

**Data sheet
of ANGSTREM cable test van
with a computer-assisted control system**



The ANGSTREM cable test van (hereinafter referred to as the electrotechnical laboratory, ANGSTREM cable test van) **has the following functions:**

- Tests with an increased rectified voltage value of up to 70 kV with leakage current testing
- Tests with an increased AC commercial-frequency voltage value of up to 100 kV with conduction current measurement
- Burning damaged insulation of power cables
- Measuring the distance to the place of damaged insulation of power cables using the following methods:
 - pulse
 - pulsed-arc
 - voltage wave
 - current wave
- Localization of the damaged insulation of power cables by acoustic and electromagnetic-acoustic methods

- Tracing and localizing damages to power cable lines by induction method
- Loss angle tangent measurement
- Measurement of power transformer parameters

The electrical laboratory is based on a modular concept, allowing flexible configuration of equipment in accordance with the Customer's requirements.

The laboratory equipment is divided into main and supplementary equipment.

The main equipment is installed and mounted in ANGSTREM cable test van permanently.

The supplementary equipment includes optional devices, tools and accessories.

The laboratory is powered by a stationary AC 220V / 50 Hz network.

If a stationary network is not available, the ANGSTREM cable test van is powered by a self-contained electrical generator, which forms its part.

<p>Interior packaging of the ETL</p>	<p>The ETL interior is divided into two compartments – operator compartment and high-voltage compartment.</p> <p>The operator compartment contains a control panel, operator's workstation, places for transporting crew members and built-in furniture. High-voltage and power equipment for testing and cable reel system are installed in the high-voltage compartment.</p> <p>The divisional plane of the compartments is formed by the rear surface of the control panel and a transparent non-conducting partition that covers the opening above the control panel along its entire width to the interior ceiling.</p> <p>The partition dimensions (width not less than 1,500 mm) provide excellent view of the equipment in the high-voltage compartment.</p> <p>Rear door of the chassis includes a lockable tilted cable hatch to route the connecting cables.</p> <p>The AC voltage test cable is routed through a removable wall bushing installed in the tailgate glass.</p> <p>The high-voltage compartment provides for a box for storing tools and accessories; special quick-release clamps are provided on the compartment walls for fastening operating poles and high voltage sensors.</p> <p>The operator compartment contains 2 sockets for powering additional devices and auxiliary equipment with an alternating current voltage of 220V and a total power of up to 2kW.</p> <p>Boards of the vehicle contain the customer's logo.</p> <p>The van, vehicle colors, logos and lettering are made in accordance with the corporate style requirements of the Customer's organization.</p>
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1. Main equipment

1.1 Electrical laboratory control system



The Control System (CS) for ANGSTREM cable test van modules provides centralized control over the testing processes, localizing damages, various measurements, as well as the performance of service functions.

The laboratory CS automatically saves the data of test results; it provides for the possibility of generating and printing reports.

The ANG24[®] software allows:

- resolving a full range of tasks for testing, diagnostics and finding the places of damage to underground cable lines of voltage types of 0.4, 6, 10, 20, 35 kV with any type of insulation,
- resolving a full range of tasks for testing and troubleshooting the substation equipment.

Features:

- Centralized control over measurement processes.
- Complete monitoring of parameters (grounding, door closure, high-voltage contactors, etc.)

related to on-line maintaining the required level of safety.

- An increased efficiency of the electrical laboratory is achieved owing to the use of modern digital signal processing technologies embedded in the ANG24® software.
- The automatic formation of a permit to work in accordance with the current task for the test type of power equipment allows reducing personnel labor costs.

The upper part of the panel consists of 3 sections of the 8U height (~ 360 mm) with standard control modules of 19" (483 mm) in width. Modules are built into a common rigid frame, ensuring a reliable protection against mechanical stress.

Basic information is displayed on an 18" color monitor located on the control panel (CP).

The middle section is a convenient tabletop for placing additional devices, documentation, etc.; it has a width of at least 1,600 mm and a depth of 340 mm.

Power modules of the impact-excited generator, burning unit and the power supply switching module are installed in the lower part of the CP, under the tabletop, which is an additional support for the CP housing.

Under the tabletop, in its central part, a footwell to a depth of at least 300 mm is provided for operator's legs, which further increases the operational comfort.

The CP has terminals to connect external measuring and searching devices to the connecting cable system.

A High-Voltage Switching Module (HVSM) with connectors for connecting test cables is installed in a cantilever manner in the upper right part of the CP, on the side of the high-voltage compartment.

1.2 High-voltage switching module MVK-70/1



The high-voltage switching module ensures safe remote switching of the high-voltage terminals of the main equipment and measuring instruments to high-voltage shielded cables. An important difference of this module from the equivalents is an increased reliability of the contact system. PC-based control.

The module has the following features:

- increased operational efficiency – single-knob selection of both the power cable phase and the ANGSTREM cable test van equipment
- the ability to connect measuring instruments not only to the core and screen of the cable, but also between its conductors in any combination (for a 3-phase design version of the switch)
- convenient and simple switching algorithm: pull out the knobs (the knob is in a 1-phase design version), turn them to the desired position until they click, return the knobs to their original positions; in the working position, the knobs extend beyond the control panel to a distance of not more than 50 mm, without interfering with the operator's work
- clear fixing of the rotor angular positions
- double monitoring of the real state of main contacts – visual, according to the position of the control knobs, and via the increased operational efficiency – single-knob selection of both the power cable phase and the ANGSTREM cable test van equipment control system, which receives signals from feedback sensors
- simple and reliable design with an oil-free air-barrier insulation
- main contacts – plug-in type, rated current of up to 240A; the sockets have a spring-pressed stamped insert of a special shape and are characterized by low transient resistance, low separation force and high wear resistance; when operating in the modes of large pulse currents (thousands of amperes, acoustic search method), sparking is completely excluded
- the availability of built-in automatic output contactors
- compact design that allows integrating the MVK in control panels complete with the 19" modules: width in a 1-phase design version – no more than 200 mm, in a 3-phase design version – 480 mm; height – no more than 9U (400 mm)
- cantilever mounting on the laboratory CP; it does not occupy the space in the high-voltage compartment.

1.3 Power security module MBP-220

It is designed for galvanic separation of control system elements from the mains and stabilizing the supply voltage. The power security module includes:

- separation (isolation) transformer 220/220
- voltage regulator 190-260/220±8%.

1.4 Voltage regulator module MRN5-220/250

Designed for smooth regulation of output voltages of laboratory power modules.

- Control is of remote electric type, from the laboratory CP.
- The voltage regulator has 2 voltage rise speeds and a position sensor connected to the laboratory control system, allowing the launching of tests at zero output voltage only.
- The “dry” one-piece structure, designed to operate in the strong shaking and high humidity environments.

1.5. Low voltage measurement module

The module is designed to measure the parameters of power transformers (short circuit and open circuit tests, measurement of resistance of contacts, etc.).

The laboratory has the following equipment to conduct LW measurements:

- voltage regulator 0-220V (common to the whole ANGSTREM cable test van)
- load isolating transformer 220//0-220-380
- control panel terminals – load transformer voltage output 0-220-380 and 4 terminals to connect to the connecting cable *
- measuring connection cable with 4 conductors of 2.5 sq. mm (voltage is supplied to the object via two wires, and the other two wires are used to output voltage to the CP terminals to connect a voltmeter); the same cable can be used for other types of measurements, including for connecting a bridge winding resistance meter.

1.6. Testing and burning complex IPK20-100/70

Designed for rectified voltage and AC commercial-frequency voltage testing.

Optional feature is the burning of damaged insulation of power cables with a voltage of up to 60 kV.

The complex includes:

- test voltage source TIS20-100/70
- automatic burning current regulator AOT-25
- SVI-100/140 system for measuring high voltage, leakage currents and conductivity
- combined communication module MSK-60
- automatic discharge complex
- control system

Features of the complex:

- high-voltage source – maintenance-free
- built-in high voltage rectifier
- digital certified system for measuring output voltage, leakage currents and conductivity; information transmission method – over radio channel

- leakage currents and conductivity are measured on the high voltage side, with no additional test cable required
- high input impedance of the high-voltage divider minimally affects measurements; an additional automatic compensation device completely eliminates the dependence of the results of measurements of leakage currents and conductivity on ambient conditions; the presence of capacitance links in the divider significantly reduces the dependence of voltage measurement results when operated as a part of mobile ANGSTREM cable test vans with a densely-packed equipment
- The availability of the current type automatic detection function increases the reliability of equipment and work safety.
- **the possibility of automatic burning the damaged insulation of power cables with a voltage of 60 kV, including a combined operation of the main burning unit; in a cooperative burning mode, the maximum current is limited to 350 mA (adjustable) in order to exclude the formation of a metal bridge at the faulty place that prevents the use of modern non-burning search methods (pulsed-arc and acoustic)**
- Centralized control from the laboratory CP.
- Automatic two-stage system for discharging high capacity objects (high-voltage cables, capacitors): first, the contactors ensuring a smooth discharge are tripping; then, after 2 to 3 seconds, the contactors connecting the test object directly to the ground line activate.

Main specifications of test equipment:

Test voltage source TIS20-100/70

Output power	20kVA
Output voltage	100kV / 50Hz 70kV, rectified voltage
Maximum output current, min	200mA

Measuring system SVI-100/140

Voltage measuring range <ul style="list-style-type: none"> • alternating current • direct current 	<ul style="list-style-type: none"> • 10 to 100kV • 10 to 140kV
High voltage measurement accuracy	at least 2%
Measurement range of leakage currents and conductivity	0 to 300 mA
Switching current measurement sub-bands	Automatic
Input impedance and input capacitance of the voltage divider, min.	1,000 MOhms 100pF
Dimensions / weight, max	Ø234×1037mm 10.5kg

When testing objects with low capacitance (for example, valve arresters), a smoothing capacitor of 0.25 μF / 100 kV (optional) is additionally used.

Combined communication module MSK-60

Application

- automatic limitation of currents occurring during the object breakdown
- signal generation when searching places of damage to power cables using a voltage wave method
- creating an opportunity for combined operation of the test voltage source and the main burning unit, which forms part of the ANGSTREM cable test van.

1.7. Measuring complex for the localization of damages to power cable lines.

1.7.1 Reflectometer system KR 90



Designed to measure the cable line length, the distance to the place of damage to insulation and to determine the nature of a damage. It has a three-phase connection function. It supports all known non-burning methods. PC-based control.

Features:

- Totally computerized control.
- The most advanced and popular operating modes: pulse reflectometry, pulsed-arc method, current oscillating discharge method and voltage oscillating discharge method.
- Individual fused inputs are provided to conduct work using each of these methods; additional reswitching for shifting from one method to another is not required
- The design of the device has three connectors for operation by pulse reflectometry method, allowing easy performance of a comparative analysis of a 3-phase cable line.
- The ability to save OTDR traces or their individual fragments with operator comments. This function allows evaluating the degradation of cable lines over time.
- Easy device adjustments and measurements, achieved by a user-friendly software.
- Easy software updating.
- The diagonal size of the display is at the customer's option (typical value is 18.5", which ensures excellent conditions for viewing OTDR traces).
- The reflectometer is used to equip electrical laboratories.

Basic specifications:

Maximum sampling frequency	1 GHz
The maximum length of the measured cable line with a velocity factor of 1.5	250 km
Velocity factor	arbitrary (from 1 to infinity – user-defined)
Maximum number of connected phases	3
Sounding pulse amplitude	30, 60, 90 V
Sounding pulse duration	from 10 ns to 10 μs
Distance measurement resolution with a velocity factor of 1.5	0.1 m
Simultaneous work with saved OTDR traces	10 pcs.
Matching impedance range	10 to 620 Ohms
The opportunity to set up to 10 markers, without counting the zero ground marker	Available
Changing parameters without stopping the measurement process	Available

1.7.2 Terminal device IDM-36

It allows determining the distance to the place of damage to the power cable main insulation by the pulsed-arc method using pulses reflected from the arc. It does not require a preliminary use of the burning unit.

The device ensures safe connection of the reflectometer to a high-voltage circuit to receive and process signals of wave processes in the cable.

The main unit of the device is a powerful low-loss induction reactor, which increases the arc dura-

tion.

The device consists of: a remotely controlled power high-voltage switchboard, which provides the “Acoustics / PAM” operating modes. Modes should be selected from the ANGSTREM cable test van CP.

The switchboard sockets have special spring-pressed inserts that ensure sparkless transmission of high surge currents.

The device top cover contains sockets (the socket is in a 1-phase ANGSTREM cable test van design version) for convenient connection of the shields of connecting test cables.

1.7.3 Terminal device USN-60

Allows determining the distance to the place of particularly complex high-resistance insulation damages with a breakdown voltage of up to 60 kV using the voltage wave method.

The device ensures safe connection of the reflectometer to a high-voltage circuit to receive and process signals of wave processes in the cable.

Test transformer serves as a high voltage source when using the voltage wave method.

The device is integrated into the combined communication module, and it does not utilize an additional space in the ANGSTREM cable test van.

1.7.4 Terminal device UST-36

Allows determining the distance to the place of high-resistance damages to insulation of power cables using the current wave method.

The device ensures safe connection of the reflectometer to a high-voltage circuit to receive and process signals of wave processes in the cable.

Impact-excited generator serves as a high voltage source when using the current wave method.

The device is integrated into the IDM device.

1.8. Burning module MP 15/90

It is designed to convert high-resistance damages to power cables to low-resistance ones in order to create conditions for determining the distance to a defect using the pulse method and to accurately determine the location of a defect using audio-frequency units. PC-based control.

Features:

- Own powerful high-voltage source
- 4 stages of burning with rectified voltage and 3 stages of afterburning with alternating current
- Increased burning efficiency owing to continuous switching of output voltage stages without switching off the module at full-rated power
- The ability to jointly act with a high-voltage test-burning complex with a voltage of up to 60

kV

- Increased afterburning efficiency due to the ultra-low output resistance of the unit (there are no rectifiers, the transformer winding is made using a heavy-gauge wire)
- The operation principle of the unit eliminates the avalanching uncontrolled formation of a metal bridge in the breakdown path, which makes
- The further use of acoustic and pulsed-arc search methods impossible; the operator has the ability to stop the burning process at any selected stage
- The ability to control output current **without distorting the input current waveform**
- Integrated automatic contactor for smooth discharging
- Controls and indications are integrated in the ANGSTREM cable test van CP
- Enclosed dust-proof case, which requires little or no maintenance of internal surfaces.

Basic specifications

Parameter name	Parameter value
Rated input voltage	220 V
Maximum power / current consumption under short-circuit conditions at the output of the unit	5.7 kVA / 26 A
Output voltage at XX, kV / short circuit output current at the output of the module	=15kV / 0.34A =8kV / 0.65A =4kV / 1.3A =2kV / 2.6A ≈750V / 7A ≈220V / 23.9A ≈58V / 91A
Output voltage switching method when burning at the constant voltage stages	Without cutting-off, under full load
Output voltage control	0 to 100 % (from the ANGSTREM cable test van VR)
Output current control	50-100%
Integrated automatic output contactor with damping resistor	+
Continuous run time under short-circuit conditions, followed by a break	2h / 2h

1.9. Acoustic module MA-36/26

It is designed to create powerful electric discharges in power cable lines in order to provide opportunities for using the acoustic and pulsed-arc search methods. PC-based control.

Features:

- Own high-voltage source, independence from the operational performance of voltage sources of other ANGSTREM cable test van modules
- A 3-stage switchboard ensures even use of energy from storage capacitors in the entire voltage range, which significantly improves the conditions for the use of acoustic and pulsed-arc search methods; the switchboard has manual remote control, fixation of angular positions and feedback sensors to control the stage selection and the complete mating of power contact groups; power contacts – of plug-in type, have special spring-pressed inserts of a special shape and are characterized by low transient resistance, low separation force and high wear resistance; when operating in the modes of large pulse currents (thousands of amperes, acoustic search method), sparking is completely excluded
- Integrated automatic contactor for smooth discharging
- Controls and indications are integrated in the central ANGSTREM cable test van CP

Basic specifications

Parameter name	Parameter value
Output voltage adjustment range	0 to 9 / 18 / 36kV
Maximum stored energy	2600J
Discharge period adjustment range	3 to 15 sec.

1.10. Inductive search kit KP 500-K.

Application

- Determining the location of cable route and burial depth
- Searching and accurate localizing damages to insulation of cable lines using the induction method
- Searching and accurate localizing damages to the insulation of cable lines using the acoustic method (when combined with an impact-excited generator)
- Estimating the distance to the fault location using the electromagnetic-acoustic method (estimation of the distance by delay time of the acoustic signal relative to the electromagnetic one)
- Selecting the desired cable from the bundle
- Determining the location of damaged cable sheath by a potential method based on alternating current voltage.
PC-based control.

Basic specifications:

- Generator capacity – 500W
- Output signal – sinusoidal, THD – 1%, max
- Active frequencies – 480 / 1069 / 9796Hz
- Operating modes

- continuous
- pulse
- multifrequency (2- and 3-frequency)
- Maximum cable length – up to 50 km
- Maximum cable burial depth – up to 12 m
- Receiver pass band with the induction search method is no more than 7 Hz.
- Controls and indications of the generator are integrated in the laboratory CP

Search kit contents:

- Generator GP-500K
- General-purpose search receiver PP-500K
- Magnet antenna MA-500
- Detachable frame NR-100
- Acoustic sensor AD-500
- Induction tongs KI-500 (for contactless connection to a cable)
- Potential contact device AP-500 (A-frame)
- Headphones TF-500
- Accessories
- Documents

1.11. Loss angle tangent measurement equipment**SA7100-2K – mobile diagnostic kit**

Full automation of the measurement process helps to reduce the impact of staff errors on the results of monitoring the insulation parameters. Automatic switching of the measurement modes “ $\text{tg}\delta$, C” << “R, Ka” and the measuring schemes “direct” << “inverse” (“normal” << “inverted”) allows measuring $\text{tg}\delta$, C, R and Ka using one connection to the object.

1.12. Equipment for measuring the power transformer parameters

K540-3 – power transformer parameters meter

The functions of the power transformer parameters meter K540-3:

- Measurement of current and open circuit losses at low and rated-load field voltages of transformers;
- Measuring current and short circuit losses;
- Transformer ratio measurement;
- Determination of the phase-displacement group of three-phase transformers and the polarity of the lead terminals of single-phase transformers;
- Measuring the direct current resistance of transformer windings.

1.13. MPI-530 – meter for measuring the electrical safety parameters of electrical installations

Specific features of the MPI-530 device:

- Measuring the impedance of the ‘phase-zero’, ‘phase-phase’ and ‘phase-protective conductor’ circuits;
- Measuring the impedance of the ‘phase-protective conductor’ circuit without RCD tripping;
- Calculating the prospective short-circuit current in the ‘phase-zero’, ‘phase-phase’ and ‘phase-protective conductor’ circuits;
- Measurement of current intensity and tripping time of RCD of types AC, A, B;
- Automatic measurement of RCD parameters;
- Measuring the resistance of ground connection and equipotential bonding conductors (metal-on-metal connection);
- Measuring the resistance of grounding devices according to a three-pole circuit (3p);
- Measuring the resistance of grounding devices according to a four-pole circuit (4p);
- Measuring the resistance of multiple grounding devices without breaking the ground conductor circuit (3p+clamp meters);
- Measurement of the resistance of grounding devices by two-clamp method;
- Measurement of ground resistivity;
- Measurement of electrical resistance of auxiliary electrodes, automatic calculation of additional error;
- Measurement of electrical insulation resistance with test voltage of up to 1000 V;
- Measurement of electrical insulation using the adapters WS-03, WS-04, AutoISO-1000C;
- Measurement of illumination using the LP1 adapter;
- Checking the phase sequence;
- Updated memory structure of the device and transmission of measurement results to a PC;
- The effective alternating current voltage value;
- Alternating current frequency;
- The effective value of alternating current intensity;
- Total capacity;
- RMS of voltage and current harmonics;
- Total coefficient of voltage and current harmonics;

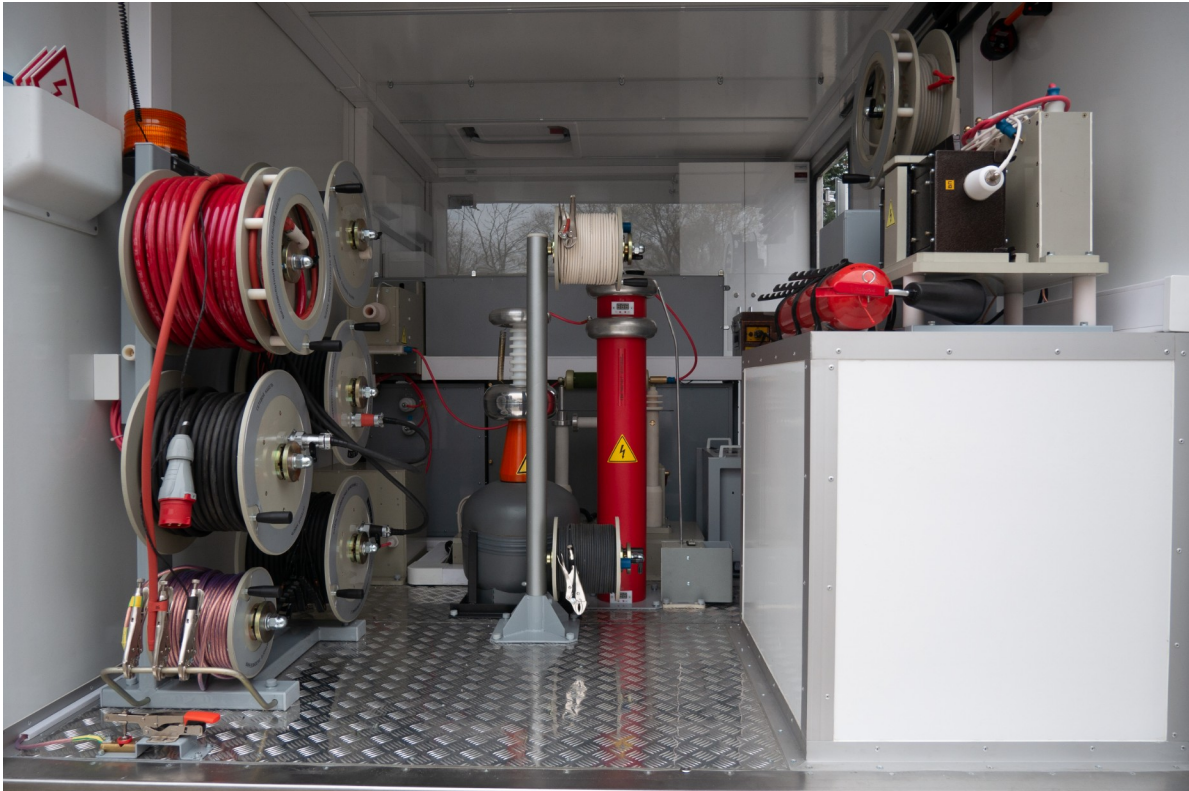
1.14. The system of cable reels and connecting cables

Cable reels provide connection of the laboratory to test objects, measurement objects, supply mains and grounding system.

The cable reel system includes:

The reel with a high-voltage shielded cable for testing with rectified voltage of up to 70 kV, making measurements and localizing damages to power cables	6mm ²	30 m	1 pc.
Reel with a protective earth conductor in transparent insulation and contact bushings in 3 m	25 mm ²	30 m	1 pc.

Reel with low-voltage measuring cable	4x2.5mm ²	30 m	1 pc.
Reel with a high-voltage cable for AC voltage testing of 100 kV	2.25 mm ²	30 m	1 pc.
Reel with working ground cable	4 mm ²	30 m	1 pc.
Reel with test ground wire	2.5 mm ²	30 m	1 pc.
Reel with laboratory power supply cable	2x8 mm ²	30 m	1 pc.



The system has the following features:

- the main reel rack (power supply, grounding, shielded test cables of 70kV) has a flat design with one-sided access; location – close to the ANGSTREM cable test van board, in order to ensure easy passage through the high-voltage compartment
- all reels have quick locks to protect them from rolling while the vehicle is moving.

1.15. Grounding control module

The grounding control module monitors the quality of the ground circuits and the potential value in the ANGSTREM cable test van body.

If the loop resistance “working ground / protective ground” increases by more than 12 Ohms and/or the potential in the body exceeds 25V, the module bans switching on or further operation

of the ANGSTREM cable test van.

The grounding control module body provides for a socket to connect a testing ground wire.

The module is located in close proximity to the rear doors of the ANGSTREM cable test van in order to conveniently connect the testing ground wire and to minimize the **Working ground / Protective ground** coupling length.

1.16. Self-contained power supply module

The self-contained power supply module includes:

- 220V / 50Hz gas generator with a power of 7.5 kVA in compliance with the customer's requirements
- generator mounting arrangement

The generator power is enough for the full-featured operation of all ANGSTREM cable test van equipment.

1.17. Electrical safety system

The ANGSTREM cable test van operational electrical safety is ensured by the following elements:

Safety control module MKZ	1 pc.
Position sensors on the HV compartment doors and the door between the compartments	3 pcs.
Acoustic alarm	1 pc.
Light alarm	1 pc.
Emergency stop button	1 pc.
Input tripping device with visible contact breaking	1 pc.
Set of automatic contactors	1 set
Safety isolation transformer	1 pc.

In addition to the above, the electrical safety system includes a set of guards and caution boards.

The electrical safety system has the following characteristics:

- The safety control module monitors the "Working ground – protective ground" loop resistance and the potential in the laboratory chassis relative to the ground. High voltage cannot be activated when the grounding resistance increases above 12 Ohms or/and the potential in the chassis exceeds 25V.
- High voltage cannot be activated when the doors of the high-voltage compartment and the door between the compartments are opened at an angle over 15 °.
- Acoustic signal is sounded at the time of high voltage activation.
- Turning on the flashing beacon for the duration of operation at a high voltage.

- Shutting down the laboratory when pressing and holding down the emergency stop button
- The design of the input tripping device ensures visual control over the presence of a separation gap between its contacts
- A set of automatic contactors performs automatic grounding of the outputs of the laboratory modules after completion of work or in case of emergency. When handling the objects with significant capacitance, contactors with damping resistors are pre-activated to ensure a smooth discharge, then, the contactors for direct connection to the grounding system are tripping; the difference in the tripping time of the groups of contactors is provided automatically within 2...3 seconds, in order to avoid damage to the ANGSTREM cable test van equipment by high-energy discharge currents
- The equipment housings and the vehicle chassis must be connected to the laboratory grounding bus with a 10mm² wire. A coil with a 25 mm² particularly flexible wire in a transparent sheath is used for protective grounding of the laboratory; in order to reduce inductance, the wire is fitted with stuffing sleeves in 3 meters along its length.

1.18. Tool and accessory kit

1	Vehicle first aid kit	1 pc.
2	Non-conducting boots	2 pairs
3	High-voltage vinyl plastic terminal	1 pc.
4	Flame-colored safety helmet	2 pcs.
5	Non-conducting mat	2 pcs.
6	Driver's tool kit	1 pc.
7	Warning triangle	1 pc.
8	SPTA kit	1 set
9	Electrician tool kit	1 set
10	Set of caution boards	1 pc.
11	OU-2 carbon dioxide extinguisher or OP-4 powder extinguisher	2 pcs.
12	Non-conducting gloves	2 pairs
13	High voltage non-conducting rack	8 pcs.
14	Low voltage indicator	1 pc.
15	Discharge device	1 pc.
16	Operating pole of up to 15 kV, inclusive	1 pc.
17	Operating pole of from 35 to 15 kV, inclusive	1 pc.
18	Vehicle earthing rod	1 pc.

2. Documentation set

- Laboratory operation manual;
- Vehicle equipment and operational record;
- Acceptance test report;
- Methods of verification and certification of the laboratory measuring and testing equipment;

- Verification certificates for measuring instruments, qualification reports for the laboratory equipment;
 - Copies of certificates for the electrical laboratory equipment;
 - Documents for registering the vehicle at the State Traffic Safety Inspectorate
- Equipment, protective equipment, tools and devices are contained in proper locations.**

3. Training

The price of the electrical laboratory includes training of 2 specialists of the Customer at the manufacturer's location.

4. Warranty liabilities

Warranty period for the equipment is 24 months.

Warranty for the vehicle is set **in accordance with the manufacturer's service book.**

*The complete set can be expanded and modified **at the Customer's request.**



Kind regards, Director of ANGSTREM LLC _____ Ye.Zavitukhin