydraulic Variable Rate from the Cab system).

The rotor has to be changed to adapt to different products. A T-shaped venturi is fitted after the outlet (6). This venturi gets air flow from the fan, product is sucked in, and blown at the entrance of the rear hopper tower.



Even if the rear hopper is not used, it is important to check that enough air is flowing through the rear tower to distribute the auxiliary product.

6.2.3 CALIBRATION

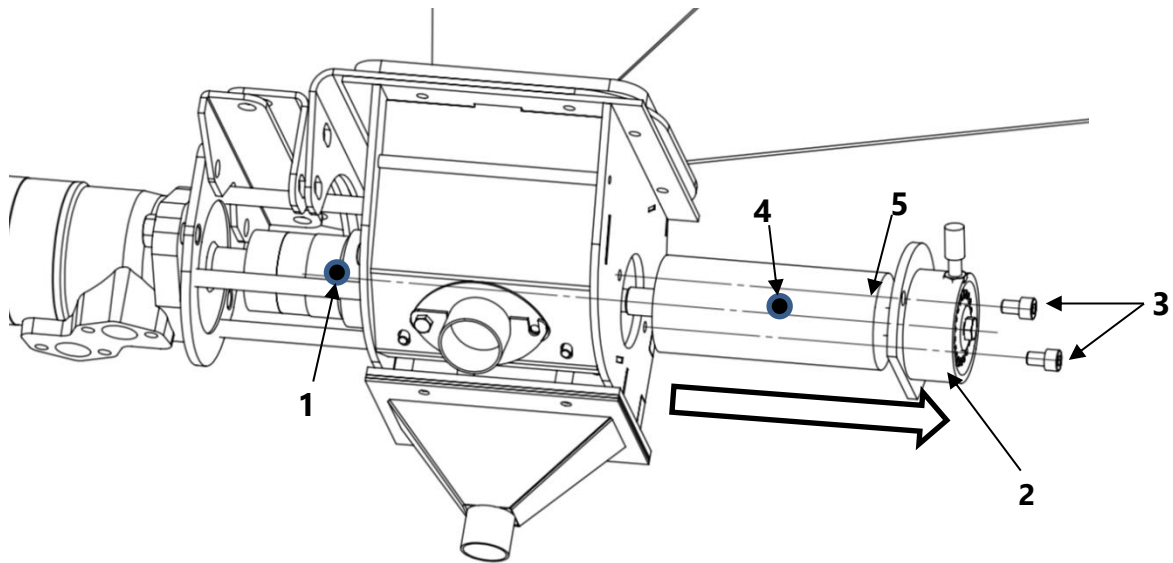
Calibration is made by removing the outlet 6 and by following the procedure described in section 6.3.

6.2.4 MAINTENANCE AND CHECKS

Rotor: As with the main hoppers, rotor clean state must be checked. The hatch (7) allows the user to see the rotor without draining the bin.

Encoder: Sensor heads must be set at 1mm from the wheel teeth. If the drill is powered, the sensor's LED switches on in front of a tooth, and stays off in front of a hole.

6.2.5 ROTOR REPLACEMENT



- A. Open the full drain flap.
- B. Untighten the shaft coupling screw (1) to free the shaft.
- C. Remove the hub (2) after unscrewing the two stainless screws (3).
- D. Pull the assembly « Hub + shaft » out of the metering unit.
- E. Unlock the rotor screw (4).
- F. Replace the rotor (5).
- G. Reassemble.

- 1/ Shaft coupling**
2/ Hub
3/ Stainless screw
4/ Rotor screw
5/ Rotor

6.3 Electronic Calibration

The role of electronic calibration is to find the exact value of the weight of seed distributed per pulse of the metering unit rotor. This value, the calibration ratio, is calculated in cg/pulse, varies with:

- The weight of 1000 seeds.
- The rotor of the metering unit.
- The actual rotation speed. The faster is the rotation, the lower is the weight of seed per turn carried by the rotor.

The procedure stays the same regardless of the bin to calibrate.

6.3.1 LAUNCHING THE PROCEDURE



Before starting electronic calibration, make sure the rotor of the metering unit is correctly set.



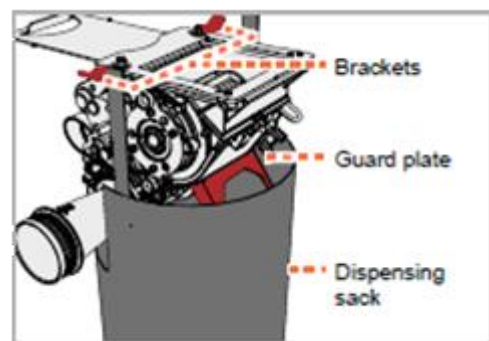
Check that all the calibration switches are deactivated before starting.

1. Open the metering unit calibration flap.

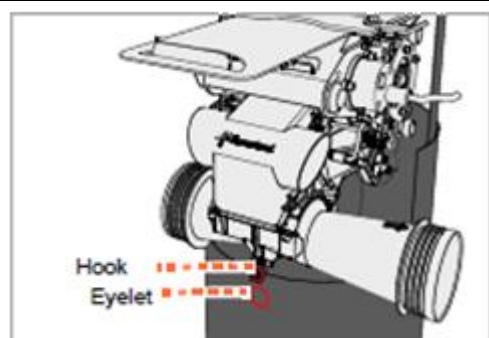


Fig. 44 : metering unit calibration flap

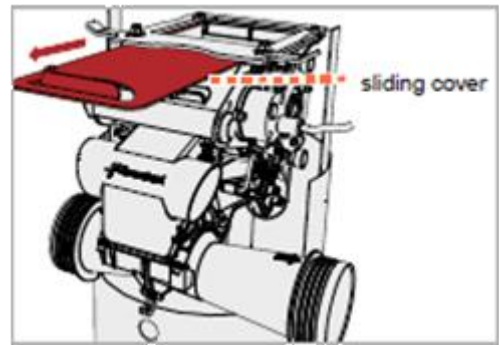
2. Attach the loops of the calibration bag to the holders.



3. Hook the eyelet onto the hooks. This secures the dispensing sack.



4. Open the sliding cover on the metering device. The seed can once again flow from the seed hopper into the metering device.



5. From the cab, activate the hydraulic circuit. Only the main spool valve has to be on.
6. From the monitor, navigate into system menu.
7. Select the option to set the front, rear, or Aux hopper.
8. From the hopper menu, select « Other » (button 4).
9. Then use the arrows (button 7 and 8) and choose "calibrate the hopper".

Press button 10 « Validate »

6.3.2 GROSS CALIBRATION

1. The monitor will state the message « waiting ».
 2. Place a bag/bucket under the hopper.
 3. Press the calibration switch under the hopper.
- Calibration switches are marked with the following stickers:



4. The motor will start rotating at a reference speed. The monitor in the cab counts the number of rotations the motor makes.



Never bring hands or fingers close to the metering unit or the coupling while the tractor motor is turned on.



5. At any time, it is possible to stop the shaft rotation by pressing on the button. The rotation can still be carried out by pressing down the button again. The monitor will add the rotations.
6. Once a satisfactory quantity of seeds/fertilizer has been collected, weigh the bucket with a scale.
7. Go back in the cab and validate the step (button 10). The monitor will then ask for the weight of product that has been collected. Input the value using the arrows (buttons 7 and 8).
8. The monitor calculates a rough calibration ratio, measured at a reference rotor rotation frequency.



This first value is not precise enough because it has not been issued at the exact drilling speed. It is recommended to make a finer calibration at the next step.

6.3.3 FINE CALIBRATION

1. Once a first ratio has been calculated, the monitor suggests to make a finer calibration.
2. Select the item « Fine Calibration – Yes » using the arrows (buttons 8 and 9) then validate (button 10).
3. Input the planned drilling speed (approximate), then the rate/ha.



Depending on the monitor software version, it is not always possible to set the rate with a 0.1kg precision. In this case, round the value to a close match and change the rate later on the main screen. See section 9.

4. The motor is ready to turn again. Note the rotational speed written on the monitor. For good results on the field, this speed must be greater than 15rpm, but lower than 80rpm. If not:
If the frequency is too low, close the opening/ use another rotor, and start the calibration again from the start.
If the frequency is too high, increase the opening/ use another rotor, and start the calibration again from the start.
5. Place the bucket under the hopper, and use the cal button to start the metering rotation and stop it.
6. Weigh the collected product.
7. Validate the step on the monitor, and input the weight.
8. The monitor calculates and displays the real rate/ha, and automatically adjusts the calibration ratio to compensate for any difference from the gross calibration.

6.3.4 CALIBRATION CHECKS

A check weighing can be made anytime using the same method as the fine calibration.

This check weighing allows for verification of check the ratio value, for example after a change of seed variety or after some work.

1. From the hopper settings menu, select « Other » (button 4), then choose « Check calibration » using the arrows (button 6 and 7), then validate (button 10).
2. Follow the instruction displayed on the monitor.
3. The calculated rate is displayed at the end of the procedure and the calibration ratio is corrected if necessary.

6.4 Calibration table

These figures are indicative, for a 6m drill. Real values calculated from the calibration can be compared to these reference values.

A theoretical drill speed of 7km/h has been chosen, to match a wide range of use. The suggested opening can be adjusted to match a narrower (close) or wider (open) drill, or totally different drilling speed.



Fine calibration made « at the drilling speed » is important for products such as oil seed rape, which requires high precision.

Imprecisions of more than 30% could be experienced if drilling is done in different conditions to the calibration. At a lower forward speed, the metering unit will seed at a higher rate, and at higher speed, at a lower rate.

Calibration ratio depends on the seed specifications: weight of 1000 seeds, volumetric weight. Use the user journal (at the back of this manual) to write down the calibration result associated with every seed and product.

Product	Drilling speed	Rate	ROTOR	Ratio	Mot. speed	Max Rate	Min Rate
Wheat	8km/h	100kg/ha	4	1300	620 pls/min	150kg/ha	25kg/ha
Wheat	10km/h	200kg/ha	1	3400	590 pls/min	330kg/ha	60kg/ha
Granular fertilizer	10km/h	150kg/ha	4	1800	840 pls/min	180kg/ha	25kg/ha
Maize	8km/h	25kg/ha	5	285	700 pls/min	35kg/ha	5kg/ha
Peas	8km/h*	300kg/ha	1	3650	770 pls/min	350kg/ha	60kg/ha
Oilseed Rape	10km/h	5kg/ha	3	75	650 pls/min	8kg/ha	1kg/ha

For heavy product delivered at a high dose, it is better to slow down the drilling speed to avoid blockages in the air system.



As a general rule, a lower rotational speed must be favored with products associated with spline blockage (fertilizer), whereas a higher rotational speed gives more regularity on the row.

7 Fan adjustment

7.1 Recommended Use

7.1.1 GENERAL

Different fan speeds are advised depending on what is being drilled. Matching the fan speed to the purpose helps to avoid:

- Excessive load on the hydraulic motor.
- Seed positioning problems: light seeds can be pushed to the center of the slot by too much air flow.
- Pipe blockages due to insufficient air flow.



Never go over 5000rpm, in any situation.

Two throttle valves are available to adjust the flow in each hopper.

7.1.2 TABLES

Scenario	Recommended fan speed	Throttle valve adjustments
Front hopper: Cereal Rear hopper: Non used	4000rpm	Front: Open Rear: Closed
Front hopper: Cereal Rear hopper: Fertilizer, Big seed	4500rpm	Front: Open Rear: Open
Front hopper: Small seed Rear hopper: Fertilizer, Big seed	4500rpm	Front: Half Open Rear: Open
Front hopper: Small seed Rear hopper: Non used	3500rpm	Front: Open Rear: Closed

7.2 Rotational Speed Adjustments

7.2.1 HYDRAULICS FROM THE TRACTOR

- If the tractor is equipped with manual flow adjustment spool valves, set them once when the oil is cold and set them again when the oil is hotter.
- Accelerate the engine to reach full oil flow from the pump.
- Maximum fan speed is a factor of tractor oil flow. If the tractor allows a precise flow adjustment, set the flow to match the desired speed according to the following table:

Spool valve flow	Piston motor
24l/min	2000 rpm
30l/min	2500 rpm
36 l/min	3000 rpm
42 l/min	3500 rpm
48 l/min	4000 rpm
60 l/min	5000 rpm

7.2.2 ADJUSTMENT OF FLOW REGULATION VALVE



Fig. 45 : Fan hydraulic valve



This valve limits the fan speed

It must be adjusted in two cases:

1/ Irregularity of rotation caused by irregular flow from the tractor. In this case, turn the valve knob counter clockwise until the speed stabilizes.

2/ Use of an embarked pump. This valve is then the only way to control the fan speed. Turn the knob clockwise to accelerate the speed and counter clockwise to decrease the speed.



Lock the counter nut after making the adjustments.

7.3 Air flow adjustment for each hopper.

7.3.1 THROTTLE VALVES

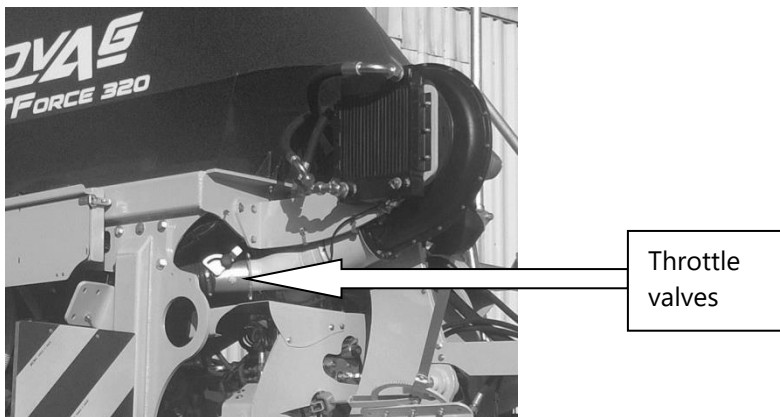


Fig. 46 : Throttle valves

These flaps can be used to close completely one hopper and increase the flow going into the other. They can also be used to decrease the flow for a hopper distributing very light seeds.

- 1 To adjust a throttle, toggle the handle on an open, closed or intermediate position.
- 2 Make the adjustment when the fan is active and control the air flow at the end of the row pipes.



Closing and opening the throttles affects the hydraulic flow control valve. The adjustment of the hydraulic valve must be performed after the throttles are set.

7.3.2 AIR SPEED CHECKING



Always make sure air is consistently flowing out of every row pipe before any use on the field, to find any potential blockage.

- Using the joystick, it is possible to make the metering units turn for a few seconds and deliver the correct flow of seeds under each pipe.
- To do so, activate the main hydraulic circuit from the tractor and press the joystick yellow button.
- To learn how to activate the forced rotation of the motor using the monitor, see section 13 of this manual.

8 Field use

The drill must have been calibrated and the essential points of section 5, 6 and 7 must have been observed.

8.1 General principle

8.1.1 BEFORE START

1. Turn the fan on and the main hydraulic circuit.
2. Perform a first depth adjustment following the guidelines explained in section 8.3. Choose a downforce control mode: "Automatic" or "Manual"

8.1.2 BEFORE STARTING A SEEDING PASS

1. Check GPS signal status. (section 8.4) If necessary, use the forced speed mode described in 8.4.2.
2. Accelerate the tractor engine to get to nominal point.

8.1.3 TO START DRILLING

1. Hold the joystick down, or lower the openers from the monitor.
2. The drills automatically switches into work state. The openers go down rapidly. The hopper status on the main monitor screen and the pressure gauge both turn green.
3. Engage in the field progressively to reach working speed.

8.1.4 WHILE DRILLING

1. The main page on the monitor displays:
 - The rate of product distributed by the metering unit.
 - The hydraulic pressure in the openers.
 - The closing force measured under the press wheels.
2. Different error message « Hopper empty, row blocked, rate error... » may be displayed with an alarm. See section 14. Incident Cause Remedy



Avoid drilling along curves or circular trajectory.



Never drive rearwards when the openers are down!

8.1.5 AT HEADLAND

- A brief upwards impulse to the joystick or a brief push on the monitor raising button will make the openers raise completely.
- Seed metering immediately stops. The pressure gauge on the monitor and the hopper status color become grey or red.



Before making a U-turn, make sure the openers are raised enough and away from the soil.

8.2 Depth adjustment

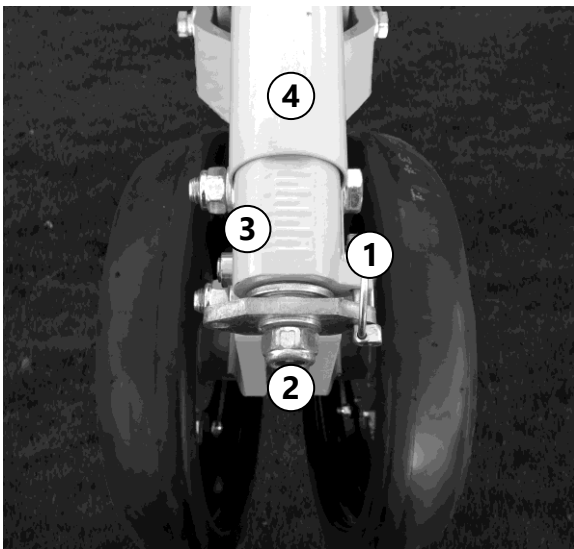


It is advised to make one or more pass without delivering seeds, to correctly adjust the seeding depth using the following guidelines.

Seeding depth is factor of 3 parameters:

8.2.1 PRESS WHEEL HEIGHT ADJUSTMENT

This parameter is the height of the press wheels are compared with the blades/disc. This setting is made individually on each opener.



To change this setting:

1. Remove the lock pin (1).
2. Using a wrench, turn the nut (2) to move the scaled pivot (3) in or out of the tube (4).
3. Rotating the nut clockwise raise the press wheels resulting in deeper seed placement.
4. Rotating the nut counterclockwise will lower the press wheels resulting in shallower seed placement.
5. Replace the lock pin.

Fig. 47 : Press wheel adjustment mechanism.



The scale does not match any real measurement of depth. They only provide a reference for adjustment.

8.2.2 HYDRAULIC DOWNFORCE PRESSURE

This pressure is directly measured in the opener cylinders. It greatly affects the job made by the openers. Its value is displayed on the monitor main page.

This pressure can be manually set by the user or automatically controlled by the IntelliForce (IForce) system.

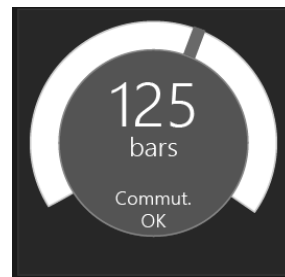


Fig. 48 : Pressure gauge on the display

Hydraulic accumulators act as a hydraulic suspension and allow the openers to follow the soil surface easily.

- To manually adjust the pressure, IntelliForce must be in Manual mode.
- Use the Horizontal axis of the joystick see Fig. 49.
- Or, on the monitor, go to the tab "IntelliForce" on the main page.

8.2.3 PRESS WHEEL CLOSURE FORCE

The opener cylinder presses on the disc and the press wheels at the same time. Once the seeding depth is reached, the press wheels become loaded by a portion of the downforce pressure. If the opener disc and blades are not pushed in the ground enough, then the press wheels are not adequately loaded.

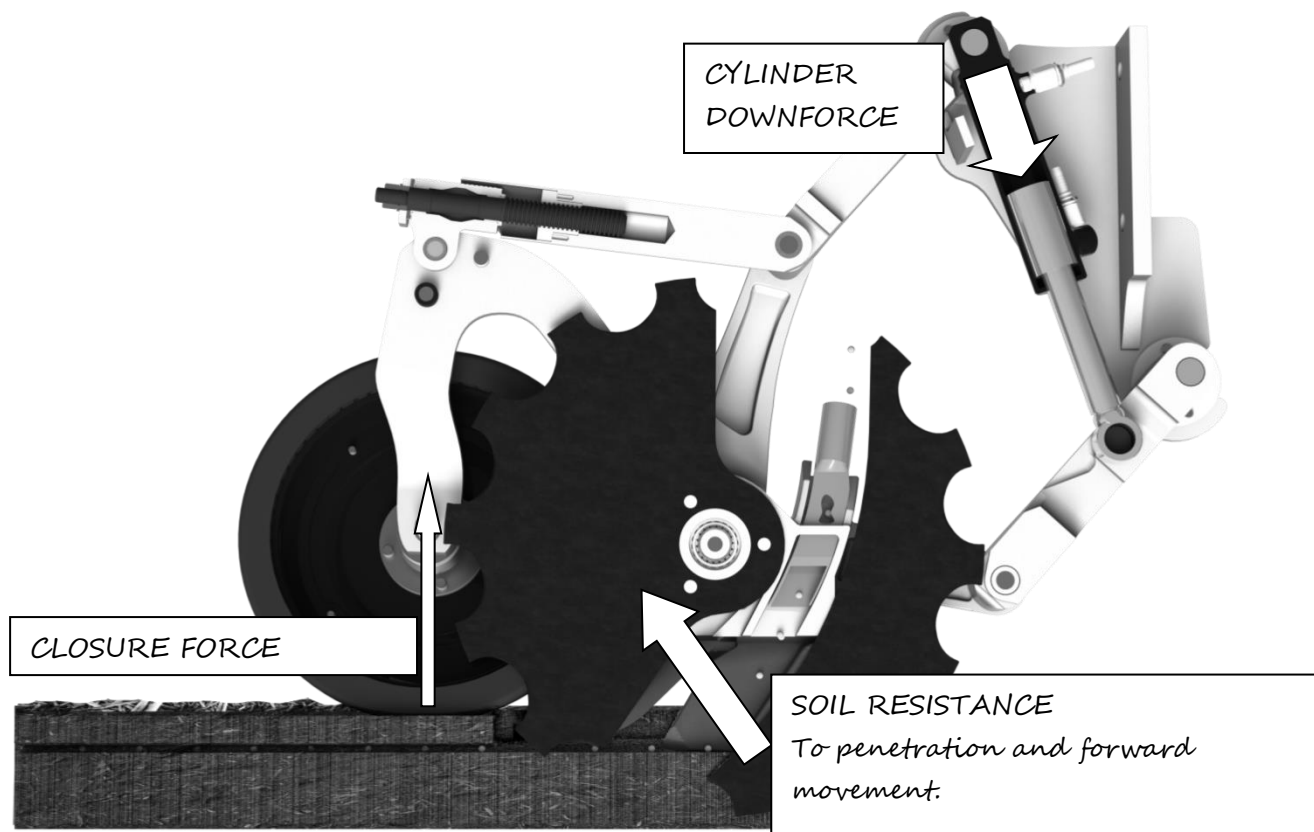


Fig. 49 : Description of closure force

$$\text{CYLINDER DOWNFORCE} = \text{SOIL RESISTANCE} + \text{CLOSURE FORCE}$$

The closure force is the pressing force made by the gauge/press wheels. This force is the basis of the IntelliForce system.

Reading a high enough closure force, combined with a proper wheel height adjustment, implies that the seeding is excellent, because the openers are working at the right depth, and the slots are well closed.

Adjusting the opener depth correctly means finding the equilibrium between the wheel height and the closure force setting (IForce auto) or, directly, the downforce pressure (IForce manual).

8.2.4 INTELLIFORCE SETTINGS

IntelliForce® system automatically adjusts the hydraulic downforce pressure in the opener cylinder according to the real time soil resistance.

1. On the monitor, select IForce Auto to activate IntelliForce. The blue button on the joystick has the same function.
2. On the monitor, go on the main page then to the « Pressure » tab, then set a desired closure force (set point). This value is generally between 10 and 100kg.

To determine the correct pressure adjustment in real time, the drill controller measures the closure force using sensors arranged in various places on the drill.



Fig. 50 : Opener with IForce sensor

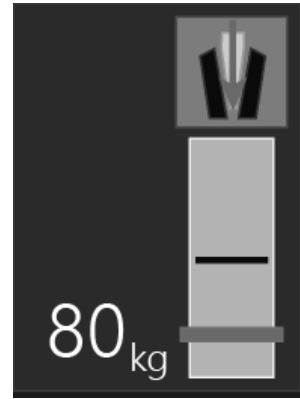


Fig. 51 Closure force gauge on the monitor

This force is continuously transmitted to the cab monitor.



If the measured force is under the set point, the system will increase the hydraulic pressure. If the force is over the set point, the system will decrease the hydraulic pressure.

Without IntelliForce the hydraulic pressure remains constant and the closure force will decrease if the soil becomes harder, because the disc has more trouble to penetrate the soil. The IntelliForce automatic control system reacts and increases the pressure and the downforce to keep the correct depth. In locally soft or wet areas, the opener encounters less resistance and the system decreases the pressure to avoid drilling too deep.

8.2.5 DRAWBAR ANGLE

The frame angle can be adjusted with the use of the drawbar cylinder.

If the front of the drill is tilted towards the soil, the opener will penetrate the soil more easily, but the seeding quality will suffer, as well as power demand.

The drawbar must be used to correct the real frame angle when drilling, to compensate the load transfer to the tractor.

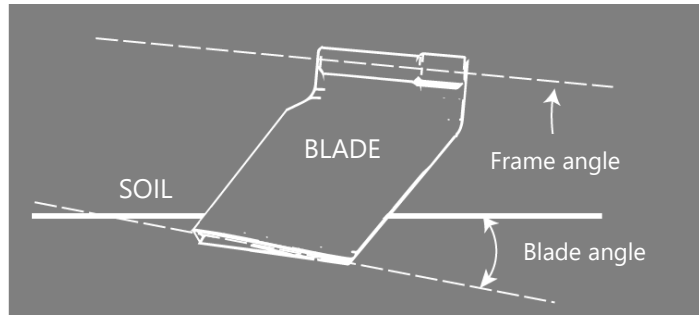
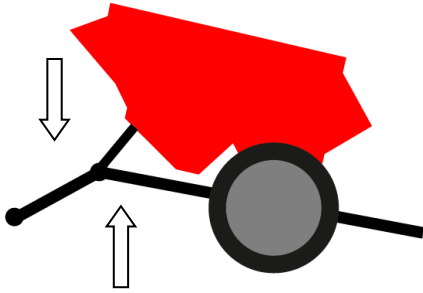


Fig. 52 : Frame tilt using the drawbar



Do not drill with an exaggerated negative blade angle (front overly raised), otherwise the risk of blockage is high.

8.2.6 ADVANCED SETTINGS

These settings can be changed on the « IForce settings » page, from the system menu of the monitor:

- **Error Margin, in kg:** The maximum allowed difference between the measured closure force and the set point, without triggering a pressure adjustment. This value is ideally set between 5 and 15kg depending on the set point. For a 30 to 50kg; set point an error margin of +/- 5kg is recommended. For a set point of over 50kg, 10kg is more suitable. This error margin is used to lower the tractor pump demand.
- **Maximum pressure, in bar.** This setting defines a reasonable maximum pressure corresponding to the soil type. The downforce pressure will not go over this setting.

8.2.7 JOYSTICK USE

The joystick provides quick access to the functions that are often used. It can control the downforce pressure, command the raising and lowering of the openers, activate or deactivate the IntelliForce system (blue button), or trigger the rotations of the hoppers at the beginning of a pass (yellow button).

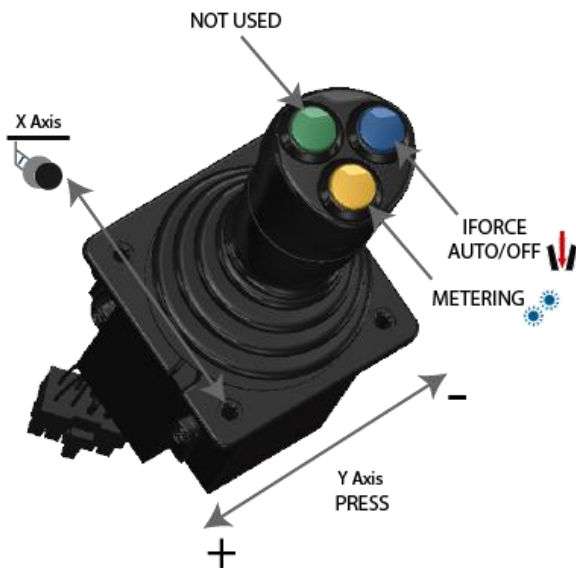


Fig. 53 : Joystick

- **X axis** : raise and lower
- **Y axis** : pressure adjustment in manual

8.3 Ideal conditions of use

8.3.1 IN PASTURE OR LIVING COVER CROP

In these conditions, the soil is generally well held together by the roots. These conditions are perfect to get familiar with the drill because they allow a great liberty of adjustment.

- The tractor finds grip easily.
- The good soil structure thanks to the roots allows drilling with very low disturbance, even at a very shallow depth. A thin layer of soil is detached and falls in place after the opener.
- The press wheel closure force can be high.
- Very tall cover crops are very well tolerated.
- Drilling speed can be high if the tractor power output is high enough, and with enough ballast.



Fig. 54 : Drilling over a pasture

8.3.2 ON DENSE RESIDUE COVER

Drilling under a thick mulch is particularly interesting because the residue cover limits evaporation and weed germination.

These conditions are encountered after the combine for example. A good straw spread is essential for a uniform crop emergence. These conditions are very good but the adjustments of the drill are often more difficult.

- The residue cover provides good reference to the gauge wheels and this allows fine depth adjustments.
- The best advice would be waiting for the soil to dry, but the residues offer a larger window for drilling because the soil does not stick to the press wheels.
- The adjustment objective is to find the balance between the height of the press wheel and the closure force, which allows drilling without blockage. This balance will be harder to find if the soil is sticky.
- Ideal drilling speed is 8km/h to 10km/h. A lower speed improves the slot quality in some situations.
- The quality of the slot is greatly improved if only one blade can be used. In this case, drilling speed can be increased.



Fig. 55 : Drilling over maize residues

8.3.3 ON STONY FIELDS

Stones do not cause special problems.

- Uniformity in seeding depth is less good than in other conditions because of repeated shocks.
- The disc must not be set at low mounting hole. The deeper the disc work, the more chance it has to find a stone and make the opener bump.
- A general principle could be to use a quite high downforce pressure to reduce the impact of stones on the depth. Manual pressure control is recommended over Automatic, because the stones will alter the closure force measurements under the press wheels.
- It is strongly advised to reduce the drilling speed to 5-6km/h for a better regularity and less wear.



Fig. 56 : Drilling on stones

8.3.4 ON SLOPING FIELDS

Common difficulties encountered on this type of ground are:

- Differences in soil type depending on the terrain.
 - Steep slopes which requires a very high power from the tractor and slippage problems.
 - Slopes that cause an angle between the drill and the tractor towards the bottom of the slope, and potential difference in depth due to roll angle.
-
- A universal solution for this type of ground is to drill in living cover crop, to enhance the tractor grip, and the opener discs grip against the slopes.
 - The IntelliForce system must be activated to automatically adjust the downforce to match the expected variation in drilling speed and soil types.
 - Use the maximum pressure function of the IntelliForce system to avoid the drill wheels lifting off the ground going across slopes.



Fig. 57 : Drilling on sloping ground

8.3.5 ON NAKED SOILS WITH LITTLE OR NO COVER

These soils can be the most difficult but the outcome can be very good under favorable soil conditions.

- It is difficult to get little soil disturbance if the soil is brittle and crumbly. In this case, drilling speed must be low.
- If the soil is sticky, the risk of disc and press wheel blockage is high. In this case, the speed must be high.
- In all circumstances, the disc height adjustment is of primary importance. It has to be adjusted down for a soft and sticky soil. In the opposite case of a very hard soil, the disc must be mounted in the top position. Ballast weight may also prove necessary.
- These soils can be drilled with more ease with only one blade instead of the two.
- Tilled soil can be drilled but, in this case, it is advised to only use one blade and low downforce pressure. Tilled soils should be well consolidated (rollers) before drilling.



Fig. 58 : Drilling over a naked soil (Sunflower residues)

8.4 Adjustments from the cab

8.4.1 RATE ADJUSTMENTS

The product metering rate set from the cab can be adjusted anytime, using the monitor.

- On the main page, go to the desired hopper tab.
- From this tab, two adjustments can be made:
 - Increase or decrease the rate, using the +, - and validate buttons.
 - Activate or completely deactivate the hopper using the button metering ON/OFF.

8.4.2 GPS SPEED

The metering system uses GPS speed as a reference. Signal quality is displayed on the main page of the monitor.



Fig. 59 : Signal quality symbol on the monitor



Fig. 60 : GPS antenna

3 quality levels can be shown:

Color	Signal quality	Effects
Green	Good. Satellite number is also shown.	Precision is between 0.1 and 0.2km/h.
Yellow	Bad. Can occur close to trees or down in valleys.	Precision is between 0.5km/h and 1km/h.
Red	Insufficient signal.	Drilling is not possible using this signal. If the drill is in work state, a sound alarm alerts the user that the signal is lost. The drill automatically uses a reference speed of 6km/h. This speed can be adjusted in the GPS settings menu.

8.4.3 WORK COUNTER

On the monitor, go to the system menu, and then to the GPS settings page.

The GPS also manages surface counters (factory and work counter).

8.5 Work lights / LED

Work lights are mounted on the drill.

8.5.1 HOPPER LIGHT



Fig. 61 : Hopper LEDs

The main hoppers are fitted with internal LED lights. These LED's can be switched on from the main drill power box.

8.5.2 WORK LIGHTS

The drill can manage up to 4 work lights that can be activated from the monitor:

- From the main page, the button 5, « Lights On » can be used to activate or deactivate all the lights.
- 2 work lights are factory mounted at the back.
- 1 work light is placed under the hopper, to light the metering units.
- 1 socket on the main drill harness is left available for a 4th light.

8.6 Blockage monitoring

8.6.1 PRINCIPLE

AGTRON® sensors count the number of seeds per second that flow through the seed tubes.

The sensor will send an error message if too few seeds are flowing through the pipe. If this is the case, the row will be reported as blocked.



If every row is reported blocked, it could mean that the hopper is empty or that the splined rotor is blocked.

8.6.2 SETTINGS

These settings are accessible through System -> Front (or Rear) hopper settings.

Sensitivity: This ratio sets an alert level in terms of seeds/second, under which the row is reported blocked. It can be adjusted from 1 to 10.

Seedfactor: corresponds to the weight of each seed.

8.6.3 ROW BLOCKAGE DISPLAY

In case of a blockage, a sound alarm will be made by the monitor and an error message will show.

The distributor head on the hopper tab (main page of the monitor) shows the blocked row in red (see section 13.1).

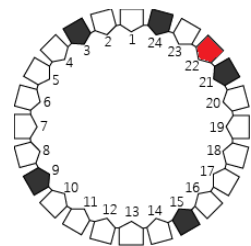


Fig. 62 : Blockage shown on the monitor

8.6.4 ADJUSTMENT ON THE FIELD

The preferred adjustment method is the following:

1. Check that none of the rows are blocked.
2. Set sensitivity to 5.
3. Make a test pass.
4. If some rows are reported blocked but are not, then the sensitivity is too high.
If this is not the case, gradually increase the sensitivity until they are reported blocked. Lower the sensitivity by 1.
5. Immediately after calibration, use the "Agtron CAL" button available on the hopper tab, while drilling. This will automatically calculate the Seedfactor and the real rate will be displayed.

9 Implement drop off

9.1 Hopper drain

9.1.1 FRONT HOPPER

The hopper outlet is located over the front toolbar and its openers. Two draining methods can be chosen:

1/ Open the plastic hatch of the metering unit, by untightening the red plastic wing nut. The content of the hopper will fall on the floor.

2/ Use the diverting air valve, placed after the venturi before the tower.

1. Remove the cover.
2. Toggle the handle in drain position.
3. Activate the fan at a moderate speed.
4. Activate the metering unit motor from the monitor.
 - In the SYSTEM menu, select « FRONT HOPPER SETTINGS ».
 - Select OTHER, then « DRAIN THE HOPPER ».
 - Activate the main hydraulic circuit.
 - Use the calibration switch under the hopper to activate fast rotation of the motor.

9.1.2 REAR HOPPER

The rear hopper can be drained:

1. Either, by opening the plastic hatch. The contents of the hopper will fall down on the floor.
2. Or by removing the plastic elbow and activating the motor from the monitor using the same procedure as for the front hopper.
3. In both cases, the fan use is not necessary.

9.1.3 AUX BIN

Auxiliary bins can be drained:

- Manually, by removing the black knob (1) and by toggling the cover (2).
- Manually, by opening the hatch (4) after removing the screws (5).

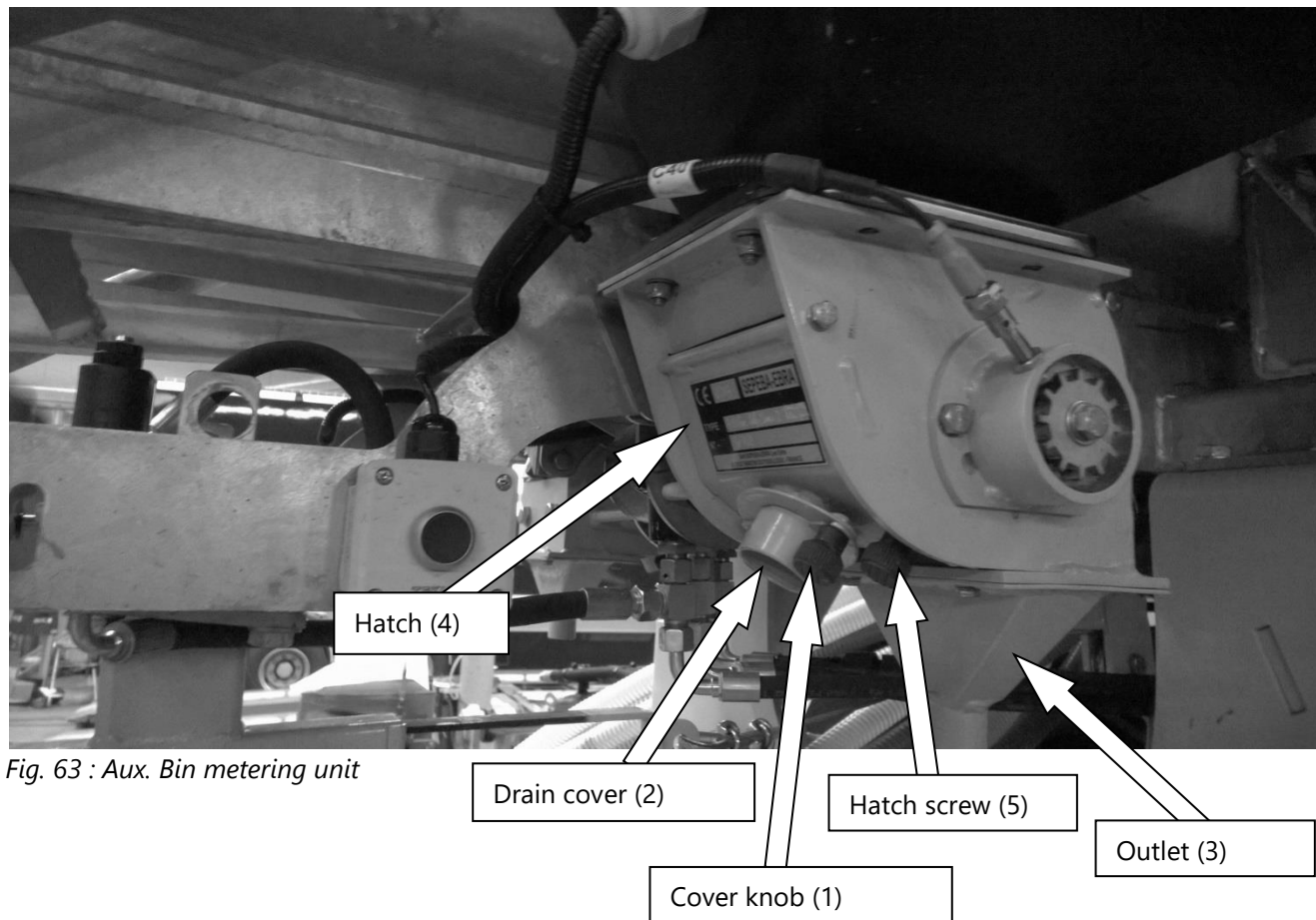


Fig. 63 : Aux. Bin metering unit

9.2 Uncoupling from the tractor

9.2.1 DECOMPRESSION OF HYDRAULIC ACCUMULATORS

Before shutting down the drill, the accumulators must be de-pressure and the openers set on the floor. This will prevent any pressure build up in the return line.

Activate the IntelliForce manual mode.

1. Lower the openers to the ground. Use repeated downwards impulses on the joystick to lower them slowly.
2. Deactivate the tractor hydraulics/turn the engine off.
3. Activate the drill work state (holding down the joystick/the monitor down button).
4. Use the joystick or the IForce page on the monitor to set the opener cylinder pressure to the minimum.



In the case of an embarked pump, the accumulators discharge can make the PTO shaft turn in reverse.

9.2.2 DISCOUPLING

1. Lift the front of the drill using the drawbar cylinder.
2. Extend the crutch.
3. Tighten the parking brake.
4. Remove the safety pin from the tractor hitch.
5. Set down the front of the drill on the crutch with the drawbar cylinder, and carry on until the hitch is freed from the drill weight.
6. Disconnect the battery connector, the road lights socket and the hydraulic hoses.




Always remove the return hose last.

10 Hydraulic circuit specifications

10.1 Hydraulic oil

10.1.1 HYDRAULIC OIL

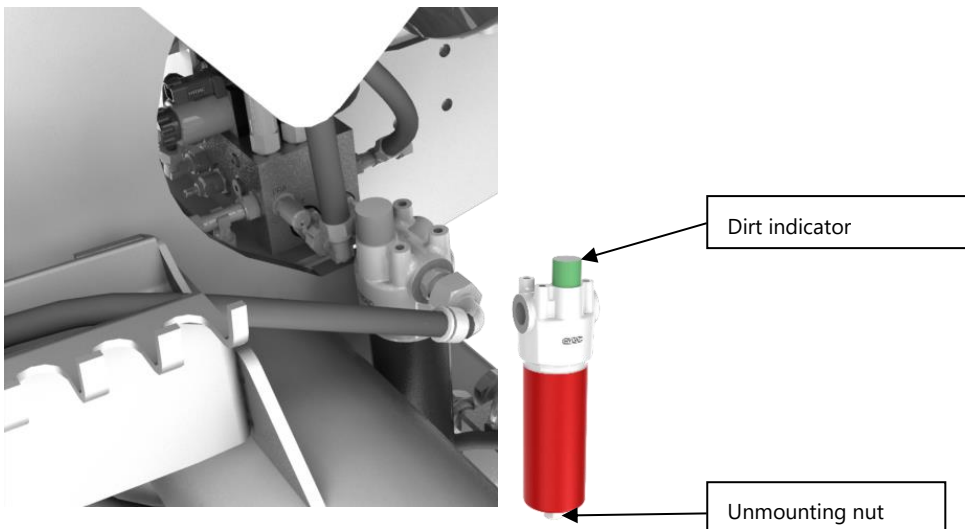
Compliance	Mineral oil complying with DIN 51524 (chap. 1 & 2)
Temperature range	Min : -20°C Max : +80°C
Filtering	Maximum pollution permitted according to ISO44 06, class 19/17/14.
 Use the specified oil quality. The use of another type of oil or mixing between them can cause serious damage to the installation.	

10.2 Filters

10.2.1 LOCATION OF FILTERS

The drill is fitted with:

- An inline high-pressure filter, located before the P line of the main distributor.



10.2.2 FILTERING CARTRIDGE REPLACEMENT

Cartridges must be replaced at frequent intervals. Stay in accordance with the following recommendations:

At factory	After filtering and first tests.
After the first uses	After the first 50h
Before each season	Every 200h

Cartridge reference:

Manufacturer	Manufacturer Ref	NOVAG Ref.
HYDAC INTERNATIONAL	1262050	CONPR001

How to replace the filter cartridge:

1. Place an oil collect bucket under the filter.
2. Remove the cover bell and remove the used cartridge.
3. Drain the cover and fill it with new oil.
4. Tighten without exaggerating the new cartridge in its seat, and mount the cover back.
5. Check the correct flow of pressured oil.

10.3 Embarked distributors

10.3.1 MAIN DISTRIBUTOR

The main distributor can handle, depending on tractor and drill configurations, the following functions:

- The raising and lowering of the openers.
- The hopper motors.
- The folding and unfolding of the frame.



Fig. 64 : Main Distributor

10.3.2 DOWNFORCE DISTRIBUTOR

The downforce distributor manages the hydraulic downforce pressure. It is fitted with 2 accumulators which serves as a suspension for the openers and to quickly restore the pressure at the beginning of a pass.

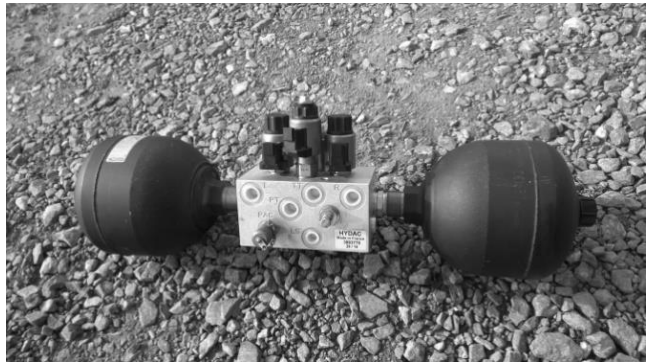


Fig. 65 : Downforce distributor

10.3.3 FOLDING BLOCK

The folding distributor manages the folding and unfolding sequences on folding drills.

Its functions are: the automatic locking and unlocking of the frame wings, the folding/unfolding of the wings, and the walkway control.

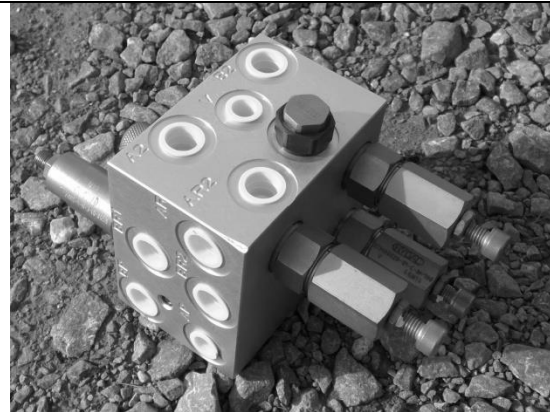


Fig. 66: Folding Block

10.3.4 HOSES AND HYDRAULIC PIPING




Every hose on the drill is referenced.

To determine the connections of any hose, consult the schematics in section 10.4.



Fig. 67 : Location of reference number on a hydraulic hose.

10.3.5 HYDRAULIC MOTORS

Designation	NOVAG Ref	Picture
Metering unit motor	FOUH052	
Piston motor for fan	FOUH030	
Gear motor for fan	FOUH010	

10.4 In case of intervention

10.4.1 WEO COUPLINGS

These couplings are crimped on all the opener hoses as well as on some distributor hoses.



The disconnection of the hose cannot be made if the hose is under pressure.

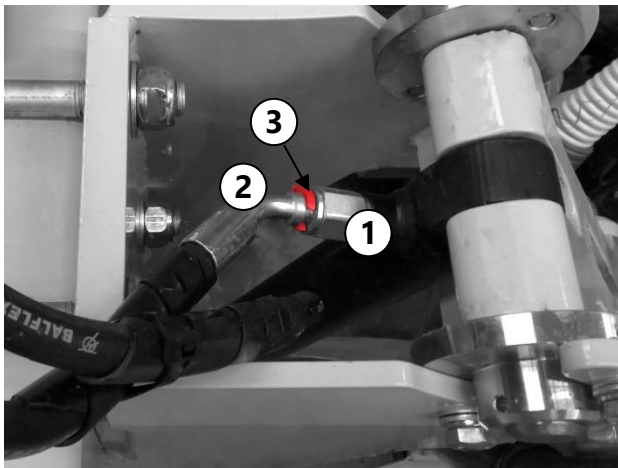


Fig. 68 : WEO coupling

- ① Female fitting
- ② Male fitting
- ③ Clip

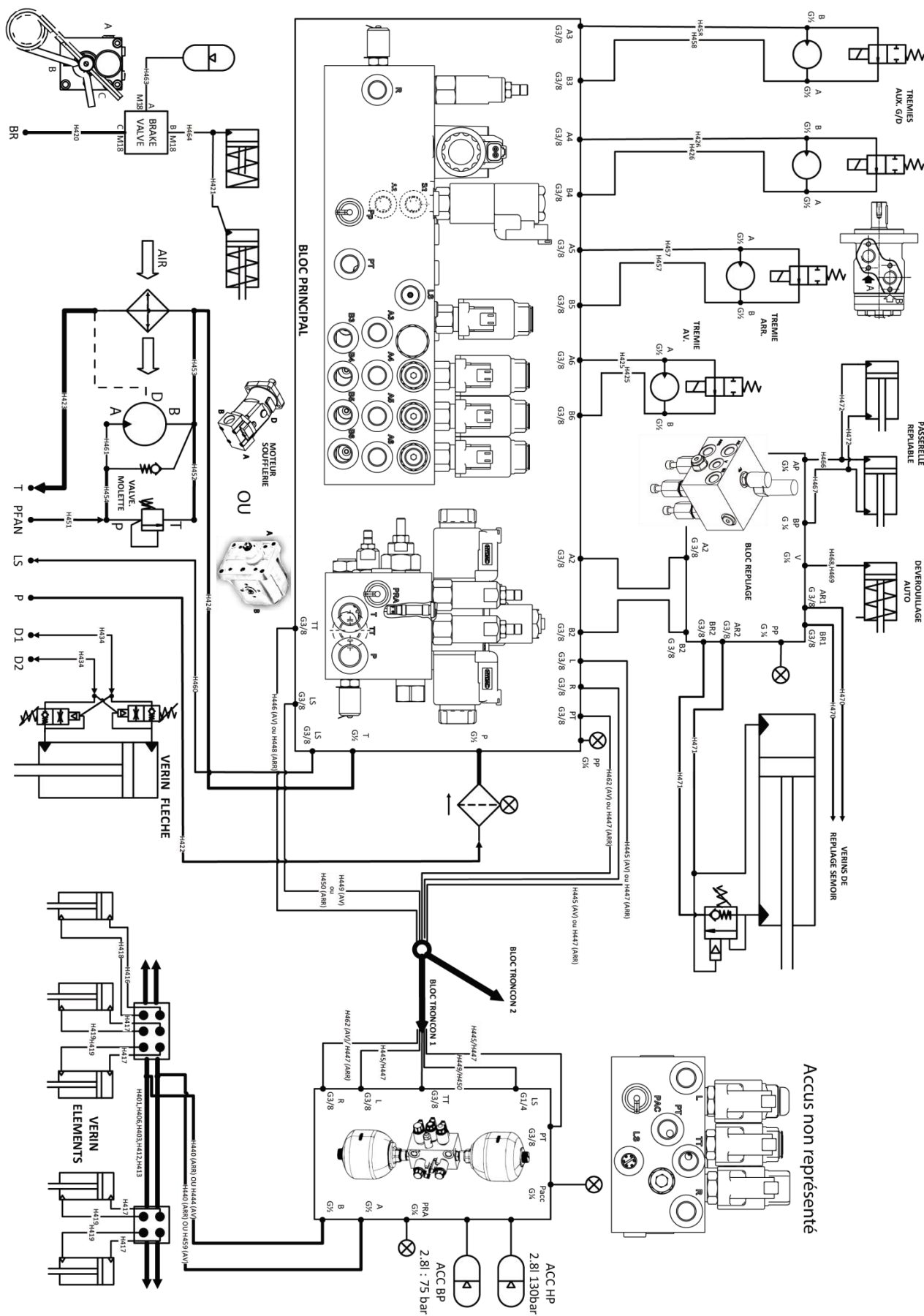
To connect the couplings:

1. Insert the plastic clip (3) on the male fitting (2).
2. Push the male fitting into the female fitting (3), until the plastic clip touches the edge of the female fitting.
3. Check the coupling by trying to pull out the hose. It must not disconnect.

To disconnect the couplings:

1. Remove the clip (3)
2. Push the male fitting to free it from the female fitting.
3. Pull the male fitting out.

10.5 Hydraulic circuit



11 Electrical circuit

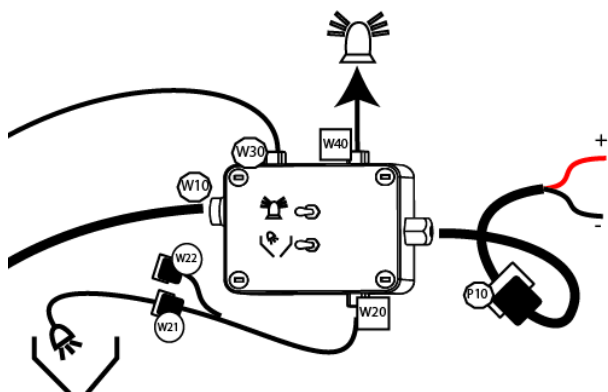


Always take care of the connectors in every connections. In particular, make sure there is not any short circuit after any intervention, using appropriate equipment, before connecting the drill to the battery or switching on the cab monitor.

11.1 Power box

11.1.1 DESCRIPTION

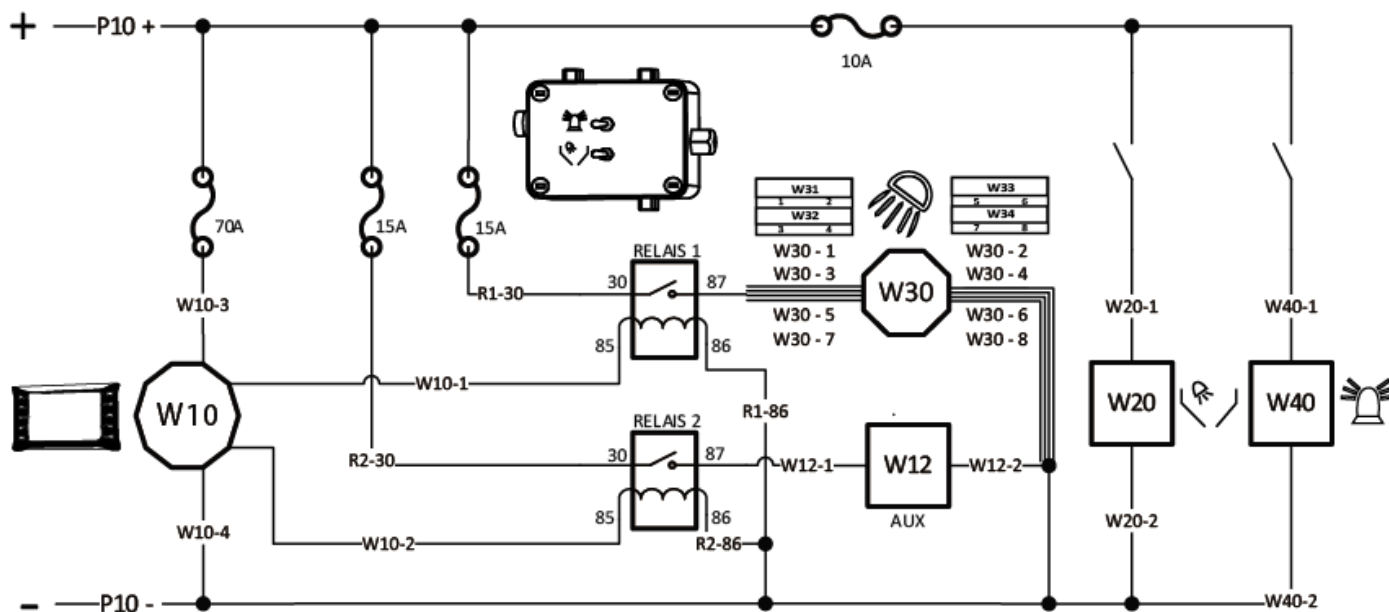
The power box distributes electrical current coming from the tractor battery. The drill features separated circuits, each protected by a fuse located inside the power box. The rotating beacon and hopper LED switches are also part of this box.



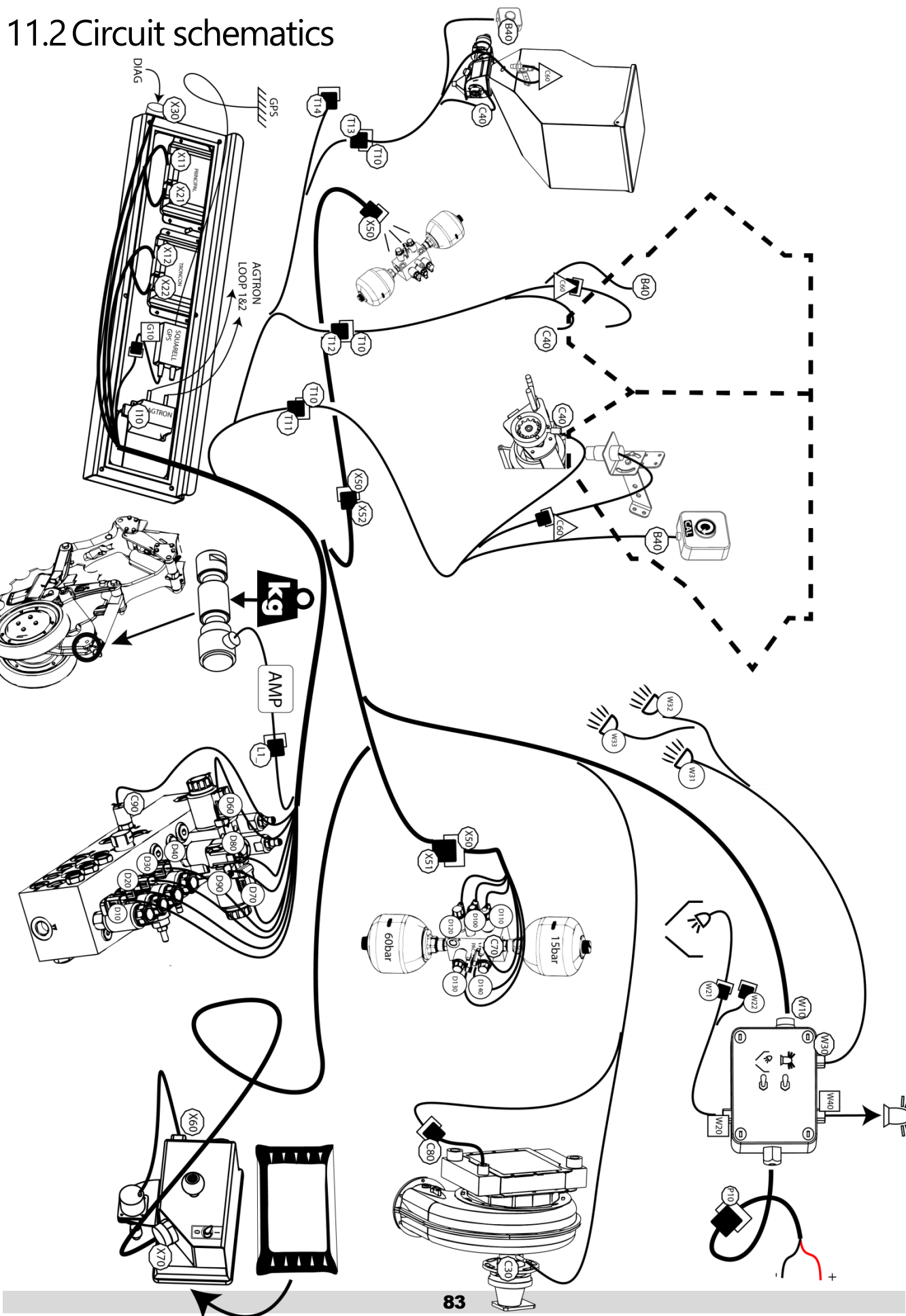
Required electrical current

Circuit	Voltage	Current
Main circuit	12V	30A
Work lights	12V	20A
Hopper LED	12V	5A
Rotating beacon	12V	20A

Internal schematics









11.2 Circuit schematics



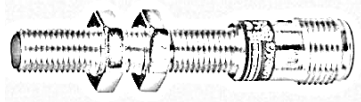
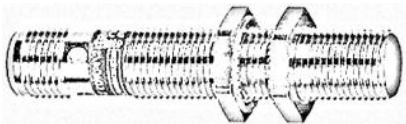
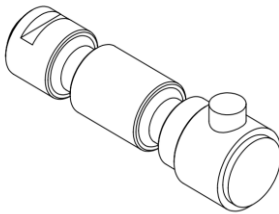

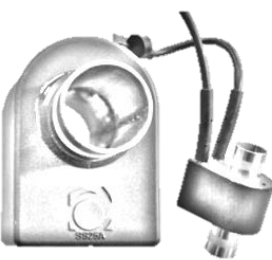
11.3 Spare parts

11.3.1 CONNECTORS

	Designation	Ref NOVAG	Connector Nb	Picture
	Male crimp contact	FOUE009		
	Female crimp contact	FOUE008		
	Female housing + Wedgelock	2 pins FOUE019 3 pins FOUE021 4 pins FOUE023 6 pins FOUEDEU004 8 pins FOUEDEU003 12 pins FOUEDEU006	Various connector Various connector T10 X60 D50	
	Male housing + Wedgelock	2 pins FOUE018 3 pins FOUE020 4 pins FOUE022 6 pins FOUEDEU005 8 pins FOUE024 12 pins FOUEDEU002	T11 à T14 X61 D51 à D53, X80	
	Cap	2 pins FOUE004 3 pins FOUE005 4 pins FOUE006 6 pins FOUEDEU001 8 pins FOUEDEU007 12 pins FOUE017		
	M8 female connector	FOUE049	Load pins connectors	
	M12 female connector	FOUE034	C31, C90, C70, C40	




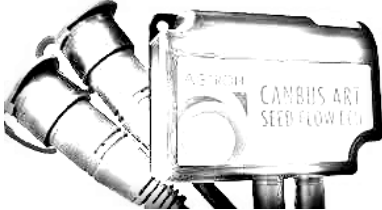
This table does not mention the special connectors for cab, controller and battery. In case of a problem with these connectors, contact the machine dealer.

11.3.2 SENSORS




Designation	Picture	Connector	REF. NOVAG
Metering unit sensor		C60	FOUE016
Fan sensor		C31	FOUE038
Load pin (opener IForce sensor)		L11 à L16	PFE004
GPS Antenna			FOUE001
Agtron sensor			FOUZACG002

11.3.3 CONTROLLER

**Before undertaking any welding job on the tractor or the implement, disconnect the battery and alternator cables.
(90% of reported controller malfunctions are directly caused by this problem).**

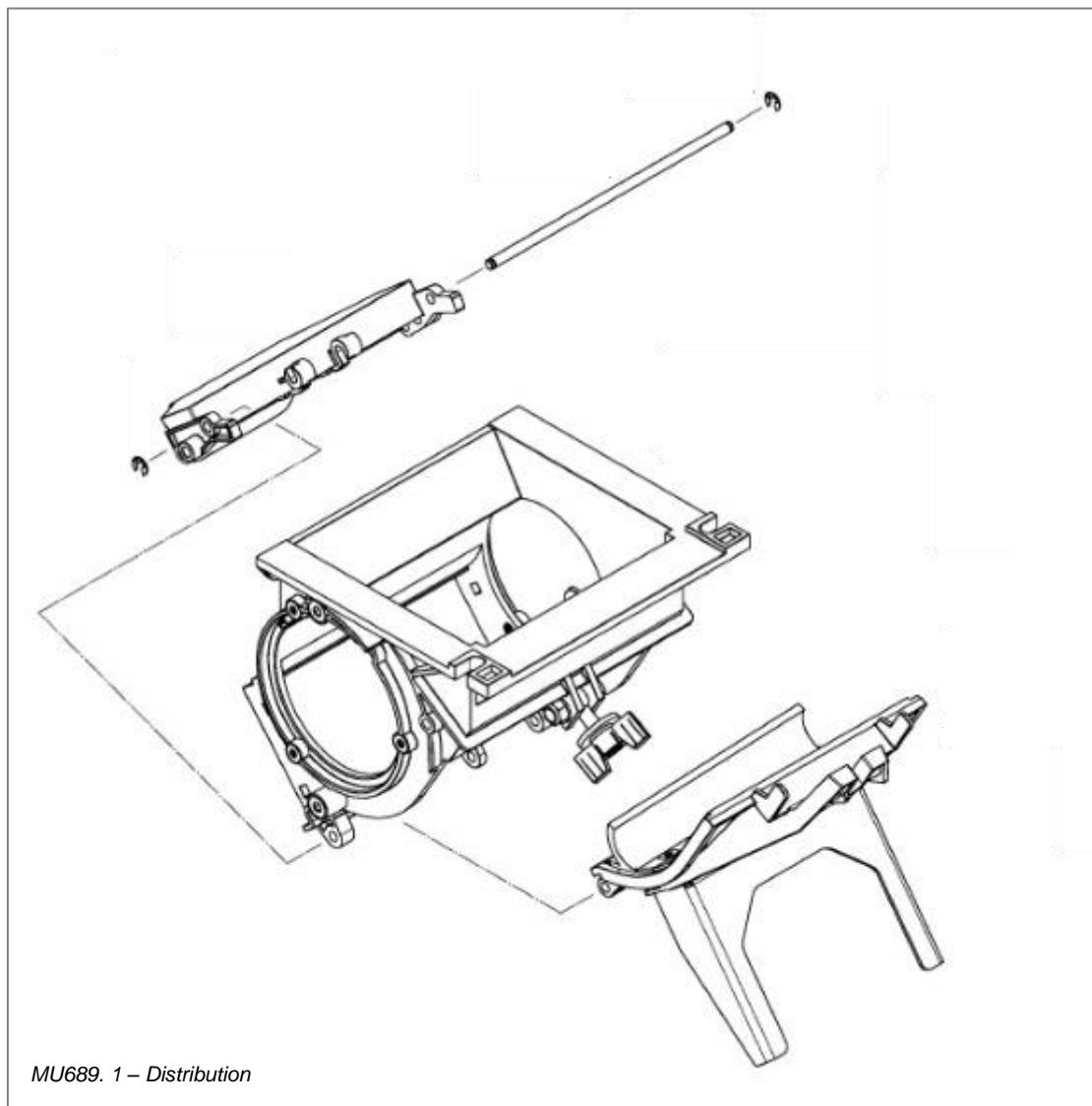
Designation	Picture	Ref. NOVAG
Main Controller		FOUE010
Downforce controller		FOUE059
GPS controller		FOUE002
Agtron controller		FOUZAG003

11.3.4 WORK LIGHTS

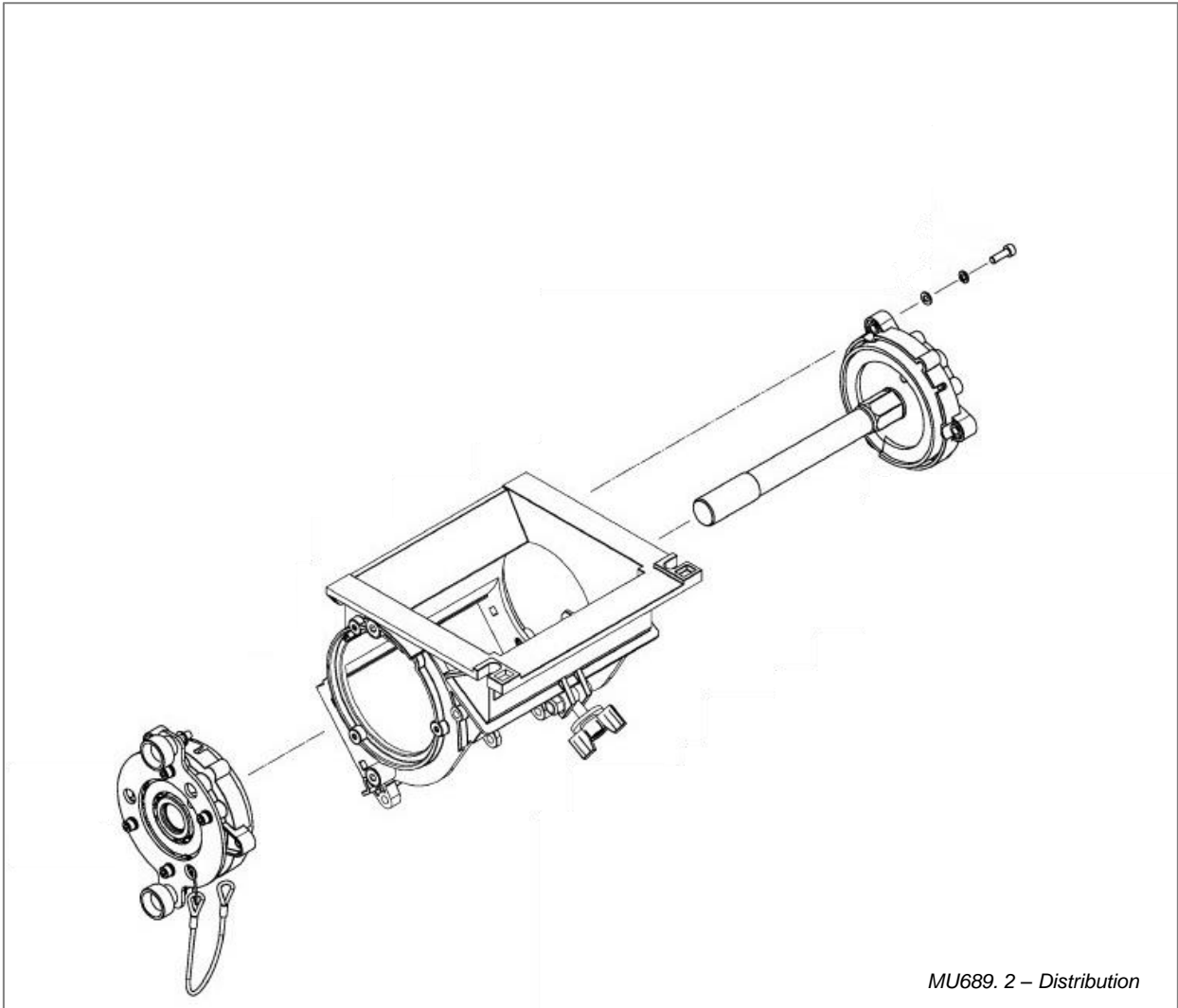
Designation	Picture	NOVAG Ref.
Long range work light		FOUA041
Short range work light		FOUA040
Hopper LED		FOUE123

12 Drawings, Spare parts

12.1 Metering Unit

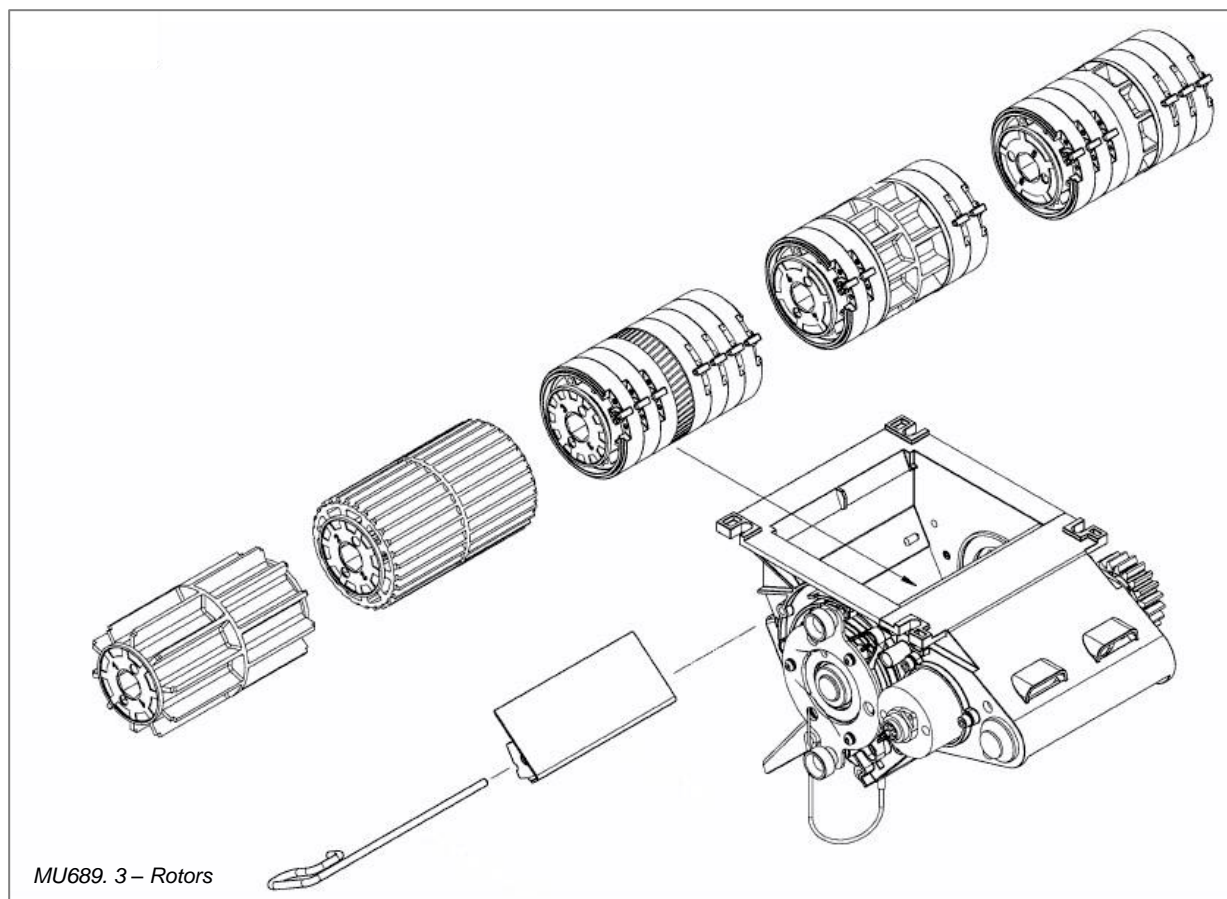


Pos.	Qty	Ref	Designation
1	1	FOUZAC057	BOX MOUNTED
2	1	FOUZAC053	FLAP
3	2	FOUZAC059	LOCK WASHER 5 DIN6799 VA
4	1	FOUZAC061	HINGE BOLT
5	1	FOUZAC062	CALINDRATION COVER

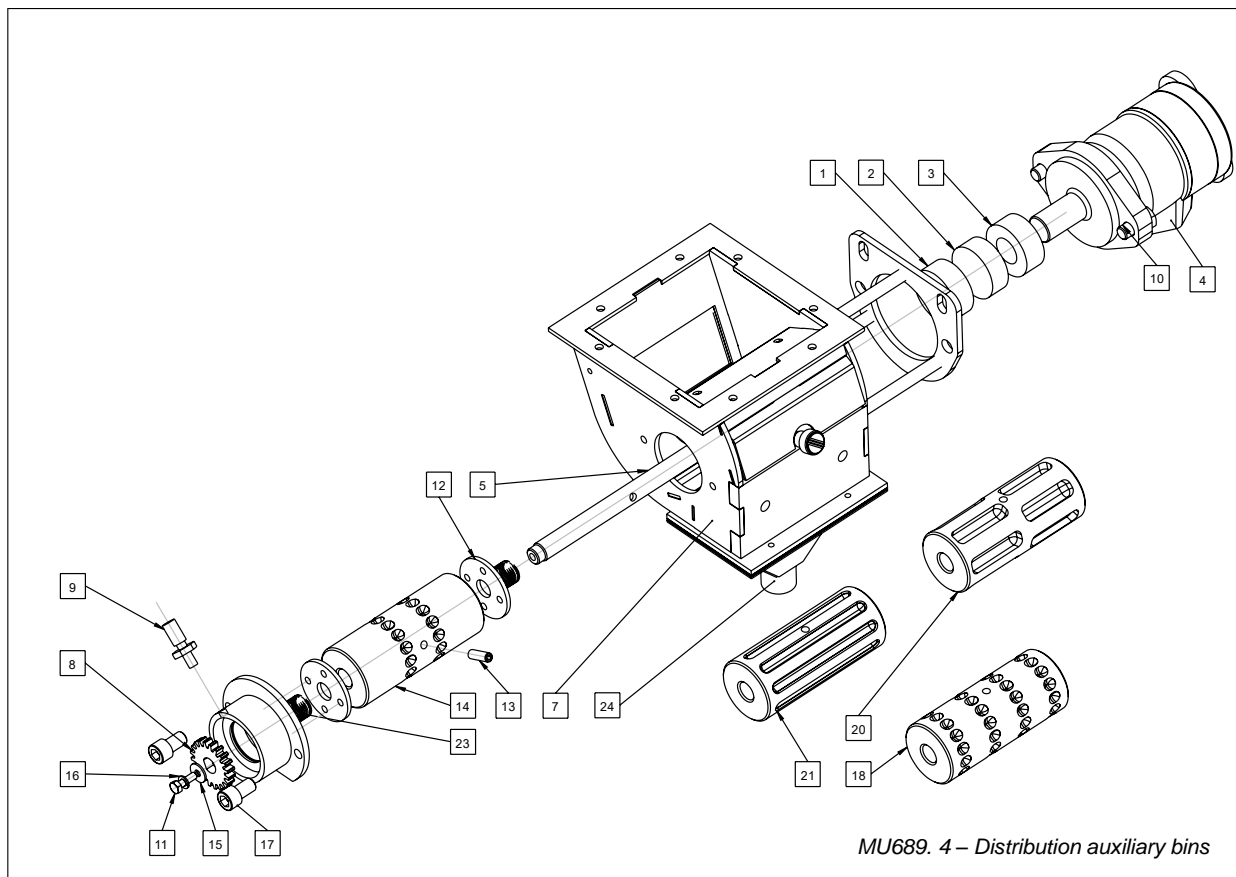


MU689. 2 – Distribution

Pos.	Qty	Ref	Designation
1	1	FOUZAC057	BOX MOUNTED
2	1	FOUZAC056	LEFT BEARING
3	1	FOUZAC060	RIGHT SET

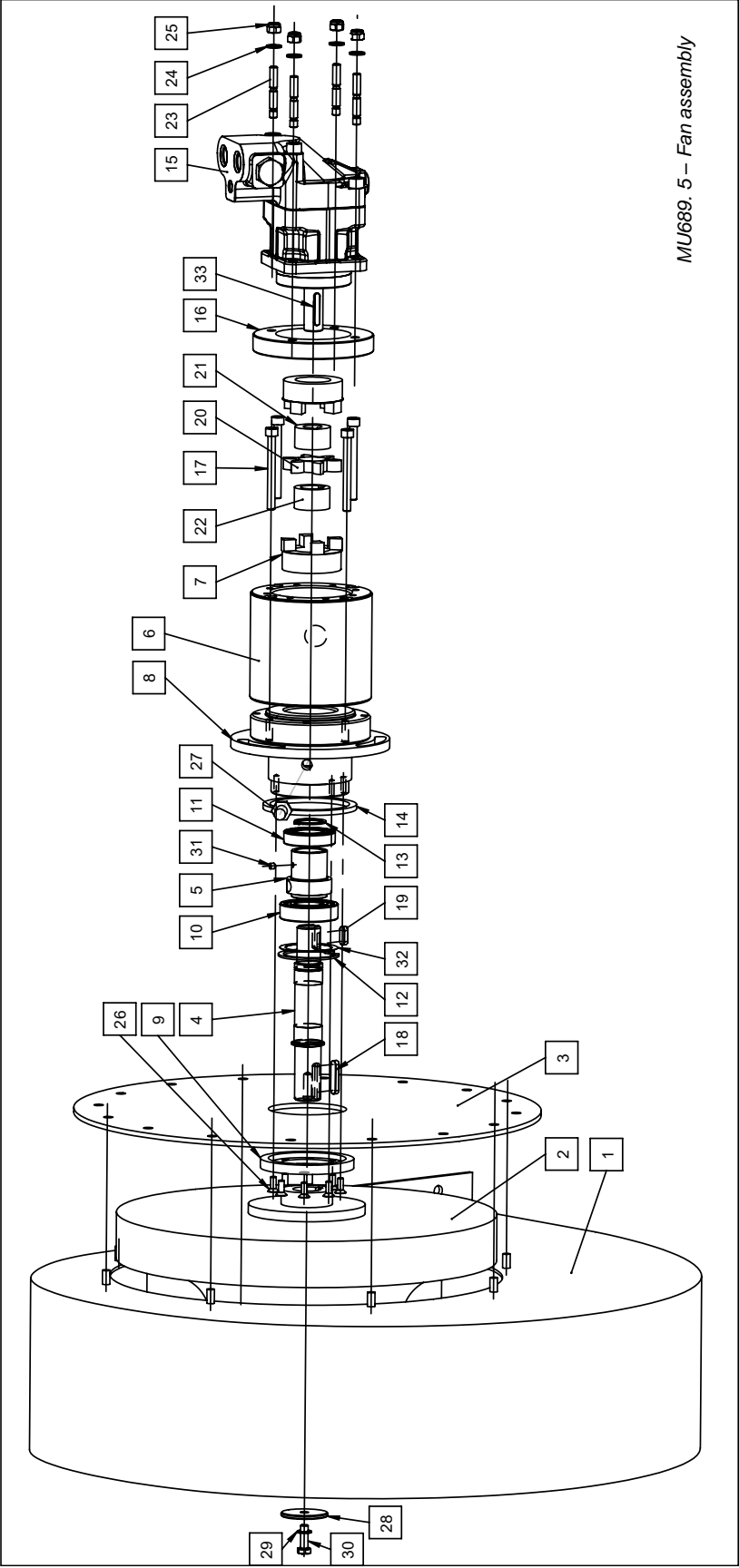


Pos.	Qty	Ref	Designation
1	1	FOUZAC071	TRAPPE
2	1	FOUZAC072	LOCK
3	1	FOUZAC068	SIZE "2" ROTOR
4	1	FOUZAC069	SIZE "3" ROTOR
5	1	PF189	SIZE "4" ROTOR
6	1	PF190	SIZE "1" ROTOR
7	1	PF191	SIZE "5" ROTOR

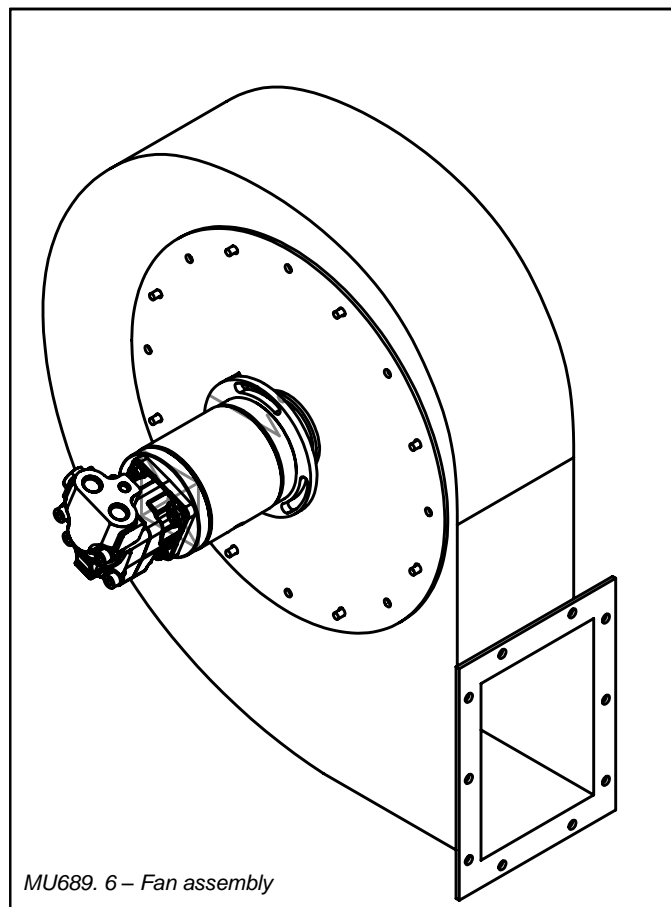


Pos.	Qty	Ref	Designation
1	1	FOUT001	14mm DISTRIBUTION COUPLING
2	1	FOUT005	51mm ACETAL DISC
3	1	FOUT004	25mm DISTRIBUTION COUPLING
4	1	FOUH052	80cm ³ ORBITAL MOTOR
5	1	FOUZSE013	ROTOR PIN
7	1	FOUZSE002	POLYDOSEUR METERING HOUSING
8	1	PFC024	DISTRIBUTION GEAR WHEEL
9	1	FOUE015	DISTRIBUTION SENSOR
10	2	FOUVIXHEX1240	M12x40 SS HEXAGON HEAD SCREW
11	1	FOUVIXHEX820	M8x20 SS HEXAGON HEAD SCREW
12	2	FOUZSE012	POLY METERED WASHER
13	1	FOUV092	M6x6 HEADLESS SCREW
14	1	PFU044	SIZE "A" 6.7cm ³ ROTOR
15	1	FOUVIXROL8	M8 SS WIDE WASHER
16	1	FOUVIXROW8	M8 SS GROWER WASHER
18	1	PFU049	SIZE "B4" 15cm ³ ROTOR
19	1	PFC059	HOPPER MOTOR SUPPORT
20	1	PFU048	SIZE "D" 100cm ³ ROTOR
21	1	PFU047	SIZE "C" 45cm ³ ROTOR
23	2	FOUZSE020	SPRING
24	1	FOUZSE016	OUTLET CHUTE

12.2 Fan



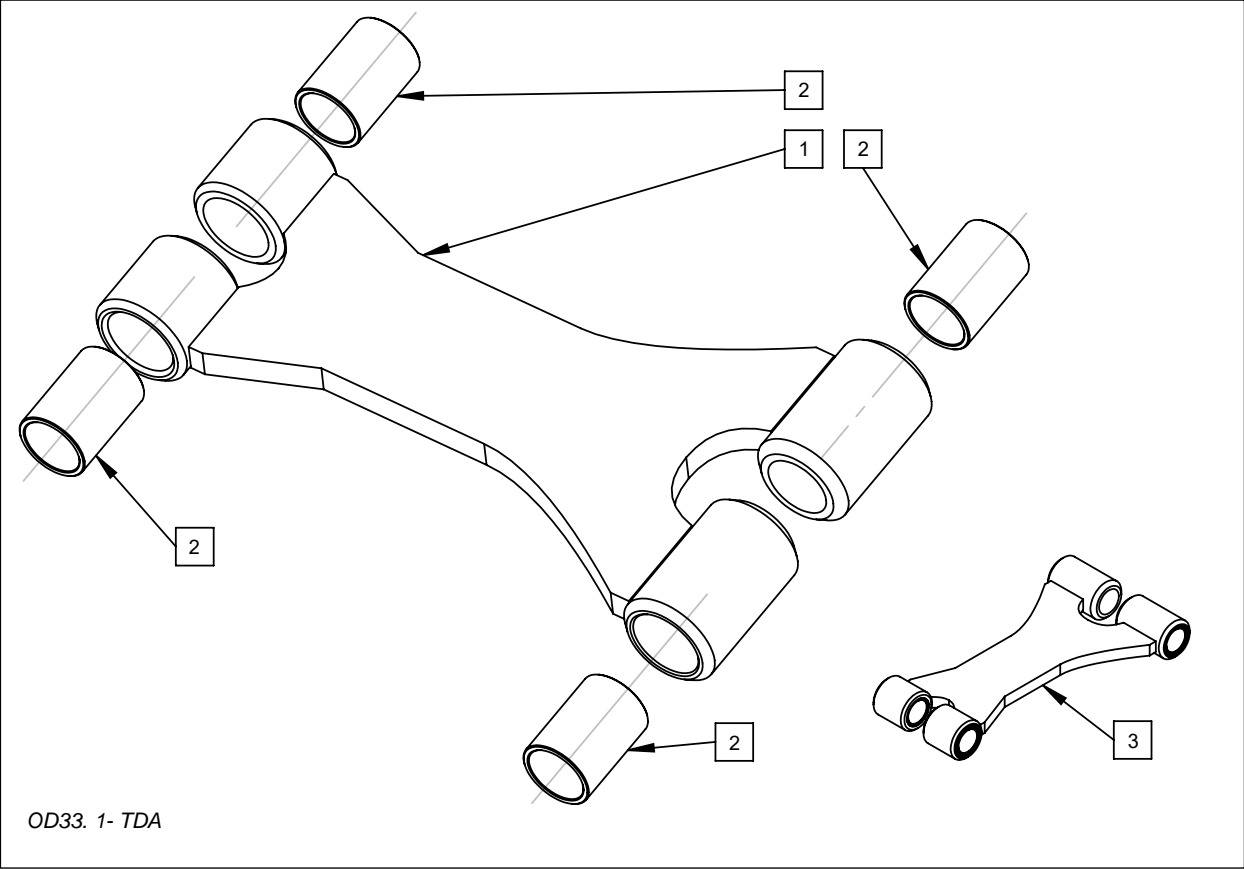
MU689.5 – Fan assembly



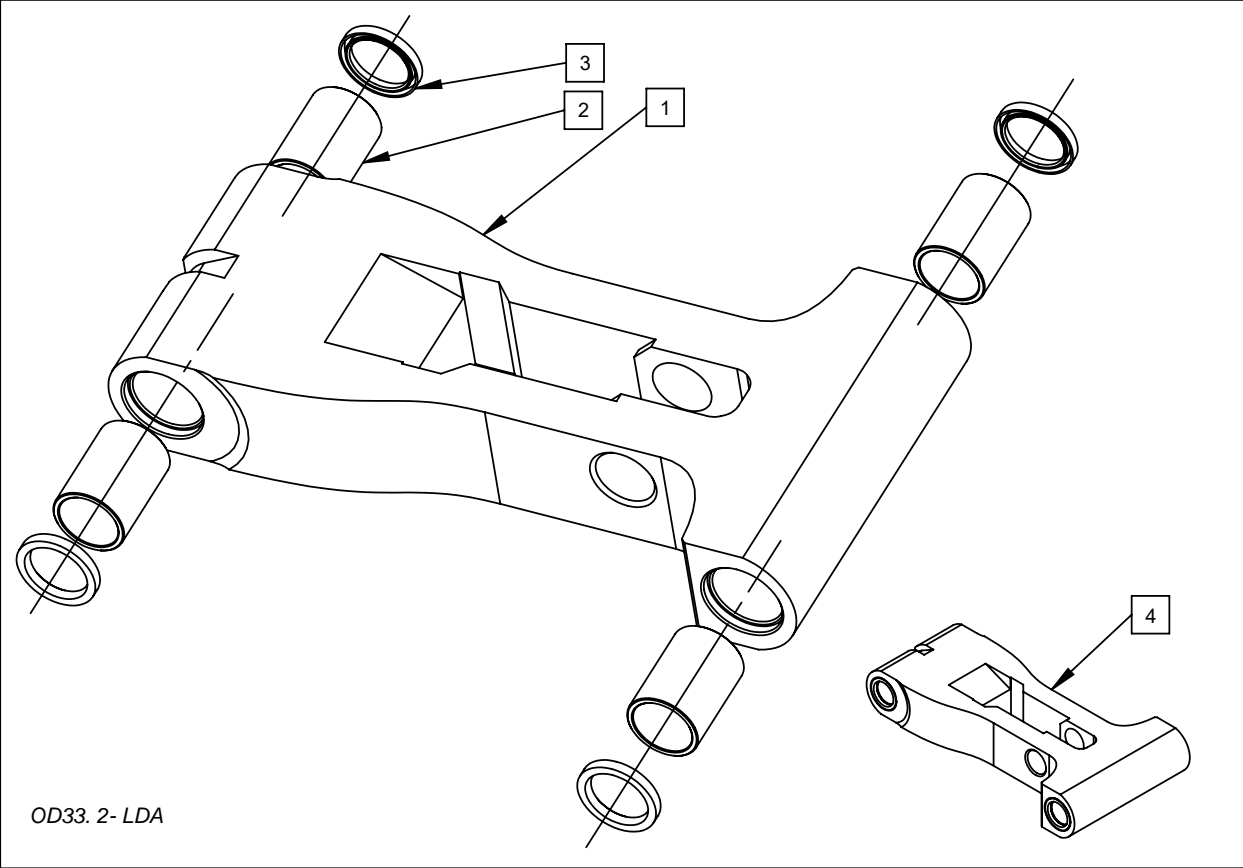
Pos.	Qty	Ref	Designation
1	1	FOUA009	FAN HOUSING
2	1	FOUA049	TRC 401 IMPELLER
3	1	PF117	FLANGE
4	1	PFU027	IMPELLER SHAFT
5	1	PFU028	SPACER
6	1	PFU009	SPECIAL BELL
7	2	FOUT018	HABIX COUPLING HUB
8	1	PF062	BEARING HOUSING
9	1	PFU018	FLANGE RING
10	1	FOUB025	6206 BALL BEARING
11	1	FOUB024	6006 BALL BEARING
12	1	FOUV037	OD62mm CIRCLIPS
13	1	FOUV035	OD30mm CIRCLIPS
14	1	PFX071	FLANGE WASHER
15	1	FOUH108	PARKER MOTOR
16	1	PFU029	BELL EXTENSION

Pos.	Qty	Ref	Designation
17	4	FOUVBTR880	M8x80 SOCKET HEAD SCREW
18	1	FOUT021	KEY 8x7x32
19	1	FOUT016	KEY 8X7X25
20	1	FOUT019	HABIX COUPLING STAR
21	1	FOUT006	20mm TAPERLOCK
22	1	FOUT020	25mm TAPERLOCK
23	4	FOUV068	M8x45 BLACK STUD CL8.8
24	4	FOUVROE8	M8 WASHER
25	4	FOUVECFR8	M8 NUT
26	8	FOUVTF612	M6x12 COUNTERSUNK SCREW
27	1	FOUE143	FAN SENSOR
28	1	FOUA051	IMPELLER WASHER
29	1	FOUVROW8	M8 SPRING WASHER
30	1	FOUVHEX825	M8x25 HEXAGONAL SCREW
31	1	FOUV082	M6x6 HEADLESS SCREW
32	1	FOUV086	WASHER THICKNESS 0.3
33	1	FOUH122	KEY 6X6X35

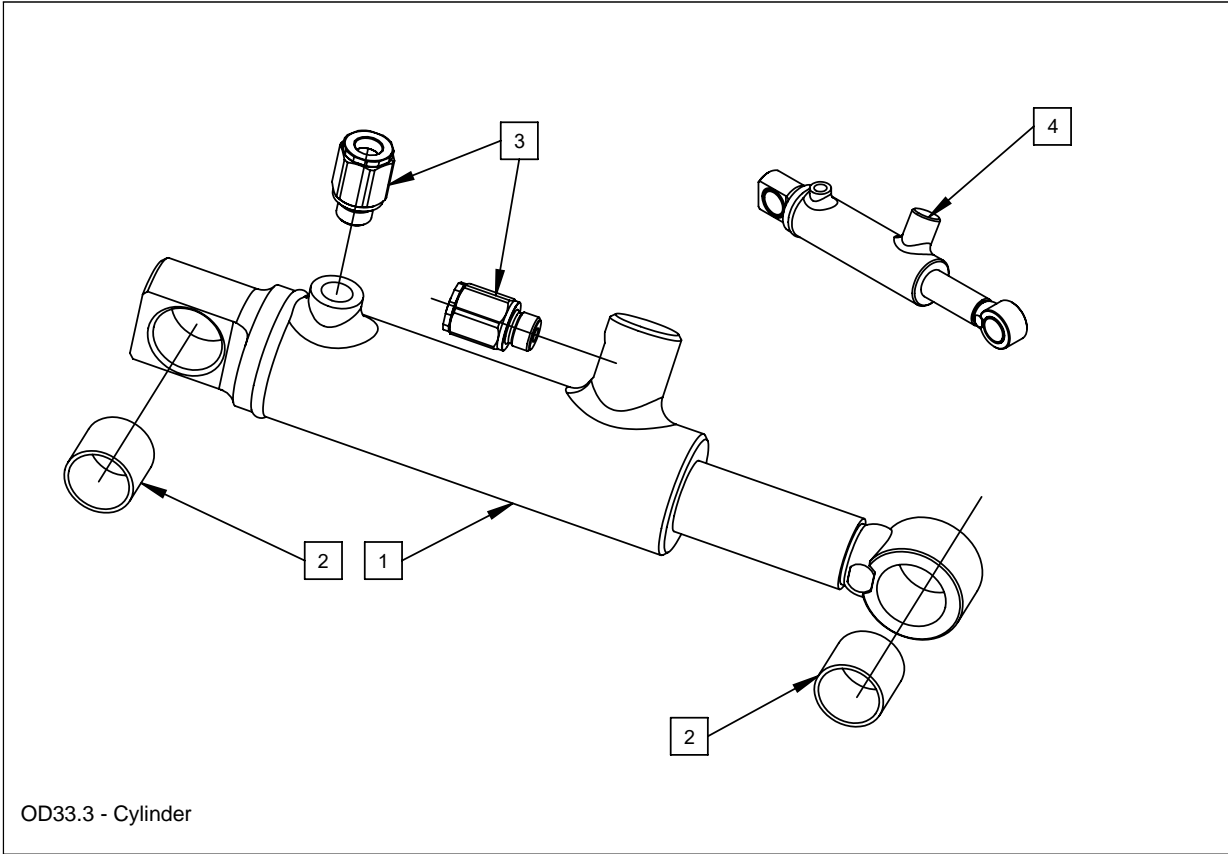
12.3 Opener drawings



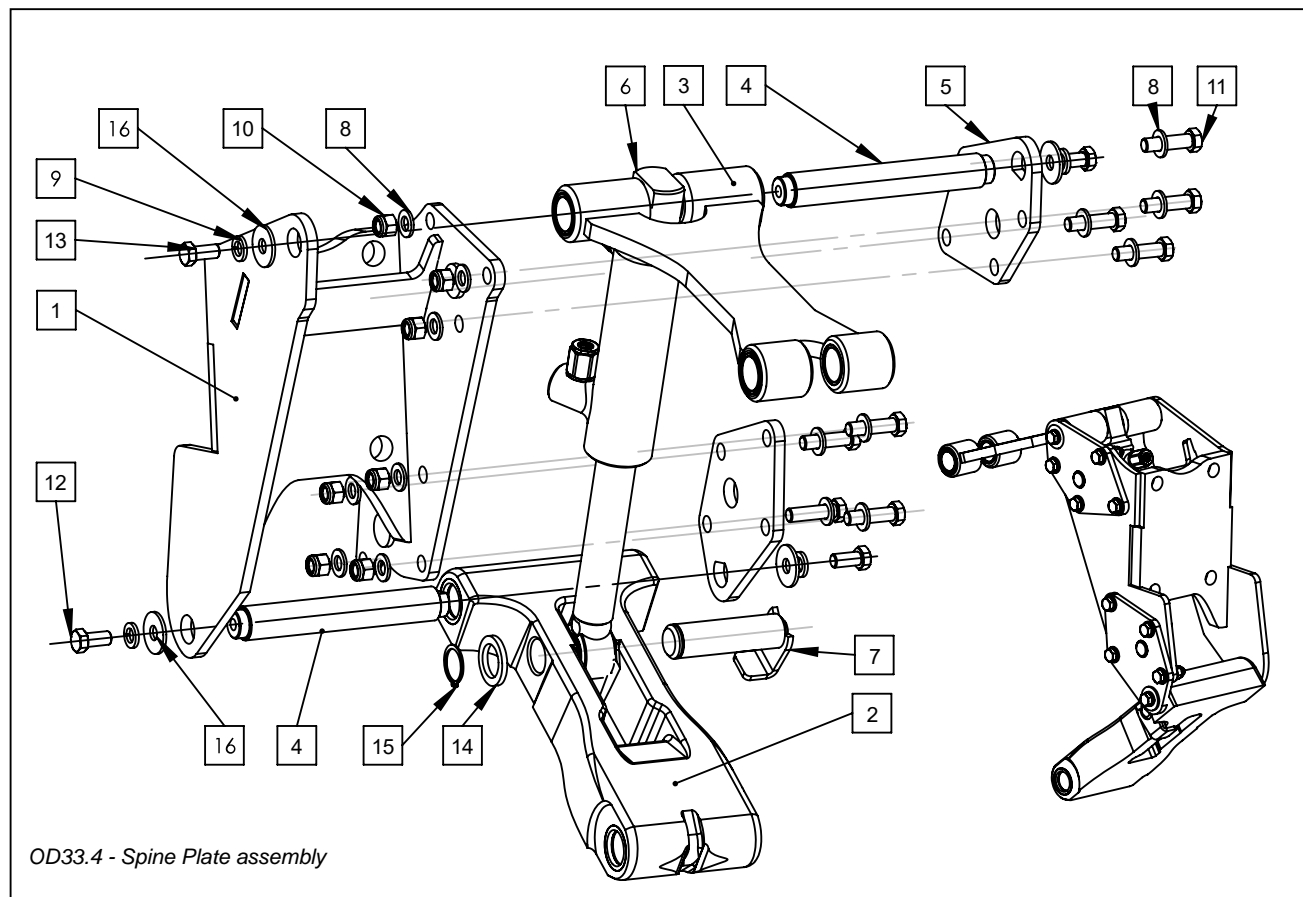
Pos.	Qty	Ref	Designation
1	1	PFOP019	TOP DRAG ARM (TDA)
2	4	FOUB017	COMPOSITE BUSHING 30x36x50
3	1	PFXOP009	TDA WITH BUSHES



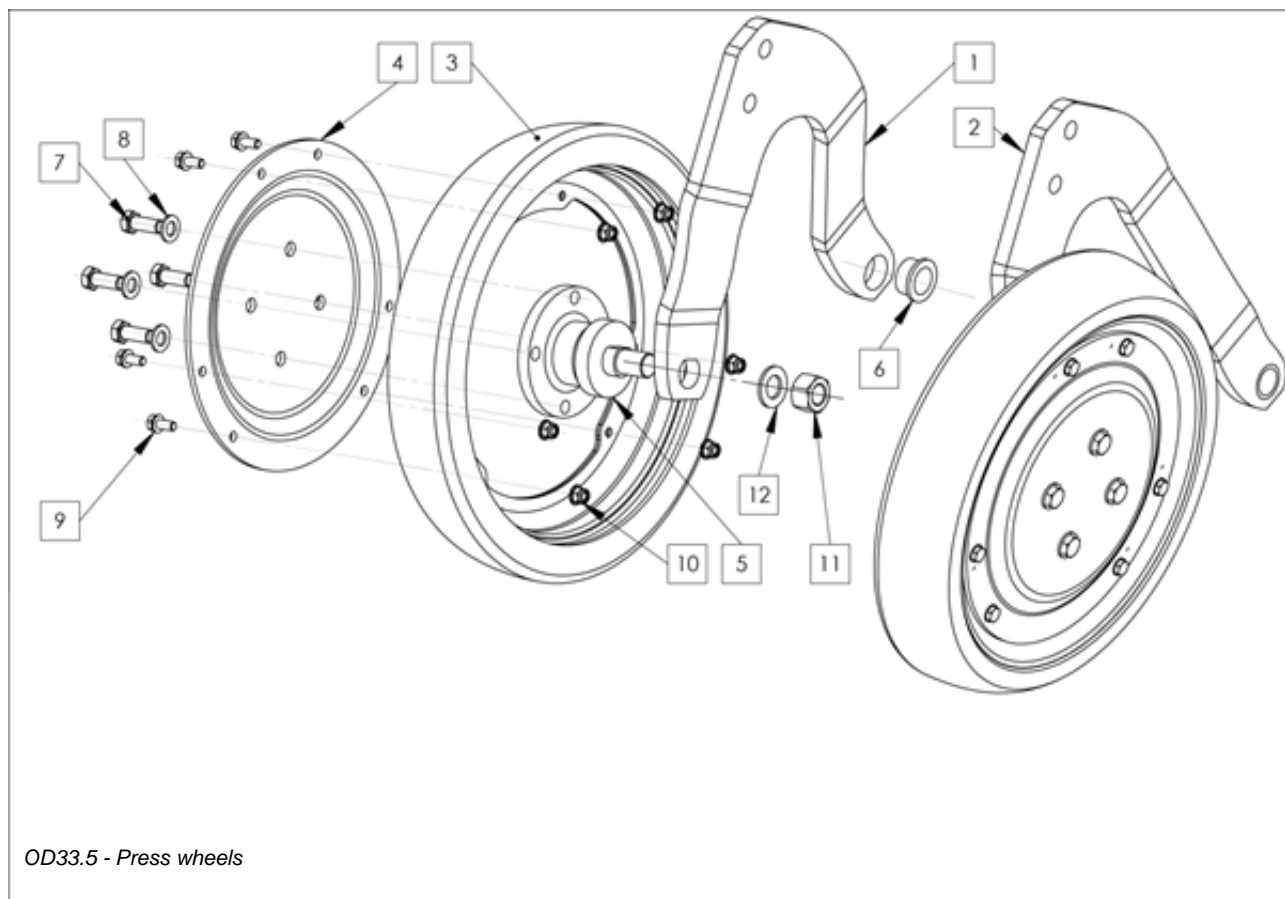
Pos.	Qty	Ref	Designation
1	1	PFF009	LOWER DRAG ARM (LDA)
2	4	FOUB017	COMPOSITE BUSHING 30x36x50
3	4	FOUJ003	LIP SEAL 30x40x5
4	1	PFXOP020	LDA WITH BUSHES



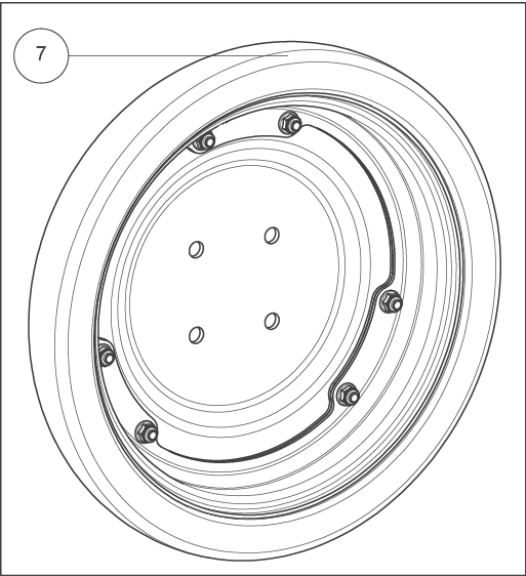
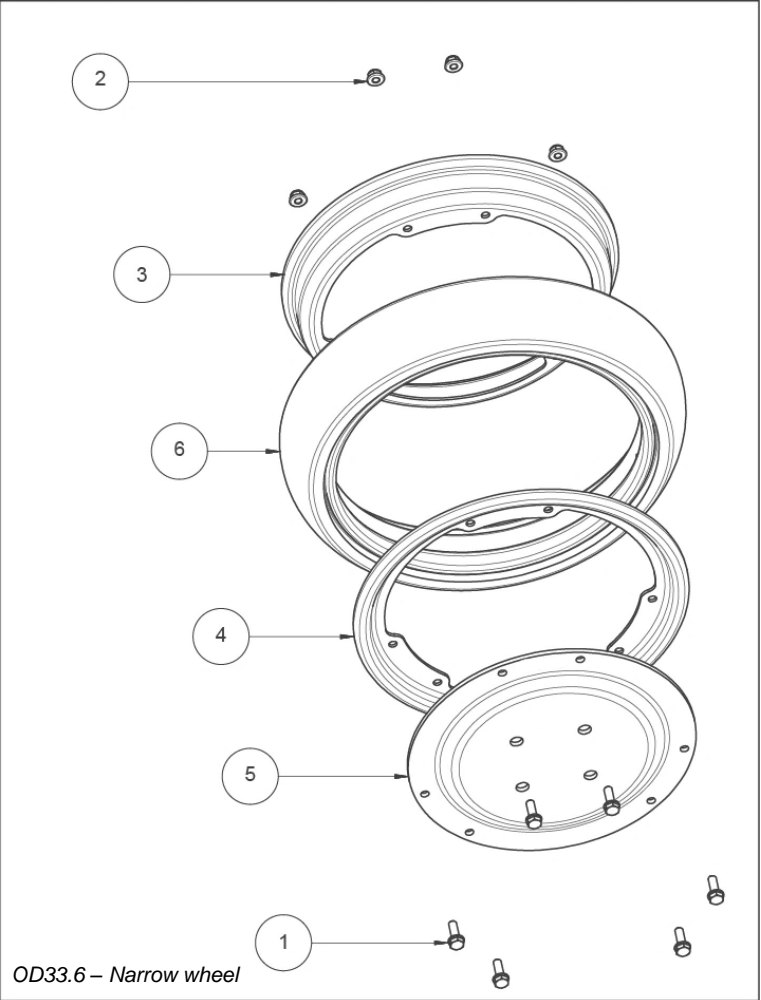
Pos.	Qty	Ref	Designation
1	1	PFH007	OPENER CYLINDER
2	2	FOUB019	COMPOSITE BUSHING 30x34x30
3	2	FOUHWEO009	WEO 3/8 – 3/8"
4	1	PFOP048	OPENER CYLINDER WITH BUSHES



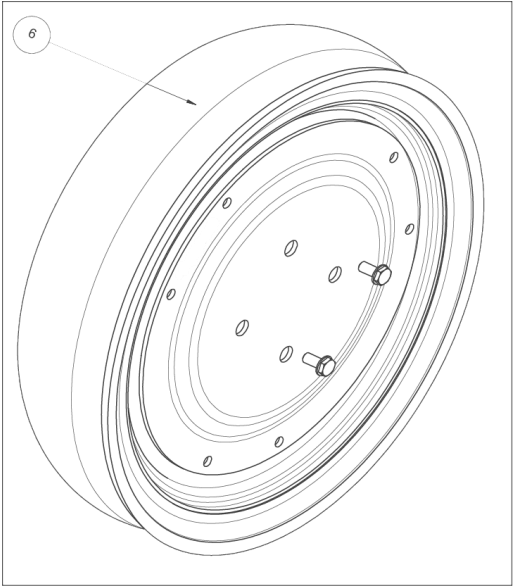
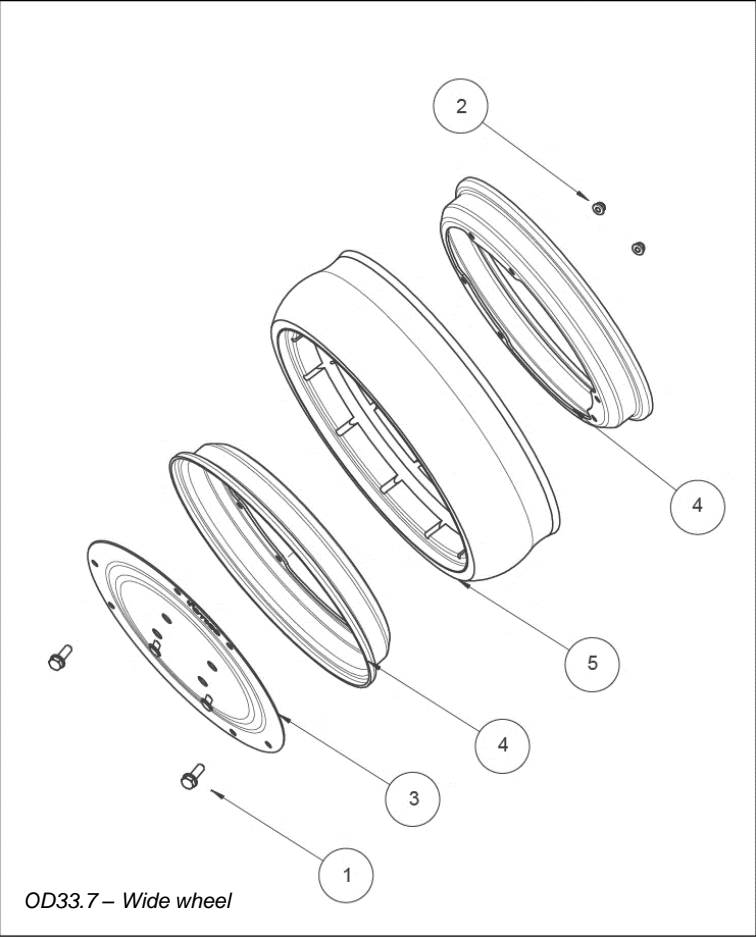
Pos.	Qty	Ref	Designation
1	1	PFXOP017	SPINE PLATE
2	1	PFXOP009	LOWER DRAG ARM (LDA)
3	1	PFXOP020	TOP DRAG ARM (TDA)
4	2	PFUOP021	CHROMED PIN
5	2	PFXOP008	PLATE FOR SPINE PLATE
6	1	PFH007	OPENER CYLINDER 50X35X100
7	1	PFOP013	OPENER CYLINDER PIN
8	16	FOUVROE12	M12 WASHER
9	4	FOUVROW12	M12 GROWER WASHER
10	8	FOUVECFR12	M12 LOCKING NUT
11	8	FOUVHEX1245	M12x45 HEXAGONAL SCREW
12	2	FOUVHEX1225P125	M12x25 P125 HEXAGONAL SCREW
13	2	FOUVHEX1220	M12x20 HEXAGONAL SCREW
14	1	FOUVRO30	M30 WASHER
15	1	FOUV035	OD 30mm CIRCLIPS
16	4	FOUVROL12	M12 WIDE WASHER



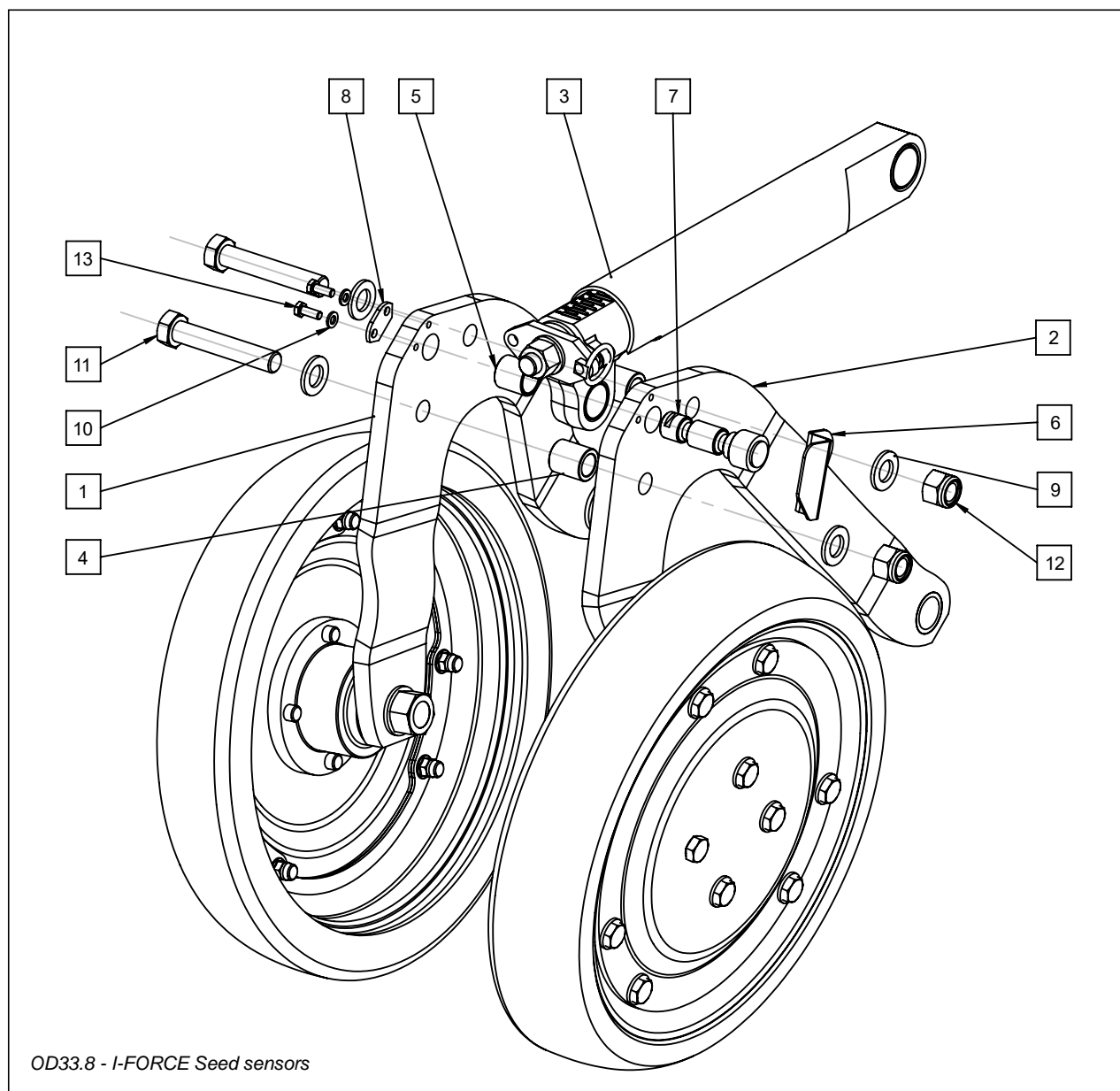
Pos.	Qty	Ref	Designation
1	1	PFXOP006	LEFT BOOMERANG
2	1	PFXOP013	RIGHT BOOMERANG
3	2	PFP002	OTICO COMPLETE WHEEL
4	2	PFOP044	WHEEL FLANGE
5	2	FOUB028	"PEER" HUB
/5	/2	/ FOUB030	/ "SKF" HUB
6	2	FOUB001	COMPOSITE BUSHING 25X32X20
7	8	FOUVHEX1225P125	M12X25 HEXAGONAL SCREW
8	8	FOUVROE12	M12 WASHER
9	12	FOUVHEX825RO	M8X25 HEXAGONAL SCREW with washer
10	12	FOUVECFR8	M8 LOCKING NUT
11	2	FOUVEC20150	M20 LOCKING NUT
12	2	FOUVROE20	M20 WASHER



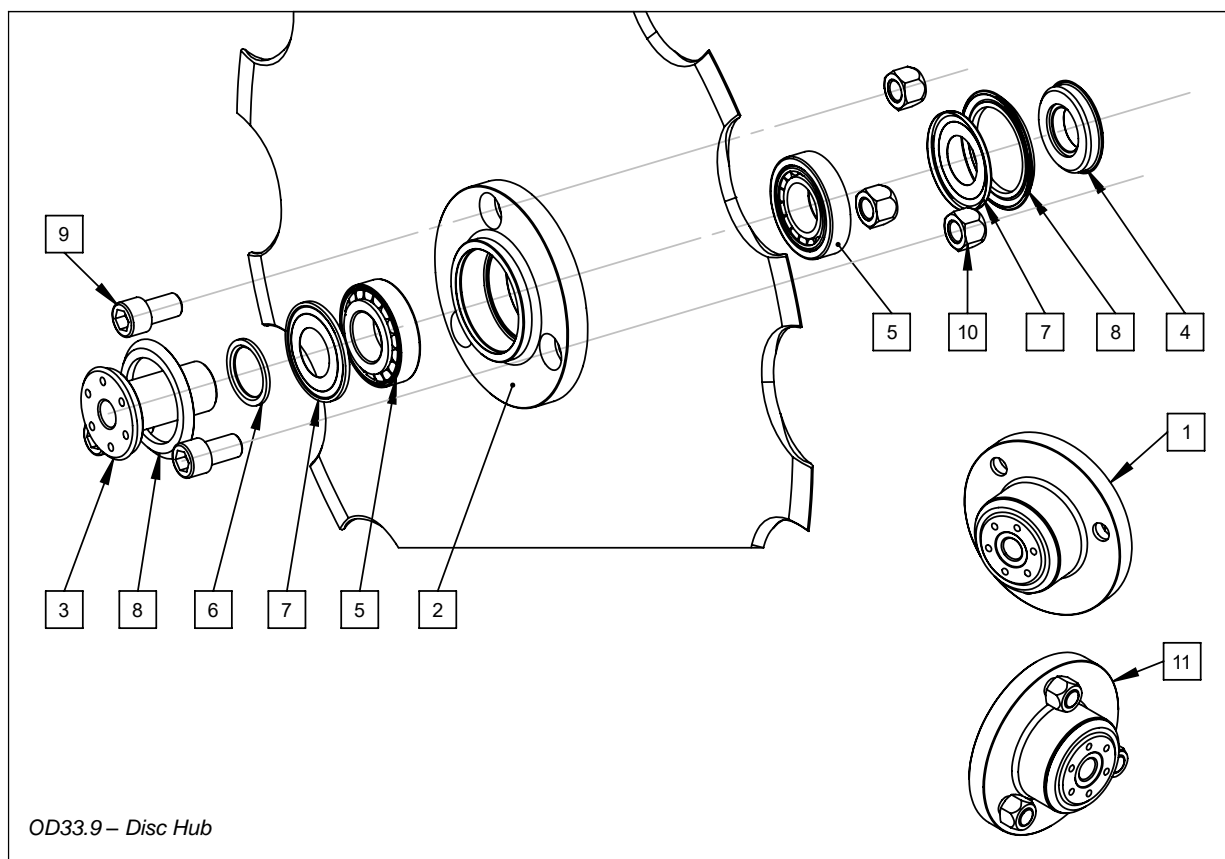
Pos.	Qté	Ref	Designation
1	6	PFOP059	WASHER SCREW/H M8x25/DIN6900/16x1.6
2	6	PFOP058	NUT WITH EMBASE M8
3	1	PFOP057	WHEEL FLANGE FARMFLEX/M/340x50/247
4	1	PFOP056	WHEEL FLANGE FARMFLEX/M/340x16/247
5	1	PFOP044	WHEEL FLANGE FARMFLEX/M/292x15/-/4x13-98
6	1	PFOP051	TIRE FARMFLEX/410x75/LX/71S
7	1	PFP002	WHEEL FARMFLEX 410x75 CPL



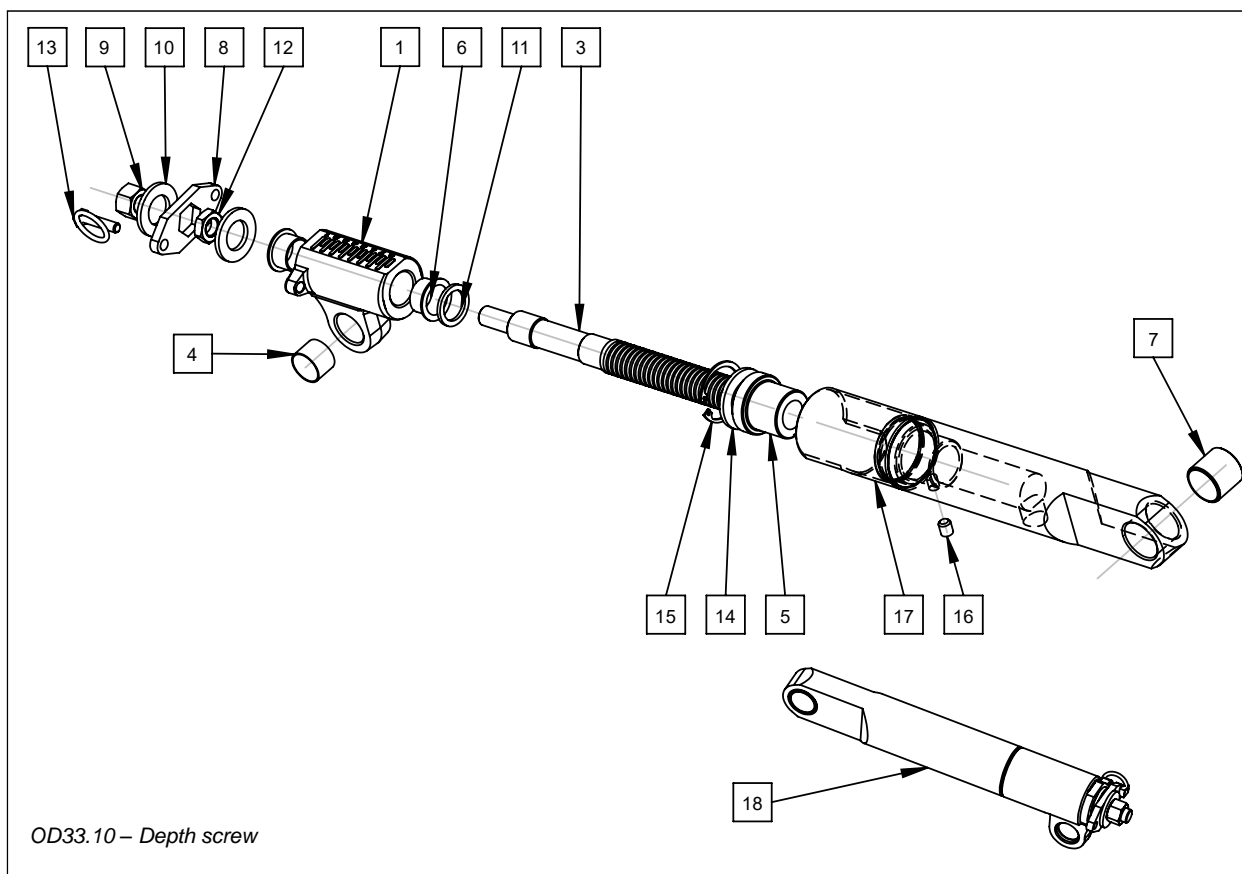
Pos.	Qté	Ref	Designation
1	6	PFOP059	WASHER SCREW/H M8x25/DIN6900/16x1.6
2	6	PFOP058	NUT WITH EMBASE M8
3	1	PFOP044	WHEEL FLANGE FARMFLEX/M/292x15x4x13-98
4	2	PFOP054	WHEEL FLANGE FARMFLEX/M/341x50/247
5	1	PFOP055	TIRE FARMFLEX/400x115/LX/71S
6	1	PFP014	WIDE WHEEL FARMFLEX 400x115 CPL



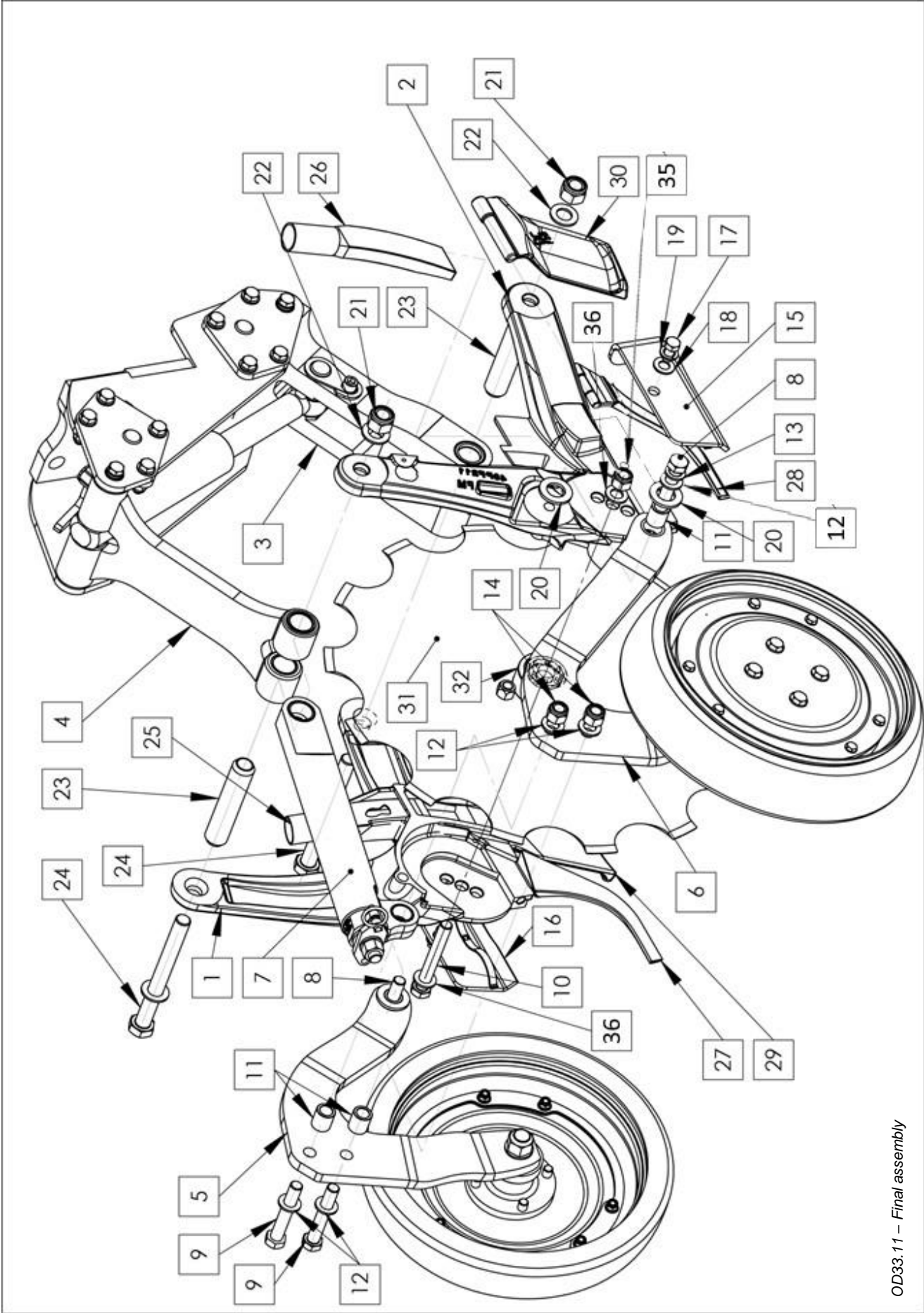
Pos.	Qty	Ref	Designation
1	1	PFXOP014	LH BOOMERANG FOR SENSOR
2	1	PFXOP007	RH BOOMERANG FOR SENSOR
3	1	ASSOP003	COMPLETE ADJUSTMENT SCREW
4	2	PFOP045	25/16.5 x 28 SPACER
5	1	FOUB033	SENSOR BUSH
6	1	PFCOP026	SENSOR SHIELD
7	1	PFE004	IFORCE LOAD PIN
8	1	PFC139	LOAD PIN WEDGE
9	4	FOUVROE16	M16 WASHER
10	2	FOUVROW6	M6 GROWER WASHER
11	2	FOUVHEX1690	M16x90 HEXAGONAL SCREW
12	2	FOUVECFR16	M16 NUT
13	2	FOUVHEX616	M6x16 HEXAGONAL SCREW



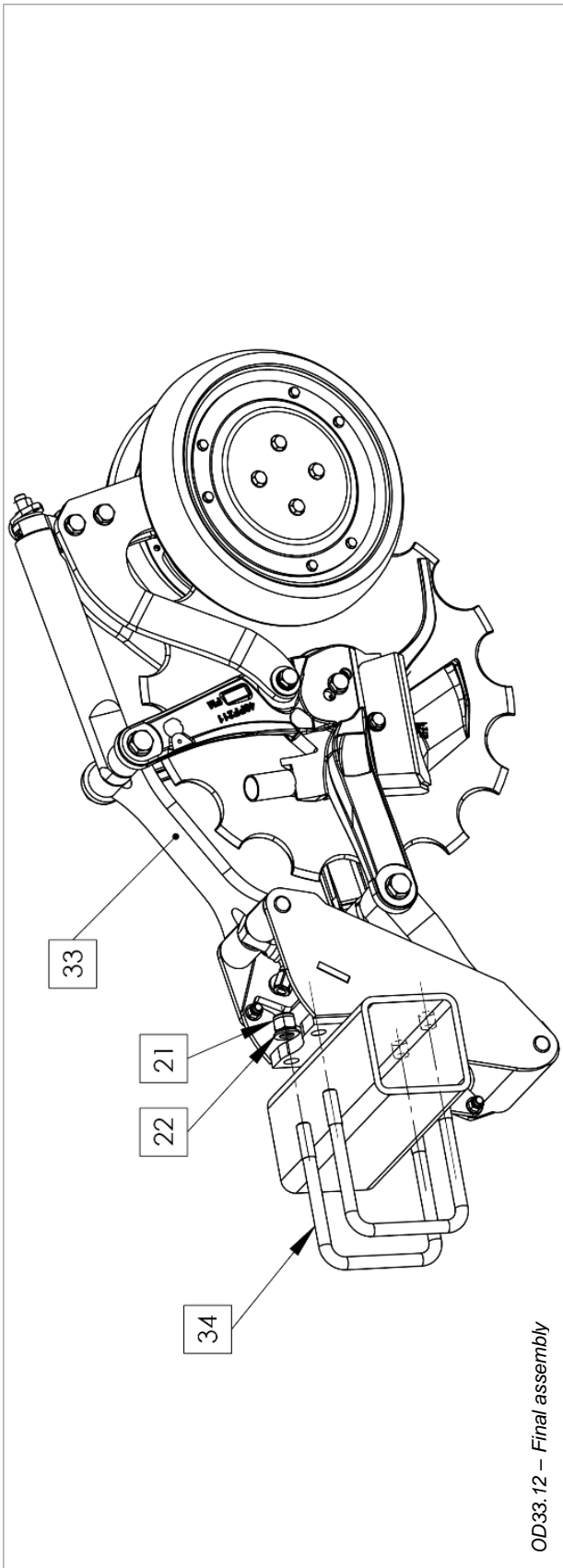
Pos.	Qty	Ref	Designation
1	1	ASSOP004	Gen 4 DISC HUB
2	1	PFOP006	DISC HUB BODY
3	1	PFUOP001	DISC HUB AXIS
4	1	PFUOP017	PRELOAD NUT
5	2	FOUB021	30206 TAPERED ROLLER BEARING
6	1	PFUOP022	NILOS SEAL SPACER
7	2	FOUJ005	"NILOS" SEAL
8	2	FOUJ006	"ALPHASEAL" RC 52x72x5.5 SEAL
9	3	FOUVBTR1425129	M14x25 STOCKET HEAD SCREW
10	3	FOUVEC14CL10	M14 SELF LOCKING NUT CL10
11	1	ASS084	DISC HUB KIT



Pos.	Qty	Ref	Designation
1	1	PFXOP002	GRADUATED PIVOT
3	1	PFOP024	TRAPEZOIDAL SCREW
4	1	FOUB002	COMPOSITE BUSHING 25x28x25
5	1	PFUOP004	POM DEPTH ADJUSTEMENT NUT POM
6	2	FOUB006	COMPOSITE BUSHING 25x28x21
7	1	FOUB019	COMPOSITE BUSHING 30x34x30
8	1	PFOP025	ADJUSTMENT HANDLE
9	1	FOUVECFR16	M16 NUT
10	2	FOUVROE16	WACHER M16
11	1	PFCOP007	SPECIAL WASHER
12	1	FOUVECEB16	HEXAGONAL JAM NUT. M16X2
13	1	FOUVOP002	ADJUSTMENT SCREW 8mm
14	1	FOUVROE27	M27 WASHER DIN 126
15	1	FOUV062	50 mm CIRCLIPS DIN 472
16	1	FOUV064	M10X12 HEADLESS SCREW
17	1	PFXOP001	SCREW HOUSING
18	1	ASSOP003	COMPLETE DEPTH SCREW



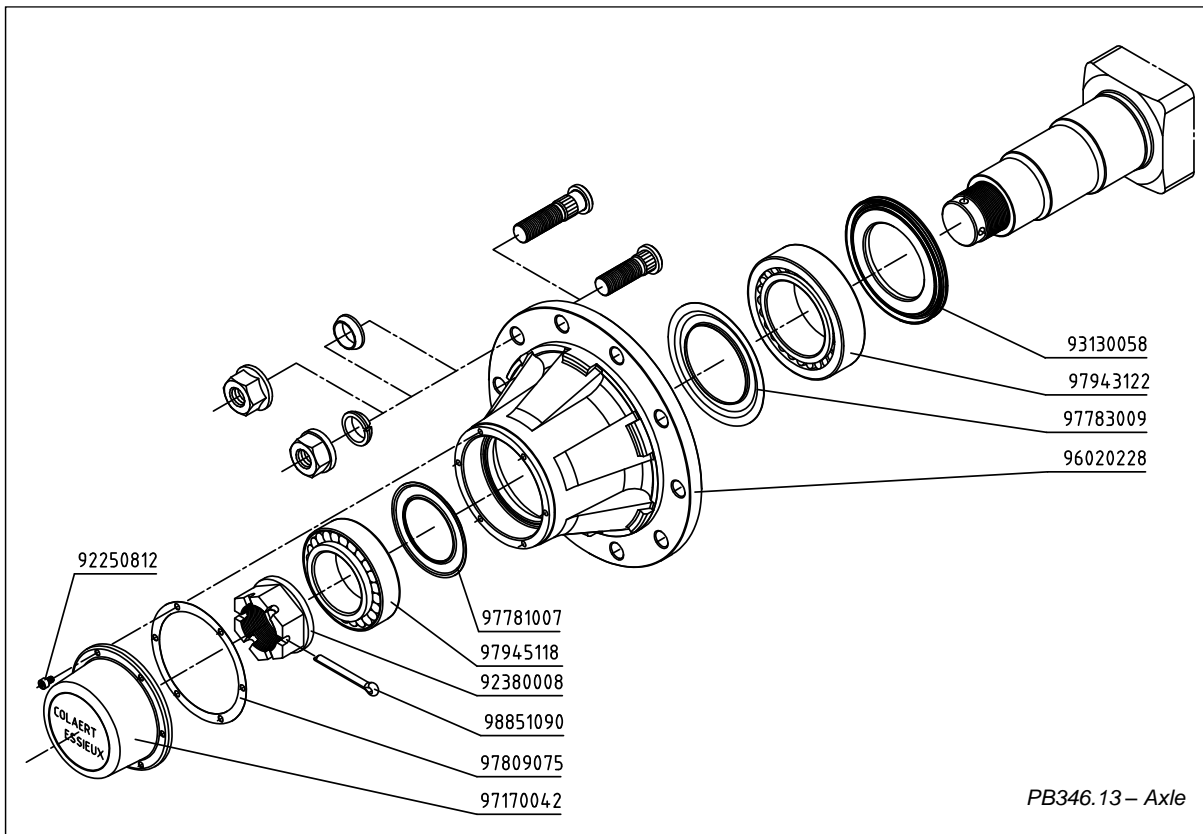
OD33.11 – Final assembly



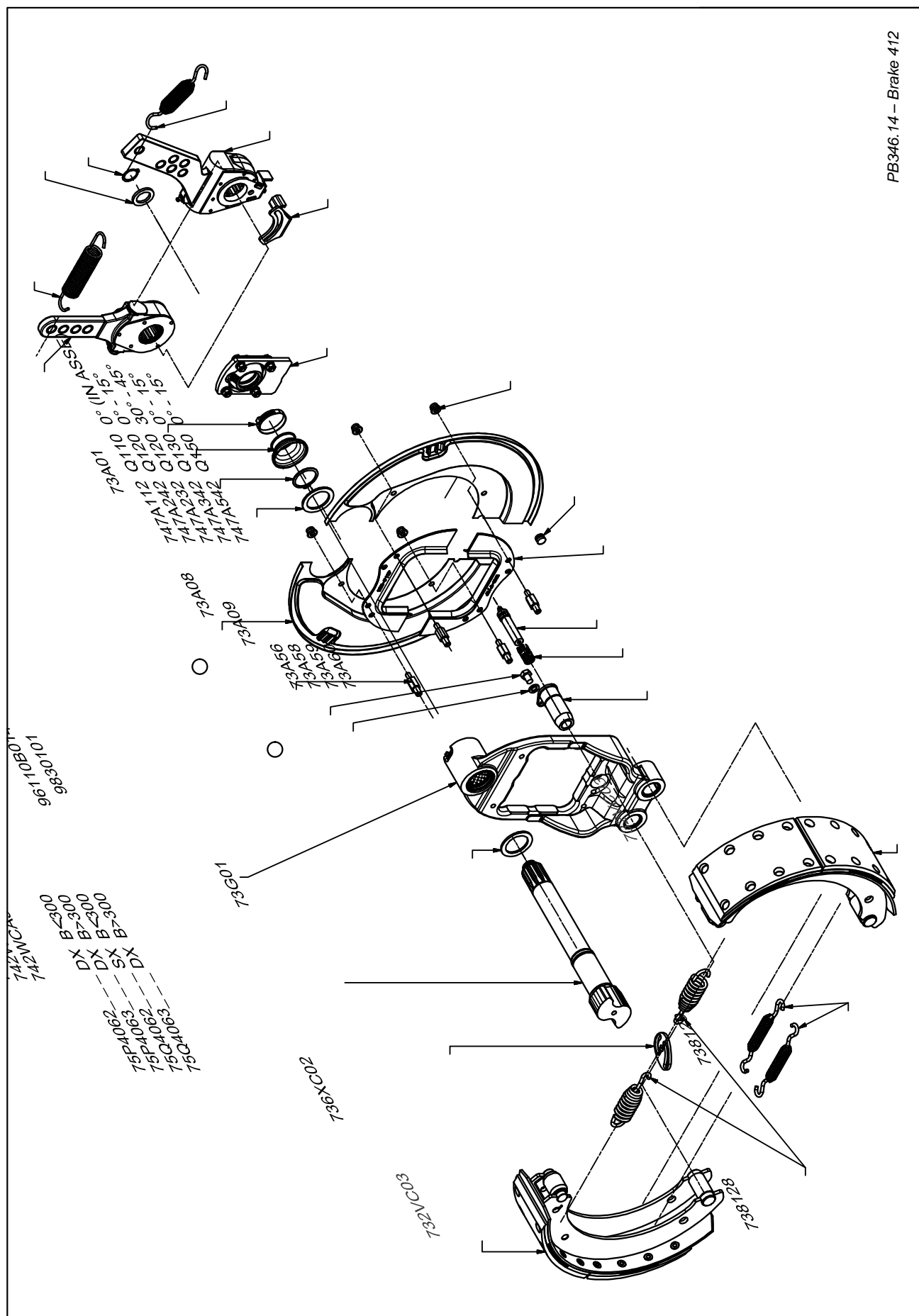
Pos.	Qty	Ref	Designation
19	2	FOUVROW14	M14 GROWER WASHER
20	4	FOUVROE24	M24 WASHER
21	6	FOUVECFR20	M20 NUT
22	4	FOUVR0L20	M20 WASHER
23	2	PFUOP019	SPACER CHROME
24	2	FOUVHEX20200	M20x200 HEXAGONAL SCREW
25	1	PFPOP002	LEFT SEED TUBE
26	1	PFPOP003	RIGHT SEED TUBE
27	1	PFPOP002	LEFT SCRAPER
28	1	PFPOP002	RIGHT SCRAPER
29	1	PFPOP011	LONG BLADE RIGHT HAND
30	1	PFPOP012	LONG BLADE LEFT HAND
31	1	PFPO10	575 x 5 mm BIG NOTCHED DISCS
31	1	PFPO11	520 x 5 mm small notched discs
32	1	ASSOP004	Gen 4 DISC HUB
33	/	ASS023	COMPLETE TFORCE OPENER
34	2	PFV001	M20 150x200 U BOLT
35	1	FOUVECFR16P150	M16 LOCKING NUT
36	2	FOUVROC16	M16 WIDE WASHER

Pos.	Qty	Ref	Designation
1	1	PFXOP004	LH BODY F211
2	1	PFXOP003	RH BODY 212
3	1	PFXOP020	LOWER DRAG ARM (LDA)
4	1	PFXOP009	TDA WITH BUSHES
5	1	PFXOP006	LEFT BOOMERANG
6	1	PFXOP013	RIGHT BOOMERANG
7	1	ASSOP003	ADJUSTMENT SCREW
8	2	FOUVHEX1660	M16x60 HEXAGONAL SCREW
9	2	FOUVHEX1685	M16x85 HEXAGONAL SCREW
10	1	FOUVHEX16120P150	M16x120 P150 HEXAGONAL SCREW
11	4	PFOP045	25/16.5 x 28 SPACER
12	6	FOUVROE16	M16 WASHER
13	2	FOUVROW16	M16 GROWER WASHER
14	2	FOUVECFR16	M16 NUT
15	1	PFOP022	RIGHT SPRING PLATE W SPRING
16	1	PFOP021	LEFT SPRING PLATE W SPRING
17	2	FOUVHEX1425	M14x25 HEXAGONAL SCREW
18	2	FOUVROE14	M14 WASHER

12.4 Axle



Pos.	Qty	Ref	Designation
1	1	FOUR114	93130058 – Spare parts
2	1	FOUR115	97943122 – Spare parts
3	1	FOUR116	97783009 – Spare parts
4	1	FOUR117	96020228 – Spare parts
5	1	FOUR118	97781007 – Spare parts
6	1	FOUR119	97945118 – Spare parts
7	1	FOUR120	92380008 – Spare parts
8	1	FOUR121	98851090 – Spare parts
9	1	FOUR122	97809075 – Spare parts
10	1	FOUR123	97170042 – Spare parts
11	1	FOUR124	92250812 – Spare parts



Pos.	Qty	Ref	Designation
1	1	FOUR073	738128 – Spare parts
2	1	FOUR072	738129 – Spare parts
3	1	FOUR074	732VC03 – Spare parts
4	1	FOUR077	73A56 – Spare parts
5	1	FOUR078	73A58 – Spare parts
6	1	FOUR079	73A59 – Spare parts
7	1	FOUR080	73A60 – Spare parts
8	1	FOUR081	73A09 – Spare parts
9	1	FOUR082	73A08 – Spare parts
10	1	FOUR083	73A01 – Spare parts
11	1	FOUR084	747A112 Q110 0° (IN ASSE) – Spare parts
12	1	FOUR085	747A242 Q120 0° - 15° – Spare parts
13	1	FOUR086	747A232 Q120 30° - 45° – Spare parts
14	1	FOUR087	747A342 Q130 0° - 15° – Spare parts
15	1	FOUR088	747A542 Q150 0° - 15° – Spare parts
16	1	FOUR089	N° 4 97708A1 – Spare parts
17	1	FOUR090	74417.... – Spare parts
18	1	FOUR091	76A02 – Spare parts
19	1	FOUR092	7631600 – Spare parts
20	1	FOUR093	738203 – Spare parts
21	1	FOUR094	58508 – Spare parts
22	1	FOUR095	9812601 – Spare parts
23	1	FOUR096	738201 – Spare parts
24	1	FOUR097	7621603 – Spare parts
25	1	FOUR098	98E01 – Spare parts
26	1	FOUR099	53A11 – Spare parts
27	1	FOUR100	58514 – Spare parts
28	1	FOUR101	73G01 – Spare parts
29	1	FOUR102	743WC0006 – Spare parts
30	1	FOUR103	N°4 57708A1 – Spare parts
31	1	FOUR104	96110B0141 – Spare parts
32	1	FOUR105	9830101 – Spare parts
33	1	FOUR106	742WCA113 Q110 (IN ASSE) – Spare parts
34	1	FOUR107	742WCA216 Q120 (IN ASSE) – Spare parts
35	1	FOUR108	742WCA313 Q130 (IN ASSE) – Spare parts
36	1	FOUR109	742WCA513 Q150 (IN ASSE) – Spare parts
37	1	FOUR110	75P4062 - - - DX B<300 – Spare parts
38	1	FOUR111	75P4063 - - - DX B>300 – Spare parts
39	1	FOUR112	75Q4062 - - - SX B<300 – Spare parts
40	1	FOUR113	75Q4063 - - - DX B>300 – Spare parts

Monitor

12.5 Main page

This page is first displayed after the monitor has been switched on

12.5.1 MAIN TAB

This screen is an example of what can be seen while drilling.

- IntelliForce is set on « Manual »
- GPS found a good signal
- The Aux bin is empty but is deactivated.



Display 1 : Main Page

Displayed:

- **Front hopper rate.**
- **Rear hopper rate.**
- **Aux Bin rate** (in the example, the hopper is deactivated).


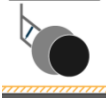


These displayed rates are not the measured rates but only indications of the metering motors speed combined with the calibration ratio.

- Downforce control **IntelliForce Manual or Auto.**
- **GPS Signal quality.**
- **Fan speed.**
- **Ha counter** (work counter).
- **Main circuit pressure (pump pressure).**
- **Maximum drilling speed.** Factor from the desired rate and the maximum permitted speed of the metering units.

- **Downforce pressure gauge.** In the example, the drill is in work state and the gauge back color is green.
- **Closure force gauge.** Measured force under the press wheel.
- Status of worklights **ON/OFF**.
- **Selected mode. Frame folding/unfolding or Opener raise/lower.**
- **Error windows** (example: Aux Bin empty).

Buttons

B1	Go to front hopper tab
B2	Go to rear hopper tab
B3	Go to aux bin tabs (press more times to select which aux bin)
B4	Go to pressure control tab
B5	Go to system menu. (Settings, calibration...)
B6	Switch work lights on/off
B7	Select mode: <ul style="list-style-type: none"> - Fold/unfold the frame  - Raise/Lower the opener  - Manage tramline counter (with tramline option)
B8 et B9	Use the selected mode
B10	No effect

12.5.2 HOPPER TAB

The tab system on the main page changes contents in the dashed line box.

In this example :

- Front hopper is selected. The front hopper box is in black. And the selected bin is indicated in the center of the distributor head drawing.
- The drills features 19 rows. (Some head outlets are colored in black/dark gray – these are not active).
- The front hopper rate is 110kg/ha.
- The user is modifying this rate but he has yet to validate his choice.
- The rear hopper is deactivated.
- The IntelliForce is in automatic mode. The closure force display is green. And the Intelliforce (ADF) box is in green with the text « Auto ».




Display 2 : Hopper Tab

Display

- **Filling gauge bar.** This bar (yellow) calculates the remaining quantity in the hopper based from the initial quantity that has been loaded after filling the hopper. Its status is based on a theoretical calculation which does not take in account incidents like blockages.
- **Distributor head.** The rows are numbered like on the real head. The blocked rows are shown in red is the AGTRON system as activated.
- **Sensitivity.** Agtron sensitivity.
- **Seedfactor.** Agtron Seedfactor.
- **Actual motor rotational speed.**
- **Calibration ratio** of the hopper.
- **Rate adjustment input.**
- **Current rate** saved.
- **Metering unit status Activated or Deactivated.**

Buttons

B1	Go to front hopper tab.
B2	Go to rear hopper tab.
B3	Go to aux bin tabs (press more times to select which aux bin).
B4	Go to pressure control tab.
B5	Go back to main tab.
B6	Activate or deactivate the metering unit.
B7	Auto calibration of Agtron Seedfactor.
B8 et B9	Change the rate settings.
B10	Validate the rate changes.  The rate will not be modified without validating.

12.5.3 I FORCE TAB




Display 3: IntelliForce tab

Display

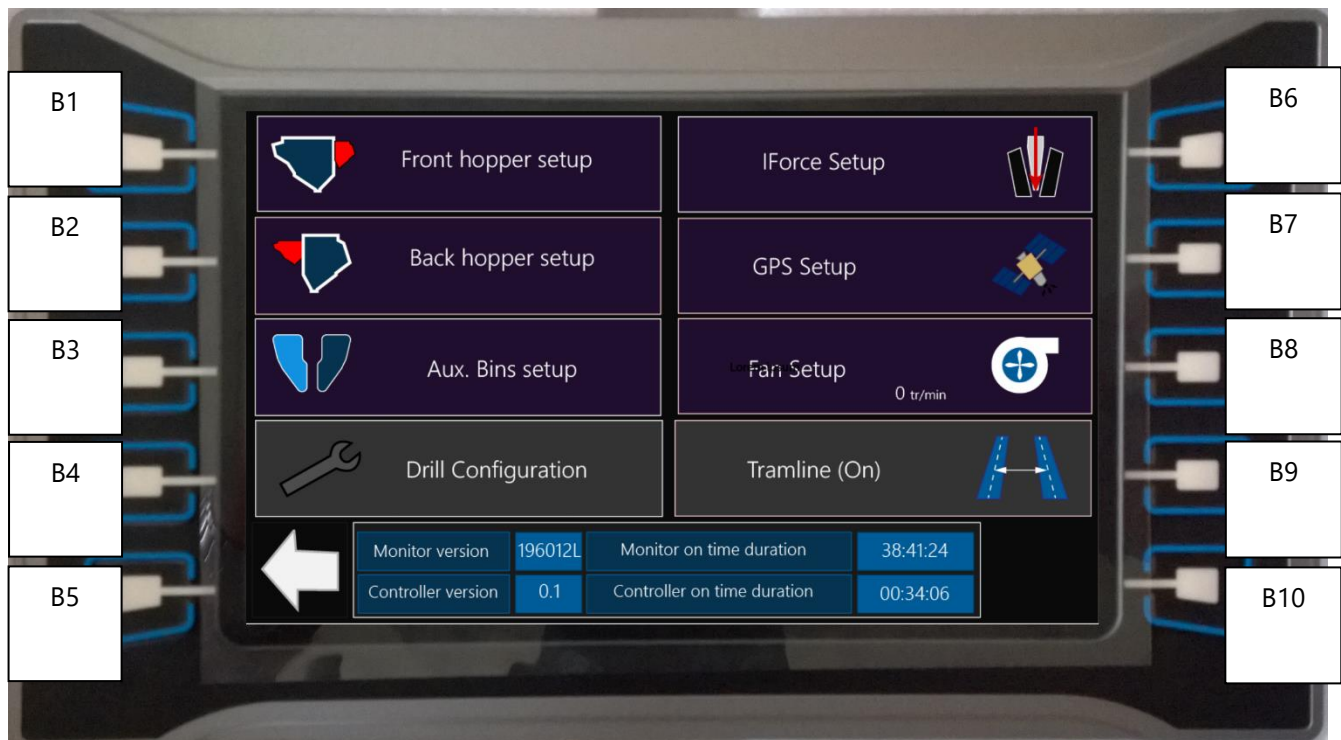
- **Hydraulic pressure in bar.**
Gauge color: green = work state, gray = opener raised
- **Closure force measurement** gauge bar centered on the set point.
- Downforce control **IntelliForce Manual or Auto.**
- **Closure force set point input, in auto** mode, or **hydraulic pressure** in manual mode, selectable with buttons B7 and B8.
- **Closure force set point or pressure set point saved.**

Buttons

B1	Go to front hopper tab.
B2	Go to rear hopper tab.
B3	Go to aux bin tabs (press more times to select which aux bin).
B4	Go to pressure control tab.
B5	Go back to main tab.
B6	Switch between manual or auto control.
B7	No effect.
B8 & B9	Change the set point settings. In auto mode, the closure force can be set. In manual mode, the hydraulic pressure can be set.
B10	Validate the set point modifications.  The modifications will not take effect without validation.

12.6 Settings pages

12.6.1 SYSTEM MENU



Display 4 : System menu

Displayed:

- Software version (last update).
- Drill Controller version.
- Total Monitor run time.
- Total controller run time.

Buttons

B1	Go to front hopper settings.
B2	Go to back hopper settings.
B3	Go to aux bins settings. The same page manages the two bins.
B4	Go to factory settings (password required).
B5	Go to main page.
B6	Go to IForce settings.
B7	Go to GPS settings.
B8	Set the fan speed alarm. The speed is then set using the buttons B8, B9 and has to be validated with B10.
B9	Go to Tramline settings.
B10	Validate fan speed alarm.

12.6.2 HOPPER SETTINGS



Display 5 : Hopper settings page

4 points can be adjusted regarding the hoppers, corresponding to 4 zones on the page. The general principle is the following:

1. Select a zone with button B1, B2, B3 or B4.
2. The items related to this zone are then shown in the list on the right.
3. Select the desired item with B6 and B7.
4. Validate the selection with B10.

The hopper which is being set is shown in the bottom rectangle.

Zone 1: Agtron (Button B1)

- Status **Activated/Deactivated**.
- **Sensitivity** as a factor of minimum number of seeds per second flowing through the sensor required not to trigger a blockage alarm.
- **Seedfactor**: Individual Seed weight ratio.
- **Number of sensors** counted by the monitor. In case of malfunction of the sensors, this number would be « 0 »
- Sound alarm activated or not.

Zone 2: Fan motor parameters. (Button B2)

- **Maximum speed**. The motor will not turn over this specified speed.
- **Start the motor in manual**. This procedure can be used to check the correct flow of seeds or to drain at a low speed the hopper.
 1. Select the motor menu using the button B2.
 2. Select item « Manual Startup »

3. Validate with B10
4. Select the desired rotational speed with B8 and B9 and validate (B10)
5. Use the calibration switch under the hopper to start and stop the motor rotation.

Zone 3: Filling (Button B3)

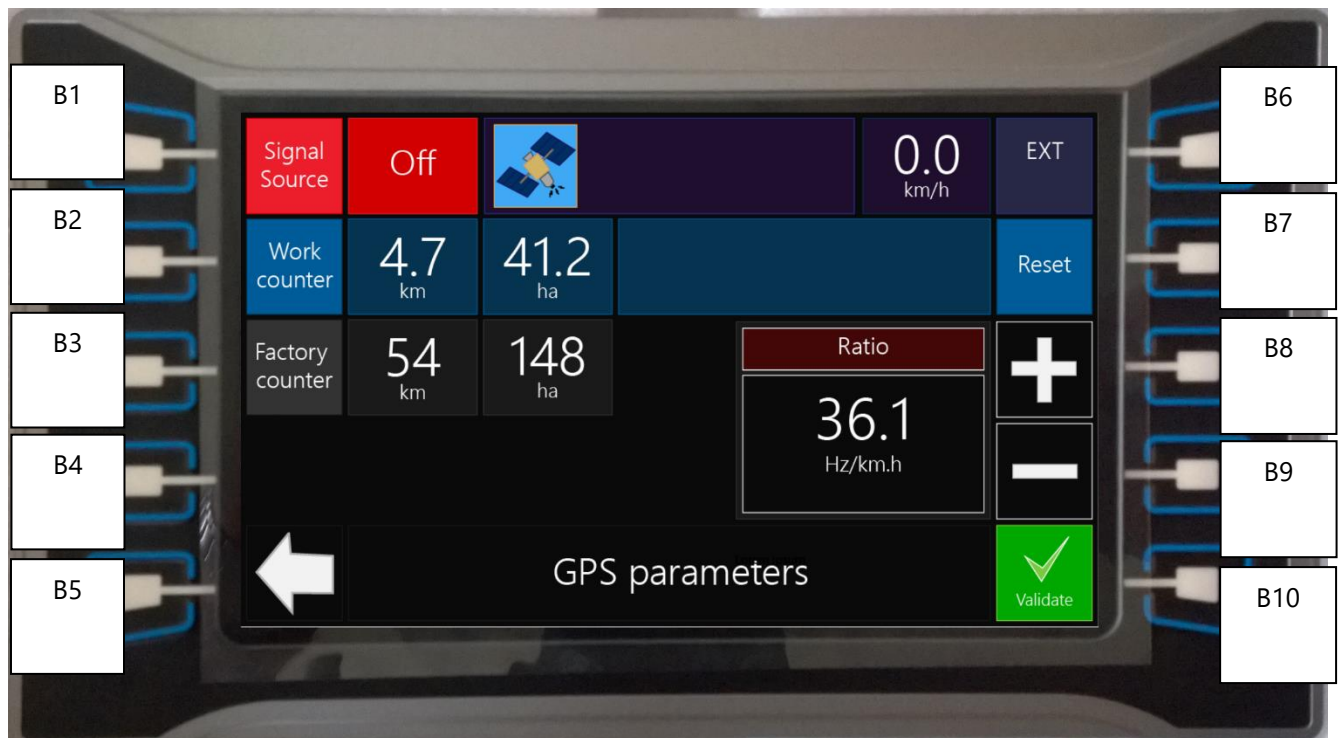
- Initial qty: total quantity in the hopper after refill.
- Current qty: calculated quantity while drilling. This qty can be adjusted anytime.

Zone 4: Other (Bouton B4)

- Error margin: Agtron error margin before showing a rate error.
- **Calibration ratio:** Calibration coefficient in memory for the hopper.
- **Drain the hopper.** Choosing this procedure will make the motor rotate at 80% of its maximum speed.
- **Calibrate the hopper. Launch the procedure explained in section 6.3.**
- **Check calibration.** Launch a check weighing to confirm calibration after a variety change for example.

Button B5:

B5 goes to main system menu.

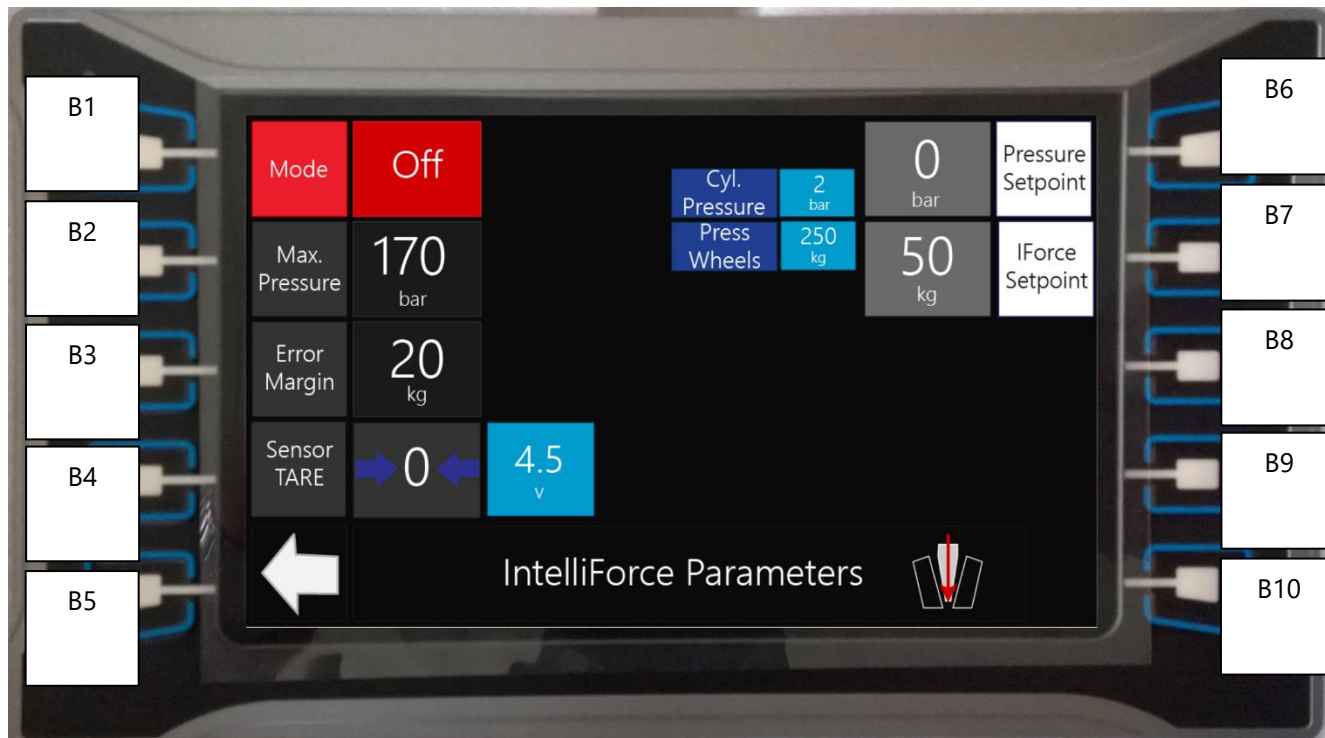
12.6.3 GPS SETTINGS*Display 6 : GPS parameters*Contents

- **Signal status.**
- **Work counter** in km and ha.
- **Factory counter** in km and ha.
- **Drill speed.** Either the GPS speed (if signal is good enough) or a forced speed.
- **Adjustable forced speed.**
- **Mode « GPS speed » or forced speed**

Buttons

B1	Activate/Override GPS. (use forced speed).
B2	
B3	
B4	
B5	Back to system menu.
B6	Show forced speed adjustment.
B7	Reset work counter.
B8 & B9	Set forced speed.
B10	Validate forced speed.

12.6.4 INTELLIFORCE SETTINGS



Display 7 : IntelliForce settings

Display

- **Mode: Manual (constant hydraulic pressure) or Automatic (Variable hydraulic pressure and closure force control).**
- **Max Pressure:** Maximum permitted pressure for the IntelliForce system in auto.
- **Error tolerance:** In this example, the IntelliForce will not adjust the pressure when the load is in the range of the closure force set point (80kg) + or – 10kg.
- **Pressure set point for manual mode.**
- **Closure force set point for auto mode.**

Buttons

B1	Switch to Auto/Manual.
B2	Adjust max pressure.
B3	Adjust error margin.
B4	Not used.
B5	Back to System menu.
B6	Set the manual pressure set point.
B7	Set the auto closure force set point.
B8 & B9	Change the selected value.
B10	Validate the changes.

13 Incident cause remedy

13.1 General issues

Incident	Cause	Remedy
Actual Rate/ha does not match the desired figure.	Incorrect Metering unit opening setting.	Start the calibration again at the correct opening.
	Product build up in the splined rotor.	Use the stainless steel shutter plate and clean the rotor.
	Sealing lip damaged by pest.	Replace the sealing lip.
	Wrong calibration/ error during the procedure.	Check calibration ratio. Start the procedure again.
Irregular motor rotation during drilling or calibration.	Sensor malfunction.	Check the sensor and electrical harness. If the sensor is damaged, replace it.
	Foreign object located in the rotor.	Remove the foreign object.
	Main distributor malfunction.	Check the associated flow valve. Check the solenoid.
Pipe blockage.	Excessive banding in the pipe.	Push the pipe further inside the protection tube in the opener. Cut the pipe to length. Replace pinched pipes if necessary.
	Insufficient air flow.	Accelerate the fan or open the air throttle valves.
	Reduction of fan power while raising the opener.	Do not reduce tractor throttle in headlands.
Opener blockage.	Excessively sticky soil.	Postpone the operations.
	Wrong blade disc contact.	Replace the spring plate, the blade, or the disc.

	Tractor slippage.	Decrease the downforce, use only one blade.
	Irregular disc rotation.	Move the disc to a lower mounting hole.
Monitor reports an empty hopper when it is not, or opposite fashion.	Capacitive sensors malfunction.	<p>Check that the sensor does not detect the hopper wall.</p> <p>Check that the status LED changes when an object is placed under the sensor head.</p> <p>Check the electrical cables.</p> <p>Replace the sensor.</p>
Monitor reports a rate error.	Metering motor malfunction.	See above.
	Irregular motor rotational speed.	Rotation speed is too low, reduce the metering unit opening and start the calibration again.
	The drilling speed is above the maximum speed (see 13.1).	<p>Do not drive over the maximum speed.</p> <p>Further open the metering unit and start calibration again.</p>
Hydraulic downforce pressure does not increase enough	IForce max. pressure has been reached.	Change the maximum pressure setting in the IForce page.
	Electrical malfunction.	Check the connections on the downforce distributor.
	Hydraulic pollution.	Replace hydraulic oil.
Difference in depth between front and rear toolbar.	Difference in opener press wheel height.	Check the adjustment screw scale.
	Incorrect frame angle.	Correct the frame angle using the drawbar cylinder.
	Insufficient drill weight.	Add ballasts on the frame.
Irregular fan rotation.	Tractor regulator defects.	<p>Use priority functions.</p> <p>Adjust the fan valve on the drill.</p>

13.2 Monitor error messages

These error messages are displayed on the main page:

13.2.1 MESSAGES OCCURING WHILE DRILLING

These messages show in the middle of the main page if a seeding anomaly is reported. A sound alarm is emitted.

	Message	Comments
Empty hopper	« Warning, one hopper is empty »	The rate rectangle of the hopper back color is red.
Row blockage*	« Warning, row blocked on H1,2»	Check the distributor head drawn on the hopper tab. The blocked row appears in red. This message often occurs in the beginning of a pass, when the seeds have not reached the sensors yet.
Fan	« Fan speed error »	The fan speed measured by the sensor is too low. Check the tractor hydraulics.
Rate	« H1,2 Rate error »	Either, the metering unit motor is not able to rotate at the right speed, or the Agtron system reports an invalid number of seeds/s actually flowing*.
GPS signal	« Warning, GPS signal lost. Reference speed is 6km/h »	The drill has lost its GPS signal and is not able to measure the forward speed. The system uses instantly a reference speed of 6km/h.
Drilling speed	"Warning, drilling speed is over the maximum"	Forward speed is above the maximum permitted speed. One of the hoppers cannot distribute enough product to meet the required rate.
Oil temp	« Oil temp too high »	Hydraulic oil is too hot and could damage the installation. Let it cool down before carrying on work.

*Where the « Seed Monitor Option” is fitted.

13.2.2 PERSISTANT ERROR MESSAGES

These messages show in the error message box on the main page of the monitor.

Message	Comment
<i>ERR Joystick</i>	Joystick is not connected or malfunctioning.
<i>ERR Pump Press</i>	Pump press sensor (connector ID C90) is disconnected or malfunctioning.
<i>ERR GPS</i>	GPS is disconnected, malfunction, or is unable to find satellite signal.
<i>ERR Press T1,2,3</i>	Downforce pressure sensor is disconnected or malfunctioning.
<i>H1,2,3,4 ERR Motor</i>	Hopper motor cannot start successfully.
<i>H1,2 blocked row</i>	Front, Rear hopper reports a row blockage.
<i>Oil temp high</i>	Hydraulic oil is too hot and must be cooled down.
<i>H1,2,3,4 Sensor ERR</i>	Metering sensor is disconnected or malfunctioning.
<i>H1,2,3,4 empty</i>	The hopper is empty.
<i>Agtron ERR</i>	Agtron system malfunction. Check the wiring.

14 User notes

14.1 Calibration results

14.1.1 FRONT HOPPER

Type	Variety/Brand name	Rate/ha	Drill Speed	Opening	Ratio

14.1.2 REAR HOPPER

Type	Variety/Brand name	Rate/ha	Drill Speed	Opening	Ratio

14.1.3 AUX BINS

Type	Variety/Brand name	Rate/ha	Drill Speed	Rotor Ref	Ratio

14.2 Intervention notes

[illegible]