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## **PLEASE NOTE!**

When unfolding the sprayer beams, you must activate the air support so that the air tunnels fill themselves with air. This allows the air tunnels to follow the sprayer beams better and prevents them from being caught anywhere, which can cause damage.

When folding the sprayer beams in, keep the air tunnels filled with air, 125-150 bar on the meter. Now, they will follow the sprayer beams better and will not be caught anywhere, so that no damage can occur.

At the last moment, let the air flow away so that the sprayer beams fall nicely in the transport brackets.

If the air support is equipped with a variable plunger pump and you want to activate the power take-off, you must ensure that the hydraulic pump is always in its neutral position. If it is not, the hydraulic pump can be seriously damaged.

## FOREWORD

As an air support accessory on the spraying machine, the *TURBULANCE* increases the yield and reduces the consumption of water and spraying agents.

The manufacturer-MB TECHNIEK-hopes that the performance of this combination will justify your trust in the manufacturer.

This manual contains information about the operation, use and maintenance of the *TURBULANCE* air support. **Therefore, read the manual carefully and have the air support expertly commissioned.**

### Guarantee

MB Techniek gives a factory guarantee of 12 months with a maximum of 500 ha, to be reckoned from the date of delivery that is stated on the delivery note or invoice.

MB Techniek gives a guarantee on material and/or construction faults. The replacement of parts that have become defective through wear and/or inexpert use fall outside this guarantee.

The guarantee also becomes null and void with inexpert use and/or using the machine with the wrong type of oil. Furthermore, if the machine has been modified and/or altered in the guarantee period without permission from the manufacturer, the guarantee becomes null and void.

For the request and approval for guarantee of defective parts, such parts must be sent to the manufacturer, with the following information:

**A copy of the delivery note/invoice, machine number and year of construction.**

Always state the machine number when ordering parts.

MACHINE NUMBER, *TURBULANCE* : .....

YEAR OF CONSTRUCTION, *TURBULANCE* : .....

DATE OF DELIVERY : .....

BUILT ON SPRAYER MAKE : .....

MACHINE NO. OF SPRAYER : .....

## 1. INTRODUCTION

To properly fight fungi, sicknesses and plagues, crop protection agents must be distributed over the crop as well as possible. In the first instance, it is very important that you choose the right type of nozzle and balancing system. To make the “penetration” of spraying agent in the crop as optimum as possible, *Turbulance* has developed a unique vacuum-air support system. The unit can be assembled on almost every existing or new field sprayer.

Use of the vacuum-air support system provides a large number of advantages:

- \* The drift reduces considerably through the use of the air support’s vacuum-air support system.
- \* Better leaf covering, both on the top and bottom, less shadow operation.
- \* The consumption of water and spraying agents is more efficient, and your spraying capacity increases because you need to refill the water and spraying agents less frequently.
- \* There are more spraying hours available because you can spray up to wind velocities of 5 Beaufort.

From these advantages, it appears that the *Turbulance* air support not only sprays your crop better, but also affects the environment less (less drift/fewer spraying agents) and gives considerable financial advantages through fewer spraying agents, more spraying hours and less damage from drift. Depending on the use, the building scheme and the size of the company, you can generally retrieve the investment in the *Turbulance* air support after about 2 to 3 years.

## 2. CONDITIONS FOR GOOD OPERATION

You can mount the *Turbulance* air support on almost all current makes of field sprayers. When using the air support, you should always have a slotted nozzle to obtain good operation. The rain nozzle and the swivel nozzle have irregular droplets that cannot be controlled by the air flow. These droplets fall into the crop as a result of their own weight, so that the distribution will not be optimum.

In its standard form, the Air support’s fan is driven by the hydraulic system of the tractor. For this purpose, the tractor must have a single-operation regulator block. There must also be a free return connection present, which goes directly to the oil tank or rear bridge of the tractor. The return pressure of the oil from the hydromotor may not amount to more than 2 bar!

**NOTE: Always check that the hydraulic system of the tractor is functioning well and/or the oil delivery is sufficient. As a guideline, you can assume that you need 2.5-3 litres oil per metre working width, with a minimum pressure of 150 bar. Above 25 metres working width, however, a minimum of 75 litres oil per minute is required.**

EXAMPLE: WITH 24 METRES WORKING WIDTH, you need:  $24 \times 2.5 = 60$  l/min.

More information about the hydraulics-system is given in Chapters 6 and 7: ‘Assembly/Connecting the hydraulics system.

### 3. OPERATION

There is much known about conventional spraying. The spray pattern of the modern slotted nozzle is good and there is no reason to change it. The *Turbulence* air support supplements the conventional spraying technique by creating an air flow behind the spray pattern, see fig 1. This air flow causes a vacuum behind the spray pattern, so that the small droplets are sucked into the crop. These droplets are then finally deposited at the bottom of the leaf, so that is hardly any shadow operation. In addition, the air flow blows the crop open, so that the droplets can penetrate more deeply into the crop. The result is a spectacularly better utilisation of the crop protection agents, in contrast to a field sprayer without air support.

Depending on the type of crop and the weather conditions, you can vary the air flow direction and the air velocity. You can change the direction by aiming the air flow more to the rear. As a result, the crop is blown open as it were, because it moves with the air. The fluid droplets continue to move, even when they are in the middle of the crop.

The air support limits the drift to a minimum, so that you obtain a better leaf covering, while you use less water and fewer spraying agents. The capacity of your spraying machine therefore increases considerably because you need to refill the water and spraying agents less frequently.

Another advantage of the *Turbulence* air support is that you no longer only need to spray on wind-free days. When spraying with the wind against you, the spray mist is pressed into the air flow of the air support. Next, the air flow ensures that the spray mist gets into the crop. When the wind is in the right direction, the air flow of the air support works as a wall, so that the spray mist can reach the crop unhindered, see fig. 1: dwg. c and d.

**Remember that it is irresponsible to spray with wind velocities above 4 to 5 Beaufort, even with the *Turbulence* air support system.**

When spraying with the wind against you or with the wind in the right direction, a correct adjustment of the air flow is very important. For example, when spraying with lots of wind, you must always give the maximum amount of air to the air support. This also applies to spraying in lush crops. We return to setting the air flow in chapter 4: 'Settings'.

**NOTE:** Because of the low dosing of water and spraying agents, use the correct filters and clean them regularly. Preferably do not use water from a dirty ditch or pool!

## 4. SETTINGS

### Amount of air

You can set the amount of air required for spraying continuously with the oil flow control valve. The amount of air depends on the crop to be sprayed: the purpose of spraying and the wind strength and/or direction.

In general, we can state:

- \* Little air with small short crops and/or plants.
- \* Lots of air with high dense crops and/or plants.

**NOTE:** With small short crops or no crops, the amount of air must be set such that, when you place your hand on the ground, you feel the air 'caressing' your hand. This method of setting also applies to high/dense/lush crops.

You determine the amount of air by adjusting the oil flow control valve for the oil delivery, which sets the number of fan revolutions. The more air you want to use, the larger the number of revolutions of the fan, i.e. larger oil delivery.

The amount of air that you use can be seen from the shape of the air tunnel:

- \* With little air, the air tunnels have their normal shape (round).
- \* With moderate air consumption, the air tunnels feel medium-hard.
- \* With lots of air consumption, the air tunnels feel hard (convex).

### Air flow

The direction of the air flow and the amount of air depend on:

1. The density of the crop: the denser the crop, the more air.
2. The wind direction: with the wind against you, aim the air flow downwards; with the wind in the right direction, aim the air flow more to the rear.
3. The wind velocity in the field: the more wind, the more air.
4. The driving speed: the higher the driving speed, the more air.

You can set the direction of the air flow continuously with an electrical spindle motor that you can operate from the tractor with a switch or rotary knob with scale division of the air control.

**NOTE:** Only rotate the air tunnels when they are filled with air, otherwise the air tunnels will not rotate over the whole sprayer beam width and there is a chance of damage to the spindle motor or other parts.

### General guidelines

- \* The higher the sprayer beams hang above the crop, the less will be the effect of the air flow. Therefore, the sprayer beam may never hang higher above the crop than the field sprayer manufacturer advises. The most ideal height is 55-70 cm.
- \* Make sure that the air flow never disturbs the spray pattern. Therefore, always aim the air flow to the rear. If the air flow is aimed much too straight downwards, the spraying fluid can be blown away and lots of spray mist will be lost. With the wind in the right direction, you must aim the air flow so far backwards that the spray pattern is not affected.
- \* With small crops, aim the air flow to the rear and use little air, otherwise there can be too much drift.
- \* **When folding the sprayer beams up, there must be air in the air tunnels!** Switch the fan off at the end of the folding. This prevents damage to the air tunnels.

## 5. CHOICE OF NOZZLE

It is of great importance that you choose the nozzle to match the crop and the weather situation. Therefore read the following text about droplet size and degree of cover thoroughly.

### Droplet size and degree of cover

The sprayer nozzles break the spraying fluid down into a large number of droplets that are spread over the crop. The size of the droplets is expressed in microns (1 micron = 0.001 mm). The VDM (Volume Medium Diameter) is used to indicate the droplet size, above and below which all droplets form half of the total volume. The spectrum of the spraying fluid is a degree of spread of the droplet size. A wide spectrum has relatively many large and small droplets. The optimum is a narrow spectrum, because we then have lots of droplets of the same size. As the fluid is broken down into more equal small droplets, the degree of cover will increase. After all, the volume of one droplet with a diameter of 0.5 mm is equal to the volume of 1000 droplets with a diameter of 0.05 mm.

### Droplet size and drift

Small droplets have the disadvantage that they are sensitive to drift. They are easily carried by the wind to adjacent fields or other undesired places. By using the **Turbulance** vacuum-air support system, drift can be considerably limited. Large droplets are less sensitive to drift but have the disadvantage that they easily roll off the leaf.

An optimum droplet size is 200 µm.

### Effects on the droplet size

The VDM of a sprayer nozzle depends on several factors:

- Top angle: a larger top angle gives relatively smaller droplets.
- Spray pressure: a higher pressure gives relatively smaller droplets.
- Nozzle size: a larger nozzle or larger opening gives relatively larger droplets.
- Type of nozzle: a slotted nozzle is preferred.

**The *Turbulance* system works best in combination with slotted nozzles.**

With a powerful wind (wind force 5 to 7), it is necessary to use a nozzle that gives larger droplets. In these weather conditions, small droplets cannot be kept under control, even with an air support. If you choose a nozzle that gives larger droplets, then it makes no sense to use a **Turbulance** air support system because the air flow has no control over the larger droplets.

If you work with smaller nozzles, fill your tank with clean filtered water. Sprayer nozzles that give small droplets are more sensitive for blockages. Make sure that spray powders are properly dissolved in the spraying fluid.

**NOTE:** The use of an incorrect nozzle can irrevocably damage your crop!  
Therefore, let your choice depend on the type of crop and the weather situation.

## 6. ASSEMBLY

### Assembling the fan housing

The fan housing must be mounted on the centre part of the sprayer beam. During the assembly, you must remember to place the fan housing exactly in the middle, because of the balancing. The fan housing is assembled on the assembly points at the front of the fan housing. Do not forget that the top must also be fastened. If the top is not fastened, no claim can be made on the guarantee if the fan housing fractures.

### Assembling the rings

The stainless steel rings for the air tunnels must be mounted such that the bottom of the rings runs parallel to the sprayer beams. The rings must be fastened on the sprayer beams at equal distances from each other as much as possible: minimum 70 cm, maximum 200 cm. The last ring at the end of the sprayer beam may not be situated further than 20 to 30 cm from the end of the sprayer beam.

**NOTE:** It is preferred to mount the rings on the beam where the retracted beam rests on the transport brackets. In this case, the air tunnels remain properly supported and will not catch behind the transport brackets and be damaged when the sprayer beams are unfolded. Six types of rings are provided with the air support, with a cross-section of 500, 450, 400, 350, 300, 250 mm, respectively.

The largest ring (500 mm) must be mounted at 70-150 cm from the fan housing. The middle rings (450 to 300 mm) are at the centre part of the sprayer beam and the smallest ring (250 mm) is at 20-30 cm from the end of the sprayer beam.

**NOTE:** Never weld the ring holder to the sprayer beam, but use bolted joints. This is to counter damage and weakening of the sprayer beams. With bolted joints, you always have the possibility to move the ring holder without much trouble, for example if they get stuck with the folding-in.

### Assembling the air tunnels

The air tunnels must be slid through the rings and mounted at the end of the fan housing. The two air tunnels are fastened with the clamps provided. The air tunnels can now be suspended on the rings with the plastic tie rods provided.

**NOTE:** Ensure that the air holes of the air tunnels are aligned as best as possible with the air holes in the fan housing. This only applies if the plate with the air holes in the fan housing is also adjustable.

If the plate with the air holes in the fan housing is not **adjustable**, the air holes of the two air tunnels must be the same in the neutral position, i.e. aimed straight downwards.

## 7. THE HYDRAULICS SYSTEM

The propeller of the *Turbulence* air support is driven by a hydraulic motor.

The smaller working widths (up to 18 metres) are mostly driven by the hydraulic system of the tractor; the tractor must have a single-operation regulator block. Please note, the return oil may never run through a regulator block and/or return filter. It must be directly connected to the oil tank and/or rear bridge of the tractor.

**THE RETURN PRESSURE MAY NOT BE HIGHER THAN 2 BAR, TO PREVENT DAMAGE ON THE HYDRAULIC MOTOR AND/OR OIL CATCHER.**

With the larger working widths (from 18 metres), an own hydraulic system is mounted on the sprayer; this set can be equipped with a variable plunger pump or a geared pump.

The hydraulic pump (including gearbox) is mounted in front of the water pump, to prevent damage to the water pump.

## 8. MAINTENANCE

For optimum operation of the *Turbulence* air support, the following actions must be adhered to.

### Hydraulics system

The oil filter in the fan housing must be replaced at least 1x per year. When, with certain types of oil filter, the green part of the indicator on the oil tank is no longer visible or the indicator has become red, the filter element must be replaced immediately!

**NOTE:** Always check if there is any oil leakage in the fan housing, leaks must be repaired immediately to prevent damage to the hydraulics system from too little oil in the system and to prevent oil damage in the crop.

When the fan housing becomes dirty from dust or spraying fluid that is sucked in, it must be cleaned with an environmentally-friendly cleaning agent. If there is too much dirt on the propeller blades, this must also be cleaned to prevent imbalance.

**NOTE:** Never clean the inside of the fan housing with a high-pressure cleaner. This can cause water to penetrate into the electrical spindle motor or other components.

Regularly check the air tunnels for damage, and repair with a repair set as necessary. Clean the damage properly before gluing or repairing the damage.

## 9. User instructions for the *TURBULANCE* air support

No wind	Sprayer beam height 60-80 cm above the crop with a normal sprayer nozzle, e.g. 025, 03, 04 or 05 slotted nozzle. If you want to have sufficient spraying agent at the bottom with a high crop, use a sprayer nozzle with a larger top angle, so that the sprayer beam height can be lower. With an unsteady sprayer beam i.e. lack of balance and wobbling, the distribution of the spraying fluid is compensated by the air flow.
Weak wind	Sprayer beam height 40-50 cm above the crop. Adjust the air flow such that the spraying fluid cannot blow away. The air flow and air amount can be set from the tractor.
Strong wind	Sprayer beam height 30-40 cm above the crop, air adjustment as for weak wind.
Short lush crop	Sprayer beam height 40-50 cm above the crop, air flow as far backwards as possible and give maximum air.
General guideline	When the driving direction is changed, the state of the air flow and air velocity must also be adapted.

## 10. POSSIBLE MALFUNCTIONS AND SOLUTIONS

PROBLEM	CAUSE	SOLUTION
The air pressure in the air tunnels is not constant.	Propeller speed is not constant.	Check oil delivery and oil pressure. Replace the components if required.
	There is too little oil in the hydraulic system, hydraulic pump sucks air.	Top the oil tank up to level with the prescribed oil.
	Oil filter is blocked.	Replace oil filter element.
Oil leakage of the hydraulic motor in the blower housing.	The return pressure of the return oil is too high; return pressure may be a <b>maximum of 2 bar</b> .	Check the return hose and couplings for damage. Replace oil catcher of hydraulic motor.
The air tunnels do not want to rotate any more. Spindle motor does not work.	Check fuse in control box.	Replace the fuse(s).
	Rotary knob/switch of control box defective.	Replace the defective parts.
	Spindle motor is defective or contacts dirty.	Replace the spindle motor and/or clean contacts.
	Fracture in the cable.	Replace the cable.
The air tunnels are not sufficiently filled with air at full propeller speed.	The air tunnels are too badly damaged or cracked, lots of air is lost.	Repair the air tunnel(s) or replace as necessary.
The crop is insufficiently opened.	The air flow is not sufficient.	Increase the propeller speed.
	The air flow is aimed too far to the rear and/or driving speed is too high.	Aim air flow forwards and adapt driving speed.
	The sprayer beams are too high above the crop.	Adapt sprayer beam height.
There is too much drift with a short and/or too small crop.	Too much air, air flow is aimed too straight downwards.	Give less air and aim the air flow backwards.

## 11 **Technical data.**

Working width	15-39 metres
Dimensions of blower housing	1.50 x 1.00 x 1.00
Weight of the unit	95-128 kg (depending on the model)
Air capacity	max. 72000 m <sup>3</sup> /h
Air velocity	0-52 m/s
Maximum revolution of propeller	2750 rpm
Maximum pressure of hydraulic system	250 bar
Required oil delivery	2.5-3.0 litre per metre sprayer beam
Air delivery control	electrically, via control box on tractor manually on request.
Air direction control	electrically, via control box on tractor

## 12: Maintenance on Hydraulic drive unit/Gearbox *TURBULANCE* air support

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- 1: Under normal working conditions, the hydraulic drive unit for the *Turbulance* air support requires no extra maintenance.

Before starting work, the oil level of the oil tank must be checked; the gauge glass must be at least three quarters full. If necessary, top up with the prescribed hydraulic oil.

- 2: Gearbox, the oil must be replaced after the first 50 hours of operation, then once per year. The oil level must be regularly checked through the gauge glass. If necessary, top up with the prescribed oil.

The hydraulic drive unit can be fitted with the following components/hydraulic pumps, depending on the model.

* hydraulic pump	series 2: HP variable plunger pump series 3: Cassappa/HP geared pump
* gearbox	gearbox mounted in front of the water pump: type ML 72 1-3 gearbox mounted behind the water pump: type ML 52 1-3.4
* contents of oil tank	45 litres for variable plunger pump 70 litres for geared pump
* prescribed type of oil	for plunger pump: type SAE HV 48 or equivalent for geared pump: type SAE HV 68 or equivalent for gearbox: type SAE 15 W 40 (this is engine oil) <b><u>not gear oil!!</u></b>
* contents of gearbox	0.5-1.3 litres, depending on the type of gearbox
* safety valve working pressure	HP variable plunger pump: 250 bar geared pump: 185 bar

## 1.0 Wiring diagram(s), Air control box

For machines equipped with one Air control box, the connections of the 7-pole socket and 7-pole plug are as follows:

7-pole socket	7-pole plug	
to no. 1 green	to no. 1 green	motor actuator
no. 2 yellow	no. 2 yellow	motor actuator
no. 3 black	no. 3 black	potentiometer actuator
no. 4 blue	no. 4 blue	potentiometer actuator
no. 5 brown	no. 5 brown	potentiometer actuator
no. 6 red	no. 6 red	spindle motor, hydraulic pump
no. 7 white	no. 7 white	spindle motor, hydraulic pump

For machines equipped with two Air control boxes, the connections of the 13-pole socket and 13-pole plug are as follows:

### Air control box no. 1

13-pole socket wire colours	13-pole plug wire colours		distribution box wire colours	
no. 1 white	no. 1 dark-green	→	green + white	motor actuator
no. 2 red	no. 2 yellow	→	red + yellow	motor actuator
no. 3 black	no. 3 black	→	black	potentiometer
no. 4 blue	no. 4 dark-blue	→	blue	potentiometer
no. 5 green	no. 5 brown	→	brown	potentiometer

### Air control box no. 2 (this is equipped with an extra switch for more/less air)

no. 9 green	no. 9 light-green	→	green + white	motor actuator
no. 10 yellow	no. 10 purple	→	red + yellow	motor actuator
no. 11 black	no. 11 grey	→	black	potentiometer
no. 12 blue	no. 12 light-blue	→	blue	potentiometer
no. 13 brown	no. 13 orange	→	brown	potentiometer
no. 6 red	no. 6 red	→	black	spindle motor, hydraulic pump
no. 7 white	no. 7 white	→	white	spindle motor, hydraulic pump