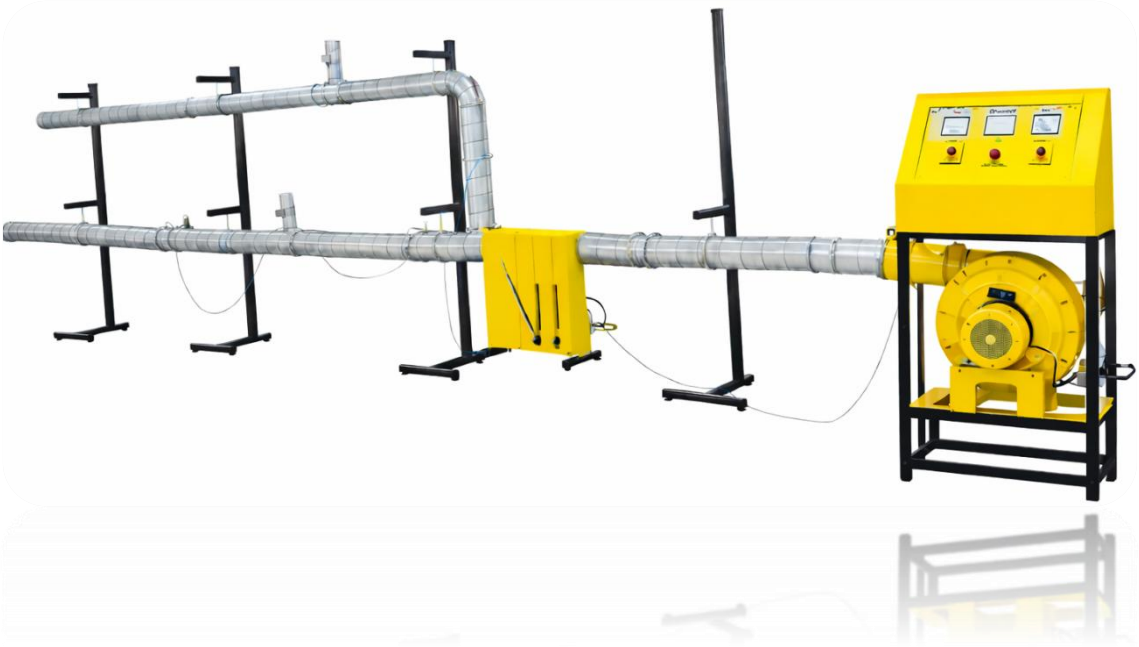
FLUID MECHANICS

CENTRIFUGAL FAN AIR AND DUCTING TRAINER



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INTRODUCTION

The Centrifugal Fan Air and Duct Trainer is a professional ventilation training system designed for technical education and laboratory instruction. The unit provides a full-scale experimental platform for the direct study of airflow dynamics, system commissioning and balancing, and air distribution in parallel branch and linear duct configurations. The trainer accurately replicates real-world ventilation system operating conditions, enabling users to reinforce theoretical principles through hands-on experimentation and to develop practical skills in system analysis, adjustment, and optimization.

- Scalable and modular design: The system features a flexible, modular architecture that allows the duct layout to be reconfigured or expanded according to instructional or research requirements. This scalability ensures adaptability to a wide range of educational programs and advanced training applications.
- Comprehensive measurement and control instrumentation: The trainer is equipped with professional-grade instrumentation, including analog voltmeters and ammeters, portable manometers, Pitot tubes, and digital anemometers. All devices are integrated into a dedicated console, enabling accurate data acquisition and detailed performance analysis.
- Operational safety and user-friendly design: Electrical protection systems and emergency stop devices are incorporated to ensure safe operation during training activities. A transparent protective plastic cover is provided for the console, safeguarding components and extending the service life of the equipment.
- Complete training support: The system is supplied with a detailed experimental manual and instructor training, ensuring effective utilization of the equipment for both teaching and learning purposes.

- The Centrifugal Fan Air and Duct Trainer is a high-performance educational solution that combines practical operation, technical measurement, and system analysis, making it ideal for developing competencies in ventilation system design, operation, and maintenance.

SYSTEM CONFIGURATION

The training system is divided into three main components:

1 - Fan: One of the core components is a variable-speed centrifugal fan with backward-curved blades. The fan is designed to deliver adjustable airflow rate and static pressure, enabling students to analyze airflow behavior under different operating conditions. Fan speed and performance are controlled by varying electrical current, directly influencing airflow dynamics, pressure characteristics, and overall system energy efficiency.

2 - Ductwork System: The ductwork system consists of 200 mm diameter circular galvanized steel ducts, including main trunks, coupling kits, and fastening elements. This subsystem is essential for studying air transport, flow distribution, and pressure losses within the ventilation network. The modular and expandable duct design allows users to reconfigure the layout according to experimental requirements, facilitating the analysis of different duct arrangements and their impact on system performance.

3 - Control Console: The integrated control console is equipped with voltmeters and ammeters for real-time monitoring of the fan's electrical and operating parameters. This instrumentation enables precise control, measurement, and data acquisition during experimental activities. The console also incorporates essential safety features, including emergency stop push-buttons and overload protection, ensuring safe operation throughout laboratory exercises.

The Control Console Includes:

2-Pole Circuit Breaker (2P): Electrical protection device designed to safeguard the circuit. In the event of overcurrent or short circuit, the 2-pole circuit breaker automatically disconnects the power supply, preventing overload conditions and protecting electrical components from damage.

Voltmeter: Measures and displays the operating voltage of the fan in real time, allowing continuous monitoring of the electrical system and ensuring operation within safe voltage limits**.**

Ammeter: Measures the current drawn during fan operation, enabling evaluation of fan load, power consumption, and overall energy efficiency. This information assists in determining optimal operating conditions.

Fan Speed Controller: Electronic control device used to regulate the fan rotational speed. Airflow rate is adjusted by varying the supply frequency, allowing precise control of air velocity and system performance.

Power Indicator Light: Visual indicator that displays the power status of the equipment, providing immediate confirmation of system energization.

Emergency Stop Push Button: Safety device that enables immediate shutdown of the fan in emergency situations, ensuring protection of both users and equipment.

FLUID MECHANICS

TECHNICAL SPECIFICATIONS

- Power supply: single-phase, 50/60 Hz.
- Weight: Approximately 386 kg.
- Operating conditions: Ambient temperature: 10 ℃ to +40 ℃, relative humidity: < 85 % (at 25 ℃).
- Overall dimensions: Approximately 12,000 mm × 640 mm × 1,540 mm.

INCLUDES THE FOLLOWING ACCESSORIES:

- Multi-tube differential pressure gauge.
- Split-type anemometer.
- L-type Pitot tube, Ø6 × 300 mm.
- Silicone Hose Set.
- Graduated measuring cup.
- Syringe, 50 ml.
- Aviation-grade plug and socket connector.

TRAINING OBJECTIVES

The Centrifugal Fan Air and Duct Trainer support four (4) experimental exercises designed to develop practical understanding of ventilation system operation, measurement, and analysis. These experiments allow students to progressively study system components, perform installation and commissioning tasks, and evaluate airflow and pressure characteristics under controlled laboratory conditions.

Experimental practices:

- Study of Ventilation System Components.
- Component Connection, Installation, and System Functional Verification.
- Measurement of Air Circuit Pressure and Air Velocity.
- Pressure Loss Analysis and Air Damper Calibration.