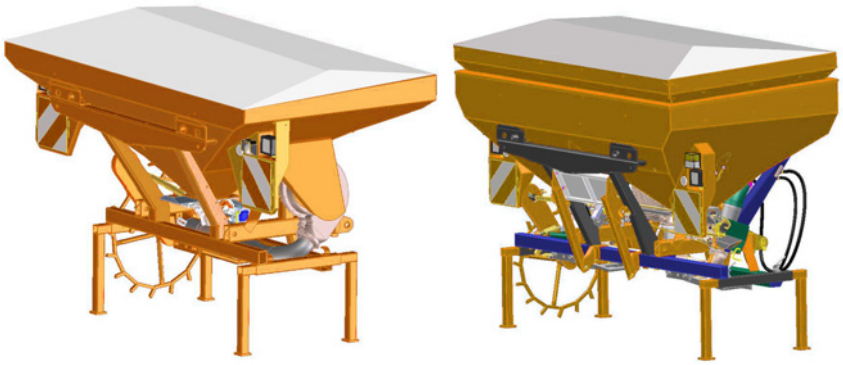


SH1150 & SH1650

⚠ **WARNING:** Cancer and birth defects - www.P65Warnings.ca.gov

Operating manual

Original operating manual

Edition	07.2020
Date of printing	08.2020
Language	EN-US
From machine number	ACKSHxx106
Reference number	A156193240

Identification of the machine

Operating manual valid from machine number	

In order for your dealer to assist you as quickly as possible, you will need to provide some information about your machine. Please enter the data here.

Designation	Serie SH1000
Working width	
Weight	
Machine number	
Accessories	
Address of dealer	
Address of manufacturer	Kverneland Group Soest GmbH Coesterweg 42 D-59494 Soest Germany Tel. +49 (0) 2921/974-0

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Target group of this operating manual

WARNING

Simplified depiction to enable better understanding
To enable better understanding, illustrations of the machine are shown in the operating manual without—or with open—safety equipment. Observe the safety information and instructions in the operating manual. Serious or fatal injury can result.

This operating manual is intended for trained farmers and individuals who are otherwise qualified to perform agricultural activities and who have received instruction in how to handle this machine.

For your safety
Be sure to familiarize yourself with the contents of this operating manual before assembling the machine or putting it into operation. In this way, you will achieve optimum work results and operational safety. The operating manual is part of the machine and must always be readily accessible. This enables you to:

- Prevent accidents.
- Comply with the warranty terms.
- Have a machine that is always functional and in working order.

Training and instruction

You will receive instruction from your dealer in how to operate, maintain and care for the machine.

Information for the employer
The personnel is to be instructed regularly, at least once a year, in accordance with the regulations of the national organization for occupational safety. Untrained or unauthorized persons are not permitted to use, care for, repair or maintain the machine.

You are personally responsible for operating and maintaining the machine safely. Make sure that you and all other persons who operate the machine, maintain it or work in the immediate vicinity of it are familiar with the operating and maintenance instructions as well as with the corresponding safety instructions from this operating manual.

Other applicable documents

Spare parts list	Available via https://www.kvgportal.com/publicquest/
“CB1000/CB2000” operating manual [+]	Integral part of the delivery of the CB1000 / CB2000
Operating manual for the electronic control system [+]	For example, ESA software
Operating manual of the PTO shaft manufacturer	Integral part of the delivery with this machine
Operating manual for the terminal [+]	For example, IsoMatch Tellus

Symbols

In order to make this manual clear and easy to read, we have used various symbols. They are explained below:

- A bullet point accompanies each item in a list

▸ A triangle indicates operating functions which must be performed

→ An arrow indicates cross-references to other text passages

[+] A plus sign indicates an accessory that is not included in the standard version.

Pictograms

We have also used pictograms to help you find instructions more quickly:



This sign indicates important instructions regarding the machine. Failure to observe these safety instructions can result in:

- Serious faults in the correct operation of the machine
- Damage to the machine



This symbol indicates information, tips and notes on operation.



This symbol indicates tips for assembly or adjustment work.



This symbol indicates examples that assist a better understanding of the instructions.

Parts in the text which refer to individual machines or to conditions have a colored background. After the colored section, the text then again applies to all conditions and machines. For example:

Before folding out only

▸ Release the locking mechanism for transport

▸ Actuate the control unit

California Proposition 65

WARNING

The exhaust gases, some of their constituent parts and specific components of the implement contain or release chemical substances that are known to the State of California to cause cancer, birth defects, or other reproductive harm.

SAFETY FIRST

This symbol, which is usually used in the industry for a safety warning, is used in this operating manual and on safety signs on the machine to warn of potential injury. Read the instructions carefully. It is important and mandatory that you familiarize yourself with the contents of this operating manual and the safety instructions before assembling the machine or putting it into operation.

DANGER

Indicates an impending hazardous situation. Ignoring this warning will result in serious or fatal injuries.

WARNING

Indicates a potential hazardous situation. Ignoring this warning will result in serious or fatal injuries.

ATTENTION

Indicates a potential hazardous situation. Ignoring this warning will result in minor to moderate injuries.

You will find the warning information associated with individual operations, where it is important to observe the warning information before these operations are carried out.

In the »Safety« chapter, you will also find safety instructions which are not related to individual operations, but rather are designed to encourage safety-conscious behavior in various situations.

For your safety

This chapter contains general safety instructions. Each chapter of the operating manual contains additional specific safety instructions, which are not described here. Observe the safety instructions:

- In the interest of your own safety
- In the interest of the safety of others
- To ensure the safety of the machine

Numerous risks can result from handling agricultural machines in the wrong way. Therefore, always work with great care and never under time pressure.

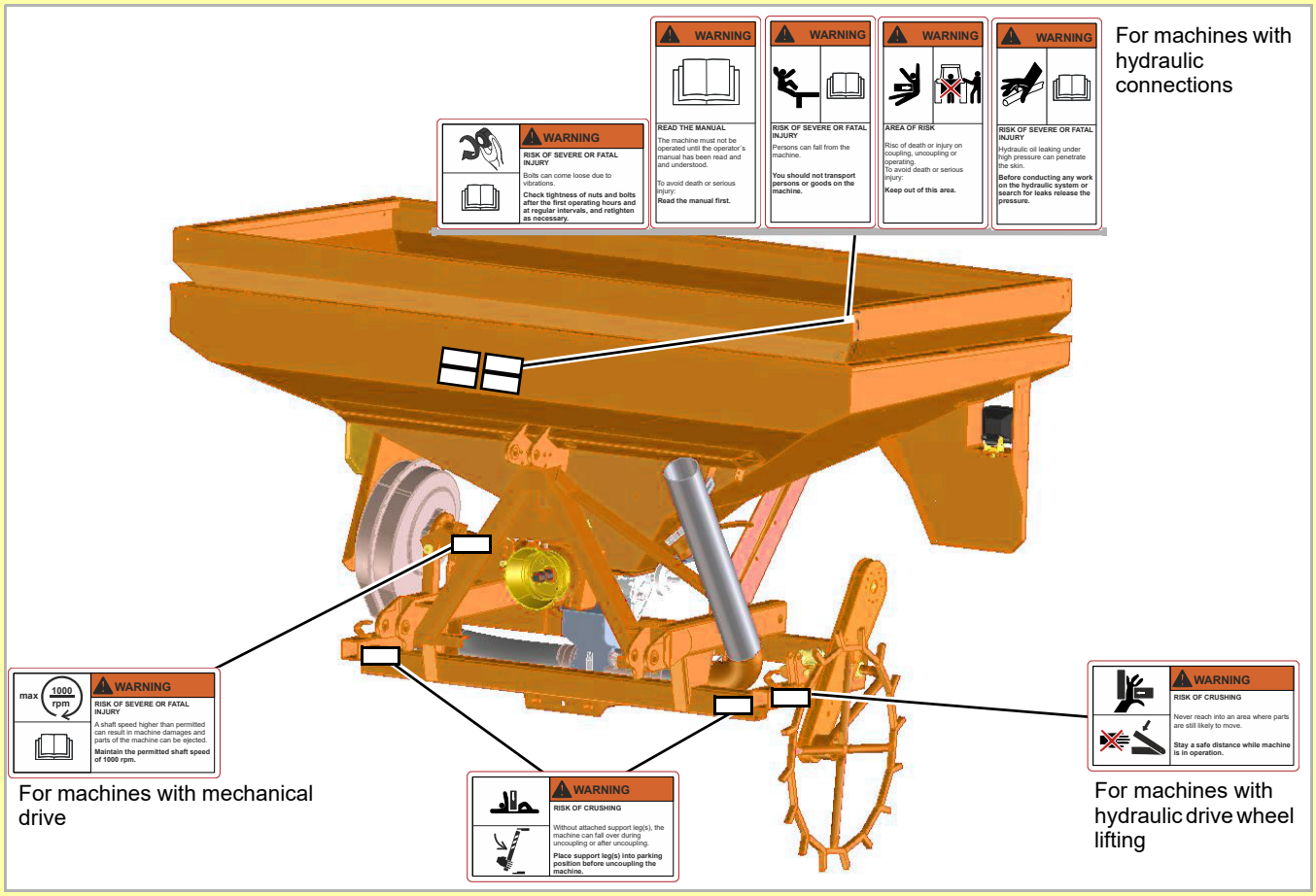
For the employer

Inform all individuals who work with the machine of these safety instructions on a regular basis and provide information on statutory regulations.

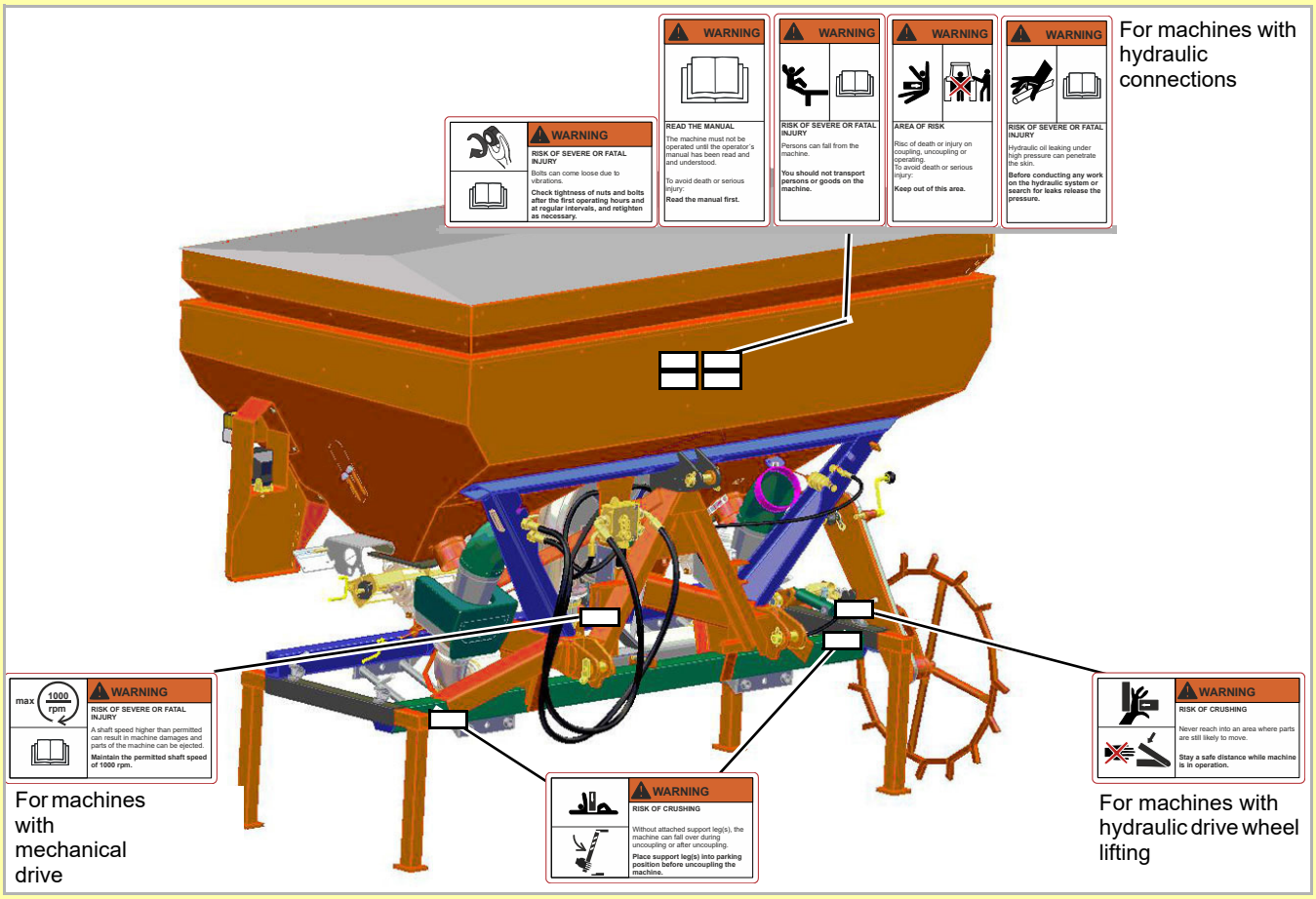
Warning signs

On the machine you will find stickers that serve to ensure your safety. The stickers must not be removed. If stickers become illegible or begin to peel off, new stickers can be ordered and attached in the appropriate places.

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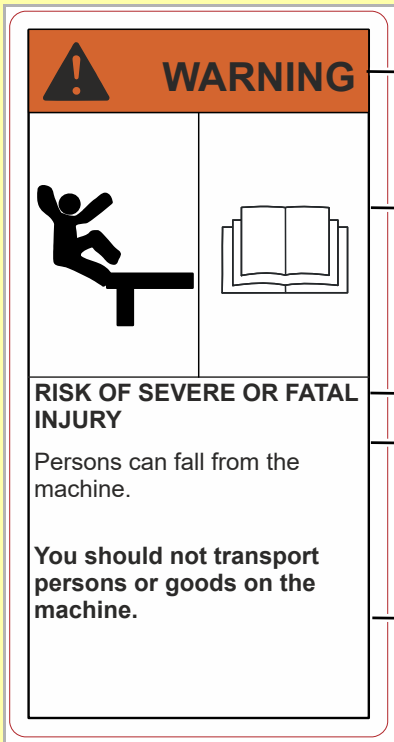


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Structure

The structure of the warning signs follows a consistent pattern:



Signal word: caution, warning or risk
The signal word provides information about the severity of a possible injury if the content of the warning sign is not observed.

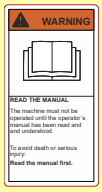
Pictograms:
Pictograms depict the danger that a warning sign warns against or what is to be observed. Additional information may also be depicted.

Type of possible danger

Consequences or possible consequences if the content of the warning sign is not observed

Information or instructions if a danger can be avoided

Meaning



Read the operating manual carefully and follow the instructions
Initial operation of the machine must not take place before the operating manual has been read and understood. This particularly applies to safety instructions.



Do not stand between the tractor and the machine
Standing between the tractor and the machine with the engine running is prohibited, especially during coupling and uncoupling. The tractor must be additionally be secured against rolling away before entering this area.



Riding on the machine is strictly prohibited
Never transport persons or objects on the machine. Riding on the machine is life-threatening and strictly prohibited.



Caution in the event of leaking hydraulic fluid
The hydraulic system is under high pressure. Regularly check all pipes, hoses and screw-on connections for leaks and externally visible damage. Use suitable tools only when looking for leaks. Eliminate damage immediately. Oil escaping under pressure may result in injuries and fires. In the event of injuries, seek medical attention immediately.



Do not remove the protective devices
The protective devices must not be removed or bypassed. Check all protective devices before starting the machine. Unprotected machine components can cause severe or fatal accidents.



Risk of tipping

The machine or parts can tip over. Before entering the hazard area, attach supporting legs. To uncouple, use the supports provided and position the machine on firm ground.



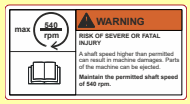
Risk of crushing

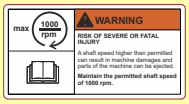
Avoid hazard area. The space between components may become smaller or disappear completely.



Retightening bolts

After the first operating hours, all bolts must be checked and tightened if necessary. Screw connections might have come loose due to vibration.





Check the PTO speed

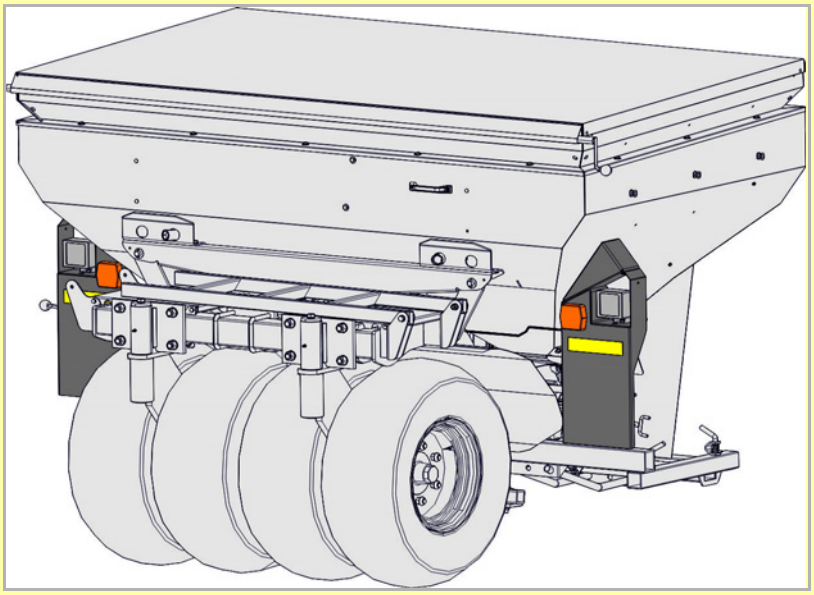
When working on the machine, switch off the PTO. The permissible PTO speed is either 540 rpm or 1000 rpm, depending on the equipment fitted.

Lighting equipment – USA

There are lighting and signaling equipment and stickers on the machine that serve to ensure safety during transport on public roads. This equipment must be in perfect working condition at all times.

The machine must have lighting equipment fitted for road transport.

Ask your dealer for suitable lighting equipment for your machine.



Markings

In some US states and some Canadian provinces, additional markings are required. Please check with the local authorities which regulations apply for the area in which you wish to drive the machine on public roads.

SMV

Marking for slow-moving vehicles on public roads.

Up to 40 km/h (25 mph)



Use of SMV marking is exclusively reserved for machines approved for speeds up to 40 km/h (25 mph).

40 km/h (25 mph) to 65 km/h (40 mph)

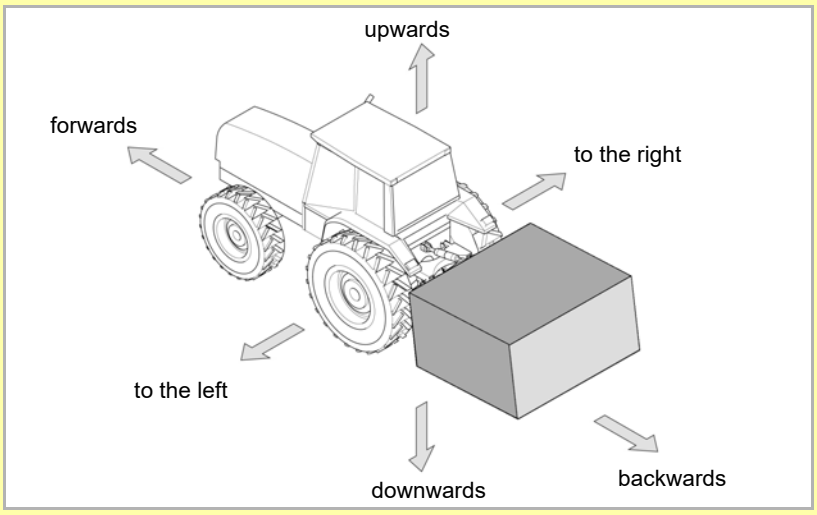


SMV marking and a sign bearing the maximum permissible speed is exclusively reserved for machines approved for speeds over 40 km/h (25 mph) but below 65 km/h (40 mph).

The 50 km/h (30 mph) symbol is used in addition to the symbol for slow-moving vehicles (SMV) to indicate that the device is able to travel at higher speeds.

Definitions

For all direction information, the direction of travel is the starting direction:



Who is authorized to operate the machine?

Only qualified personnel
Only qualified persons who have been informed of the dangers associated with handling the machine are permitted to operate, service, or repair the machine. As a rule, such persons are trained and experienced in agricultural work or have been thoroughly trained in a similar activity.

General safety information

WARNING

The general safety information and safety symbols apply to all lifecycle phases and fields of application.

Instruction required before operation
The machine must not be put into operation unless the user has received detailed instruction from an authorized dealer or an employee of the manufacturer. If someone who has not received instruction puts the machine into operation, operator errors can result in damage to the machine or accidents.

Safety is your responsibility
Comply with the safety regulations. Ensure that all operators comply with the safety instructions. Prevent serious and fatal accidents by complying with the safety regulations.

Instructions in the event of malfunctions
In the event of a malfunction, you must immediately do the following:

- Shut down the machine
- Stop and secure the machine
- Remedy faults immediately if you are qualified or
- Commission an authorized dealer

Operation of a faulty machine can lead to accidents or damage.

No persons in the work area
Make sure that no persons—especially children—are in the movement range or work area of the machine. Anyone within this area can be caught by the machine. This can result in accidents with serious or fatal injuries.

Safety for children
Never assume that children will stay where you saw them last. Be alert and shut down the machine if children are in the work area of the machine. Prohibit children from playing on or near the machine and from operating the machine.

Perfect working condition
Make sure that the tractor and machine are always in perfect working condition. Make sure that the tractor brakes work together with the machine. In addition, observe the instructions in the operating manual of your tractor.

Stipulated work clothing
Do not wear any clothes that are baggy, loose or otherwise unsuitable. Baggy or loose pieces of clothing can get caught in rotating parts. Wear work and protective clothing suitable for the operating environment and conditions. Wear the work and protective clothing stipulated by the trade association. Serious or fatal injury can result.

Riding/transporting prohibited
Persons or objects must never be transported on the machine. Carrying passengers—especially children—on the machine is potentially fatal and is prohibited. Serious or fatal injury can result.

Distance from suspended and unsecured loads
Never work under suspended loads. Maintain a sufficient distance from suspended and unsecured loads. Failure to do so can result in serious or fatal injuries.



Unobstructed rear visibility
Make sure you have an unobstructed view of the hitched machine when it is in the work and transport position. Hazardous situations are not recognized in time. This can result in accidents or damage.

Make sure the machine is level
Make sure the machine is level before moving it from the transport position to the work position (and vice versa). The machine can tip over, especially when on sloping terrain. This can result in damage to the machine and in serious or fatal injuries.

Never work on a machine when it is in operation
No tasks are allowed to be performed on the machine when it is in operation. Objects or persons may get caught, pulled in or crushed. Serious or fatal injury can result.

Do not make any changes to the machine
No changes of any kind are allowed to be made to the machine. Unauthorized changes can impair the function and safety as well as impact the service life of the machine. In the event of unauthorized changes to the machine, the manufacturer's warranty and liability shall be void.

Switching off the drive for the drive shaft of the tractor
Switch off the drive shaft drive for the tractor - especially if persons could potentially enter the work area of the machine - when doing the following:

- Lifting the machine
- Switching from the work position to the transport position (and vice versa)
- Driving into the work position in reverse

Rotating and unprotected parts may cause damage to the machine as well as serious and potentially fatal injuries.

Coupling

Increased risk of injury
Coupling the machine to the tractor creates an increased risk of injury. Therefore:

- Secure the tractor against rolling away
- The tractor and machine categories must be the same
- Never stand between the tractor and the machine during coupling
- Actuate the three-point linkage system slowly and carefully

If these instructions are ignored, serious or fatal injuries may occur.

Using the specified drive shaft
Only use the drive shafts specified by the manufacturer and read the provided operating manual carefully. Adjust the length of the drive shaft if necessary. Incorrect drive shaft lengths can cause damage to the machine and injuries to persons.

Checking and attaching the drive shaft guard
The rotating drive shaft is protected by the drive shaft guard. Make sure that the guard is not damaged. Attach the drive shaft guard by hooking it into the chains on the implement and tractor sides. Unprotected drive shafts can cause serious injuries.

Observe the drive shaft manufacturer's operating manual
The drive shaft manufacturer's operating manual provides instructions on correct handling of the drive shaft. Failure to observe these instructions can result in damage to the drive shaft and the machine.

Hydraulics

Only connect the hydraulics when depressurized
Only connect the hydraulic hoses to the tractor hydraulic system if the tractor and machine hydraulic system is depressurized. A hydraulic system under pressure can trigger unpredictable movements of the machine.

High pressures in the hydraulic system
The hydraulic system is under high pressure. Regularly check all pipes, hoses and screw-on connections for leaks and externally visible damage. Use suitable tools only when looking for leaks. Eliminate damage immediately. Oil escaping under pressure may result in injuries and fires. In the event of injuries, seek medical attention immediately.

Color-coded hydraulic hoses
To prevent operating errors, the hydraulic connections between the tractor and machine are color-coded. Incorrectly connected hydraulic hoses can trigger unpredictable machine movements.

Electrics

Connect electrical supply only after mounting the equipment
Only fit the lighting equipment when the power supply to the tractor has been switched off. Short-circuits and damage to the electronics are possible.

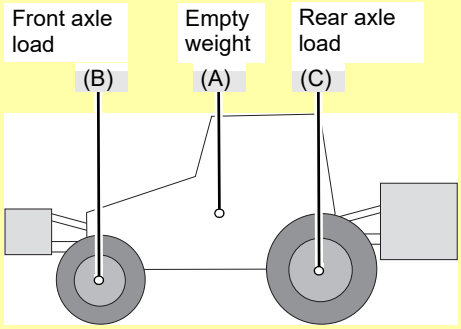
Center of gravity

Observe the total weight, axle loads, tire load-bearing capacity, and minimum added weight
The machine's front or rear attachment must not exceed the tractor's permissible total weight, its permissible axle load or its tire load-bearing capacity. In order for steering capability to be maintained, the front axle must bear at least 20% of the tractor's empty weight.

The following can be easily calculated:

- Total weight
- Axle loads
- Tire load-bearing capacity
- Minimum ballast

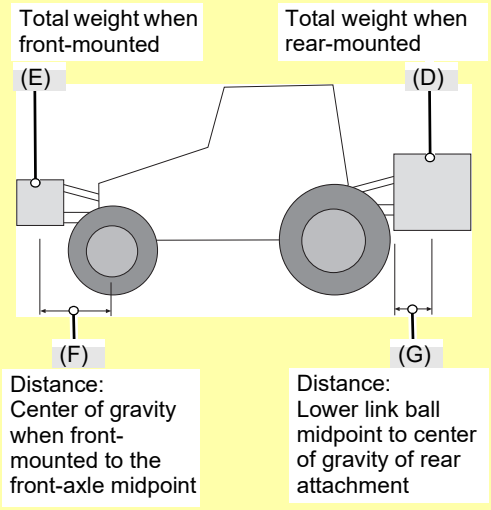
For this calculation, the following data is required:



Data from the tractor's operating manual:

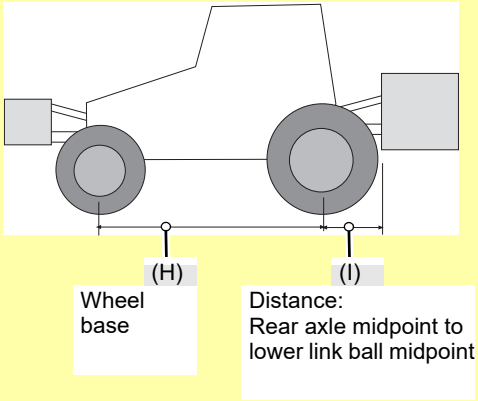
- (A) Empty weight
- (B) Front axle load
- (C) Rear axle load

Also consider the weight of water in the tires, accessories and other additional weights.



Data from this operating manual:

- (D) Total weight of the machine when rear-mounted; the supporting load with the machine hitched
- (E) Total weight of the machine when front-mounted
- (F) Distance between the machine's center of gravity when front-mounted and the front-axle midpoint
- (G) Distance between the lower link ball midpoint and the machine's center of gravity when rear-mounted. With machines attached, G=0.



Data which you can determine by measuring:

- (H) The tractor's wheel base
- (I) Distance between the rear axle midpoint and the lower link ball midpoint

Calculation

The measured values can now be inserted into the formulae.

Ballast with front weights

Calculation of the ballast with front weights
for rear-mounted machines

$$\text{Front ballast in kg} = \frac{D \times (I + G) - (B \times H) + (0,2 \times A \times H)}{F + H}$$

Ballast with rear weights

Calculation of the ballast with rear weights
for front-mounted machines

$$\text{Rear ballast in kg} = \frac{(E \times F) - (C \times H) + (0,45 \times A \times H)}{H + I + G}$$

Front axle load

Calculation of the actual front axle load

$$\text{Front axle load in kg} = \frac{E \times (F + H) + (B \times H) - D \times (I + G)}{H}$$

Total weight

Calculation of actual total weight

Total weight = E + A + D

Rear axle load

Calculation of the actual rear axle load
Rear axle load in kg = actual total weight - actual front axle load

Tire load-bearing capacity

Data on the tire load-bearing capacity of the front and rear wheels can be found in the tire manufacturer's documentation.

- The front tire load-bearing capacity for two wheels is equal to twice the permissible tire load-bearing capacity of a single front wheel.
- The rear tire load-bearing capacity for two wheels is equal to twice the permissible tire load-bearing capacity of a single rear wheel.

Summary

Check if the following conditions are met:

- The actual values for the rear axle load must be less than the permissible values given in the tractor's operating manual.
- The tire load-bearing capacity must be greater than the values for the rear axle load given in the operating manual.
- The actual total weight must be less than the permissible total weight given in the tractor's operating manual.

If these conditions are not met, the machine must not be attached to this tractor.

If you have a sufficiently large weigh-bridge, you can determine the total weight and the rear axle load by weighing.



Road transport

Ensure that the condition of the machine conforms to traffic regulations

The machine must conform to current road traffic regulations if you intend to drive with it on public roads. This includes, for example:

- Lighting, warning and protective devices must be fitted
- The permissible transport width and weight, axle loads, tire load-bearing capacity and total weights are observed
- The machine may only be hauled by agricultural and forestry tractor units

The driver and owner of the vehicle are liable if road traffic regulations are not observed.

Close the ball valves

If there are ball valves on the hydraulic lines or chassis cylinders, the ball valves must be closed for driving on the road. Otherwise, accidental actuation of control units in the tractor could trigger machine movements. This can result in accidents with serious or fatal injuries or damage to the machine.

Check tire pressures

Check the tire pressures on a regular basis. If the tire pressure is too high or too low, this can reduce the service life of the tire and result in undesirable work results and can result in accidents when traveling on roads.

Check the hitch pins

Hitch pins must be in perfect condition. Hitch pins must show no signs of wear and be properly secured. Attached machines may become detached. This can result in accidents with serious or fatal injuries.

Check trip ropes for the quick-release coupling

Trip ropes must hang loose and must not, when in their lowered position, release the couplings of their own accord. Coupled machines could otherwise be released of their own accord from the three-point linkage.

Take altered driving and braking performance into account

Driving and braking performance are altered when the machine is attached to the tractor. Take the width and balancing weight of the machine into consideration, especially when cornering. A driving style not adapted to conditions can cause accidents.

Adapted driving speed

Always adapt the driving speed to the ambient conditions. Driving too fast, for example on uneven terrain, can result in damage to the machine and cause accidents.

Putting the machine into operation

Ensure that the machine is in perfect working condition
Do not operate the machine unless it is in perfect working condition. Check all important components and replace any defective components before starting the machine. Defective components can cause damage to equipment and personal injuries.

Do not remove the protective devices
The protective devices must not be removed or bypassed. Check all protective devices before starting the machine. Unprotected machine components can cause severe or fatal accidents.

Height of machine and overhead power lines
If a height of 4.00 m (13.12 ft) is exceeded when folding the machine in and out, the machine must not be folded in the vicinity of live overhead power lines! Danger of electrocution! Should the machine come into contact with a live overhead power line:

- Do not attempt to exit the tractor cabin
- Do not touch any metal parts on the tractor
- Ensure that there is no conductive contact with the ground
- Warn all persons in the area not to approach the tractor or the machine
- Wait for help from professional emergency service personnel as power in the overhead line must first be switched off

Never climb onto the machine beneath live overhead power lines. Electrocution does not require direct contact.

Working during a storm
Never work on the machine outdoors during a storm. This poses the risk of being struck by lightning.

Check the immediate vicinity
Before driving off, folding out, and operating the machine, check its immediate vicinity. Ensure sufficient visibility. Do not begin work until the immediate vicinity is cleared of any persons or objects. Any use of the machine without first checking the immediate vicinity can cause accidents.

Retighten all nuts and bolts
Nuts and bolts should be checked for firm seating after the first hours of operation and at regular intervals thereafter and tightened if necessary. Bolts can come loose unnoticed while operating. This can result in damage to the machine or accidents.



Drive shaft continues turning after being switched off
The machine continues to run after the PTO drive of the tractor is switched off due to the moment of inertia. Maintain a sufficient safety distance until all moving parts have come to a complete standstill. This can result in damage to the machine and in serious or fatal injuries.

Cornering and turning maneuvers
Centrifugal forces have an effect when turning corners. The center of gravity of the machine behind the tractor is shifted. Take the turning radius and the moment of inertia into account. Failing to adapt the driving style can lead to accidents. This can result in accidents with serious or fatal injuries.

Uncoupling

Increased risk of injury
Uncoupling the machine creates an increased risk of injury. Therefore:

- Secure the tractor against rolling away
- Never stand between the tractor and the machine during uncoupling
- Actuate the three-point linkage system slowly and carefully
- Make sure the machine is standing on a secure and level surface
- Park the drive shaft in the provided holder
- Secure the machine from rolling away (use wheel chocks)
- Make sure the provided support feet are securely locked
- Only uncouple the hydraulic hoses if the tractor and machine hydraulic system is depressurized
- Disconnect electrical connections

If these instructions are ignored, serious or fatal injuries may occur.

Care and maintenance

Observe the working intervals and maintenance intervals
Observe the prescribed intervals for maintenance checks and inspections specified in the operating manual. Failure to observe the time periods can result in damage to the machine, poor work quality and accidents.

Spare parts and accessories
Only use original parts or parts that meet the manufacturer's requirements. In case of doubt, confirm the suitability of the parts with the dealer or manufacturer. Using unsuitable spare parts and accessories compromises the safety of the machine. Damage to the machine and serious injuries are possible.

During all care and maintenance work:

- Switch off the PTO
- Depressurize the hydraulic system
- Ensure that the machine is standing securely. Provide additional support as required
- Whenever possible, uncouple the tractor
- Do not use parts of the machine as climbing aids; use only proper safety climbing aids
- Secure the machine against rolling away
- Do not grab running drives

It is only possible to guarantee work safety during care or maintenance work by observing these regulations.

Turn off the power supply
Prior to carrying out work on the electrical system, disconnect the system from the power supply. Systems being supplied with electrical power can cause damage to equipment and personal injury.

Replacing hydraulic hoses
Replace hydraulic hoses every six years. Hydraulic hoses can age without any externally visible signs. Defective hydraulic lines can cause serious or fatal injuries.

Before carrying out welding work, disconnect the battery and generator
Before carrying out electrical welding work on the attached machine, disconnect the tractor's battery and generator. This prevents damage to the electrical system.

Tighten screw connections firmly
Retighten screw connections that have been loosened during care and maintenance work. If screwed connections are loose, machine parts may become detached. Serious injury or damage to equipment can result.

Further regulations

Observe the regulations
In addition to the safety instructions listed above, please observe the following:

- Regional and national accident prevention regulations
- Generally recognized safety, occupational health and traffic regulations and national traffic laws
- Information in this operating manual
- Regulations relating to operation, maintenance and repair

This chapter contains general information on your machine and information on:

- Range of application
- Proper use
- Definitions
- Characteristics
- Differences between SH1150 and SH1650
- Component designations
- Technical data

Range of application

Machines of the DF series are front hoppers that are designed to be used in conjunction with a sowing unit for sowing seeds or in conjunction with precision seeding machines for spreading fertilizer.
This chapter contains general information on your machine and information on:

- Range of application
- Characteristics
- Component designations
- Technical data

Proper use

Any application other than or beyond this, e.g., as a means of transport, for stump pulling or to transfer power to other objects, is considered improper use. The manufacturer and dealer are not liable for damage caused by improper use. The risk is borne solely by the user.

This product is classified as agricultural equipment in accordance with ASABE S390.

Definitions

There are different interpretations and definitions for some agronomic terms. The terms used in this operating manual are defined as follows.

Seeding after plowing

Seeding after completion of turning the soil with the plow.

Seeding after seedbed preparation

Seeding after completion of seedbed preparation or secondary cultivation after turning the soil. The aim of seedbed preparation is to prepare the top soil layer for seeding. By cultivating at a constant depth, clods are crushed, the ground surface leveled and the ground below the grain deposit is re-compacted to achieve the required soil contact.

Mulch seeding

Seeding after mixing the soil. The soil must be worked deeper than the required deposit depth.

Direct seeding

Seeding without any soil preparation. Residue from the previous crop is chopped up or in a condition that allows direct seeding.

Characteristics

Perfected design
Specially hardened materials combined with an optimized construction, a flexible modular design and a favorable center of gravity all make this efficient and precision machine a reliable and sturdy device.

Exact metering
The original Accord Pneumatic System ensures precision metering. A specially equipped metering device is used for the spreading of fertilizer to meet the particular requirements of this operation.

Distributor external to the hopper
The entire hopper volume can be utilized, and the filling is easy to handle.

Sowing unit on the packer roller
When using the power harrows from the same brand, the sowing unit can be directly fitted to the packer roller. The major advantage of this as compared to conventional attachment to the power harrow is that the depth control and the coulter pressure for the sowing unit are independent of the power harrow and therefore remain stable. Clean and precise grain deposit is thereby guaranteed.

Safety
The machine is constructed in accordance with EU regulations for maximum possible safety of operation.

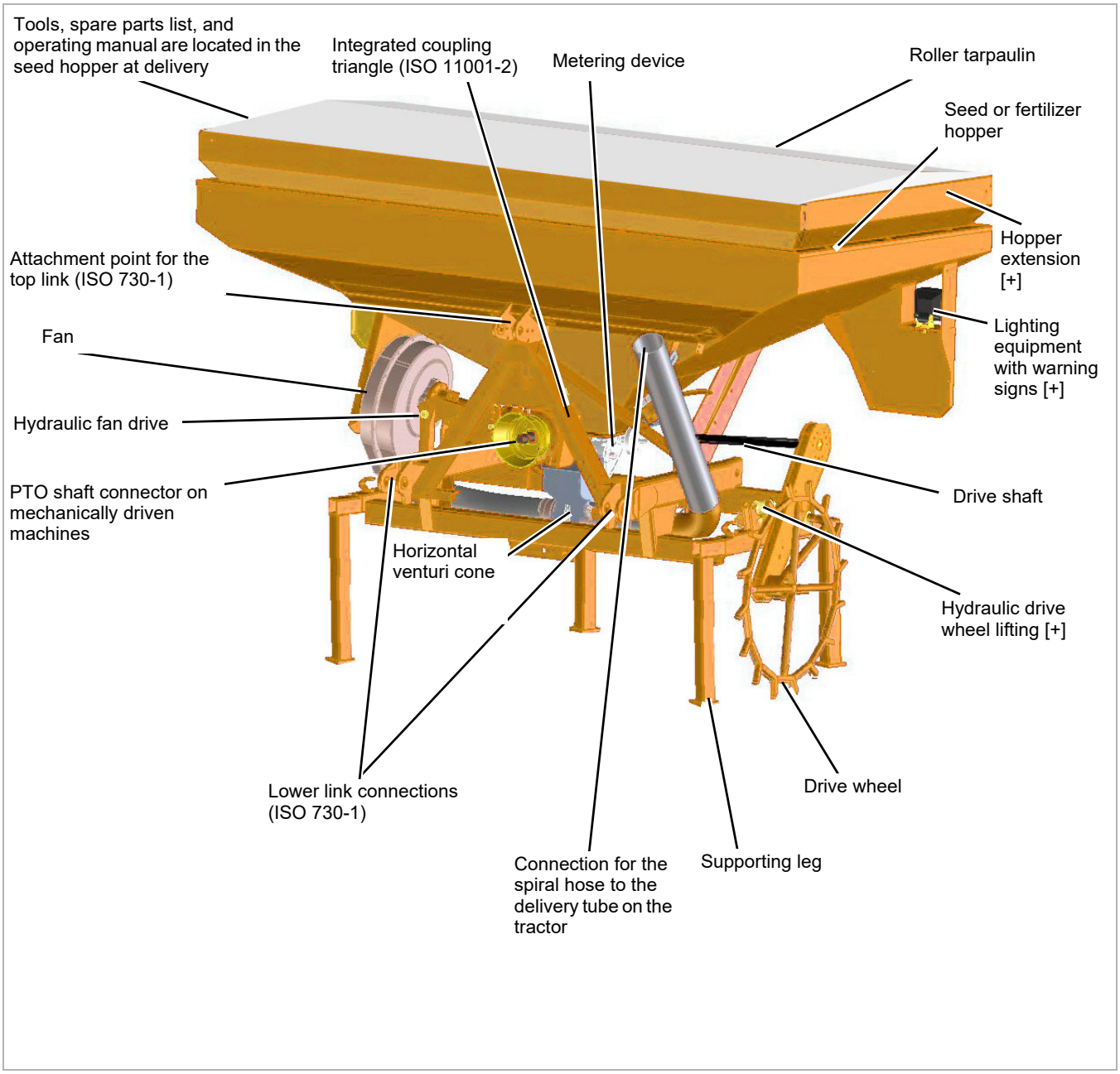
Differences between SH1150 and SH1650

The differences between SH1150 and SH1650 are:

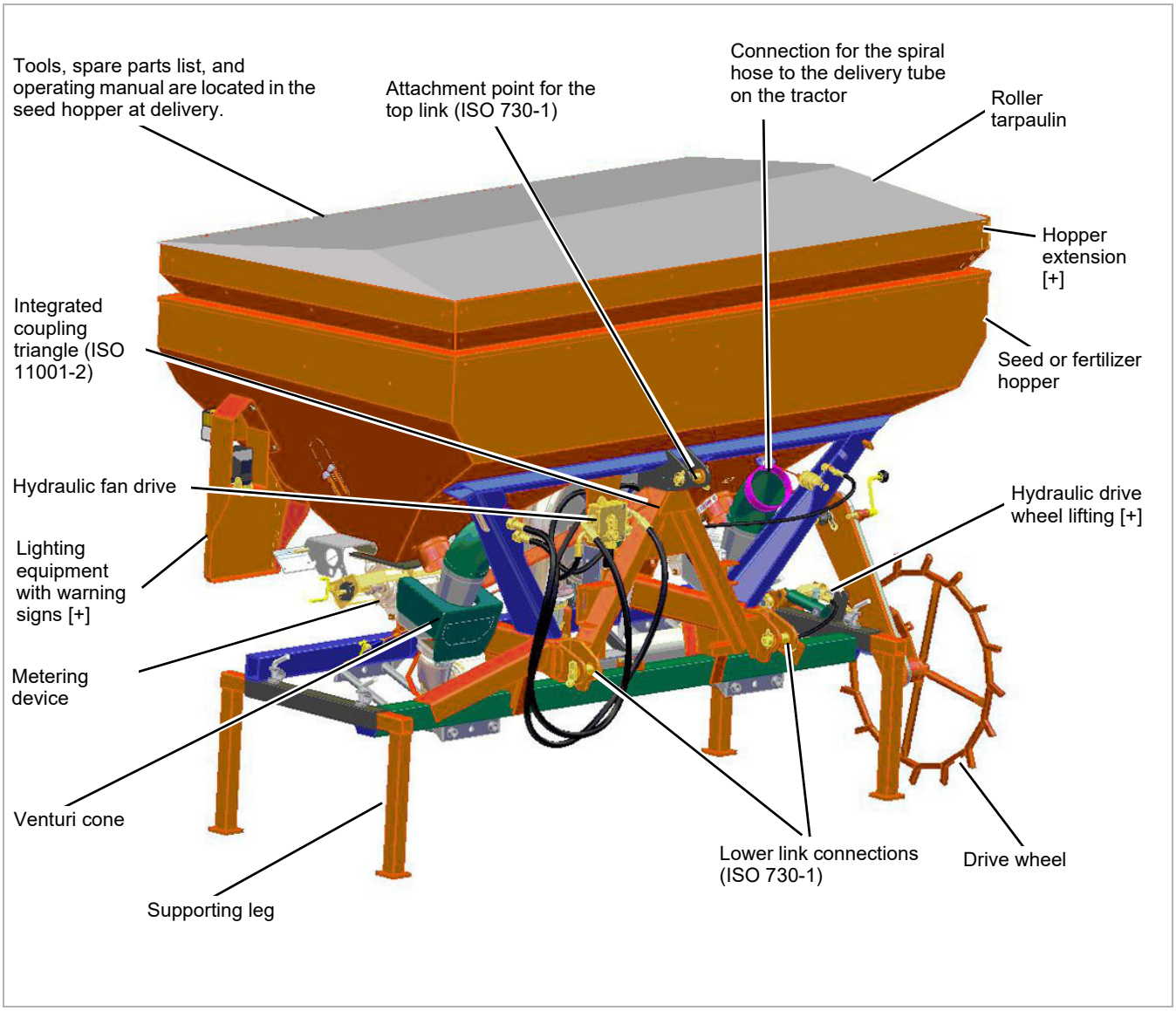
	SH1150	**SH1650**
Possible working widths of the CB1000/CB2000	3.00 – 4.00 m 9.84 – 13.12 ft	5.00 – 6.00 m 16.40 – 19.69 ft
Fan	Small	Large
Metering devices	1	2
Distribution system	1	2
Tank volume	1150 l 32.6 bu	1650 l 46.8 bu

Component designations

SH1150 and SH1650



SH1650


Tools, spare parts list, and operating manual are located in the seed hopper at delivery.
Attachment point for the top link (ISO 730-1)
Connection for the spiral hose to the delivery tube on the tractor
Roller tarpaulin
Hopper extension [+]
Integrated coupling triangle (ISO 11001-2)
Seed or fertilizer hopper
Hydraulic fan drive
Hydraulic drive wheel lifting [+]
Lighting equipment with warning signs [+]
Metering device
Venturi cone
Lower link connections (ISO 730-1)
Drive wheel
Supporting leg

Technical data, metric

General

	SH1150	SH1650
Height [m] without lifting height of tractor		
Parked on supports	1.60	1.70
Width [m]		
Machine in work position	2.40	2.60
Depth [m]		
Machine in work position	1.35	1.35
Total weight [kg]		
Empty, without hopper extension	400	478

Seed hopper			
	Fill level [m] / with hopper extension	1.08/1.25	1.45/1.75
	Hopper volume [l] / with hopper extension	1150/1700	1650/2000
	Maximum hopper capacity [kg of wheat] / with hopper extension	920/1520	1380/1760
Noise level [dBA]			
	Fan with PTO at 1000 rpm	98	98

Others

Tractor			
	Minimum drive capacity [kW/m] without power harrow Drive capacity for the fan	2.5 4.0	2.5 6.0
	Maximum PTO speed [rpm] Model	 1000 1 3/8", 6-part	 1000 1 3/8", 6-part
Electronic control system			
	Power supply [V]	12	12
	Fuse [A]	30	30
Wheel packer			
	Total weight, empty [kg]	450	450
	Tire pressure [bar]	1.0	1.0

Technical data, imperial

General

	SH1150	SH1650
Height [ft], not including lifting hight of the tractor		
Parked on supports	5.25	5.58
Width [ft]		
Machine in work position	7.87	8.53
Depth [ft]		
Machine in work position	4.43	4.43
Total weight [lbs]		
Empty, without hopper extension	885	1055

Seed hopper			
	Fill level [ft] / with hopper extension	3.54 / 4.10	4.76 / 5.74
	Hopper volume [bu] / with hopper extension	32.63 / 48.24	46.82 / 56.76
	Maximum hopper filling, [lbs wheat] / with hopper extension	2028 / 3351	2042 / 3880
Noise level [dBA]			
	Fan with 1000 RPM PTO	98	98

Others

Tractor			
	Minimum drive capacity [kW/ft] without power harrow Drive capacity for the fan	0.76 1.22	0.76 1.83
	Maximum PTO speed Model	1000 1 3/8", 6-part	1000 1 3/8", 6-part
Electronic control system			
	Power supply [V]	12	12
	Fuse [A]	30	30
Wheel packer			
	Total weight, empty [lbs]	992	992
	Tire pressure [bar]	14	14

Scope of delivery

The machine is fully assembled on delivery. If parts of the machine have not been assembled, please contact your dealer.

Do not assemble the machine yourself
Do not do assembly work yourself because prerequisites for an orderly condition of the machine are :

- The observance of a sequence of worksteps
- Observance of tolerances and torques
- Safe handling of the electronics

Assembling the unit without specialist knowledge may lead to damage to the machine or to poor work results.

Electronic control system
An electronic control system is provided as an accessory, for example, to create tramlines. Your dealer will perform the final assembly on your tractor.

If parts are missing or have been damaged during transportation, please submit a claim immediately to your dealer, importer, or the manufacturer.

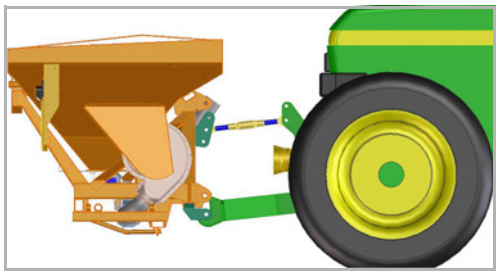
WARNING

Increased risk of injury

Coupling the machine to the tractor creates an increased risk of injury. Therefore:

- Check the tractor and machine categories. The categories must match.
- Secure the tractor against rolling away
- Never stand between the tractor and the machine during coupling
- Actuate the three-point linkage system slowly and carefully

Failure to observe these instructions can result in severe or fatal accidents.



The machine is factory-equipped for mounting with a three-point linkage or coupling triangle.

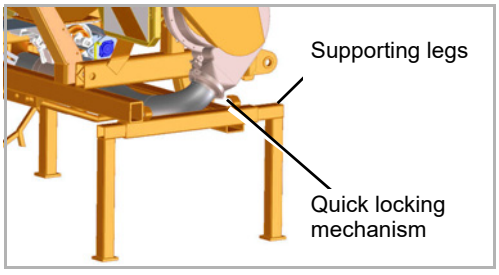
With coupling triangle:

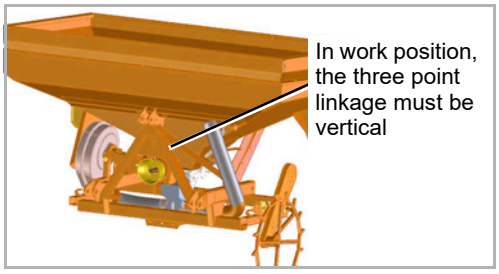
- Couple the machine as usual using the coupling triangle and secure. The ratchet must lock and be secured with the R-pin.

With three-point linkage:

- Slide suitable catch pans or vessels on the lower link arms of the machine for the tractor and secure with linchpins
- Fit top link

- Lift the machine slightly
- Release the quick locking mechanism, remove the supporting legs, turn by 180° and refit them. Ensure that the quick locking mechanism is locked.





- Set the top link so that the frame is parallel to the ground in the work position and the three-point linkage is vertical

Connections

▸ Secure the machine

→ Chapter »Maintenance«, section »Secure the machine«, page 100

After coupling, make the following connections:

- PTO shaft (if present)
- Electrics
- Hydraulics
- Spiral hose to delivery tube

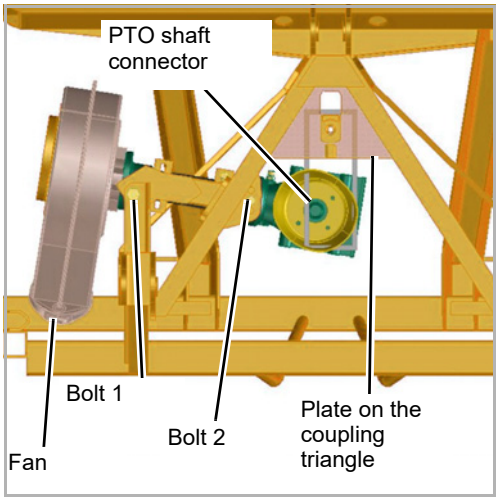
PTO shaft

If a PTO shaft connector is fitted:
In the work position of the front hopper, the PTO shaft should be as horizontal as possible.

On SH1150
The height of the fan can be adjusted to suit the tractor.

▸ Lower front hopper to working depth

→ Chapter »Preparation work«, section »Working depth«, page 75



▸ Release bolt 1
▸ Release bolt 2 and remove
▸ Set PTO shaft connector as desired
▸ Insert bolt 2 and tighten both bolts
▸ Connect PTO shaft

If the PTO shaft connector touches the plate on the coupling triangle:

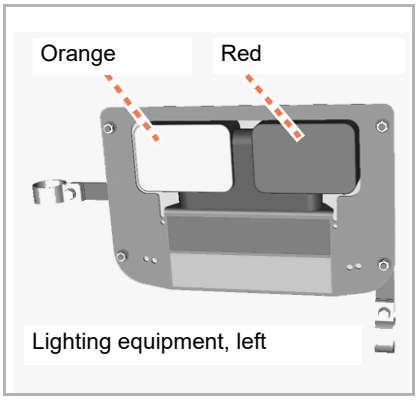
In this case, it is possible to remove the interfering area from the plate with an angle grinder. Use of the coupling triangle is then no longer possible, however; only the three-point linkage can then be used.

Electrics

Attach the following electrical cables to the tractor, if installed, for:

- The electronic control system
- The lighting equipment of the machine

Electrical system: USA lighting equipment



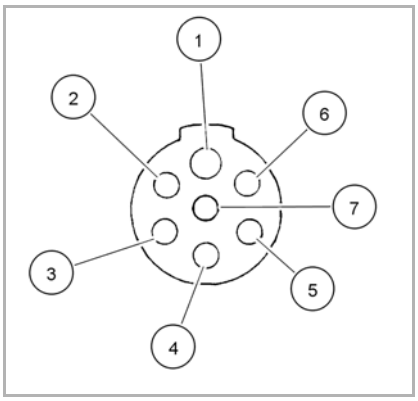
Lighting equipment, left

The machine features lighting equipment for street driving. The lighting equipment is mounted on the left and right of the rear deflectors and connected to the tractor via a 7-pin plug. A corresponding connection must be present on the tractor (SAE J560).

If your tractor does not feature the corresponding connection, one must be retrofitted. Contact your dealer.

The lighting equipment is controlled using the lighting controller of the tractor. The lamps on the machine are only switched on if either the parking lights or the driving light of the tractor are switched on.

SAE J560 pin assignment



PIN	Cable	Connection to
1	White	Ground; all lamps
2	Black	Not used
3	Yellow	Left blinker (orange)
4	Red	Brake lights
5	Green	Right blinker (orange)
6	Brown	Reversing lights (red)
7	Blue	Not used

- Connect plug for the 12 V power supply to the 7-pin socket on the tractor

Functional overview of USA lighting equipment

▸ Check the lighting function using the following table.

	Device lights			
Tractor lights	**Left orange**	**Left red**	**Right red**	**Right orange**
Headlight "OFF"	—	Off	Off	—
Headlight "ON"	—	Dimmed	Dimmed	—
Orange flashing light "OFF"	Off	—	—	Off
Orange flashing light "ON"	Flashing (same frequency as right)	—	—	Flashing (same frequency as left)
Brake lights (on tractors with brake lights)	—	Bright	Bright	—
Orange flashing light "ON" Turning not indicated (tractor with brake lights)	Flashing (same frequency as right)	Bright	Bright	Flashing (same frequency as left)
Orange flashing light "ON" Turning not indicated (no tractor brake lights)	Flashing (same frequency as right)	Off	Off	Flashing (same frequency as left)
Left turning indicated	Higher flashing frequency	Depending on tractor equipment: Off, dimmed or flashing in unison with the left light	Off or dimmed	Lights up, not flashing
Right turning indicated	Lights up, not flashing	Off or dimmed	Depending on tractor equipment: Off, dimmed or flashing in unison with the right light	Higher flashing frequency

Comply with local regulations for lighting equipment in road traffic. Contact your dealer if the lighting equipment does not function as specified.

▸ Check all connections to ensure they are working properly

Hydraulic connections

:

WARNING

Check hydraulic hoses and hydraulic couplings
Before making connections, check all hydraulic hoses for damage. Check all hydraulic couplings for firm seating after connecting them.
Defect hydraulic tubes or poorly seated hydraulic couplings can initiate unforeseen movements on the machine or lead to accidents.

Only connect the hydraulics when depressurized
Only connect the hydraulic hoses to the tractor hydraulic system if the tractor and machine hydraulic system is depressurized.
A hydraulic system under pressure can trigger unpredictable movements of the machine and cause injuries.

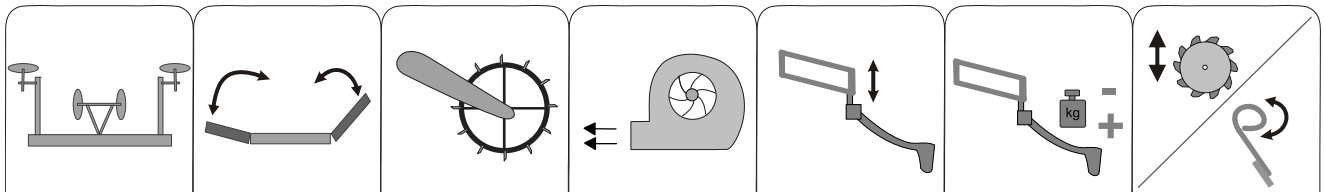
Secure the control units
In the transport position, secure the control units on the tractor to prevent accidental operation.
Accidental actuation of the control units can trigger unpredictable movements on the machine and cause accidents.

Avoid mixtures of different oils
If the machine is used with different tractors, incompatible types of oil may become mixed.
Mixtures of incompatible oils can result in the destruction of tractor components.

Familiarize yourself with the hydraulics

The machine must be connected to the tractor's hydraulic system. For this, the tractor needs a single-acting control valve with a return line.

The hydraulic hoses are color-coded so that you can assign the functions to the individual hydraulic hoses more easily.

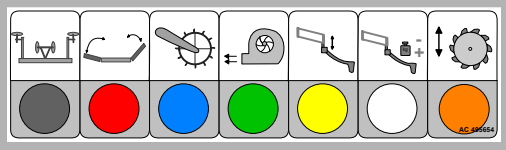


Track marker and pre-emergence marker [+] | Folding in and out | Drive wheel lifting | Hydraulic fan drive | Coulter bar lifting system [+] | Coulter pressure adjustment [+] | Clod Board/ tine section [+]

Control valves

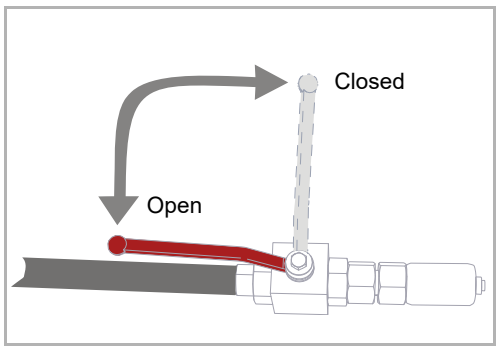
The hydraulic fan drive should be connected to a control valve with a high-priority supply on the tractor. When actuating the control unit for lifting or lowering the machine, the fan drive speed is reduced but still remains in a non-critical range.

- Connect the hydraulic hoses as specified in the following table:

Function 	Control valves		Color coding
	Single-acting	Double-acting	
Hydraulic fan drive (additional pressureless return line and LS on Power Beyond)	x	(x)	Green
Hydraulic drive wheel lifting	x	(x)	Blue

If ball valves are present:

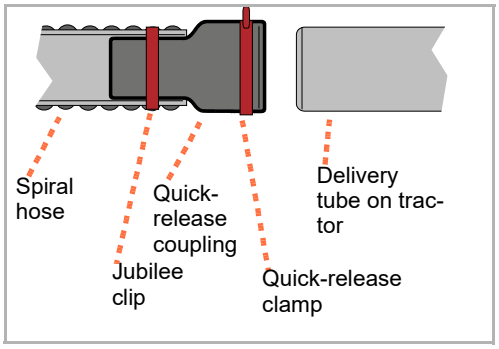
- Open the ball valves on the hydraulic hoses to the tractor



Spiral hose

The spiral hose is fitted between the front hopper and the tractor on the delivery tube. The delivery tube is fitted to the tractor. If the delivery tube is not yet fitted to the tractor, have it fitted by a specialist workshop.

For the first fitting: a smear of soft soap on the inside of the spiral hose at both ends makes it slide on much easier.



- Fit a quick-release coupling to both ends of the spiral hose and secure with jubilee clips.
- Push the spiral hose with the quick-release coupling onto the delivery tube and the connecting piece on the front hopper and secure with quick-release clamp

Hydraulic fan drive [+]

The oil flow is directed to the 3-way flow control valve and is thus regulated according to the speed of the hydraulic motor. The constant oil flow rate results in a specific rotational speed of the hydraulic fan drive. This speed is monitored via the display in the terminal or by using a speed sensor.

Technical data, metric

		Values	
		SH1150	SH1650
Hydraulic motor	Displacement [ccm] Speed [rpm]	8 4300	8 4500
Oil supplies	Minimum feed line pressure [bar] Maximum return line pressure [bar] Oil flow rate [l/min]	130 10 40.5	140 10 43.5
Fan	Fan speed [rpm]	4300	4500

The rotational speed has a fluctuating range of ± 50 RPM if the speed has been set at a constant oil temperature.

Technical data, imperial

		Values	
		SH1150	SH1650
Hydraulic motor	Displacement [cu.in.] Rotational speed [RPM]	0.5 4300	0.5 4500
Oil supplies	Minimum supply pipe pressure [PSI] Maximum return line pressure [PSI] Oil flow [gpm]	1848 142 10.7	1990 142 11.5
Fan	Fan speed [RPM]	4300	4500

The rotational speed has a fluctuating range of ± 50 rpm, if the speed has been set at a constant oil temperature.

Line diameter, metric

	Feed line	Return line
Minimum line diameter Outer Inner	DN 10 12 mm 9 mm	DN 12 15 mm 12 mm
Recommended line diameter Outer Inner	DN 16 18 mm 15 mm	DN 16 18 mm 15 mm

Line diameter, imperial

	Feed line	Return line
Minimum line diameter Outer Inner	Size 6 3/8" 23/61"	Size 8 1/2" 31/64"
Recommended line diameter Outer Inner	Size 10 5/8" 37/64"	Size 10 5/8" 37/64"

Prerequisites

Prerequisites for the hydraulic fan drive on the tractor:

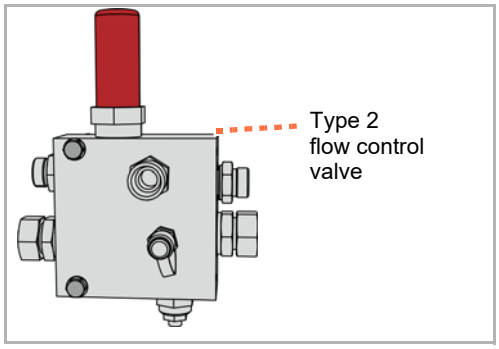
- Sufficient oil supply by the tractor
- The appropriate number of control valves is available
- Parallel operation of the control valves is possible
- Oil cooler is available

For John Deere tractors up to and including series 50:

- The flow control valve must be converted from 3-way to 2-way

→ Section »Tractors without flow control valve, with regulating pumps«, page 41

Flow control valve



The machine is equipped with a type 2 flow control valve.

Fan speed

WARNING

Check hydraulic connections
Prior to operation, carefully check the hydraulic hose connections and the hoses themselves.
Hot hydraulic fluid under pressure can squirt from insufficiently tightened or damaged hydraulic hoses, resulting in serious injury.

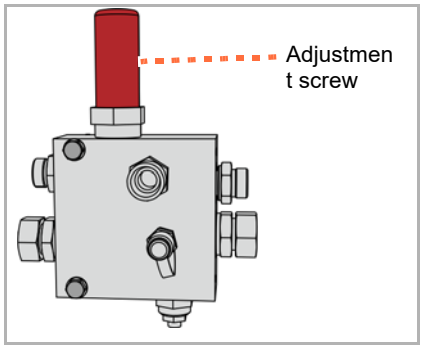
Wear ear protection
Wear ear protection when working near the fan.
Noise can cause temporary or permanent hearing impairment.

Do not exceed the maximum fan speed
The fan speed must not exceed 5,000 rpm for hydraulic fan drives.
At higher speeds the fan can be destroyed by explosion, causing serious damage to the machine.

Conversions only with fan turned off
Conversion from a 3-way to a 2-way flow control valve, or vice versa, and the setting of speed must only be performed with the fan turned off.
Making settings when the fan is running may damage the hydraulic motor.

The basic settings for the flow control valve must be made only during initial operation or when changing tractors.

Tractors with flow control valve

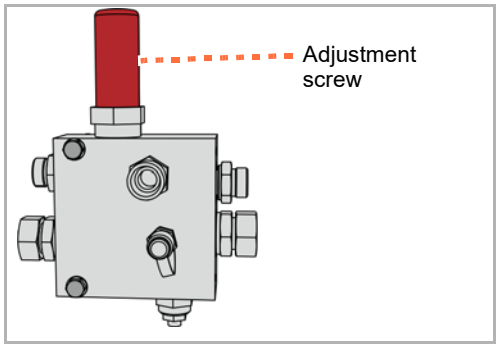


- Fully open the 3-way flow control valve

The 3-way flow control valve is completely open when the adjustment screw is fully screwed in.

- Actuate the control unit on the tractor
- Set the desired fan speed by regulating the oil flow rate on the tractor

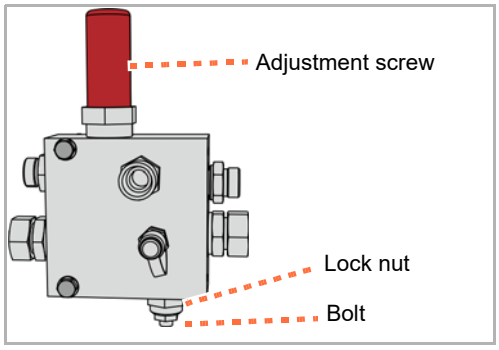
Tractors without flow control valves, without regulating pumps



- Use the adjustment screw on the 3-way flow control valve to set the desired speed

Tractors without flow control valve, with regulating pumps

The flow control valve must be converted from 3-way to 2-way. Perform the conversion as follows:



- Release the lock nut
- Turn the screw fully in. The conversion to a 2-way flow control valve is now completed.
- Retighten the lock nut
- Use the adjustment screw on the 2-way flow control valve to set the desired speed

Power Beyond [+]

The hydraulic fan drive is a permanent consumer in the hydraulic system. This means that other power consumers often have no power. With the Power Beyond, the power loss can be minimized when using the hydraulic fan drive as a permanent power consumer. Other consumers can be operated in parallel. However, the conveying capacity of the hydraulic pump is not increased by Power Beyond.

WARNING

Check hydraulic connections
Prior to operation, carefully check the hydraulic hose connections and the hoses themselves.
Hot hydraulic fluid under pressure can squirt from insufficiently tightened or damaged hydraulic hoses, resulting in serious injury.

Wear ear protection
Wear ear protection when working near the fan.
Noise can cause temporary or permanent hearing impairment.

Installation in specialist workshop
Installation tasks must be carried out by a specialist workshop. Work on the hydraulic system requires specialist knowledge.
Work carried out incorrectly can cause damage to the machine.

Conversions only with fan turned off
Conversion from a 3-way to a 2-way flow control valve, or vice versa, and the setting of speed must only be performed with the fan turned off.
Otherwise, the machine can be damaged.

Switch off the PTO
Make connections only with the PTO deactivated.
A correct connection is otherwise impossible.

Prerequisites

Prerequisites for the use of Power Beyond:

Equipment

The tractor is equipped with:

- Regulating pump
- Load Sensing System
- Feed line (P)
- Return line (T)
- Control line (LS)
- Possibly a leak-off oil line (D)

The machine is equipped with:

- A type 2 flow control valve

→ Chapter »Hydraulic system«, section »Flow control valve«, page 40

Calculation of the remaining conveying capacity

The conveying capacity of the tractor's hydraulic pump determines the working speed of the consumers. The higher the conveying capacity, the faster the working speed of the consumers.
Power Beyond allows the operation of other consumers in parallel to the permanent consumer, but does not increase the conveying capacity of the hydraulic pump. The lifting speed decreases.

Example, metric:

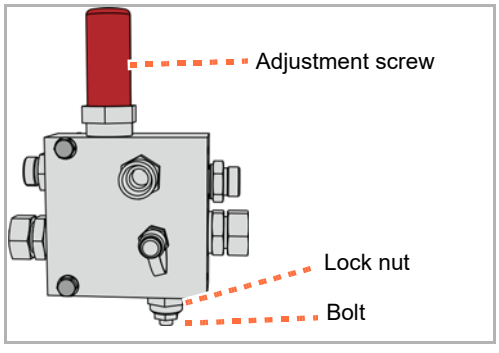
Conveying capacity of the hydraulic pump	100 l/min
Quantity of oil required for permanent consumer	40 l/min
Remaining conveying capacity for other consumers	60 l/min
Reduction of the lifting speed to	60 %

Example, imperial:

Conveying capacity of the hydraulic pump	25 gpm
Quantity of oil required for permanent consumer	40 gpm
Remaining conveying capacity for other consumers	15 gpm
Reduction of the lifting speed to	60 %

Conversion to 2-way flow control valve

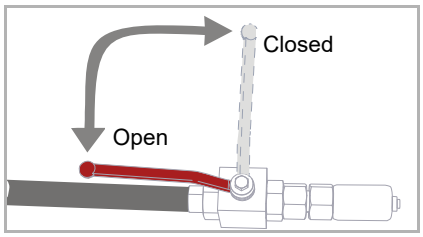
The flow control valve must be converted from 3-way to 2-way. Perform the conversion as follows:



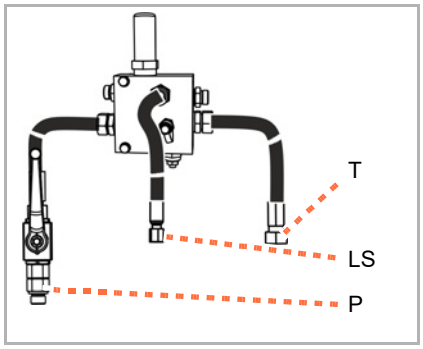
- Release the lock nut
- Turn the screw fully in. By tightening the screw the conversion to a 2-way flow control valve is done.
- Retighten the lock nut
- Use the adjustment screw on the 2-way flow control valve to set the desired speed

Connection to the tractor

The couplings and connectors may vary according to tractor manufacturer. Please contact your dealer before changing the tractor. If the tractor couplings still have to be installed, ensure that components are fitted which comply with ISO 17567. The hydraulic hoses have an 18 L connector with an M26 x 1.5 union nut.

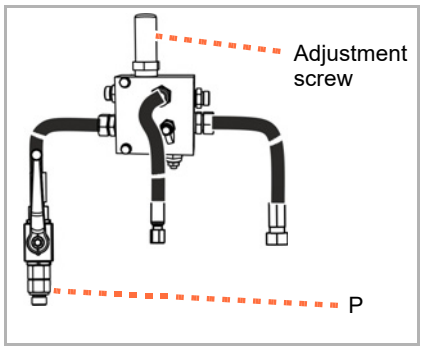


- Close the ball valve at the feed line (P).



- Make connections in the following sequence:
  1. Return line (T)
  2. Control line (LS)
  3. Feed line (P)
- Activate the fan speed counter (depending on the available display unit or monitor)

Operation

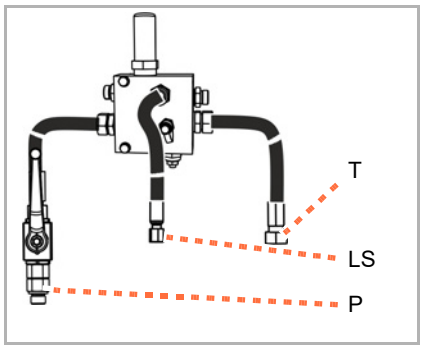


Only change settings when the tractor engine is turned off
Adjustments to the rotational speed may only be made when the fan is stationary.
Otherwise, the machine can be damaged.

The setting of the speed is usually only required during commissioning or when a tractor is changed. A check should be carried out at the start of the season – and more frequently if the work rate is high.

- Open the ball valve at the feed line (P)
- Stopping the fan
- Set the desired speed with the adjustment screw at the 2-way flow control valve;
  check the settings while the fan is running.

Uncoupling



- Switch off the tractor motor
- Close the ball valve at the feed line (P).
- Uncouple the connections in the following sequence:
  1. Feed line (P)
  2. Control line (LS)
  3. Return line (T)

Operation

WARNING

Check hydraulic connections
Prior to operation, carefully check the hydraulic hose connections and the hoses themselves.
Hot hydraulic fluid under pressure can squirt from insufficiently tightened or damaged hydraulic hoses, resulting in serious injury.

Wear ear protection
Wear ear protection when working near the fan.
Noise can cause temporary or permanent hearing impairment.

Initial commissioning

The following applies for the initial commissioning with cold oil:

- The fan speed will continue to alter automatically until the hydraulic oil has reached the operating temperature
- Only when the fan speed persists the setting is completed

▸ Constantly check the fan speed during the settings at the electronic control system

→ Operating manual for the electronic control system

Repeated commissioning

The following applies for the repeated commissioning with cold oil:

- The fan speed is slightly higher in the warming up process
- After a short period of time, the fan speed settles down to the value set during initial operation

Operation with two hydraulic motors

The oil supply of the tractor must be designed to allow for the simultaneous operation of two hydraulic motors. If you have worked up to now only with one hydraulic motor, you should definitely arrange for parallel switching to be installed.

Application rate

Prior to the calibration test, which is performed with an electronic control system or by hand, it is necessary to set the desired application rate.

The application rate is dependent on:

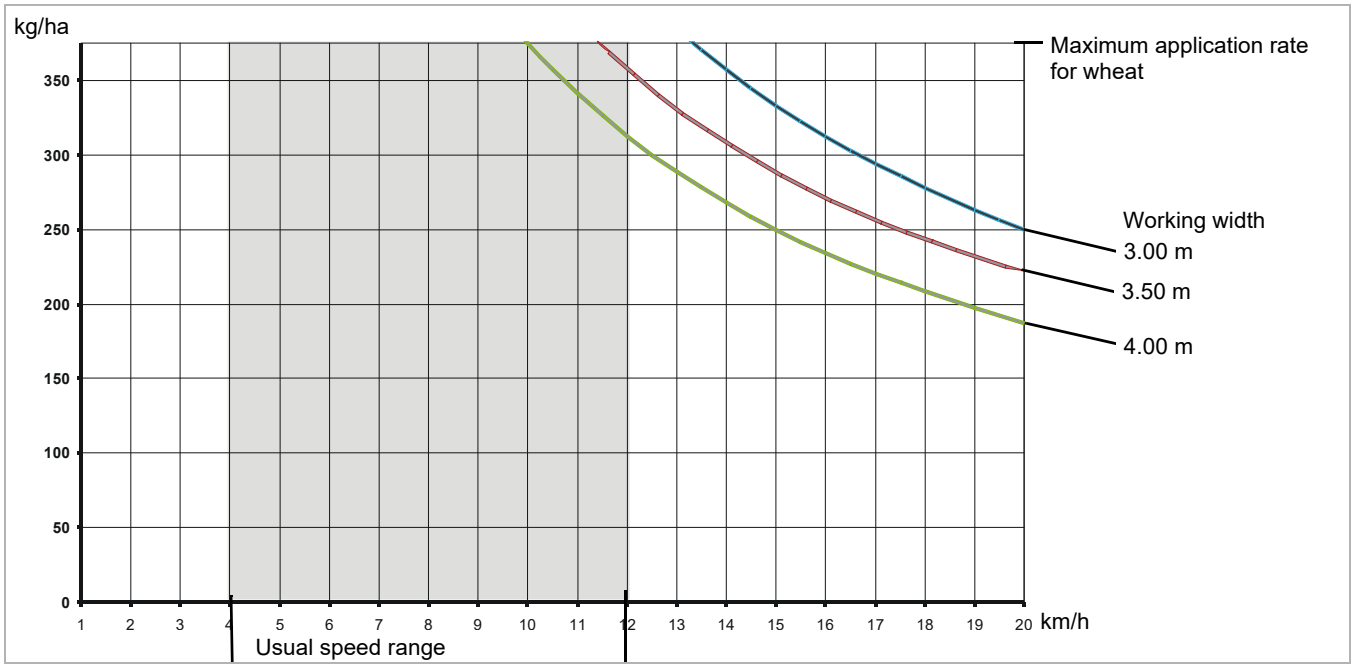
- The machine
- The diameter of the distribution system
- The working width
- Driving speed

The greater the driving speed, the lower the possible application rate. For this reason, it may be necessary to reduce the driving speed if a high application rate is desired.

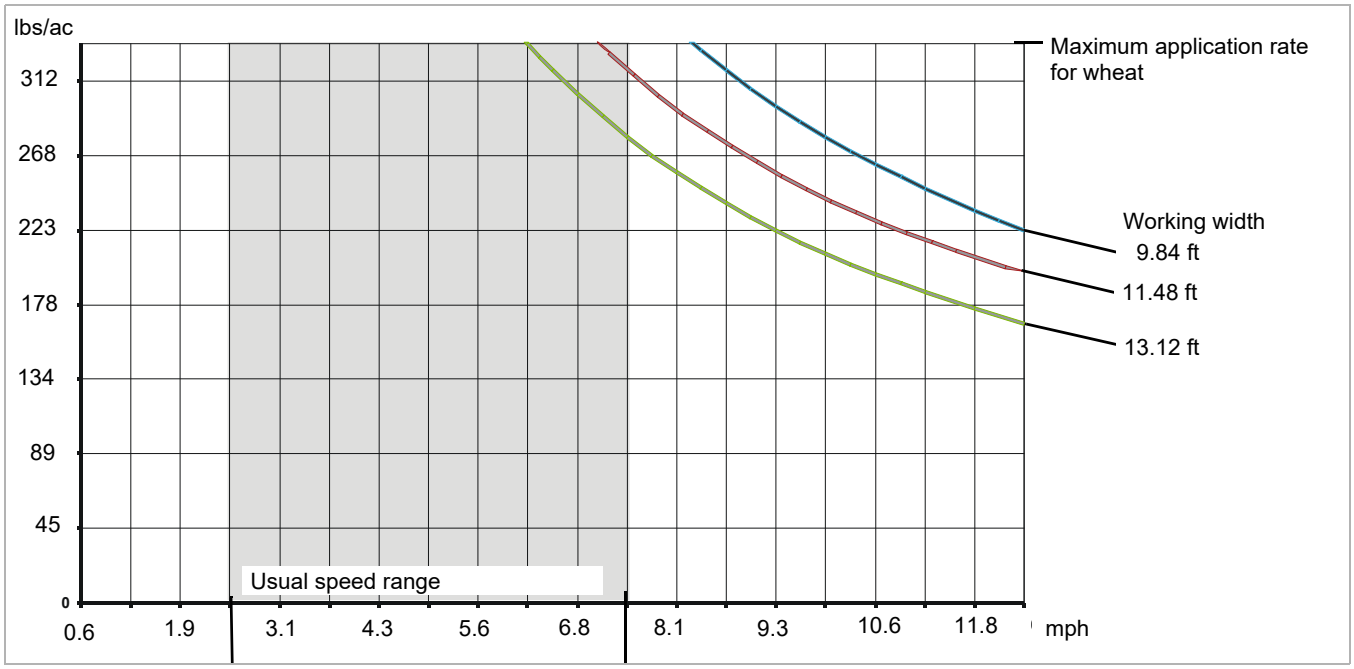
SH1150 and sowing

Only the areas to the left of the curves can be achieved. Also observe the usual speeds here, which should not be considerably exceeded or dropped below.

System 100, metric

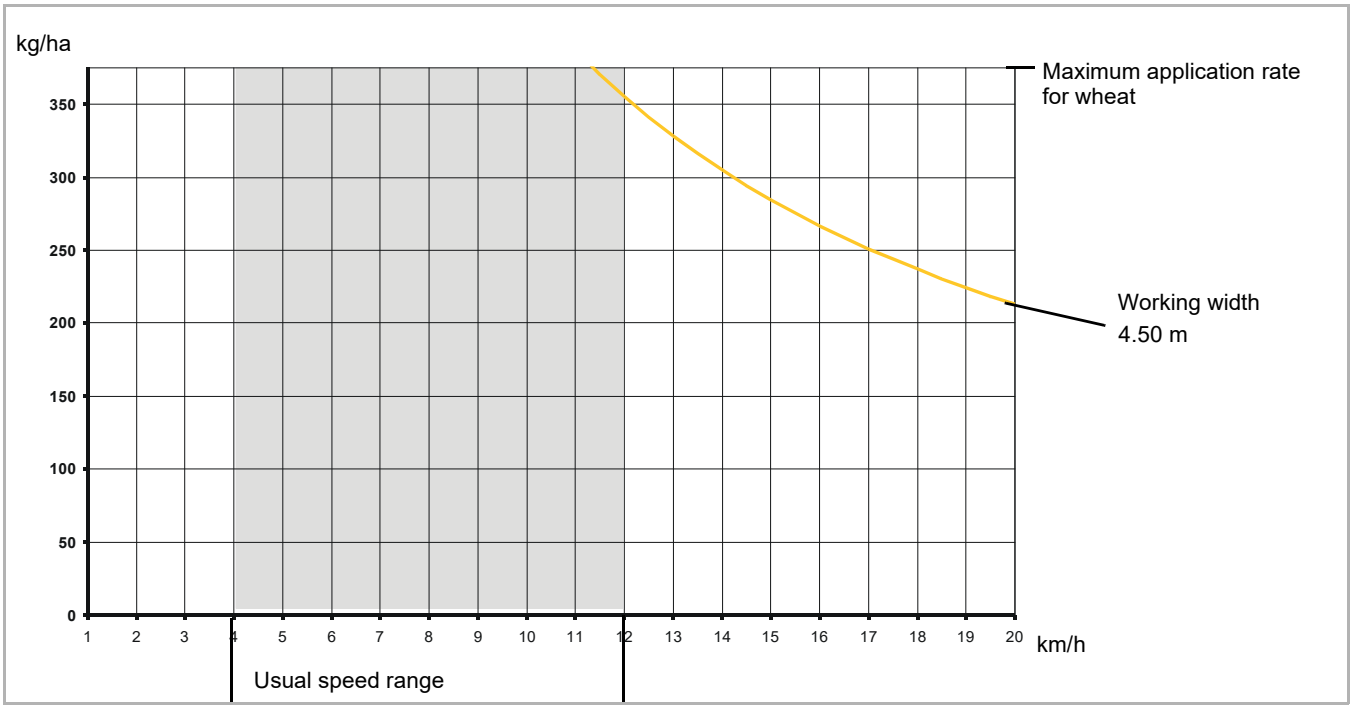


System 100, imperial

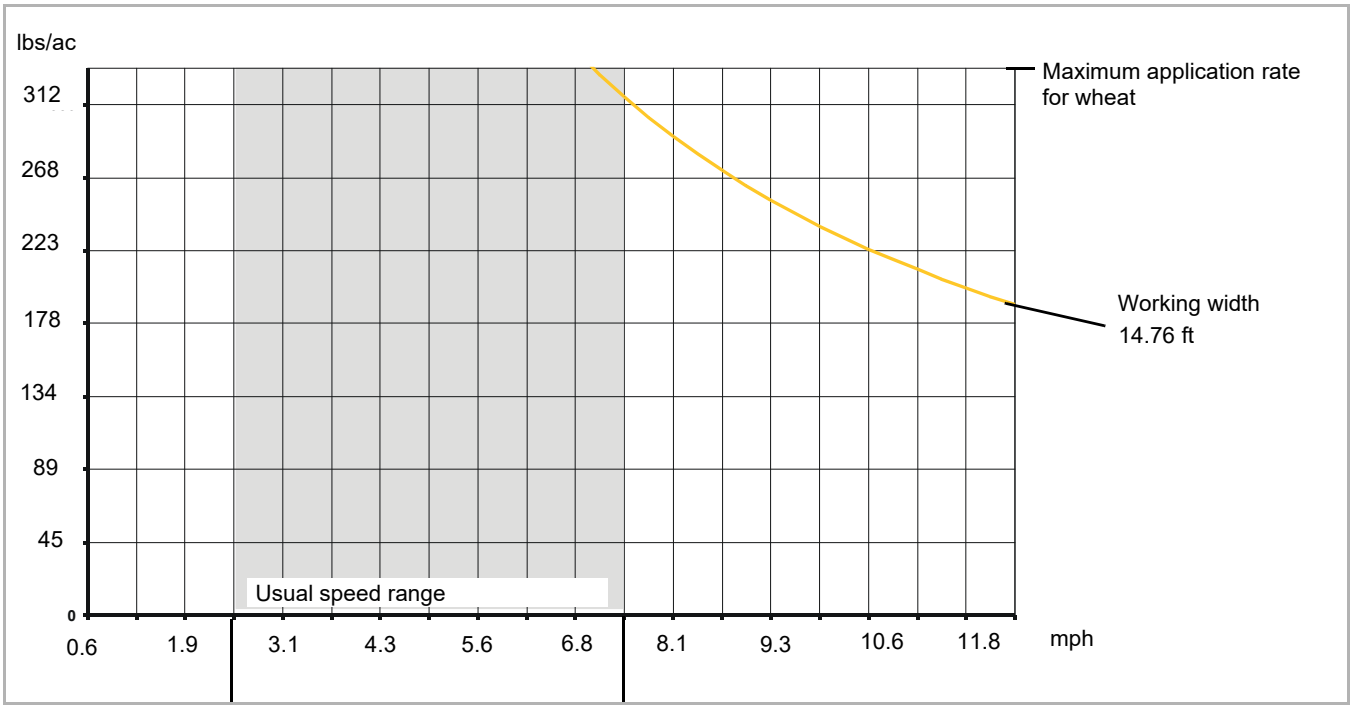


Application rate

System 135, metric



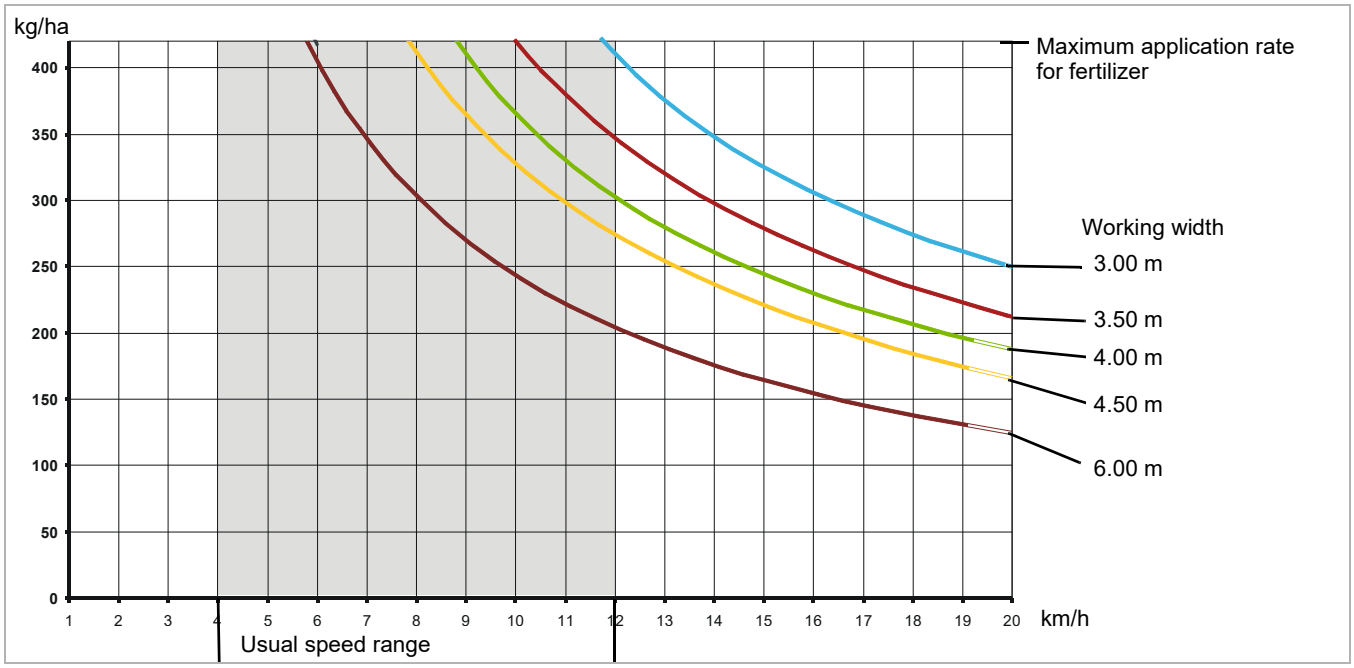
System 135, imperial



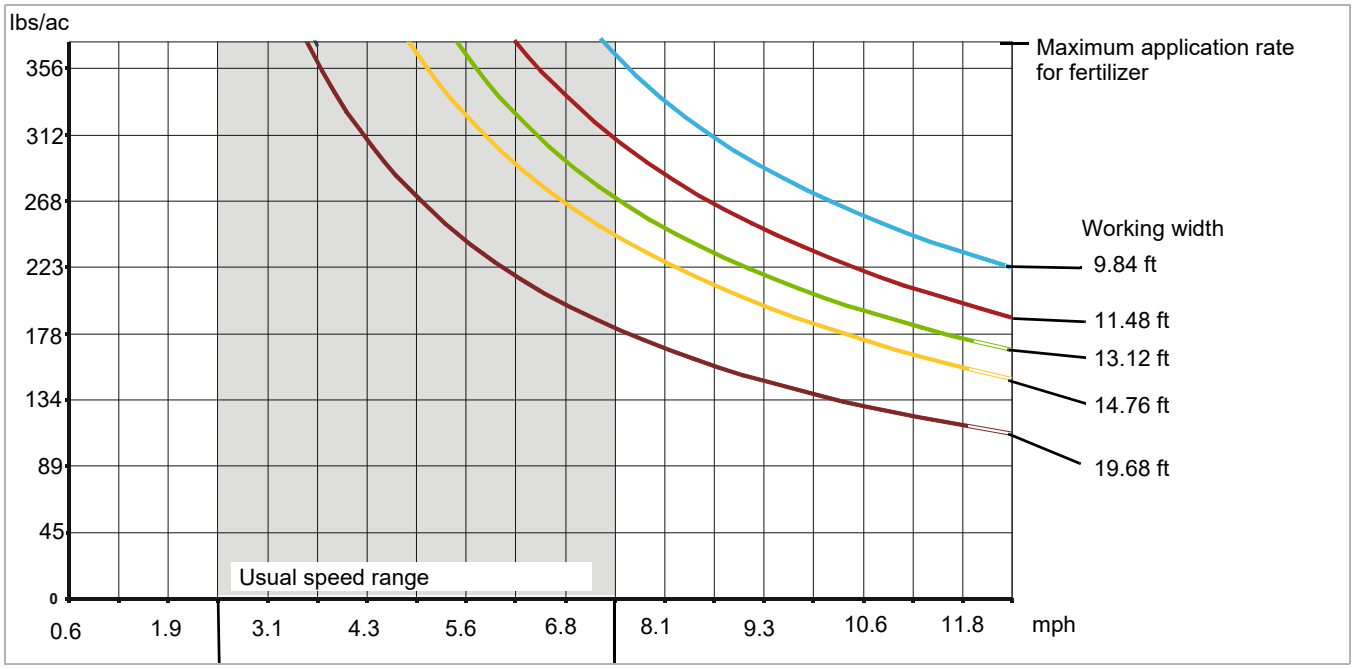
SH1150 and fertilizing

Only the areas to the left and below the curves can be achieved. Also observe the usual speeds here, which should not be considerably exceeded or dropped below.

System 100, metric

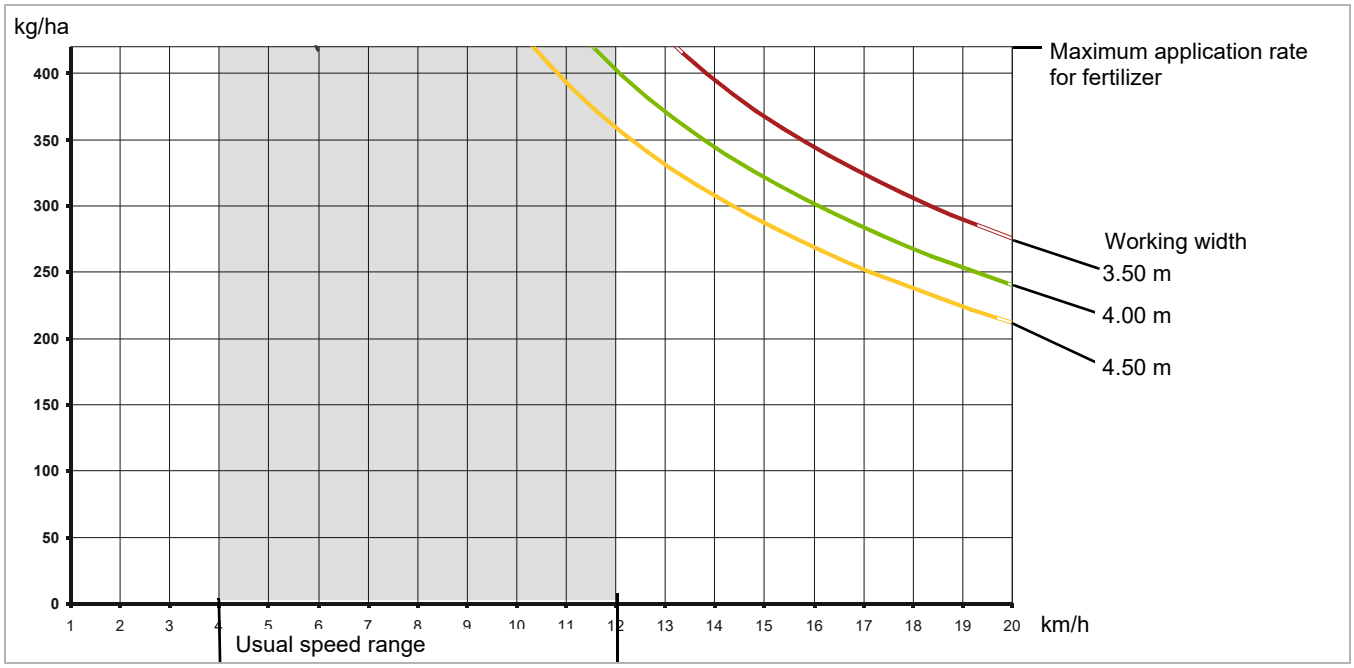


System 100, imperial

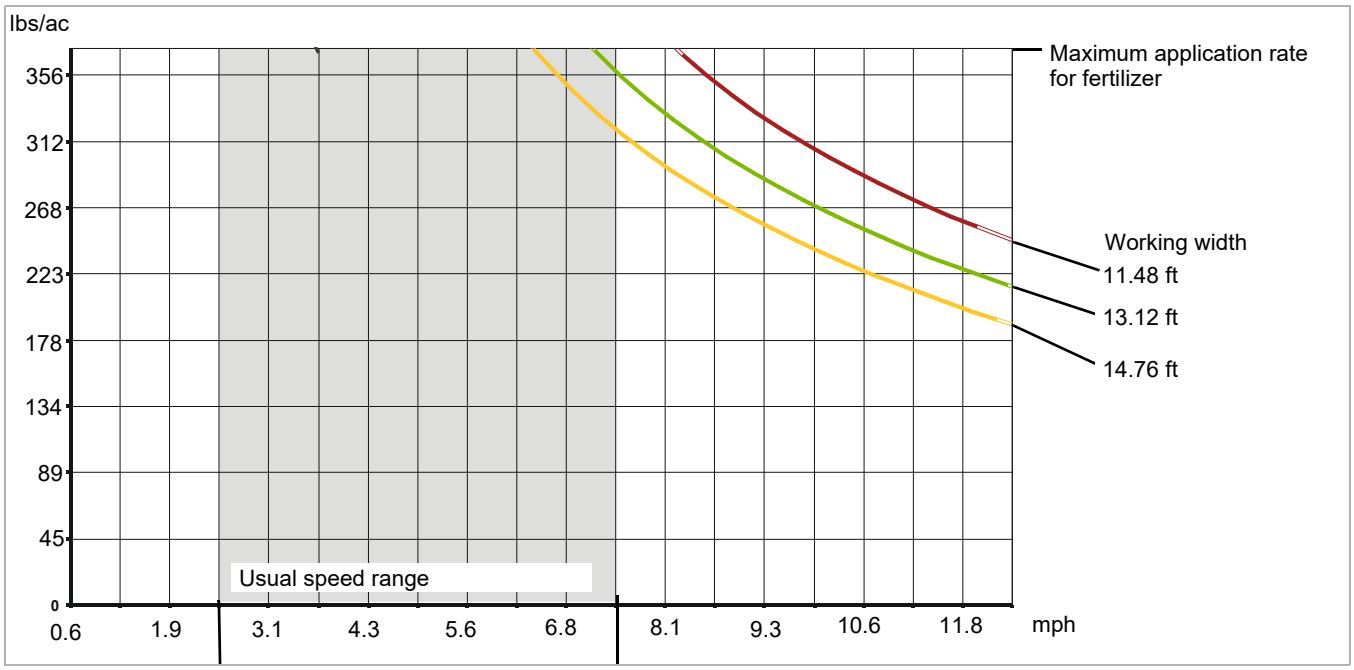


Application rate

System 135, metric



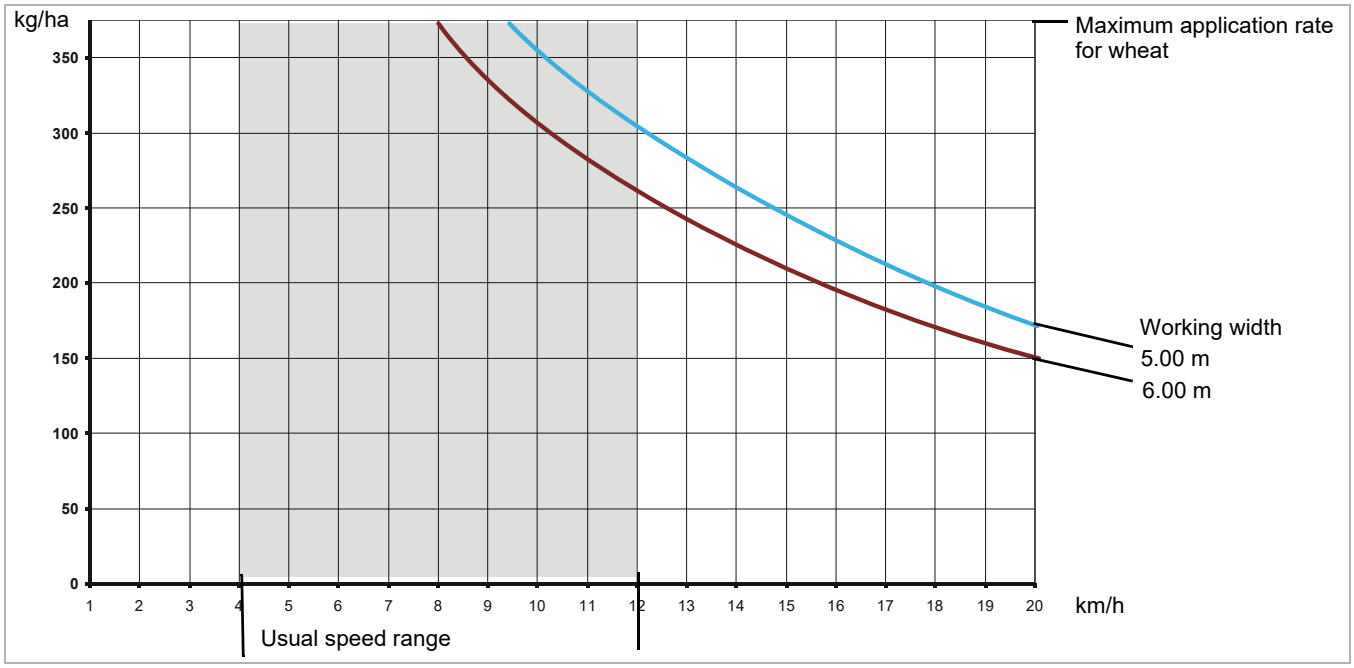
System 135, imperial



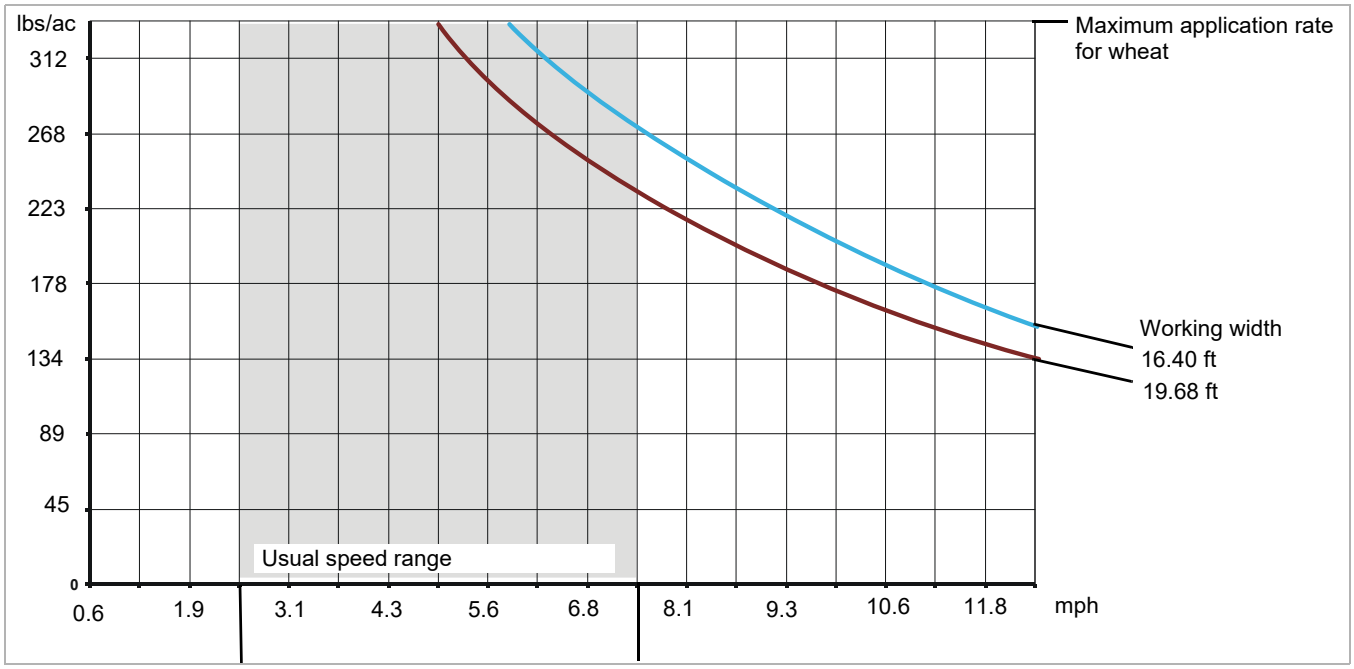
SH1650 and sowing

Only the areas to the left and below the curves can be achieved. Also observe the usual speeds here, which should not be considerably exceeded or dropped below.

System 100, metric



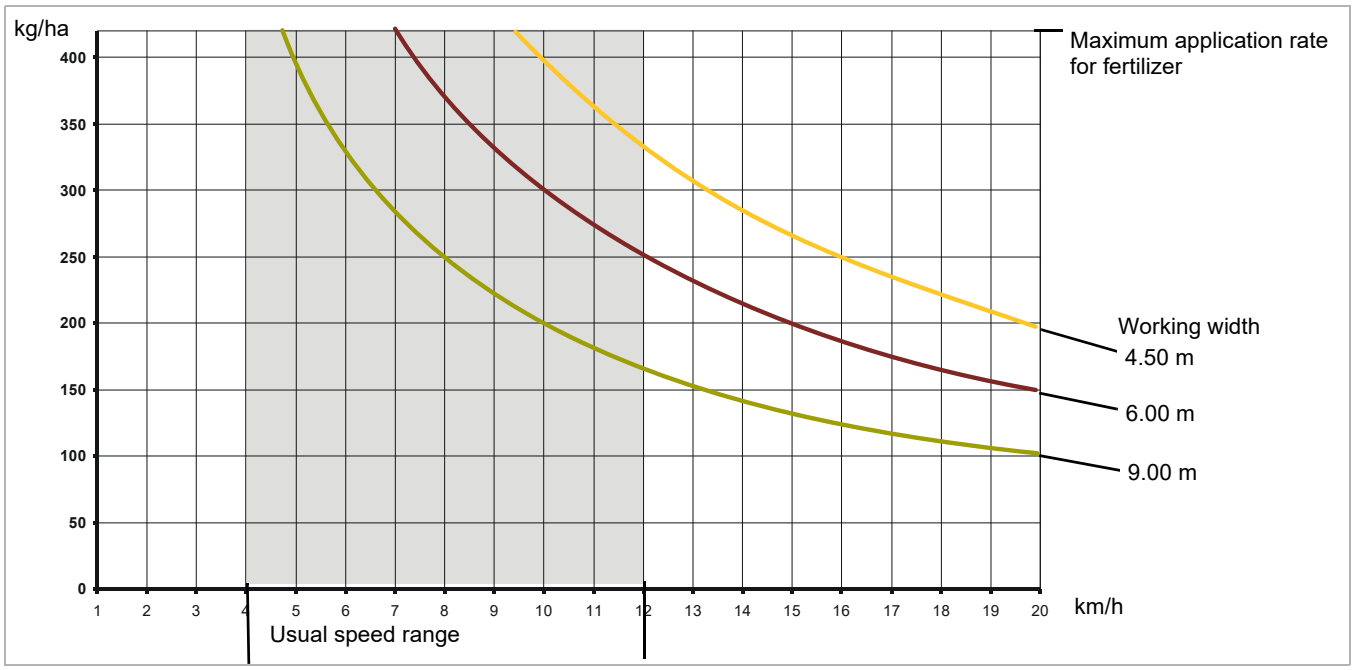
System 100, imperial



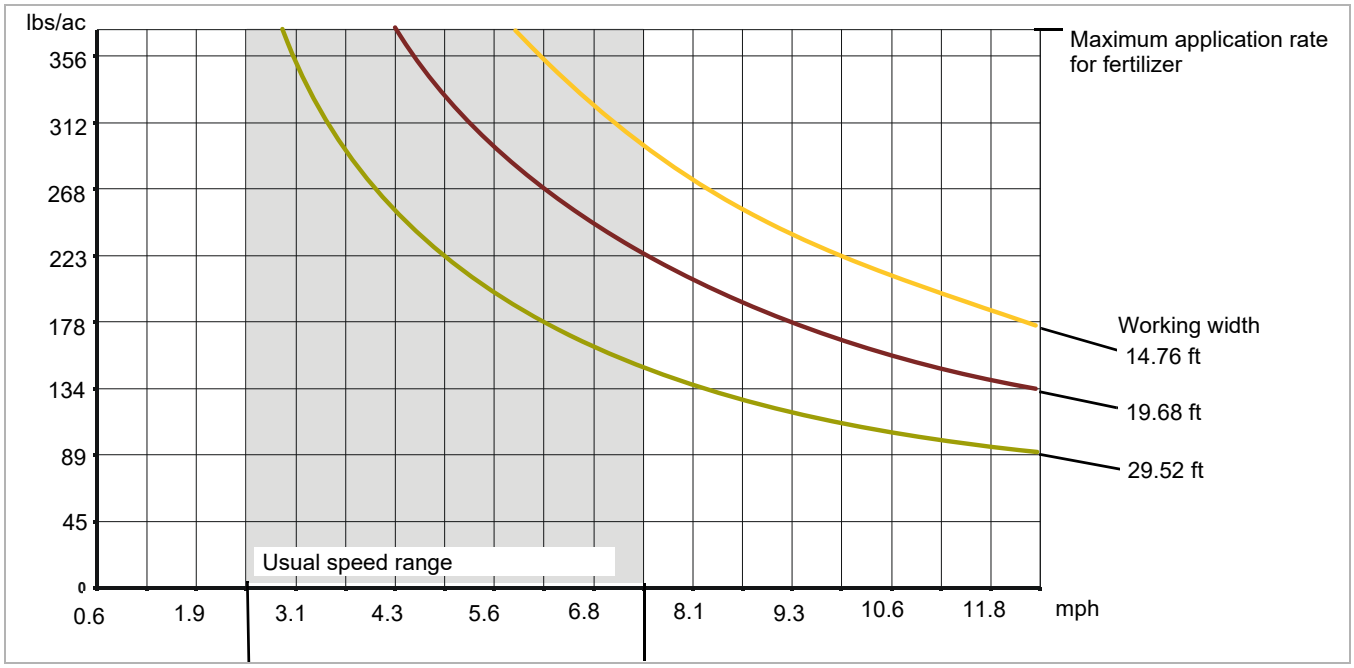
SH1650 and fertilizer spreading

Only the areas to the left and below the curves can be achieved. Also observe the usual speeds here, which should not be considerably exceeded or dropped below.

System 100, metric



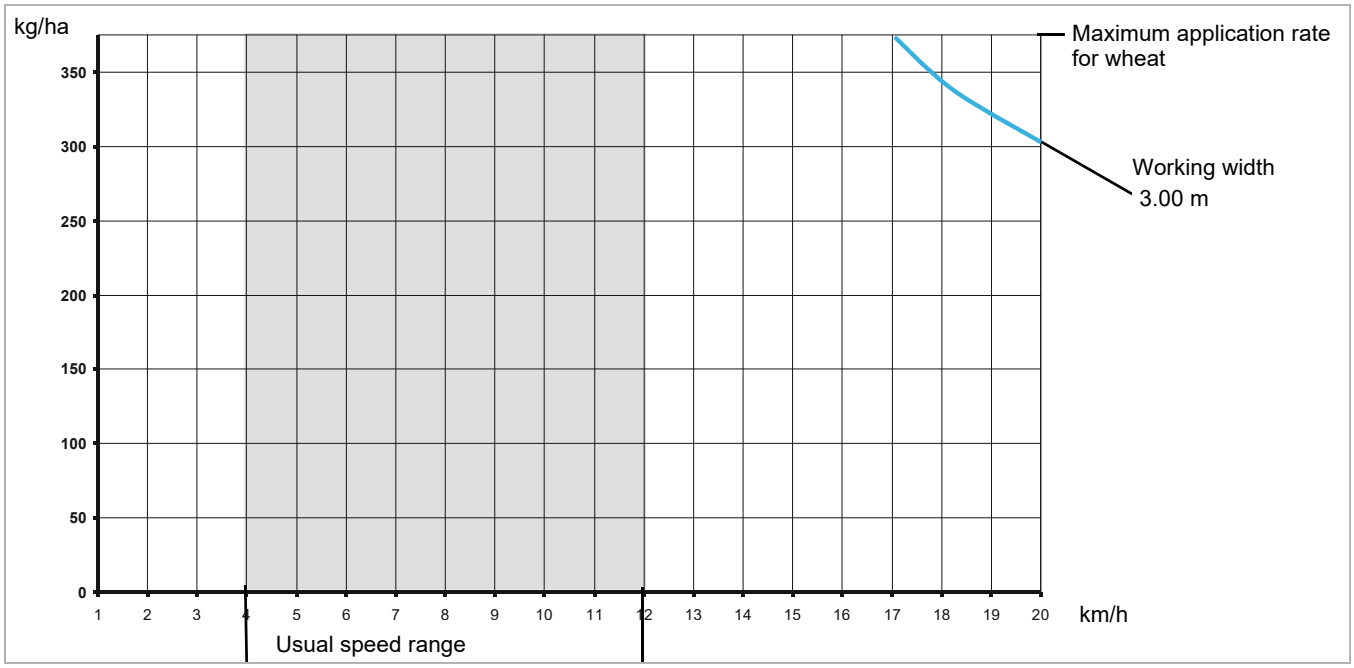
System 100, imperial



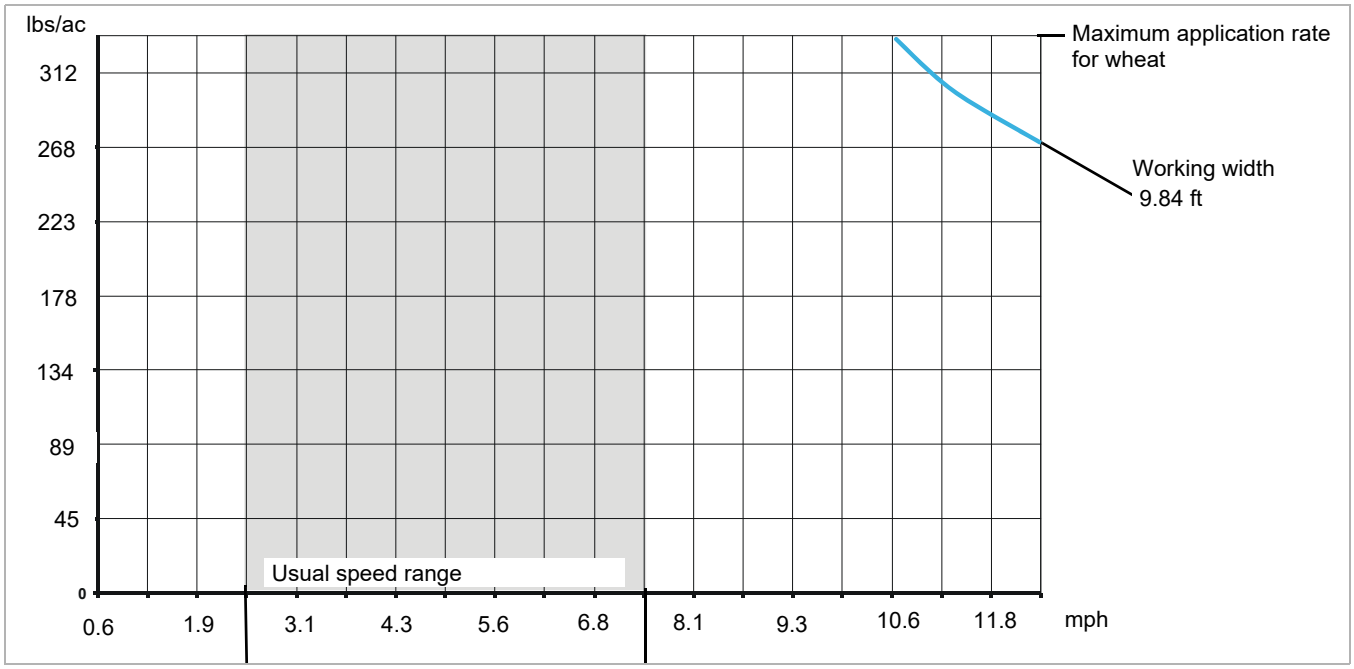
SH1650C and sowing

Only the areas to the left and below the curves can be achieved. Also observe the usual speeds here, which should not be considerably exceeded or dropped below.

System 100, metric

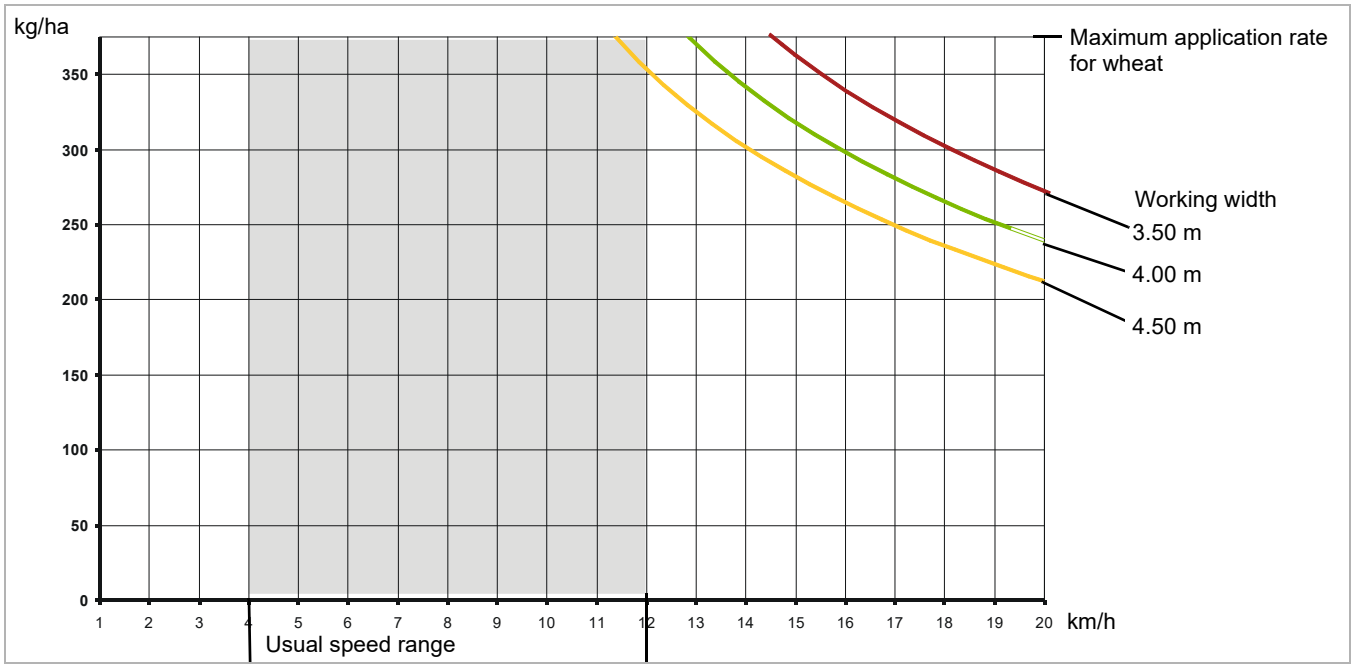


System 100, imperial

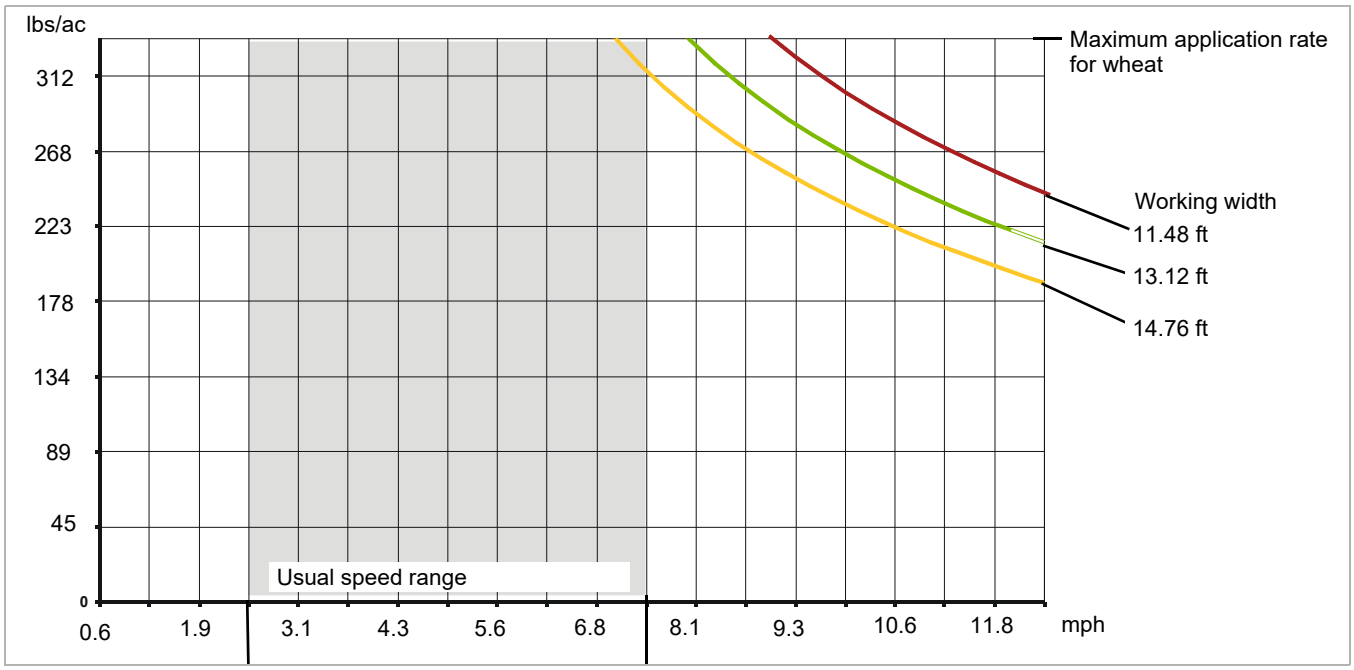


Application rate

System 135, metric



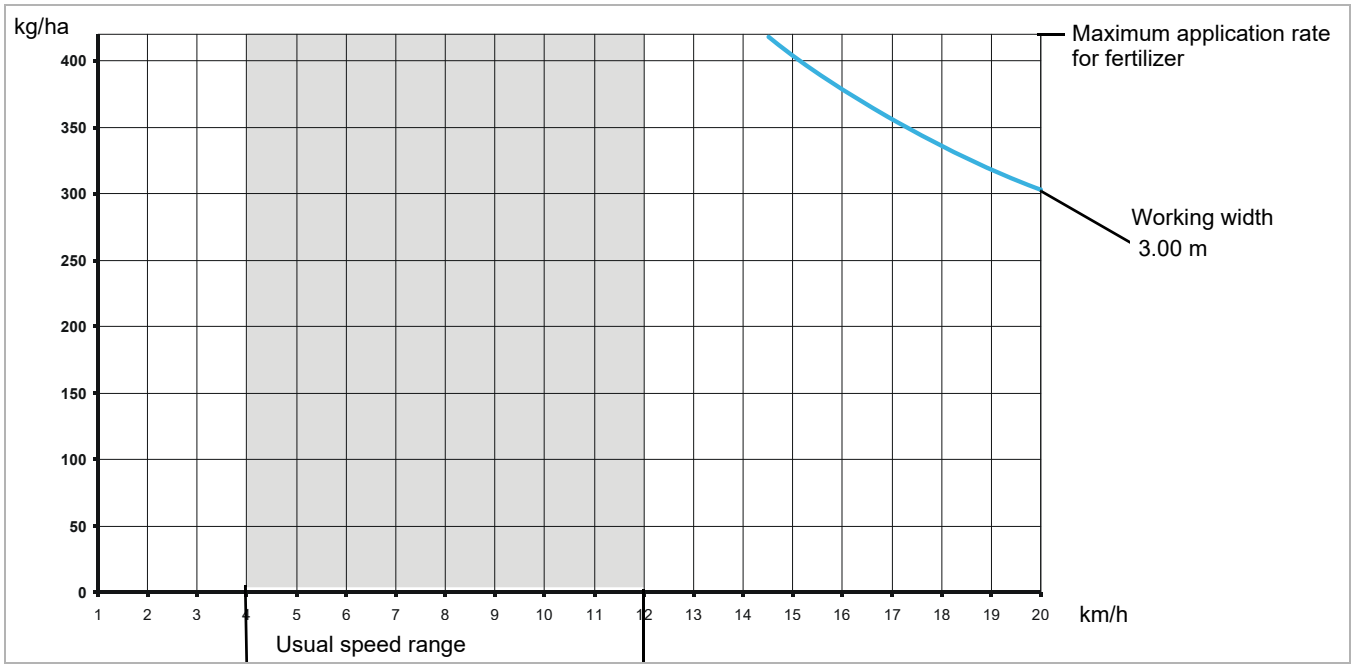
System 135, imperial



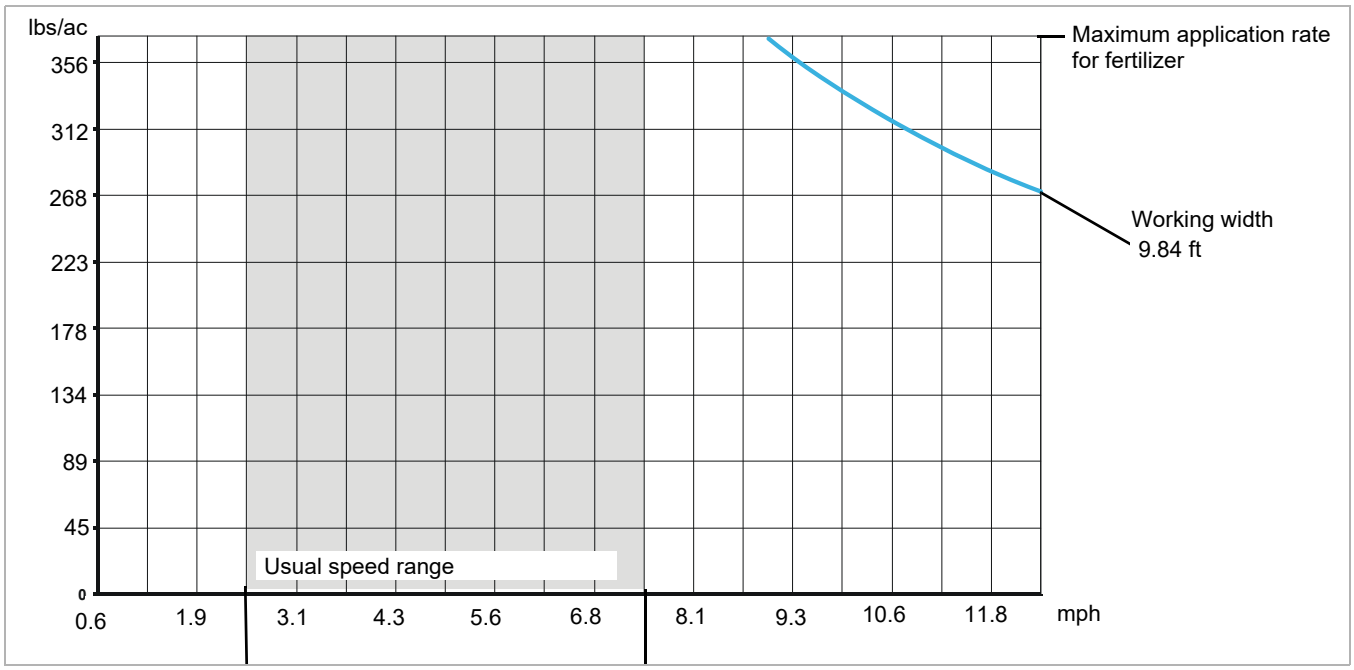
SH1650C and fertilizing

Only the areas to the left and below the curves can be achieved. Also observe the usual speeds here, which should not be considerably exceeded or dropped below.

System 100, metric

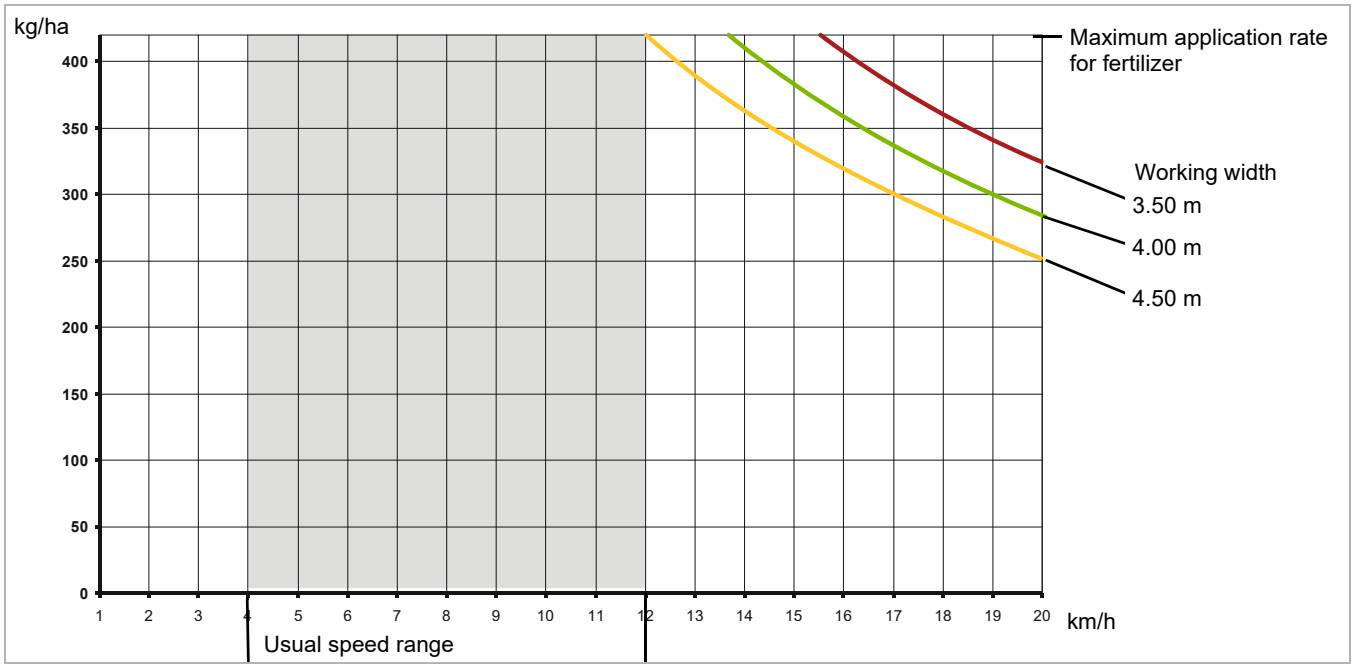


System 100, imperial

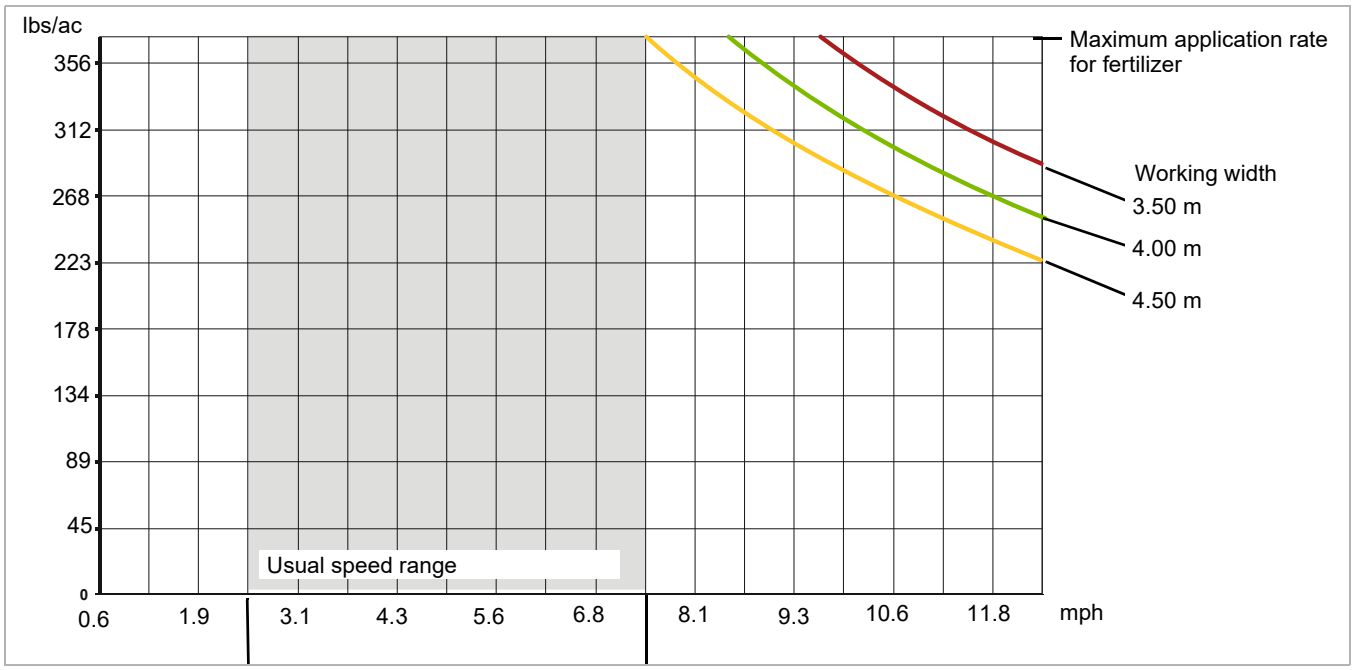


Application rate

System 135, metric



System 135, metric



Signus

All functions of Signus are described in a separate operating manual.
→ “Signus” operating manual

ESA software

All functions which are controlled via ESA software are described in a separate operating manual.
→ “ESA software” operating manual

Focus 2

→ “Focus 2” operating manual

IsoMatch Tellus

→ "IsoMatch Tellus" operating manual

The calibration test is usually performed on the farm.

WARNING

Machine in transport position
For the calibration test, the machine must be in the transport position and secured against rolling away by using chocks.
An unsecured machine can cause serious injury.

Checking the seed hopper
Check the seed hopper for foreign bodies.
Foreign bodies in the seed hopper can cause damage to the machine.

Determining the adjustment value

To determine the correct adjustment value, first specify whether the seeds are normal or fine:

- Normal seed: between 4 and 10 mm
- Fine seed: between 1.5 and 4 mm

If you intend to dress the seeds yourself, you must observe the dressing manufacturer's safety information.

Normal seed				Fine seeds	
Wheat	Barley	Corn	Peas	Grass	Clover
Rye	Oats	Beans	Lupines	Rape	
Triticale	Rice	Soybeans		Forage beet	

The table contains orientation values for a variety of normal and fine seeds, and for various amounts of seed per hectare. These values are for orientation purposes only because seed varies with respect to grain size and relative density. Determine the exact adjustment value for your seeds by means of a calibration test.
→ Chapter »Performing a calibration test«, page 69

Normal seed table, metric

	Wheat	Rye	Barley	Oats	Broad beans	Peas	Lupines	Sweet peas	Corn	Grass
Density, kg / l	0.77	0.74	0.68	0.5	0.85	0.81	0.76	0.83	0.79	0.36
Adjustment value	Normal seed [kg/ha] (red change-over switch points at the metering device)									
10 [+]	34	33	32	24	23	21	28	32	8	–
15 [+]	51	49	48	35	42	40	45	51	24	18
20 [+]	69	66	64	47	61	59	62	70	47	26
25 [+]	86	83	79	59	79	78	79	89	70	34
30	104	100	95	71	98	97	96	108	92	42
35	122	117	111	82	116	117	113	127	115	50
40	140	134	127	94	135	136	130	146	137	–
45	157	151	143	106	154	155	147	165	156	–
50	174	168	159	118	172	174	164	184	175	–
55	192	184	174	130	191	194	181	203	194	–
60	210	200	190	141	209	213	198	222	212	–
65	228	217	206	153	228	232	216	241	231	–
70	246	235	222	135	146	251	234	260	249	–
75	264	252	238	177	265	270	251	279	267	–
80	281	269	253	189	283	289	268	298	285	–
85	298	286	268	200	302	309	285	317	304	–
90	316	302	284	212	320	328	302	336	323	–
95	335	319	300	224	338	347	320	355	342	–
100	352	337	316	236	356	366	337	374	361	–
105	370	354	332	248	374	385	354	393	380	–
110	387	371	348	260	393	404	371	412	398	–

Recommendation: Switch on the micrometering system up to adjustment value 25. In most cases, this will allow the metering device to meter the seed more accurately. In this case, double the adjustment value specified on the metering device.

Normal seed table, imperial

	Wheat	Rye	Barley	Oats	Broad beans	Peas	Lupines	Sweet peas	Corn	Grass
Relative density [lbs/cu.in.]	0.028	0.027	0.025	0.018	0.031	0.029	0.027	0.030	0.029	0.013
Adjustment val-	Normal seed [lbs/ac] (red change-over switch points at the metering device)									
10 *	30	29	29	21	21	19	25	29	7	-
15 *	45	44	43	31	37	36	40	45	21	16
20 *	62	59	57	42	54	53	55	62	42	23
25 *	77	74	70	53	70	70	70	79	62	30
30	93	89	85	63	87	87	86	96	82	37
35	109	104	99	73	103	104	101	113	103	45
40	125	120	113	84	120	121	116	130	122	-
45	140	135	128	95	137	138	131	147	139	-
50	155	150	142	105	153	155	146	164	156	-
55	171	164	155	116	170	173	161	181	173	-
60	187	178	170	126	186	190	177	198	189	-
65	203	194	184	136	203	207	193	215	206	-
70	219	210	198	147	219	224	209	232	222	-
75	236	225	212	158	236	241	224	249	238	-
80	251	240	226	169	252	258	239	266	254	-
85	266	255	239	178	269	276	254	283	271	-
90	282	269	253	189	285	293	269	300	288	-
95	299	285	268	200	302	310	285	317	305	-
100	314	301	282	211	318	327	301	334	322	-
105	330	316	296	221	334	343	316	351	339	-
110	345	331	310	232	351	360	331	368	355	-

Recommendation: Switch on the micrometering system up to adjustment value 25. In most cases, this will allow the metering device to meter the seed more accurately. In this case, double the adjustment value specified on the metering device.

Fine seed table, metric

	Rape		Red clover		Grass		Forage beet	
Density, kg / l	0.65		0.77		0.39		0.70	
Adjustment value	Fine seed [kg/ha] (red change-over switch in the hexagonal shaft groove)							
2.5	2.20	1.10	2.30	1.15	–	–	2.50	1.25
5.0	4.60	2.30	5.30	2.65	–	–	5.00	2.50
7.5	6.80	3.40	8.60	4.30	2.80	1.40	7.50	3.75
10.0	9.10	4.55	12.00	6.00	5.20	2.60	10.00	5.00
12.5	11.40	5.70	15.30	7.65	7.20	3.60	12.50	6.25
15.0	13.70	6.85	18.00	9.00	9.20	4.60	15.00	7.50
17.5	15.90	7.95	21.30	10.65	11.20	5.60	17.50	8.75
20.0	18.20	9.10	24.00	12.00	13.20	6.60	20.00	10.00
22.5	20.50	10.25	26.60	13.30	15.00	7.50	21.50	10.75
25.0	22.80	11.40	27.50	13.75	16.20	8.10	23.00	11.50
	N	**M**	**N**	**M**	**N**	**M**	**N**	**M**
N = Normal seed, M = Micrometering system								

Fine seed table, imperial

	Rape		Red clover		Grass		Forage beet	
Relative density [lbs/cu.in.]	0.023		0.028		0.014		0.027	
Adjustment value	Fine seed [lbs/ac] (red change-over switch in the hexagonal shaft groove)							
2.5	1.96	0.98	2.05	1.03	–	–	2.23	1.12
5.0	4.60	2.05	4.73	2.36	–	–	4.46	2.23
7.5	6.08	3.03	7.67	3.84	2.50	1.25	6.69	3.35
10.0	8.12	4.06	10.71	5.35	4.64	2.32	8.92	4.46
12.5	10.17	5.09	13.65	6.82	6.42	3.21	11.15	5.58
15.0	12.22	6.11	16.06	8.03	8.21	4.10	13.38	6.69
17.5	14.18	7.09	19.00	9.50	9.99	5.00	15.61	7.81
20.0	16.24	8.12	21.41	10.71	11.78	5.89	17.84	8.92
22.5	18.29	9.14	23.73	11.87	13.38	6.69	19.18	9.59
25.0	20.34	10.17	24.53	12.27	14.45	7.23	20.52	10.26
	N	**M**	**N**	**M**	**N**	**M**	**N**	**M**
N = Normal seed, M = Micrometering system								

Dressed seeds

WARNING

Dressing only in accordance with manufacturer's instructions
Dress seeds only in accordance with the manufacturer's instructions and observe all relevant safety precautions when dressing and handling dressed seeds.
Never dress seeds:

- In the machine
- By hand
- When filling the seed hopper

Failure to observe the manufacturer's instructions may endanger your health.

For fine seeds, please note:
Glutinous dressing agents can have a negative influence on metering accuracy.

Fertilizer table, metric

This table lists the values for diamon phosphate and is intended as a reference. You can add your own information regarding other types of fertilizer to the table. The calibration test is carried out in exactly the same way as for normal seed.

Adjustment value	Diamon phosphate 1.03 kg/dm3 [kg/ha] Regulating flap to “N”	Your own data
10	39	
15	58	
20	77	
25	97	
30	116	
35	135	
40	155	
45	174	
50	193	
55	213	
60	232	
65	251	
70	270	
75	290	
80	309	
85	328	
90	348	
95	367	
100	386	
105	406	
110	425	

Fertilizer table, imperial

This table lists the values for diamon phosphate and is intended as a reference. You can add your own information regarding other types of fertilizer to the table. The calibration test is carried out in exactly the same way as for normal seed.

Adjustment value	Diamon phosphate 0.037 lbs/cu.in. [lbs/ac] Regulating flap to "N"	Your own data
10	35	
15	52	
20	69	
25	87	
30	103	
35	120	
40	138	
45	155	
50	172	
55	190	
60	207	
65	224	
70	241	
75	259	
80	276	
85	293	
90	310	
95	327	
100	344	
105	362	
110	379	

Fill with seed



Observe maximum fill level
The maximum fill height depends on the filling material. The maximum fill level must always be observed.
If overfilled, the metering device will be overloaded. Or, the filling material will be so heavily compacted that it cannot flow smoothly through.

Seed filling takes place in the field.

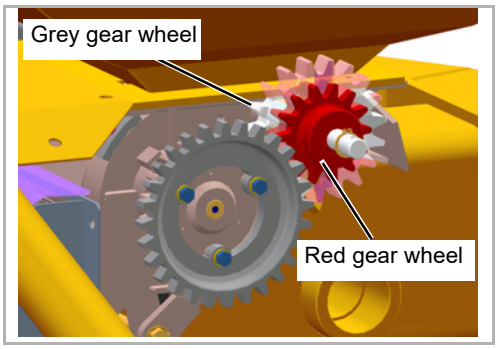
For the subsequent calibration test, it is sufficient to add enough seed by hand to cover the hopper low level sensor to a depth of at least 3 cm.

Micrometering system

The micrometering system allows for the application of fine seed and small amounts of seed per ha. The factory-defined default value for the micrometering system is “ON”.

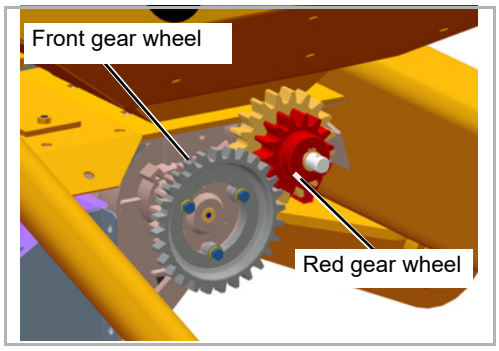
When inserted or pulled out, the gear wheels must align so that the red gear wheel can be easily pushed in or pulled out.

Switch off the micrometering system



- Push the red gear wheel into the gray gear wheel behind it until they mesh

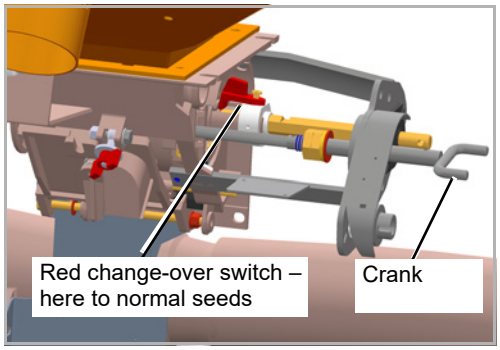
Switching on the micrometering system



- Pull the red gear wheel out until it meshes with the front gear wheel on the left

Normal seed

The “normal seed” setting is designed for seeds such as cereals, peas or beans. Small seed, such as grass or clover, cannot be sown with this setting. For these smaller seeds, select the “fine seed” setting.

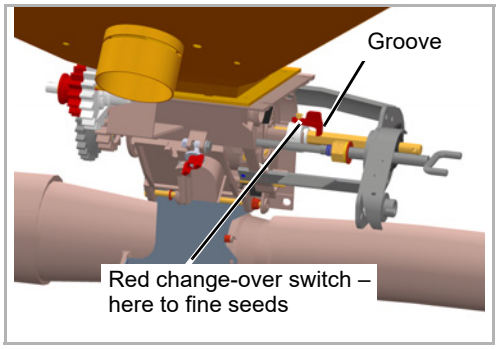


- Set the red change-over switch on the metering device to “normal seed”:

Normal seed	=	Red change-over switch points towards the metering device

Fine seed

The “fine seed” setting is designed for seeds such as grass or clover. Larger seed, such as cereals, peas or beans, cannot be sown with this setting. For these seeds, select the “normal seed” setting.



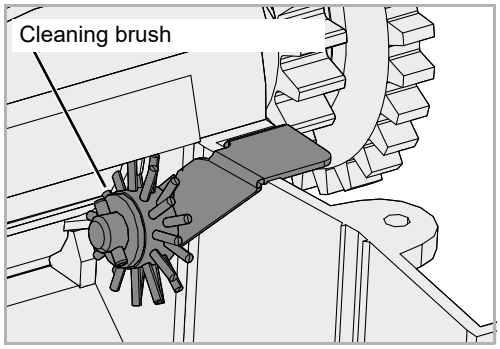
- Now set the red change-over switch on the metering device to “fine seed”:

Fine seed	=	Red change-over switch must engage in the hexagonal shaft groove on the metering device

Cleaning brush

Cleaning brush for rape
Only use the cleaning brush when seeding rape.
If it is used when seeding cereals, the wrong amount of seed may be metered.

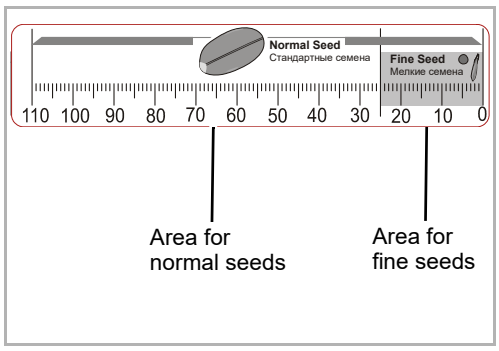
Fit a cleaning brush to each of the metering devices when seeding rape.



- Fit the cleaning brush

Cell width

The cell width adjusts the quantity of seed released per revolution of the metering device.

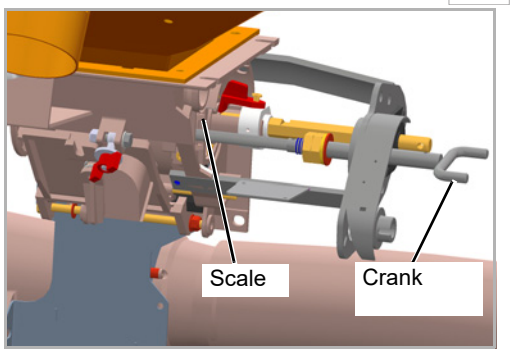


A scale from 0 – 110 can be seen on the metering device.

Signus
To make the setting, you will need the correct adjustment value from the tables for normal seed, fine seed or fertilizer.
→ Pages 59, 61 and 63

ESA software
To make this setting, you will need the correct adjustment value from the ESA software or from the normal seed, fine seed or fertilizer tables.
→ Pages 59, 61 and 63

The maximum cell width of 110 mm must not be exceeded.



- Using the crank, set the adjustment value for the desired seed type. Turn until the desired adjustment value appears at the edge of the housing

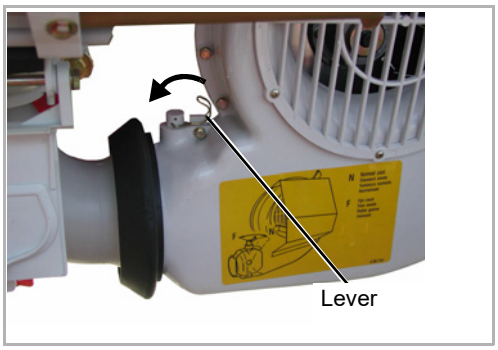
Regulating flap

Different regulating flaps are fitted to the fan on SH1150 and SH1650.

SH1150

The regulating flap on the fan regulates the airflow for the seed. Check the adjustment. The fan must still be set for “normal seed”. In the “fine seed” setting, the air stream is not sufficient for the delivery tube, even for fine seed.

The picture shows the “normal seed” setting.

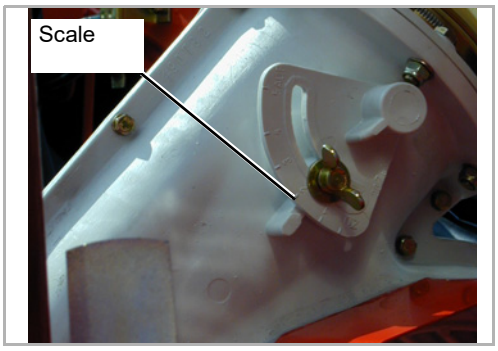


▸ Check the “normal seed” setting

SH1650

The regulating flap on the fan regulates the airflow for the seed. The default setting is “ON”. For fine seed like rape or grass check in the field whether any seed has been blown out of the seed furrow. If so, continue to close the regulating flap in small increments.

Ensure that you do not close the regulating flap too far to prevent clogging the seed delivery hoses.

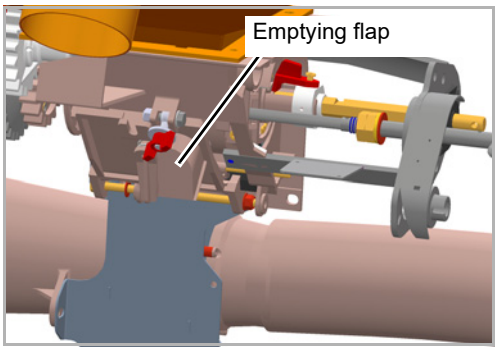


▸ Now set the regulating flap on the fan with the aid of the scale

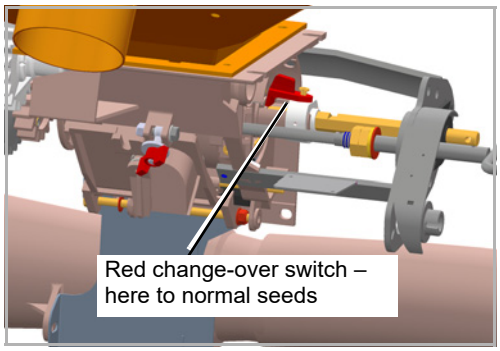
- CLOSED = 1
- OPEN = 5

Performing a calibration test

Prerequisites for performing the calibration test:

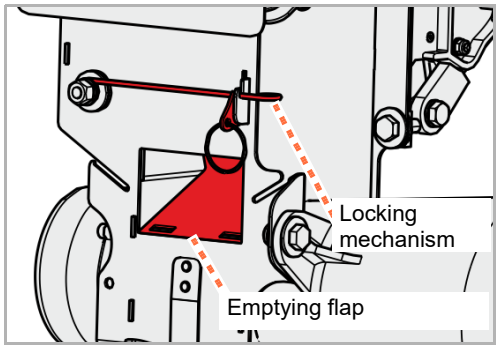


- Close the emptying flaps on all metering devices



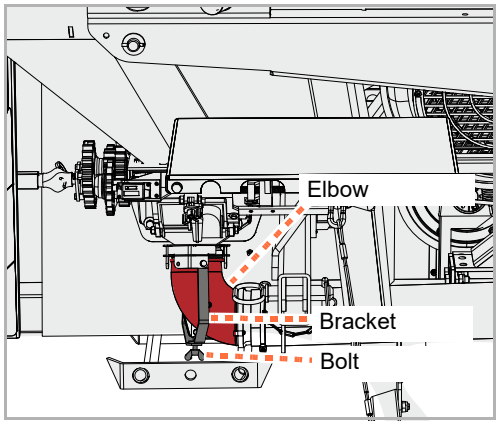
- Place the red change-over switch in the “Fine” or “Normal” seed position

SH1150



- Open the locking mechanism for the emptying flap
- Swivel in the emptying flap
- Place a catch pan under the metering device

The catch pan must be large enough to hold the calibrated amount of seed.



SH1650

The calibration test is performed with both metering devices simultaneously.

- Release the bolt on both metering devices, fold down the bracket at the sides and remove the elbow
- Place a catch pan under each metering device

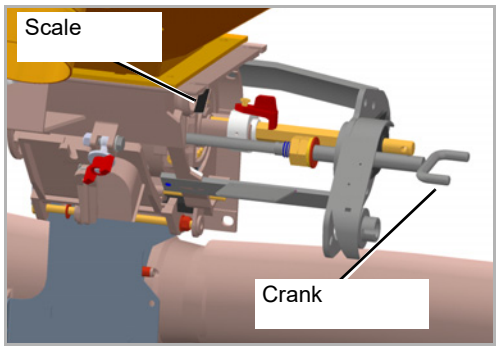
The catch pans must be large enough to hold the amount of seed generated during calibration.

- Read the adjustment value for normal seed, fine seed or fertilizer from the table. Or read the value using the electronic control system on the terminal.

→ »Preparation work« Section »Determining the adjustment value«, page 58

For example, the adjustment value in the table is 50.

There must be no seed or fertilizer in the metering device if you are decreasing the cell width.



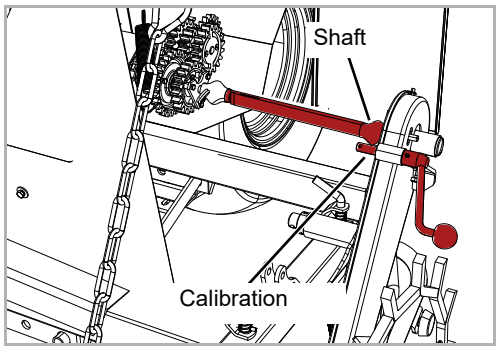
- Using the crank, set this value at the existing metering devices. Adjusting to this value changes the metering device cell width.

- Add sufficient seed to the seed hopper for the calibration test.

Hopper low level sensor [+]

The hopper low level sensor in the seed hopper must be covered by at least 3 cm of seed or the alarm for the hopper low level sensor must be switched off.

Mechanical drive



- Pull off the shaft and fit onto the calibration handle. Secure the shaft with a cotter pin.

The seeding machine is now ready for the calibration test. Perform the calibration test according to the machine settings for normal or micrometering.

Calibration test without electronic control system

- Set the metering device to normal metering or micrometering, as required

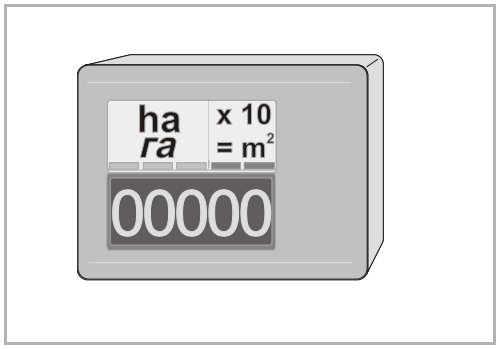
→ Chapter »Preparation work«, section »Micrometering system«, page 65

Completely fill the cells of the metering device:

- Carry out two revolutions with the calibration handle on the metering device
- Empty the catch pan

Hectare meter

- Set the hectarmeter to “0”



Normal metering

For normal metering, the calibration test is performed for 0.10 ha (0.20 ac).

- Carry out 85 revolutions with the calibration handle mounted on the metering device

Select the calibration speed with the calibration handle so that it corresponds approximately to the later driving speed, with a maximum of 1 revolution per second.

Micrometering system

For micrometering, the calibration test is performed for 0.10 ha (0.20 ac).

- Carry out 85 revolutions with the calibration handle mounted on the metering device

Select the calibration speed with the calibration handle so that it corresponds approximately to the later driving speed, with a maximum of 1 revolution per second.

Hectare meter

Counting the revolutions is the recommended procedure. If you want to use a hectarmeter for checking, you can see the following values on the hectarmeter after 85 revolutions for a surface of 0.10 ha (0.20 ac):

Machine	Hectarmeter display	Corresponds to ha (ac)
SH1150	100	0.10 (0.20)
SH1650 Two distributors for the total working width, seed or fertilizer	50	0.10 (0.20)
SH1650C, seed and fertilizer	100	0.10 (0.20)

Calibration test with Signus

The metering device cells must be filled first.

- Carry out two revolutions with the calibration handle on the metering device
- Empty the catch pan
- If a hectarmeter is installed, set it to “0”
- Set the metering device to normal metering or micrometering, as required

→ Chapter »Preparation work«, section »Micrometering system«, page 65

Normal metering

For normal metering, the calibration test is performed for 0.10 ha (0.20 ac).



- Making adjustments at the terminal

→ “Signus” operating manual

- Carry out 85 revolutions with the calibration handle mounted on the metering device

With metering device monitoring: an alarm will sound after 85 revolutions.



Select the speed at calibrating with the calibration handle to fit the later driving speed.

Micrometering system

For micrometering, the calibration test is performed for 0.10 ha (0.20 ac).



- Making adjustments at the terminal

→ "Signus" operating manual

- Carry out 85 revolutions with the calibration handle mounted on the metering device

With metering device monitoring:
An alarm will sound after 84 revolutions.

- Continue for one additional revolution



Select the calibration speed with the calibration handle so that it corresponds approximately to the later driving speed, with a maximum of 1 revolution per second.

Calibration test with ESA software

Normal metering and micrometering

For normal metering and micrometering, the calibration test is performed for 0.10 ha (0.20 ac).

→ "ESA software" operating manual



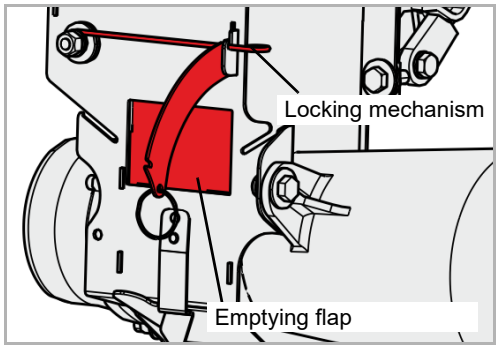
The speed is controlled from the terminal.

Evaluating the calibration test

- The calibrated amount of seed corresponds to the seeding for 0.10 ha (0.25 ac)
- For seed amounts of up to approx. 100 kg/ha (89.21 lbs/ac), we recommend performing the calibration test with 0.10 ha (0.25 ac), for higher seed amounts with 0.05 ha (0.12 ac). At 0.05 ha (0.12 ac), halve the number of revolutions.
- The amount of calibrated seed does not necessarily correspond to the amount specified in the table. One reason for this might be, e.g., a different thousand grain weight.

SH1150

Close emptying flap
If the emptying flap is not closed, it will result in the seed falling directly onto the ground during sowing and not being passed to the seed coulters.
The seed will not be distributed correctly and large amounts will be wasted.



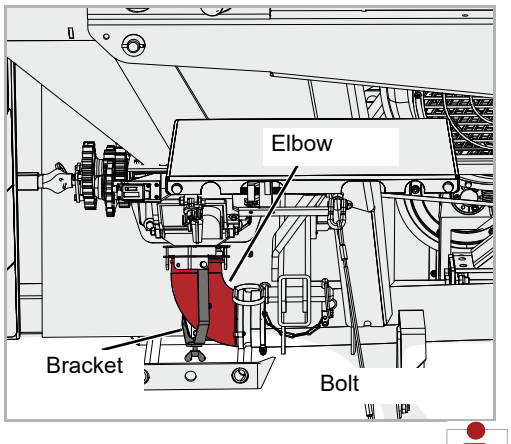
- Open the locking mechanism
- Close emptying flap
- Place a catch pan under the metering device

The catch pan must be large enough to hold the calibrated amount of seed.

- Weigh the seed from the catch pan

SH1650

Connecting the elbow
If the elbow is not connected, this will result in the seed falling directly onto the ground during sowing and not being passed to the seed coulters.
The seed will not be distributed correctly and large amounts will be wasted.



- Fit the elbow on both metering devices and secure with the bracket
- Secure the bracket with the bolt
- Place a catch pan under each metering device

The catch pans must be large enough to hold the amount of seed generated during calibration.

Seed only

- Combine the seed from both metering devices and weigh it

Seed and fertilizer

- Weigh the seed and fertilizer separately

Separate weighing is also required when each metering device is metering another seed.

Different amounts of seed

- Convert the difference to the amount of seed in the table into percent
- Correct the adjustment value at the metering device up or down by this percentage. When doing this, ensure there is no seed in the metering device if you are decreasing the cell width.

Some preparations are required prior to use in the field:

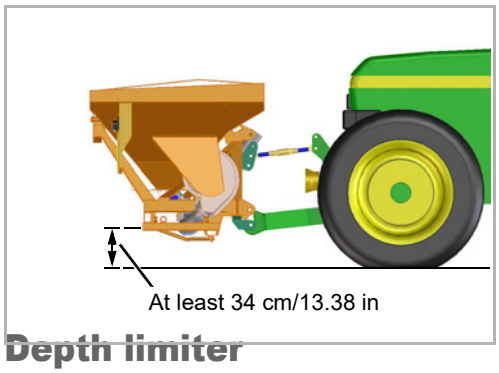
- Setting working depth
- Check the rolling direction of the front PTO
- Setting the metering device
- Performing a calibration test

Prerequisites for the preparation work:

- The machine is coupled to the tractor
- The hydraulic system is connected and ready
- The machine is secured and lowered to its work position

Working depth

In the field, the machine must have a ground clearance of at least 34 cm (13.38 in).



▸ Set the machine to a ground clearance of at least 34 cm (13.38 in)

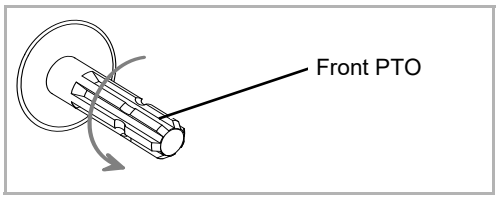
Depth limiter

In order to prevent accidentally lowering the machine further, a depth limiter has to be provided. This could be a chain, for example, which limits the lowering of the front power lift.

Ensure that the coupling triangle is vertical in your selected lower position. It can be adjusted with the top link.

Direction of rotation of the front PTO stub shaft

If the machine is not fitted with a mechanical fan drive, you have to check the rolling direction of the front PTO. Looking at the tractor straight from the front, the front PTO has to turn counter clockwise.



If the front PTO stub shaft turns clockwise, contact your dealer to replace the drive wheel assembly at the front hopper with an appropriate drive unit.

Metering device

The following settings can be made for metering device:

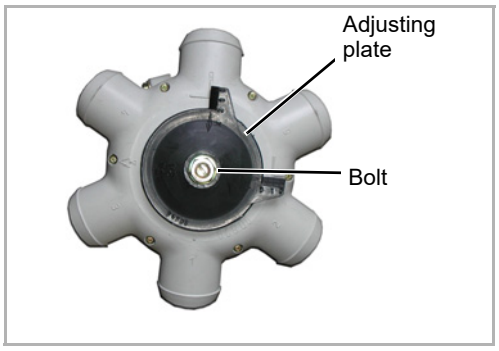
- The adjustment value (from the electronic control system or the table)
- The micrometering system (“ON” or “OFF”)
- The cell width, and
- The change-over switch (to normal seed or fine seed)

→ Chapter »Calibration test«, from page 58

Checking the application rate (fertilizer)

If the machine is used for the application of fertilizer, the application rate and the distribution have to be checked. The application rate should be equal for each fertilizer coulter. Check by placing a catch pan underneath each fertilizer coulter and performing a calibration test.

If there are differences in the application rate of the fertilizer coulters:



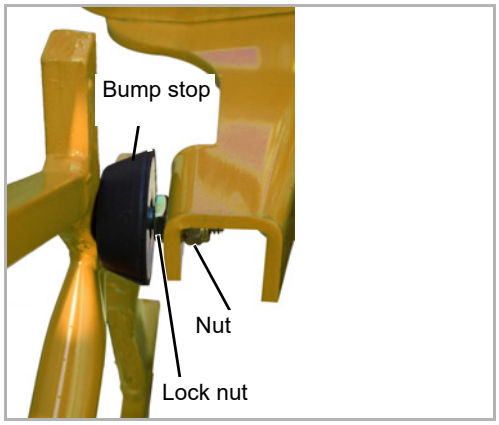
- Release the bolt on the fertilizer distribution head
- Move the adjusting plate towards the outlets of those fertilizer coulters that discharge the largest amount of fertilizer
- Tighten bolt
- Repeat calibration test and, if necessary, correct the setting of the adjusting plate again

Drive wheel

Brake

The brake for the drive wheel prevents the drive wheels from continuing to run when the front hopper is running, e.g., at headlands. This stops seed or fertilizer from being discharged unintentionally.

Braking force



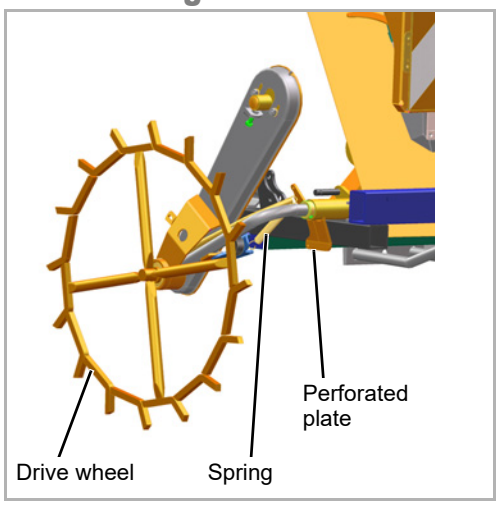
Set the brake bump stop on the drive wheel as required.

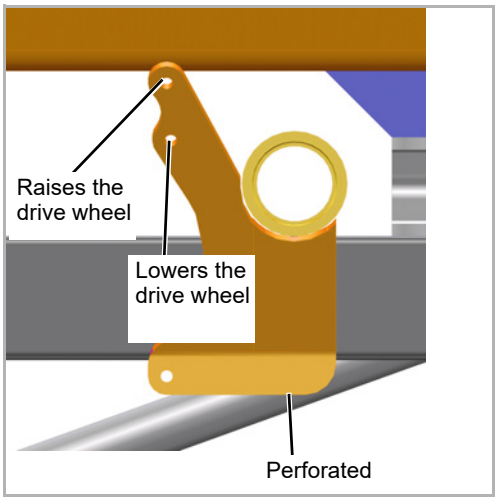
- Release the nuts and lock nuts
- Set the bump stop so that the drive wheel is blocked against the lifted machine
- Tighten the nuts and lock nuts

Depth

It may be necessary to set the drive wheel lower or higher depending on the soil conditions.

Without hydraulic drive wheel lifting

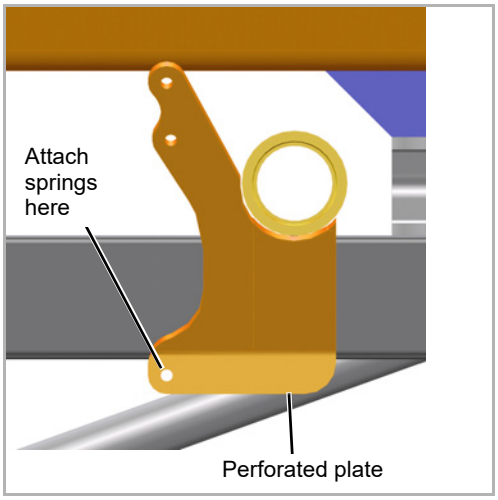




- Reposition the spring as desired

With hydraulic drive wheel lifting [+]

No setting is necessary with hydraulic drive wheel lifting. The springs must be attached in the bottom position on the perforated plate.

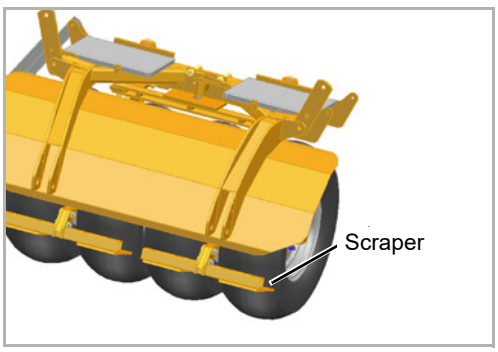


- Check the position of the springs

Wheel packer [+]

Scraper

The scraper prevents the tires becoming clogged with soil.



- Adjust the scraper so that a distance of about 1 cm (0.39 in) remains between the scraper and the tires. Set all scrapers to the same position.

Safety

Before transporting the machine on public roads, read the following safety information. Compliance will help you to avoid accidents.

General

Ensure that the condition of the machine conforms to traffic regulations
The machine must conform to current road traffic regulations if you intend to drive with it on public roads. This includes, for example:

- Lighting, warning and protective devices must be fitted
- The permissible transport width and weight, axle loads, tire load-bearing capacity and total weights are observed

The driver and owner of the vehicle are liable if road traffic regulations are not observed.

Before road transport

⚠ WARNING

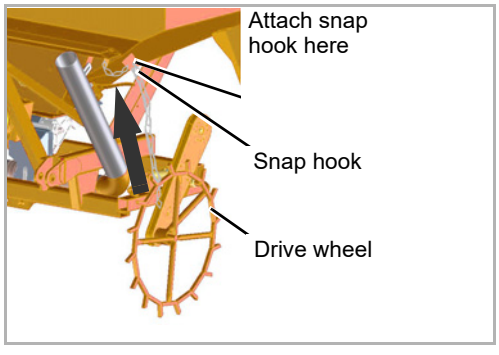
Remove soiling
Remove debris, stones, or clods of earth.
During road transport, these foreign bodies can fall off the machine and cause accidents.

Check locking mechanisms
Check all locks for secure seating. Loose locking mechanisms can open during road transport and cause unexpected machine reactions.
This can result in damage to the machine or accidents.

Attach lighting equipment
Attach the lighting equipment or warning signs. All turn indicators and side lights must be clearly visible.
If turn indicators or boundary lights are not visible, accidents may result.

Drive wheel

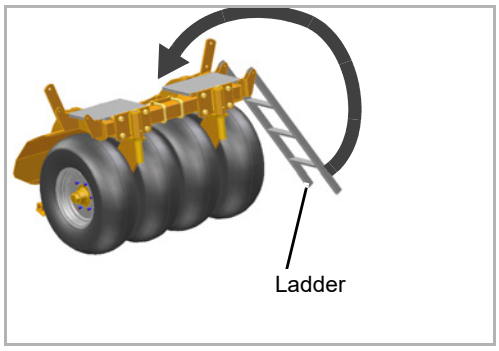
The drive wheel must be set to the transport position when driving on the road.



- Lift drive wheel and attach snap hook. Ensure that the snap hook is securely engaged.

Wheel packer [+]

Ladder



During road travel, the ladder must be folded in.

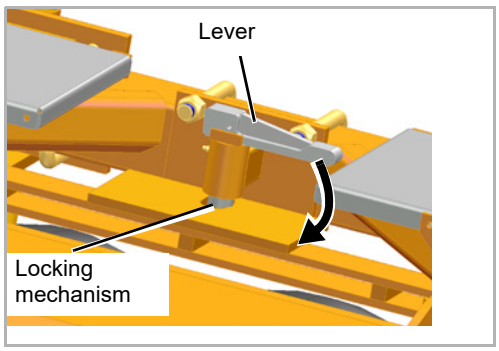
- Folding the ladder

Locking mechanism

During road travel, the lock must be locked.

WARNING

Checking the locking mechanism
During road travel, the wheel packer must be locked and lifted.
If the wheel packers are not lifted or not locked, this can make the steering hard to control. This can result in accidents.



- Push the lever down and the check that the wheel packer is securely locked

Road transport

DANGER

Ensure clear visibility
Check the immediate vicinity before driving off. Always make sure that you have a clear field of vision and, in particular, look out for children within the operating area of the machine.
Persons who could be struck when the machine starts up can be seriously or fatally injured.

Check before road transport
Before road transport, check that the following conditions are met:

- The folding ladder is folded in and secured
- The lighting equipment is installed and operational
- Emptying flaps are closed

All conditions must be met before beginning a journey.
Failure to observe these instructions can result in damage to the machine and accidents.

Lock the control units
Lock all control units on the tractor when driving and close the shut-off valves on the hydraulic couplings.
Accidentally actuated control units can cause accidents.

Riding on the machine is strictly prohibited
Never transport persons or objects on the machine.
Riding on the machine is life-threatening and strictly prohibited.

Only drive with an empty seed hopper
Road transport should only be undertaken with an empty seed hopper.
A seed hopper which is not empty influences the driving performance of the machine and can cause accidents when driving on roads.

Adapted driving speed
Always adapt the driving speed to the ambient conditions. Extremely large forces may result under poor road conditions and excessively high speeds and these will severely load or overload the tractor and machine.
Driving without adapting your speed can cause damage to the machine and accidents.

No sudden load changes
Avoid sudden load changes. Sudden load changes result from sudden movements to the right or left.
Sudden load changes can cause accidents.

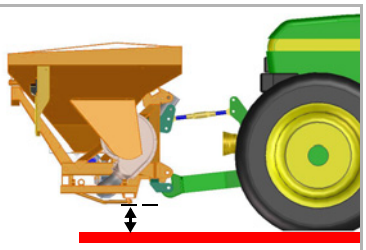
Depending on country-specific road traffic law and impeded line of sight due to the front hopper, a second person may be required to guide the driver.

Transport position

If the machine is in the work position, you must raise the machine and move it to the transport position.

The distance to level ground at the point of the machine closest to the ground must not be greater or less than the following values:

Minimum distance	40 cm (15.75 in)
Maximum distance	60 cm (23.62 in)



Minimum 40 cm (15.75 in)
Maximum 60 cm (23.62 in)

Checking

Before traveling on the road, check the following:

☑ Are the stop valves on the hydraulic couplings closed (if present)?

☑ Are all tools folded in?

☑ Has lighting equipment been fitted?

☑ Is the emptying flap closed?

☑ Are the control units on the tractor protected against accidental actuation?

Working depth

The working depth is set at the front power lift. Please note:

- The minimum ground clearance must be at least 34 cm (13.38 in)

→ Chapter »Preparation work«, section »Working depth«, page 75

- To ensure that the minimum ground clearance is adhered to, chains should be used to secure the front power lifts against further lowering
- At the desired working depth, the coupling triangle has to be vertical

Filling

Remove seed
Remove all seed residue from the hopper when changing seed types.
Remaining seed can contaminate the new seed.

Close the emptying flap
The emptying flap on the metering device must be closed before filling the hopper with seed.
An emptying flap, which is open during filling, cannot be closed again until the hopper is completely empty.

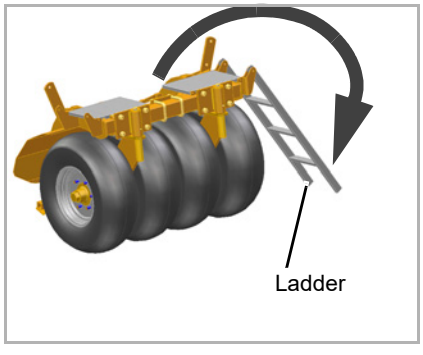
Wheel packer [+]

Ladder

When using the platform, the ladder must be folded out.

WARNING

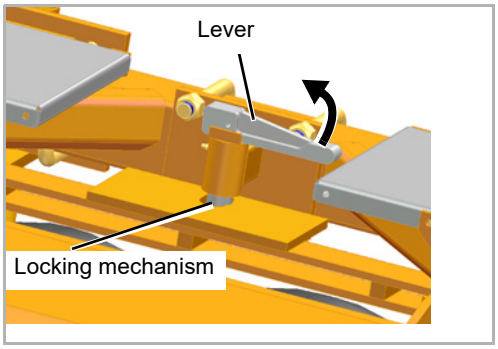
Wheel packer roller on the ground
For the ladder to be used, the wheel packer and the folded out ladder must be in contact with the ground.
Using the ladder without the wheel packer and the folded out ladder in contact with the ground can cause injuries due to falling.



▸ Folding out the ladder

After filling, fold the ladder back in.

Locking mechanism



For work in the field, the locking mechanism must be released.

- Push the lever up and the check that the wheel packer is securely released

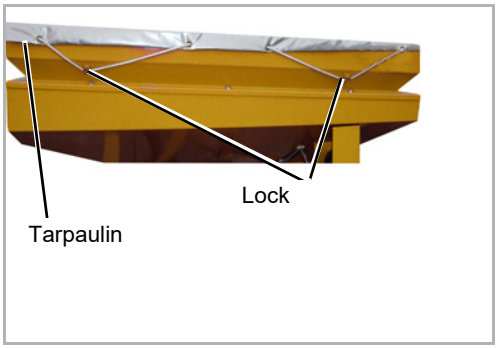
Changing seed types

Before adding a different seed type to the seed hopper, remove all old seed residue from:

- Seed hopper
- Metering device

→ Chapter »Operation«, section »After sowing or fertilizer spreading«

Filling



The seed hopper is protected with a tarpaulin.

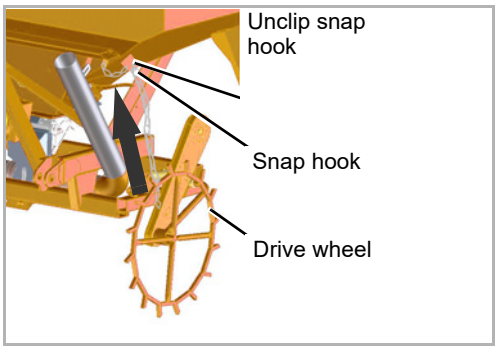
- Release the tarpaulin lock
- Check seed or fertilizer hopper for foreign bodies and remove foreign bodies
- Fold the tarpaulin back
- Fill the seed or fertilizer hopper as usual

Maximum fill level		
For cereals or fertilizer	=	Top edge of the seed hopper
For rape or grass seed	=	To the removable sieve

After filling

- Close the tarpaulin and fasten to the seed or fertilizer hopper

Drive wheel



In the transport position, the drive wheel is secured with a snap hook.

- Lift drive wheel and unclip snap hook

The chain remains tensioned with a spring and does not need to be removed while working.

Inspection tasks

Carry out the inspection using the checklist:

Work position

- ☑ Is the wheel packer unlocked?
- ☑ Is the drive wheel in the work position?
- ☑ Are the stop valves on the hydraulic couplings open (if present)?
- ☑ Are the control units on the tractor released?

Settings

- ☑ Does the electronic control system, e.g., Signus or IsoMatch Tellus/Focus 2, operate perfectly?
- ☑ Are all counters of the electronic control system reset to “Zero” prior to first use?
- ☑ Is the correct tramline rhythm set?
- ☑ Is the regulating flap set correctly?
- ☑ Is the micrometering system correctly switched?
- ☑ For rapeseed: Is the cleaning brush OK?
- ☑ Is the correct seed value set?
- ☑ Is the emptying flap closed?

SH1150

- ☑ Is the emptying flap closed?

SH1650

- ☑ Is the elbow connected?

Test drive

DANGER

Riding on the machine is strictly prohibited
Never transport persons or objects on the machine.
Riding on the machine is life-threatening and strictly prohibited.

Check the immediate vicinity
Before driving off, folding out, and operating the machine, check its immediate vicinity. Ensure sufficient visibility. Do not begin work until the immediate vicinity is cleared of any persons or objects.
Any use of the machine without first checking the immediate vicinity can cause accidents.

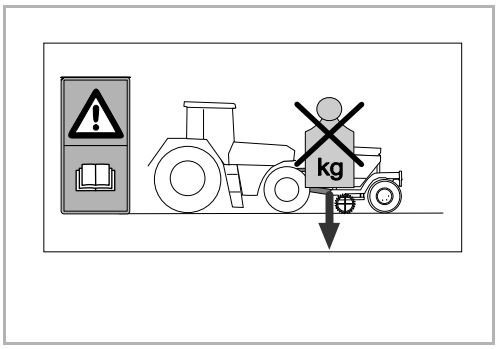
First perform the test drive over a typical section of the field without sowing. The headland or areas with obstacles are not suited for the test drive.

Lower the machine to its work position

- Lower the machine to its work position. Do not let it fall below a ground clearance of 34 cm (13.38 in).

Wheel packer [+]

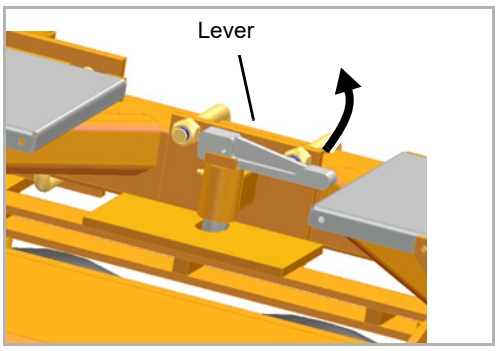
No additional load
The front hydraulics of the tractor must not put an additional load on the front hopper with wheel packers.
An additional load can severely damage the machine.



Releasing the locking mechanism

When working in the field, the lock must be released.

- Pull the lever upwards



DANGER

Do not remove the protective devices
The protective devices must not be removed or bypassed. Check all protective devices before starting the machine.
Unprotected machine components can cause severe or fatal accidents.

Riding on the machine is strictly prohibited
Never transport persons or objects on the machine.
Riding on the machine is life-threatening and strictly prohibited.

Check the immediate vicinity
Before driving off, folding out, and operating the machine, check its immediate vicinity. Ensure sufficient visibility. Do not begin work until the immediate vicinity is cleared of any persons or objects.
Any use of the machine without first checking the immediate vicinity can cause accidents.

Height of machine and overhead power lines
If a height of 4.00 m is exceeded when folding the machine in and out, the machine must not be folded in the vicinity of conducting overhead power lines! Danger of electrocution!
Should the machine come into contact with a live overhead power line:

- Do not attempt to exit the tractor cabin
- Do not touch any metal parts on the tractor
- Ensure that there is no conductive contact with the ground
- Warn all persons in the area not to approach the tractor or the machine
- Wait for help from professional emergency service personnel as power in the overhead line must first be switched off

Never climb onto the machine beneath live overhead power lines.
The supply voltage can jump across and cause electrocution even if the lines are not actually touching the machine.

Sowing with sowing unit

Switch on the alarm for fan speed

- When sowing using the ESA software, always switch on the “RPM” alarm.

Otherwise, the metering device may start while the fan drive is switched off.

- When sowing with the Signus, always leave the Signus switched on during sowing, otherwise no alarms can be generated.

Adjustments and tasks performed with the aid of Signus are described in detail in the relevant chapters, as are the calibration test and the calculation and setting of the tramline rhythm.

For ESA software:
→ “ESA software” operating manual

During sowing, access the required information from the electronic control system.

Always check the electronic control system input values before starting to sow.

Work position and cultivation

- Move the machine to its work position
- Switch on the electronic control system
- Lower the track marker on the correct side
- Switch on the fan
- Begin sowing

Signus/ESA software
→ “ESA” operating manual
→ “Signus” operating manual

Working speed

During sowing, monitor the working speed. The possible working speed within the range of 5 – 12 km/h (3.1 – 7.44 mph) depends on the soil type, the soil preparation and the desired application rate.

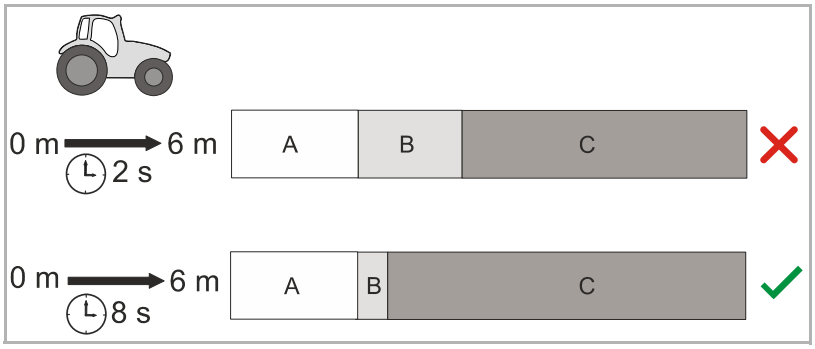
Where the soil is loose and the working speed is too high, the front sowing units can easily be covered by too much soil by the rear coulters. Drive a bit slower or decrease the coulter pressure.

Turning

The machine is lifted before the turning procedure.

- Throttle the engine back just before reaching the field edge and raise the seeding machine while still driving.
- After the turn, lower the front hopper approximately 2 m (6.56 ft) ahead of where you want to start sowing.
- Drive off slowly, otherwise the seed will be spread with a delay and at a lower rate, because it takes around three seconds for the seed to pass from the metering device to the seed coulter.

After turning, increase speed slowly
In the event of excessive acceleration after turning, the seed will be spread with a delay and at a lower rate. This will result in surfaces with a minimal seeding rate.
Failure to observe leads to poor work results



- A: Headland
- B: Surface with minimal seeding rate
- C: Correct seeding

Electronic control system
At the headland, the electronic control system automatically switches one sequence further when the track marker is activated.
Following an interruption in the voltage, always check the displayed trip in the tramline rhythm and correct if necessary. Depending on the type of tractor, the tractor may accidentally advance the tramline rhythm when switched on.

Inspection tasks during sowing

During sowing, use the checklist to examine the following:

☑ Does the fan speed remain constant during sowing?

Periodically climb down and check the following:

☑ For rape:
Is the seed flow still OK?

☑ Is the cleaning brush working properly?

☑ Because of the tendency of glutinous seed to bridge:
Is the seed flow still OK?

Inspection tasks during fertilizing

During fertilizing, use the checklist to examine the following:

☑ Does the fan speed remain constant during fertilizer spreading?

Periodically climb down and check the following:
☑ Does the fertilizer run freely through the hoses?

After sowing or fertilizer spreading

After sowing or fertilizer spreading:

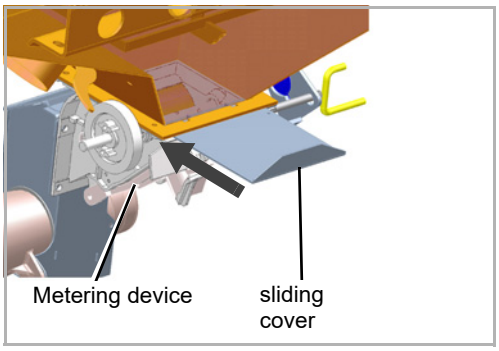
- Park the machine
- Empty the seed or fertilizer hopper
- Empty the metering device

Park the machine

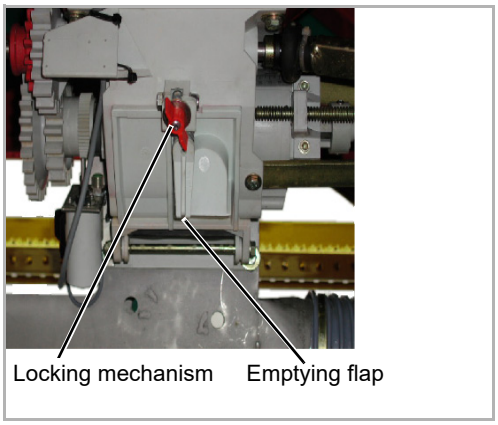
- Switch the PTO or hydraulic fan drive off
- Park the tractor and machine on even ground

With fertilizer

Fertilizer generally absorbs water very easily and tends to clump. Simply leaving the machine filled and standing overnight is enough to cause this. To prevent clumps in the metering device, the sliding cover must be closed over the metering device and the metering device must be emptied.



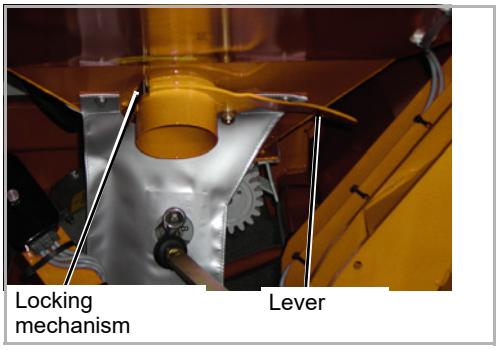
- Close the sliding cover over the metering device



- Open the emptying flap
- Empty the metering device. To do this, turn the metering device one revolution with the hand crank or using the electronic control system.
- Close the emptying flap again before the next application of fertilizer

Empty the seed or fertilizer hopper

Larger amounts of seed or fertilizer can be removed via the outlet on the hopper.

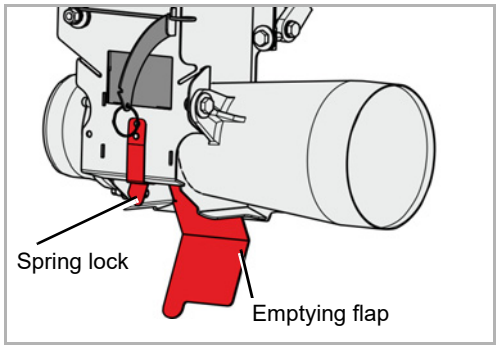


- Place a catch pan under the outlet
- Push the locking mechanism to the side and pull the lever up
- Then empty the metering device

→ Chapter »Operation«, section »Empty the metering device«, page 91

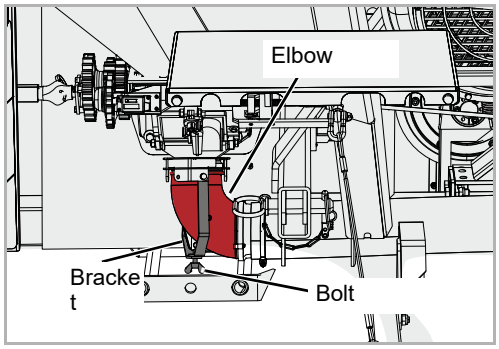
Empty the metering device

SH1150



- Place a catch pan under the emptying flap
- Actuate the spring lock
- Open the emptying flap

SH1650



- Release the bolt on both metering devices, fold down the bracket at the sides and remove the elbow
- Place a catch pan under each metering device

- Empty the metering device. To do this, turn the metering device one revolution with the hand crank or using the electronic control system.

This method can also be used to empty the seed or fertilizer hopper. For this purpose, set as high an adjustment value as possible for the metering device.

Cleaning

Cleaning can be performed using, e.g., a pressure washer.

Not all machine components are waterproof
Housings, signal distribution boxes, electric drive motors, screw-on connections, and ball bearings are not waterproof.
The ingress of water can result in damage to the machine.

Only use low pressure to clean the bearings
When cleaning the bearings, use only low pressure.
The ingress of water shortens the service life of the bearings.

Seed or fertilizer hopper

Before cleaning:

- Pull the tarpaulin over the seed hopper and lock it in place.
- Open the emptying flaps on the metering devices to allow any water that accidentally gets into the hopper to drain off.

After cleaning:

- Open the tarpaulin and inspect the seed hopper for moisture. Wipe dry if necessary.
- Leave the flaps on the metering devices open

Only wash the outside of the seed or fertilizer hopper with water.

Loading step on packer [+]

WARNING

Clean loading step
After each field operation, the loading step has to be carefully cleaned.
Dirt build-up could create a slip hazard.

Seed or fertilizer hopper

WARNING

Wear breathing protection when in contact with dust which is harmful to health
For example, harmful dust could be created if dressing has been used or fertilizer has been deposited.
If harmful dust could be released when blowing out with compressed air, breathing protection with the appropriate protection class must be worn.

- Blow out the seed or fertilizer hopper with compressed air

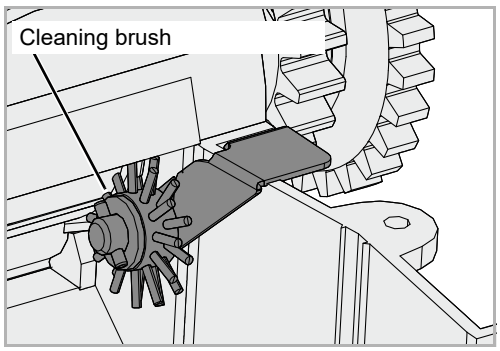
Metering device

Under no circumstances may a pressure washer be used for the following cleaning operations!

Before each change of seed or fertilizer, remove the remainders from the metering devices and the seed or fertilizer hopper through the emptying flaps.
→ Chapter »Operation«, section »After sowing or fertilizer spreading«, page 90

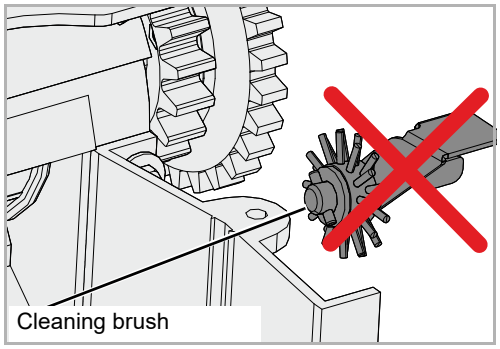
Cleaning brush

Cleaning brush for rape
Only use the cleaning brush when seeding rape.
If it is used when seeding cereals, the wrong amount of seed may be metered.



Cleaning brushes are only fitted to the metering devices for seeds.

- Clean the cleaning brushes at the metering device
- Check the cleaning brushes for freedom of movement while cleaning them



Fertilizer metering devices do not require a cleaning brush.

Care

To ensure the machine's long service life, we recommend applying a protective coating of oil after the end of the season and during storage. Use only approved and biodegradable oil, e.g. rapeseed oil.

WARNING

Increased risk of injury
Uncoupling the machine creates an increased risk of injury. Therefore:

- Ensure that the machine is lowered onto a level and stable surface
- Use support legs to stabilize the machine

If these instructions are ignored, serious or fatal injuries may occur.

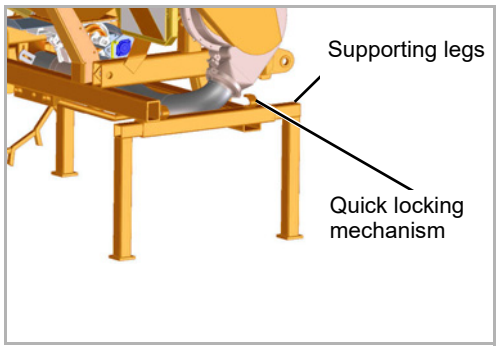
Seed or fertilizer hopper

- ▸ Empty the seed or fertilizer hopper

→ Chapter »Operation«, section »After sowing or fertilizer spreading«, page 90

- ▸ Cover the empty seed or fertilizer hopper with tarpaulin
- ▸ Leave the emptying flaps open

Uncoupling the machine



- ▸ Switch off the electronic control system
- ▸ Unfold supporting legs and secure in support position. The quick locking mechanism must lock.
- ▸ Remove the hydraulic and electrical connections and the PTO
- ▸ Connect the delivery tube on the tractor to the quick-release coupling
- ▸ Disconnect electronic control system from connecting cables and remove from tractor holder
- ▸ Store the electronic control system in a dry place. The settings remain in memory for a considerable time.

Uncouple the machine in the reverse order in which it was coupled, observing the special safety instructions.

Sowing unit

The sowing unit consists of a CB1000/ CB2000. The machine is described in a separate operating manual.

CB1000/CB2000
→ “CB1000/CB2000” operating manual

Machine storage

After cleaning, the machine should be stored in the transport position in a dry location and on a level and stable surface.

Apply a protective coating of oil during storage. Use only approved and biodegradable oil, e.g. rapeseed oil.
→ Chapter»Cleaning and care«

For your safety

Special safety information

WARNING

Prerequisites for maintenance work
Only perform the maintenance work if you have the required expert knowledge and suitable tools.
Insufficient technical knowledge or the use of unsuitable tools can cause accidents.

Protect the machine against accidental activation
Only carry out repair and maintenance work and only rectify faults on the coupled machine if:

- Deactivated PTO
- Engine switched off
- Ignition key removed
- Electronic control system switched off

Serious accidents can result if the device starts inadvertently.

Spare parts and accessories
Only use original parts or parts that meet the manufacturer's requirements. In case of doubt, confirm the suitability of the parts with the dealer or manufacturer.
Using unsuitable spare parts and accessories compromises the safety of the machine. Damage to the machine and serious accidents are then possible.

Welding work
Before performing welding work on the tractor or machine, always disconnect the voltage supply to the electronic control system.
Otherwise, damage to the electronics cannot be excluded.

Do not use pneumatic grease guns
Never use a pneumatic grease gun to lubricate bearings.
The high pressure damages the bearings.

Protective measures when handling oils or lubricants

Additives in oils and lubricants may have adverse health effects. Since the hazardous material code does not require any special identification, please always observe the following:

WARNING

Avoid skin contact
Prevent skin contact with oils and lubricants.
Contact can result in skin damage.

Protect your skin
When handling oils and lubricants, protect your skin with lotion or wear oil-resistant gloves.
Oils can be harmful to health.

Do not use oils for cleaning
Do not use oils or lubricants to clean your hands.
Burrs and fine particles in these materials can result in injuries.

Change contaminated clothing
Change any clothing that is heavily contaminated with oil as soon as possible.
Oils can be harmful to health.

- Collect and dispose of waste oil in accordance with legal regulations
- If your skin becomes irritated by oil or lubricants, contact a doctor immediately

General information

This information relates to general maintenance work. For all maintenance work, the machine must be folded out and secured in its work position. If it is necessary to put the machine in its transport position for maintenance work, an appropriate reference will appear in the maintenance instructions.

Working with the grease gun:
One to two grease gun strokes handle are sufficient for lubrication. If you feel resistance during the second stroke, do not complete it.
Too much grease will force the bearings apart. This could allow dust and dirt to enter the bearing, resulting in premature wear.

Fundamentals

The following table contains a brief explanation of the most important terms used for maintenance.

Tasks	Model
Greasing	• Apply grease to sliding surfaces with a brush
Lubrication	• Unless otherwise specified, one to two pumps with a grease gun are generally sufficient
Oiling	• Unless otherwise specified, use only vegetable-based oil such as rapeseed oil • Mineral oils are not suitable • The use of waste oil represents a health hazard and is strictly prohibited
Replacement	• Replace the component in question according to the instructions in the »Maintenance« chapter
Checking	• An inspection may be required in conjunction with the replacement of the component in question
Observe the maintenance intervals	• All information is based on average machine usage • In the case of heavy usage (e.g. contract work), shorten the maintenance intervals accordingly • Shorter maintenance intervals may also be required under extreme operating conditions (e.g. heavy dust generation)

Screw connections

All bolts must be retightened:

- After the first operating hours
- Depending on the frequency of use
- But at least once a season

Tightening torques, general

Tighten all screw connections using the information provided in the table. If different tightening torques are necessary, they are specified. The minimum quality of the bolts is “8.8”.

Tightening torques in and lbf in						
Bolt size	Bolt quality					
	„8.8“		„10.9“		„12.9“	
	Nm	lbf in	Nm	lbf in	Nm	lbf in
M6	9.9	88	14	124	17	150
M8	24	212	34	301	41	363
M10	48	425	68	602	81	717
M12	85	752	120	1062	145	1283
M16	210	1859	290	2567	350	3098
M20	425	3762	610	5399	710	6284
M24	730	6461	1050	9293	1220	10798
M27	1175	10400	1675	14825	1960	17347
M12x1.5	75	664	89	788	125	1106
M14x1.5	125	1106	150	1328	205	1328
M16x1.5	190	1682	220	1947	310	2744
M18x1.5	270	2390	320	2832	450	3983
M20x1.5	380	3363	450	3983	630	5576
M22x1.5	510	4514	600	5310	850	7523
M24x1.5	670	5930	800	7081	1120	9913
M27x1.5	990	8762	1170	10355	1640	14515

Tightening torques, special

The tightening torque for the wheels of the wheel packer and transport wheels is 400 Nm (3540.30 lbf in) for M18x1.5 bolts.

Maintenance intervals

		After the first 2 operating hours	Daily	After 25 operating hours	Once per season	After heavy use	If required	In case of wear	Lubrication	Greasing	Checking	Replacement	Page
General	Retighten all bolts				•	•							101
	Bearings				•	•			•				101
	Hydraulic hoses every 6 years and						•	•				•	101
Electronic control system	All sensors						•					•	from 103
Seed or fertilizer hopper	Hose connections Seed delivery tube				• •			• •			• •	• •	–
	Metering device • Sealing lip at the metering device • Cleaning brush				• •			• •			• •	• •	102 102
	Fan drive • Bearings				•						•		–
	Angular gearbox or reverse drive gearbox for the fan drive • Change transmission oil 1.2 l SAE 90 EP						•					•	
	According to the PTO shaft manufacturer's instructions								•		•		–
Other	Hydraulic cylinder of the drive wheel lifting				•		•		•				–

Secure the machine

Before any tasks are carried out directly on the machine, by you or by other persons, you must secure the machine.

WARNING

Hazard due to the machine being unsecured
An unsecured machine can cause hazards which are not immediately obvious. Secure the machine before carrying out any tasks directly on the machine.
If the machine is not secured, persons may be injured or killed.

- Lower the machine to its work position
- Switch off the machine's electronic control system
- Switch off the tractor's PTO
- Switch off the tractor engine
- Secure the tractor against starting up accidentally
- Secure the tractor against rolling away

Working under the machine

WARNING

Hazard due to the machine being unsecured
An unsecured machine can cause hazards which are not immediately obvious. Secure the machine before carrying out any tasks directly on the machine.
If the machine is not secured, persons may be injured or killed.

- Mechanically secure the machine against lowering

Lubricating work

- Secure the machine

→ Chapter »Maintenance«, section »Secure the machine«, page 100

Lubricating bearings

The bearings must be lubricated regularly. Only use one or two strokes from the grease gun:

- According to the maintenance chart
- After heavy use
- But at least once a season

Do not lubricate maintenance-free bearings.

Lubrication points

Annually

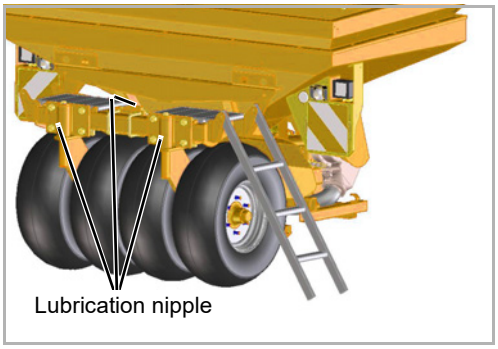
Generally:

- In addition to the lubrication points shown in this operating manual, your machine may have other lubrication points
- As a rule, lubrication points are located at pivots or bearings. Therefore, check the entire machine for any such lubrication points.

The position of the lubrication nipples is shown as an example for one component. If several components are available, each component's lubrication nipples have to be lubricated accordingly.

Wheel packer [+]

Once per season, if required



Lubrication nipple

- Lubricate with one to two pumps of the grease gun

Hydraulic hoses

Hydraulic hoses can age without any externally visible signs. In accordance with international regulations, the hydraulic hoses must be replaced every 6 years.

Replacing hydraulic hoses

Every 6 years or if required

Hydraulic hoses on the frame or track marker may only be replaced with the machine folded out and in compliance with all relevant safety regulations. The hoses must be depressurized for this purpose.

→ Chapter »Hydraulic system«, page 38

Front hopper

- Secure the machine

→ Chapter »Maintenance«, section »Secure the machine«, page 100

Metering device

Tasks

- Remove the remaining seed
- Replace the sealing lip

Sealing lip

If the sealing lip behind the emptying flap is worn, replace it.

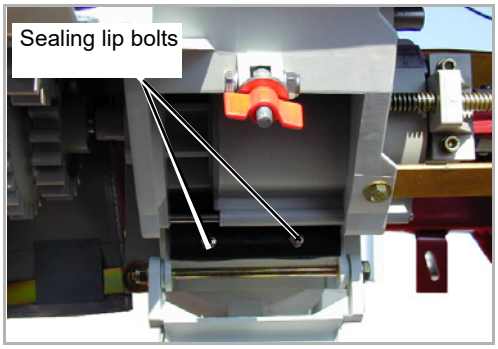
Remove remaining seed or fertilizer

If the seed or fertilizer hopper contains remaining seed or fertilizer, remove all remnants.

Replacing the sealing lip

In case of wear

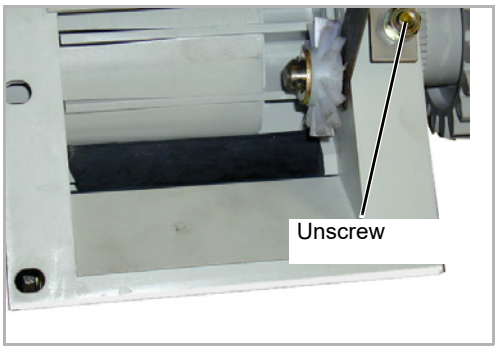
- Open the emptying flap
- Unscrew the worn sealing lips and replace them
- Close the emptying flap
- Reinstall the air hose under the emptying flap and fasten it with the jubilee clip



Cleaning brush replacement

In case of wear

- Unscrew the worn cleaning brush from the rear of the metering device and replace it



Electronic control system

This section contains information regarding the adjustment and replacement of sensors.

Setting the sensors

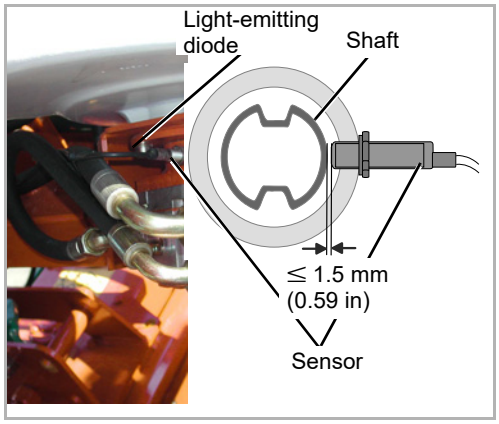
The following sensors may be connected by the electronic control system:

Operation sensor	Signus	ESA software
RPM sensor	X	X
Radar sensor [+]	–	X
Sensors of the shut-off valve	X	X
Sensors on the metering shafts	X	X
Hopper low level sensor [+]	X	X
Travel sensor	X	X

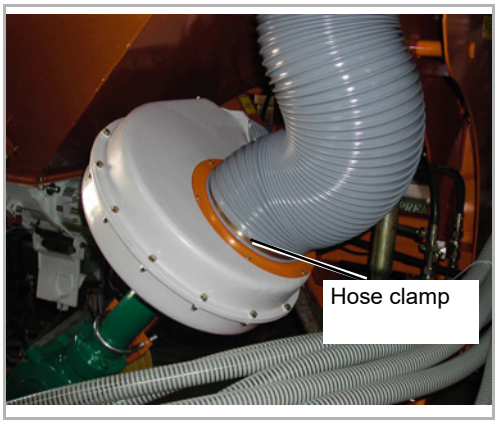
With the exception of the RPM sensor, all other sensors may only be set in the shop.

Setting the RPM sensor

If you find that the RPM display does not increase in accordance with the speed or if no RPM is displayed, it may be that the sensor pulse is only being generated by a single fan cam (normally, there are two pulses per rotation, from two cams). In this case, correct the RPM sensor setting.



- Release the sensor nut slightly
- Turn the sensor into the fan shaft bearing until it comes into contact with a shaft
- Then back the sensor out one-half turn. The distance to the shaft should be approximately 1.5 mm (0.59 in).



Check to ensure that the cams pass by the sensor unhindered:

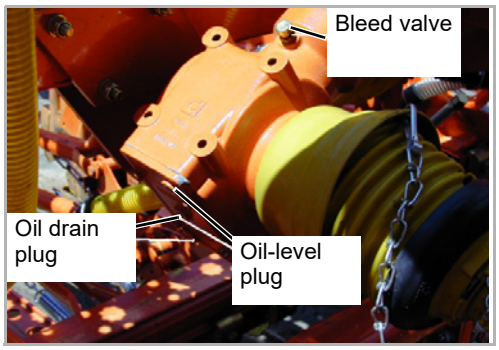
- Release the hose clamp and remove the hose
- Slowly turn the fan by hand. The cams should not touch the sensor, but should produce two pulses per revolution.

As it passes the sensor, each cam generates a switching pulse, and the LED on the sensor goes on twice during each fan revolution.

- Secure the sensor with the nut again
- Refasten the hose

Angular gearbox for SH1150

If required



The oil in the angular gearbox for the fan drive must be changed annually.

Requirement: 0.6 l (0.16 gal.)
Specification: SAE 90 EP

Drain oil:

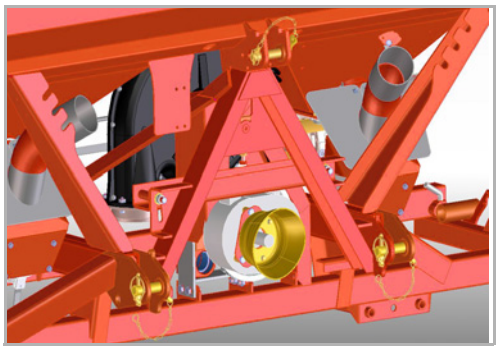
- Place a container underneath
- Unscrew oil drain plug
- After draining, screw the bolt in again

Pour in oil:

- Unscrew bleed valve
- 0.6 l (0.16 gal.) Fill SAE 90 transmission oil
- Screw the bleed valve in again

Reverse drive gear-box for SH1650

If required



The oil in the reverse drive gearbox for the fan drive has to be changed annually.

Requirement: 0.6 l (0.6 gal.)
Specification: SAE 90 EP

Drain oil:

- Place a container underneath
- Unscrew oil drain plug
- After draining, screw the bolt in again

Pour in oil:

- Unscrew bleed valve
- Pour in 0.6 l (0.6 gal.) transmission oil SAE 90
- Screw the bleed valve in again

Faults can often be eliminated in a fast and easy manner. Before contacting the customer service, make sure you have read the corresponding instructions.

Electronic control system

Fault	Cause	Remedy
The electronic control system is not receiving a pulse	Power supply interrupted	• Connect the power cable if the power supply was disconnected • Check the voltage: The supply voltage must be 12 V
Sensors on the shut-off valves or the drive motors receive no pulses	Fault at the shut-off valves or the metering device drive motors	Check the function of the shut-off valves and the engines with the function keys of the electronic control system Notify customer service if necessary

Fan

Fault	Cause	Remedy
Speed drops	Worn V-belt	Have the V-belt replaced
Increasing rotational-speed drop to approximately half-speed	Pulse only being provided by one cam	Correct the RPM sensor setting → Chapter »Maintenance«, section »Setting the RPM sensor«
Speed sensor only registering half the rotational speed	Pulse only being provided by one cam	Correct the RPM sensor setting → Chapter »Maintenance«, section »Setting the RPM sensor«
Speed sensor shows no reading	No voltage	Check the electrical wiring and fuses
	No pulse triggered	Correct the RPM sensor setting
	Sensor defective	Check the RPM sensor and replace it if necessary → Chapter »Maintenance«, section »Setting the RPM sensor«

Hydraulics

Fault	Cause	Remedy
Hydraulic fan drive		
Hydraulic oil overheating	Although the oil flow can be regulated at the tractor, it was actually regulated on the machine	Fully open the 3-way flow control valve on the machine and set the fan speed at the tractor
Hydraulic oil will overheat if the tractor is not equipped with a flow control valve	The 3-way flow control valve on the machine is set for 2-way flow control	Set to 3-way flow control
Hydraulic oil overheating	Insufficient oil reserve in the reservoir: The returning oil is mixed with the low quantity of oil in the tank and thus becomes hot	Have an additional oil cooler installed
	The control of the pump at the tractor malfunctions because of excessive oil flow in a closed hydraulic system	Have the pump and the control unit at the tractor checked
Hydraulic motor intermission	Unfavorable return path for the hydraulic oil	Select a better connection point for the zero pressure return
	Oil reserve on the tractor too low	Have a larger oil tank installed
	Additional control valve was actuated	Do not actuate during work
Hydraulic motor provides insufficient speed	3-way flow control valve is incorrectly set	Check 3-way flow control valve and readjust it
	Tractor does not supply enough oil or oil pressure insufficient	Have hydraulic pump checked Have the pressure limiting valve checked
Valve lever jumps out of the catch	Pressure peaks in the feed line Shutdown pressure too low	Check the drive capacity of the pneumatic system
	Supply pipe pressure too high	Have piping fitted by specialist workshop
Fan does not run at required speed	Pneumatic lines not completely closed	Completely close the seeding machine's pneumatic system
The hydraulic motor shaft seal was pressed out	Return line pressure too high	Reduce the return line pressure to a maximum of 10 bar
	Feed and return lines have been switched	Refit lines correctly and connect hydraulic connections cleanly
Oil leaking from the hydraulic motor	Worn or reversed shaft seal	Have a new shaft seal fitted or have the current one installed in the right direction

When the service life of your machine is over, it must be properly disposed of. Please observe the currently valid disposal regulations.

Metal parts
All machine components are suitable for metal recycling.

Plastic parts
All plastic parts are marked and can be recycled.

Tires
Tires can be sent to tire recycling facilities.

Oil
Collect fluid from the hydraulic system in a suitable container and dispose of it at an waste oil collection point.

Electronics
PCBs or terminals are disposed of as electronic waste. If there is no special waste handling facility in your area, you can return the electronic component to the manufacturer for proper disposal. It will then be disposed of in an environmentally-friendly manner.

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kg <—> lbs

kg	lbs	lbs	kg
0	0,00	0	0,00
5	11,02	5	2,27
10	22,05	10	4,54
15	33,07	15	6,80
20	44,09	20	9,07
25	55,12	25	11,34
30	66,14	30	13,61
35	77,16	35	15,88
40	88,18	40	18,14
45	99,21	45	20,41
50	110,23	50	22,68
55	121,25	55	24,95
60	132,28	60	27,22
65	143,30	65	29,48
70	154,32	70	31,75
75	165,35	75	34,02
80	176,37	80	36,29
85	187,39	85	38,56
90	198,42	90	40,82
95	209,44	95	43,09
100	220,46	100	45,36
105	231,49	105	47,63
110	242,51	110	49,90
115	253,53	115	52,16
120	264,55	120	54,43
125	275,58	125	56,70
130	286,60	130	58,97

g <—> oz

g	oz	oz	g
0	0,0000	0,00	0,00
5	0,1764	0,05	1,42
10	0,3527	0,10	2,83
15	0,5291	0,15	4,25
20	0,7055	0,20	5,67
25	0,8818	0,25	7,09
30	1,0582	0,30	8,50
35	1,2346	0,35	9,92
40	1,4110	0,40	11,34
45	1,5873	0,45	12,76
50	1,7637	0,50	14,17
55	1,9401	0,55	15,59
60	2,1164	0,60	17,01
65	2,2928	0,65	18,43
70	2,4692	0,70	19,84
75	2,6455	0,75	21,26
80	2,8219	0,80	22,68
85	2,9983	0,85	24,10
90	3,1747	0,90	25,51
95	3,3510	0,95	26,93
100	3,5274	1,00	28,35
105	3,7038	1,05	29,77
110	3,8801	1,10	31,18
115	4,0565	1,15	32,60
120	4,2329	1,20	34,02
125	4,4092	1,25	35,44
130	4,5856	1,30	36,85

Annex: Tables metric – imperial

m <—> in

m	in	in	m
0	0,00	0	0,00
5	196,85	5	0,13
10	393,70	10	0,25
15	590,55	15	0,38
20	787,40	20	0,51
25	984,25	25	0,64
30	1181,10	30	0,76
35	1377,95	35	0,89
40	1574,80	40	1,02
45	1771,65	45	1,14
50	1968,50	50	1,27
55	2165,35	55	1,40
60	2362,20	60	1,52
65	2559,05	65	1,65
70	2755,90	70	1,78
75	2952,75	75	1,91
80	3149,60	80	2,03
85	3346,45	85	2,16
90	3543,30	90	2,29
95	3740,15	95	2,41
100	3937,00	100	2,54
105	4133,85	105	2,67
110	4330,70	110	2,79
115	4527,55	115	2,92
120	4724,40	120	3,05
125	4921,25	125	3,18
130	5118,10	130	3,30

m <—> ft

m	ft	ft	m
0	0,00	0	0,00
5	16,40	5	1,52
10	32,81	10	3,05
15	49,21	15	4,57
20	65,62	20	6,10
25	82,02	25	7,62
30	98,43	30	9,14
35	114,83	35	10,67
40	131,23	40	12,19
45	147,64	45	13,72
50	164,04	50	15,24
55	180,45	55	16,76
60	196,85	60	18,29
65	213,25	65	19,81
70	229,66	70	21,34
75	246,06	75	22,86
80	262,47	80	24,38
85	278,87	85	25,91
90	295,28	90	27,43
95	311,68	95	28,96
100	328,08	100	30,48
105	344,49	105	32,00
110	360,89	110	33,53
115	377,30	115	35,05
120	393,70	120	36,58
125	410,10	125	38,10
130	426,51	130	39,62

l <—> bu (bushel)

l	bu	bu	l
0	0,00	0,05	1,76
5	0,14	0,10	3,52
10	0,28	0,15	5,29
15	0,43	0,20	7,05
20	0,57	0,25	8,81
25	0,71	0,30	10,57
30	0,85	0,35	12,33
35	0,99	0,40	14,10
40	1,14	0,45	15,86
45	1,28	0,50	17,62
50	1,42	0,55	19,38
55	1,56	0,60	21,14
60	1,70	0,65	22,91
65	1,84	0,70	24,67
70	1,99	0,75	26,43
75	2,13	0,80	28,19
80	2,27	0,85	29,95
85	2,41	0,90	31,72
90	2,55	0,95	33,48
95	2,70	1,00	35,24
100	2,84	1,05	37,00
105	2,98	1,10	38,76
110	3,12	1,15	40,52
115	3,26	1,20	42,29
120	3,41	1,25	44,05
125	3,55	1,30	45,81
130	3,69	1,35	47,57

l <—> gal.

l	gal.	gal.	l
0	0,00	0	0,0
5	1,32	5	18,9
10	2,64	10	37,9
15	3,96	15	56,8
20	5,28	20	75,7
25	6,60	25	94,6
30	7,93	30	113,6
35	9,25	35	132,5
40	10,57	40	151,4
45	11,89	45	170,3
50	13,21	50	189,3
55	14,53	55	208,2
60	15,85	60	227,1
65	17,17	65	246,1
70	18,49	70	265,0
75	19,81	75	283,9
80	21,13	80	302,8
85	22,45	85	321,8
90	23,78	90	340,7
95	25,10	95	359,6
100	26,42	100	378,5
105	27,74	105	397,5
110	29,06	110	416,4
115	30,38	115	435,3
120	31,70	120	454,2
125	33,02	125	473,2
130	34,34	130	492,1

Annex: Tables metric – imperial

kW <—> PS

kW	PS	PS	kW
0	0,00	0	0,00
5	6,80	5	3,68
10	13,60	10	7,35
15	20,39	15	11,03
20	27,19	20	14,71
25	33,99	25	18,39
30	40,79	30	22,06
35	47,59	35	25,74
40	54,38	40	29,42
45	61,18	45	33,10
50	67,98	50	36,77
55	74,78	55	40,45
60	81,58	60	44,13
65	88,38	65	47,81
70	95,17	70	51,48
75	101,97	75	55,16
80	108,77	80	58,84
85	115,57	85	62,52
90	122,37	90	66,19
95	129,16	95	69,87
100	135,96	100	73,55
105	142,76	105	77,23
110	149,56	110	80,90
115	156,36	115	84,58
120	163,15	120	88,26
125	169,95	125	91,94
130	176,75	130	95,61

l/min <—> gpm

l/min	gpm	gpm	l/min
0	0,00	0	0,0
5	1,32	5	18,9
10	2,64	10	37,8
15	3,96	15	56,8
20	5,28	20	75,7
25	6,61	25	94,6
30	7,93	30	113,5
35	9,25	35	132,5
40	10,57	40	151,4
45	11,89	45	170,3
50	13,21	50	189,2
55	14,53	55	208,2
60	15,85	60	227,1
65	17,17	65	246,0
70	18,49	70	264,9
75	19,82	75	283,9
80	21,14	80	302,8
85	22,46	85	321,7
90	23,78	90	340,6
95	25,10	95	359,6
100	26,42	100	378,5
105	27,74	105	397,4
110	29,06	110	416,3
115	30,38	115	435,3
120	31,70	120	454,2
125	33,03	125	473,1
130	34,35	130	492,0

bar <—> PSI

bar	PSI	PSI	bar
0	0	0	0,00
5	71	5	0,35
10	142	10	0,70
15	213	15	1,06
20	284	20	1,41
25	355	25	1,76
30	426	30	2,11
35	497	35	2,46
40	569	40	2,81
45	640	45	3,17
50	711	50	3,52
55	782	55	3,87
60	853	60	4,22
65	924	65	4,57
70	995	70	4,92
75	1066	75	5,28
80	1137	80	5,63
85	1208	85	5,98
90	1279	90	6,33
95	1350	95	6,68
100	1421	100	7,04
105	1492	105	7,39
110	1564	110	7,74
115	1635	115	8,09
120	1706	120	8,44
125	1777	125	8,79
130	1848	130	9,15

°C <—> °F

°C	°F	°F	°C
0	32,0	0	-17,78
5	41,0	5	-15,00
10	50,0	10	-12,22
15	59,0	15	-9,44
20	68,0	20	-6,67
25	77,0	25	-3,89
30	86,0	30	-1,11
35	95,0	35	1,67
40	104,0	40	4,44
45	113,0	45	7,22
50	122,0	50	10,00
55	131,0	55	12,78
60	140,0	60	15,56
65	149,0	65	18,33
70	158,0	70	21,11
75	167,0	75	23,89
80	176,0	80	26,67
85	185,0	85	29,44
90	194,0	90	32,22
95	203,0	95	35,00
100	212,0	100	37,78
105	221,0	105	40,56
110	230,0	110	43,33
115	239,0	115	46,11
120	248,0	120	48,89
125	257,0	125	51,67
130	266,0	130	54,44

Nm <—> lbf ft (poundforce feet)

Nm	lbf ft	lbf ft	Nm
0	0,00	0	0,00
5	3,69	5	6,78
10	7,38	10	13,56
15	11,06	15	20,34
20	14,75	20	27,12
25	18,44	25	33,90
30	22,13	30	40,67
35	25,81	35	47,45
40	29,50	40	54,23
45	33,19	45	61,01
50	36,88	50	67,79
55	40,57	55	74,57
60	44,25	60	81,35
65	47,94	65	88,13
70	51,63	70	94,91
75	55,32	75	101,69
80	59,00	80	108,47
85	62,69	85	115,24
90	66,38	90	122,02
95	70,07	95	128,80
100	73,76	100	135,58
105	77,44	105	142,36
110	81,13	110	149,14
115	84,82	115	155,92
120	88,51	120	162,70
125	92,20	125	169,48
130	95,88	130	176,26

kW/m <—> kW/ft

kW/m	kW/ft	kW/ft	kW/m
0	0,0	0	0,0
5	1,5	5	16,4
10	3,0	10	32,8
15	4,6	15	49,2
20	6,1	20	65,6
25	7,6	25	82,0
30	9,1	30	98,4
35	10,7	35	114,8
40	12,2	40	131,2
45	13,7	45	147,6
50	15,2	50	164,0
55	16,8	55	180,4
60	18,3	60	196,9
65	19,8	65	213,3
70	21,3	70	229,7
75	22,9	75	246,1
80	24,4	80	262,5
85	25,9	85	278,9
90	27,4	90	295,3
95	29,0	95	311,7
100	30,5	100	328,1
105	32,0	105	344,5
110	33,5	110	360,9
115	35,1	115	377,3
120	36,6	120	393,7
125	38,1	125	410,1
130	39,6	130	426,5

ccm <—> cu.in.

ccm	cu.in.	cu.in.	ccm
0	0,00	0	0,0
5	0,31	5	81,9
10	0,61	10	163,9
15	0,92	15	245,8
20	1,22	20	327,7
25	1,53	25	409,7
30	1,83	30	491,6
35	2,14	35	573,6
40	2,44	40	655,5
45	2,75	45	737,4
50	3,05	50	819,4
55	3,36	55	901,3
60	3,66	60	983,2
65	3,97	65	1065,2
70	4,27	70	1147,1
75	4,58	75	1229,0
80	4,88	80	1311,0
85	5,19	85	1392,9
90	5,49	90	1474,9
95	5,80	95	1556,8
100	6,10	100	1638,7
105	6,41	105	1720,7
110	6,71	110	1802,6
115	7,02	115	1884,5
120	7,32	120	1966,5
125	7,63	125	2048,4
130	7,93	130	2130,3

N <—> lbf

N	lbf	lbf	N
0	0,00	0	0,0
5	1,12	5	22,2
10	2,25	10	44,5
15	3,37	15	66,7
20	4,50	20	89,0
25	5,62	25	111,2
30	6,74	30	133,4
35	7,87	35	155,7
40	8,99	40	177,9
45	10,12	45	200,2
50	11,24	50	222,4
55	12,37	55	244,6
60	13,49	60	266,9
65	14,61	65	289,1
70	15,74	70	311,4
75	16,86	75	333,6
80	17,99	80	355,8
85	19,11	85	378,1
90	20,23	90	400,3
95	21,36	95	422,6
100	22,48	100	444,8
105	23,61	105	467,0
110	24,73	110	489,3
115	25,85	115	511,5
120	26,98	120	533,8
125	28,10	125	556,0
130	29,23	130	578,2

ha <—> ac

ha	ac	ac	ha
0	0,0	0	0,0
5	12,4	5	2,0
10	24,7	10	4,0
15	37,1	15	6,1
20	49,4	20	8,1
25	61,8	25	10,1
30	74,1	30	12,1
35	86,5	35	14,2
40	98,8	40	16,2
45	111,2	45	18,2
50	123,6	50	20,2
55	135,9	55	22,3
60	148,3	60	24,3
65	160,6	65	26,3
70	173,0	70	28,3
75	185,3	75	30,3
80	197,7	80	32,4
85	210,1	85	34,4
90	222,4	90	36,4
95	234,8	95	38,4
100	247,1	100	40,5
105	259,5	105	42,5
110	271,8	110	44,5
115	284,2	115	46,5
120	296,5	120	48,6
125	308,9	125	50,6
130	321,3	130	52,6

kg/ha <—> lbs/ac

kg/ha	lbs/ac	lbs/ac	kg/ha
0	0,00	0	0,00
5	4,46	5	5,60
10	8,92	10	11,21
15	13,38	15	16,81
20	17,84	20	22,42
25	22,30	25	28,02
30	26,76	30	33,63
35	31,22	35	39,23
40	35,68	40	44,84
45	40,15	45	50,44
50	44,61	50	56,05
55	49,07	55	61,65
60	53,53	60	67,26
65	57,99	65	72,86
70	62,45	70	78,47
75	66,91	75	84,07
80	71,37	80	89,67
85	75,83	85	95,28
90	80,29	90	100,88
95	84,75	95	106,49
100	89,21	100	112,09
105	93,67	105	117,70
110	98,13	110	123,30
115	102,59	115	128,91
120	107,05	120	134,51
125	111,51	125	140,12
130	115,98	130	145,72

kg/l <—> lbs/cu.in.

kg/l	lbs/cu.in.	lbs/cu.in.	kg/l
0	0,00	0	0,0
5	0,18	5	138,4
10	0,36	10	276,8
15	0,54	15	415,2
20	0,72	20	553,6
25	0,90	25	692,0
30	1,08	30	830,4
35	1,26	35	968,8
40	1,45	40	1107,2
45	1,63	45	1245,6
50	1,81	50	1384,0
55	1,99	55	1522,4
60	2,17	60	1660,8
65	2,35	65	1799,2
70	2,53	70	1937,6
75	2,71	75	2076,0
80	2,89	80	2214,4
85	3,07	85	2352,8
90	3,25	90	2491,2
95	3,43	95	2629,6
100	3,61	100	2768,0
105	3,79	105	2906,4
110	3,97	110	3044,8
115	4,15	115	3183,2
120	4,34	120	3321,6
125	4,52	125	3460,0
130	4,70	130	3598,4

km/h <—> mph

km/h	mph	mph	km/h
0	0,0	0	0,0
5	3,1	5	8,0
10	6,2	10	16,1
15	9,3	15	24,1
20	12,4	20	32,2
25	15,5	25	40,2
30	18,6	30	48,3
35	21,7	35	56,3
40	24,9	40	64,4
45	28,0	45	72,4
50	31,1	50	80,5
55	34,2	55	88,5
60	37,3	60	96,6
65	40,4	65	104,6
70	43,5	70	112,7
75	46,6	75	120,7
80	49,7	80	128,7
85	52,8	85	136,8
90	55,9	90	144,8
95	59,0	95	152,9
100	62,1	100	160,9
105	65,2	105	169,0
110	68,4	110	177,0
115	71,5	115	185,1
120	74,6	120	193,1
125	77,7	125	201,2
130	80,8	130	209,2