USER MANUAL

Trailed field sprayer

BRUNO
BRUNO X

WARRANTY CERTIFICATE

PRODUCTION, SERVICE AND TRADING COMPANY

TOLMET

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EC DECLARATION OF CONFORMITY
for the machine:
In accordance with the Regulation of the Minister of Economy of 21 October 2008
(Journal of Laws No. 199, item 1228)
and European Union Directive 2006/42/EC of 17 May 2006
In accordance with the Regulation of the Minister of Economy of 21 October 2009
(Journal of Laws No. 124, item 701)
and European Union Directive 2009/127/EC of 17 May 2006

We declare with full responsibility that the machine:

Machine: TRAILER-MOUNTED SPRAYER

Type/model: BRUNO _____Serial number:_____
Year of manufacture:_____

to which this declaration refers, complies with the requirements of: The Regulation of the Minister of Economy of 21 October 2008 on the essential requirements for machinery (Journal of Laws No. 199, item 1228)
and European Union Directive 2006/42/EC of 17 May 2006
Regulation of the Minister of Economy of 21 October 2009 on the essential requirements for machinery for the application of pesticides (Journal of Laws No. 199, item 1228)
and European Union Directive 2006/42/EC of 17 May 2006

Person responsible for the technical documentation of the machinery: Piotr Wawrzyniak

In order to fulfil the relevant safety, health and environmental protection requirements contained in Directive 2006/42/EC, the following harmonised standards are taken into account:

PN–EN ISO 12100 :2012 PN–EN ISO 4254-6:2011
PN–EN ISO 4254-1 :2013 PN-EN ISO 11684:1998

This EC Declaration of Conformity loses its validity if the machine is modified or rebuilt without our consent.

Świnice Warckie_____ _____
Place and date of issue First name and surname of the person authorised to sign

TOLMET PRODUCTION, SERVICES AND TRADING COMPANY
Piotr Wawrzyniak
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MACHINE IDENTIFICATION

Trailed field sprayer

The data on the nameplate is used to identify the machine and should correspond to the details entered at the time of sale.

Symbol -_____

Year of manufacture-_____

Serial number-_____

The sprayer has a nameplate located on the frame at the front of the machine. The nameplate contains basic information used to identify the machine.

Fig. 1. Location of the nameplate on the machine.

When writing to us, asking questions or raising warranty issues, please state the model and identification number of the machine. You will find the machine's identification details on the plate located on the frame on the right-hand side.

The user manual is included as standard with the sprayer.

Table of contents

1. Introduction.

This manual describes the operation and maintenance of the Bruno trailed field sprayer (manual boom extension). If any specific problems arise during operation that are not sufficiently covered in this manual, please contact the manufacturer or your dealer. The manufacturer's key obligations are set out in the warranty certificate, which contains the full and binding terms of the warranty. The machine is designed to ensure safe operation provided it is used in accordance with the operating instructions. Before first use, it is recommended that you read this manual to familiarise yourself thoroughly with the conditions for the correct operation of the machine. Familiarising yourself with the principles of correct operation of the sprayer ensures the machine is used correctly and also ensures that any warranty claims can be honoured. The terms used in the operating manual: left side, right side, rear, front – refer to the observer facing in the direction of travel of the combination (tractor + sprayer).

It is essential that you read this manual

thoroughly before starting work.

2. Intended use.

The trailed field sprayer is designed for carrying out agrotechnical operations in agriculture relating to plant protection and foliar fertilisation. Using the sprayer for other purposes will be considered misuse of the machine, which will result in the loss of the warranty. Familiarising yourself with the sprayer's design, reading the operating manual carefully and following its instructions will ensure safe operation of the sprayer.

2.1. Intended use.

The trailed field sprayer may only be started, operated and repaired by persons familiar with the operation of the machine and the tractor it is coupled to, as well as with the rules of conduct regarding the safe operation and maintenance of the machine. The manufacturer accepts no liability for unauthorised modifications to the sprayer's design. During operation, only genuine TOLMET parts must be used.

REMEMBER

**The sprayer is intended solely for agricultural use.
Using it for purposes other than those specified in point 2 shall be deemed to constitute misuse. Misuse
in a manner inconsistent with its intended purpose. Failure to comply with the manufacturer's recommended operating conditions, maintenance requirements and keeping the machine in good working order shall also be considered use inconsistent with its intended purpose. The manufacturer shall not be liable for any damage resulting from the use of the sprayer in a manner inconsistent with its intended purpose.**

REMEMBER

**Before operating and using the sprayer, read this user manual, familiarise yourself with the construction of its components, their
operation, adjustment ranges and methods, paying particular attention to safety information. It is never too late to do this
too late.**

3. Safety.

3.1. Intended use of the sprayer.

Trailed field sprayers have been designed, manufactured and adapted for use in agricultural production. They are used for tasks such as applying fertilisers to field crops and applying plant protection products. The machine is designed to work exclusively with agricultural tractors, utilising the tractor's power via the power take-off shaft through the use of a jointed-telescopic shaft.

REMEMBER

**The regulations regarding the intended use and configurations specified for the trailed field sprayer are the only ones permitted. It is prohibited to use the machine for
purposes other than those for which it is intended. The instructions contained in this manual do not replace the applicable regulations relating to safety standards and accident prevention; they are a summary thereof.**

3.2. Potential hazards associated with the operation of the sprayer.

When using trailed field sprayers in accordance with their intended purpose, certain risks to human life and health can be anticipated.

To avoid these, follow the instructions in the machine's user manual. Particular attention should be paid to the sprayer's components, as well as to situations that may pose a risk to the operator and bystanders. These include, amongst others:

- The rotating articulated telescopic boom,
- The boom during raising and lowering,
- The boom during unfolding and folding,
- Failure to secure the boom during transport,
- The sprayer's pressurised liquid system,
- Pressurised hydraulic system of the sprayer,
- Sprayer brake system under pressure,
- The boom extended whilst driving,
- Spray boom suspension,
- Boom edges,
- Pressure in the sprayer system,
- Sprayer support,
- Sprayer chassis,
- Risk of loss of stability,
- Risk arising from contact with chemical used in agricultural practices,
- Risks arising from negligence in the use of plant protection products.

3.3. Technical support and safety.

Maintenance work may be carried out provided the trailed sprayer is disconnected from the tractor. If the machine is coupled to the tractor, the tractor must be switched off, braked, and the key removed from the ignition. Only serviceable tools and equipment, as well as original parts and materials, should be used for maintenance. Operation of the articulated telescopic boom without a guard or with a damaged guard is prohibited. Use the designated safety devices and pins to secure the pins. The use of makeshift safety devices such as screws, rods, wires, etc., which may cause damage to the tractor or sprayer, is prohibited.

3.4. **Transport.**

A sprayer being transported on public roads must have a fully functional lighting system connected to the tractor's lighting system.

REMEMBER

The trailer beam must be folded into the transport position before driving onto a public road

In addition, a triangular warning sign indicating a slow-moving vehicle must be displayed. When transporting sprayers by road from the manufacturer to the dealer or customer, safety rules must be observed during loading and the sprayer must be properly secured on the vehicle's trailer.

REMEMBER

It is prohibited to drive on public roads without the sprayer being properly marked. When driving a tractor with a sprayer on public roads, you must comply with all provisions of the Highway Code applicable to this type of vehicle.

Sprayers coupled to agricultural tractors require the following when transported on public roads:

- marking with warning signs featuring red and white stripes,
- fitting lights,
- marking of the machine protruding from the sides of the tractor (white front position lights),
- repetition of the tractor's rear lights (combination lights and red reflectors),
- marking with a triangular sign indicating slow-moving vehicles,
- do not exceed the speed limit during transport, which is on roads:

3.5. Working with plant protection products.

When working with plant protection products, special precautions must be taken. The greatest risks associated with working with plant protection products and fertilisers occur:

- when filling the tank,
- when adding and preparing the substance,
- during application,
- during adjustment,
- when rinsing and drying the tank,
- when changing plant protection products,
- during operation,
- when disposing of packaging.

To ensure safety when working with plant protection products, you must:

- Always wear protective clothing (the choice of appropriate protective clothing depends on the toxicity class of the product). Protective clothing includes:
  - ✔ rubber boots,
  - ✔ gloves,
  - ✔ a coat,
  - ✔ hat,
  - ✔ mask or half-mask,
- Do not start working with plant protection products on an empty stomach;
- do not eat or drink whilst filling, preparing the substance, or during the application,
- Do not fill the tank with substances that contaminate the water;
- do not carry out the treatment whilst under the influence of alcohol, nor consume alcohol whilst operating the sprayer,
- Do not discharge any remaining liquid into open water or biological sewage treatment plants.
- residual working solution must be diluted and sprayed onto cultivated land or drained from the tank into a sealed container and taken to a facility authorised to dispose of such substances,
- the working solution must be prepared at least 50 metres away from wells or water reservoirs from which water is used for drinking purposes,
- Only adults familiar with the instructions for use may handle plant protection products,
- in the event of poisoning, contact a doctor immediately, specifying which product has been ingested (state the active ingredient),
- The sprayer operator must strictly follow the instructions on the plant protection product packaging;
- after completing the treatment, wash your hands, face and whole body, rinse your mouth and change your clothes.

Handling plant protection products before preparing the spray mixture:

- When purchasing plant protection products, check that the packaging is undamaged and that the label is legible,
- during transport, secure the product with additional packaging,
- do not transport plant protection products together with foodstuffs, agricultural produce or animals,

- use the product in accordance with the instructions,
- check the expiry date of the product,
- check the waiting period (the period during which contact with the treated plants is prohibited),
- check the toxicity class,
- Check the active ingredient in the event of poisoning.

Environmental protection:

- spraying may carried out only if suitable weather conditions, when the wind speed does not exceed **3 m/s,**
- do not spray flowering plants when using a substance toxic to bees,
- always observe the safety periods for bees and other living organisms,
- always use a sprayer that is in good working order and free from faults,
- dispose of any remaining spray mixture properly at collection points or dilute and spray it on cultivated land,
- do not apply plant protection products within 50 metres of water intakes,
- do not discharge any remaining spray mixture into water bodies,
- do not contaminate nearby plantations as a result of spray drift carried by the wind,
- Plant protection products must not be used within 20 metres of apiaries, nature reserves, herb plantations, allotments or sites where protected plant species are found.

Failure to comply with the above rules may lead to poisoning of humans or the environment, or damage to the sprayer or other objects. The user is liable for any damage resulting from failure to comply with these rules the user.

3.6. Operation.

The trailed field sprayer may only be operated by persons authorised to drive an agricultural tractor who have familiarised themselves with the operating instructions.

It is forbidden for unauthorised persons, and in particular children, to be present whilst the machine is in operation. To carry out any repairs or adjustments, switch off the engine, remove the key from the tractor's ignition and apply the tractor's handbrake.

Before starting work, carefully check the technical condition of the machine and the tractor. Check that the sprayer is leak-free. Spraying should be carried out in suitable weather conditions as recommended by the manufacturer of the plant protection product. It is recommended that wind speed does not exceed 3 m/s. You must comply with the regulations governing the use of plant protection products, which stipulate that spraying must be carried out at least 5 metres from public roads, excluding local roads. It is prohibited to carry out spraying within 20 metres of residential buildings or livestock buildings. In the event of a leak in the sprayer during operation, the treatment must be stopped immediately and

Rectify the fault. No unauthorised persons are permitted in the work area whilst the procedure is being carried out.

After each application, the sprayer must be washed and rinsed; this must also be done when changing the plant protection product.

It is prohibited to carry passengers on the sprayer or to enter the sprayer tank. Operating the sprayer at an angle exceeding 8.5 degrees is prohibited. After finishing work, the boom must be folded and secured.

3.7. Safety when working with a telescopic-articulated boom.

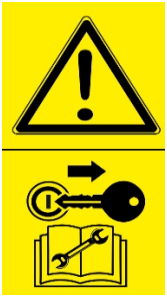
When working with a telescopic-articulated boom, please remember to:

- using the shaft recommended by the manufacturer,
- use the shaft only with a full set of guards,
- secure the guard against rotation using a chain,
- secure the shaft,
- Before engaging the drive, check that there are no bystanders in the vicinity;
- Before fitting the shaft, switch off the tractor engine, remove the key from the ignition and apply the handbrake,
- Ensure that the PTO shaft is of the correct length (no less than 25 cm, or 1/3 of the shaft's length; the sections must overlap),
- Use a PTO shaft with the correct torque.
- do not use a PTO shaft that is in poor condition,
- do not engage the PTO shaft abruptly,
- clean and lubricate the PTO shaft before attaching it,
- after finishing work, store the shaft in the designated area.

Operating the telescopic articulated shaft with a damaged guard or without a guard is STRICTLY PROHIBITED!!!!

3.8. Safety signs.

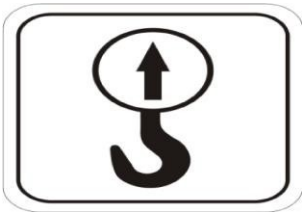
1		Rating plate
2		Before starting the machine, read and then follow the safety instructions

		safety instructions in this manual!
3		Warning of the risk of poisoning from toxic substances. Danger of vapours and toxic gases entering the respiratory tract
4		Risk of crushing the whole body due to the need to remain under raised, unsecured parts of the machine!
5		Hazards when carrying out tasks on the machine, such as assembly, adjustment, troubleshooting, cleaning, maintenance and repairs, caused by the machine starting up accidentally and the tractor rolling away with the machine attached!

6		Maximum drive speed (maximum 540 rpm) and direction of rotation of the drive shaft.
7		Risk of crushing the whole body caused by standing under a suspended load or raised parts of the machine!
8		Risk of crushing the whole body due to being in the lifting zone of the 3-point linkage system when operating the three-point linkage hydraulics!
9		Risk of crushing fingers or hands caused by accessible, moving parts of the machine!

10		Risk of falling when walking on surfaces or loading platforms!
11		Risk of inhaling harmful substances caused by toxic vapours in the working fluid tank!
12		Risk of arms or upper body being drawn in or caught by moving, unguarded machine parts!
13		It is forbidden to enter the sprayer

14		No drinking water
15		You must wash your hands
16		CE safety mark
17		Symbol for permissible transport speed
18		It is prohibited to drive on public roads with a tractor towing a machine with a transport width exceeding 3 m

19		Pictogram indicating loading points for machinery onto transport vehicles.
20	BRUNO	Sticker showing the name and model of the sprayer
21		Put on a face mask!
22		Wear protective clothing!
23		Wear safety goggles!

24		Wear safety footwear!
25		Wear protective gloves!

Table 1. Pictogram table.

4. Residual risk.

4.1. Description of residual risk.

Residual risk most often results from incorrect behaviour on the part of the sprayer operator due to inattention or lack of knowledge. The greatest danger arises in the following situations:

- the operation of the sprayer by minors or persons who are not familiar with the operating instructions,
- operating the machine by persons under the influence of alcohol or other intoxicating substances,
- using the sprayer for purposes other than those described in the operating instructions,
- standing between the tractor and the machine whilst the tractor engine is running,
- the presence of bystanders, particularly children, near the sprayer whilst it is in operation,
- cleaning the sprayer whilst it is in operation,
- manipulating moving parts of the machine whilst it is in operation,
- checking the technical condition of the sprayer.

When presenting the residual risk of the sprayer, it is treated as a machine that was designed and manufactured in accordance with the state of the art at the time of its manufacture, in compliance with basic health and safety principles.

WARNING!

There is a residual risk if the specified recommendations and instructions are not followed.

4.2. Residual risk assessment.

By following the recommendations set out below, the occurrence of residual risk can be minimised:

- ✔ follow the safety instructions in the user manual,
- ✔ read the user manual carefully,
- ✔ do not put your hands in dangerous or prohibited areas,
- ✔ No spraying in the presence of bystanders, particularly children,
- ✔ maintenance and repair of the sprayer must only be carried out by suitably trained personnel,
- ✔ the sprayer must only be operated by persons who have been previously trained and have familiarised themselves with the operating instructions,
- ✔ keep the sprayer out of reach of children,
- ✔ operating the sprayer by competent persons who are not under the influence of intoxicating substances.

5. Lighting.

Our trailed field sprayers are fitted with rear lights and reflective plates (Fig. 2). Before driving on public roads, connect the power cable to the tractor's electrical system.

Fig. 2. Lights and reflective plates

6. Construction of a trailed field sprayer.

The sprayer consists of a frame supported at the rear by two road wheels mounted on an axle and at the front by a support. At the front of the machine there is a drawbar with pins for attachment to the tractor's suspension system via drawbars. Behind the drawbar is the pump, together with a cover for the PTO shaft end. Mounted on the frame is the main tank, made of plastic, with a capacity of 1200 l, 1500 l, 2000 l, 2500 l or 3000 l. Access to the tank's filling port is provided by a fold-out ladder and a platform. The sprayer also features a water tank for hand washing and a water tank for flushing the sprayer system. These tanks are located beneath the platform. This machine offers two types of boom deployment – hydraulic deployment (BORYS) or manual deployment(BRUNO). The boom is equipped with gravity or hydraulic stabilisation. Attached to the boom are nozzle holders, liquid supply hoses, as well as rear lights connected to the tractor along with warning signs.

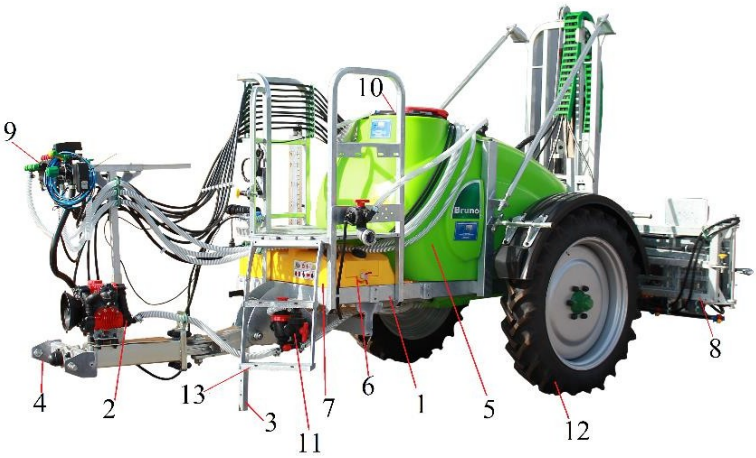


Fig. 3. 1. Main frame. 2. Pump. 3. Support. 4. Hitch beam. 5. Main tank. 6. Hand wash water tank. 7. System wash water tank. 8. Boom. 9. Main control manifold. 10. Filling port. 11. Three-way valve. 12. Wheel. 13. Side . 14. Stairs.

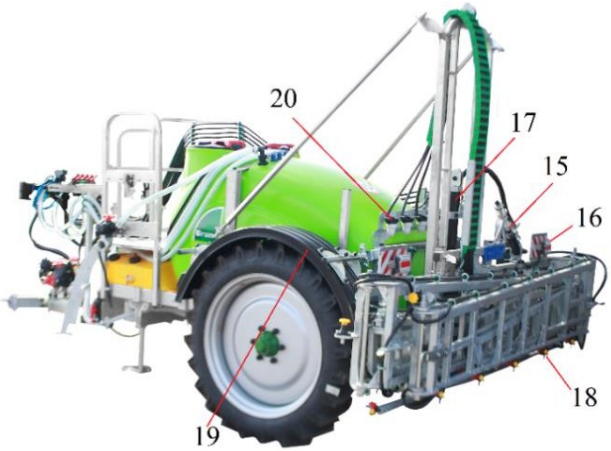


Fig. 4. 15. Boom stabiliser. 16. Lights with warning signs. 17. Cylinder for adjusting the working height of the boom. 18. Spray head. 19. Mudguard. 20. In-line filter

6.1. Sprayer frame.

The frame (Fig. 3, item 1) of the trailed field sprayer has been designed and constructed to ensure the machine is both robust and lightweight. The structure is made up of various types of thick-walled sections and sheet metal. The sprayer frame is hot-dip galvanised, making it corrosion-resistant.

6.2. Pump.

The sprayer utilises a Tolveri® PU-3/140 diaphragm pump manufactured by us (Fig. 3, Item 2). The pump has been designed and manufactured for use in . The device ensures the correct working pressure of the liquid. The Bruno 1500, 2000, 2500 and 3000-litre models are fitted with two diaphragm pumps. Each pump has a flow rate of 140 l/min. These are 3-piston pumps. Both pumps are connected to each other via a coupling. The pumps work together, thereby increasing the boom's capacity. The first pump supplies the working fluid to the boom, whilst the second pump controls the agitator cleaning system, ensuring that there is no drop in pressure at the boom when the agitators in the main tank are switched on. The pumps are mounted on the drawbar using rubber shock absorbers, which dampen vibrations. The pumps are driven by a PTO shaft at a speed of 540 rpm. The operation and construction of the pump are described in more detail in the diaphragm pump operating manual.

Fig. 5. Tolveri® PU-3/14 Tandem diaphragm pump

6.3. Support.

The front support (Fig. 3, item 3) is used to support the sprayer frame when the machine is not coupled to the tractor. It is height-adjustable.

6.4. Hitch beam.

The hitch beam (Fig. 3, item 4) is located at the very front and is used to securely attach the trailed field sprayer to the tractor. We use 28 mm pins as standard, but larger or double pins can be fitted by selecting this option when ordering the sprayer.

6.5. Main Tank.

This tank is made of durable plastic – polyethylene, microgranules (LLD-PE). The tank features two liquid inlet ports. Inside, at the rear of the tank, two anti-foam agitators), and in the upper section, two wide-angle rotating nozzles are centrally p e exception of the 1200-litre tank – here

there is only one wide-angle rotating nozzle (Fig. 7), designed to clean the inside of the tank after the sprayer has finished work. Additionally, hoses are fitted inside the tank which drop to the bottom of the tank and reduce the risk of plant protection products or fertilisers foaming when the liquid returns.

6.6. Water tank for hand washing.

tank at for clean water for hand washin

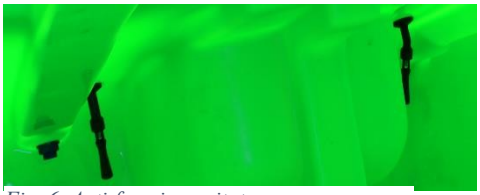


Fig. 6. Anti-foaming agitators

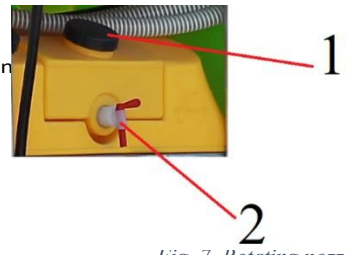


Fig. 7. Rotating nozzle

is

is under platform on the side of the sprayer, inside the system flushing tank. It is fitted with an easy-to-use plastic tap and a centrally located water inlet (8. Point 2).

6.7. Water tank for flushing the sprayer system.

The clean water tank for flushing the system (Fig. 9, item 2) is located beneath the platform. The water inlet for the system flushing tank (Fig. 8, item 1) is situated to the left of the inlet for the hand-washing tank.

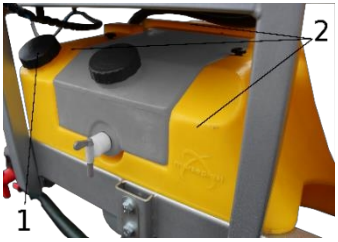


Fig. 9. 1. Water inlet for system flushing. 2. System wash water tank.

6.8. Spray boom.

Thanks to the manual extension of the boom (Fig. 11), the sprayer can be safely transported on public roads, and when unfolded, it can cover a wide area of crops.

The field boom is fitted with spray nozzles on a triple swivel head (10.) and hydraulic hoses, which supply the working fluid from the tank to the nozzles and enable precise application of plant protection products and fertilisers.

Fig. 10. Triple spray head

Hydraulically extendable boom (optional)

The X-shaped boom is extended and raised using the Hydro Panel from the tractor cab. Its functionality is ensured by appropriate hydraulic cylinders and a scissor mechanism enabling the sprayer boom to extend. The boom is fitted with shock-absorbing springs and a hydraulic cylinder to force the tilt.

6.9. Control manifold.

The Fermo 5, Fermo CP1 and Fermo 5 CP2 control units are mounted on a special mast located on the sprayer's hitch, whilst the full electrical system is mounted on the left-hand side of the sprayer. A series of valves and solenoid valves are used to control the sprayer, allowing the amount of substance to be adjusted,

controller supplied as standard.

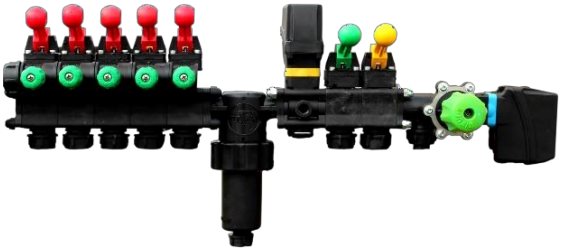


Fig. 12. Basic control manifold with two solenoid valves used in Bruno sprayers.

to be sprayed onto a given area, as well as switching individual boom sections on and off. In the basic version, the sprayer is equipped with the Tolmet/Meyer Control Panel 2®, which allows the operator to switch all sections on and off simultaneously and increase or decrease the pressure of the spray liquid from the tractor cab.

The lower manifold is used to operate the agitators and for partial flushing. The green lever (Fig. 14) is used to flush the main tank, the yellow lever is used to flush the sieve diluter, and the purple lever controls the supply to the side diluter. The agitators are driven by a second pump. The agitators do not affect the pressure at the boom. The agitators are adjusted using the pressure control knob, increasing

The pressure on the pressure gauge increases as the force of the working fluid being mixed inside builds up. The agitators are switched off by turning off the green valves located next to the hydrant. The valves must be closed every time before flushing the sprayer system.

6.10. Filling point.

The main sprayer tank has two independent liquid inlets. The inlets are fitted as standard with strainers to prevent contamination of the tank. The strainer on one inlet (left) is fitted with a diluter for solid fertilisers.

Fig. 15. Filling ports.

6.11. Hydrant

The hydrant is used to fill the main tank with liquid, as well as the auxiliary tanks. It is located on the platform beneath the distributor.

6.11. Control valve.

Depending on the specification, the trailed field sprayer is fitted with either a three-way valve (Fig. 7) or a four-way valve. It is located at the front of the sprayer, beneath the steps. This valve allows you to control the flow of liquid through the pump. The operation of the valve will be described in the following sections.

Fig. 17. Three-way valve.

6.12. Wheels.

The trailed field sprayer is fitted with a pair of wheels with adjustable track width. 9.5 x 32 wheels are fitted as standard.

6.13. Side diluter.

A side diluter can be fitted to each trailed sprayer, allowing fertilisers or plant protection products to be conveniently added from ground level. This is optional equipment for the sprayer, controlled via a second distributor. There are 3 nozzles inside

6.14. Stairs.

The stairs provide safe and convenient access to the platform and to the upper part of the main tank. Thanks to special latches, the stairs are secured to prevent them from opening during transport.

6.15. Hydraulic boom stabilisation.

The boom of the trailed field sprayer is stabilised by hydraulic cylinders. This solution reduces the risk of the boom striking the ground when moving over uneven terrain whilst operating the sprayer.

6.16. Suction unit

The suction unit is used to draw liquid plant protection products from large tanks (e.g. Mauzer) or reservoirs when there is no water hydrant nearby. If the sprayer is equipped with a suction filter or two pumps, the suction unit is connected in place of the shut-off valve knob (Fig. 19). On the manifold, switch off all sections, open the main valve and engage the PTO. If the sprayer has a three-way or four-way valve, the suction unit is connected in place of the upper ø32 elbow; then the four-way valve knob should
turned upwards. On the manifold, switch off all sections, open the main valve and engage the PTO.

Fig. 18. side *of the*

Fig. 19. Suction filter with shut-off valve

6.17. Light.

The use of rear lights and warning signs ensures safe travel on public roads, whilst the fitted work lights enable night-time operation.

6.18. Actuator for adjusting the boom working height.

Our 'Borys' trailed field sprayers come with hydraulic boom height adjustment as standard.

6.19. Spray head.

The rotating spray head is equipped with three different types of nozzles. We use the following nozzles as standard: KR5 04, EŻ 03, RS 02 (Fig. 20). Thanks to the use of a rotating head, depending on the type of spray or wind conditions, we are able to quickly and easily change the active nozzle by turning the head.

Fig. 20. Standard-fit nozzles

6.20. Mudguard.

Standard trailer-mounted field sprayers are equipped with mudguards that can be adjusted to accommodate changes in wheel spacing. The mudguards are made of high-quality plastic.

6.21. Line filter.

These filters are fitted separately on the lines of each sprayer section. They are designed to clean the liquid very thoroughly, which prevents disruption to the operation of low-capacity nozzles.

Fig. 21. Line filter

7. Description of the sprayer's operation.

7.1. Sprayer equipment.

Basic field sprayer "Bruno" Basic field sprayer "Bruno":

- ✔ Main tank for clean water, with two inlets fitted with strainers, one of which includes a diluter for solid fertilisers,
- ✔ Clean water tank for hand washing, fitted with a tap,
- ✔ Clean water tank for cleaning the sprayer system, including a rotating nozzle for cleaning the interior of the main tank,
- ✔ 28 mm drawbar,
- ✔ 9.5x32 wheels with mudguards,
- ✔ Adjustable wheelbase (150–180 cm),
- ✔ Tolveri® PU-3/140 pump,
- ✔ Control Panel 2® with pressure gauge and illuminated switch, allowing the working pressure to be switched on/off and adjusted from the tractor cab,
- ✔ field boom symmetrical, fold-out manual with mechanical stabilisation,
- ✔ Hydraulically raised boom to a nozzle height of 2.00 m above ground level,
- ✔ Fermo 5 constant-pressure manifold (except for the 12 m Fermo 3), equipped with two solenoid valves, enabling switching on/off and regulating the operating pressure via the Control Panel 2® controller from the tractor cab,
- ✔ Three-position rotary spray heads fitted with KR5 04, EŻ 03 and RS 02 nozzles, distributed across five independent sections (except for the 12 m boom – three independent sections) via high-quality hydraulic hoses,
- ✔ Liquid level indicator in the main tank,
- ✔ Linear filters for each section of the field beam,
- ✔ Suction filter,
- ✔ LED lighting with warning signs,

- ✔ 2 x hydraulic anti-foaming agitators,

Equipment for for the "Bruno" available at extra cost:

- ✔ Addition of 2 sections to the liquid distribution system (applies only to the 12 m field boom)
- ✔ Hydraulic stabilisation of the field boom,
- ✔ Control Panel 4® enabling the activation/deactivation of all sections as well as separately the activation/deactivation of the outermost sections and adjustment of operating pressure,
- ✔ Control Panel 7® enabling the activation/deactivation of all sections on as well as and and each separately and adjustment of operating pressure
  working pressure,
- ✔ The Alfa 100 computer, which, in addition to switching each section on and off , enables m. in. maintaining the set taking into account spraying speed taking into account the forward speed of the tractor coupled with a trailed field sprayer,
- ✔ 9.5x36 wheels, 11.2x32 wheels, 11.2x36 wheels
- ✔ Side sprayer,
- ✔ Ejector nozzles or non-standard nozzles available in our range
- ✔ PTO shaft,
- ✔ Foam marker.

7.2. Preparing the sprayer.

Preparing a trailed field sprayer for operation involves carrying out a general inspection and rectifying any faults that may have arisen during storage or transport of the sprayer. It is recommended to do this each time, and in particular before the first start-up:

- ➢ Check that there is no debris inside the tank and remove it if necessary,
- ➢ Check that all bolts, particularly those securing the wheel discs, the axle and the drawbar, are properly tightened – if any play is detected, tighten the bolts,
- ➢ Check the tyre pressure with a pressure gauge,
- ➢ adjust the tractor hitch position so that the sprayer, levelled using the support leg, has the hitch beam at the correct height,
- ➢ if driving on public roads is anticipated, attach a warning triangle in a visible position at the rear of the sprayer.

7.3. Hitch up a trailed field sprayer to a farm tractor using the lower links.

When attaching the sprayer to the tractor, carry out the following steps:

- remove the implement hitch from the lower links of the three-point linkage (3PL),

- drive the tractor close enough to the machine's frame,
- switch off the tractor engine, remove the key from the ignition and apply the handbrake,
- Fit the tractor's lower link rods (first the left one, then the right) onto the sprayer's 28 mm pins and secure them with standard pins;
- to prevent the sprayer from swaying sideways, tighten the side chains of the tractor's lower linkages,
- Fit the articulated telescopic shaft onto the sprayer's PTO end and the tractor's PTO end (tractor – outer tube, sprayer – inner tube), and attach the shaft guard chain to the PTO guard on both the machine and the tractor, Depending on the model and type of tractor to be used with the machine,

the length of the universal joint shaft must be adjusted accordingly. We offer universal joint shafts of various lengths, but in some cases the length this may prove to be non-standard. In In such a case, follow the procedure shown in Fig. 22. Connect the articulated telescopic shaft onto the sprayer's PTO end and the tractor's PTO end (tractor – outer tube, sprayer – inner tube), attach the shaft guard chain to the WPM guard on the machine and th the PTO shaft guard chain to the WPM guard on the machine and the tractor. The shaft must be adjusted so that the minimum overlap length of the shaft sections, when fully extended, is not less than 150 mm. And the minimum distance when retracted must be no less than 20 mm. Please note that if the shaft is cut, the length must be the same on both sides.

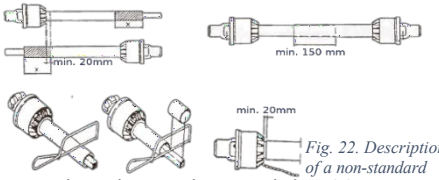


Fig. 22. Description of a non-standard shaft fit.

- raise the sprayer so that the frame (viewed from the side) is parallel to the ground,
- attach the safety cable preventing the sprayer from detaching from the tractor so that it does not interfere with the telescopic-telescopic boom and ensures the sprayer remains guided in the event of an emergency disconnection, connect the hydraulic hoses to the tractor's external hydraulic sockets (on a sprayer with hydraulic boom lift, on a sprayer with hydraulic boom extension boom field boom, in sprayers with hydraulic stabilisation field boom),
- connect the electrical cable to the lights and check that they are working,
- connect the Control Panel 2@ (if applicable Optional controllers: Control Panel 4@, Control Panel 7@ or the Alfa 100® computer, which are optional extras for the sprayer, should be installed in the tractor cab,
- attach the slow-moving vehicle warning sign,

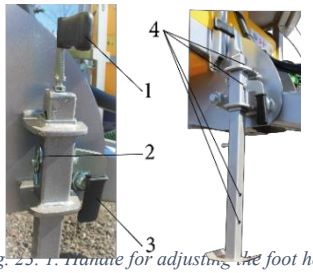


Fig. 23. 1. Handle for adjusting the foot height. 2. Safety pin. 3. Pin with handle. 4. Holes for adjusting the foot height.

- raise and secure the support to level the sprayer frame (Fig. 23).

7.4. Operating the sprayer.

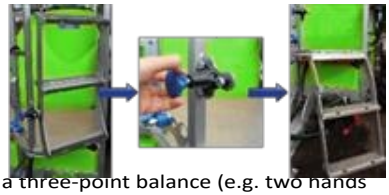
7.4.1. First start-up of the sprayer.

After coupling the field sprayer to the tractor, carry out a test run of the sprayer. To do this:

- ✔ extend the boom to the working position,
- ✔ remove the filters and nozzles to facilitate the removal of any mechanical debris from the hoses,
- ✔ fill the tank with approx. 600 litres of clean water,
- ✔ open the fluid supply to the spray nozzles on the boom,
- ✔ switch on the pump drive and run for approx. 1 minute.

After completing the flushing of the system , carry out a test of the operation and calibrate the sprayer. To do this, refit the nozzles and filters, open the system and then follow the steps below.

7.4.2. Sprayer operation.



Fill the main tank with clean water via the filler opening located at the top (Fig. 3, item 10). Access to the platform is via a folding ladder (Fig. 24), which is the main component of the sprayer equipment, which is attached to the field sprayer. You should Take particular care to ensure that you always maintain a three-point balance (e.g. two hands and one foot) when climbing the steps leading to the platform. During transport or working with a ladder must be **secured**. You may only stand on the platform whilst the sprayer is stationary. It is not permitted to carry people or unsecured objects on

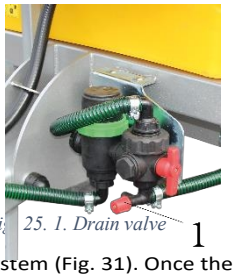


Fig. 25. 1. Drain valve

Please observe this when driving on public roads and whilst the sprayer is in operation. The tank is filled by connecting a hose fitted with a quick-connect coupling to a hydrant. Turn the three-way valve knob downwards (Fig. 30), then turn on the water supply. To fill the hand-washing tank or the clean water tank for flushing the system, turn the valve knob to the closed position (Fig. 30), unscrew the relevant tank, then to the tank insert the hose into additional tanks (Fig. 26.), Turn valve knob upwards to the washing tank position system (Fig. 31). Once the filling process is complete, turn the valve knob to the closed position (Fig. 31) and disconnect the hose from the hydrant. Hoses used to fill the tank must not be used for any other purpose. To

The drain located next to the three-way/four-way valve (Fig. 46) is used to empty the tank.

CAUTION: Do not discharge any residual liquid into open water or biological sewage treatment plants.

CAUTION: It is prohibited to calibrate the sprayer when it is filled with any liquid other than clean water.

1) Rules for adjusting the spray boom on a trailed sprayer. During transport, on "Borys" sprayers fitted with hydraulic boom folding, the knob must be turned to the "padlock" position to prevent the boom from opening accidentally whilst the sprayer is being transported.

Unfolding the field beam.

BRUNO – manually extended field boom.

The illustration shows the manual unfolding of a fifteen-metre-wide field boom. To release the arms field , , (Fig. 27, item 1), whilst at the ends of the spring-loaded safety devices are used, which release the end arms when a sufficient force is applied. The field beam is unlocked in the same way on the other side.

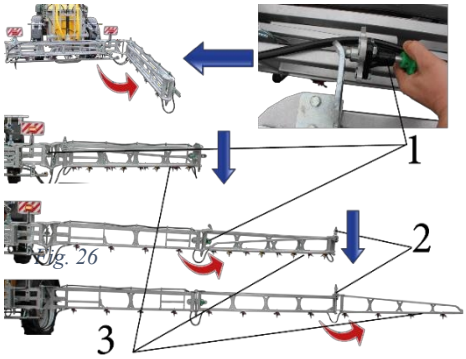


Fig. 26

Fig. 27. Manual opening of the 15-metre field boom on the 'Bruno' sprayer. 1. Latch lock. 2. Spring lock. 3. Handholds during

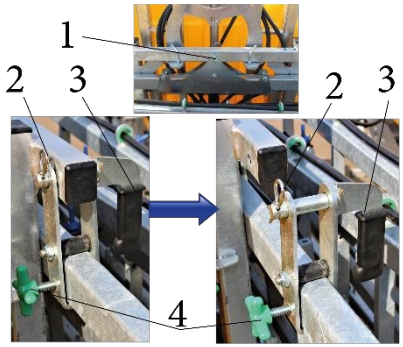


Fig. 28. Construction of the gravity stabilisation system for the boom. 1. Central pin. 2. . 3. Stabilisation lock handle. 4. Locking screw.

DANGER

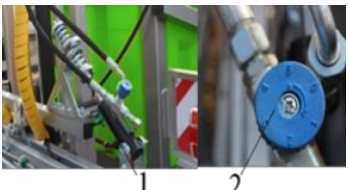
Take particular care when folding and unfolding the boom. Always position yourself in relation to the boom in such a way that there is no risk of being crushed by the boom against the machine.
Booms with gravity stabilisation must not be unfolded when the stabilisation is unlocked (Fig. 28).

2) Boom stabilisation.

A. BRUNO manually unfoldable sprayer.

- **Gravity stabilisation of the boom.**

The "Bruno" sprayer with a manually unfolded boom is fitted as standard with
Gravity stabilisation of the field beam. When transporting on public roads, the field beam stabilisation must be locked. To unlock the stabilisation, pull out the cotter pin (Fig. 28, item 2), then pull out the stabilisation locking pin using the handle (Fig. 28, item 3) and loosen the bolt (Fig. 28, item 4). The next step is to move the entire locking mechanism outwards, tighten the bolt (Fig. 28, item 4), insert the pin into the holes and secure it with a cotter pin. **Note:** Do not unfold the boom with the stabiliser when it is unlocked (Fig. 28).



The field boom is suspended on a steel cable connected to a hydraulic cylinder in the case of "BRUNO" sprayers, and its height is controlled by levers corresponding to inputs connected to tractor hydraulic lines sprayer's hydraulic lines connected to the tractor. The boom should be raised 50 cm above the surface being sprayed. To raise the boom to the correct height, first extend the boom sections.

Please note: Take particular care when lifting the boom.

3) Operating the control valve.

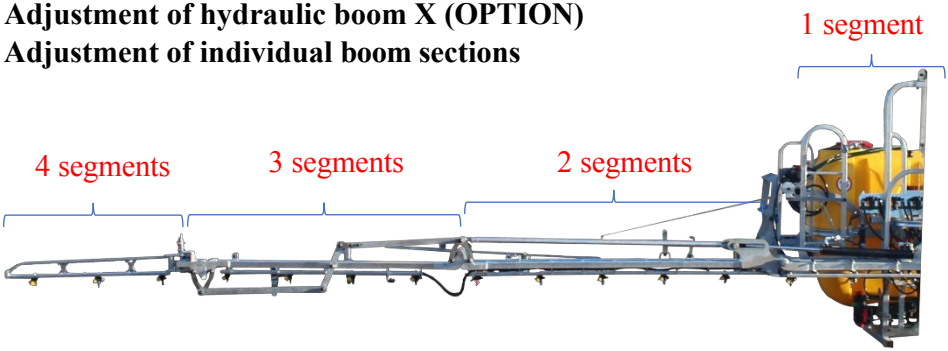
This valve allows you to select which tank the sprayer pump draws liquid from. A suction filter is directly connected to the control valve, providing additional protection against damage to the pump caused by any contaminants that may enter the sprayer's liquid circuit.

A. Three-way valve.

This valve is used in the "Bruno" field sprayer, which is not equipped with an optional side diluter. The arrow on the red valve knob indicates the direction of liquid intake by the pump. Operation of the valve is shown in Fig. 30.
The arrow on the three-way valve knob is set:

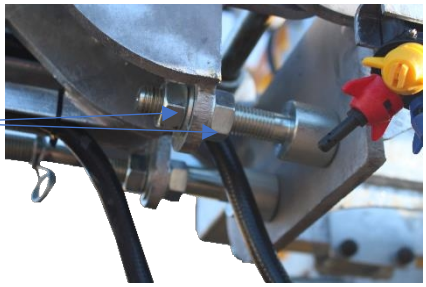
- upwards – draws water from the clean water tank to flush the sprayer system,
- to the left – fluid intake blocked, not possible.
- Down – fluid intake from the main tank.

Adjustment of hydraulic boom X (OPTION)
Adjustment of individual boom sections

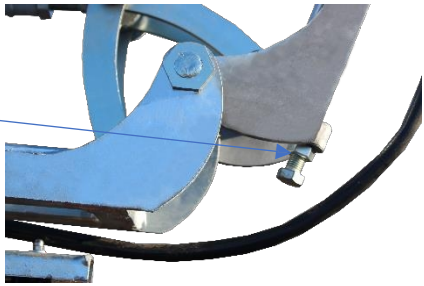


Although the boom has been factory-adjusted, its segments may need to be readjusted in the future. Adjustment is carried out on three segments on each side of the boom by tightening or loosening the levelling screws.

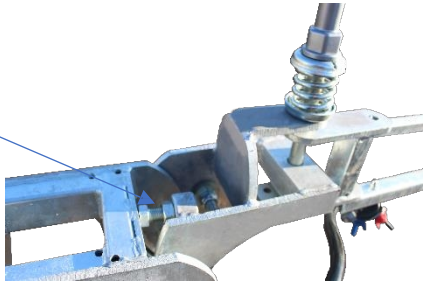
Adjustment of the 2nd segment of the boom



Adjustment of the 3rd segment of the boom



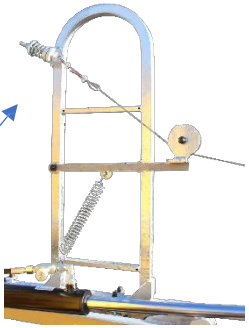
Adjustment of the 4th boom section



Adjustment of the smooth lance extension mechanism

The lance is fitted with a drop-dampening system. To adjust the damper, remove the cover and then tighten or loosen the screw on the damper.

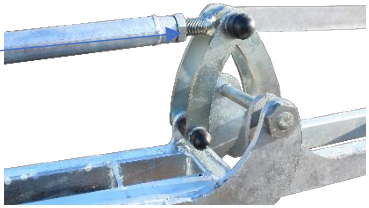
Adjusting the shock absorber



Adjustment of the lance scissor mechanism

The field lance is extended using actuators and a scissor mechanism, which allows the 3rd and 4th segments to be extended using a single actuator per side. This mechanism requires appropriate
adjustment by tightening the screws appropriately.

Adjustment 1



Adjustment 1.

Turn the screw to level the lance.

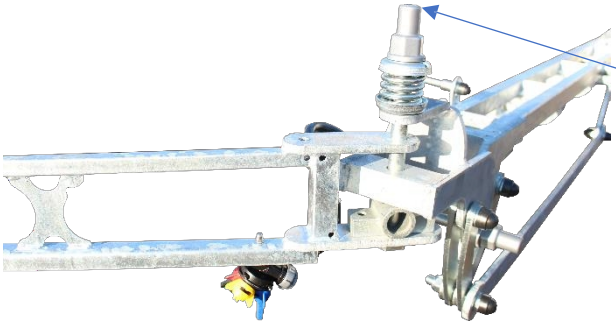
Adjustment 2

Adjustment 2.

Remove the screw covers, then adjust and move them to a position that allows the boom to unfold fully and freely.

Adjustment of the emergency folding force for the outer segments of the boom

When encountering an obstacle, the outer segments of the boom can fold inwards. This prevents damage to the boom in the event of a collision, for example with a pole or a tree. The sensitivity of this system is adjusted using a screw located under the cover, which is marked in the diagram.



Extending the hydraulic boom

To extend/retract, raise/lower or level the boom, select the appropriate option on the Hydro panel, then move the lever controlling the hydraulic pump on the tractor.

CAUTION!

When extending and retracting the boom, there is a risk of of cutting or crushing body parts. Exercise extreme caution.

CAUTION!

When extending or retracting the boom, ensure that there are no bystanders nearby who could be struck, cut or crushed.

Boom stabilisation

The boom is stabilised by two springs mounted beneath the boom, along with a tensioning mechanism that must be adjusted. A hydraulic cylinder is used to tilt the boom. To tilt the boom, activate the appropriate function on the HYDROPANEL.

Fig. 30. Operation of the three-way valve. 1. Knob.

B. Four-way valve. This valve is used in the "Bruno", which is equipped with an optional side diluter. The arrow drawn on the red valve knob indicates the direction of flow fluid through the pump. The valve operation is shown in Fig. 31.

Four-way valve arrow set:

- upwards – intake from the clean water tank for flushing the sprayer system,
- to the left – fluid intake from the side diluter.
- Down – liquid intake from the main tank.

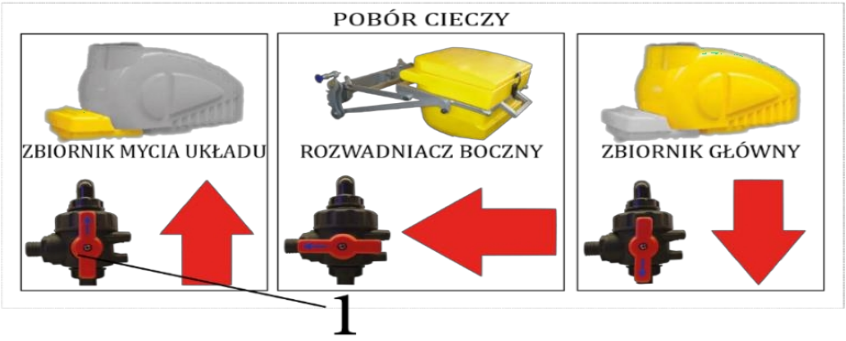


Fig. 31. Operation of the four-way valve. 1. Knob.

4) Calibration of sprayer nozzle pressure.

Use clean water for calibration!

Set the three-way valve to the 'down' position (Fig. 30), which allows fluid to be drawn from the main tank. The fluid flowing through the suction filter (Fig. 52, item 9) and the Tolveri® PU-3/140 pump will reach the control manifold (Fig. 52, Item 2). Use the regulator knob (Fig. 52, Item 20) to adjust the appropriate pressure of the fluid supplied to the control manifold by the pump. Check the pressure reading on the pressure gauge built into the Control Panel 2®.

*Fig. SEQ Figure * ARABIC 32. Setting the three-way valve to the liquid intake position*

Remember: The pressure set using the green regulator knob (Fig. 52, item 20) is the maximum that can be achieved when subsequently controlling the Control Panel 2® from the tractor cab. We therefore recommend setting the highest pressure that will be required when operating the sprayer.

The next step is **to calibrate the valve pressure Fermo 5 manifold**. Activate all valve sections by moving the lever (Fig. 52, point 22) upwards. Water will begin to flow from the nozzles corresponding to the sections located at the far left of the boom. Then, using the green compensation valve (Fig. 52, item 21), which is located directly below the lever for the relevant section, set the appropriate pressure. This pressure may correspond to the pressure set on the main regulator (Fig. 49, item 20) or be lower, depending on the user's preference. After setting the pressure, ensure that liquid flows evenly from all nozzles.

4) Manifold control.

The sprayer's manifold is located on its left-hand side, thanks to which
Its location ensures convenient and safe access. It is fitted with levers that allow the operator to activate various sprayer functions, such as:

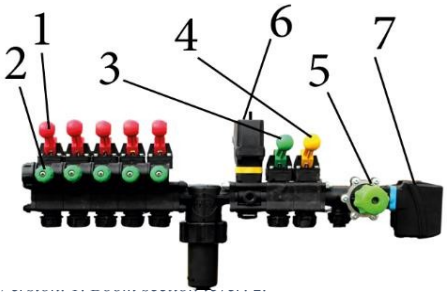
- switching sprayer sections on/off, switching the washing system on/off,
- switching the diluter and the optional side diluter for solid fertilisers on/off,

- washing the main tank with a nozzle located inside the main tank,

and knobs, which are used to:

- adjust the pressure supplied to the manifold,
- calibrate individual sprayer sections.

In the basic version, the manifold is equipped with two solenoid valves, which allow the manifold to be controlled from the Control Panel 2®, which is also included in the standard equipment. Thanks to this solution, we can switch all sections on/off simultaneously and adjust the pressure from the tractor cab.



Pressure calibration knob. 3. dilution tank. 4. Lever for cleaning the main tank. 5. Main pressure control valve. 6. Pressure control solenoid valve. 7. On/off solenoid valve.

Fig. 34. Manifold fitted with additional solenoid valves enabling the activation/deactivation of individual sprayer sections together with the Control Panel 7®.

5) Wheel track adjustment.

The sprayer's design allows the wheel track to be adjusted within a range of 150–180 cm. This enables the machine's wheel track to be adapted to the tractor's wheel track and the tramlines in the fields.

To achieve the desired wheel track width of the sprayer, you should:

- ✔ connect the sprayer to tractor andsecure the tractor against rolling away by placing chocks under the wheels,
- ✔ with the a jack , lift the sprayer's axle,
- ✔ secure the sprayer with fixed supports to prevent it from tipping over,
- ✔ loosen the securing the mudguards (Fig. 46, point 3),
- ✔ move the mudguards apart to the required width,
- ✔ loosen the bolts on the axle mounting brackets,
- ✔ spread the wheels to the required width,
- ✔ tighten the bolts securing the axle half-shaft brackets,
- ✔ tighten the mudguard bolts.

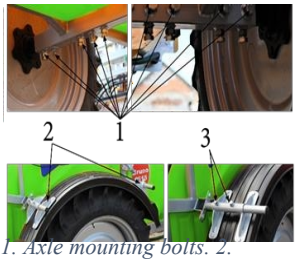


Fig. 35. 1. Axle mounting bolts. 2. Mudguard mounting brackets. 3. Mudguard mounting bolts

6) Wheel alignment.

To proceed with wheel calibration:

- In the calibration settings menu, select WHEEL CALIBRATION and press the OK button
- During the first calibration, reset the value using the button, then drive a straight distance of 100m;
- The value displayed is the number of pulses from the inductive sensor per 100 metres; press the button to save the value
- This value can be entered manually using the buttons

If the computer is reset, or if the wheels are changed, you must access the Configuration settings. To do this, press the OK and ESC buttons simultaneously and hold them down for a few seconds. Then select the Wheel Calibration programme and confirm. Proceed as described above.

Fig. 36. Wheel calibration sensor

CONTROLLERS.

To control the distributor from the tractor cab, we use specially designed Meyer/Tolmet controllers. We offer three types of controllers and the advanced

Alfa 100 computer, which allow us to manage the individual functions of the distributor.

Fig. 37. Basic Control Panel 2 controller. Functions: On/Off, pressure adjustment.

Fig. 38. Optional Control Panel 4 controller. Functions: On/Off, pressure adjustment, switch extreme sections on/off.

Fig. 39. Optional Control Panel 7 controller. Functions: On/Off, pressure adjustment, switch each section on/off individually.

CONTROL OF THE HYDRAULICALLY EXTENDABLE BOOM

The field boom is controlled from the tractor cab using the Hydro Panel. Use the rotary knob to select the desired function, then activate it using the hydraulic lever in the tractor cab. An LED indicates the selected field boom function

.

1. No function; 2. Extending/retracting the left boom; 3. Extending/retracting the right boom;
4. Extending/retracting both booms; 5. Adjusting the height of the spray boom; 6. Levelling.

7) Operating the solid fertiliser spreader.

Fill the main tank with running water, checking the level using the red ball on the gauge located on the right-hand side of the tank (Fig. 40). When the water reaches the desired level, turn off the water supply. Next, pour the appropriate amount of solid fertiliser into the sieve located in the inlet opening (the larger-diameter opening fitted with a dilution nozzle) in the

Fig. 40. Main tank water gauge

. Then, screw the lid on tightly. To dilute the fertiliser, use the yellow lever located on the control manifold (Fig. 47, item 18). The liquid flowing out through the nozzle will dilute

supply levers

Solid fertiliser is fed into the sieve. This process should take a few minutes, and the duration depends on the composition of the chemicals being diluted. Once the operation is complete , you should switch off all levers.

NOTE: Check that the solid fertiliser has been thoroughly dissolved by the diluter and that there are no residues in the sieve. Incomplete dissolution will affect the proportions of the working solution.

8) Operation of the side/auxiliary solid fertiliser diluter.

The side diluter is available as an optional extra for the sprayer. It makes the job easier as it allows you to add chemicals from ground level without having to climb onto the sprayer platform. To open the diluter cover, release the cover latch. Add the measured quantity of fertiliser or plant protection products to it. Next, use the blue lever (Fig. 43) to fill the side diluter with liquid from the main tank. Engage the red lever (Fig. 43) so that the agitator mixes the water with the fertiliser. If using solid fertilisers, wait until they have dissolved. Then turn the four-way valve (Fig. 31) to the left. In this position, the pump draws liquid from the side diluter. To clean the bottle after using chemicals, place it over the nozzle located in the centre of the side diluter and then use the silver lever (Fig. 43). Do not fill the side diluter with too much chemical. If a large dose of the chemical is to be applied, this process

The operation should be broken down into the appropriate number of stages. Once the operation is complete, all levers must be released.

9) Pump operation.

The Bruno trailed field sprayer is equipped a PU-3/140 diaphragm pump.

Fig. 42. Dilution tank

Initial start-up.

You must check and and, if necessary, adjust the following:

✔ The oil level in the running pump should be set centrally between the min and max marks. Top up with LUX 10 oil if necessary.

✔ Air pressure in the air regulator using e.g. car tyre pressure gauge. The correct pressure should be 1/3 of the pump's operating pressure but no more than 1.5 bar.

✔ Connection of the pump to the power take-off shaft. Is the connection correct and secure? Is the shaft properly protected by guards?

Once the above checks have been carried out, the pump can be started at a maximum speed of 540 rpm. During start-up, the pump must not be under pressure, and the outlet pipes must be closed to remove all air from the system. After a few seconds, the pressure may be increased to the desired value, taking care not to exceed the maximum pressure of 1.5 bar. During longer periods of inactivity (e.g. winter breaks), the interior of the pump should be flushed using clean water or antifreeze, then the suction hose should be removed and the pump run for a few seconds (15–20) to remove any water from the interior.

The oil should be changed every 500 operating hours or every 3 years.

Remember to check the oil level and the air pressure in the air chamber regularly.

Fig. 44. Tolveri PU-3/140 pump. 1. Discharge connection. 2. Suction connection. 3. Oil filler with level indicator. 4. Air tank vent. Correct pressure: 1/3 of the pump's working pressure – no more than 105 bar.

10) Operation of sprayers.

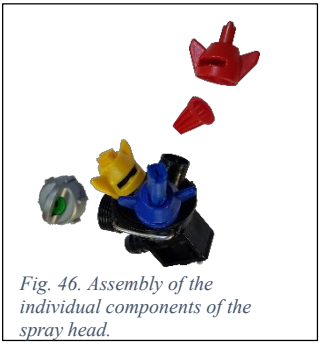


Fig. 46. Assembly of the individual components of the spray head.

No additional tools are required to service the spray heads or individual nozzles, as all components are fitted using caps or nuts that can be unscrewed by hand. One task that may be necessary during the use of the sprayer is cleaning the strainers located in the fittings. To clean the strainers, unscrew the cap and remove the strainer. The assembly sequence for the individual components is shown in the photograph

Fig. 45. Assembly sequence of the individual nozzle components and the valve.

above.

11) Operation of the suction filter.

The filter inside contains a reusable filter cartridge. To clean the filter, there is no need to ensure that the sprayer tank is empty of working fluid, as the filter is fitted with a shut-off valve. To shut off the flow, turn the shut-off valve in the direction indicated on the knob, then use a spanner to unscrew the green nut and remove the filter cover. To remove the cartridge, pull it out as it is a push-fit design.

The next step is to clean the filter cartridge and reassemble the unit in reverse order. The filter also has a drain valve for the working fluid; to use it, unscrew the red knob at the bottom of the filter. To close the drain, simply screw the knob back on.

Fig. 48. Suction filter

12) Maintenance of the in-line filter.

In-line filters prevent the nozzles from becoming blocked. Before each use of the sprayer, clean the in-line filter screen by washing it in clean water or blowing it out with compressed air. To do this, unscrew the filter housing, then remove the screen, clean it, reinsert it into the housing and screw the housing back onto the body.

Fig. 49. In-line filter 1. In-line filter body. 2. 45° elbow. 3. In-line filter screen. 4. Filter housing

13) Maintenance of the manifold filter.

Fig. 50. Manifold filter

The distributor filter is responsible for cleaning the fluid that is fed to the agitators located at the rear of the main tank. At the distributor filter, unscrew the supply hose, then use a spanner to unscrew the black nut. To remove the cartridge

, pull it out as it is press-fitted. The next step is to clean the filter cartridge and reassemble the unit in reverse order. The final step is to reconnect the agitator supply hose.

14) Swivel coupling.

Two tapered roller bearings are mounted on the swivel coupling, which are secured from below with a bolt. The swivel coupling pin must be tightened; if the play is not checked and removed, it will cause permanent damage to the entire coupling. For sprayers with a capacity of 1200 l, 1500 l and 2000 l, 30307 A bearings are used, whilst for sprayers with a capacity of 2500 l and 3000 l, 30309 A bearings are used

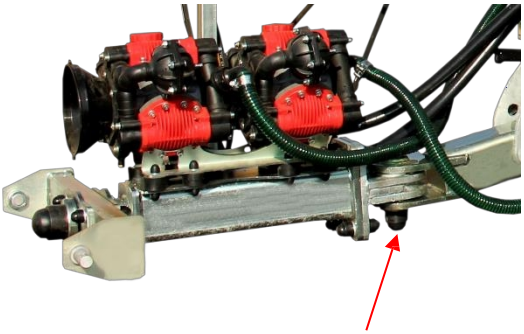
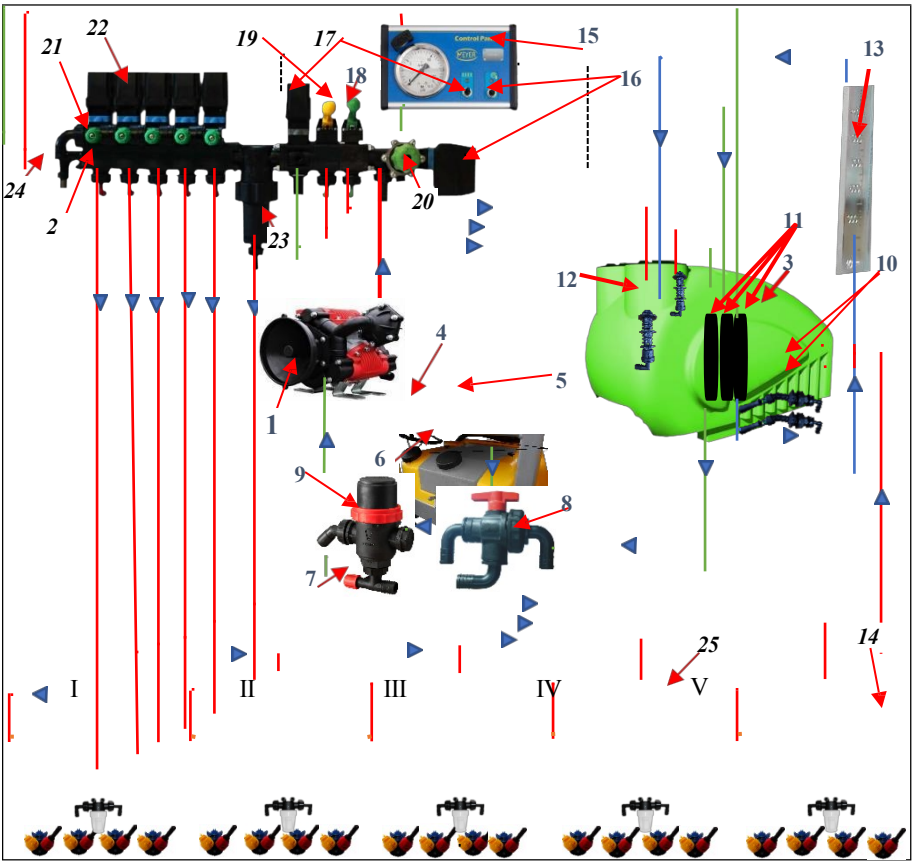


Fig. 51. Hitch pin

7.4.3. The sprayer's fluid system.

❖ **The liquid circulation system in the basic version of the sprayer**



SECTIONS OF THE FIELD BEAM

KEY

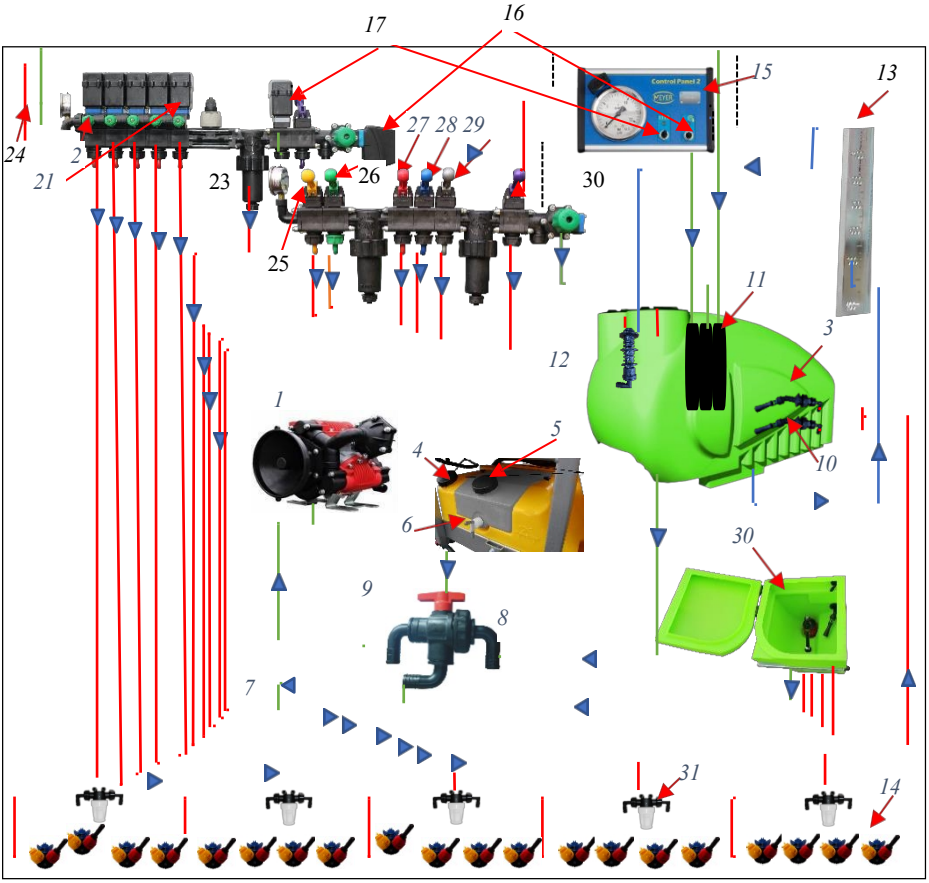
High-pressure hydraulic hoses (max 15 bar)

Hydraulic hoses for the water level gauge in the main tank

Hydraulic hoses, fluid return

Fig. 52. *Tolveri® PU-3/140 pump. 2. Control manifold. 3. Main tank. 4. Tank for system flushing . 5. Hand-washing water tank. 6. ON/OFF tap for the hand-washing tank. 7. Drain valve. 8. Three-way valve for controlling the suction of fluid from individual tanks. 9. Suction filter. 10. Anti-foaming hydraulic agitators. 11. Hydraulic hoses preventing foaming of the working fluid circulating in the system. 12. Solid fertiliser diluter. 13. Water level gauge in the main tank. 14. Rotating head with spray nozzles. 15. Control Panel 2®. 16. On/off solenoid valve controlled via Control Panel 2®. 17. Solenoid valve for controlling sprayer pressure via Control Panel 2®. 18. Diluter lever. 19. Main tank wash lever. 20. Pressure regulator for the control manifold. 21. Section pressure compensation valve. 22. On/off solenoid valves for individual sections. 23. Pressure filter. 24. Pressure gauge hose*

- **Fluid circulation system of a sprayer equipped with an optional side diluter.**



BOOM SECTIONS

KEY

- High-pressure hydraulic hoses (max 15 bar)
- return
- main tank water level gauge hydraulic hoses Hydraulic hoses, liquid
- Electrical cables. Control Panel 2 Solenoid valves

Fig. 53. 1. Tolveri® PU-3/140 pump. 2. Control manifold. 3. Main tank. 4. System flushing water tank. 5. Water tank for hand washing. 6. ON/OFF tap for the hand-washing tank. 7. Drain valve. 8. Three-way valve for controlling the suction of fluid from individual tanks. 9. Suction filter. 10. Anti-foaming hydraulic agitators. 11. Hydraulic hoses preventing foaming of the working fluid circulating in the system. 12. Solid fertiliser diluter. 13. Water level gauge in the main tank. 14. Rotating head with spray nozzles. 15. Control Panel 2®. 16. On/off solenoid valve controlled via Control Panel 2®. 17. Solenoid valve for controlling sprayer pressure via Control Panel 2®. 18. Diluter lever. 19. Main tank cleaning lever. 20. Pressure regulator for the control manifold.
21. Section pressure relief valve. 22. Solenoid valves for switching individual sections on/off. 23. Pressure filter. 24. Pressure gauge hose connected to the Control Panel 2®. 25. Side diluter lever for mixing fertilisers. 26. Lever for filling the side diluter. 27. Lever for the side diluter for washing bottles. 28. Side diluter. 29. In-line filter.

❖ Fluid circuit of a sprayer equipped with a tandem pump

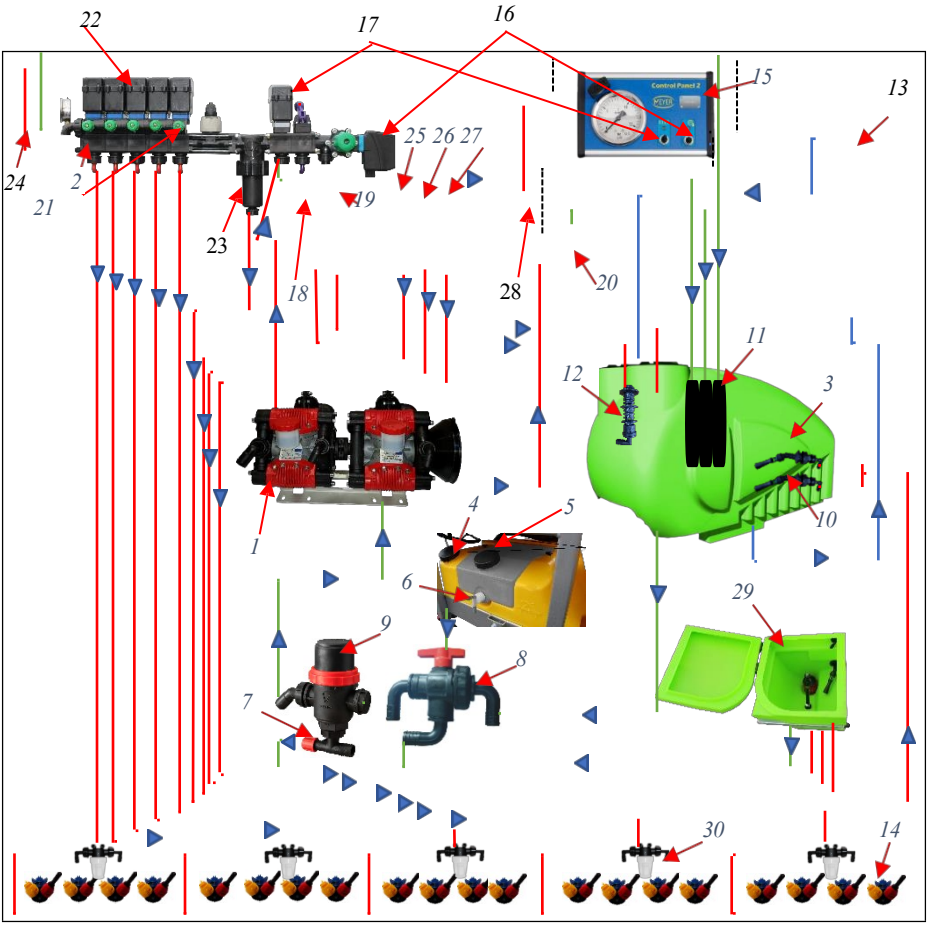


Fig. 54. 1. Tandem Tolveri® PU-3/140 pump. 2. Control manifold. 3. Main tank. 4. Tank for system flushing water. 5. Water tank for hand washing. 6. ON/OFF tap for the hand-washing tank. 7. Drain valve. 8. Three-way valve for controlling the suction of fluid from individual tanks. 9. Suction filter. 10. Anti-foaming hydraulic agitators. 11. Hydraulic hoses preventing foaming of the working fluid circulating in the system. 12. Solid fertiliser diluter. 13. Water level gauge in the main tank. 14. Rotating head with spray nozzles. 15. Control Panel 2®. 16. On/off solenoid valve controlled via Control Panel 2®. 17. Solenoid valve for controlling sprayer pressure via Control Panel 2®. 18. Screen diluter lever. 19. Main tank cleaning lever. 20. Pressure regulator for the control manifold. 21. Section pressure compensation valve. 22. Section solenoid valves. 23. Pressure filter. 24. Pressure gauge hose connected to Control Panel 2®. 25. Agitator lever. 26. Lever for filling the side diluter. 27. Lever for the side diluter from the bottle washing unit. 28. Feed lever for the side diluter. 29. Side diluter. 30. In-line filter

7.5. Performing and setting the required spray rate.

1) Setting the spray rate.

When adjusting the sprayer, the first step is to select the type of nozzles. We typically use the following nozzles: KR5 04, EŻ 03, RS 02 (Fig. 20). The desired spray rate per hectare can be achieved by adjusting three parameters:

- the size of the nozzles used,
- changes in driving speed,
- the pressure of the liquid supplied to the nozzles.

2) Selection of nozzles according to the type of spraying.

Recommendations regarding the selection and parameters of nozzles are provided on the packaging of plant protection products. If there is no information regarding the type of recommended nozzles, please refer to the general recommendations provided below.

Type of treatment	Type of spraying	Type of nozzle	Type of droplets produced	Notes
Herbicide (soil-applied) sprays and mineral fertilisers	Soil-applied preparations	Sprayers producing a flow rate flow rate of 1.5 l at a pressure of 3 bar	Large droplets	Even distribution of the product across the entire soil surface
Foliar spraying	Foliar products	Spray nozzles providing a flow rate flow rate of 1.0 l at a pressure of 3 bar	Small droplets that do not run off the leaves	Even distribution of the product across the entire leaf surface
Insecticide sprays	Insecticides	Sprayers with a flow rate flow rate below 1.0 l at at a pressure of 3 bar	Small droplets	Prevents the accumulation of of spray on the leaves
Fungicide spraying	Fungicides	Swirl nozzles	Small droplets	Working fluid reaching under the leaves

To select the correct driving speed, pressure and spray rate, please refer to the table below:

Solution colour according to ISO	Pressure [bar]	Nozzle flow rate [l/min]	Amount of spray liquid [l/ha] at a 50 cm between nozzles for different speeds [km/h]							
			4.0	5.0	6.0	7.0	8.0	9.0	10	12
Yellow	2.0	0.65	195	156	130	111	98	87	78	65
	2.5	0.72	216	173	144	123	108	96	86	72
	3.0	0.79	237	190	158	135	119	105	95	79
	3.5	0.85	255	204	170	146	128	113	102	85
	4.0	0.91	273	218	182	156	137	121	109	91
Blue	2.0	0.96	288	230	192	165	144	128	115	96
	2.5	1.08	324	259	216	185	162	144	130	108
	3.0	1.18	354	283	236	202	177	157	142	118

	3.5 4.0	1.27 1.36	381 408	305 326	254 272	218 233	191 204	169 181	152 163	127 136
Nozzle RSM Flange 1	2.0	0.62	186	155	124	108	93	83	74	62
	3.0	0.80	240	200	160	140	120	108	96	80
	4.0	0.95	285	237	190	166	142	128	114	95
	5.0	1.06	318	265	212	185	159	143	127	106

Example: if the instructions for the product used in the agricultural treatment specify that a yellow nozzle should be used and the amount of liquid applied per hectare should be approximately 200 litres per hectare, the working pressure should be set to 3.0 bar and the driving speed maintained at 5 km/h. With these settings, 190 litres of liquid will be used per hectare. You can also set the pressure to 3.5 bar, in which case 204 litres of liquid will be used per hectare; however, you must take headlands into account where passes overlap. An example is shown in the table below:

02	80	2	BG	0,65	156	130	111	98	87	78	65	56	49	43	39
		2,5	G	0,73	175	146	125	110	97	88	73	63	55	49	44
		3	G	0,80	192	160	137	120	107	96	80	69	60	53	48
		3,5	G	0,86	206	172	147	129	115	103	86	74	65	57	52
		4	Ś	0,92	221	184	158	138	123	110	92	79	69	61	55
		4,5	Ś	0,98	235	196	168	147	131	118	98	84	74	65	59
		5	Ś	1,03	247	206	177	155	137	124	103	88	77	69	62
		6	Ś	1,13	271	226	194	170	151	136	113	97	85	75	68
03	50	2	BG	0,97	233	194	166	146	129	116	97	83	73	65	58
		2,5	BG	1,08	259	216	185	162	144	130	108	93	81	72	65
		3	G	1,19	286	238	204	179	159	143	119	102	89	79	71
		3,5	G	1,28	307	256	219	192	171	154	128	110	96	85	77
		4	Ś	1,37	329	274	235	206	183	164	137	117	103	91	82
		4,5	Ś	1,46	350	292	250	219	195	175	146	125	110	97	88
		5	Ś	1,53	367	306	262	230	204	184	153	131	115	102	92
		6	Ś	1,68	403	336	288	252	224	202	168	144	126	112	101
04	50	2	BG	1,29	310	258	221	194	172	155	129	111	97	86	77
		2,5	BG	1,44	346	288	247	216	192	173	144	123	108	96	86
		3	G	1,58	379	316	271	237	211	190	158	135	119	105	95
		3,5	G	1,71	410	342	293	257	228	205	171	147	128	114	103
		4	Ś	1,82	437	364	312	276	243	218	182	156	137	121	109
		4,5	Ś	1,94	466	388	333	291	259	233	194	166	146	129	116
		5	Ś	2,04	490	408	350	306	272	245	204	175	153	136	122
		6	Ś	2,23	535	446	382	335	297	268	223	191	167	149	134

3) Sprayer calibration.

Determining the working speed

If it is not possible to read the driving speed on a farm tractor, use the formula provided. To use the formula and calculate the working speed, fill the sprayer tank halfway with water, mark out a 100-metre stretch and drive along it at a constant engine speed whilst measuring the time.

$$Prędkość jazdy\ [\frac{km}{h}] = \frac{100[m]}{czas[s]} \times 3.6$$

Selection of nozzle and pressure

To select the correct nozzle and operating pressure, use the nozzle selection tables discussed earlier.

Flow rate measurement

To determine the flow rate, fill the sprayer tank, mark the liquid level and set the pressure for the required application rate. The next step is to switch on the sprayer pump for one minute. Once this time has elapsed, you should

switch off the pump drive immediately and top up the missing amount of water (measuring it) to the level prior to switching on the drive. With this data, use the formula:

$$Q = \frac{600 \times q_c}{b \times v}$$

You can also carry out a simplified test by measuring the amount of liquid from a single nozzle in one minute, using, for example, a measuring cylinder. In this case, the formula is as follows:

$$Q = \frac{600 \times q \times n}{b \times v}$$

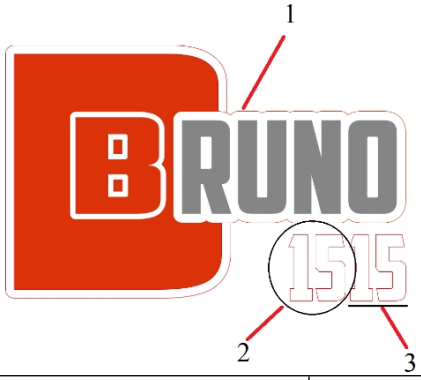
where
:
Q – liquid application rate per hectare [l/ha],
qc – volume of water sprayed in one minute [l],
q – amount of water sprayed in one minute by a single nozzle [l], n – number of nozzles,
b – working width of the sprayer [m], v – driving speed [km/h].

The calculated rate should equal the rate recommended for the agricultural treatment; however, if the rate is lower than required, the working pressure should be increased, or reduced if the rate is too high. After changing the pressure, the test should be repeated until the recommended rate matches the calculations.

If adjustment by means of pressure proves insufficient, change the driving speed or the type of nozzle used.

8. Technical specifications of the sprayer.

7.1. “Bruno” sprayer – manually folding boom.



BRUNO 1200 series		Bruno 1212	Bruno 1214	Bruno 1215	Bruno 1216	Bruno 1218
Net weight of sprayer [kg]		900	950	950	980	1100
Dimensions of the folded sprayer [mm]	Length	3000	3000	3000	3000	3000
	Width	2850	2850	2850	2850	2850
	Height	2500	2500	*2500*	2500	2500

BRUNO 1500 series		Bruno 1512	Bruno 1514	Bruno 1515	Bruno 1516	Bruno 1518
Net weight of sprayer [kg]		1500	1550	1550	1580	1600
Dimensions of the folded sprayer [mm]	Length	4000	4000	4000	4000	4000
	Width	2850	2850	2850	2850	2850
	Height	2500	2500	*2500*	2500	2500

BRUNO 2000 series	Bruno 2012	Bruno 2014	Bruno 2015	Bruno 2016	Bruno 2018
Net weight of sprayer [kg]	1800	1850	1850	1880	1900

Dimensions of the folded sprayer [mm]	**Length**	4000	4000	4000	4000	4000
	Width	2850	2850	2850	2850	2850
	Height	2500	2500	*2500*	2500	2500

7.2. Specifications of the PU-3/140 diaphragm pump

Specification	**Unit**	**PU-3/140 pump**
Symbol		
Type	Diaphragm	
Overall dimensions of the pump		
Length	mm	420
Width	mm	420
Height	mm	310
Features		
Flow rate	l/min	134
Maximum pressure	MPa	15
Direction of rotation		any
Rotational rotational	rpm	540
Oil capacity	l	1.1
Oil grade	-	LUX 10
Weight	kg	15.8

7.3. Field beam characteristics

A. Specifications of the manually unfoldable boom used in **'BRUNO'** trailed field sprayers**.**

	Unit	**Field boom width**				
Working Working	m	12	14	15	16	18

Width of section	mm	2350–2240-2560-2240-2350	1355-1954-1830-2560–1830–1954–1355	1855-1954-1830-2560-1830–1954–1855	2355-1954–1830-2560-1830-1954-2355	821-1630-2335-2352-2560-2352-2335-1630-821
Nozzle spacing	mm	500				
Height adjustment range	mm	500–1250	500–1600	500–1600	500–1600	500–1600
Lifting mechanism and	Hydraulic					

8. Delivery and loading onto transport vehicles.

The sprayer is delivered to the user in a partially dismantled state. The extent of dismantling depends on the means of transport used. When loading and unloading, use the frame components as attachment points.

9. Storage.

Before storing the machine for an extended period, clean it and rectify any faults found. Protect it from the elements. Store the sprayer on a level, hard surface. During the winter,

- remove the working fluid from the pump to prevent damage.
- removing chemical residues from the walls and water from the cavities of all components,
- check all components and systems for leaks and rectify any sources of leakage,
- inspect all metal parts and remove any corrosion,
- check that all components are functioning correctly,
- lubricate moving parts,
- protecting the entire unit against the harmful effects of weather conditions.

10. Dismantling and scrapping.

The sprayer is constructed from materials that do not pose a threat to the environment. At the end of its service life, when further use is no longer justified, the sprayer must be dismantled. Due to the heavy weight of the components, lifting equipment such as a crane or forklift must be used during dismantling. Metal parts should be taken to a scrap yard, whilst rubber and plastic parts should be sent for disposal or to a waste storage facility for this type of

. Used oil from the hydraulic system must be collected in sealed containers and handed over to petrol stations that collect it.

11. Possible faults.

The quality of cultivation under specific conditions depends on the speed, the condition of the working parts and the correct settings. If any irregularities are detected, check the condition of the working parts and adjust the settings to achieve a satisfactory cultivation result. Any malfunctions may adversely affect the sprayer's performance, increase the cost of the operation, and lead to damage to both the sprayer and the tractor.

WARNING!

Operating a faulty or incorrectly adjusted implement may pose serious risks to the operator and bystanders. Any faults or damage detected must be rectified immediately.

The most common faults, their causes and how to rectify them are described in the table below.

Fault, malfunction	Possible cause	Remedy
The pump is not drawing in	Clogged suction hose	Clean the hose
	No liquid in the tank	Fill the tank
	Leaky suction hose	Repair the leak
	Filter malfunction	Check the cleanliness and settings of the filter
Pump capacity too low	Stuck or damaged pump valves	Replace or clean the valves
Strong vibration of the pressure gauge needle	Insufficient pressure in the air tank	Increase the air pressure in the air tank
	Air in the system	Check connections and hoses for leaks
	Damaged diaphragm	Replace the diaphragm
A mixture of oil and water is leaking from the filling the pump or drops of oil in the reservoir	Damaged diaphragm	Replace the diaphragm
No fluid flow to the spray nozzles when the and control valve	Damaged or incorrectly fitted valves in the pump	Check or replace the valves in the pump
	Contaminated suction or discharge filter	Clean the filters
	A leak between the pump and the tank	Repair the leak
	Clogged discharge filter	Clean the discharge filter
The pressure on the pressure gauge drops and it is	Damaged pressure hose	Replace the hose

impossible to set it to the operating pressure	Inappropriate or worn nozzles	Replace the nozzles
Uneven flow of working fluid from the nozzle	Incorrect pressure in the air regulator	Check and top up the pressure in the air tank
	Low oil level in the pump	Check and top up the oil in the pump if necessary
	Pump speed too high	Check the pump speed
Uneven or excessive tyre wear	Incorrect tyre pressure	Check the tyre pressure and adjust to the recommended
Noisy pump operation	Low oil level in the pump	Check and top up the oil if necessary
	Pump speed too high	Check the speed; the maximum speed is 550 rpm.

12. Warranty terms and warranty services.

Detailed information on the warranty conditions for agricultural equipment is contained in the Civil Code, Part III, Warranties, Articles 577–581. This information should be available at all agricultural equipment sales outlets and at all repair centres for such equipment. The providers of warranty services are: (seller/dealer) – entered on the warranty card at the time of sale.

13. Warranty procedures

The term 'user' refers to a natural or legal person purchasing agricultural equipment; the term 'seller' refers to a commercial entity bound by a sales and service agreement which supplies the equipment to the user; and the term 'manufacturer' refers to the producer of agricultural equipment. Upon handing over the machine/equipment for use, the manufacturer provides a warranty in accordance with the following terms:

1. The manufacturer warrants that the product is free from defects in materials or workmanship.
2. Warranty services are provided by the manufacturer or a dealer authorised to provide maintenance services.
3. Under the warranty, the manufacturer or a dealer authorised to provide maintenance services undertakes, in the event that a claim is upheld, to:

- repair the equipment subject to the complaint free of charge, including the replacement of parts,
- to supply the user, free of charge, with new, correctly manufactured parts,
- replace the equipment with a new one if, on the basis of a report by an authorised expert, it is determined that repair is not possible.

4. The warranty is valid for a period of 24 months, starting from the date of sale confirmed by the seller with a stamp and an entry in the warranty card.
5. The warranty is extended for the duration of the equipment repair.
6. The manufacturer or a dealer authorised to provide servicing shall carry out warranty repairs within 14 days of the date the machine is delivered for repair.
7. In the case of complex repairs, this period may be extended, subject to prior agreement with the user.

8. The user should submit a complaint immediately upon discovering a fault or damage.
9. A correctly completed warranty card is required to make a complaint. The warranty card is invalid without dates, signatures and the point of sale's stamp.
10. The user must submit the complaint to the seller in writing or by telephone, providing the following details:
- where the machine was purchased (name of the point of sale),
- the date of sale,
- year of manufacture of the machine,
- the machine's serial number,
- your address/contact telephone number,
- who carried out the initial start-up,
- the nature of the fault or damage.

11. The warranty does not cover:
- damage caused by unforeseeable events, unless it resulted from defects inherent in the product,
- damage caused by accidents or their consequences,
- damage resulting from improper storage, use contrary to the intended purpose, inadequate maintenance of mechanisms (lubrication) and other causes not attributable to the manufacturer. Such damage may only be repaired at the user's expense.

12. Parts damaged mechanically and working parts subject to natural wear and tear, i.e. fluids, lubricants and bulbs, are not covered by the warranty. The replacement of damaged parts is at the user's expense.
13. The warranty does not cover damage to the hydraulic system resulting from contamination of the hydraulic oil. The oil cleanliness class in the tractor's power hydraulic circuit must meet the 20/18/15 requirement in accordance with ISO 4406-1996
14. For parts not manufactured by us, the warranty is passed on by us to their manufacturer.
15. The warranty is void if the user makes any technical modifications, uses the machine for purposes other than those for which it is intended, or operates the machine in a manner that significantly deviates from the instructions.
16. The purchase of equipment covered by this warranty constitutes acceptance of the above warranty terms.

14. How to order spare parts.

Spare parts for the trailed field sprayer can be ordered via the website, by telephone or by post, providing:

1. The customer's exact address.
2. The name, model and serial number of the machine, and year of manufacture.
3. The exact name of the part.
4. Quantity.
5. Terms of payment.

Parts are dispatched via courier, or the customer may collect them in person from the manufacturer or from the nearest TOLMET representative.

WARRANTY CERTIFICATE

Trailed field sprayer

Model BRUNO -_____

Serial number-_____

Date of manufacture-_____

_____ _____

Date of sale, seller's signature Seller's stamp

Warranty service is provided on behalf of the manufacturer by:

_____

to be completed by the seller

TOLMET reserves the right to make design changes without prior notice and without assuming any liability. Unauthorised modifications to the sprayer's design may invalidate the warranty. During the operational period, only TOLMET-manufactured parts should be used.

15. Service.

No.	Date of report	Date of fault rectification	Description of work carried out and parts replaced	Signature

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