

**TECHNICAL SPECIFICATION**  
**For the supply of a Cable Fault Location**  
**HVT-200L**



**Larnaca, Cyprus**

## HVT-200L

### CABLE TEST VAN FOR 132 KV POWER CABLE

The 200kVp hipot testing and cable fault location test van has everything you need in order to conduct testing comfortably and safely. The unique and original patented long proven oil filled system is suitable for withstand and testing of cable systems up to 150 KV. The HVT-200L is smaller and more affordable than a power frequency AC resonant test set. The test van can perform quick and reliable cable fault location as well as the following functions:

1. Very Low Frequency (VLF) AC voltage 0.1-0.02 Hz high voltage withstand test of power cables
2. Burning down defective insulation of power cables
3. Pre-locating power cable faults by the pulse echo method (TDR), the arc reflection method, the impulse current method
4. Insulation Resistance Testing
5. Audio frequency cable route tracing and cable depth evaluation
6. Locating power cable faults by the acoustic and inductive methods



### A. Main Equipment

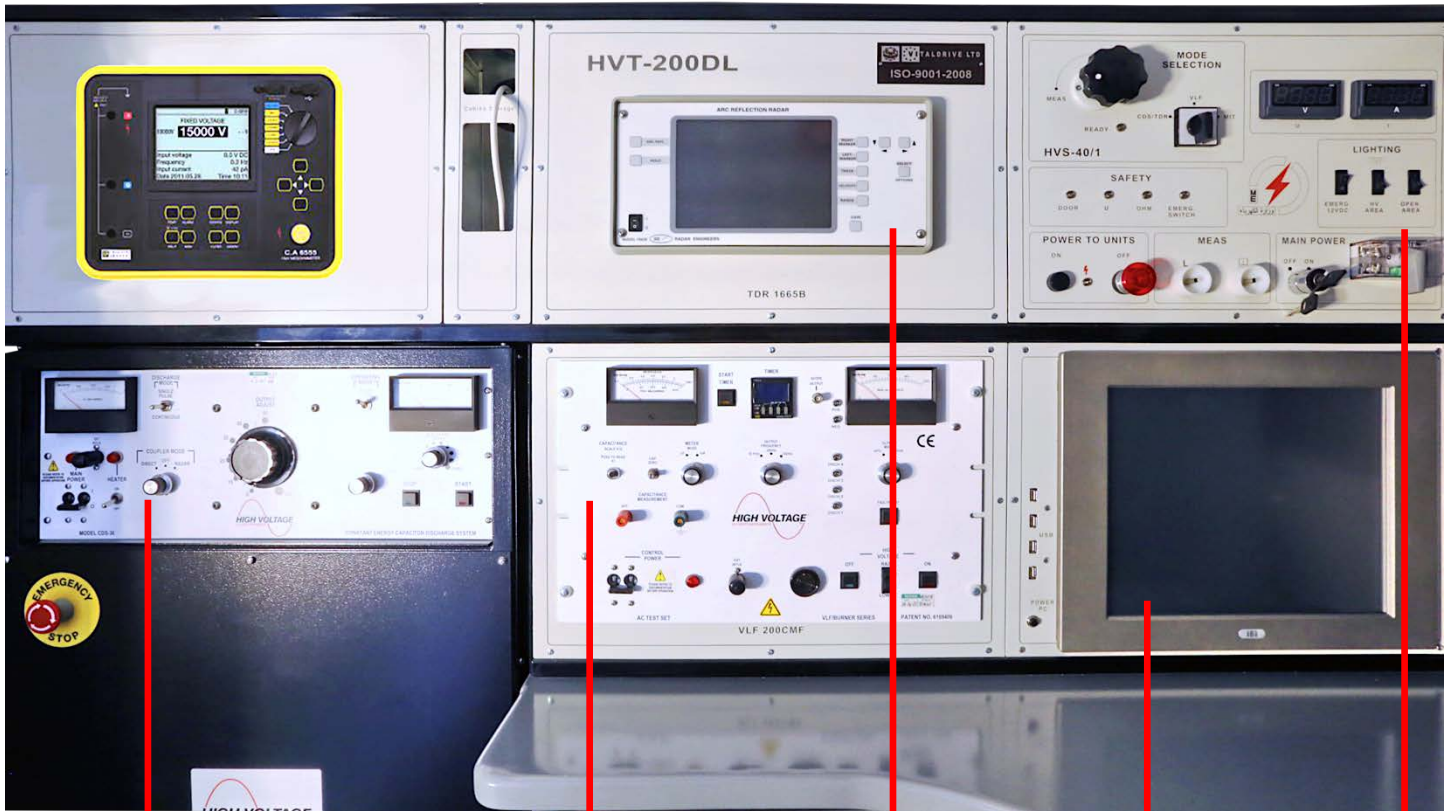
The cable test van equipment is divided into main (Mounted) and additional (Non mounted) equipment. A full-featured use of the test van is possible only with a complete set of main and additional equipment.

#### 1.1 Central Control Operating Unit

The Central Control Operating Unit is designed around the operator needs. Ergonomic, all tests and controls easily accessible, operator can perform with ease all the required tasks for cable testing and fault location while being in a comfortable working position. An industrial panel computer, installed into the control panel, is provided to interact with the installed testing units and to store data and to prepare reports that can also be exported to USB drives.

#### 1.2 Control Module

The control module is designed for switching units and blocks of the laboratory, as well as for control of the testing by fault location of the cable. From the control module it is possible to control the interior lighting of the laboratory and control the safety system. Digital indicator meters are also installed and display the input voltage and load current of the supply network.


**CDS-3632**
**VLF-200CMF**
**Time Domain  
Reflectometer**
**Computer  
Module**
**Control  
Module**
**Control Panel** \*for reference only

## B. High Voltage Testing

### 2. AC HIPOT/BURNER VLF-200CMF

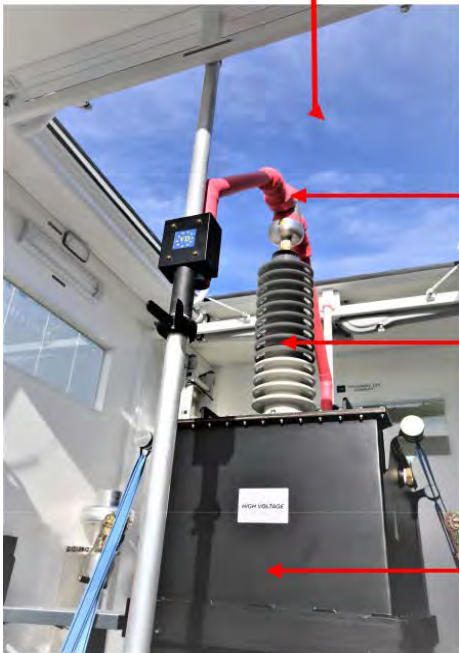
The VLF-200 CMF hipot is an AC output tester but with an output frequency of 0.1 Hz or lower rather than 50/60Hz. Although the frequency is low, it is still an alternating current with polarity reversals every half cycle. At 0.1 Hz output, rather than 50Hz, it takes 500 times less current and power to apply an AC voltage to a capacitive load, like a long cable. The VLF-200 CMF provides a 200 kVac peak output voltage, suitable for performing VLF hipot tests on 132 kV cable. In addition to the standard controls, this model also contains a Cable Burn mode. A VLF burner is one of the most effective methods of reducing a cable fault's impedance, or arc-over voltage, in order to permit the use of lower voltage and energy rated fault locators – thumpers. The VLF hipot applies its voltage to the faulted cable. The voltage output raises to the arc-over level and the cable arcs. The current of the VLF and the stored energy in the cable discharges into the fault. This process continues, but now in the opposite polarity, as the sine wave output of the VLF continues. This arcing of the cable fault repeatedly in opposite polarities rapidly reduces the fault voltage.



**Technical Specification**

<b>Input</b>	230 volts, 50/60 Hz, 80 A peak
<b>Output</b>	Voltage: 0 - 200kVac peak, Current: 100mA
<b>Duty</b>	Continuous
<b>Load Rating</b>	0.75μF @ 0.1 Hz 1.5μF @ 0.05 Hz 3.75μF @ 0.02 Hz
<b>Metering</b>	Voltmeter: 0 - 200kVac peak Charging Current meter: 0 - 200 mA peak
<b>Controls</b>	HV On/Off, Motorized Voltage Control, Zero Start Interlock, External Interlock, Digital Dwell Timer, Capacitance Measuring Circuit, Burn/Hipot Operation Mode Switch, Fixed 120% Overload
<b>Size &amp; Weight</b>	Controls: 610 x 650 x 180 mm Tank: 1550 x 930 x 2200 mm Controls: 295 kg, Tank: 1678kg

**High Voltage Window**



**High Voltage Insulation Support**

**High Voltage Insulator 200 KV**

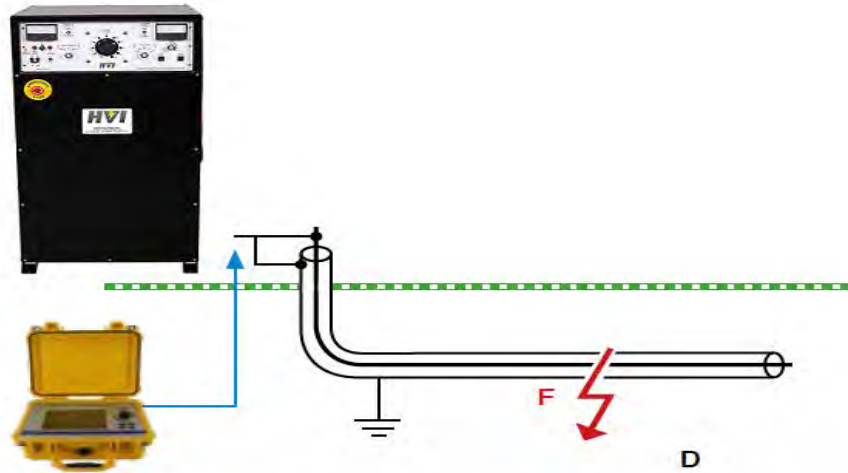
**Transformer Tank 200 KV**

The VLF- 200CMF comes with a data logger, the ADL data logger is designed to monitor, record, and wirelessly download all test data from the Very Low Frequency VLF-200 CMF tester to a computer. Users now have the best of both worlds: economical and easy to use VLF testers along with full test data collection. Use a computer on-site to watch and record the test or store all results in the ADL-1 for later downloading.

## C. Power Cable Fault Location

### 3. Controlled energy surge wave generator and Fault burner CDS-3632

A surge generator is used to inject a high voltage DC surge into the faulty cable. By supplying a sufficiently high voltage to the faulty cable, the open-circuit fault will break down creating a high-current arc. This high current arc makes a characteristic thumping sound at the exact location of the fault. To find the location of cable fault using the thumping method, a thumper is set to thump repeatedly and then walking along the cable route to hear the thumping sound. The higher the dc voltage applied, the louder will be the resulting thump.



**Surge Generator Fault Prelocation Principle**

To deliver the full joules of energy possible to a fault, the capacitors within a thumper must be charged to the maximum voltage. With the wrong thumper, this often results in thumping a cable at an excessive voltage, causing significant damage to insulation and accessories.

Since the applied voltage is a square function ( $\frac{1}{2} CV^2$ ), if the thumper is at  $\frac{2}{3}$  voltage, only 45% of the joules are delivered to the fault. At half voltage only 25% energy is delivered, making the fault hard to hear. Either fault locating takes far longer than necessary or the crew gets impatient and turns the voltage all the way up to get the loudest bang. The fault is found but more are made. This practice can and should be avoided.

The CDS 3632 is a controlled energy fault locator/burner for testing and fault locating in primary cable systems. It is designed to provide constant energy at each of three different selectable output voltages. This controlled energy feature provides full energy at each output voltage tap, allowing the user to thump at a lower voltage with a higher energy while minimizing further cable damage. The measure of a good thumper is not the maximum voltage it can discharge, but the minimum voltage still capable of delivering the full energy.



\* CDS 3632 Control Panel View

### Technical Specification



<b>Input:</b>	230V, 50/60Hz, 15 amps
<b>Output</b>	0-9/18/36kV
<b>Burn:</b>	
<b>Current:</b>	280/140/70 mA
<b>Energy:</b>	3200J at full output on all output taps
<b>Polarity:</b>	Negative output
<b>Duty:</b>	Continuous
<b>Repetition rate:</b>	6 to 10s, variable
<b>TDR interface</b>	ARC Reflection and Current Impulse
<b>Voltmeter:</b>	3.5", Scaled 0-40kVdc, ±2% F.S.
<b>Current-meter:</b>	3.5", ±2% F.S. Ranges: 0-500uA, 0-50mA, 0-500mA
<b>Dimensions</b>	635x737x1130 mm
<b>:</b>	
<b>Weight:</b>	204 kg



**Output Adjust**

**Discharge Timing**

**Output Tap**

**CDS 362U Series front panel control**

### Features:

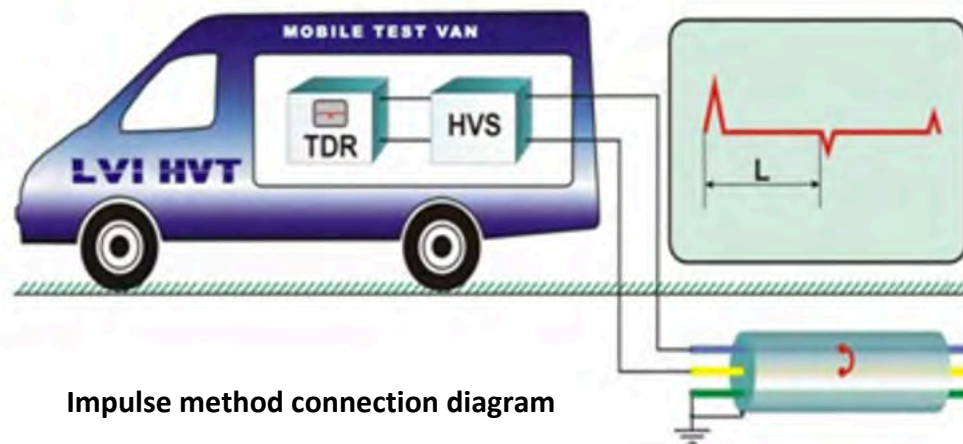
- Single piece combination Hipot, Burner and Surge Generator to support Fault Location on power cables
- Constant energy at each output voltage setting
- Adjustable thump (impulse) repetition rate, from 6 to 10 seconds
- Motorized output voltage tap switch
- Zero Start high voltage interlock
- Single pulse or continuous discharge modes

### 4. Digital Cable Radar



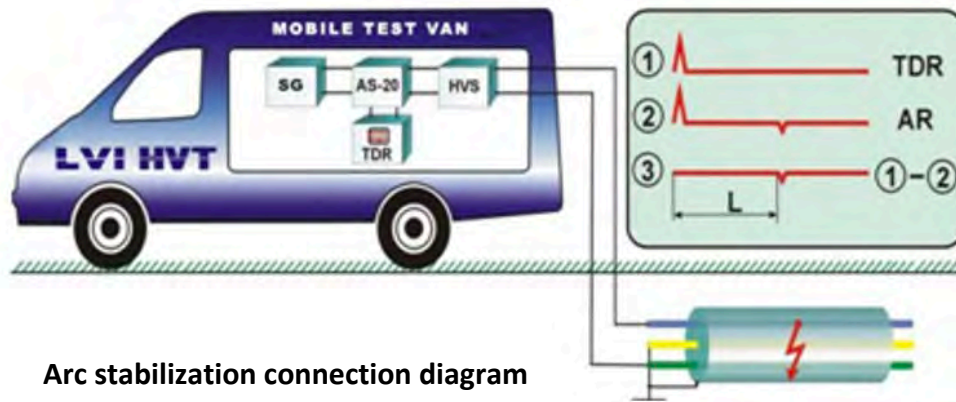
A Time Domain Reflectometer (TDR) sends a short-duration low energy signal at a high repetition rate into the cable. This signal reflects back from the point of change in impedance in the cable (such as a fault). The TDR measures the time taken by the signal to reflect back from the point of change in impedance (or the point of fault). The reflections are traced on a graphical display with amplitude on y-axis and the elapsed time on x-axis. The elapsed time is directly related to the distance to the fault location. If the injected signal encounters an open circuit, it results in high amplitude upward deflection on the trace. While in case of a short-circuit fault, the trace will show a high amplitude

negative deflection. This is a low voltage method known as impulse method, a fault pre-location technique suitable for locating short and open circuits as well as other faults below approximately 200 Ohms.



**Impulse method connection diagram**

The TDR is unable to identify high resistance ground faults or intermittent faults, where its effectiveness in finding underground cable faults is limited. To overcome this limitation the TDR is combined with the surge generator (thumper) and a filter, providing several methods of high voltage (HV) fault pre-location methods such as arc reflection and impulse current.



**Arc stabilization connection diagram**

The **Arc reflection** method uses the effect of reflection of the TDR pulses from the arc ignited at the location of the fault for a short time during the operation of a high-voltage surge generator (CDS-3632UF). A reference trace is taken without the arc, then a real-time trace is taken during the arc recorded and compared to the reference trace. The point of divergence indicates the fault position. Arc Reflection is the most widely used high voltage method and is suitable to quickly determine the distance for high resistance and intermittent faults without using a burning down installation.

The **Impulse Current** method is suitable for long or wet cables. In long cables, the natural damping of the cable may cause the TDR impulse to be damped off before returning to the reflectometer. The fault is ignited and the resultant transients are recorded by the reflectometer, which is acting as a transient recorder. The trace displays impulses at both the point of the fault (low impedance) and also where the surge generator (CDS-3632UF) is connected to the cable. The distance between the impulses is the distance to fault. The connection of the TDR with the cable is made using a special current connection device (pulse current converter). Structurally, this device is built into the surge generator.

The TDR is a time domain reflectometer designed to provide quick, effective, accurate and safe prelocation of cable faults in electrical networks. Operation of the instrument is simple with an intuitive menu system. The large color display further enhances operator comfort and aids rapid and accurate fault prelocation. The system is housed in a rugged, robust, field-proven case making it suitable for use in hostile or challenging environments.

### Technical Specification

<b>Input:</b>	100-265V AC (50/60Hz),
<b>Range:</b>	64000 m
<b>Pulse Amplitude:</b>	30V
<b>Sampling Rate:</b>	100 Mhz
<b>Accuracy/Resolution:</b>	±1 m
<b>Screen:</b>	Touch, 640 x 480 dots, colour LCD



<b>Storage:</b>	>100 records
<b>Velocity:</b>	90 – 300 m/μs
<b>Output impedance:</b>	5 – 80 Ω
<b>Menu Style:</b>	Guided menu
<b>Connection:</b>	USB
<b>Fault Location Method:</b>	TDR, Arc Reflection, Impulse Current
<b>Dimensions:</b>	330 mm x 310 mm x 150 mm
<b>Weight:</b>	3 kg

**Features:**

- Single jog dial operation
- Intuitive operator friendly menu system
- Automatic recognition of impulse waveform and fault location
- Robust, rugged construction

## D. Additional Test Equipment

### 5. Super Directional Acoustic Detector S.D.A.D II

For pin-pointing of faults in buried cables the acoustic method is used to pin-point the exact fault location. The surge generator SG-2000 is used in repetitive pulsing mode. High energy pulses which are released from the SG-2000 force a voltage pulse to travel along the cable. At the fault the flashover happens. This causes a high acoustic signal that is locally audible. Depending on the pulse energy, the intensity of the acoustic signal varies. These noises are detected on the ground surface with the addition of the S.D.A.D II. The unit conveys more information about the fault location, and faster, with the addition of new microprocessor controlled electronics that provide bright, easier-to-see-and-read signals - day or night.

Complete Detection System includes:

1. Two earth Probe Microphones W/Wireless Transmitters
2. Two Tri-Pod's (for use on hard surfaces)
3. A-T Ballistic Impulse Detection System
4. Direction to fault indication Color Touch Screen LCD and Super Bright LED
5. Stereo Bluetooth Headphones - High quality and comfortable
6. Audio output limitation: Automatic ear protection for the operator, even if a microphone is dropped.
7. Foam lined carrying case
8. Instruction Manual & Batteries



\* Super Acoustic Detector SDAD II  
View



**Features:**

- Next generation high voltage fault pinpointing
- Touch screen color display
- Wireless microphone
- Wireless headphones
- Full automatic operation

**6. Audio Frequency Cable Tracer Set IFL-1210**

The IFL-1210 cable locator set is used for the successful location of the exact track and depth of different underground networks (cables and metallic pipelines). This lightweight user-friendly instrument operates at multiple active frequencies and provides passive 50/60 Hz detection services as an excellent safety feature for identifying live underground utility cables. The IFL-1210 features a digital readout of the depth reading that helps to identify service depths prior to digging.

**Technical Specification****TRANSMITTER**

<b>Operating Frequency :</b>	200-10000 Hz
<b>Modes of Generation :</b>	Continuous, Intermittent, tri-band (three frequencies)
<b>Permissible Load Resistance :</b>	0 ... ∞
<b>Specified Output Current:</b>	
- Continuous and tri-band	0,1 ... 10 A
- Intermittent	0,1 ... 15 A
<b>Max Output Power:</b>	120 W (continuous) / 180 W (intermittent)
- Battery Operated	
- External Battery Operated	180 W (continuous) / 270 W (intermittent)
<b>Protection :</b>	IP 54
<b>Dimensions:</b>	305 x 270 x 194 mm
<b>Weight:</b>	12 Kg

**RECEIVER**

<b>Operating Frequency :</b>	Active: 512, 1024, 1450, 8928, 9820 Hz Passive: 50/60 Hz, 100 Hz, 12-24 KHz
<b>Max Depth Measurement :</b>	Up to 10 m
<b>Max Depth of Detection :</b>	Up to 25 m

<b>Max Distance of Detection :</b>	Up to 5 Km
<b>Continuous Operating Time:</b>	Up to 50 h
<b>Operating Temperature:</b>	-40 ... +60 °C
<b>Dimensions :</b>	720 x 110 x 150 mm
<b>Weight :</b>	1,7 Kg

## 7. Insulation Resistance Tester

The insulation tester with its site-proof casing is suitable to check equipment insulation during manufacturing, on-site installation work, periodic inspections and re-commissioning of installations. It complies with the most recent recommended practices while taking into account future developments. The multiple test modes mean that you can both assess the insulation in qualitative terms by non-destructive testing and use samples to investigate insulation ageing problems for preventive maintenance purposes.



\* C.A. 6550 View

### Technical Specification

<b>Test Voltages</b>	<b>Ranges</b>	500V: 10 kΩ to 2 TΩ 1000V: 10 kΩ to 4 TΩ 2500V: 10 kΩ to 10 TΩ 5000V: 10 kΩ to 15 TΩ 10000V: 10 kΩ to 25 TΩ
	<b>Fixed Test Voltages</b>	500, 1000, 2500, 5000, 10000
	<b>Variable Test Voltages</b>	40V – 10000V, 3 presettable voltage values
	<b>Adjustment Increment for Variable Voltages</b>	Variable:40-10KV Step: 40V-1KV:10V 1KV-10KV:100V
	<b>Ramp Mode</b>	3 presettable ramps: start voltage/end voltage/duration
	<b>Ramp Configuration Range</b>	40-1100V / 500-10000V
	<b>Step Mode</b>	Up to 10 steps (value and duration configurable for each step)
<b>Voltage Measurement After Test</b>		AC:0-2500V / DC: 0-4000V
<b>Capacitance Measurement</b>		0.001-9.999 μF / 10.00-49.99 μF
<b>Leakage Current Measurement</b>		0 – 8 mA
<b>Discharge After Test</b>		Yes / Automatic
<b>Additional Test Stop Modes</b>	<b>I-limit</b>	Programmable: 0.2-5mA
	<b>Early-Break</b>	di/dt
	<b>Timer</b>	Up to 99 minutes 59 seconds
<b>Burning Mode</b>	<b>Burning</b>	Constant testing
<b>Ratio Calculation</b>		PI, DAR, DD

<b>Calculation of R at ref. T°</b>	Yes
<b>Measurement Display Filter</b>	3 filters with 3 possible time-constant
<b>Graphs on Display Storage</b>	R(t)+u(t);i(t);i(u) 256 recordings, 80000 points: R, U, I and date
<b>Communication PC Software</b>	Optically isolated port for USB and RS232 links Dataview
<b>Power Supply</b>	NiMH rechargeable batteries, 8x 1.2 V / 4,000 mAh, charging by external voltage: 90-260 V 50/60 Hz
<b>Battery Charging</b>	Battery charging possible while performing insulation measurements
<b>Electrical Safety EMC, Mechanical Protection, Altitude</b>	1000 V CAT IV – IEC 61010-1 and IEC 61557 EN 61326-1, IP54, 3000m
<b>Dimensions</b>	340x300x200 mm (LxWxH)
<b>Weight</b>	6.2 kg

## E. High Voltage Connecting Devices

### 8. Main HV Switch HVS-75/1



The main high voltage switch along with the control panel form the heart of the testing process of the cable test van. The unit is air-insulated with a reliable and robust design. The switch once it receives power through the control panel it selects and gets locked to a particular high voltage instrument. Once the test is completed the unit automatically connects to ground making the operation of the test van safe.

#### Features:

- Number of switched equipment outputs - up to 5; no additional switching devices required
- Reliable manual control and air-barrier isolation of the main contacts
- Instrument-type control knobs; one-handed mode operation is enough for switching
- Clear predefined angular positions
- Feedback sensors for monitoring selected equipment
- Built-in visible contacts for automatic discharge of power cable capacitance
- Compact size and light
- Minimum maintenance needed; has an easily removable top cover for routine inspection of the main contacts

## 9. Cable Drum Rack



External connections for the cable test van are provided with a power feeding cable drum, a grounding cable drum and a high voltage cable drum

- Drum with main power cable, cable length 50 m
- Drum with grounding cable with a cross-section 16 mm<sup>2</sup> copper transparent plastic sheath with connection every 4 to 5 m, cable length 50 m
- Drum with output HV EPR shielded cable, cable length 50 m
- Drum with auxiliary ground cable, cable length 15 m

## F. Electrical Safety System

### 10. Electrical Safety Check System

The electrical safety system provides protection to the operating personnel as follows:

- monitoring the potential on the car (switching off if the potential is higher than 24V)
- monitoring the earth resistance (switching off if the resistance is higher than 25 Ohm)
- monitoring the door of the high voltage compartment (switching off the equipment if doors are opened)
- Emergency Switch to shut down the equipment in case of hazard
- Automatic grounding of high voltage test devices
- Visible break load switch
- Beacon and warning siren



## G. Protective Equipment

### 11. Voltage Detector

Voltage Detectors are used to verify live or de-energized conductors. These testers may be used with rubber insulating gloves or hot sticks using the splined universal end fitting. Testers indicate the presence of voltage with an extra bright LED light and a distinctive audible signal. It is recommended that the tester be moved closer to conductor until warning is indicated, or it touches conductor, apparatus, or test point. Test the unit on a nearby energized conductor.



## 12. Personnel Protective Equipment / Tool Kit

1	Ground pole / Insulating stick	1 unit
2	Dielectric gloves	2 pair
3	Dielectric boots	1 pair
4	Protective helmet	2 units
5	Tool kit	1 unit
6	Fire extinguisher	1 unit
7	Reflecting triangle	1 unit
8	Ground spike	1 unit
9	Hammer	1 unit



\* Electrical Insulating Gloves

## H. Carrier Vehicle

### 13. IVECO EURO CARGO MLC100E22

Sustainable, efficient, manoeuvrable and versatile: the Eurocargo is the perfect truck for urban missions and municipal applications. From city delivery to road services and container applications, it can satisfy every need. Thanks to the reduced cab width (2.1 meters), its large steering angle (52 degrees) and the best turning circle in its category (just under 11 meters for the 2790 mm wheelbase version), it is the perfect partner for your business.



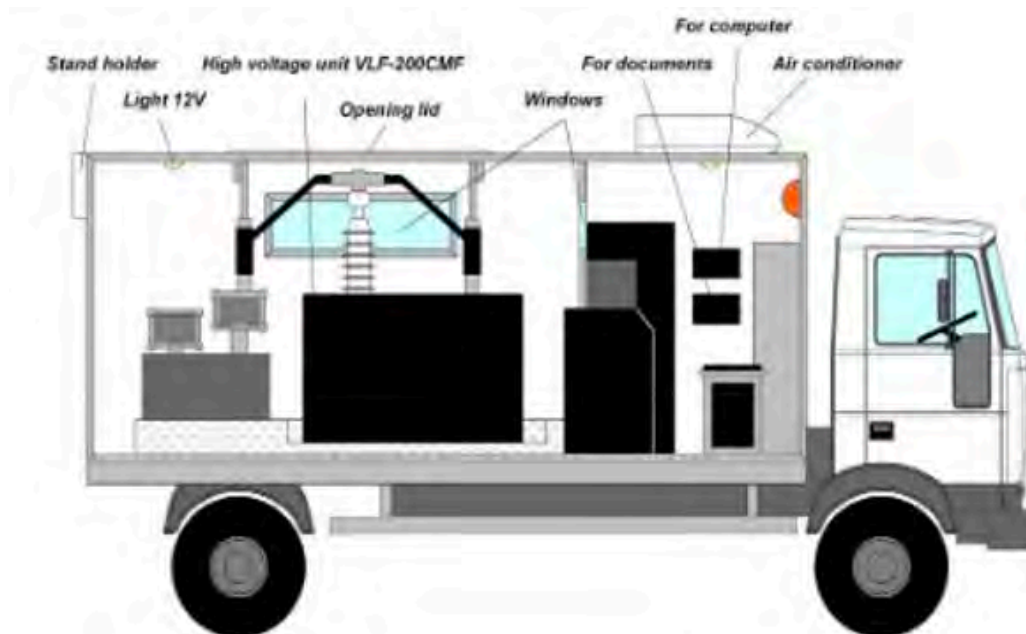
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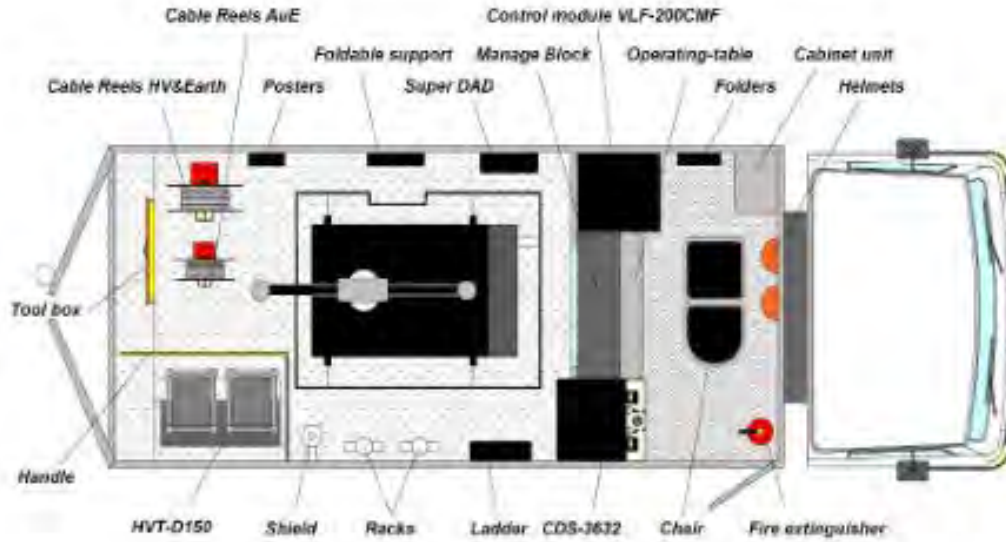
## 14. Vehicle Body

All testing, diagnostic and fault locating equipment is installed inside the specially made insulated truck body container. The container body is divided into technical and operator compartments separated by a partition wall. The technical compartment includes all the necessary tools and equipment for carrying out testing and inspections. Safety is an important feature of the cable test vans and hence all equipment is properly mounted and secured for transit. The operator compartment provides a pleasant environment to work in with more room and plenty of storage. It is equipped with cabinetry and workbenches that increase the operators' efficiency and productivity.

### Van Characteristics

- Roof mounted air conditioner
- Internal lighting 230 VAC & 12V DC
- Insulated walls and roof for thermal and noise
- Special antistatic floor in operator area
- Special aluminium tread plate suitable for rough loading in high voltage area
- Partition wall, Operating desk & chair
- Drawers for storage of accessories
- Two rear doors, opening to 270 degrees with «recessed» handles and locks.
- One side door with «recessed» handle and lock.
- One side window in high voltage department.
- Swing two-folding upper roof with electric control and remote control.
- Spare wheel.
- Two separated compartments: operator compartment and high voltage compartment.
- Body is divided to two compartments: high voltage compartment and operator





**HVT200L location plan** *\*for reference only*

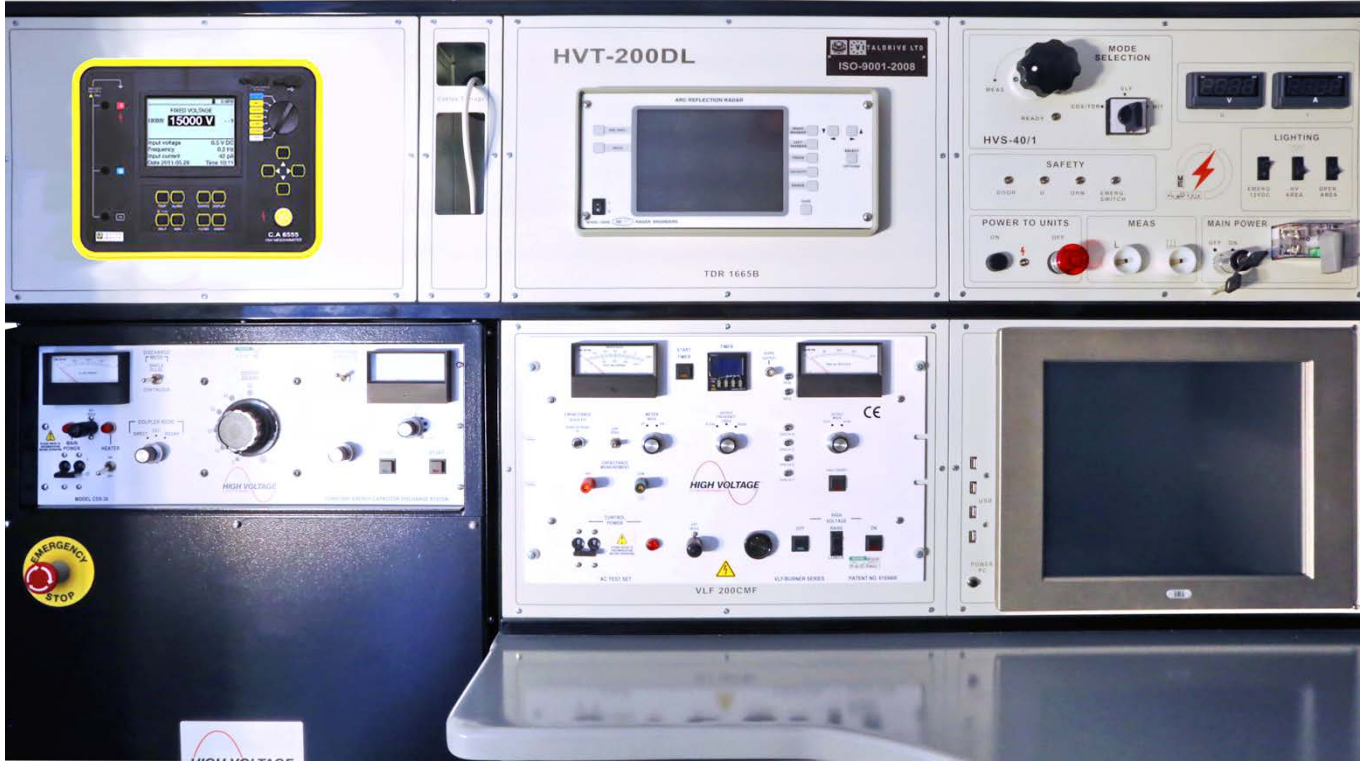
**High Voltage Compartment:** the high voltage transformer is installed, 3 cable drums, tool cupboards, high voltage racks, and also high voltage screen and stairs.

**Operator compartment:** the VLF module and the control panel of the Test van are installed. It also has the operator table, chair and cupboard for devices. There is a built-in air conditioner with temperature control (heat/cold). On the control panel there is an industrial computer, responsible for supervising the work of the laboratory equipment. For ease of reference there are folders for storing documentary information.

- The Van has the step for going inside in laboratory for working on the equipment. The Test Van is mounted on the vehicle IVECO EuroCargo.







**View of the Control Panel** *\*for reference only*



**View of the High Voltage area** *\*for reference only*



**View of the High Voltage area** *\*for reference only*



**View of the Testing System** *\*for reference only*

## H. Documentation

The below documentation is included with the HVT-200:

1. Users Manual
2. Electrical drawings
3. Program and methodology of periodic tests
4. Factory Acceptance Test Report

All supplied measuring instruments and equipment are calibrated and verified, which is confirmed by certificates of state verification, performed no earlier than 3 months at the time of delivery.

## I. Operating Conditions

Test Vans are designed for operation at temperatures up to + 40 ° C, relative humidity up to 80% and atmospheric pressure 630-800 mm Hg. The lower temperature limit is not limited, provided that the temperature inside the test van is not lower than 1 ° C above zero.

## J. Warranty

According to the Declaration of Warranty, the test van has a warranty period of 12 months. At the end of the warranty period, the manufacturer, at the request of the customer, provides after-sales service for the delivered equipment. The warranty for the vehicle is set in accordance with the manufacturer's service book.

## K. Training

Full training is provided for the test van personnel. The training includes the full use of the equipment and covers the basic test van operations such as safety management, routine, and preventative maintenance of equipment.



**Training at Vitaldrive's factory**



**Training at customers location**

### HVT-200 on-site



View of the HVT-200 on-site



View of the HVT-200 in operation