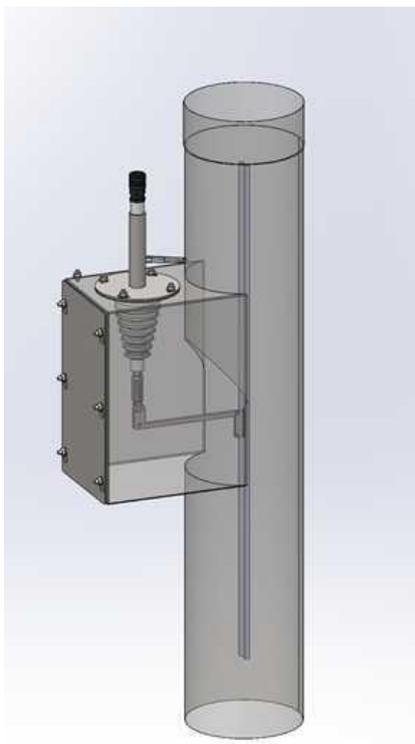


Electrostatic Micro-Dust Filter OekoTube-Inside (OTi) for Woodstoves

Installation, Operation, Maintenance and Servicing Manual



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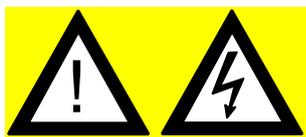
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1 General Information

The OekoTube line of products, including the OekoTube-Inside (OTi) are high quality precision devices designed and engineered in Switzerland. One World Resource Management is the General Distributor for the United States and has adapted the product to meet the specific needs and characteristics of the United States market. This device is designed to meet the highest safety standards if handled professionally and in accordance with all safety precautions during the installation, operation and maintenance. The device is specifically designed to generate a high voltage charge on an electrode which is inserted into the flue of any wood fired stove. The device must never be operated outside of a flue. **CAUTION: Risk of severe electric shock!**



Notice and Disclaimer:

You must read these instructions carefully prior to the installation and operation of the OekoTube-Inside device. Failure to follow these instructions or tampering with the product in any way will void the warranty. In no case will distributor be liable for personal or material damages arising out of the improper installation, maintenance and operation of this product. In no event will the distributor be liable for potential damages which exceed the purchase price of the device and will not cover labor or other incidental costs.

1.1 Safety Notes



- The installation may only be performed by authorized and skilled personnel.
- The dust-separation module must be installed subject to local fire code, but no less than 16" (40 cm) from combustible materials.
- The statics and stability of the flue must be ensured prior to installation.
- The flue must be checked for deposits and fire safety prior to installation.
- After ignition of a fire, the temperature in the flue increases and the high voltage from the ESP automatically switches on. The electrode or the electrode holder **MUST** not be touched during operation! **WARNING: CONTACT WITH THE ELECTRODE DURING OPERATION MAY LEAD TO SERIOUS INJURY OR DEATH.**
- During the installation of the OekoTube device all applicable occupational health and safety requirements prescribed by law must be complied with.
- Disconnect all electric power from the OekoTube before commencing any work on the OekoTube device.
- The OekoTube device must be accessible at all times for maintenance.

No liability is assumed for personal or material damages caused by failure to follow these safety instructions.

1.2 General Description

The OekoTube-Inside is an electrostatic micro-dust precipitator ("ESP") that significantly reduces particulate emissions from small wood burning devices (pellets, wood chips and cord wood). The OekoTube ESP precipitator is designed to be installed inside the boiler room next to the wood burning devices with a capacity of less than 275,000 BTU (80 kW).

1.3 Advantages of an Electrostatic Precipitator (ESP) Filter

ESPs offer significant advantages over other dust removal devices like wet scrubbers and traditional filters:

- High dust removal efficiency, in particular of extremely fine dust particulate matter (PM 2.5)
- Only minimal losses in updraft and pressure;
- Minimal maintenance and operating costs;
- Minimal wear & tear or expendable parts

1.4 Cleaning

The owner or chimney sweep should perform a scheduled inspection check within the first month of the OekoTube operation to determine the necessary cleaning intervals.

1.5 Maintenance

Depending on the capacity and the frequency of using the wood heating device, maintenance may need to be performed on the filter every 2 - 5 years. The OekoTube-Inside must therefore be easily accessible.

1.6 Operating Principle

The OekoTube-Inside operates on the principle of a highly charged electrostatic field. As micro-dust particles pass through the flue, electrons are released from a high voltage electrode. The electrostatic field electrically polarizes the micro-dust particles which then get deflected towards the flue wall where they precipitate and clump together to form large flakes. These coarse particles will eventually be removed by sweeping the chimney at the regular intervals and annual chimney inspection.

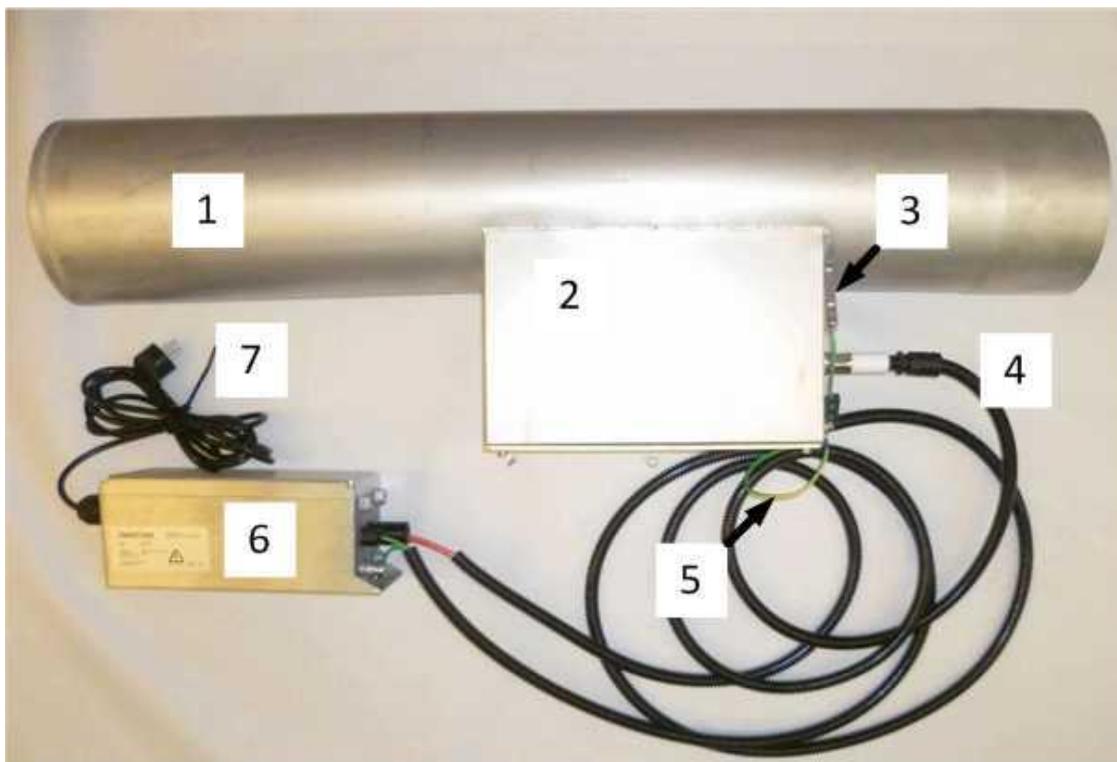
1.7 Automatic Activation

The ESP is automatically activated by an integrated temperature sensor at a pre-set temperature difference.

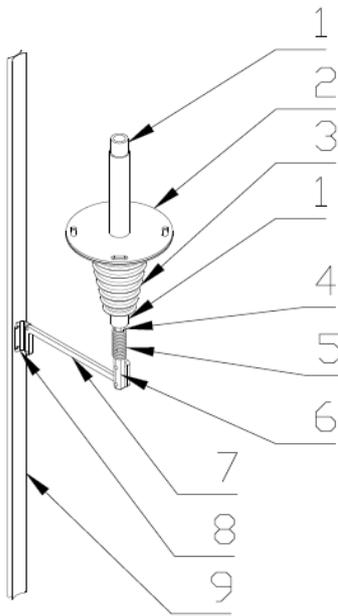
2 Description of the OekoTube-Inside (OTi)

2.1 Components List

1. High grade stainless steel flue (with flexible electrode and electrode holder)
2. High grade stainless steel insulator chamber (with insulator)
3. Temperature sensor with 8' cable (2.5 m)
4. 8' High voltage cable (2.5 m) with conduit and cable glands
5. Grounding (bolt)
6. Electronic control box with high voltage module with LED signal light
7. Power cable (110V AC)

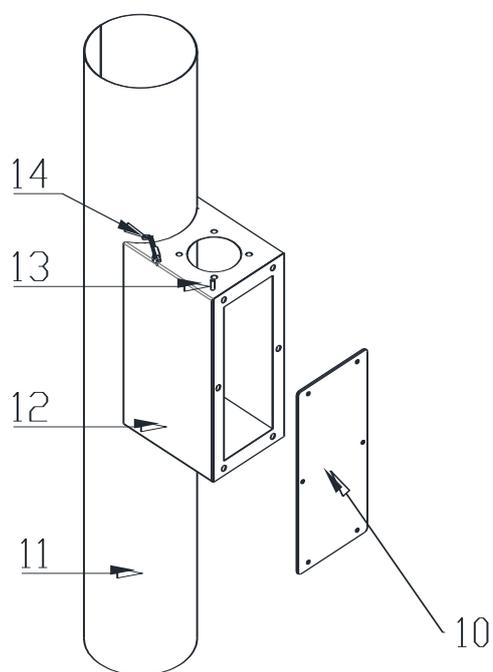


2.2 Diagram of Insulator and Electrode



1. Teflon insulator
2. Load attachment plate insulator
3. Insulator ribs
4. Hexagonal electrode holder
5. Tension spring
6. Angle adjustor
7. Electrode holder
8. Mounting bracket
9. Electrode

2.3 Diagram of Flue with Insulator Box



- 10. Removable Inspection Cover (lid)
- 11. OekoTube-Inside Flue
- 12. Insulator Box
- 13. Grounding Connection
- 14. Temperature Sensor Mounting

3 Installation Instructions

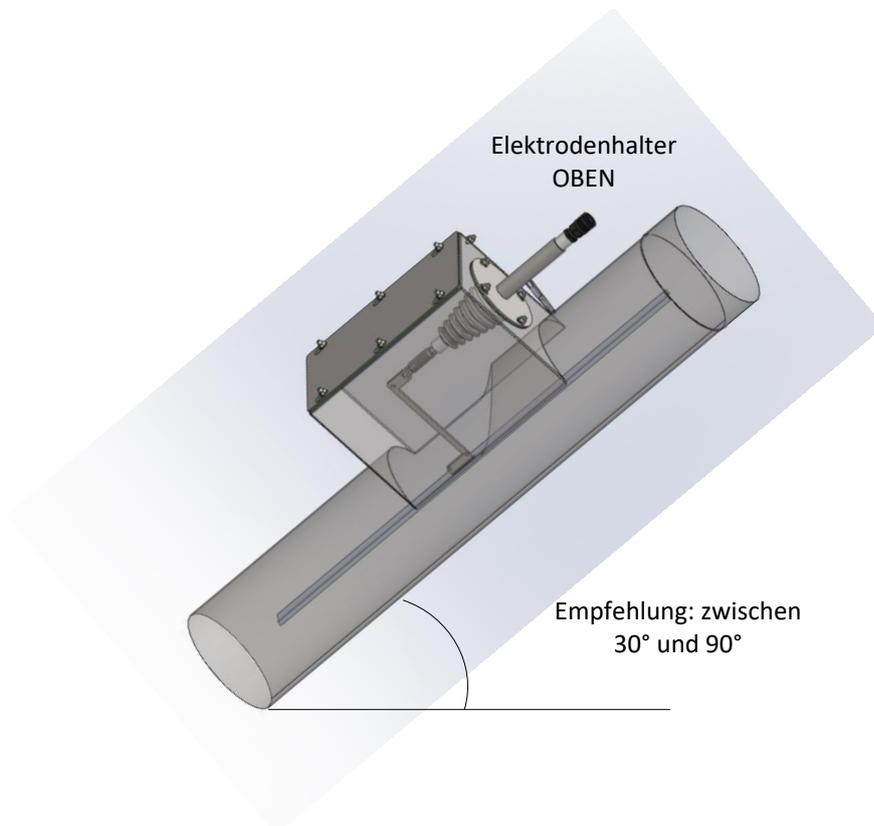
3.1 Installation

The OekoTube-Inside is designed to function as an integral part of the chimney flue. It is installed immediately behind the heating device as a fixed component of the exhaust system. Access to the flue must be ensured for cleaning purposes at /or after the OekoTube-Inside.

See point 11 for dimensions and measurements.

3.2 Installation of the OekoTube-Inside tube

The OekoTube-Inside must be mounted horizontally at an angle between 30° und 90°. An angle below 45° shortens the cleaning intervals. The insulator chamber must be mounted horizontally between 30° und 90°.

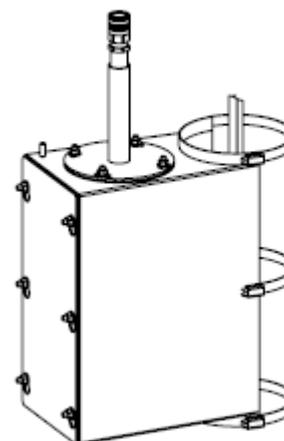


3.3 Mounting the OekoTube-Inside as a Retrofit

The OekoTube-Inside retrofit is identical to the OekoTube-Inside, except that the flue is not welded to the insulator chamber but is firmly strapped to the existing flue.

This requires the following installation:

1. Mark and flatten the existing flue segment with the appropriate gauge. The gauge is diameter specific.
2. Open the buckles and bend the flexible electrode to insert it into the flue.
3. Check that the gasket is properly aligned in all places.
4. Tighten the three buckles around the pipe.
5. Ensure that the electrode is properly centred by visual inspection through the cleaning opening. In order to open the box, loosen the six screws which hold the lid and push lid upwards.



3.4 Mounting the Controller

1. The high voltage cable and the cable for the temperature sensor are approx. 8' (2.5m) in length. The controller can be fixed to a nearby wall.
2. Attach the controller with screws. The drilling stencil for the control box can be found at the end of this manual.
3. The room temperature shall not exceed 100° F (40°C).
4. The controller must not be attached to the flue.

3.5 Connecting the High Voltage Cable

1. Clean the banana plug and high voltage cable with a surface degreaser, such as ethyl alcohol/brake cleaner.
2. Insert the high voltage cable into the insulator. The banana plug must be plugged in correctly. If pulled back lightly, resistance must be felt.
3. Tighten the cable nut.



4. The high voltage cable must be fastened properly.



CAUTION: When installing the high voltage cable, small loops and kinks in the cable must be avoided!

3.6 Installation of the Temperature Sensor

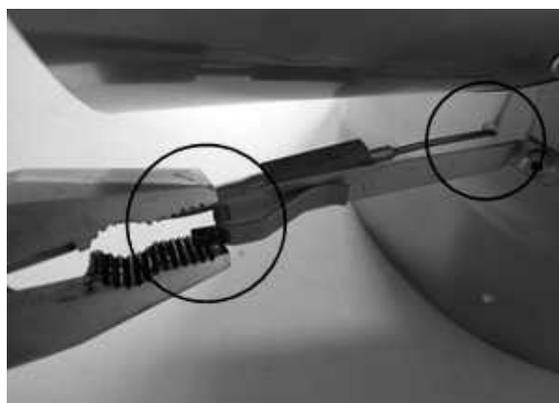
1. The temperature sensor is mounted above the insulator box.
2. Insert the tip of the temperature sensor through the hole. The tip of the probe must protrude 3mm (1/10") into the flue. This can be checked by looking into the flue.
3. Gently squeeze the two tips on the temperature sensor mount with pliers (see image) to prevent the temperature sensor from slipping out.
4. The cable for the temperature probe must be fastened properly.

3.7 Grounding

Ground the OekoTube-Inside device to the insulator chamber by using the ground wire connection provided.

3.8 Warning Sign Labeling

High-voltage warning signs shall be displayed in a visible manner on the servicing box lid of the OekoTube-Inside ESP, additionally to any other areas required by local fire code.



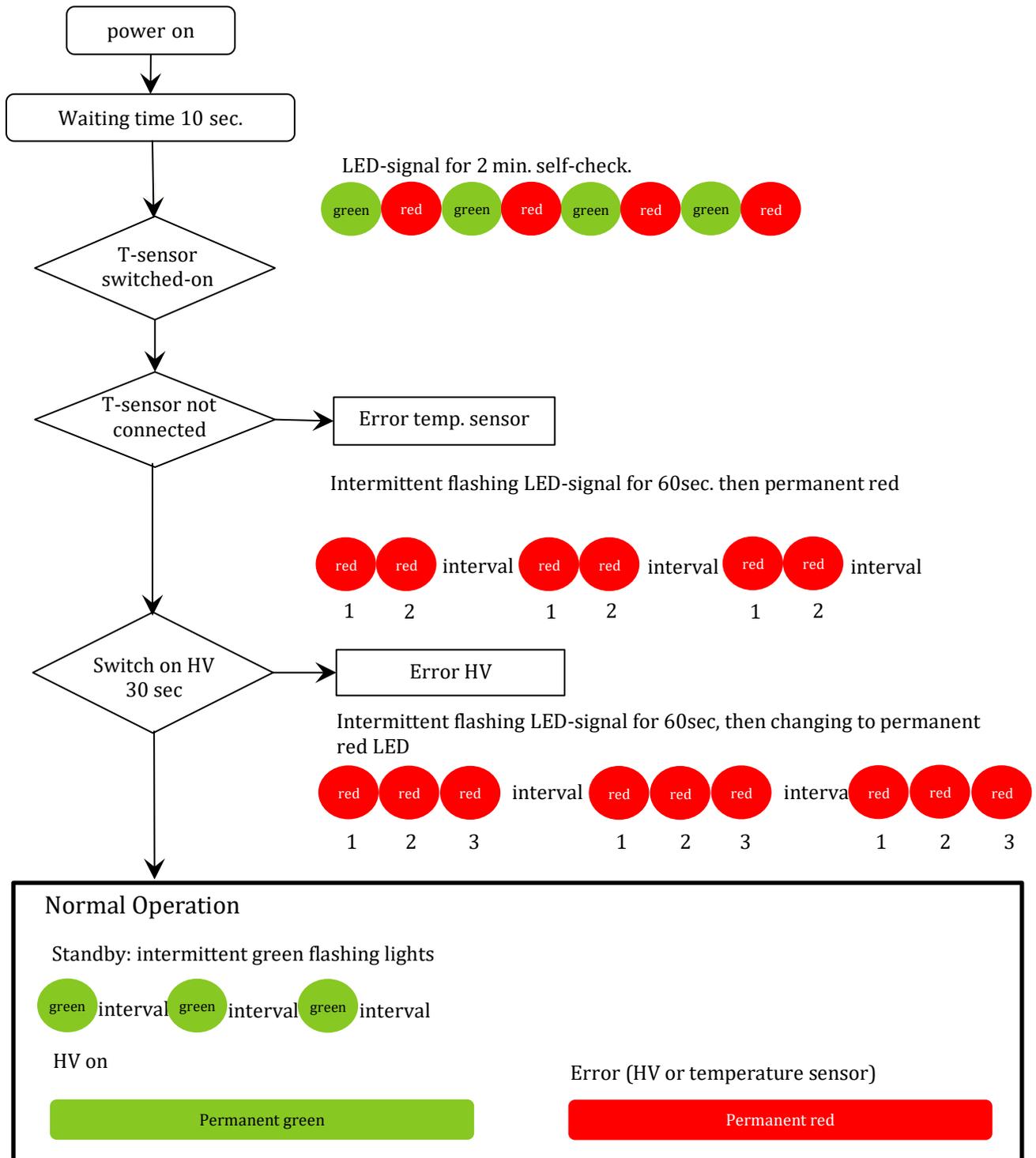
3.9 Power Supply

After the OekoTube ESP is plugged in to the electrical outlet, a self-test is automatically performed (duration: approx. 1 minute). The OekoTube-Inside then begins normal operation (green flashing LED every 5 seconds in standby mode).

3.10 On-Switch Control

With a heating device in operation the OekoTube-Inside LED will display a solid green light.

4 LED-Signal: Test mode and normal mode (HV=high voltage)



5 Electrical connection

5.1 General Information

The electrical installation must be performed by a qualified electrician. Remove the electric plug from the OekoTube-Inside so it is disconnected from the electric power supply.

Connection: 110V AC / 0.2 A / 30W, 60 Hz 

5.2 Power Connection

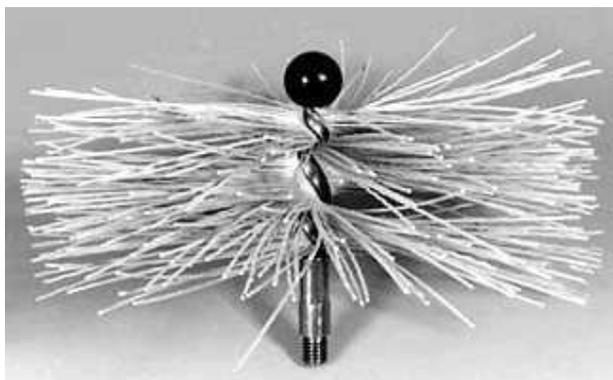
The power plug or an insulation switch must be readily accessible for the chimney sweep.

6 Maintenance and Cleaning

The cleaning intervals vary depending on the use of the heating system and fuel type. Proper care must be taken to avoid short circuits (arc-formation) between the electrode and the flue. This may otherwise lead to functional failure or defects.

6.1 Safety Precautions:

- Prior to performing any kind of work on the OekoTube ESP device, it must be disconnected from the main electric power supply (either by unplugging the device or by switching it off).
- The flue cleaning must only be performed by a skilled and certified chimney sweep.
- In standby-mode an increase in temperature in the flue will automatically activate the high voltage ESP. **DO NOT touch the electrode or the electrode holder during operation. THIS IS VERY DANGEROUS and can lead to a LIFE-THREATENING ELECTRIC SHOCK!**
- The precipitator consists of a high-quality acid-proof stainless steel. Do not use a metal brush for cleaning the flue of ESP device.



THERE SHALL BE NO EXPRESS OR IMPLIED LIABILITY BY THE MANUFACTURER AND SUPPLIER OF THIS DEVICE FOR DIRECT OR CONSEQUENTIAL PERSONAL OR PROPERTY DAMAGES FROM THE IMPROPER INSTALLATION, HANDLING, LABELLING, OPERATION AND MAINTENANCE OF THIS DEVICE.



For regular flue cleaning, do not remove or open any part of the filter!

6.2 Cleaning

1. Switch off the filter.
2. Perform the cleaning with a synthetic brush.
3. Remove the cover of the insulator box.
4. Clean the insulator box and the opening into the flue.
5. Clean insulator (using a vacuum cleaner, soft cloth with ethyl alcohol/brake cleaner).
6. Place the lid on the insulator box and tighten the screws.
7. Reconnect the power supply. Check whether the LED changes to green (5 second intervals) after the test phase (see point 4).



7 Dust Measurement

In order to measure the dust removed by the ESP device, the following points must be followed:

7.1 Cleaning the ESP Device

Clean the ESP before each measurement.

WARNING: The safety instructions outlined in point 6.1 must be strictly observed!

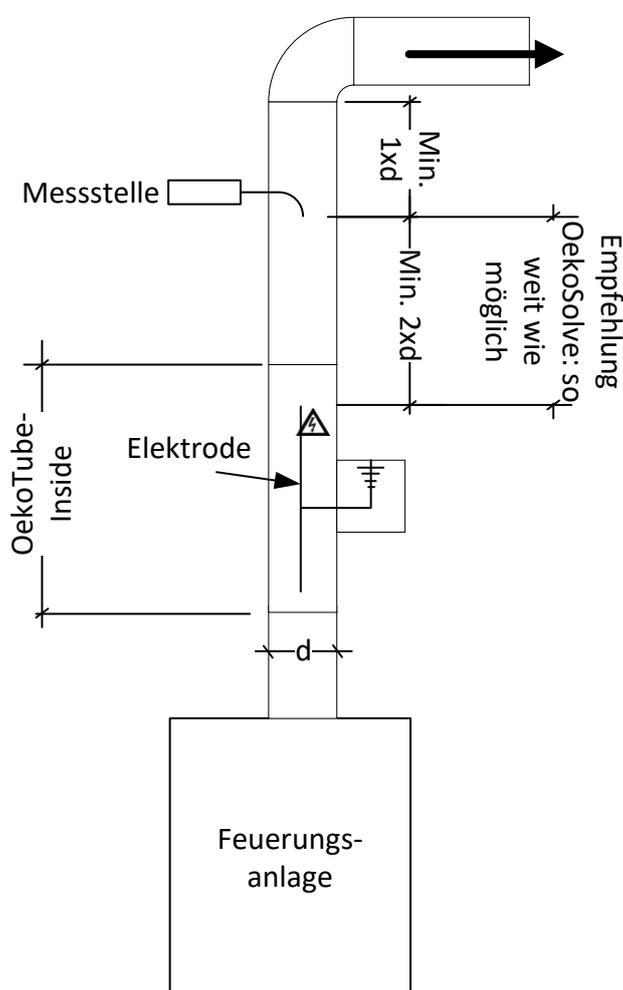
7.2 Position of the Weld Socket

In general, the distance between the ESP and the point of measuring should be as great as possible. The local regulations regarding the measurement of fine dust point source emissions must be followed.

It is suggested that the position of the measuring point be as far removed from the electrode as possible to minimize any electrostatic influence and to maximize the dust removal distance.

Germany: According to VDI 4207 sheet 2, the distance between the filter and the measuring point must be at least twice the diameter of the flue pipe. The distance between the measuring point and the next bend should be at least the length of a smoke tube diameter.

WARNING: If the measuring probe (measuring dust collector) of the dust measuring device is positioned very close (less than 25cm) to the electrode for the OekoTube-Inside in the chimney, there is a risk of short circuiting the electrode (high voltage) and the measuring probe.



7.3 One Week Before Measuring

Clean the entire heating installation.

7.4 Preparatory Steps for Measurements

1. Disconnect the power supply.
2. Open the maintenance box lid.
3. Clean the insulator with a cloth and ethyl alcohol.
4. Clean the electrode.
5. Check the position of the electrode (must be centered).
6. Close the maintenance box lid.
7. Ensure that the LED is green.

WARNING: Do not clean while performing any measurements: Risk of reentrainment!

8 Fault indicators / fault causes

Indicator	Fault	Suggested Action (ALWAYS DISCONNECT THE ELECTRIC POWER SUPPLY!)
Standby mode despite rising temperature in the flue	Temperature sensor is not properly inserted in the flue.	Re-insert the temperature sensor. Check contacts
No or delayed activation of ESP after fire ignition.	High voltage is not switched-on or was switched on too late.	Open the control box, select operating temperature.
Permanent red LED	Electrode not centred	Centre the electrode
	Dirty insulator box	Clean insulator box
	Excessive deposits in flue	Clean flue
	Damaged high voltage cable (visual inspection, buzzing noise in box)	Clean insulator box
	Damaged high voltage module in the electronic controls (audible sound)	Replace the control box
	Dirty insulator	Clean insulator
	Problem with the temperature sensor: damaged cable	Replace the cable / temperature sensor / box
Permanent red LED after cleaning	Electrode altered / damaged	Center / replace electrode
	Excessive ash accumulation in the opening between insulator box and flue.	Clean flue / insulator
	Temperature sensor is not connected	Check the connection / damaged cable
No visible LED light	ESP is not connected to power	Connect to power
	No power at the outlet	Check the electrical connection / fuse in your house
	Power cord of the control box is not connected correctly	Reconnect power cord
	No power on the control box	Replace control box

9 Dip-Switch Settings

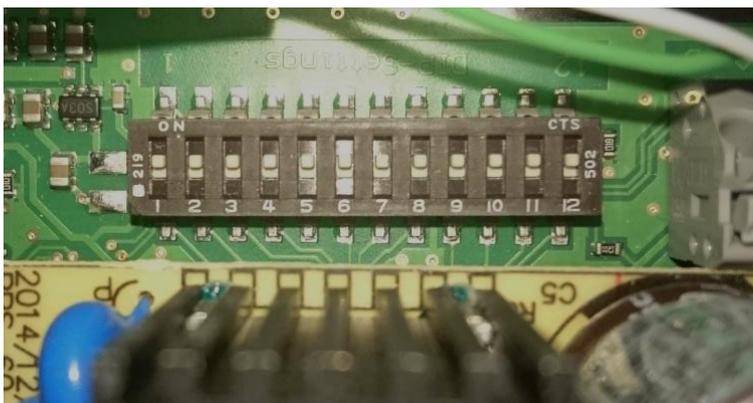
Through the adjustment of individual dip-switches, parameters like the voltage or the starting temperature can be adjusted.

1. Disconnect the OekoTube-Inside.
2. Open the control box cover.



9.1 Changing the Dip-Switch Settings

1. Look at the label on the inside of the box cover.
2. Change the dip-switch settings (1=ON / 0=OFF).



1 = on
0 = off

OekoTube Settings

1	2	3	4	5	6	7	8	9	10	11	12
address				RS485 Abschluss	u.limit			temp.			
"1111 = 31"					111 = 30			111 = +ΔT°C			
0111 = 14					011 = 26			011 = 50°C			
..					101 = 25			101 = 70°C			
..					001 = 24			001 = 60°C			
..					110 = 22			110 = 45°C			
0100 = 2					010 = 20			010 = 40°C			
1000 = 1					100 = 18			100 = 35°C			
0000 = 0				000 = Soft			000 = (ON)				
								1 = enable 0 = disable			

9.2 Recommendation for the High Voltage Setting

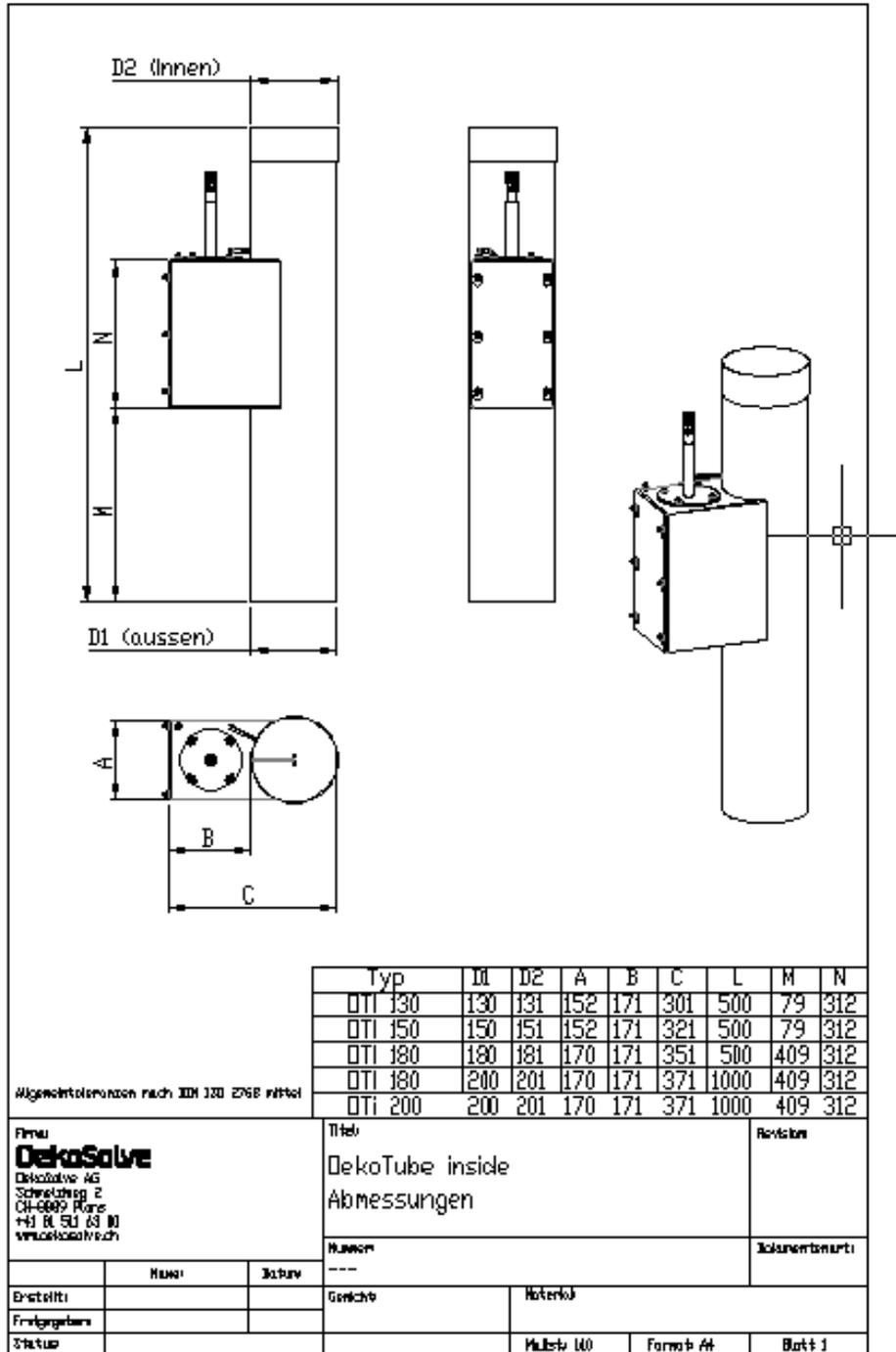
The level of the voltage setting depends on the diameter, the composition of the fine dust and the desired separation effect. The recommended settings are summarized in the table below:

Diameter (mm / in.)	Low dust removal / long maintenance intervals	Normal dust separation and maintenance intervals	High separation and short maintenance intervals
130 mm / 5"	20 kV	22 kV	24 kV
150 mm / 6"	22 kV	24 kV	26 kV
180 mm / 7"	24 kV	26 kV	30 kV
200 mm / 8"	26 kV	30 kV	30 kV

10 Data sheet

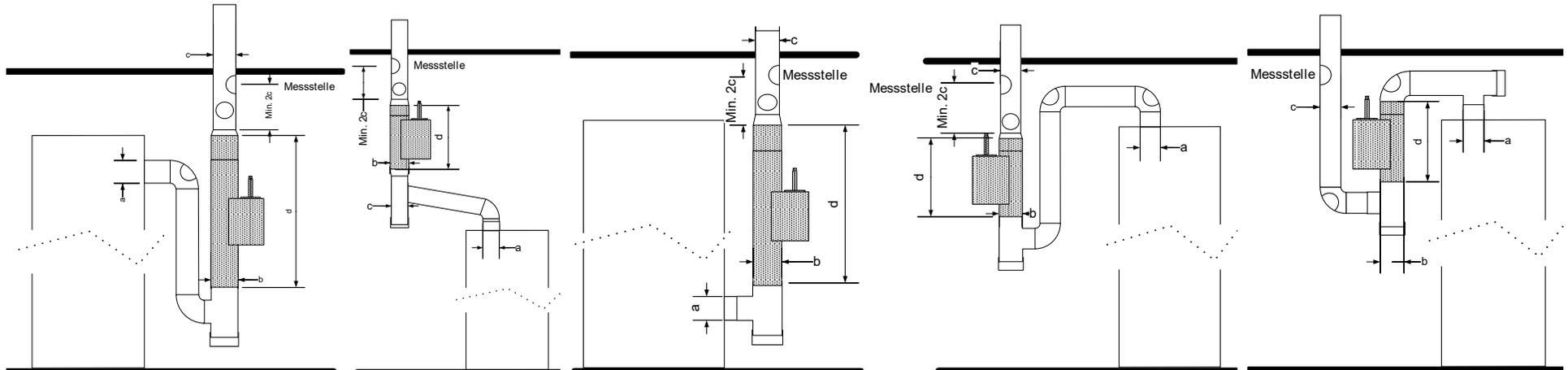
Performance data						
Separating Efficiency	%	70 - 80				
max. exhaust temperature	°C / °F	250 / 480				
Space requirement						
Service space		<ul style="list-style-type: none"> - The insulator box must be easily accessible - Access for cleaning the flue must be set up before and after the filter 				
Weight						
Weight (without control unit and insulation)	Kg / lbs	8 / 17.5				
flue connection						
Wall thickness	mm	1				
Inside diameter of flue at chimney entry	mm	130	150	180	180	200
Inside diameter of flue at chimney exit	mm	131	151	181	181	201
Length	mm	500	500	500	1000	1000
Pressure loss	Pa	0				
Cleaning opening		before and / or after the filter				
Soot / dust pan		below the filter				
Weld socket (for measurements of boiler system)		After the filter, as far as possible				
Electrical connection						
Power connection		110V AC / 13 A				
max. power consumption	W	30 W				
Voltage						
max. voltage at electrode	V	30'000				
Length high voltage cable	m / ft	2.5 / 8				
General information						
Sound level	dB (A)	0				
Option: Insulation (rock wool)	mm	30				
Material		Stainless steel 1.4404				
Max. operating ambient room temperature	°C / °F	40 / 100				

11 Physical Dimensions



With OekoTube-Inside retrofit, the dimensions are identical with the OekoTube-Inside, however without a pipe.

12 Recommended Positioning



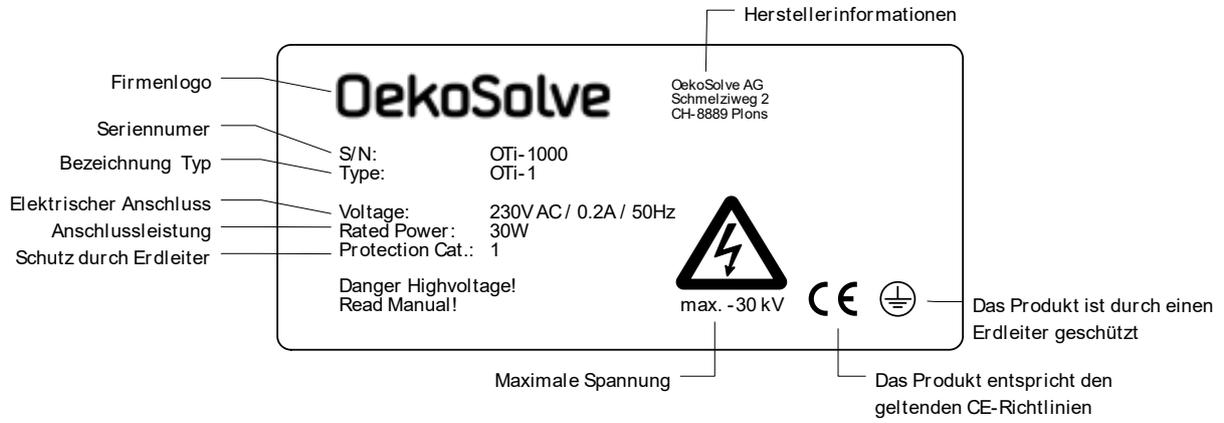
[a] Ø Boiler outlet [mm]	130	130	130	130	130	130	130	130	130	130	150	150	150	150	150	180	180
[b] Ø OT-I [mm]	130	150	150	180	180	180	180	180	180	180	150	180	180	180	180	180	180
[c] Ø Chimney tube [mm]	130	130	150	130	130	130	150	180	180	180	150	150	150	180	180	180	180
[d] Length OT-I [mm]	500	500	500	500	1000	500	1000	500	1000	500	500	1000	500	1000	500	1000	1000
Length electrode [mm]	400	400	400	400	800	400	800	400	800	400	400	800	400	800	400	800	800
min. distance to measuring point after the OT-I [mm]	260	260	300	260	260	260	300	360	360	360	300	300	300	360	360	360	360
Cleaning interval																	
Pellet up to 30 kW	-	+	+	+	+	+	++	+	++	-	+	+	+	++	+	+	+
Pellet from 30 to 50 kW											-	+	+	+	++	-	-
Cord wood up to 30 kW	-	+	+		+		++		++	-	+	+	+	++	+	+	+
Cord wood from 30 to 50 kW											-	+	+	+	++	-	-
Wood chips up to 50 kW											--	-	--/-	-	-	--	--

Cleaning intervals: ++ = Expected: regular cleaning / + = one additional cleaning / - = two to three additional cleanings / -- = high cleaning needs

13 Special layout

NOTICE: The customer must be informed of potential higher cleaning requirements!

	<p>Horizontal installation: This setup can lead to an impairment of energy production, since the cross-section of the flue is considerably reduced by the dust separation.</p> <p>The separated dust accumulates, which can lead to flashovers between the electrode and the chimney pipes. The separation effect of the filter sinks and the separator breaks down faster. To avoid defects, the cleaning interval must be greatly reduced.</p>
	<p>Vertical installation directly at the boiler outlet: The fine dust collects in the flue and can fall into the boiler fan. The dust can adversely affect the proper operation of the fan which ultimately may lead to problems with the heating device.</p>
	<p>Diagonal installation: A diagonal installation can lead to an impaired energy production since the cross-section of the flue can rapidly decrease from the build-up of separated dust.</p> <p>The separated dust accumulates rapidly, which can lead to flashovers between the electrode and the chimney pipe. The separation effect of the ESP is rapidly reduced leading to a fast separator malfunction.</p> <p>If the separator is installed directly at the boiler outlet, the fine dust collects in the flue and can fall into the boiler fan. This interferes with the proper operation of the fan and can lead to problems with the boiler.</p>





Deutsches Institut für Bautechnik **DIBt**

Approval number Z-7.4-3451



15 EC declaration of conformity

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OekoSolve hereby declares that the following product:

Product name: OekoTube-Inside, Micro-dust filter for wood boilers
Type designation: OTi-1 (models D130 to D200)

conforms to all the requirements of the directives for electrical equipment (2006/95/EC) and electromagnetic compatibility (2004/108/EC).

The following harmonised standards were applied:

EN 61000-6-1: 2007	Electromagnetic compatibility (EMC) – Part 6-1: Generic standards – Interference immunity – Residential, commercial and light-industrial environments
EN 61000-6-2: 2005	Electromagnetic compatibility (EMC) – Part 6-2: Generic standards – Interference immunity – Industrial sector
EN 61000-6-3: 2007	Electromagnetic compatibility (EMC) – Part 6-3: Generic standards – Generic standard emitted interference - residential, commercial and light-industrial environments
EN 61000-6-4: 2007	Electromagnetic compatibility (EMC) – Part 6-4: Generic standards – Generic standard emitted interference – Industrial sector
EN 60335-1: 2007-02	Electrical safety, Part 1: General requirements

Responsible for the documentation: Beat Müller, Tel. +41 (0)81 511 63 00

Plons, 21 May 2015



Beat Müller, Manager

Commissioning / service / measurement OekoTube-Inside Protocol

Date: _____

Installation
 Commissioning
 Service
 Measurement

Address / Client / Operator _____

Contact on site _____

Boiler _____ Type _____ Rated power _____ kW Combustion power _____ kW

Year _____ Fuel _____

Electrostatic precipitator

OekoTube-Inside 130 150 180 200

Signal boiler yes no Serial No. OS-Ctrl _____ Year _____

Mechanical control

- | | |
|--|--|
| <ul style="list-style-type: none"> <input type="checkbox"/> Insulator flange fixed correctly <input type="checkbox"/> Screwing the electrode holder screws tightly <input type="checkbox"/> Electrode centred <input type="checkbox"/> High voltage cable (banana plug) inserted correctly <input type="checkbox"/> Cable routed correctly between filter and control box | <ul style="list-style-type: none"> <input type="checkbox"/> Seal at the service plate of the insulator chamber available <input type="checkbox"/> Service plate of the insulator chamber fixed correctly <input type="checkbox"/> Condensate bowl accessible <input type="checkbox"/> Service openings accessible <input type="checkbox"/> The system operator has been instructed in operating the filter and given the safety instructions. See point 1.1 and point 6.1 for this. |
|--|--|

Automatic test

Insert power plug: The automatic test is performed

Test passed yes no

Comments

Work carried out

Responsible: _____ Client: _____

16 Drilling stencil for the electronic control box

This will be supplied with the delivery of the product.

17 Pipe opening stencil for the OekoTube-Inside retrofit

The pipe opening stencil for the OekoTube-Inside retrofit will be supplied with the delivery of the product.

All products are subject to changes or modifications.