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**Asphalt plant No. 1 JSC**

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**COMPANY STANDARD**

**STO 03218295-03-08-2015**

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**Transparent polymer binders**

**for the production of colored asphalts**

## **Specifications.**

## **Revision 3**

St. Petersburg,

2021

**Information on the standard**

1. The standard has been developed and adopted by Asphalt plant No. 1 JSC, St. Petersburg

2. The standard has been approved and put into effect by the Order of the General Director, Asphalt plant No. 1 JSC No.\_\_\_\_\_\_\_ dated \_\_\_\_\_\_\_\_\_\_\_.

3. The standard complies with GOST R 1.5-2012. Standardization in the Russian Federation. National standards of the Russian Federation. Rules of structure, drafting, presentation and indication.

4. The standard shall supersede STO 03218295-03.08-2015 revision 2.

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**COMPANY STANDARD**

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B2color. Transparent polymer binders

for the production of colored asphalts

## Specifications.

**Transparent polymer binders for the production of colored asphalt**

**Specifications**

Effective date: 01.07.2015

**1 Scope**

This standard establishes requirements for manufacturing, storage, transportation, and compliance evaluation of B2color transparent polymer binders based on synthetic oils, resins, polymers and additives and used for the production of colored asphalt mixtures designed for wearing coat building.

The use of colored asphalt coats provides traffic safety due to the color identification of special areas, such as crosswalks, bike paths, public transportation areas, parking lots, etc. They can also be used to mark certain dangerous areas, such as entrances to the downtown or dangerous road curves. Light coloured surfaces increase visibility in low light conditions (tunnels, underground parking lots, etc.). The applications also extend to civil engineering (public squares, courtyards of buildings and schools, sidewalks, footpaths in parks and gardens, parking lots, and recreational areas, etc.).

**2 Regulatory references**

This standard uses references to the following national or interstate standards:

GOST 12.1.004-91 Occupational Safety Standards System. Fire Safety. General Requirements.

GOST 12.1.007-76 Occupational Safety Standards System. Harmful Substances. Classification and General Safety Requirements.

GOST 12.1.005-88 Occupational Safety Standards System. General Hygiene Requirements for Working Zone Air.

GOST 12.1.044-2018 Interstate Standard. Occupational Safety Standards System. Fire and Explosion Hazard of Substances and Materials. Set of parameters and their determination methods (enacted by the Order of Rosstandart No. 717-st dated 05.10.2018)

GOST 12.3.002-2014 Occupational Safety Standards System Production Processes. General Safety Requirements.

GOST 12.4.021-75 Occupational Safety Standards System. Ventilation Systems. General Requirements.

GOST 12.4.011-89 (ST SEV 1086-88). Interstate Standard. Occupational Safety Standards System. Means of Protection. General Requirements and Classification.

GOST 27653-88 Men's suits for protection from mechanical damage, water, and alkalis. Specifications.

 GOST 17.2.3.02-2014 Interstate Standard. Rules for Establishing Permissible Hazardous Substance Emissions by Industrial Enterprises.

GOST 1510-84 Oil and Petroleum Products. Labeling, Packaging, Transportation, and Storage.

GOST 2517-2012 Oil and Petroleum Products. Sampling Methods.

GOST 9128-2013 Asphalt Mixtures, Polymer Asphalt, Asphalt, Polymer Asphalt for Roads and Airfields. Specifications.

GOST 31015-2002 Asphalt Mixtures and Stone Mastic Asphalt. Specifications.

GOST R 58406.1-2020 Public Motor Roads. Stone Mastic Mixtures and Asphalt. Specifications.

GOST R 58406.2-2020 Public motor roads. Hot Asphalt Mixtures and Asphalt. Specifications.

GOST 14192-96 Labelling of Goods.

GOST 19433-88 Hazardous Goods. Classification and Labelling.

GOST 11508-74 Petroleum Bitumens. Method for Determination of Bitumen Adhesion to Marble and Sand.

GOST 33136-2014 Viscous Petroleum Paving Bitumens. Method for Determination of Needle Penetration Depth.

GOST 33137-2014 Viscous Petroleum Paving Bitumens. Method for Determination of Dynamic Viscosity using Rotary Viscometer.

GOST 33138-2014 Public Motor Roads. Viscous Petroleum Paving Bitumens. Ductility Test Method.

GOST 33140-2014 Public Motor Roads. Viscous Petroleum Paving Bitumens. Method for Determination of Ageing, When Exposed to High Temperature and Air (RTFOT method).

GOST 33141-2014 Public Motor Roads. Viscous Petroleum Paving Bitumens. Method for Determination of Flashing Point. Cleveland Open Cup Test Method.

GOST 33142-2014 Viscous Petroleum Paving Bitumens. Method for Determination of Softening Point. Ring-and-ball Method.

GOST 33143-2014 Viscous Petroleum Paving Bitumen. Method for Determination of Fraass Breaking Point.

GOST R 52056-2003 Polymer-bitumen Binders based on SBS type block polymers. Specifications.

GOST EN 13399-2013 Bitumens and Bituminous Binders. Storage Stability Determination of Modified Bitumens.

GOST EN 13589-2013 Bitumens and Bituminous Binders. Ductility Determination.

GOST EN 13398 -2013 Modified Bitumens and Bituminous Binders. Elasticity Determination.

GOST EN 13302-2013 Bitumens and Bituminous Binders. Dynamic Viscosity Determination.

GOST R 58400.10-2019 Public Motor Roads. Petroleum Bituminous Binder Materials. Property Measurement Method Using Dynamic Shear Rheometer (DSR).

GOST R 58400.82019 Public Motor Roads. Petroleum Bituminous Binder Materials. Method for Determination of Bending Bar Rheometer (BBR) Bitumen Hardness and Creep at Negative Temperatures.

GOST R 58400.5-2019 Public Motor Roads. Petroleum Bituminous Binder Materials. Method for Determination of Ageing, When Subjected to Pressure and Temperature (PAV).

*Note: When using this standard, the validity of the reference standards should be checked in the public information system, on the official website of the National Standards Body of the Russian Federation on the Internet or in the National Standards annual information index published as of January 1 this year and in the corresponding monthly information indexes published this year. Should the reference document be replaced (revised), when using this standard, one shall be guided by the replaced (revised) document. Should the reference document be cancelled without replacement, the provision referring thereto shall apply to the extent covering this reference.*

**3 Terms and definitions**

The following terms with their respective definitions are used in this standard:

3.1 B2color Transparent Polymeric Binder (hereinafter referred to as B2color) is a well selected mixture of synthetic oils, resins, polymers, and additives taken in certain proportions, mixed when hot until homogeneous, intended for use as a binding material in the production of colored asphalt mixtures.

3.2 Colored Asphalt Mixture (CAM) is a well selected mixture of crushed stone, sand, mineral powder, transparent polymer binder, organic or inorganic coloring agents, taken in certain proportions and mixed when hot, used for building colored pavements of all types and grades.

3.3 Colored Asphalt (CA) is compacted or cooled and shaped colored asphalt mixture.

3.4 Surfactants are chemical compounds capable of accumulating on the contact surface of two bodies or two thermodynamic phases (called the interface) and causing a decrease in surface tension of substances forming these phases.

**4 Classification**

B2color is classified into grades according to the depth of needle penetration at 250C as per Table 1.

Table 1 – B2color grades

|  |  |
| --- | --- |
| **Grade designation** | **Depth of 0.1 mm needle penetration at 250С** |
| B2color 100/130 | 101-130 |
| B2color 70/100 | 71-100 |
| B2color 50/70 | 51-70 |
| B2color 35/50 | 35-50 |

4.2 The applications of various B2color grades, depending on road building climatic zone (RBCZ), are indicated in Table 2.

Table 2 – Application of B2color grades.

|  |  |  |
| --- | --- | --- |
| Road building climatic zones | Compacted CAM as per GOST 9128, GOST 31015,national pre-standards 183, 184 | Molded CAM as per GOST 54401  |
| RBCZ I | B2color 70/100B2color 100/130 | B2color 50/70B2color 35/50 |
| RBCZ II | B2color 50/70B2color 70/100 B2color 100/130 | B2color 50/70B2color 35/50 |
| RBCZ III | B2color 50/70B2color 70/100 | B2color 50/70B2color 35/50 |
| RBCZ IV and V | B2color 50/70B2color 70/100 | B2color 50/70B2color 35/50 |

**5 Technical requirements**

5.1 Raw materials and materials used for the B2color production shall comply with the regulatory or technical documents and shall be commercially available.

5.2 For the preparation of B2color, petroleum products obtained by purification of distillate or residual petroleum oil fractions may be used as aromatic petroleum oils. The use of light petroleum products with a kinematic viscosity of at least 18 cSt at 100 °C are preferred.

5.3 For the preparation of B2color, petroleum resins and condensation products of polyatomic alcohols and modified resin are used as structure-forming materials. The use of light colored products with a softening point not below 80 °C is preferred.

5.4 For the preparation of B2color, styrene-butadiene-styrene copolymer (SBS) with a linear structure consisting of butadiene monomer (69 %) and styrene monomer (31 %) at the ends of blocks is used as a polymer; this ensures rapid distribution of oils and resins in the solution.

5.5 For the preparation of B2color, surfactant-based products, which change the colored asphalt mixture rheology at lower process temperatures and provide high adhesive properties to the binder are used as process additives. Surfactant-based additives may contain aminogen groups (at least one amine and/or modified amine-based surfactant or mixtures thereof).

5.6 When preparing B2color, antioxidants may be used, if B2color must be applied at temperatures above 160 ºC.

5.7 Crosslinkers should be used to ensure the B2color resistance to segregation during storage and shipment, provided that B2color complies with this standard.

5.8 Incoming inspection of materials shall be performed in compliance with the relevant regulatory documents. Visual inspection of container integrity, availability of markings (labels), shelf life (based on date of manufacture), as well as the availability of quality certificate for the batch and MSDS.

5.9 Based on physical and mechanical properties, B2color shall comply with the requirements and standards specified in Table 3. Before testing B2color, its homogeousness shall be determined. Provided that B2color is homogeneous, further tests may be performed.

Table 3 - Physical and chemical properties of B2color

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Item No.** | **Indicator**  | **Meas. unit** | **Testing method** | B2color **100/130** | B2color **70/100** | B2color **50/70** |
| 1 | Depth of needle penetration at 25 oС, | 0.1 mm | GOST 33136 | 101-130 | 71-100 | 51-70 |
| 2 | Ring-and-ball softening point, min, | оС | GOST 33142 | 48 | 50 | 55 |
| 3 | Elasticity at 25 оС, min, | % | GOST EN 13398 | 85 | 85 | 85 |
| 4 | Ductility at 25 оС, min |  | GOST 33138 | 60 | 50 | 40 |
| 5 | Embrittlement point, max | оС | GOST 33143 | -15 | -15 | -15 |
| 6 | Flashing point, min | оС | GOST 33141 | 235 | 235 | 235 |
| 7 | Adhesion between binder and acidrock aggregate surface (at strong boiling) | - | GOST 11508 | Based on specimen No. 2 |
| 8 | Homogeneousness |  | GOST R 52056 | Homogenous |
| *Stability in storage within 72 hours at 165 оС as per GOST EN 13399* |
| 9 | Softening point variation, max | оС | GOST 33142 | 5 |
| *Ageing resistance at 163оС as per GOST 33140* |
| 10 | Mass variation, max | % | GOST 33140  | 1.0 | 1.0 | 1.0 |
| 11 | Softening point variation, max | оС | GOST 33140 GOST 33142 | 8 | 6 | 5 |
| 12 | Elasticity at 25 оС, min, | % | GOST EN 13398 | 80 | 80 | 70 |
| *Additional post-heating testing methods* |
| 13 | Tension load, cm, N at 25 °C | N | GOST 33138 | For a set of statistical data |
| 14 | Dynamic viscosity measured by a rotary viscometer at 135 оС \* | Pa·s | GOST 33137GOST EN 13302 | For a set of statistical data |
| 15 | Complex shear modulus (DSR) | kPa | GOST R 58400.10 | For a set of statistical data within the range from +30 °С to +90 °С at a pitch of 10 °С and frequency of 1.59 Hz ( 10 rad/s) |
| 16 | Bending beam rheometer (BBR) hardness | MPa | GOST R 58400.8, GOST R 58400.5 | For a set of statistical data within the range from -12 °С to -36 °С at a pitch of -6 °С  |

\* The recommended spindle numbers should be selected, based on the polymer modified asphalt viscosity. The following should be used as the main ones: SC4-21, SC4-27, SC4-28, SC4-29.

**6 Safety requirements and environment protection**

 6.1 When applying B2color, certified PPE shall be used.

6.2 When handling B2color, general fire safety requirements as per GOST 12.1.004 and GOST 12.0.004 shall be be observed.

6.3 B2color is combustible as per GOST 12.1.04 with the flashing point above 235 **°**С.

6.4 B2color is a low-hazardous substance and, based on health effect, it belongs to hazard class 4 as per GOST 12.1.007 Low-hazardous Substances.

 6.5 When producing B2color, certified PPE shall be used as per GOST 12.4.250-2013 and GOST R 12.4.236-2011 and in compliance with CU TR 019/2011 On Safety of Personal Protective Equipment .

 6.6 The work on the B2color production shall be performed by persons above 18 years of age, having undergone medical examination, physically qualified, briefed on health and fire safety, having received training and health knowledge assessment. Medical examinations shall be performed in accordance with the current legislation.

 6.7 The B2color production must comply with Hygiene Regulations No. 2.2.2.1327-03. [3]

6.8 The room used for B2color handling shall be equipped with positive-pressure ventilation in compliance with GOST 12.4.021.

 6.9 The working zone air monitoring during manufacture and use of B2color shall be performed in accordance with HS 2.2.5.3532-18 [1] and GOST 12.1.005-88. Maximum permissible concentrations (MPC) of hazardous substances in the working zone air:

- Hydrocarbons MPC 900/300

- Silicon dioxide MPC 6/2

- Xylene MPC 150/50

- Benzene MPC 15/5

- Styrene MPK 30/10.

6.10 For the purpose of air protection, the cap management shall be arranged in compliance with GOST 17.2.3.02-2014.

6.11 Air protection activities, when producing and using B2color, shall be performed in accordance with GOST17.2.3.02-2014. Emissions of hazardous pollutants, when producing and using B2color, shall comply with the maximum permissible emission limits of hazardous substances (pollutants) into the atmosphere, air hygiene quality standards, and environmental air quality standards.

6.12 The emission compliance monitoring shall be performed by means of in-process emission compliance monitoring, based on the monitoring schedule following the instrumental and calculation procedure.

6.13 No waste water is generated in the production and use of B2color.

6.14 Temporary accumulation of waste generated in the production and use of B2color is performed in specially equipped temporary accumulation areas for this waste type as per SanPiN 2.1.7.1322-03.

 6.15 Should small amounts of B2color ignite,primary fire extinguishing equipment, such as sand, fire blanket, foam, and powder fire extinguishers shall be used.

**7 Evaluation of compliance with this standard**

7.1 B2color must be accepted by the QC Department (testing laboratory) of the manufacturer.

7.2 B2color shall be accepted in batches.

7.3 A batch is the amount of B2color, homogeneous in its physical and mechanical properties, produced at the same mixing plant during a shift, using raw materials of the same supply.

7.4 The manufacturer shall take at least two common samples from each batch for the product quality inspection. The sample size shall be determined in accordance with GOST 2517 and based on the required number of tests, but amount to not less than 2.0 kg. The sampling shall be performed at the end of the B2color production process. Should unsatisfactory test results of the first sample be obtained, for at least one indicator, the second sample shall be tested. Should unsatisfactory results be obtained for both samples, the batch shall be rejected and technical solutions shall be adopted to improve the quality.

7.5 After the B2color acceptance, two (test and retained) samples shall be taken during shipment to the consumer, a sample collection report shall be drawn up, samples shall be sealed and stored at the manufacturer's for the contractual period specified.

7.6 Acceptance, periodic, and in-service inspections shall be performed to evaluate the B2color compliance herewith.

7.7 During the acceptance testing, the B2color manufacturer shall determine the quality of each batch, based on all indicators, other than those determined for the statistical data set. The recommended product data sheet form is provided in Appendix A.

7.8 Provided that the used feed stock and the polymer-modified bitumen manufacturing technique are consistent, the acceptance tests of each batch may be held, based on the following indicators:

- Depth of needle penetration at 25 ℃

- Ring-and-ball softening point

- Elasticity at 25 °С

- Ductility at 25°C

- Homogeneousness.

7.9 When producing B2color, provided that the feed stock is consistent, the manufacturer shall ensure quality inspection of the commercial product, based on the following indicators hereof at intervals:

7.9.1 At least once per 10 batches:

- Embrittlement point

- Flashing point

- Adhesion between binder and acid rock aggregate surface (at strong boiling)

- Stability in storage within 72 hours at 165 °С

- Ageing resistance at 163 °С.

7.9.2 At least one per 30 batches:

- Tension load at 25 °С

- Dynamic viscosity measured by a rotary viscometer at 135°С

- Complex shear modulus (DSR)

- Bending beam rheometer (BBR) hardness.

7.10 The B2color buyer shall be entitled to perform incoming product quality inspection based on the following indicators hereof:

7.10.1 For every batch:

- Depth of needle penetration at 25 ℃

- Ring-and-ball softening point

- Elasticity at 25 °С

- Ductility at 25°С

- Adhesion between the binder and aggregate surface used as part of the asphalt mixture produced

- Homogeneousness.

7.10.2 On a periodic basis, at least once per 15 batches:

- Embrittlement point

- Flashing point

- Tension load at 25 °С

- Dynamic viscosity measured by a rotary viscometer at 135 °С

- Stability in storage within 72 hours at 165 °С

- Ageing resistance at 163 °С.

7.11 The testing, based on all the indicators specified in Table 3 hereof, shall only be performed, once the material homogeousness is determined.

7.12 The in-process inspection of B2color shall determine the preparation temperature inside the B2color plant and storage tanks, as well as the material homogeousness during maturation.

**8 Packaging and labeling**

8.1 B2color shall be labeled and packaged in accordance with GOST 14192 and GOST 19433.

8.2 Each B2color batch shall be accompanied by a document of quality. The document shall contain:

- Name of the manufacturer and/or its trademark

- B2color grade indication

- Date of manufacture

- Batch number

- Delivery address and name of the recipient

- Net weight

- Number of this standard

- Certificate number

- Results of tests performed to confirm the product compliance herewith.

8.3 When packaged for long-term transportation and storage, each container shall bear a label containing:

- Name of the manufacturer and/or its trademark

- B2color grade indication

- Date of manufacture

- Batch number

- Net weight

- Number of this standard

- Safety signs

- Certificate number

8.4 Example of product indication in documents and (or) for order: Transparent polymer binder B2color 70/100 as per STO 03218295- 03.08-2015.

**9 Transport and storage**

9.1 B2color sahall be transported and stored in accordance with GOST 1510-84. The transportation in hot condition should be performed using tank trucks, capable of providing temperature reduction of not more than 5-7 °C per day.

9.2 The transportation, drainage and storage of B2color in containers previously used for organic binders of other types without prior cleaning (washing, steaming) shall be prohibited.

9.3 In order to avoid the B2color degradation, process temperatures during storage, transportation and preparation of asphalt mixes should comply with Tables 4 and 5.

Table 4 Storage period and storage temperature conditions

|  |  |
| --- | --- |
| **Storage period** | **Maximum B2color temperature** |
| Up to 5 days | 110 °С |
| Up to 4 days | 140 °С |
| Up to 3 days | 150 °С |
| Up to 24 hours | 165 °С |

Table 5. Process temperature values

|  |  |
| --- | --- |
| **Process temperature** | **Depth of 0.1 mm needle penetration at 25 °С** |
| **50/70** | **70/100** | **100/130** |
| Minimum drain temperature, °С | 140 |
| Minimum temperature of binder feeding into asphalt plant mixer, °С | 150 | 160 |

9.4 Should B2color be stored for more than 24 hours, its temperature should be reduced to 110-150°C or it is to be cooled completely in order to mitigate the negative effects of ageing and segregation processes. The temperature solution selection shall be based on the technical and economic expediency of storage and shall be chosen individually for each production process.

9.5 In case of storage and transportation for more than 24 hours, B2color may be used only after stirring at temperatures between 150 and 165 °C until homogeneous and providing the compliance of properties with this standard.

9.6 B2color may be stored in a solid state for a 12-month provided it is not exposed to direct sunlight or precipitation.

**10 Manufacturer's warranty**

10.1 The manufacturer warrants that B2color will meet the quality requirements of this standard provided that the transportation and storage conditions specified in Section 9 of this standard are complied with.

10.2 The maximum shelf life of B2color at 150 °C shall be 3 days provided that all storage and transportation requirements are met.

In a solid state, when stored in a sealed container, the maximum shelf life of B2color shall be 12 months from the date of manufacture.

10.3 Upon the shelf life expiration of B2color, repeated quality inspection shall be performed in accordance with clause 7 hereof, based on the physical and mechanical properties listed in Table 3. Should the positive results be obtained, the decision on the possibility of the further product use shall be made.

**Appendix 1 (Mandatory)**

|  |  |
| --- | --- |
| C:\Users\vstrizhkova\Downloads\верт-осн-1@4x.pngAsphalt plant No. 1 Joint Stock Company  | Testing laboratory certificate of accreditation No. RU.ACK.ИЛ.886Valid till 28.01.2023 |

|  |
| --- |
| QUALITY CERTIFICATE No. 11For clear polymer binder PPV 70/100  |
| 1. Manufacturer name: Asphalt plant No. 1 Joint Stock Company, 30 Gusarskaya str. |
| 2. Product manufacture date: | 30.03.2021 |
| 3. Date shipped: |  |
| 4. Batch number: | 11 |
| 5. RD designation: | STO 03218295-03.08-2015 |
| 6. Amount, tons | 40 |
| 7. Test results: |  |

|  |  |  |  |
| --- | --- | --- | --- |
| Item No. | Indicator  | Rate as per STO 03218295-03.08-2015 for PPV 70/100 | Test results |
| 1 | Homogeneousness | Homogenous | Homogenous |
| 2 | Depth of 0.1 mm needle penetration at 25 ℃ | 71-100 | 84 |
| 3 | Ring-and-ball softening point, ℃ | Not below 50 | 56 |
| 4 | Ductility at 25 ℃, cm | Not below 50 | 76 |
| 5 | Elasticity at 25 ℃, % | At least 85 | 93 |
| 6 | Brittleness point, ℃ | Not above -15 | -16 |
| 7 | Flashing point, ℃ | Not below 235 | 275 |
| 8 | Adhesion between binder and acid rock aggregate surface (at strong boiling)\* | Based on specimen No. 2 | Specimen No. 1 |
| 9 | Dynamic viscosity at 135 ℃, Pa•s | For a set of statistical data | 0.39 |
| Ageing resistance at 163 ℃ as per GOST 33140 |
| 10 | Softening point temperature measurement ℃ | Not above 6 | 2 |
| \* The clear polymer binder contains adhesion additive Amdor-20Т in the amount of 0.3 %.Finding: The clear polymer binder corresponds to the grade PPV 70/100 as per STO "Clear polymer binders for the production of colored asphalt concrete." |

Deputy head, R&D Center Yu. N. Romanenko

/signature/ /stamp: Testing laboratory ABZ-1 Station No. 2/

Certificate issue date:

31.03.2021

|  |  |  |
| --- | --- | --- |
| ABZ-1 JSC | Phone: (812) 542-39-79 | TIN 7804016807 |
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| 66 Arsenalnaya str. | e-mail: lab@abz-1.ru | PSRN 1027802506742 |
|  | www.abz-1.ru |  |

**References**

[1] Resolution of the Russian Federation Chief Public Health Officer No. 25 dated 13.02.2018 "On Approval of Hygiene Standards HS 2.2.5.3532-18 Maximum permissible concentrations (MPC) of hazardous substances in the working zone air" (along with HS 2.2.5.3532-18. Hygiene standards...) (Registered with the Russian Ministry of Justice No. 50845 dated 20.04.2018)

[2] SanPiN 2.1.7.1322-03. Hygienic requirements for the disposal and neutralization of industrial and household waste.

[3] SOP No. 2.2.2.1327-03. Hygienic requirements for process management, production equipment and service tools.