ЭНЕРГИЯ
JSC ENERGIYA

PRODUCTION AND DEVELOPMENT:

- Chemical sources of current
- Hardware items
- Shop equipment

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Company brief history

- 1937 –
  the beginning of construction of the cell plant in Yelets.

- 8 October, 1941 –
  release of the first ever batch of electrochemical cells – anode batteries (cells of flat dry type).

Today the enterprise production range includes more than 400 types of core products of 19 electrochemical systems:
Lithium-ion, iron disulfide, manganese dioxide, mercury-zinc, nickel-cadmium, zinc-manganese with salt and alkaline electrolyte, air-zinc, electrochemical supercapacitors, cells of type “T”, hardware items, etc.

Modern energy

1650 employees | 8 PhD | 1 Doctor of Science | 4 core industrial workshops | 4 production-support sectors

Ivanov Vladimir,
JSC Energiya CEO

Core activity areas

- Electrochemical capacitors
- Li-Ion rechargeable batteries
- Batteries based on Lithium
- Thermal batteries
- Light-optical power plants
- Hardware plants and shop equipment

Arkhipenko Vladimir,
President of the Board,
Doctor of Economics

Competitive advantages (benefits of cooperation with us):

- Experience in production of power sources for civil and special application is more than 75 years
- Modern, technologically advanced and reliable equipment.
- Well-functioning manufacturing system, which allows to produce articles within short timeframes.
- High quality of products, which are highly competitive with their foreign analogues.
- Science and technology base allows to customize products according to customer requirements without delay.
- Low cost price of products, flexible pricing system.

Thermal batteries (single-use)

Thermal batteries (TB) are a technically sophisticated single-use chemical current sources of a standby type.

Bringing them into working condition is carried out by setting fire to the pyrotechnic heaters comprised in the batteries, which is effected by electrical impulse or mechanical shock.

To ensure minimal heat loss and storageability, the electrode block is placed in a durable, sealed stainless steel casing with effective, high-temperature thermal insulation.

Thermal batteries can be developed according to the technical specifications of the customer and put into production.

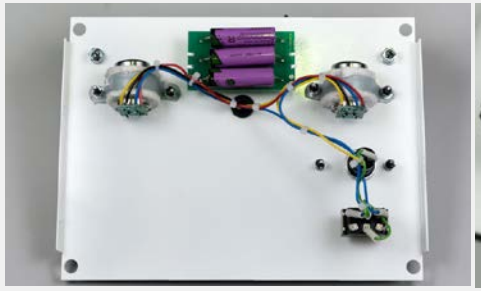
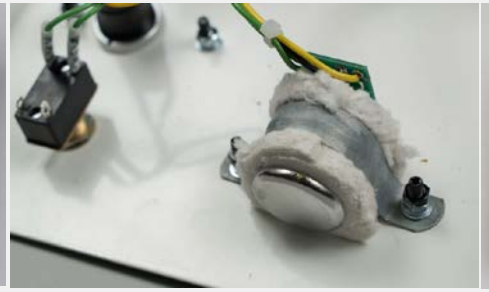
Thermal batteries (single-use)

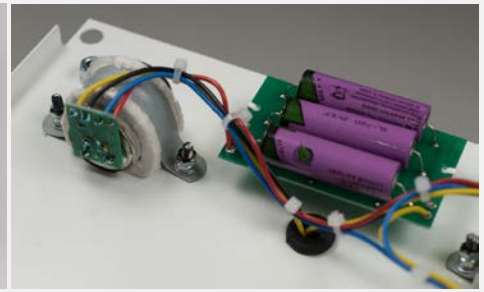


Dry powder extinguishing module TUNGUS

Advantages

- Hermetically sealed environmentally-safe design
- Long storageability without reduction of electrical capacity and principle parameters (confirmed up to 27 years)
- Operability at a wide temperature range of from minus 60°C to plus 60 °C
- Excellent endurance and resistance to tough operation and storage conditions Extra high reliability of activation, non-failure operation probability is up to 0,9999
- Little time for activation - from 0,2 to 3 sec (depending on the thermal battery size)
- Permanent readiness for activation and operation
  Total absence of maintenance and periodic technical servicing during usage and storage

Fire extinguishing device of JSC "NPG Granit-Salamandra" production

Thermal batteries (single-use)

Application of thermal batteries

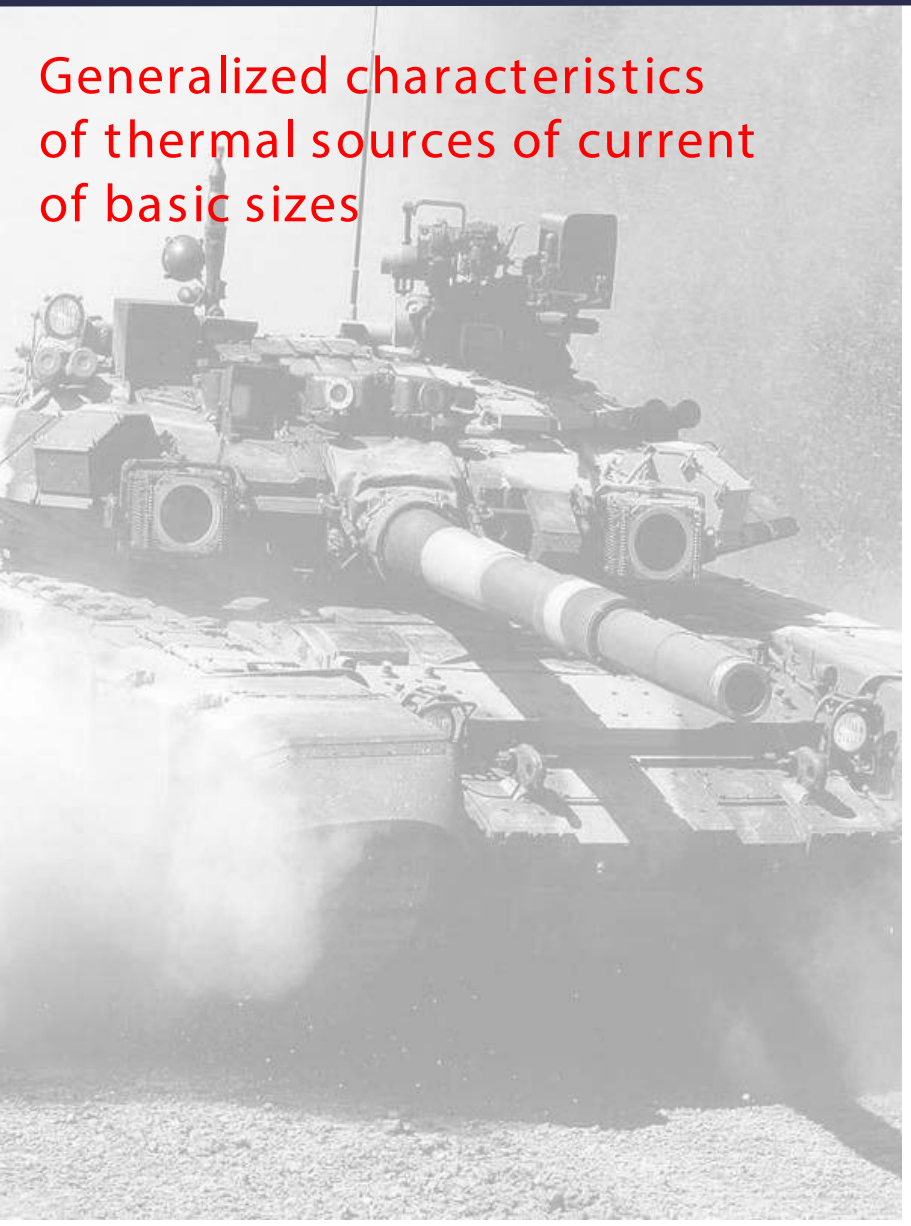
- for power supply of military equipment
- for power supply of fire-fighting systems
- for power supply of emergency and safety equipment
- for power supply of electro-technical devices
- for power supply of radio-technical devices
- for power supply of underwater sound systems

- **In fire safety systems**, thermal batteries can provide power supply for means of independent closure of the ventilation systems channels, pipelines for supplying combustible gases and liquids to the source; for means of opening the supply of extinguishing liquids, foam, aerosol, neutral gases to the source; for communication, warning, and alarm systems.
- **In mine safety systems,** in case of fire, for closure of the ventilation systems channels, for de-energization, for actuation of the water supply, irrigation means, and water curtains;
- **In high-rise buildings**, in case of fire, for automatic closure of ventilation systems channels, power outage, and gas cut-off;
- **To ensure uninterrupted power supply** of equipment in emergency situations with loss of power supply, including in space.

Fire-extinguishing aerosol generators

Thermal batteries (single-use)

Generalized characteristics of thermal sources of current of basic sizes



Parameters of thermal sources of current	Units of measure	Size			
		1	2	3	4
Dimensions: Diameter	mm	8,5÷21	28÷31	40÷48	57÷80
Height	mm	20÷55	30÷90	60÷150	60÷230
Weight	kg	0.01÷0.08	0.05÷0.15	0.3÷0.6	0.5÷2.0
Voltage	V	5÷24	4÷36	8÷56	24÷250
Maximum impulse current	A	2	10	50	100
Maximum electric capacity at a discharge to 0.7 U_{max}	A·sec	100	600	2000	6000
Maximum operating time	min	1	3	10	30
Maximum specific energy	W·h/kg	6	15	25	40
Maximum specific power	W/kg	1000		2000	
Activation time	sec	0.15÷0.5	0.25÷1,0	0.6÷1.3	1.5÷3.0

Thermal batteries (single-use)

Examples of the series-produced thermal sources of current of basic sizes

Size No.	Conventional designation	Dimensions: diameter x height, mm	Weight, kg	Nominal voltage including tolerance, V	Average discharge current, A	Operating time according to Technical Specifications, sec	Actual operating time, sec	Operating temperature range, °C
1	B1	8,5x43	0,01	18±6	0,4	15	20	-40÷+60
	B2	20x52	0,05	28±4	1,25	20	40	±50
2	B3	27x55	0,08	27+4 -3	3,3	30	50	±60
	B4	31x65	0,1	23±3	2,6	30	60	-40÷+55
3	B5	40x55	0,17	8±2	7,5	180	240	-40÷+70
	B6	47x120	0,5	28,5+5,1 -4,0	7,5	90	170	-50÷+65
	B7	57x83	0,5	1st section +20±2,5 2nd section - 20±2,5 3rd section 5,15±0,65	2,2 2,2 1,4	30	50	±50
4	B8	70x175	1,5	27,5±4,5	8,0	550	650	-50÷+60
	B9	70x226	1,0	16+5 -6	7,5	900	1000	-40÷+60
	B10	70x226*	4,0	80-66	from 40 to 110 A	70	90	+5÷+28

Thermal batteries (single-use)

BT-5 and BT-5K batteries

	BT-5	BT-5K
Maximum dimensions, mm*	Ø28,5x37,0	Ø28,5x48,0
Maximum weight, kg	0,08	0,09
Voltage, V, no less than	7,5	
Activation time, sec, no more than	1,0	
Minimum operating current, A	12,0	
Operating time, sec, no less than	1,0	
Operating temperature range, °C	From minus 50 to plus 60	
Guaranteed storage life, years, no less than	10	

Thermal batteries (single-use)

BT-25 and BT-25K batteries

	BT-25	BT-25K
Maximum dimensions, mm*	Ø48,0x66,5	Ø48,0x77,5
Maximum weight, kg	0,28	0,32
Voltage, V, no less than	10,0	
Activation time, sec, no more than	0,8	
Minimum operating current, A	25,0	
Operating time, sec, no less than	12,0	
Load resistance, Ohm	0,4	
Operating temperature range, °C	from minus 60 to plus 60	
Guaranteed storage life, years, no less than	10	

Thermal batteries (single-use)

BT-8 and BT-8K batteries

	BT-8	BT-8K
Maximum dimensions, mm*	Ø28,5x28	Ø28,5x39
Resistance, Ohm Mode 1 Mode2 Mode3	2,0±1,5% 1,5±2% 0,4±2%	
Voltage, V Mode 1 Mode2 Mode 3	6,0 5,0 4,0	
Maximum voltage, V	8,0	
Minimum operationg current, A Mode 1 Mode2 Mode 3	2,5	

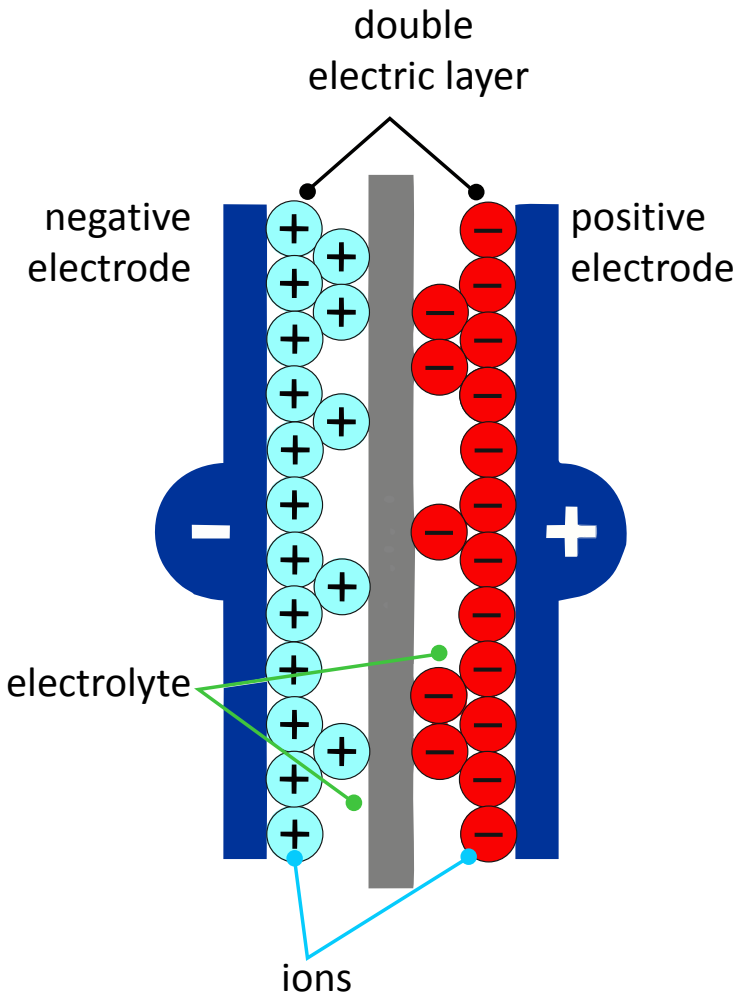
	BT-8	BT-8K
Time for achieving minimum operating current, sec, no more than Mode 1 Mode2 Mode 3	2,0 2,0 2,0	
Discharge time per load, sec, no less than Mode 1 Mode2 Mode 3	1,0 1,0 1,0	
Maximum weight, kg	0,07	0,08
Operating temperature range, °C	from minus to plus 50	
Guaranteed storage life, years	20	10

Electrochemical capacitors

Electrochemical capacitor (ECC) is a device in which energy accumulation occurs in a double electric layer (DEL) at the boundary of the electronic conductor and electrolyte. A double electric layer is created by the surface of a charged conductor and a layer of electrolyte ions adjacent to it. A double electric layer can be considered as a capacitor with two plates, the capacity of which is proportional to the area of the plates and inversely proportional to the distance between them. Since the distance between the plates is very small and is measured by angstroms, and the surface area of the conductor, for example, activated carbon, reaches 1500-2000 sq.m/g, the capacity of the double layer formed in this way is very large and the energy stored by such capacitors can reach 50-60 J/g.

A traditional electrochemical capacitor is a system consisting of two chemically inert electrodes placed in an electrolyte.

The double electric layer on the surface of each electrode is a separate capacitor. Between themselves, they are connected in series through an electrolyte, which is a conductor with ionic conductivity.



Electrochemical capacitors

Purpose of use

- Electrochemical capacitor modules are intended for use as energy sources in high-power pulse modes, for reliable start-up of internal combustion engines, uninterruptible power supplies, as on-board and stationary energy storage devices in hybrid and electric vehicles.

- In November 2015, electrochemical capacitor modules successfully passed certification tests of the Voluntary Certification System of the Association of Railway Equipment Manufacturers (SDS OPZT), a certificate of conformity No. СДС ОПЖТ RU.B.0169 was obtained. As a result of prolonged controlled operation, electrochemical capacitor modules were approved by the Russian Railways Central Directorate for their use as maintenance-free current sources for starting backup diesel generators at the infrastructure facilities of Russian Railways.

- A pilot model of trolleybus with energy storage device produced by JSC Energia is operated in the Filevsky trolleybus park in Moscow (СВАР3-6238 VINX89623800D0AF3002, Inv. No.3000)

Electrochemical capacitors

Major consumers of electrochemical capacitors

- Variety of Moscow companies engaged in spotlamp production
- JSC «Uralvagonzavod» - part of Rostech corporation speciliazes in railway and military equipment)
- JSC «MZ Arsenal» (St. Petersburg), producing space equipment
- CJSC «TROLZA» - trolley bus manufacturer from Engels town
- Potential customers: JSC «Russian Railways», tube railway, tramway depot, trolley bus parks, any enterprises, exploiting cars, specialized machinery and diesel-generators

Electrochemical capacitors



Electrochemical capacitors application areas

- Support of robust start of internal combustion engine
- Energy storage unit for hybrid transport Power buffer for e-transport
- Power buffer for electric drive machines and mechanisms
- Energy storage unit for energy stabilization systems and uninterruptible power supply units

20EC501-29

CHARGING DEVICE BCA-5KM-36-24 UZ

Advantages of ECC

- High life-cycle
- Resistance to overvoltage and overcharge Fire and explosion safety
- No need for external alignment devices capacitor voltage;
- Reliable operation in extreme temperature conditions;
- Environmental friendly
- Technical features and quality are proven by Russian and foreign organizations

Test models of energy storage units based on electrochemical capacitors have successfully been used for more than 20 years in wide range of various technical fields

Electrochemical capacitors

Technical characteristics of capacitor cells

	EC401	EC402	EC404	EC405	EC501	EC502	EC503
Application	Starting the internal combustion engines. Energy stabilization systems.	Starting the internal combustion engines	Hybrid vehicles. Energy stabilization systems. Electric transport	Starting the internal combustion engines	Starting the internal combustion engines	Energy stabilization systems	Hybrid vehicles. Electric transport.
Operating Temperature range, °C	From minus 50 to plus 60						
Operating voltage range at plus 25°C, V	1,5/0,75	1,5/0,3	1,5/0,75	1,5/0,3	1,5/0,3	1,5/0,75	1,5/0,75
Capacity, F	10000	10000	12000	12000	6000	6000	7200
Internal resistance at +25°C, mOhm	0,2	0,3	0,4	0,5	0,3	0,25	0,4
Internal resistance at minus 30°C, mOhm	0,3	0,4	0,6	0,8	0,5	0,4	0,7
Stored energy at the range of operating voltages at plus 25°C, kJ	8,4	10,8	10,1	13,0	6,5	5,1	6,1
Overall dimensions (LxWxH), mm	83,5x31,5x210,0				83,5x31,5x148,0		

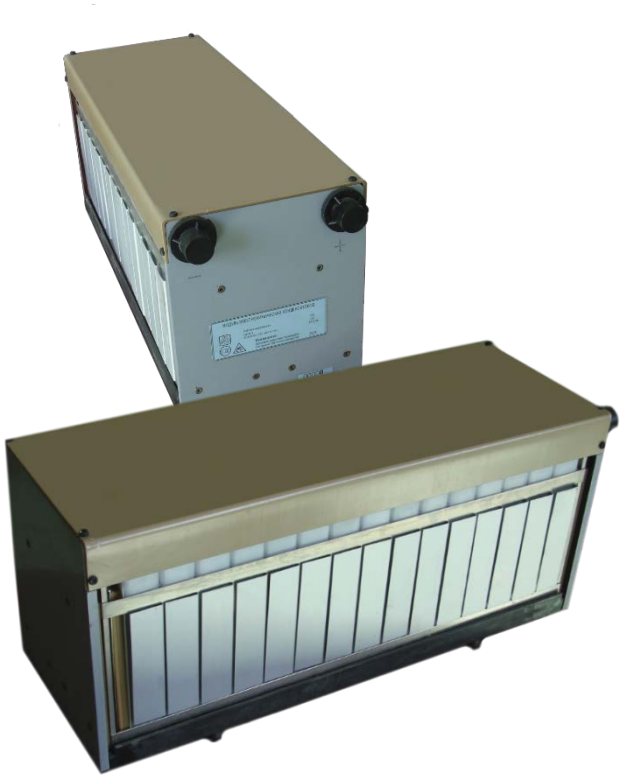
Electrochemical capacitors

Technical characteristics of 20EC402-29 and 20EC501-29

	20EC402-29	20EC501-29
Operating voltage, V	29,0 – 8,0	
Maximum operating voltage, V	32,0	
Minimum operating voltage, V	8,0	
Capacity, F	500	300
Supplied energy at plus (25 ± 10) ° C and a discharge to a load of 0.1 Ohm at the voltage range 26.0 - 13.0 V, kJ, no less than	90,0	48,0
Internal resistance at plus 25°C (minus 50°C), mOhm	6,0 (15,0)	7,0 (21,0)
Leakage current at voltage 25 V and temperature (25 ± 10) ° C, mA, no more than	25,0	20,0
Cycling, number of cycles no less than	300000	
Weight, kg	26	19
Overall dimensions (LxWxH), mm	350,0x195,0x253,0	350,0x195,0x191,0
Operating temperature range, °C	from minus 50 to plus50	
Service life, years, no less than	15	
Application	Use on track machines of the type SM-2, AC-4040, MPT-4-115, MPG-2. They provide oil pumping and reliable start-up of all engines of track equipment up to 500 hp. Annual fuel economy is up to 5 tons.	Use on diesel locomotives. Provide oil pumping and reliable start-up of the engine of the locomotive in all weather conditions. Annual fuel economy is more than 30 tons.

Electrochemical capacitors

Technical characteristics of 30EC503N-45 and 30EC404-45



	30EC503N-45	30EC404-45
Operating voltage, V	45,0-225	
Maximum operating voltage, V	48,0	
Minimum operating voltage, V	22,5	
Capacity, F	240	400
Supplied energy at plus (25±10)°C and at a discharge to a load of 0,15 Ohm at the voltage range from 45,0 to 22,5V, kJ, no less than	112,0	227,0
Internal resistance at plus 25°C (minus 50°C), mOhm	12,0(48,0)	12,0(36,0)
Time to reduce voltage in the absence of current at a temperature from minus 50 ° C to plus 50 ° C, no less than from 45.0 V to 33.0 V from 33.0 V to 27.0 V	24 hours 3 months	
Cycling, number of cycles no less than	300000	
Weight, kg	27,0	37,0
Overall dimensions (LxWxH), mm	560,0x219,0x188,0	560,0x219,0x245,0
Operating temperature range, °C	From minus 50 to plus 65	
Service life, years, no less than	15	
Application	For vehicles with a hybrid drive: hybrid bus, shunting locomotive with a hybrid drive.	For vehicles with a hybrid drive: hybrid bus, shunting locomotive with a hybrid drive. The possibility of using this module in an electric train and subway motor car.

Electrochemical capacitors

Technical characteristics of 10EC501-14,5 and 10EC402-14,5

	10EC501-14,5	10EC402-14,5
Operating voltage, V	14,5	14,5
Maximum operating voltage, V	16,0	
Minimum operating voltage, V	4,0	
Capacity, F	600	1000
Supplied energy at plus (25±10)°C and at a discharge to a load of 0,1 Ohm at the voltage range from 13,0 to 6,5V, kJ, no less than	24	45
Internal resistance at plus 20°C (minus 50°C), Ohm	0,0035	0,003
Time to reduce voltage in the absence of current at a temperature from minus 50 ° C to plus 50 ° C, no less than from 13.7 V to 11.0 V from 11.0 V to 9.0 V	24 hours 6 months	
Cycling, number of cycles no less than	300000	
Weight, kg	9,8	14,3
Overall dimensions (LxWxH), mm	350,0x105,0x194,0	350,0x105,0x249,0
Operating temperature range, °C	From minus 50 to plus 50	
Service life, years, no less than	20	
Application	For vehicles with a hybrid drive: hybrid bus, shunting locomotive with a hybrid drive. Use on diesel locomotives, provides oil pumping and reliable starting	For vehicles with a hybrid drive: hybrid bus, shunting locomotive with a hybrid drive. The possibility of using this module in an electric train and subway motor car.

Electrochemical capacitors

Technical characteristics of 20EC09-29

Overall dimensions (LxWxH), mm, no more than	324,0x111,0x197,0
Weight, kg	7,5
The guaranteed storage life from the date of acceptance of the module by the customer's representative at the manufacturer, years	16,5
The guaranteed period of operation of the module from the date of putting into operation within the guaranteed storage life, years	15
Service life including storage, operation in the buffer mode at the operating voltage and temperature range and cycling of no more than 300 000 cycles. years	15
Operating voltage, V	29,0
Minimum voltage in the absence of current (OCV) during storage, V	8
Capacity, F	75,0
Supplied energy at discharge to a load of 0.1 Ohm at the voltage range 26 - 13 V, kJ	12,0
Operating temperature range, °C	from -50 to +60
Storage temperature, °C	from -55 to +70

Launching device «Tarzan»

Designed to ensure reliable start-up of internal combustion engines of various vehicles with engine power up to 1000 horsepower with a "bad" battery in low temperatures.

Overall dimensions (LxWxH), mm	209x417x554
Maximum weight, kg	43
Operating voltage, V	29,0-8,0
Internal resistance, mOhm	6,0-8,0
Maximum power at operating voltage, kW	35,0
Stored energy at the range of operating voltages, kJ	194,0
Cycling, number of cycles no less than	300000
Service life, years, no less than	15
Operating temperature range, °C	From -50 to +50

Electrochemical capacitors

Capacitor module MKE-G-147-87C

The module is designed to operate as part of stationary energy storage devices, for example, to store and use energy arising from electrodynamic braking of electric vehicles, as well as other electric installations operating with high power of charge and discharge. The module is designed for a long service life, does not require maintenance during operation.

Capacitor module 10EC09-14,5

The electrochemical capacitor module 10EC09-14,5 is intended for use as an energy source in high-power pulsed modes, for reliable starting of internal combustion engines, uninterruptible power supplies, etc.

The climatic modification of the module is UHL, placement category 2 according to GOST 15150 for operation in temperature ranges from minus 50 to plus 50 ° C and relative humidity up to 98% at a temperature of plus (25 ± 2) ° C.

The guaranteed storage life of the modules is 16.5 years from the date of acceptance of the modules at the manufacturer.
The guaranteed period of operation of the modules is 15 years from the date of putting into operation within the guaranteed storage life.

Non-core scope of activities

Light-optical electric power installations

Used as self-contained power supply of lightning fixtures situated on highways and nearby.

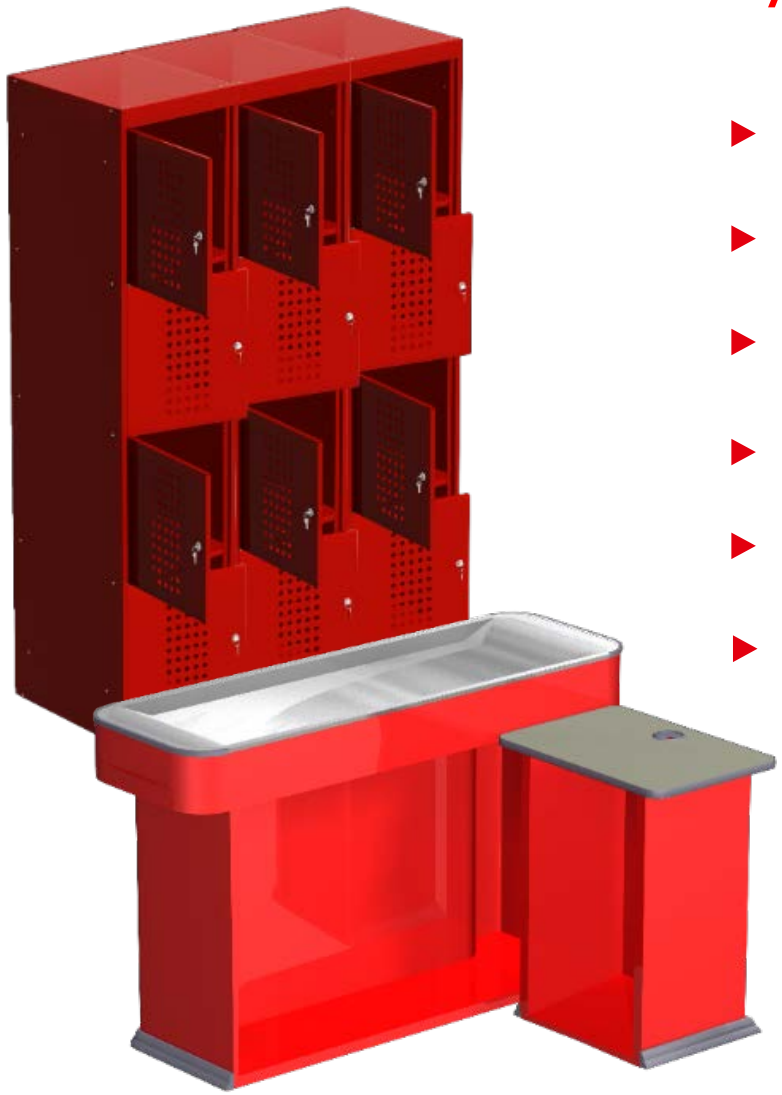
- Renewable energy source (fuel is not needed)
- Possibility of self assembling, dismantling and system set up
- No need in combustive and lubricating materials
- Simplicity of operation
- Design reliability
- Possibility of future modernization of the system to increase its capacity
- Environmentally friendly
- No need in connection to electric power network, cable laying, ditching and overhead network
- No need in set-up of energy accounting meter
- Low voltage (12 V) eliminates any possibility of electrocution

Example of light-optical electric power installations in Crimea

Non-core scope of activities

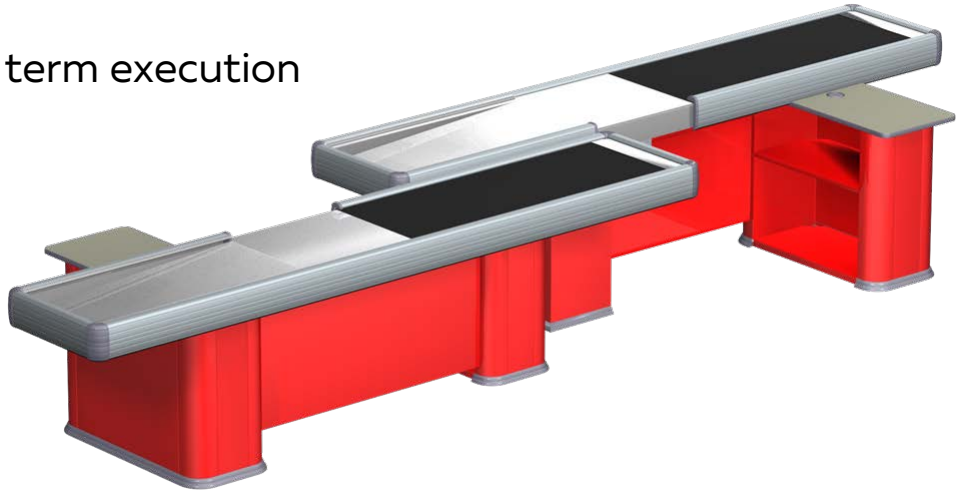
Shop equipment

- Express cash desk
- Minimarket
- Supermarket
- Hypermarket
- Lockers



Advantages

- Own production
- Certified products
- Flexible discount system
- Individual approach
- Good value for money
- Short term execution



Lithium sources of current

ЭНЕРГИЯ Lithium

- Ensure reliable operation of devices that have high current drain
- Applied for substitution of salt and alkaline sources of current
- Wide temperature range of from minus 40°C to plus 60 °C
- Storage life up to 10 years

Working up to 4 times longer

*in comparison with alkaline analogues

Cells of lithium/iron disulfide system
AAA FR10G445

Voltage 1,5 V
Capacity 1,2 A/h

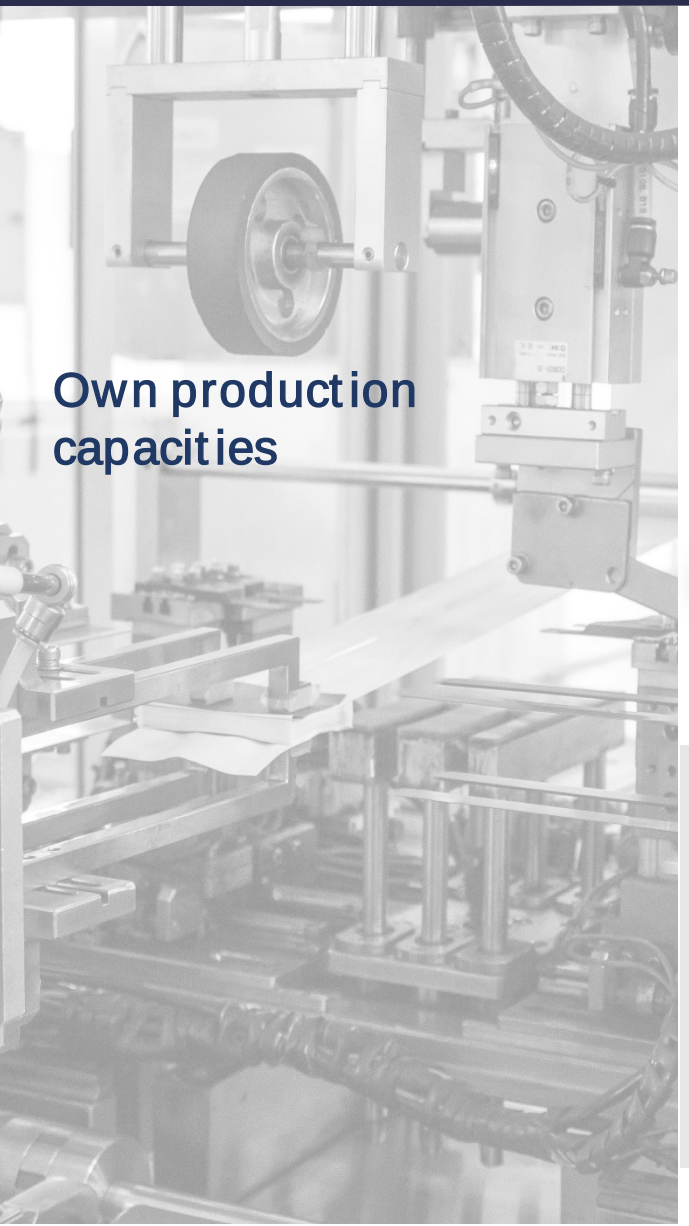
Cells of lithium-manganese dioxide system
CR 34615 (CR20) D-size

Voltage 3,0 V
Capacity 11 A/h

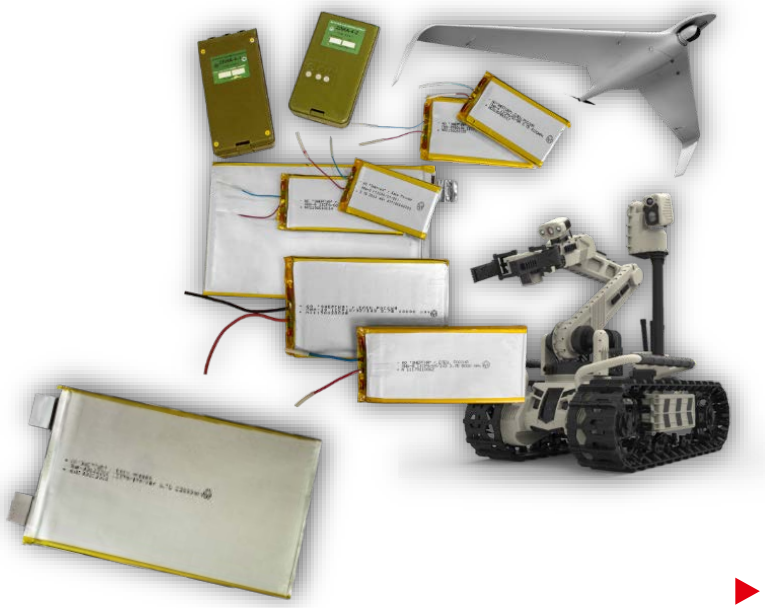
Cells of lithium/iron disulfide system
AA FR14G505

Voltage 1,5 V
Capacity 2,9 A/h

Li-ion batteries



Own production capacities



- 16 dimension types of 1C 2-28Ah Li-ion rechargeable batteries
- 1 dimension type of 9C 1.7Ah rechargeable battery

Li-ion batteries application:

- for power supply of communication
- facilities
- electric transport
  lightning equipment, and other devices.

Advantages:

Lithium - Ion (Li - Ion) current sources were introduced to replace Nickel- Cadmium (Ni - Cd) and Nickel-Metallhydrid batteries and have significant range of benefits:

- High energy density
- Increased capacity
- High relative indicators: 100 – 180 Watt h/kg и 250 – 400 Watt h/dm3
- Specific protection scheme for current and voltage limitation, preventing from overcharge, short circuit of battery clip, thermal overload of battery unit
- Rapid battery charge
- High discharge current
- Absence of memory effect

Developing directions

LIP-72

Produced since 2020

Capacity 72 A/h

1-7LIP-500

1-6LIP-400

LIC-3

Capacity 2,5 A/h

Voltage 3,6V

18650 size

Application:

- Electric transport, UAV (Unmannered Air Vehicles)
- Energy storage systems for houses, offices, health care institutions etc.
- Uninterruptable power supplies

  We carry out work for substitution of lead-aced batteries on UPS of Mobile Communications Providers

Specifications	1-7LIP-500	1-6LIP-400
Nominal capacity (Cn), Ah, no less than	500	430
Nominal Voltage, V	3,2	
Nominal discharge current, A	100	86
Cycling, cycles	2000	
Operating temperature range , C	From minus 30 to plus 50	
Dimensions, mm, no more than	290*165*255	
Weight, kg, no more than	17,5	15,5

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