

**WIRES WITH PVC PLASTIC INSULATION  
IN VARNISHED BRAIDING FOR  
ON-BOARD CIRCUITS**

**Specifications**

**TY 16-505.911-76**

**(Supersedes TY OЭIII 505-192-60  
and TY 16-06-370-69)**

Translated by **RUSSTRANS**  
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Present specification covers wire with PVC plastic insulation in varnished braid for onboard circuits, further referred to as wire.

Wire are meant for fixed wiring of electrical circuit, including aviation engineering, and work at voltage upto 250 V of AC current with frequency upto 2000 Hz or 500 V of direct current and temperature from minus 60 upto plus 70<sup>0</sup>C.

Wires are manufactured in climatic designs YXJI and B in accordance with GOST B20.39.404-81.

Example of conventional designation of wire of grade БПБЛ with conductor/core/strand of cross section 0.35 mm<sup>2</sup>, of red color for ordering the same and in the documentation of other product:

"Wire БПБЛ 0.35 to TY 16-505.911-76".

Also, in climatic design B:

"Wire БПБЛ-T 0.35 to TY 16-505.911-76".

Example of conventional designation of wire of grade БПБЛ with wire conductor of cross section 0.35 mm<sup>2</sup> of red color with index "O" (Design B), for ordering the same and in the documentation of other product:

"Wire БПБЛ-0 0.35 to TY 16-505.911-76".

## 1. TECHNICAL REQUIREMENTS

1.1. Wire should correspond to requirements of present specifications and produced as per the technological documentation approved in established order.

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1.2. Grades, basic parameters and sizes/dimensions.

1.2.1. Wire are produced in grades:

БПВЛ – wire with copper tin coated strands with PVC insulation and cotton yarn braid or combined braid consisting of antiseptization twisted cotton yarn and synthetic threads in the ratio of 1:1, lacquer coated for onboard circuits.

БПВЛЭ - same as above, shielded

БПВЛА - wire with copper tin coated strands with PVC insulation and cotton yarn braid or combined braid consisting of antiseptization twisted cotton yarn and synthetic threads in the ratio of 1:1, lacquer coated for onboard circuits;

БПВЛМ - wire with copper tin coated strands with PVC insulation and combined braiding of glass and Capron thread, lacquer coated, small sized, for onboard circuit.

БПВЛМЭ - same as above, shielded.

After the hyphen put the word “T” for wire grade БПВЛ, БПВЛЭ, БПВЛА of climatic designs including those supplied to humid tropical climates.

1.2.2. Nominal section, number/qty and diameter of the strands, thickness of insulation, maximum external diameter of the wire should correspond to values given in

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table 1 for grades БПВЛ, БПБЛЭ, БПВЛА and table 2 for grades БПБЛМ and БПБЛМЭ.

Table 1

Nominal section of the strand, in mm	Number and nominal diameter of wire, in mm	Nominal thickness of insulation, in mm	Maximum outer diameter of the wire, in mm		
			БПВЛ	БПБЛЭ	БПВЛА
0.35	7x0.26	0.35	2.4	3.1	-
0.5	7x0.30	0.40	2.7	3.3	-
0.75	7x0.37	0.40	2.9	3.5	-
1.0	19x0.26	0.45	3.2	3.8	-
1.5	19x0.32	0.50	3.6	4.4	-
2.5	19x0.42	0.50	4.1	5.0	-
4.0	7x7x0.32	0.50	5.0	5.8	-
6.0	7x11x0.32 7x7x0.39 11x7x0.32	0.50	6.2	7.0	-
10.0	7x13x0.37 13x7x0.37	0.60	7.4	8.6	-
16.0	7x12x0.49 12x7x0.49	0.60	8.7	9.9	-
25.0	7x19x0.49 19x7x0.49	0.60	10.0	11.2	-
35.0	7x27x0.49 27x7x0.49	0.80	11.9	13.1	-

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Continuation of table 1

Nominal section of the strand, in mm	Number and nominal diameter of wire, in mm	Nominal thickness of insulation, in mm	Maximum outer diameter of the wire, in mm		
			БПВЛ	БПВЛЭ	БПВЛА
35.0	37x1.1	0.6	-	-	10.8
50.0	37x7x0.49	0.80	13.6	15.0	-
	19x14x0.49 37x1.3	0.60	-	-	12.3
70.0	7x27x0.68	0.80	16.6	17.3	-
	27x7x0.68 19x10x0.68 61x1.2	0.60	-	-	14.2
95.0	37x7x0.68	0.80	17.9	19.0	-
	19x14x0.68 61x1.4	0.70	-	-	16.4

Table 2

Nominal section of the strand, in mm	Number and nominal diameter of wire, in mm	Nominal thickness of insulation, in mm	Maximum outer diameter of the wire, in mm	
			БПВЛМ	БПВЛМЭ
0.35	7x0.26	0.30	2.1	2.6
0.5	7x0.30	0.35	2.3	2.8

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Continuation of table 2

Nominal section of the strand, in mm	Number and nominal diameter of wire, in mm	Nominal thickness of insulation, in mm	Maximum outer diameter of the wire, in mm	
			БПВЛМ	БПВЛМЭ
0.75	7x0.37	0.35	2.5	3.0
1.0	19x0.25	0.40	2.8	3.3
1.5	19x0.32	0.45	3.2	3.7
2.5	19x0.42	0.45	3.7	4.3

The lower maximum deviation from the nominal thickness of the insulation should not exceed:

For wire of grade БПВЛМ, БПВЛМЭ – 0.05-мм, for wire of grade БПВЛ, БПВЛЭ, БПВЛА with strand cross section 0.35 to 1.0 мм<sup>2</sup> – 0.05, with strand cross section 1.5 мм<sup>2</sup> and above - 0.1 мм.

The upper maximum deviation is not standardized.

The design weight is given in appendix 3 as a reference material. \*

As agreed between the parties, it is permitted to twist two or three wires of same cross section (upto 1.0 мм<sup>2</sup>) with a common shield, during this each wire should correspond to requirements of present specification. It is permitted to put the shield on two parallel-arranged wire.

1.2.3. The factory length for wire brands БПВЛ, БЛВЛЭ, БПВЛМ and БПВЛМЭ – not less than 15 m, and for wire БПВЛА – not less than 10 м. It is permitted to supply wire in length of 5m minimum in quantity 10% maximum from the common length of the supplying batch.

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If agreed between the parties, it is permitted to supply in any length

### 1.3. Design requirements

1.3.1. The current carrying conductors should be of copper tin coated or aluminium wires and should correspond to GOST 22433-77, class 3 for wire with cross section of the strand 0.75; 35.0 - 95.0 mm<sup>2</sup> and class 4 for wire with cross section of strand 0.35; 0.5; 1.0-25.0 and table 1 and 2 of present specification.

Partially non-tin coated wires in quantity not more than 2 in any strand cross section are permitted.

In the wire, maximum deviation from the nominal diameter of the strand wire is not standardized. Missing of wires in strands with cross section 4.0 mm<sup>2</sup> and above is permitted. During this the electrical insulation should correspond to GOST 22483-77.

Joining of separate wires or strand is carried out as per soldering or brazing method.

Brazing or soldering in one section is not permitted.

Distance between the place/spot of brazing or soldering should be minimum 200 mm for separate wires and minimum 3 m for separate strands.

1.3.2. The current-carrying conductor should be insulated with PVC plastic material. Put a braid of antisepticised twisted cotton yarn or combined braid consisting of twisted cotton yarn and synthetic threads in the ratio of 1:1 on the top of the wire of grade БПВЛ, БПВЛЭ, БПВЛА

Surface density factor of the braid should be minimum 90 %

In wire of grade БПВЛМ and БПВЛМЭ, mount a braid of glass and capron threads

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on the top.

Surface density factor of the braid should be minimum 95%. While cutting, thread should be trimmed short.

Presence of separate gray or off-shade of the thread is permitted in braids of white color.

Absence of strand for length 0.5 m and insignificant soiling for a length of maximum 200mm in quantity not more than 5 in factory length wire.

Braids of wire of grade: БПВЛ, БПВЛЭ, БПВЛА should be coated with ethyl cellulose or nitro-lacquer. Braid of the wire of grade БПВЛ, БПВЛЭ, БПВЛА of climatic design Б should be coated with ethyl cellulose.

Combined braid of wire БПВЛМ, БПВЛМЭ should have polyamide lacquer coating.

1.3.3. The wire should have colored braids. Coloring can be by introduction of color threads and also other method of coloring are permitted in agreement the design company.

For coloring the wire of grade БПВЛ, БПВЛЭ, БПВЛА, the following colors are used: white, blue, yellow and red. In case the color is not specified in the order, then the wire can be supplied in any color.

The wire should have distinctive thread of the manufacturer. The distinctive thread can be introduced in the braid in the form of strand as per the basic tone, except for wires of grades БПВЛМ and БПВЛМЭ.

Wire of grade БПВЛМ and БПВЛМЭ are produced in white colour. The coloring of wires of grades БПВЛМ and БПВЛМЭ is permitted by covering the braid by colour nylon thread.

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1.3.4. The electric shield should be in the form of a braid on copper wires of nominal diameter from 0.12 upto 0.26 mm, tin coated or tin-lead alloy with nominal content of tin minimum 61 %.

The ends of wires or strands in places of correction or breakages should be trimmed short.

Coefficient of surface density of the shielding braid should be minimum 70 %.

Missing of separate wires in the braid and also in the strands is permitted for a length of 4 times the pitch of the braid under the conditions that the strands of reverse direction are maintained.

1.3.5. Materials used for producing the wire should correspond to the following:

Copper tin-plated wire	- TY 16-505.850-75,
Aluminium wire of grade AT	- TY 16 K 71-088-90,
Silver soldering	- GOST 19738-74,
Wires of silver solder	- GOST 19746-74,
Tin	- GOST-860-75,
PVC plastic compound	- GOST 5960-72 or equivalent
Insulation of grade И 40-14 or И 40-13A	
Twisted cotton thread	
Antiseptized	TY 17 PCΦCP 63-4452-86,
Glass threads	GOST 8325-78 or equivalent,
Shining Capron thread grade Б quality1 thermo stabilized	TY 6-13-2-88,

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Polyamide lacquer No ПА-1	- OST 6-05-421-75
Ethyl cellulose lacquer ЭД-959	- TY 6-10-691-79,
Lacquer HIQ 995A	- TY 6-10-1700-78,
Polyamide thread	- TY 6-06-018-89,
Tin-lead solder	- GOST 21930-76 or GOST 21931-76
Polyester thread for wire industry	TY 6-13-40-90

#### 1.4. Requirements for electrical parameters

1.4.1. Electrical parameters of wire for acceptance and supply should correspond to norms specified in points 1.4.1.1 - 1.4.1.3.

1.4.1.1. Electrical resistance of the current carrying conductors to constant current calculated for 1km length and temperature 20<sup>0</sup> C should correspond to the values specified in GOST 22483-77.

1.4.1.2. The wire should withstand test voltage of 1500V of AC of frequency 50Hz for 1minute or 4000 V in pass in normal climatic conditions.

1.4.1.3. Electrical insulation resistance of wires in normal climatic conditions calculated for 1-meter length and temperature 20 °C should be, in MOhm, Minimum, for wires with strand cross section area of 4.0 mm<sup>2</sup> - 500, for wires with strand cross-section area of 4.0 mm<sup>2</sup> and above -10.

1.4.2. Value of electrical parameter of wire during the operation period and period of storage should correspond to norms, specified in point 1.4.2.1 - 1.4.2.3.

1.4.2.1. Electrical resistance of current carrying conductors to DC calculated for 1 km length and temperature 20 °C should be not more than 110 % from the value during

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acceptance and supply.

1.4.2.2. The wire should withstand test voltage of 750V of AC of frequency 50Hz for 1 minute in normal climatic conditions.

1.4.2.3. Electrical insulation resistance of wires in normal climatic conditions calculated for 1-meter length and temperature 20 °C should be, in M Ohm, Minimum, for wires with strand cross section area of 4.0 mm<sup>2</sup> - 500, for wires with strand cross-section area of 4.0 mm<sup>2</sup> and above-10.

1.5. Requirements for mechanical parameters

1.5.1. Braid of wire grade БПБЖМ should withstand testing of needle test point of diameter 0.5mm by contact with pressing force 5.9 N at needle double pass in strands of section

0.35 and 0.5 mm<sup>2</sup> - 3000

0.75 and 1.0 mm<sup>2</sup> - 5000

1.5 and 2.5 mm<sup>2</sup> - 8000

1.6. Requirements for resistance to external influencing factors (EIF).

1.6.1. Wire should be resistant to influence of mechanical, climatic and biological factors as given in table 3.

Table 3

Type of EIF	Characteristics of EIF, Unit of measurement	Characteristic value
1. Sinusoidal vibration	Frequency range, in Hz Acceleration amplitude, m.s <sup>-2</sup> (g)	1-500 400 (40)

Continuation of table 3

Type of EIF	Characteristics of EIF, Unit of measurement	Characteristic value
2. Acoustic noise level	Frequency range, Hz Acoustic pressure level (with respect to $2 \cdot 10^{-5}$ Pa), dB	50-10000 160
3. Single action mechanical impacts	Peak impact acceleration, $m \cdot s^{-2}$ (g) Duration, s	10000 (1000) 0.1-2
4. Multiple action mechanical impacts	Peak impact acceleration, $m \cdot s^{-2}$ (g) Duration, s	1500(150) 1-5
5. Linear acceleration	Value of linear acceleration, $m \cdot s^{-2}$ (g)	5000 (500)
6. Reduced atmospheric pressure	Reduced working pressure, kPa (MM.Hg.scale)	0.670 (5)
7. Increased atmospheric pressure	Increased working pressure, kPa (MM.Hg.scale)	295 (3)
8. Increased working temperature, °C	Increased working temperature, °C	70
9. Decreased working temperature, °C	a) Decreased working temperature under conditions of fixed wiring, °C b) Decreased working	

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Continuation of table 3

Type of EIF	Characteristics of EIF, Unit of measurement	Characteristic value
	temperature at which wiring bends of the wire, meant for operation in condition of fixed wiring is permitted	Minus 30
10. Change in temperature from high to low during operation		plus 70 minus 60
11. Increase in humidity	Relative humidity at temperature 35°C, in %. Rigidity group as per GOST 20.57.406-81	98
12. Salty fog	For unshielded wire	+
13. Dynamic dust (sand)		+
14. Static dust (sand)		+

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Continuation of table 3

Type of EIF	Characteristics of EIF, Unit of measurement	Characteristic value
15. The atmospheric condensed deposits (hoarfrost and dew)		+
16. Fungus for wire of climatic design B	Points, not more than	2

1.6.2 The wire should be resistant to short-term influence of oil and gasoline for 6 hours and kerosene of grades T-1 and TC – 1 for 20 hours.

1.6.3. The wire should be low inflammable; during this speed of spreading of the flame should not be more than 50 mm in 30 s.

1.6.4. Wire should be resistant to influence of the special factors established in the corresponding state standard with values of characteristics, corresponding to design group 1y - except for factors with characteristics И6, И7 and K.

During the process and directly after the influence of factors with values of characteristics И1, И2, И3, it is permitted to decrease the insulation resistance on 1m length up to value 0.1 kOhm with subsequent restoration up to the value  $3 \cdot 10^5$  Ohm for a period not more than 2 ms

During influence of factors with characteristics И8 - И11, the circuit and constructive wiring designs of the wire in the target should ensure value of switching

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pulse voltage on the wire insulation by more than 700V.

Coupling resistance of shielded wire at frequency 10 MHz on 1m length is given in reference appendix 3.

1.6.5. Wire of grades БПВЛ, БПВЛЭ with index "O" can be kept in conditions of influence of vapors of aggressive medium of fuel components, content of which in the air should not exceed the sanitary norms (not more than – for amyl 0,005 mg/litre, for heptyl - 0.0001 mg/litre).

General time of presence of wire in specified conditions should not exceed 6 months.

### 1.7. Requirements for reliability

1.7.1. Minimum operating time of wire in modes and conditions established in the present specifications should be 10000 Hrs at temperature up to 50 °C or 25000 Hrs for wires of grades БПВЛ, БПВЛЭ, БПВЛА at temperature upto 55 °C under condition of protection from continuous influence of oil, petrol, fuel mix, acids and other aggressive mediums and also at absence of influence of bends, torsions etc. while in operation.

Note. The operating time of wires for onboard electric circuit is not limited with the values specified in point 1.7.1 and determined by technical condition of the wire at the end of operating time.

1.7.2. The minimum shelf life of wire during storage in conditions of central heating and also wired in protection equipment or which is located in protected SPTA set should be 15 years for wire with minimum operating time of 10000 hours and 17.5 years for wire with minimum operating time 25000 Hrs.

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While storing the wire in other conditions, the minimum storage period is reduced in compliance with the factor specified in table 4.

Table 4

Place of storage as per GOST B.9.003-80	Reduction factor of minimum storage period	
	In the manufactures packing	Wired in un-protected apparatus or which are located in un-protected SPTA kit
Non-heated store-room	1.5	1.5
Under the shade	1.5	2
Open platform	Storage is not permitted	3

1.7.3. Minimum service life of the wire within the limits of which the minimum shelf-life is ensured while following the requirements for operating conditions should be 15 years for wire with minimum operating time of 10000 hour and 17.5 years for wire with minimum operating time of 25000 hours

Note: Minimum service life of wire of on-board electrical circuit grade is not limited by the values of point 1.7.3 and is determined by the conditions of the tables towards the end of the service life.

1.7.4. The recommended value of 95% operating life of wire is give in the appendix 3.



## 1.8. Requirements for marking

1.8.1. Marking of the wire should correspond to the requirements of GOST-BД 18690-89.

On the label, which is attached to the coils or the drum, the following should be specified:

Trademark of the manufacturer;

Conventional designation of the wire;

Designation of the specification;

Date of manufacturing, month, year;

Batch number;

Total length in meters, number of cut pieces and length of every cut pieces in meters for drums;

The label should have the stamp of the inspection department of the manufacture, and wire accepted by the customer's representative should have the stamp of the representative

1.8.2. Transport marking should correspond to requirements of GOST BД 18690-89 and GOST 14192-77.

## 1.9. Requirements for packing

1.9.1. Packing of the wire should correspond to GOST BД 18690-89.

1.9.2 Wire with cross-sections of the strands up to  $4.0 \text{ mm}^2$  should be supplied in coils, above  $4.0 \text{ mm}^2$  - either in coils or in drums.

1.9.3. Internal diameter of the coils or the diameter of the neck of drum should not be less than 20 times the outer diameter of the wire.

Not more than 6 cut pieces are allowed on one drum, and in coils- not more than 3 cut pieces of wire of the same grade, size and color.

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## 2. ACCEPTANCE PROCEDURES

Requirements for acceptance testing and test methods are sent only to the organizations having subscriber account on special inquiry.

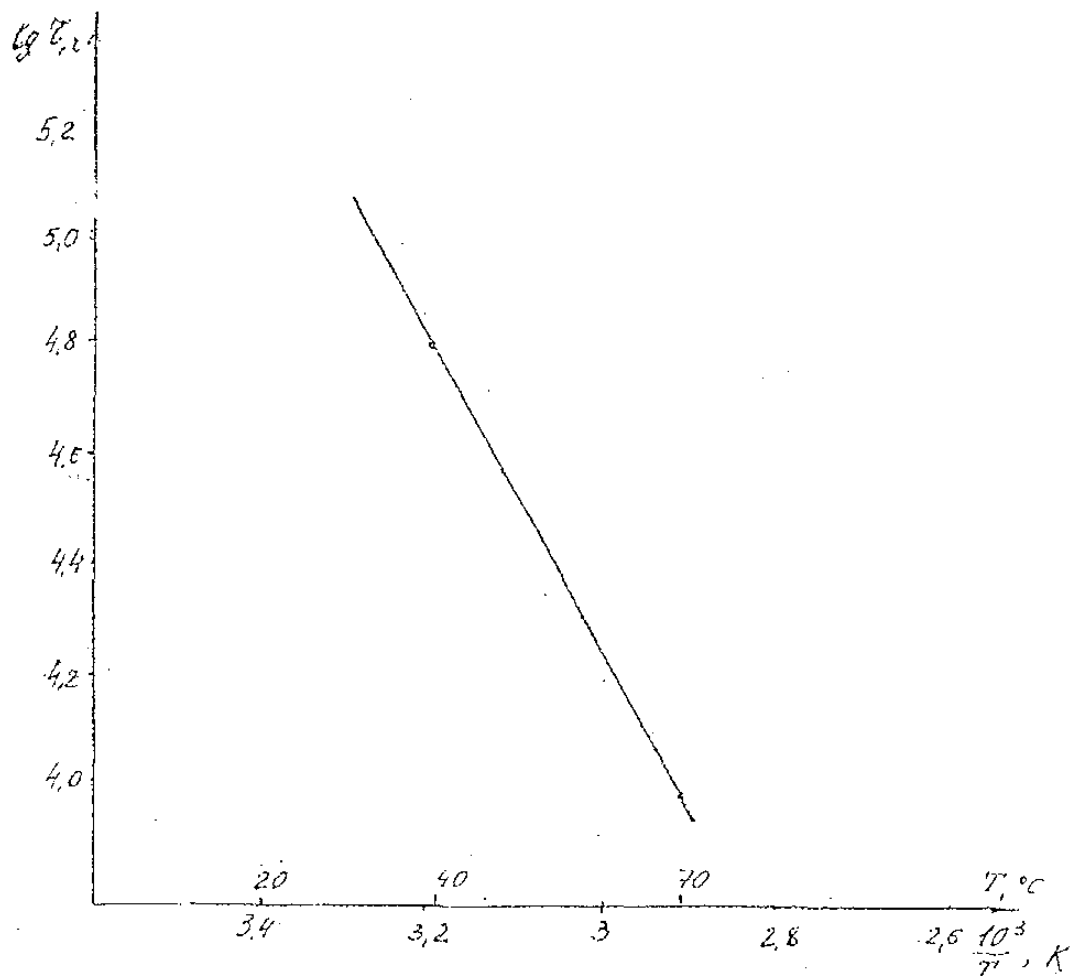
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## REFERENCE DATA

1. 95% operating life of the wire- 15000 hours and for wire meant for on-board electrical circuits of civil-aviation aircrafts under the conditions of influence of temperature bellow  $70^{\circ}\text{C}$ - 37500 hours.

2. Coupling impedance of shielded wire of grade БПВЛЭ with cross-section  $0.35 \text{ mm}^2$  at frequency 10 MHz for length – 75 mOhm.

3. Dependence of minimum operating time o the temperature bellow the permissible minimum value is give in the bellow give graph.



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4. Design weight of 1 km wire is given in table 1.

Table 1

Nominal section of the strand, mm <sup>2</sup>	Design weight of 1 km wire, in kg				
	БПВЛ	БПВЛЭ	БПВЛА	БПВЛМ	БПВЛМЭ
0.35	7.1	20	-	3.2	12.5
0.5	8.9	23	-	8.1	15.0
0.75	11.8	29	-	11.0	18.5
1.0	16.5	33	-	14.3	20.0
1.5	23	61	-	20.6	30.0
2.5	35	68	-	32.1	46
4.0	50	86	-	-	-
6.0	73	117	-	-	-
10.0	127	193	-	-	-
16.0	179	263	-	-	-
25.0	270	360	-	-	-
35.0	372	479	134	-	-
50.0	515	634	179	-	-
70.0	695	829	240.6	-	-
95.0	952	1100	326	-	-

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