

BOOM TERRA FORCE

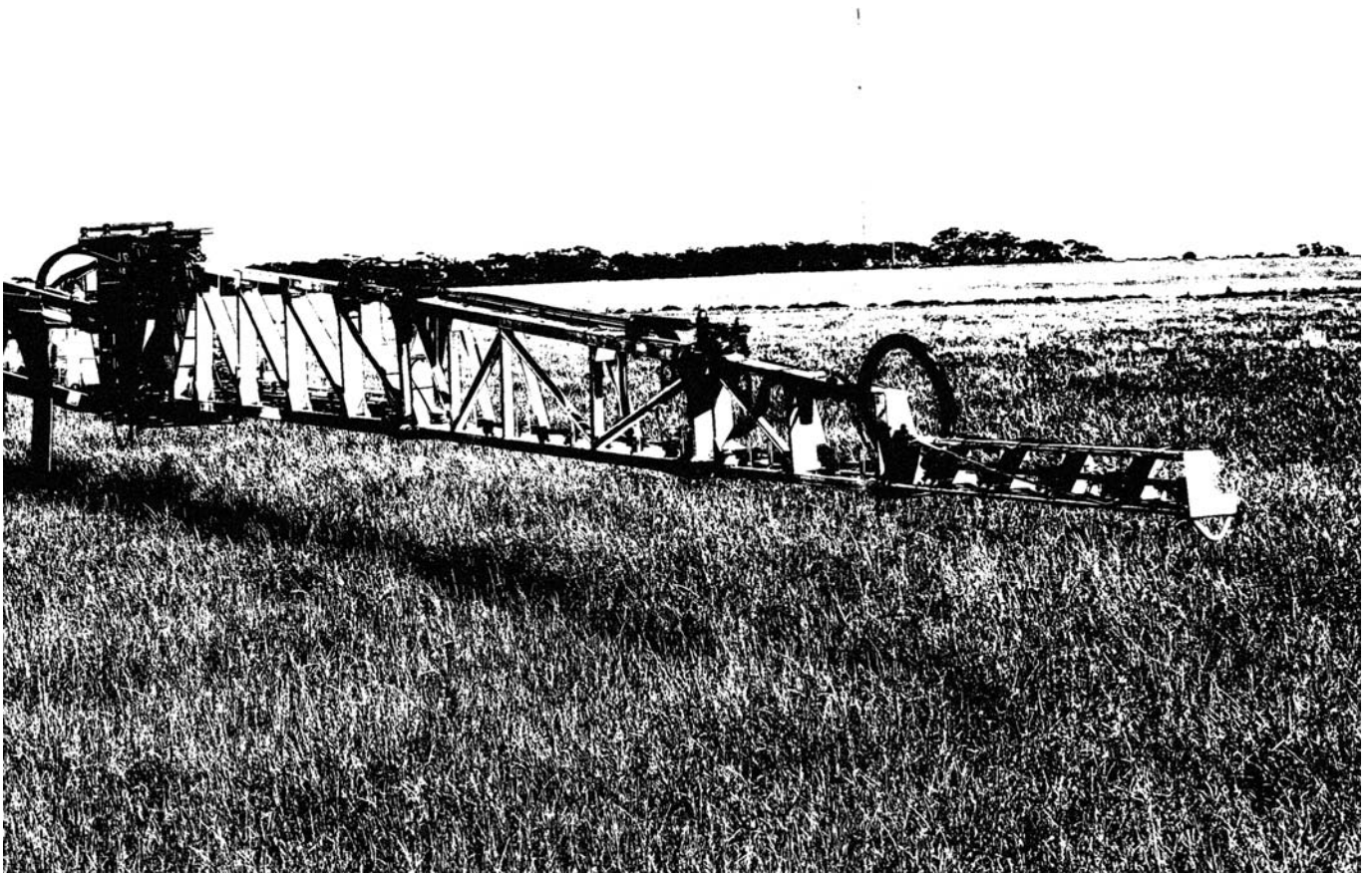


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We congratulate you for choosing a HARDI plant protection product. The reliability and efficiency of this product depend upon your care. The first step is to carefully read and pay attention to this instruction book. It contains essential information for the efficient use and long life of this quality product.



This book covers B3 BOOM AND CENTRE

The original instruction book is approved and published in English. All other languages are translations of the original. In the event of any conflicts, inaccuracies or deviations between the English original and other languages the English version shall prevail.

Illustrations, technical information and data in this book are to the best of our belief correct at the time of printing. As it is HARDI AUSTRALIA policy permanently to improve our products, we reserve the right to make changes in design, features, accessories, specifications and maintenance instructions at any time and without notice.

HARDI AUSTRALIA is without any obligation in relation to implements purchased before or after such changes.

HARDI AUSTRALIA cannot undertake any responsibility for possible omissions or inaccuracies in this publication, although everything possible has been done to make it complete and correct.

As this instruction book covers more models and features or equipment, which are available in certain countries only, please pay attention to paragraphs dealing with precisely your model.

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Obligations and Liability

Comply with the Instruction Book

Knowledge of the basic safety information and safety regulations is a fundamental requirement for safe handling and fault-free sprayer operation.

Lack of knowledge or non-compliance of the safety instructions can lead to injuries and fatal accidents as well as damage to the sprayer and its surroundings.

Follow the safety instructions in this Instruction Book.

Before First Use of the Sprayer

The owner of the sprayer must take note of the following obligations before using the sprayer. These obligations also apply to the employer or the supervisor of the sprayer operators.

Workplace Assessment

This must be completed to start with. Check your national regulations regarding

- the content of the workplace assessment
- the frequency of repeating the workplace assessment.

Worker / Operator Instructions

Only let those people work with, or on the sprayer, who

- are aware of the basic workplace safety information and accident prevention regulations
- have been instructed in working with/on the tractor and sprayer and hereby achieving appropriate qualifications
- have read and understood this Instruction Book.

If you still have queries after reading the Instruction Book, or if something remains unclear after reading it, please contact the manufacturer or your HARDI dealer.

A worker is hereinafter called an operator. An operator is a person who installs, operates, configures, adjusts, maintains, cleans, repairs, transports or moves the sprayer.

Use of Work Equipment

Throughout the lifetime of the sprayer, the owner shall take every measure to ensure the safety of the sprayer and its equipment.

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Statutory Inspection

Before first use of the sprayer, a surveyor must complete a statutory inspection of the tractor and sprayer. However, the rules often allow the tractor and the sprayer to be inspected separately before being connected. Contact your local HARDI dealer for more information on this inspection and when it has to be completed.

Restricted Use

As the use of the sprayer is likely to involve a specific risk, the owner shall ensure restricted access to its use as needed, and any modification of the restrictions is to be allowed to specialized persons only.

Restricted use also applies to the selection of tractor to be used together with the sprayer. Usable tractors must be tested for driving the sprayer, and the owner must keep a document showing which tractors may be used for driving the sprayer, as well the information about the tests. This information must be available to the operator of the sprayer.

Maintenance Regulations

Throughout its working life, the owner shall keep the sprayer compatible with the current national Machinery Directive by means of adequate maintenance.

The owner shall ensure that the sprayer is installed and set up correctly and is operating properly by inspection/testing of the sprayer (initial, after assembly, periodic and special) by authorized persons. The results of inspection/testing shall be recorded and kept.

Health Issues

Ergonomics and occupational health aspects shall be taken fully into account by the owner.

Obligations of the Operator

Before starting work, the operator or anyone in charge of working with/on the sprayer is obliged to

- comply with the basic workplace safety instructions and accident prevention regulations.
- read and follow the safety instructions as described in this Instruction Book.
- read the section "Representation of Safety Symbols" in this Instruction Book and to follow the safety instructions represented by the danger, warning and attention symbols, when operating the sprayer.
- get to know the sprayer.
- connect the sprayer securely and correctly to a tractor, which has passed the test for driving the sprayer.
- read the sections of this Instruction Book that are important for carrying out the work.
- read the manufacturer's information regarding safety and use of chemical products for crop care, such as spray chemicals or liquid fertilizer.
- keep all the danger, warning and attention labels on the sprayer in a legible state.
- replace damaged labels on the sprayer.
- know the importance of the use of genuine HARDI spare parts.

If the operator discovers that a function is not working properly, he must eliminate this fault immediately. If this is not the task of the operator, or if the operator does not possess the appropriate technical knowledge, then he should report this fault to his superior (a qualified operator).

Risks in Handling the Sprayer

The sprayer has been highly developed and constructed to the recognized rules of safety. However, operating the sprayer may cause risks and restrictions to

- the health and safety of the operator or third parties
- the sprayer
- other property.

Only use the sprayer

- for the purpose for which it was intended
- in a perfect state of repair.

Eliminate any faults immediately which could impair the safety.

Disclaimer

Our "General Terms of Sale and Delivery" are always applicable. These shall be available to the owner at the latest on conclusion of the contract.

Guarantee and liability claims for damage to people or property will be excluded by HARDI, if they can be traced back to one or more of the following causes:

- Improper use of the sprayer
- Improper installation, commissioning, operation and maintenance of the sprayer
- Operation of the sprayer with defective safety equipment, or improperly attached or non-functioning safety equipment
- Non-compliance with the instructions in the instruction manual regarding commissioning, operation and maintenance
- Unauthorized design changes to the sprayer
- Insufficient monitoring of sprayer parts which are subject to wear
- Improperly executed repairs
- Spare parts used are not genuine HARDI spare parts. If the operator decides to use a spare part, which is not approved by HARDI, the operator immediately assumes responsibility for any accident, damage or malfunction, which can be traced back to the use of this spare part. HARDI accept no liability for such incidents caused by the use of non-approved spare parts, wear parts or aids.
- Disasters through the impact of foreign bodies, natural disasters or force majeure.

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Organizational Measures

This Instruction Book

- must always be kept together with the sprayer
- must always be easily accessible for the operator

Personal Protective Equipment

The operator must use the necessary personal protective equipment as per the information provided by the manufacturer of the plant protection product to be used, such as:



Chemical-resistant gloves



Chemical-resistant and disposable overalls



Water-resistant footwear



Face shield



Breathing protection



Eye protection



Head protection



Skin protection products

Representation of Safety Symbols

Explanation of Symbols

Safety symbols are used in the following chapters throughout this Instruction Book to designate, where the reader has to pay extra attention.

The signal word (DANGER, WARNING, ATTENTION or NOTE) describes the severity of the risk.

The symbols have the following meaning:



This symbol means DANGER. Be very alert as your safety is involved! The DANGER symbol indicates a high risk for an immediate death or serious physical injury, if the instruction is not followed.



This symbol means WARNING. Be alert as your safety can be involved! The WARNING symbol indicates a medium risk for immediate death or serious injury, if the instruction is not followed.



This symbol means ATTENTION. This indicates an obligation to special behaviour or an activity required for proper sprayer handling. This instruction will help you to avoid faults on the sprayer or disturbance to the environment.



This symbol means NOTE. This indicates handling tips and particularly useful information. This instruction will help you to use all the functions of your sprayer in the best way possible for a better, easier and more safe operation.

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Warning Signs On The Sprayer

Explanation of Labels

The labels on the sprayer are designating potential dangerous areas on the machine. Operators, or anyone in close range of the sprayer, must respect these warnings!

The labels should always be clean and readable! Worn or damaged labels must be replaced with new ones. Contact your HARDI dealer for new labels.

Note that not all labels shown hereafter will apply to your sprayer - this depends on the sprayer model which labels apply.



978437 Chemical handling!

Carefully read the informations about chemical preparation before handling the machine. Observe instructions and safety rules when operating.



978443 Service!

Carefully read the Instruction Book before handling the machine. Observe instructions and safety rules when operating.



978436 Service!

Turn off the engine and remove ignition key before performing maintenance or repair.



978440 Service!

Tighten to the torque according to instruction book.



97802100 Risk of death!

Do not attempt to enter tank.



978447 Risk of burn!

Stay clear of hot surfaces.



978444 Risk of injury!

Do not open or remove safety shields while engine is running.



978586 Risk of injury!

Flying objects - keep a safe distance from the machine, as long as the engine is running.



978448 Risk of injury!

Keep sufficient distance away from electrical power lines.



978435 Risk of injury!

Keep hands away.

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978441 Risk of squeezing!
Stay clear of raised and unsecured loads.



978445 Risk of squeezing
Never reach into the crushing danger area as long as parts are moving.



978434 Risk of squeezing!
Keep hands away, when parts is moving.



978442 Risk of falling off!
Do not ride on platform or ladder.



978446 Risk of sprayer tipping over!
Be aware when disconnecting the sprayer.



978438 Grapping area!
Manual handling of the boom etc.



97802200 Not for drinking!
This water must never be used for drinking.



97802300 Not for drinking!
This water must never be used for drinking.



97829000 Lifting point!



978439 Lifting point!



97831500 Load index!
Max. permitted load rating is 164 at 40 km/h or 5000 kg.



97827000 EasyClean filter service!
Open and clean filter monthly.

97827000

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Safety and Protection Equipment

Safety at Start-up

Each time before the sprayer is started up, all the safety and protection equipment must be properly attached and fully functional. Check all safety and protection equipment regularly. Repair or replace the equipment as needed.

Faulty Safety Equipment

Faulty or disassembled safety and protection equipment can lead to dangerous situations.

Informal Safety Measures

Additional Safety Instructions

Together with the safety information in this Instruction Book, also comply with the general and national regulations related to

- A. Accident prevention
- B. Environmental protection
- C. The applicable workplace safety.

Follow these regulations, especially when

- driving on public roads and routes. Comply with the appropriate statutory road traffic regulations. These vary from country to country, and there may be local regulations which need to be followed.
- local law demands that the operator is certified to use spray equipment.
- using pesticides or liquid fertilizer. Make sure you understand the information from the supplier regarding their use.

2 - General Safety Instructions

Operator Training

Authorized Persons

Only those people who have been trained and instructed may work with/on the sprayer. The operator must clearly specify the responsibilities of the people in charge of operation and maintenance work.

People being trained may only work with/on the sprayer under the supervision of an experienced operator.

Activity	Person	Person especially trained for the activity ¹⁾	Trained operator ²⁾	Person with specialist training (specialized workshop) ³⁾
Loading / Transport		X	X	X
Commissioning		0	X	0
Setup and tool installation		0	0	X
Operation		0	X	0
Maintenance		X	X	X
Troubleshooting and fault elimination		X	0	X
Disposal		X	0	0

Symbols: X - permitted, 0 - not permitted.

1. Persons who can assume a specific task, and who can carry out this task for an appropriately qualified company. Examples of these persons are truck drivers, machinery dealer and scrap dealers (depending on the activity).
2. Persons who have been instructed in their assigned tasks and in the possible risks in the case of improper behaviour, who have been trained if necessary, and who have been informed about the necessary protective equipment and measures. Examples of these persons are customers, farmers and farm workers.
3. Persons with specialist technical training shall be considered as a specialist. Due to their specialist training and their knowledge of the appropriate regulations, they can evaluate the work with which they have been appointed to and detect possible dangers. Examples of these persons are sprayer importers, dealers and service engineers and service technicians.

Comment:

A qualification equivalent to specialist training can be obtained from several years of experience in the relevant field.

If maintenance and repair work on the sprayer is additionally marked "Workshop work", or a similar marking, only a specialized workshop may carry out such work. The personnel of a specialized workshop shall possess the appropriate knowledge and suitable aids (tools, lifting and support equipment) for carrying out the maintenance and repair work on the sprayer in a way that is both appropriate and safe.

Safety Measures in Normal Operation

Protection Equipment

Only operate the sprayer if all the safety and protection equipment is fully functional.

Check the sprayer at least once a day for visible damage and check the function of the safety and protection equipment.

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Residual Energy

Possible Dangers

Note that there may be residual energy from mechanical, hydraulic, pneumatic and electric / electronic parts on the sprayer.

Use appropriate measures to inform the operators.

Prevent any accidents from happening due to residual energy.

Below are some examples on where the sprayer's residual energies may be present.

Mechanical Energy

- springs under tension
- weights exposed to gravity

Hydraulic Energy

- trapped oil under pressure in cylinders, hoses and accumulators
- heat from cylinders and oil tank.

Pneumatic Energy

- air tank
- air activated brake system
- pressure dampers for fluid system

Electric Energy

- energy stored in capacitors
- tractor battery

Service and Maintenance Work

Statutory Inspection

A surveyor must complete a statutory inspection of the tractor and sprayer prior to connecting the two. However, the rules often allow the tractor and the sprayer to be inspected separately before being connected.

Each country should regulate the level and frequency of this inspection. Contact your local HARDI dealer for more information, before using the sprayer the first time.

Preventive Measures

Before carrying out service and maintenance work, secure all media against unintentional start-up. This goes for:

Hydraulic system

- set the tractor's hydraulic levers in neutral position to relieve oil pressure
- turn off the tractor and remove the ignition key
- dismantle the hydraulic hoses connected from the tractor to the sprayer.

Electric system

- turn off the tractor and remove the ignition key
- dismantle the electric cables from the tractor's battery.

Fluid system

- turn off the tractor and remove the ignition key.

Compressed air

- turn off the tractor and remove the ignition key

Carry out prescribed service, maintenance and inspection work in due time. This will help to eliminate faults on the sprayer, including safety related functions.

Carefully fix and secure larger components to lifting gear when carrying out replacement work.

Check all the screw and bolt connections for firm seating. On completion of the maintenance work, check the function of the safety devices.

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Design Changes

Operator Limitations

You may make no changes, expansions or modifications to the sprayer without an authorization from HARDI. This also applies when welding support parts.

Any expansion or modification work shall require the written approval from HARDI. Only use modification and accessory parts approved by HARDI, so that the type approval or other design approvals remain valid in accordance with national and international regulations.

Vehicles with an official type approval, or with equipment connected to a vehicle with a valid type approval, or approval for road transport according to the local road traffic regulations, must be in the state specified by the approval.

It is strictly forbidden to

- drill holes in the steel frame or in the running gear
- increase the size of existing holes in the steel frame or in the running gear
- weld support parts.

Risk of crushing, cutting, catching, squeezing, getting trapped, being drawn in or being struck by sprayer parts due to the failure of support parts.

Spare Parts, Wear Parts and Aids

Immediately replace any sprayer parts which are not in a perfect state.

Only use genuine HARDI spare and wear parts or those approved by HARDI, so that the type approval remains valid according to the national and international regulations. The use of spare and wear parts from third parties does not guarantee that they have been constructed in a way as to meet the requirements placed on them.

HARDI accept no liability for damage caused by the use of non-approved spare parts, wear parts or aids.

Cleaning and Disposal

Environmental Protection

Carefully handle and dispose of any materials used, in particular

- when carrying out work on oiled or lubricated sprayer parts.
- when cleaning using solvents.

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Workstation

Intended Place for Operator

There may be only one person sitting in the driver's seat of the tractor connected to the sprayer. This is the intended workstation for operating the sprayer.

Risks of Non-Compliance

During the operation or transport of the sprayer:

If another person disturbs or interferes with the operator, or if the operator is trying to operate the sprayer from other places than the tractor's driver seat, this can result in negligent or incorrect handling of the vehicle.

- risk of the operator losing his concentration and focus on operating the vehicle correctly
- risk of the operator losing his ability to operate the vehicle correctly
- risk of fatal accidents while driving
- risk of damages to the tractor, sprayer and foreign objects while driving
- risk of inefficient spraying due to incorrect operation of the sprayer.

If the Safety Information is Ignored

Possible Risks and Dangers

Non-compliance with the safety information

- can pose a danger to people, to the environment and to the sprayer
- danger to people through non-secured working areas
- danger to people through mechanical and chemical influences
- failure of important sprayer functions
- failure of prescribed methods of maintenance and repair
- leakage of hydraulic fluid or spray fluid to the environment
- can lead to the loss of all warranty claims.

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Safety Information For Operators

General Safety and Accident Prevention

Before use or starting up the sprayer and the tractor, always check their

- roadworthiness
- operational safety

Risk of crushing, cutting, catching, squeezing, getting trapped, being drawn in or being struck by sprayer parts due to inadequate roadworthiness and operational safety.

Beside these instructions, comply with the generally applicable national safety and accident prevention regulations.

The warning symbols and other labels attached to the sprayer provide important information on safe sprayer operation. Compliance with this information is in the interests of your safety.

Keep the spray boom in folded position, whenever the sprayer is not coupled to a tractor. Unfolding the boom on an uncoupled sprayer will shift the balance point of the sprayer causing a risk of overturning.

Before driving off and starting up the sprayer, check the immediate area of the sprayer - look out especially for children and instruct them and other unauthorized persons to stay out of reach of the sprayer. Ensure that you can see clearly.

Drive in such a way that you always have full control over the tractor with the attached sprayer. In doing so, take your personal abilities into account, as well as the road, traffic, visibility, weather conditions and the driving characteristics of the tractor and of the connected sprayer.

Slow down when driving in uneven terrain or when making sharp turns, as the sprayer might be in risk of turning over.

It is forbidden to ride on the sprayer or use it as a means of transport.

It is forbidden to stay in the working area of the sprayer's drawbar, on the sprayer's platform or behind the operating area (the tractor), unless the hydraulic pressure to the sprayer has been switched off.

Only authorized persons are allowed inside or outside the tractor cabin during operation.

Keep persons, children and animals away from the operation areas of the sprayer and from the sprayer's equipment. Be careful when manoeuvring the sprayer, especially when reversing, as there is a risk of hitting people or surroundings.

Avoid eating, drinking or smoking while spraying or working with equipment contaminated with chemicals.

The chemicals used for spraying are dangerous to your health! In case of ingestion, poisoning or damages to your skin or face, immediately seek medical advice. Remember to identify the chemicals used.

Coupling and Uncoupling the Sprayer

Only connect and transport the sprayer with tractors suitable for the task. See the section "Technical Specifications" in this book to make sure that the tractor matches the requirements to operate the sprayer.

When coupling sprayers to the tractor's three-point linkage, the linkages of the tractor and the sprayer must always be the same.

Connect the sprayer to the prescribed equipment in accordance with the specifications.

When coupling sprayers to the front or the rear of the tractor, the following may not be exceeded:

- the approved total tractor weight
- the approved tractor axle loads
- the approved load capacities of the tractor tyres
- the approved load capacities of the tractor hitch points.

Secure the tractor and the sprayer against rolling unintentionally before coupling or uncoupling the sprayer.

It is forbidden for people to stand between the sprayer to be coupled and the tractor, while the tractor is moving towards the sprayer.

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Any helpers may only act as guides standing next to the vehicles, and helpers may only move between the vehicles when both are at a standstill.

Before connecting the sprayer to or disconnecting the sprayer from the tractor's three-point linkage, secure the operating lever of the tractor hydraulic system, so that unintentional raising or lowering is prevented.

When coupling and uncoupling sprayers, move the support equipment (if available) to the appropriate position (check stability and strength of the support).

When actuating the support equipment, there is a risk of injury from crushing and cutting points.

Be particularly careful when coupling the sprayer to the tractor or uncoupling it from the tractor. There are crushing and cutting points in the area of the coupling point between the tractor and the sprayer.

It is forbidden to stand between the tractor and the sprayer when actuating the three-point linkage.

Coupled supply lines

- must yield to all movements while cornering without tensioning, kinking or rubbing
- must not rub against other parts.

Ropes or cords releasing quick couplings must hang loosely, and they must not release themselves when lowered.

Also ensure that uncoupled sprayers are stable.

Use of The Sprayer

Before starting work, ensure that you understand all the equipment and actuation elements of the sprayer and their function. There is no time for this when the sprayer is already in operation.

Only wear tight clothes. Loose clothing increases the risk of being caught by the drive shaft / PTO.

Only start-up the sprayer, when all the safety equipment has been attached and in the safety position.

Comply with the maximum load for the connected sprayer and the permissible axle and drawbar loads for the tractor. If necessary, drive only with a partially filled tank.

It is forbidden to

- stand in or near the working area of the sprayer
- climb the sprayer
- stand or sit on the sprayer
- stand in the turning and swivel range of the sprayer.

There are crushing and cutting points at externally actuated sprayer points, e.g. hydraulic cylinders.

Only actuate externally actuated sprayer parts when you are sure that no one is standing within the prescribed safety distance.

Before leaving the tractor:

- lower the spray boom to around waist height above the ground or lower, or
- fold the spray boom into the transport position
- turnoff the tractor engine
- remove the ignition key.

When use of the TurboFiller has ended, make sure that all manifold handles are closed / deactivated.

If parking or stopping the tractor with the sprayer pump running, always keep the sprayer under supervision.

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Road Transport

When driving on public roads or highways with the sprayer coupled to the tractor, the following instructions must be followed. Failure to do so will create a risk of traffic accidents and fatalities!

Comply with the national or local road traffic regulations when using public roads and highways.

When driving in areas with special rules and regulations for markings and lights on sprayers, you should observe these and equip your sprayer accordingly.

Checking the vehicle

Before transporting the sprayer on a road, complete the following check points for the tractor and sprayer.

1. Spray boom is folded and resting in transport brackets with the intended locks engaged.
2. Engage transport locks on the steering cylinders.
3. Supply lines for hydraulic, electric and pneumatic systems (if installed) are correctly connected.
4. Parking brake is completely disengaged. Safety line is secured (if applicable).
5. Hydraulic pressure from tractor to sprayer is turned off.
6. PTO drive is turned off.
7. Hitch bolt(s) between tractor and sprayer must be secured with a linchpin or other appropriate means.
8. If the sprayer is coupled onto a lift link drawbar, the lower link should be laterally fixed.
9. Traffic lights and reflectors are in good working order, clean and free from damages.
10. Signs or markings on the vehicle regarding road transport are correctly placed and visible.
11. Brakes are in good working order and free from visible damages.
12. Tyre pressure is correct according to the load.
13. No cables or other parts must be strained or caught in the tractors wheels when cornering.
14. Crop residues and dirt are removed.
15. All moveable or loose equipment are securely latched or stowed away in the designated compartments.

Ensure that the tractor has sufficient steering and braking power. If necessary, use front weights to the tractor in a stable position.

Any sprayers and front/rear weights connected to the tractor influence the driving behaviour and the steering and braking power of the tractor.

The front tractor axle must always be loaded with at least 20% of the tractor's empty weight, in order to ensure sufficient steering power.

Always fix the front or rear weights to the intended fixing points according to regulations.

Comply with the maximum load for the connected sprayer and the approved axle and drawbar loads for the tractor.

The tractor must guarantee the prescribed brake delay for the loaded vehicle combination (tractor plus connected sprayer).

When turning corners with the sprayer connected, take the broad load and balance weight of the sprayer into account. Slow down as needed to avoid tilting or overturning of the vehicle, especially on sloping roads.

If the sprayer is fixed to the tractor's three-point linkage or lower links, ensure sufficient side locking of the tractor lower links before driving off.

Before driving off, secure the operating lever of the three-point hydraulic system against the unintentional raising or lowering of the connected sprayer.

Check that the transport equipment, e.g. lighting, warning equipment and protective equipment, is correctly mounted on the sprayer.

Carry out a visual check that the upper and lower link pins are firmly fixed with linchpins against unintentional release.

Adjust your driving speed to the prevailing conditions.

Before driving downhill, switch to a low gear.

Before driving off, always switch off independent wheel braking on the tractor (lock the pedals).

Do not use the sprayer as a means of transportation of people or goods.

No one is allowed outside the tractor cabin during road transport, as this can lead to fatalities.

The tractor driver must not be disturbed by other people in the cabin during driving.

Hydraulic System

The hydraulic system is operating under a high pressure.

Ensure that the hydraulic hose lines are connected correctly.

When connecting the hydraulic hose lines, ensure that the hydraulic system is depressurized on both the sprayer and tractor sides.

The operator controls in the tractor used for hydraulic and electrical movements of components must stay unlocked, e.g. for folding, swivelling and pushing movements. The movement must stop automatically when you release the appropriate control. This does not apply to equipment movements that

- are continuous
- are automatically controlled
- require a floating position or pressed position to function.

Before working on the hydraulic system:

- lower the spray boom to its lowest position or into the transport position
- turn off / depressurize the hydraulic system
- turn off the tractor engine
- engage the parking brake
- remove the ignition key.

Have the hydraulic hose lines checked at least once during a calendar year by an expert to ensure that they are in safe working order.

Replace the hydraulic hose lines if they are damaged or worn, which is when

- it is leaking
- reinforcement material inside the hose is visible due to cracks in the outer layers.

Only use genuine HARDI hydraulic hose lines.

The hydraulic hoses should not be in use for longer than 5 calendar years, including any storage time of maximum 2 years. Even with proper storage and approved use, hoses and hose connections are subject to natural ageing, thus limiting storage time and the time of use. However, it may be possible to specify the length of use from experience values, in particular when taking the risk potential into account. In the case of hoses and hose connections made from thermoplastics, other guide values may be decisive.

Never attempt to plug leaks in hydraulic hose lines using your hand or fingers. Escaping high pressure fluid (hydraulic oil) may pass through the skin and ingress into the body. Risk of infection and serious injuries.

If you are injured by hydraulic oil, contact a doctor immediately.

When searching for leaks, use suitable aids to avoid the serious risk of infection and injury.

2 - General Safety Instructions

Electrical System

When working on the electrical system, always disconnect the tractor's battery.

When disconnecting the battery, disconnect the negative terminal first, followed by the positive terminal.

When connecting the battery, connect the positive terminal first, followed by the negative terminal.

Always place the appropriate cover over the positive battery terminal. If there is accidental earth contact, there is a risk of explosion.

If climbing onto the sprayer during service work, be aware of the low voltage danger from electric components.

Only use the prescribed fuses. If the fuses used are too highly rated, the electrical system will be destroyed. Risk of fire.

The sprayer may be equipped with electronic components whose functions are influenced by electromagnetic interference from other units. Such interference can pose risks to people, if the following safety information is not followed.:

- If retrofitting electrical units and/or components on the sprayer with a connection to the on-board power supply, the user is responsible for checking whether the installation might cause faults on the vehicle electronics or other components

Field Sprayer Operation

Observe the recommendations from the manufacturer of the crop protection product in respect of

- personal protective equipment
- warning information on exposure to crop protection products
- regulations on dosing, applications and cleaning.

When there will be exposure to the crop protection product, wear the proper personal protective equipment. This may differ depending on the chemical being sprayed. Follow the local law. Wash and change clothes after spraying. Wash tools if they have been contaminated.

Observe the information in the national plant protection law.

Keep hoses, pipes or other lines closed, when they are under pressure.

Only use genuine HARDI hoses and hose clamps for replacement, which stand up to chemical, mechanical and thermal requirements.

The rated volume of the spray liquid tank must not be exceeded during filling. If overfilling, some sprayer functions may be disabled. However, the main tank is a little oversized to allow for foaming.

When using tractors with a cab with ventilation fans, replace the fresh air filters with activated carbon filters.

Observe the information on the compatibility of crop protections and substances for the field sprayer.

Be aware that some crop protection products have a tendency to stick together or settle when being mixed.

Do not fill the sprayer with water from bodies of water, which are open to the public. This is for the protection of people, animals and the environment due to the risk of contamination.

Only fill the sprayer using a free flow of water from the mains water supply or from an external water tank.

Environmental Precautions

It is essential to reduce the environmental impact of plant protection chemicals to a minimum. Particularly the soil, subsoil water, streams, lakes, flora and fauna must be in focus. Contamination of subsoil water must be prevented by paying particular attention to avoidance of spot contamination of the soil in connection with filling and washing and parking of the sprayer.

If any concentrated chemicals are spilled on the soil, the contaminated soil should be removed and sent for cleaning at a capable facility. Follow local regulations regarding disposal. This must be done to avoid seepage of chemicals to the subsoil waters. Avoid spillage - use the chemical filling device for filling the sprayer with chemicals.

Do not overfill the main tank. The rated volume inside the main tank is stated with large printed numbers on the outside of the tank. If overfilling, the spray liquid could leak from the sprayer causing contamination of the soil.

Before filling the sprayer with plant protection chemicals, the sprayer must be calibrated to apply the precise dose rate selected. The important input sensors are the flowmeter and the speed sensor.

It is recommended to establish a proper filling and washing location with hard, impenetrable surface drained to a receptacle if the sprayer is always filled or cleaned on the same spot at the farm. If a washing/filling location is NOT available, the following precautions should be taken:

- The sprayer should only be filled with clean water at the farm
- The plant protection chemicals must be added and mixed in the field to be sprayed
- Select a different location each time the sprayer is refilled.

2 - General Safety Instructions

Service Work Precautions

Before carrying out any service work, all of the following instructions must be followed in order to prevent damages to the sprayer, injuries and fatalities:

- do not walk under any part of the sprayer, unless it is secured. The spray boom is secured when placed in the transport brackets
- if the spray boom is folded up and resting in the transport brackets for service, check visually that the paralift locks are engaged (the boom is locked in place)
- if the spray boom is unfolded for service, the boom must be lowered, until it reaches its end stop. Place strong trestles under the boom for support or use a lifting crane for support
- never service or repair any equipment while it is operating
- any service work is preferable carried out on level ground with only authorized persons nearby
- depressurize the hydraulic system for the sprayer to prevent unintentional movements of the sprayer
- switch off the PTO
- switch off the tractor and remove the ignition key to prevent unintentional starting
- activate the parking brake to prevent rolling
- put chocks in front of and behind the wheels to prevent rolling
- electric power must be disconnected from the sprayer
- any service work on electronic /electric parts must be carried out under dry conditions - no rain or splashes from water or other liquids.

Cleaning

When cleaning nozzles and filters, lower the spray boom to around waist height above the ground. For safety reasons, do not walk or stand below the boom or paralift during this cleaning work!

Dispose of oils, greases and filters in the appropriate way to protect the environment.

Cleaning of tanks:

- Due to toxic vapours from spray liquids in the main tank, climbing into this tank is very hazardous. Cleaning should only be done from the outside.
- Refrain from entering the main tank.
- Refrain from inspecting any of the tanks with the liquid pump running.

Rinse and wash equipment with clean water after use and before servicing.

Service and Maintenance

Always reassemble all safety devices or shields immediately after servicing.

After a longer period of standstill, the sprayer must be inspected by a qualified operator. Contact your HARDI dealer for more information.

Repair work in the main tank must only be carried out by a specialized workshop.

Do not attempt to enter the tank.

Access to the rinsing tank must only take place with the spray boom in transport position, and after it is verified that the transport locks are engaged.

Regularly check the nuts and bolts for firm seating and retighten them as necessary.

If electrical welding is used on the tractor and on the attached sprayer, disconnect the cable to the tractor's generator and battery before carrying out electrical welding work on the tractor and on the connected sprayer. Remove all inflammable or explosive materials from the area to prevent fire.

Pressure test the spray functions with clean water prior to filling with chemicals.

Refrain from dismounting hoses, pipes, or any equipment, if the sprayer is in operation.

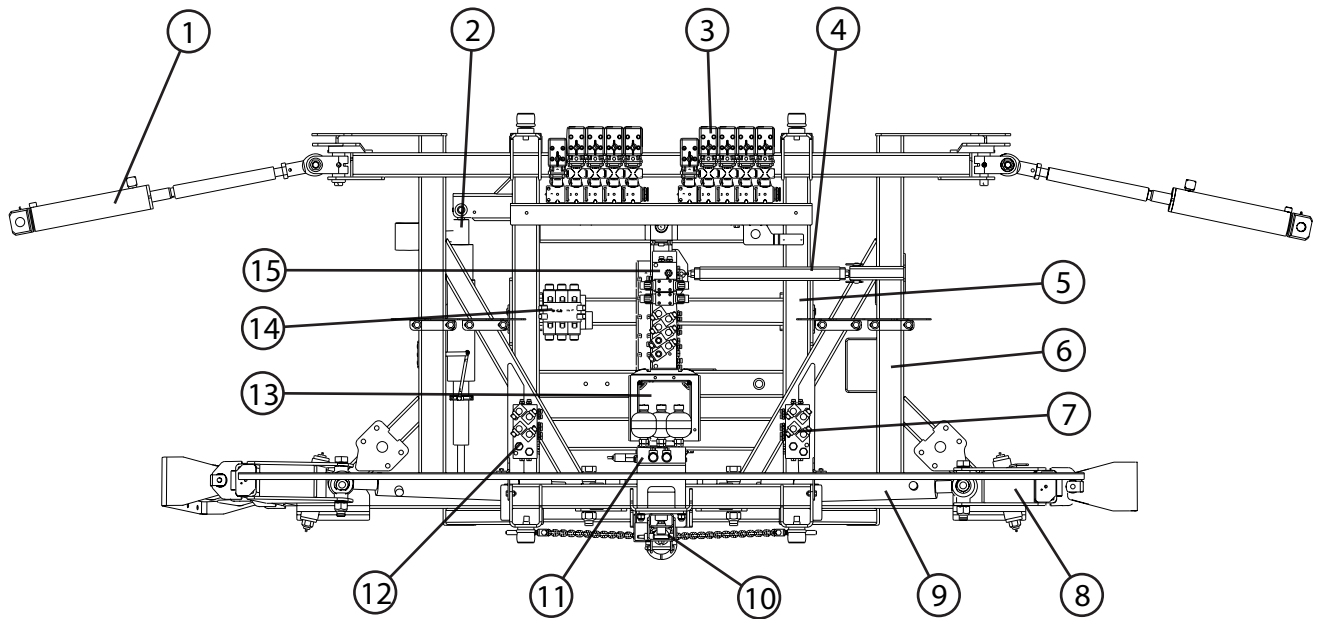
Stay below the maximum speed (rpm) suitable for the PTO shaft.

When replacing spare parts, use suitable tools and personal protective equipment.

Spare parts must at least meet the specified technical requirements of HARDI. This is ensured through the use of genuine HARDI spare parts.

2 - General Safety Instructions

Overview AutoTerrain centre



- | | |
|--|--|
| 1. Tilt cylinder | 9. Inner wing fold cylinder |
| 2. Active roll cylinder | 10. Pendulum lock |
| 3. Distribution valves | 11. Inner fold hydraulic block |
| 4. Tie alignment bar | 12. Hydraulic block for outer left wing fold |
| 5. Lift frame | 13. Electrical junction box |
| 6. Centre frame | 14. AutoTerrain hydraulic block |
| 7. Hydraulic block for outer right wing fold | 15. Main hydraulic block |
| 8. Inner fold hinge | |

3 - Description

Boom

Boom and terminology

TDZ booms are supported by a wide Paralift which enhances the stability of the boom and is hydraulically dampened for smooth ride and performance. The AutoTerrain centre is a Pendulum type specifically designed for stability and auto height control. Yaw-dampening occurs through the main fold cylinders.

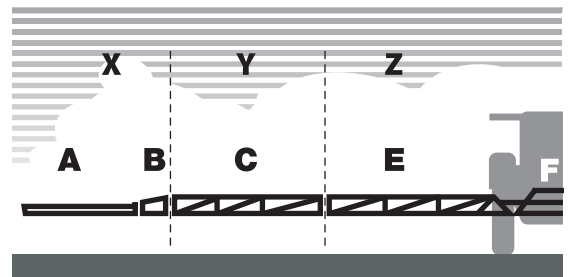
The boom is fully hydraulically operated Z-version with all functions controlled via the Direct Hydraulic System (D.H.).

Boom features:

- AutoTerrain centre
- Hydraulic centre lock.
- 3-folded boom wings
- Outer sections incorporate spring-loaded breakaway.
- Wing tilt
- Yaw suspension
- Second outer hydraulic safety relief valve

For 3-folded booms the terminology is as follows:

- A. Breakaway section
- B. 2nd outer wing
- C. 1st outer wing
- E. Inner wing
- F. Centre section



NOTE! When controlling the boom at the SetBox, the folding sections sequence are:

- X. 2nd outer wing
- Y. 1st outer wing
- Z. Inner wing



NOTE! A break-away section. This spring loaded section is a safety section of the boom, positioned for operational mistakes. It is NOT! designed for hitting obstacles or the ground at speed as it can be damaged. If damaged it is recommended to be replaced.

AutoTerrain

AutoTerrain is a computer controlled pre-emptive boom stability and auto height control system which maintains the correct relationship and height of the boom from the ground in different field conditions. AutoTerrain uses highly tuned computer controlled proportional electro-hydraulics and ultrasonic sensors help spray more safely, reducing potential ground strikes and prevents incorrect spray height.



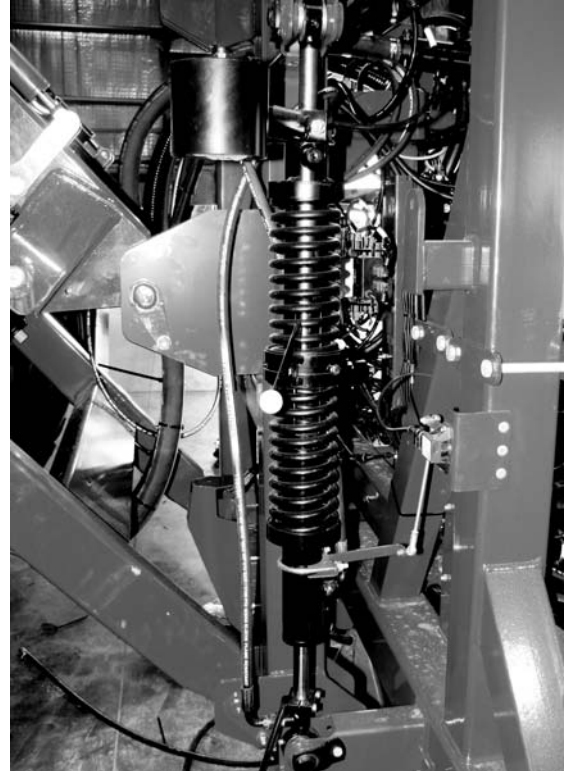
WARNING!

- Stability control roll sensor and indicator must be correctly aligned to prevent uncontrolled and continuous boom oscillation.
- The pendulum centre stability control linkage points must be regularly lubricated to protect swivel balls from moisture penetration and prevent swivel ball seizure.
- The boom should never be used to spray with the pendulum lock engaged.



ATTENTION!

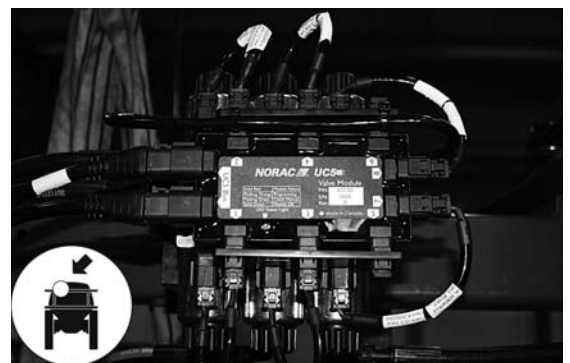
- Dusty, damp or missing sensors pads will not read accurately and AutoTerrain will be compromised. For optimum AutoTerrain performance the stability & height control sensors must be checked and cleaned regularly.
- Foam pads must be washed and dried daily. The boom should not be used if foam pads are missing from the sensors.
- Wet foam pads fitted for a prolonged period will cause corrosion of the sensor, Always let cleaned foam pads dry before re-fitting them.
- Please refer to specific AutoTerrain manual for information about Operation, Calibration and Maintenance.



AutoTerrain Hydraulic block

The AutoTerrain hydraulic block manages hydraulic pressure for the automatic boom height control functions. Functions controlled include:

- Lift (paralift)
- Wing Tilt (left and right hand side)
- Centre AutoTerrain active roll cylinder



3 - Description

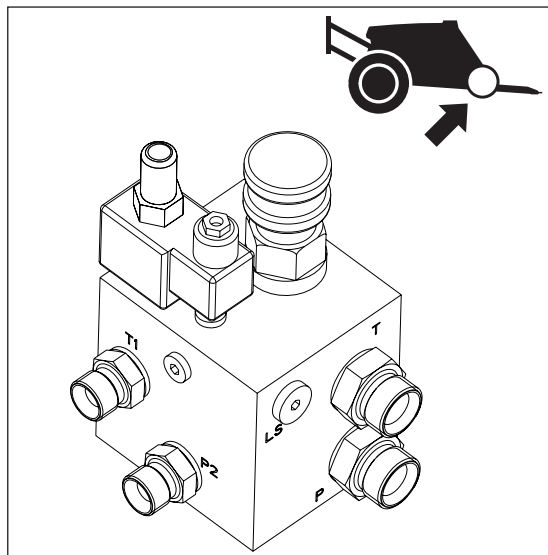
ParaLift

This hydraulic block manages the direct activation of the paralift boom height control.



Open/Close centre hydraulics

The open centre hydraulics block is necessary to select between tractors with open centre hydraulics and/or load sensing. For adjustment see “Open/Close Centre Hydraulics” on page 41.



Boom SetBox controls (Commander 2)

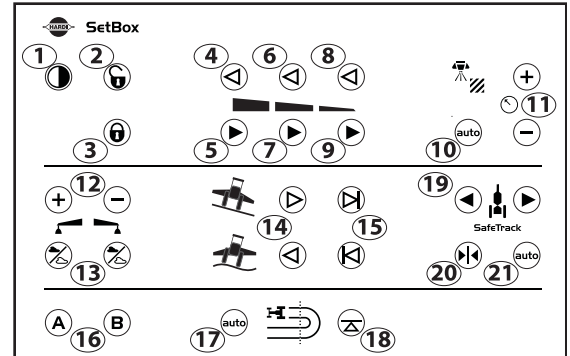


ATTENTION! For instruction how to operate the boom please see "Operating the boom" on page 44



ATTENTION! The following information is intended as a general guide only. For detailed Safety, Set-up, Operation and Maintenance information for your specific boom configuration please refer to your individual Boom Operators Manual supplied with you sprayer.

The SetBox controls the volume rate, foam marker, HeadlandAssist, pendulum lock, boom folding and stability functions. Furthermore two optional functions can be controlled. The buttons on the SetBox control the following functions:

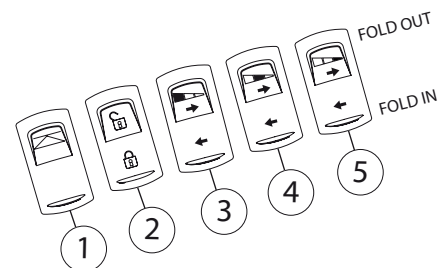


1. Power ON/OFF.
2. Pendulum unlock.
3. Pendulum lock.
4. Inner wing fold.
5. Inner wing unfold.
6. 1st outer wing fold.
7. 1st outer wing unfold.
8. 2nd outer wing fold.
9. 2nd outer wing unfold.
10. Automatic volume rate control
11. Manual pressure control.
12. Foam marker regulation.
13. Foam marker Left/Right selector.
14. DynamicCentre adjustment (step wise).
15. DynamicCentre outer positions 1 or 5.
16. Optional function A-B.
17. HeadlandAssist automatic (not used).
18. HeadlandAssist boom align.
19. SafeTrack manual control (not used).
20. SafeTrack align selector (not used).
21. SafeTrack automatic selector (not used).

Boom Controls Saritor

The boom buttons on the console control the following functions:

1. AutoTerrain centre levelling.
2. Lock/Unlock centre.
3. Unfold/Fold inner wing.
4. Unfold/Fold 1st outer wing.
5. Unfold/Fold 2nd outer wing.

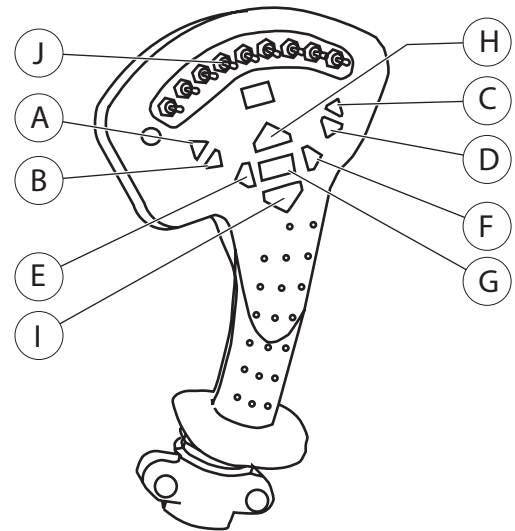


3 - Description

Grip controls Saritor and Commmander2

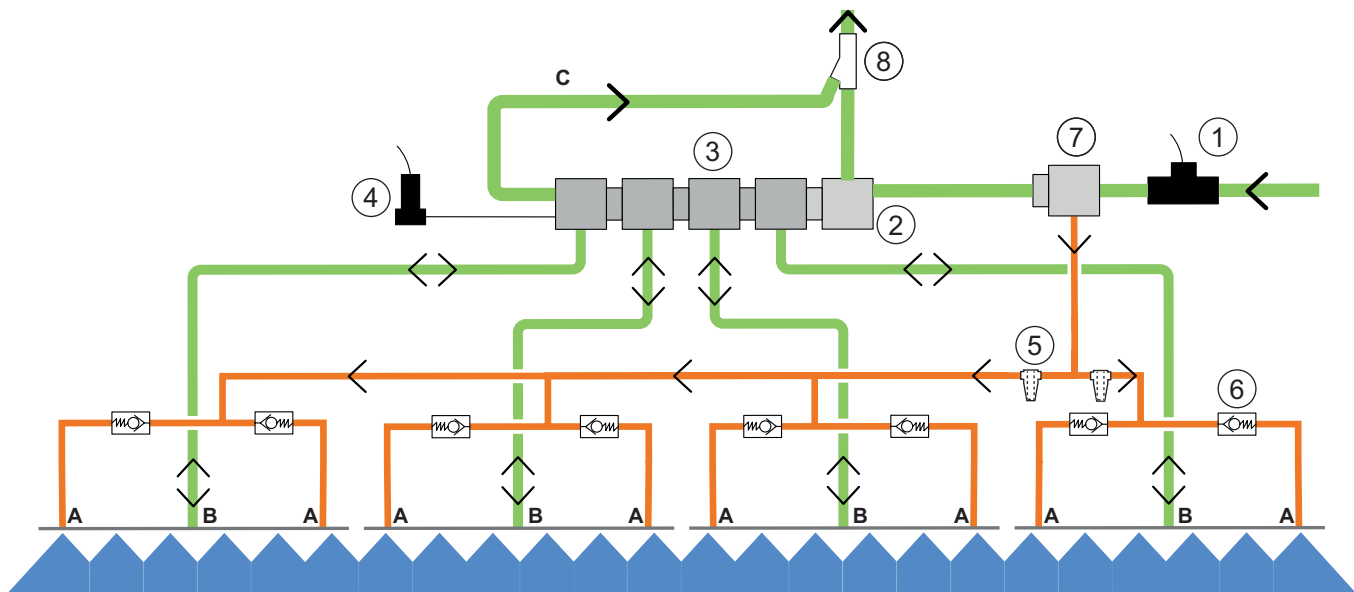
The grip controls the following:

- A. Boom tilt up left
- B. Boom tilt down left
- C. Boom tilt up right.
- D. Boom tilt down right
- E. Boom slant left.(not used)
- F. Boom slant right.(not used)
- G. Main nozzle ON/OFF.
- H. Boom lift.
- I. Boom lower.
- J. Boom nozzle section control



BoomPrime (optional)

BoomPrime is a low pressure circulation system, which primes the spray boom tubes prior to spraying, ensuring a homogenous fluid in the boom tubes and in the main tank. Below the illustration shows the BoomPrime circuit for the boom.



1. Flow meter

2. Bypass valve

3. Distribution Valves

4. Pressure sensor

5. In-Line filter for boom prime
6. One-Way Valve for boom prime

7. Boom prime valve

8. Venturi

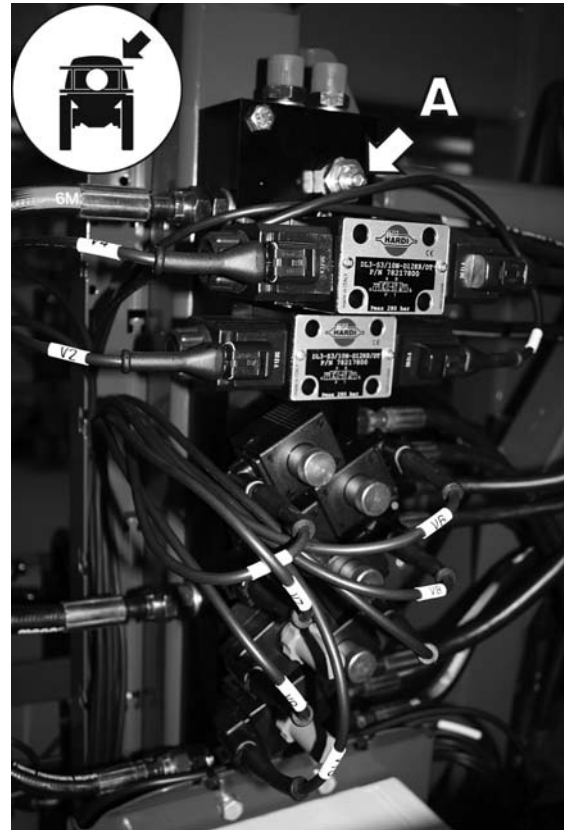
• The BoomPrime circuit is attached to each end or one end of a boom section (A).
Liquid for BoomPrime is taken from the boom prime valve (7) just after the flowmeter. This valve operates in opposite phase:

Operating state	Section valves	Bypass valve	Boom prime valve
Spraying	Open	Closed	Closed
Not spraying	All Closed	Open	Open

When priming, the direction of liquid flow will be reversed. The liquid will be fed into the nozzle tubes from each end, and is returned back to the main tank through the EFC section valves dump line (C).

Boom folding speed adjustment

The restrictor for adjusting the boom folding speed is in the main hydraulics block.
The throttle valve (A) can adjust the folding speed of the boom.
Adjusting inwards = slower boom.



Open/Close Centre Hydraulics

The open/close centre hydraulics block is used to select tractors fitted with open centre hydraulics and/or load sensing.

The valves (1) and (2) is factory set for open centre hydraulics, but if closed centre hydraulics is used (also in combination with load sensing), screw in the valve (clockwise).

Certain tractor models are able to use Load Sensing without connecting an external sensing line. But if optimal sensing control pressure cannot be obtained, an external sensing line needs to be connected (3). Please consult your tractor dealer for correct setup and correct connection.

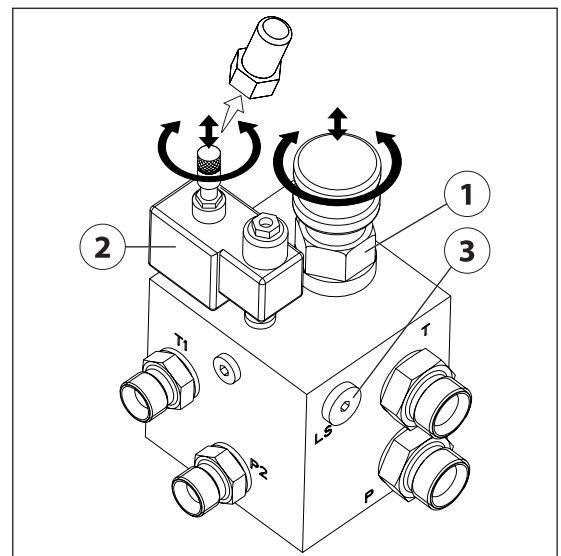


WARNING! Before operating the hydraulics, the valve should be set according to the specific tractor model. If you are unsure of the type of hydraulic system in your tractor, please contact your tractor dealer.

Combinations of settings for flow element and circuit value:

Valve no.	1	2	3 (LS port)
Open centre	Out	Out	Not connected
Closed centre	In	In	Not connected
Load sensing (LS)	In	Out*	Connected

*if the tractor requires pressure relief, contact your tractor dealer for further advice.



WARNING! Always be sure to fully open or close the open/closed centre selection valves. Failure to do so may cause damage to vital pump parts.



WARNING! It is essential that connectors on sensing line are kept totally clean. Failure to do so can result in impurities entering the pump and causing damage to vital pump parts.

4 - Sprayer setup

Auto-steer

Auto Steering system and warnings



WARNING!

- Failure to take note of this warnings will damage the boom.
- Auto steer should never be engaged before the tractor is brought on the line. The combined aggression of the auto steering system snapping to the line and continued uncontrolled auto steer oscillation is a major cause of boom yaw movement and fatigue.



ATTENTION!

- Auto-steering is a GPS controlled system that control or allows the tractor to acquire and stay on a predetermined heading. Auto-steer is user friendly however a poorly setup system or worn tractor can result in very aggressive boom behaviour.
- Auto-steer systems can contribute to uncontrolled boom yaw movements and therefore must be considered when trying to control yaw movement.
- Auto steer re-tuning is highly recommended to minimise tractor oscillation and boom Yaw movement. Contact your guidance system provider for the latest firmware available that should provide the most up-to-date line acquisition settings and performance.
- Recalibrated the dead-zone & gain settings to minimise oscillation (chasing the line) and line acquisition aggression.
- Ask your dealer service technicians to help evaluate your auto-steer aggressiveness.

General info

Environmental info

For environmental info, please refer to the following parts in the Spray Technique book:

- Nozzles.
- Spray quality.
- Choosing Nozzles for arable crops.
- Spraying speed.

5 - Operation

Boom

Safety info



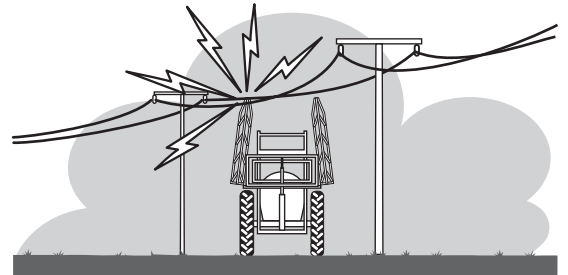
WARNING!

- The boom must not be folded/unfolded while driving!
- Never use the folding/unfolding functions before the sprayer has been stopped! FOLDING THE BOOM WHILE DRIVING WILL DAMAGE THE BOOM.
- If maintenance work is going to be carried out on the boom hydraulic system, ensure that it is completely unfolded and placed on steady sturdy stands.



DANGER!

- (Trailer only) Before unfolding the boom it is important to connect the sprayer to the tractor to prevent overbalancing of the sprayer.
- Always engage the parking brake on the tractor/self-propelled sprayer before commencing any maintenance.
- When folding or unfolding the boom, make sure that no persons or objects are within the operating area of the boom.
- Always follow the guidelines listed below when driving in areas with overhead power lines:
 - Never use the folding/unfolding or tilt functions in areas with overhead power lines.
 - Unintended boom movements may cause contact with overhead power lines.
- Only unfold and fold the boom on level ground.



Operating the boom



ATTENTION!

- If a folding sequence is not completed, a warning message will ask you to complete this sequence before starting next sequence.
- Only buttons relevant for boom functions are mentioned here. Refer page 37 for descriptions of other buttons.

Operation of the boom control HC6500 on Commander 2



ATTENTION! The centre locks automatically when pressing 2nd outer folding button.



ATTENTION! The centre lock automatically opens at speeds exceeding 1.5 km/h!



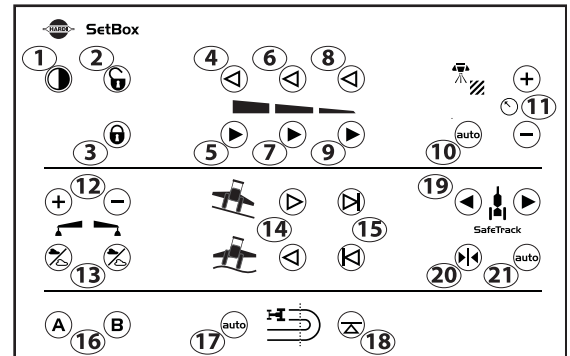
WARNING! Carefully follow steps below in order. Failure to do so may damage the boom and sprayer.



WARNING! Confirm the centre is unlocked before spraying commences.

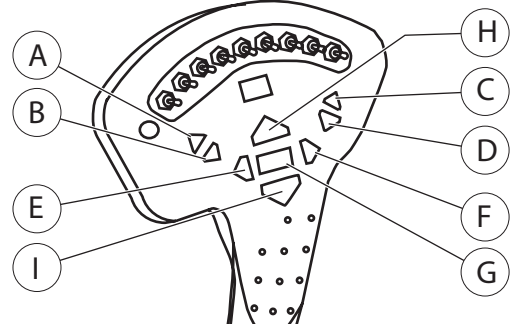
To unfold the boom

1. Turn on the tractor's hydraulic if it is not already on.
2. On the grip press and hold button **(A)** and then **(C)** to tilt boom up to clear the transport brackets.
3. On the grip press and hold the lift up button **(H)** to highest possible position. Check that the centre locked symbol **(I)** is visible in the display
4. Press and hold button **(5)** to unfold the inner wing completely.
5. On the grip press and hold button **(B)** and **(D)** to tilt boom wings down until it is straight.
6. Press and hold the button **(7)** to unfold the 1st outer wing until it is completely out, make sure that the wing locks has engaged and that the fold cylinders are fully extended.
7. Press and hold button **(9)** to unfold 2nd outer wing until it is completely out make sure the fold cylinder is fully extended.
8. On the grip press and hold the lift down button **(I)** to lower the boom to the correct working height.
9. Drive slowly until the centre is completely unlocked. If not unlocked, press **(2)** and until the **G+** symbol appears in display, this takes approximately 10 seconds.



To fold the boom

1. On the SetBox press button **(18)** to automatically level the centre.
2. Press button **(3)** to lock the centre. The symbol **(I)+** appears in display until centre is locked. This takes approximately 10 seconds.
3. On the grip press and hold lift up button **(H)** to raise the boom to the highest possible position.
4. Press and hold button **(8)** to fold the 2nd outer wings. Check that the centre lock symbol **(I)** is visible in the display.
5. Press and hold button **(6)** to fold the 1st outer wings.
6. Press and hold the button **(4)** to fold the inner wings until they touches the side posts. Make sure the wings will clear the transport brackets, if not press button **(A)** and **(C)** to tilt the boom up.
7. Push the lift down button **(I)** to lower the boom until it rests on the paralift locks.
8. Press tilt button **(B)** and **(D)** to lower boom until they rests in the transport brackets.



5 - Operation

Operation of the boom control on Saritor



ATTENTION! The centre locks automatically when pressing 2nd outer folding button.



ATTENTION! The centre lock automatically opens at speeds exceeding 1.5 km/h!



WARNING! Carefully follow steps below in order. Failure to do so may damage the boom and sprayer.



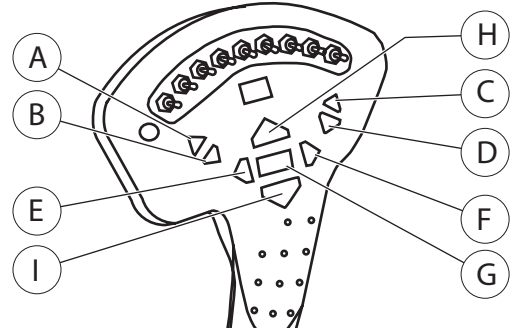
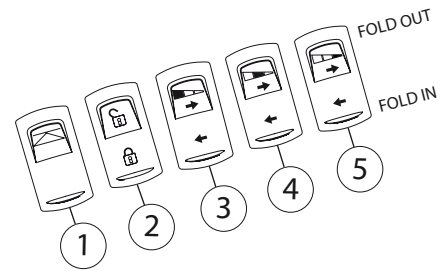
WARNING! Confirm the centre is unlocked before spraying commences.

To unfold the boom



WARNING! Carefully follow steps below in order. Failure to do so may damage the boom and sprayer.

1. On the grip press the boom lift up button **(H)**. Check that the centre locked symbol **(I)** is visible in the display
2. On the grip press and hold button **(A)** and then **(C)** to tilt boom up until it's clear from the transport brackets.
3. On the console press and hold the button **(3)** to unfold the inner wings completely.
4. On the grip press and hold button **(B)** and **(D)** to tilt boom wings down until it is level with the ground.
5. On the console press and hold the button **(4)** to unfold the 1st outer wing until it is completely open, make sure that the wing locks has engaged and that the fold cylinders is fully extended.
6. Press and hold button **(5)** to unfold 2nd outer wing until it is completely open make sure the fold cylinder is fully extended.
7. On the grip press and hold the lift down button **(I)** to lower the boom to the correct working height.
8. Drive slowly until the centre is completely unlocked. If not unlocked, press **(2)** and until the **(I)** symbol appears in display, this takes approximately 10 seconds.



Operating the boom control on Saritor

To fold the boom



WARNING! Carefully follow steps below in order. Failure to do so may damage the boom and sprayer.

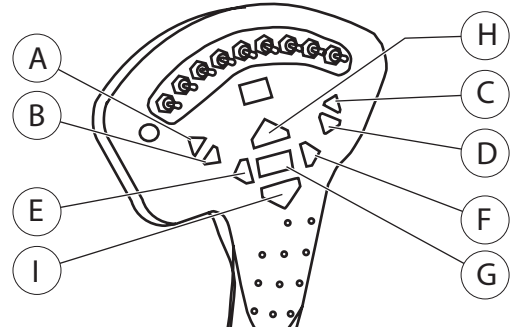
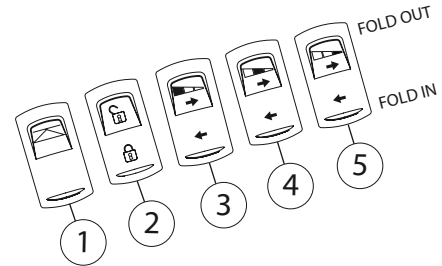


ATTENTION! The centre locks automatically when pressing 2nd outer folding button.



WARNING! Confirm the centre is locked before folding continues.

1. Press and hold buttons (4) to automatically set the centre to horizontal position (AutoTerrain only). If not equipped with AutoTerrain use button (E) and (F), until the centre is horizontal.
2. Press button (2) to lock the centre. The symbol appears in display until pendulum is locked. This takes approximately 10 seconds.
3. On the grip press the boom lift button (H) to raise the boom to the highest possible position.
4. On the console press and hold the button (5) to fold the 2nd outer wing until it's resting on the wing support.
5. On the console press and hold the button (4) to fold the 1st outer wing until it's resting on the wing support.
6. On the grip press button (A),(B),(H) and (C) tilt wings to around 10 degree angle
7. On the console press and hold the button (3) to fold the inner wing until the boom touch the side post. Make sure the wings will clear the transport brackets, if not press button (A) and (C) to tilt the boom up.
8. On the grip press and hold button (B) and (D) to tilt boom down into the transport rests
9. On the grip press button (I) to lower the centre until the paralift transport locks engage.



Boom tilt function

The tilt buttons (A),(B) (C), (D) can individually change the inclination of the boom wings.

Alternative boom widths

The boom can also be used partially-folded. If applicable, only unfold the inner wing or inner and 1st outer wing sections. On the grip unit make sure to deactivate spray sections, that should not be used.



WARNING! When using the boom partially folded there is no active break-away section. Therefore any contact on the end of the boom will damage the boom.

Lubrication

General Info

Always store lubricants clean, dry and cool - preferably at a constant temperature - to avoid contamination from dirt and condensed water. Keep oil filling jugs, hoppers and grease guns clean, and clean the lubricating points thoroughly before lubricating. Avoid skin contact with oil products for longer periods.

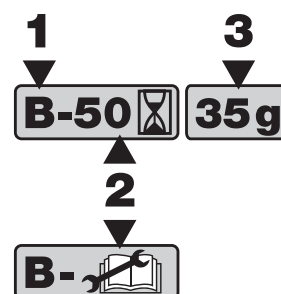
Always follow the quality and quantity recommendations. If no quantity is recommended, grease the nipple until new grease becomes visible.

Pictograms in Lubrication & Oiling Plans Designate:







1. Lubricant to be used (see "Recommended lubricants" below).
2. Recommended intervals. Shown in hours or with a symbol for occasional maintenance.
3. Amount to be used. Only shown if an amount is specified.



ATTENTION! If the sprayer has been cleaned with a high pressure washer, lubrication of the entire machine is recommended.



Suitable Lubricants

What to Lubricate?	Lubricant Type	Factory Use	Suitable Alternatives
 A BALL BEARINGS and PUMP	Lithium based grease Consistency NLGI grade 2 Viscosity (@40°C) > 460 cSt	SHELL Gadus S3 V550L 1 Hardi pump grease cartridge (400g); Item no. 28164600	MOBIL grease XHP 462 TOTAL Multis Complex SHD 460
 B SLIDE BEARINGS	Lithium based grease Consistency NLGI grade 1/2 Viscosity (@40°C) > 200 cSt	MOBIL XHP 222	SHELL Gadus S3 V220C 2 TOTAL Multis Complex SHD 220
 C OIL LUBRICATION POINTS	Engine or transmission oil Viscosity 20W-50 or 80W-90	OK Tractor UTTO GL 4 80W	SHELL Spirax S4 TXM CASTROL ACT EVO 4T MOBIL Mobilube HD 80W/90
 D GLIDE SHOES	Stearic or a non-greasy type of wax		
 D BOLTS	Anti-corrosive wax	PAVA PV 700	TECTYL 506 WD
 D VALVES and SEALS (O-RINGS)	NSF 51, NSF 61 silicone compound	DOW CORNING MOLYKOTE 111 Compound	

6 - Maintenance

Grease Nipple

When lubricating the sprayer, please use a greasing gun which fits the dimensions of the grease nipple.

Nipple head type: DIN 71412

Nipple head size (A): 6.5 mm



ATTENTION! If grease is leaking from the nipple near its threaded part, when grease is being applied, please tighten the nipple by using a spanner or similar. Replace the nipple, if it is damaged or bent out of shape.



ATTENTION! If applying grease into the nipple seems difficult, unscrew the nipple. Check if the nipple is blocked inside, or if the spring-loaded ball is stuck. Clean or repair as needed.



Grease Gun Calibration

Before lubricating the sprayer, you must calibrate your grease gun to ensure that the correct amount of grease is applied to each lubrication point. The correct amount of grease applied will prolong the lifetime of the sprayer.

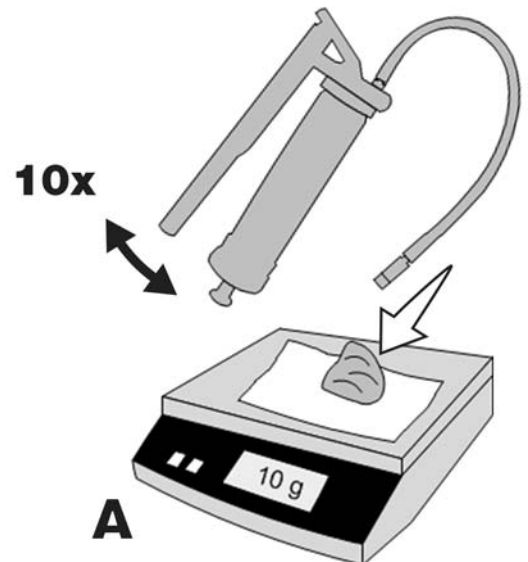
Calibration example

1. Insert the correct grease cartridge in your grease gun.
2. Apply grease onto a tissue or a piece of paper. Complete 10 full strokes of the grease gun.
3. Place the paper with grease on a scale (A).
4. If your grease pile weighs for example 10 grams, then 1 stroke equals 1 gram of grease.

When calibrated, you can count how many strokes to complete, when lubricating the different grease points on the sprayer according to the specifications.

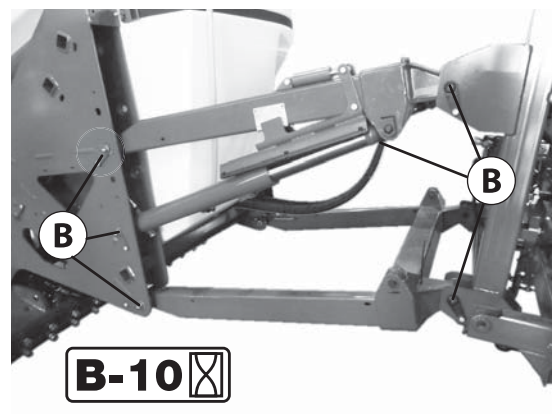
Alternative method

1. Count the strokes, until you have 10 grams of grease piled up on the scale (A).
2. Now you can figure out how many strokes to use for applying a certain amount of grease to a lubrication point.

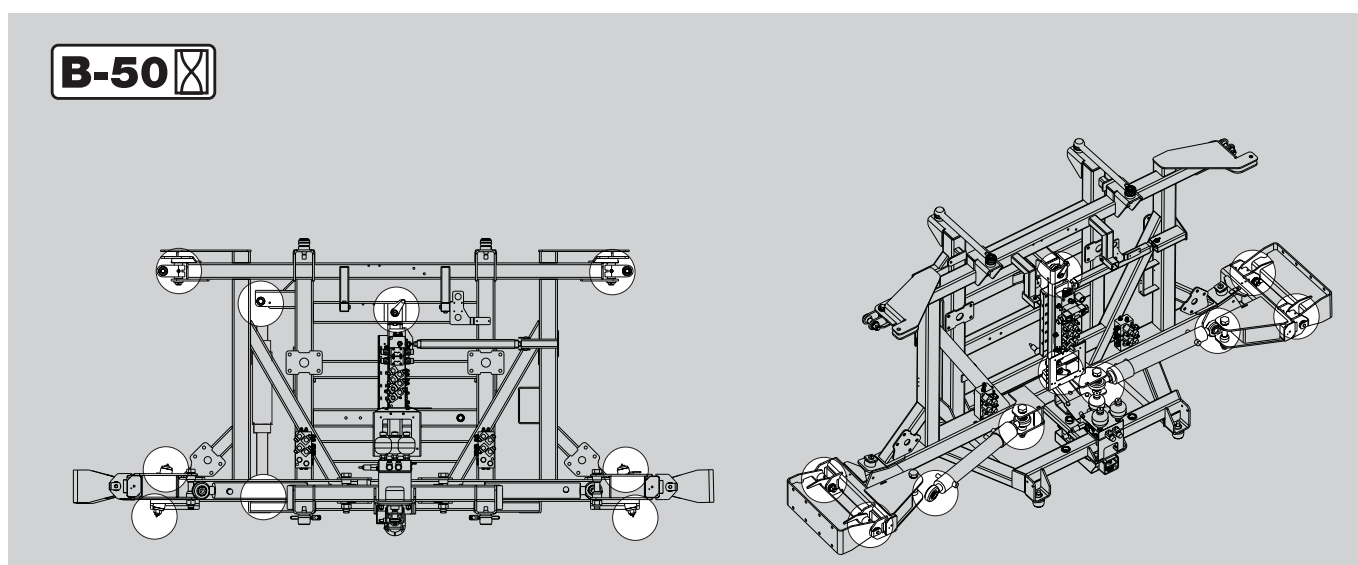


Paralift lubrication & oiling plan

The lift is lubricated from the outside of the trailer's rear end.

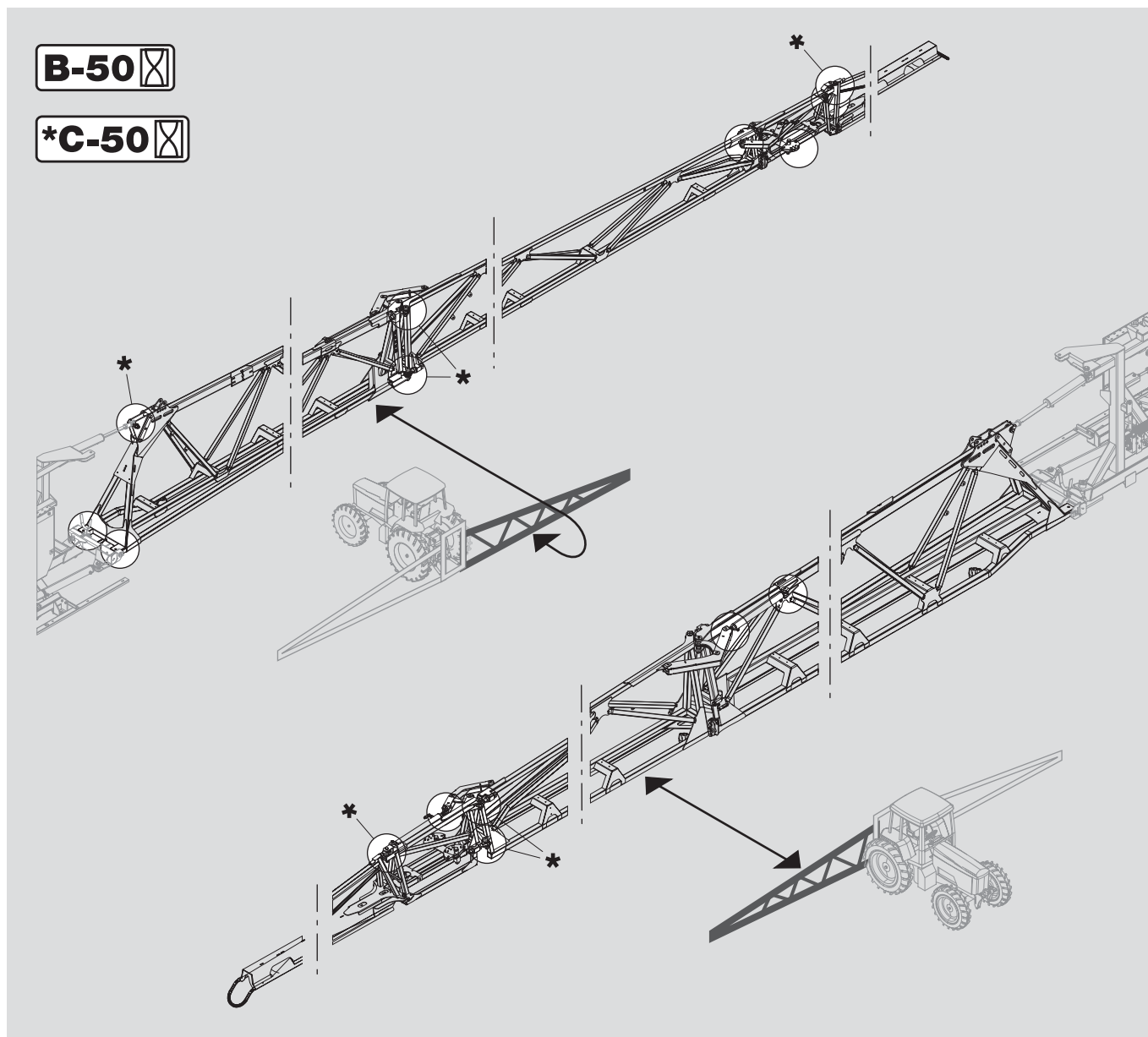


Centre Lubrication points



6 - Maintenance

Boom lubrication



Service and maintenance intervals

General Info

The periodic service and maintenance work may be carried out by the user. Contact your HARDI dealer if in doubt. If this work is completed correctly, the sprayer will run efficiently and its lifetime will be prolonged.

When a number of hours are mentioned in this chapter, this means hours of spraying, unless otherwise explained. Operation hours can be read in the controller in the tractor (see instruction book for controller).

Tightening Bolts and Nuts

When tightening bolts and nuts as a part of periodic service or due to replacement of spare parts, it is important to apply the correct torque. This will prevent accidents and prolong the lifetime of the parts included in the bolted joints.

If not otherwise stated in this book, please tighten bolts and nuts using the following torques.

Bolt size	Recommended torque (Nm)	Maximum torque (Nm)
M4	2.4	3
M5	5	6
M6	8	10
M8	20	25
M10	39	50
M12	70	85
M14	112	140
M16	180	215
M18	240	305
M20	350	435
M22	490	590
M24	600	750
M27	976	1100
M30	1300	1495



WARNING! Applying too little torque will result in these risks:

- bolted joints will rattle and thus fail under fatigue
- bolts are being worn quickly and thus will not fulfil their design purpose
- bolted joints will come loose
- accidents caused by assembled parts coming apart due to bolts or nuts failing or falling off.



WARNING! Exceeding the maximum torque will result in these risks:

- damaging or stripping the threads and deforming the fastener
- bolt heads will be broken
- bolted joints will come loose
- accidents caused by assembled parts coming apart due to bolts breaking at a later time.

6 - Maintenance

Tightening Hydraulic Hoses

When tightening hydraulic hoses as a part of periodic service or due to replacement of spare parts, it is important to apply the correct torque. This will prevent accidents and prolong the lifetime of the parts connected with the hoses.

If not otherwise stated in this book, please tighten hydraulic hoses using the following torques:

Hose size (")	Fitting thread size (")	Spanner size (mm)	Recommended torque (Nm)
1/4	9/16	19	28
3/8	11/16	22	44
1/2	13/16	24	62
3/4	13/16	36	130



DANGER! A hydraulic hose or joint leaking or coming apart with the oil under pressure can cause severe injuries to persons standing nearby! The oil can be very hot, around 80 °C, and the oil streaming out can penetrate human skin. Risk of burns on the skin, internal injuries and facial injuries.



WARNING! Applying too little torque will result in these risks:

- hydraulic joints will leak due to the high oil pressure.
- hydraulic joints will rattle and thus fail under fatigue.
- hydraulic joints are being worn quickly and thus will not fulfil their design purpose.
- accidents caused by sudden loss of oil pressure due to hydraulic parts coming apart.



WARNING! Applying too much torque will result in these risks:

- damaging or stripping the threads and deforming the hydraulic joints.
- fittings will be broken.
- hydraulic joints will leak.
- accidents caused by assembled parts coming apart due to bolts breaking at a later time.



WARNING! When assembling a hydraulic joint, this is often being twisted around in different directions to make it fit between other components on the sprayer. Remember to finish off by applying the correct torque.



NOTE! The sealing system for hoses and fittings is ORFS type (O-Ring Face Seal). This ensures a high level of sealing and good vibration resistance. The fittings use the O-ring compression mechanism to seal.

After first use - Bolts and nuts boom

- Check that all bolts and nuts are properly tighten and re-tighten if necessary using suitable tool. See page 53 for correct torque settings.

10 hours service - In-Line filter (not PrimeFlow)

If the boom is equipped with In-Line Filters, unscrew the filter bowl to inspect and clean the filter. When reassembling, the O-ring should be greased and if damaged replaced.

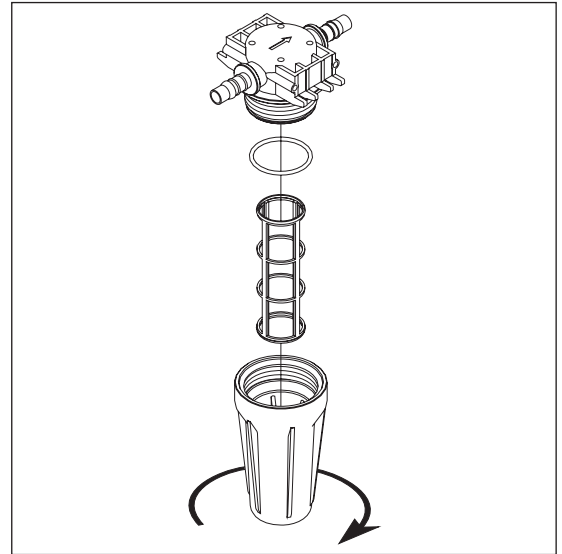
Alternative filter meshes are available. See section on Technical specifications - Filters and nozzles.



WARNING! Be careful not to splash out liquid when unscrewing the filter bowl.



WARNING! Always wear protective clothing and gloves before opening the filter!



10 hours service - Nozzle filters

Check and clean.



10 hours service - Spraying circuit

Fill with clean water, operate all functions and check for leaks using higher spray pressure than normal. Check nozzle spray patterns visually using clean water.

50 hours service - Lubricate boom and centre

Lubrication points on the boom and centre needs attention every 50 working hours to work correctly. parts. see "Paralift lubrication & oiling plan" on page 51 and "Lubrication" on page 49

50 hours service - Bolts and nuts boom

-Check that all bolts and nuts are properly tighten and re-tighten if necessary using suitable tool. Large bolt and nuts should be really tight, it is recommended to use a spanner with a 1-metre extension bar.

50 hours service - Spring break away

Check the tension of the break-away spring see "Breakaway section adjustment" on page 64

6 - Maintenance

250 hours service - Readjustment of the boom

See section "Readjustment boom - general info" on page 60.

250 hours service - Hydraulic circuit

Check the hydraulic circuit for leaks and repair if any.

Refill Nitrogen accumulators see page for page 71 correct pressure

- Yaw system
- Tilt system



WARNING! Hoses for boom lifting device must be changed after every 5 years of use.



WARNING! Nitrogen accumulators contain oil under pressure.

Occasional maintenance

General info

The maintenance and renewal intervals for the following will depend very much on the conditions under which the sprayer will be operated and are therefore impossible to specify.

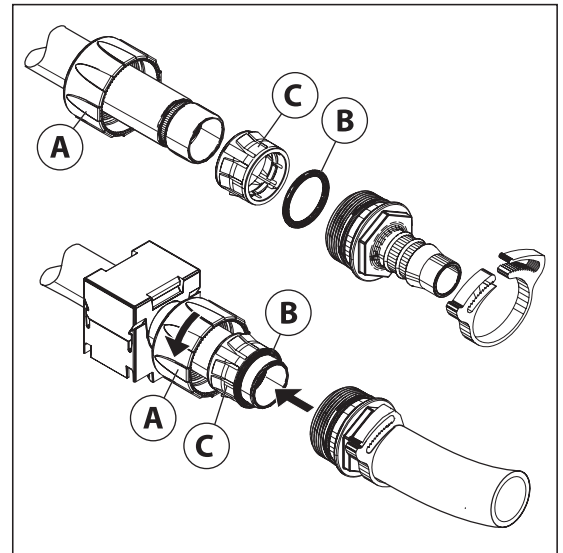
Feed pipe snap-lock assembly

Disassembly

1. Screw the union nut (A) completely off.
2. Pull the feed piping and hose barb apart.
3. Take out the O-ring (B).
4. Inspect and oil O-ring (B). Change the O-ring (B) if worn, before reassembly.

Reassembly

1. Check that the barbed lock ring (C) is fitted to the feed pipe with barb pointing away from pipe opening.
2. Fit the oiled O-ring (B) on top of the lock ring (C).
3. Push the feed pipe and hose barb together.
4. Screw the union nut (A) on the hose barb and tighten union nut (A) by hand.

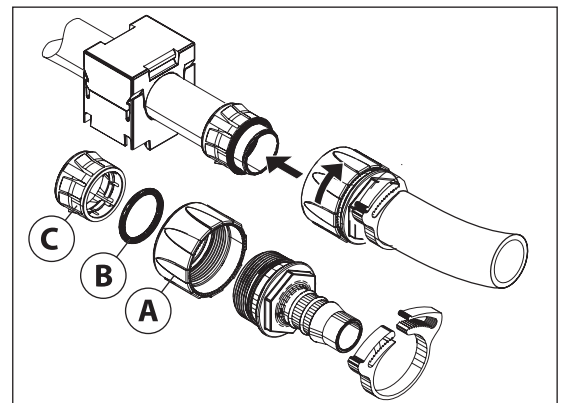


Initial fitting of fittings



ATTENTION! This method can only be used for pipes not fitted into pipe clamps.

1. Fit the barbed lock ring (C) to the feed pipe with barb pointing away from pipe opening.
2. Fit the oiled O-ring (B) on top of the lock ring.
3. Screw the union nut (A) partly on the hose barb.
4. Press the feed pipe and hose barb together.
5. Tighten the union nut (A) by hand.

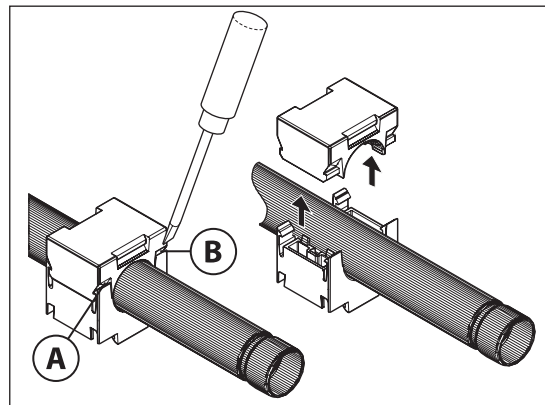


6 - Maintenance

Feed pipe clamp assembly

A feed pipe can be removed from the pipe clamps the following way:

1. Use a flat bladed screwdriver to prize the cover off the first corner (A).
2. Hold the clamp top with your hand and prize off the opposite corner (B) with the screwdriver.
3. Prize off the other side of the pipe clamp with the screwdriver.
4. Take out the feed pipe.



Opening the cable trays

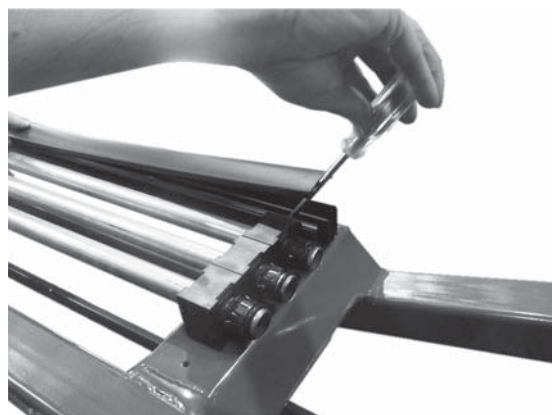
The cable trays on the boom can be opened for servicing or re-wiring.

Disassembly

1. Use a screwdriver at the end of a cable tray to prize the cable tray cover off the lock hooks.
2. Pull the cable tray cover off.

Assembly

1. Press the cover on by hand until it hits the hooks of the cable tray.



Airbag Boom wheel (Optional)

The boom wheel can be used when spraying with a low boom height in the early stages of the crop development. They should be removed when there is a risk that the boom wheel can be dragged into the crop canopy. The airbag provides a pneumatic suspension which reduces the shock transfer to the boom in the event of a ground strike.



ATTENTION!!

- The air bag boom wheel is mounted to the second outer boom section as illustrated. Boom will not rest in horizontal position if wheels are not located on even distance from centre



WARNING!

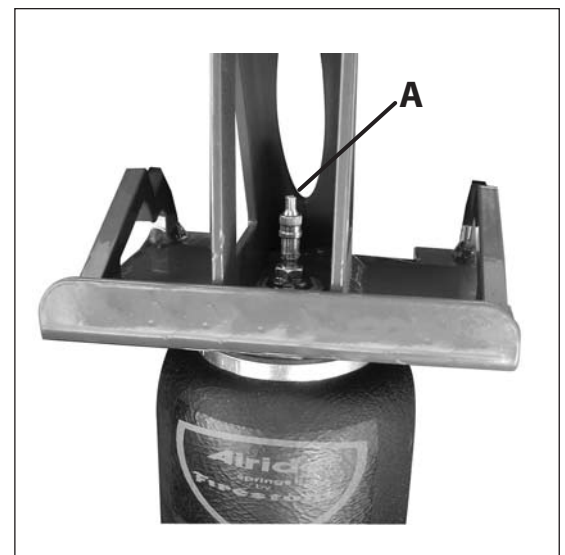
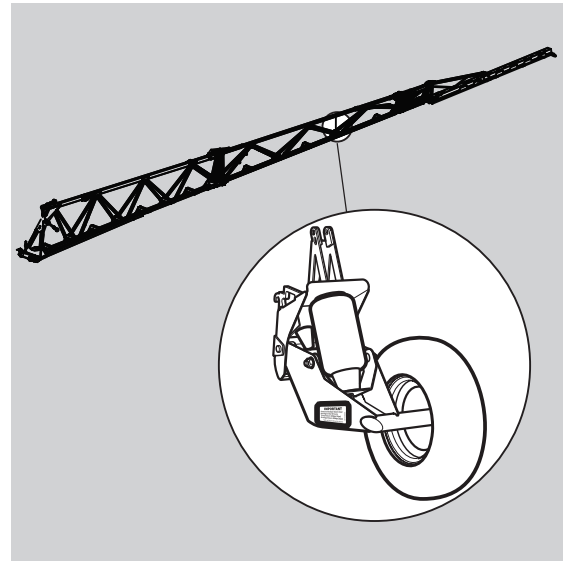
- The boom wheel hangs lower than the boom structure and it is the operator responsibility to make sure it is not at risk of getting hooked on anything or caught in the crop.
- The airbag boom wheel is not designed for constant ground engagement. Running the boom wheel on the ground can damage the boom. **ATTENTION!**
- Maintain correct boom wheel tire and airbag pressures to support the boom in the event of a ground strike. To inflate or check the air bag remove the valve cap A and use an automotive tire inflation device.

Pressure	kPa	psi
Airbag	206	30
Tire	220	32



ATTENTION!

- Ensure boom wheel is free rolling on a daily or weekly basis depending on use. Check, repack and adjust wheel bearings as required
- Boom wheel must be removed for road transportation.



6 - Maintenance

Readjustment boom - general info

Before commencing adjustments jobs please check the following points:

1. Boom and centre must be well lubricated (see "Lubrication").
2. The sprayer should be parked on flat horizontal ground.
3. The boom must be unfolded and horizontal (slant corrector in neutral position).



WARNING! As a safety measure, there should be no one near the boom during adjustment operations.



DANGER! If maintenance is going to be done on the tilt cylinder. Make sure the boom rest on sturdy support before commencing any work.

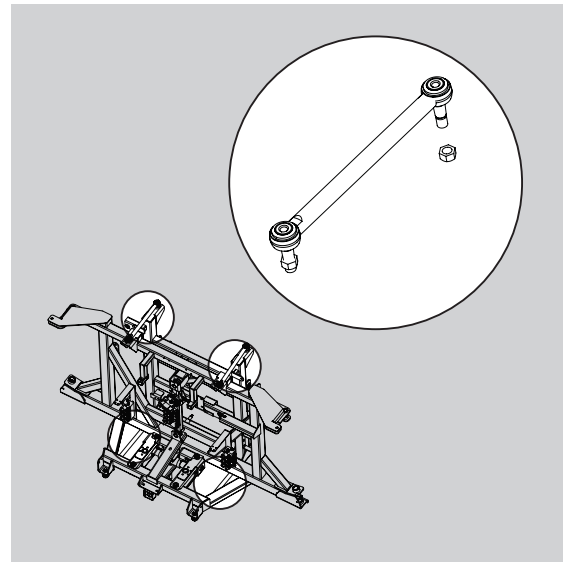


The adjustment of the hydraulic rams must take place when there is no pressure in the system.

Tighten the nuts on the horizontal parallelogram link arms

The link arms act on the boom centre as a form of suspension. The link arms have no adjustment however they are fitted with a high quality ball end with a tapered shaft locked into each side of the boom centre. It is important that the tapered shafts remain tight in their respective housing.

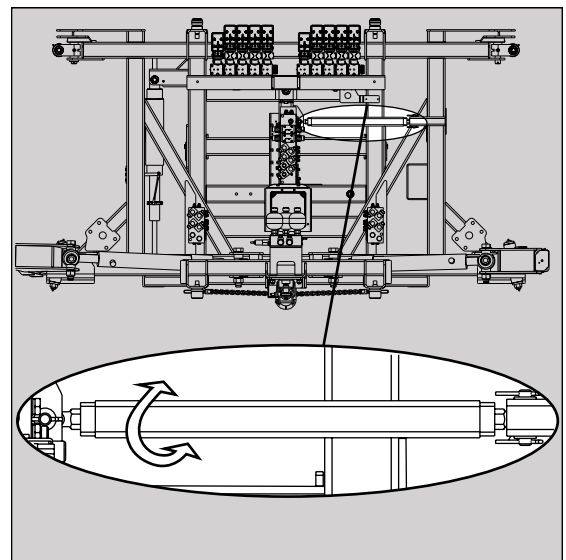
The nuts should be done up at 160 Nm. It is recommended to check this after the first days of operation and then at regular intervals of 250 hours.



Alignment of centre and lift frame

The centre is connected to the lift frame by an adjustable tie rod. Adjust it as follows:

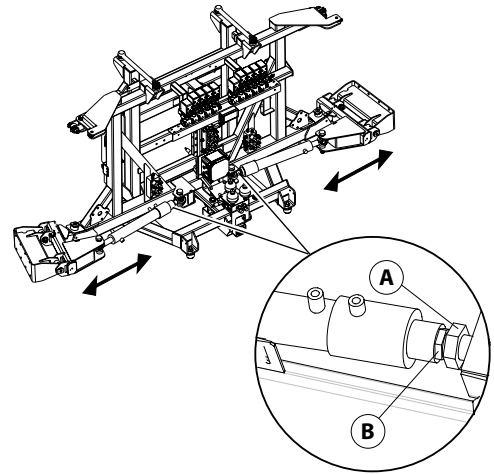
1. Unfold all boom sections
2. Loosen the locknut on the tie rod
3. Put a spirit level at the top or side of the centre, or measure if centre is parallel to lift frame. Rotate the tie rod until the centre is completely horizontal and aligned with the lift frame
4. Tighten the locknuts again



Alignment of centre and inner boom sections

The boom tip should point slightly forward. If necessary adjust the inner section folding as follows: De-pressurise the folding rams.

1. Loosen the counter-nut **A**
2. Adjust stop screw **B** until the correct setting is reached.
3. Tighten counter-nuts again.

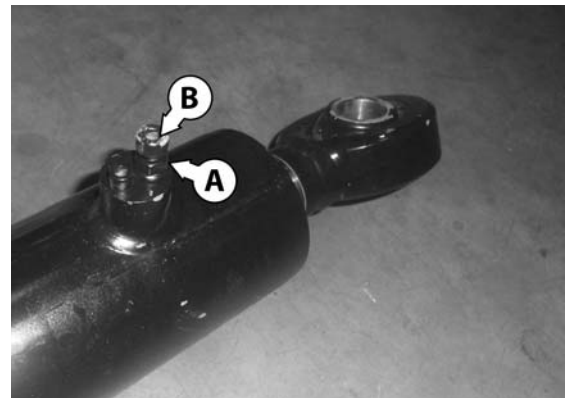


Soft close adjustment inner fold

The speed of the last part of the extension stroke can be adjusted. This prevents the wing from hitting the transport brackets during folding.

Adjust it as follow:

1. Unfold the boom loosen nut **A**.
2. The setting is very sensitive so proceed slowly, rotating the screw **B** one tenth of a turn at a time. By rotating the nut inwards the damping effect will increase, by undoing the bolt dampening will decrease.
3. Once adjusted tighten the nut **A** again
4. Fold the wing hydraulically. If adjustment is necessary repeat step 1-4.



6 - Maintenance

Vertical alignment of boom between first outer, second outer, third outer & breakaway sections



NOTE!

- This is a basic adjustment of the boom. This is only to be carried out if an adjustment of the transport brackets is insufficient.

Procedure is:

1. Loosen the lock nuts (A) and (C).
2. Adjust the nuts at (B) and (D) until the boom sections align.



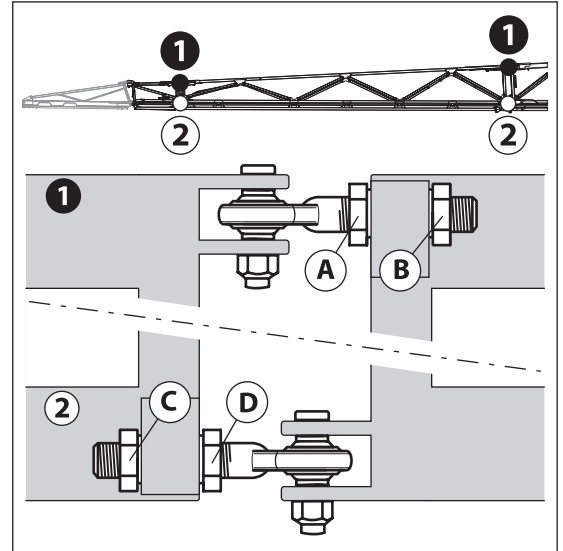
ATTENTION!

- The upper edges of the boom sections must align so the hydraulic lock will engage when folded.



NOTE! It is important that the adjustments are done simultaneously and equally on nuts (B) and (D).

3. Tighten the lock nuts (A) and (C) again.
4. Do the "Horizontal alignment of boom between inner, intermediate and short outer sections" on page 32.



ATTENTION!

- Illustration shows left boom wing.
5. Fold the boom to see if it hits and rests correctly in the transport brackets or locks.
 6. If necessary to readjust, unfold the boom and loosen the nuts (A) and (C) again.
 7. Adjust the nuts at (B) and (D) simultaneously and equally until the boom rests correctly in the lock bracket.



ATTENTION!

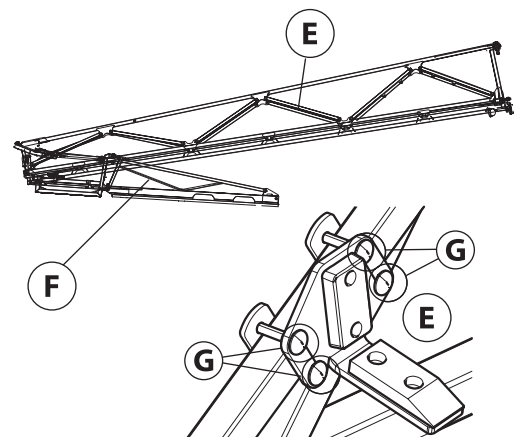
- The upper bolt adjusts only half of the travel, while the lower bolt adjusts the other half.

8. Tighten the lock nuts (A) and (C) to 300-500 Nm.

When folded, check if the boom rests correctly at the transport pads between second outer section (E) and third outer section (F).

If adjustment is necessary:

1. Loosen the four bolts (G) holding the bracket.
2. Reposition the bracket.
3. Tighten the four bolts (G) again.



Occasional maintenance

Wing sections lock mechanisms and horizontal alignment of first & second outer and second & third outer/breakaway

Wing-lock mechanisms are those positioned at the first & second and the second & third outer wing fold hinge points. They lock the wing sections together in the open position minimising movement between them during operation. They are spring applied and hydraulically released. Any misalignment between the spigot and lock plate will prevent locks from engaging and allow the wing sections to move uncontrolled. Monitor the spigot and lock plate for any sign of burring which would indicate misalignment and adjusting as required.

Boom must be unfolded and the hydraulic lock locked.

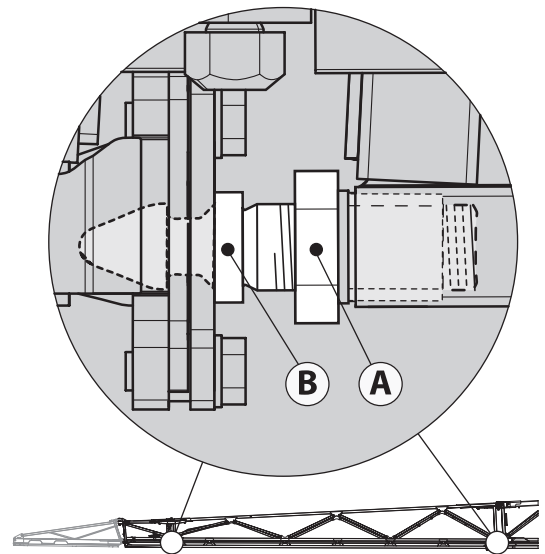
Procedure is:

1. Loosen lock nut (A).
2. Adjust the lock bolt (B) until the boom sections align.

i NOTE! The lock bolt (B) is exccentric. Therefore it is important to check that it centres on the hole in the lock mechanism while adjusting.

3. Tighten the lock nut (A) again.

⚠ Warning! The boom must not be operated without the wing locks correctly engaged otherwise wing sections will be free to flounder, breakaway or whip around and damage the boom. Wing locks must be monitored observing burred steel on the nose of the spigot and lock plate for any misalignment and adjusted as required.



Transport wing fold lock adjustment

The fold lock mechanism positioned on the top cord of the first outer wing sections is designed to retain and lock the second outer wing section during transport. The lock is spring applied and hydraulically released. Any misalignment will prevent the lock mechanism engagement and allow the boom to flounder in transport. If there has been any boom damage the lock mechanism may need to be realigned.

The "Vertical alignment of boom between first, second and third outer sections" on page 25 must be done prior to this adjustment.

The fold lock adjustment is divided into two parts: Vertical and horizontal adjustment:

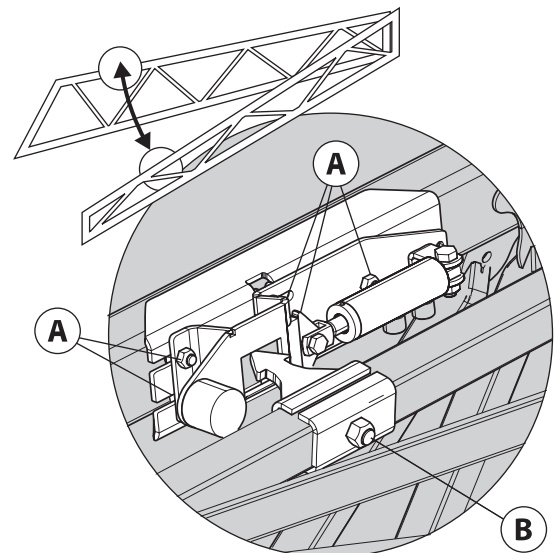
Horizontal adjustment

1. Loosen the five bolts (A) on the fold lock bracket.
2. Reposition the fold lock until the hook is aligning to the centre of the fold lock hole.
3. Tighten the five bolts (A) on the fold lock bracket.

Vertical adjustment

1. Loosen the bolt (B).
2. Turn the hook upside down if needed for better fit.
3. Tighten the hook bolt (B) again.

⚠ WARNING! Any misalignment of the wing sections will prevent the lock mechanism from engaging and will allow the boom to flounder during transport which may damage the boom.

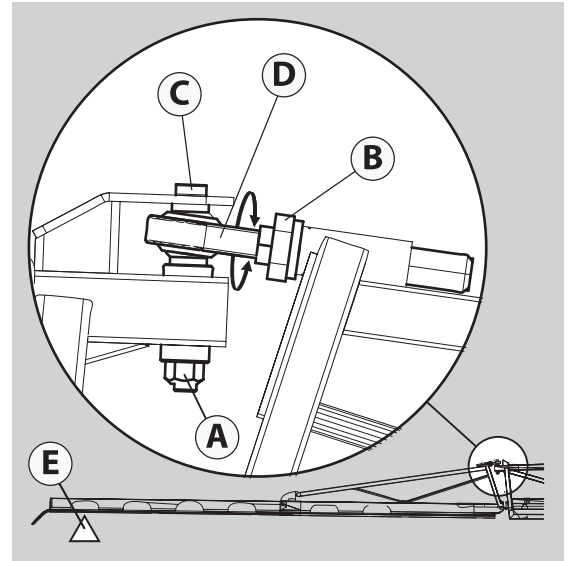


6 - Maintenance

Occasional maintenance

Vertical alignment of breakaway sections

1. Support the breakaway section with a jack stand (E).
2. Loosen lock nut (B).
3. Remove nut (A).
4. Take out bolt (C).
5. Turn eye rod (D) to adjust the section.
6. Refit the bolt (C).
7. Remove the jack stand to see if the sections align.
8. If not, support the breakaway with the jack stand (E) again and repeat point 4-7 until the sections align.
9. Tighten nut (A).
10. Tighten the lock nut (B)

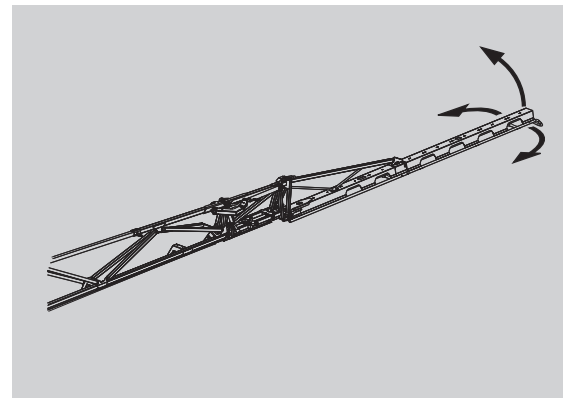


Breakaway section adjustment

The breakaway is part of the third outer section of the boom and is designed to breakaway in the event you make contact with something for example a fence. The breakaway is held in position under spring tension and if forced is designed to breakaway in three planes as illustrated.



WARNING! If the breakaway hits hard enough it may be damaged beyond repair.



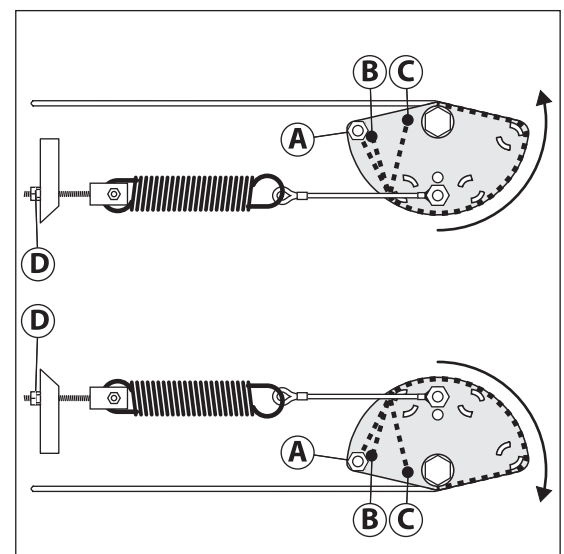
The progressive breakaway function is adjusted by altering the spring attachment point on the progressive mechanism.

The turning "half circle" part should be in a rest position as in the picture. If out of adjustment, the "half circle" part is turned more or less as in the picture and needs adjustment:

1. Loosen the nut (D) on the fork bolt to slacken the spring.
2. Remove the bolt (A) on the turning progressive mechanism that holds the breakaway wire.
3. Reposition the bolt into hole (B) or (C) to adjust the "half circle" rest position.
4. Tighten the nut (D) on the fork bolt until a suitable spring load is achieved.



ATTENTION! Observe the amount of spring load required when driving with the sprayer. If the breakaway sections release too much, the spring load must be increased.



Occasional maintenance

ParaLift Lock

The boom is mechanically held in transport position with paralift lock mechanisms that automatically engage when the first outer is closing. The folded channel-section locks are fixed to the top paralift arm and engage directly on the top of the paralift cylinders when lowered for transport. This means the boom is not supported by hydraulic oil pressure when in transport.



WARNING! when the sprayer is being transported along rough road and is bounced over potholes, in extreme cases there is a risk that the lock arms can disengage. Paralift locks should be checked before and after transport to ensure positive lock engagement.

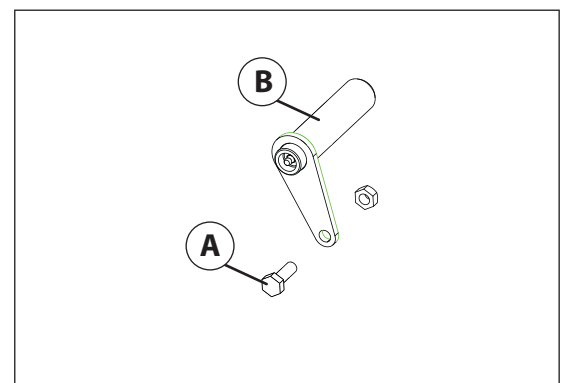
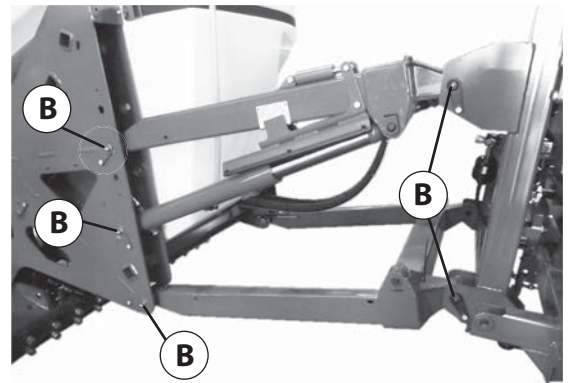


ParaLift wear bush renewal

The ParaLift is used to raise and lower the boom height to suit the terrain however with AutoTerrain small adjustments are being made continuously. Greasing the ParaLift pivot points on a regular basis will prolong the life of the wear bushes.

Inspect and replace the wear bushes before they are worn through.

1. Connect the trailer to a tractor and unfold the booms to working position.
2. Lift the boom centre frame with a lifting device and support it until the load is taken off the parallelogram arms.
3. Remove the bolts (A), pull out the pins (B) at one of the upper parallelogram arms and replace the wear bushes.
4. Refit the arm.
5. Repeat this on the other upper arm.
6. The lower arms must be disconnected simultaneously.
7. Grease all grease nipples.
8. Remove the lifting gear again.



Operational problems

General info

Operational incidents are frequently due to the same reasons:

1. A suction leak reduces the pump pressure and may interrupt suction completely, it also causes pulsing in the pressure hoses.
2. A clogged suction filter may damage suction or interrupt and prevent the pump from running normally.
3. A clogged pressure filter increases pressure in the fluid system in front of the pressure filter. This may blow the safety valve.
4. Clogged In-line or nozzle filters increase pressure in the pressure gauge but decrease pressure at the nozzles.
5. Impurities sucked by the pump may prevent the valves from closing correctly, thus reducing the pump flow.
6. A poor reassembly of the pump elements, especially the diaphragm covers, causes air leaks and reduces the pump flow.
7. Rusted or dirty hydraulic components cause bad connections.
8. A badly charged or faulty battery causes failures and misbehaviour in the electrical system.

Therefore ALWAYS check

1. Suction and pressure filters, as well as nozzles, are clean.
2. Hoses for leaks and cracks, paying particular attention to suction hoses.
3. Gaskets and O-rings are present and in good condition.
4. Pressure gauge is in good working order. Dosage accuracy depends on it.
5. Operating unit functions properly. Use clean water to check.
6. Hydraulic components are clean.
7. The good condition of the tractor battery and its connectors.

7 - Fault finding

Liquid system

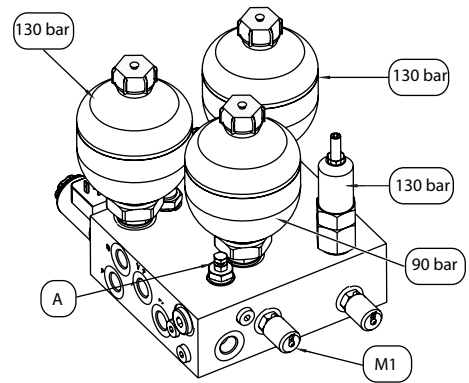
FAULT	PROBABLE CAUSE	CONTROL/REMEDY
No spray from boom when turned on.	SmartValve positions wrong. Suction/pressure filters clogged. No suction from tank.	Set correct valve positions for spraying. Clean suction and pressure filters. See if suction fitting in main tank sump is free of sedimentation.
Lack of pressure.	Incorrect assembly. Air in system. Too much agitation. Pump valves blocked or worn. Blocked filters Defect pressure gauge.	Boost valve is open. Fill suction hose with water for initial prime. Close the agitation valve. Check for obstructions and wear. Clean all filters. Check for dirt at inlet of gauge.
Pressure dropping.	Filters clogging. Nozzles worn. Sucking air towards end of tank load.	Clean all filters. Fill with cleaner water. If using powders, make sure agitation is on. Check flow rate and replace nozzles if it exceeds 10%. Lower pump r.p.m.
Pressure increasing.	Pressure filters beginning to clog.	Clean all filters.
Formation of foam.	Air is being sucked into system. Excessive liquid agitation.	Check tightness/gaskets/O-rings of all fittings on suction side. Reduce pump r.p.m. Check safety valve is tight. Ensure returns inside tank are present. Use foam damping additive.
Liquid leaks from bottom of pump.	Damaged diaphragm.	Replace. See changing of valves and diaphragms.
Vibrations in system and unpleasant noise from pump.	Air is being sucked into system. Blocked suction filter	Check for leaks, holes in hoses, tightness/gaskets/O-rings of all fittings on suction side. Clean suction and pressure filters
Operating unit not functioning or having malfunction.	Blown fuse(s). Wrong polarity. Valves not closing properly. No power. Not fully 12volt supply	Check mechanical function of microswitches. Use cleaning/lubricating agent if the switch does not operate freely. Check motor. 450-500 milli-Amperes max. Change motor, if over. Brown to positive (+). Blue to negative (-). Check valve seals for obstructions. Check microswitch plate position. Loosen screws holding plate a 1/2 turn. Wrong polarity. Check that brown is pos. (+), Blue is neg. (-). Check print plate for dry solders or loose connections. Check fuse holder is tight around fuse. Check cable connection between trailer and tractor

Hydraulic system - Z model

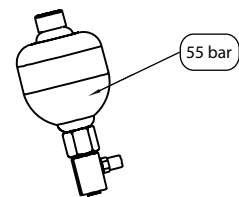
FAULT	PROBABLE CAUSE	CONTROL/REMEDY
No boom movements when activated.	Insufficient hydraulic pressure.	Check oil pressure.
	Insufficient oil supply.	Check tractor hydraulic oil level. Oil flow must be min. 50 l/min. and max. 130 l/min.
	Blown fuse(s).	Check tractor hydraulic oil level.
	Bad / corroded electrical connections.	Check / replace fuse in junction box.
	Insufficient power supply.	Check / clean connections, multi plugs etc. Voltage on activated solenoid valve must be more than 8 volts.
	Defect relay / diodes in junction box.	Use wires of at least 4 mm for power supply. Check relays, diodes and soldering at PCB in junction box. LED diodes indicate boom functions.
	Clogged restrictors in bypass block.	Remove and clean restrictors in bypass block (See hydraulic diagram). Change hydraulic oil + filter.
ParaLift lock does not lock. Boom lift raises to max. position when tractor hydraulics are engaged.	Wrong polarity.	Check polarity. Red positive (+) Black negative (-).
	Back pressure in return line exceeds 15 bar.	Connect the return line with free flow to hydraulic oil reservoir. Divide return line in two and lead return oil back to reservoir via two spool valves.
Oil heats up in Closed Centre systems.	Bypass valve does not close properly.	Check / close (screw in) by-pass valve.
	Internal leaks in flow regulator.	Replace flow regulator O-rings and backup rings. Replace flow regulator.
Individual ram does not move.	Clogged restrictor.	Dismantle and clean restrictor.

Accumulator and Hydraulic pressures

Accumulator pressure and hydraulic pressure on the main fold block



Tilt accumulator pressure should be 55bar



8 - Technical specifications

Filters and nozzles

Possible options:

Mesh	Filter gauze width	EasyClean	Cyclone	In-line**	Nozzle
30	0.58 mm	Yes	-	-	-
50	0.30 mm	Yes, standard	-	Yes*	Yes*
80	0.18 mm	Yes	Yes, standard	Yes*	Yes*
100	0.15 mm	-	-	Yes*	Yes*

*depends on selected nozzles

**not with PrimeFlow

Materials and recycling Disposal of the sprayer

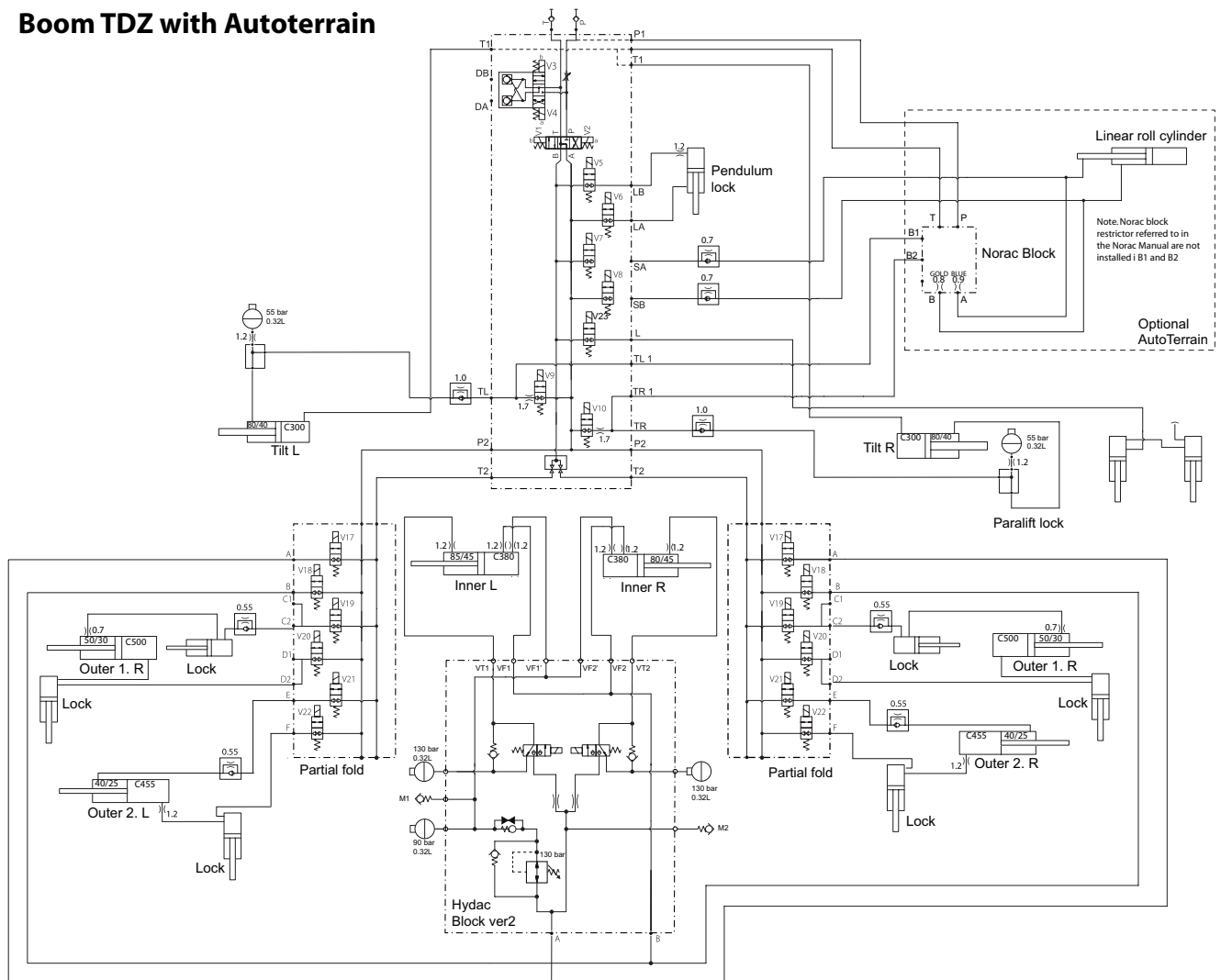
When the equipment has completed its working life, it must be thoroughly cleaned. The tank, hose and synthetic fittings can be incinerated at an authorized disposal plant. The metallic parts can be scrapped. Always follow local legislation regarding disposal.

Materials used:

Boom Frame etc.:	STEEL
Hoses (suction):	PVC
Hoses (pressure):	EPDM
Valves:	Glass reinforced PA
Filters:	PP
Nozzles:	Unfilled POM
Fittings:	Glass reinforced PA

Charts

Boom TDZ with Autoterrain



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Spare parts

To see updated spare part information the website www.agroparts.com can be visited. Here all parts information can be accessed when free registration has been made.



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