

NK SB/MB

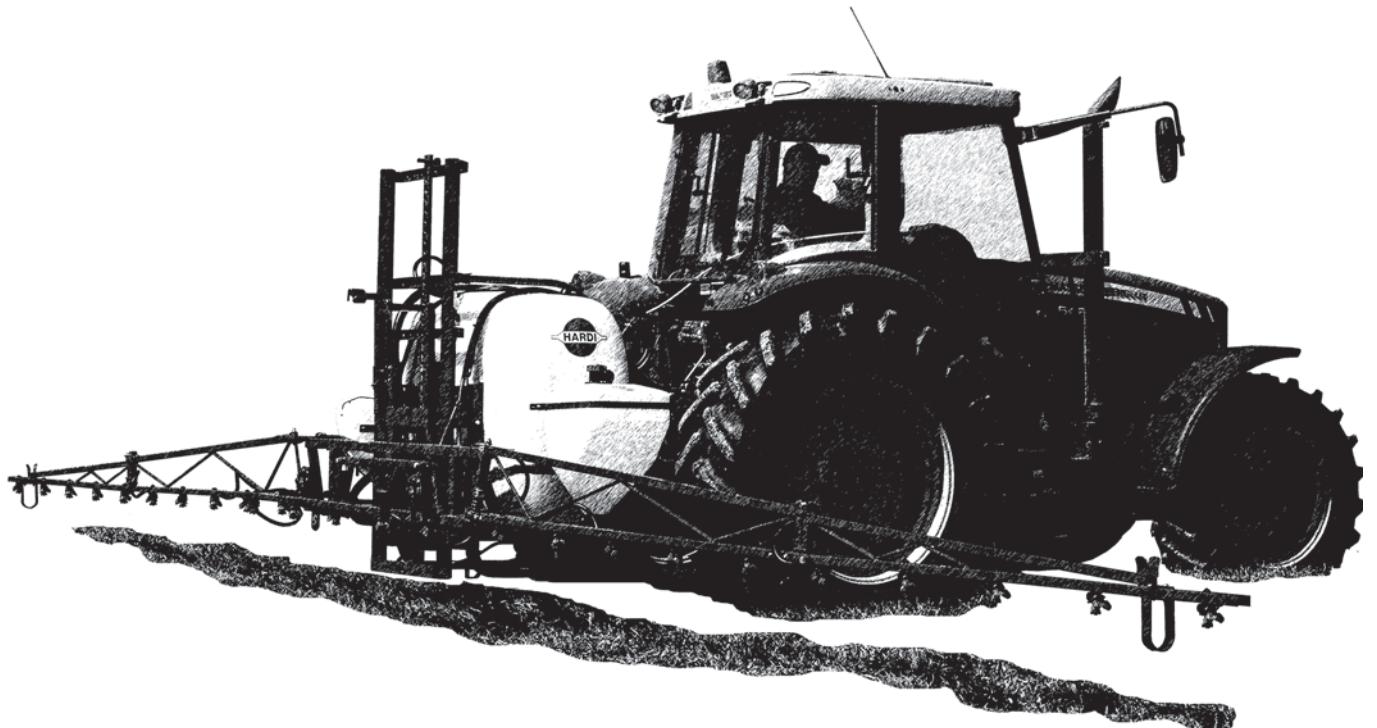


Original

Instruction book

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

Instruction Book Formalities

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

Illustrations, technical information and data in this book are believed to be correct at the time of printing. As it is the policy of HARDI INTERNATIONAL A/S to continuously 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 INTERNATIONAL A/S is without any obligation in relation to implements purchased before or after such changes.

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

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

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User Evaluation

Dear Reader,

We update our instruction books regularly. Your suggestions for improvement are appreciated and will help us to create ever more user-friendly instructions. Send us your suggestions to this e-mail address:

TechDoc@hardi-international.com

Thank you.

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Identification Data

Sprayer

Model : NK - SB/MB

Identification number is to be filled out at the Product Delivery Inspection (PDI).

Identification No.

Further sprayer data is shown on the type sign mounted on the sprayer.

Manufacturer

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Spare Parts

To see or updated spare parts catalogue, visit the Agroparts website on the internet.

Here all spare parts information can be accessed in the catalogue:

1. Go to www.agroparts.com, register for free and log in.
2. Select "HARDI" in the menu on the left.
3. Select "Spare parts catalogue" and find your spare part.
4. Online ordering is also possible.



Contact your HARDI dealer for further information on spare parts.

1 - Identification

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 applies 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.

2 - General Safety Instructions

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.

2 - General Safety Instructions

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.
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.

2 - General Safety Instructions

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).

2 - General Safety Instructions

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.

2 - General Safety Instructions

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.

2 - General Safety Instructions

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.



978436 Service!

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



97802100 Risk of death!

Do not attempt to enter tank.



978444 Risk of injury!

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



978448 Risk of injury!

Keep sufficient distance away from electrical power lines.



978443 Service!

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



978440 Service!

Tighten to the torque according to instruction book.



978447 Risk of burn!

Stay clear of hot surfaces.



978586 Risk of injury!

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



978435 Risk of injury!

Keep hands away.

2 - General Safety Instructions



978441 Risk of squeezing!

Stay clear of raised and unsecured loads.



978434 Risk of squeezing!

Keep hands away, when parts is moving.



978446 Risk of sprayer tipping over!

Be aware when disconnecting the sprayer.



97802200 Not for drinking!

This water must never be used for drinking.



97829000 Lifting point!



97831500 Load index!

Max. permitted load rating is 164 at 40 km/h or 5000 kg.



978445 Risk of squeezing

Never reach into the crushing danger area as long as parts are moving.



978442 Risk of falling off!

Do not ride on platform or ladder.



978438 Grapping area!

Manual handling of the boom etc.



97802300 Not for drinking!

This water must never be used for drinking.



978439 Lifting point!



97827000 EasyClean filter service!

Open and clean filter monthly.

2 - General Safety Instructions

Safety and Protection Equipment

Safety at Start-up

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

Faulty Safety Equipment

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

Informal Safety Measures

Additional Safety Instructions

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

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

Follow these regulations, especially when

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

2 - General Safety Instructions

Operator Training

Authorized Persons

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

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

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

Symbols: X - permitted, 0 - not permitted.

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

Comment:

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

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

Safety Measures in Normal Operation

Protection Equipment

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

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

2 - General Safety Instructions

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

Electric system

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

2 - General Safety Instructions

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.

2 - General Safety Instructions

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 loosing his concentration and focus on operating the vehicle correctly
- risk of the operator loosing 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.

2 - General Safety Instructions

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.

2 - General Safety Instructions

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 lynchpin 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 lynchpins against unintentional release.

Adjust your driving speed to the prevailing conditions.

2 - General Safety Instructions

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 your 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.

2 - General Safety Instructions

Service Work Precautions

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

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

Cleaning

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

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

Cleaning of tanks:

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

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

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.

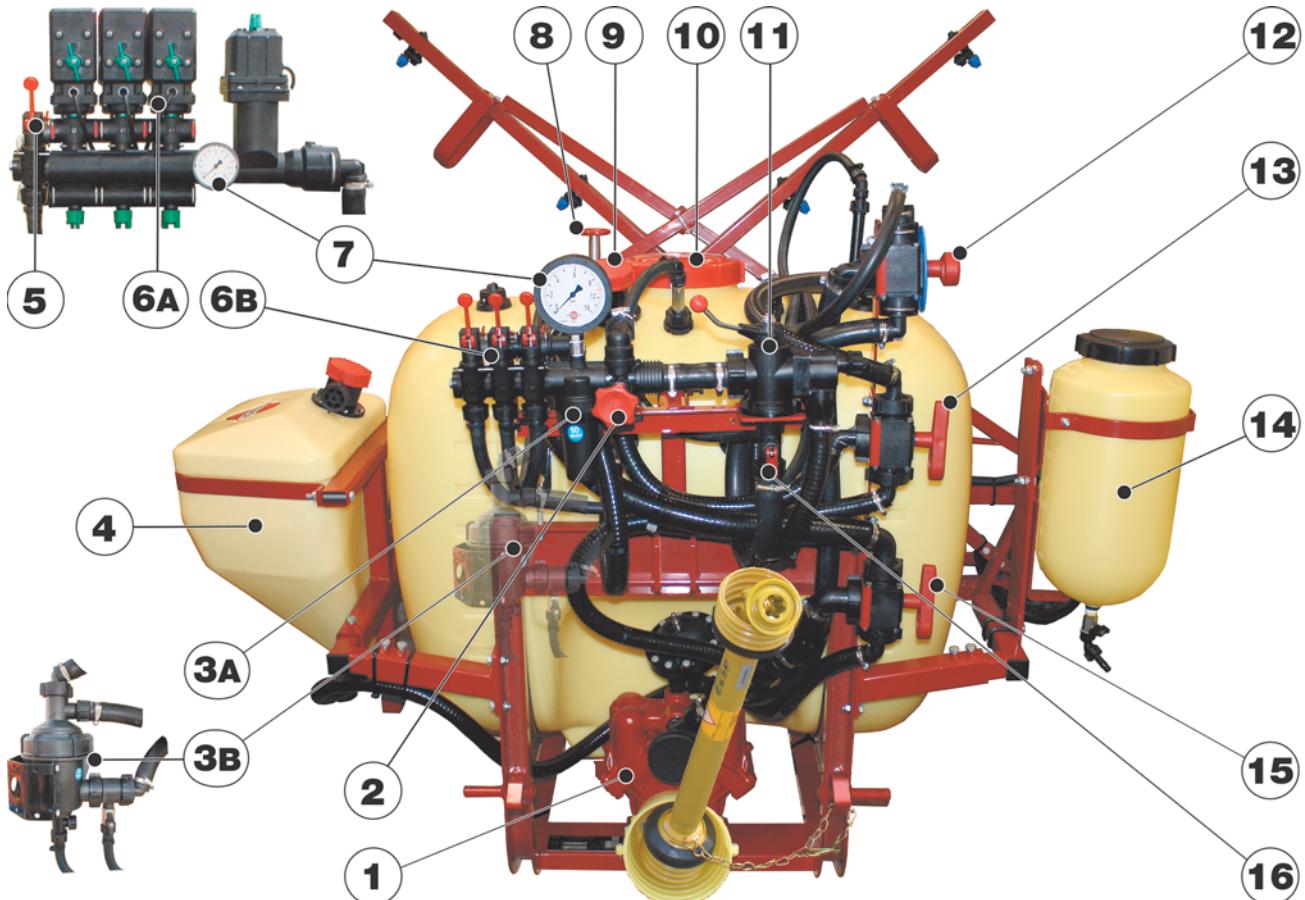
When replacing spare parts, use suitable tools and personal protective equipment.

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

General Info

Front View

 ATTENTION! The sprayer is equipped with optional equipment!

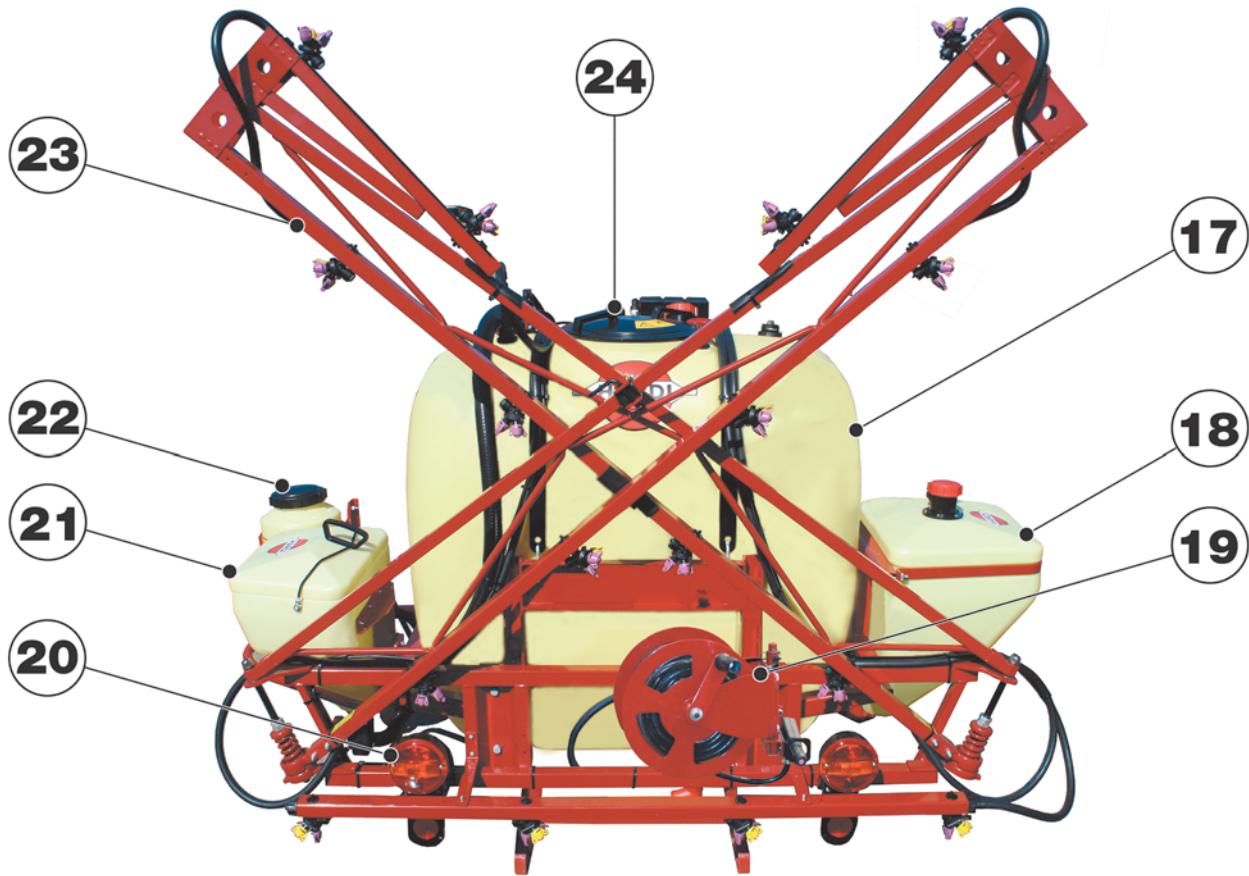


1. Pump
2. Spray Pressure Regulation
3. Pressure Filter
 - A. BK operating unit
 - B. Self-Cleaning Filter for EVC operating unit
4. Rinsing Tank
5. External Cleaning Device ON/OFF
6. Spray Section Valves
 - A. EVC operating unit
 - B. BK operating unit
7. Spray Pressure Gauge
8. Drain Valve Handle
9. Suction Filter
10. Main Tank Lid
11. Main Valve ON/OFF
12. Pressure Valve
13. Agitation Valve
14. Clean Water Tank
15. Suction Valve
16. Agitation Valve (BK operating unit only)

3 - Description

Rear View

 ATTENTION! The sprayer is equipped with optional equipment!



17. Main Tank

18. Rinse Tank

19. Hose Reel for External Cleaning Device

20. Road Lights

21. ChemFiller

22. Clean Water Tank

23. Spray Boom

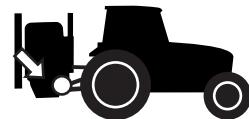
24. Main Tank Lid

Identification Plates

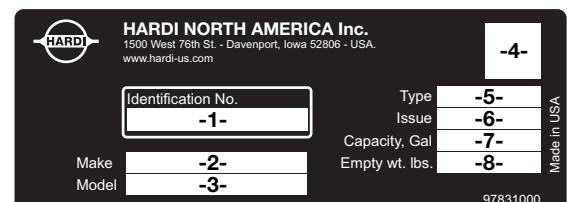
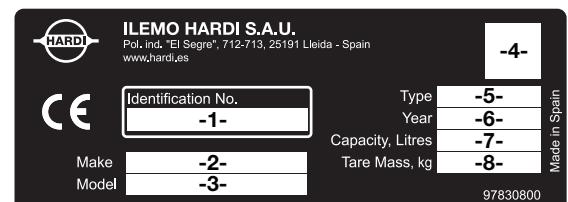
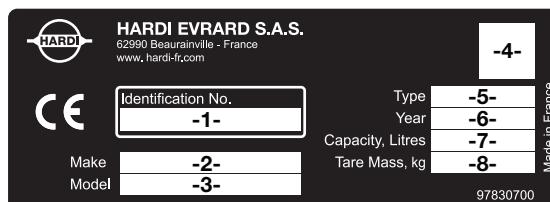
An identification plate indicating data for the sprayer is mounted in the steel frame near the front of the sprayer on the right-hand side.

The identification number for the sprayer is also punched into the steel frame near the ID plate.

The example to the right is the international model of the ID plate.



If the sprayer is sold to a market requiring another language, the ID plate text might be different. The standard types of ID plates belonging to sprayers sold to the equivalent markets are shown below.



No.	Field name	Description
-1-	Identification No.	Coded number identifying the machine. Includes manufacturer, production year, type and ends with a continuous serial number. The identification number uniquely identifies one specific sprayer amongst the lot.
-2-	Make	Manufacturer or brand name. The HARDI group currently have two makes: HARDI and EVRARD.
-3-	Model	A particular design within a sprayer type. E.g. type of sprayer models are NK, MASTER, METEOR etc.
-4-	Not used.	Reserved for future use.
-5-	Type	Defined type – related to type approvals definition: A grouping based on shared characteristics. E.g. lift sprayer, trailer sprayer, mist blower, field sprayer, self-propelled sprayer etc. In homologation and type approval context, the "Type" refers to the particular form and shape of a chassis (i.e. the chassis drawing number). Can be stated encoded.
-6-	Year	Year of completed production. In all factories and markets in the EU, the production year is stated in clear text separately. In other regions, "1521" means "produced in week 52 of the year 2011" etc.
-7-	Capacity	Rated or nominal content of the main tank. (The tank is oversized to retain overfilling, foam etc.)
-8-	Tare mass	Same as unladen weight. Vehicle net weight without load, but with fuel, driver etc. Typically the heaviest configuration is stated for all variants (most vehicles are lighter than the stated tare mass).

3 - Description

Sprayer Use

The HARDI sprayer is for the application of crop protection chemicals and liquid fertilizers. 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 prevent unnecessary risk for persons and the environment, when carrying out your spray job.

Frame

Very strong and compact steel frame with a strong chemically resistant and weatherproof electrostatic lacquer coat. Screws and bolts etc. have been Delta/Magni treated to be resistant to corrosion.

Tanks

The tanks are made of impact-proof polyethylene, resistant to UV radiation and chemicals. The main tank has a purposeful design with no sharp corners for easy cleaning. The filling hole is placed in the centre of the sprayer. An optional footboard is placed at the right hand side of the sprayer. This ensures an easy access for the filling of sprays, cleaning of the tank etc. A suction filter is located at the top of the tank to facilitate safe and easy filter inspection and maintenance, even if the tank is filled with spray liquid. The sprayer may also be equipped with optional TurboFiller, rinsing tank and a clean water tank.

Nominal tank contents are 400, 600 or 800 litres.

Lifetime

The expected lifetime for the sprayer is 20 years. To obtain this successfully, these instructions should be followed:

- All service and maintenance work must be completed in due time
- Repair any damages parts as quickly as possible
- Replace or change spare parts as instructed
- Only use original HARDI spare parts.

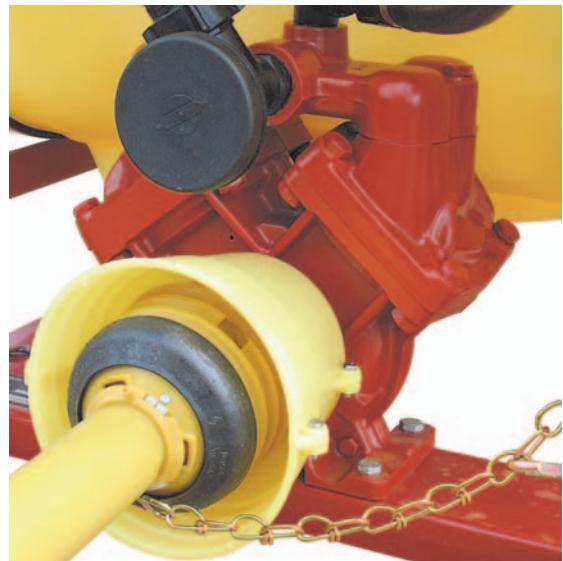
Liquid System

Pump

Diaphragm pump with 2 diaphragms, model 603 or 1203 or a pump with 3 diaphragms, model 1303.

Standard = 540 rpm (6 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.



ChemFiller (optional)

When fitted the ChemFiller is situated in the working zone on the sprayers left side.

Handle Functions

A. The valve enables the ChemFiller. Point the handle:

- Upwards for spraying (disable ChemFiller).
- Downwards for enabling the ChemFiller functions.

ChemFiller Functions

B. Point handle up or down to empty the ChemFiller. Valve is closed when handle is in horizontal position.

C. The flip valve engages the ChemFiller flushing device, used when mixing the chemicals.

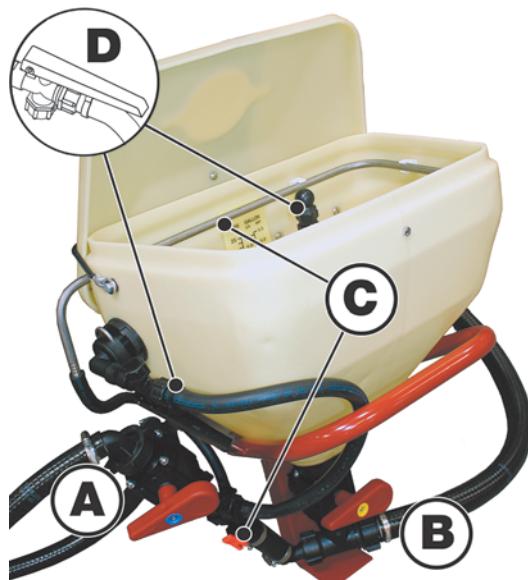
D. The lever is used for two purposes.

1. When the ChemFiller lid is open:

For rinsing empty containers. Place the container over the flushing nozzle in the middle of the ChemFiller to rinse the inside of the container.

2. When the ChemFiller lid is closed:

Use the Chemical Container Rinsing lever to rinse the hopper, when the filling of chemicals is completed.



DANGER! Do not press the lever (D), unless the multi-hole nozzle is covered by a container or the ChemFiller lid is placed in closed position, as spray liquid may otherwise hit the operator!

3 - Description

Filters

A suction filter is fitted at the top of the tank. In-line pressure filters can be fitted at each boom section as an option (J).

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.



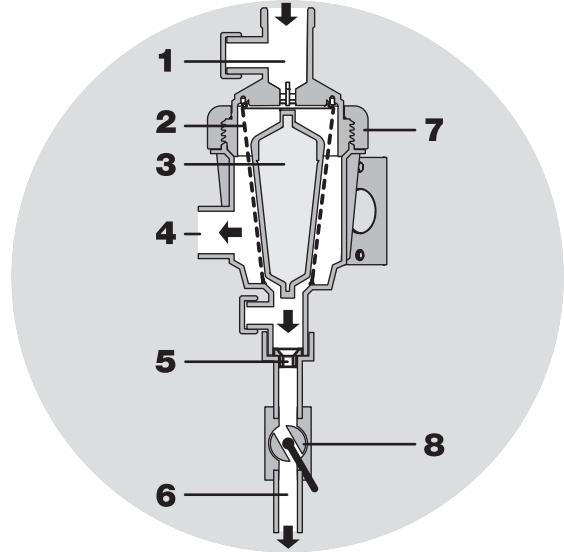
Self-Cleaning Filter

With the self-cleaning filter, the impurities that exist in the spray liquid will be filtered out and returned to the tank via the return flow.

Function diagram:

1. From pump
2. Double filter screen
3. Guide cone
4. To operating unit
5. Exchangeable restrictor
6. Return to tank
7. Screw joint
8. Ball valve

Ball valve (8) should normally be open, but it may be closed in situations, where return flow is to be avoided, e.g. flushing of spray lines without diluting the spray liquid in the main tank.



 ATTENTION! If the ball valve is closed, the self-cleaning function is inoperative!

RinseTank (optional)

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

Nominal content is approximately 35 or 50 litres.

Clean Water Tank (optional)

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 15 litres.

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



BK control unit

The BK control unit consists of: pressure agitator valve, safety valve, main ON/OFF valve, pressure filter with pressure gauge, distribution valves with pressure equalization and HARDI-MATIC pressure control valve.

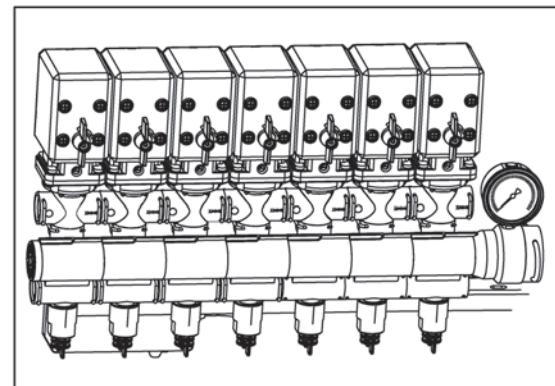
EVC Control Unit

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 are fitted with a constant pressure device and a pressure drop line.

These features allows 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

Valves and symbols (optional)

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.

Correct valve positions are:

- Vertical handle = Open valve
- Horizontal handle = Closed valve

(A) Pressure valve

This valve selects to direct pressurized liquid to spraying or tank rinsing.

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



(B) Agitation valve

With this valve you select whether return liquid should be directed back to the pump or is used for agitation in the tank.

If the valve is kept closed the liquid will be directed back to the main tank. When the tank is nearly empty, the handle is turned to pump so that the liquid is directed to the suction side of the pump in order to fully empty the tank prior to cleaning.



(C) Suction valve

This valve selects suction from main tank for spraying or rinsing tank for cleaning purpose.

Turn the handle up or down to vertical position so the indicator points towards the label of the required function.



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

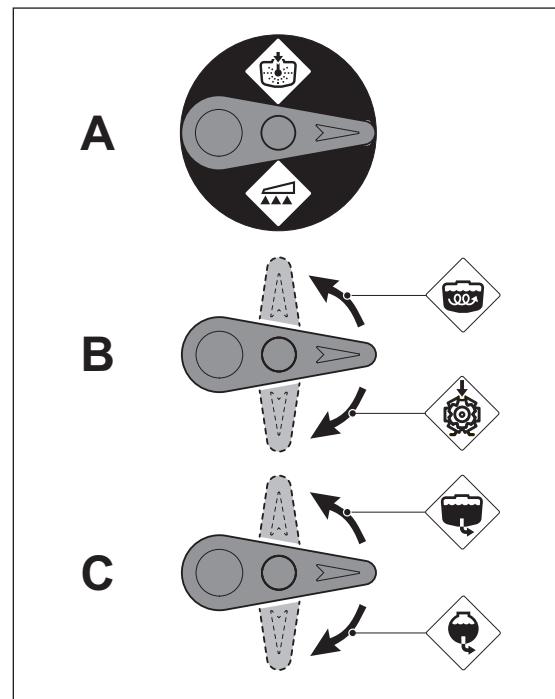
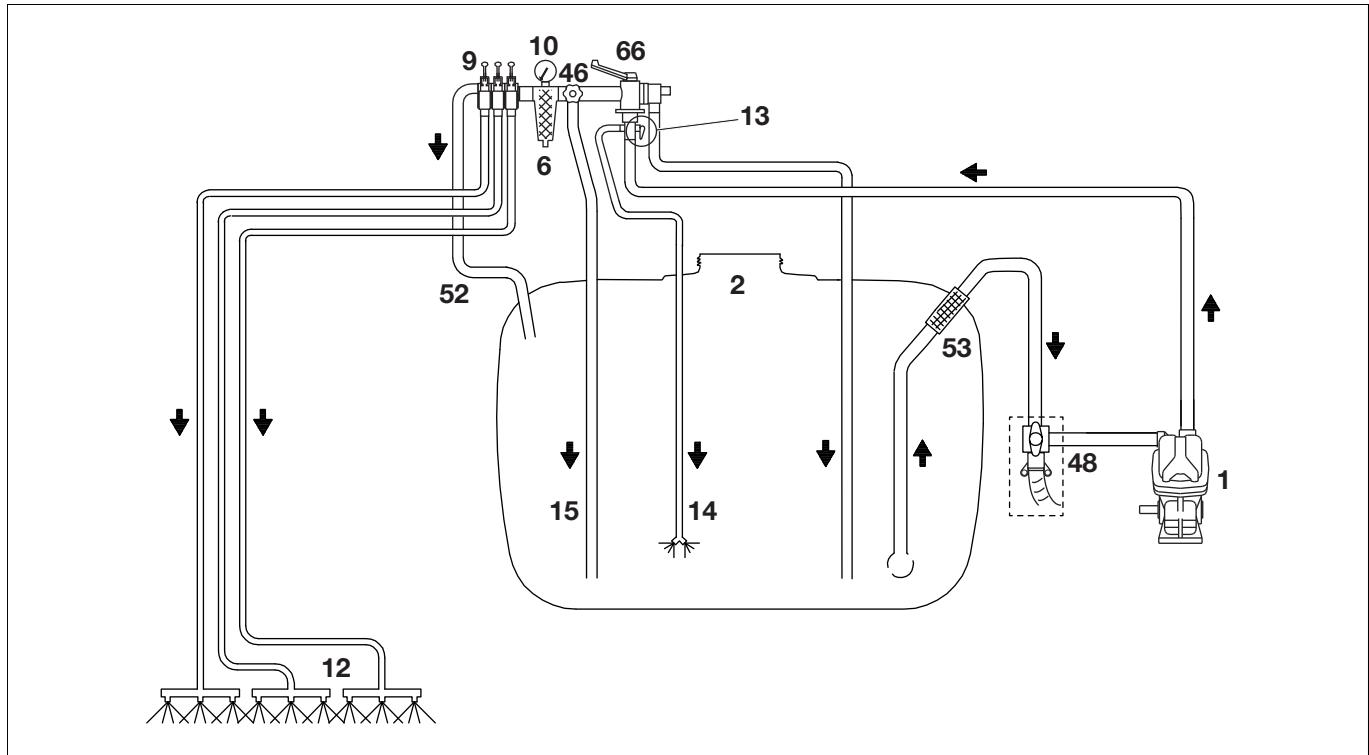


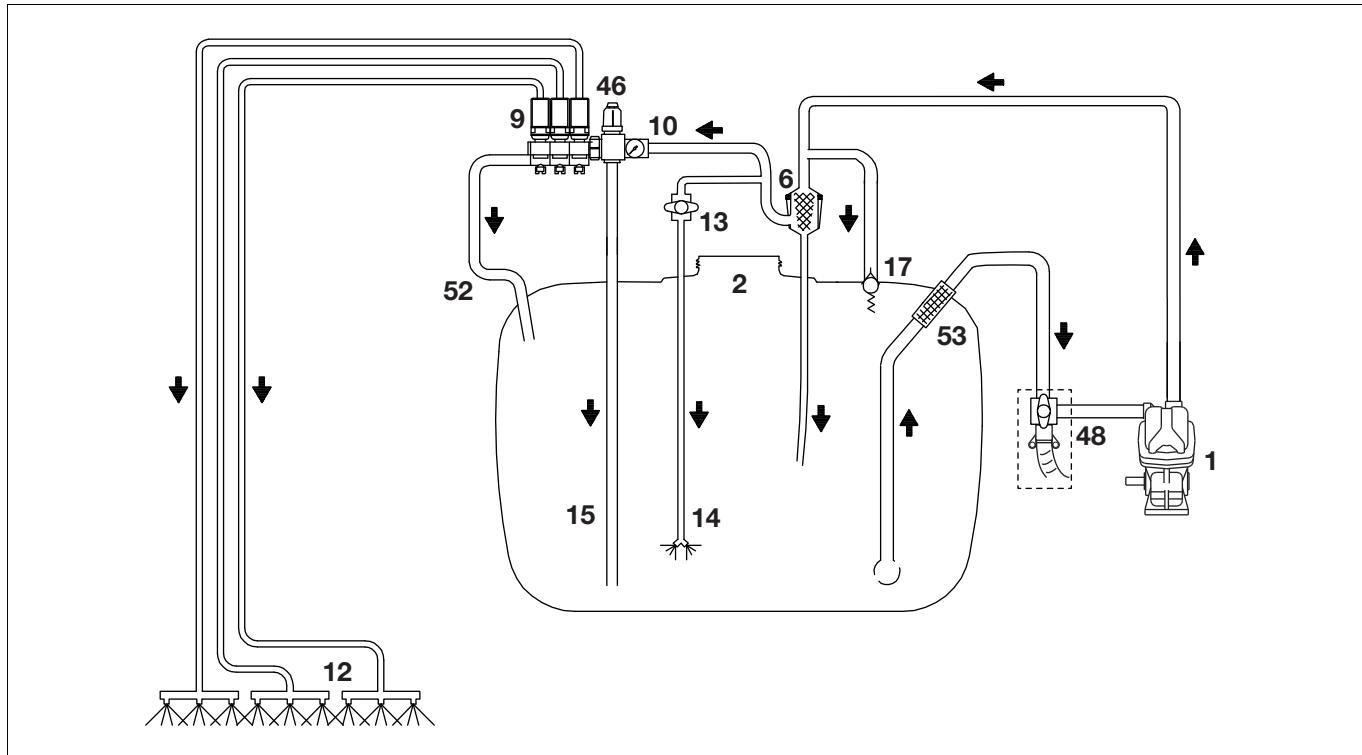
Diagram - Basic Liquid System (BK Operating Unit)



- | | |
|------------------------|--|
| 1. Pump | 14. Agitation Nozzles |
| 2. Main Tank | 15. Return Line for Main Tank |
| 6. Pressure Filter | 46. Pressure Regulation |
| 9. Distribution Valves | 48. External Filling Device Valve (Optional) |
| 10. Pressure Gauge | 52. Return Line - Pressure Equalization |
| 12. Spray Boom | 53. Suction Filter |
| 13. Agitation Valve | 66. Main ON/OFF Valve |

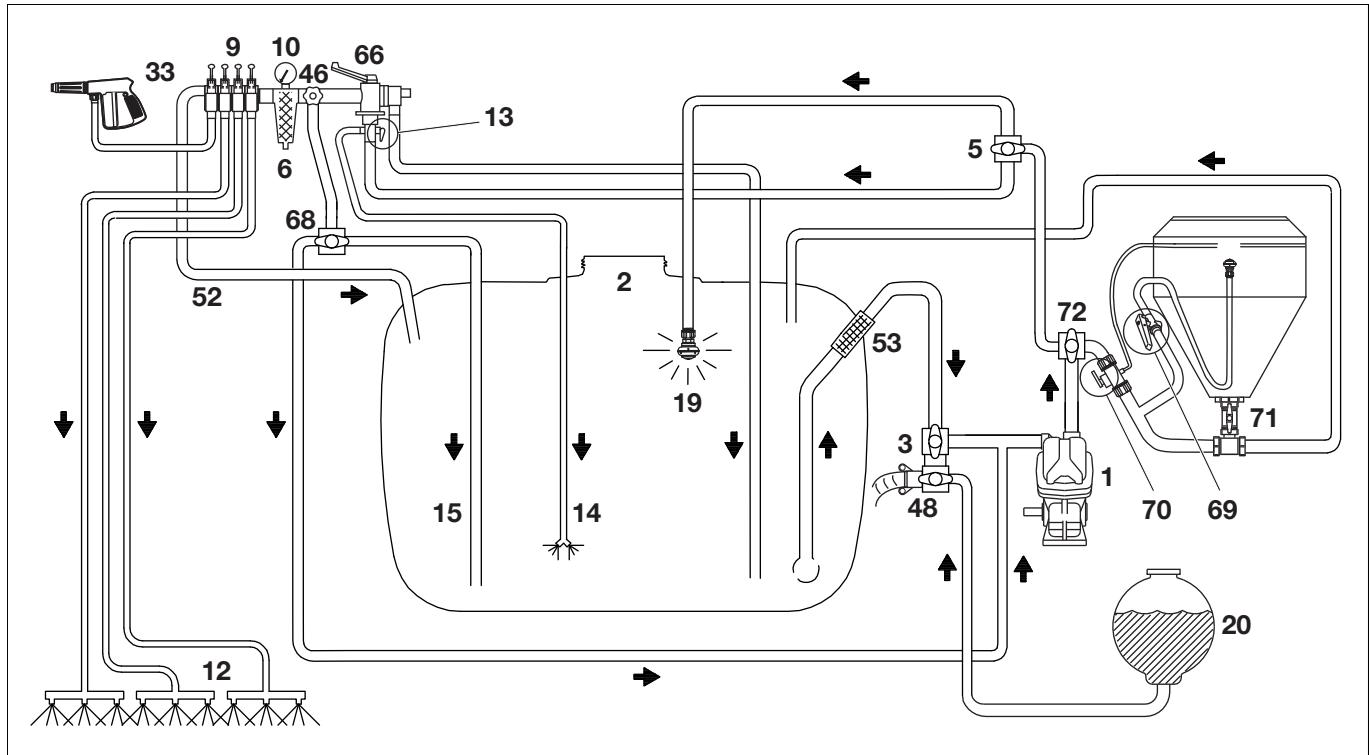
3 - Description

Diagram - Basic Liquid System (EVC Operating Unit)



- | | |
|------------------------|--|
| 1. Pump | 14. Agitation Nozzles |
| 2. Main Tank | 15. Return Line for Main Tank |
| 6. Pressure Filter | 17. Safety Valve |
| 9. Distribution Valves | 46. Pressure Regulation |
| 10. Pressure Gauge | 48. External Filling Device Valve (Optional) |
| 12. Spray Boom | 52. Return Line - Pressure Equalization |
| 13. Agitation Valve | 53. Suction Filter |

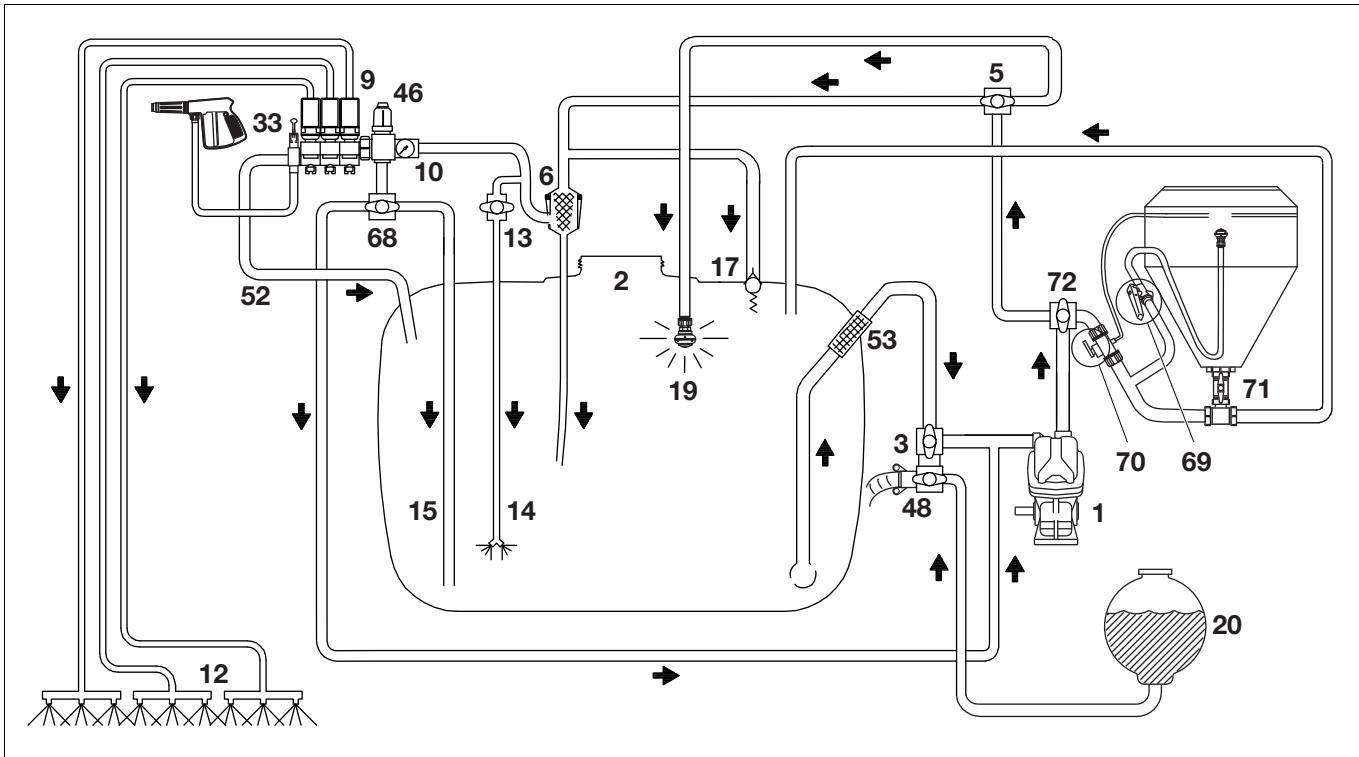
Diagram - Liquid System with Options (BK Operating Unit)



1. Pump
2. Main Tank
3. Suction Valve
5. Pressure Valve
6. Pressure Filter
9. Distribution Valves
10. Pressure Gauge
12. Spray Boom
13. Agitation Valve
14. Agitation Nozzles
15. Return Line for Main Tank
19. Rinsing Nozzle
20. Rinse Tank
33. External Cleaning Valve and Spray Gun
46. Pressure Regulation
48. External Filling Device Valve
52. Return Line - Pressure Equalization
53. Suction Filter
66. Main ON/OFF Valve
68. Return Valve
69. ChemFiller Cleaning Valve
70. ChemFiller Flush Valve
71. ChemFiller Suction Valve
72. ChemFiller ON/OFF Valve

3 - Description

Diagram - Liquid System with Options (EVC Operating Unit)



- 1. Pump
- 2. Main Tank
- 3. Suction Valve
- 5. Pressure Valve
- 6. Pressure Filter
- 9. Distribution Valves
- 10. Pressure Gauge
- 12. Spray Boom
- 13. Agitation Valve
- 14. Agitation Nozzles
- 15. Return Line for Main Tank
- 17. Safety Valve
- 19. Rinsing Nozzle
- 20. Rinse Tank
- 33. External Cleaning Valve and Spray Gun
- 46. Pressure Regulation
- 48. External Filling Device Valve
- 52. Return Line - Pressure Equalization
- 53. Suction Filter
- 66. Main ON/OFF Valve
- 68. Return Valve
- 69. ChemFiller Cleaning Valve
- 70. ChemFiller Flush Valve
- 71. ChemFiller Suction Valve
- 72. ChemFiller ON/OFF Valve

Spray Boom

Boom and Terminology

The sprayer can be fitted with the manually folded 6, 8, 10 SB boom or 12 metre MB boom. The booms are supported by a trapeze which is fitted to the tank frame.

The trapeze helps the boom to stay horizontal when unfolded and it protects the boom against vibrations and shocks when driving on uneven ground. This ensures longer boom life and improves boom stability for better spray distribution.

Height adjustment of the boom can be manual or hydraulic.

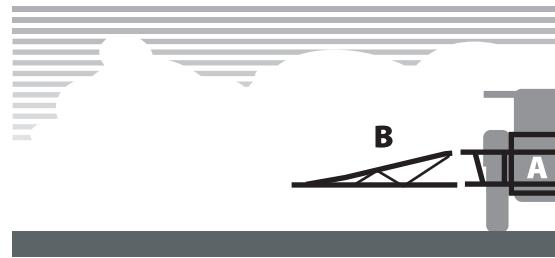
Boom options

- Hydraulic boom lift.
- Individual hydraulic boom tilt control.

Terminology

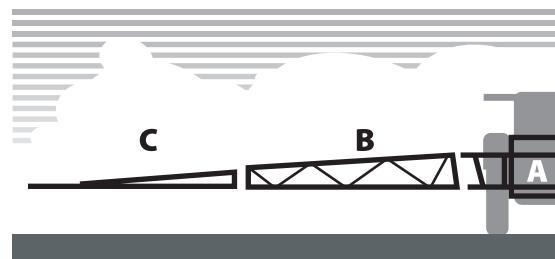
For single folded booms, the terminology is as follows:

- A. Centre section
- B. Outer section



For 2-folded booms, the terminology is as follows:

- A. Centre section
- B. Inner section
- C. Outer section



3 - Description

Equipment

Footboard (optional)

The footboard gives access to the main tank lid. It ensures easy access for filling of sprays, cleaning of tank, etc.



Nozzle Pressure Gauge

The pressure gauge is located at the manifold. This gauge measures the working pressure in the boom tubes as close to the nozzles as possible.

The outputs stated in the nozzle charts are always based on the pressure measured at the nozzle. Both when calibrating and spraying, the pressure must be adjusted according to the readings of this pressure gauge.



Safety Locker

A safety locker (A) can be mounted on the sprayers left side. The safety locker is for storage of safety gear such as non-contaminated protective gear, soap for hand washing etc. The locker is split in two compartments for the separation of clean clothes and contaminated equipment.



WARNING! Although this locker is meant for the storing of non-contaminated items, it must never be used for the storing of food, beverage or other items meant for human consumption.



Canister for Pesticide Information

This canister is for storing information about the present pesticide product in the tank - such as labels, instructions and safety data sheet (SDS) from the pesticide supplier.

Unscrew the lid and store this information inside the canister at all times when using the sprayer.

The canister (A) is placed vertically at the sprayers frame, just behind the main tank.



ATTENTION! Although this canister is meant for the storing of non-contaminated items, it must never be used for the storing of food, beverage or other items meant for human consumption.



External Cleaning Device

This equipment comprises a hose reel and a spray gun (A) for cleaning the complete sprayer externally in the field with clean water. The External Cleaning Device is located on the boom centre section at the back.



WARNING! The cleaning device produces a high water pressure. Incorrect use may result in injuries!



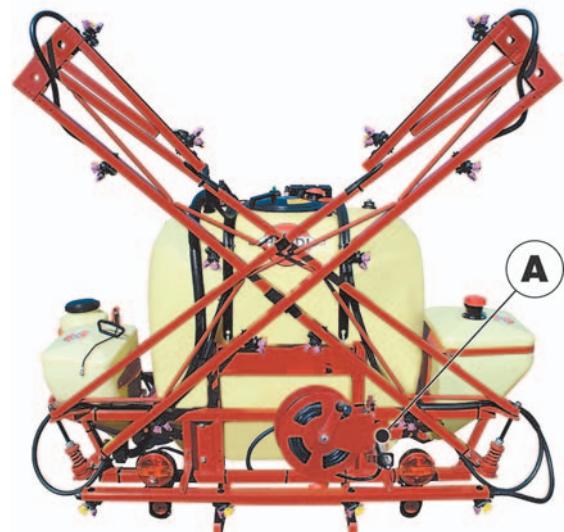
DANGER! Never work in bare feet or sandals. It is recommended to wear goggles during the cleaning work. It is recommended that the user, or anyone near the cleaning place, protects himself against particles bouncing up during the cleaning.



DANGER! For the safety of yourself and others, the following rules should always be observed:

Never point the water jet at people, animals, electrical installations or other sensitive objects.

Never try to clean clothing or footwear which you or other people are wearing.



A

3 - Description

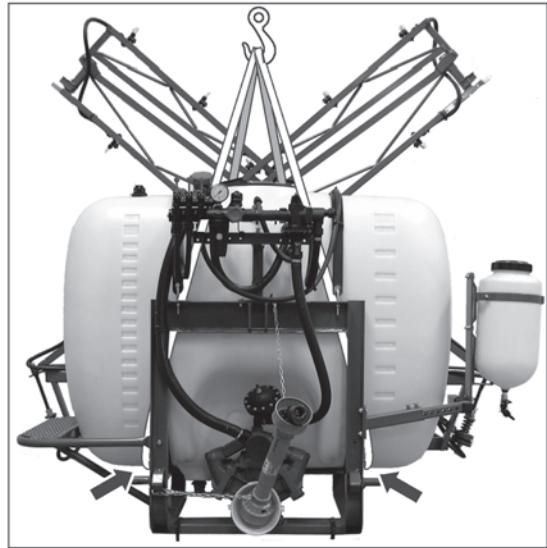
General Info

Unloading the Sprayer from the Truck

For the unloading of the sprayer, you need a crane. When unloading with a crane, please observe the lifting points as shown in the picture, and make sure that the straps or belts used for lifting are strong enough.

 DANGER! Lifting of machines require special training according to national regulations.

 ATTENTION! Only lift the sprayer when the tanks are empty!



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.

4 - Sprayer Setup

Checking the Suitability of the Tractor

General Info

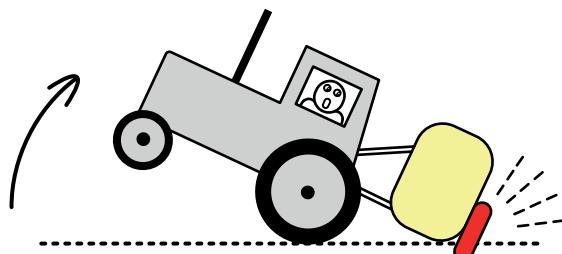
Before connecting the sprayer to your tractor, you must check the suitability of the tractor. Only connect a tractor which is suitable for the purpose.

Perform a brake test to check whether the tractor achieves the required braking rate with the sprayer connected.



DANGER! An unsuitable tractor, or improper use of the tractor, causes a risk of:

- insufficient tractor stability, steering and braking power
- severe or fatal injuries
- the sprayer being damaged during operation



Requirements for the suitability of a tractor are, in particular:

- Permissible total weight
- Permissible approved axle loads
- Load capacity of the tyres fitted
- Approved front weights must be sufficient

You can find this data on the rating plate of the tractor or in the tractor's instruction manual or documentation. Ask your tractor dealer if in doubt.

The front axle of the tractor must always be subjected to at least 20% of the total weight of the vehicle.

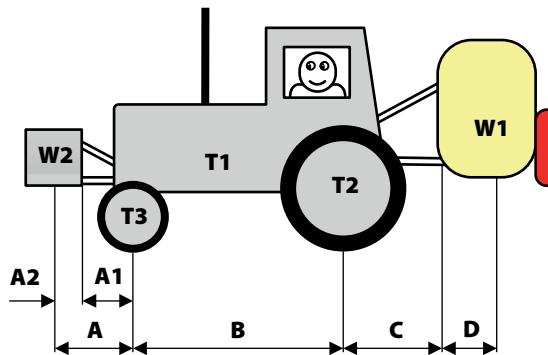
The tractor must achieve the braking rate specified by the tractor manufacturer, even with the sprayer connected.

Calculating Actual Weights and Loads

The permissible total tractor weight, specified in the tractor documentation, must be greater than the sum of the:

- Tractor's tare weight
- Tractor's ballast and weights
- Sprayer's total weight

Data Required for the Calculation



T1	(kg)	Tractor empty weight.	See tractor's instruction book or documentation.
T2	(kg)	Rear axle load of the empty tractor.	
T3	(kg)	Front axle load of the empty tractor.	
W1	(kg)	Total weight of rear-mounted sprayer with a full tank.	See the section "Technical Specifications" in this instruction book and add the weight of your spray liquid for a full tank.
W2	(kg)	Total weight of front weights or front-mounted sprayer with a full tank.	Front weights: Total weight of all front weights. Front-mounted sprayer: See technical data for this equipment and add the weight of your spray liquid for a full tank.
A	(m)	Distance between the centre of gravity of the front weights, or front-mounted sprayer with a full tank, and the centre of the front axle (total A1 + A2).	See tractor's instruction book or documentation, or data for front weights, or perform a measurement.
A1	(m)	Distance from the centre of the front axle to the centre of the lower link connection.	See tractor's instruction book or documentation, or perform a measurement.
A2	(m)	Distance between the centre of the lower link connection point and the centre of gravity of the front weights, or front-mounted sprayer with a full tank (centre of gravity distance).	Front weights: See technical data for front weights. Front-mounted sprayer: See technical data for this equipment and add the weight of your spray liquid for a full tank. Or perform a measurement.
B	(m)	Tractor wheel base.	See tractor's instruction book or documentation, or perform a measurement.
C	(m)	Distance between the centre of the rear axle and the centre of the lower link connection.	See tractor's instruction book or documentation, or perform a measurement.
D	(m)	Distance between the centre of the lower link connection point and the centre of gravity of the rear-mounted sprayer with a full tank (centre of gravity distance).	

Calculation of Required Minimum Front Weight

To ensure the tractor's steering capability, the minimum front weight [$W_{2\min}$] is calculated:

$$W_{2\min} = \frac{W_1 \times (C + D) - T_3 \times B + 0,2 \times T_1 \times B}{A + B}$$

4 - Sprayer Setup

Calculation of Actual Front Axle Load [T3] of the Tractor

$$T3 = \frac{W2 \times (A + B) + T3 \times B - W1 \times (C + D)}{B}$$

Calculation of Actual Total Weight [W] of the Combined Tractor and Sprayer(s)

$$W = W2 + T1 + W1$$

Calculation of Actual Rear Axle Load [T2] of the Tractor

$$T2 = W - T3$$

Calculation Compared to Permissible Values

	Actual value according to calculation	Permissible value according to the tractor's instruction book or documentation.
Minimum weight front / rear	/ kg	--
Total weight	kg	is less than kg
Front axle load	kg	is less than kg
Rear axle load	kg	is less than kg

 NOTE! Fill in the values in the fields above. You can find the permissible values for the total tractor weight, axle loads and load capacities in the tractor's registration papers or in the tractor documentation.

 ATTENTION! Add weights to your tractor at the front or rear, if the tractor axle load is exceeded on only one axle.

 ATTENTION! If you do not achieve the minimum weight at the front ($W_{2\min}$) from a front-mounted sprayer alone, you must add front weights to the tractor.

 DANGER! It is forbidden to couple the sprayer to the tractor, if one of the actual calculated values is greater than the permissible value, or if there is no front ballast (if required) mounted on the tractor.

 DANGER! When driving on hilly ground, the centre of gravity can change significantly for the combined tractor and sprayer - allow for this when calculating the minimum ballast for the tractor as well as driving carefully. Risk of the tractor turning over resulting in the driver being crushed or trapped. Risk of impact with the sprayer through insufficient stability of the tractor and insufficient steering abilities and braking power.

Transmission Shaft

Operator Safety

1. Always read the manufacturer's instruction book before applying any changes to the transmission shaft!
2. Always STOP THE ENGINE and remove the ignition key, before carrying out maintenance or repairs to the transmission shaft or implement.
3. 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.
4. When attaching the shaft, make sure that the snap lock is FULLY ENGAGED - push and pull the shaft until it locks.
5. 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.
6. 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.
7. Prevent protection guards from rotating by attaching the chains allowing sufficient slack for turns.
8. Make sure that protection guards around the tractor PTO and the implement shaft are intact.

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

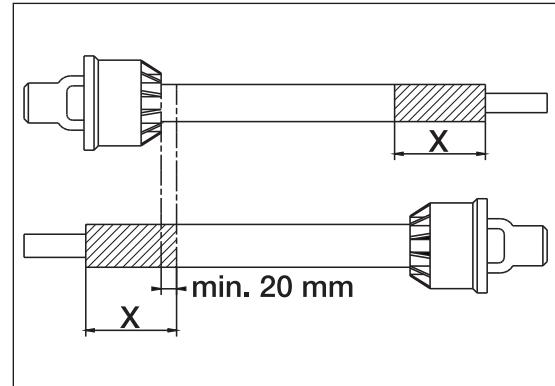
PTO Installation

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.

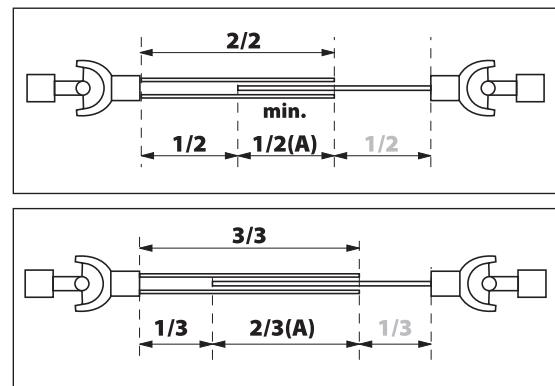


WARNING! Only shorten the shaft if it is absolutely necessary!



The shaft must always have minimum overlap (A) of 1/2 of the sawn shaft length.

The recommended overlap (A) is 2/3 of the sawn shaft length.



4 - Sprayer Setup

Hydraulic Systems

General Info

Ensure that the snap couplers are clean before connection!

After having operated the boom and the system has been filled with oil, check the tractor's hydraulic oil level and top up, if necessary.

 DANGER! Test of the hydraulic system should be done very cautiously. There may be air trapped in the system which can cause violent movements of the boom.

 DANGER! Hydraulic leaks: Never use your fingers to locate a leakage in any part of the hydraulic system. Due to high pressure, hydraulic oil may penetrate the skin.

Requirements for Tractor

The hydraulic system requires:

- One single-acting outlet for raise and lower of the boom.
- One double-acting outlet for the hydraulic operated boom fold.

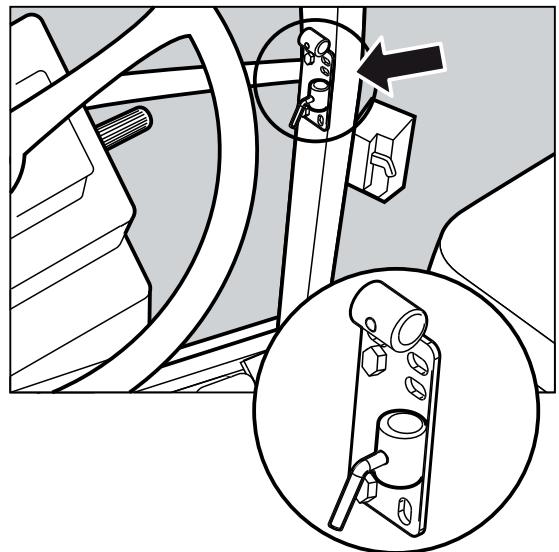
 ATTENTION! The hydraulic hoses are marked with arrows to indicate the direction of oil flow.

- The system has a built-in flow regulator that maintains constant speed on hydraulic movements.
- Oil flow between 15 and 80 l/min at a pressure of 200 bar.
- Minimum oil pressure is 180 bar to obtain correct operation. Maximum permissible oil pressure is 210 bar.
- Return flow restriction of the connected tractor must be maximum 15 bar.

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.



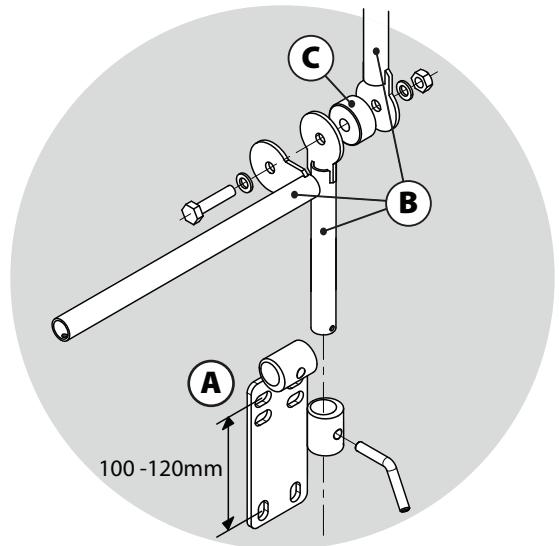
The supplied tractor pillar bracket (A) has a hole spacing of 100 and 120 mm, which fits most tractors. Threaded mounting holes may be hidden behind front corner cover. Check the tractor's instruction book for information regarding attachment points.

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.



4 - Sprayer Setup

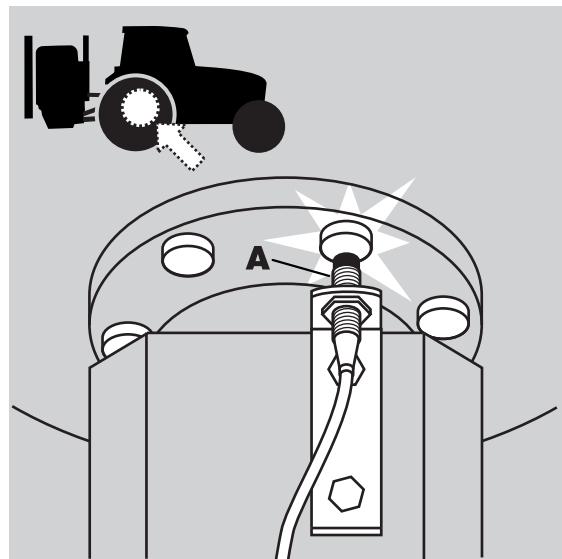
Speed Transducer for Tractor

Note the following if the speed transducer is fitted to the tractor.

The speed transducer (A) and the speed ring should be located at the inside of the tractor's right wheel. The sensor is an inductive type that requires a metallic protrusion (e.g. a bolt head) passing by in order to trigger a signal. It should be adjusted, so that the transducer is placed to the centre of the holes in the speed ring (vertical direction).

Recommended distance between protrusion and transducer (A) is 3 to 6 mm. Check this in the entire circumference.

Correct fitting is indicated by a constant flashing of the transducer, when the wheel is rotating.



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".



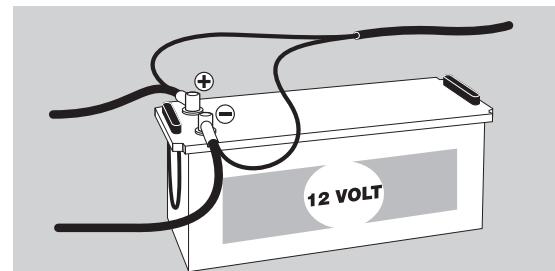
ATTENTION! Turn OFF all work lights when driving on public roads!

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 mm². Fuse 10 amps.

Hydraulic control unit requires:

Wire 4.0 mm². Fuse 16 amps.

Traffic light connector, 7-pin

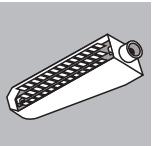


The unit requires:

Wire 6 x 1.5 mm² + 1 x 2.5 mm²

The cable is custom made and must not be changed to another type.

EVC Spray Box connector, 39-pin



The unit requires:

Wire 39 x 1.0 mm²

The cable is custom made and must not be changed to another type.

Liquid System

Self-Cleaning Filter - Choice of Restrictor

It is important to have a large flow through the filter. This is achieved by choosing the restrictor size in relation to the liquid consumption of the spray boom. 4 restrictors are supplied. Use the green one with largest orifice (A) first.

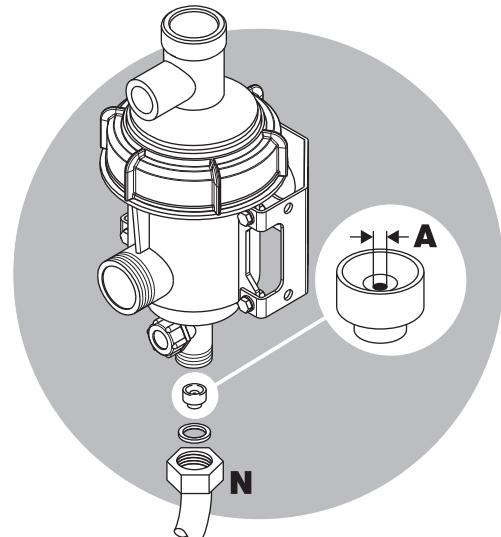
Remove the hose (N) from the filter. Be careful not to loosen the seal. Place the restrictor in the hose and mount the hose again.

If the required working pressure cannot be obtained, the restrictor is too large. Choose a smaller restrictor. Start with a black one, then a white and finally a red one.

When cleaning the filter, remove the hose (N) and the hose at the safety valve and check that there are no residues.

Standard filter size is 80 mesh. Filters of 50 and 100 mesh are available and can be changed by opening the filter top.

Check the condition of the O-rings before reassembly and replace them if damaged.



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

4 - Sprayer Setup

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

Keep the spray boom in folded position while driving. Stop the sprayer before using the folding/unfolding functions.

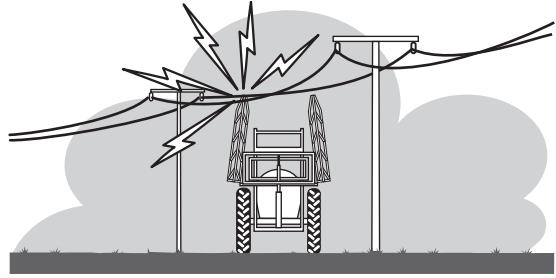
Failure to do so will damage the boom and cause dangerous situations to people and the surroundings.

 DANGER! Before unfolding the boom it is important to connect the sprayer to the tractor to prevent overbalancing of the sprayer.

 DANGER! When folding or unfolding the boom, make sure that no persons or objects are within the operating area of the boom.

 DANGER! Always follow the guidelines listed below when driving in areas with overhead power lines:

Keep from using the folding/unfolding functions in areas with overhead power lines. Unintended boom movements may cause contact with overhead power lines, causing a risk of fatal accidents.



 ATTENTION! A label (HARDI item no. 978448) follows the sprayer. This label must be placed in the cabin visible from the operator's seat.

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

Manoeuvring of the Spray Boom

The SB and MB boom are manually operated. Optionally the boom lift can be manually or hydraulic controlled.

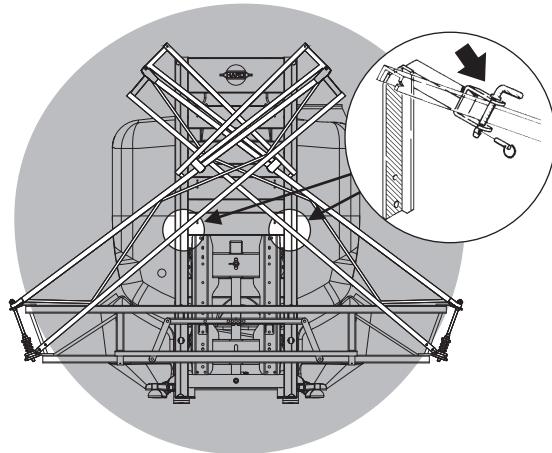
If hydraulic, following operations can be carried out by the tractor's hydraulic control lever(s).

- Raising/lowering of the boom.
- Vertical boom fold.

Correct boom height is very important in order to achieve the most optimal spray pattern. Please refer to the Spray Technique book for further information.

To unfold the boom

1. Remove boom transport lock pins.
2. Swing the right boom wing down. When unfolding the initial force to release the spring loaded breakaway will be higher than the actual unfolding.
3. Swing the left boom wing down. When unfolding the initial force to release the spring loaded breakaway will be higher than the actual unfolding.
4. If applicable, unfold outer boom wings by lifting the boom wing up and outwards until it clicks into locked position (A).
5. Unlock the trapeze suspension by removing the lock pin (B). The lock pin can be stored at the hole farther to the left (C).



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

To hydraulically fold the boom (MB boom only)

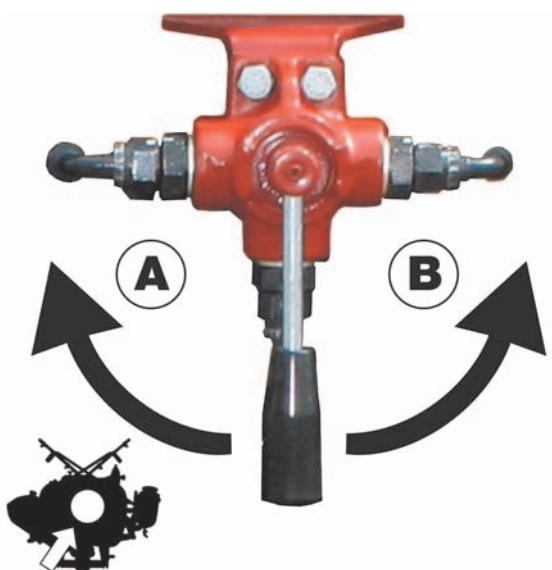
1. Turn lever to position (A) to fold the right boom wing to vertical position.
2. Turn lever to position (B) to fold the left boom wing to vertical position.
3. Push the button (I) to lower the boom, until it is resting in the paralift locks.
4. Push hydraulic lever to lower the boom, until they are resting in the transport brackets.

 WARNING! The folding functions must only be operated, when the sprayer is stationary! Failure to do so will damage the boom. The pendulum lock automatically opens at speeds exceeding 1.5 km/h!

Boom Tilt Function

The following boom tilt function controls enables you to adjust the boom height individually in the right and left hand side.

Boom tilt is adjusted by turning the lever to position (A) or (B) depending on which boom wing to be tilted.



5 - Operation

Liquid System

General Info

Please refer to the Spray Technique book for instructions on the use of filters, nozzles etc., and their combination in use with specific spraying applications.

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.

At a dedicated filling site

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) securing against seepage, 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 sums and cesspools of drainage systems, and
3. 50 metres from surface water (watercourses, lakes and coastal waters) and from nature reserves.

In the field

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 sums, cesspools of drainage systems, and nature reserves.



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



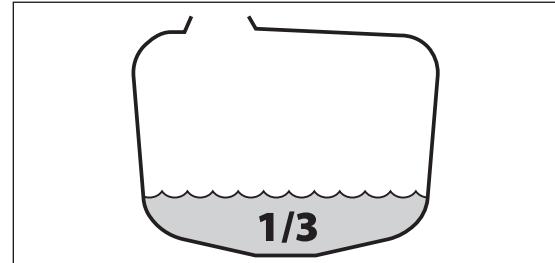
ATTENTION! It is the responsibility of the sprayer owner/operator to comply with all relevant legislation. HARDI cannot undertake any responsibilities for incorrect operation and use.

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!



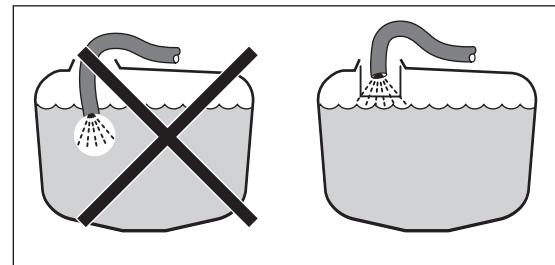
WARNING! If the sprayer is put aside with liquid in the main tank, all manifold valves must be closed.



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. The tank lid is accessible from the optional footboard. 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 overfilling. Follow local legislation in force at any time.

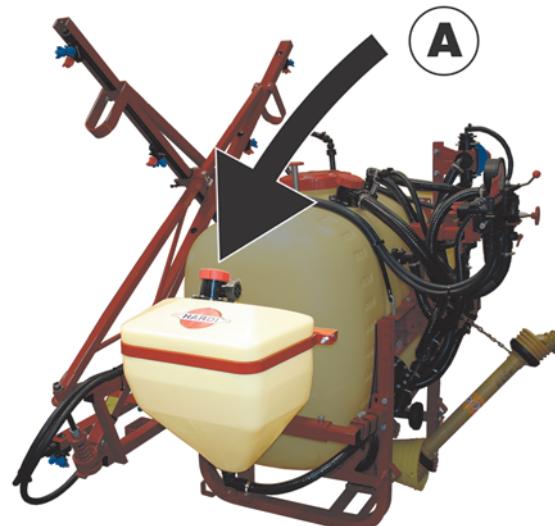
Filling of Rinsing Tank (Optional)

The rinsing tank is fitted to the sprayers right side, and is filled via the lid (A) on the top of the tank:

1. Remove the filler lid (A) of the tank.
2. Engage external water pump, if any.
3. Fill water into the tank. Keep an eye on the tank opening in order not to overfill the tank.
4. Stop filling and refit the lid.

Volume: approximately 50 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.



Filling of Clean Water Tank (Optional)

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 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

External Filling Device

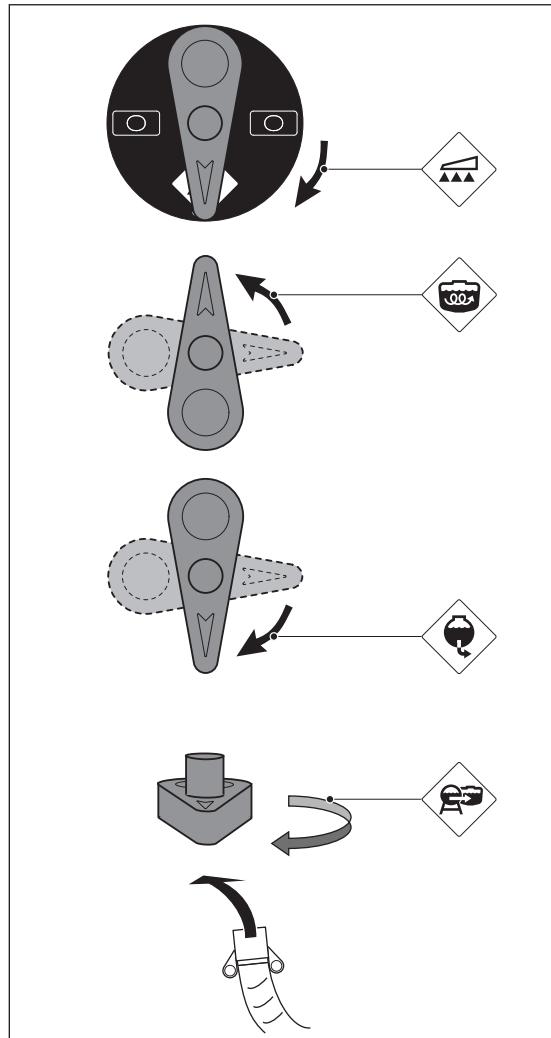
The External Filling Device is operated as follows:

1. Remove cover and connect suction hose to the suction manifold.
2. Turn pressure valve to "Spraying", and the blue return valve to "Agitation".
3. Turn suction valve to RinseTank.
4. Turn handle on External Filling Device valve towards Filling Device.
5. Engage diaphragm pump and set PTO revolutions at 540 rpm.
6. The tank is now filled with water. Keep an eye on the liquid level indicator.
7. Turn handle on suction manifold away from Filling Device to discontinue filling process. Now disengage the pump. Disconnect suction hose and replace cover.

⚠ DANGER! Prevent contamination or injury. Do not open suction valve towards Filling Device, unless the pump is running and the filling hose is connected. If this valve is opened without the pump running, liquid will stream out of the coupler.

⚠ WARNING! Do not leave the sprayer while filling the tank, and keep an eye on the level indicator in order NOT to overfill the tank.

⚠ ATTENTION! Observe local legislation regarding use of filling device. In some areas, it is prohibited to fill from open water reservoirs (lakes, rivers etc.). It is strongly recommended only to fill from closed reservoirs (mobile water tanks etc.) to prevent contamination.



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.

5 - Operation

Filling Chemicals Through Tank Lid

The chemicals are filled through the tank lid - Note instructions on the chemical container!



WARNING! Be careful not to slip or to splash chemicals, when carrying chemicals up to the tank lid!



ATTENTION! Due to risk of spillage and spot contamination, several countries do not allow to fill chemicals directly through the tank lid. Use the TurboFiller for all filling of chemicals instead.

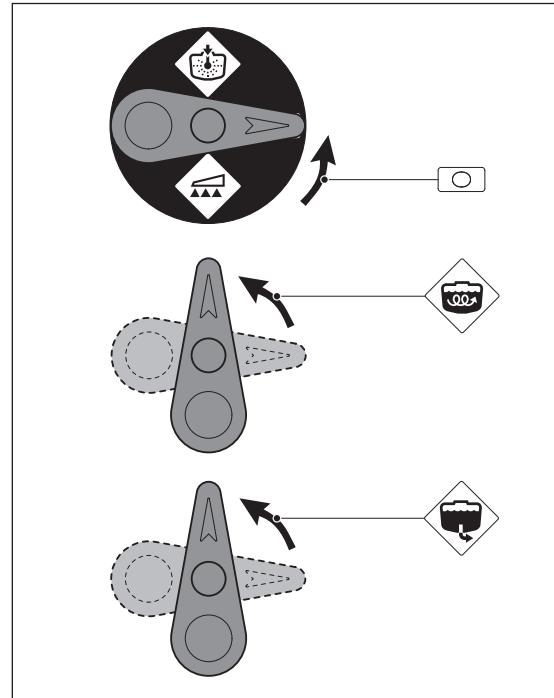
1. Make sure the spray control unit is switched off.
2. Set suction valve towards "Suction from main tank", Agitation valve towards "Agitation". Other valves should be closed.
3. Engage the pump and set PTO revolutions to 540 rpm.
4. Add the chemicals through the main tank hole.
5. Keep PTO engaged, so that the spray liquid is continuously agitated, until it has been sprayed on the crop.



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



NOTE! Local legislation may not allow filling through the tank lid, but will require use of the chemical inductor instead.



Filling Liquid Chemicals by using HARDI ChemFiller (optional)



NOTE! We advice to use the ChemFiller, 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 valve to closed position. Close the AgitationValve.



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

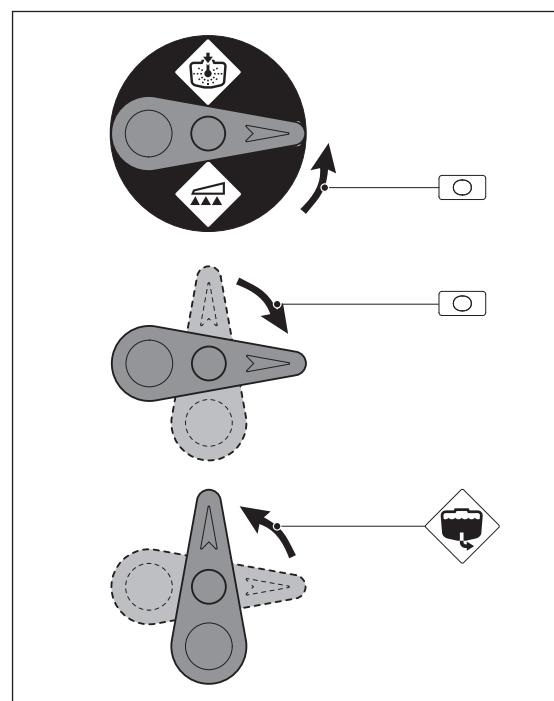
3. Engage the pump and set PTO speed at 540 rpm.
4. Open ChemFiller lid. Measure the correct quantity of chemical and fill it into the hopper.



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.



- Engage the hopper transfer device by opening the ChemFiller suction valve (A) to transfer chemicals to the main tank. The ChemFiller 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 ChemFiller and the transfer hoses are not completely emptied, there is a risk of chemicals being sucked out of the main tank!

- 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 lever (C) container for cleaning.

⚠ DANGER! In order to avoid spray liquid hitting the operator, do not press the lever (C), 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.

- Flush the ChemFiller with clean water from the rinsing tank by shifting to suction from Rinsing Tank. The ChemFiller suction valve (A) 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.

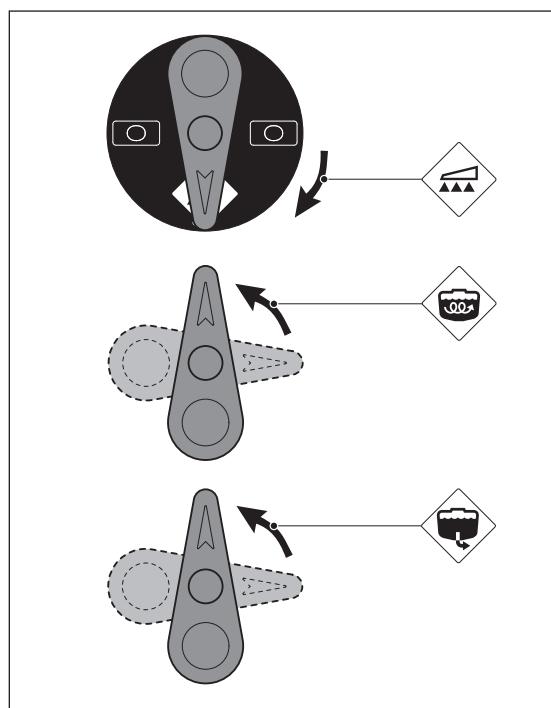
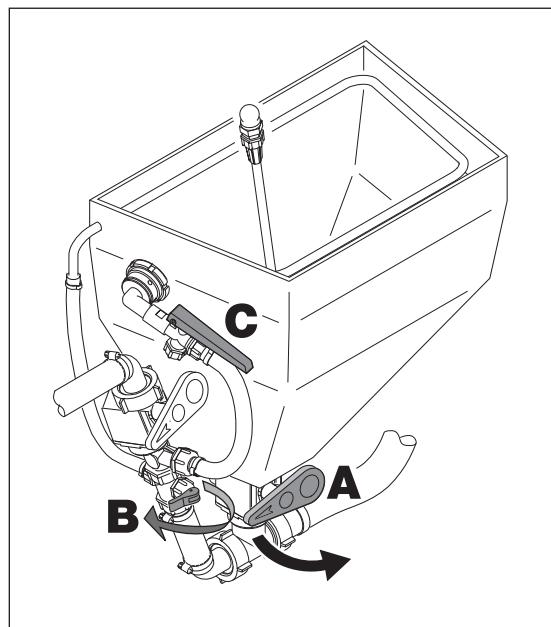
⚠ ATTENTION! If not flushed with clean water, the hopper rinsing device uses spray liquid for rinsing the hopper! Cleaning the ChemFiller must always be done, when the spray job is ended, and together with cleaning the entire sprayer. A cleaning after the last filling, and before spraying, does not ensure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

- Close the ChemFiller suction valve (A), when the hopper has been rinsed. Close the lid.

- Turn the AgitationValve towards "Agitation".

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

- When the spray liquid is well agitated, turn handle of the pressure valve towards "Spraying" position. Keep the PTO engaged for continuous agitation during spraying of the crop.



5 - Operation

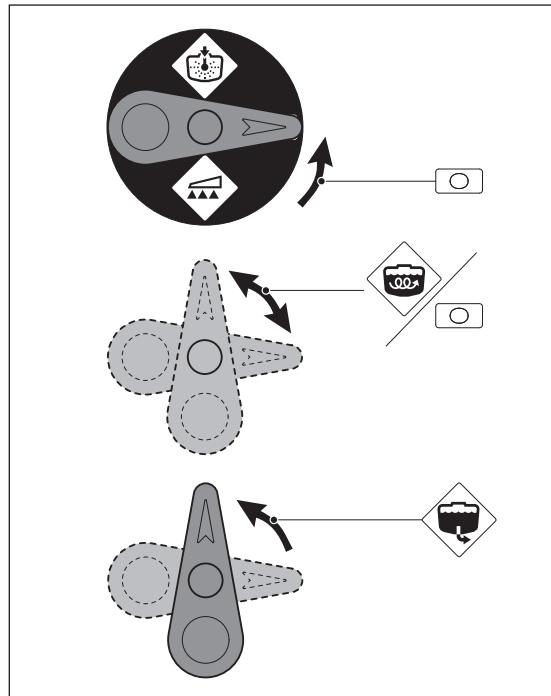
Filling Powder Chemicals by using HARDI ChemFiller (optional)

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

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

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

3. Engage the pump and set PTO speed at 540 rpm.

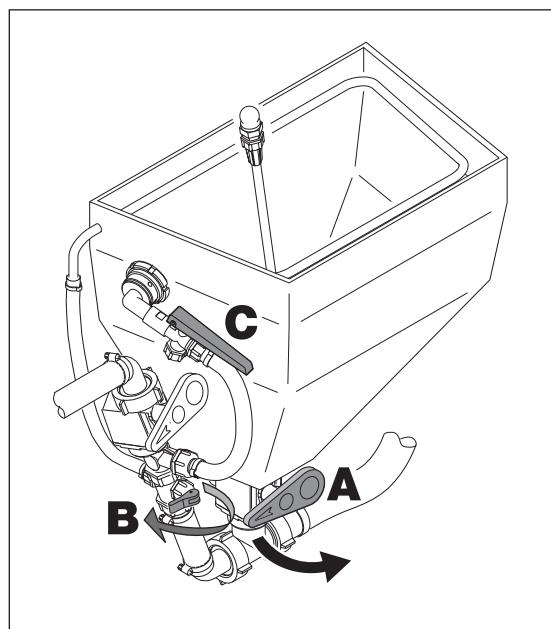


4. Open ChemFiller lid. Open the flushing device valve (B) and ChemFiller suction valve (A).
5. Measure the correct amount of powdered chemical and sprinkle it into the hopper as fast as the transfer device can flush it down. The ChemFiller suction valve (A) must be open for at least 20 seconds after the chemical is no longer visible in the hopper in order to completely empty the transfer hoses into the main tank.

 DANGER! If the ChemFiller 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.

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 lever (C) to the left of the ChemFiller.



 DANGER! In order to avoid spray liquid hitting the operator, do not press lever (C) 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.

7. Flush the ChemFiller with clean water from the rinsing tank by shifting to suction from Rinsing Tank. The ChemFiller suction valve (A) 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 ChemFiller 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 ChemFiller!

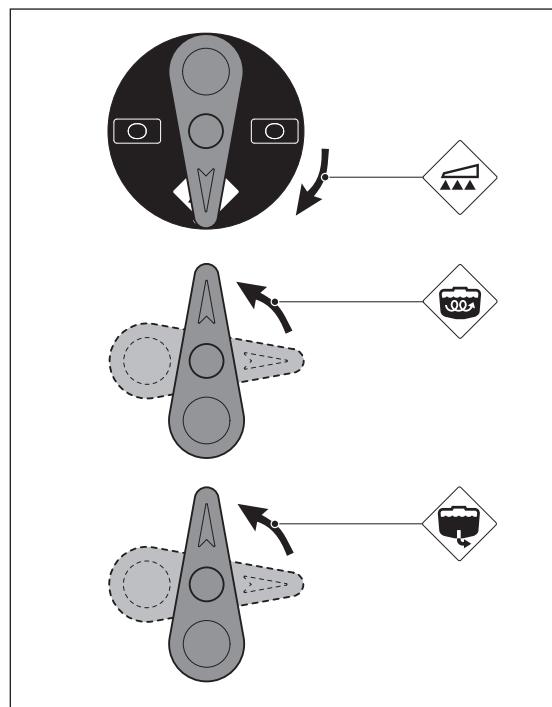
8. Close ChemFiller suction valve (A), when the hopper has been rinsed. Close the lid.

- If closed, turn the Agitation Valve towards "Agitation".

When the spray liquid is well agitated, turn handle of the pressure valve towards "Spraying" position. Keep the PTO engaged for continuous agitation during spraying of the crop.



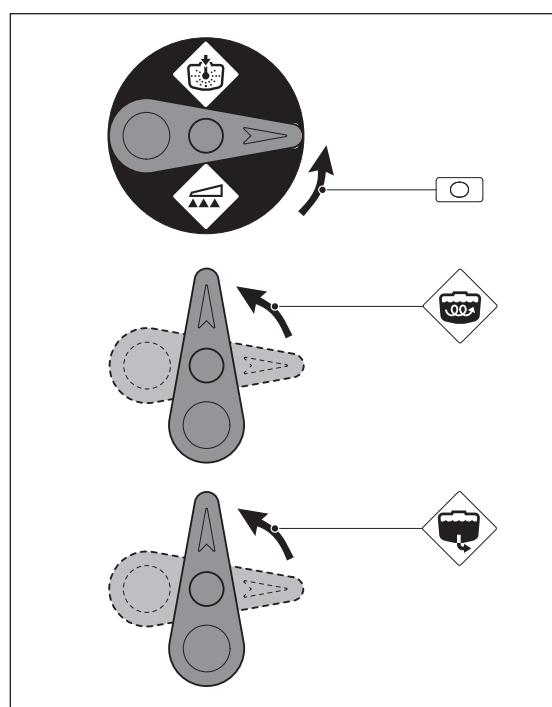
ATTENTION! If foaming is a problem, turn down the agitation.



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.

- Turn the handle at the suction valve towards "Suction from main tank". Turn the pressure valve to closed position and turn the agitation valve towards "Agitation" (If BK operating unit: turn agitation on at lever on BK operating unit). Other valves are closed.
- Engage the pump and set PTO speed to 540 rpm.
- Agitation has started and should be continued for at least 10 minutes.
- The spray job can now be resumed. Turn pressure valve 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.

5 - Operation

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.

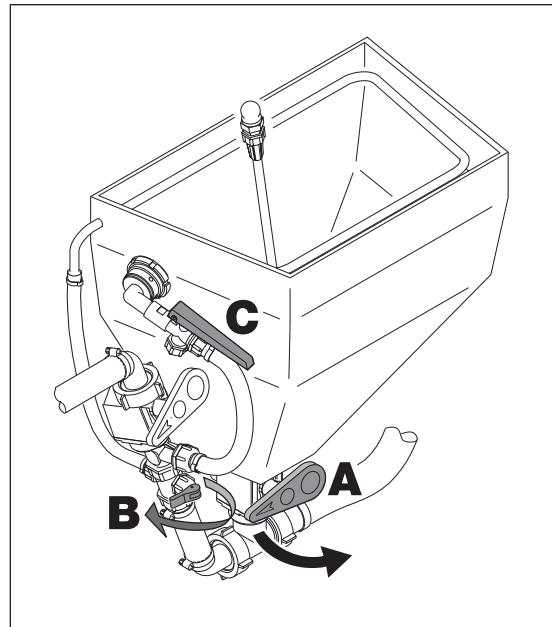
ChemFiller Rinsing

i NOTE! It is important to suck from the rising tank or an external tank with clean water.

Rinse the ChemFiller and chemical containers as follows:

Cleaning empty containers - ChemFiller lid is open

1. Put container over the flushing nozzle in the middle of the ChemFiller, so that the nozzle is inside the container.
2. Open the ChemFiller suction valve (A) and then press the Chemical Container Cleaning lever (C). This rinses the chemical container with the flushing nozzle, while the rinsing liquid is emptied out of the ChemFiller.



ChemFiller rinsing - ChemFiller lid is closed

1. Close ChemFiller lid.
2. Turn the suction valve towards "Rinsing tank".
3. Open the ChemFiller Suction valve (A) and then open the ChemFiller Flush valve (B) for 1 minute to get plenty of clean water through the hoses.
4. Press the Chemical Container Cleaning lever (C). This rinses the hopper with the flushing nozzle, while the rinsing liquid is emptied out of the ChemFiller.
5. Rinse the hopper for 30-40 seconds.
6. Open the lid to inspect if the ChemFiller is empty. If not, close the lid again and open the ChemFiller suction valve (A), until the ChemFiller is empty.
7. After the last flushing, the ChemFiller Suction valve (A) 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! The ChemFiller needs to be cleaned thoroughly after finishing spraying. This is to ensure that it is clean, before spraying other crops that may be sensitive to the chemicals just used. See the section "Cleaning" on page 76 for details.

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: $3.0 \times 1.20 = 3.6$.

The adjusted pressure is now 3.6 bar for spraying the liquid fertilizer.

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

Calibrated pressure (bar) [Spraying with pesticides]	Density (g/cm ³) for liquid fertilizer				
	1.10	1.15	1.20	1.30	1.40
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

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

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.

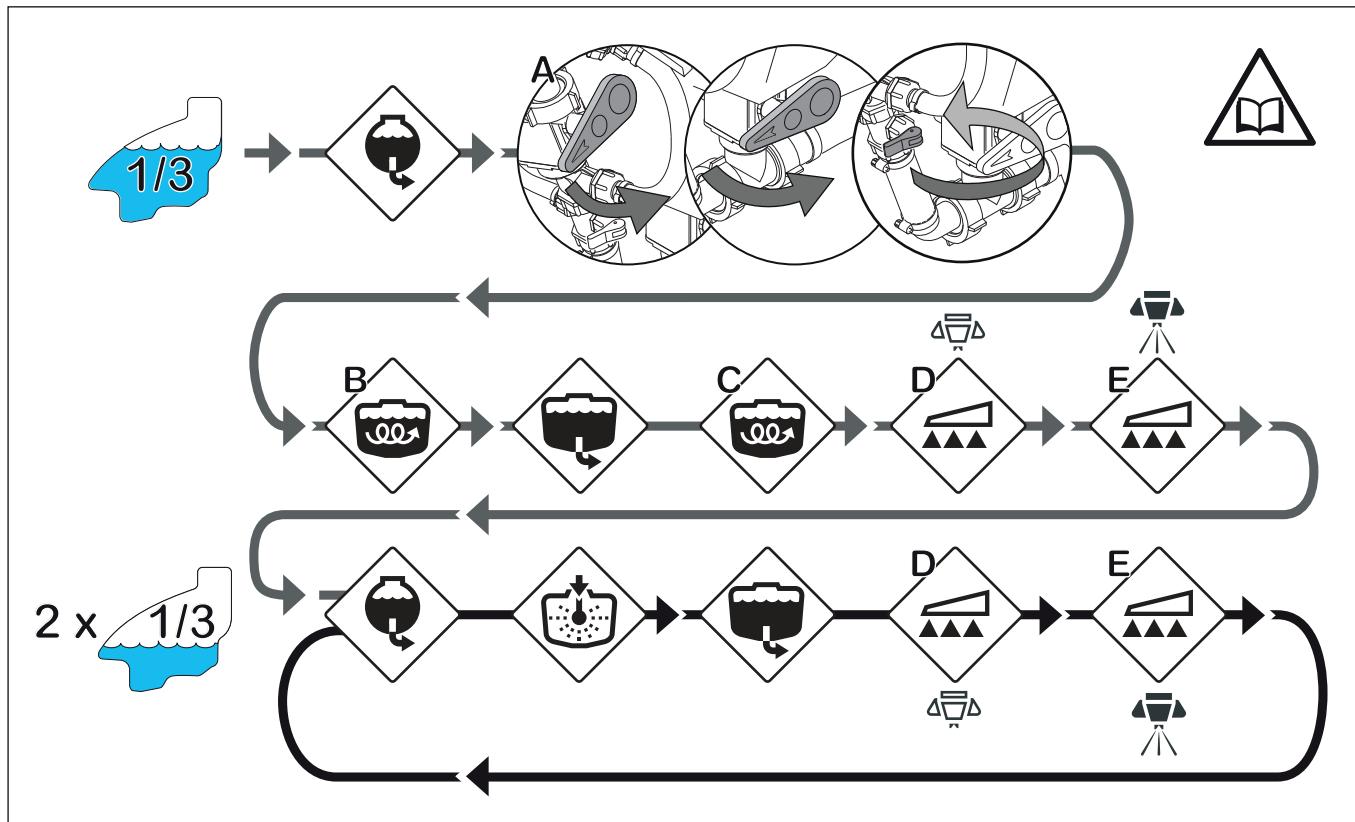
Clean sprayers are ready for action.

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 66.
- 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.

Quick Reference - Cleaning



NOTE! Pump speed 250-280 rpm.

- A. If ChemFiller is fitted: Turn ChemFiller On, turn ChemFiller suction valve On and turn ChemFiller flush valve On.
- B. Turn On.
- C. Turn Off.
- D. Minimum 45 seconds with nozzles OFF.
- E. Spray until air comes out of nozzles. When the boom is completely empty, close the main ON/OFF valve.



NOTE! If no RinseTank, add approximately 15 litres of clean water to the main tank 3 times.

5 - Operation

Standard Cleaning

 ATTENTION! For cleaning between spray jobs where crops are not very sensitive towards chemicals just sprayed.

1. Engage pump with tractor in idle, so that pump speed is as low as possible (250 rpm).
2. Turn suction valve towards  and the pressure valve towards  while sucking approximately 1/3 of the rinse tank content into the main tank. It is important to have full agitation for approximately 20 seconds, and then close agitation valve completely.
3. Turn suction valve towards  and the pressure valve towards  with all sections off for approximately 45 seconds.
4. Turn all sections on. Spray until air comes out of nozzles. When the boom is completely empty, close the main ON/OFF valve.

Repeat the following 3 steps 2 times:

1. Turn suction valve towards  and the pressure valve towards  while sucking approximately 1/3 of the rinse tank content into the Main tank.
2. Turn suction valve towards  and the pressure valve towards  with all sections off for approximately 45 seconds.
3. Turn all sections on. Spray until air comes out of nozzles. When the boom is completely empty, close the main ON/OFF valve.

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.

Use of Detergents

It is recommended to use an appropriate cleaning detergent suitable for cleaning agricultural sprayers.

- Cleaning detergents containing a suitable lube or conditioner are recommended.
- If for some reasons this is not available, and e.g. triple ammonia water is used, it is important to rinse the spray circuit immediately after and add some lubricant to the rinsing water to prevent ball valves etc. seizing up.
- Use of automotive antifreeze/radiator coolant (ethylene glycol) will protect valves and seals from drying or seizing up.

5 - Operation

Use of Rinsing Tank and Rinsing Nozzles (Optional)

The integrated rinsing tank can be used for two different purposes.



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

In-field diluting before cleaning

In-field diluting of remaining spray liquid residue in the spraying circuit should be carried out, before cleaning the sprayer.

Rinsing the main tank and liquid system:

1. Empty the sprayer as much as possible. Close the AgitationValve (no agitation) and spray until air comes out of all nozzles.
2. Close the main ON/OFF valve.
3. Turn suction valve towards
4. Turn pressure valve towards
5. Engage the pump. Set the pump speed to approximately 300 rpm and increase the spraying pressure to 6 bar.
6. When 1/3 of the contents in the rinsing tank is used, turn suction valve towards
7. Operate all valves on the pressure side of the system in the following order, so that all hoses and components are rinsed:
 - A. Turn the pressure valve towards
 - B. Open the ChemFiller flushing valve and close it again, when clean water comes out of nozzles.
 - C. Close the ChemFiller lid and squeeze the Chemical Container Cleaning grip to clean this device.
 - D. Open the ChemFiller lid again, and make sure that the ChemFiller is empty.
 - E. When empty, close the ChemFiller suction valve again.
8. Turn the suction valve towards
9. Turn the pressure valve towards
10. Spray the liquid in the field just sprayed.

Cleaning of Main Tank:

11. Turn the suction valve towards
12. Turn the pressure valve towards
13. Remove the filling strainer to avoid any cleaning shadows behind it.
14. When another 1/3 of the contents in the rinsing tank is used, turn the suction valve towards
15. Turn pressure valve towards
16. Spray the liquid in the field just sprayed.
17. Repeat step 6 - 8 one more time.



WARNING! When critical chemicals (like sulphonylurea) have been used, or a cleaning detergent is recommended, do an extra cleaning:

18. Fill the rinsing tank again.
19. Fill the main tank to 1/3 of capacity (up to 80 litres) with clean water.
20. Add the cleaning detergent to the main tank by using the ChemFiller. Follow instructions on the label of the cleaning agent.
21. Clean the whole system again.
22. To get the best cleaning effect, the Self-Cleaning Filter and the Suction Filter sieves should be washed with clean water.
23. Rinse the sprayer with clean water afterwards.



ATTENTION! The rinsing nozzle cannot always guarantee a 100% cleaning of the tank. Always clean manually with a brush afterwards, especially if crops, which are sensitive to the chemical just sprayed, are to be sprayed afterwards!

Rinsing when main tank is not empty

Rinsing the pump, operating units, spray lines, etc. in case of stop in spraying (e.g. because of rain), before main tank is empty.

Cleaning of the liquid system:

1. Turn suction valve towards . (Keep pressure valve in -position).
2. Close AgitationValve (no agitation).
3. Engage the pump. Set the pump speed to approximately 300 rpm and increase the spraying pressure to 6 bar. Spray the water from the rinsing tank into the field, until all nozzle tubes and nozzles have been flushed with clean water.
4. Disengage the pump.

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

Cleaning the sprayer on the outside

 WARNING! External cleaning with a spray gun is only possible with emptied and cleaned main tank. Do a complete main tank cleaning, before attempting to use the spray gun!

1. Turn suction valve towards  and close the other valves.
2. When another 1/3 of the contents in the rinsing tank is transferred to the main tank, turn the suction valve towards . Adjust the spraying pressure to 8 - 10 bar.
3. Open the (manual) External Cleaning Device valve at the operating unit and wash the sprayer with the cleaning device located on sprayer's rear side. If necessary, the pressure can be adjusted on the pressure regulation valve.
4. Disengage pump again.

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

Full Internal Cleaning (Soak Wash)

 ATTENTION! This cleaning procedure is always used, if one or more of these situations occur:

- A. The next crop to be sprayed is at risk of being damaged by the chemical just used.
- B. The sprayer is not going to be used right away for the same chemical or crop.
- C. Before any repair or maintenance job is going to be carried out on the sprayer.

 ATTENTION! Washing the sprayer between jobs with incompatible crops must be done according to prescriptions from the chemical manufacturer. Use e.g. AllClearExtra, as this is a commonly used cleaning agent. If your chemical prescribes another cleaning agent and/or another cleaning procedure, you must follow that.

Procedure for washing with a cleaning agent, such as AllClearExtra:

1. Rinse the sprayer in the field (See the section "Use of Rinsing Tank and Rinsing Nozzles").
2. Drive to the filling location.
3. Prepare sprayer for cleaning with cleaning agent. Fill water in the main tank to 10% of its capacity. Fill the rinsing tank completely. This water is later used for rinsing.
4. Turn suction valve towards "Main tank" and pressure valve towards "Tank cleaning nozzle". Set agitation valve to "Agitation".
5. Engage and set the pump speed at approximately 300 rpm.
6. Allow the liquid to circulate the system for 3 minutes.
7. Close all valves for minimum 10 seconds in order to burst and flush the safety valve.
8. Open the ChemFiller enable valve, the ChemFiller transfer valve and the flush valve. Allow the liquid to circulate for 3 minutes.

5 - Operation

9. Close the lid and activate the container rinsing valve to clean the hopper inside.
10. Shut off all four valves on the ChemFiller again.
11. Turn the agitation valve towards "to pump" for 3 minutes to clean the fluid lines.
12. Verify that all nozzles are shut at the main ON/OFF.
13. Turn the pressure valve towards "Spraying".
14. Allow the liquid in the main tank to circulate for minimum 3 minutes with the nozzles shut. This is done to clean the return lines from boom to tank.
15. Turn the pressure valve towards "Tank cleaning nozzle". Allow the liquid to circulate for 3 minutes.
16. Spray out water with cleaning agent and chemical residue. Set the spray pressure at 3-5 bar. Note that the washing water still contains active chemical and choose an appropriate area to spray this out. Alternatively, the washings can be dumped at the filling/washing location and retained in an appropriate receptacle (e.g. slurry tank or similar) - see the section "Filling/washing location requirements" for more information. Spot contamination and accumulation must be prevented. Continue to spray until all liquid has exited from the boom tubes and nozzles.
17. Shut off all nozzles by the main ON/OFF.
18. Rinse the sprayer again with clean water to rinse out all remains of the cleaning agent - see the section "Use of Rinsing Tank and Rinsing Nozzles (Optional)" on page 80". This to prevent that the cleaning agent remains in the fluid system, which could damage the next spray chemical filled into the main tank.
19. Include rinsing of the ChemFiller in step 8 and 9. Operate all 4 valves during this process.
20. Dismantle all filters (suction, pressure, in-line and nozzle filters) and clean the filter screens using clean water and detergent.



WARNING! It is the responsibility of the sprayer operator or owner, that the sprayer is cleaned sufficiently to prevent contamination of the environment, crop damages and health and safety hazards to the operator and the public. HARDI cannot be held responsible for any damages or incidents related to insufficient cleaning.



ATTENTION! The rinsing nozzles cannot always guarantee a 100% cleaning of the tank. Clean manually with a high pressure cleaner afterwards, especially if crops sensitive to the chemical just sprayed are going to be sprayed afterwards!

Technical Residue

An amount of spray liquid will inevitably remain in the system. It cannot be sprayed properly on the crop, as the pump takes in air, when the tank is just about empty.

This technical residue is defined as the remaining amount of liquid in the system, when the first clear pressure drop appears on the pressure gauge.

The residual dilutable volume is approx. 6 litres. See the section "Technical Specifications" for more details.

The residues in the tank should be diluted immediately in a ratio of 1:10 with clean water. Afterwards it should be sprayed on the crop just sprayed with increased driving speed.

In addition, also pump, linkage and armature can be separately rinsed with water from the rinsing tank. However, it must be ensured that the liquid in the spray lines are in unchanged concentration. Therefore there should be an untreated field area available to spray this liquid out.

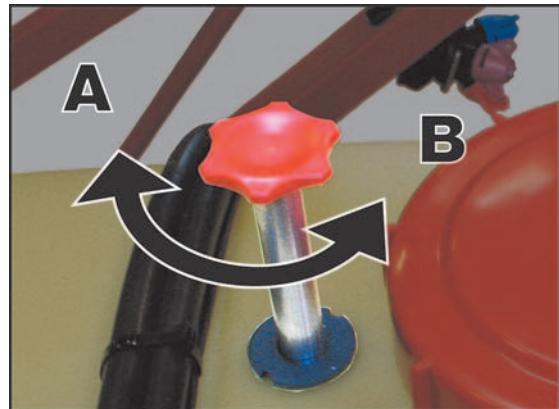
Follow national regulations when disposing of chemical residues.

Using the Drain Valve

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

- A. Turn clockwise to close valve.
- B. Turn counterclockwise to open valve.

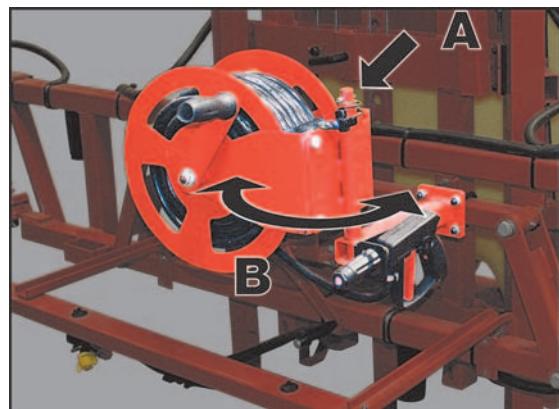
If draining residues, e.g. liquid fertilizer into a reservoir, a hose can rapidly be connected to the drain valve, and the liquid is safely drained.



Outside Cleaning - Use of External Cleaning Device

Use the External Cleaning Device to wash everything on the outside of the sprayer.

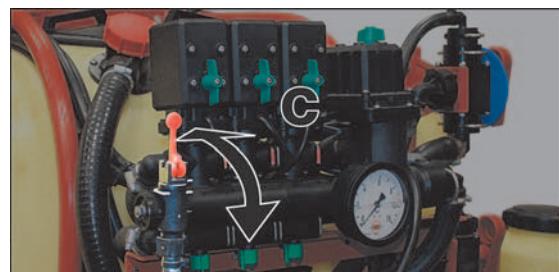
1. Remove split (A) to turn out hose reel (B).
2. Unroll the hose from the reel.
3. Engage pump speed to approximately 250 rpm.
4. Turn suction valve towards "Suction from Rinsing tank" and close the other valves.



5. Turn on tap valve (C) and clean the sprayer.
6. After cleaning, close the tap valve (C) again.
7. Roll the hose to the reel again.



ATTENTION! If the safety valve is activated, then lower the PTO speed to minimize the amount of rinsing water being lost into the main tank.



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

5 - Operation

Lubrication

General Info

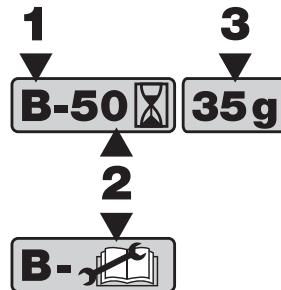
Always store lubricants clean, dry and cool - preferably at a constant temperature - to avoid contamination from dirt and condensed water. Keep oil filling jugs, hoppers and grease guns clean, and clean the lubricating points thoroughly before lubricating. Avoid skin contact with oil products for longer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

6 - Maintenance

Grease Nipple

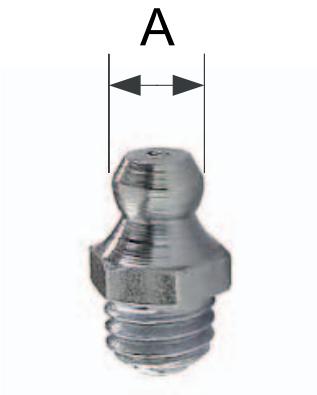
When lubricating the sprayer, please use a greasing gun which fits the dimensions of the grease nipple.

Nipple head type: DIN 71412

Nipple head size (A): 6.5 mm

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

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



Grease Gun Calibration

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

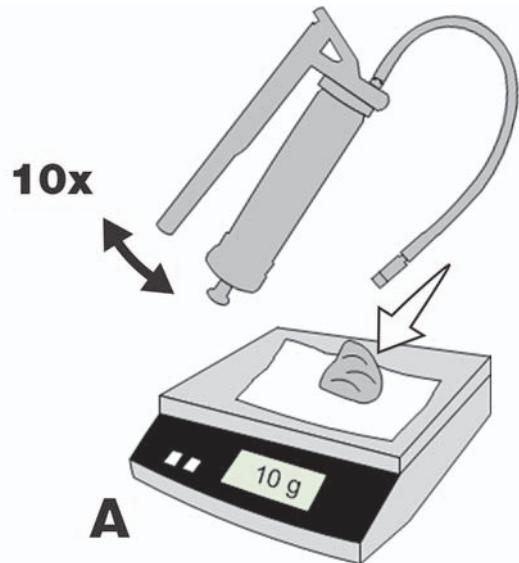
Calibration example

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

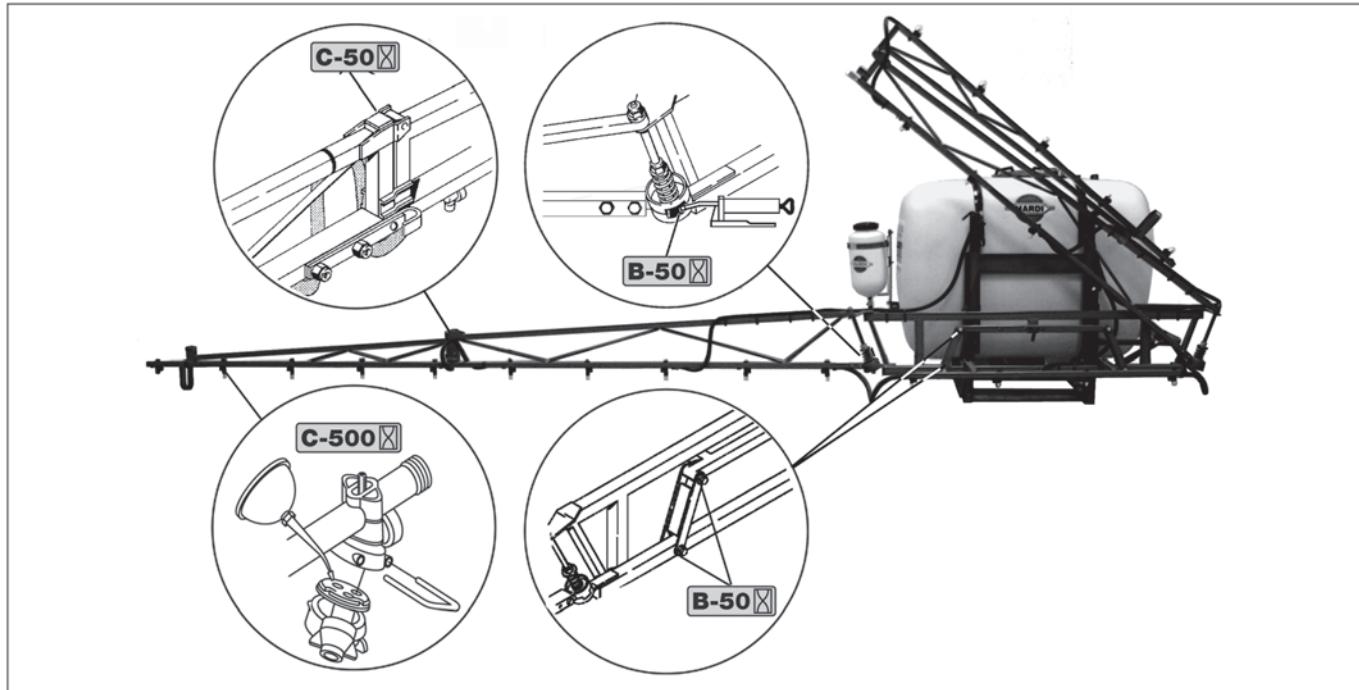
When calibrated, you can count how many strokes to complete, when lubricating the different grease points on the sprayer according to the specifications.

Alternative method

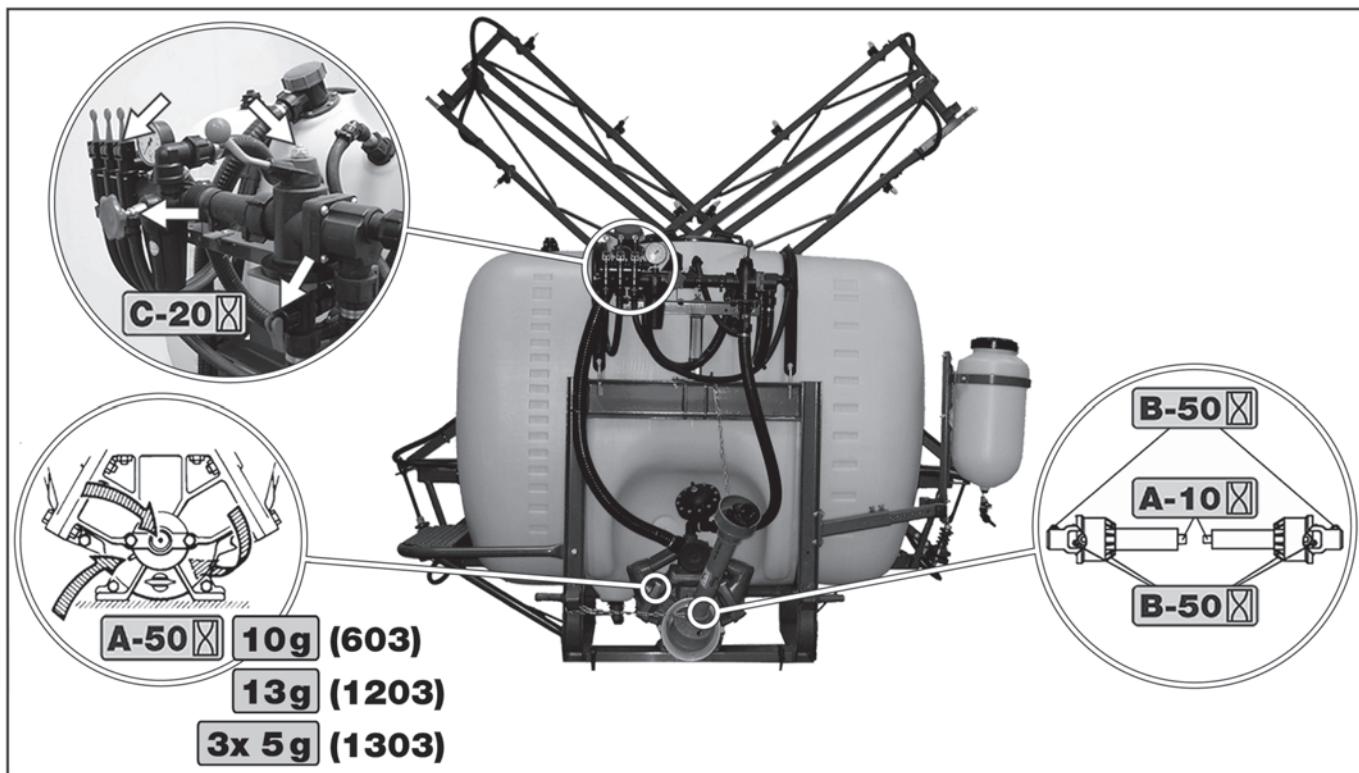
1. Count the strokes, until you have 10 grams of grease piled up on the scale (A).
2. Now you can figure out how many strokes to use for applying a certain amount of grease to a lubrication point.



Boom Lubrication & Oiling Plan



Lift Lubrication & Oiling Plan



6 - Maintenance

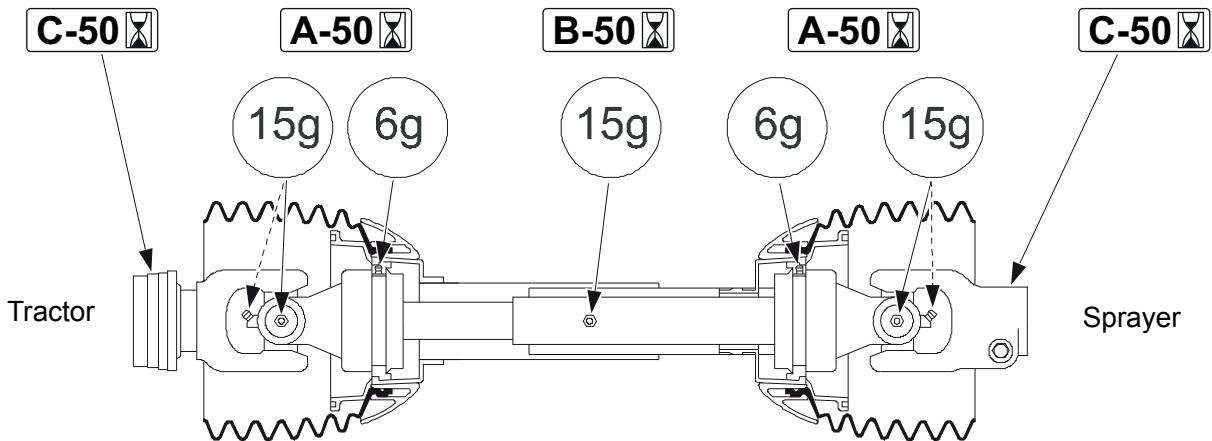
Lubrication & Oiling Plan - PTO

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



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.

6 - Maintenance

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.

Tightening Hydraulic Hoses

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

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

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



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

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

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

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

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

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

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

6 - Maintenance

10 hours service - Self-Cleaning Filter

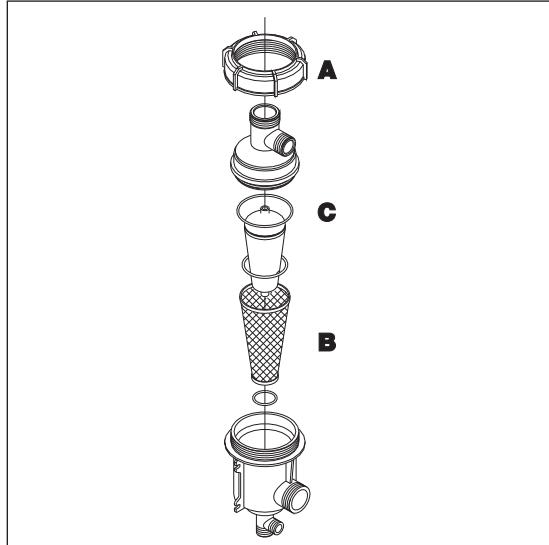
This filter should be cleaned every 10 hours.

1. Unscrew the union nut (A) and open filter.
2. Check filter gauze (B), clean if necessary.
3. Grease the O-ring (C) on the filter lid.

To reassemble:

4. Assemble all filter parts in the order shown on the picture.
5. Turn union nut (A) clockwise to close filter.

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



10 hours Service - Suction Filter

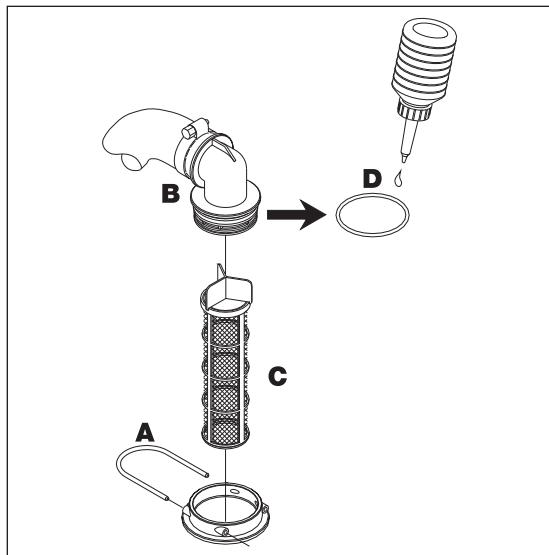
To service the suction filter:

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!



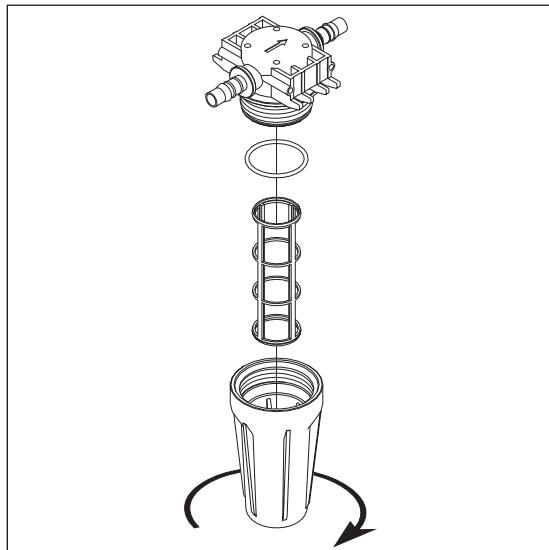
10 Hours Service - InLine Filter

If 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.

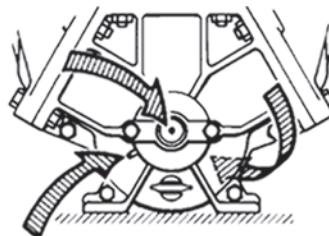
50 Hours Service - Greasing the Pump

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 5 g (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.

250 Hours Service - Hydraulic Circuit

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

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

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.

6 - Maintenance

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!

Pump Valves and Diaphragms Renewal

Valves

- Loosen the 2 valve cover bolts (1).
- Remove valve cover (2).

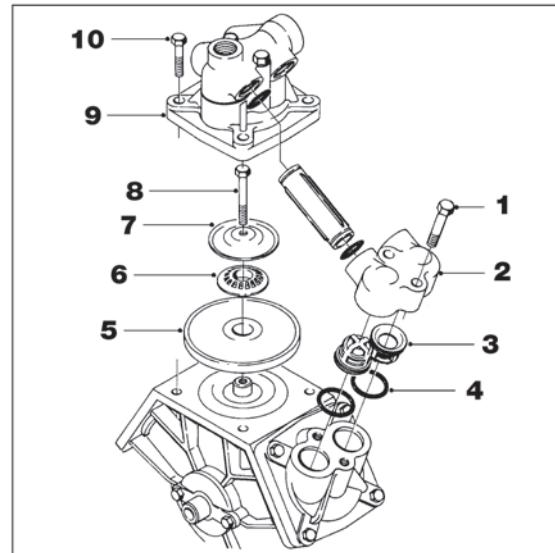
 ATTENTION! For 1303 pump only: Bolts (1) on centre valve cover are shorter than the other valve cover bolts!

- Change the valves (3). Note their orientation, so that they are replaced correctly!

 ATTENTION! It is recommended to use new gaskets (4), when changing or checking the valves.

Diaphragms

- Loosen the 4 head bolts (10).
- Remove the head (9).
- Loosen the diaphragm bolt (8).
- Remove the diaphragm washer (7) and the plastic disc (6).
- The diaphragm (5) may then be changed. Note the orientation of the new diaphragm. The side that need to be faced into the pump has written "DOWNWARD" close to diaphragm centre.
- Check that the drain hole at the bottom of the pump is not blocked.
- Apply a small amount of pump grease on the underside of the diaphragms (between diaphragm and conrod washer).
- Reassemble pump with the following torque setting:



Pump Model	Valve cover	Diaphragm cover	Diaphragm bolt
603	50 Nm	50 Nm	25 Nm
1203	80 Nm	80 Nm	80 Nm
1303	80 Nm	80 Nm	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 603: 60 g.
- Model 1203: 90 g.
- 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.

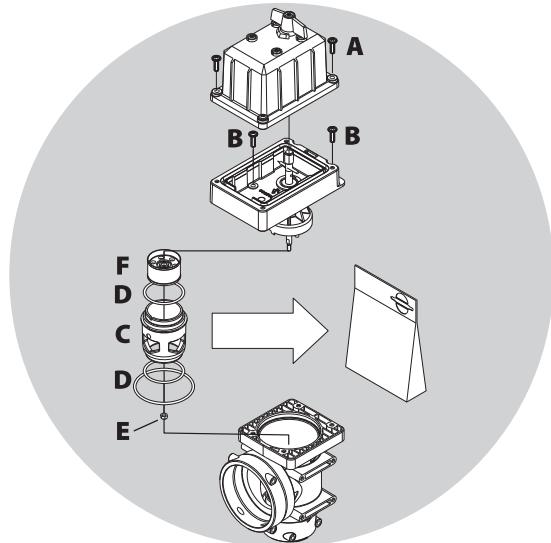
- Model 603: HARDI item no. 750656.
- Model 1203: HARDI item no. 750657.
- Model 1303: HARDI item no. 750658.

6 - Maintenance

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.

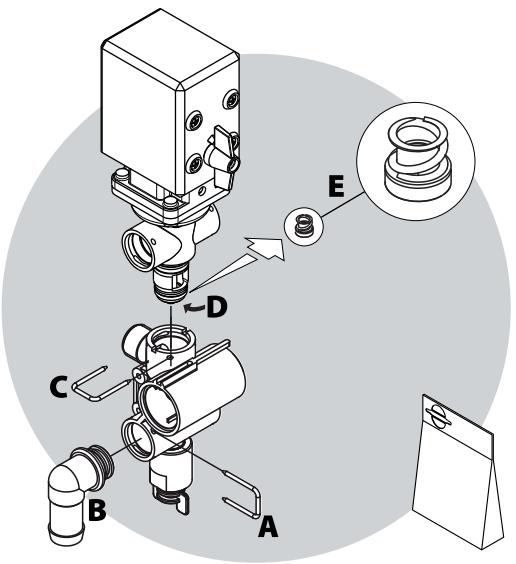


Cone Check/Renewal for EVC Distribution Valve

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.

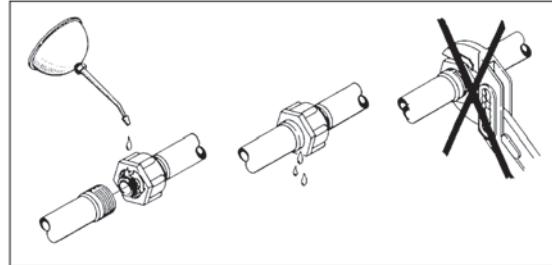


ATTENTION! Follow this procedure if you are having problems maintaining the chosen application rate.

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



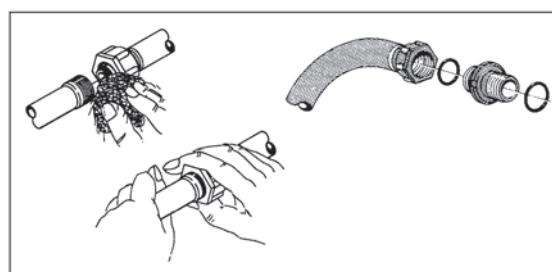
In case of leaks:

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

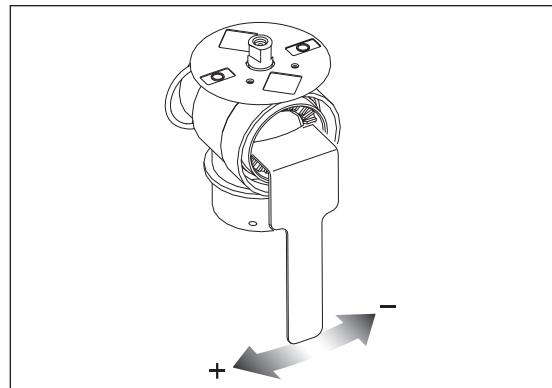
The large ball valve (type s93) can be adjusted, if it is too tight to operate - or if it is too loose (= liquid leakage).

- 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.



6 - Maintenance

Readjustment of Boom - General Info

Before commencing adjustment jobs, please go through this checklist.

1. The sprayer must be well lubricated (see the section "Lubrication").
2. Connect the sprayer to the tractor.
3. Place tractor and sprayer on level and solid ground.
4. Activate parking brake for tractor.
5. Put wedges under the wheels to prevent rolling.
6. Unfold the boom.
7. Place strong supports below the centre section to relieve the load from the hydraulic lift cylinder (if fitted).



DANGER! No one is allowed under the boom, while the adjustment is carried out.



DANGER! Adjustment of hydraulic cylinders (if fitted) is to be carried out without pressure in the system.



ATTENTION! For information on boom terminology, see "Boom and Terminology" on page 49.

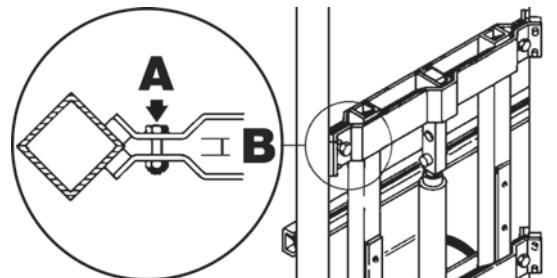


ATTENTION! Adjustments are to be completed equally for both right and left boom wings.

Boom Lift Adjustment

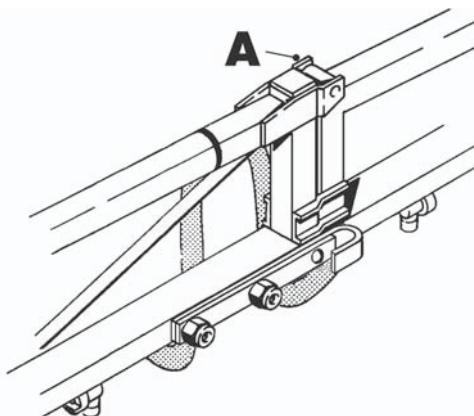
The boom lift should be adjusted so the boom can freely move up and down when the lift ram is operated. Adjust both sides simultaneously.

Adjust (A) so gap (B) is equal at all 4 contact points.



Outer Section Adjustment

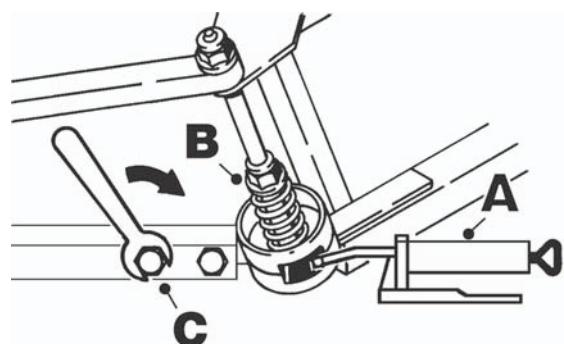
- A. The hinge should be firm. If too tight it is difficult to fold. To adjust, tighten or loose nut.



Boom Breakaway Adjustment

The function of the breakaway is to prevent or reduce boom damage if it should strike an object or the ground. If it is over-tight, it will not function. If it is too loose, it will yaw (forward and back movement) under spraying.

- A. Lubricate coupling before adjusting spring tension.
- B. First loosen counter nut, then slacken nut to adjust breakaway resistance. Do not overtighten; better loose than over-tight. Minor adjustments in the field may be necessary.
- C. Ensure also channel bolts are tight.



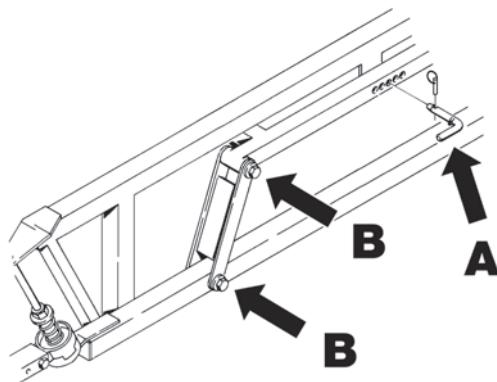
Trapeze Suspension Adjustment

For the trapeze to function it must not be over-tight. If it is too loose the boom will yaw. This results in a poor spray distribution.

Adjustment is made after having lubricated all pivot points (see section on Lubrication).

- A. Remove the lock pin for the trapeze suspension.
- B. Adjust trapeze bolts so it is not too tight nor too loose.

 ATTENTION! Again minor adjustment in the field may be necessary.



Shield Replacement on Transmission Shaft

- See the manufacturer's instruction book.

Replacement of Transmission Shaft Cross Journals

- See the manufacturer's instruction book.

6 - Maintenance

Change of Light Bulb

1. Switch off the light.
2. Loosen the screws on the lamp and remove the cover or lens.
3. Remove the bulb.
4. Fit a new bulb, refit the cover and tighten the screws.

 ATTENTION! If halogen bulbs are used, never touch the bulb with your fingers. Natural moisture in the skin will cause the bulb to burn out, when the light is switched on. Always use a clean cloth or tissue when handling halogen bulbs.

Venting the Boom Hydraulics

If the hydraulic cylinders or hoses have been dismantled, it is necessary to vent the cylinders after reassembly.

 DANGER! Failing to vent the hydraulic system when needed may result in violent boom movements and poor boom performance. Risk of damage to the boom parts or foreign objects nearby. Risk of severe injuries or death.

 ATTENTION! To vent the hydraulic cylinders you must loosen the hydraulic hose connected to the cylinder to let the air out this way. Note that ORFS fittings are used - be careful not to damage the sealing O-ring, when venting oil.

 ATTENTION! The following venting instructions are for the optional double acting tilt cylinders only. For the single acting lift cylinder, the venting is easily completed: After service, apply hydraulic pressure to the cylinder, retract and extend the piston approx. 5 times, and the air is then removed from the system automatically.

Sequence of Cylinders for Venting

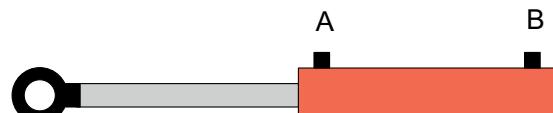
To complete an efficient venting of air in the system, this sequence should be followed.

1. Left tilt cylinder.
2. Right tilt cylinder.

Venting Procedure

Follow these steps to complete the venting. Both venting screws or valves (A and B) are closed to begin with.

1. Cylinder piston is retracted.
2. Loosen hydraulic hose connected to (A).
3. Activate the hydraulic oil pressure and extend the piston fully.
4. Tighten hose at (A).
5. Loosen hydraulic hose connected to (B).
6. Activate the hydraulic oil pressure and retract the piston fully.
7. Tighten hose at (B).
8. Repeat steps 3 - 10 a few times until air bubbles are no longer visible.
9. Venting is completed for this cylinder.
10. Check your hydraulic oil level - top up if needed.



 DANGER! Be careful when operating the cylinders. Make sure that no unauthorized persons are in the working area, when folding or unfolding the boom! When retracting the pistons into the cylinders, keep fingers, tools and clothes away from the piston. Risk of getting trapped between moving boom parts or folded boom sections resulting in severe injuries or death.

 ATTENTION! A helping hand is useful to complete the venting procedure.

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.

6 - Maintenance

13. Apply grease to all hydraulic ram piston rods, which are not fully retracted in the housing, to protect against corrosion.
 14. 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. Wipe off the grease from hydraulic ram piston rods.
3. Fit the pressure gauges again. Seal with Teflon tape or similar.
4. Connect the sprayer to the tractor, including 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.
5. Hydraulic hoses are connected correctly to tractor (see flow directions marked on the hoses), and they are without damages.
6. 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.
7. 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.
8. Antifreeze is drained from the tank and spray boom.
9. 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.
10. Rinse the entire liquid circuit of the sprayer with clean water.
11. Check that the main tank is clean inside and close the drain valve.
- 12.
13. Traffic lights are visible and in good working order. The protection glasses are clean and without damages.
14. Check all electric functions.
15. 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.
16. 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.
17. Speed sensor and other sensors are in good condition and free of dirt.

Operational Problems

General Info

 DANGER! Specialized persons should be involved in fault finding, as this is hazardous work! It might be necessary to have the sprayer operating to complete the fault finding.

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 (located at the bottom of the pressure filter). 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.
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.	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).
Short lifetime for diaphragm.	Lack of conservation of the fluid system during storage. Overspeeding of the pump.	Always use a proper mixture of antifreeze during storage. Observe maximum pump speed (rpm).

Hydraulic System

FAULT	PROBABLE CAUSE	CONTROL/REMEDY
Boom slow/eradic.	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.	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 lift/tilt functions will not operate.	Power supply.	Check for proper 12V power supply.
One function (lift 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. Dirt in the restrictor port of the cylinder.
Multiple hydraulic functions with one switch activated.	Various.	Check for correct solenoid electric/hydraulic hook-up. Check for short circuit in wiring in the junction box at rear of sprayer.

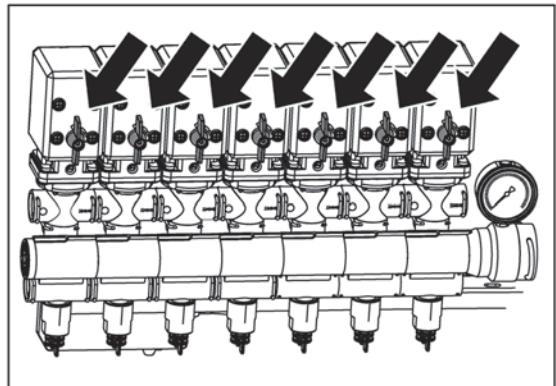
7 - Fault Finding

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 on the distribution valves.

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



Dimensions

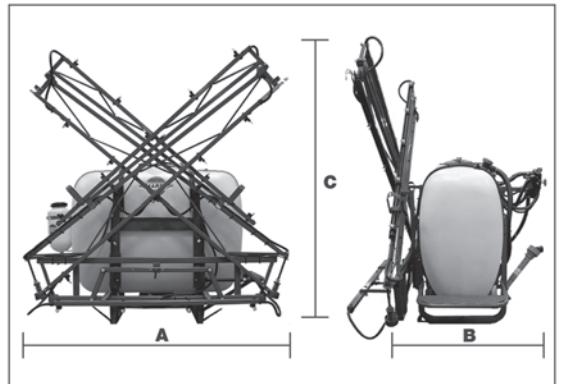
General Info

All dimensions, values and weights are depending on mounted options and specific adjustments.

Overall dimensions

Tank 400 litres

Boom width	A - Length (mm)	B - Width (mm)	C - Height (mm)
6 m	1900	1400	1700
8 m	1900	1400	2100
10 m	1900	1400	2100



Tank 600 litres

Boom width	A - Length (mm)	B - Width (mm)	C - Height (mm)
6 m	1900	1400	1700
8 m	1900	1400	2100
10 m	1900	1400	2100
12 m	2560	1400	2200

Tank 800 litres

Boom width	A - Length (mm)	B - Width (mm)	C - Height (mm)
6 m	1900	1400	1700
8 m	1900	1400	2100
10 m	1900	1400	2100
12 m	2560	1500	2200

8 - Technical Specifications

Weights

There are differences up to +/- 30 kg depending on the specifications of the sprayer.

Conditions for the weight indications in the tables below:

- Fully equipped
- Rated full main tank (nominal volume of water)
- Full RinseTank
 - 35 litres (400 litres Main Tank)
 - 50 litres (600 and 800 litre Main Tank)

Tank 400 litres

Boom Width	Pump Model		
	603	1203	1303
6 m	649	659	665
8 m	655	665	671
10 m	660	670	676
12 m	672	682	688

Tank 600 litres

Boom Width	Pump Model		
	603	1203	1303
6 m	881	891	897
8 m	887	898	905
10 m	895	905	911
12 m	907	917	923

Tank 800 litres

Boom Width	Pump Model		
	603	1203	1303
6 m	N/A	1117	1124
8 m	N/A	1124	1131
10 m	N/A	1131	1137
12 m	N/A	1143	1149

Pump Specifications

Pump Model 603/7.0

HARDI HARDI INTERNATIONAL A/S TAARSTRUP DENMARK			
Type 603/7			r/min.max. 700
No.			
r/min.	l/min.	bar	kW
540	31	0	0,4
540	29	10	1,2
		max.15	

Pump Model 1203/9.0

HARDI HARDI INTERNATIONAL A/S TAARSTRUP DENMARK			
Type 1203/9			r/min.max. 700
No.			
r/min.	l/min.	bar	kW
540	99	0	1,6
540	69	10	1,9
		max.15	

Pump Model 1303/9.0

HARDI HARDI INTERNATIONAL A/S TAARSTRUP DENMARK			
Type 1303/9			r/min.max. 700
No.			
r/min.	l/min.	bar	kW
540	114	0	1,6
540	100	10	2,5
		max.15	

8 - Technical Specifications

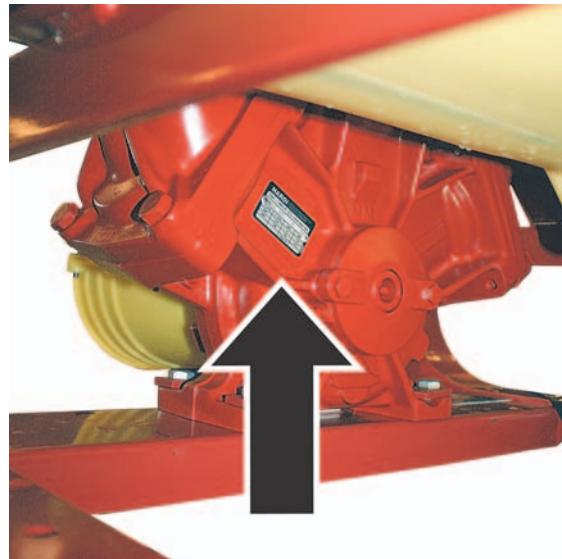
Other Specifications

Tractor Requirements

Power Take-Off

Min. / Max. operating torque See type sign for liquid pump (kW).

The type sign is located on the back side of the pump, facing pointing away from the tractor.



Hydraulic System

Max. operating temperature	80 °C
Max. operating pressure from the tractor	210 bar
Min. operating pressure from the tractor	180 bar
Max. flow from tractor	120 l/min
Min. flow from tractor @ 200 bar	15 - 80 l/min *
Max. oil filter rating	10 µm

* Depending on scope of supply.

DANGER! If one or more the values are exceeded, this may cause damages and sudden leaks on the sprayer. Risk of injuries and fatal accidents.

Voltage

Voltage	12 V DC
Tolerance for voltage	- 1.5 V / + 3.0 V
Current	40 A peak

Power Consumption

Recommended tractor engine output are as follows.

Main tank volume (litres)	Output (hp)	Output (kW)
400	70	51
600	85	62
800	100	73

Temperature and Pressure Ranges

Spray Liquid System

Operating temperature range	2 - 40 °C
Operating pressure for the safety valve	15 bar ± 1 bar
Max. pressure on the pressure manifold	20 bar
Max. pressure on the suction manifold	1.5 bar

8 - Technical Specifications

Voltage

The sprayer is designed for the following voltage only:

Voltage	12 V DC
Tolerance for voltage	- 1.5 V / + 3.0 V
Blade fuses	25 A *

* The blade fuses usually allow up to 50 A for a few seconds before blowing.

10.5 12 15.0



 DANGER! If the tolerances for voltage are exceeded, the electrical system can fail. Risk of fire. Risk of defect or malfunctioning components.

Airborne Noise Emission

Airborne noise emission from operating the sprayer relates to the two defined operator positions (in the tractor cab or operating the chemical incorporator/filling device/ChemFiller). Reference measurements indicate only in the latter case (operating the chemical filling device) a contribution from the sprayer of additionally 4 dB(A).

Filters

Mesh	Gauze width	Color	Filter				
					In-line**	Tank strainer	Nozzle
18	1.00 mm	White	-	-	-	Yes	-
30	0.58 mm	Green	Yes	-	-	-	-
50	0.30 mm	Blue	Yes, standard	-	Yes*	-	Yes*
80	0.18 mm	Red	Yes	Yes	Yes*	-	Yes*
100	0.15 mm	Yellow	-	-	Yes*	-	Yes*

*depending on selected nozzles

**not with PrimeFlow system

Technical Residue

Residue in the dilutable volume is mentioned in the table below.

The non-dilutable volume varies depending on the boom width and installed options in the fluid system.

Sprayer combination	Dilutable volume for tank and fluid system
Main tank: 600 litres Boom width: 12 meters	6 litres

8 - Technical Specifications

Materials and Recycling

Disposal of the Sprayer

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

Materials used:

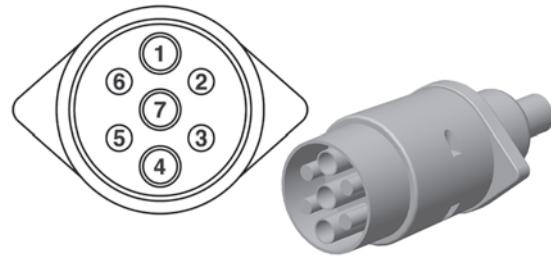
Tanks:	Plastic (HDPE)
Chassis, frame:	Steel (various types)
Boom:	Steel (various types)
Pump housing:	Grey cast iron (GG200)
Pump diaphragms:	Plastic (PUR)
Hoses (suction):	Plastic (PVC)
Hoses (pressure):	Rubber (EPDM)
Valves:	Glass reinforced plastic (PA)
Hose and pipe fittings:	Glass reinforced plastic (PA)
Filter housings:	Plastic (PP)
Nozzles:	Plastic (POM)

Electrical Connections

Rear Lights

The wiring is in accordance with ISO 1724.

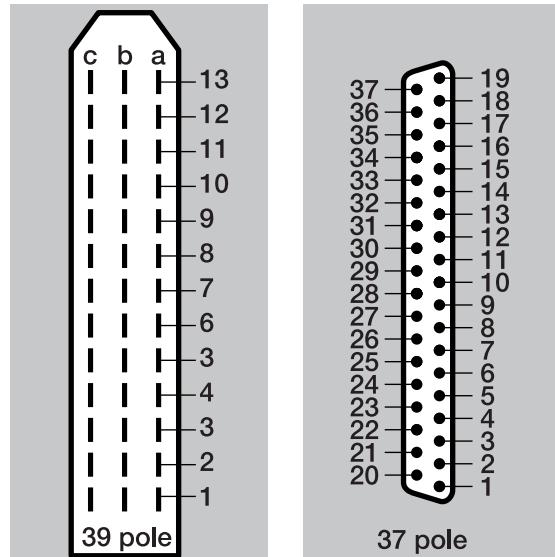
Position	Designation	Wire colour
1	Left direction indicator	Yellow
2	Free (max. 55 W)	Blue
3	Ground	White
4	Right direction indicator	Green
5	Right rear position lamp	Brown
6	Stop lamps	Red
7	Left rear position lamp	Black



Electrical Connections for SPRAY II

39- or 37-poled plug with cable.

39-pole	37-pole	SPRAY II
1a	5	S1+
1b	6	S1-
1c	26	End nozzle L
2a	7	S2+
2b	8	S2-
2c	25	End nozzle R
3a	9	S3+
3b	10	S3-
3c	29	+12V sensor
4a	11	S4+
4b	12	34-
4c	4	PWM 1TX
5a	14	S5+
5b	15	S5-
5c	27	GND
6a	16	S6+
6b	17	S6-
6c	13	Optional 5 Reg. feedback
7a	18	S7+
7b	19	S7-
7c	33	Option 1 4-20mA
8a	37	S8+
8b	36	S8-
8c	32	Option 2 Frq
9a	35	S9+/Air angle 0-5V
9b	34	S9-/Fan speed 0-5V
9c	not connected	Option 3/Tank gauge
10a	21	On/off+
10b	22	On/off-
10c	not connected	PWM Output option
11a	23	Pressure+
11b	24	Pressure-
11c	28	Flow
12a	20	Foam blop 0-5V
12b	1	Option 4 Rx
12c	31	Speed
13a	3	FM L
13b	2	FM R
13c	30	Gnd sensor

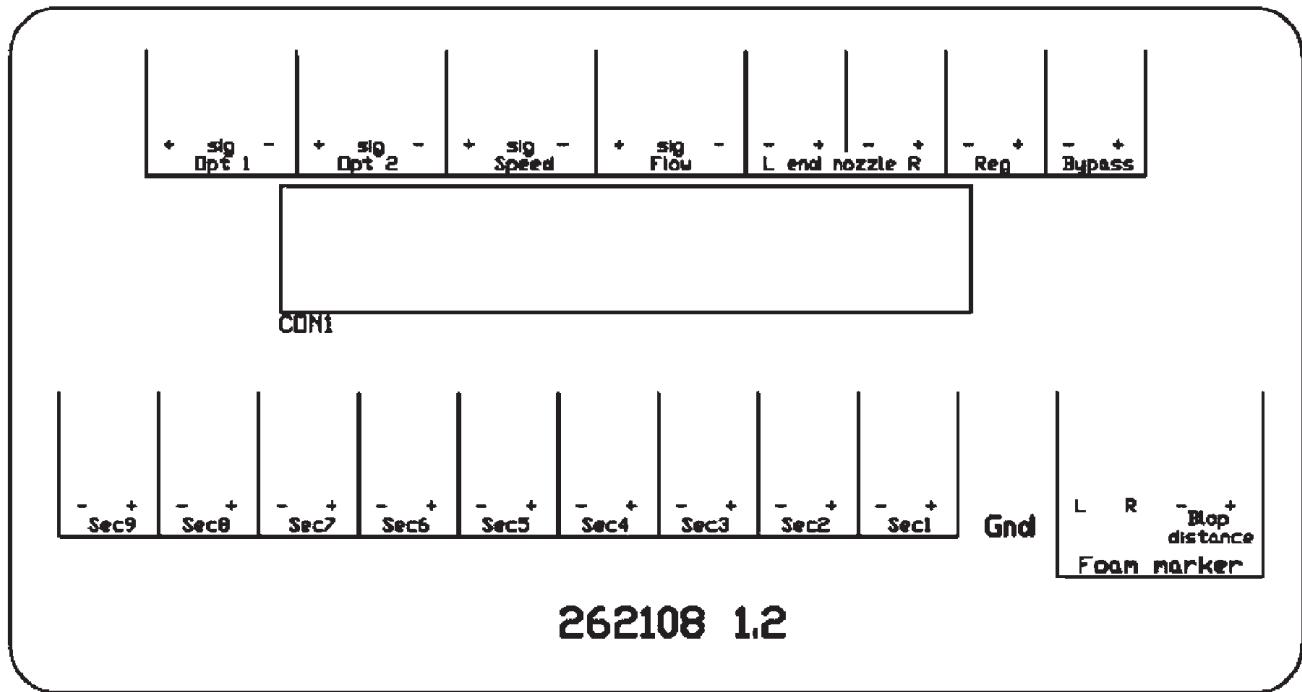


8 - Technical Specifications

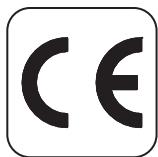
EVC Junction Box

The EVC operating unit fulfils the EC noise reduction standards.

When connecting an optional function, be aware that maximum current for every connector is 2 amps. Total current for the whole connector box may not exceed 10 amps.



HC 5500	Function	+	Signal	-
Option 1	Pressure sensor	Brown	Blue	-
Option 2	RPM sensor	Brown	Blue	Black
Speed		Brown	Blue	Black
Flow		Brown	Blue	Black
Left end nozzle	Pendulum lock at HAY/LPY	Brown	Blue	
Right end nozzle	Pendulum lock at HAY/LPY	Brown	Blue	
Regulation (Yellow)		Brown	Blue	
Bypass	EC on/off	Brown	Blue	
Section 9	User defined A&B 2	x		x
Section 8	User defined A&B 1	x		x
Section 7	Twin speed	Brown		White
Section 6	Twin angle	Yellow		Grey
Section 5		Brown		Blue
Section 4		Brown		Blue
Section 3		Brown		Blue
Section 2		Brown		Blue
Section 1		Brown		Blue
Foam marker	No. 4 Not used	Ground Black	Left Brown Red	- + Orange

EC Declaration of Conformity

As manufacturer:

HARDI INTERNATIONAL A/S

Helgeshøj Allé 38

DK-2630 Taastrup

DENMARK

hereby declare that the following product:

NK - SB/MB

- fulfils all the relevant provisions of Machinery Directive 2006/42/EC, 2009/127/EC and later amendments, and all the relevant provisions of Council Directive 2004/108/EC (EMC).

The identification number of this sprayer is found in chapter 1 in this book.

Taastrup, 01.12.2015

A handwritten signature in black ink that reads "Henning Jørgensen".

Henning Jørgensen

Vice president, Product development

HARDI INTERNATIONAL A/S

9 - EC Declaration

Index**Numerics**

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Spare Parts

To see updated spare part information, visit the Agroparts website.

Here all parts information can be accessed in the spare parts catalogue:

1. Go to www.agroparts.com, register for free and log in.
2. Select "HARDI" in the menu on the left.
3. Select "Spare parts catalogue" and find your spare part.
4. Online ordering is also possible.
5. Contact your HARDI dealer for further information on spare parts.



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