

• • , • • , • •

« »

1. . -

[1].  
 ( ) [2, 3] ( ) [4, 5], -  
 ( 2-4 ) -  
 ( 1.5 ) -

[6-10]

2. . -

$t < 8^{\circ}\text{C}$ .

$\alpha = 0^{\circ}$ ,  $\beta = \varphi + 15^{\circ}$ ,  $\varphi$  -  
 , :

$$Q = Q^{\max} \frac{t - t}{t - t},$$

$Q^{\max}$  - , , -  
 $t = t$  [11, . 12].  
 , / :

$$E = 24 \cdot 3600 n Q,$$

$n$  -

$$, \quad /(\text{ }^2. \text{ }):$$

$$e \text{ } = KE \text{ ,}$$

$$E \text{ } -$$

$$, \quad /(\text{ }^2. \text{ } ) \text{ } [12, \text{ } . 16], K \text{ } -$$

$$,$$

$$K \text{ } \text{ } :$$

$$K = \left( 1 - \frac{E}{E} \right) K + \frac{1 + \cos \beta}{2} \frac{E}{E} + \frac{1 - \cos \beta}{2} \rho \text{ ,}$$

$$E \text{ } -$$

$$(\text{ } \text{ } ) \text{ } -$$

$$, \quad /(\text{ }^2. \text{ } ) \text{ } [12, \text{ } . 16]; \rho \text{ } -$$

$$,$$

$$\rho = 0.2 \text{ ,}$$

$$\rho = 0.7 \text{ ; } K \text{ } -$$

$$:$$

$$K = \frac{\cos(\varphi - \beta) \cos \delta \sin \omega + \frac{\pi}{180} \omega \sin(\varphi - \beta) \sin \delta}{\cos \varphi \cos \delta \sin \omega + \frac{\pi}{180} \omega \sin \varphi \sin \delta} \text{ ,}$$

$$\omega \text{ , } \omega \text{ } -$$

$$-$$

$$, \text{ } ,$$

$$\omega = \arccos(-\operatorname{tg} \varphi \operatorname{tg} \delta) \text{ , } \omega = \min \{ \omega \text{ , } \arccos [ - \operatorname{tg} (\varphi - \beta) \operatorname{tg} \delta ] \} \text{ ;}$$

$$\delta \text{ } -$$

$$, \text{ } ,$$

$$\delta = \frac{1}{n} \sum_{m=n_1}^{n_2} 23.45 \sin \left( 360 \frac{284 + m}{365} \right) \text{ ,}$$

$$n_1 \text{ , } n_2 \text{ } -$$

$$(\text{ } \text{ } 1 - \text{ } \text{ } ) \text{ .}$$

$$, \quad /(\text{ }^2. \text{ } ) \text{ }:$$

$$e \text{ } = \eta \text{ } \eta \text{ } \Phi e \text{ } n$$

$$\eta = \frac{1}{2} \left( \frac{1}{\eta} + \frac{1}{\eta} \right) ; \eta = \frac{1}{2} \left( \frac{1}{\eta} + \frac{1}{\eta} \right) ; \Phi = \frac{1}{2} \left( \frac{1}{\eta} + \frac{1}{\eta} \right) ;$$

$$=1-a_1P+a_2P^2\,,$$

$$a_1,\,a_2 = \frac{1}{2} \left( \frac{1}{\eta} + \frac{1}{\eta} \right) , \qquad \qquad \qquad ;$$

$$P=\frac{t-t}{K}\,,$$

$$K = \frac{1}{2} \left( \frac{1}{\eta} + \frac{1}{\eta} \right) [12, \quad .16]; \, t = \frac{1}{2} \left( \frac{1}{\eta} + \frac{1}{\eta} \right) - \frac{1}{2} \left( \frac{1}{\eta} + \frac{1}{\eta} \right) , \, t = t + 5^{\circ}\text{C}; \, t = \frac{1}{2} \left( \frac{1}{\eta} + \frac{1}{\eta} \right) - \frac{1}{2} \left( \frac{1}{\eta} + \frac{1}{\eta} \right) .$$

$$F, \quad ^2 ( \frac{1}{\eta} + \frac{1}{\eta} ) - \frac{1}{2} \left( \frac{1}{\eta} + \frac{1}{\eta} \right) ):$$

$$F=\frac{E}{e}.$$

$$, \quad / \quad :$$

$$E = e \, F \, .$$

$$(\frac{1}{\eta} + \frac{1}{\eta}):$$

$$f = \begin{cases} E/E & E < E \\ 1 & E \geq E \end{cases} ,$$

$$:$$

$$f = \frac{\sum \min(E, E)}{\sum E};$$

$$, \quad ^3 \quad :$$

$$B=\frac{f\,E}{E\,\eta}\,,$$

$E$  – , / [13, . ];  $E$  – , / <sup>3</sup> / ;  $\eta$  – -

**3.** -  
 . -  
 -  
 $t$  -  
 ( ).  
 :

$$\varepsilon = \nu \frac{273+t}{t-t_0},$$

$\nu$  – ,  $\nu=0.5$ ;  $t$  –  
 ;  $t$  –  
 ,  $t_0=0^{\circ}\text{C}$ .  
 , :

$$Q_1=Q_2,$$

$Q$  – .  
 , :

$$W=\frac{Q}{\varepsilon}.$$

: ,

$$Q_1=Q_2-W=Q\left(1-\frac{1}{\varepsilon}\right).$$

, / :

$$q=\frac{1}{R}(t-t_0),$$

$R$  – ,  $^{\circ}/$  ;  $t$  – ,



	$t_{\text{max}}=20^{\circ}$ .	-
	$t=18^{\circ}$ .	
	$t=35^{\circ}$ , $t=25^{\circ}$ .	
	$\Delta t=4^{\circ}$ .	-
	:	
	$Q^{\text{max}}=q \cdot F$ ,	
	$q=$ , $\sigma^2$ , $q=(t-t)/R$ ;	
	$R=$ ,	
	$\sigma^2/\sigma^2$ , $R=0.024DF/(e \cdot F)$ ; $e=$	
	$e=113$ , $\sigma^2/\sigma^2$ .	[13]
	$q=50.5 \sigma^2$ , $Q^{\text{max}}=6.06$ .	-
	$E=3.6 \cdot 10^{-3} e \cdot F=48.8$ .	
	:	-
	$\eta=0.75$ , $a_1=7.9 \cdot 10^{-3}$ , $a_2=1.6 \cdot 10^{-5}$ .	
	$\eta=0.97$ .	
	$R$	-
	[4, 10, 14]	-
	$R$	-
	(...1).	
	[15].	-
	$R=0.15 \sigma^2/\sigma^2$ .	
	:	-
	$E=34.4 \cdot 10^6 \sigma^3$ ;	
	$\eta=0.9$ .	
	<b>5.</b>	
	$\cdot 2 \cdot 3$	-
	.	-
	.	-
	.	-
	,	
	.	

1.

$R$  , ° / .

	$R$		$R$
$(\lambda > 3 \text{ } / ( \cdot ^\circ ))$	0.11	, -	0.15
( )	0.12	( )	0.17
,	0.13	,	0.2
( )	0.14	$(\lambda < 1.5 \text{ } , / ( \cdot ^\circ ))$	0.38

2.

	XI	XII	I	II	III
$t$ , °	2.5	-2.1	-5.5	-4.1	-0.8
$E$ , /	5.94	7.70	9.00	8.48	6.58
$E$ , /	2.35	1.75	1.96	3.29	6.58
$f$	0.40	0.23	0.22	0.39	1
$F = 46 \text{ } ^2$ ; $f = 0.42$ ; $B = 662 \text{ } ^3$ .					

3.

	XI	XII	I	II	III
$Q$ ,	2.29	2.97	3.47	3.27	2.54
$Q$ ,	1.81	2.32	2.68	2.54	2.00
$\varepsilon$	4.75	4.54	4.40	4.46	4.67
$f$	0.79	0.78	0.77	0.78	0.79
$h = 50.3$ ; $Q = 3.47$ ; $W = 0.79$ ; $f = 0.76$ ; $B = 1201 \text{ } ^3$ .					

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