TOLMET

OPERATING INSTRUCTIONS

Trailed field sprayer

BORYS

WARRANTY CARD

PRODUCTION, SERVICE AND TRADE COMPANY

TOLMET

Piotr Wawrzyniak

ul. Dworcowa 3, 99-140 Świnice Warckie

tel./fax (63) 288 10 18

www.tolmet.pl

issue: 2019 EN

Congratulations!

We are delighted that you have joined us by purchasing our company's sprayer. We are confident that it will meet your expectations.
This manual has been prepared to help you familiarise yourself with the sprayer, enabling you to learn about all its functions as well as the safety rules for its operation.
Remember, only proper use of our machines and subsequent maintenance activities significantly extend their service life and allow you to enjoy working together for many years.

Owner

Piotr Wawrzyniak

DESIGNER DATA:

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TOLMET PRODUCTION, SERVICE AND TRADE COMPANY
Piotr Wawrzyniak
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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: TRAILED SPRAYER

Type/model: BRUNO / BORYS ..... Serial number: .....
Year of manufacture: .....

to which this declaration refers meets the requirements of:

Regulation of the Minister of Economy of 21 October 2008 on the essential requirements for machinery (Journal of Laws No. 199, item 1228)
I 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 pesticide application machinery (Journal of Laws No. 199, item
1228)
I of European Union Directive 2006/42/EC of 17 May 2006.

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

In order to supplement 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 shall cease to be valid if the machine is modified or modified without our consent.

Świnice Warckie .....
Place and date of issue

.....
Name and surname of the person authorised to sign

TOLMET PRODUCTION, SERVICE AND TRADE COMPANY
Piotr Wawrzyniak
Ul. Dworcowa 3, 99-140 Świnice Warckie
Tel./fax. (63) 288 10 18

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Place and date of issue Name and surname of the person authorised to sign

MACHINE IDENTIFICATION

Trailed field sprayer

The information on the nameplate is used to identify the machine and should correspond to the following information 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 plate contains basic data for identifying the machine.

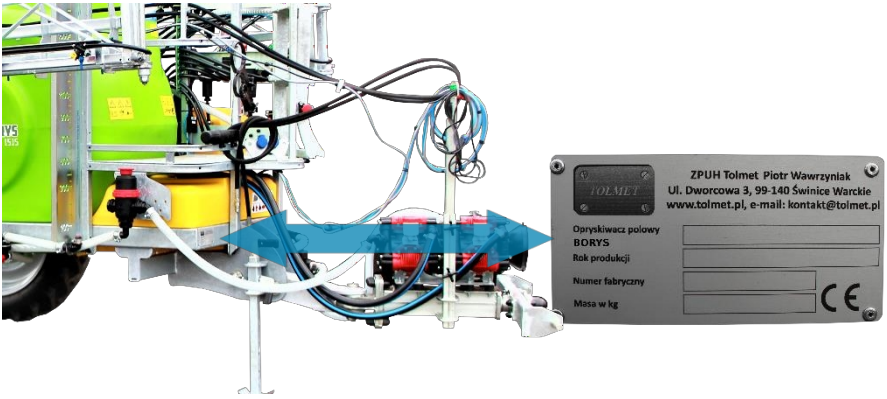

Fig. 1. Location of the nameplate on the machine.

When corresponding, asking questions or reporting warranty issues, please provide the type and identification number of the machine. The machine identification data can be found on the plate located on the right-hand side of the frame.

The operating manual is the basic equipment for the sprayer.

Table of contents

1. Introduction.

The manual describes the operation and maintenance of the Bruno (manual boom extension) and Borys (hydraulic boom extension) trailed field sprayers. If you encounter any specific problems during operation that are not sufficiently covered in this manual, please contact the manufacturer or dealer. The manufacturer's relevant obligations are specified in the warranty card, which contains the complete and binding warranty terms and conditions. The machine is designed to ensure safe operation when used in accordance with the operating manual. Before starting the machine for the first time, it is recommended that you read this manual carefully to familiarise yourself with the conditions for proper operation of the machine. Familiarisation with the rules for proper operation of the sprayer ensures correct use of the machine and also ensures that you can make use of your warranty rights. The terms used in the operating manual: left side, right side, rear, front – refer to the position of the observer facing the direction of travel of the unit (tractor + sprayer).

Before commencing work, it is essential to read this manual thoroughly.

2. Intended use.

The trailed field sprayer is designed for agricultural treatments in the field of plant protection and foliar fertilisation. Using the sprayer for other treatments will be considered misuse of the machine and will void the warranty. Familiarising yourself with the construction of the sprayer, carefully reading the operating instructions and following them will ensure safe operation of the sprayer.

2.1. Intended use.

The trailed field sprayer may only be started, used and repaired by persons familiar with the operation of the device and the tractor it is connected to, as well as with the rules for safe operation and maintenance of the machine. The manufacturer is not responsible for any unauthorised modifications to the sprayer's design. During operation, only use factory parts manufactured by TOLMET.

REMEMBER

The sprayer is intended exclusively for agricultural use. Use for purposes other than those specified in point 2 shall be considered improper use. Failure to comply with the manufacturer's recommendations regarding operation, maintenance and upkeep of the machine shall also be considered improper use. The manufacturer shall not be liable for any damage resulting from the use of the sprayer for purposes other than those for which it is intended.

REMEMBER

Before operating and using the sprayer, read this operating manual, familiarise yourself with the design of its components, their functions, ranges and adjustment methods, paying particular attention to the information on work safety. It is too late to do this during operation.

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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 fertilising field plantations and applying plant protection products. The machine can only be used with agricultural tractors, utilising the tractor's drive via a power take-off shaft thanks to the use of an articulated telescopic shaft.

REMEMBER

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

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

When using field sprayers in accordance with their intended use, certain risks to human life and health can be anticipated. To avoid them, follow the instructions in the machine's operating manual. Pay particular attention to the sprayer's components and situations that may pose a risk to the machine operator and bystanders. These include
, among others:

- Rotating articulated telescopic shaft,
- The boom during lifting and lowering,
- The boom during unfolding and folding,
- Unsecured boom during transport,
- Pressurised liquid system of the sprayer,
- Pressurised sprayer hydraulic system,
- Pressurised sprayer brake system,
- Field beam unfolded while driving,
- Field beam suspension,
- Field boom edges,
- Pressure in the sprayer system,
- Sprayer support,
- Sprayer drive system,
- Risk resulting from loss of stability,
- Hazard resulting from contact with chemicals used in agricultural treatments,
- Hazard resulting from negligence in the use of plant protection products.

3.3. Technical maintenance and safety.

Technical maintenance may be performed if the trailed sprayer is disconnected from the tractor. If the machine is attached to the tractor, it must be switched off, braked and the key removed from the ignition. Only serviceable tools and instruments as well as original parts and materials should be used for maintenance. It is prohibited to operate the articulated telescopic shaft without a guard or with a damaged guard. Use the appropriate safety devices and pins to secure the pins. It is forbidden to use substitute safety devices such as screws, rods, wires, etc., which may cause damage to the tractor or sprayer.

3.4. **Transport.**

A sprayer transported on public roads must have a working lighting system connected to the tractor's lighting system. In addition, a triangular sign distinguishing slow-moving vehicles must be installed. When transporting sprayers by means of transport from the manufacturer to the dealer or customer, it is important to remember the safety rules during loading and to secure the sprayer properly on the car trailer.

REMEMBER

It is prohibited to drive on public roads without appropriate marking of the sprayer. When driving a tractor with a sprayer on public roads, comply with all traffic regulations applicable to this type of vehicle.

REMEMBER

The boom must be folded into the transport position before driving on public roads.

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

- marking with warning signs with white and red stripes,
- equipment with lights,
- marking of the machine protruding from the sides of the tractor (white front position lights),
- repeated rear lights of the tractor (combined lights and red reflectors),
- marking with a triangular sign distinguishing slow-moving vehicles,
- do not exceed the speed limit during transport, which is as follows on roads:

- smooth surface (asphalt) up to **15** km/h,
- on dirt or cobbled roads **6-10** km/h
- bumpy roads no more than **5** km/h

ATTENTION!

The speed must be adjusted to the condition of the road and the prevailing conditions.

CAUTION!

Be particularly careful when passing, overtaking and on bends.

CAUTION!

The permissible width of a machine that can travel on a public road is 3.0 m.

3.5. Working with plant protection products.

Special precautions must be taken when working with plant protection products. The greatest risk associated with working with plant protection products and fertilisers occurs:

- when filling the tank,
- adding and preparing substances,
- when performing the treatment,
- when adjusting,
- when rinsing and drying the tank,
- when replacing plant protection products,
- during operation,
- during the destruction of packaging.

In order to maintain safety when working with plant protection products

plant protection products, you should:

- Always wear protective clothing (the choice of appropriate protective clothing depends on the toxicity class of the preparation). Protective clothing includes:
  - ✓ rubber boots,
  - ✓ gloves,
  - ✓ a coat,
  - ✓ a hat,
  - ✓ mask or half mask,
- Do not work with plant protection products on an empty stomach.
- do not eat or drink while filling, preparing substances, or during treatment,
- do not fill the tank with water-contaminating devices,
- do not perform the treatment under the influence of alcohol or consume alcohol while operating the sprayer,
- residual liquid must not be discharged into open waters or biological sewage treatment plants,
- residual working liquid should be diluted and sprayed on farmland or poured from the tank into a sealed container and taken to a point that deals with the disposal of this type of substance,
- the working solution may be prepared at a distance of at least 50 metres from wells or water reservoirs from which water is used for consumption,
- only adults familiar with the instructions for use may work with plant protection products,
- in case of poisoning, immediately contact a doctor, specifying which agent has been absorbed (provide the active substance),
- the sprayer operator must strictly follow the instructions on the plant protection product packaging,
- after treatment, wash your hands, face and entire body, rinse your mouth and change your clothes.

Handling plant protection products before preparing a

:

- When purchasing plant protection products, make sure that the packaging is undamaged and that the label is legible.
- during transport, secure the product with additional packaging ,
- plant protection products must not be transported with foodstuffs, agricultural produce or animals ,

- use the product in accordance with the instructions,
- check the expiry date of the product,
- check the prevention period (the period during which contact with plants on which the product has been applied is prohibited),
- check the toxicity class,
- check the active substance in case of poisoning.

Environmental protection:

- spraying may only be carried out in appropriate weather conditions, when the wind speed does not exceed **3 m/s**,
- do not spray flowering plants when using a substance that is toxic to bees,
- always observe the protection periods for bees and other living organisms,
- always use a sprayer that is in good working order and free of faults,
- dispose of any remaining working liquid properly at collection points or dilute it and spray it on farmland,
- do not use plant protection products within 50 metres of water intakes,
- do not discharge residual working fluid into water reservoirs,
- do not contaminate nearby plantations as a result of the working liquid being carried by the wind,
- Do not use plant protection products 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
ning of people or the environment, damage to the sprayer or other objects. The user is responsible for any damage resulting from failure to comply with these rules.

3.6. Operation.

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

Unauthorised persons, especially children, are not allowed to be present while the machine is in operation. Before carrying out any repairs or adjustments, switch off the engine, remove the key from the tractor ignition and apply the tractor handbrake.

Before starting work, carefully check the technical condition of the machine and the tractor. Check the sprayer for leaks. Spraying should be carried out in appropriate weather conditions recommended by the manufacturer of the plant protection product. It is recommended that the wind speed does not exceed 3 m/s. It is necessary to

comply with the regulations governing the use of plant protection products, which stipulate that the treatment must be carried out 5 metres from public roads, excluding municipal roads. It is prohibited to carry out the treatment at a distance of less than 20 metres from residential buildings or livestock buildings. In the event of a leak in the sprayer during operation, the treatment must be stopped immediately and the fault rectified. No unauthorised persons may be present in the treatment area during the treatment.

After each treatment, the sprayer must be washed and rinsed,

This should also be done when changing the plant protection product.

It is forbidden to transport people on the sprayer or to enter the sprayer tank. It is forbidden to operate the sprayer at an angle exceeding 8.5 degrees. After finishing work, fold and secure the boom.

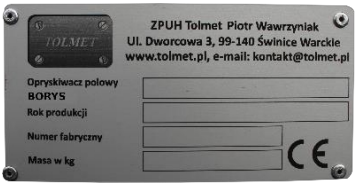
3.7. Safety when working with a telescopic articulated shaft.

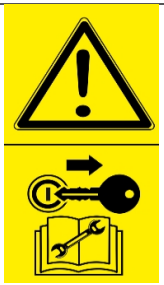
When working with a telescopic articulated shaft, remember to:

- use the roller recommended by the manufacturer,
- use the shaft only with a complete set of guards,
- secure the guard against rotation with a chain,
- secure the shaft,
- when engaging the drive, check that there are no bystanders nearby,
- before installing the shaft, switch off the tractor engine, remove the key from the ignition and apply the handbrake,
- make sure that the length of the shaft is appropriate (no less than 25 cm or 1/3 of the length of the shaft; the parts must overlap),
- use a shaft with the appropriate torque,
- do not use a shaft that is in poor technical condition,
- do not start the PTO shaft abruptly,
- clean and lubricate the shaft before mounting,
- after finishing work, put the shaft back in its designated place.

Working with a telescopic articulated shaft with a damaged cover or without a cover is PROHIBITED!!!!

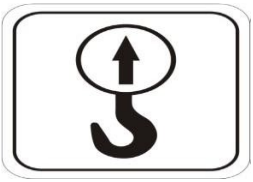
3.8. Safety signs.

1		Nameplate
2		Before starting the machine, read and follow the safety instructions contained in this operating manual!
3		Warning of the danger of poisoning by toxic substances. Danger of inhaling vapours and toxic gases.
4		Danger of crushing the entire body due to the need to stand under raised, unsecured parts of the machine!

5		Hazards when performing activities on the machine, such as assembly, adjustment, troubleshooting, cleaning, maintenance and repairs, due to accidental start-up of the machine and rolling of the tractor with the machine!
6		Maximum drive speed (maximum 540 rpm) and direction of rotation of the drive shaft.
7		Danger of crushing the entire body caused by standing under a suspended load or raised machine parts!
8		Danger of crushing the entire body due to standing in the lifting zone of the 3-point suspension system when operating the hydraulic three-point linkage!

9		Danger of crushing fingers or hands caused by accessible, moving parts of the machine!
10		Risk of falling when driving on surfaces or platforms used for loading!
11		Danger of arms or upper body being pulled in or caught by driven, unprotected machine parts!
		It is forbidden to enter the interior of the sprayer.

		Danger of inhaling substances harmful to health caused by toxic vapours in the working fluid tank!
12		Do not drink water
13		Mandatory hand washing
14		CE safety mark
15		Symbol for permissible speed transport

16		It is prohibited to drive on public roads with a tractor with a machine whose transport width exceeds 3 m.
17		Pictogram showing where to load the machine onto transport vehicles.
18		Sticker with the name and model of the sprayer 19
19		Put on a protective mask
		Wear protective clothing

		Wear safety goggles
		Wear protective footwear
		Wear protective gloves

Table 1. Table of pictograms.

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 ignorance. The greatest danger occurs in the following situations:

- operation of the sprayer by minors and persons unfamiliar with the operating instructions,
- operation of 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 while the tractor engine is running,
- allowing unauthorised persons, especially children, to be near the sprayer while it is in operation,
- cleaning the sprayer during operation,
- manipulating moving parts of the machine during operation
  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 according to the state of the art in the year of its manufacture, in compliance with basic health and safety rules.

CAUTION!

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

4.2. Residual risk assessment.

By following the recommendations below, residual risks can be minimised:

- ✓ follow the safety rules described in the user manual,
- ✓ read the operating instructions carefully,
- ✓ do not put your hands in dangerous and prohibited areas,
- ✓ do not operate the sprayer in the presence of bystanders, especially children,
- ✓ have the sprayer serviced and repaired only by appropriately trained persons,
- ✓ operate the sprayer only by persons who have been previously trained and familiarised with the operating instructions,
- ✓ securing the sprayer against access by children,
- ✓ operating the sprayer only by able-bodied persons who are not under the influence of intoxicants.

5. Light signalling.

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

Fig

6. Construction of a trailed field sprayer.

The sprayer consists of a frame supported at the rear by two wheels on an axle and at the front by a support. At the front of the machine there is a hitch beam with pins for connecting to the tractor's suspension system. Behind the hitch beam, on the 1200 l capacity sprayer, there is a pump with a drive shaft end cover, while the 1500 l, 2000 l, 2500 l and 3000 l capacity tanks have two pumps connected by a coupling. The main tank is mounted on the frame and is made of plastic with a capacity of 1200 l, 1500 l, 2000 l, 2500 l or 3000 l. Access to the tank filler opening is possible.

thanks to the use of opening stairs and a platform. The sprayer also has a water tank for washing hands and a water tank for washing the sprayer system. These tanks are located under the platform. This machine has hydraulic folding field booms. The field boom is equipped with gravitational or hydraulic stabilisation. Sprayer fittings, liquid supply lines, rear lights connected to the tractor with warning signs, and a working light illuminating the working boom are attached to the field boom.

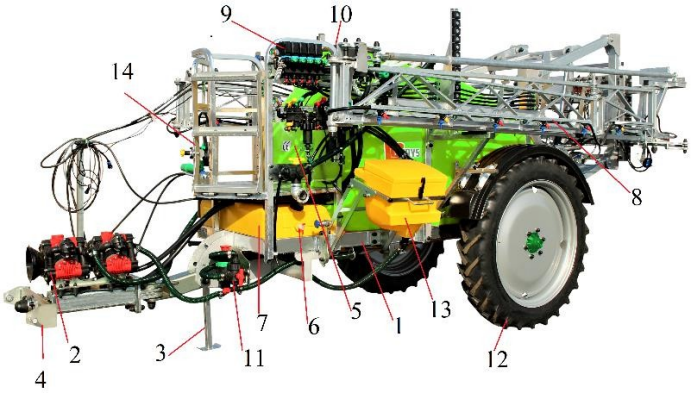


Fig. 3. 1. Main frame. 2. Pump. 3. Support. 4. Hitch beam. 5. Main tank.
6. Hand washing water tank. 7. System washing water tank. 8. Field boom.
9. Main control distributor. 10. Filling opening. 11. Four-way valve. 12. Wheel. 13. Side diluter.
. 14. Stairs.

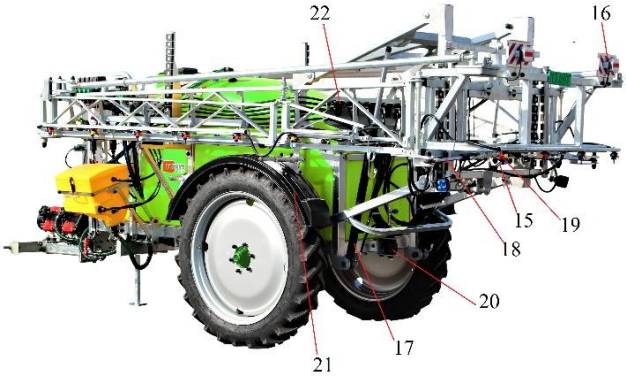


Fig. 4. 15. Hydraulic boom stabilisation. 16. Lights with warning signs. 17. Actuator for adjusting the working height of the field boom. 18. Actuator for unfolding the boom. 19. Sprayer head. 20. Shock absorber. 21. Mudguard. 22. Line filter.

6.1. Sprayer frame.

The frame (Fig. 3, item 1) of the trailed field sprayer has been designed and constructed to ensure the strength and lightness of the machine. The structure is made of various types of thick-walled profiles and sheets. The sprayer frame is hot-dip galvanised, which makes it resistant to corrosion.

6.2. Pump.

In BORYS 1200 BORYS 1200 uses a Tolveri® PU-3/140 pump manufactured by us (Fig. 3, item 2). The pump was designed and manufactured for use in field sprayers . The device guarantees the appropriate working pressure of the liquid. The BORYS 1500, 2000, 2500 and 3000 l sprayers are equipped with 2 diaphragm pumps. Each pump has a capacity of 140 l/min. These are 3-piston pumps. Both pumps are connecte o e mps work together, which increases the efficiency of the field boom r supplying the field boom with working fluid, while the second p nks to which there is no pressure drop on the field b on. The pumps are mounted on the drawbar with rul are powered by a PTO shaft with a speed of 540 rpm. The operation and design of the pump are described in more detail in the sprayer pump operating manual.

Fig. 5. Tolveri® PU-3/140 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 attached 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 connect the field sprayer to the tractor.
to the tractor. We use 28 mm pins as standard, but it is possible to use larger or double pins by selecting this option at when ordering the sprayer.

6.5. Main tank.

This tank is made of durable polyethylene microgranulate (LLD-PE). The tank has two openings for filling with liquid. Inside, at the rear of the tank, there are two anti-foam agitators (Fig. 7), and at the top there are two wide-angle rotating nozzles, except for the tank.

Fi e

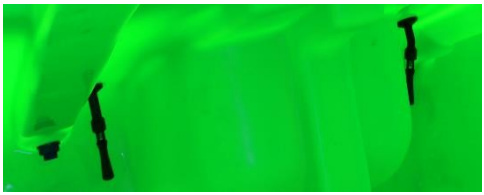


Fig. 7. Anti-foaming agitators

1200 l. Here, there is only one wide-angle rotating nozzle (Fig. 6) designed to wash the inside of the tank after the sprayer has finished working. In addition, hoses are used inside the tank, which fall to the bottom of the tank and reduce the risk of foaming of plant protection products or fertilisers when the liquid returns.

The filling of the main tank is shown in (Fig. 17). The arrow drawn on the red valve knob indicates the direction of liquid intake by the pump.

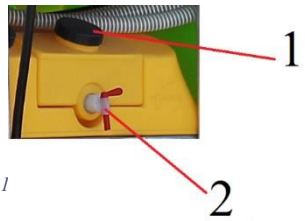


Fig. 8. 1

6.6. Hand washing water tank.

The clean water tank for hand washing is located under the platform on the left side of the sprayer.
inside the tank for cleaning the system. It is equipped with an easy-to-use plastic tap and a centrally located water inlet (Fig. 8, point 2).

6.7. Water tank for washing the sprayer system.

The clean water tank for washing the system (Fig. 9, item 2) is located under the platform. The water inlet to the system washing tank (Fig. 9, item 1) is located on the left side of the hand washing tank inlet.

6.8. Hydraulically folding boom

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

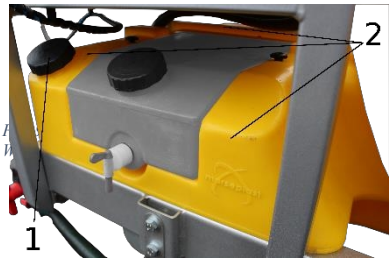


Fig. 10. Triple spray head

Fig. 11. Hydraulically extendable boom

The field boom is equipped with sprayers on a triple rotating head (Fig. 10) and hydraulic hoses that supply the working fluid from the tank to the nozzles and enable precise dosing of plant protection products and fertilisers.

6.9. Control distributor.

In order to facilitate control, the control distributor has been mounted on a special mast located on the sprayer hitch. The complete electrical system is mounted on the balcony on the left side of the sprayer. A number of valves and solenoid valves are used to control the sprayer, allowing you to adjust the amount of substance to be sprayed on a given area and to turn it on and off.

Fig. 13. Control Panel 2 – standard controller.

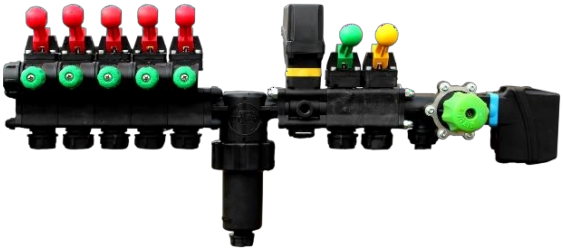


Fig. 12. Basic control manifold with two solenoid valves.

unselected sections of the boom. In the basic version, the sprayer is equipped with Tolmet/Meyer Control Panel 2®, which allows you to: switch all sections on and off simultaneously and increase increase/decrease the pressure of the sprayed working fluid.

The lower distributor is used to operate the agitators and wash the parts. The green lever (Fig. 14) is used to wash the parts system, e.g. the main tank, the yellow lever is used to activate the sieve agitator, and the purple lever is responsible for supplying the side diluter. The agitators are driven by a second pump. The agitators do not affect the pressure on the boom. The agitators are adjusted using the pressure regulator knob; increasing the pressure on the pressure gauge increases the pressure force.
working fluid inside. Switch off the agitators by turning the green valves located next to the hydrant.

the hydrant. Close the valves each time before flushing the sprayer system.

6.10. Filler.

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

Fig. 15. Filling openings

6.11. Hydrant

The hydrant is used to pour liquid into the main tank and auxiliary tanks. It is located on the balcony under the distributor.

Fig. 16. Hydrant.

6.12. Control valve.

Fig. 17. Four-way valve

Depending on the equipment, the trailed field sprayer has a three-way (Fig. 17) or four-way valve. It is located at the front of the sprayer under the steps. This valve allows you to control the liquid intake by the pump. The operation of the valve will be described in the following chapters.

6.13. Wheels.

The trailed field sprayer is equipped with a pair of wheels with adjustable wheelbase. Standar ly, 9.5 x 32 wheels are used.

6.14. Side diluter.

Each trailed sprayer can be fitted with a side feeder, which allows fertilisers or plant protection products to be conveniently added from ground level. This is optional equipment

sprayer. Colours lever distributor

Fig. 18. Diluter

indicate water supply functions, while the arrow on the red knob indicates the direction in which the valve should be turned so that the contents of the diluter are sucked into the main tank. All functions are shown in (Fig. 19).

Fig. 19 Functions of the side diluter

6.15. Stairs.

The stairs allow safe and comfortable access to the platform and the upper part of the main tank. Thanks to the use of special latches, the stairs are secured against opening during transport.

6.16. Suction device

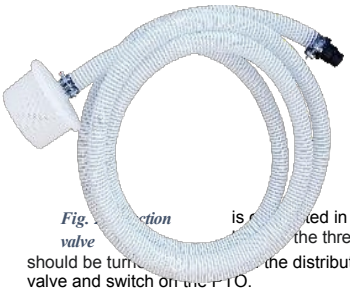


Fig. 20 Suction valve

The suction device is used to suck liquid plant protection products from large tanks (e.g. Mau-
zer) or pools. When the sprayer is equipped with a suction filter or two suction pumps
, it is connected in place of the shut-off valve knob (Fig. 21). On the distributor, switch off all sections, switch on the main valve and switch on the PTO. If the sprayer has a three-way or four-way valve, the suction pump is connected in place of the upper ø32 elbow, then the three-way/four-way valve should be turned to the distributor, switch off all sections, switch on the main valve and switch on the PTO.

Fig. 21 Suction valve shut-off knob

6.17. Hydraulic stabilisation of the boom.

The boom of the trailed field sprayer is stabilised by hydraulic cylinders. This solution reduces the risk of the boom hitting the ground when moving over uneven terrain while working with the sprayer.

6.18. Lights.

The use of rear lights and warning signs enables safe movement on public roads, while working lights enable work at night.

6.19. Actuator for adjusting the working height of the boom.

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

6.20. Hydraulic boom extension.

Hydraulic control of the boom extension is a feature of the "Borys" field sprayer with a boom of any width. The Hydro Panel® (Fig. 21) is used to control the boom from the tractor cab. The Hydro Panel controls the sprayer boom via solenoid valves and a hydraulic block. By selecting the appropriate mode

Fig. 22. Hydro Panel®

mode: single-sided unfolding, double-sided unfolding, lifting-lowering and levelling, we control the field boom using the hydraulic system levers.
When driving the sprayer on public roads, always set the knob to the lock position.
.

6.21. 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. 23). Thanks to the use of a rotating head, depending on the type of spraying or wind, we are able to quickly and easily change the working nozzle by turning the head.

Fig. 23. Standard spray nozzles

6.22. Field boom shock absorber.

The use of a pneumatic shock absorber (Fig. 24) in the hydraulically mounted, foldable "BORYS" field sprayer is intended to dampen the vibrations of the field boom during operation. The shock absorber is located at the rear of the sprayer on the lower part of the frame.

Fig. 24. Field boom vibration shock absorber

6.23. Mudguard.

Field sprayers are equipped as standard with mudguards that can be adjusted when changing the wheel spacing. The mudguards are made of high-quality plastic.

6.24. Line filter.

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

Fig. lter

7. Description of the sprayer's operation.

7.1. Sprayer equipment.

Basic equipment of the "Borys" hydraulically folding field sprayer:

- ✓ Main tank for clean water, with two inlets equipped with strainers, including one in a solid fertiliser diluter,
- ✓ Clean water tank for hand washing equipped with a tap,
- ✓ Clean water tank for washing the sprayer system, including a rotating nozzle for washing the inside of the main tank,
- ✓ 28 mm hitch beam,
- ✓ 9.5x32 wheels with mudguards,
- ✓ Adjustable drive axle in the range of 150-180 cm,
- ✓ Tolveri® PU-3/140 pump,
- ✓ Control Panel 2® with pressure gauge and backlight lamp, which enables switching on/off and adjusting the operating pressure from the tractor cab,
- ✓ Hydro Panel® for controlling the field boom from the tractor cab,
- ✓ Symmetrical, hydraulically folding field boom,
- ✓ Hydraulic stabilisation of the field boom,
- ✓ Hydraulically lifted field boom to a nozzle height of 2.00 m. from ground level,
- ✓ Fermo 5 constant pressure distributor, equipped with two solenoid valves for switching on/off and adjusting the working pressure via the Control Panel 2 ® controller from the tractor cab,
- ✓ Three-position rotary spray heads equipped with nozzles: KR5 04, EŻ 03, RS 02, distributed in five independent high-quality hydraulic hoses,
- ✓ Liquid level indicator in the main tank,
- ✓ Line filters for each section of the boom,
- ✓ Suction filter,
- ✓ LED lighting with warning signs,
- ✓ 2 x hydraulic anti-foam agitators,
- ✓ Working lights
- ✓ Spirit level
- ✓ Hydrant

Optional equipment for the hydraulically folding "Borys" field sprayer available at an additional cost:

- ✓ Control Panel 4® for switching sections on/off, as well as separately switching the outer sections on/off and adjusting the working pressure ,

- ✓ Control Panel 7® for switching all sections on/off at once and each section separately, as well as adjusting the working pressure
  ,
- ✓ The Alfa 100 computer, which, in addition to switching each section on and off, allows, among other things, the maintenance of a set spray rate, taking into account the travel speed of the tractor aggregated with a trailed field sprayer.
  spray speed, taking into account the travel speed of the tractor aggregated with the trailed field sprayer,
- ✓ 9.5x36 wheels, 11.2x32 wheels, 11.2x36 wheels
- ✓ Side diluter,
- ✓ Ejector nozzles or non-standard nozzles available from MMAT Agro Technology ®,
- ✓ PTO shaft,
- ✓ Liquid suction kit for sprayer tank,
- ✓ Vertical marker,

7.2. Sprayer preparation.

Preparing a trailed field sprayer for operation involves performing a general inspection and removing any faults that may have arisen during storage or transport of the sprayer. It is recommended that each time, and in particular during initial start-up:

- ➢ Check that there is no contamination inside the tank and remove it if necessary.
- ➢ Check that all bolts, especially those securing the wheel discs, axle and drawbar, are properly tightened – if any looseness is detected, tighten the
  the bolts,
- ➢ Check the tyre pressure with a pressure gauge,
- ➢ set the position of the tractor hitch so that the sprayer, levelled with the support leg, has the hitch beam at the correct height,
- ➢ If you plan to drive on public roads, attach a warning triangle in a visible place at the rear of the sprayer.

7.3. Aggregation on the lower links of a field sprayer attached to an agricultural tractor.

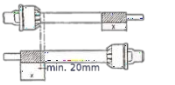
When attaching the sprayer to the tractor, perform the following steps:

- remove the tool hitch beam from the lower links of the three-point suspension system (TUZ),
- drive the tractor close enough to the machine frame,
- turn off the tractor engine, remove the key from the ignition and apply the handbrake,
- attach the tractor's lower links (first the left and then the right) to the 28 mm sprayer pins and secure them with standard pins,
- To prevent the sprayer from swaying sideways, tighten the chains on the tractor's lower side links after removing the shaft cover.
- fit the articulated telescopic shaft to the WPM end of the sprayer and the PTO end of the tractor (tractor - outer pipe, sprayer - inner pipe), fasten the shaft cover chain to the WPM cover of the machine and tractor,

There are 2 pumps on the drawbar. The drawbar has a levelling function, which allows you to correct the position of the terrain deviation relative to the tractor. The drawbar is bent in order to copy the tractor's tracks.

Depending on the model and type of tractor that is to work with the machine, the length of the articulated shaft must be adjusted accordingly . We offer PTO shafts of various lengths, but in some In some cases, this length may be non-standard. In such case, follow the diagram (Fig. 27). Attach the telescopic shaft to the WPM end of the sprayer and the PTO end of the tractor (tractor - outer tube, sprayer - inner tube), attach the shaft cover chain to the cover

Fig. 26. Spirit level.



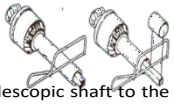
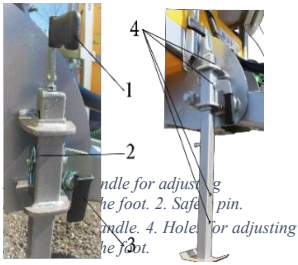


Fig. 27. Description of non-standard adjustment

WPM machine and tractor) attach the articulated telescopic shaft to the WPM end of the sprayer and the PTO end of the tractor (tractor - outer pipe, sprayer - inner pipe), fasten the shaft cover chain to the WPM cover of the machine and tractor. The shaft should be adjusted so that the minimum length of overlap of the shaft parts, when fully extended, is not less than 150 mm. The minimum distance when retracted should not be less than 20 mm. Please note that if the shaft is cut, the length must be the same on both sides.

- Raise the sprayer so that the frame (when viewed from the side) is parallel to the ground (spirit level, Fig. 26).
- attach the safety cable preventing the sprayer from detaching from the tractor so that it does not interfere with the articulated telescopic shaft and ensures that the sprayer remains guided in the event of an emergency disconnection, connect the hydraulic hoses to the tractor's external hydraulic sockets (in sprayers with hydraulic boom lifting, sprayers with hydraulic field boom folding, sprayers with hydraulic boom stabilisation),
- connect the electrical cable to the lights and check their operation,
- connect Control Panel 2@ (or optional controllers: Control Panel 4@, Control Panel 7@ or Alfa 100® computer, which is optional equipment for the sprayer, and place it in the tractor cab,
- attach the slow-moving vehicle sign,
- raise and secure the support so that the sprayer frame is level (Fig. 28).



ndle for adjust g he foot. 2. Safe pin. ndle. 4. Hole for adjusting he foot.

7.4. Working with the sprayer.

7.3.1. First start-up of the sprayer.

After connecting the field sprayer to the tractor, test the sprayer.

To do this:

- ✓ extend the boom to the working position,
- ✓ remove the filters and nozzles to facilitate the removal of any mechanical impurities from the pipes,
- ✓ fill the tank with approx. 600 litres of clean water,
- ✓ open the liquid supply to the sprayers on the boom,
- ✓ switch on the pump drive and operate for approximately 1 minute.

After flushing the system, perform a test run and calibrate the sprayer.

To do this, reinstall the nozzles and filters, open the valve and then follow the steps below.

7.3.2. Sprayer operation.

Fill the main tank with clean water through the filling valve or the filler opening located in its upper part (Fig. 3, item 10). The platform is accessed via a folding ladder (Fig. 29), which is a basic piece of equipment for a field-mounted sprayer. Pay particular attention to always having three points of support (e.g. two hands and

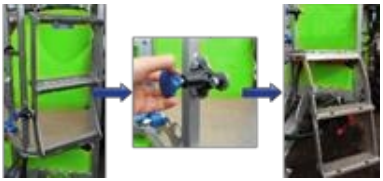


Fig. 29. Opening the ladder providing access to the platform

foot). The ladder must be **closed** during transport or operation of the sprayer. The platform may only be used when the sprayer is stationary. It is unacceptable to transport people or unsecured objects on the platform when travelling on public roads or during operation of the sprayer. The tank is filled by connecting a hose with a quick-connect coupling to a hydrant. Turn the three-way valve knob downwards (Fig. 35), then turn on the water pressure. To fill the hand washing tank or the clean water tank for rinsing the system, turn the knob to the

Fig. 30. 1. Drain valve

Fig. 31 .

Fig. 31.

to the closed valve position (Fig. 35), unscrew the tank, then insert the hose for filling additional tanks into the tank (Fig. 31). Turn the valve knob upwards to the system washing tank position (Fig. 35). After completing the filling operation, turn the valve knob to the closed position.

closed bag (Fig. 35) and disconnect the hose from the hydrant. Hoses used for

filling the tank must not be used for other purposes. To empty the tank, use the drain located at the three-way/four-way valve (Fig. 30, item 1). **NOTE: Liquid residues must not be discharged into open waters or biological**

logical sewage treatment plants.

CAUTION: It is prohibited to calibrate a sprayer that is filled with any liquid other than clean water.

1) Rules for adjusting the boom of a trailed sprayer.

During transport, the boom in the "Borys" sprayer, which uses hydraulic boom folding, should be switched to the "padlock" position to prevent accidental opening of the boom during transport of the sprayer.

Folding the field boom.

BORYS – hydraulically folding field boom.

The hydraulically folding "Borys" field sprayer is equipped with a "Hydro panel®" controller as standard (Fig. 32), which allows you to control the sprayer's hydraulics from the tractor cab.

DANGER

Exercise extreme caution when folding and unfolding the boom. Always stand in relation to the boom in such a way that there is no risk of being crushed by the boom against the machine. Gravity-stabilised booms should not be unfolded when they are unlocked.

F
L
c

2) Field boom stabilisation.

A. Hydraulic stabilisation of the boom.

The hydraulic pressure lines should be connected to the tractor's hydraulic system. Thanks to the use of a hydraulic cylinder with adjustment, it is possible to adjust the response speed of the field boom levelling when the tractor encounters uneven terrain. The blue knob (Fig. 33, item 2) is used to adjust the response speed. The Hydro Panel® and the tractor's hydraulic levers are used to control the field boom – its height, tilt, unfolding/folding.

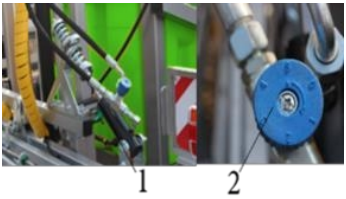
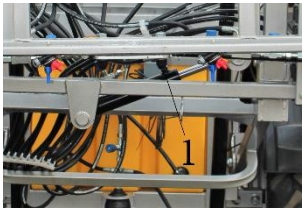


Fig. 33. Hydraulic stabilisation of a manually folding field boom. Description 1. Hydraulic cylinder.
2. Adjustment knob.

B. Hydraulically extendable sprayer "BORYS". The "Bo-rys" sprayer uses hydraulic stabilisation of the boom (Fig. 34). The reaction of the boom can be adjusted to suit to your preferences using the blue knob located next to the actuator.



Longitudinal levelling.

This involves setting the machine in such a position that, when viewed from the side, the sprayer frame is perpendicular to the ground. To do this, lift the sprayer on the sprayer drawbars to the appropriate height
.

Setting the field boom at the appropriate height.

In "BORYS" field sprayers, the height of the boom is controlled by means of a lever

"BORYS" field sprayers, the height of the boom is controlled by

Connect to the appropriate position on the "HYDRO PANEL®" and then use the tractor's hydraulic control lever. The boom should be raised 50 cm above the surface to be sprayed. To raise the boom to the appropriate height, first unfold the boom sections.

Remember: Take special care when lifting the boom.

3) Control valve operation.

This valve allows you to decide from which tank the sprayer pump draws liquid. A suction filter is directly connected to the control valve, which additionally protects the pump from damage by any contaminants that may enter the sprayer's liquid circuit.

A. Three-way valve.

This valve is used in the "Borys" 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. The operation of the valve is shown in Fig. 35.

The arrow on the three-way valve knob set:

- upwards – intake from the clean water tank for washing the sprayer system,
- to the left – liquid intake blocked, impossible.
- Down – liquid intake from the main tank.

B. **Four-way valve.**

This valve is used in the Borys field sprayer, which is equipped with an optional side diluter. The arrow drawn on the red valve knob

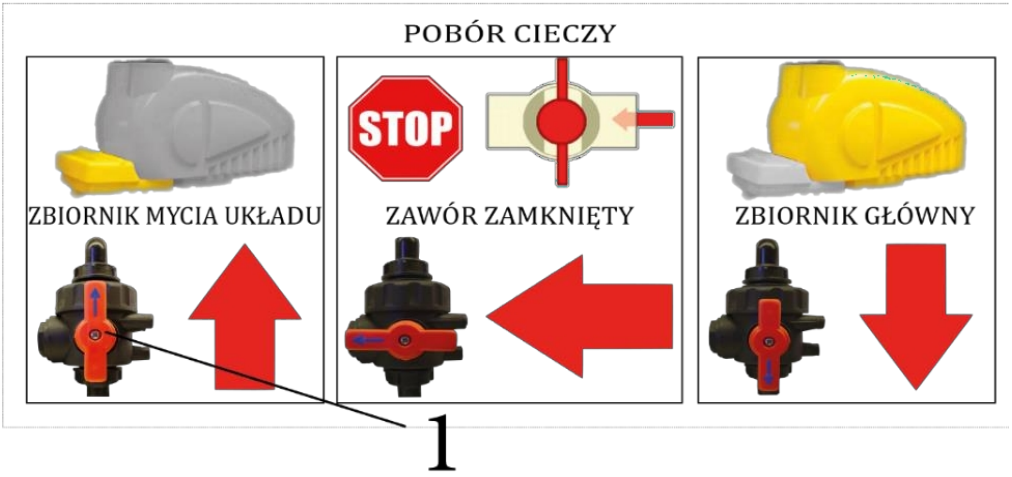


Fig. 35. Three-way valve operation. 1. Knob.

indicates the direction of liquid intake by the pump. Valve operation is shown in Fig. 36.

The arrow on the four-way valve is set:

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

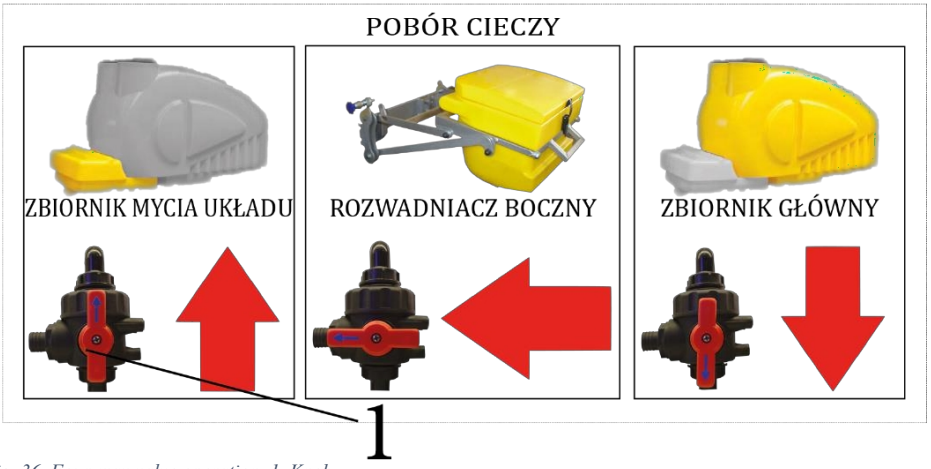


Fig. 36. Four-way valve operation. 1. Knob.

4) Calibration of sprayer nozzle pressure.

Use clean water for calibration!

Set the three-way valve to the "down" position (Fig. 37), which allows liquid to be drawn from the main tank. The liquid flows through the suction filter (Fig. 59, item 9) and the Tolveri® PU-3/140 pump to the control distributor (Fig. 59, item 2). Use the regulator knob (Fig. 59, item 20) to adjust the pressure of the liquid supplied to the control distributor by the pump. Check the pressure value on the pressure gauge built into the Control Panel 2®.

Fig. 37. Setting the three-way valve to the position for drawing liquid from the main tank.

Remember: The pressure set by the green regulator knob (Fig. 59, item 20) is the maximum pressure that can be achieved when controlling Control Panel 2® from the tractor cab. We therefore recommend setting the highest pressure that will be needed when operating the sprayer.

The next step is to calibrate the pressure of the Fermo 5 distributor valves.

All valve sections should be activated by moving the lever (Fig. 52, item 22) upwards. Water will start to flow from the nozzles of the corresponding sections, located on the far left side of the boom. Then, use the green compensation valve (Fig. 52, item 21), located directly under the lever of the given section, to 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 preferences

Fig. 38. QR code

. After setting the pressure, ensure that the liquid flows evenly from all nozzles.

Distributor control.

The sprayer distributor is located on its left side, which makes it convenient and safe to access. It is equipped with levers (Fig. 39) that enable the activation of individual sprayer functions, such as:

- turning the sprayer sections on/off, turning the washing system on/off,
- turning the diluter and optional side diluter for solid fertilisers on/off,
- washing the main tank with a nozzle located inside the main tank.

and knobs that are used to:

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

Fi

In the basic version, the distributor is equipped with two solenoid valves, which enable control of the distributor.

from the tractor cab using the Control Panel 2®, which is also included in the basic equipment. Thanks to this solution, we can switch all sections on/off simultaneously and adjust the pressure from the tractor cab. The solenoid valves are located on the boom.

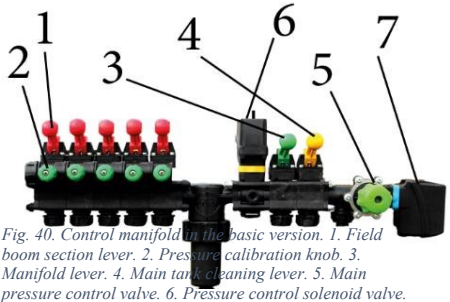


Fig. 40. Control manifold in the basic version. 1. Field boom section lever. 2. Pressure calibration knob. 3. Manifold lever. 4. Main tank cleaning lever. 5. Main pressure control valve. 6. Pressure control solenoid valve. 7. On/off solenoid valve.

Fig. 41. Distributor equipped with additional solenoid valves for switching individual sprayer sections on/off with Control Panel 7®.

CONTROLLERS.

We use specially designed Meyer/Tolmet controllers to control the distributor from the tractor cab. We have three types of controllers and an advanced Alfa 100 computer, which allow us to manage the individual functions of the distributor.

Fig. 42. Optional Control Panel 4 controller. Functions: On/Off, pressure adjustment,
switch extreme sections on/off.

Fig. 43. Basic Control Panel 2 controller. Functions: On/Off, pressure regulation.

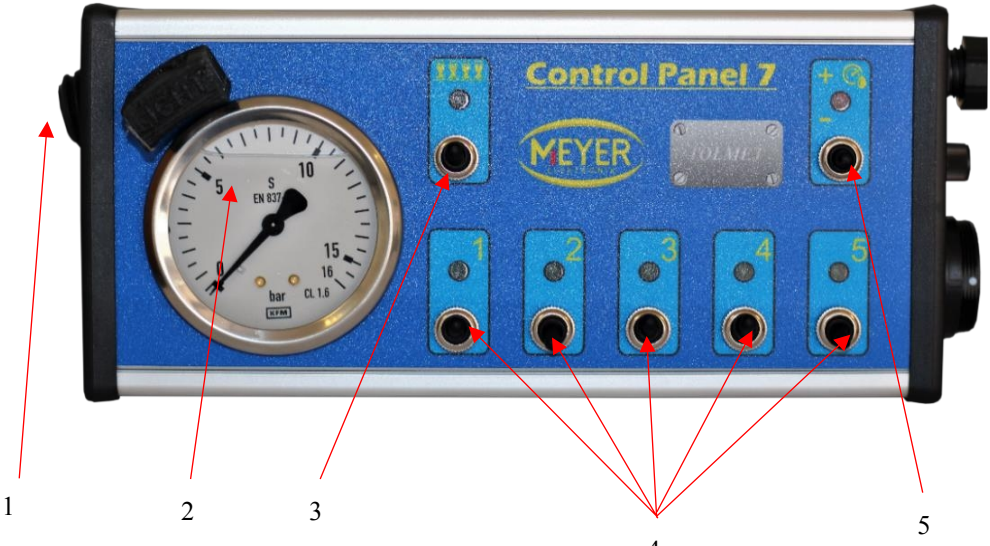
Fig. 44. Optional Control Panel 7. Functions: On/Off, pressure adjustment, turn each section on/off separately.

Fig. 45. Alfa 100 computer. Optional Control Panel 4 controller. Functions: On/Off, pressure adjustment, turn each section on/off separately, dose adjusted to tractor/sprayer speed, memory. It is clear, easy to use, and signals when driving too fast/slow, which prevents the correct dose from being applied.

7.5. Controller operation

CONTROL OF THE DISTRIBUTOR FROM THE TRACTOR CAB

The distributor control functions are described based on the most advanced Control Panel 7 controller.



1. Panel backlight switch; 2. Pressure gauge; 3. Switch all sections on/off;
4. Switch individual sections on/off; 5. Pressure adjustment.

HYDRAULICALLY FOLDABLE FIELD BAR CONTROL

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

1. No function; 2. Unfolding/folding the left lance; 3. Unfolding/folding the right lance; 4.

Unfolding/folding both booms; 5. Adjusting the height of the field boom;
6. Levelling.

8. Operation of the solid fertiliser spreader.

Fill the main tank with running water, checking its level using the red ball on the gauge located on the right side of the tank (Fig. 46). When the water reaches the desired level, disconnect the water source. Next, pour the appropriate amount of solid fertiliser into the sieve located in the filling opening (a larger diameter opening with a dilution nozzle) in the main tank. Then, close the lid tightly the lid tightly. To dilute the fertiliser, use the yellow lever located on the distributor. The liquid that will be

power

The solid fertiliser poured into the sieve will flow [illegible] process should take several minutes, and its duration depends on the composition of the diluted chemicals. Finally, turn off the lever.

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 fluid.**

Operation of the side/additional solid fertiliser diluter.

The side diluter is available as an optional element of the sprayer. It facilitates work as it allows chemicals to be added from ground level without having to climb onto the sprayer platform. To open the diluter cover, unlock the cover lock. Add the measured amount of fertiliser or plant protection products to the diluter. Then use the blue lever (Fig. 49) to fill the side diluter with liquid from the main tank. Turn on the agitator with the red lever (Fig. 49) to create the substance mixed together. If we use a

For fixed vehicles, wait until they dissolve. T ve (Fig. 36) to the left. In this position, the pu de diluter. To wash the bottle after using chemic g. 6) located in the central part of the side diluter and then use the silver lever (Fig. 49). Do not fill the side diluter with too much chemical. Finally, turn off all levers. If a large dose of chemical is to be used, the process should be divided into an appropriate number of stages

9. Pump operation.

The Borys trailed field sprayer with a capacity of 1,200 litres is equipped with a PU-3/140 diaphragm pump, while sprayers with capacities of 1,500 litres, 2,000 litres, 2,500 litres and 3,000 litres are equipped with two pumps connected by a coupling.

First start-up.

Check and, if necessary, adjust the following elements:

- ✓ The oil level in the operating pump should be set centrally between min and max. If necessary, top up with LUX 10 oil.
- ✓ Check the air pressure in the air tank using, for example, a car tyre pressure gauge. The correct pressure should be 1/3 of the working pressure of the pump, but no more than 1.5 bar.
- ✓ Connection of the pump to the power take-off shaft. Is the connection correct and safe? Is the shaft adequately protected by guards?

After completing the above checks, you can start the pump at 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 can be increased to the desired value, remembering not to exceed the maximum pressure of 1.5 bar. During longer breaks from operation (e.g. winter breaks), wash the inside of the pump with clean water or antifreeze, then remove the suction pipe and run the pump for several seconds (15-20) to remove water from inside the pump.

The oil should be changed every 500 hours of operation or every 3 years.
Remember to constantly check the oil level and air pressure in the air vent.

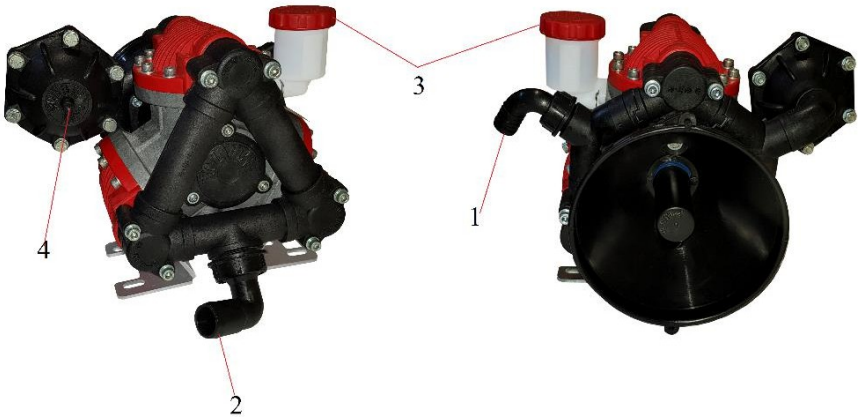


Fig. 50. Tolveri PU-3/140 pump. 1. Pressure connection. 2. Suction connection. 3. Oil filler with level control. 4. Air vent. Correct pressure: 1/3 of the pump's operating pressure – no more than 105 bar.

10. Sprayer operation.

No additional tools are required to operate the heads or individual sprayers, as all components are mounted using caps

Fig. 52. Assembly of individual sprayer head components.

or nuts that can be unscrewed by hand. One of the possible tasks that may occur during the use of the sprayer is the need to clean the strainers located in the frames. To clean the strainers, unscrew the cap and remove the strainer. The order of assembly of individual components is shown in Fig. 52.

11. Adjusting the wheel spacing.

Fig. 51. The order of assembly of individual nozzle components and the valve

The sprayer design allows the wheelbase to be adjusted within the range of 150-180 cm. This allows for... the machine's wheel track to be adjusted to the tractor's wheel track and the tramlines in the fields.

To obtain the desired wheelbase of the sprayer, you should:

- ✓ connect the sprayer to the tractor and secure the tractor against rolling, place
  placing wedges under the wheels,
- ✓ Use a jack to lift the sprayer axle,
- ✓ secure the sprayer against falling with fixed supports,
- ✓ loosen the mudguard fixing bolts (Fig. 53, point 3),
- ✓ Spread the mudguards to the required spacing.
- ✓ loosen the bolts securing the axle shafts,
- ✓ spread the wheels to the required spacing,
- ✓ tighten the bolts securing the half-shaft yokes,
- ✓ tighten the mudguard bolts.

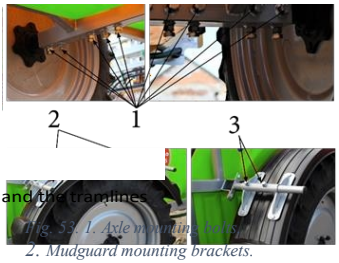
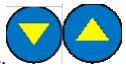


Fig. 53. 1. Axle mounting bolts.
2. Mudguard mounting brackets.
3. Mudguard mounting bolts.

12. Wheel calibration.

To proceed with wheel calibration, you must:

- In the calibration settings menu, select WHEEL CALIBRATION and press the OK button.
- During the initial calibration, reset the value using the button, then drive 100 metres in a straight line.
- The displayed value is the number of pulses from the inductive sensor per 100 metres. To save the value, confirm with the button.

- This value can be entered manually using the buttons. 

If the computer is reset or the wheels are changed, enter 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. Then proceed as described above.

Fig. 54. Wheel calibration sensor

13. Filter operation.

The filter inside has a reusable filter cartridge. To clean the filter, there is no need to empty the sprayer tank of working fluid, as the filter has a shut-off valve. To shut off the flow, turn the shut-off valve according to the markings on the knob, then use a wrench to unscrew the green nut and remove the filter cover. To remove the cartridge, pull it out as it is pressed in. The next step is to clean the filter cartridge and reassemble everything in reverse order.

The filter also has the option of draining the working fluid. To do this, unscrew the red knob at the bottom of the filter. To close the drain again, turn the knob.

Fig. 55. Suction filter

14. Line filter operation.

Fig. 56. Linear filter: 1. Linear filter body. 2. 45° elbow. 3. Linear filter strainer. 4. Linear filter housing.

Line filters prevent nozzles from clogging. Each time before using the sprayer, clean the line filter strainer by washing it in clean water or blowing it with compressed air. To do this, unscrew the filter housing, then the strainer, clean it, put it back in the housing and screw it to the body.

15. Distributor filter operation.

Fig. 57. Distributor filter

The distributor filter is responsible for cleaning the liquid 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 wrench to unscrew the black nut. To remove
the cartridge, pull it out as it is pressed in. The next step is to clean the filter cartridge and reassemble everything in reverse order.

The final step is to connect the mixer supply hose.

16. Swivel hook

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

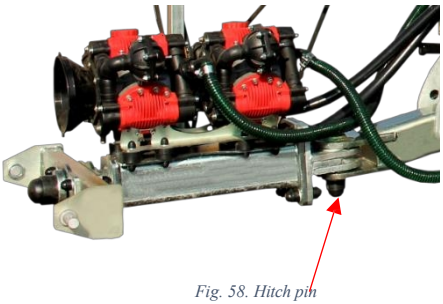


Fig. 58. Hitch pin

7.4.3. Sprayer fluid system.

❖ **Liquid circulation system in the basic version of the sprayer**

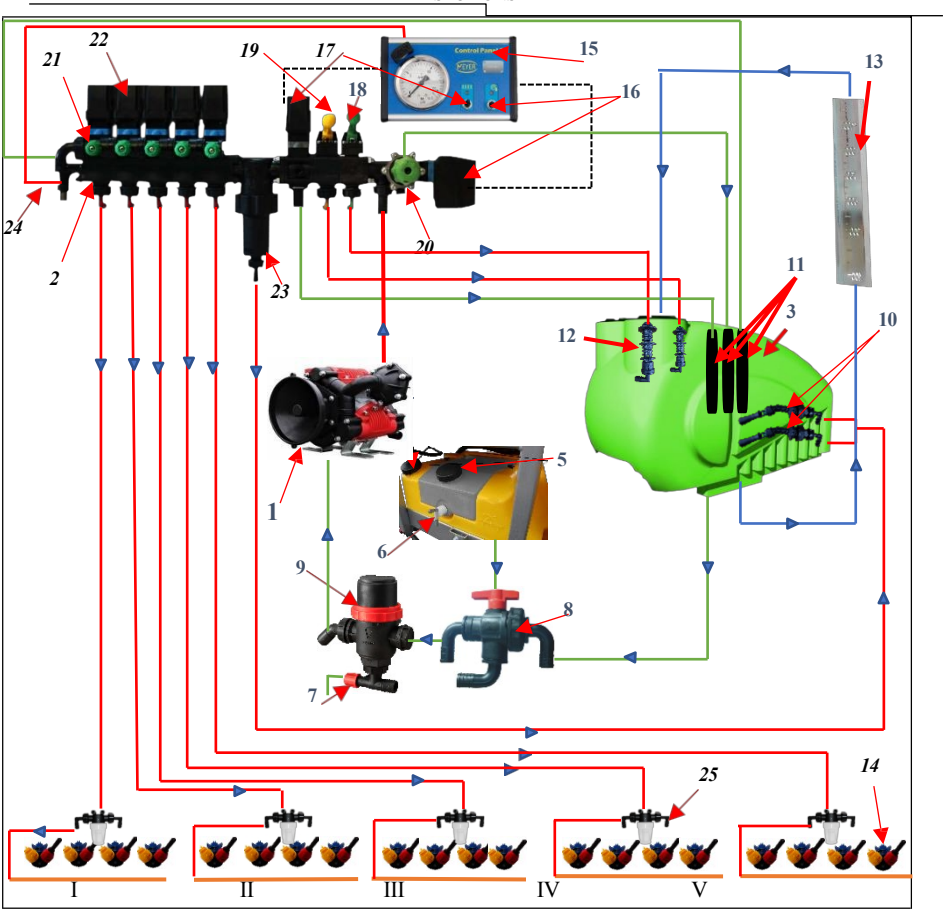


Fig. 59. *Tolveri® PU-3/140 pump. 2. Control manifold. 3. Main tank. 4. Tank for water used to wash the system. 5. Hand washing water tank. 6. ON/OFF tap for the hand washing tank. 7. Drain valve. 8. Three-way valve for controlling the intake of liquid from individual tanks. 9. Suction filter. 10. Anti-foaming hydraulic agitators. 11. Hydraulic hoses preventing foaming of the working fluid circulating in the circuit. 12. Solid fertiliser diluter. 13. Water content meter in the main tank. 14. Rotating head with spray nozzles. 15. Control Panel 2®. 16. On/off solenoid valve controlled by 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 supplying the control manifold. 21. Section pressure compensation valve. 22. Solenoid valve. 23. Pressure filter. 24. Pressure gauge hose connected to Control Panel 2®. 25. Line filter.*

❖ **Liquid circulation system of a sprayer equipped with an optional side diluter.**

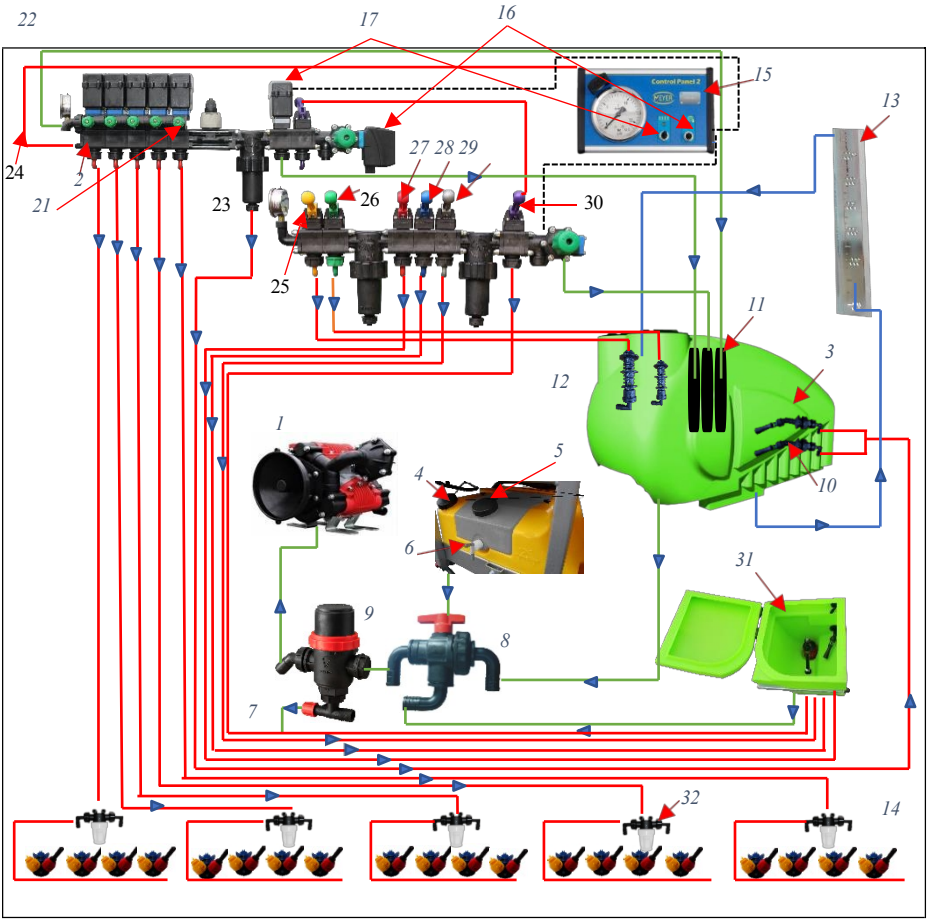


Fig. 60. 1. Tolveri® PU-3/140 pump. 2. Control manifold. 3. Main tank. 4. Tank for system washing water. 5. Hand washing water tank. 6. ON/OFF tap for the hand washing tank. 7. Drain valve. 8. Three-way valve for controlling the suction of liquid from individual tanks. 9. Suction filter. 10. Anti-foaming hydraulic agitators. 11. Hydraulic hoses preventing foaming of the working fluid circulating in the circuit. 12. Solid fertiliser diluter. 13. Water content meter in the main tank. 14. Rotating head with spray nozzles. 15. Control Panel 2®. 16. Solenoid valve switched on/off via Control Panel 2®. 17. Solenoid valve for controlling spray nozzle pressure via Control Panel 2®. 18. Dilution lever. 19. Main tank cleaning lever. 20. Pressure regulator supplying the control distributor. 21. Section pressure compensation valve. 22. Section on/off lever. 23. Pressure filter. 24. Pressure gauge hose connected to Control Panel 2®. 25. Side diluter lever. 26. Side diluter lever for washing the main tank. 27. Side diluter lever - agitator. 28. Lever for filling the side diluter. 29. Side diluter lever for washing bottles. 30. Lever for supplying the side diluter. 31. Side diluter. 32. Line filter

❖ **Liquid circulation system of a sprayer equipped with a tandem pump**

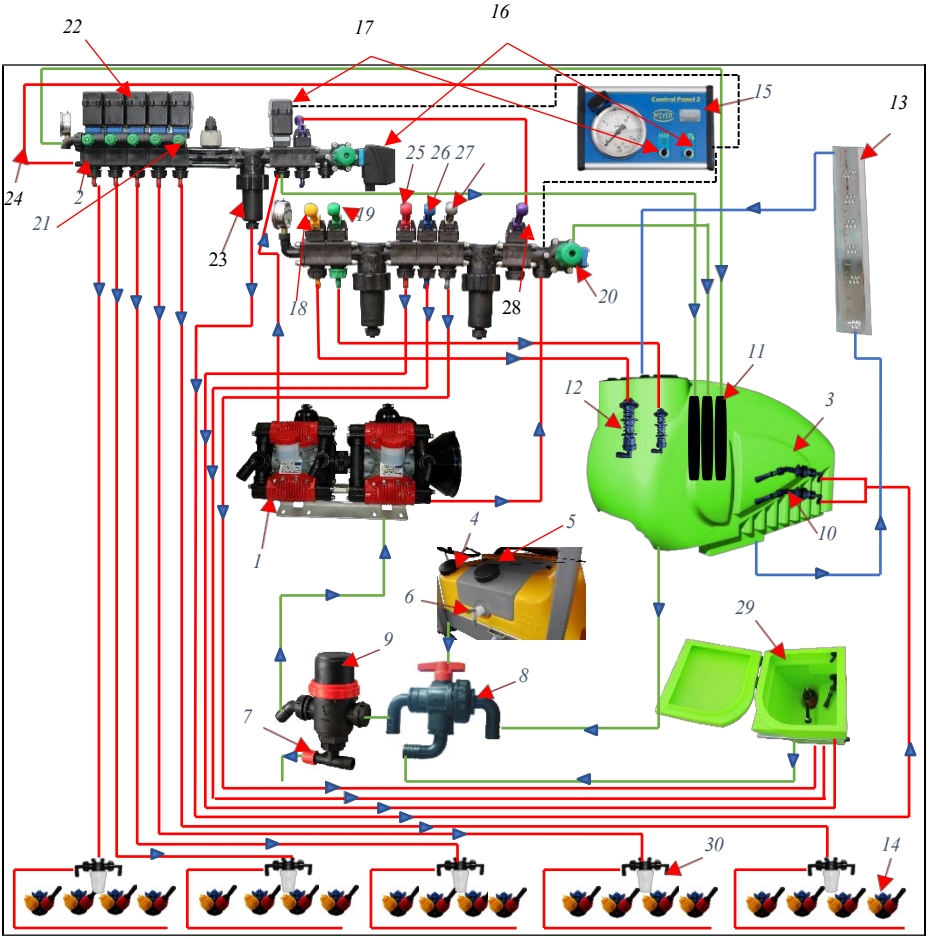


Fig. 60. 1. Tolveri® PU-3/140 Tandem pump. 2. Control manifold. 3. Main tank. 4. Tank for system washing water. 5. Hand washing water tank. 6. ON/OFF tap for the hand washing tank. 7. Drain valve. 8. Three-way valve for controlling the suction of liquid from individual tanks. 9. Suction filter. 10. Anti-foaming hydraulic agitators. 11. Hydraulic hoses preventing foaming of the working fluid circulating in the circuit. 12. Solid fertiliser diluter. 13. Water content meter in the main tank. 14. Rotating head with spray nozzles. 15. Control Panel 2®. 16. Solenoid valve switched on/off via Control Panel 2®. 17. Solenoid valve for controlling spray nozzle pressure via Control Panel 2®. 18. Screen diluter lever. 19. Main tank cleaning lever. 20. Pressure regulator supplying the control distributor. 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 for bottle washing. 28. Lever for supplying the side diluter. 29. Side diluter. 30. In-line filter

7.6. Performing and rules for setting the required spray dose.

1) Setting the spray dose.

When adjusting the sprayer, the first step is to select the type of spray nozzles. We typically use the following nozzles: KR5 04, EŻ 03, RS 02 (Fig. 23). Optionally, we can use any type of nozzle available in the company's offer. The desired dose of sprayed liquid per hectare can be obtained by adjusting three parameters:

- the size of the spray nozzles used,
- change in driving speed,
- the pressure of the liquid supplied to the sprayers.

2) Selecting the nozzle for 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 on the type of sprayers recommended, use the general recommendations below.

Type of treatment	Type of spraying	Type of nozzle	Type of droplets droplets	Comments
Herbicide sprays (soil-applied) and mineral fertilisers	Soil preparations	Sprayers providing a flow rate of 1.5 l at a pressure of 3 bar	Large droplets spray	Even distribution of the preparation over the entire soil surface
Foliar spraying	Foliar preparations	Sprayers with a 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 preparation over the entire surface of the leaves
Insecticide spraying insecticides	Insecticides	Sprayers with a flow rate of less than 1.0 l at a pressure of 3 bar	Small droplets ple	Prevent the working liquid from collecting on the leaves
Fungicide spraying Fungicides	Fungicides	Swirl nozzles	Small droplets ple	Working fluid getting under the leaves

To select the appropriate driving speed, pressure and working fluid output, use the table below:

Colour according to ISO	Pressure [bar]	Nozzle output [l/min]	Working fluid quantity [l/ha] at a distance of 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	1.27	381	305	254	218	191	169	152	127
	4.0	1.36	408	326	272	233	204	181	163	136
Nozzle RSM Kryza 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 recommendations for the agent used for the agro-technical treatment say to use a yellow nozzle and the amount of liquid used per hectare should be approximately 200 litres per hectare, set the working pressure to 3.0 bar and maintain a driving speed of 5 km/h. With these settings, we will use 190 litres of liquid per hectare. You can also set the pressure to 3.5 bar, in which case we will use 204 litres of liquid per hectare, but remember to take into account headlands where passes overlap. The 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 an agricultural 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 m section and drive along it at a constant engine speed while measuring the time.

$$Prędkośćjazdy\left[\frac{km}{h}\right] = \frac{100[m]}{czas[s]} \times 3.6$$

Nozzle and pressure selection

In order to select the appropriate nozzle and working 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 dose. The next step is to switch on the sprayer pump drive for one minute. After this time, immediately switch off the pump drive and add the missing amount of water (measuring it) to the level before switching on the drive. With this data, use the formula:

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

A simplified test can also be performed by measuring the amount of liquid escaping from one 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 dose per hectare [l/ha],
qc- amount of water sprayed in one minute [l],
q - amount of water sprayed per minute by one nozzle [l], n - number of nozzles,
b – working width of the sprayer [m], v – driving
speed [km/h].

The calculated dose should be equal to the dose recommended for the agrotechnical treatment, but if the dose is lower than required, increase the working pressure, or reduce it if the dose is too high. After changing the pressure, repeat the test until the recommended dose and the calculations are equal.

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

8. Technical characteristics of the sprayer.

8.1. BORYS sprayer - hydraulically folding boom.

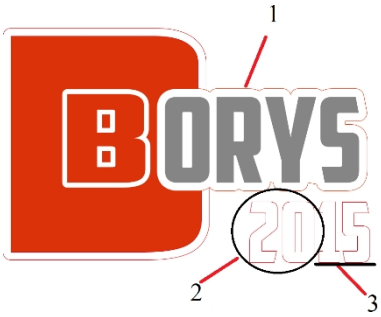


Fig. 61. Description of the sticker. 1. Proper name. 2. The first two digits indicate the tank capacity x100. 3. Field boom width.

BORYS 1500 series		**Borys 1515**	**Borys 1518**	**Borys 1521**
Net weight of the sprayer [kg]		1750	1800	1850
Dimensions of the assembled sprayer [mm]	**Length**	4000	4000	4000
	Width	2850	2850	2850
	Height	2500	2500	*2500*

BORYS 2000 series		**Borys 2015**	**Borys 2018**	**Borys 2021**
Net weight of sprayer [kg]		1850	1880	1900
Dimensions of the folded sprayer [mm]	**Length**	4000	4000	4000
	Width	2850	2850	2850
	Height	2500	2500	*2500*

BORYS 2500 series		Borys 2515	Borys 2518	Borys 2521
Net weight of sprayer [kg]		2050	2100	2150
Dimensions of the folded sprayer [mm]	Length	4000	4000	4000
	Width	2850	2850	2850
	Height	2500	2500	*2500*

BORYS 3000 series		Borys 3015	Borys 3018	Borys 3021
Net weight of sprayer [kg]		2150	2200	2250
Dimensions of the assembled sprayer [mm]	Length	4000	4000	4000
	Width	2850	2850	2850
	Height	2500	2500	*2500*

8.2. Characteristics of the PU-3/140 diaphragm pump

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

9. Delivery and loading onto means of transport.

The sprayer is delivered to the user in a partially disassembled state. The degree of disassembly depends on the means of transport used. Use the frame elements as attachment points for loading and unloading.

10. Storage.

Before long-term storage, clean the machine and repair any faults found. Protect it from the effects of weather conditions. Store the sprayer on a level, hard surface. During winter, you should:

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

11. Disassembly and disposal.

The sprayer is made of 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 should be dismantled. Due to the heavy weight of the components, lifting equipment such as a crane or forklift truck should be used during dismantling. Metal parts should be taken to a scrap yard, and rubber and plastic parts should be taken for disposal or to a storage facility for this type of waste. Used oil from the hydraulic system should be collected in sealed containers and taken to a petrol station that collects it.

12. Possible faults.

The quality of cultivation in specific conditions depends on the speed, condition of the working parts and correct adjustments. If any irregularities are found, check the condition of the working parts and adjust the settings to achieve a satisfactory cultivation result. Malfunctions can adversely affect the performance of the sprayer, increase the cost of the treatment, and damage both the sprayer and the tractor.

CAUTION!

Working with a faulty or poorly adjusted tool can pose a serious risk to the operator and bystanders. Any malfunctions or damage noticed must be rectified immediately.

The most common faults, causes of malfunction and how to remedy them are described in the table below.

Fault, malfunction	Possible cause	Repair method
Pump does not suck	Clogged suction pipe	Clean the pipe
	No liquid in the tank	Fill the tank
	Leaky suction pipe	Remove the leak
	Filter malfunction of the filter	Check the cleanliness and of the filter
Pump output too low	Pump valves stuck or damaged	Replace or clean valves
Strong vibration of the pressure gauge needle gauge	Insufficient pressure in the air chamber	Increase the air pressure in the air vent
	Air in the system	Check the tightness of connections and pipes
	Damaged diaphragm	Replace the diaphragm
A mixture of oil and water flows out of the pump filling hole or oil droplets oil in the tank	Damaged diaphragm	Replace diaphragm
No liquid flow to the sprayers when the pump and control valve are switched on pump and control valve	Damaged or incorrectly installed valves in the pump	Check or replace valves in the pump
	Contaminated suction filter or discharge filter	Clean the filters
	Leak between the pump and the tank	Eliminate the leak
The pressure on the pressure gauge drops and it is impossible to set it to the operating pressure	Contaminated discharge filter	Clean the pressure filter
	Damaged pressure hose	Replace the hose
	Inappropriate or worn nozzles	Replace nozzles
Uneven flow of working fluid from the nozzle	Insufficient pressure in the air regulator	Check and top up the pressure in the air valve
	Low oil level in the pump	Check and top up the oil in the pump if necessary
	Excessive rotational speed Check the pump speed	Check the pump speed
Uneven or excessive wear of the wheels	Incorrect tyre pressure	Check the pressure in and adjust to the recommended
Loud pump operation	Low oil level in the pump	Check and top up oil if necessary
	Excessive rotational speed of the pump	Check the speed, maximum speed is 550 rpm.

13. Warranty conditions and warranty services.

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

14. Service.

No.	Date of notification of	Date of of failure	Description of actions taken and parts replaced	Signature

WARRANTY CARD

Trailed field sprayer

Symbol BRUNO / BORYS -.....

Serial number.....

Date of manufacture-.....

....Date of

of sale, seller's signature seller's stamp

Warranty service on behalf of the manufacturer is provided by:

---------- 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 design may void the warranty. Only TOLMET parts should be used during operation.

16. Warranty terms and conditions

The user is understood to be a natural or legal person purchasing agricultural equipment, the seller is a commercial entity bound by a commercial and service agreement that delivers the equipment to the user, and the manufacturer is the producer of agricultural equipment. When putting the machine/device into operation, the manufacturer provides a warranty according to the following rules:

1. The manufacturer ensures that the product has no material or manufacturing defects.
2. The warranty services are provided by the manufacturer or a seller authorised to provide maintenance services.
3. Under the warranty, the manufacturer or authorised service provider undertakes, in the event of a valid complaint, to:

- repair the equipment free of charge, including replacement of parts,
- supplying the user with new, correctly manufactured parts free of charge,
- replacement of the equipment with new equipment if, based on the opinion of an authorised expert, it is determined that repair is not possible.

4. The warranty is granted for a period of 24 months 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 seller authorised to provide servicing shall carry out warranty repairs within 14 days of the date of delivery of the machine 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 report a complaint immediately after discovering a failure or damage.
9. The basis for filing a complaint is a correctly completed warranty card. The warranty card is invalid without dates, signatures and stamps from the point of sale.
10. The user shall submit a complaint to the seller in writing or by telephone, providing the following information:

- where the machine was purchased (name of the point of sale),
- date of sale,
- year of manufacture of the machine,
- serial number of the machine,
- your address/contact telephone number,
- who performed the initial start-up,
- the type of failure or damage.

11. The warranty does not cover:

- damage caused by random events, unless it resulted from causes inherent in the product,
- accident damage or consequences resulting from them,
- damage resulting from improper storage, use contrary to the intended purpose, improper maintenance of mechanisms (lubrication) and other causes not attributable to the manufacturer. They can only be removed at the user's expense.

12. Mechanically damaged parts and working elements that wear out naturally, i.e. fluids and lubricants, 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 hydraulics circuit must meet the 20/18/15 requirement according to ISO 4406-1996.
14. For parts not manufactured by us, the warranty is transferred by us to their manufacturer.
15. The warranty shall be revoked if the user makes any technical changes, uses the machine for purposes other than those for which it is intended, or uses the machine in a manner that significantly deviates from the instructions for use and operation.
16. The purchase of equipment covered by this warranty is tantamount to acceptance of the above warranty terms and conditions.

17. How to order spare parts.

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

1. The exact address of the person placing the order.
2. The name, symbol and serial number of the machine, year of manufacture.
3. The exact name of the part.
4. Number of items.
5. Terms of payment.

Parts are shipped by courier or collected in person by the customer from the manufacturer or the nearest TOLMET representative.

All spare parts are available on the website

www.tolmet.pl

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