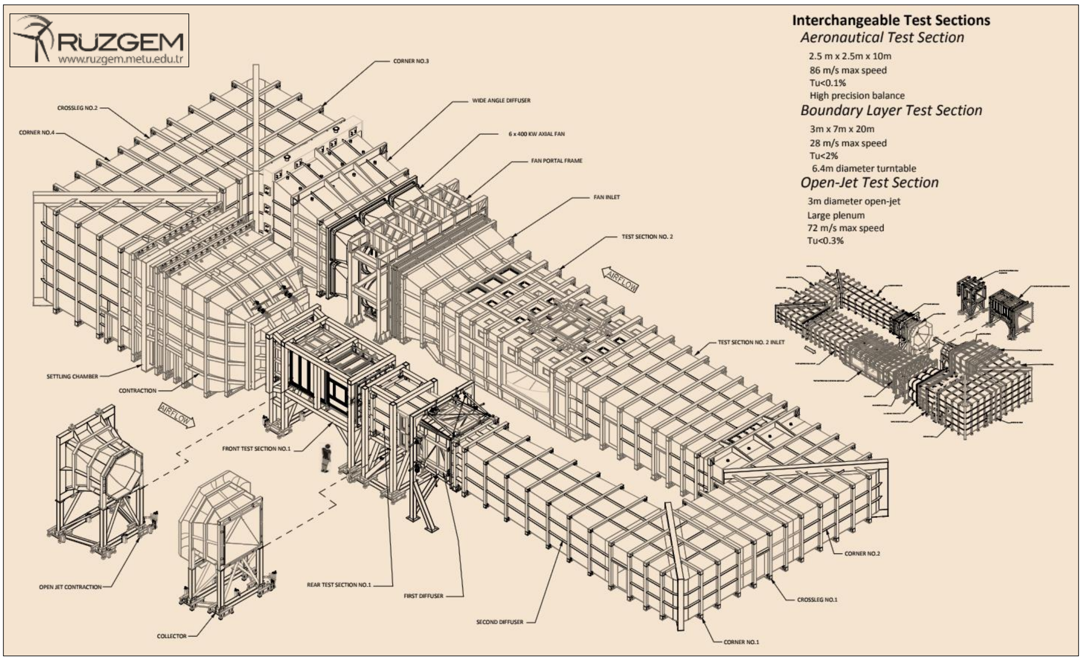
## RÜZGEM (METU Center for Wind Energy Research)
## Aerodynamics Laboratories

### RÜZGEM Large Scale Wind Tunnel

### Pictures:





**General description**

Type: Closed return atmospheric wind tunnel with interchangeable test sections

Fan Power and Configuration: 6 x 400 kW (2.4 MW total) axial fan system

Flow Conditioning: 2 honeycombs, 5 screens

Size of Test Section 1: 2.5m x 2.5m x 10m (width x height x length)

Size of Test Section 2: 7m x 3m x 20m (width x height x length)

Size of Test Section 3: 3 m diameter open jet

Velocity range: up to 86 m/s in Test Section 1
up to 28 m/s in Test Section 2

up to 72 m/s in Test Section 3

Background TI: below 0.1% in Test Section 1
below 2 % in Test Section 2

below 0.3% in Test Section 3

Cooling: yes, 750 kW heat exchanger

Additional features: turntable (diameter 2 m) in Test Section 1

turntable (diameter 6.5 m) in Test Section 2

wake rake system in Test Section 1

**RÜZGEM C3 Boundary Layer Wind Tunnel**

**Pictures:**

**General description**

Type: Open return atmospheric wind tunnel

Fan Power and Configuration: 45 kW axial fan

Flow Conditioning: 1 honeycomb, 1 screen

Size of Test Section 1: 1m x 1m x 8m (width x height x length)

Velocity range: up to 25 m/s

Background TI: below 0.3%

Cooling: No cooling

Additional features: 1m x 1m active grid with 20 motors (in design phase)

**Measurement equipment:**

| | |
|---|---|
| Pressure: | 8 × pitot-static tubes, 4 × 5-hole probes, 1 × 3-hole probe<br>1 × Kiel probe<br>128-channel pressure scanner system (Pressure Systems)<br>448-channel pressure scanner system (7 × Scanivalve MPS4264)<br>4 × differential pressure transducers (Aplisens and Setra)<br>4 × absolute pressure transducers (Aplisens) |
| Forces: | 2 × 6-component force sensors (ATI Omega series)<br>2 × 6-component force sensors (ATI Gama series)<br>2 × torque meters (HBM)<br>Several single-component load cells |
| Velocity: | Hot-wire anemometry system (Dantec Dynamics):<br>Straight and right-angle miniature single-wire probes<br>Multichannel CTA system (8 channels – max. 10 kHz)<br>Hot-wire calibrator (0.5 m/s – 60 m/s)<br>High-speed stereoscopic (2D3C) PIV system (TSI)<br>1 × Litron LDY304 Nd: YLF laser (max. 20 kHz)<br>2 × Phantom V640 HS cameras (1.5 kHz @ 4 MP)<br>6-jet Laskin nozzle (TSI)<br>Fog generator (Safex)<br>Fog probe system (Safex NS4)<br>Several camera and laser lenses |
| Temperature: | Thermocouples and PT 100 sensors<br>2 × infrared thermal cameras |

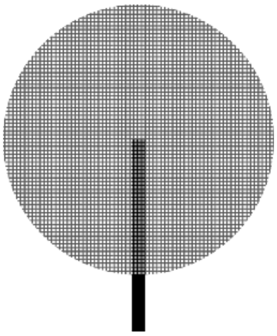
**Additional equipment:**

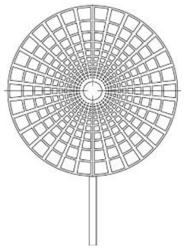
| | |
|---|---|
| Traverse: | 2 × 3-axes traverse systems<br>2 × 360° rotary traverse systems |

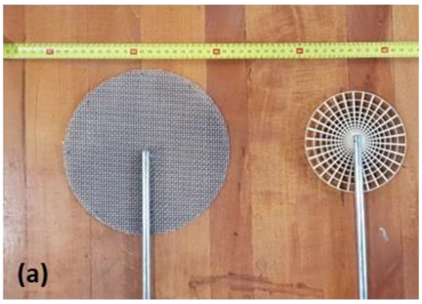
**WEA Models:**

| | |
|---|---|
| No. of Turbines | 2 |
| Turbine Type | Horizontal axis wind turbine |
| Rotor Diameter | 0.95 m |
| Blade Profile | NREL S826 |
| Blade Material and Manufacturing | 1 turbine with precision CNC machined aluminum, 1 turbine with 3 printed titanium (with internal air flow channel inside the blades for tip injection) |
| Drive | 1.5 kW Panasonic AC servo motor |
| On-board Measurement Devices | Torque transducer (HBM) and 6-component force sensors (ATI Gama series) |

**Discs:**








| | Disc A | Disc B |
|---|---|---|
| Solidity | 57 % | Inhomogeneous |
| Disc thickness [mm] | 2 | 3.2 |
| Disc diameter [mm] | 200 | 120 |
| Mast diameter [mm] | 10 | 10 |
| Mast properties | Smooth Shaft | Smooth Shaft |
| Hub diameter [mm] | N/A | 10.8 |
| Material | Metallic mesh with a hole size of 2mm and wire diameter of 1mm | Plywood |

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