



OPEN WIND TUNNEL



DL HC-OWT

INTRODUCTION

Aerodynamics plays a fundamental role in the analysis and design of systems operating in gaseous environments. It focuses on understanding how air and other gases interact with moving objects, describing flow behavior, force generation, and the resulting physical effects. These principles are essential in a wide range of engineering applications, particularly in the development and optimization of aerodynamic components and structures.

From a technical perspective, aerodynamic phenomena can be analyzed according to flow velocity regimes and fluid properties, allowing engineers to distinguish between low-speed and high-speed flow conditions, as well as between idealized and viscous behaviors. This classification framework enables accurate modeling and precise experimental validation.

To support these studies, open-type wind tunnel systems provide controlled airflow environments for experimental testing. These systems are specifically designed for low-speed and viscous flow investigations and are composed of a main airflow generation unit and a modular accessory section that allows multiple experimental configurations and validations.

TECHNICAL DESCRIPTION

- The device incorporates a safe electrical design with robust and reliable grounding performance.
- An integrated electrical architecture is implemented, enabling clear visualization of sensor data through a smart display for more efficient data handling.



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- Dedicated software is provided, allowing users to process and analyze data directly on a PC.
- A wide range of experimental accessories is available, expanding the variety and scope of experiments that can be conducted.
- Manufactured with corrosion-resistant and high-strength materials, the equipment offers enhanced safety and an extended service life.
- Power supply: three-phase, 50/60 Hz.
- Overall dimensions: 2850 × 950 × 1600 mm.
- Net weight: less than 478 kg.
- Ambient temperature from $-10\text{ }^{\circ}\text{C}$ to $+40\text{ }^{\circ}\text{C}$; relative humidity below 85% at $25\text{ }^{\circ}\text{C}$.
- Smoke generator unit and adapter and control.
- Allen wrench set.
- Hard tube (4–6 mm diameter) 3 pieces.
- Hose (2 mm diameter) one piece.
- RS485 communication cable 3 pieces.
- Software CD and USB data cable set.



INCLUDED ACCESSORIES

- **Electronic displacement measuring device:**
Measuring range is 10mm, to measure the thickness of the velocity boundary layer.
- **Display three-force real-time data unit:**
Input power supply is AC110V, to display real-time data of the three-force sensor.
- **Variable frequency fan:**
The input power supply is three-phase five-wire system 220V, source for air flow in wind tunnels.
- **Velocity inclined tube pressure gauge**
Range 0-200Pa, to measure pressure difference and convert flow rate.
- **Three-point force sensor**
The maximum X-axis and Y-axis measurement is 10N, and the maximum Z-axis measurement is 20N (this axis is not enabled), to measure the drag and lift of experimental models.
- **Electronic differential pressure and speed measuring unit**
Input power supply is AC110V, to measure the pressure difference and velocity of flowing.
- **18-Channel electronic pressure measurement unit**
Input power supply is AC110V, to measure the pressure of 18 channels (including atmospheric pressure).
- **Sixteen-tube liquid level pressure gauge**
The indicated solvent is pure water with colored dye added to measure pressure difference.
- **Bernoulli experiment module**
Size: 360mmx292mmx345mm; Weight: about 0.8kg, to demonstrate Bernoulli's experiment.
- **Velocity boundary layer analysis module**
Measuring surface size: 250mmx279mmx3mm, to measure the velocity boundary layer.
- **Spherical resistance body model**
Size: 80mmx80mmx280mm; Weight: about 0.3kg.
- **Hemispherical resistance body model**



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Size: 80mmx40mmx280mm; Weight: about 0.2kg.

- **Disc-type resistance body model**

Size: 80mmx5mmx280mm; Weight: about 0.2kg.

- **Ring-shaped resistance body model**

Dimensions: outer diameter: \varnothing 113mm; inner diameter: \varnothing 56,5mm, 113mmx5mmx300mm; weight: about 0.2kg.

- **Small square plate resistance body model**

Size: 71mmx4mmx280mm; Weight: about 0.2kg.

- **Cylindrical resistance body model**

Size: 50mmx50mmx290mm; Weight: about 0.3kg.

- **Parallel resistance body model**

Size: 80mmx90mm; Weight: about 0.5kg.

- **Streamlined resistance body model**

Size: 240mmx60mmx270mm; Weight: about 0.5kg.

- **Thick Pitot total pressure pipe**

Effective length: 396mm; bending radius: 15mm; small limb: 47mm; inner diameter: $\varnothing=3,1$ mm; outer diameter: $\varnothing=4$ mm, to measure the pressure difference in the wind tunnel, suitable for measuring pressure difference or measuring flow rate.

- **Pitot total pressure tube**

Effective length: 396mm; bending radius: 15mm; small limb: 47mm; inner diameter: $\varnothing=1,1$ mm; outer diameter: $\varnothing=2$ mm, to measure the pressure difference in the wind tunnel, suitable for measuring the pressure difference or the thickness of the velocity boundary layer.

- **Small Pitot static pressure tube**

Effective length: 250mm; Diameter: $\varnothing=3$ mm, to measure the pressure difference in flowing fluids. It generally needs to be used together with a differential pressure meter.

- **Concave resistance body model**

Size: 80mmx68.65mm; Weight: about 0.5kg.

- **Flag-shaped lifting body model**

Size: 100mmx4mmx360mm; Weight: 0.2kg.

- **NACA 0015 airfoil lifting body model**

Size: 100mmx15mmx290mm; Weight: about 0.2kg.

- **Large square plate lifting body model**

Size: 100mmx4mmx360mm; Weight: about 0.2kg.

- **NACA 4415 airfoil lifting body model**

Size: 100mmx16mmx290mm; Weight: about 0.2kg.

- **NACA 54118 airfoil lifting body model**

Size: 100mmx20mmx290mm; Weight: 0.2kg.

- **Airfoil with slats and slot flaps**

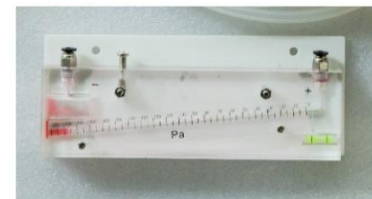
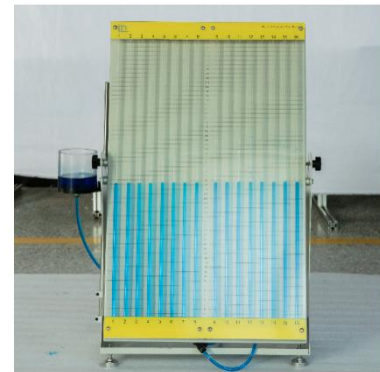
Size: 120mmx120mmx300mm; Weight: about 0.4kg.

- **NACA 0015 airfoil pressure distribution module**

Size: 100mmx60mmx15mm; Weight: 0.6kg.

- **NACA 4415 airfoil pressure distribution module**

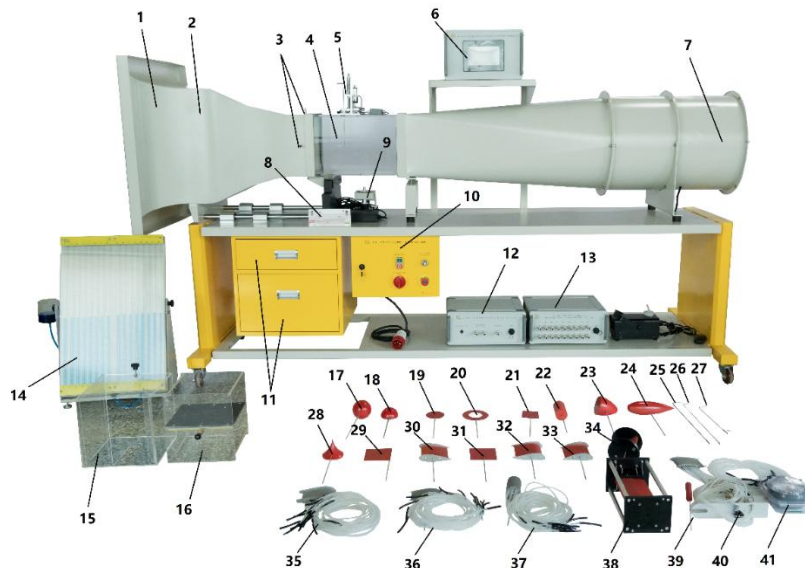
Size: 100mmx60mmx15.5mm; Weight: about 0.6kg.





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- **Cylindrical resistance body pressure distribution module**
Size: 50mmx50mmx280mm; Weight: about 0.5kg.
- **Wing module fixed by multiple sets of springs**
Size: 200mmx100mmx15mm; Weight: about 0.2kg, to demonstrate the state changes of the airfoil as the wind tunnel flow speed changes.
- **Wake measurement module**
Cylindrical resistance body size: 100mmx20mmx290mm; Measuring end size: 1.1mm-2mm, Pitot tube spacing: 3mm.
- **NACA 54118 airfoil pressure distribution module**
Size: 100mmx60mmx19.65mm; Weight: about 0.6kg.
- **Differential pressure gauge**
Measuring range: 0-5mbar, to measure the pressure difference in the wind tunnel.



No.	Name	Function
1	Nozzle profile air duct opening	It can ensure that the wind speed is evenly distributed in the closed measurement section.
2	Equalizing orifice plate	It can ensure that the wind speed is evenly distributed in the closed measurement section.
3	Wind speed measuring hole	Four measuring holes are distributed to measure wind speed.
4	Transparent visual experimental measurement section	Measurement experiments can be performed here
5	Electronic displacement measuring device	Used to measure the thickness of the velocity boundary layer
6	Display three-force real-time data unit	Displays real-time data for the third force
7	Variable frequency fan	Used to provide power for wind flow
8	Velocity Inclined Tube Pressure Gauge	Used to indicate real-time pressure differentials in wind tunnels
9	Three-force sensor	Used to measure the Three-force of the experimental model



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10	Electrical control box	Used to Control device electrical
11	Cabinets for placing experimental components	Cabinets for placing experimental components
12	Electronic differential pressure and speed measuring unit	For displaying real-time differential pressure and flow velocity at the measuring point
13	18-channel electronic pressure measurement unit	Used to provide 18-channel electronic pressure measurement
14	16-tube liquid level pressure gauge	Used to measure the pressure difference of 16 channels
15	Bernoulli experiment module	Module for providing Bernoulli experiments
16	Velocity boundary layer analysis module	Experimental module for velocity boundary layer measurements
17	Spherical resistance body model	Experimental model
18	Hemispherical resistance body model	Experimental model
19	Disc-type resistance body model	Experimental model
20	Ring-shaped resistance body model	Experimental model
21	Small square plate resistance body model	Experimental model
22	Cylindrical resistance body model	Experimental model
23	Parallel resistance body model	Experimental model
24	Streamlined resistance body model	Experimental model
25	Thick pitot total pressure pipe	Pitot tube for measuring total pressure
26	Fine pitot static pressure tube	Pitot tube for measuring static pressure and differential pressure
27	Small pitot static pressure tube	Pitot tube for measuring static pressure and differential pressure
28	Concave resistance body model	Experimental model
29	Flag-shaped lifting body model	Experimental model
30	NACA 0015 airfoil lifting body model	Experimental model
31	Large square plate lifting body model	Experimental model
32	NACA 4415 airfoil lifting body model	Experimental model
33	NACA 54118 airfoil lifting body model	Experimental model
34	Airfoil with slats and slot flaps	Experimental model
35	NACA 0015 airfoil pressure distribution module	Experimental model
36	NACA 4415 airfoil pressure distribution module	Experimental model
37	Cylindrical resistance body pressure distribution module	Experimental model
38	Wing module fixed by multiple sets of springs	Observe the state changes of the wing as the wind speed changes
39	Wake measurement module	Experimental model
40	NACA 54118 airfoil pressure distribution module	Experimental model
41	Differential pressure gauge	Differential Pressure Gauge



TRAINING OBJECTIVES

The system supports up to 16 different experiments, covering key aerodynamic principles such as force measurement, pressure distribution, boundary layer analysis, wake measurement, velocity measurement, and data acquisition, suitable for comprehensive teaching and laboratory applications:

- Demonstration of the electrical control operation in the open wind tunnel.
- Demonstration of the drag body module and three-force sensor testing in the open wind tunnel.
- Demonstration of the lifting body module and three-dimensional force sensor testing in the open wind tunnel.
- Pressure distribution experiment on the lifting body module using a sixteen-tube liquid column manometer in the open wind tunnel.
- Pressure distribution measurement on the lifting body module using an 18-channel electronic differential pressure device in the open wind tunnel.
- Bernoulli principal demonstration experiment in the open wind tunnel.
- Measurement of boundary layer thickness over different rough surfaces in the open wind tunnel.
- Comparative measurement of pressure difference using mechanical and electronic differential pressure gauges in the open wind tunnel.
- Wind tunnel velocity measurement using an inclined tube manometer and electronic anemometer.
- Observation of state changes in a spring-mounted wing model under varying wind speeds in the open wind tunnel.
- Wake flow measurement experiment in the open wind tunnel.
- Introduction to data acquisition software for the 18-channel electronic differential pressure measurement system in the open wind tunnel.
- Introduction to data acquisition software for the electronic displacement measurement system in the open wind tunnel.
- Introduction to data acquisition software for the electronic differential pressure measurement system in the open wind tunnel.
- Introduction to data acquisition software for electronic wind speed measurement devices in the open wind tunnel.
- Introduction to data acquisition software for the three-point force and angle of attack measurement system in the open wind tunnel.