Aerodynamic Tunnel, 50 x 250 mm

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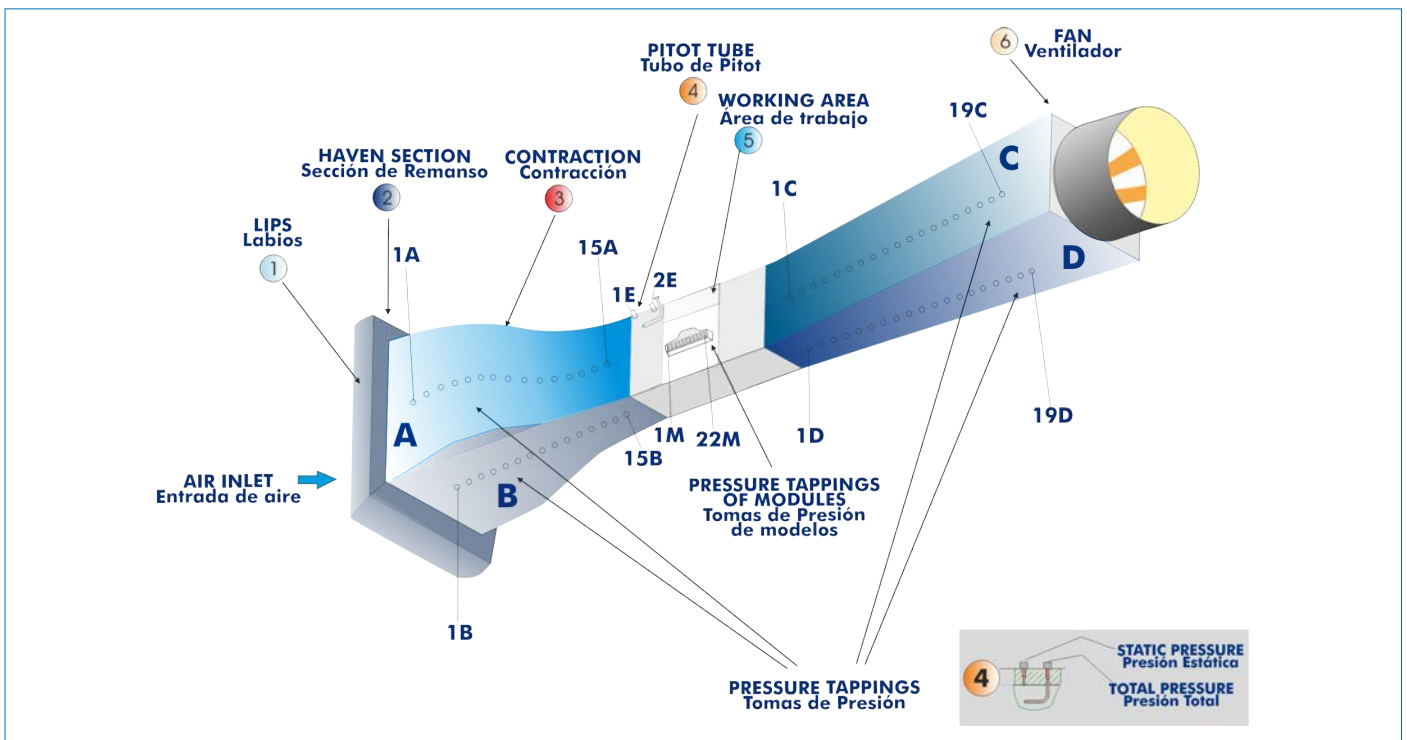
Engineering and Technical Teaching Equipment

TA50/250

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⤷PRODUCTS
⤷80.- FLUID MECHANICS

PROCESS DIAGRAM AND UNIT ELEMENTS ALLOCATION

PITOT TUBE
Tubo de Pitot

4

WORKING AREA
Área de trabajo

5

6 FAN
Ventilador

19C

HAVEN SECTION
Sección de Remanso

2

CONTRACTION
Contracción

3

1C

C

LIPS
Labios

1

1A

15A

1E 2E

D

AIR INLET
Entrada de aire

A

B

1M 22M

15B

1D

19D

PRESSURE TAPPINGS OF MODULES
Tomas de Presión de modelos

1B

PRESSURE TAPPINGS
Tomas de Presión

4

STATIC PRESSURE
Presión Estática

TOTAL PRESSURE
Presión Total

INTRODUCTION

Aerodynamics is the part of fluid mechanics that studies the motion of gases and the forces or reactions to which the bodies they interact with are subjected. Aerodynamics is not only important by itself but also as a complement to aeronautics. According to Mach number, or relative speed of a movable object with respect to air, these studies are divided into subsonic and supersonic aerodynamics, depending on whether that number is higher or lower than one.

Knowing the aerodynamics principles is useful for many activities, from the take-off and piloting of an airplane to driving a car or kicking a ball. Every time we move or throw an object, there are many physical principles acting, but we do not notice them.

A wind tunnel is a place widely used to determine the action of wind on different types of bodies. The model under study remains motionless, whereas air moves to generate the desired flow.

GENERAL DESCRIPTION

The Aerodynamic Tunnel, 50 x 250 mm, "TA50/250", is a wind tunnel designed to study subsonic aerodynamics in a tunnel in open circuit and with incompressible subsonic flow. Air is drawn by a variable speed fan located at the discharge end of the tunnel. Several models and accessories are available, allowing a comprehensive study of subsonic aerodynamics.

The unit includes several tunnel sections. In the same order in which the flow crosses them, they are: lips, haven section, contraction, working area, diffuser and fan.

Lips and a haven section are incorporated at the tunnel inlet to reduce the pressure drop and the interferences in the flow. An 8:1 contraction ratio and a perfectly studied contour curve of the contraction ensures well developed airflow through the working area.

The working area is located after the contraction. It is a constant section tract, where the models to be tested are assembled, and the dimensions of the transverse section is bigger than the models. It is made of PMMA to allow to observe the models. This section includes a Pitot static tube in the top side to study the static pressure, dynamic pressure and total pressure.

A diffuser is included at the tunnel outlet to avoid the generation of turbulences, which can generate damages in the current quality at the working area.

An axial-flow fan, located at the discharge end of the tunnel, provides a more uniform velocity profile at the working area. An electronic console contains the controller for the axial fan.

There are sixty different appropriate tappings for the pressure takings (along the tunnel and in the different models). The unit includes a twenty tube water manometer to measure the static pressure.

The models are mounted on a circular hatch (200 mm), and they are coupled to the working area to seal the opening. They are secured by knobs on the side wall of the working area.

SPECIFICATIONS

Bench-top wind tunnel in open circuit and with incompressible subsonic flow.

Anodized aluminum frame and panels made of painted steel.

Main metallic elements made of stainless steel.

Diagram in the front panel with distribution of the elements similar to the real one.

Inlet section with lips, a haven section and a 8:1 contraction ratio.

Transparent working area of 50 x 250 mm to assemble and test the different models.

The working area includes a Pitot static tube mounted in the top side.

Outlet section with diffuser that allows to avoid the generation of turbulences, which can generate damages the current quality in the working area.

Variable speed axial-flow fan:

    Velocity range: 0 – 2800 rpm.

    Air velocity in the working area: 0 – 27 m/s.

    An electronic console contains the controller for the axial fan.

Sixty different pressure tappings (along the tunnel and in the models).

Water multi-manometer:

    Anodized aluminum structure.

    30° inclination approx.

    Twenty manometric tubes of 250 mm length. Tubes inner diameter: 8 mm, to avoid bubbles.

    Water tank for filling.

    Drain valve.

    Millimeter precision rules of 250 mm length.

Several models and accessories are available, allowing a comprehensive study of subsonic aerodynamics. All these models include several pressure tappings.

Manuals: This unit is supplied with the following manuals: Required Services, Assembly and Installation, Starting-up, Safety, Maintenance & Practices Manuals.

Models and Accessories included:

    - TA1. House Scale Model.

    - TA2. Cylinder Model.

    - TA3. Convex Semi-Cylinder Model.

Models and Accessories included:

TA1. House Scale Model

TA2. Cylinder Model

TA3. Convex Semi-Cylinder Model

Available a wide range of Optional Models and Accessories (Not included). (See in page 3)
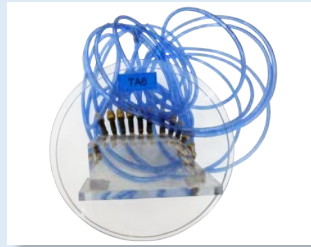
Optional Models and Accessories: (Not included)
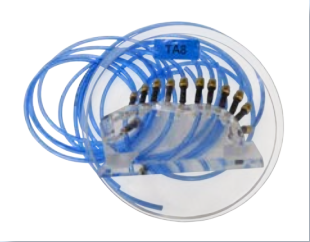

TA4. Car Model

TA5. Lorry Model

TA6. Lorry with Wind Deflector Model

TA7. Plane Model

TA8. Train Model

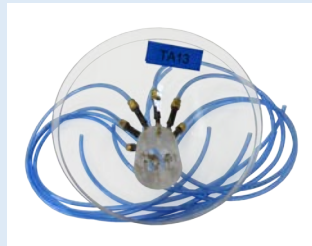TA9. Projectile Model

TA10. Circular Disc Model

TA11. Wing of a Plane Model

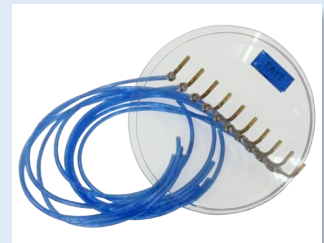TA12. Concave Semi-Cylinder Model

TA13. Blunt Element Model

TA14. Bernoulli Apparatus Model

TA15. Boundary Layer Plate Model

TA16. Model under "Custom Design"

TA17. Wake Survey Rake

TA18. Streamlined Shape
(TA19 + TA50/250-TAR models are required)

TA19. Lift and Drag Balance
(TA50/250-TAR model is always required to operate TA18 and/or TA20 models)

TA20. Drag Models
(TA19 + TA50/250-TAR models are required)

TA50/250-TAR. Forces Measurement Console (TA19 model is always required to operate TA18 and/or TA20 models)

TA50/250-BLE. Boundary Layer Experiment Accessory

TA50/250-SG1. Smoke Generator

EXERCISES AND PRACTICAL POSSIBILITIES

1.- Comprehensive study of subsonic aerodynamics and airflow studies.

2.- Measurement of pressure distribution around a two dimensional body.

3.- Study of flow visualization.

4.- Study of static pressure, dynamic pressure and total pressure using a Pitot tube.

5.- Study of velocity measurement using a Pitot tube.

6.- Flux in a nozzle: Determination of the characteristics of the pressures field in a nozzle.

7.- Flux in a nozzle: Observation of the local characteristics, depending on whether the walls have a curvature or not, as well as what happens at the inlet and outlet areas of the contraction.

8.- House Scale Model (TA1): Study of aerodynamic forces due to the wind on a house.

9.- House Scale Model (TA1): Determination of the aerodynamic loads generated by the wind on a house walls.

10.-Cylinder Model (TA2): Study of flow around a cylinder.

11.-Cylinder Model (TA2): Determination of the form of the pressures field around a cylinder on which a current perpendicular to the axis impacts.

12.-Cylinder Model (TA2): Determination, by the type of detachment, whether the boundary layer finally becomes turbulent or remains laminar.

13.-Cylinder Model (TA2): Determination of the resistance coefficient of the cylinder.

14.-Cylinder Model (TA2): Relation of all the above-mentioned with the Reynolds's number.

15.-Convex Semi-Cylinder Model (TA3): Study of flow around a convex semi-cylinder.

16.-Convex Semi-Cylinder Model (TA3): Determination of the field of pressures in the convex semi-cylinder.

17.-Convex Semi-Cylinder Model (TA3): Determination of the aerodynamic resistance coefficients in the convex semi-cylinder.

Additional practical possibilities to be done with the Optional Models and Accessories: (Not included)

18.-Study of aerodynamic forces due to the wind on a Car Model (TA4).

19.-Study of aerodynamic forces due to the wind on a Lorry Model (TA5).

20.-Study of aerodynamic forces due to the wind on a Lorry with Wind Deflector Model (TA6).

21.-Study of aerodynamic forces due to the wind on a Plane Model (TA7).

22.-Study of aerodynamic forces due to the wind on a Train Model (TA8).

23.-Study of aerodynamic forces due to the wind on a Projectile Model (TA9).

24.-Study of aerodynamic forces due to the wind on a Circular Disc Model (TA10).

25.-Study of aerodynamic forces due to the wind on a Wing of a Plane Model (TA11).

26.-Study of flow and pressure distribution around a Wing of a Plane Model (TA11) at different angles of attack.

27.-Study of aerodynamic forces due to the wind on a Concave Semi-Cylinder Model (TA12).

28.-Study of aerodynamic forces due to the wind on a Blunt Element Model (TA13).

29.-Study of effect of changing in Bernoulli Apparatus Model (TA14) the cross section and application of the Bernoulli equation.

30.-Study of laminar and turbulent boundary layer development with the Boundary Layer Plate Model (TA15) and the Boundary Layer Experiment Accessory (TA50/250-BLE).

31.-Study of static pressure, dynamic pressure and total pressure with the Wake Survey Rake (TA17).

32.-Study of aerodynamic forces due to the wind on a Streamlined Shape (TA18).

33.-Investigation into the influence of models shape in the drag forces (Lift and Drag Balance (TA19), Drag Models (TA20) and Forces Measurement Console (TA50/250-TAR)).

34.-Demonstration of flow patterns around different objects with the Smoke Generator (TA50/250-SG1).

REQUIRED SERVICES

- Electrical supply: single-phase, 220 V/50 Hz or 110 V/60 Hz.
- Water supply and drainage.

DIMENSIONS AND WEIGHTS

TA50/250:

  -Dimensions: 2720 x 820 x 700 mm approx.

                 (107.08 x 32.28 x 27.56 inches approx.)

  -Weight: 220 Kg approx.

          (485 pounds approx.)

OPTIONAL MODELS AND ACCESSORIES (Not included)

- TA4. Car Model.
- TA5. Lorry Model.
- TA6. Lorry with Wind Deflector Model.
- TA7. Plane Model.
- TA8. Train Model.
- TA9. Projectile Model.
- TA10. Circular Disc Model.
- TA11. Wing of a Plane Model.
- TA12. Concave Semi-Cylinder Model.
- TA13. Blunt Element Model.
- TA14. Bernoulli Apparatus Model.
- TA15. Boundary Layer Plate Model.
- TA16. Model under "Custom Design".
- TA17. Wake Survey Rake.
- TA18. Streamlined Shape (TA19 + TA50/250-TAR models are required).
- TA19. Lift and Drag Balance (TA50/250-TAR model is always required to operate TA18 and/or TA20 models).
- TA20. Drag Models (Sphere, Hemisphere, Convex, Hemisphere Concave, Circular Disc) (TA19 + TA50/250-TAR models are required).
- TA50/250-TAR. Forces Measurement Console (TA19 model is always required to operate TA18 and/or TA20 models).
- TA50/250-BLE. Boundary Layer Experiment Accessory.
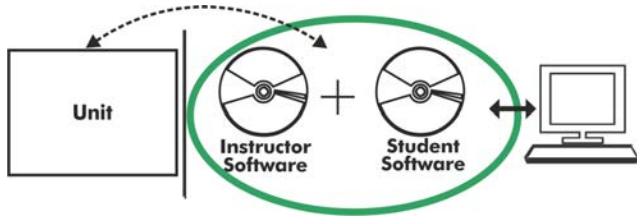- TA50/250-SG1. Smoke Generator.

AVAILABLE VERSIONS

Offered in this catalogue:

- TA50/250. Aerodynamic Tunnel, 50 x 250 mm.

Offered in other catalogue:

- TA50/250C. Computer Controlled Aerodynamic Tunnel, 50 x 250 mm.

TA50/250/ICAI. Interactive Computer Aided Instruction Software System:

With no physical connection between unit and computer (PC), **this complete software package consists of an Instructor Software (EDIBON Classroom Manager -ECM-SOF) totally integrated with the Student Software (EDIBON Student Labsoft -ESL-SOF).** Both are interconnected so that the teacher knows at any moment what is the theoretical and practical knowledge of the students.
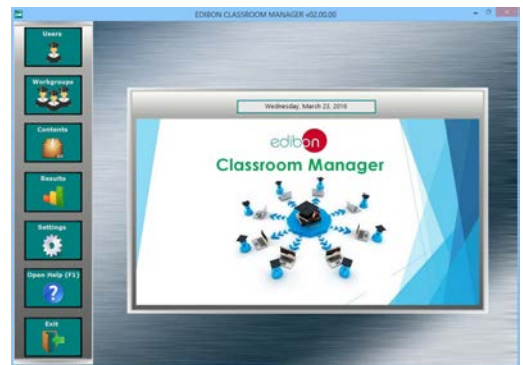
Instructor Software

- ECM-SOF. EDIBON Classroom Manager (Instructor Software).

ECM-SOF is the application that allows the Instructor to register students, manage and assign tasks for workgroups, create own content to carry out Practical Exercises, choose one of the evaluation methods to check the Student knowledge and monitor the progression related to the planned tasks for individual students, workgroups, units, etc... so the teacher can know in real time the level of understanding of any student in the classroom.

Innovative features:

- User Data Base Management.
- Administration and assignment of Workgroup, Task and Training sessions.
- Creation and Integration of Practical Exercises and Multimedia Resources.
- Custom Design of Evaluation Methods.
- Creation and assignment of Formulas & Equations.
- Equation System Solver Engine.
- Updatable Contents.
- Report generation, User Progression Monitoring and Statistics.

ECM-SOF. EDIBON Classroom Manager (Instructor Software) Application Main Screen
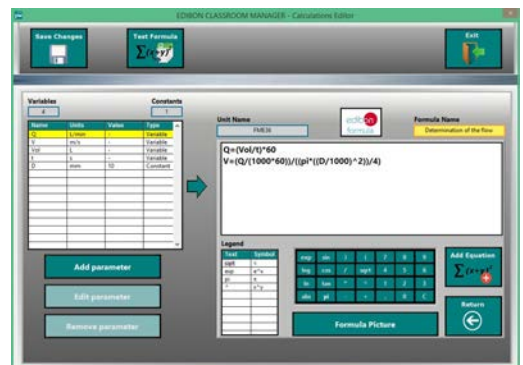
ECAL. EDIBON Calculations Program Package - Formula Editor Screen
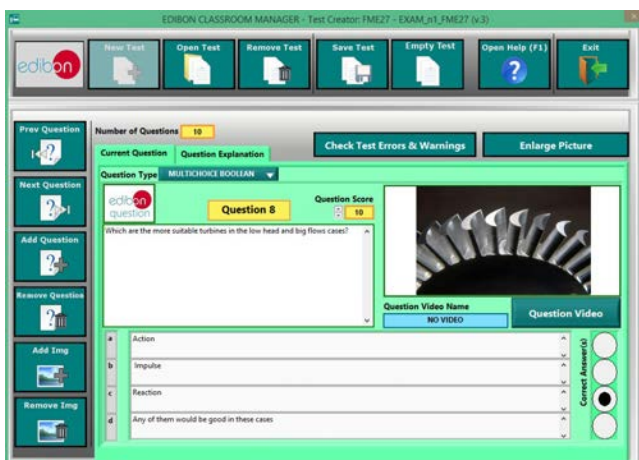
ETTE. EDIBON Training Test & Exam Program Package - Main Screen with Numeric Result Question

ERS. EDIBON Results & Statistics Program Package - Student Scores Histogram

- ESL-SOF. EDIBON Student Labsoft (Student Software).

ESL-SOF is the application addressed to the Students that helps them to understand theoretical concepts by means of practical exercises and to prove their knowledge and progression by performing tests and calculations in addition to Multimedia Resources. Default planned tasks and an Open workgroup are provided by EDIBON to allow the students start working from the first session. Reports and statistics are available to know their progression at any time, as well as explanations for every exercise to reinforce the theoretically acquired technical knowledge.

Innovative features:

- Student Log-In & Self-Registration.
- Existing Tasks checking & Monitoring.
- Default contents & scheduled tasks available to be used from the first session.
- Practical Exercises accomplishment by following the Manual provided by EDIBON.
- Evaluation Methods to prove your knowledge and progression.
- Test self-correction.
- Calculations computing and plotting.
- Equation System Solver Engine.
- User Monitoring Learning & Printable Reports.
- Multimedia-Supported auxiliary resources.

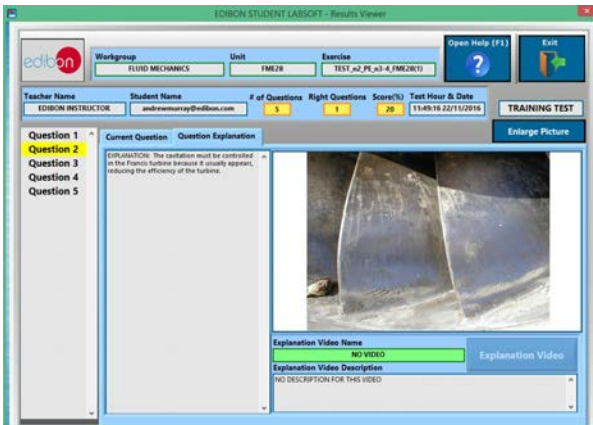For more information see ICAI catalogue. Click on the following link:
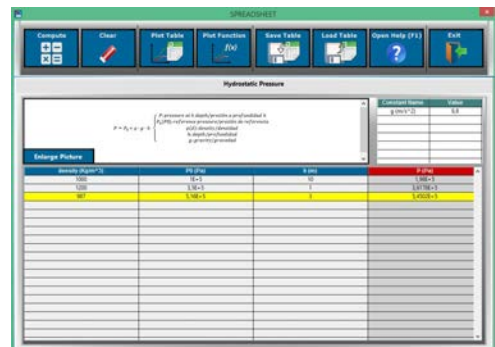www.edibon.com/en/files/expansion/ICAI/catalog

ESL-SOF. EDIBON Student LabSoft (Student Software)
Application Main Screen
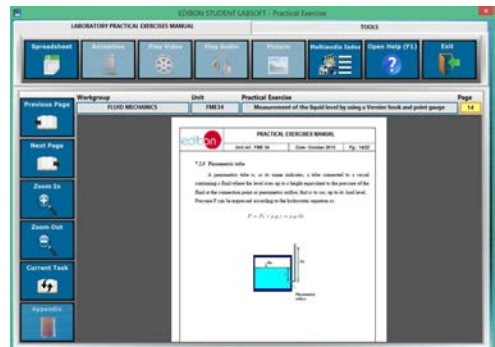
EPE. EDIBON Practical Exercise Program Package Main Screen

ERS. EDIBON Results & Statistics Program Package - Question Explanation

ECAL. EDIBON Calculations Program Package Main Screen

✱ Specifications subject to change without previous notice, due to the convenience of improvement of the product.