

Grassland 1200



Original

Instruction book

67028904-100 - Version 1.00

GB - 07.2016





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 sprayer Grassland 1200

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.

Published and printed by HARDI AUSTRALIA

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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 made available to operators according to European Directive 2009/104/EC – Use of Work Equipment. Amendments to the directive, as well as subsequent directive versions are to be followed when applicable.

In this directive, the “minimum safety and health requirements for the use of work equipment by workers at work” are described in full. To guide you in this matter, the issues concerning your work with the sprayer are listed below. However, HARDI do not accept liability that the issues listed cover the requirements in the directive fully. This responsibility lies with the owner of the sprayer.

From European Directive 2009/104/EC:

CHAPTER I GENERAL PROVISIONS

Article 1

Subject matter

1. This Directive, which is the second individual directive within the meaning of Article 16(1) of Directive 89/391/EEC, lays down minimum safety and health requirements for the use of work equipment by workers at work, as defined in Article 2.
2. The provisions of Directive 89/391/EEC are fully applicable to the whole scope referred to in paragraph 1, without prejudice to more stringent or specific provisions contained in this Directive.

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Article 2

Definitions

For the purposes of this Directive, the following terms shall have the following meanings:

- (a) 'work equipment': any machine, apparatus, tool or installation used at work;
- (b) 'use of work equipment': any activity involving work equipment such as starting or stopping the equipment, its use, transport, repair, modification, maintenance and servicing, including, in particular, cleaning;
- (c) 'danger zone': any zone within or around work equipment in which an exposed worker is subject to a risk to his health or safety;
- (d) 'exposed worker': any worker wholly or partially in a danger zone;
- (e) 'operator': the worker or workers given the task of using work equipment.

CHAPTER II

EMPLOYERS' OBLIGATIONS

Article 3

General obligations

1. The employer shall take the measures necessary to ensure that the work equipment made available to workers in the undertaking or establishment is suitable for the work to be carried out or properly adapted for that purpose and may be used by workers without impairment to their safety or health.

In selecting the work equipment which he proposes to use, the employer shall pay attention to the specific working conditions and characteristics and to the hazards which exist in the undertaking or establishment, in particular at the workplace, for the safety and health of the workers, and any additional hazards posed by the use of the work equipment in question.

2. Where it is not possible in this way fully to ensure that work equipment can be used by workers without risk to their safety or health, the employer shall take appropriate measures to minimize the risks.

Article 5

Inspection of work equipment

1. The employer shall ensure that where the safety of work equipment depends on the installation conditions, it shall be subject to an initial inspection (after installation and before first being put into service) and an inspection after assembly at a new site or in a new location by competent persons within the meaning of national laws and/or practices, to ensure that the work equipment has been installed correctly and is operating properly.
2. In order to ensure that health and safety conditions are maintained and that deterioration liable to result in dangerous situations can be detected and remedied in good time, the employer shall ensure that work equipment exposed to conditions causing such deterioration is subject to:

- (a) periodic inspections and, where appropriate, testing by competent persons within the meaning of national laws and/or practices;
- (b) special inspections by competent persons within the meaning of national laws and/or practices each time that exceptional circumstances which are liable to jeopardize the safety of the work equipment have occurred, such as modification work, accidents, natural phenomena or prolonged periods of inactivity.

3. The results of inspections shall be recorded and kept at the disposal of the authorities concerned. They must be kept for a suitable period of time.

When work equipment is used outside the undertaking it shall be accompanied by physical evidence that the last inspection has been carried out.

4. Member States shall determine the conditions under which such inspections are made.

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Article 6

Work equipment involving specific risks

When the use of work equipment is likely to involve a specific risk to the safety or health of workers, the employer shall take the measures necessary to ensure that:

- (a) the use of work equipment is restricted to those persons given the task of using it;
- (b) in the case of repairs, modifications, maintenance or servicing, the workers concerned are specifically designated to carry out such work.

Article 8

Informing workers

1. Without prejudice to Article 10 of Directive 89/391/EEC, the employer shall take the measures necessary to ensure that workers have at their disposal adequate information and, where appropriate, written instructions on the work equipment used at work.
2. The information and the written instructions shall contain at least adequate safety and health information concerning:
 - (a) the conditions of use of work equipment;
 - (b) foreseeable abnormal situations;
 - (c) the conclusions to be drawn from experience, where appropriate, in using work equipment.

Workers shall be made aware of dangers relevant to them, work equipment present in the work area or site, and any changes affecting them, inasmuch as they affect work equipment situated in their immediate work area or site, even if they do not use such equipment directly.

3. The information and the written instructions shall be comprehensible to the workers concerned.

Article 9

Training of workers

Without prejudice to Article 12 of Directive 89/391/EEC, the employer shall take the measures necessary to ensure that:

- (a) workers given the task of using work equipment receive adequate training, including training on any risks which such use may entail;
- (b) workers referred to in Article 6(b) receive adequate specific training.

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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.

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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
- disconnect the hydraulic hoses connected from the tractor to the sprayer.

Electric system

- turn off the tractor and remove the ignition key
- disconnect 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.

2 - General Safety Instructions

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
- Ensure that the retrofitted electrical and electronic components comply with the EMC directive 2004/108/EC in the appropriate version and bear the CE mark.

Universal Joint Shaft

A rotating shaft can catch clothes, tools or aids, if touching or getting in contact with each other. Risk of severe damages and injuries as the rotating shaft is driven by a powerful torque from the tractor.

Use only the power take-off (PTO) shaft prescribed by HARDI, equipped with the proper safety devices.

Read and follow the delivered instruction manual from the manufacturer of the PTO shaft.

The protective pipe and PTO shaft guard must be undamaged, and the shield of the tractor and sprayer universal joint shaft must be attached and be in proper working condition.

Safety devices must be in good condition when you are working with the sprayer.

You may install or remove the PTO shaft only after you have done all of the following:

- Switched off the universal joint shaft drive
- Switched off the tractor engine
- Removed the ignition key
- Applied the parking brake.

Always ensure that the PTO shaft is installed and secured correctly both at the tractor end and at the sprayer pump end.

When using wide-angle PTO shafts, always install the wide angle joint at the pivot point between the tractor and sprayer.

Secure the PTO shaft guard by attaching the chain(s) to prevent movement.

Observe the prescribed pipe overlaps in transport and operational positions. See the operating manual from the PTO shaft manufacturer.

When turning corners, observe the permitted bending and displacement of the PTO shaft.

Before switching on the universal joint shaft, check that the selected universal joint shaft speed (rpm) of the tractor matches the permitted drive speed of the sprayer.

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

Instruct people to leave the danger area of the sprayer, before you switch on the universal joint shaft.

While work is being carried out on the universal joint shaft, there must be no one in the area of the universal joint shaft or PTO shaft, while it is rotating.

When the tractor engine is turned off, the universal joint shaft must also be switched off. This prevents an unintentional restart of the universal joint shaft immediately, when the tractor engine is turned on again.

Always switch off the universal joint shaft if it is not needed in action, or if excessive bending of the PTO shaft occurs.

After the universal joint shaft is switched off, there is a danger of injury from the continued rotation of freewheeling sprayer parts. Keep distance to the sprayer during this time. You may work on the sprayer only after all sprayer parts have come to a complete stop.

Secure the tractor and sprayer against unintentional starting and unintentional rolling, before you perform any cleaning, service or maintenance work on universal joint shaft-driven sprayers or PTO shafts.

After decoupling the PTO shaft, place it on the holder provided.

After removing the PTO shaft, attach the protective sleeve to the universal joint shaft stub.

If using a travel-dependent universal joint shaft, note that the universal joint shaft speed depends on the drive speed of the vehicle, and that the direction of rotation reverses, when you drive in reverse.



2 - General Safety Instructions

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.

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.

2 - General Safety Instructions

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.

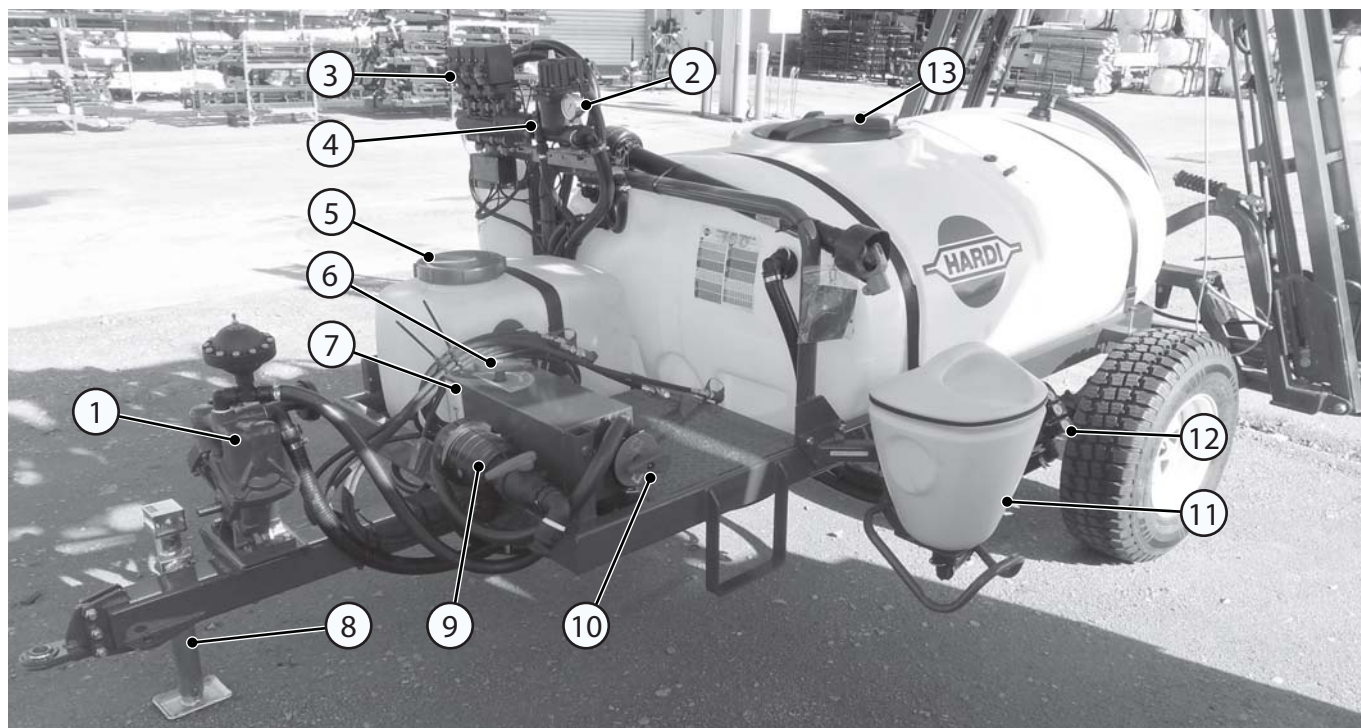
When replacing spare parts, use suitable tools and personal protective equipment.

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

Front View



ATTENTION! The sprayer is equipped with optional equipment!



- | | |
|----------------------------------|--------------------------|
| 1. Pump | 11. TurboFiller |
| 2. Pressure Gauge | 12. Controls TurboFiller |
| 3. Spray Section Valves | 13. Main Tank Lid |
| 4. Agitation On/Off Valve | |
| 5. Rinse Tank Lid | |
| 6. Suction Valve | |
| 7. Suction Filter (behind plate) | |
| 8. Jack | |
| 9. Self Cleaning Filter | |
| 10. Pressure Valve | |

3 - Description

Identification plate

An identification plate is located on the chassis on the right hand side of the sprayer. The reference number on plate will help you and your HARDI dealer to clearly identify your machine and assist in the correct supply of spare parts and service information.



Road worthiness

When driving on public roads and other areas where the highway code applies, or areas with special rules and regulations for marking and lights on implements, you should observe these and equip implements accordingly.



ATTENTION! Max. driving speed for models without brakes and for models equipped with brakes is different. Be aware that these speeds may differ due to local law. Contact local authorities for information of max. driving speeds!

Sprayer Use

The HARDI sprayer is for the application of crop protection chemicals and liquid fertilisers. The equipment must only be used for this purpose. It is not allowed to use the sprayer for any other purposes. If no local law demands that the operator must be certified to use spray equipment, it is strongly recommended to be trained in correct plant protection and in safe handling of plant protection chemicals to avoid unnecessary risk for persons and the environment when doing your spray job.

Frame

Very strong and compact frame which also has a strong chemical and weather resistant electrostatic lacquer coat. Screws, nuts, etc. have been DELTA-MAGNI treated to be resistant to corrosion.

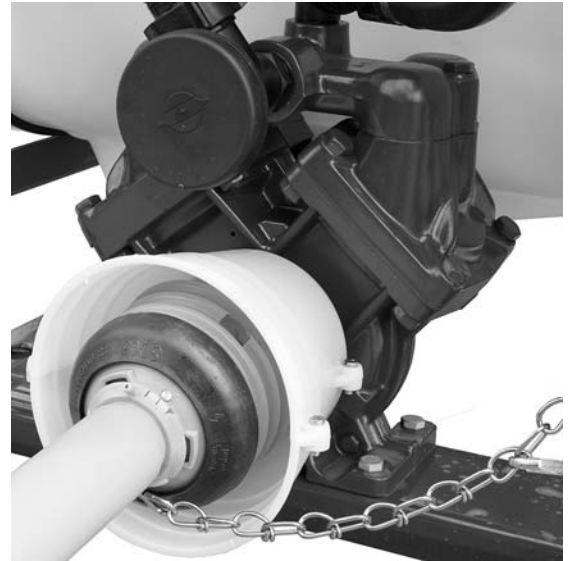
Liquid System

Pump

Diaphragm pump with 2 diaphragms, model 1203 or a pump with 3 diaphragms, model 1303.

Standard = 540 rpm (6 splines shaft). Optional = 1000 rpm (21 splines shaft). The design of the diaphragm pump is simple, with easily accessible diaphragms and valves, which ensure that liquid does not contact the vital parts of the pump.

Pump model 1203 is shown on the picture.



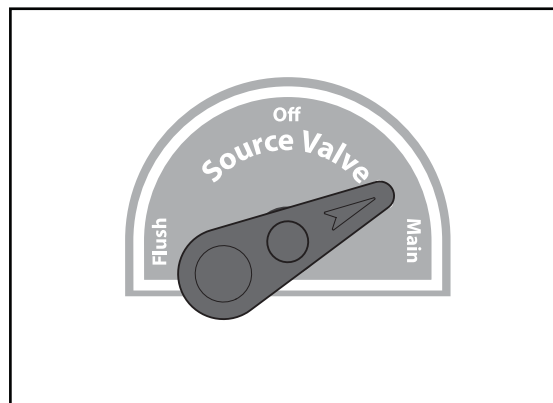
3 - Description

Valves and symbols

The valves of the valve system are distinguished by coloured identification on the function labels. Symbols corresponding to every possible function of use are located on the discs for easy identification and operation. A function is activated by turning the handle towards the desired function.

Suction Valve:



- Flush tank = Suction from Flush Tank
- Off = Closed valve
- Main Tank = Suction from Main Tank

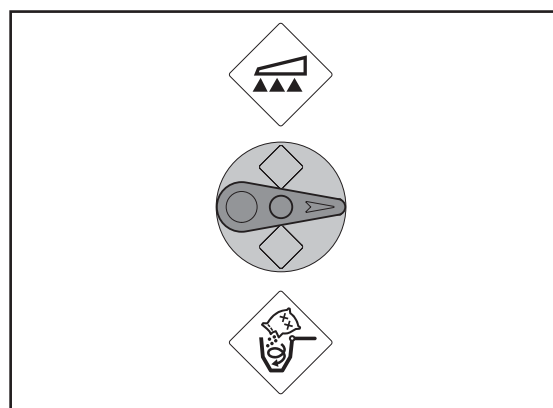


Pressure valve

This valve selects to direct pressurized liquid to spraying or TurboFiller

The active function is indicated by the indicator pointing at the label of the required function.

-  = Pressure to Boom
- Off = Closed valve (Horizontal position)
-  = Pressure to TurboFiller



ATTENTION! If a valve is too tight to operate - or too loose (= liquid leakage) - the valve needs to be serviced. Please see the section 'Maintenance' for further information.

HARDI®TURBO FILLER (Optional)

The TurboFiller is situated in the working zone on the sprayers left side. When being used it should be unlocked by pulling the handle (A) situated to the right of the TurboFiller and pushed down (B) by grabbing the handle on the TurboFiller until it clicks into locked down-position.

When retracting the TurboFiller after use, then unlock it by pulling the handle (A) situated to the right of the TurboFiller and pull it back in storing position until it clicks into the lock.



WARNING! Before releasing the lock (A) always keep a hand on the grip to avoid abrupt movement of the TurboFiller!

Before use

- Pull the handle (arrow) to unlock.
- Grab the handle to push TurboFiller down until it clicks into locked down-position.

After use

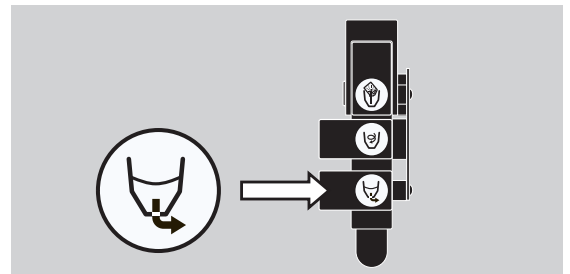
Grab the handle to push TurboFiller back in storing position until it locks.

TurboFiller Suction Valve

The valve is used simultaneously with the TurboFiller. The valve has 2 settings: Continuously open or spring loaded normally closed. Open the valve when chemicals are to be filled into the TurboFiller and transferred to main tank.



Suction from TurboFiller

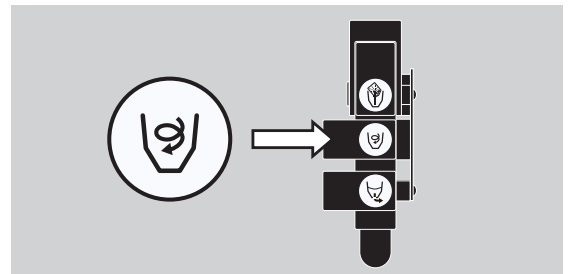


TurboDeflector Valve

This TurboDeflector valve activates the Vortex flushing of the TurboFiller. Lift the lever to lock it in open position for continuous liquid rotation in the hopper.



Start TurboDeflector



Chemical Container Rinsing Lever

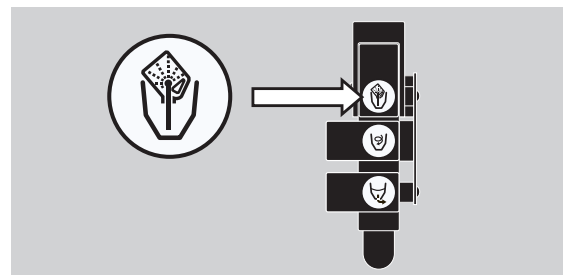
The upper lever is used for two purposes:

When the TurboFiller lid is open: For rinsing empty containers. Place the container over the rotating flushing nozzle in the middle of the TurboFiller to rinse the inside of the container.

When the TurboFiller lid is closed: Use the Chemical Container Rinsing lever to rinse the hopper when the filling of chemicals is completed.



Chemical Container Rinsing



DANGER! Do not press the lever unless the multi-hole nozzle is covered by a container as spray liquid may otherwise hit the operator.

3 - Description

Suction Filters

A suction filter is located under the (suction valve)

In-line pressure filters can be fitted at each boom section as an option (J) (standard for certain booms).

Nozzle filters are fitted at each nozzle..



ATTENTION! All filters should always be in use and their function should be checked regularly. Pay attention to the correct combination of filter and mesh size. For more, see the chapter “Technical Specifications” in this book.



ATTENTION! Always run your sprayer with cleaned filters to ensure proper functions and to protect the interior of the pump.

RinseTank

A rinsing tank can be mounted at the right siderear of the sprayer. The tank is made of impact-proof and chemical resistant polyethylene.

Filling is done via the 1" threaded stud placed in the working area. The rinsing tank level indicator is placed at the platform.

Nominal content is approximately 120 litres.

Clean Water Tank

The water in this tank is for hand washing, for cleaning of clogged nozzles etc. Only fill this tank with clean water from the tap.

The clean water tank is placed on the sprayer's left side.

Capacity: approximately 19 litres.



WARNING! Although the clean water tank is only filled with clean water, this water must NOT be used for drinking.



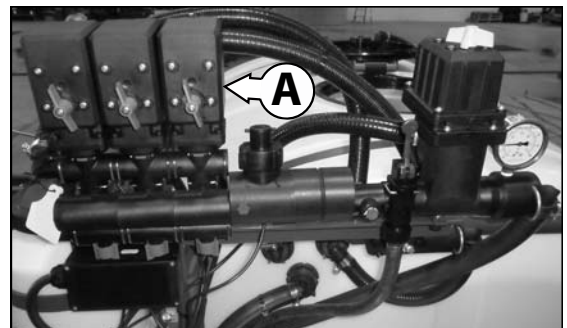
EVC Control Unit

The system is based on EVC - Electrical Valve Control. The ON/OFF is linked to the section valves (one valve for each spray boom section), which results in a quick response to ON/OFF. The operating unit is of modular design, and it is electrically controlled by a remote control box.

The section valves (**A**) are fitted with a constant pressure device and a pressure drop line.

These features allow the operator to shut off individual boom sections.

The unit has a built-in HARDI-MATIC system. This system ensures a constant liquid volume per hectare (l/ha) when driving forward at varying speed within the same gear, as long as the number of PTO revolutions are kept between 300-600 rpm.



3 - Description

Spray Boom

Boom and Terminology

Please refer to boom manual

Transmission Shaft

Operator Safety

1. Always STOP THE ENGINE before attaching the transmission shaft to the tractor power take-off (PTO) - most tractor PTO shafts can be rotated by hand to facilitate spline alignment, when the engine is stopped.
2. When attaching the shaft, make sure that the snap lock is FULLY ENGAGED - push and pull the shaft until it locks.
3. Always keep protection guards and chains intact and make sure that it covers all rotating parts, including CV-joints at each end of the shaft. Do not use without protection guard.
4. Do not touch or stand on the transmission shaft, when it is rotating - keep your safety distance at 1.5 meter. Also NEVER cross over a rotating PTO shaft to reach the other side of the sprayer.
5. Prevent protection guards from rotating by attaching the chains allowing sufficient slack for turns.
6. Make sure that protection guards around the tractor PTO and the implement shaft are intact.
7. Always STOP THE ENGINE and remove the ignition key, before carrying out maintenance or repairs to the transmission shaft or implement.



DANGER! A ROTATING TRANSMISSION SHAFT WITHOUT PROTECTION GUARDS IS FATAL!

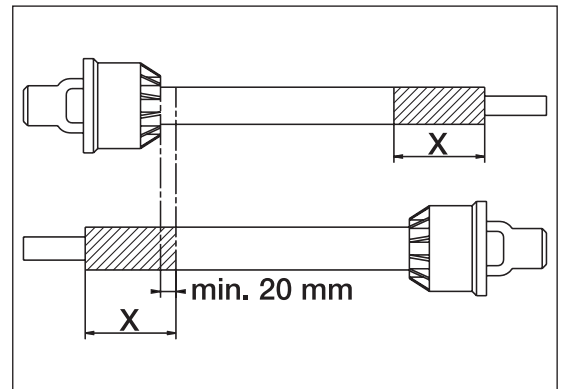
PTO Installation



DANGER! As PTO shafts are dangerous in operation, always read the manufacturer's instruction book before applying any changes to the transmission shaft!

First installation of the transmission shaft is done in the following way:

1. Attach the sprayer to the tractor and set the sprayer height in the position with the shortest distance between the tractor and the sprayer pump PTO shafts.
2. Stop the engine and remove the ignition key.
3. If the transmission shaft needs to be shortened, pull the shaft apart. Fit the two shaft parts to the tractor and the sprayer pump and measure how much the shaft needs to be shortened. Also mark the protection guards with the same length to be shortened.

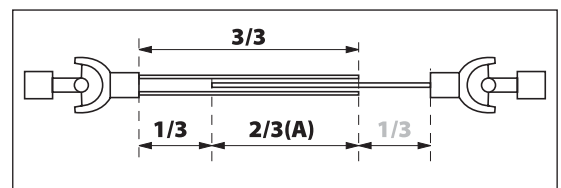
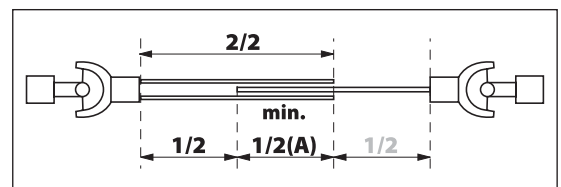


WARNING! Only shorten the shaft if it is absolutely necessary!



WARNING! The shaft must always have minimum overlap of half a shaft length!

The recommended overlap (A) of the two shaft parts is $\frac{2}{3}$ of the length. The shaft must always have minimum overlap (A) of $\frac{1}{2}$ of the length.

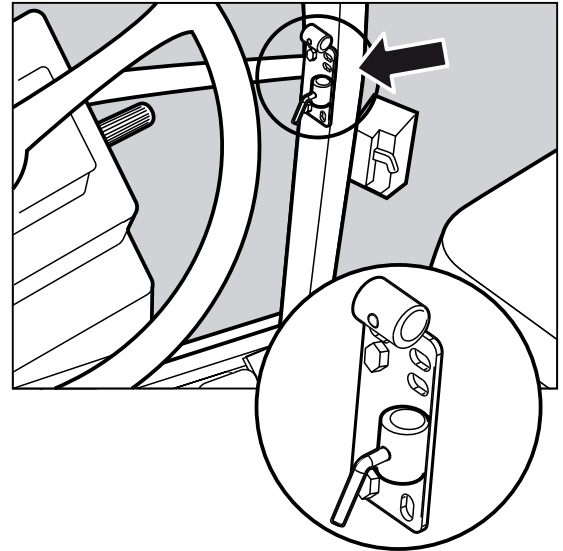


4 - Sprayer setup

Electrical Connections

Installation of Control Unit Brackets

Find a suitable place in the tractor cabin to mount the control units. Best recommended position is to the right of the driver seat.



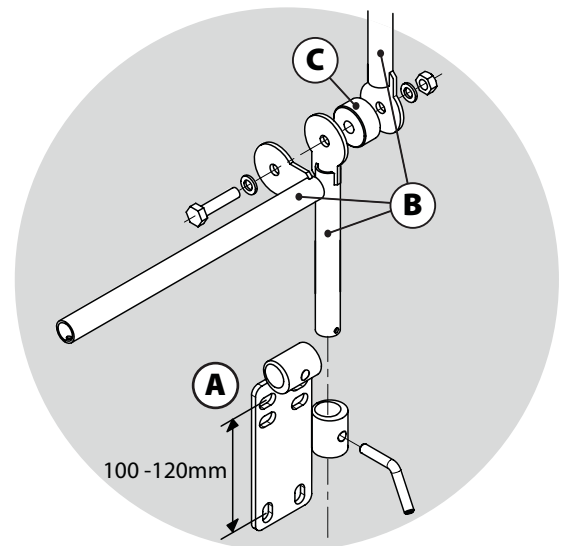
The supplied tractor pillar bracket (A) has a hole spacing of 100 and 120 mm, which fits most tractors. Threaded mounting holes may be hidden behind front corner cover. Check the tractor's instruction book for information regarding attachment points.

Three mounting tubes (B) are supplied. One, two or all three may be used. They can be bent and shortened. A spacer (C) is also supplied to allow further attachment possibilities. Find the best solution for your tractor or vehicle.

Tube (B) plate is staggered so that, if correctly orientated, all boxes will line up.



ATTENTION! See also the controllers instruction book for further details of fitting the controller equipment.



Electrical connections

Road Safety Kit

Connect the plug for rear lights to the tractor's 7-pin socket and check the function of rear lights, stop lights, side lights and direction indicators on both sides before driving.

The wiring is in accordance with ISO 1724. See the section "Technical Specifications".



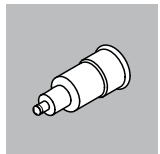
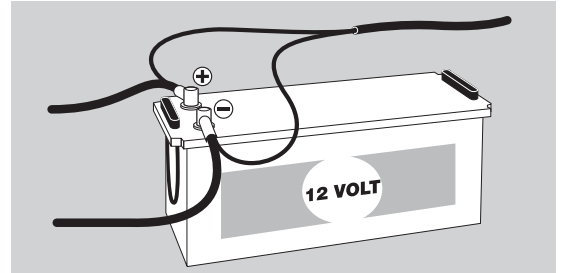
ATTENTION! Turn OFF all work lights when driving on public roads!

Power Supply

Power requirement is 12 V DC. Always note polarity! For proper function of the electric equipment, the wires must have the following recommended cross sectional areas and correct fuses to ensure a sufficient power supply.

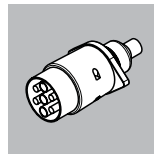
The delivered power connectors follows the standard of most modern tractors. If you have a tractor with another power connector, it is necessary to disassemble the connector and fit it to the actual tractor connector.

The number and the type of connectors may vary on the specific sprayer, depending on its equipment.



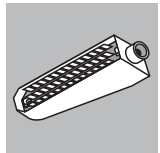
Cigar connector, 1-pin

Spray control unit requires:
Wire 2.5 mm^2 . Fuse 10 amps.
Hydraulic control unit requires:
Wire 4.0 mm^2 . Fuse 16 amps.



Traffic light connector, 7-pin

The unit requires:
Wire $6 \times 1.5 \text{ mm}^2 + 1 \times 2.5 \text{ mm}^2$
The cable is custom made and must not be changed to another type.



EVC Spray Box connector, 39-pin

The unit requires:
Wire $39 \times 1.0 \text{ mm}^2$
The cable is custom made and must not be changed to another type.

4 - Sprayer setup

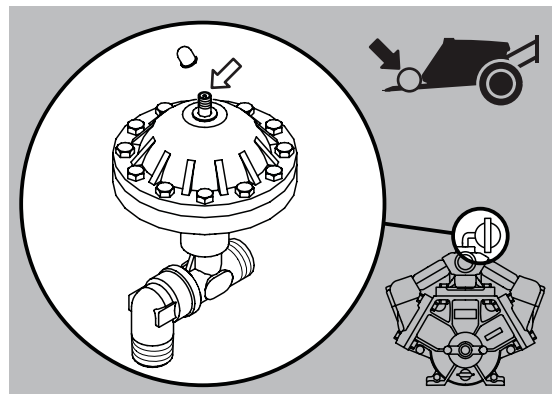
Liquid System

Pulsation Damper

The air pressure in the pulsation damper is factory preset at 2 bar to cover spray working pressures between 3 and 15 bar.

When using spray pressures outside this range, the air pressure should be adjusted as shown in the diagram. The diagram is embossed on the damper.

Spray pressure (Bar)	Damper pressure (Bar)
1.5 - 3	0 - 1
3 - 15	1 - 3
15 - 25	3 - 4



Before Putting the Sprayer into Operation

Although the sprayer has been supplied with a strong and protective surface treatment on steel parts, bolts etc. in the factory, it is recommended to apply a film of anti-corrosion oil (e.g. CASTROL RUSTILO or SHELL ENSIS FLUID) on all metal parts in order to avoid chemicals and fertilizers discolouring the enamel.

If this is done before the sprayer is put into operation for the first time, it will always be easy to clean the sprayer and keep the enamel clean for many years. This treatment should be carried out every time the protection film is washed off.

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



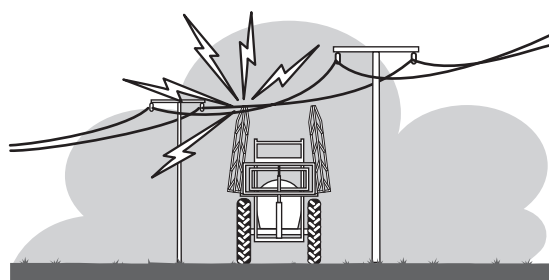
WARNING!

- Never use the folding/unfolding functions when the sprayer is moving, 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 sturdy stands.



DANGER!

- For trailed sprayer before unfolding the boom it is important to connect the sprayer to the tractor to prevent overbalancing of the sprayer
- 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 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.



Manoeuvring of the boom Y-version



Attention! This is a general instruction, it may differ depending on boom type. Please refer to specific boom manual for more instructions.

Boom with hydraulic Y-version is operated as follows:

1. Activate the single acting hydraulic outlet to raise the boom and release it from the transport brackets.
2. Activate the double acting hydraulic outlet to unfold the boom. Both wings will now unfold simultaneously.
3. When the boom is completely unfolded, it can be raised or lowered to the desired spray height by activating the single acting hydraulic outlet.
4. Before attempting to fold the boom back into transport position, it must be raised all the way to the top by activating the single acting outlet. This will enable the rear cylinder transport lock.
5. The boom is folded by activating the double acting outlet in the opposite direction as for unfolding the boom. The boom can now be lowered into the transport brackets.
6. The rear cylinder transport lock will automatically engage when lowering the boom, after it has been raised all the way to the top. To disengage the rear transport lock, simply raise the boom back up a few centimetres and then lower it again.



ATTENTION! Only unfold and fold the boom on level ground.



WARNING! Ensure that the pendulum lock is locked before using the fold functions.



WARNING! Ensure that the rear cylinder transport lock is properly engaged before transport.

5 - Operation

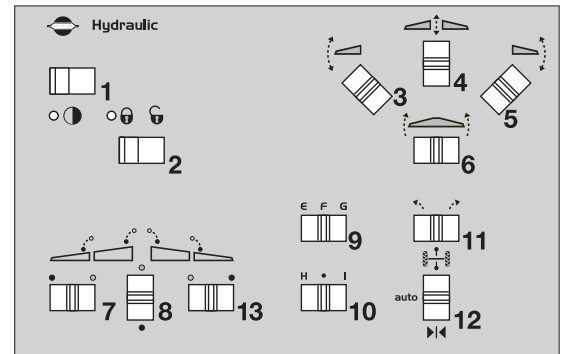
Manoeuvring of the boom (Z-version) with HC 5500



Attention! This is a general instruction, it may differ depending on boom type. Please refer to specific boom manual for more instructions.

The switches on the hydraulic control box controls the following functions:

1. Power ON/OFF
2. Pendulum lock
3. Boom tilt left
4. Boom lift raise/lower
5. Boom tilt right
6. Boom slanting
7. Boom outer folding left
8. Boom inner folding (both sides)
9. Optional function
10. Optional function
11. Manual track control (left/right) (optional)
12. Track control auto (manual/auto/lock) (optional)
13. Boom outer folding right



WARNING! Ensure that the pendulum lock is locked before using the fold functions.



WARNING! Ensure that transport safety chains are removed and the boom is clear from the transport brackets before unfolding.



WARNING! The folding functions must only be operated when the sprayer is stationary! Failure to do so will damage the boom.

For unfolding of the boom then do the following:

1. Check that pendulum (2) is locked.
2. Push switch (4) upwards to lift the boom clear of the front transport brackets.
3. Push switch (8) downwards to unfold the inner sections. Rear transport hooks disengage automatically.
4. Push switches (3) and (5) downwards to lower the individual tilt rams.
5. Push switch (7) to the left and (13) to the right to unfold outer sections.
6. Push switch (6) to correct slant angle.
7. Push switch (4) downwards to lower the boom to correct height above crop or ground level.
8. Unlock pendulum (2).

For folding of the boom then do the following:

Push switch (6) to set neutral slant angle (no slant). Check that pendulum (2) is locked.

Push switch (4) upwards to raise the boom to highest possible position.

Push switch (7) to the right and (13) to the left to fold outer sections.

Push switches (3) and (5) upwards to raise the individual tilt rams.

Push switch (8) upwards to fold the inner sections. Make sure to fold the inner sections against the vertical slide pads. Push switch (4) downwards to lower the boom until the rear transport hooks are firmly engaged.

Push switches (3) and (5) downwards to lower the individual tilt rams until they rest on the front transport brackets.

Liquid System

Filling/Washing Location Requirements

When filling the sprayer with chemicals and water, it is important to avoid spot contamination by spraying chemicals in order to protect the subsoil water resources.

- A. If the sprayer is always filled on the same location, a special filling/washing location should be established. This should have a hard, liquid-impenetrable surface (e.g. concrete), together with edges securing against run-off to the surrounding areas. The location should be drained to an adequate receptacle (e.g. slurry tank or similar).

Any spillage or washings should be retained and diluted in order to be distributed in a larger area. This is to ensure minimal environmental impact and avoid build-up of larger chemical concentrations at one spot.

If no other requirements of distances exist, the following general recommendation of distance can be used. Filling location must be no closer than:

1. 50 metres from public water supplies for drinking purposes, and
2. 25 metres from non-public water supplies for drinking purposes and from treatment sumps and cesspools of drainage systems, and
3. 50 metres from surface water (watercourses, lakes and coastal waters) and from nature reserves.

- D. Alternatively the sprayer can be filled in the field, where the spraying is to take place. If so, choose a different location for each refilling.

If no other requirements of distances exist, the filling should not take place closer than:

1. 300 metres from public or non-public water supplies for drinking purposes, and
2. 50 metres from surface water (watercourses, lakes and coastal waters), treatment sumps, cesspools of drainage systems, and nature reserves.



ATTENTION! Legislation and requirements vary from country to country. Always follow local legislation in force at any time.



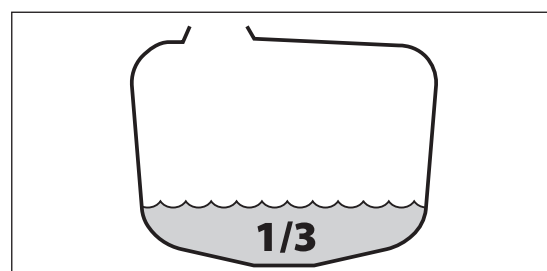
NOTE! It is the responsibility of the sprayer owner/operator to comply with all relevant legislation. HARDI cannot undertake any responsibilities for incorrect operation and use.

Filling of Water

The tank should normally be filled 1/3 with water before adding chemicals. Always follow the instructions given on the chemical container!



WARNING! If the sprayer is put aside with liquid in the main tank, all manifold valves must be closed.



5 - Operation

Filling Through Tank Lid

Water is filled into the tank by removing the big tank lid, which is located at the top of the sprayer tank near the front, which is accessible from the platform. It is recommended to use as clean water as possible for spraying purposes. Always fill water through the strainer basket to prevent foreign particles from entering the tank. An overhead tank can be used in order to obtain high filling capacity.



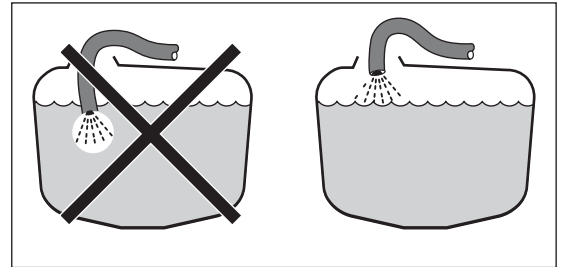
WARNING! Do not let the filling hose enter the tank. Keep it outside the tank, pointing towards the filling hole. If the hose is led into the tank, and the water pressure drops at the water supply plant, chemicals may be sucked back and contaminate the water supply lines, supply plant and supply well.



WARNING! The water supply line should be provided with a check valve as additional safety precaution. Follow local legislation in force at any time.



WARNING! The water supply should be provided with a water meter to avoid spillage by over-filling. Follow local legislation in force at any time.



Filtered Fill (Optional)

The main tank can be filled water from an external water source by the Filtered Fill.

1. Open the main tank lid.
2. Connect a suction hose to the suction filter.
3. Open the valve on the filter.
4. Start the external pump.
5. Fill water into the tank. Keep an eye on the level in order not to overfill the tank.
6. When the tank is full close the pump and close valve on the filter and then disconnect the hose.



ATTENTION! Only fill main tank with clean water!

Filling of Rinsing Tank

1. Remove the filler lid, then fit the external water hose into top of the tank.
2. Engage external water pump, if any.
3. Fill water into the tank. Keep an eye on the level indicator tank opening in order not to overfill the tank.
4. Stop filling and refit the lid.

Volume: approximately 500 litres.



ATTENTION! Only fill rinsing tank with clean water! To avoid algae developing in the rinsing tank, always drain this tank, if the sprayer is not in use for a longer period of time.



ATTENTION! For cleaning purposes etc., the rinsing tank is also accessible via the tank lid on top of the tank.

Filling of Clean Water Tank

To fill the clean water tank:

1. Remove the tank lid
2. Fill with clean water
3. Reposition the tank lid.

For use of water:

- Turn the ball valve lever to open (arrow). The ball valve is located on the valve cover.

The water from this tank is for hand washing, cleaning of clogged nozzles etc.



ATTENTION! Only fill this tank with clean water! To avoid algae developing in the clean water tank, always drain this tank, if the sprayer is not in use for a longer period of time.



WARNING! Although the clean water tank is only filled with clean water, this water must NOT be used for drinking.



5 - Operation

Safety Precautions - Crop Protection Chemicals

Always be careful when working with crop protection chemicals!



WARNING! Always wear proper protective clothing before handling chemicals!

Personal protection

Depending on chemical type, protective gear/equipment should be worn to avoid contact with the chemicals, such as:

- Gloves
- Waterproof boots
- Headgear
- Respirator
- Safety goggles
- Coverall with chemical resistance



WARNING! Protective clothing/equipment should be used, when preparing the spray liquid, during the spray job and when cleaning the sprayer. Follow the chemical manufacturer's instructions given on the chemical label and/or local legislation.



WARNING! It is always advisable to have clean water available, especially when filling the sprayer with chemicals.



WARNING! Always clean the sprayer carefully and immediately after use.



WARNING! Only mix chemicals in the tank according to directions given by the chemical manufacturer.



WARNING! Always clean the sprayer before changing to another chemical.

Filling Liquid Chemicals by using HARDI TurboFiller (optional)

NOTE! We advice to use the TurboFiller, when you fill chemicals from an external tank.

1. Fill the main tank at least 1/3 with water (unless otherwise stated on the chemical container label).
2. Turn the handle of the suction valve towards "suction from Main tank". Turn pressure SmartValve towards "Pressure TurboFiller". Close the AgitationValve.



ATTENTION! If filling water from an external tank, this can be continued while doing the next steps.



DANGER! Before turning Pressure SmartValve to "Pressure draining/TurboFiller" it is very important to be sure that the quick coupler lid is correct and completely mounted to the filling stud into its locked position. Failure to do so may cause risk of contamination and injury from quick coupler lid being "shot" off when pressurized! If not possible to mount lid completely, lubricate the rubber seal and the grip hooks.

3. Engage the pump and set PTO speed at 540 rpm or 1000 rpm (depending on pump model).
4. Open TurboFiller lid, engage the TurboDeflector valve. Measure the correct quantity of chemical and fill it into the hopper.



DANGER! Always wear face shield and other appropriate personal safety equipment, when filling chemicals.



ATTENTION! The scale in the hopper can only be used, if the sprayer is parked on level ground! It is recommended to use a measuring jug for best accuracy.

5. To empty the hopper, press the TurboFiller Suction Valve. The TurboFiller suction valve must be open for at least 20 seconds after the chemical is no longer visible in the hopper, in order to empty the transfer hoses completely into the main tank.



DANGER! If the TurboFiller and the transfer hoses are not completely emptied, there is a risk of chemicals being sucked out of the main tank!

6. If the chemical container is empty, it can be rinsed by the Chemical Container Cleaning device. Place the container over the multi-hole nozzle and push the container for cleaning.



DANGER! In order to avoid spray liquid hitting the operator, do not press the lever, unless the multi-hole nozzle is covered by a container, as spray liquid may otherwise hit the operator!



ATTENTION! The rinsing device uses spray liquid to rinse containers for concentrated chemicals. Before disposal, always rinse the chemical containers with clean water several times, until they are clean.

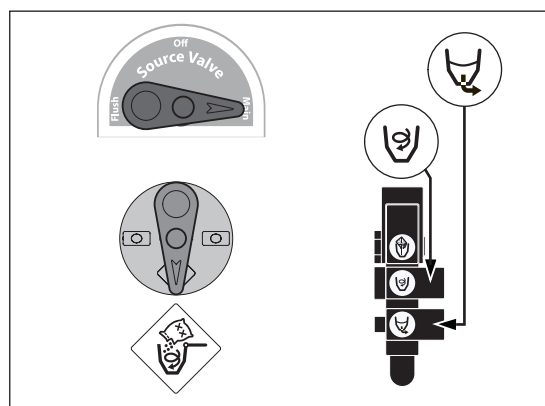
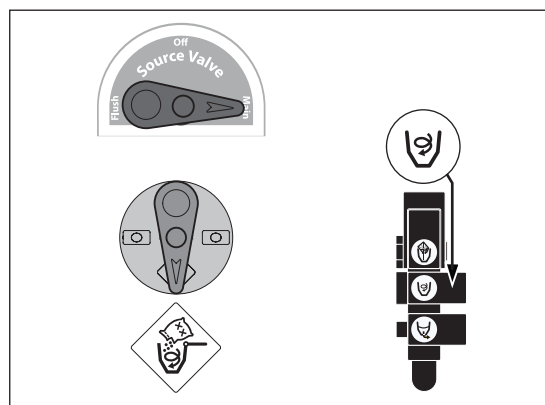
7. Flush the TurboFiller with clean water from the rinsing tank or from an external tank by shifting to suction. The TurboFiller suction valve must be open for at least 20 seconds after the rinse water is no longer visible in the hopper, in order to empty the transfer hoses completely into the main tank.



ATTENTION! If not flushed with clean water, the hopper rinsing device uses spray liquid for rinsing the hopper! Cleaning the TurboFiller must always be done, when the spray job is ended, and together with cleaning the entire sprayer. A cleaning after the last filling, and before spraying, does not ensure a clean TurboFiller!

8. Close the TurboFiller suction valve, when the hopper has been rinsed. Close the lid and turn the Pressure valve to neutral position (horizontal).

9. Turn the "on" the Agitation.



5 - Operation

- When the spray liquid is well agitated, turn handle of the pressure SmartValve towards "Spraying" position. Keep PTO engaged, so that the spray liquid is continuously agitated, until it has been sprayed on the crop.



ATTENTION: If foaming is a problem, turn down the agitation.

Filling Powder Chemicals by using HARDI TurboFiller (optional)

- Fill the main tank at least 1/2 with water (unless otherwise stated on the chemical container label). See section "Filling of water".
- Turn the handle of the suction valve towards "suction from Main tank". Turn pressure SmartValve towards "Pressure draining/TurboFiller". Turn the AgitationValve towards "Agitation" if required. Close remaining valves.



ATTENTION! For increased suction from the TurboFiller the AgitationValve can be kept closed.



DANGER! Before turning Pressure SmartValve to "Pressure draining/TurboFiller" it is very important to be sure that the quick coupler lid is correct and completely mounted to the filling stud into its locked position. Failure to do so may cause risk of contamination and injury from the quick coupler lid being "shot" off when pressurized! If not possible to mount lid completely, lubricate the rubber seal and the grip hooks.

- Engage the pump and set PTO speed at 540 rpm or 1000 rpm (depending on pump model).
- Open the TurboFiller lid. Open TurboDeflector valve and TurboFiller suction valve.
- Measure the correct amount of powdered chemical and sprinkle it into the hopper as fast as the transfer device can flush it down. The TurboFiller suction valve must be open for at least 20 seconds after the chemical is no longer visible in the hopper in order to completely empty the transfer hoses into the main tank.



DANGER! If the TurboFiller and the transfer hoses are not completely emptied, there is a risk of chemicals being sucked out of the main tank!



DANGER! Always wear face shield and other appropriate personal safety equipment, when filling chemicals.

- If the chemical container is empty, it can be rinsed by the Chemical Container Cleaning device. Place the container over the multi-hole nozzle and push the upper lever to the left of the TurboFiller.



DANGER! In order to avoid spray liquid hitting the operator, do not press lever unless the multi-hole nozzle is covered by a container, as spray liquid may otherwise hit the operator!

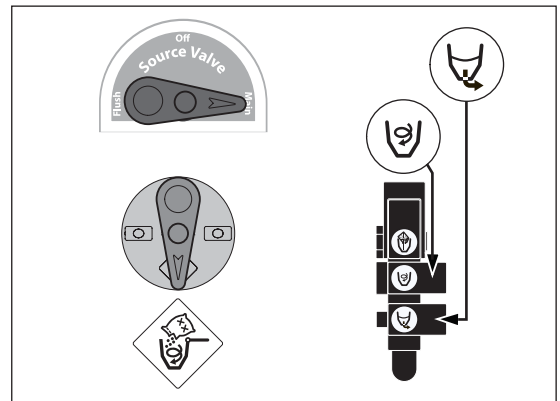
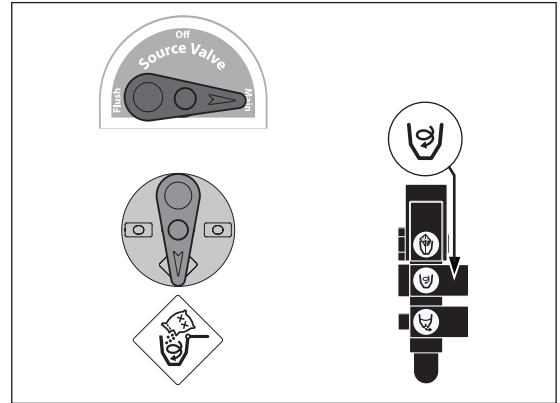


ATTENTION! The rinsing device uses spray liquid to rinse containers for concentrated chemicals. Always rinse the chemical containers with clean water several times, until they are clean before disposal.

- Flush the TurboFiller with clean water from the rinsing tank by turning the Suction Valve to "Rinse Tank". The TurboFiller suction valve must be open for at least 20 seconds after the rinse water is no longer visible in the hopper, in order to completely empty the transfer hoses into the main tank.



ATTENTION! If not flushed with clean water, the hopper rinsing device uses spray liquid for rinsing the hopper! Cleaning the TurboFiller must always be done, when the spray job is ended, and together with cleaning the entire sprayer. A cleaning after the last filling, and before spraying, does not ensure a clean TurboFiller!



8. Close TurboFiller suction valve, when the hopper has been rinsed. Close the lid.
9. If closed, turn the on the Agitation.
10. When the spray liquid is well agitated, turn handle of the pressure SmartValve towards "Spraying" position. Keep PTO engaged, so that the spray liquid is continuously agitated, until it has been sprayed on the crop.



ATTENTION! If foaming is a problem, turn down the agitation.

5 - Operation

Operating the Control Unit While Spraying - Spray Box III

EVC operating unit only



The switches of the spray control unit (Spray Box) control the following functions:

1. Power ON/OFF. Turns the Spray Box power on or off.
 2. Spray pressure regulation. Regulates the main spray pressure.
 3. Main valve ON/OFF. Turns all sections on or off. Lever up is OFF and down is ON.
 4. Optional function (A/OFF/B). If extra equipment is added, it can be controlled from here. Middle position is OFF.
 5. End nozzle (Left/OFF/Right). If end nozzles are fitted, they can be turned on for each side. Middle position is OFF.
 6. Foam marker blob interval. Foam marker equipment is not included from HARDI.
 7. Foam marker (Left/OFF/Right). Foam marker equipment is not included from HARDI.
 8. Section valves. Turns individual spray sections on or off. Lever up is OFF, and lever down is ON.
- In order to close the entire boom, switch main ON/OFF (3) to OFF position. This returns the pump output to the tank through the return system. The diaphragm non-drip valves ensure instantaneous closing of all nozzles.
 - In order to close one or more sections of the boom, switch the relevant distribution valve (7) to off position (upwards). The pressure equalization ensures that the pressure does not rise in the sections, which remain open.
 - On the sprayer the suction valve should be turned toward "Suction from Main tank" and the pressure valve should be turned toward "Spraying". Turn the agitation valve to "Agitation" if necessary.

Agitation Before Resuming a Spray Job

If a spray job has been interrupted for a while, severe sedimentation may occur depending on the chemicals being used. Before resuming the spray job, it might be necessary to agitate sediment material.

1. Turn "On" agitation valve.
2. Engage the pump and set PTO speed to 540 rpm or 1000 rpm (depending on pump model).
3. Agitation has started and should be continued for at least 10 minutes.
4. The spray job can now be resumed. Turn pressure SmartValve towards "Spraying" and start spraying.

Before Returning to Refill the Sprayer

If the sprayer is to be refilled at the farm, or at a fixed filling place without a filling space with hard surface and drain to a closed reservoir, the sprayer should be rinsed before returning to refill.

Dilute the residues of the spraying circuit, and spray it on the crop. Now rinse the sprayer on the outside with the External Cleaning Device (optional equipment), before returning to the farm.



WARNING! Always follow local legislation in force at any time.

Parking the Sprayer

To avoid spot contamination, the sprayer should always be parked at either the washing/filling location or under roof.

This prevents rainfall from washing down chemical residues from the sprayer's surfaces.

- Parking at the washing/filling location will retain residues.
- Always park the machine out of reach of children, animals and unauthorized persons.

Liquid Fertilizer

Spraying pressure

If you are spraying with liquid fertilizer instead of pesticides, the spraying pressure must be increased in comparison to pesticide spraying to get the desired output (l/ha).

The density for liquid fertilizer is normally higher than for water and spray liquids - so to get the correct output (l/ha), the spraying pressure must be adjusted.

Example:

Nozzle output is 2.40 l/min at 3.0 bar pressure. Density of liquid fertilizer is 1.20 g/cm³.

Multiply the pressure value with the density value: $3.0 \times 1.2 = 3.6$; the adjusted pressure is then 3.6 bar for spraying the liquid fertilizer.

5 - Operation

In the table below, adjusted pressure values can be found for different densities of liquid fertilizers.

Calibrated pressure (bar) - Pesticide spraying	Density (g/cm ³) - Liquid fertilizer				
	1.10	1.15	1.20	1.30	1.40
	Adjusted pressure (bar) - Liquid fertilizer spraying				
1.5	1.7	1.7	1.8	2.0	2.1
2.0	2.2	2.3	2.4	2.6	2.8
2.5	2.8	2.9	3.0	3.3	3.5
3.0	3.3	3.5	3.6	3.9	4.2
3.5	3.9	4.0	4.2	4.6	4.9
4.0	4.4	4.6	4.8	5.2	5.6
4.5	5.0	5.2	5.4	5.9	6.3
5.0	5.5	5.8	6.0	6.5	7.0



ATTENTION! Pressure values below 1.5 bar or above 5.0 bar are considered to be out of range for the nozzles.



NOTE! Find the density for your liquid fertilizer on the packaging or on the material safety data sheet (MSDS) included.

Additional Information

See the other book delivered from HARDI - Spray Technique - to get further information about:

- Calibration of the sprayer
- Nozzle Choice
- Nozzle Wear
- Spray Distribution
- Spray Pressure
- Water Volume Rates
- Weather Influence on Spraying
- Useful Formulae

Nozzle selector App

Nozzle selector App is available for both android and iphone phones.

The App can be downloaded from the Google Play for android devices and iTunes Store for iphones.

For Optional Extras - see other books delivered or contact HARDI.

Operating Limits

The following things are important when considering the performance of the sprayer.

- Maximum driving speed
- Pressure setting
- Minimum / maximum flow rate

The operating limits for your sprayer are closely related to:

5. Pump size
6. Boom width
7. Nozzle size

In the table below, the operating limits for volume rate are calculated, when driving at different speeds.

Nozzle size, type HARDI ISO F-110	Min. volume rate (l/ha) at 4 km/h	Max. volume rate (l/ha) at 4 km/h	Min. volume rate (l/ha) at 8 km/h	Max. volume rate (l/ha) at 8 km/h	Min. volume rate (l/ha) at 12 km/h	Max. volume rate (l/ha) at 12 km/h	Min. volume rate (l/ha) at 16 km/h	Max. volume rate (l/ha) at 16 km/h
02 (yellow)	171	309	86	155	57	103	43	77
025 (purple)	213	387	107	194	71	129	53	97
03 (blue)	255	465	128	233	85	155	64	116
04 (red)	339	621	170	311	113	207	85	155
05 (brown)	423	774	212	387	141	258	106	194
06 (grey)	510	930	255	465	170	310	128	233
08 (white)	678	1239	339	620	226	413	170	310
10 (light blue)	849	1548	425	774	283	516	212	387



NOTE! The specified nozzle type is a standard flat fan nozzle. Other special nozzle types will show different results. Ask your HARDI dealer if in doubt.



ATTENTION! It is recommended not to drive faster than 16 km/h when spraying.



ATTENTION! The pressure range for the nozzles are 1.5 - 5 bar (except for HARDI INJET nozzles, which are ranging from 3-8 bar). The spraying pressure should be within these limits.



ATTENTION! In the table below, the specified combination of nozzle size and sprayer setup is not suitable, as the full pressure range of 5 bar for the nozzle cannot be reached, when spraying the maximum volume rate (l/ha) on the crop. This is due to the nozzle design.

Pump model	Boom width	Nozzle size
363/364	18 m	08 (white)
363/364	All	10 (light blue)
1303	15, 16, 18 m	05 (brown)
1303	16, 18 m	06 (grey)
1303	All	08 (white)
1303	All	10 (light blue)



According to the standard for environmental requirements for sprayers, ISO 16119 / EC Directive 2009/127/EC (amending 2006/42/EC), the farmer shall be able to use the full pressure range.

5 - Operation

Cleaning

General Info

In order to derive full benefit from the sprayer for many years, the following service and maintenance program should be followed.



ATTENTION! Always read the individual paragraphs. Read instructions for service/maintenance jobs carefully before starting on the job. If any portion remains unclear, or if it requires facilities which are not available, then please leave the job to your HARDI dealer's workshop for safety reasons.



ATTENTION!

Clean sprayers are safe sprayers.

Clean sprayers are ready for action.

Clean sprayers cannot be damaged by pesticides and their solvents.

Guidelines

- Read the whole chemical label. Take note of any particular instructions regarding recommended protective clothing, deactivating agents, etc. Read the detergent and deactivating agent labels. If cleaning procedures are given, follow them closely.
- Be familiar with local legislation regarding disposal of pesticides washings, mandatory decontamination methods, etc. Contact the appropriate authority if you are in doubt.
- Pesticide washings can usually be sprayed out on the field just sprayed or at a suitable cultivated area. Avoid emptying the washings at the same spot every time and keep sufficient distance to the water environment. You must prevent seepage or runoff of residue into streams, watercourses, ditches, wells, springs, etc. The washings from the cleaning area must not enter sewers. Alternatively the washings can be retained in an appropriate receptacle, diluted and distributed over a larger cultivated area - see also "Filling/Washing Location Requirements" on page 51.
- Cleaning starts with the calibration, as a well calibrated sprayer will ensure the minimal amount of remaining spray liquid.
- It is good practice to clean the sprayer immediately after use, and thereby rendering the sprayer safe and ready for the next pesticide application. This also prolongs the life of the components. It is strongly advised to perform an internal cleaning of the sprayer, when high concentrations of acids or chloride are present in the active ingredients, or if the spray liquid is corrosive. For the best result, use a cleaning agent recommended by HARDI, e.g. AllClearExtra.
- It is sometimes necessary to leave spray liquid in the tank for short periods, e.g. overnight, or until the weather becomes suitable for spraying again. Unauthorized persons, children and animals must not have access to the sprayer under these circumstances.
- If the product applied is corrosive, it is recommended to coat all metal parts of the sprayer before and after use with a suitable rust inhibitor.
- The sprayer must always be parked under roof to avoid rain washing off pesticides as well as build-up of spot contamination in the soil. If parked outside, the sprayer should be parked on the filling/washing location in order to retain possible pesticides.

Cleaning the Tank and Liquid System



ATTENTION! Thorough cleaning of the sprayer is to be carried out when shifting to crops, which are very sensitive to chemicals just sprayed, or prior to storage for a longer period of time.



NOTE! Prior to the described cleaning, a standard cleaning should be carried out.

- Select and use the appropriate protective clothing. Select detergent suitable for cleaning and suitable deactivating agents if necessary.
 - Rinse and clean sprayer and tractor externally. Use detergent if necessary.
1. Remove tank filters and suction filters and clean the sprayer. Be careful not to damage the filter mesh. Put back the suction filter top. Put back all filters, when the sprayer is completely clean.
 2. With the pump running, rinse the inside of the tank. Do not forget to clean the tank roof. Rinse and operate all components and any equipment, which have been in contact with the chemical. Before opening the distribution valves and spraying the liquid out, decide whether this should be done in the field or on the seepage location.
 3. After spraying the liquid out, stop the pump and fill at least 1/5 of the tank with clean water. Note that some chemicals require the tank to be completely filled. Add appropriate detergent and/or deactivating agent, e.g. washing soda or triple effect ammonia. Special detergents for sprayer cleaning is recommended as some also lubricate ball valves etc.
 4. Start the pump and operate all controls enabling the liquid to come into contact with all the components. Operate the distribution valves as the last thing. Some detergents and deactivating agents work best, if they are left in the tank for a short period. Check the label.
 5. Drain the tank and let the pump run dry. Rinse inside of the tank, again letting the pump run dry.
 6. Stop the pump. If the pesticides used have a tendency to block nozzles and filters, remove and clean them immediately.
 7. Put back all the filters and nozzles and store the sprayer. If it is noted, from previous experiences, that the solvents in the pesticides are particularly aggressive, store the sprayer with the tank lid open.



ATTENTION! It is advisable to increase the forward speed (double, if possible) and reduce the spraying pressure to 1.5 bar, when spraying diluted remaining liquid in the field just sprayed.



ATTENTION! If a cleaning procedure is given on the chemical label, follow it closely.



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

Cleaning and Maintenance of Filters

Clean filters ensure:

- Sprayer components such as valves, diaphragms and operating units are not hindered or damaged during operation.
- Nozzle blockades do not occur whilst spraying.
- Long life of the pump. A blocked suction filter will result in pump cavitation. The main filter protecting sprayer components is the suction filter. Check it regularly.

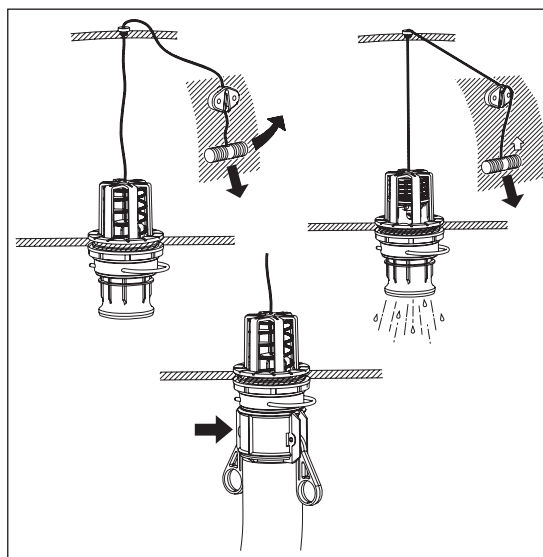
5 - Operation

Using the Drain Valve

The drain valve is operated from the platform just beside the main tank lid.

1. Pull the string to open the drain valve.
2. The valve is spring-loaded, but can be kept open by pulling the string upwards in the V-shaped slit.
3. To release, pull the string downward and the valve will close automatically.

If draining residues, e.g. liquid fertilizer into a reservoir, a snap coupler with hose can rapidly be connected to the drain valve, and the liquid is safely drained.



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.

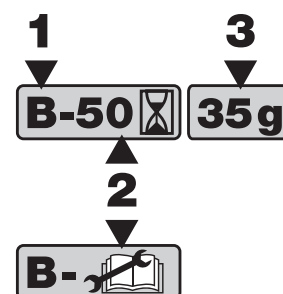
Always follow the quality and quantity recommendations. If no quantity is recommended, feed the lubricator until new grease becomes visible.

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	

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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.

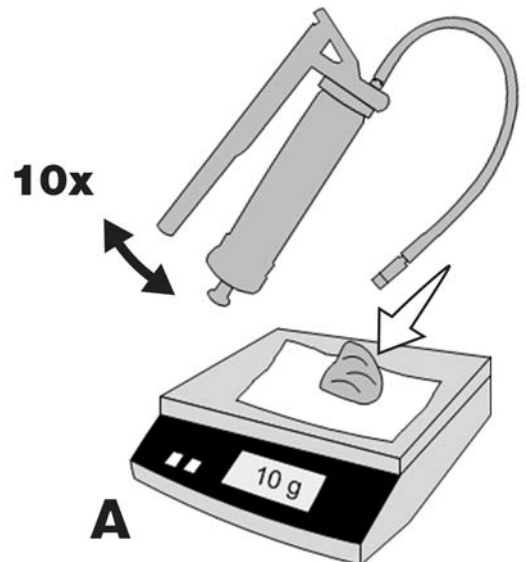
Calibration example

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.



Boom Lubrication & Oiling Plan

Please refer to Boom Manual

Lift Lubrication & Oiling Plan

Please refer to Boom Manual

6 - Maintenance

Lubrication & Oiling Plan - PTO

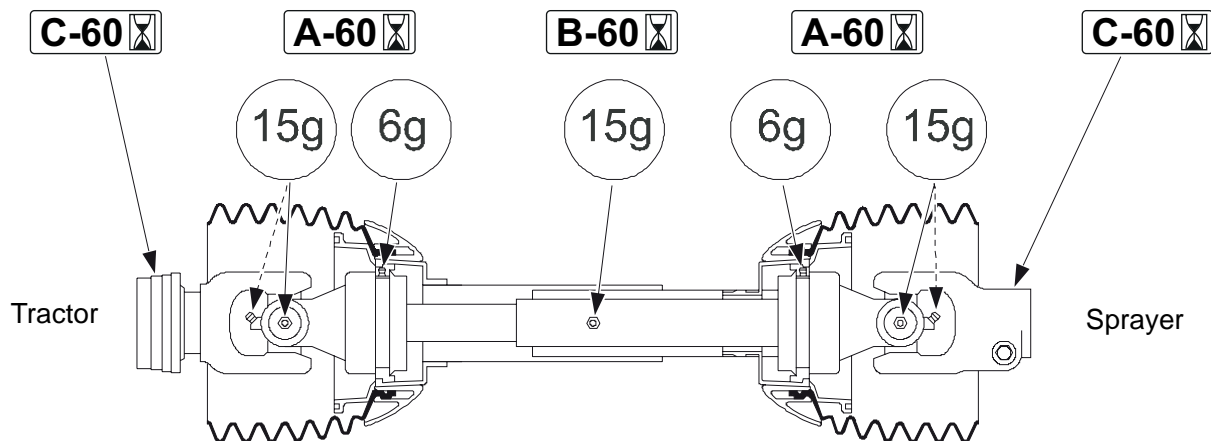
The amount of grease to be applied is mentioned in grams (g). Test your grease gun to see how many grams it provides, for example after 5 strokes.



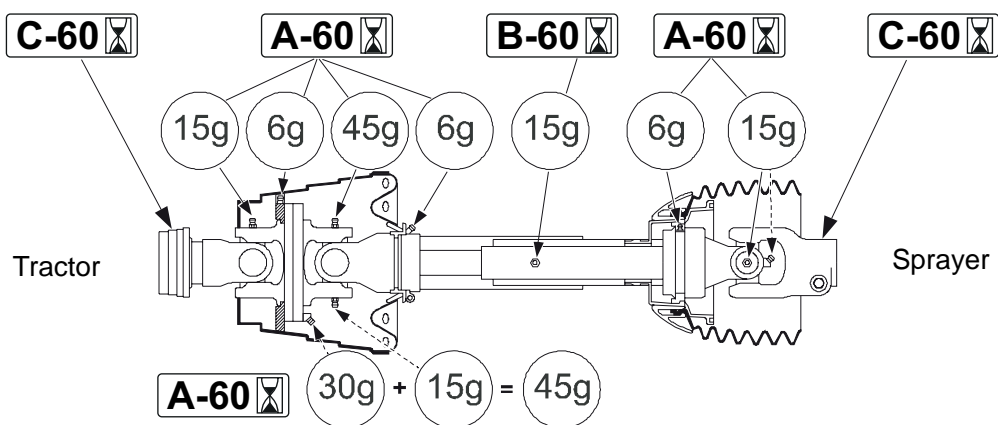
ATTENTION! The correct amount of grease applied at the intervals is important. Too little or too much grease will shorten the lifetime of the PTO.

The grease points and amount of grease to be applied are shown in the pictures below together with the intervals.

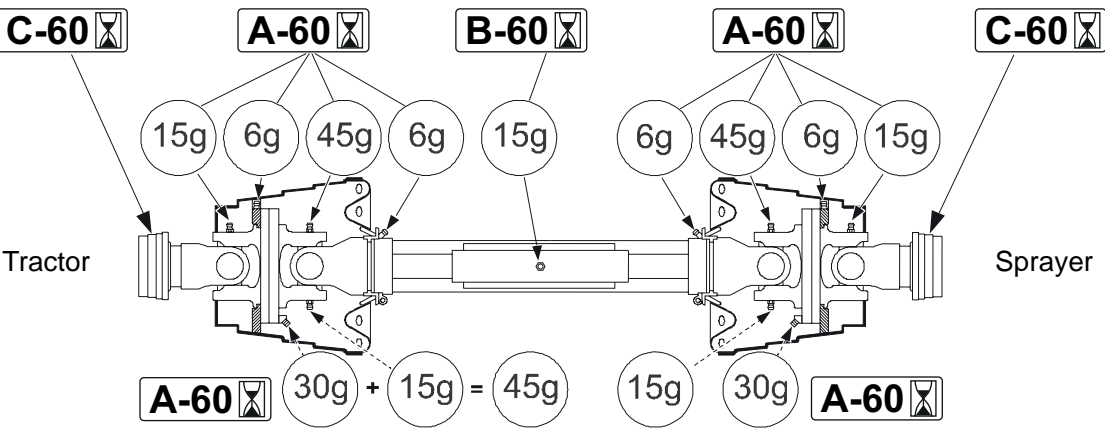
Standard PTO for tractor and sprayer



Wide angle PTO for tractor, standard PTO for sprayer



Wide angle PTO for both tractor and sprayer



6 - Maintenance

Service and Maintenance Intervals

General Info

National or regional laws may require periodic inspection of the sprayers in use. See the following section for more details.

The subsequent 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).

Periodic Inspection

According to EU Directive 2009/128/EC regarding sustainable use of pesticides, all countries in the European Union are obliged to inspect sprayers used for plant protection. This mandatory inspection also includes your HARDI sprayer.

The condition of the sprayer must be verified. The object of the inspection is to ensure a safe and uniform distribution of spray liquid on the plants, as well as minimizing leaks into the environment. The inspection on your sprayer may involve testing the condition of the pump, PTO, tanks, liquid system, measuring components, spray boom, nozzles, agitation of spray liquid, filters, pipes and hoses.

The interval for inspection in some countries are once before the end of 2016 and then every 3 years.

The inspection and testing is carried out by an authorized person, who is not the owner nor the operator of the sprayer. With a positive result, a certificate or test sticker will then show that the inspected sprayer is approved for future use. With a negative result, the faults must be rectified to get the approval.

Check your national rules and guidelines for requirements included in this inspection. For more information on how to approach this inspection, please contact your local HARDI dealer.

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

10 hours Service - Suction Filter

To service the suction filter:

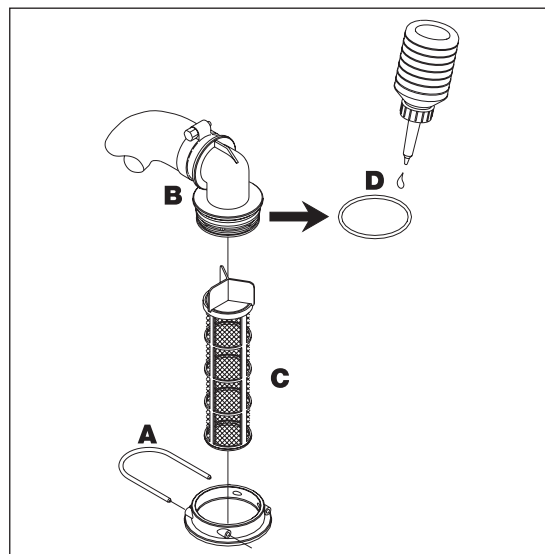
1. Pull out the steel clip (A).
2. Lift the suction hose fitting (B) from housing.
3. Filter guide and filter (C) can now be removed.

To reassemble:

4. Press the guide onto filter end.
5. Place the filter into housing with guide facing up.
6. Ensure the O-ring (D) on the hose fitting is in good condition and lubricated.
7. Refit the suction hose (B) and steel clip (A).



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



10 Hours Service - InLine Filter

If PrimeFlow is installed in the spray boom, these filters are not included.

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.

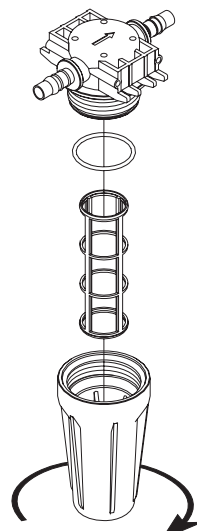
Alternative filter meshes are available. See section "Technical specifications" - Filters and nozzles.



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



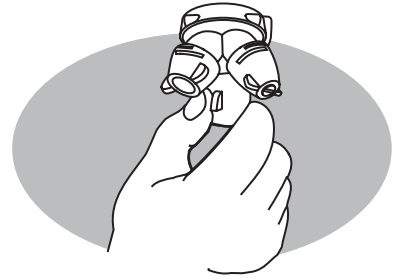
WARNING! Always wear protective clothing and gloves, before servicing the filter!



10 Hours Service - Nozzle Filters

The filters are located inside the nozzles.

Check the filter condition and clean the filter.



10 Hours Service - Spraying Circuit

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

50 Hours Service - Greasing the Pump

When operating the pump, it must be greased every 50 hours into each lubrication point.

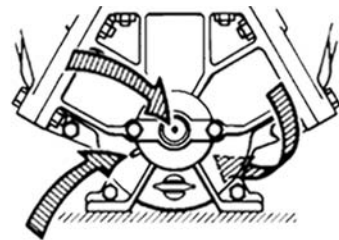
Grease with amount as specified for the specific pump type.



ATTENTION! In order to avoid excessive wear, it is important to use a recommended lubricant! See the section "Recommended Lubricants" for more information.



ATTENTION! The pump MUST be stopped during greasing!



A-50 

10g (603)

13g (1203)

3x 5g (1303)

50 Hours Service - Transmission Shaft (PTO)

1. Check function and condition of the transmission shaft protection guard. Replace any damaged parts.
2. Lubrication. See the section "Lubrication and Oiling Plan - PTO".

100 Hours Service - Re-tightening the Spray Boom

Due to several movements of the spray boom from driving in the field with an unfolded boom, you must re-tighten all bolted connections on the boom centre and boom wings. Please refer to Boom Manual for more instructions.

250 Hours Service - Hydraulic Circuit

Check the hydraulic circuit for leaks and repair, if needed.

Refill nitrogen accumulators for:

- ParaLift suspension (if fitted)
- Wheel axle suspension (if fitted)
- Yaw suspension (if fitted)



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



WARNING! Nitrogen accumulators may contain oil under pressure.

6 - Maintenance

250 Hours Service - Hoses and Tubes

Check all hoses and tubes for possible damage and proper attachment. Replace damaged hoses or tubes.

In general, a hose or tube should always be replaced, if

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

Occasional Maintenance

General Info

The maintenance and service intervals for the following components will depend very much on the conditions under which the sprayer is operated, and therefore it is almost impossible to specify the intervals.

The operator must select appropriate intervals for the occasional maintenance. If in doubt, contact your local HARDI dealer.

Safety Valve Activation

To make the fluid system work perfectly over time, it is good practice to regularly provoke opening of the safety valve. This is good practice for all sprayers; particularly for sprayers without optional equipment.

This prevents clogging and ensures proper function of the safety valve. Depending on valve system opening of the safety valve is done as follows:

No Rinse Tank (no 3-way valves)

1. Close the main spray ON/OFF valve.
2. Engage pump at 540 rpm.

With Rinse Tank

1. Close the main spray ON/OFF valve.
2. Turn the suction valve to "Suction from Main Tank" and close the Agitation valve.
3. Engage pump at 540 rpm.
4. Turn the pressure valve to "Spraying".



DANGER! BK operating unit together with Rinse Tank only: The pressure valve must not be closed when the pump is running! Doing so causes a risk of contamination and injury from a pressure hose being "shot" off when pressurized!

6 - Maintenance

Pump Valves and Diaphragms Renewal

Pump models: 1303

Valves

Remove valve cover (1), before changing the valves (2) - note their orientation, so that they are replaced correctly!

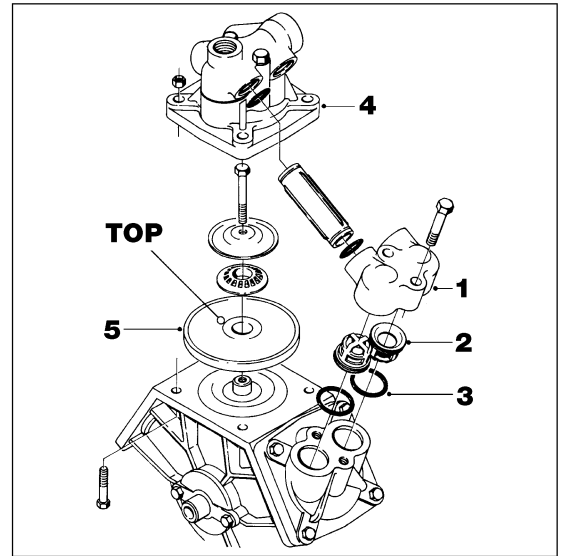


ATTENTION! A special valve with white flap (2A) is used at the two upper side inlets. It has to be placed in the valve openings as shown. All others are the type with black flap. It is recommended to use new gaskets (3), when changing or checking the valves.

Diaphragms

Please note that this instruction may contain pump models not available for the specific sprayer.

Remove the diaphragm cover (4). The diaphragm (5) may then be changed. If fluids have reached the crankcase, re-grease the pump thoroughly. Also check that the drain hole at the bottom of the pump is not blocked.



Reassemble pump with the following torque setting:

Valve cover	80 Nm
Diaphragm cover	80 Nm
Diaphragm bolt	80 Nm



ATTENTION! Before tightening the 4 bolts for the head (9), the diaphragm must be positioned between centre and top to ensure correct sealing between diaphragm pump housing and diaphragm cover. Turn the crank shaft if necessary.

Lubrication After Assembly

After disassembling the pump (diaphragm renewal, etc.), the pump MUST be lubricated into each lubrication point with:

- Model 1303: 3x 35 g.

HARDI pump grease cartridge (400g): HARDI item no. 28164600

Overhaul Kit

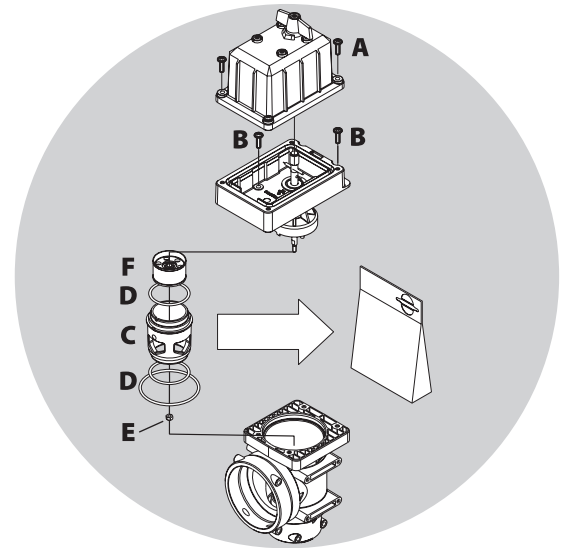
Diaphragm pump overhaul kit (valves, seals, diaphragms etc.) can be ordered. Detect the pump model - the overhaul kit can be ordered by your local dealer.

Model 1303: HARDI item no. 750658.

Cone Check/Renewal for Pressure Regulation Valve

If it becomes difficult to build up sufficient pressure or if pressure fluctuations occur, it may be necessary to renew cone and cylinder.

1. Remove 4 screws (A) and remove the housing.
2. Remove 4 screws (B).
3. Replace cylinder (C) and O-ring (D).
4. Loosen the nut (E), remove and replace the cone (F).
5. Reassemble in reverse order.



Cone Check/Renewal for EVC Distribution Valve

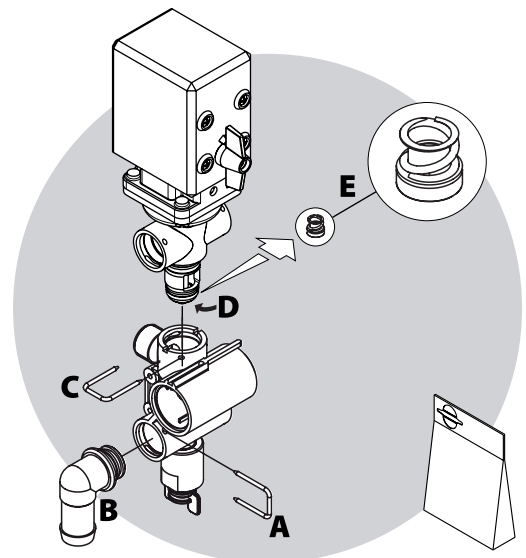
Periodically check the distribution valves for proper sealing. Do this by running the sprayer with clean water and open all distribution valves. Cautiously remove the clip (A) and pull out the hose (B) for the return line. When the housing is drained, there should be no liquid flow through the return line.

If there is any leakage, the valve cone (E) must be changed.

1. Remove the clip (C)
2. Lift the motor housing off the valve housing.
3. Unscrew the screw (D) and replace the valve cone (E).
4. Reassemble in reverse order.



ATTENTION! Follow this procedure if you are having problems maintaining the chosen application rate.

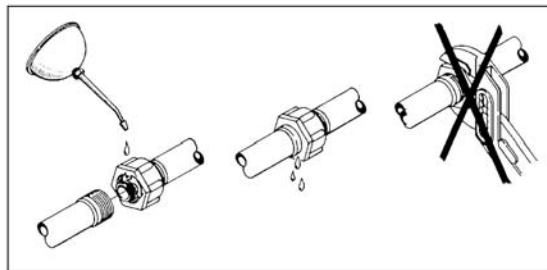


6 - Maintenance

Nozzle Tubes and Fittings

Poor sealings are usually caused by:

- Missing O-rings or gaskets
- Damaged or incorrectly seated O-rings
- Dry or deformed O-rings or gaskets
- Foreign objects



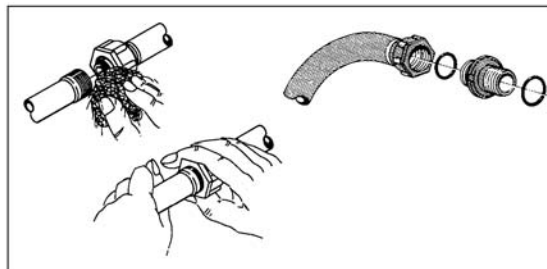
In case of leaks:

DO NOT overtighten. Disassemble, check condition and position of O-ring or gasket. Clean, lubricate and reassemble.

The O-ring must be lubricated ALL THE WAY AROUND, before fitting it on to the nozzle tube. Use a non-mineral lubricant.

For AXIAL connections, a little mechanical leverage may be used.

For RADIAL connections, only tighten by hand.



Adjustment of 3-Way Valve

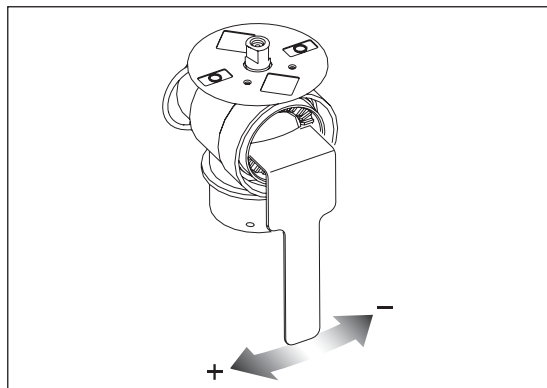
The large ball valve used for SmartValves and valves for filling equipment (type s93) can be adjusted, if it is too tight to operate - or if it is too loose (= liquid leakage).

- Correct setting is when the valve can be operated smoothly by one hand.

Use a suitable tool and adjust the toothed ring inside the valve as shown on the drawing.



ATTENTION! The small ball valves (type s67) cannot be adjusted.



Readjustment of Boom

Please refer to Boom Manual for maintenance and operation of boom.

Off-Season Storage

General Info

To preserve the sprayer intact and to protect its components, the following off-season storage program is carried out.

Before Storage

When the spraying season is over, you should devote some extra time to the sprayer.

If chemical residues are left over in the sprayer for longer periods, it may reduce the life of its individual components.

1. Clean the sprayer completely - inside and outside - as described under "Cleaning" on page 76. Make sure that all valves, hoses and auxiliary equipment have been cleaned with detergent and flushed with clean water afterwards, so that no chemical residues are left in the sprayer.
2. Replace any damaged seals and repair any leaks.
3. Empty the sprayer completely, and let the pump work for a few minutes. Operate all valves and handles to drain as much water off the spraying circuit as possible. Let the pump run, until air comes out of all nozzles. The rinsing tank is also drained.
4. Protection against frost:

First complete the cleaning inside and outside the sprayer.

Pour approximately 50 litres of antifreeze mixture (e.g glycol and water), into the main tank. Include any remaining water in hidden places in the sprayer circuit in the mixture.

Depending on your winter temperatures, use the recommended mixture ratio in the table below:

Freezing temperature (°C)	Water volume (litres)	Glycol volume (litres)
-7	10	2.5
-12	10	4.3
-20	10	6.7
-31	10	10
-40	10	12.2

Engage the pump and operate all valves and functions, operating unit, chemical inductor etc., allowing the antifreeze mixture to be distributed around the entire circuit without leaving any unmixed water in hidden places.

Unmixed water will freeze and possibly damage the sprayer's components!

Open the operating unit main valve ON/OFF and distribution valves, so that the antifreeze is sprayed through the nozzles as well. The antifreeze will also prevent O-rings, seals, diaphragms etc. from drying out.

Empty filters and boom pipes. Remember to unscrew the end plugs, as unmixed water can build up in blind pipe ends causing a risk of a broken end plug or pipe, when the boom pipes are pressurized at the next spray job.

5. Remove the glycerine-filled pressure gauges and store them frost-free in a vertical position.
6. Lubricate all lubricating points according to the lubricating intervals.
7. When the sprayer is dry, remove rust from scratches or damage in the paint, if any, and touch up the paint.
8. Apply a thin layer of anti-corrosion oil (e.g. SHELL ENSIS FLUID, CASTROL RUSTILO or similar) on all metal parts. Avoid oil on rubber parts, hoses and tyres.
9. Fold the boom in transport position and relieve pressure from all hydraulic functions.
10. All electric plugs and sockets are to be stored in a dry plastic bag to protect them against moisture, dirt and corrosion.
11. Remove the control boxes and computer display from the tractor. Store them dry and clean (indoor) in a non-condensing environment.
12. Wipe hydraulic snap couplers clean and fit the dust caps.
13. Apply grease to all hydraulic ram piston rods, which are not fully retracted in the housing, to protect against corrosion.
14. Chock the wheels to prevent moisture damage and deformation of the tyres. Tyre blacking can be applied to the tyre walls to preserve the rubber.

6 - Maintenance

15. Drain air brake tank for condensed water.
 16. To protect against dust, the sprayer can be covered by a tarpaulin. Ensure ventilation to prevent condensation.
-

After Storage

After a storage period, the sprayer should be prepared for the next season the following way:

1. Remove the tarpaulin.
2. Remove the support for the wheel axle, and adjust the tyre pressure.
3. Wipe off the grease from hydraulic ram piston rods.
4. Fit the pressure gauges again. Seal with Teflon tape or similar.
5. Connect the sprayer to the tractor, including pneumatic, hydraulic, electric and electronic connections. Check that the hoses and cables are free to move along when driving with the sprayer. No rubbing or stretching of cables and hoses.
6. Hydraulic hoses are connected correctly to tractor (see flow directions marked on the hoses), and they are without damages.
7. Electric cables to the tractor are intact and connected correctly. Cable sheaths are without damage due to wear, stretching and rubbing. The electric plugs are without copper rust and damages. Electric boxes are without cracks.
8. PTO shaft is connected correctly to the tractor, and protection guards are in good working order. See the delivered instruction manual for the PTO for more about correct installation.
9. Antifreeze is drained from the tank and spray boom.
10. Fill with clean water and check all functions. Liquid test: Fill a small amount of water in the tank and circulate it around the liquid system. Spray pressure = 5 bar. Repair leaks if any. Check spray patterns.
11. Rinse the entire liquid circuit of the sprayer with clean water.
12. Check that the main tank is clean inside and close the drain valve.
13. Brakes are in good working order. Hydraulic or pneumatic hoses are intact and connected correctly to the tractor, and they are without damages. Check function of the brakes. Please note that brake power will be reduced, until the rust is worn off the drums. Always brake lightly until the drums are clean.
14. Traffic lights are visible and in good working order. The protection glasses are clean and without damages.
15. Check all electric functions.
16. PTO shaft is connected correctly to the tractor, and protection guards are in good working order. See the delivered instruction manual for the PTO for more about correct installation.
17. Check that the spray boom folds correctly - make adjustments if needed. Repair oil leaks if any. Check that hydraulic hoses and electric cables are in place, and that they follow the folding movements without being damaged.
18. Speed sensor and other sensors are in good condition and free of dirt.

Operational problems

General Info

Operational incidents are often due to the same reasons:

- A suction leakage reduces the pump pressure and may interrupt suction completely.
- A clogged suction filter may damage suction or interrupt and prevent the pump from running normally.
- A clogged pressure filter increases pressure in the fluid system in front of the pressure filter. This may blow the safety valve.
- Clogged in-line filters or nozzle filters increase pressure in the pressure gauge, but it decreases pressure at the nozzles.
- Impurities sucked in by the pump may prevent the valves from closing correctly, thus reducing the pump flow.
- A bad reassembly of the pump elements, especially the diaphragm covers, causes air intakes or leaks and reduces the pump flow.
- Rusted or dirty hydraulic components cause bad connections and early wears.
- A poorly charged or faulty battery causes failure and misbehaviour in the electrical system.

Therefore ALWAYS check that

- Suction and pressure filters, as well as nozzles, are clean.
- Hoses are free of leaks and cracks, especially suction hoses.
- Gaskets and O-rings are present and in good condition.
- Pressure gauges are in good working order. Dosage accuracy depends on it.
- Operating unit functions properly. Use clean water to check.
- Hydraulic components are clean.
- The tractor battery and its connectors are in good condition.

7 - Fault finding

Liquid System

FAULT	PROBABLE CAUSE	CONTROL/REMEDY
No spray from boom when turned on.	SmartValve/Pressure valve positions are wrong. Suction/pressure filters are 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. Clean if needed.
Lack of pressure.	Incorrect assembly. Air in system. Too much agitation. Pump valves are blocked or worn. Blocked filters Defective pressure gauge.	Boost valve is open. Fill suction hose with water for initial priming. Close the agitation valve. Check for obstructions and wear. Clean all filters. Check for dirt at inlet of pressure gauge.
Pressure dropping.	Filters are clogging. Nozzles are 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. Replace nozzles, if it exceeds 10%. Lower pump speed (rpm).
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. Lower pump speed (rpm). Check safety valve is tight. Ensure returns inside the tank are present. Use a foam damping additive.
Liquid leaks from bottom of the pump.	Damaged diaphragm.	Replace diaphragm. See relevant section.
Vibrations in system and unpleasant noise from the pump.	Air is being sucked into system.	Check for leaks, holes in hoses, tightness/gaskets/O-rings of all fittings on the suction side.
Operating unit is not functioning, or it is having a malfunction.	Blown fuse(s). Wrong polarity. Valves not closing properly. No power.	Check mechanical function of micro switches. Use cleaning/lubricating agent if the switch does not operate freely. Check motor current, max. 450-500 mA. If over, change the motor. Brown to positive (+). Blue to negative (-). Check valve seals for obstructions. Check micro switch plate position. Loosen the screws holding the plate a 1/2 turn. Wrong polarity. Check that brown is positive (+), blue is negative (-). Check print plate for dry solders or loose connections. Check fuse holder is tight around fuse.

Pump

Liquid leaks from the bottom of the pump.	Damaged diaphragm.	Replace diaphragm. See relevant section in this book.
Grease leaks from the bottom of the pump.	Grease used has too low viscosity.	Change to recommended grease type.
Grease leaks from the shaft grease seals.	Grease used has too low viscosity. Bearings worn/too high friction.	Change to recommended grease type. Replace pump bearings and grease seals.
Lack of pressure.	Pump valves are blocked or defect. Plugged filters in fluid system.	Check for obstructions or, if needed, replace valves. Clean filters.
Vibrations in system and unpleasant noise from the pump.	Pump valves are blocked or defect. Air is being sucked into system.	Check for obstructions or, if needed, replace valves. Check for leaks, pinholes in suction hoses, tightness/gaskets/O-rings of all fittings on the suction side.
Lack of flow/capacity.	Internal wear on conrod and conrod ring. Pump valves are blocked or defect.	Poor greasing. Replace parts as needed and observe proper grease quality and intervals. Check for obstructions or, if needed, replace valves.
Extreme internal erosion on diaphragm covers and housing.	Too high vacuum caused by clogged suction filter or excessive pump speed (rpm). Lack of internal cleaning. Lack of conservation of the fluid system during storage.	Replace affected pump parts. Clean suction filter and observe maximum pump speed (rpm). Use recommended cleaning procedures and add extra cleaning agents (e.g. AllClearExtra or similar). Always use a proper mixture of antifreeze during storage.
Short lifetime for diaphragm.	Overspeeding of the pump.	Observe maximum pump speed (rpm).

Hydraulic System, Z-boom version

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. 25 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.
	Defective 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.
Oil heats up in Closed Centre systems.	Wrong polarity.	Check polarity. Red positive (+), black negative (-).
	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 hydraulic piston does not move.	Clogged restrictor.	Dismantle and clean restrictor.

Hydraulic System, Y-boom version

FAULT	PROBABLE CAUSE	CONTROL/REMEDY
Boom slow/erratic.	Air in system.	Loosen ram connection and activate hydraulics until oil flow has no air in it (not whitish).
	Regulation valve incorrectly set.	Open or close until desired speed is achieved (clockwise = less speed).
	Insufficient hydraulic pressure.	Remember oil must be at operating temperature. Check output pressure of tractor hydraulics. Minimum for sprayer is 170 bar.
	Insufficient amount of oil in tractor reservoir.	Check and top if needed.
Ram not functioning.	Restrictor or regulation valve blocked.	Secure boom. Dismantle and clean.
Hydraulic system fold/tilt functions will not operate.	Power supply.	Check for proper 12V power supply.
One function (fold or tilt) will not operate.	Various.	Check for defective switch(s).
		Check continuity of cables.
		Check for operation of applicable solenoid (coil not activating or plunger stuck).
		Check for short circuit in wiring junction box at rear of sprayer.
Multiple hydraulic functions with one switch activated.	Various.	Dirt in the restrictor port of the cylinder.
		Check for correct solenoid electric/hydraulic hook-up. Check for short circuit in wiring in the junction box at rear of sprayer.

7 - Fault finding

Mechanical Problems

Emergency Operation - Liquid system

In case of power failure, it is possible to operate all functions of the operating unit manually. First disconnect the multi-plug from the control box. Now manually turn the emergency control knobs.

The problem may be due to a blown fuse. A fuse is placed inside the control box. Fuse type: Thermo.

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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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