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STATE STANDARD

ADHESIVE 51-K-10V (51-K-10B)

Specifications

TU 2513-001-00152081-93

(Abstract)

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ADHESIVE 51-K-10V (51-K-10B)
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Specifications

The specifications refer to cold cure high-strength epoxy-rubber adhesive 51-K-10$V_м$ (51-K-10$B_м$).

Component A is rubber compound solution based on rubber in acetic ether (ethyl acetate).

Component $B_м$ ($Б_м$) is solution of copolymer "Vitan-2M" («Витан-2М») and epoxy resin ED-20 (ЭД-20) in ethyl acetate.

Adhesive 51-K-10$V_м$ (51-K-10$B_м$) is used for cold glueing of rubber (based on unsaturated rubber) together, with metals and other materials in air at temperature from minus 50 to plus 80 °C and in sea water at temperature from minus 2 to plus 30 °C.

1 TECHNICAL REQUIREMENTS

1.1 Adhesive 51-K-10V_M (51-K-10B_M) shall comply with the specifications.

1.2 Weight ratio of adhesive components dry residue shall comply with standard values given in Table 1.

Table 1

Component	Weight ratio of adhesive 51-K-10V_M (51-K-10B_M) dry residue, %
A	25.0 ± 2.0
B_M ($Б_M$)	21.7 ± 1.0

1.3 Parameters of adhesive 51-K-10V_M (51-K-10B_M) properties shall comply with the requirements given in Table 2.

Table 2

Parameter	Value for adhesive 51-K-10V_M (51-K-10B_M)
1. Color	Brown or dark-brown
2. Homogeneity	Even consistency substance without foreign impurities and undissolved blobs of adhesive mixture
3. Relative viscosity, s, within limits of	8–60
4. Adhesion strength in three days after glueing for rubbers V-14 (B-14), IRP-1074 (ИРП-1074): – In case of rubber peeling from steel St3 (Ст3), kN/m (kgf/cm), minimum;	3.45 (3.50)
5. Pot life, h, minimum	8.0
6. Destruction shall have cohesive nature.	

1.4 Completeness of set

Adhesive 51-K-10V_M (51-K-10B_M) components shall be supplied in ratios given in Table 3.

Table 3

Adhesive	Component	
	A	B_M ($Б_M$)
	Weight parts	
51-K-10V_M (51-K-10B_M)	100	310

1.5 Packing

Components A and B_M ($Б_M$) shall be supplied in clean, dry aluminum or tin-plated steel canisters of 40 l capacity maximum, with tightly closing caps or in aluminum drums of 250 l capacity maximum.

No rust or scale is allowed on container walls or caps.

2 SAFETY REQUIREMENTS

2.1 Fire and explosion hazardous properties of adhesive 51-K-10V_M (51-K-10B_M) depending on ethyl acetate properties are given in Table 4.

Table 4

Parameter		Value
Flame propagation in the air,		
volume, %	lower	2.0
	upper	11.4
°C	lower	minus 6
	upper	plus 28
Flash-point, °C		minus 3
Spontaneous ignition temperature, °C		446

2.2 Use of open fire and other ignition sources is not allowed in the room designated for adhesive storage and handling, electrical equipment, electrical networks and artificial lighting fitting shall be explosion-proof.

When opening containers, use of tools that generate sparks upon hitting is not allowed.

2.3 In case of adhesive burning, the following fire fighting means may be used: sprayed water, all types of foam, aliphatichalide-based compounds, powders, fire-fighting hoses (water mist, sprinkler and mechanical foam installations), fire extinguishers, sand, asbestos cloth.

2.4 Toxic properties of adhesive depending on properties of its components: ethyl acetate, epoxy resin; m-phenylenediamine are given in Table 5.

Table 5

Component	Influence on organism	MAC (ПДК) in working air, mg/m^3
Ethyl acetate	At concentrations significantly exceeding MAC (ПДК), it has narcotic action, irritates conjunctivas and mucosal lining of respiratory tract. It may not soak through uninjured skin, causes dermatitis and tetter. No accumulation.	200
Epoxy resin (in terms of chloropropylene oxide)	Upon skin contact it causes irritant action. It may not soak through uninjured skin. No accumulation.	1
M-phenylenediamine	It has toxic action on blood, nervous system and skin (allergic agent). It soaks through skin, features low accumulation.	0.1

2.8.2 Waste water formed at the equipment cooling are standard clean as they have no contact with adhesive components.

3 ACCEPTANCE RULES

3.1 To check adhesive quality for compliance with the specifications, it shall be subjected to acceptance tests in the order given in Table 7.

Table 7

Parameter	Batch sample scope
1. Color	From 20 % of packages in the batch or from the blending machine
2. Homogeneity	The same
3. Weight ratio of dry residue, %	From 20 % of packages in the batch or from the blending machine
4. Relative viscosity	_ " _
5. Adhesion strength of rubber IRP-1074 (ИРП-1074) or V-14 (В-14) with metal and together at peeling and layer separation	_ " _
6. Pot life	_ " _

3.2 If unacceptable test results are obtained even for one parameter, repeated tests for the parameter for a duplicate test sample shall be carried out. Results of the repeated tests are final.

Test of each package item is allowed.

4 INSPECTION METHODS

4.1 Sampling

Samples with weight of 200 g minimum are taken from the middle of package item or from the middle of blending machine. The samples taken shall be compounded, thoroughly mixed, and average sample of 200 g, minimum, shall be taken.

4.2 Adhesive color is determined visually.

4.3 Weight ratio of dry residue shall be determined at temperature of (50 ± 5) °C for component A and at temperature of (100 ± 5) °C for component $B_м$ ($Б_м$).

4.4 Adhesion strength between rubber and metal shall be tested.

Equipment, materials:

Fused alumina, grain size No. 40–60.

A technical glass thermometer with readout range of 0 to 150 °C, division value of 1 °C and allowable error of ±1 °C.

Sorption hydrometer with measurement range of relative humidity from 15 to 98 % and measurement error of ±3 %.

Note. Adhesive 51-K-10V_M (51-K-10B_M) and its components do not contact with effluent waters during manufacture and application.

2.5 Works associated with adhesives application shall be executed according to the established sanitary regulations and rules ensuring occupational safety.

While handling adhesive, use individual protective equipment. Follow the personal hygiene rules.

The room designated for adhesive handling shall be equipped with general supply and exhaust ventilation. The supply and exhaust ventilation shall be switched on 0.5 h before the works start, and switched off 15 min. after completion of the works.

2.6 Fire prevention while working with adhesive shall be achieved as follows:

– use of mechanisms and equipment which operation does not form ignition sources;

– use of fast-acting means of fire suppression and disconnection of possible ignition sources in structures;

– use of nonsparking tools;

– use of sealed equipment;

– prevention of combustible medium generation by limitation of weight and volume of combustibles, combustible medium isolation, maintenance of temperature and pressure excluding flame propagation,

Fire protection shall be provided as follows:

– availability of fire fighting means and corresponding types of fire-fighting equipment;

– use of automated fire alarm and fire fighting installations;

– fire barriers and other means ensuring fire localization;

– organization of timely people evacuation;

– use of means preventing or localizing liquid spillage and drainage in case of fire.

Box respirator of grade A (with aerosol filter) and heat-resistant overalls are individual protective equipment in case of fire.

2.7 In case of adhesive spillage, carefully collect the product in a separate container, the spill area shall be strewed with sand with its further removal. In case of emergency use the box respirator of grade A (with aerosol filter).

2.8 Environment protection

2.8.1 Production waste, methods of their use are given in Table 6.

Table 6

Waste description	Q-ty	Process procedure	Equipment	Environment protection methods
Gaseous waste - solvents	5-10 g/h	Preparation of adhesive and its components	Balances, containers for preparation of adhesive components	They are discharged in the atmosphere without additional cleaning

5 TRANSPORTATION AND STORAGE

5.1 Adhesive 51-K-10V_M (51-K-10Вм) can be transported by any means of transport ensuring inflammable goods shipping following the shipping rules applicable for the given means of transport.

5.2 Components A and B_M ($Б_м$) shall be stored indoors in leak-proof closed containers at temperature of 0 to 25 °C.

5.3 Sedimentation is allowed during storage of component A.

6 APPLICATION NOTE

6.1 Prior to using, component A shall be thoroughly mixed till uniform distribution of sediment.

6.2 If components A and $B_м$ ($Б_м$) concentration and viscosity are increased, in the course of transportation and storage they can be diluted with ethyl acetate and used in case of their compliance with the specification.

6.3 Adhesive shall be prepared at least 20 min. before using.

6.4 Prior to glueing, rubber surfaces shall be modified through bromation.

6.5 Adhesive consumption is 500–800 g per 1 m^2 of the surface being glued.

6.6 If relative viscosity of adhesive is above 30 s, and in case of difficulties in its application, adhesive is allowed to be diluted by adding up to 10 % of ethyl acetate from adhesive weight.

7 APPLICATION NOTE

7.1 Shelf life of solutions A and $B_м$ ($Б_м$) is six months after manufacture date.

Stopwatch.

General-purpose laboratory balance with the maximum weighting limit of 1 kg.

Electric secondary clock with run error of ±60 s for 24 hours

Sandpaper No. 50–80 (Appendix to GOST 5009-82).

Nefras (Abstract from TU 38.401-67-108-92).

Rubber surface is roughed by corundum sandpaper No. 50–80 and bromated according to Appendix No. 1.

Bromating time is (90–100) s.

The metal surface is treated with fused alumina and degreased with nefras with further drying within (12 ± 2) min.

Adhesive is prepared by mixing of components in weight ratio A:B_M ($Б_M$)=100:310.

Adhesive is applied at temperature of (23 ± 5) °C and relative air humidity of 70 %, maximum in three layers. Drying of the first layer – (35 ± 5) min., the second layer – (25 ± 5) min., the third layer – (3 ± 1) min. (before transition of adhesive film to gluish state).

Stickiness is determined by touching of glued sections with length of (5 ± 1) mm on the plate ends. In this case the glued surfaces shall be adhered to each other without sliding in shear with formation of tension at the plates disconnection.

Samples after glueing shall be rolled down with a smooth roller of (700 ± 200) g ten times in each direction.

Rolling down shall be done twice with an interval of (30 ± 2) min., upon which samples shall be held without load for 3 days at temperature of (23 ± 5) °C.

Rubber and metal shall be glued together as per item 4.4.

4.5. Pot life of adhesive is determined in (8.0 ± 0.1) h after its manufacture. The adhesive is applied on metal or rubber specimens, in this case adhesive shall be applied using a brush easily and in a uniform layer.

Appendix 1

Instruction on modification of rubber surface by bromating to increase adhesion properties.

The instruction refers to rubbers (based on unsaturated rubber), and it stipulates the requirements to parameters of the modification process of their surface by the method of its bromating to increase adhesion properties. In this case adhesion strength is above rubber strength.

The bromating method is based on adjoining of bromine produced with reaction of its salts in solution to the rubber surface.

1 COMPOSITION, PREPARATION AND INSPECTION OF PROCESS SOLUTIONS

1.1 Brominating solution.

1.1.1 Brominating solution is a mixture of two solutions:

1– aqua solution of bromide and potassium bromate with weight ratio of 7 %;

2 – sulphuric acid solution, weight ratio is 7 %.

With interaction of these components bromine dissoluble in brominating solution is produced by the reaction:

$$5KBr + KBrO_3 + 3\ H_2SO_4 \text{ ---- } 3Br_2 + 3K_2SO_4 + 3H_2O$$

1.1.2 Solution 1 shall be prepared by dissolving (15.0 ± 0.5) g of potassium bromate first and then (60 ± 1) g of potassium bromide in 1 dm^3 of hot (temperature of (70 ± 5) °C) tapwater.

1.1.3 Solution 2 shall be prepared by gradual pouring 40 cm^3 of strong sulphuric acid (Abstract from GOST 2184-77) into 1 dm^3 of cold tapwater.

1.1.4 Solutions 1 and 2 are mixed with thorough agitation in the ratio of 2.5:1.0 by volume.

1.1.5 Solutions 1 and 2, as well as brominating solution shall be prepared in containers made of bromine and acid resistance materials: glass, enameled or rubber-coated steel, ceramics, titanium, polyethylene, fluoroplastic.

1.1.6 Amount of brominating solution required for treatment of 1 m^2 of rubber surface is approximate 3 dm^3.

1.1.7 Bromine mass concentration in the fresh brominating solution shall be (25 ± 3) g/dm^3.

1.1.8 Bromine mass concentration in the brominating solution shall be inspected as per item 4 of the present instruction. The first sample for determination of initial bromine content is taken in (10 ± 1) min. after pouring and mixing solutions 1 and 2.

1.2 Neutralizing solutions

1.2.1 Sodium sulphite solution (weight ratio of 5 %) shall be prepared by dissolving (60 ± 2) g of Na_2SO_3 in 1 dm^3 of hot (temperature of (70 ± 5) °C) tapwater when mixing.

The solution is used until free bromine forms.

Na_2SO_3 solution shall be visually inspected for free bromine formation – as per yellowing.

1.2.2 Alkali liquor (weight ratio of 20 %) shall be prepared by dissolving (250 ± 5) g of NaOH in 1 dm^3 of cold tapwater when mixing.

2 RUBBER TREATMENT PROCEDURE

2.1 Rubber preparation.

2.1.1 Abrasive treatment of rubber surface shall be performed using sandpaper No. 50–80. Time break between abrasive treatment and further bromating shall not exceed (48 ± 1) h. Works shall be performed at temperature of (23 ± 5) °C and relative air humidity of 60 %, maximum. If relative air humidity is above 60 %, rubber is dried after abrasive treatment at temperature of (55 ± 5) °C for (2.5 ± 0.5) h.

2.1.2 Rubber surfaces based on various types of rubbers are degreased by solvents given in Table 1.

Table 1

Rubber type	Solvent
SKN (CKH)	Mixture of nefras and ethyl acetate in the ratio of 1:1.

Time break between degreasing and further operations shall not exceed 2 h.

2.2 Rubber bromating

2.2.1 Rubber bromating is carried out by its immersion into brominating solution.

2.2.2 Bromating is executed at temperature of (23 ± 5) °C. While bromating, specimens shall not touch each other.

2.2.3 Optimal duration of bromating for the specific rubber grade shall be determined based on information on amount of graft bromine and adhesion strength of rubber treated in brominating solution with bromine mass concentration of (25.0 ± 3.0) g/dm^3 and (12.0 ± 0.5) g/dm^3. Volume of graft bromine shall be not less than 1.5 %.

Bromated rubber shall be attached as per the technical documentation for adhesive.

2.2.4 Spent brominating solution (bromine mass concentration of less than 12 g/dm^3) shall be treated by sodium sulphite solution prepared as per item 1.2.1 to neutralize bromine residues.

Bromine is neutralized by the following reaction:

$$Br_2 + Na_2SO_3 + H_2O = 2NaBr + H_2SO_4$$

Neutralization completeness is inspected visually – upon full vanishing of yellow color.

2.2.5 Sulphuric acid formed after bromine fixation shall be neutralized by NaOH solution prepared as per item 1.2.2, up to pH = 6.0–8.0.

Neutral solution diluted up to MAC (ПДК) shall be drained into tap effluents.

2.3 Neutralization of free bromine on the rubber surface.

2.3.1 Free bromine on the rubber surface shall be neutralized by its immersion into sodium sulphite solution prepared as per item 1.2.1.

Neutralization duration shall be not less than bromating duration.

2.3.2 Neutralization temperature is (23 ± 5) °C.

2.4 Rubber washing.

2.4.1 Rubber parts are washed from neutralents in flowing tapwater for 2 min, minimum, depending on their area, shape, and other process parameters.

2.4.2 Completeness of traces washing shall be inspected with general-purpose indicator paper (up to dirty yellow color).

2.5 Rubber is dried at temperature of (23 ± 5) °C and relative air humidity of 65 % maximum for 2 days or at temperature of (65 ± 5) °C for 2 h.

3 MEASURING INSTRUMENTS AND EQUIPMENT

3.1 A thermometer with readout range of 0 to 100 °C and measurements error of ±1 °C for monitoring of tapwater temperature.

3.2 Stopwatch

3.3 Sorption hydrometer with measurement range of relative humidity from 15 to 98 % and measurement error of ±3 %.

3.4 Laboratory pH-meter – millivoltmeter with readout range of 1 to 14 pH units.

3.5 General-purpose indicator paper.

3.6 Glass pipettes of 5 and 10 cm^3 volume.

3.7 Laboratory drying electric furnace with the range of automatic temperature control in the working area of 50 to 350 °C with control error of ±2 °C in the preset condition.

3.8 General-purpose laboratory balance with the maximum weighting limit of 1 kg.

4 INSPECTION METHOD

4.1 Determination of bromine content in brominating solution.

4.1.1 The method for determination of bromine concentration in the brominating solution is based on iodine displacement reaction by bromine from potassium iodine solution with further titration of liberated iodine by sodium thiosulfate solution.

4.1.2 The solution being tested in amount of 5 cm^3 is taken from the sample and put into a flask with ground plug containing 20 cm^3 of solution KJ with weight ratio of 10 %. Tightly closed flask is held for 3–5 min. in dark place, and then (50 ± 1) cm^3 of water is added. Liberated iodine shall be titrated to straw color by sodium

thiosulfate solution with ($Na_2S_2O_3$) = 0.1 mol/dm^3, 1–2 cm^3 of starch solution is added, and titrated up to discoloration while thorough mixing.

Quantity of free bromine (B), g/dm^3 shall be calculated using the following formula:

$$B = \frac{V * K * 0{,}00799 * 1000}{3}$$

where V is volume of sodium thiosulfate solution spent for titration, cm^3;

K is correction to titer of sodium thiosulfate solution;

0.00799 is bromine weight corresponding to 1 cm^3 of sodium thiosulfate solution, g.

5 STORAGE OF SOLUTIONS AND RUBBER

5.1 Solutions 1 and 2 as per item 1.1.1 and brominating solution shall be stored in containers specified in item 1.1.5.

5.2 Shelf life of solutions 1 and 2 is unlimited.

5.3 Shelf life of neutralizing solutions is unlimited.

5.4 Brominated rubber shall be stored in closed containers or a wrap.

5.5 Shelf life of brominated rubber before glueing is 15 days, maximum.

6 SAFETY REQUIREMENTS

6.1 A toxic level of bromating depends on bromine properties. Maximum allowable concentration of bromine in working air is 0.5 mg/m^3. Bromine boiling point is 58.8 °C.

6.2 All works associated with rubber bromating shall be performed with serviceable general and local ventilation in draft conditions.

6.3 While handling brominating solution, use individual protective equipment: overalls, rubber gloves, rubber aprons, goggles and protective mask or respirator.

6.4 In case of brominating solution spillage, it shall be strewed with sodium sulphite and then with alkali liquor.

6.5 Upon contact of alkali, acid or bromine with skin, wash them off immediately with plenty of water.