



APPLIED TURBINE TECHNOLOGIES

# Operating Manual

Zirocco-M Jet Dryer & Cleaner



**ATT**



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# EU Declaration of Conformity

The undersigned, representing the following manufacturer:

<b>Applied Turbine Technology ApS</b>
<b>Nordborgvej 81, 6430 Nordborg, Denmark</b>

hereby declares that:

<b>Machine type no. 10000-40</b>
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is in conformity with all relevant provisions of the following EC directive(s):

<b>DIRECTIVE 2006/42/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 17 May 2006 on machinery The EMC Directive 2004/108/EC</b>
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Person authorized to collect technical data and make them available to the relevant authorities:

<b>Name</b>	<b>Address</b>
<b>Mike Claudi Kühl</b>	<b>Nordborgvej 81, DK-6430 Nordborg</b>

The machine's design has taken the standards and specifications referenced in Annex 1 of the EU Declaration of Conformity into consideration.

Nordborg, May 10, 2019

  
Brian Ellegaard Andersen  
CEO



## Annex 1 to EU Declaration of Conformity

References to standards and specifications used for the Declaration of Conformity:

### Harmonized standards

Number	Version	Title
DS/EN 60204-	2006	Safety of machinery - Electrical equipment of machines - General requirements
DS/EN ISO 13849-1	2006	Safety of machinery - Safety-related parts of control systems - General principles for design
ISO 12100	2011	Safety of machinery - General principles for design. Risk assessment and risk reduction.

### Other standards:

Number	Version	Title

### Other specifications:

Number	Version	Title



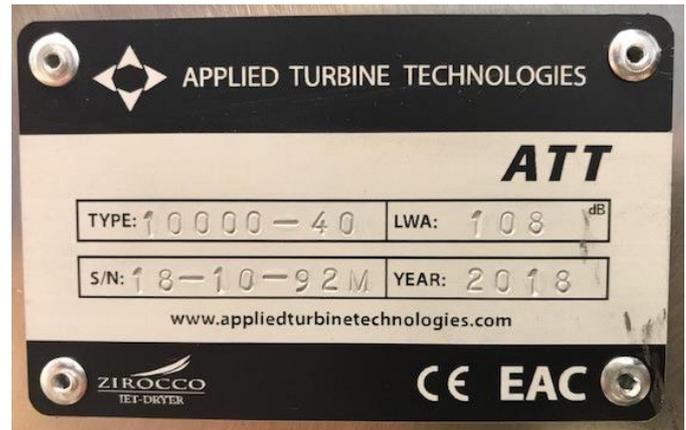
## Nameplate

The Zirocco is provided with a name plate according to the requirements stated in the Directive 2006/42/EC placed in the front of the product above the nozzle cover.

The nameplate is showing the CE symbol as well as the name and contact address of the manufacturing company.

The nameplate is also showing some important product information such as:

- TYPE/model number of the product
- S/N fabrication number, a unique product number
- Year of manufacturing
- LWA, which gives the sound pressure in dB at 0-m distance from the noise source.



The Zirocco has an A-weighted max sound power level of 108 dBA around the machine and **103 dBA at the operators' position**, at its max performance. The LWA is here not directly related to an environmental noise level as weighted average of the different work steps during machine operation. It is the maximum sound pressure which the operator will experience when using the machine at 100% performance level

This choice of LWA was made to ensure proper health protection even when the machine is used above its intended use.

Level of noise (dB A)	Maximum daily exposure time
85	8 hours
91	2 hours
97	30 minutes

When persons are exposed to excessively loud environments (85 dB or more), hearing protection is required to prevent noise-induced hearing losses. The table to the left is showing the acceptable noise levels without hearing protection during a maximum daily exposure.

It is required that the operator of the Zirocco is using relevant hearing protection to prevent work induced hearing losses.

In the United States hearing protection is by law assigned a single number rating, NRR, which is an abbreviation for a Noise Reduction Rating. Hearing protection is available with NRR ratings from 0 to 30.

The required NRR level of a hearing protection is an estimate of the exposed daily noise level dose, which then can be converted to an 8-hour Time Weighed Average called TWA.



The following table shows the required NRR rating for the hearing protection dependent of the average machine usage a day.

TWA exposure		Operator				
Working	hours	1	2	3	4	
Work exposure (100% Machine performance level)	dB(A)	103	103	103	103	
TWA dose	dB(A)	89	93	96	98	
NRR protection rating		15	23	29	33	
dB(A) reduction	$(NRR-7)/2$	4	8	11	13	
Requirement	dB(A)	85	85	85	85	

In this table the LWA value is used in the calculation of the TWA dose as a “worst case”, although the operator normally would operate the machine at lower performance level because the marking equipment often is limiting the overall operation.

The highest **NRR rating** for earplugs is 33, and the highest available **NRR rating** for earmuffs is 31. These values reflect the **level** of noise **protection** available for each device when worn alone. Combining earplugs with earmuffs can offer a **NRR protection level** of 36.

The environmental exposure will depend on how the work is done. It is possible to work below an environmental sound pressure LWA of 108, if that is needed, but it will require that the machine is operated below 50% of the maximum possible.



# Safety Instructions

## Obligations

### **Obligations of the Operator/manager:**

The Zirocco must only be operated by personnel with the following knowledge:

- Are aware of the basic workplace safety information and accident prevention regulations.
- Have been instructed and trained in working with the Zirocco.
- Have read and understood this operating manual.

### **The operator is obliged to as follows:**

- To ensure that the required service and maintenance is performed according to the instructions laid out in this operating manual.
- To keep all the warning pictograms on the machine in a legible state.

If you still have queries, please contact the representative or manufacturer.

### **Obligations of the Operator:**

Before starting work, all operators are obliged to as follows:

- To comply with the basic workplace safety instructions and accident prevention regulations.
- To read and understand the operating section of the operating manual.
- To use the required personal protective equipment, when working with the Zirocco.
- To read the section "Warning symbols and other labels on the machine" in this operating manual, and to follow the safety instructions represented by the warning symbols, when operating the machine.
- To get the required work training from instructors having participated in the recommended product courses.

If the operator discovers that a function is not working properly, he must eliminate the fault immediately. If this is not the task of the operator or if he does not possess the appropriate technical knowledge, then he must report this fault to his superior (supervisor).



## Intended use

The product Zirocco-M's intended use is for outdoor drying and cleaning of roads, runways, concrete areas or other areas of non-flammable materials.

The product is using the exhaust from a micro jet turbine to dry and clean the surfaces and should not be used on surfaces covered with sand or gravel as well as waste of or close to flammable materials.

The product is intended to be operated by a professional construction worker according to the guidelines in the instruction manual using the required PPE's.

***When operating the Zirocco ear protections is mandatory. In restricted work areas with limited air exchange respiratory protection or a limited use can be necessary to apply.***

A backup operator needs to be present, where oncoming traffic is not shielded from the working area or on roads in hilly areas.

## Misuse

The product Zirocco should not be used indoor, since the jet turbine is using diesel fuel and the exhaust emission could be toxic.

As soon as the turbine engine is warming up or running the machine needs to be moved in order not to leave unintended hot spot marks on the ground.

Bystanders should be kept behind the machine when working, or at a safety distance of 5m away from the nozzle cover in the working direction. The exhaust can lead to ejection of debris such as dust, sand or small gravel, which can lead to eye injuries.

Examples of intended use:



Line and Tape marking



Concrete drying



Crack repair

This Operating Manual utilise the following safety signs. Follow these safety signs carefully since failure comply may cause personnel injuries or irreparable damage to the equipment.



**WARNING**

**Personal injury / mortal danger**

A usage situation of a technical nature or similar that may cause personal injury or mortal danger.



**CAUTION**

**Damage to machine or accessories**

A usage situation of a technical nature or similar that may cause damage to the machine or its accessories.



**ATTENTION**

**Important information**

A usage situation of a technical nature or similar that is very important.



**INFORMATION**

The product without operational disturbances. Provides useful tips and recommendations as well as information about the efficient use.



## Disclaimer

All specifications and instructions in this document conform to the rules and provisions in the EU Machinery Directive 2006/42/EC and Directive 2004/104/EC.



### **INFORMATION**

This Operating Manual is subject to change without prior notice.  
Contact [info@zirocco.dk](mailto:info@zirocco.dk) to request new editions of the Guide.

**The warranty will be voided if the product is damaged for one of the following reasons:**

- Non-compliance with the instructions in this Operating Manual
- Use of the product for a purpose it is not designed for
- Natural wear or tear
- Incorrect installation performed by the owner or a third party
- Mechanical or technical alterations
- Use of unauthorized spare parts
- Non-compliance with the maintenance instructions or lack of maintenance within the prescribed service intervals.



## Introduction

### Zirocco - Jet Dryer & Cleaner

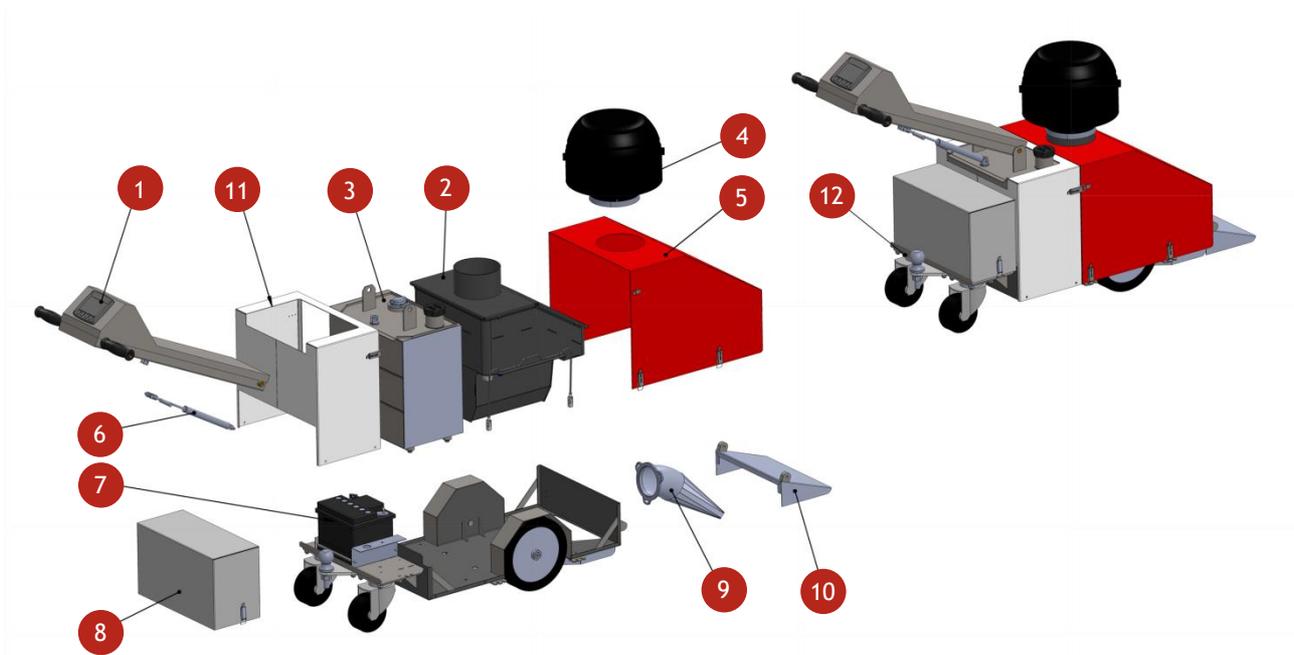
The Zirocco jet dryer sets new standards for surface treatment in e.g. the road marking, paving, fugue sealing, and crack repair industries. The Zirocco takes advantage of our innovative gas turbine technology to ensure effective cleaning and drying of surfaces, roads, fugues, and cracks.

- A very flexible machine, which can be pushed by hand for minor jobs or be attached to and pushed by a line driver for larger projects.
- Independent and convenient machine operation as there is no need for a compressor or bottled gas supply.
- The Zirocco is equipped with a standard diesel engine EN590. The machine does not use LPG, which makes its use possible also in populated areas.
- Only hot air - no open flames (a requirement for operations in airports etc.)
- Drying and cleaning speed from 1 to 6 km/h depending on the surface and weather conditions and nozzle width.
- Both our Display DP250 and Telematics WS 403 controller are constructed to industrial specifications relevant to the automotive and transport industries.





## Product Overview



- 1) Handle and display
- 2) Turbine box
- 3) Fuel tank
- 4) Cyclone separator
- 5) Engine cover plate
- 6) Adjusting lever
- 7) Battery
- 8) Battery cover
- 9) Nozzle
- 10) Nozzle Cover/Shroud
- 11) Bonnet
- 12) Line driver hook

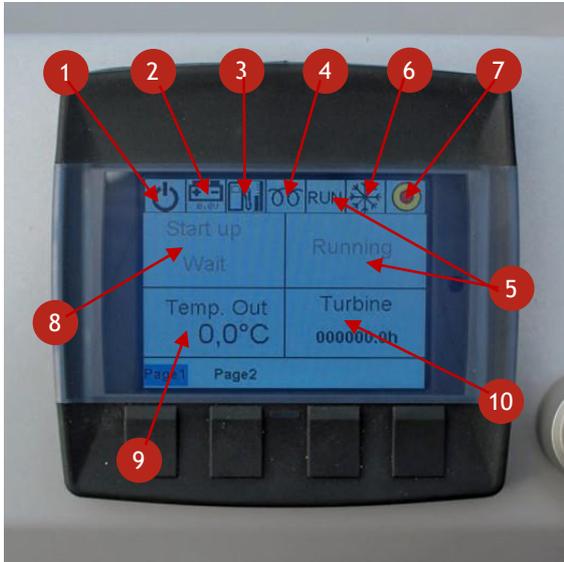


Figure 2: Display, page 1 (Page 1)

### Display “Page 1”

- 1) Operating symbol
- 2) Battery voltage
- 3) Fuel level
- 4) Pre-heater
- 5) “Run” and “Running” indicate that the machine is ready for operation
- 6) Cooling
- 7) Emergency stop Flashes red when the emergency stop is enabled
- 8) Start-up/Wait. Flashes when the machine is ready for operation
- 9) Temperature indication
- 10) Operational hours



Figure 3: Display, page 2 (Page 2)

### Display “Page 2”

- 1) Air Flow adjustment up / down
- 2) - Air Flow is adjusted down
- 3) + Air Flow is adjusted up
- 4) Percentage indication



## Accessories

Item	Description	Order no.
Battery charger	8 A, 12 volts	4000-20
Fuel filter	40 µm	5000-100
Air filter	50 m2	5000-60
Cyclone separator	0-25 m2	5000-40
Wheels	Ø 250	5000-10
Battery	60 Ah	4000-10
Display	DP 250	1000-20
Standard Nozzle	300 mm	2000-30
Labels: ATT	Logo	9000-30
Label: Heat	Warning sign	9000-20
Label: Hearing protection	Warning sign	9000-10
Turbine oil	ATT Turbine oil	7000-80



# Operation

## Operation

Zirocco may only be operated by personnel, who have been instructed properly in the safety and use of the Zirocco.

The product-training should cover the following subjects:

- Operation of the Zirocco
- Maintenance procedures
- Engine box replacement
- Engine box ventilation
- Telematics portal
- Machine safety

## Safety Instructions



### **WARNING**

#### **Fire hazard**

Do not use the Zirocco indoors or close to inflammable material.

#### **Hot exhaust air/safety distance**

The outlet temperature next to the turbine is 350 to 550°C. Keep a distance of at least 5 m from the machine during operation.

#### **Hearing and eye protection**

The personnel in the immediate vicinity of the machine must use hearing protection and safety goggles, when operating the Zirocco.



### **CAUTION**

#### **Fuel**

Use Diesel EN 590 along with 5 % ATT Turbine oil (7000-80) in the mixing ratio 1 to 20. (20 liters of fuel to 1 liter of ATT Turbine oil). When utilizing US Gallons, the mixing ratio is 1 liter ATT Turbine Oil to 5 US Gallons of Diesel. In areas where low smoke emission is needed, then use odourless and smokeless petroleum (use Exxsol D 80 or Shellsol D70 petroleum corresponding to Diesel EN 590).

#### **Exhaust nozzle**

Always check the exhaust nozzle for damages, cracks or constrictions before use.

#### **Keep under supervision**

Do not power up and leave Road Dryer unsupervised.

Do not move the machine before it has cooled down completely.



## Power-Up

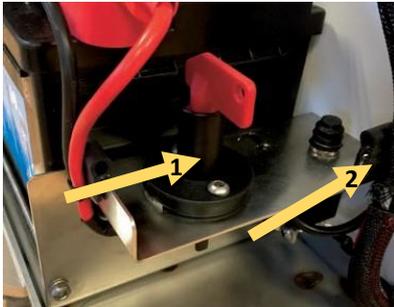


Figure 1

- 1) Main switch - cuts power to the machine. " Never use when the machine is in operation".
- 2) Thermal fuse.



Figure 2

- 3) Press the green start button of the main switch to turn on the control.



Figure 3

- 4) Turn the key switch to position "1".



Figure 4

- 5) The green operating symbol on the display will light.



## Warm-Up



Figure 5

- 1) Turn the key switch to position 2 and keep it in this position for 4 seconds.
- 2) Release the key switch.



Figure 6

- 3) The pre-heater symbol in the display will flash, and the current temperature will be displayed.



Figure 7

- 4) The “Start-up/Wait” symbol flashes. Once the machine has warmed up, the “Running” symbol will flash steady green.

It is important to move the machine when the Start-up/Wait symbol sign flashes in order to avoid hot spot marks on the ground.



## Operating the machine

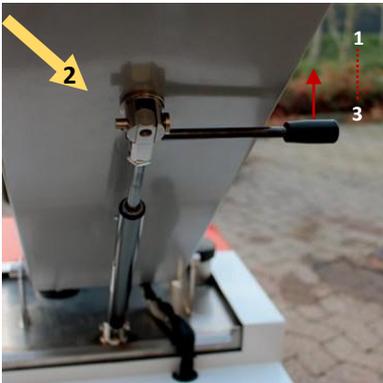


Figure 8

Set the operating lever to the correct working height:

- 1) Pull the handle up.
- 2) Set the operating lever.
- 3) Release the lever.



Figure 9

The safety wire is connected to a stop switch. The string is attached to the operator during operation. If the driver moves to a distance of more than 0.5 m from the machine, the safety wire is pulled, and the machine stops.

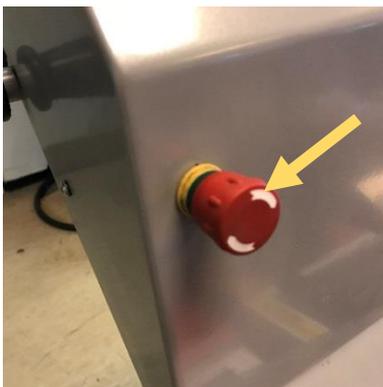


Figure 10

If you press the safety button, the machine stops, and the turbine cools down.



## Parking



Figure 11

The machine needs to be placed on firm surfaces before the shut down procedure can be initiated.

The product has parking brakes on each pivot wheel, which must be activated before leaving the machine.

## Cooling



Figure 12

- 1) Turn the key switch from position "1" to position "0". The machine will shut down to 0 %, stay there for 30 seconds and then start a cooling program.

The machine can be restarted once the display shows the text " Ready to Start again".



Figure 13

- 2) During cooling, the cooling symbol will flash in the display, and the current temperature will be displayed.



## Machine shut-down



Figure 14

- 1) The red stop button of the power switch can only de-activated, when the turbine`s cooling program is completed and the operating symbol on the display has been off for 2 minutes. The machine turns off automatically after 60 minutes (factory setting). The time can be set from 20 to 60 minutes.

## Re-fueling



Figure 15



## Low Fuel Level

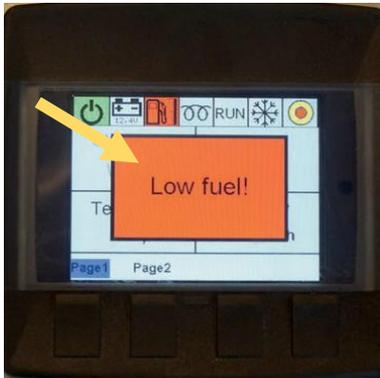


Figure 16

- 1) If the fuel tank is empty, the turbine turns off, and the display indicates “Low Fuel”. Fill up the fuel tank and power up again.

## Air filters



Figure 17

- 1) Daily Air Filter Check before use:
- 2) Inspect for intact filters and excess dirt and damage.
- 3) The two air filters must be replaced simultaneously and after maximum 10 hours of operation.
- 4) When prompted to change filter or if the filters are not serviceable, then follow the step 2(changes filters)

## Changes filters



Figure 18

The two air filters must be replaced simultaneously and after maximum 10 hours of operation. Switch off the machine before replacing the filters. Use only filter type ATT 5000-60. Then change the filters and turn the key to the left to reset the warning.



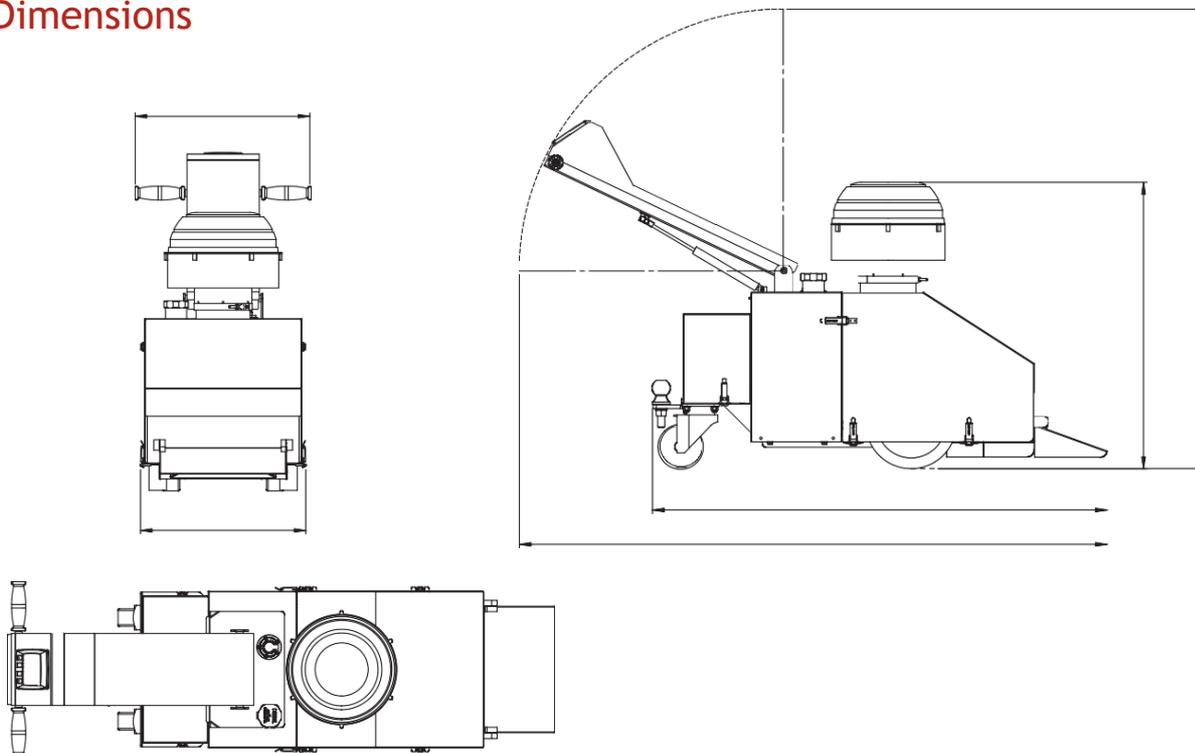
# Technical Data

## Specifications

<b>Gas turbine:</b>	350 kW
<b>Fan:</b>	100 m3 at an outlet temperature of 350- 550° C
<b>Weight (approx.):</b>	120 kg/264 lbs
<b>Drying width (approx.):</b>	30-120 cm
<b>Fuel (EU specifications):</b>	EN 590
<b>US specifications:</b>	1-D S15 ULSD
<b>Battery:</b>	ATT 4000-10 (12V, 60 Ah Box size L02)
<b>Air filter:</b>	PM 2.5 (2 pcs filters with maximum 10 hours of operation)
<b>Fuel filter:</b>	40 µm
<b>Cyclone separator:</b>	0-25 m2

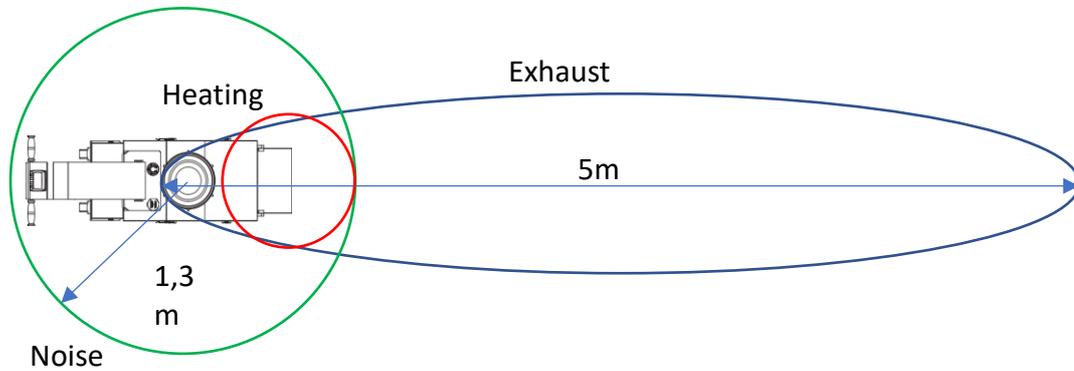
See order numbers in “Accessories” on page 10.

## Dimensions





## Hazard and danger zones



The hazard and danger zones are illustrated in the above figure.

Each hazard zone requires its own protection measures

- The NOISE zone requires earmuffs to avoid loss of hearing ability
- The EXHAUST zone, where the use of safety glasses are required
- The HEATING zone, where use of safety shoes are required'



## Warning Signs



Figure 4: Heating



Figure 5: Hearing protection

The nozzle cover can still be warm after the turbine engine has cooled down. Care should be used when touching the cover plate.

Order immediately new warning signs if the old ones get damaged. Warning signs can be ordered via ATT Distributors (see order numbers in “Accessories” on page 10).



# Troubleshooting

## Error Messages

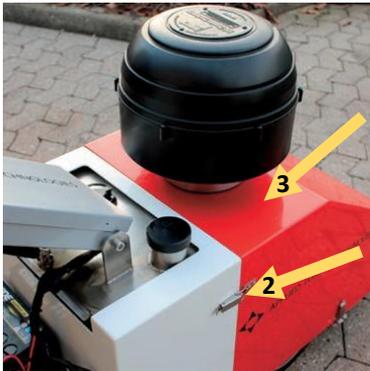
Error message	Solution
Black user screen	Remove battery cover and check <ul style="list-style-type: none"> <li>• Main switch is activated</li> <li>• Reset the thermo fuse</li> <li>• Battery cable logs and connections</li> <li>• Measure battery voltage</li> </ul> Remove handlebar cover and check <ul style="list-style-type: none"> <li>• The electric fuse</li> </ul>
User screen turns off immediately after start up attempt	Reset safety switch on the handlebar
No preheat after 4 seconds	Terminal will show <ul style="list-style-type: none"> <li>• To low battery voltage</li> <li>• To low fuel level</li> <li>• Wait 2 minutes and try again</li> </ul>
Low battery level. symbol flashes red.	Recharge the battery with the battery charger.
Low fuel level. The fuel level symbol flashes red.	Fill up with fuel. Wait 2 minutes to get CANBUS updated
Safety switch activated	Reset safety switch
Turbine will not start after repeated attempts.	Follow the trouble shooting guide, page XX
The display flash one time	Reset the safety switch
The battery symbol shows no voltage and flashes red	Check the electric plug outside the turbine engine module is connected. Check if any wire is damaged or loose to the electric plug
Low airflow with 100% on the display	Check if the diesel filter is dirty
Unstable airflow in range 0 to 100%	Check the diesel system and ventilate the system
Air flow high flashes on display	Change air filters
Air flow low flashes on display	Check air filters = install air filters
Rotor Blocked	Follow the trouble shooting guide, page XX



## Fuel System Ventilation

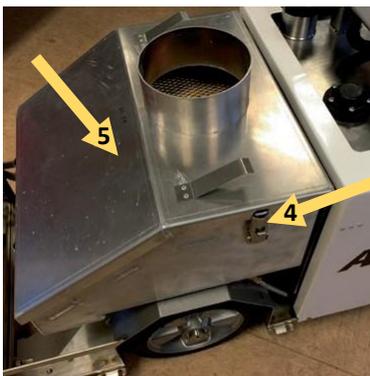


1) Remove the cyclone separator.



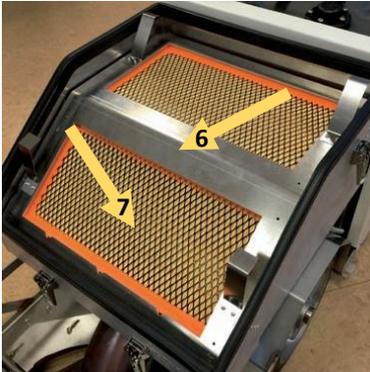
2) Loosen the quick releases on both sides of the heat shield.

3) Lift and remove the heat shield.



4) Loosen the quick releases on the engine box cover on both sides.

5) Remove the engine box cover.



- 6) Pull out and remove the filter frame.
- 7) Remove the air filter.



- 8) Check for air bubbles in the hose.
- 9) Air out the system.



## Check and service

### Turbine Module Box

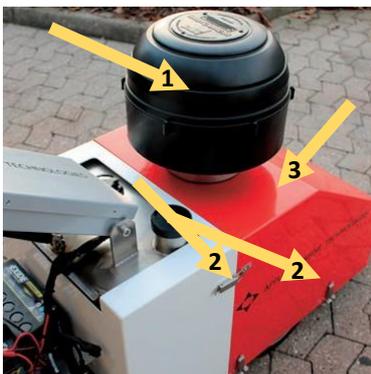
Ensure completion of the service check of the turbine module box after maximum 100 hours or once a year. ATT has the only authorised workshop for service checks.

### Air filter

Inspect the air filters daily. Replace the air filters if they are soiled or blocked.

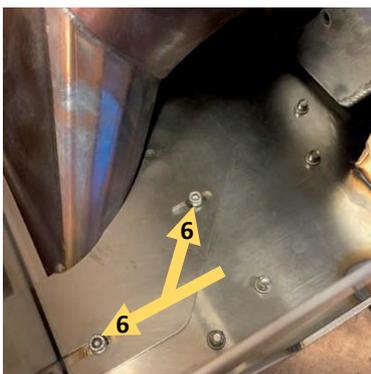
### Cyclone

Inspect the cyclone daily. Clean and check for any damage or other elements, which can prevent full functionality



### Turbine Module Box Replacement:

- 1) Remove the cyclone separator.
- 2) Loosen the quick releases on both sides of the heat shield.
- 3) Lift and remove the heat shield.
- 4) Remove the electric plug.
- 5) Remove the fuel hose.



- 6) Remove the 4 screws on the nozzle lock plate.
- 7) Pull out the engine box.

Once the new turbine box is installed, ship the replaced turbine box to Applied Turbine Technologies for service etc.

Pack the replaced turbine box into the transport box, write down your contact details on the supplied shipment label, place the label on the box and return the package.



### Overview of Recommended Maintenance and Service

Daily	Remarks	Every 10 Hours	Every 100 Hours
Clean the wheels	Remove bitumen or other sticking materials	Replace the Air Filters	Service check at ATT
Clean the Cyclone Filter	If cleaned with water, then dry before installation	Check the wheel locks	
Clean the Nozzle Cover	Remove bitumen or other sticking materials	Clean the engine cover plate	
Dust off and clean the Zirocco	Remove dust and dirt incl. bitumen leftovers etc.		
Check the Air Filters	Replace if dirty or showing signs of tear		
Check fuel level in the display	Refuel if necessary (premix in a plastic cannister)		

### Battery

Standard battery of the type EXIDE 600 (12V, 60 Ah) or similar.



#### Battery charging

1) Charging plug



2) Charge the battery with an ATT battery charger.

When the battery is charged at a temperature below freezing point, use the 14.7 V charging button.



#### Battery replacement

1) Dismantle the battery wires.

First, remove the (+) pole and then the (-) pole.



- 2) Dismantle the two battery holders.
- 3) Install the new battery and battery holders.

### Wheels

The Zirocco wheels are subject to extensive heat and wear. It is recommended that they are replaced, as soon as they show signs of damage. New wheels and other spares and accessories can be ordered via our distributors (see more on our website: <https://appliedturbinetechnologies.com/en/distributors>) or if distributors are not available via direct order to [info@zirocco.dk](mailto:info@zirocco.dk)



### Replacement of wheels

- 1) Dismantle the fixed wheels on the front end of the machine with a hex key.



- 2) Install the new wheels.



- 3) Dismantle the swivel wheels on the machine's back end (Ø250/Ø125 mm). Each wheel is installed with four nuts. Install the new wheels.



## Storage & Transportation

If the Zirocco is not utilised for more than three months, dismantle the battery and empty the machine's fuel tank.

Store the Zirocco in a place with low air humidity and do not expose to dust, dirt, rain, snow and vibrations. If possible the Zirocco should be stored in the relevant packaging box from ATT.

## Wastedisposal

Zirocco - Road Dryer should be returned to Applied Turbine Technologies for proper waste disposal.



### **ATTENTION**

#### **Important information**

Do not try to take apart the Zirocco yourself. It contains components that need separate treatment in connection with waste disposal.

Prior to returning:

- 1) Empty the machine of fuel



APPLIED TURBINE TECHNOLOGIES

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