

HIGH VOLTAGE LABORATORY SYSTEM



Hampden[®]
ENGINEERING CORPORATION



HAMPDEN MODEL H-MHVS-1 MODULAR HIGH VOLTAGE SYSTEM

General

Furnish a Modular High Voltage System complete, including all items hereinafter specified. This equipment shall be as manufactured by Hampden Engineering Corporation of East Longmeadow, MA, or approved equal. All catalog numbers used are those of the Hampden Engineering Corporation, and have been used as a reference to establish quality desired.

Control Desk (H-SRP5TRE):



For control and operation of AC, DC and IMPULSE
Voltage Test Equipment
SUPPLY VOLTAGE = 230V, 50/60Hz
POWER RATING = 5kVA Continuous and 10kVA, 2 min.
duty
SOCKETS = 24V for ES and 220V for AKF, MF100 etc.

- Additional wiring for Trigger-device and Measuring
Instruments

All panels shall be constructed of 1/8" thick stretcher-leveled steel. Hinged panels shall be formed back one inch with all corners welded and ground smooth, and mounted with heavy-duty concealed hinge, Hinged panels shall be recessed 1" from front of case. All cabinets shall be of code gauge steel with all corners welded and ground smooth. Front edge of the cabinet shall have a formed end one inch deep recessed and with return on all four sides, so that the panel may set flush into the trim. Panel and case finish shall be polished, degreased, primed, filled, glazed, hand rubbed, and finished with two coats of baked on enamel. Case shall be dark grey hammertone, panel light blue/grey.

FOLLOWING CONTROL AND SAFETY FEATURES ARE PROVIDED IN THE CONTROL DESK:

- Emergency 'OFF' and key Interlock
- Compulsory 'ZERO START' Interlock
- Control Switches and Signal Lamps
- Instantaneous Over-Current and Bimetallic Thermal Overload Protections
- Measurement of Primary Voltage and currents
- Provision for inserting AC, DC and Impulse Voltmeters
- Provision for External door-interlock and Safety Loops

Wiring and Guarantee

All equipment shall be completely factory assembled and wired conforming to standard switchboard practice, using type JIC switchboard wire. All equipment shall be provided with solderless lugs for incoming and outgoing connections of #12 wire or larger.

All equipment shall be guaranteed against electrical and mechanical defects for a period of not less than one year from date of acceptance.

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MODULAR HIGH VOLTAGE SYSTEM

Voltmeter (H-DSM): *



Digital Display with hold facility. Provision for external Oscilloscope waveform display. Including one LV divider plug-in (UK-DSM), 10m long 750hms measuring-cable and housing but without Battery backup.
 METER ACCURACY = 0.5%
 MEASURING RANGE = (0 - 100) or (0 - 1000) U (rms) kV

Voltmeter (H-DC): *



For measurement of HV DC, Digital Display. To be used in conjunction with Measuring Resistor (Type RM280), 10m measuring-cable and housing.
 METER ACCURACY = 1%
 MEASURING RANGE = +/- 199.9kV with RM280 (max 140kV) and 1999kV with suitable RM (max. 400kV)

Voltmeter (H-DSTM): *



For measurement of High Voltage Impulse with Digital Display Provision for external Oscilloscope waveform display. To be used in conjunction With Impulse Divider (CB) and LV Divider (NTZ), 10m measuring-cable and housing.
 METER ACCURACY = 1%
 MEASURING RANGE = 150-300-450 kV(peak)

Trigger Device (H-TU): *



The Electronic Trigger Unit (TU) in conjunction with Trigger Sphere (EZK) is used to fire the sphere-gap(KF) or chopping output voltage using Measuring Spark gap (MF100). This ensures reproducible test results and Oscillograms
 POWER SUPPLY = 220V, 50/60Hz
 OSCILLOSCOPE TRIGGER DELAY TIME = 0.20 micro seconds
 CHOPPING DELAY TIME = 0.120µs
 OSCILLOSCOPE TRIGGER MAGNITUDE = +/- 20V
 JITTER = +/- 0.1µs

* Mounted in Control Desk

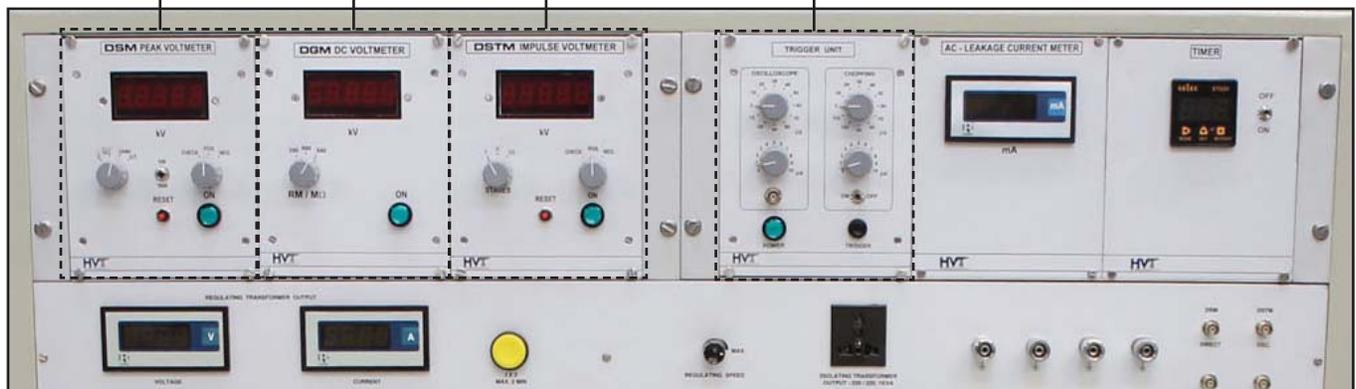


Voltmeter (H-DSM)

Voltmeter (H-DC)

Voltmeter (H-DSTM)

Trigger Device (H-TU)



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MODULAR HIGH VOLTAGE SYSTEM

HV Test Meter (H-TE0100/10):



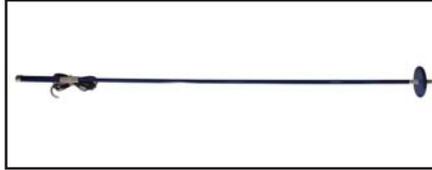
RATED INPUT/OUTPUT VOLTAGE = 2X220V /100kV/ 220V, 50/60Hz
 RATED TEST VOLTAGE = 120kV
 RATED OUTPUT POWER = 5kVA Continuous, 10kVA 1h'ON', 23h'OFF'
 SHORT CIRCUIT IMPEDANCE = <5%
 RATED PD LEVEL < 2pC at Rated Voltage
 The Transformer is of Three winding type with insulating shell design with Top and Bottom Corona free shielding electrodes. The insulation cylinder is made of epoxy resin with fiberglass reinforcement and coated with anti-tracking varnish. The exciter winding is divided into two groups viz. 100% output voltage when connected in parallel and 50% output voltage at rated current when connected in series. The coil is vacuum impregnated and insulated with high quality EHV grade transformer oil. The third winding known as 'Coupler Winding' is provided for further cascade connection.

HV Flexible Connector (H-HSV):



Flexible metal connector for corona free connection of Test object to HV Test Transformer.

Earthing Rod (H-EST):



For manual discharging of energized components as a safety-measure LENGTH = 2.5m
 BUILT-IN DISCHARGE RESISTANCE = 100 Ohms

Connecting Rod (H-V):



Aluminum conductive element.

Connecting Cup (H-K):



Aluminum cast conductive element.
 Four elements can be inserted horizontally and two vertically

Floor Pedestal (H-H-FS):



Aluminum cast conductive element.
 For inserting four spacer-bars (D) horizontally and to support one component vertically
 RECTIFIER (H-GS140):
 RATED PEAK INVERSE VOLTAGE = 140kV, dc
 RATED CURRENT = 20mA
 PROTECTIVE RESISTOR = 100kOhm

Capacitor (Impulse) (H-CS25):



Oil impregnated and PU resin cast impulse Capacitor
 RATED VOLTAGE = 140kV, dc
 RATED TEST VOLTAGE = 160kV, dc
 RATED CAPACITANCE = 25nF +/-10%

Resistor (Measuring) (H-RM280):



RATED VOLTAGE = 140kV DC,
 RESISTANCE VALUE = 280 Meg Ohms +/- 3%



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Spacer Tube (H-D):



Aluminum conductive element.

Earthing Switch (H-ES):



For grounding the HV construction kit automatically, in the event of de-energization or power failure

RATED VOLTAGE = 140kV DC and IMPULSE
SUPPLY VOLTAGE = 24V,50Hz



Earthing Switch H-ES in use.
Control Desk control triggers rod.

Voltage Divider (Impluse) (H-CB):



Oil insulated and hermetically sealed capacitor in FRP housing

RATED VOLTAGE = 140kV, dc
RATED TEST VOLTAGE = 160kV, dc
RATED CAPACITANCE = 1.2nF +/-10%

Resistor (Charging) (H-RL10):



RATED VOLTAGE = 140kV dc/Imp.
RESISTANCE VALUE = 10 MegOhms +/- 3%

Resistor (Wavefront) (H-RD350):



RATED VOLTAGE = 140kV dc/Imp.
RESISTANCE VALUE = 350 Ohms +/- 3%

Resistor (Wavetail) (H-RE2400):



RATED VOLTAGE = 140kV dc/Imp.
RESISTANCE VALUE = 2400 Ohms +/- 3%



Rectifier (H-GS140):



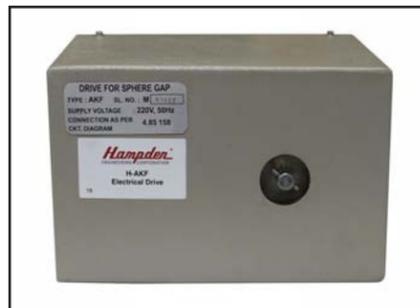
RATED VOLTAGE = 140kV dc/Imp.
RESISTANCE VALUE = 20 mA

Insulating Rod (H-IS):



Insulating Component
RATED VOLTAGE = 100kV AC, 140kV dc and Impulse

Electrical-Drive-for-Sphere Gap (H-AKF):



For adjusting the sphere-gap spacing.
SUPPLY VOLTAGE = 220V, 50/60Hz

Spheregap (H-KF):



As switching device for Impulse Voltage Generator
RATED VOLTAGE = 140kV Impulse
SPHERE DIA. = 100 mm
MAX. gap setting = 90 mm



H-KF Spheregap in use

Electrode (H-EL1):



Serves as discharging point for Earthing switch (ES)

Electrode (H-EL2):



Serves as Corona free termination

Electrode (H-EL3):



Serves as Corona free termination

Electrode (H-EL300):



Top shielding electrode for 300kV Transformer Cascade

Voltage Divider (AC) (H-CM100-S):



Oil insulated and hermetically sealed capacitor in FRP housing
Mounted on mobile platform and with Corona-free HV Electrodes
RATED VOLTAGE = 100kV, 50/60Hz
RATED TEST VOLTAGE = 120kV, 50/60Hz
RATED CAPACITANCE = 100pF +/-10%
RATED PD LEVEL < 2pC

Low Voltage Divider (H-NTZ):



Dividers (Type:CB or RCT)and Impulse Peak voltmeters (Type DSTM)

Voltage Divider (AC) (H-CM300):



Oil insulated and hermetically sealed capacitor in FRP housing
Mounted on mobile platform and with Corona-free HV Electrodes
RATED VOLTAGE = 300kV, 50/60Hz
RATED TEST VOLTAGE = 360kV, 50/60Hz
RATED CAPACITANCE = 100pF +/-10%
RATED PD LEVEL < 5pC

Electronic Triggersphere (H-EZK):



Electronic Trigger Sphere used for controlled triggering of Impulse Generator. It has the same dia. as that of passive spheres(100mm) used in Sphere-gap (KF) enabling easy interchange. The trigger energy is supplied by battery operated electronic circuit inside the Trigger-Sphere. The command pulse from Trigger Unit (TU) is fed via Fiber-optic Cable.
SPARK VOLTAGE = approx. 6 to 15kV
SPARK PLUG = Special Plug (type MICO)
BATTERY = Two 9V High Energy Alkaline Batteries
ACCESSORY: Fiber-optic cable (LWL), 10m long with special screw adapters at both ends.
The Trigger Unit and Electronic Trigger Sphere serve to trigger and control the output voltage of the impulse generator setup.

DC Load Resistor (H-RL2.5):



RATED VOLTAGE = 140kV dc/Imp.
RESISTANCE VALUE = 2.5 MegOhms +/- 3%

Measuring Spheregap (H-MSG250):



- Motor Driven 250mm dia. Sphere Gap mounted on MS Platform with wheels
- to measure AC,DC and Impulse Voltages as per IEC 600052
- Min. Negative Peak Voltage=72.5kV; Max. Negative Peak Voltage=282kV
- Min. positive Peak Voltage=31.7kV; Max. Positive Peak Voltage=299kV
- provided with remote control and digital display of gap spacing

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Oil Testing Cup (H-OP):



With electrodes having spherical shape with a gap-setting of 2.5mm
Used for the measurement of breakdown voltage of insulating oils

Cascade Connection Set (H-CCS):



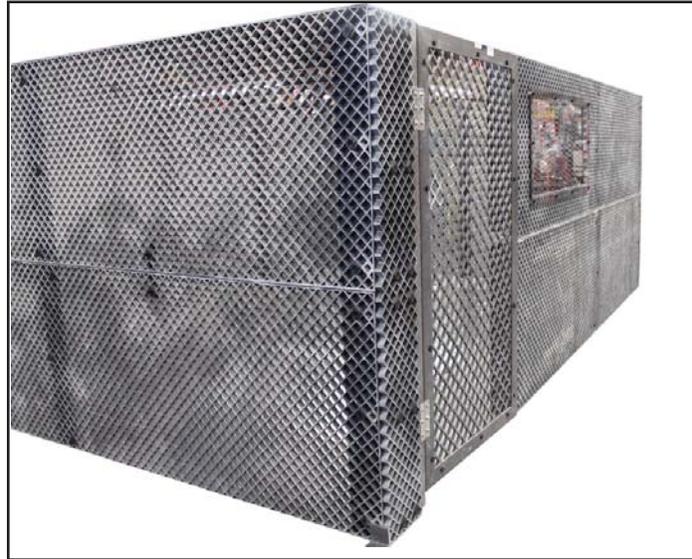
Hardware for cascading HV Transformers

Component Stand (H-CS):



Mobile metal stand to safely store components

Safety Cage (H-CAGE):



A fiberglass enclosure provided for protection. The entry door will incorporate a safety disconnect switch that will shut down the control panel when the door is opened. The enclosure will be 72" high and include red and green lights for visual indication and (2) 3' x 2' clear Lexan windows for viewing.



H-CS Component Stands holding various modular components

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Corona Cage (H-KR):



For determination of glow intensity as a function of wire diameter. The corona cage has to be inserted into the WSTS Vessel for vacuum and pressure (type DKU). The measurement can be made at vacuum and also at higher pressures.

Vessel for Vacuum and Pressure with Suitable Pump & Compressor (H-DKU):



For the determination of flashover voltage of different electrode configurations as a function of vacuum and pressure
RATED VOLTAGE = 100 kV AC, 140kV DC and IMPULSE

MAX. OPERATING PRESSURE (abs) = 6 bar

ACCESSORIES =

- i) SPHERES (50&20mm Dia.),
- ii) ROD-PLATE, iii) ROD-ROD
- iv) Compressor and Vacuum-pump with manifold, control valve, oil-filter

Vacuum Add-on (H-DKU-V): *(To be used with H-DKU)*



Compressor Add-on (H-DKU-C): *(To be used with H-DKU)*



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Standard Capacitor (Compressed Gas Capacitor) (H-CP100):



SF6 insulated Compressed Gas Standard capacitor in FRP housing
Mounted on mobile platform and with Corona-free HV Electrode
RATED VOLTAGE = 100kV, 50/60Hz
RATED TEST VOLTAGE = 110 kV
RATED CAPACITANCE = approx. 37pF +/-10%
SF6 Compressed gas Standard Capacitor,
Tan delta= .002%
Filling Pressure (abs) = 3.5bar

Coupling Capacitor (H-CK120):



Oil insulated and hermetically sealed capacitor in FRP housing
Mounted on mobile platform and with Corona-free HV Electrodes
RATED VOLTAGE = 120kV, 50/60Hz
RATED TEST VOLTAGE = 144kV, 50/60Hz
RATED CAPACITANCE = 1000pF +/-10%
RATED PD LEVEL < 5pC

Coupling Capacitor (H-CK300):



Oil insulated and hermetically sealed capacitor in FRP housing
Mounted on mobile platform and with Corona-free HV Electrodes
RATED VOLTAGE = 300kV, 50/60Hz
RATED TEST VOLTAGE = 360kV, 50/60Hz
RATED CAPACITANCE = 1000pF +/-10%
RATED PD LEVEL < 5pC



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Optional Accessories

Partial Discharge Meter (H-PDM)



Consisting of :

- Partial discharge meter (Type DTM) with built-in:
 - basic measuring unit
 - built-in oscilloscope
 - Elliptical display output and window blanking facility
 - Provision for bridge type measurement
- Measuring impedance - Quadruple (Type AKV-D-2Nos)
- Filter insert Narrow Band (Type DTF1)
- Pulse generator (Type PDG)
- Coaxial connecting cable (10m Long)

Oil Dielectric Test Set



The BAUR oil tester BAUR DPA 75 C is developed especially for mobile usage and it is unique in the market due to its functionality and the excellent user benefits in comparison to the costs. The BAUR DPA 75 C provides delivers clear and reliable measurement results. It is no longer necessary to send samples to the laboratory. Environmental and transport influences on the samples are minimised.

Digital Ground Resistance Tester



Earth Ground Tester, Earth Ground Resistance Range 0 to 2000k Ohms, Resolution 0.01 to 1 Ohms, Operating Frequency 128 Hz, Accuracy +/-2 Percent of Reading +/-1 Count, Measuring Current 0.1 to 10mA Earth Volts 42VAC, Soil Resistivity Yes, Display Digital LCD, Counts 1999, Power Source (8) C Batteries, Alkaline Recommended, Standards IEC, CE, EN 61010-1, Pollution Degree 2, Safety Rating CAT III 30V Includes (8) C Batteries and Instructions.



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Sample List of Experiments

1. Generation and Measurement of AC Volts
 - i.) Capacitive Divider
 - ii.) Sphere gaps and standard tables
 - iii.) Chubb and Forescue method
2. Generation and Measurement of DC Volts
 - i.) Rectifier Load characteristics
 - ii.) Ripple Factor Measurement
3. Generation and Measurement of DC Volts II
 - i.) Greinacher Voltage Doubler Circuit
 - ii.) Polarity effect and Insulating screens
4. Generation of Impulse
 - i.) Lightning impulse voltage
 - ii.) Single stage impulse voltage circuits
 - iii.) Measuring peak value with sphere gaps
 - iv.) Break down probability
5. Measurement of Impulse
 - i.) Multiplex circuit after Marx
 - ii.) Impulse voltage divider
 - iii.) Impulse voltage time curves
6. Power Frequency and Impulse Voltage Tests on Power Transformer
 - i.) Specifications for high voltage tests
 - ii.) Insulation coordination
 - iii.) Insulating oil break down test
 - iv.) Alternating voltage transformer test
 - v.) Lightning impulse voltage transformer test
7. Experiment on Insulating Liquids.
 - i.) DC Conductivity
 - ii.) Tan delta and Capacitance
8. Experiment on Solid and Insulating Liquids
 - i.) Fibre- Bridge breakdown Insulating Oil
 - ii.) Breakdown Strength of Hard Board Plate
9. Experiment on Partial Discharge and Corona
 - i.) Partial Discharges at Needle Electrode in air
 - ii.) Measurement in Corona cage
10. Experiment on PD and Gliding Discharges
 - i.) PD Measurement in High Voltage Insulation
 - ii.) Measurement of Onset Voltages of Gliding Discharge
11. Break down of Gases
 - i.) Townsend mechanism
 - ii.) Streamer mechanism
 - iii.) Insulating gases



11kV, AC Voltage - Test Set-up



280kV, Impulse Voltage - Test Set-up



280kV, DC Voltage Test Set-up



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