

Note of comment

All parameters are given for one section of electric locomotive

System of fire-alarm and automatic fire-fighting САП2 ЭТ «Радуга-5МГ» (SAP2 ET “Raduga-5MG”) is destined for fire detection, announcing to locomotive crew and engine house operator on duty, manual or automatic fire-fighting in an electric locomotive using gas fire extinguishing agent Khladon 125.

At present the system is mounted on electric locomotives 2ЭС6 (2ES6) and 2ЭС10 (2ES10).

Type of climatic version Y2 (Y2) (for external fire-fighting panel ППВ-1 ЭТ (PPV-1 ET) – version Y1 (Y1)) in accordance with GOST 15150.

Basic parameters and specifications

Nominal power supply voltage – 110 V DC.

Connection scheme – two-wire.

Power consumption, W:

- not more than 10 W in stand-by mode,
- not more than 120 W at active display of sound-and-light alerter in case of fire,
- not more than 60 W at active display of light alerter in case of fire,
- not more than 300 W at actuation of gas fire-fighting modules (not more than 3 seconds).

Communication between the sections of a locomotive – through 3-wire communication line.

Gas fire extinguishing agent Khladon 125 (C₂F₅H) – toxic-safe, ozone-safe, permitted by the Montreal Protocol.

Modes of operation:

- «manual» – automatic detection of a seat of fire, manual fire-fighting;
- «automatic» – automatic detection of a seat of fire, automatic fire-fighting.

Notes

1 The system switching from manual mode to the automatic one and vice versa is executed using mode selection toggle switch on the unit БУИ-1 ЭТ.000-01 (BUI-1 ET.000-01) (for locomotive 2ЭС6 (2ES6)), БУИ-1 ЭТ.000-02 (BUI-1 ET.000-02) (for locomotive 2ЭС10 (2ES10)), further in the text BUI-1 ET.

2 Gas fire-fighting modules containing gas fire extinguishing agent Khladon-125 are used to perform fire-fighting.

3 Fire-fighting in a motorman's cab is not executed, in the vehicle body it is executed in two turns with 1 min. interval.

4 Fire warning is generated by a fire alarm unit located in a motorman's cab or by two out of six fire alarm units located in electric locomotive body.

5 At actuation of one of fire alarm units located in locomotive body it is generated a signal «ВНИМАНИЕ СРАБОТКА ДАТЧИКА №» (“ATTENTION ACTUATION OF SENSOR No”).

Basic system specifications are listed in Table 1.

Table 1

Operation temperature range, °C	from - 50 up to + 60
Range of sensitivity as per air transmission density air, dB/m (through waste-gas flue of a fire alarm unit)	from 0,05 up to 0,20*
Permitted level of background noise, lx, not more than (through waste-gas flue of a fire alarm unit)	12000*
Allowable air speed in a protected area, m/s, not more than (through waste-gas flue of a fire alarm unit)	10*
On threshold as per temperature, °C (through thermal max. flue of a fire alarm unit)	70±6*
Relay output of control signals in microprocessor system of locomotive control	2 NO (normally-open), 2 NC (normally-closed)
Weight, kg, not more than: – control and display unit БУИ-1 ЭТ (BUI-1 ET) – interface unit БС-2-01 ЭТ (BS-2-01 ET)	2,0 12,0

– display panel БЛИК-3С-24 (BLIK-3S-24) «ПОЖАР» (ТИ-1) (“FIRE” (ТИ-1))	0,3
– display panel БЛИК-3С-24 (BLIK-3S-24) «ГАЗ-НЕ ВХОДИ» (ТИ-2) (“GAS-KEEP OUT” (ТИ-2))	0,3
– display panel БЛИК-3С-24 (BLIK-3S-24) «ГАЗ-УХОДИ» (ТИ-3) (“GAS-GO AWAY (ТИ-3))	0,3
– display panel БЛИК-3С-24 (BLIK-3S-24) «АВТОМАТИКА ВКЛЮЧЕНА» (ТИ-4) (“AUTOMATICS IS ON” (ТИ-4))	0,3
– remote panel ПВ-2 ЭТ (PV-2 ET)	0,3
– external fire-fighting panel ППВ-1 ЭТ (PPV-1 ET)	3,3
– data recording unit БЗИ-1 ЭТ (BZI-1 ET)	1,15
– interface device УС1 ЭТ (US1 ET)	0,9
– uninterruptible power supply unit battery (ББПА-1 ЭТ) (BBPA-1 ET)	11,0
– gas fire-fighting module МГП-16-25 (MGP-16-25), (for 2ЭС6 (2ES6)) filled with Khladon-125	50
– gas fire-fighting module МГП-35-60 (MGP-35-60), (for 2ЭС10 (2ES10)) filled with Khladon-125	140
– high-pressure hose РВД-16-215 (RVD-16-215) (for 2ЭС10 (2ES10))	2,0
– hermetic stop valve ОКГ-16 (OKG-16) (for 2ЭС10 (2ES10))	0,5
– additional pipe С-Р-В-110-1/2`-А (for 2ЭС10 (2ES10))	0,5
– adapter sleeve КМЧ САП2 ЭТ.503 (for 2ЭС10 (2ES10))	0,5
– disperser КМЧ САП2 ЭТ.505 (for 2ЭС6 (2ES6))	0,8
– combined fire alarm unit ИПК ТУ (IPK TU)	0,4
– sound-and-light alerter ФИЛИН 1-12 (FILIN 1-12)	3,0
Note – Mark «*» means that the parameter value is given for reference.	

The system should keep operability at parameters of supply system as follows:

- supply voltage from 77 to 164 V;
- at voltage increase in power supply circuit up to 600 V in 0,5 sec, not more than;
- at voltage increase in power supply circuit up to 1000 V in 50 Mx, not more than;
- at voltage decrease in power supply circuit up to 0 V in 0,5 sec, not more than.

1.2.1 The system should ensure:

- fire detection in a section with elevated fumigation with a change of air transmission density from 0,05 up to 0,2 dB/m and announcing it to locomotive crew;

- fire detection in a section with elevated temperature up to $(70\pm 6)^{\circ}\text{C}$ and announcing it to locomotive crew;
- fire detection in a section at temperature increase rate not less than $5^{\circ}\text{C}/\text{min}$;
- actuation of gas fire-fighting modules in a section using button «Тушение» (“Extinction”) on control and display unit БУИ-1 ЭТ (BUI-1 ET), which is located in a motorman's cab, or panel ППВ-1 ЭТ (PPV-1 ET) on the back-side of a locomotive;
- automatic fire-fighting in automatic mode;
- signal shaping for disconnection of a locomotive from overhead system at signaling for actuation of gas fire-fighting modules (further in the text GFFM);
- mutual operation with other analogous systems in a coupling from one up to four sections of a locomotive;
- automatic periodic test of condition of fire alarm units' loops and launchers of GFFM in the aspect of unavailability of open failure or of a short circuit, accompanied with announcing tests' results to locomotive crew;
- supply of a low-frequency voice message to electric locomotive radio facilities at getting a signal about fire availability;
- announcing about the opening of a between-section or machinery compartment door to locomotive crew;
- recording and storage in a nonvolatile memory of events that take place in the system, with a possibility of information read-out using a PC and a special adapter.
- transmission to microprocessor system of electric locomotive control of the data about the system condition (ON/OFF, “fire” («пожар»)).
- automatic switch to uninterruptable power supply in case power supply using locomotive SB is not available.

Purpose of the System Units САП2 ЭТ (SAP2 ET)

Interface Unit БС-2-01 ЭТ (BS-2-01 ET)



Interface unit БС-2-01 ЭТ (BS-2-01 ET) – it is the main microprocessor-based unit of the system and it is destined for:

- processing of signals from fire alarm units, sealed contacts of the doors closing;
- determination of the number of sections in locomotive coupling and their interfacing;
 - putting on of information display panels «ПОЖАР» (“FIRE”), «ГАЗ-НЕ ВХОДИ» (“GAS-KEEP OUT”), «ГАЗ-УХОДИ» (“GAS-GO AWAY”), «АВТОМАТИКА ВКЛЮЧЕНА» (“AUTOMATICS IS ON”);
 - actuation of sound-and-light alerter in case of fire;
 - actuation of gas fire-fighting modules in case of fire availability through pushing of the button «ТУШЕНИЕ» (“EXTINCTION”) on control and display unit in a motorman's cab, external fire-fighting panel or automatically;
 - generation and transmission of a voice message about the fire to interface device УС1 ЭТ (US1 ET) with locomotive radio facilities;

- transmission of a signal to locomotive control circuit for disconnection from overhead system at actuation of gas fire-fighting modules;
- tests of fire alarm units' loops and GFFMs once in two hours or in accordance with a command sent by control and display unit in the aspect of unavailability of open failure or of a short circuit, accompanied with announcing tests' results to control and display unit in a motorman's cab;
- recording and storage in a nonvolatile memory of events that take place in the system prior to actuation of GFFM, with a possibility of information read-out using a PC;
- switch to uninterruptable power supply in case power supply using locomotive SB is unavailable.

Control and Display Unit БУИ-1 ЭТ (БУИ-1 ЭТ.000-01 (BUI-1 ET.000-01) (for locomotive 2ЭС6 (2ES6)), БУИ-1 ЭТ.000-02 (BUI-1 ET.000-02) (for locomotive 2ЭС10 (2ES10)).

The only one difference is the paint color: RAL-1013 or RAL-1015 for БУИ-1 ЭТ.000-01 (BUI-1 ET.000-01), RAL-7013 or RAL-7015 for БУИ-1 ЭТ.000-02 (BUI-1 ET.000-02).





Control and display unit БУИ-1 ЭТ (BUI-1 ET) is located in a motorman's cab and is destined for:

- shaping and displaying of the data for locomotive crew, which comes from interface unit;

- transmission of a signal to the interface unit (at pushing the button «ТУШЕНИЕ» (“EXTINCTION”)) for actuation of gas fire-fighting modules at availability of a signal about the fire from two out of six fire alarm units;

- transmission of a signal to the interface unit (at pushing the button «ТЕСТ» (“TEST”)) about the wish to test the system;

- deactivation of the sound alarm in case of fire (at pushing the button «ОТКЛ» (“OFF”)).

Types of displayed messages:

ТЕСТ (TEST) – message about the test started;

ТЕСТ С1, С2, С3, С4 (TEST C1, C2, C3, C4) – message about separate locomotive sections being tested;

КОСТАВ (ROLLING STOCK) – message about calculation of the number of sections in the rolling stock set;

ЗАКРОЙ ДВЕРЬ (CLOSE THE DOOR) – message about between-sections or between-vestibule doors being opened;

ДАТЧИК 1, 2....7 ОБРЫВ (SENSOR 1, 2....7 OPEN FAILURE) – open failure of a loop indicated in the message of a fire alarm unit;

ДАТЧИК 1, 2....7 КЗ (SENSOR 1, 2....7 SC) – short circuit of a loop indicated in the message of a fire alarm unit;

МГП 1, 2....4 ОБРЫВ (GFFM 1, 2....4 OPEN FAILURE) – open failure of a loop indicated in the message of a gas fire-fighting module;

МГП 1, 2....4 КЗ (GFFM 1, 2....4 SC) – short circuit of a loop of a gas fire-fighting module indicated in the message;

ВНИМАНИЕ СРАБОТКА ДАТЧИКА 1,2,.....7 (ATTENTION ACTUATION OF SENSOR 1,2,.....7) – message about actuation of one sensor with indication of its number;

НЕТ СВЯЗИ (NO COMMUNICATION) – message about unavailability of communication with interface unit;

ПОЖАР (FIRE) – message about actuation of two fire alarm units in a locomotive;

ПОЖАР В КАБИНЕ (FIRE IN CAB) – message about actuation of fire alarm unit in the cab.

Display Panel БЛИК-3С-24 (BLIK-3S-24)

«ПОЖАР» (“FIRE”)



It is sound-and-light display panel announcing about a fire in a protected section. It is located over the entries into the protected section.

Display Panel БЛИК-3С-24 (BLIK-3S-24)
«ГАЗ-НЕ ВХОДИ» (“GAS-KEEP OUT”)



It is sound-and-light display panel announcing about gas outlet to the protected section. It is located over the doors of protected section, outside protected section.

Display Panel БЛИК-3С-24 (BLIK-3S-24)
«ГАЗ-УХОДИ» (“GAS-GO AWAY”)



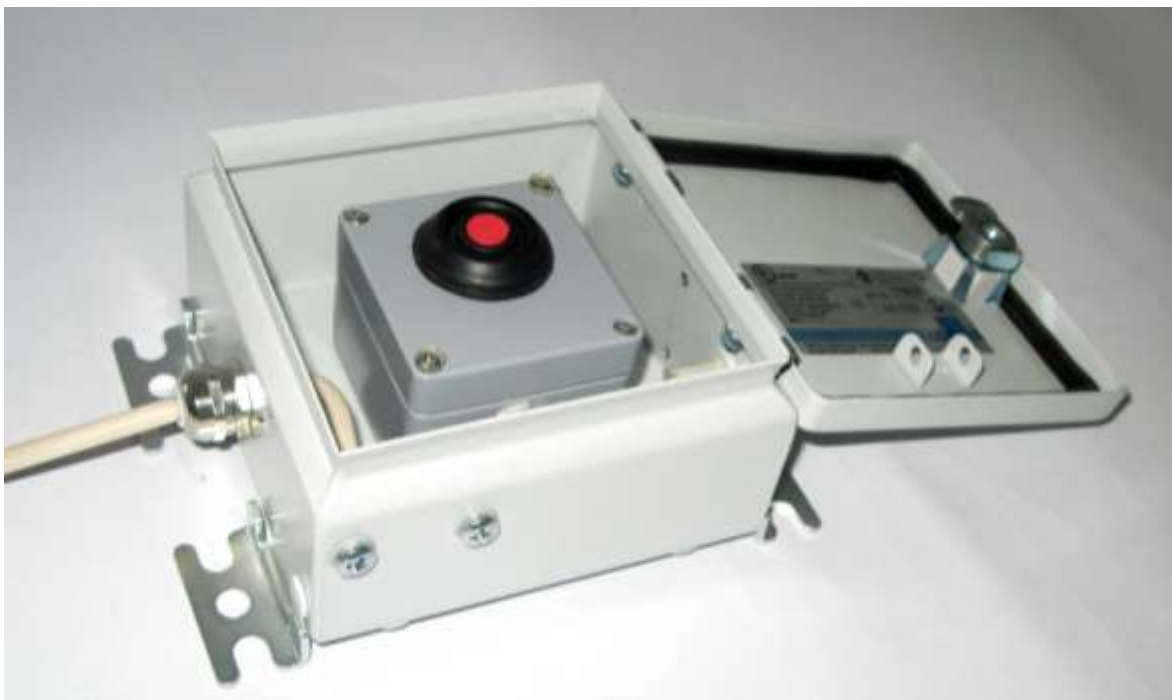
It is sound-and-light display panel announcing about gas outlet to the protected section. It is located over the doors of protected section, inside protected section.

Display Panel БЛИК-3С-24 (ВЛІК-3S-24)**«АВТОМАТИКА ВКЛЮЧЕНА» (“AUTOMATICS IS ON”)**

It is sound-and-light display panel announcing that the system of fire-alarm and automatic fire-fighting is in automatic mode, and gas outlet will be automatic in case of fire, in 60 sec after fire warning. It is located in any well-seen area.

Remote Panel ПВ-2 ЭТ (PV-2 ET)**«СБРОС АВТОМАТИЧЕСКОГО ТУШЕНИЯ»
 (“AUTOMATIC EXTINGUISHMENT RESET”)**

It is destined to cancel automatic fire-fighting mode. Location – uniform, in a protected section, in an easily accessible place.

External Fire-Fighting Panel ППВ-1 ЭТ (PPV-1 ET)

It is destined for actuation of gas fire-fighting modules on the exterior of a locomotive. It is located on the exterior of a locomotive on the body in any easily accessible place.

Data Recording Unit БЗИ-1 ЭТ (BZI-1 ET)

It is destined for record of a voice message about fire into the interface unit through an integrated microphone. It is supplied in the quantity – 1 for 50 sets of the system САП2 ЭТ (SAP2 ET) (or in any other quantity, determined by Supply Contract).

Interface Device УС1 ЭТ (US1 ET)

It is destined for interfacing amplitude levels between interface unit БС-2-01 ЭТ (BS-2-01) and electric locomotive radio facilities PBC-1 (RVS-1).

Uninterruptible Power Supply Unit Battery (ББПА-1 ЭТ (BBPA-1 ET))

It is an emergency power supply source for the system САП2 ЭТ (SAP2 ET) in case power supply using locomotive SB is not available. It ensures operability of the system during not less than 24 h.

Gas Fire-Fighting Module МГП-16-25 (MGP-16-25) (for 2ЭС6 2ES6) filled with Khladon-125



It is destined for storage and outlet of Khladon. The outlet is performed through electromagnetic valve.

Capacity – 25 l.

Weight of a module without gas fire extinguishing agent - not more than 55 kg.

Time of output of 95% of gas fire extinguishing agent (GFEA) – not more than 5 sec.

Overall dimensions of a module are not more than mm: - diameter, D – 224

- height, H – 1140

Operational pressure MPa (kgf/cm²) – 3,92 (40), no more

Parameters of electric triggering of a module:

- DC voltage, V - 12±1;

- current A – from 0,85 up to 1,1

- time of voltage application, not less than, sec – 2

There is a disperser located on cylinder used for uniformity of Khladon spray in a protected area. Spraying using piping is also possible. Control of a filled condition of a module is performed using manometer of a locking-starting device.

**Gas Fire-Fighting Module МГП-35-60 (MGP-35-60) (for 2ЭС10 (2ES10))
filled with Khladon-125**

It is destined for storage and outlet of Khladon. The outlet is performed through electromagnetic valve.

Capacity – 60 ± 3 l.

Weight of a module without gas fire extinguishing agent - not more than 75 kg.

Time of output of 95% of gas fire extinguishing agent (GFEA) – not more than 7 sec.

Overall dimensions of a module are not more than mm: - diameter, D – 370

- height, H – 1060

Operational pressure MPa (kgf/cm²) – 3,92 (40), no more

Parameters of electric triggering of a module:

- DC voltage, V - 12 ± 1 ;

- current A – from 0,85 up to 1,1

- time of voltage application, not less than, sec - 2

There is a disperser located on cylinder used for uniformity of Khladon spray in a protected area. Spraying using piping is also possible. Control of a filled condition of a module is performed using manometer of a locking-starting device.

Combined Fire Alarm Unit ИПК- ТУ (IPK- TY)

Combined fire alarm unit ИПК -ТУ (IPK -TY) – transport-destined, multipurpose, destined for detection of fire symptoms using the following:

- ambient transmission density 0,05 – 0,2 dB/m (other versions are possible);
- ambient temperature increase by more than $70\pm 6^{\circ}\text{C}$;
- temperature increase rate more than $5^{\circ}\text{C}/\text{min}$.

Sound-and-Light Alerter ФИЛИН 1-12 (FILIN 1-12)

It is destined for a loud announcing about a fire. It can be located anywhere.