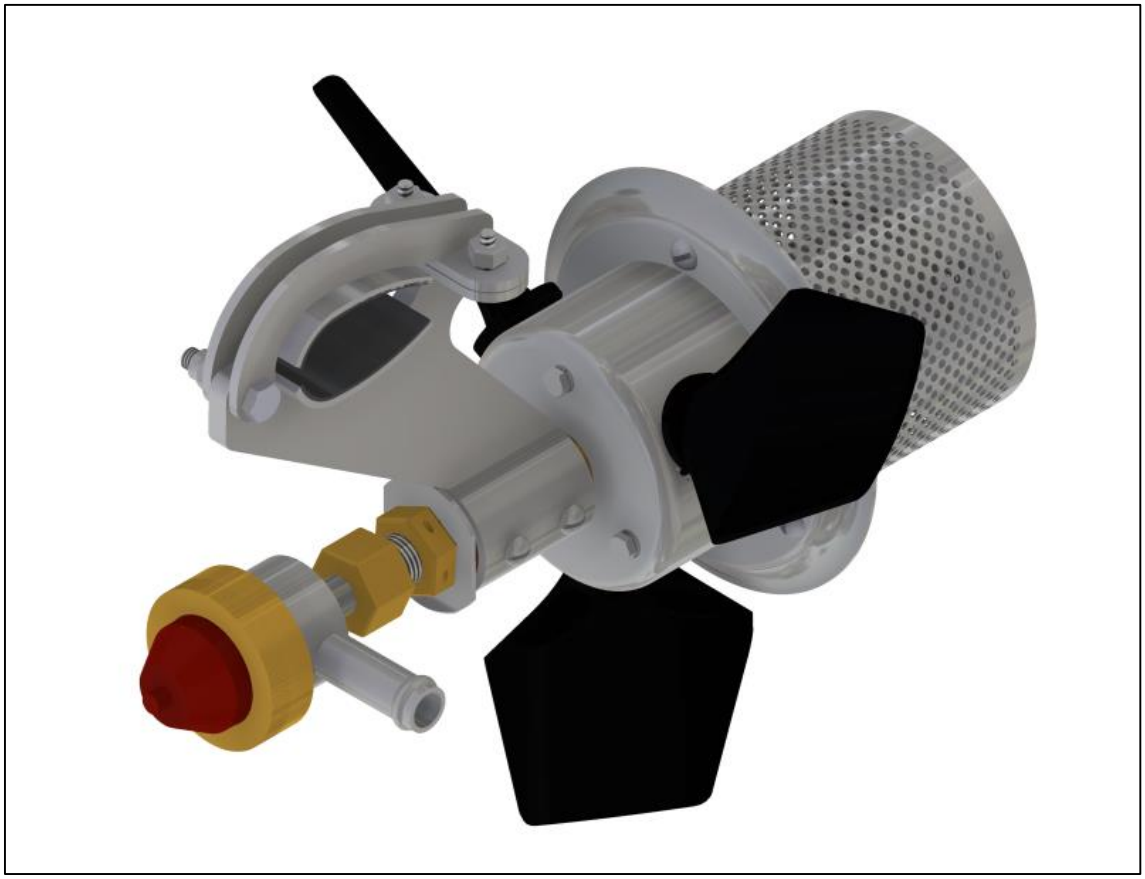
TECHNICAL MANUAL

ROTARY ATOMIZER



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INTRODUCTION

After years of research, the Zanoni Equipamentos® rotary atomizers began to be developed through high quality and accuracy procedures, using materials resistant to the most corrosive products used in aerial spraying. They are equipped with a cylindrical stainless steel screen and are available in several mesh sizes, producing the necessary spectrum of droplet sizes for each type of operation.

The Zanoni atomizer is driven by the airflow that hits the fan blades, which are adjustable, thus changing the rotation speed and producing the desired droplet size. Each atomizer can handle a flow of up to 30 liters per minute (7.9 USG/min), which is controlled by the variable restriction units (V.R.U). The equipment also has an anti-dripping system on the inner side (a check valve on the shaft exit) and another on the outside (on the shaft entrance).

The essential number of atomizers depends on the type of aircraft. Zanoni Equipamentos recommends the use of 8 to 12 units.

The complete Zanoni atomizers are composed of:

- Mounting clamp;
- Check valve;
- Fan blades (available in three sizes);
- Hoses;
- Fittings;
- Connections (nipples, elbows and caps);
- Variable Restriction Unit (VRU).

TECHNICAL SPECIFICATION

- Weight: 2,30 Kg (with the mounting clamp, VRU, and check valve);
- Liquid throughput: 0 to 30 L/min or 7.9 gal / min (values obtained in tests using water, this number may vary according to the chemical product);
- Rotational speed: 2000 to 10000 rpm

All components of the atomizer are presented in the Chapter 1 of this document. When ordering any replacement material, please provide the complete part name, part number and your equipment serial number.

1. COMPOSITION

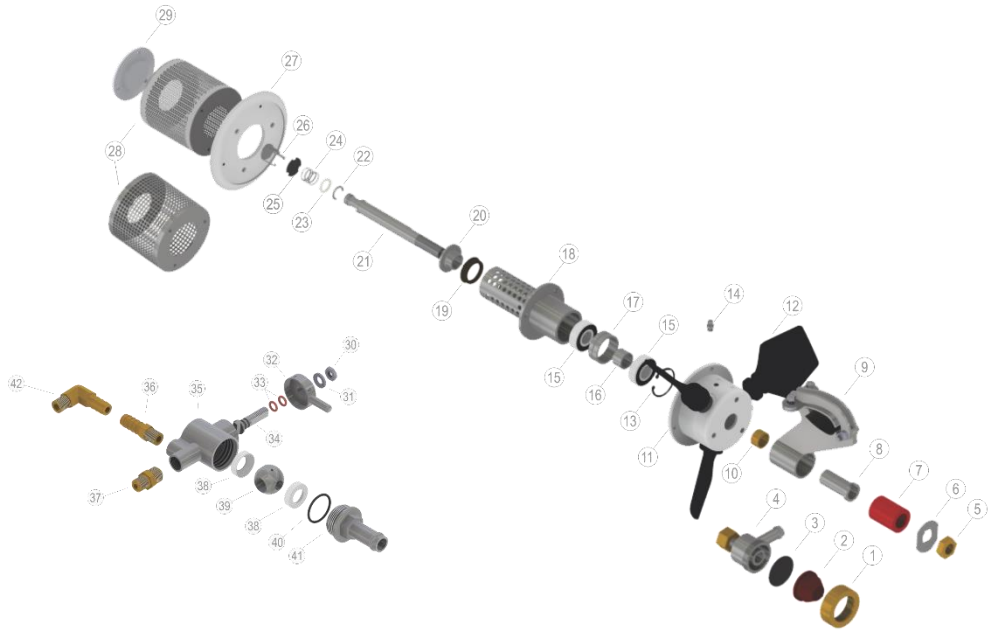

Image 01: Components of the Zanoni Equipamentos rotary atomizer®

ITEM	PART NUMBER	DESCRIPTION	ITEM	PART NUMBER	DESCRIPTION
1	Z 20224-05-04	RING, SECURING	21	Z 20224-01-03-01	SHAFT
2	Z 20224-05-02	CAP	22	Z 20224-01-03-05	SPRING CLIP
3	Z 20224-05-05	VITON DIAPHRAGM	23	Z 20224-01-03-04	TEFLON GUIDE
4	Z 20224-05-01	1/2" DIAPHRAGM CHECK VALVE BODY	24	Z 20224-01-03-03	SPRING
5	Z 20224-01-09	BRASS NUT	25	Z 20224-01-03-02-03	VITON RING
6	Z 20224-02-05	WASHER	26	Z 20224-01-03-02	RETENTION VALVE
7	Z 20224-02-04	POLYURETHANE BUSH	27	Z 20224-01-07	DEFLECTOR DISC
8	Z 20224-02-03	BUSH PIPE	28	Z 20224-01-06-M2,5	ATOMIZER GAUZE M2,5
				Z 20224-01-06-M3	ATOMIZER GAUZE M3
				Z 20224-01-06-M14	ATOMIZER GAUZE M14
9	Z 20224-02	MOUNTING CLAMP (1.1/2" BOOMS)	29	Z 20224-01-13	DEFLECTOR CAP
	Z 40224-02	MOUNTING CLAMP (2" BOOMS)			
10	Z 20224-01-10	BRASS BUSHING	30	Z 20208-01-04	5/16” HEX NUT
11	Z 20224-01-01	HUB BODY ASSEMBLY	31	Z 20208-08	5/16” WASHER
12	Z 20224-01-08	FAN BLADES	32	Z 20224-03-09	DISC WITH LEVER
	Z 50224-01-08	FAN BLADES	33	Z 20224-09	O´RING 009
	Z 80224-01-08	FAN BLADES	34	Z 20224-03-04	VRU SHAFT
13	Z 20224-01-02-04	SNAP RING I-35	35	Z 20224-03-01	VRU BODY
14	Z 20224-01-01-03	GREASE NIPPLE	36	Z 00093	NOZZLE FOR HOSE (3/8" X 1/8" NPT)
15	Z 20224-01-02-03	BEARING	37	Z 00089	¼” X 1/8" NPT NIPLE
16	Z 20224-01-02-06	BEARING SPACER (INSIDE)	38	Z 20224-03-05	MAIN SEAL (TEFLON)
17	Z 20224-01-02-05	BEARING SPACER (OUTSIDE)	39	Z 20224-03-03	STAINLESS STEEL BALL
18	Z 20224-01-02-07	BEARING HOUSING	40	Z 20224-08	O´RING 019
19	Z 20224-01-05	V'RING	41	Z 20224-03-02 Z 20224-03-11	V.R.U. CAP 1/2" V.R.U. CAP 5/8"
20	Z 20224-01-04	DEFLECTOR RING	42	Z 00092	ELBOW (3/8" X 1/8" NPT)

Table 01: Atomizer components

2. OPERATION

Before each operation, it is necessary to pay attention to some guidelines to guarantee a positive work result. Check the following recommendations:

- The brass nut must be tight and braked;
- Make sure the bearings are properly greased;
- The fan blades must be adjusted correctly, all with the same angle;
- The gauzes must be free of dirt and clogging, maintaining the correct balance;
- The atomizers must rotate freely, the only existing friction must be from the V´ring;
- Check the seals of the anti-drip systems, if there is any irregularity, the diaphragms must be replaced;
- The VRUs must be correctly installed, all in the same position and without any signs of leakage.
- If you notice any vibration, stop the operation, decrease the speed, land as soon as possible and check the entire installation (adjustments, fan blades and atomizer gauze).
- Atomizers must be greased after every 10 hours of work.

If any problem arises which you cannot solve, please contact the Zanoni sales team for guidance.

3. INSTALLATION

The Zanoni Equipamentos® atomizers can be used in all types of ag aircraft, changing only the quantity of equipments, their arrangement in the booms, the size of the fan blades, and the mesh of the atomizer gauze. Here we presente the installation suggestions for each airplane, with dimensions in millimeters. It is recommended that the operator carry out tests to obtain the best suitability of the atomizers.

Ipanema, Pawnee, and Cessna

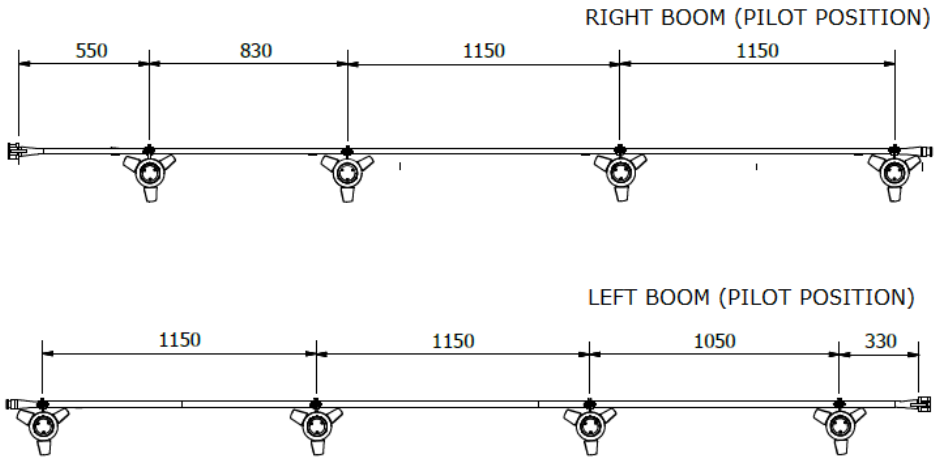

Image 02: Suggested arrangement for the Ipanema, Pawnee and Cessna aircraft.

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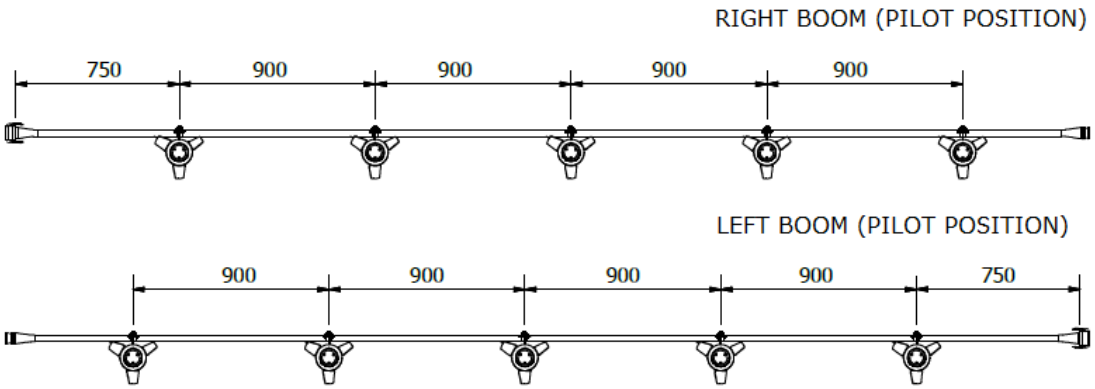


Image 03: Suggested arrangement for the Ipanema, Pawnee and Cessna aircraft.

4. CALIBRATION

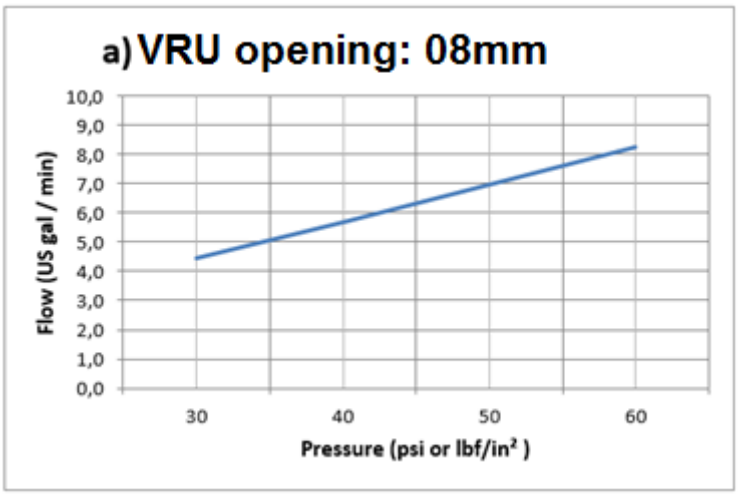
The calibration of the equipment is essential to obtain the expected result and it is the pilot's role to monitor occurrences during the flight. The pilot must be aware of excessive vibrations, the right rotation of the atomizers (RPM) and inconsistencies in the application, which is why reading the manual is very important before starting operations.

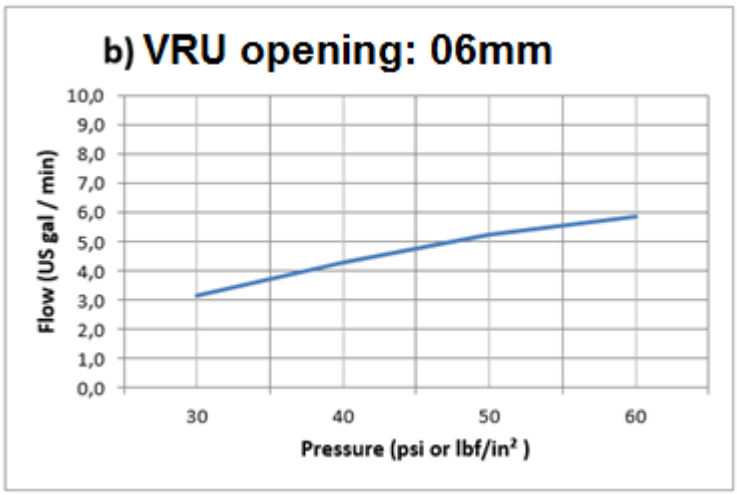
The calibration procedure is divided into two parts: flow adjustment and droplet size adjustment.

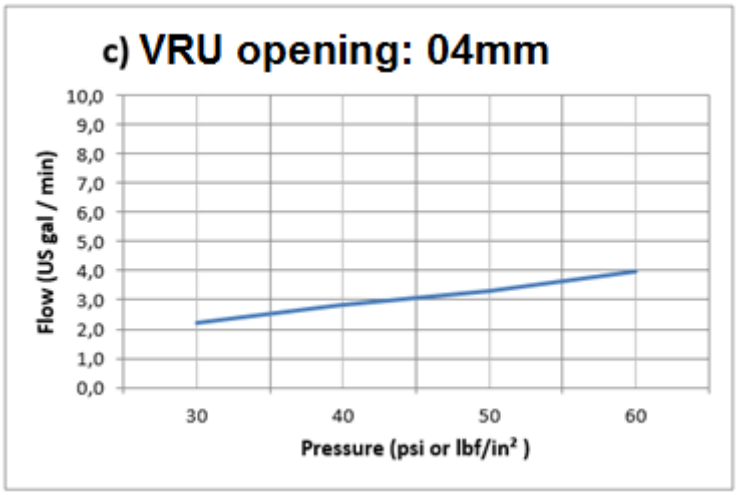
➢ Flow adjustment

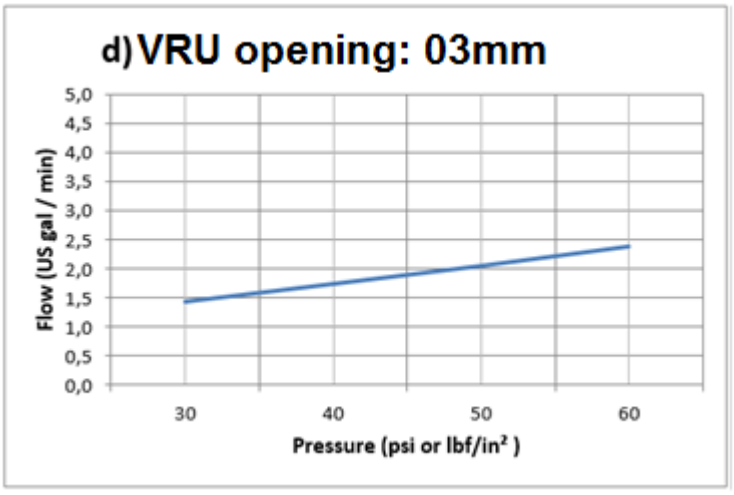
The flow adjustment must be carried out to ensure the exact amount of product that will be sprayed over the crop field. The flow of the atomizer is controlled by the Variable Restriction Unit (VRU - Z 20224-03), which has 5 holes in its stainless steel ball. Each hole defines the desired flow (2mm, 3mm, 4mm, 6mm, and 8mm) according to the pressure of the wind pump.

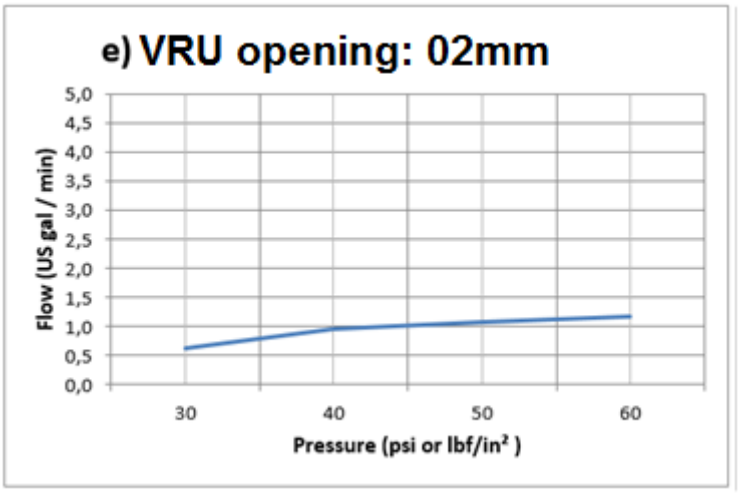
The flow rate obtained according to the pump pressure and VRU opening are shown in the charts below.











- **Droplet size adjustment**

The droplet diameter is obtained according to the speed of rotation of the atomizer gauzes. This rotation varies according to the speed of the aircraft and the angle of the atomizer propeller blades.

The Zanoni Equipamentos® atomizers were designed for a maximum speed of 10,000 RPM, therefore, it is necessary to be careful during any flight or descent before starting an application range, so as not to exceed this rotation, because without liquid passing through the atomizers, the speed increases. The blade angle can vary as shown in figure 04.

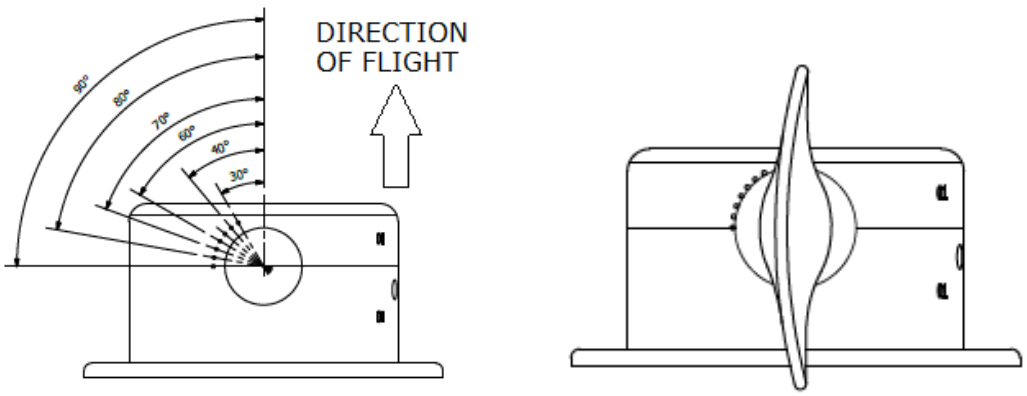


Image 04: Possible variations in blade angle..

Field tests with variation in the flow and in the fan blades position, at a speed of 140mph, provided the droplet sizes shown in the following table:

SPEED: 140mph	FLOW 5L/ha	FLOW 10L/ha	FLOW 15L/ha
 LOW ROTATION BLADE IN POSITION 2	180 µm	190 µm	200 µm
 MEDIUM ROTATION BLADE IN POSITION 3	150 µm	160 µm	170 µm
 HIGH ROTATION BLADE IN POSITION 4	130 µm	140 µm	150 µm

Table 02: Droplet size variation according to blade position and flow rate, at 140mph.

Note: These results are preliminary, resulting from tests performed with M3 mesh on an Air Tractor aircraft. Zanoni Equipamentos also offers other types of meshes, with different spectrum of drops. For more information, contact the company's technical team.

Zanoni supplies three types of fan blades:

- Z 20224-01-08: larger blades, suitable for smaller and slower aircraft with speeds from 100 to 120 mph.
- Z 50224-01-08 medium blades, suitable for larger aircraft with speeds from 130 to 150 mph.
- Z 80224-01-08 smaller blades, suitable for larger and faster aircraft with speeds from 160 to 180mph.

5. MAINTENANCE

For the expected performance and durability, inspect and clean the atomizers regularly. In order to avoid clogging and equipment malfunctions, which can be caused by residues of the application products, the spray system must be cleaned internally at the end of each day.

5.1 Pre-flight inspections

- Make sure the mounting clamp is securely attached to the booms.
- Check if the supply hoses are properly tightened.
- Observe the condition of the fan blades (remembering that all of them must be in good condition and in the same marking on the hub body assembly).
- Check the brass nut, it must be properly tightened and braked.
- The atomizer gauzes must be free of solid products and dents, to avoid imbalance.
- Bearings should be in good condition (and properly greased) and atomizers must turn freely when rotated by hand, with no looseness in any direction.

5.2 Tools required for assembly and disassembly

- 7/8" wrench
- 1 1/4" wrench
- 7/16" wrench
- Screwdriver
- Snap ring pliers

6. DISASSEMBLY

a) Using the screwdriver, loosen the clamps.
b) Using the 7/16" wrench, loosen the two support nuts (if the atomizer is attached to the bar) according to image 06.
c) With the screwdriver, remove the 3 screws from the deflector cap (image 07).

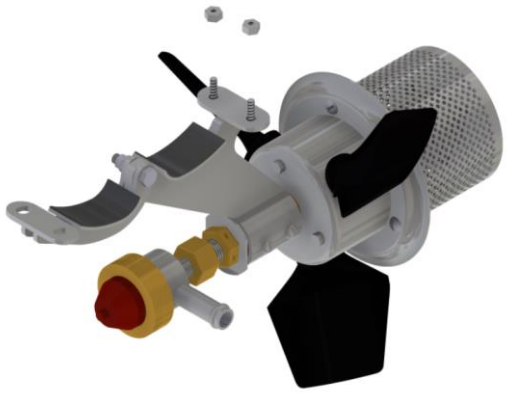


Image 06:

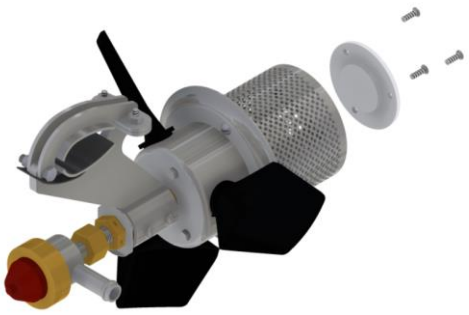


Image 07:

d) With the 7/8" wrench, release the check valve (image 08).
e) Cut the safety wire.
f) With the 1 1/4" wrench, hold the waher and with the 7/8" wrench loosen the brass nut, as shown in image 09.

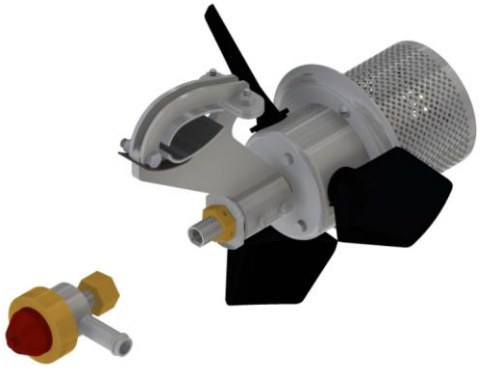


Image 08:

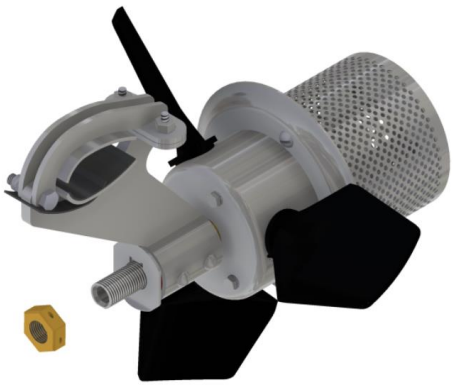


Image 09:

g) Remove the washer, the mounting clamp and the brass bushing (Image 10), then push the shaft in the opposite direction from the side which the mounting clamp and the washer came out, as in Image 11.

Image 10:

Image 11:

h) Using the 7/16" wrench, remove the 3 bolts from the hub body assembly, where the fan blades are attached (Image 12), then separate the cap from the hub body as in Image 13 (in this operation it is already possible to change the bearings, according to item 6.1 of this manual).

Image 12:

Image 13:

i) Using the screwdriver, remove the 3 screws that secure the hub body assembly to the deflector disk, then pull the atomizer gauze (it should come out attached to the deflector disk, as shown in Image 14). Remove the 3 screws that secure the bearing to the hub body assembly, as in Image 15.

Image 14:

Image 15:

j) Using the screwdriver, unscrew the 3 screws that secure the atomizer gauze to the deflector disk, as shown in Image 16.

Image 16:

k) Remove the snap ring. Insert a round bar (of approximately 180 mm long) into the bearing housing, pressing the bearings until they are removed, as shown in figure 17:

Image 17:

Thus, the atomizer will be completely disassembled.

6.1 Bearing Exchange

a) Remove the shield from one side of each of the new bearings, as shown in Image 18.

Image 18:

b) Insert the first bearing in the bearing housing with the face without shield facing upwards (Image 19) and then insert the bearing spacers, external and internal, as in Image 20.

Image 19:

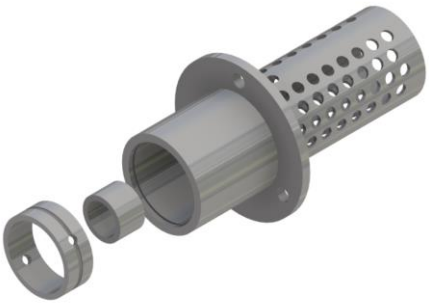


Image 20:

c) Insert the second bearing with the unshielded face down (Image 21) and place the snap ring (Image 22). The bearings must be inserted by hand and with little effort.

Image 21:

Image 22:

d) Once inserted (Image 23) there should be no clearance in any direction.

Image 23:

NOTE: ZANONI EQUIPAMENTOS® ROTARY ATOMIZERS ATOMIZERS ARE ASSEMBLED WITH HIGH PERFORMANCE BEARINGS. WHEN YOU NEED TO MAKE ANY EXCHANGE, USE FIRST LINE BEARINGS TO GET THE BEST OPERATION OF THE EQUIPMENT.

7. ASSEMBLY

a) Using a screwdriver, screw 3 flat-head screws securing the deflector disk to the atomizer gauze (Image 24).

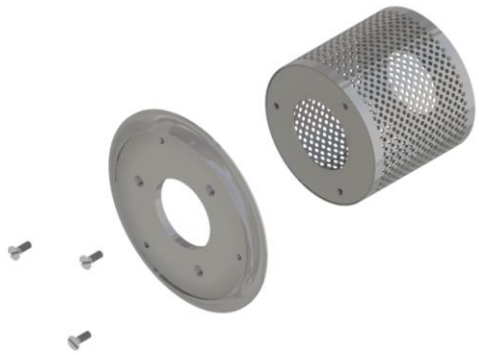


Image 24:

* The two parts must be centered (as in Image 25), for this use the central hole of the them as a reference.

Image 25:

b) Using the screwdriver, screw the 3 screws that secure the bearing housing to the hub body assembly, as shown in Image 26 (the bearing housing must have the bearings already fitted and secured). Image 27 shows the bearing housing and hub body assembly joined.

Image 26:

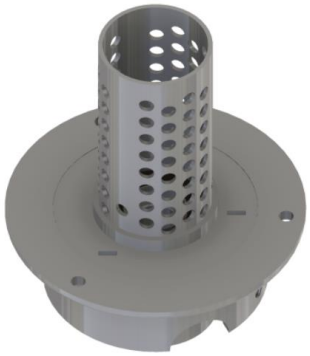


Image 27:

c) Fit the deflector disc and the atomizer gauze to the bearing housing and to the hub body assembly (Image 28), checking that the bearing housing tube has fitted into the hole in the upper part of the atomizer gauze. Then, screw the 3 round head screws securing the deflector disc and the atomizer gauze to the hub body assembly (Image 29).

Image 28:

Image 29:

d) Insert the fan blades in their housings on the hub body assembly and fit the hub cap (Image 30), checking that the numbers engraved on the hub cap and hub body must be aligned (it is important due to the balance of the equipment). Then, with the 7/16" wrench, place the screws on the hub body assembly (Image 31), regulate the fan blades until they reach the desired position and tighten the screws to the approximate torque of 2.3 nm (1.7 lb ft), checking that the screws are fitted with lock washers.

Image 30:

Image 31:

e) Fit the shaft through the atomizer gauze passing inside the bearing housing (Image 32).

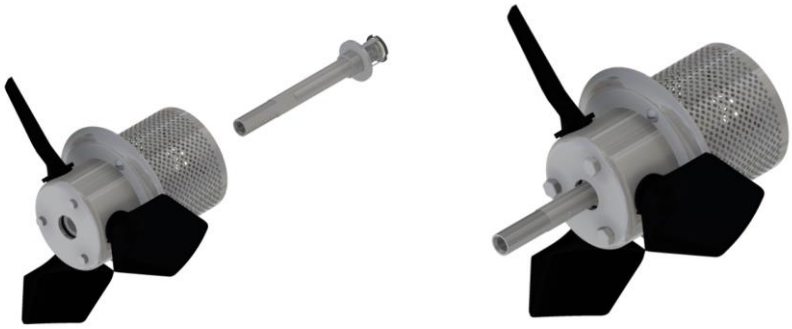


Image 32:

f) Fit the brass bushing, put the shaft into the mounting clamp (checking if the shaft chamfer is facing down) and fit the washer (Image 33).

Image 33:

g) Thread the brass nut onto the shaft until it touches the washer (Image 34).

Image 34:

h) With the 1 1/4" wrench, hold the washer and with the 7/8" wrench tighten the nut to the approximate torque of 14 nm (10 lb ft). The atomizers must be rotating freely, the only existing friction must be from the V'ring..

i) Brake the brass nut on the washer.

j) With the small screwdriver, screw the deflector cap onto the atomizer gauze (Image 35).

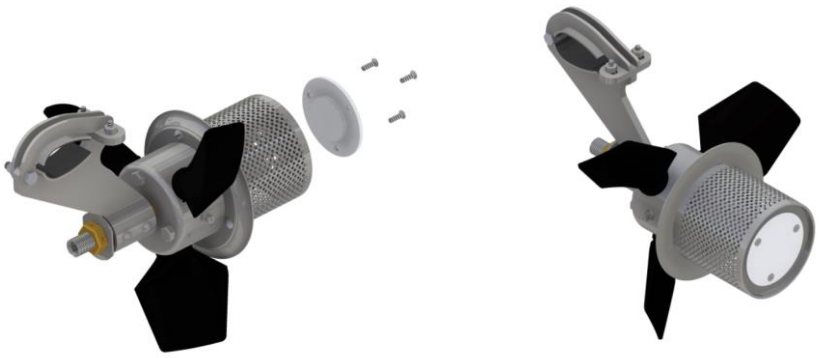


Figura 35:

k) Screw the check valve onto the end of the shaft (Image 36) and tighten until it locks in the desired position.

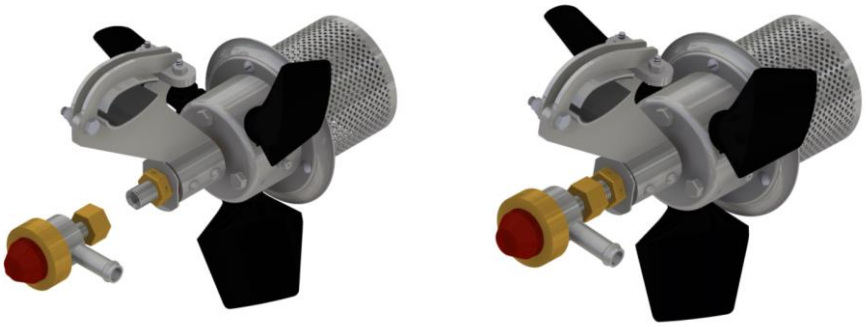


Image 36:

l) Fit the mounting clamp to the boom and with the 7/16" wrench tighten the screws, checking that they have a lock washer. Then fit the supply hoses and secure them with clamps. In case of doubts or problems, contact Zanoni team.

8. CONVERSION TABLE

CONSUMPTION
1 gal/ac = 9,353944 l/ha 1 l/ha = 0,106907 gal/ac

DISTANCE MEASURES	
1 nautical mile = 1852 meters = 1,852 km	1 mile = 1609 meters = 1,609 km

VOLUME
1 US GAL (AMERICAN GALLON) = 3,785 LITERS = 0,833 UK GAL (IMPERIAL GALLON)

FLOW RATE
1 l/s = 60 l/min = 15,85 US gal / min

PRESSURE
1 psi = 1 lbf/in² = 0,0703 kgf/cm² = 0,0689 bar = 0,0680 atm

MASS
1 kg = 2,205 lb = 35,274 oz

NOTES

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