Plasticizer S-3 – universal admixture with stable composition and precise action, permitting wide range variation of concrete and mortar mixtures properties

Product summary

Plasticizer S-3 – an additive for poured concrete mixtures and construction mortars with normal setting time.

Plasticizer S-3 – excellent plastifying properties and effective water reducing action.

Plasticizer S-3 – has shown excellent results in the production of high quality commercial concrete and various reinforced concrete elements.

Plasticizer S-3 is the admixture which has perfectly proved by manufacture of high-quality ready-mixed concrete and concrete products of different function.

General provisions


2. Superplasticizer “Plasticizer S-3” is used for heavy- and light-weight concretes for the production of precast constructions and high-strength concrete B20 or higher, precast standpipes, for the production of densely clad constructions (like frames, beams, columns and frameworks of bridges), flags and panels in mold batteries, on circulate-aggregate and conveyer lines, in building of main constructions of monolith structures with high level of reinforcement and complex configuration.

3. Superplasticizer “Plasticizer S-3” is used with the aim of gaining of high-mobility concrete mixes (from P1 to P5) without concrete strength reduction, and also for strength increase, waterproofing and other concrete quality rates owing to water-reducing activity and gaining the combined effect with partial use of the first two.

4. Practicability of superplasticizer “Plasticizer S-3” in concretes and mortars usage is determined by gaining of different technological and economic rates of effectiveness in production of precast items and constructions and building of structures, and also rates of economic effectiveness of their exploitation.

5. Superplasticizer “Plasticizer S-3” can be used in combination with all special purpose admixtures – accelerators and retarders, air entrainers and other.
Material requirements.

1. Superplasticizer “Plasticizer S-3” with its quality rates must meet the requirements of TS 5745-001-97474489-2007 in dry and liquid form: in the condition of water-soluble brown powder and water solution of dark-brown color with the concentration of less than 32%.

2. For the production of concretes with superplasticizer “Plasticizer S-3” the use of cements and Portland cements (meeting the state standard 10178, 31108) is recommended.

3. Concrete fillers must meet the requirements of state standards 26633, 25820.

4. Concrete fillers must not include additions of reactive silica (opal, chalcedony and other).

5. The water for the preparing of concrete must meet the requirements of the state standard 23732.

The effectiveness of superplasticizer “Plasticizer S-3” usage

1. The technological and economical effectiveness of superplasticizer “Plasticizer S-3” usage in concrete mixes and in the production of precast constructions is given in Table 1.

<table>
<thead>
<tr>
<th>Indicators</th>
<th>Indicators changing in comparison with content without admixture</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>At W/C = const</td>
</tr>
<tr>
<td>Vibration time and intensity reduction</td>
<td>in 3 – 5 times</td>
</tr>
<tr>
<td>(or vibration quantity reduction, in some cases – refuse from vibration)</td>
<td></td>
</tr>
<tr>
<td>Items, constructions forming duration reduction</td>
<td>in 3 – 10 times</td>
</tr>
<tr>
<td>Saving of electric power by preparing, transporting and concrete mix placement</td>
<td>in 2.5 – 3.5 times</td>
</tr>
<tr>
<td>Labor efforts reduction by items production</td>
<td>in 2 – 3 times</td>
</tr>
<tr>
<td>Service life period of vibrators, forms, repair expenses increase</td>
<td>in 1.5 – 2 times</td>
</tr>
<tr>
<td>Items surface improvement, pores quantity reduction (at horizontal forming)</td>
<td>in 1.1 – 1.3 times</td>
</tr>
</tbody>
</table>
2. Superplastisizer “Plasticizer S-3” usage allows gaining of the following effects:

- giving higher mobility of concrete – from P1 to P5;
- reduction of water consumption in cement tempering by 20 – 25%;
- increase of end strength characteristics by 25% or more (in equally-mobile mixes);
- increase the concrete binding with installed reinforcement and metal items;
- gain concretes with high moisture resistance, crack resistance, frost resistance (350 cycles);
- lower cement consumption by 25%.

In Table 2 the superplasticizer “Plasticizer S-3” influence on concrete mix mobility and concrete strength.

<table>
<thead>
<tr>
<th>Admixture</th>
<th>Concrete mix</th>
<th>Concrete compression strength, MPa in the age, days</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Content</td>
<td>W/C</td>
</tr>
<tr>
<td>Control</td>
<td>---</td>
<td>0.5</td>
</tr>
<tr>
<td>Plasticizer S-3</td>
<td>0.5</td>
<td>0.5</td>
</tr>
<tr>
<td>#1</td>
<td>0.44</td>
<td>2370</td>
</tr>
</tbody>
</table>

Tests are made on the following materials:
- portland cement PC 500 (without admixture), meeting the state standard 10178-85;
- quartz sand microns =2.4, meeting the state standard 8736-85;
- crushed stone of granite fraction 5-20 mm, meeting the state standard 8267-93;
- water, meeting the state standard 23732-79.

3. The liquefying effect from superplasticizer “Plasticizer S-3” usage in production of pre-strained constructions is for placement facilitation, excluding “false” setting, prolonging the period of concrete mix workability. By this there is a strength and self-
Improving the properties of concrete

strain increase by 10-20%, frost resistance – by 10-20%, and also water- and gas-penetrability.

The liquefying effect of superplasticizer “Plasticizer S-3” is appropriate to use in concreting of thin-walled densely reinforced constructions, complex configuration constructions, monolith floors, roads and other.

4. In aerocretes the effectiveness of superplasticizer “Plasticizer S-3” is applied in quality of Portland cements binding agent and less – mixed binding agent (Portland cement + lime), and as silica component – thinly-milled quartz sand.

5. The addition into concrete mix of superplasticizer “Plasticizer S-3” helps to increase the strength characteristics of concrete (what is important for gaining high-strength concretes), increase of production output, cement saving, reduction of the period of strain passing from reinforcement to concrete and other.

In Table 3 given the approximate indicators of cement consumption reduction in concretes of different classes with usage of superplasticizer “Plasticizer S-3”.

<table>
<thead>
<tr>
<th>Concrete class</th>
<th>Slump, cm</th>
<th>Cement consumption reduction, %, addition of superplasticizer “Plasticizer S-3” in quantity, %</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0.4</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M200</td>
<td>0,4</td>
<td>2 – 4, 6 – 8</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4 – 5, 4 – 6</td>
</tr>
<tr>
<td></td>
<td></td>
<td>12 – 14, 3 – 4</td>
</tr>
<tr>
<td></td>
<td>0,8</td>
<td>22 – 24, 2 – 3</td>
</tr>
<tr>
<td>M300</td>
<td>2 – 4</td>
<td>6 – 8, 10 – 12</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4 – 6, 7 – 9</td>
</tr>
<tr>
<td></td>
<td></td>
<td>12 – 14, 5 – 7</td>
</tr>
<tr>
<td></td>
<td></td>
<td>22 – 24, 3 – 5</td>
</tr>
<tr>
<td>M400</td>
<td>2 – 4</td>
<td>12 – 15, 18 – 20</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4 – 5, 12 – 14</td>
</tr>
<tr>
<td></td>
<td></td>
<td>12 – 14, 10 – 12</td>
</tr>
<tr>
<td></td>
<td></td>
<td>22 – 24, 8 – 10</td>
</tr>
<tr>
<td>M500</td>
<td>2 – 4</td>
<td>15 – 18, 20 – 22</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4 – 5, 12 – 15</td>
</tr>
<tr>
<td></td>
<td></td>
<td>12 – 14, 16 – 18</td>
</tr>
<tr>
<td>M600</td>
<td>2 – 4</td>
<td>14 – 16, 20 – 22</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4 – 5, 12 – 14</td>
</tr>
</tbody>
</table>

6. In high-strength concretes production technology superplasticizer “Plasticizer S-3” is recommended to use:
with the aim of Portland cements use (class 500) (in some cases there is an opportunity of gaining concretes (class M 600) on Portland cement and slag Portland cement (class 400));
- at using of high-classes cements (classes 550 and 600) with the aim of consumption reduction;
- with the aim of substitution of large high-strength filler to less-strength.

8. At usage of superplasticizer “Plasticizer S-3” the gaining of high-strength concretes is possible, which are made from high-mobility and solid concrete mixes.

9. In concretes for transport structures the usage of superplasticizer “Plasticizer S-3” is recommended in observance of the requirements of normative documents and departmental recommendations on concrete works in transport construction.

10. Superplasticizer “Plasticizer S-3” is recommended to use in pre-strained concrete construction with cement consumption from 450 to 600 kg/m3 and to add in concrete mix content with the aim:
- dissolution of concrete mix without strength reduction in all periods of hardening;
- increase of concrete compression strength characteristics, axial tension and tension in bending without increase of cement consumption;
- extra increase of water-proofing and frost-resistance;
- providing of projected compression strength with reduced cement consumption.

11. At preparing of construction light concretes (classes M7.5-M200) superplasticizer “Plasticizer S-3” is recommended to use with the aim of:
- concrete mix mobility increase;
- concrete strength increase;
- cement consumption reduction.

12. Superplasticizer “Plasticizer S-3” can be used in production of construction-heat-insulated light concretes of classes M35 – M100 simultaneously with air-entrainers aiming at concrete mix water content reduction at optimal rigidity (5-10 cm) and selling concrete moisture, which is produced on water-demanding small fillers (ash and ash-slag mix thermoelectric power station, bellied pearlite sand and other).

13. At production of items from aircrete the use of complex admixture (superplasticizer “Plasticizer S-3” and alkali component) is recommended to use.
Projecting and concrete mix design

1. Concrete mix design with superplasticizer “Plasticizer S-3” is correcting of working content of concrete without admixture considering the aims of superplasticizer use.

2. The test concrete mixings with superplasticizer “Plasticizer S-3” must be done on the same fillers and cement, which are projected in calculating of concrete content without admixture.

3. Concrete mix design must be made under the state standard 27006 by any common practice method, which is meeting the project requirements of strength, mobility and rigidity of mix, volumes of entrained air or other indicators with post-correcting of them owing to water consumption reduction and setting of the optimal admixture quantity.

4. The concrete mix design must be made in lab conditions on dry fillers. During it one must consider water, which is in superplasticizer “Plasticizer S-3”. At concrete mix (with the superplasticizer) separating one should increase the content of small filler by about 10%. The preparing of all test mixings is made in lab mixer with obligatory determination of fresh mix density and precision of actual material consumption on 1 m³ of concrete.

5. All the lab-selected concrete contents and items and construction thermal treatment regimes must be corrected in the conditions of manufacturing.

6. At usage of superplasticizer “Plasticizer S-3” for improving of technology and quality of light concrete on manufacture the production content assumed as ground and its correcting is made according to the aims of concrete addition considering the following trends:
   a) at production of light concrete items and constructions, in forms on stream-aggregate or conveyer technology, the mobility of plasticized light concrete mix must not be more than 9 cm, and by stand technology – 15 cm. At production of items by upright-cassette method, and also volume elements the mix mobility can be increased to 15-17 cm and more. At high-mobility mixes content correcting firstly the arrangements must be made, which exclude the separation of light-concrete mix at content forming: for large filler the fraction of 5-10 mm grain density must be firstly considered, close to concrete density. The pore sand presence must be obligatory;
   b) at limited level of plasticizing the water and cement consumption with superplasticizer “Plasticizer S-3” is reduced during pass from $CS = 1-4$ cm (without admixture) to $CS = 5-9$ cm by 10%, and to $CS = 10-15$ cm – by 5%;
c) at adding of superplasticizer “Plasticizer S-3” aiming at cement saving the concrete content is re-calculated with reduced by 20% water and cement consumption, the required dosage of superplasticizer is determined and cement consumption is specified;

d) at adding of superplasticizer “Plasticizer S-3” aiming at increase of light construction concrete strength the concrete contents is re-calculated with reduced by 20% water consumption and after that the cement consumption is specified, which provides the required increased strength according to method theory, which is given above.

7. At usage of superplasticizer “Plasticizer S-3” for production of items from construction heat-insulated light concretes in horizontal forms the mobility of light concrete mix must not be more than 1-4 cm. Reducing of water content, which is causing concrete density increase, must be compensated by increase of the entrained air with appropriate consumption increase of air-entraining or pore-forming admixture. The consumption of the other components, density and strength of concrete are not changed.

**Preparation of water solution of the admixture**

1. The superplasticizer “Plasticizer S-3” is added to a concrete mix as water solution of working concentration. Working concentration of the solution is chosen by a consumer considering the technology requirements, using conditions and usability.

2. It is recommended to prepare the admixture solution at the positive temperature in thoroughly cleaned reservoirs impenetrable from precipitations reach. The solution must be made mixing until the full gaining of homogeneous product. After the long period of storing the solution must be mixed before using.

3. Calculation example.
Prepare 35% of superplasticizer “Plasticizer S-3” solution of working concentration. Install from passport-certificate or by experiment moisture content in dry superplasticizer “Plasticizer S-3”.
Assume that the moisture in dry product is $W = 8\%$. The mass of the admixture for solution preparing is 38.04 grams to 100 grams of the solution. Consequently, for the preparing of 100 kg of admixture solution of working concentration 38.04 kg of dry admixture and 61.96 kg (l) of water is needed.
For better solution the admixture must be added with intense mixing.
The solution is faster by the water temperature of 30-90°C.
Before using the solution of working concentration must be precipitated for 24 hours.
The density of the made solution must be determined by the temperature of 20°C (2 grades more or less).
The example of the calculating of the admixture quantity put in the mix

Assume that the quantity of the admixture put into the mix is 0.5%. The consumption of the admixture to 100 kg of cement:

\[
\begin{align*}
100 \text{ kg} & \quad 100\% \\
X \text{ kg} & \quad 0.5\% \\
\end{align*}
\]

kg of dry superplasticizer “Plasticizer S-3”.

The admixture is added as solution of working concentration (here – 35%). Consequently:

\[
\begin{align*}
0.5 \text{ kg} & \quad 35\% \\
X \text{ kg} & \quad 100\% \\
\end{align*}
\]

kg of solution of working concentration from the calculation for 100 kg of cement.

If the dosage of working solution of the admixture made in liters, not in kilograms, then:

where: \( m \) – admixture working solution mass in kilograms;
\( d \) – density of 35% admixture solution of working concentration \( g/cm^3 \).

If to 1 m\(^3\) spent, for example, 360 kg of cement, then by the dosage 0.5% of the admixture appears the working solution of superplasticizer “Plasticizer S-3”:

\( l \) (to 360 kg of cement).

If the dosage is in kilograms, then:

\( \text{kg} \) (to 360 kg of cement).

Quality control of concrete mixes and items with superplasticizer “Plasticizer S-3”

1. In usage of superplasticizer “Plasticizer S-3” in concrete technology, the manufacture control must be made during the following working stages:
   - in preparing (for preparing of the concrete mix with superplasticizer “Plasticizer S-3” admixture all kinds of concrete mixers can be used if the regular mixing is provided according to state standard 7473-85);
   - in transporting (the transporting of high-active and cast concrete mixes (cone slump more than 15 cm) to places of forming must be done by the devices, which construction does not allow the leakage of laitance and excludes immixing, the quantity of overcharges must be minimum);
   - in concretes hardening.

2. In concrete mix preparing one should control the duration of its mixing, the temperature, and the flow.

The test of the concrete mix should be made in 15 minutes after the take of sample according to the state standard 27006-86 “Concretes. Mix design regulations”. 
3. In concrete hardening one should control the chosen moisture-temperature regime, and in hardened concrete – its strength (in the control cubes and in items if necessary) and other required rates.

**Storing and dosage of superplasticizer “PLASTICIZER S-3”**

1. The recommended dosage of superplasticizer “Plasticizer S-3” is 0.3 – 1.5% from cement mass in dry substance calculation.

2. The adding of superplasticizer “Plasticizer S-3” to the concrete mix must be done simultaneously with the first portions of mixing water. In concrete manufacturing one should provide the uniformity of the admixture dosage according to the normative requirements.

3. The dosage of the admixture must be done precisely – 2 % less or more from its projected quantity.

4. The superplasticizer “Plasticizer S-3” in the condition of solution must be stored in reservoirs, protected from precipitation at positive temperature.

5. The dry product must be protected from moisture penetration and stored in dry room by the temperature not more than 35°C.

6. The shelf-life of superplasticizer “Plasticizer S-3”:
   - dry – 1 year;
   - liquid – 6 months.

   After the expiration date the admixture must be tested by all of the quality norm rates and, in case of state standards requirements answering, can be used in manufacturing.
The security requirements during the work with the admixture

1. The superplasticizer “Plasticizer S-3” is moderately dangerous substance and it relates to the third class of danger according to state standard 12.1.007. It does not separate harmful substances or steams. The admixture adding to the concrete mix does not change the toxic hygienic characteristics of concrete. The hardened concrete with the admixture does not separate toxic substances in the air.

2. In places of admixture and mixes solution preparing the combined extract and input ventilation must be considered.

3. Indoors, where the works with superplasticizer “Plasticizer S-3” are made, one should not use open flame and do electric welding works.

4. Superplasticizer “Plasticizer S-3” can cause the irritant action on the mucous membrane of eyes, breathing and unprotected skin. During the work the individual security equipment answering state standards 12.4.103 and 12.4.011. The workers, who make the admixture solution, must be provided with the special clothes (depending on the kind of work), shoes and hands, eyes and breath security equipment.