



**59032.1-  
2020**

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**(IEC/TR 62001-1:2016, NEQ)**

**2020**

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IEC/TR 62001\*1:2016 « ( ).  
1. »  
(IEC/TR 62001\*1:2016 «High-voltage direct current (HVDC) systems — Guidance to the specification and design evaluation of AC filters — Part 1: Overview». NEO)

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29 2015 . > 162- « 26  
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(www.gost.fu)

© . 2020

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3	.....	2
4	.....	3
4.1	.....	3
4.2	.....	3
4.3	.....	8
5	.....	9
5.1	.....	9
5.2	.....	10
6	.....	12
6.1	.....	12
6.2	.....	12
6.3	.....	15
7	.....	18
7.1	.....	18
7.2	.....	19
7.3	.....	19
7.4	.....	19
7.5	.....	20
7.6	.....	22
7.7	.....	23
8	.....	24
8.1	.....	24
8.2	..... /	24
8.3	.....	27
( )	.....	29
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( )	.....	47
.....	.....	52

**High-voltage direct current power transmission.  
Guidance to the specification and design of AC filters. Part 1. Overview**

— 2021—01—01

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1.1

1.2

1.3

**2**

12.1.036

15150

16311

32144

56735 (IEC/TS 60815-1:2008)

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59032.1—2020

56736 (IEC/TS 60815\*2:2006)

2.

59032.3

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14.13330.2018

11\*7\*81\*

20.13330.2016

2.01.07\*85\*

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3.1

(specification):

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(customer):

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3.4 (branch arm): , , ,  
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3.5 (sub-bank): , , -  
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##### 4.2.1.1

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4.2.1.6  
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4.2.1.8

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56736.

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4.2.2				-
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4.2.10

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5.1

5.1.1

n-  $K_{U(n)}$  %.

\*«.>= £'00%. (1)

$U_n$

( ) ;

$$K_U = \sqrt{\sum_{n=2}^N U_n^2} \quad (2)$$

N

$$N^{-2} \quad (3)$$

1

N 49.

2

(1) (U]

5.1.2

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6 -

6.1 -

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5.7.11.13.17.19,... 6 ± 1 ( — «6-» -

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 7,13.19. 25,... 6 + 1 — ;

11.13. 23.25.... 12/ ± 1;

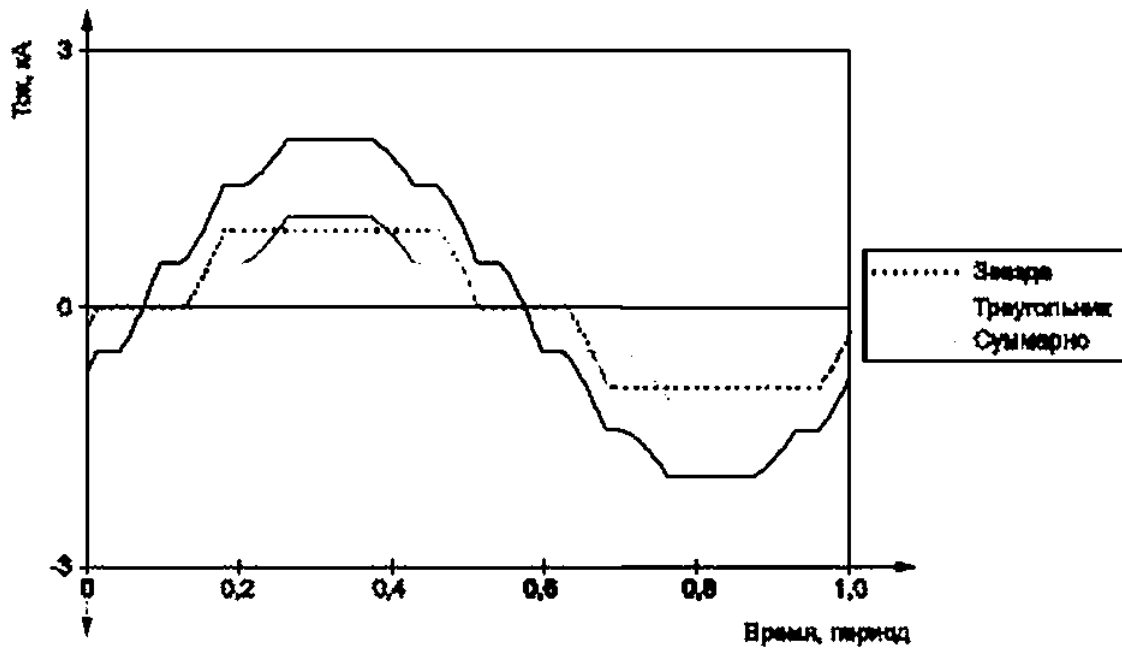


Рисунок 1 — Идеальная форма фазного тока на стороне переменного тока трансформатора преобразователя

- $F = 50$  —
- $- 230$  —
- $U_d = 500$  —
- $I_d \ll 1000$  —
- $X_s = 14\%$  —
- $= 15$  —

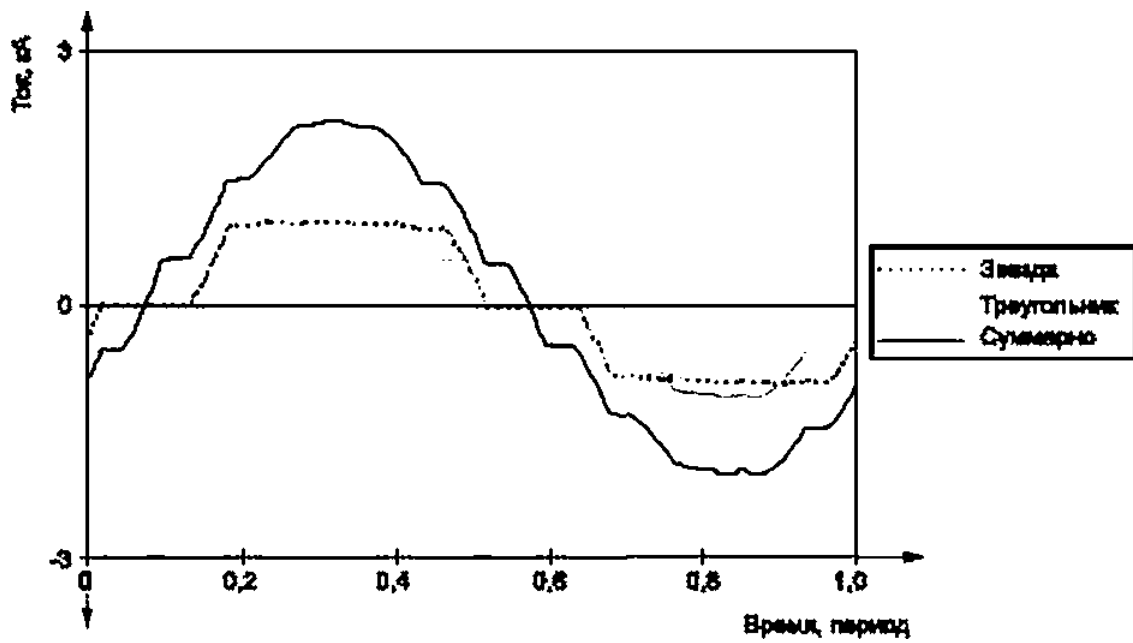
6.2.2



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12\*

2.



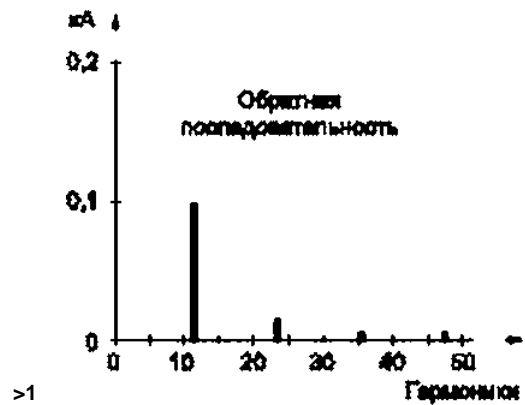
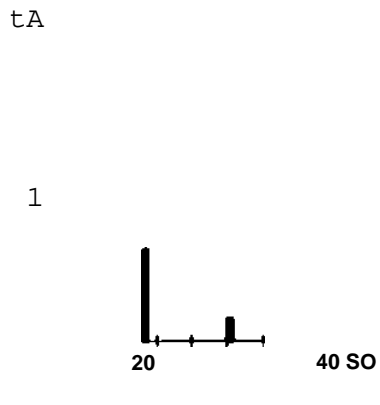
2—

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- 1% —
- 5% ( X<sub>1</sub>) —
- ±0.5\* —

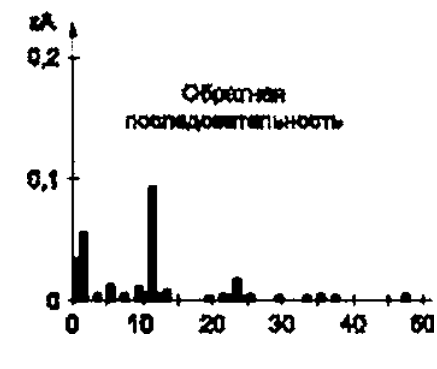
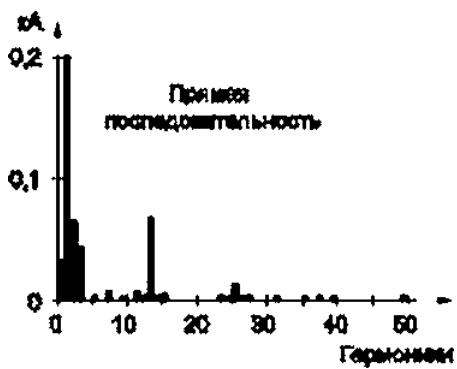
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6.3.1

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6.3.2

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6.3.3

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6.3.4

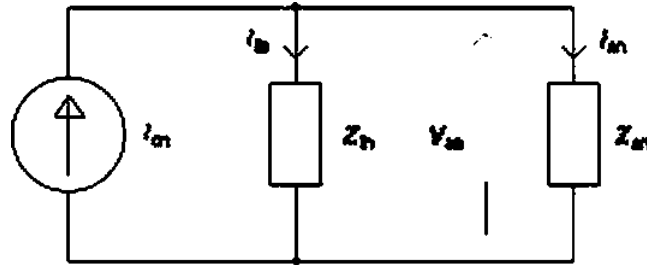
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7.1

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4).



$Z_n$

4—

$$I = i_{en} \frac{Z_n}{Z_n + Z_n} \quad (4)$$

$$I = \frac{i_{en}}{2} \frac{Z_n}{Z_n + Z_n} \quad (5)$$

$Y_n$

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$Z_{sn}$

7.3

$v$ ;

7.4

( 4)

$Z_n$



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7.5.3

7.5.4

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7.6

7.6.1

7.6.2

- 0 80 < 5:
- ±75\* 5 S < 11;
- ±70° 11 £ £ 49.

Z<sub>max</sub> , —

Z<sub>min sc</sub> —

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7.6.3

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2 \* 100 %. 3 50%. 4 « 33.3 %

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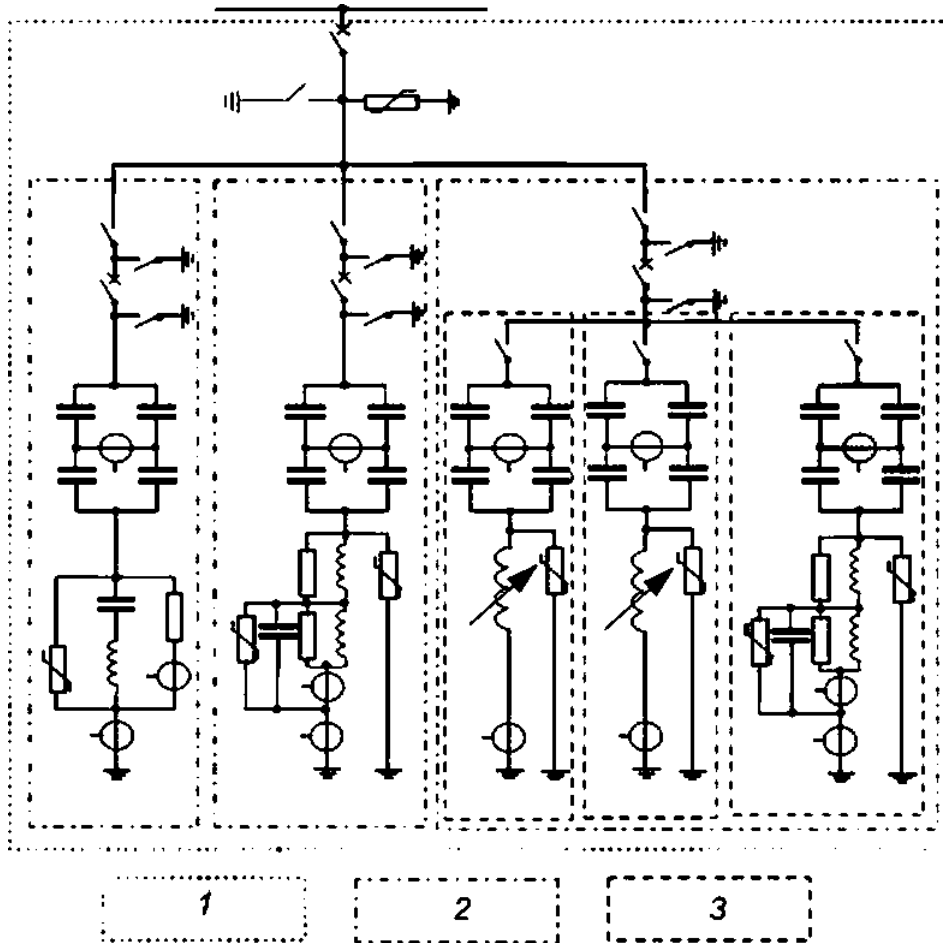
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8.2

8.2.1

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8.2.2

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8.2.3

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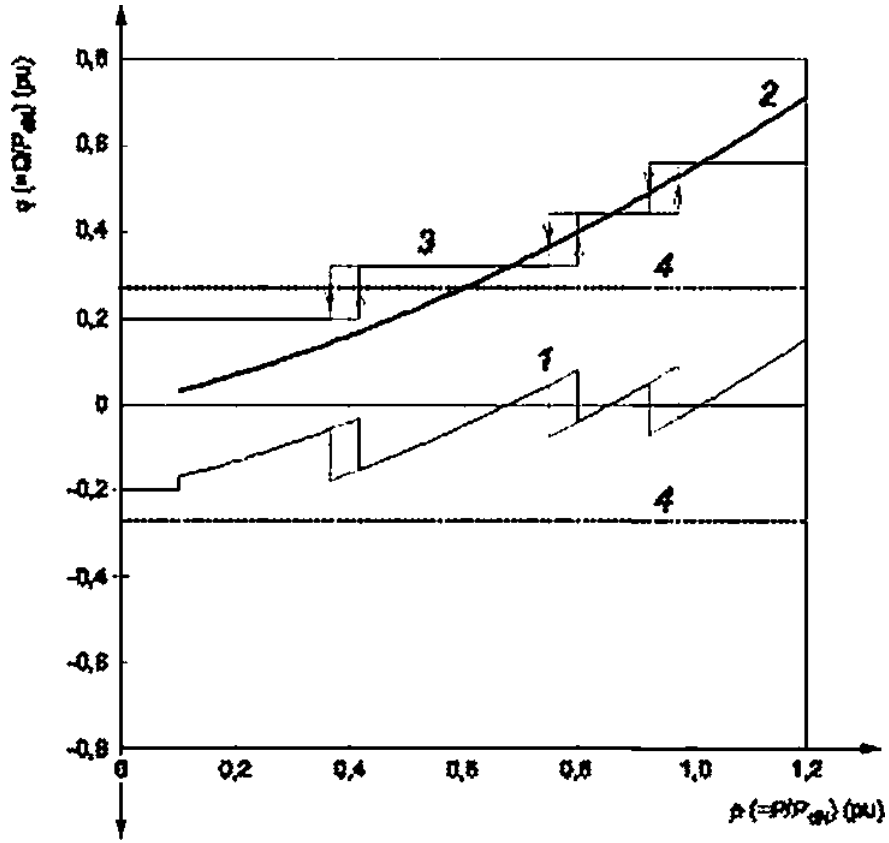
6. 1 — 2 /

3 ( $Q_{\text{exc}(\text{hng})}$ )

4 ( $Q_{\text{ae}(\text{hmi}i)}$ )

7 .

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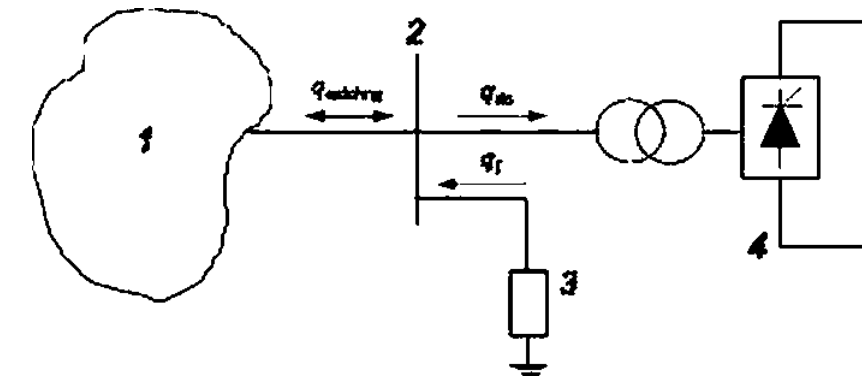


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<4>-3

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.1

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.2.1

THFF

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$U_n$  —  
 $N$  —  
 $U$  —

$\approx 1^{\wedge} < 2$

$\approx 5$

$f_o$  —

(50 ).

THFF

1 %.

.2.2

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$Pt$  —  
 $If$  —

$f.$   
 $f.$

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( .4)

$N$  —  
 $I$  —  
2)

\*16  $I_j^{\wedge} -1$

( .5)

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$$7 < \dots < 20$$

$$1 < / \wedge < \dots$$

.3.1

TIF

$I_s$

$$TIF = \frac{\dots}{\dots} \quad (16)$$

$U_n$  —  
 $N$  —  
 $IV_n$  —

TIF

{ ... };

$$W = C_{\dots} 5nf_n \quad (.7)$$

$f$  —

(60 ...).

TIF

.3.2

IT

T1F

15 50.

$$= U_n W X \quad (.8)$$

$I$  —  
 $N$  —  
 $kV_n$  —

T1F

(.7).

15 000 50 000.

.3.3

$$= j Y_n (w_n \dots) \quad (.9)$$

$N$  —

(1000 ...),

$I$  —

( ... )

$$+ ( I / )^2 \quad \{ 10$$

$i_m$  —

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								$I_{eq}$	-
	(	TIF	THFF						-
									-
			TIF	THFF					-
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6.

$$I_{\text{me}} = \frac{tAafr}{Mme} \cdot 1. \quad (1)$$

$F_n$   
 $U_{v-ve}$

$N_b$   
 $I_d$

$F_n$

$$F_n = 2 \cdot t \cdot B^2 \cdot \dots \quad (2)$$

$$A = -L \cdot \sin(n+1)l \quad (3)$$

$$S \llcorner L \cdot \sin(n-1)l \quad (4)$$

(.5>

$cftc_N$   
 $I_d$

$^dnN$

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$I$   
 $N$   
 $F_n$

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.3.1

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.4.1— .4.3.

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.3.2 ( . . . )

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.3.3 « »

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R— . L— .

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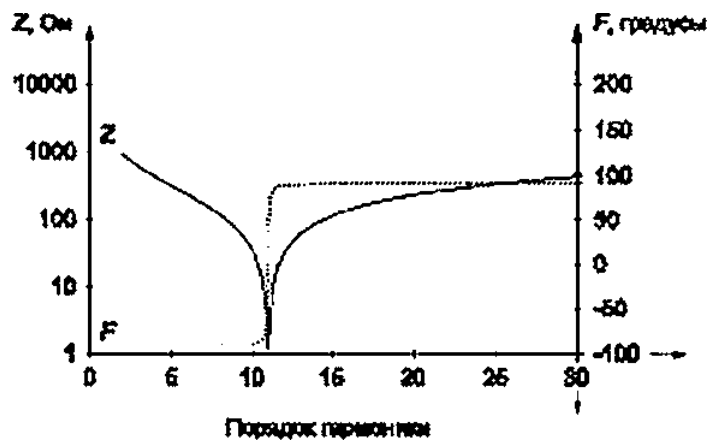
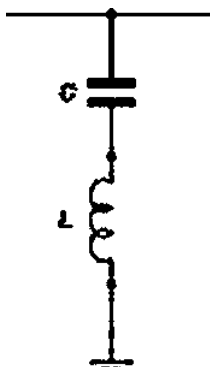
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.4.1



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$$\frac{1}{2 \cdot 4} \quad ( .2)$$

$I_q$  —

Q

$$Q - \frac{2n^2 Q^2 L}{t} \quad ( . )$$

Q

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Q.

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( 11.13. 23.25 . . ).  
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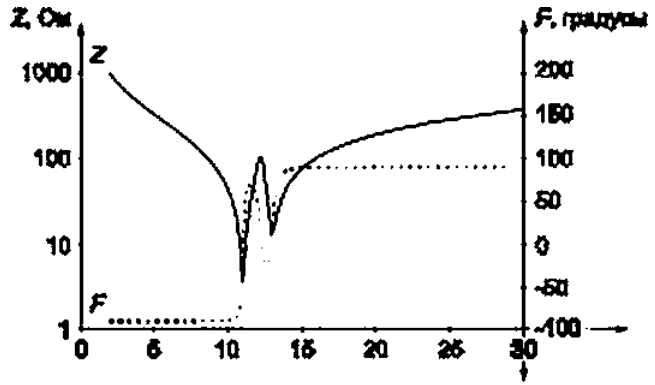
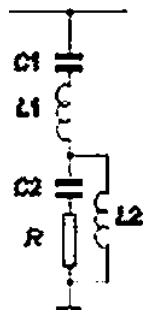
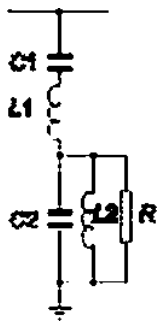
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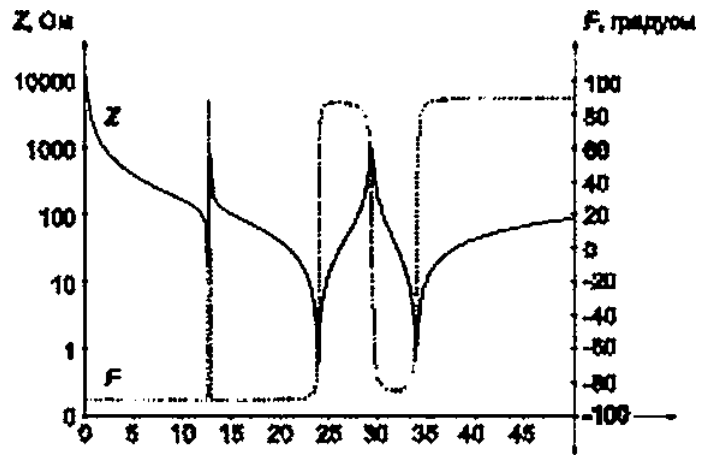
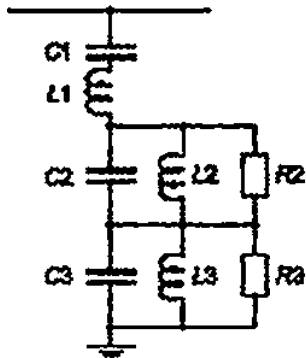
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.4.2.

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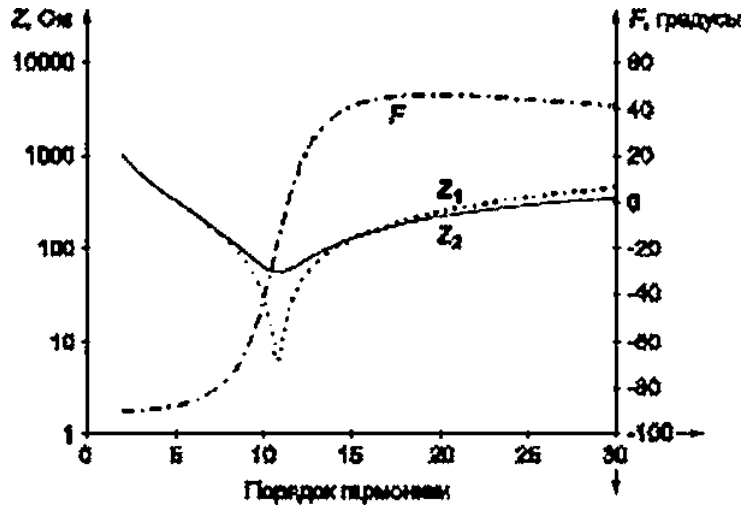
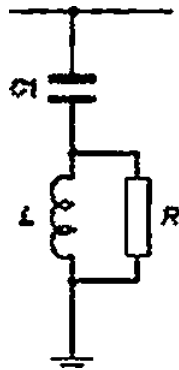
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$$Q = \frac{R}{\sqrt{L^2 + R^2 C^2}} \quad (.4)$$

$$\frac{L}{R^2 C} \quad (.5)$$

(.4.1). Q (Z). R.

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- 1)
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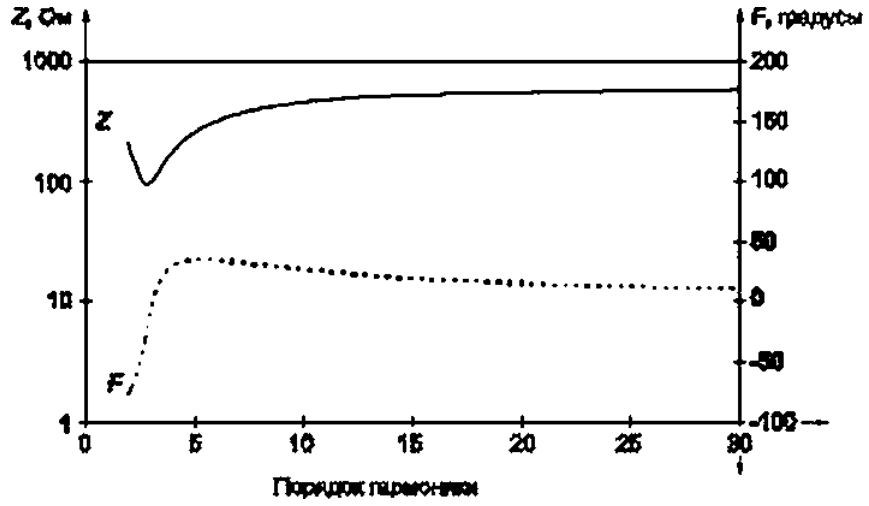
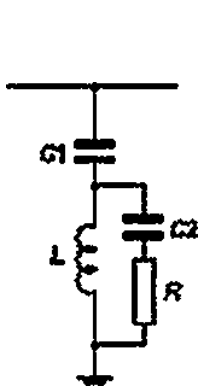


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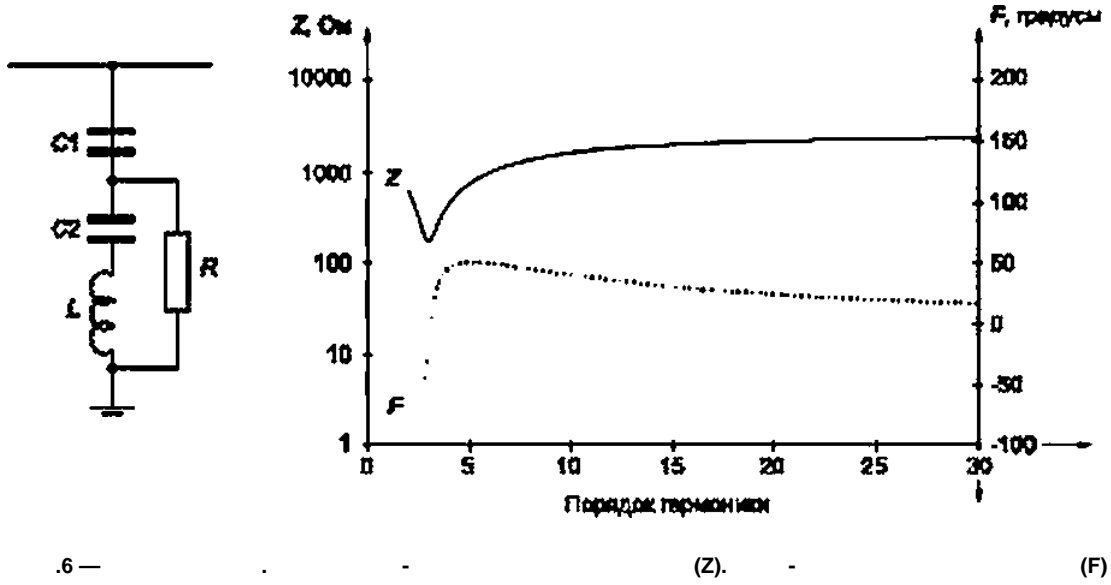
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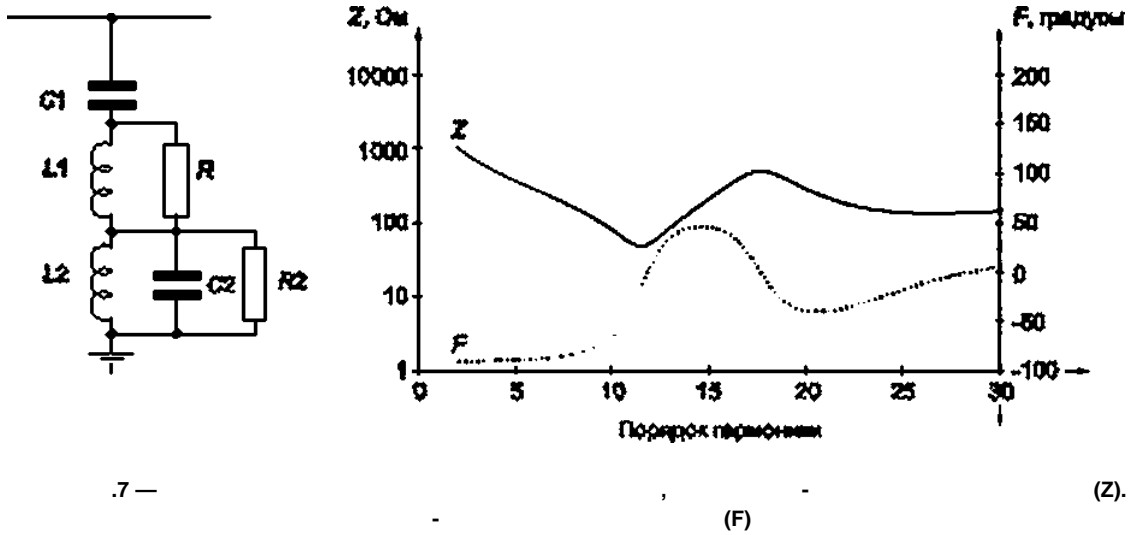
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$$3 = \frac{Af_1}{\%Lh} + \frac{AL}{\%Lh} \quad (.1)$$

$$v \cdot 1[ al' ] = < 2 >$$

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$$f = f_0 j / ^ . \quad (. )$$

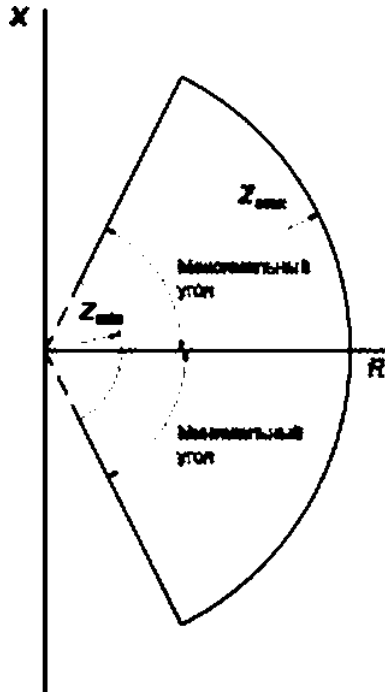
$$= ' + . \quad ( -4 >$$

$$= ' - \quad < .5 >$$

l ( f\_min / 1 f\_n .

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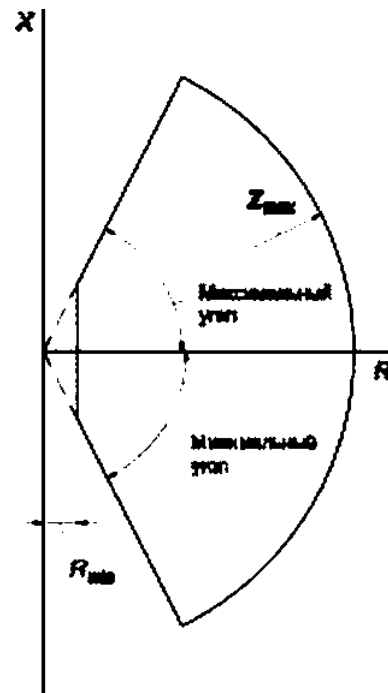
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$Z_{mn}$

$Z_{max}$



.2 —

$Z_{max}$

( . . . .1)

( . . . .2).

$Z^x$

$X_{wiir}$

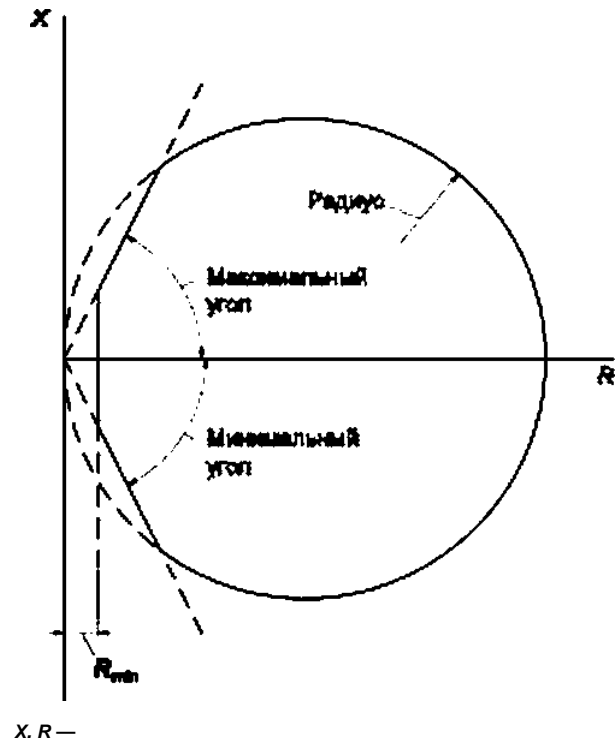
( . . . .1) —

$Z^$

$Z^ R_{mn}$

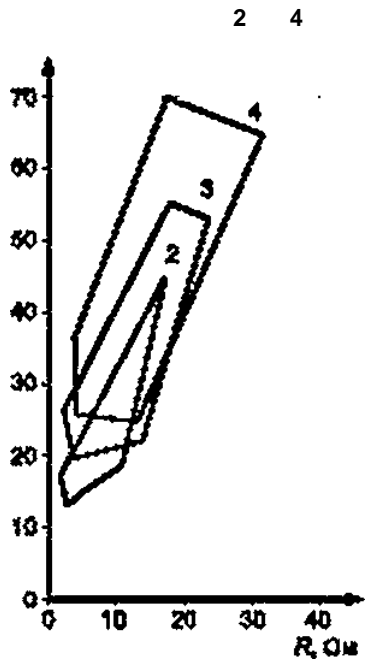
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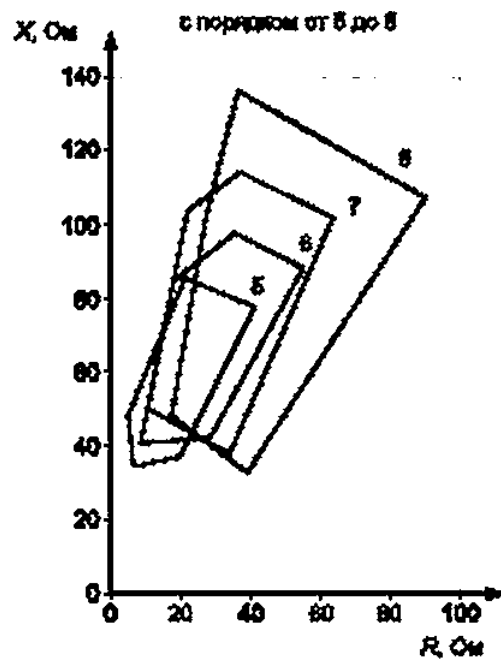
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X. —

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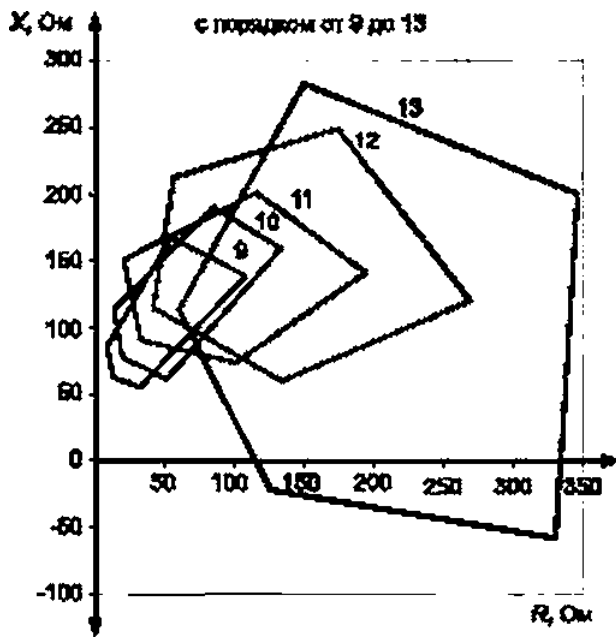
2 4



X, R — реактивная и активная составляющие импеданса сети

.5—

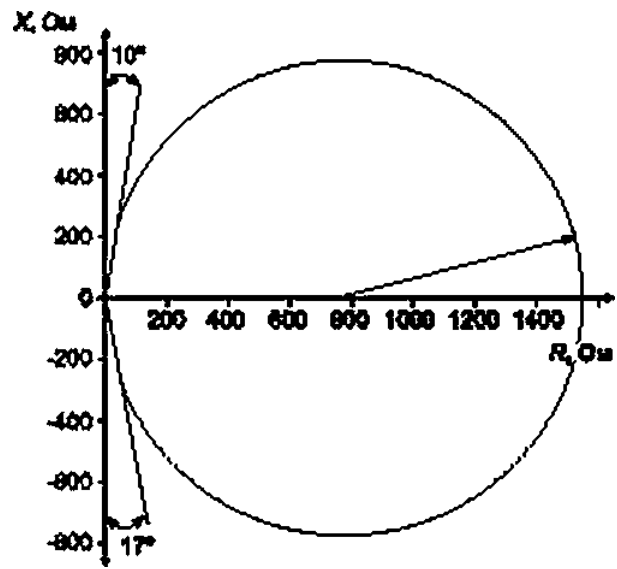
5 8



X. —

.6—

9 13



X, R —

.7—

14 49



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.4— .7 R.7 -

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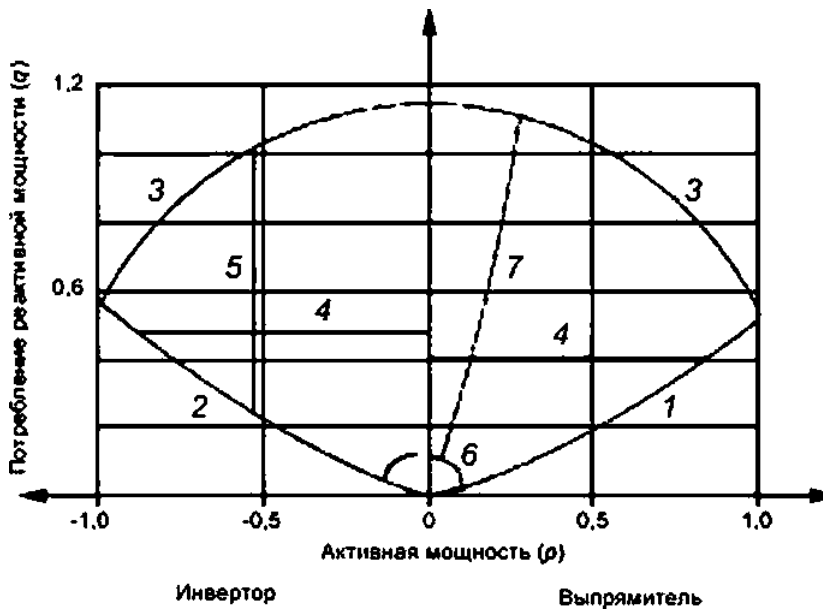
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1—

U

2—

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(5°); 3°

; 5—

; 4—

: 7—

<U<sub>max</sub>)

.1—

1. 2. 3.

.2

$$-Q = 35 \cdot 6_1 = 40'' = 1,2 \cdot N$$

( \* ),

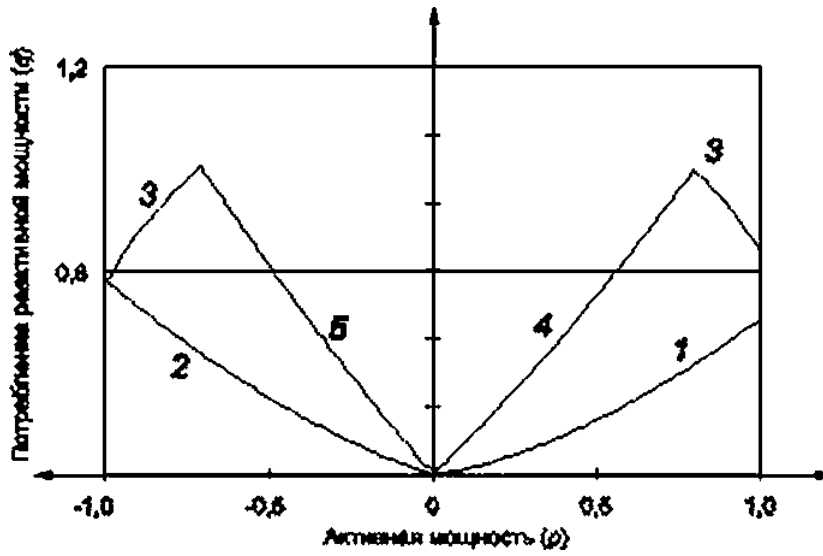
U<sub>дто</sub> (

$$\frac{3^{\wedge}..}{i-iJ}$$

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= 1.0 . . .

$U_{dio}$   
6.



1 —  
( ^ ) 3 —

U . 2 — . 4 —

(0^): 5 —

.2 —

$$= 1 - 5TM = \alpha' \cdot \%, = 5' - \alpha = 35'$$

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$U_{dio}$

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.1.2

90°

$I_d$

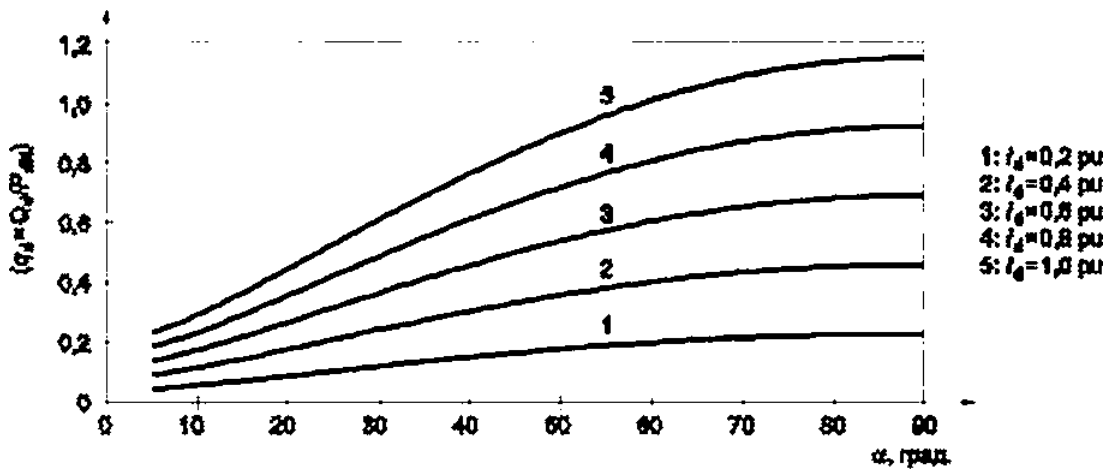
$U_{d10} - U_{d10N}$

7.7.

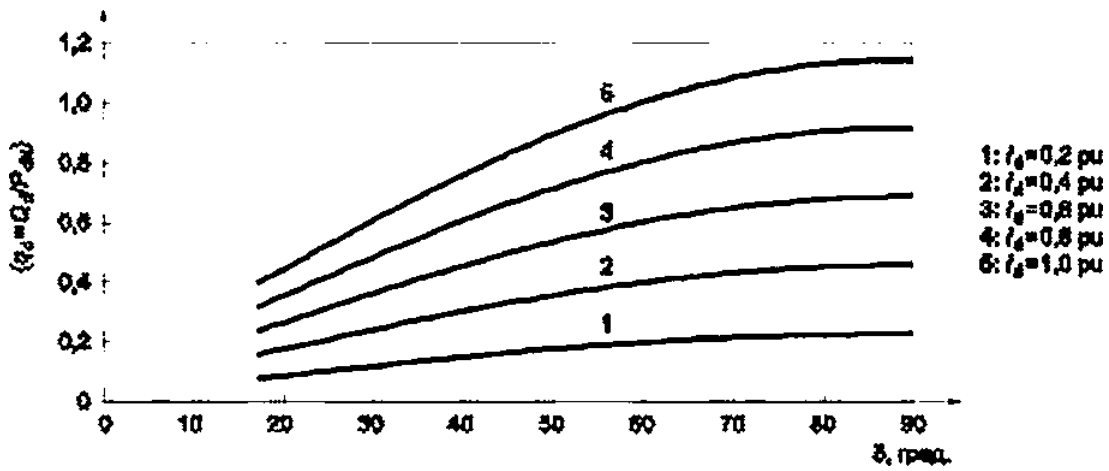
5

6.

\*.1



$U_{d10} = \dots = 9.4\% \quad d = 0.2\%$



.4—

do dan  $\langle \dots \rangle = 9.4\% \quad d = 0.2\%$

6



QcO S  
 / ), / ( , -  
 1/ S U  
 $s = \sqrt{u_{+a_{40}}}$  ( . )

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- [1] 60507:2013  
{Artificial pollution tests on high-voltage ceramic and glass insulators to be used on a.c. systems)
- [2] 62271-1:2017  
(High-voltage switchgear and controlgear — Part 1: Common specifications for alternating current switchgear and controlgear)
- [3] 2.2.4-2.1.8.562-96
- [4] IEC/TR 60146-1-2:2011  
1-2: (Semiconductor converters and line commutated converters — Part 1 -2: General requirements and application guide)

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621.316.1:006.354

29.240.01

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