Wind Turbine Assembly
Assembling the WT1kW

The parts for the installer

<table>
<thead>
<tr>
<th>Ref./Ref.</th>
<th>Oggetto/Description</th>
<th>Q.tà/Qt.y</th>
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<tbody>
<tr>
<td>101</td>
<td>ASSEMBLATO PROFILI ALARE WT1kW - WARM GREY 2UO</td>
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<tr>
<td>110</td>
<td>FLANGIA SUP.RE TELAIO TRIPALA WT1kW - ZINCATURA ELETTROLITICA BIANCA</td>
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<td>111</td>
<td>BRACCIO TELAIO TRIPALA WT1kW 2N - ZINCATURA ELETTROLITICA BIANCA</td>
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<td>112</td>
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<td>113</td>
<td>CHIUSURA SUP.RE TURBINA TRIPALA WT1kW - WARM GREY 2UO</td>
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<td>114</td>
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<td>116</td>
<td>ASSIEME SUPPORTO WT1kW</td>
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<tr>
<td>117</td>
<td>FLANGIA TIRANTI WT1kW VERNICIATA PANTONE WARM GREY 2U OPACO</td>
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<tr>
<td>118</td>
<td>BOCCOLA GUIDA FLANGIA TIRANTI WT1kW</td>
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<td>119</td>
<td>SEMICARENZA MOBILE TURBINA TRIPALA WT1kW - WARM GREY 2UO</td>
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</table>
**Assembling the WT1kW**

### The parts in the box

<table>
<thead>
<tr>
<th>RIF</th>
<th>CODE</th>
<th>DESCRIPTION</th>
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<tbody>
<tr>
<td>400</td>
<td>SW00002012</td>
<td>Assembly Blade WT1kw Warm Grey 2uo</td>
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<tr>
<td>401</td>
<td>G006538</td>
<td>Box for Assembly Blade WT1kw Warm Grey 2uo</td>
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<td>402</td>
<td>SW00002010</td>
<td>Assembly Support WT1kw</td>
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<tr>
<td>403</td>
<td>G006539</td>
<td>Box for Assembly Support WT1kw</td>
</tr>
<tr>
<td>404</td>
<td>G006540</td>
<td>Box for top Assembly Support WT1kw</td>
</tr>
<tr>
<td>405</td>
<td>G006536</td>
<td>Turbine Box</td>
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<tr>
<td>406</td>
<td>SW00004911</td>
<td>Arm Cover 3-blade WT1kw Warm Grey 2uo</td>
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<tr>
<td>407</td>
<td>SW00004912</td>
<td>Axial plastic parts kit</td>
</tr>
<tr>
<td>408</td>
<td>G006537</td>
<td>Metallic Arms and flanges kit</td>
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</table>
Assembling the WT1kW

**Phase 1**

- Insert the lower central plastic cover inside the shaft
- Insert the lower flange in the shaft
- 2 screws for each sector to lock the lower flange to the shaft
- 3 screws to lock each arm to the lower flange (pay attention to the angle between the arms – 120°)
Assembling the WT1kW

Phase 2

• Insert the lower conical cover into the shaft
• Insert the plastic ring inside the central tie-rod ring
• Insert the assembled central tie-rod ring into the shaft
• Insert the upper conical cover into the shaft
• Insert the upper flange in the upper part of the shaft (1 screw needed)
• 3 screws to lock each arm to the lower flange (pay attention to the angle between the arms – 120°)
Assembling the WT1kW

**Phase 3**

- Connection of the upper cover to its conical cover
- Connection of the blade assembly to the chassis (6 screws for each blade)
- With 2 screws for each blade you can lock the central tie-rod to the central ring
- Repeat the operation for the 3 blades
Assembling the WT1kW

The final result

- Connection of the plastic covers to the horizontal arms (4 screws for each arm)
PRAMAC Wind Turbines

Electric installation
<table>
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<tr>
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<th>Contents</th>
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</thead>
<tbody>
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<td>1</td>
<td>Introduction</td>
</tr>
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<td>2</td>
<td>Alternator</td>
</tr>
<tr>
<td>3</td>
<td>Wind Box</td>
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<tr>
<td>4</td>
<td>Inverter</td>
</tr>
<tr>
<td>5</td>
<td>Braking</td>
</tr>
<tr>
<td>6</td>
<td>Operating</td>
</tr>
</tbody>
</table>
Introduction

Components:

- Wind turbine
- Rectifier
- Braking system
- Inverter grid-connected
- Grid
Introduction

Electrical diagram
<table>
<thead>
<tr>
<th>Specification</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type</td>
<td>Permanent Magnets</td>
</tr>
<tr>
<td>Number of phases</td>
<td>3</td>
</tr>
<tr>
<td>Rated power</td>
<td>1 kW @ 415 rpm</td>
</tr>
<tr>
<td>Rated voltage</td>
<td>240 Vac @ 415 rpm</td>
</tr>
<tr>
<td>Rated Frequency</td>
<td>110 Hz @ 415 rpm</td>
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</tbody>
</table>
Wind Box

SPECIFICATIONS

• Input voltage range 0 - 220 V~rms
• Max input voltage 500 V~rms
• Max input current 6 A~rms
• Output voltage range 0 – 300 Vdc
• Max output current 4 A
• Max power 1 kW
PURPOSE

- Rectifier
- Turbine’s Safety Management
Inverter

**SPECIFICATIONS**

- Max input voltage 400 Vdc
- Max input current 10 A
- Grid voltage range 198 – 260 V$_{ac}$
- Max output current 4 A
- Grid frequency range 49.8 – 50.2 Hz
- Max output power 1 kW
Braking

**Type**

*Diversion Load*  *Braking Resistance*
Braking System

1. Diversion Load

**SPECIFICATIONS**

- Resistance: 75 Ω
- Power: 800 W

**Characteristics:**

- Auto-reset system
- Slowing down of turbine
2. Braking Resistance

**SPECIFICATIONS**

- Resistance: 3 x 28 Ω
- Max power: 400 W

**Characteristics:**

- non-autoreset system
- shut down the turbine
Braking

Passive Braking Block and Protection

COMPONENTS

- N°1 Residual current device 3P, In<63A - type A - Idn= 0.03A
- N°1 Thermal magnetic circuit breaker 3P - 400V - In=6A
- N°1 Current release Vn= 110÷415Va.c. e 110÷125Vd.c.
- N°1 Auxiliary contacts 1NO/NC+tripped relay 1NO/NC In=6A
Operating

**Characteristics:**

1. Until rated speed (415 rpm)
2. From 415 rpm to 430 rpm
3. @ 430 rpm
4. @ 300 Vdc

- Grid
- Diversion Load
- Braking Resistance
- Short circuit
Operating
Wind Turbine Supports
Types of installation

- Ground installation
- Flat roof installation

➢ It is of utmost importance to determine the right installation site with respect to the surrounding obstacles.
Position of wind turbine

- Influence of obstacles on wind

- Wind flow lines around a building

**Urban area**

**Countryside**

**Off-shore and flat land**

*Area di influenza degli ostacoli sul vento*
Types of poles

<table>
<thead>
<tr>
<th>Weight and Dimensions of Poles</th>
<th></th>
<th></th>
<th></th>
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<th></th>
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<tbody>
<tr>
<td>H 1 (mt)</td>
<td>3 (mt)</td>
<td>6 (mt)</td>
<td>6 (mt)</td>
<td>10 (mt)</td>
<td>0,3 (mt)</td>
<td>1 (mt)</td>
<td>3 (mt)</td>
</tr>
<tr>
<td>ø 219,1 (mm)</td>
<td>219,1 (mm)</td>
<td>219,1 (mm)</td>
<td>-</td>
<td>-</td>
<td>139,7 (mm)</td>
<td>139,7 (mm)</td>
<td>139,7 (mm)</td>
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<tr>
<td>W 25 (kg)</td>
<td>88 (kg)</td>
<td>190 (kg)</td>
<td>-</td>
<td>-</td>
<td>10 (kg)</td>
<td>17 (kg)</td>
<td>56 (kg)</td>
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</table>

We are testing a new polygonal section for 6 mt and 10 mt poles
Ground Installation with plinth for Wind Turbine WT1KW

At the top there is a welded flange for the connection with the turbine.

At the bottom there is a welded flange with reinforces.

<table>
<thead>
<tr>
<th>Analysis Code</th>
<th>Clay</th>
<th>Clayey Silt</th>
<th>Silty Sand</th>
<th>Sand</th>
<th>Gravelly Sand</th>
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<tbody>
<tr>
<td></td>
<td>D (m)</td>
<td>φ (m)</td>
<td>D (m)</td>
<td>φ (m)</td>
<td>D (m)</td>
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<tr>
<td>A3</td>
<td>1,10</td>
<td>1,40</td>
<td>1,10</td>
<td>1,40</td>
<td>1,10</td>
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<tr>
<td>A6</td>
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<td>1,90</td>
<td>1,10</td>
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<td>A10</td>
<td>1,40</td>
<td>2,50</td>
<td>1,20</td>
<td>2,50</td>
<td>1,20</td>
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</tbody>
</table>
Ground Installation with plinth for Wind Turbine WT1KW

**Soil Foundation**

- With poles we can supply the internal plinth metal structure, made with two flanges (same as the bottom pole flange) and anchor bolts.

- We suggest to the designer of foundations to make a structure like this, by using a wire net.

![Diagram of Soil Foundation with labeled parts: Flange, Anchor Bolt, Wire Net, Radial bracket, Inner bracket, Outer bracket, Corrugated Pipe]
Ground Installation with plinth for Wind Turbine WT1KW

**Coupling with pole and foundation**

Phase 1
- Assembling of the wind turbine

Phase 2
- Coupling the wind turbine with pole and lifting
- With crane and strap or sling

Phase 3
- Assembling of the pole with foundation through anchor bolt
Ground Installation with plinth for Wind Turbine WT1KW

Realization of a Wind Farm

- In case of multiple Wind Turbine → pay attention to their Spacing.

- In case of doubts about prevailing wind direction, it’s mandatory to increase this distance.
Ground Installation with plinth for Wind Turbine WT400W

At the bottom there is a welded flange for the connection with the plinth.

At the top there is a welded flange for the connection with the turbine.

The WT400W’s size and appearance makes the best applications for the turbine on roof and buildings.

Similar soil foundation and same coupling procedure of WT1KW Wind Turbine

<table>
<thead>
<tr>
<th>Analysis Code</th>
<th>Clay</th>
<th>Clayey Silt</th>
<th>Silty Sand</th>
<th>Sand</th>
<th>Gravelly Sand</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>D (m)</td>
<td>D (m)</td>
<td>D (m)</td>
<td>D (m)</td>
<td>D (m)</td>
</tr>
<tr>
<td>A3</td>
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<td></td>
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<td></td>
<td></td>
</tr>
</tbody>
</table>

Table: Analysis Code, D (m), φ (m)

- Parameters:
  - D: Diameter
  - φ: Thickness

Clay, Clayey Silt, Silty Sand, Sand, Gravelly Sand

- Code D (m) and φ (m) for each type of soil.
Possible future developments: installation with Krinner ground-screws

Installation with:
- One central ground-screw below the pole
- Four or six ground-screws around the pole
- Four or six Tie-Rods to connect the ground-screws to the upper part of the pole
Roof Installation for Wind Turbine WT1KW

Roof support for 3 meters pole

- Only for 3 meters pole
- Only for flat roof
- Only for roof that can support the weight of the structure and forces with wind at a Wind Speed of 42 m/s.

<table>
<thead>
<tr>
<th>Analysis Code</th>
<th>Normal Stress (N)</th>
<th>Bending Moment M (Nm)</th>
<th>Cross Arm (m)</th>
<th>F_{max} support (kN)</th>
<th>F_{min} support (kN)</th>
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<tbody>
<tr>
<td>A3</td>
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<td>6155</td>
<td>3,2x3,2</td>
<td>2,7</td>
<td>-1,15</td>
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</table>

Total weight= 380 kg

High Wind conditions
Roof Installation for Wind Turbine WT1KW

Exploded View

Main elements of the Roof’s Support

- A → Omega sheet steel
- B → Base for pole
- C → Reinforce
- D → Polyurethane damper
- E → Collet
- F → Strut
- G → Pivot
- H → Spacer
- I → Collar

The connection with the roof is made using Screw Anchor
Roof Installation for Wind Turbine WT1KW

1 meter pole as roof support

- Only for flat roof
- Only for roof that can support the weight of the structure and forces with wind at a Wind Speed of 42 m/s.

Total weight = 90 kg
Low wind conditions

The connection with the roof is made using Screw Anchor
Roof Installation for Wind Turbine WT400W

**0.3 meter pole as roof support**
- Only for flat roof
- Only for roof that can support the weight of the structure and forces with wind at a Wind Speed of 42 m/s.
- Total weight = 35 kg
- Low forces

**1 meter pole as roof support**
- Only for flat roof
- Only for roof that can support the weight of the structure and forces with wind at a Wind Speed of 42 m/s.
- Total weight = 42 kg
- Low forces

The connection with the roof is made using Screw Anchor