AERODYNAMICS MAIN UNIT

DL HC-AMU

INTRODUCTION

Aerodynamics is a specialized branch of fluid mechanics concerned with the analysis of force characteristics acting on aircraft and other bodies in relative motion with air or gaseous media. It examines gas flow behavior, flow field structures, and the associated physical and chemical phenomena arising from such motion. Aerodynamics is commonly classified according to two principal criteria.

The first classification is based on the velocity regime of the fluid flow or the flight speed of the aircraft, distinguishing between low-speed aerodynamics and high-speed aerodynamics, the second classification criterion considers the influence of gas viscosity on the flow field, leading to a distinction between ideal aerodynamics (or ideal gas dynamics), where viscous effects are neglected, and viscous aerodynamics, where viscosity plays a significant role.

The aerodynamic master device is an instructional system designed to demonstrate fundamental aerodynamic principles and phenomena. It supports a clearer understanding of experimental aerodynamic theories for students and professionals through practical visualization. The system primarily consists of a main structural unit integrated with multiple experimental modules, enabling a wide range of aerodynamic experimental demonstrations.

Features

1. The device has an enhanced electrical safety design, providing stable and highly reliable grounding performance to ensure safe operation.
2. An integrated electrical architecture is implemented, in which the electrical control system and experimental components are housed within a unified structure. This configuration significantly reduces the overall footprint of the equipment while improving operational safety. Additionally, this design minimizes dependence on specific environmental or site conditions, increasing deployment flexibility.
3. The system supports a wide range of interchangeable experimental modules, enabling progressively expanded experimental capabilities and a diverse set of aerodynamic demonstrations.
4. The equipment is manufactured using corrosion-resistant and high-strength materials, resulting in improved structural safety and an extended operational service life.
5. Technical Parameters:
   Input Power Supply: Single-phase from the mains, 50/60 Hz.
   Overall Dimensions: 1960 × 870 × 2120 mm.
   Net Weight: 272 kg.

Control Panel main features

- **Fan Speed Control Knob:** Used to regulate the rotational speed of the fan.
- **Fan Start Switch:** Used to initiate fan operation.
- **Emergency Stop Switch:** Used to immediately disconnect power from the circuit under emergency conditions.
- **Expansion Jack:** Used to connect auxiliary or external devices.
- **Circuit Breaker:** Used to control the activation and deactivation of the electrical circuit.
- **Smoke Generator Power Socket:** Provides electrical power to the smoke generator.

No.	Name	Function
1	FAN	Promote the flow of air
2	ELECTRICAL BOX	Where electrical controls are installed
3	THERMOMETER	Measure the temperature inside the pipe
4	MEASURING HOLE	Used to measure pressure difference or flow rate in pipelines
5	AIR FLOW VALVE	Valves used to control air flow
6	OVERFLOW PROTECTION	Used to protect the fan when the damper is fully closed
7	BUCKLE	For fixing replaceable experimental modules
8	FLUID START / END	Duct air outlet
9	AIR RETURN END	Used to collect outgoing airflow

INCLUDED ACCESSORIES

- **Smoke Oil:** 2 units.
- **Oil Injector:** 1 unit.
- **Smoke Generator:** 1 unit.
- **Blue Ink:** 1 unit.
- **Hexagon Socket Wrench Set:** 1 set.
- **Industrial Plug:** 1 unit.
- **Air Hose (Trachea):** 100 units.
- **Fan module:**
  Input power supply is three-phase AC380V, power is 0.75kW, to provide fluid flow power.
- **Fluid visualization experiment module:**
  Equipped with visual module, experimental module can be replaced, to demonstrate the flow patterns of various experimental modules.
- **Bernoulli Principle Experiment Module:**
  Maximum range is 290mm, to demonstrate Bernoulli's principle.
- **Coanda effect experimental module**
  Maximum adjustable total angle is 120 degrees, to demonstrate the Coanda effect.
- **Experimental module for measuring velocity boundary layer thickness**
  Maximum range of displacement measurement is 50mm, to demonstrate experiments measuring velocity boundary layers.
- **Flow resistance loss (with airfoil) experimental module**
  The total adjustable angle is 80 degrees, to demonstrate flow resistance loss.
- **Local Pressure Loss Experiment Module**
  Up to 29 sets of measurement holes can be provided, for experiments demonstrating local pressure loss.
- **Multi-tube liquid column differential pressure meter**
  Up to 16 sets of pressure measurement comparisons can be provided, to measure the pressure difference in experiments.

Experiment List

The aerodynamic main device supports a total of 7 experimental demonstrations, designed to illustrate fundamental aerodynamic principles and flow phenomena. These experiments enable users to analyze airflow behavior, pressure variation, boundary layer development, and energy losses through structured experimental observation and measurement.

The available experiments are listed as follows:

- Understanding the electrical control principles of the aerodynamic main device.
- Flow visualization experiment demonstrates the aerodynamic main device.
- Measuring velocity boundary layer thickness using the aerodynamic main device.
- Demonstration of flow resistance loss in the aerodynamic main device.
- Experiment demonstrates local pressure loss in the aerodynamic main device.
- Free jet demonstration experiment using the main aerodynamic device.
- Demonstration of the Coanda effect experiment of the main aerodynamic device
- Demonstration experiment of Bernoulli's principle using the main aerodynamic device

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