High Voltage Laboratory System







Key features:

- > Advanced Real-Time SCADA.
- Advanced impulse testing systems to analyze the response of high voltage systems (optional).
- Advanced AC High Voltage testing systems to analyze the response of high voltage systems (optional).
- Advanced DC High Voltage testing systems to analyze the response of high voltage systems (optional).
- > Real control devices.
- > Real power component used in power substations.
- > Real experiments in solids and insulating liquids.
- > Modular elements easy to assemble.
- > Study of real industrial components in a safe environment.
- > Study of air insulation capacity at different pressure conditions.

For more information about Key Features, click here













There are always considerations for owning and operating a business, but this is especially true when the business makes use of high-voltage equipment. In order to ensure that the business is up and running at any given time and to reduce the possibility that injuries could occur, it is important to include routine high-voltage equipment testing and repair services.

The High Voltage Laboratory System "HVLS" has been designed by EDIBON in order to show the students, teachers and researchers the most important aspects about how carry out the testing procedures of high voltage test..

GENERAL DESCRIPTION

The High Voltage Laboratory System "HVLS" is formed by a base unit and some optional modular components made with highest precision to build different configurations in order to carry out high AC Voltage Tests, DC Voltage Tests and Impulse Voltage Tests. This High Voltage Laboratory System includes safety equipment such as enclosed metal cage to protect the user against partial discharges.

Optional test kits:

<u>HVLS-AC. AC Voltage Tests Kit</u>. This test is generally done at power frequency (In Europe it is 50 Hz & in America it is 60 Hz). This is most commonly used high voltage test, carried on H.V. equipment. This test i.e. sustained low frequency test are carried out on a specimen of insulating material to determine and ensure, dielectric strength, dielectric losses of the insulating material. This test is also carried out on high voltage equipment and high voltage electrical insulators to ensure the dielectric strength and losses of these equipment and insulators.

<u>HVLS-DC. DC Voltage Tests Kit</u>. This test is normally applicable to those equipments which are used in high voltage DC transmission system. But this test is also applicable for high voltage AC equipments, when high voltage AC testing is not possible due to unavoidable condition. For example mainly at site, after installation of equipments it is quite difficult to arrange for high voltage alternating power as high voltage transformer may not be available at site. Hence, high voltage test with alternating power is not possible at site after installation of equipment. At that situation high voltage DC test is most suitable.

HVLS-IV. DC Impulse Voltage Tests Kit. This test allows generate impulse voltages that simulate lightning strokes and switching surges.

The complete High Voltage Laboratory System consists of the HVLS-B. Base Unit, HVLS-AC. AC Voltage Tests modules, HVLS-DC. DC Voltage Tests modules and HVLS-IV. Impulse Voltage Tests modules as well as the most important devices such us charging rectifier, impulse stages, an impulse voltage divider and impulse voltage measurement system.

The following list indicates the required elements in order to carry out the AC, DC and impulse tests separately. But if user acquires the three optional modular components then the common elements listed below will not be repeated.

The complete High Voltage Laboratory System "HVLS" is formed by:

HVLS-B. Base Unit:

HVRACK. Control and measurement desk.

Optional Test Kits:

HVLS-AC. AC Voltage Tests Kit:

Basic Modules:

HVSPHT/100. Single phase transformer 100kV.

HVFMC. Flexible metal connection.

HVMD. Manual discharger.

HVCB. Connecting bars.

HVAES. Assembly elements set.

HVES. Electrode set.

HVMCS. Measuring capacitor set.

Measurement and control equipment:

HVDACV. Digital AC Peak voltmeter.

HVPCM. Partial Discharge meter.

Test Modules:

HVMSGS. Measuring Spark Gap set.

HVCC. Corona cage.

HVOT. Oil testing.

HVCGC. Compressed gas capacitor.

HVCACO. Capacitor coupling.

HVLS-DC. DC Voltage Tests Kit:

Basic Modules:

HVSPHT/100. Single phase transformer 100kV.

HVFMC. Flexible metal connection.

HVMD. Manual discharger.

HVCB. Connecting bars.

HVAES. Assembly elements set.

HVD. HV Diode.

HVFIC. Filter/impulse capacitor.

HVCR280. Charging resistor 280M.

HVIB. Insulating bar.

HVGSE. Grounding switch electrode.

Measurement and control equipment:

HVDCV. DC voltmeter.

Test Modules:

HVMSGS. Measuring Spark Gap set.

HVSPHT/100. Single phase transformer 100kV.

HVCC. Corona cage.

HVCR2.5. Charging resistor 2.5M.

HVLS-IV. Impulse Voltage Test Kit:

Basic Modules:

HVFMC. Flexible metal connection. HVMD. Manual discharger. HVCB. Connecting bars. HVAES. Assembly elements set. HVD. HV Diode. HVFIC. Filter/impulse capacitor. HVCR280. Charging resistor 280M. HVLC. Load capacitor. HVCR10. Charging resistor 10M. HVWFR. Wave front resistor. HVWTR. Wave tail resistor. HVSG. Sphere gap. HVDFSG. Drive for sphere gap. HVIB. Insulating bar. Measurement and control equipment: HVLVD. Low voltage divider. HVTD. Triggering device. HVETS. Electronic trigger sphere. HVACPV. AC peak voltmeter. HVDCV. DC voltmeter. HVIV. Impulse voltmeter. Test Modules:

HVMSGS. Measuring Spark Gap set. HVCC. Corona cage.

The HVLS-B. Base Unit is always required to work with any other optional test modules.



HVMCS. Measuring capacitor set: Capacitor for 100kV and 100pF. Capacitor for 200kV and 100pF. Capacitor for 300kV and 100pF. HVTD. Triggering device: Supply voltage: 220 V. Frequency: 50 Hz. In control and measurement rack. HVETS. Electronic trigger sphere: Supply voltage: 220 V. Frequency: 50 Hz. Measuring Range: 100-1000 $\hat{U} / \sqrt{2}$ kV. HVDACV. Digital AC Peak voltmeter: Supply voltage: 220 V. Frequency: 50 Hz. Measuring Range: 100-1000 \hat{U} / $\sqrt{2}$ Kv. In control and measurement rack. HVDCV. DC voltmeter: Supply voltage: 220 V. Frequency: 50 Hz. Measuring Range: 140kV/280kV/400kV. In control and measurement rack. HVIV. Impulse voltmeter: Supply voltage: 220 V. Frequency: 50 Hz. Measuring Range: 100-1000kV. In control and measurement rack. HVOT. Oil testing: Measuring Rod. Oil testing cup. HVCGC. Compressed gas capacitor: AC voltage 100 Kv. Capacitance 37pF. Dielectric gas: Sf6. Pressure: 3.5 bar. HVCACO. Capacitor coupling: Rated Voltage: 120 kV. Capacitance: 1 nF. Partial Discharge: 5 pC. HVMSGS. Measuring Spark Gap set: Measuring Spark Gap. Connecting bar. Vessel for vacuum/pressure. Vacuum Pump. Compressor. The complete unit includes as well: Advanced Real-Time SCADA. Advanced impulse testing systems to analyze the response of high voltage systems (optional). Advanced AC High Voltage testing systems to analyze the response of high voltage systems (optional). Advanced DC High Voltage testing systems to analyze the response of high voltage systems (optional). Real control devices. Real power component used in power substations. Real experiments in solids and insulating liquids. Modular elements easy to assemble. Study of real industrial components in a safe environment. Study of air insulation capacity at different pressure conditions. 2 Cables and Accessories, for normal operation. ③ Manuals:

This unit is **supplied with 8 manuals**: Required Services, Assembly and Installation, Interface and Control Software, Starting-up, Safety, Maintenance, Calibration & Practices Manuals.

*References 1 to 3 are the main items: HVLS + Cables and Accessories + Manuals are included in the minimum supply for enabling normal and full operation.

EXERCISES AND PRACTICAL POSSIBILITIES TO BE DONE WITH THE MAIN ITEMS

- 1.- Experiments of generation and measurement of AC Voltage.
- 2.- Experiments of generation and measurement of DC Voltage.
- 3.- Experiments of generation of Impulse Voltages.
- 4.- Experiments of measurement of Impulse Voltages.
- 5.- Experiments on insulating liquids.
- 6.- Experiments of Partial Discharge and Corona.
- 7.- Experiments on PD and Gliding Discharges.
- 8.- Power frequency and impulse voltage tests on power transformer.
- 9.- Break down of Gases.

Other possibilities to be done with this Unit:

10.-Many students view results simultaneously.

To view all results in real time in the classroom by means of a projector or an electronic whiteboard.

11.-This unit is totally safe as uses mechanical, electrical and electronic, and software safety devices.

REQUIRED SERVICES —

-Electrical supply: three-phase, 380V/50Hz o 208V/60Hz, 20Kw -Computer.

- 12.-This unit can be used for doing applied research.
- 13.-This unit can be used for giving training courses to Industries even to other Technical Education Institutions.
- 14.-Visualization of all the sensors values used in the HVLS unit process.
- Several other exercises can be done and designed by the user.

DIMENSIONS AND WEIGHT

HVLS:
Unit:

-Dimensions: 5000 x 2500 x 4000 mm. approx. (196.84 x 98.42 x 157.47 inches approx.). -Weight: 600 Kg. approx. (1322 pounds approx.) Additionally to the main items (1 to 3) described, we can offer, as optional, other items from 4 to 6.

All these items try to give more possibilities for: a) Technical and Vocational Education configuration. (ICAI)

b) Multipost Expansions options. (Mini ESN and ESN)

a) Technical and Vocational Education configuration

(a) HVLS/ICAI. Interactive Computer Aided Instruction Software System.

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.

This software is optional and can be used additionally to items (1 to 3).

-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.

-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/products/catalogues/en/ICAI.pdf





Program Package - Student Scores Histogram Package - Main Screen with Numeric Result Question



Instructor Software

b) Multipost Expansions options

⑤ Mini ESN. EDIBON Mini Scada-Net System.

Mini ESN. EDIBON Mini Scada-Net System allows up to 30 students to work with a Teaching Unit in any laboratory, simultaneously. It is useful for both, Higher Education and/or Technical and Vocational Education.

The Mini ESN system consists of the adaptation of any EDIBON Computer Controlled Unit with SCADA integrated in a local network.

This system allows to view/control the unit remotely, from any computer integrated in the local net (in the classroom), through the main computer connected to the unit. Then, the number of possible users who can work with the same unit is higher than in an usual way of working (usually only one).

Main characteristics:

- It allows up to 30 students to work simultaneously with the EDIBON Computer Controlled Unit with SCADA, connected in a local net.
- Open Control + Multicontrol + Real Time Control + Multi Student Post.
- Instructor controls and explains to all students at the same time.
- Any user/student can work doing "real time" control/multicontrol and visualisation.
- Instructor can see in the computer what any user/student is doing in the unit.
- Continuous communication between the instructor and all the users/students connected.

Main advantages:

- It allows an easier and quicker understanding.
- This system allows you can save time and cost.
- Future expansions with more EDIBON Units.

For more information see Mini ESN catalogue. Click on the following link: www.edibon.com/products/catalogues/en/Mini-ESN.pdf

6 ESN. EDIBON Scada-Net System.

This unit can be integrated, in the future, into a Complete Laboratory with many Units and many Students.

For more information see **ESN** catalogue. Click on the following link:

www.edibon.com/products/catalogues/en/units/energy/esn-alternativeenergies/ESN-ALTERNATIVE_ENERGIES.pdf



<u>Main items</u> (always included in the supply)

Minimum supply always includes:

- ① Unit: HVLS. High Voltage Laboratory System.
- ② Cables and Accessories, for normal operation.
- ③ Manuals.

*IMPORTANT: Under HVLS we always supply all the elements for immediate running as 1, 2 and 3.

Optional items (supplied under specific order)

a) <u>Technical and Vocational configuration</u>

HVLS/ICAI. Interactive Computer Aided Instruction Software System.

b) Multipost Expansions options

- **(5)** Mini ESN. EDIBON Mini Scada-Net System.
- **6** ESN. EDIBON Scada-Net System.

1 HVLS. Unit:	
HVRACK. Control and measurement rack:	
Voltage regulator 0-220V	
Instrumentation panel	
Manurement and control instruments according with the ention chose	
	(11013-AC, 11013-DC, 11013-10).
HVSPHI/100. Single phase transformer 100kV:	
Iranstormation ratio: 2x220V/100kV/220V.	
Nominal Power: 5 kVA, 10kVA for 60 min.	
Frequency: 50/60 Hz.	
Cascade Connection Set.	
HVEMC Elevible metal connection:	
Elevible metal connection	
Connector transformer.	
Connecting cup.	
Length: 1.5m.	
HVMD. Manual discharger:	
Length: 2.5m.	
HVCB. Connecting bars:	
Aluminum	
HV/AES Assembly elements set	
Connection Cun	
Horizontal connection element.	
Vertical connection element.	
HVD. HV Diode:	
Resistor.	
Rated current: 20mA.	
HVEIC. Filter/impulse capacitor:	
Nominal voltage: 140kV	
Canacitance: 25nE	
Nominal voltage: 140kV.	
Capacitance: 25nF.	
HVCR280. Charging resistor 280M:	
280Mohm.	
HVCR2.5. Charging resistor 2.5M:	
2.5 Mohm	
HVCR10 Charging resistor 10M	
10Mahm	
HVWFR. Wave front resistor:	
350 ohm.	
HVWTR. Wave tail resistor:	
2400 ohm.	
HVIB. Insulating bar:	
Voltage:	
TV3G. Sphere gap:	
Impulse voltage: 140 kV	
HVDFSG. Drive tor sphere gap:	
Input: 220 Kv.	
Frequency: 50/60 Hz.	
HVES. Electrode set:	
Electrode 200 mm.	
Electrode 300 mm	
HVGSE Grounding switch electrode	
lermination in conjuction with grounding switch for safety grounding.	
HVMCS. Measuring capacitor set:	
Capacitor for 100kV and 100pF.	
Capacitor for 200kV and 100pF.	
Capacitor for 300kV and 100pF.	
HVTD. Triagering device:	
Supply voltage: 220 V	
Fraguency 50 Hz	
In control and measurement rack.	
HVEIS. Electronic trigger sphere:	
Supply voltage: 220 V.	
Frequency: 50 Hz.	
Measuring Range: 100-1000 Û / √2 kV.	

HVDACV. Digital AC Peak voltmeter: Supply voltage: 220 V. Frequency: 50 Hz. Measuring Range: 100-1000 $\hat{U} / \sqrt{2}$ Kv. In control and measurement rack. HVDCV. DC voltmeter: Supply voltage: 220 V. Frequency: 50 Hz. Measuring Range: 140kV/280kV/400kV. In control and measurement rack. HVIV. Impulse voltmeter: Supply voltage: 220 V. Frequency: 50 Hz. Measuring Range: 100-1000kV. In control and measurement rack. HVOT. Oil testing: Measuring Rod. Oil testing cup. HVCGC. Compressed gas capacitor: AC voltage 100 Kv. Capacitance 37pF. Dielectric gas: Sf6. Pressure: 3.5 bar. HVCACO. Capacitor coupling: Rated Voltage: 120 kV. Capacitance: 1 nF. Partial Discharge: 5 pC. HVMSGS. Measuring Spark Gap set: Measuring Spark Gap. Connecting bar. Vessel for vacuum/pressure. Vacuum Pump. Compressor. The complete unit includes as well: Advanced Real-Time SCADA. Advanced impulse testing systems to analyze the response of high voltage systems (optional). Advanced AC High Voltage testing systems to analyze the response of high voltage systems (optional). Advanced DC High Voltage testing systems to analyze the response of high voltage systems (optional). Real control devices. Real power component used in power substations. Real experiments in solids and insulating liquids. Modular elements easy to assemble. Study of real industrial components in a safe environment. Study of air insulation capacity at different pressure conditions.

(2) Cables and Accessories, for normal operation.

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 - To view all results in real time in the classroom by means of a projector or an electronic whiteboard.
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a) Technical and Vocational Education configuration

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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.

b) Multipost Expansions options

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- Instructor controls and explains to all students at the same time.
- Any user/student can work doing "real time" control/multicontrol and visualisation.

- Instructor can see in the computer what any user/student is doing in the unit.

- Continuous communication between the instructor and all the users/students connected.

Main advantages:

- It allows an easier and quicker understanding.
- This system allows you can save time and cost.
- Future expansions with more EDIBON Units.
- The system basically will consist of:

This system is used with a Computer Controlled Unit.

- Instructor's computer.
- Students' computers.
- Local Network.
- Unit-Control Interface adaptation.
- Unit Software adaptation.
- Webcam.
- Mini ESN Software to control the whole system.
- Cables and accessories required for a normal operation.

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



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