



Е.В. Тарасов

**МОНТАЖ, НАЛАДКА, ЭКСПЛУАТАЦИЯ
ЭЛЕКТРООБОРУДОВАНИЯ**

**ВОЗДУШНЫЕ И КАБЕЛЬНЫЕ
ЛИНИИ**

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Учебное пособие

2010

M>D 621.31

L19

LZjZkh\ ?.<.

L19 FhglZ`, gZeZ^dZ, wdkiemZIZpby we_dljhh[hjm^h\Zgby. QZklv I.
<ha^mrgu_ b dZ[_evgu_ ebgb we_dljhi_j_^Zqb: mq_[gh_ ihkh[b_ /
?.<. LZjZkh\; Lhfkd b ihebl_ogbq_kdb mgb_jkb_l. – Lhfkd: Ba^
\h Lhfkd[h]h ihebl_ogbq_kdh]h mgb_jkb_lZ, 2010. – 146 k.

< ihkh[bb hibkZgu we_f_glu dhgk ljm d pbc \ha^mrguo b dZ[_evguo eb-
gbc we_dljhi_j_^Zqb, bo fhglZ`Z, j_fhglZ , l_ogbq_kdh]h h[kem`b\Zgby b wdk-
iemZIZpbb.

Ij_^gZagZq_gh ^ey klm^_glh\ ^g_ghc b aZhqghc nhjf h[mq_gby ki_pb-
Zevghklb 140211 «We_dljhkgZ[_gb_» gZijZ\ e_gby 140200 «We_dljhwg_j]_lb-
dZ».

M>D 621.31

J_p_ga_glu

DZg^b^Zl l_ogbq_kdbo gZmd, ^hp_gl dZn_^ju
h[s_c we_dljhl_ogbdb b Z\lhfZlbdb L=:KM
<.F. I_^bdh\

DZg^b^Zl l_ogbq_kdbo gZmd, klZjrbc gZmqguc
khljm^gbd GBB \ukhdb gZijy`_gbc
N.=. K_dbkh\

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ihebl_ogbq_kdh]h mgb_jkb_lZ, 2010

<<?>?GB?

GZklhys__ mq_[gh_ ihkh[b_ ih kh^_j`Zgbx khhl_lkl\mxl ijh-
ljZff_ ^bkpbiebg «FhglZ`, gZeZ^dZ, wdkiemZlZpby we_dljhh[hjm^h-
\Zgby» ^ey klm^_glh\ we_dljhl_ogbq_kdbo b we_dljhf_oZgbq_kdbo ki_-
pbZevghkl_c WELB Lhfkdh]h ihebl_ogbq_kdh]h mgb_jkb_lZ. Ijb wlhf
Z\lhjhf mqblu\Zehkv aZgbfZ_fh_ \ mq_[ghf ieZg_ mdZaZgguo ki_pb-
Zevghkl_c f_klh wlhc ^bkpbiebg \ jy^m ^jm]bo we_dljhl_ogbq_kdbo
^bkpbiebg, gZ^_ykv gZ agZgb_ klm^_glhf jZg__ bamq_gguo ^bkpbiebg .

JZ[hIZ hjb_glbjh\ZgZ gZ bamq_gb_ l_hj_lbq_kdh]h fZl_jbZeZ
^bkpbiebg k ijZdlbq_kdbf _]h bkihevah\Zgb_f ijb ijh_dlbjh\Zgbb
kbbkl_fu \gmljbaZ\h^kdh]h b \g_rg_]h we_dljhkgZ[_gby.

JZkkfhlj_gu l_ogheh]bq_kdb_ hkgh\u fhglZ`Z \ha^mrguo ebgbc
we_dljhi_j_^Zqb. DeZkkbq_kdbc \ZjbZgl \ha^mrghc ebgb k jheufb
ijh\h^Zfb (<E) gZ deZkk gZijy`_gby ^h 35 d< ij_^klZ\e_g \ \b^_ gZ[h-
jZ l_ogbq_kdbo ijb_fh\ ijh_^_gby hi_jZpbc, ih^dj_ie_gguo beexkl-
jZpbyfb. ;hevrh_ \gbfZgb_ m ^_e_gh \ha^mrguf ebgyf k bahebjh\Zg-
gufb ijh\h^Zfb (<EB), fhglbjm_fufb ijh\h^Zfb KBI 1, KBI 2,
KBI 3, gZijy`_gb_f ^h- b k\ur_ 1000<. < l_ogbq_kdbo Zki_dlZo \h-
ijhkZ ijb_^_gu jZaebqgu_ \ZjbZglu ijb_f_g_gby ZjfZlmju b ijbkih-
kh[e_gbc ^ey fhglZ`Z. GZ k_]h^ gyrgbc ^_gv wlh gh\bgdZ \ hl_q_kl_g-
ghc we_dljhl_ogbd_ b agZgb_ kh\j_f_gguo l_ogheh]bc ijb]h^blky klm -
^_glZf gZ ijhba\h^kl_gghc ijZdlbd_ b ijb jZ[hl_ gZ wg_j]_lbq_kdbo
ij_^ijbylbyo.

L_ogheh]bb fhglZ`Z dZ[_evguo ebgbc we_dljhi_j_^Zqb \gmljbaZ-
\h^kdbo we_dljhbq_kdbo k_l_c ih^dj_ie_gu [hevrhf dhebq_kl\hf be-
exkljZpbc, ihdZau\Zxsbo hl^_evgu_ ijb_fu \uiheg_gby hi_jZpbc. <
khhl_lkl\bb k «IjZ\beZfb mkljhckl\Z we_dljhmklZgh\hd» (IMW) gZ jb-
kmgdZo ijhbeexkljbjh\Zgu ghjfZlb\gu_ jZkklyhygby i_j_k_q_gbc,
k[eb`_gbc, i_j_oh^h\ b hl_l\e_gbc dZ[_evguo ebgbc (DE).

Hkh[h_ f_klh \ jZ[hl_ m^_ey_lky f_lh^bdZf \uy\e_gby \b^h\ b
f_kl ih\j_^_gbc \ha^mrguo b dZ[_evguo ebgbc we_dljhi_j_^Zqb k_-
l_c ^h 35 d< \dexqbl_evgh k jZaebqgufb j_bfZfb aZa_fe_gby g_c-
ljZeb.

L_dms__ h[kem`b\Zgb_ k_l_c khklhbl ba i_jbh^bq_kdbo hkfhljh\,
dhgljhevguo baf_j_gbc b bkiulZgbc, f_lh^bdb dhlhjuo ih^jh[gh ba-
eh`_gu \ jZ[hl_.

**=E:<: 1. FHGL:@ <HA>MRGUO EBGBC
WE?DLJHI?J?>:QB**

1.1. Ih^]hlh\bl_evgu_jZ[hlu

>h gZqZeZ jZ[hl ih khhjm`_gbx \ha^mrguo ebgbc we_dljhi_j_-
^Zqb (<E) ^he`gu [ulv \uiheg_gu ke_^mxsb_jZ[hlu:
• ihemq_gu jZaj_r_gby gZ _^_gb_jZ[hl ih ljZkk_ <E, \dexqZy
l_jjblhjbb e_kguo fZkkb\h\ b k_evkdohayckl_gguo m]h^bc;
• ih^]hlh\e_gu \j_f_ggu_ ihf_s_gby ^ey jZaf_s_gby fhglZ`-
guo [jb]Z^ b ijhZ[kdbo mqZkldh\;
• hj]Zgbah\Zgu \j_f_ggu_ [Zau ^ey kdeZ^bjh\Zgby fZl_jbZeh\;
• ijh_j_gu khklhygb_ ^hjh], fhklh\ b ih^t_a^guo iml_c d ljZk-
k_ <E, ijb g_h[oh^bfhklb khhjm`_gu \j_f_ggu_ ih^t_a^gu_ ^hjh]b;
• jZkqbs_gZ ihehkZ a_feb \^hev ljZkku, Z \ e_kghc f_klghklb
mkljh_gu ijhk_db;
• hkms_kl\e_g ij_^mkfhlj_gguc ijh_dlhf kghk kljh_gbc, gZoh-
^ysboky gZ ljZkk_ <E beb \[ebab g__ b ij_iylkl\mxsbo ijhba\h^kl\m
jZ[hl;
• \uiheg_g ijhba\h^kl_gguc ibd_lZ` - mklZgh\dZ \^hev ljZkku
<E ibd_lh\, hlf_qZxsbo [m^msb_ f_klZ mklZgh\db hihj.
Ihke_ mkljhckl\Z \j_f_gguo [Za ^ey ojZg_gby fZl_jbZeh\ \u-
ihegy_lky ljZgkihjbjh\dZ wlbo fZl_jbZeh\ \jZchg ijhoh`^_gby ljZk-
ku <E.
I_j_hadZ hihj gZ ljZkkm <E hkms_kl\ey_lky ki_pbZevgufb
klhe[h\haZfb. ;ZjZ[Zgu k ijh\h^hf i_j_hayl \ _jlbdZevghf iheh`_-
gbb, aZdj_ieyy bo \ dmah_Z\hljZgkihjlZ jZkly`dZfb ba klZevghc ijh-
\hehdb. NZjnhjh\^u_ b kl_deyggu_ ih^_kgu_ baheylhju, ij_^Zjb-
l_evgh ijh_j_ggu_ b kh[jZggu_ \]bjeyg^u lj_[m_fhc ^ebgu ljZgk-
ihjlbjmxlky gZ ljZkkm <E \ ki_pbZevguo ^_j_ygguo dhgl_cg_jZo,
ij_^hojZgyxsbo baheylhju hl f_oZgbq_kdbo ih\j_^_gbc. JZa]jmadZ
hihj b [ZjZ[Zgh\ k ijh\h^hf ^he`gZ \uihegylvky, dZd ijZ\beh, ih^t-
_fgufb djZgZfb.
IhklZ\dZ kljhbl_evghc l_ogbdb gZ ljZkkm <E hkms_kl\ey_lky
k\hbf oh^hf beb gZ ki_pbZevguo Z\lhfh[bevguo ieZlnhjfZo.

1.2. <ha^mrgu_ ebgb k jheufb ijh\h^Zfb

1.2.1. K[hjdZ b mklZgh\ dZ hihj

K[hjdZ hihj . Klhcdh ^_j_ygguo hihj (jbk. 1.1) kh_^bgylky \gZoe_kl k ` _e_ah[_lhggufb ijbkI\ dZfb (iZkugdZfb). Kh_^bg_gby ijbkI\hd k ^_j_ygghe klhcdh \uihegy_lky k ihfsvx [Zg^Z`_c ba klZevghc ijh\hehdb beb klZevguo ohfmlh\ . >ey [Zg^Z`_c ijbf_gy_lky fy]dZy hpbgdh\ZggZy ijh\hehdZ ^bZf_ljh 4 ff beb g_hpbgdh\ZggZy ijh\hehdZ ^bZf_ljh 5...6 ff. Qbkeh \bldh\ [Zg^Z`_c ijbgfZ_lky jZ\guf:

- 12 – ijb ^bZf_lj_ ijh\hehdb 4 ff;
- 10 – ijb ^bZf_lj_ ijh\hehdb 5 ff;
- 8 – ijb ^bZf_lj_ ijh\hehdb 6 ff.

>_j_ygguo_ hihju ^ey <E gZijy`_gb_f 35 d< b \ur_ ihklZ\ey-
xlky hl^_evgufb we_f_gI\Zfb (klhcdh, ljZ_jkZ, jZkdhku), k[hjdZ dhlh-
juo f`^m kh[hc \uihegy_lky k ihfsvx [helh\uo kh_^bg_gbc.

< klhcdZo ^_j_ygguo hihj <E gZijy`_gb_f ^h 10 d< \uk_jeb-
\Zxlky hl_jklby ^ey \djmqb\Zgby kl Zevguo djxqv_ , gZ dhlhju_ k ih-
fsvx ihebwbe_gh\uo dheizqdh\ Zjfbjmxlky rluj_u_ baheylhju.

GZ ljZ_jkZo ^_j_ygguo I-h[jZaguo hihj <E gZijy`_gb_f 35 d< b
\ur_ \ ijhk_je_ggu_ hl_jklby mklZgZ\eb\Zxlky we_f_glu kp_ighc
ZjfZlmju ^ey ^Zevg_cr_lh dj_ie_gby]bjeyg^ baheylhjh\ . Ijb g_h[oh-
^bfhklb ih klhcd_ ^_j_ygghe hihju ijhdeZ^u\Z_lky aZa_feyxsbc
kimkd ba klZevghc ijh\hehdb.

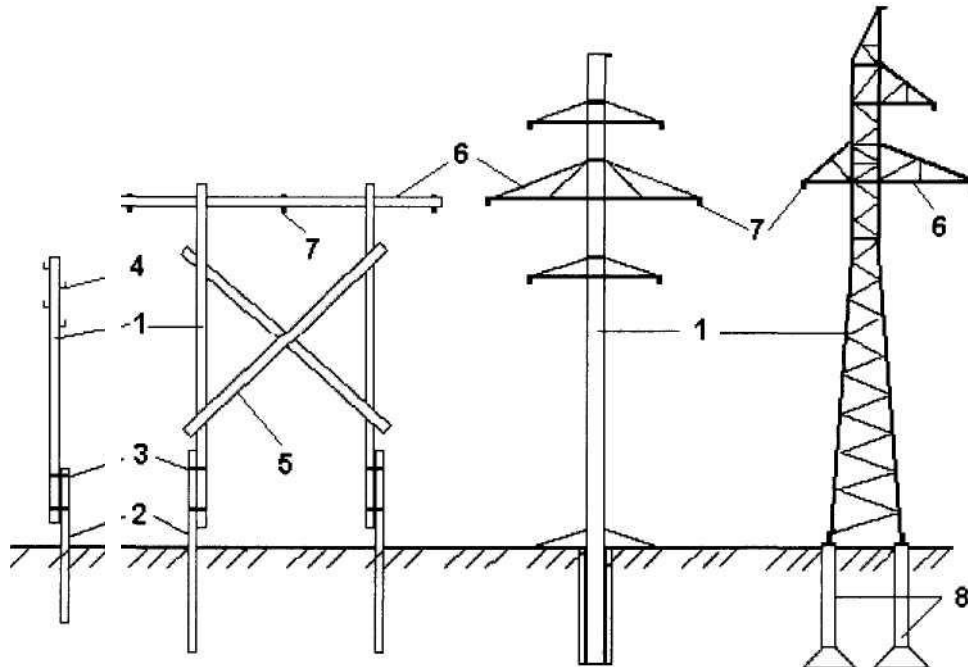
GZ ` _e_ah[_lhgguo hihjZo <E k ihfsvx ki_pbZevguo ohfm-
lh\ fhglbjmxlky klZevgu_ ljZ_jku. >ey <E gZijy`_gb_f ^h 10 d<
wlb ljZ_jku bf_xl rlujb, gZ dhlhju_ k ihfsvx ihebwbe_gh\uo
dheizqdh\ Zjfbjmxlky rluj_u_ baheylhju. >ey <E gZijy`_gb_f
35 d< b \ur_ gZ dhgpu ljZ_jk mklZgZ\eb\Zxlky we_f_glu kp_ighc Zj-
fZlmju ^ey ^Zevg_cr_lh dj_ie_gby]bjeyg^ ih^_kguo baheylhjh\.

F_lZeebq_kdb_ hihju ihklZ\eyxlky hl^_evgufb we_f_gI\Zfb,
k[hjdZ dhlhjuo f`^m kh[hc \uihegy_lky k ihfsvx [helh\uo kh_^b-
g_gbc. Ihke_ aZ_jr_gby k[hjdb f_lZeebq_kdbo hihj ijhba\h^blky
\hkkI\Zgh_e_gb_ bo Zglbdhjjhabcgh\h ihdjulby \ f_kI\Zo _]h ih\j_`^_-
gby ijb ljZgkihjljbh\d_ b k[hjd_.

K[hjdZ hihj \uihegy_lky ih \hafh`ghklb [eb`_ d f_klm __ [m-
^ms_c mklZgh\db. Ijb k[hjd_ ijbf_gylky Z\lhdjZgu, ^hfdjZlu b ^jm-
]b_ f_oZgbafu b bgkljmf_glu. Kh[jZgguo_ hihju ^he`gu khhl_lkl\h-
\Zlv jZ[hqbf q_jl`_Zf ijh_dI\Z <E.

Nmg^Zf_glu hihj . F_lZeebq_kdb_ hihju mklZgZ\eb\Zxlky gZ
`_e_ah[_lhgguo_ nmg^Zf_glu (ih^gh`gdb) beb k\Zb. Dhleh\Zgu ih^

nmg^Zf_glu f_lZeebq_kdbo hihj jZajZ[Zlu\Zxlky wdkdZ\ZlhjZfb. AZ-
lem[e_gb_`_e_ah[_lhgguo k\Zc \ limgl \uihegy_lky \b[jhm^Zjguf
kihkh[hf. =em[bgZ aZeh`_gby nmg^Zf_glh\ beb k\Zc ^he`gZ kh-
hl_lkl\h\Zlv ijh_dlm <E.



Z

[

\

Jbk. 1.1. >_j_yggu_(Z), `_e_ah[_lhggZy (I) b klZevgZy (\) hihju <E:
1 - klhcdZ hihju; 2 - `_e_ah[_lhggZy ijbklZ\ d Z (iZkughd); 3 - [Zg^Z` ba klZev-
ghc ijh\hehdb beb klZevghc ohfml; 4 - djxqvy ^ey Zjfbjh\db baheylhjh; 5 - jZk-
dhku ^ey `_kldhklb; 6 - ljZ_jku; 7 - kp_igZy ZjfZlmjZ ^ey dj_ie_gby jbjeyg^u
baheylhjh; 8 - `_e_ah[_lhggu_nmg^Zf_glu.

H^gh\j_f_ggh k mkljhckl\hf nmg^Zf_glh\ \uihegy_lky fhglZ`
aZa_feyxsbo mkljhckl\ - mklZgZ\eb\Zxlky bkdmkkl_gggu_ _jlbdZev-
gu_ b]hjbahglZevgu_ aZa_feb_l_eb. < dZq _kl_kl_kl_gggu_ aZa_feb_l_-
e_c bkihevamxlky g_ihkj_^kl_ggh `_e_ah[_lhggu_nmg^Zf_glu hihj.

<_jogb_qZklb `_e_ah[_lhgguo nmg^Zf_glh\ gb_ebjmxlky ih]h-
jbahglZeb b gZ gbo mklZgZ\eb\Z_lky `_kldbc rZ[ehg, khhl_lkl\mxsbc
jZaf_jZf gb`g_c qZklb f_lZeebq_kdhc hihju. Ihke_ wlh]h dhleh\Zgu
aZkuiZxlky k ihkehcghe l]Zf[h\dhc]imglZ. RZ[ehg kgbfZ_lky ihke_
aZkuidb dhleh\Zgh\.

@_e_ah[_lhggu_ b ^_j_yggu_ hihju mklZgZ\eb\Zxlky [_a nmg^Z-
f_glh_. Dhleh\Zgu ^ey ^_j_ygguo b `_e_ah[_lhgguo hihj jZajZ[Zlu-
\Zxlky ki_pbZevgufb [mjh\ufb fZrbgZfb. >bZf_lj dhleh\ZgZ ^he`_g

ij_\urZlv gb`gbc ^bZf_lj (jZaf_j) klhcdh hihju gZ 5...10 kf. =em[b-gZ dhleh\Zgh\ ^he`gZ khhl_lkl\h\Zlv ijh_dlm <E.

MklZgh\dZ hihj. F_lh^u mklZgh\db hihj aZ\bkyl hl bo dhgkljmd-pbc, nmg^Zf_glh\, Z lZd`_ gZebqby l_o beb bguo ih^t_fgguo kj_^kl\ b f_oZgbafh\; hevrbgkl\h hihj mklZgZ\eb\Zxlky k ihfhsvx ih^t_fgh-jh djZgZ khhl_lkl\mxs_c ljmahih^t_fghklb. <ue_l b jZ[hqbc oh^klj_eu ih^t_fZ djZgZ ^he`gu h[_ki_qb\Zlv iheguc ih^t_f hihju, i_-j_f_s_gb_ __ d f_klm mklZgh\db b m^_j`Zgb_ \ \jlbdZevghf iheh`_-gbb ^h aZdj_ie_gby hihju gZ nmg^Zf_gl_ beb \ ljmgl_.

Ijb mklZgh\d_ hihju \u_jy_lky __ \jlbdZevgh_ iheh`_gb_. >ey f_lZeebq_kdbo hihj bkihevamxlky f_lZeebq_kdb_ ijhdeZ^db, mklZgZ\eb\Z_fu_ f`^m iylhc hihju b \jog_c iehkdhklvx `^_e_ah[_lhggh]h nmg^Zf_glZ. <_jlbdZevghklv ^_j_ygguo b `^_e_ah[_lhgguo hihj ^hk-lb]Z_lky k ihfhsvx \j_f_gguo hlly`_d b mihjh\ ^h hdhgqZl_evgh]h aZdj_ie_gby hihju \ ljmgl_. Dhleh\ Zgu ih^ ^_j_ygg_ b `^_e_ah[_lhggu_ hihju ihke_ \u_jdb bo \jlbdZevgh]h iheh`_gby aZkuiZxlky ljZ\bcgh-i_kqZghc kf_kvz k ihkehcguf ljZf[h\Zgb_f.

1.2.2. FhglZ` ijh\h^h\ b fhegb_aZsblguo ljhkh\

FhglZ` ijh\h^h\ (ljhkh\)\uihegy_lky hl^_evgh gZ dZ`^hf mqZ-kld_ <E, h]jZgbq_gghf ^\mfy [eb` Zcrfbf Zgd_jgufb hihjZfb (Zg-d_jghf ijhe_l_), b khklhbl ba ke_^mxsbo hkgh\guo hi_jZpbc:

- jZkdZldb ijh\h^h\, \dexqZy bo kh_^bg_gby b ih^t_f gZ hihju;

- gZly`_gby ijh\h^h\ k j_]mebjh\dhc klj_eu ijh_kZ;
- dj_ie_gby ijh\h^h\ d baheylhjZf hihj.

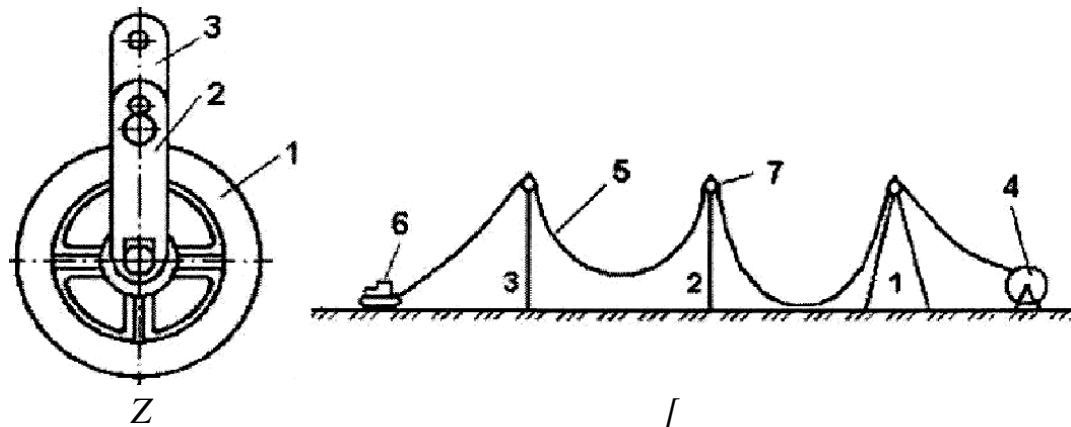
I_j_^ jZkdZldhc ijh\h^h\ d hihjZf ih^_rb\Zxlky ki_pbZev-gu_ fhglZ`gu_ jhebdb (1.2, Z), gZ dhlhju_ \u_rb\Z_lky ijh\h^ \ijhp_kk_ j ZkdZldb, b ih dhlhjuf \uihegy_lky ihke_^mxs__ gZly`_-gb_ ijh\h^Z. JZkdZldZ ijh\h^h\ ijh\h^blky k ihfhsvx ly]h\h]h f_-oZgbafZ (ljZdlhjZ) b fh`_l hk ms_kl\eylvky ^\mfy kihkh[Zfb:

- mklZgh\dhc [ZjZ[ZgZ k ijh\h^hf gZ klZpbhgZjghf mkljhckl_ (dhaezo beb \bglh\uo ^hfdjZlZo) \ gZqZe_ fhglbjm_fh]h mqZkldZ b aZdj_ie_gb_f dhgpZ ijh\h^Z m ^\b` ms_]hky ^hev ljZkku ljZdlhjZ (jbk. 1.2, l);

- aZdj_ie_gb_f dhgpZ ijh\h^Z \ gZqZe_ fhglbjm_fh]h mqZkldZ b mklZgh\dhc [ZjZ[ZgZ k ijh\h^hf gZ ^\b`ms_fky ^hev ljZkku ljZd-lhj_.

<lhjhc kihkh[jZkdZldb h[_ki _qb\Z_l emqrmx khojZgghklv ijh\h^Z hl f_oZgbq_kdbo ih\j`_^_gbc ij b lj_gbb h ljmgl_, h^gZdh ijb-

f_g_gb_ wlv]h kihkh[Z h]jZgbq_gh. < qZklghklb, g_\hafh`gh jZkdZ-
lZlv b \u_kblv kj^gbc ijh\h^ m ^_j_ygguo I-h[jZaguo hihj k jZk-
dhkZfb.



Jbk. 1.2. FhglZ`guc jhebd (Z) b n jZ]f_gl jZkdZldb ijh\h^Z (I);
Z: 1 - ^bkd; 2 - hldb^gZy s_dZ ^ey mdeZ ^db ijh\h^Z; 3 - ih^_kdZ ^ey dj_ie_gby;
I: 1 - Zgd_jgZy hihjZ; 2, 3 - ijhf_`mlhagu_ hihju; 4 - [ZjZ[Zg k ijh\h^hf;
5 - ijh\h^; 6 - ly]h\uc f_oZgbaf (ljZdlhj); 7 - fhglZ`guc jhebd.

MdZaZggZy l_ogheh]by jZkdZldb ijb_fgy_lky ^ey]heuo (g_baheb-
jh\Zgguo) Zexfbgb_\uo b klZe_Zexfbgb_\uo ijh\h^h\.
Ijb jZkdZld_ ijh\h^h\ ijhba\h^b_lky bo kh^bg_gb_ =heuo_Zexfbgb_-
\u_ b klZe_Zexfbgb_\u_ ijh\h^Z k_q_gb_f ^h 185 ff ² kh^bgylky k
ihfsvx h\Zevguo kh^bgbl_e_c, ij^klZ\eyxsbo kh[hc Zexfbgb_-
\mx ljm[dm h\Zevgh]h k_q_gby. < kh^bgbl_ev k jZaguo kljhgh \klZ\
eylky dhgpu kh^bgy_fuo ijh\h^h\, ihke_q_]h k ihfsvx i_j_ghk-
guo fhglZ`guo bgkljmf_glh\ ijhba\h^b_lky kdjmqb\Zgb_ kh^bgbl_ey
(jbk. 1.3, Z) beb _]h h[Zlb_ (jbk. 1.3, I).

>ey ih\ur_gby gZ^`ghklb dhglZdlgh]h kh^bg_gby b mf_gvr_-
gby _]h i_j_oh^gh]h khijhlb\e_gby dhjhlb_ dhgpu kh^bgy_fuo ijh-
\h^h\, \uoh^ysb_ ba h\Zevgh]h kh^ bgbl_ey, k\Zjb\Zxlky k ihfsvx
l_jfblgh]h iZljhgZ (jbk. 1.3, I).

KlZe_Zexfbgb_\u_ ijh\h^Z k_q_gb_f 240 ff ² b [he__ kh^bgy-
xlky k ihfsvx ij_kkm_fuo kh^bgbl_e_c, khklhysbo ba ^\mo ljm[hd -
klZevghc b Zexfbgb_\hc (jbk. 1.3, \). >ey kh^bg_gby lZdbo ijh\h^h\
ijb_fgy_lky i_j_ghkguc jmqghc ij_kk. K ihfsvx klZevghc ljm[db 1
hij_kkh\u\Zxlky dhgpu klZevguo k_j^_qgbdh\ kh^bgy_fuo ijh\h^h\,
k ihfsvx Zexfbgb_\hc ljm[db 2, gZdeZ^u\Z_fhc ih\jo klZevghc,
hij_kkh\u\Zxlky Zexfbgb_\u_ qZklb kh^bgy_fuo ijh\h^h\.

< h^ghf ijhe_l_ <E ^himkdZ_lky g_ [he__ h^gh]h kh^bg_gby gZ
ijh\h^ dZ^hc nZau.

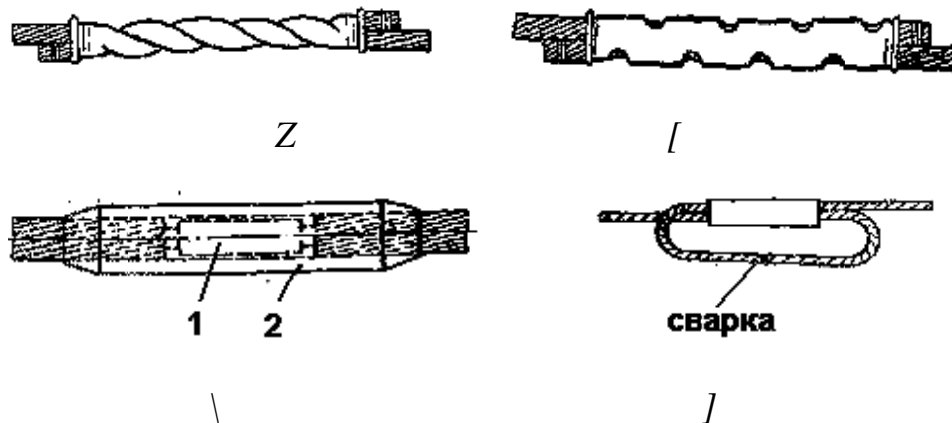
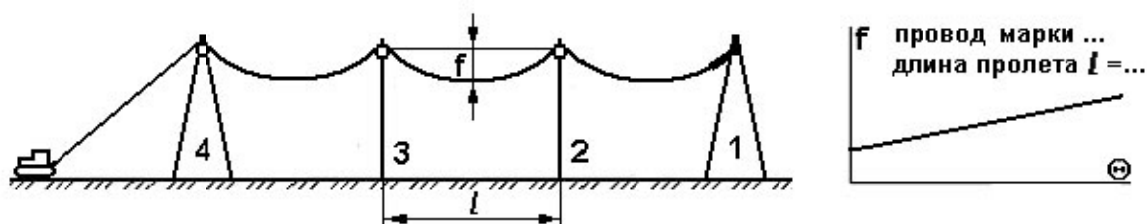


Рис. 1.3. Конструкция кабельных соединений в кабельных линиях

Вспомогательные (рис. 1.4, Z) и основные (рис. 1.4, I) типы кабельных соединений. Вспомогательные соединения (рис. 1.4, Z) используются для соединения кабелей в кабельных линиях. Основные соединения (рис. 1.4, I) используются для соединения кабелей в кабельных линиях.



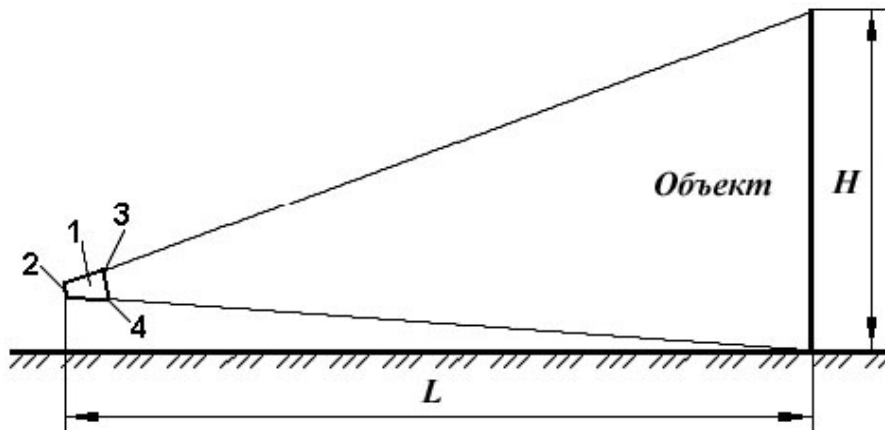
Z

I

Рис. 1.4. Вспомогательные (Z) и основные (I) типы кабельных соединений

Вспомогательные (рис. 1.4, Z) и основные (рис. 1.4, I) типы кабельных соединений. Вспомогательные соединения (рис. 1.4, Z) используются для соединения кабелей в кабельных линиях. Основные соединения (рис. 1.4, I) используются для соединения кабелей в кабельных линиях.

Вспомогательные (рис. 1.4, Z) и основные (рис. 1.4, I) типы кабельных соединений. Вспомогательные соединения (рис. 1.4, Z) используются для соединения кабелей в кабельных линиях. Основные соединения (рис. 1.4, I) используются для соединения кабелей в кабельных линиях.



Жбк. 1.5. Бaf_j_gb_ \ukhlu h[t_dIz

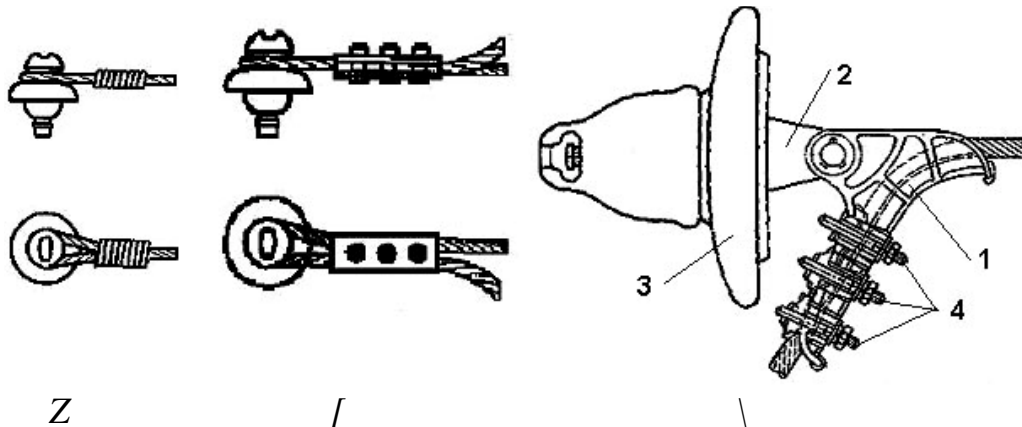
>ey hij_^_e_gby \ukhlu baf_jy_fh]h h[t_dIz G gZ[ex^Zl_ev m^Zey_lky hl g_]h, ^_j`Z ijb[hj kfh]h\ufb hl_jklbyfb m]eZa, gZ lZ-dh_jZkklhygb_ L , ijb dhlhjhfh _jogy jbk dZ kh\iZ^_l k _jrbghc h[t_dIz, Z gb`gyy – k_]h hkgh\Zgb_f. =_hf_ljbq_kdb_ jZaf_ju ijb[hjZ b jbkdb gZ kl_de_ \uiheg_gu lZd, qlh $G = L \cdot I \cdot 2$. Baf_j_gb_ jZkklhygby L ijh[e_f g_ ij_^klZ\ey_l.

>ey hij_^_e_gby klj_eu ijh_kZ ijh\h^Z baf_jy_lky kgZqZeZ \u-khlZ ih^_kdb ijh\h^Z gZ hihj_, aZl_f jZkklhygb_ hl gbar_c lhqdb ijh-\bkZgby ijh\h^Z ^h a_feb b gZoh^blky jZaghklv ihemq_gguo agZq_gbc. Ih]j_rghklv baf_j_gbc lZdbf ijb[hjhfh khklZ\ey_l 3...4 %, qlh \iheg_ ijb_fe_fh.

Dj_ie_gb_]heuo ijh\h^h\ gZ Zgd_jguo hihjZo <E gZijy`_gb-_f ^h 1 d< kh rluj_ufb baheylhj Zfb hkms_kl\ey_lky aZdjmqb\Zgb_f ijh\h^h\ lZd gZau\Z_fhc «aZ]emrdhc» (jbk. 1.6, Z). GZ hihjZo <E gZ-ijy`_gb_f \ur_ 1 d< kh kl_j`g_ufb baheylhjZfb dj_ie_gb_ ijh\h^h\ \uihegy_lky i_le_c, h[jZah\Zgghc k ihfhsvx [helh\h]h ieZr_q-gh]h aZ`bfZ (jbk. 1.6, /).

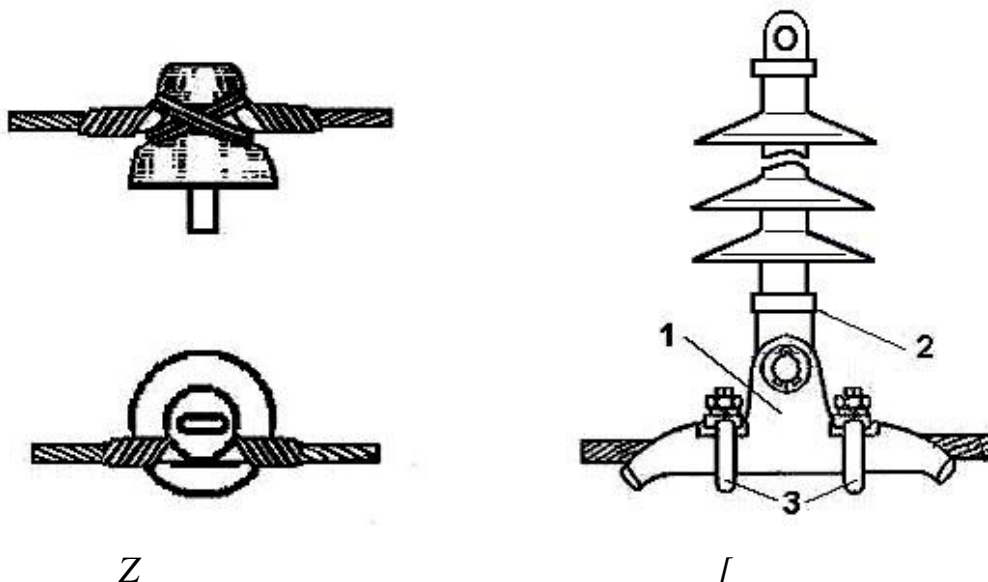
Dj_ie_gb_ ijh\h^h\ gZ Zgd_jguo hihjZo k ih^_kgufb baheylh-jZfb hkms_kl\ey_lky k ihfhsvx gZly`guo aZ`bfh\ (jbk. 1.6, \). AZ-`bf 1 k ihfhsvx kp_ighc ZjfZlmju 2 dj_iblky d gb`g_fm baheylhjm]bjeyg^u 3. Ijh\h^ \ aZ`bf_ aZly]b\Z_lky ijb`bfgufb ieZrdZfb k ihfhsvx U-h[jZaguo ribe_d 4.

GZ Zgd_jguo hihjZo dhjhldb_d hgpu ijh\h^h\ (re_cnu), b^msb_hl ^\mo gZly`guo aZ`bfh\ h^ghc nZau, kh_`bgyslky [helh\ufb aZ`b-fZfb beb k\Zjb\Zxlky k ihfhsvx l_jfblgh]h iZljhgZ.



Jbk. 1.6. Dj_ie_gb_ ijh\h^h\ gZ Zgd_jguo hihjZo kh rluj_ufb
baeylhjZfb (Z, [); k ih^_kgufb baeylhjZfb (\)

Dj_ie_gb_ jheuo ijh\h^h\ gZ ijhf_mlhqguo hihjZo kh
kl_j`g_ufb baeylhjZfb hkms_kl\ey_lky \yadhc ba Zexfbgb_uo
ijh\hehd (jbk. 1.7, Z). GZ ijhf_mlhqguo hihjZo k ih^_kgufb baey-
lhjZfb ijh\h^ k fhglZ`guo jhebdh\ i_j_deZ^u\Z_lky \ ih^^_j`b\Zx-
sbc aZ`bf 1 (jbk. 1.7, [), ijbdi_ey_fuc d gb`g_c qZklb baeylhjZ 2.
Ijh\h^ \ aZ`bf_ aZlyjb\Z_lky ijb` bfgufb ieZrdZfb k ihfhsvx U-
h[jZaguo ribe_d 3. GZ jbk. 1.7, [ihdZaZg ihebf_jguc ih^_kguc bah-
eylhj.



Jbk. 1.7. Dj_ie_gb_ ijh\h^h\ gZ ijhf_mlhqguo hihjZo kh rluj_ufb
baeylhjZfb (Z) b ih^_kgufb baeylhjZfb ([)

FhglZ` fhegb_aZsblguo ljkhk ZgZeh]bq_g fhglZ`m ijh\h-
 ^h\ . Kh_`bg_gb_ ljkhk\ \uihegy_lky , dZd ijZ\beh, k ihfhsvx klZevguo
 ij_kkm_fuo kh_`bgbl_e_c. GZ <E gZ ijy`_gb_f ^h 110 d< dj_ie_gb_
 ljkhZ d hihjZf \uihegy_lky k ihfhsvx kp_ighc ZjfZlmju [_a baheylh-
 jZ. GZ <E gZijy`_gb_f 220 d< dj_ ie_gb_ ljkhZ dh \k_f hihjZf \uihe-
 gy_lky q_j_a ih^_kghc baheylhj, dZd ijZ\beh, kl_deygguc, rmgibjh-
 \Zgguc bkdjh\uf ijhf_`mldhf. < dZ`^hf Zgd_jghf mqZkld_ gZ h^ghc
 ba Zgd_jguo hihj ljkh aZa_fey_lky.

;hevrbgkl\h jZ[hl ih fhglZ`m ijh\h^h\ b ljkhk\ k\yaZgh k
 ih^t_fZfb gZ hihju. GZ <E gZijy`_gb_f ^h 10 d< fhglZ`gdbd ih^_
 gbfZxlky gZ hihju, dZd ijZ\beh, k ihfhsvx fhglZ`guo dh]l_c (eZah\)
 b ihykh\ . GZ <E [he_ \ukhdh]h gZijy`_gby rbjhdh bkihevamxlky l_-
 e_kdhibq_kdb_ \urdb b]b^jhjh^t_fgdbd.

Ihke_ hdhgqZgby \k_o fhglZ`guo jZ[hl gZ hihju <E gZ \ukhl_
 2...3 f gZghkylky ke_`mxsb_ agZdb:

- ihjy^dh\u_ ghf_jZ hihj;
- ghf_j <E beb _ mkeh\gh_ h[hagZq_gb_;
- bgnhjfZpbhggu_ agZdb k mdZaZgb_f rbjbggu hojZggghc ahgu;
- ij_`mij_`bl_evgu_ ieZdZlu gZ \k_o hihjZo \ gZk_e_gghc f_-

klghklb.

1.2.3. **FhglZ` ljm[qZluo jZajy^gbdh\ b aZa_feyxsbo mkl- jhckl**

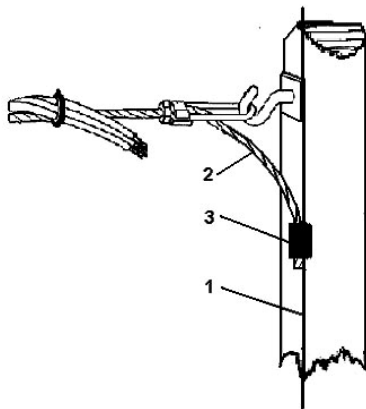
Ljm[qZlu_ jZajy^gdbd dj_iylky aZdjuluf dhgphf d we_f_glZf
 hihj ih^ m]ehf 15° d]hjbahglZeb ijb [he_ gbadhf jZkiheh`_gbb hl-
 djulh]h dhgpZ. AZdjuluc dhg_p jZajy^gbdZ kh_`bgy_lky k aZa_feyxsbf
 kimkdhf gZ hihj_ ba ^j_`kbggu beb k f_lZeehf ijh\h^ys_c hihju
 (klZevghc b `e_ah[_lhggghc). >ebgZ \g_rg_]h bkdjh\h]h ijhf_`mldZ
 mklZgZ\eb\Z_lky \ khhl\`lkl\bb k ijh_dlhf <E.

Ihkdhvdm kjZ[Zlu\Zgb_ jZajy^gbdZ khijh\h^`Z_lky kbevuf
 \uoehihf]_g_jbjh\Zggh]h we_dljbb_kdhc ^m]hc]ZaZ, hldjuluc dhg_p
 jZajy^gbdZ ^he`_g jZkiheZ]Zlvky lZ d, qlh[u \uoehigu_]Zau g_ \ua\Z-
 eb f_`^mnZaguo i_j_djulbc beb i_j_djulbc gZ a_fex. Ahgu \uoehiZ
 jZajy^gbdh\ jZaguo nZa g_ ^he`gu i_j_k_dZlvky b ho\Zlu\Zlv we_f_g-
 lu dhgkljmdpbc b ijh\h^h\ <E.

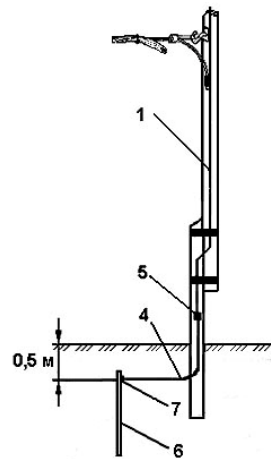
Ijb fhglZ`_ <E gZijy`_gb_f ^h 1d< \uihegyxlky **aZa_feyx-
 sb_ mkljhckl\Z** ^ey ih\lhjgh]h aZa_fe_gby gme_\h]h ijh\h^Z (PEN-
 ijh\h^gbdZ), aZsblu hl]jah\uo i_j_gZijy`_gbc, aZa_fe_gby we_d-
 ljhh[hjm^h\Zgby, mklZgh\eggh]h gZ hihjZo <E. Ih\lhjgu_ aZa_fe_gby
 \uihegyxlky gZ dhgp_\uo hihjZo ebgbb b hihjZo k hl_l\`e_gbyfb d
 \h^Zf \ a^Zgby, \ dhlhjuo fh`_l [ulv khkj_`hlhq_gh [hevrh_ dhebq_-

kl\h ex^_c (rdheu) beb dhlhju_ ij_^klZ\eyxl [hevrnx fZl_jbZevgm x p_gghklv (kdeZ^u). AZa_feyxsb_ mkljhckl\Z aZsblu hl ljhah\uo i_j_- gZijy`_gbc kh\f_sZxlky k ih\lhjgufb aZa_fe_gbyfb.

Ko_fZ \uiheg_gby kh\f_s_ggh]h aZa_fe_gby gZ ^_j_\ygghc hih- j_ <E gZijy`_gb_f ^h 1 d< ijb_^_gZ gZ jbk. 1.8. AZa_feyxsbc kimkd 1 \uihegy_lky klZevghc ijh\hehdhc ^bZf_ljh f g_ f_g__ 6 ff b dj_ibl- ky d l_em hihju U-h[jZagufb kdh[dZfb. Ijbkh_^bg_gb_ aZa_feyxs_]h kimkdZ d gme_\hfm ijh\h^m 2 \uihegy_lky [helh\uf aZ`bfhf 3. M`_- e_ah[_lhgguo hihj gme_\hc ijh\h^ kh_^bg y_lky kh klZevghc ZjfZlmjhc, m f_lZeebq_kdbo hihj - k l_ehf hihju.



Z



I

Jbk. 1.8. Ko_fZ \uiheg_gby aZa_fe_gby gZ hihj_ <E:
Z - \jogyy qZklv hihju; I - hihjZ k aZa_feyxsbf mkljhckl\hf

Ijb fhglZ`_ <E gZijy`_gb_f \ur_ 1d< aZa_feyxsb_ mkljhckl- \Z \uihegyxlky m hihj:

- bf_xsbo fhegb_aZsblguc ljhk;
- bf_xsbo ljm[qZlu_ jZajy^gdbd, jZat_^bgbl_eb, ij_^hojZ- gbl_eb b ijhq__ h[hjm^h\Zgb_;

- `e_ah[_lhgguo b f_lZeebq_kdbo ijb gZijy`_gbb 6...35d<.

AZa_feyxsb_ kimkdb m ^_j_\ygguo hihj \uihegyxlky klZevguf fgh]h`bevguf ijh\h^hf k_q_gb_f g_ f_g__ 35 ff ² beb klZevghc ijh- \hehdhc ^bZf_ljh f g_ f_g__ 10 ff.

< dZq_kl\ aZa_febl_e_c gZ <E \k_o gZijy`_gbc ke^_m_l \ i_j\mx hq_j_^v bkihevah\Zlv _kl_kl_gguo_ aZa_febl_eb (^_e_ah[_lhgguo_ nmg- ^Zf_glu). Ijb g_^hklZlhqghf khijhlb\e_gbb _kl_kl_gguo aZa_febl_- e_c mklZgZ\eb\Zxlky bkdmkkl_gguo_ aZa_febl_eb 6 (jbk. 1.8, I). Ijb- kh_^bg_gb_ aZa_feyxs_]h kimkdZ ^_j_\ygghc hihju, klZevghc ZjfZlm- ju `e_ah[_lhgguc hihju, l_eZ f_lZeebq_kdhc hihju d aZa_febl_eyf

\uihegy_lky aZa_feyxsbf ijh\h^gbdhf 4. AZa_feyxsbc ijh\h^gbd
kh^bgy_lky k aZa_febl_e_f k\Zjdhc 7, Z k aZa_feyxsbf kimkdhf - k\Zj-
dhc beb [helh\uf aZ`bfhf 5.

1.3. <ha^mrgu_ ebgb k ijh\h^Zfb KBI

< gZklhys__ \j_fy ^ey ebgb we _dljhi_j_^Zqb gZijy`_gb_f ^h
20 d< rbjdh ijbf_gyxlky bahebjh\Z ggu_ ijh\h^Z. GZ gZijy`_gb_
^h 1 d< bkievamxlky kZfhg_kmsb_ bahebjh\Zggu_ ijh\h^Z (KBI),
ij^klZ\eyxs_b_kh[hc kdjmq_ ggu_ \ `]ml bahebjh\Zggu_ ijh\h^gbd-
db. <hkijbgfZxsbc hk_\mx gZ]jmadm (g_kmsbc) gme_\hc ijh\h^gbd
fh`_1 \uihegylvky [_a baheypbb beb k baheypb_c. < g_dhlhjuo dhg-
kljmdpbyo KBI \k_ ijh\h^gbd \u ihegyxlky g_kmsbfb. Ebgb k
KBI h[hagZqZxlky <EB.

Ij_bfms_kl\Z kZfhg_kmsbo bahebjh\Zgguo ijh\h^h\:

- \ukhdZy gZ^`_ghklv b [_ki_j_[hcgh_ h[_ki_q_gb_ ihlj_[b-
l_e_c we_dljhwg_j]b_c;
- khdjZs_gb_ wdkiemZlZpbhgguo jZkoh^h\ aZ kq_l bkdexq_-
gby kbkl_fZlbq_kdhc jZkqbklb lJZkk, aZf_gu ih\j_`^_g-
guo baheyljh\;
- kgb`_gb_ wg_j]hihl_jv \ ebgb \ke^kl\b_ mf_gvr_gby j_-
Zdlb\gh]h khijhlb\e_gby (0,1 Hf/df ih kjZ\g_gbx k 0,35
Hf/df ^ey g_bahebjh\Zgguo ijh\h^h\);
- \hafh`ghklv kh\f_klghe ih^_kdb gZ hihjZo ijh\h^h\ k
jZaguf mjh\g_f gZijy`_gby b k l_e_nhggufb ebgyfb;
- ijhklhlZ fhglZ`Z b j_fhglZ, hkh[_ggh ijb jZ[hIzo ih^ gZ-
ijy`_gb_f;
- khdjZs_gb_ h[t_fh\ Z\Zj bcgh-\hkkIzgh\bl_evguo jZ[hI;
- hlkmkl\b_ beb g_agZ qbl_evgh_ h[jZklZgb_]hehe^hf b
fhdjuf kg_]hf bahebjh\Z gghe ih_joghklb ijh\h^h\;
- \hafh`ghklv fhglZ`Z EWI ih nZkZ^Zf a^Zgbc, qlh fh`_1
bkdexqblv mklZgh\dm qZklb hihj, aZ]jhfh^Zxsbo ljhlmZ-
ju, b memqrbv h[smx wk l_lbdl \]hjh^kdbo mkeh\byo;
- bkdexq_gb_ hiZkghklb \hagbdgh_gby ih`Zjh\ \ kemqZ_ iZ-
^_gby ijh\h^h\ gZ a_fex;
- bkdexq_gb_ \hafh`ghklb dhjhldh]h aZfudZgby f_`^m nZa-
gufb ijh\h^Zfb beb gZ a_fex;
- \ukhdZy [_ahiZkghklv h[kem`b\Zgby b hlkmkl\b_ jbkZ ih-
jZ`_gby ijb dZkZgbb nZaguo ijh\h^h\, gZoh^ysboky ih^
gZijy`_gb_f;

- [_{ahi}Zkghklv jZ[hl \[ebab EWI;
- kgb`_gb_ _jhylghklb obs_gby we_dljhwg_j]bb b jZajmr_gby.

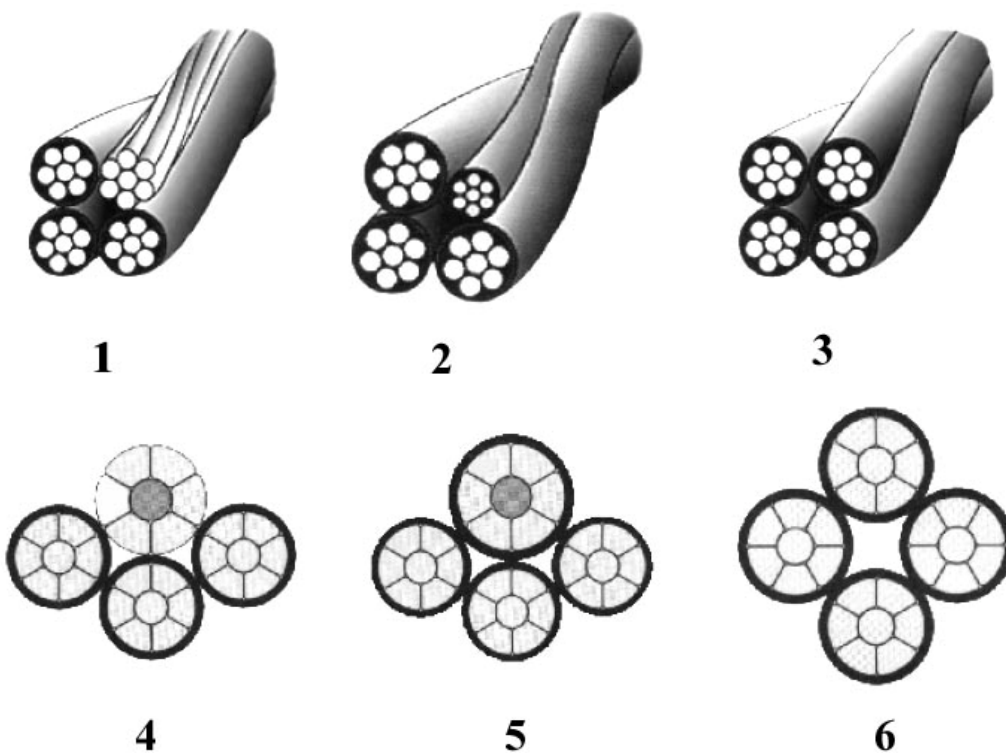
Bahebjh\Zggu_ ijh\h^Z ih^jZa^_eyxl:

Z) ih gZagZq_gbx:

- kZfhg_kmsb_ bahebjh\Zggu_ ijh\h^Z – ^ey \ha^mrguo eb-gbc we_dljhi_j_^Zqb gZ gZijy`_gb_ ^h 0,6/1 d< \dexqb-l_evgh;
- aZsbs_ggu_ ijh\h^Z – ^ey \ha^mrguo eb-gbc we_dljhi_j_^Zqb gZ gZijy`_gb_ 10...20 b 35 d<;

[) ih dhgkljmdlb\ghfm bkiheg_gbx (jbk. 1.9):

- k g_bahebjh\Zgghc gme_\hc g_kms_c`behc (1,4);
- k bahebjh\Zgghc gme_\hc g_kms_c`behc (2,5);
- k aZsblghc baheypb_c (3,6);
- [_a gme_\hc g_kms_c`beu;
-]_jf_lbabjh\Zggu_.



Jbk. 1.9. KZfhg_kmsbc bahebjh\Zgguc ijh\h^

1,2,3 – aZjm[_`gu_kbkl_fu; 4,5,6 – hl_q_kl_ggu_kbkl_fu;

1,4 – k g_bahebjh\Zgghc g_kms_c`behc; 2,5 – k bahebjh\Zgghc g_kms_c`b-ehc; 3,6 – k q_lujvyf g_kmsbfb`beZfb k aZsblghc baheypb_c

Qbkeh hkgh\guo lhdhijh\h^ysbo `be mklZgZ\eb\Zxl ba jy^Z: 1, 2, 3, 4.

GhfbgZevgh_ k_q_gb_ hkgh\guo lhdhijh\h^ysbo `be mklZgZ\eb\Zxl ba jy^Z: 16, 25, 35, 50, 70, 95, 120, 150, 185, 240 ff².

GhfbgZevgh_ k_q_gb_ lhdhijh\h^ysbo `be ijh\h^h\ [_a gme_\hc g_kms_c g_cljZeb – 16 beb 25 ff².

GhfbgZevgh_ k_q_gb_ gme_\hc g_kms_c `beu mklZgZ\eb\Zxl ba jy^Z: 25, 35, 50, 54,6, 70, 95 ff².

Qbkeh \kihfh]Zl_evguo lhdhijh\h^ysbo `be \ ijh\h^Zo k gme_\hc g_kms_c `behc ghfbgZevguf k_q_gb_f 50 ff² b [he__ mklZgZ\eb\Zxl ba jy^Z: 1, 2, 3.

GhfbgZevgh_ k_q_gb_ \kihfh]Zl_evguo lhdhijh\h^ysbo `be ^ey p_i_c gZjm`gh]h hk_s_gby – 16, 25 beb 35 ff², ^ey p_i_c dhg_ljhey – 1,5; 2,5 beb 4 ff².

< p_ehf ^ey lbih[h]h mqZkldZ <E k KBI fh`gh \u^_eblv ke_- ^mxsb_ wlZiu \uiheg_gby fhglZ` guo jZ[hl:

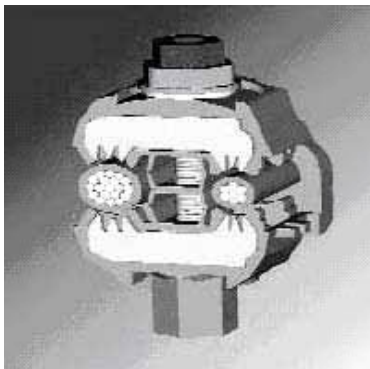
1. MklZgh\dZ hihj.
2. FhglZ` dj_i`guo mkljhckl\.
3. JZafhldZ KBI.
4. GZly`_gb_ <EB b __ Zgd_jgu_ aZdj_ie_gby.
5. AZf_gZ jhebdh\ gZ ijhf`_mlhqgu_ aZ`bfu.
6. H[mkljhckl\h ebg_cgguo hl_l_e_gbc hl fZ]bkljZeb.
7. AZsblZ <EB hl i_j_gZijy`_gbc. AZa_fe_gb_.
8. AZsblZ <EB hl dhjhldbo aZfudZgbc.
9. H[mkljhckl\h mebgguo k_lbevghdh\.
10. H[mkljhckl\h ljZgknjhZlhjguo \h^h\.
11. Ijbf_g_gb_ bahebjh\Zggguo kh_^bgbl_e_c.

<h \k_o mdZaZggguo \ur_ kbbk _fZo KBI fh]ml [ulv \dexq_gu 1 beb 2 ^h[Z\hqguo bahebjh\Zggguo Zexfbgb_\uo ijh\h^gbdZ k_q_gb_f 16 beb 25 ff² \ dZq_kl_ ^hihegbl_evguo `be beb `be ^ey mebggh]h hk_s_gby.

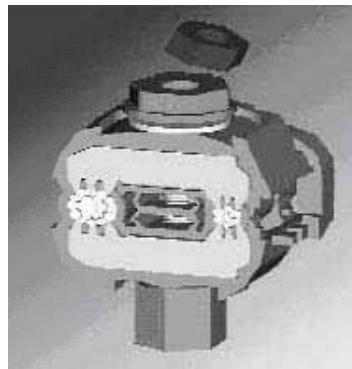
Ce_^m_l aZf_lblv, qlh dZq_kl\h bahebjh\Zggghc \ha^mrghc ebgb, [_ki_j_[hcghklv __ jZ[hlu b kjhd wdkiemZlZpbb \h fgh]hf aZ\bkbhl hl ebg_cgghc ZjfZlmju gZ dhljhgc kfghljbh\ZgZ ebgb. H^gbf ba dhfih-g_glh\ ebg_cgghc ZjfZlmju y\ey_lky hl _l_bl_evguc aZ`bf beb dZd _]h _s_gZau\Zxl gZ aZiZ^guc fZg_j , dhg_dlhj k ijhdZeu\Zgb_f baheypbb. < ijhp_kk_ wdkiemZlZpbb <EB hq_gv \Z`gmx jhev b]jZ_l dZq_kl\h b gZ^`ghklv dhglZdlZ. LZdh_ dZq_kl\h b gZ^`ghklv \ iheghc f_j_ h[_k-i_qb\Zxl]_jf_lbqgu_ dhg_dlhju, aZsblgu_ dh`mob dhlhjuo \k_]^Z fh]ml aZsblblv hl ihiZ^Zgby \eZ]b.

=_jf_l bqgu_dh g_dlhju j ZajZ[h]Zgu b bk i ulZgu ^ ey ijb f_ g_gby gZ kZfhg_kms _f bahe bjh\Zggh f ijh\h^ _^h 1 d<, k baheypb_c ba kr blh-jh i hebwlbe_gZ, khhl_lkl\mx s bo ?j hi_ckdhf mklZg^Zj lm HD 626. < wlhf klZg^Zj1_ bkiul Zgby ij h\h^ylky k mkeh\b_f ijh_ jdb gZ^_ghc jZ[h]hkihkh[ghklb \ k Zfuo ly ` _euo mkeh\byo h djm`Zxs _c kj_ ^u :

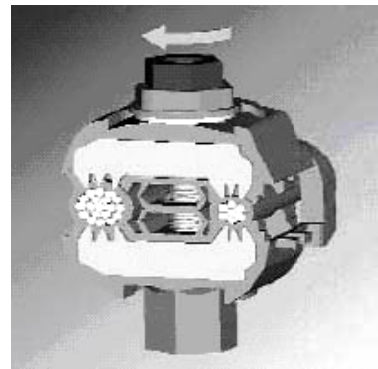
- fhg lZ` b wdkiemZlZpby ijb gb adbo l_f i _jZlmjZo;
- ^hi nklbfZy f _oZgbq_kdZy gZ] madZ gZh[Z ijh\ h^Z g_ hj Zgb-qb\ Z_lky ijb ijb f_g_ gbb ^Zggh]h dhg_dlhjZ;
-]ZjZglbjh\Z ggZy]_jf _lbqghklv ijb b kiulZgbb gZijy` _gb_f 6 d< ijb ih] j m`_gbb \ \h^m \ l_q_gbb 30 fbg.;
- g_baf_ggZy l_fi_jZl njZ b khi j hlb\e_g b_ dhglZdlZ ijb p bdeb-q_kdbo gZ]jmadZo b i_j _]jmadZo;
- bki ulZgb_ gZijy`_g b_f 6 d< i hke_ ij_ [u\Zgby \ ly`_e u o ih-jh^ guo mkeh\ byo (me\jZnbhe _lh\h_ kh eg_qgh_ baemq_gt_, dhe _[Zgby l_f i _jZlmju b \eZ`g hklb);
- dhj j habcgZy klhcdhkl v f_lZee bq_kdbo ^_lZe_c bkiulu\Z _lky \ dZf _j_ kheyg h]h lmfZgZ b \ dZf _j_ \eZ` gh]h]ZaZSO.



Z



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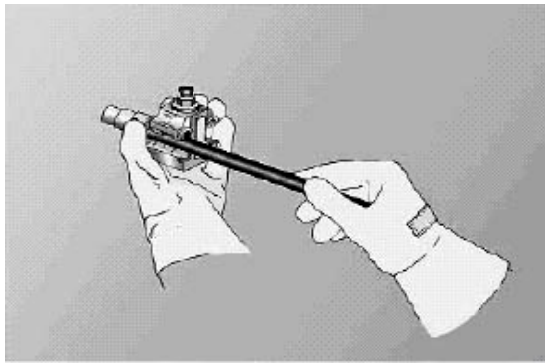
\

Jbk 1.1 0. MklZgh \ dZ ijhdZ eu\Zxs_] h aZ`bfZ :
Z - ^h fhglZ` Z; [- \h \j _fy fhgl ZZ; \ - ih ke_ kju\Z]heh\db

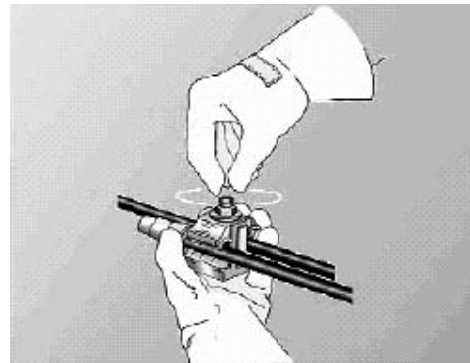
< ijhp _kk_ fhg lZ`Z dhg_dlhj e_]dh mklZgZ\eb\Z_lky gZ ij h\h^, hlklml kl\mxl \uiZ^Zx s b_ dhf i hg_glu. I jZ\bev gh_ iheh` _gb_ ij h\h^Z b^ms _]h gZ hl_l\e_g b_ e_]dh dhgljhe bjmlky q_j_a j_a bgh\uc d heiZ-qhd, dhlhjuc ijb d j_i e_g d dhj imkm aZbfZ. DhglZdlgu_ i eZklbg u ijhdZeu\Zxl ba heypbx b h[_ki_q b\Zxl g Z^_guc dhglZdl k`behc. ;hel bahebjh\Zg hl dhglZdlguo ie Zklbg, q_lh h[_ki _qb\Z_l f ZdkbfZevgm x [_ahi Zkghklv we_dljhf hgl_jZ ^Z_ ijb fhglZ` ih^ gZi j y`_gb_f. Dh-g_dlhju bf_ x l_r_klb]jZggmx kju\gm x]heh\d m m dhlhj hc fhf_ gl aZ-ly` db agZqbl_evgh gb`, q_f gZ bahebjh\Zgg u o ijhdZ eu\Zxs bf aZ-

`bf Zo, qlh i j _^hl\jZ s Z_l ih\ j_`^_gb _`be ij h\h^Z hl [hevr b o mkb-
 ebc i jb aZly] b\Zgbb. =_jf_lba bjmxb _gZdeZ^db iehlgh ijb`bf Zxlky
 d baheypbb, h[_ki_qb\ Zy ihegm x aZsbl mhl ijhg bdgh_gb y\eZ]b.

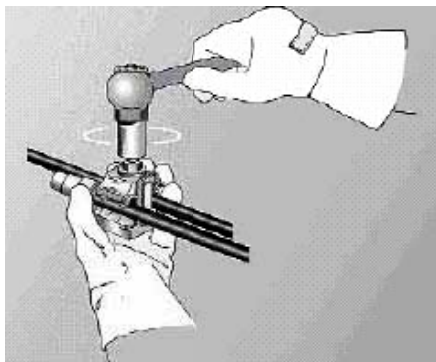
GZ jbk. 1.11 bah[jZ`g i j hp_kk f hglZ`Z]_jf_lbq gh]h ijh dZeu-
 \Zx s _]h dhg_dlhjZ gZ kZfhg_kmsbc bah ebjh\Zg guc ijh\ h^:



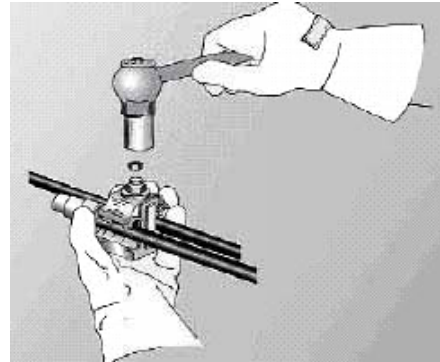
Z



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Jbk. 1.11. Ij hp_kk f hglZ`Z] _jf_lbqg h]h ijhdZ eu\Zxs_] h dhg_dl hjZ
 gZ kZfhg _kmsbc bahebjh\Zgg u c ijh\h ^:Z - mklZgh\blv hl _l\ey_fu c
 ij h\h^ \aZ` bf; [- mkl Zgh\blv a Zbf gZ hkgh\ghc i j h\h^ b ih ^lygmlv [hel;
 \ - aZ_jrbv aZ l y`dm [h elZ k ihfh svx gZdb ^gh]h dexq Z 13 ff
 ^h ihegh] h kju\Z]he h\db [hel Z

1.3.1. :j fZl njZ KBI

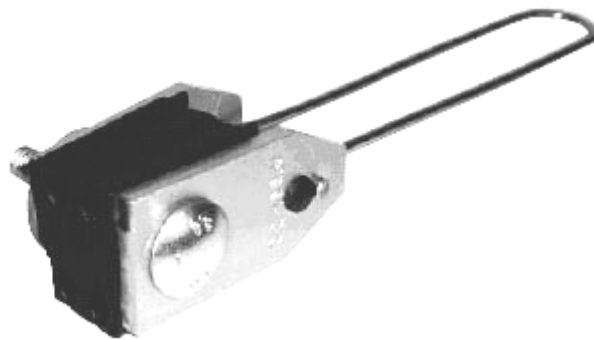
:gd_jg u _aZ`b f u

Bkiheva h\Zgb_: aZbfu i j _^gZagq_gu ^e y fhglZ`Z 2-o beb 4-o
 bahebjh\Zgg u o ijh\h ^h\, ijb i h^dexq _gbb Z[hg_glZ. Kem`Zl ^e y dj_-
 ie_g by kZfhg_kmsbo i jh\h^h\ d kl_gZf a^Zgbc b klhe[Z f, k ihf hsvx
 klZg^Zjlguo djxdh\, Zgd_jgu o djhgrl _cgh\ b ^jm]bo j Zagh\b^g hkl_c

dj_i e_gbc. ; eZ]h^Zjy kt_fghe ^m`d_ aZbf fh ` gh dj_i blv gZ \k\ha-
fh` gu_lbi u djxdh\ b djhgr l_cgh\.

Klj h_gb_:

- h[hcf Z – nhjf Zba pbgdh\Zgghc klZeb;
- ^m`dZ – g_j`Z _xsZy k lZev;
- ijb`b fgZy qZklv – mevljZnbhe_lhih]h^h klhcdbc ihebf_j , mkb-
e_ggu c kl_deh\ hehdghf ;
- ijm`b gu]hjq _]h pbgdh\Zgby;
- [hel] hjyq_]h pbgdh\Zgby.

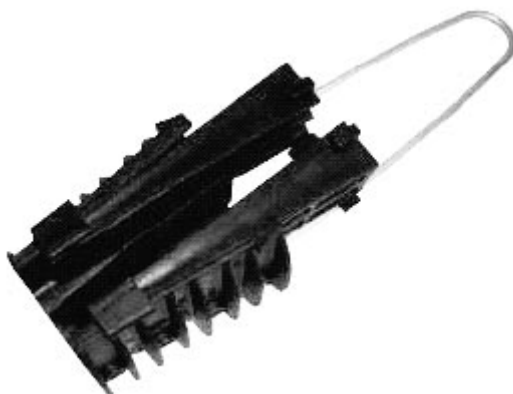


:gd_ j gu_ aZ bfu lbi ZZM – 201, ZM – 202



:g d_jgu_ a Zbfu l biZ Z – 201, Z – 202

Ij_^gZ agZq_gu dZd ^ey f hglZ`Z f Z]bkljZe_c fZeu o k_q_gbc, lZd
b ^ey dj_ie_ gby 2-o beb 4-o bahebjh\Zg guo ijh \h^h\ ij b ih^dex q_gbb
Z[hg_glZ. Kem`Zl ^ey dj_ie_g by kZfhg_kmsbo i jh\h^h\ d kl_gZf a^Z-
gbc b klhe[Zf , k ihfh s vx klZg ^Zjlguo djxdh\.

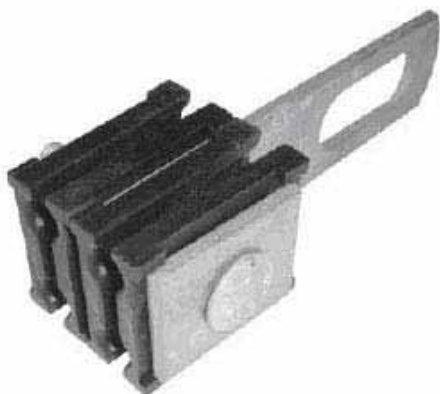


:gd_jguc aZ`bf J: 25*100

Bkihevah\Zgb_ : aZ`bf mgb_jkZe_g b ij^gZagZq_g ^ey dj_ie_gby dZd 2-o, lZd b 4-o bahebjh\Zgguo ijh\h^h\, ijb ih^dexq_gbb hl\h^Z Z[hg_glZ.

Kljh_gb_ :

- hl_qZ_l lj_[h\Zgbyf klZg^ZjlZ NF C 33 042;
- ih^b`guc debg g_ lj_[m_l fhglZ`gh]h bgkljmf_glZ;
- hldju\ZxsZyky ^m`dZ iha\hey_l dj_iblv aZ`bf dZd d djhg-rl_cgZf, lZd b d djxdZf;
- baf_gy_fZy ^ebgZ ^m`db (^h 220 ff);
- dhjimk ba]hlh\e_g ba mevljZnbhe_lhklhcdh]h ihebf_jZ b mkbe_g kl_deh\hehdghf.

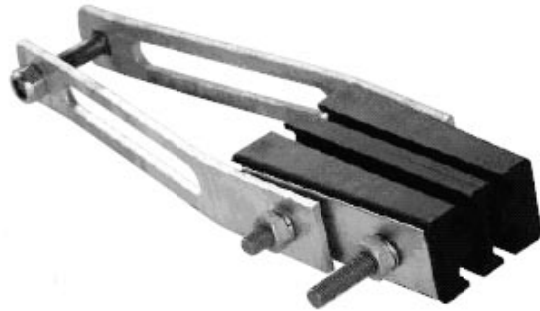
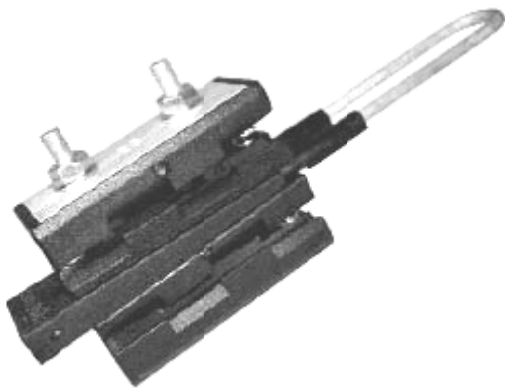


:gd_jgu_ aZ`bfu HEL – 5505, HEL – 5505-2

Bkiheva h\Zgb_: f hglZ` f Z]bkljZe_c fZeuo k_q_gbc (16...35 f f²), Z lZd`_ fhg lZ` hl\h ^h\ Z[hg_glh\ I j_^gZagZ_g ^ey Zgd_jgh] h beb ijh f`_mlhq gh]h dj_i e_gby kZ hg_kms_lh ijh\ h^Z k_q_gb_f hl 1 6 ff² ^h 35 ff². AZbf fh`_l [ulv e_]dh bkihevah\Z g \ dZq_kl`_ ijh f`_m-lhq gh]h, ih\ hjhlhf` n bdkbjmx s_c qZk lb gZ 900. Ijkh 1hlZ fhg lZ`Z, h^bg [hel 17 ff, fZe Zy ^ebgZ aZ`bfZ -165 ff, ij_djZk gZy aZsblZ hl kdhev`_gby -4 dG.

Kljh_g b_:

- aZp_i – klZev]hjyq_]h p bgdh\Zgby;
- ijb`b fgZy qZkl v – ih] h^h-mevlj Znbhe_l hklhcdbc ihebf_j , mkb-e_ggu c kl_deh\ hehdghf ;
- ijm`b gu]hjyq_]h pbgdh\Zgby.



: gd_jgu_ a Z`bfu S PIN-403, SPIN-404

Bkihev ah\Zgb_: f hglZ` f Z]bkljZe_c k bki hevah\Zgb_f bah ebjh-\Zgguo ijh\ h^h\ lbi ZAsXS(n). Kem`ZI ^ey dj_i e_gby wbo ijh\ h^h\ d kl_gZf a^Zgbc b klhe[Zf, k ih f hsvx kl Zg^Zjlg u o djxdh \.

Kljh_g b_:

- h[hcfZ – Zex fbgb_\ Zy nhjf Z
- aZp_i – klZev]hjyq_]h pbgdh\Zgby;
- ij b`bfgZy qZklv – mevlj Znbhe_lhi h]h^hklh cdbc ihe bf_j, mbe_gguc kl_deh\ hehdghf;
- ij mbgu]h j yq_]h pbgdh\Zgby;
- debg ba mevlj Znbhe_l hklhcdh]h ihebf _jZ.

Bkihevah\Zgb_: f hglZ` f Z]bkljZe_c k bki hevah\Zgb_f bah ebjh-\Zgguo ijh\ h^h\ lbi ZAsXS(n). Kem`ZI ^ey dj_i e_gby wbo ijh\h ^h\ d kl_gZf a^Zgbc b klhe[Zf, k ih f hsvx kl Zg^Zjlg u o djxdh \, Z lZd`_ \ha-fh` gh dj_ie _gb_ gZ dj hgrl_c gZo



:gd_jgu_ aZ`bfu HEL-5503 b Z-203

IjhdZeu\Zxsb_ aZ`bfu

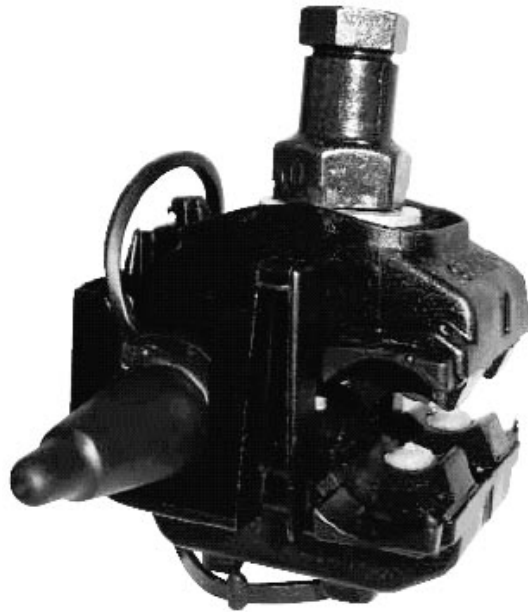
HI_l\bl_evguc ijhdZeu\Zxsbc aZ`bf ?J 95-13

=_jf_lbqguc hl_l\bl_evguc aZ`bf, ijhdZeu\Zxsbc baheypbx,
ij_gZagZq_g ^ey \k_o \b^h\ kZfhg_kms_]h ijh\h^Z ^h 1d<. DZd ijZ\beh
bkihevam_lky ^ey ih^dexq_gby hk_s_gby .

HkgZs_g kZfhkju\ghc]heh\dhc [helZ.

Ijb aZly]b\Zgbb [helZ, am[pu dh glZdlguo ieZklbg ijhdZeu\Zxl
baheypbx b kha^Zxl ij_djZkguc dhglZdl.





Hl_l\bl_evguc ijhdZeu\Zxsbc aZ`bf J2O95 (150)
 =_jf_lbqguc hl_l\bl_evguc aZ`bf, ijhdZeu\Zxsbc baheypbx,
 ij_^gZagZq_g ^ey \k_o \b^h\ kZfhg_kms_jh ijh\h^Z ^h 1 d<.
 Bkihevam_lky ^ey ih^dexq_gby hl\h^h\ Z[hg_glZ.
 HkgZs_g kZfhkju\ghc]heh\dhc [helZ.
 Ijb aZly]b\Zgbb [helZ, am[pu dhglZdlguo ieZklbg ijhdZeu\Zxl
 baheypbx b kha^Zxl ij_djZkguc dhglZdl.



Hl_l\bl_evgu_ijhdZeu\Zxsbc_ aZ`bfu J3O95, J4O150D

=_jf_lbqguc hl_l\bl_evguc aZ`bf, ijhdZeu\Zxsbc baheypbx,
 ij_^gZagZq_g ^ey \k_o \b^h\ kZfhg_kms_]h ijh\h^Z ^h 1 d< .
Bkihevam_lky ^ey ih^dexq_gby bahebjh\Zggh]h ijh\h^Z djmigu
 k_q_gbc ijb jZa_l\e_gbb fZ]bkljZeb. HkgZs_g kZfhkju\ghc]heh\dhc
 [helZ.

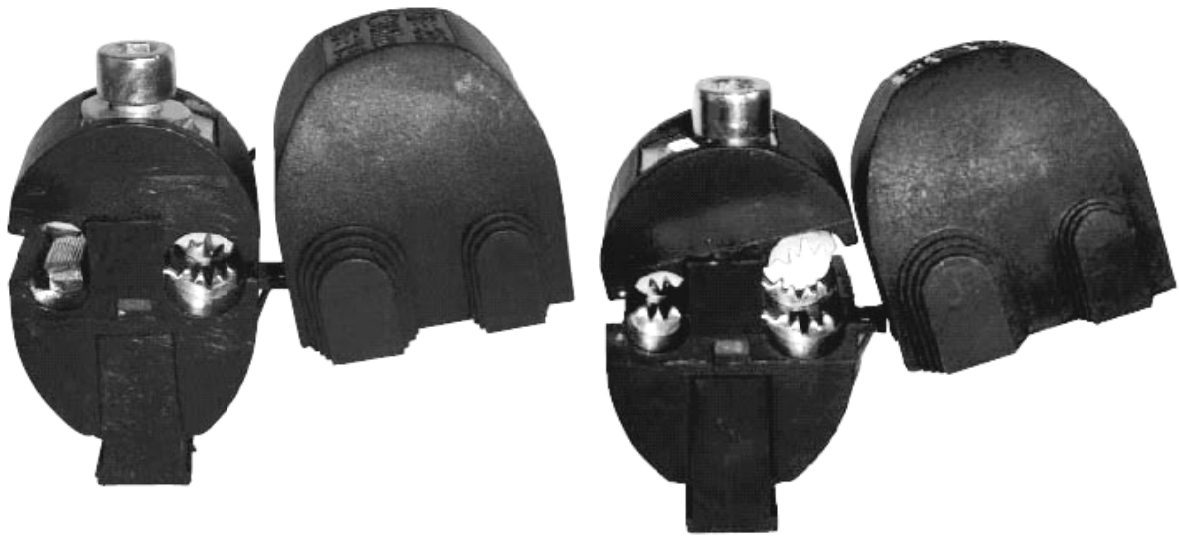


HI_l\bl_evguc ijhdZeu\Zxsbc aZ`bf RDP 25/CN

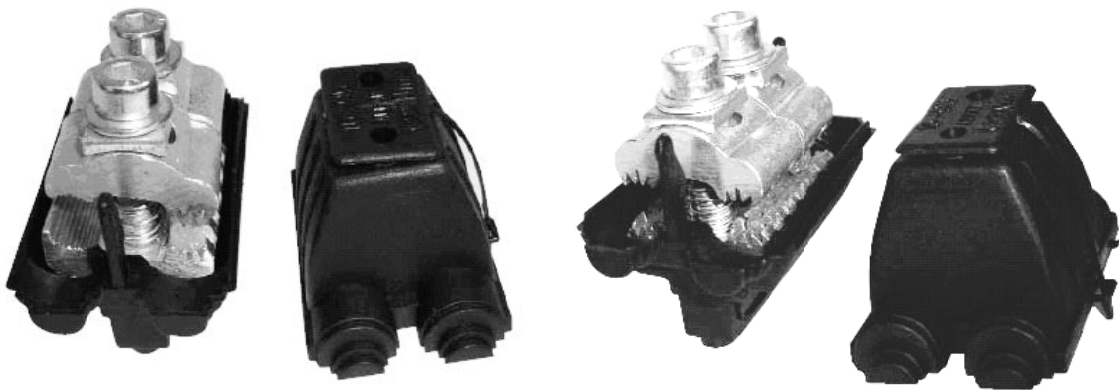
HI_l\bl_evguc aZ`bf, ijhdZeu\Z xsbc baheypbx, ij_^gZagZq_g
 ^ey \k_o \b^h\ kZfhg_kms_]h ijh\h^Z ^h 1 d<.

Bkihevam_lky ^ey ih^dexq_gby bahebjh\Z ggh]h ijh\h^Z ijb ih^dexq_gbb
 hl\h^Z Z[hg_glZ hl]hehc ebgbb.

HkgZs_g kZfhkju\ghc]heh\dhc [helZ.

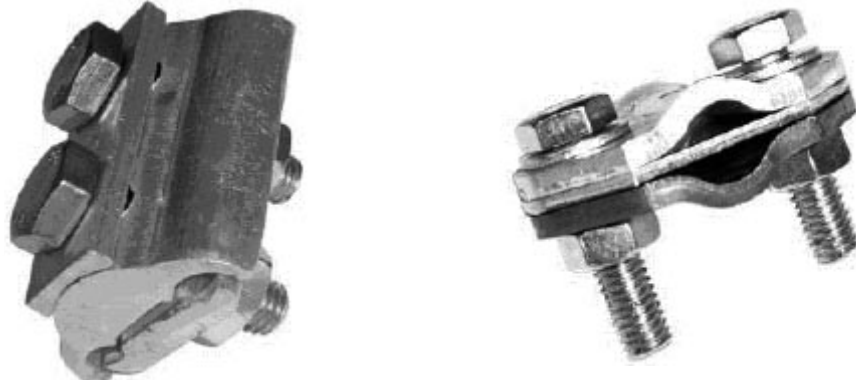


Hl_l\bl_ evgu_ijh dZeu\Zx s b_aZ`bf u Z-205 , Z-2051
 Hl_l\bl_l_evguc aZbf, ij hdZeu\Zx s bc baheypbx, ij _gZagZqg ^ey
 \k_o \b^h\ kZ f hg_kms_jh ijh\h ^Z ^h 1 d<.
 Bkiheva m_lky ^ey i h^dexq_gby bahebjh\Zggh]h ijh\h ^Z ijb ih ^dex-
 q_gbb hl\h^h \ Z[hg_gl Z lZd`_ hafh`gh i h^dexq_gb_hk_s_gby.



Hl_l\bl_ev gu_ijhd Zeu\Zx-
 sb_aZ` bfu Z-20 6, Z-2061
 Hl_l\bl_l_evguc aZbf, ij hdZeu\Zx s bc baheypbx, ij _gZagZqg ^ey
 \k_o \b^h\ kZ f hg_kms_jh ijh\h ^Z ^h 1 d<.
 Bkihevam_lky ^ey i h^dexq_gby bahebjh\Zggh] h ijh\h^ Zijb jZa\ _l\ e_-
 gbb f Z]bkljZe b b^ey ih ^dexq_g by hl\h^h \ Z[hg_gl Z.
 Z-206 i j_gZagZqg ^ey i h^dexq_gby hl g_bahebj h\Zgghc ebgb
 beb hl dZ[_ey.
 Z-2061 ij_gZa gZqg ^ey ih^dex q_gby ij b i_j_oh ^_hl bahebjh-
 \Zgghc ebgb .

IeZr_qgu_ aZ`bfu ^ey Jheuo ijh\h^h\ b g_cljZeb aZa_fe_-
gby. AZ`bfu ij_ ^gZagZq_gu ^ey kh_ ^bg_gby ^\mo Jheuo ijh\h^h\. Ijh-
 \h^Z fh]ml [ulv ba Zexfbgb_\h]h beb klZe_Zexfbgb_\h]h kieZ\Z.



F_oZgbq_kdb_ [helh\u_ gZdhg_qgbdb ijbf_gyxlky ^ey hdhgp_-
 \Zgby f_ ^guo b Zexfbgb_\uo, h^ghijh\hehguo b fgh]hijh\hehguo
 `be. GZdhg_qgbdb hkgZs_gu [helZfb k kZfhkju\gufb Jheh\dZfb, qlh
 agZqbl_evgh mijhsZ_l fhglZ`. ;helu \h] Zqb\Zxlky dexq_f k gZdb^ghc
 Jheh\dhc, ^h kju\Z Jheh\db.

L_jfhmkZ`b\Z_fZy ljm[dZ MWTM h[_k i_qb\Z_l gZ^`gmX]_jf_-
 lbaZpbx f_ ^m gZdhg_qgbdhf b bahey pb_c `beu. GZdhg_qgbd em`_g-
 guc, ihwlhfm fh`_l [ulv ijbkh_ ^bg_ g dZd d Zexfbgb_\hc, lZd b d f_ ^-
 ghc `be_.



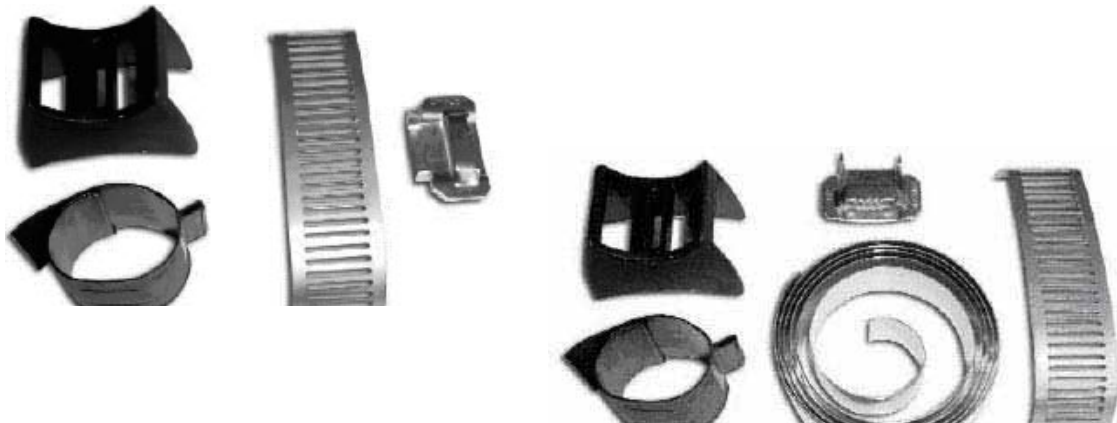
AZ`bfu ^ey ijhdeZ^db ih nZkZ^Zf a^Zgbc - BRPF 70-510-1F(6F)
 Ijh\h^ dj_iblky d k_ ^em aZ`bfZ k ihfhsvx ieZklfZkhh\uo dZ-
 [_evguo j_f_rdh\. <lhjZy ebgby fh`_l [ulv aZdj_ie_gZ gZ lhf`_ aZ-
 `bf_ k ijhlb\hiheh`ghc klhjghu ^ hihegbl_evguF j_f_rdhf. Dhjimk

aZ`bfZ b j_f_rdb ba]hlh\e_gu ba ih]h^h- b mevljZnbhe_lhklhcdh]h ihebf_jZ. RbjbgZ j_f_rdh\ 9 ff, q_jgh]h p_lZ,]Zeh_ghg_kh^_j`Z-sb_ b g_ih^^_j`b\Zxsb_]hj_gby.

FhglZ` aZ`bfZ : ^x[_evgZy qZklv aZ`bfZ mklZgZ\eb\Z_lky \ ij_^\Zjbl_evgh ijhk_je_ggh_ hl_jklb_ 0,12 ff b aZdj_iey_lky k ih-fhsvx]\ha^y. QZklv aZ`bfZ k k_`ehf gZ^b]Z_lky ^h oZjZdl_jgh]h s_eqdZ, ih^l_j`^Zxs_]h nbdkZpbx. AZ`bfu mklZgZ\eb\Zxlky gZ kl_-gZQ, h[uqgh q_j_a 0,7 f.

>bklZgpbhgguc [Zg^Z` SO 79 .5 b SO 79.6

Ij_`gZagZq_g ^ey dj_ie_gby kZfhg_kms_]h ijh\h^Z beb dZ[_e_c d hihjZf. Dj_iblky k ihfhsvx dexqZ ^ey gZl y`db b j_adb e_glu.



Ijhf_`mlhqgu_ ih^_kgu_ aZ`bfu



Ih^_kghe aZ`bf Z-224 (hl 0 ^h 30^h)

Ijbf_g_gb_ – bkihevam_lky \ dZq_kl_ ijhf_`mlhqgh]h dj_ie_gby ijh\h^h\ KBI, k_q_gb_f hl 4×16 ^h 4×120 ff ² ih ijyfhc beb k m]ehf ih\hjhlZ ebgbh hl 0^h 30^h gZ klZg^Zjlguo djxdZo.

Kljh_gb_: aZp_i ba]hlh\e_g ba ijhnbevgh]h hpbgdh\Zggh]h f_lZeZ. ;hel F8. <deZ^ur ba mevl-jZnbhe_lh]h^hklhcdh]h ihebf_jZ, mkbe_ggh]h kl_deh\hehdghf.



Ih^_kghc aZ`bf Z-225 (hl 0^h ^h 60^h)

Ijbf_g_gb_ – bkihevam_lky \ dZq_kl_ ijhf_`mlhqgh]h dj_ie_gby ijh\h^ h\ KBI, k_q_gb_f hl 4×16 ^h 4×120 ff² ih ijyfhc beb k m]ehf ih\hjhlZ ebgb hl 0^h ^h 60^h gZ klZg^Zjlguo djxdZo.

Kljh_gb_ – aZp_i ba]hlh\e_g ba kieZ\Z Zexfb-gby b bf_l ki_pbZevgm x\k lZ\dm ba klZevgh]h dhev-pZ, qlh m_ebqb\Z_l baghk hmkhlhcqb\hklv ^m`db aZ-`bfZ. <deZ^ur ba mevljZnbhe_lh]h^hklhcdh]h ih-ebf_jZ, mkbe_ggh]h kl_deh\hehdghf. HkgZs_g aZs_edhc b ebf[hf k mdZ-aZgb_f k_q_gby, qlh agZqbl_evgh h[e_]qZ_l b mkdhjy_l fhglZ`.



Ih^_kghc aZ`bf Z-226 (SPIN 320) (hl 0^h ^h 90^h)

Ijbf_g_gb_ – bkihevam_lky \ dZq_kl_ ijhf_`mlhqgh]h dj_ie_gby ijh\h^h\ KBI, k_q_gb_f hl 4 ·16 ^h 4·120 ff² ih ijyfhc beb k m]ehf ih-\hjhlZ ebgb hl 0^h ^h 90^h gZ klZg^Zjlguo djxdZo. QZs_ \k_]h bkihevam_lky gZ m]eh\uo hihjZo ijb ijhdeZ^d_ ijh\h^h\ djmigu k_q_gbc ^h 4×95+2×35. GZebqb_jheb dh\ \ kZfhf a Z`bf_ ^_eZ_l \hafh`guf ijhdeZ^dm ijh\h^Z [_a ijb_f_g_gby jZkdZlhqguo jh-ebdh\.

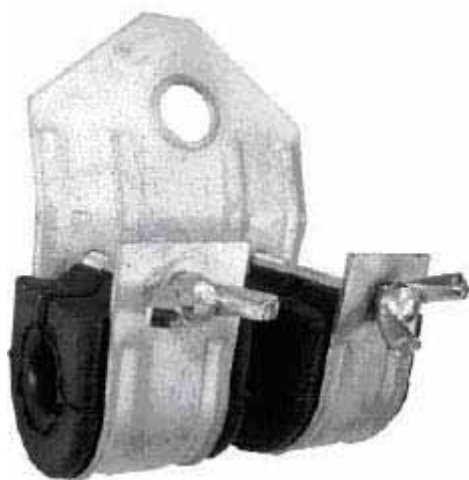
Kljh_gb_: aZp_i ba]hlh\e_g ba ijhnbevgh]h hpbgdh\Zggh]h f_lZeZ. ;hel F8. <klZ\dZ – mevljZ-nbhe_lh]h^hklhcdZy j_abgZ, jhebdb - mevljZnbhe_-lh]h^hklhcdbc ihebf_j.



Ih^_kghc aZ`bf Z-204 b Z-2044 (hl 0⁰ ^h 30⁰)

Ijbf_g_gb_ – bkihevam_lky \ dZq_kl_ ijhf_`mlhqgh]h dj_ie_gby ijh\h^h\ KBI, k_q_gb_f 16...95 ff² ih ijyfhc beb k m]ehf ih\hjhlZ ebgb ^h 30 gZ klZg^Zjlguo djxdZo.

Kljh_gb_ – aZp_i ba]hlh\e_g ba ijhnbevgh]h hpbgdh\Zggh]h f_lZeZ. ;hel fhuevdh\uc F8. <klZ\dZ j_abgh\Zy, mevljZnbhe_lh]h^hklhcdZy, ih^[bjZ_lky \ aZ\bkbfhklb hl k_q_gby ijh\h^Z (hl 2×16 ^h 4×95).



Ih[^]_kghc aZ`bf Z-2045 g- Z-2048
(hl 0^h ^h 90^h)

Ijbf_g_gb_ – bkihevam_lky \ dZq_kl-
_ ijhf_mlhqgh]h dj_ie_gby ijh\h^h\
KBI, k_q_gb_f 16...95 ff² ih ijyfhc beb
k m]ehf ih\hjhlZ ebgb ^h 90^h gZ klZg-
^Zjlguo djxdZo.

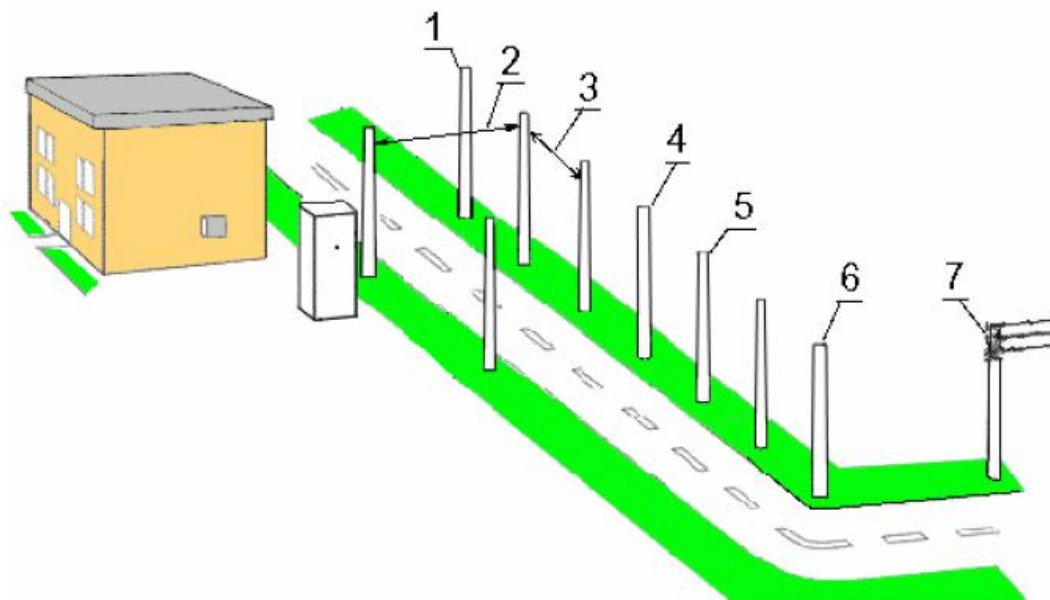
Kljh_gb_ – aZp_i ba]hlh\^e_g ba ijh-
nbevgh]h hpbgdh\Zggh]h f_lZeZ. ;hel
fhluvdh\uc F8. <klZ\dZ j_abgh\Zy,
mevljZnbhe_lh]h\h^hklhcdZy, ih^[bjZ_l-
ky \ aZ\bkbfhklb hl k_q_gby ijh\h^Z (hl
2.16 ^h 4.95).

1.3.2. MklZgh\dZ hihj (jbk. 1.12)

Hihju mklZgZ\eb\Zxlky kh]eZkgh ijh_dlm gZ <EB b fh]ml j_Zeb-
ah\u\Zlvky gZ hkgh_ klh_d:

- _e_ah_lhgguo (lbiZ K<95 b K<85);
- ^_j_ygguo (lbiZ K1 b K2);
- f_lZeebq_kdbo.

GZagZq_gb_ hihj ihdZaZgh gZ jbk. 1...12.

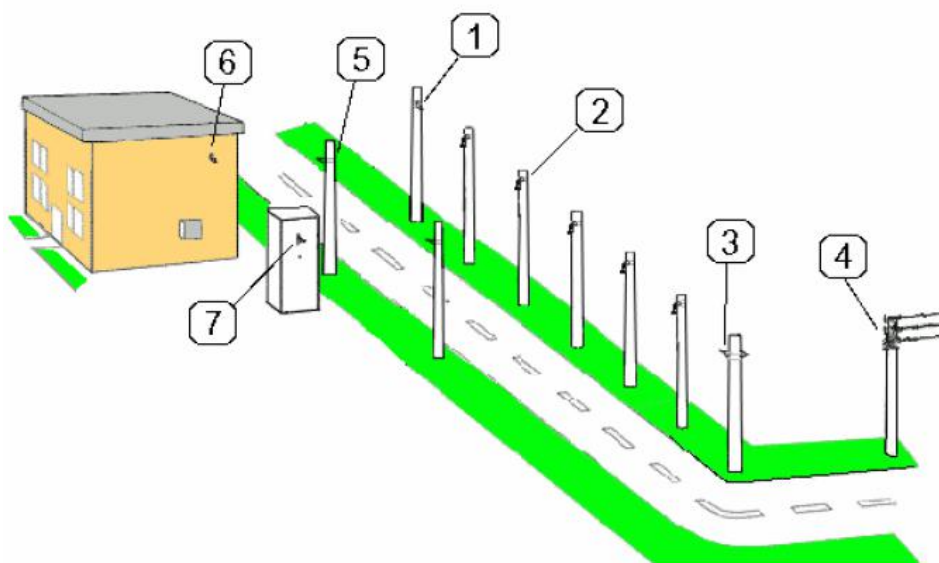


Jbk. 1.12. JZkklZgh\dZ hihj

1 - dhgp_Zy hihjZ; 2,4 - hl_lbl_evgu_ ^ey \h^Z; 3 - ijhe_l f_ ^m khk_ ^gbfb
hihjZfb fZ]bkljZeb; 5 - ijhf_mlhqgZy; 6 - m]eh\Zy (ijhf_mlhqgZy beb
Zgd_jgZy); 7 – Zgd_jgZy.

1.3.3. FhglZ` dj_i`guo mkljhckl\

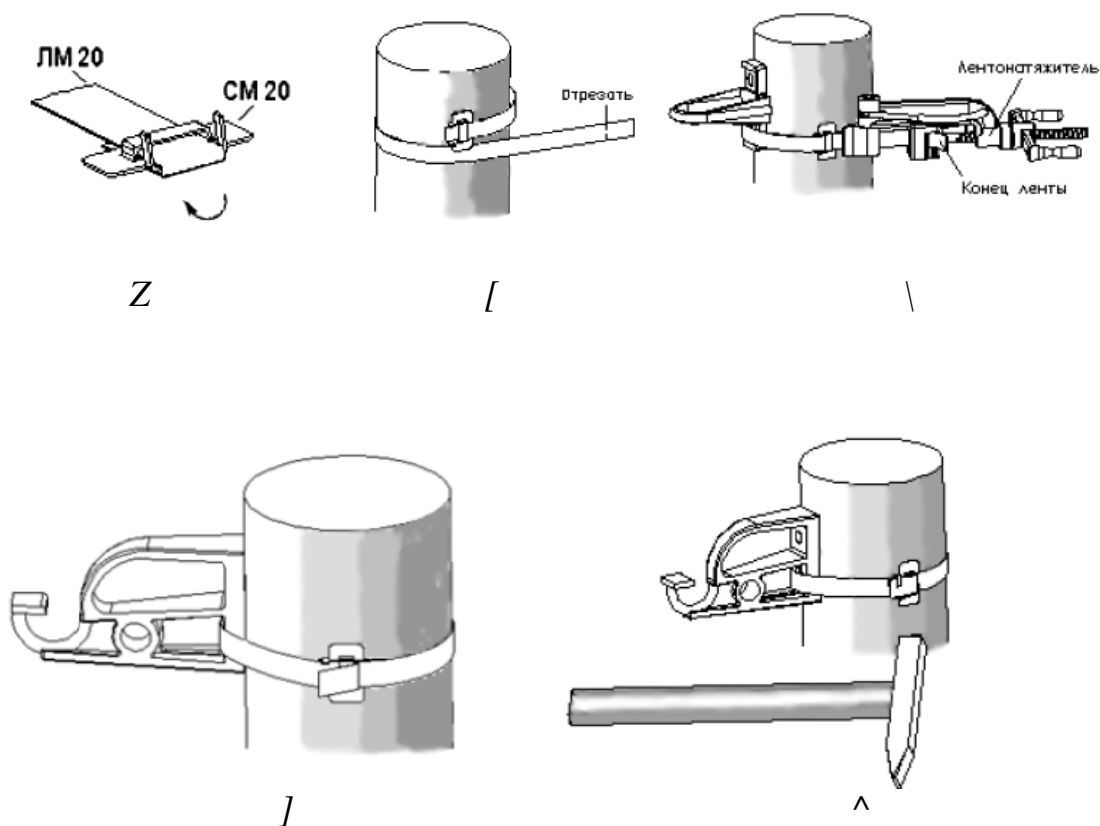
FhglZ` dj_i`guo mkljhckl\ \dexqZ_1 \ k_[y aZdj_ie_gb_ gZ hihjZo, gZ nZkZ^Zo a^Zgbc b khhj_m`_gbc f_lZeebq_kdbo djhgrl_cg\ beb djxdh\, bkihevam_fuo ^ey nbdkZpbb bahebjh\Zgguo aZ`bfh\, dh-lhju_ m^_j`b\Zxl KBI. Lbiu djhgrl_cg\ ^ey dZ`^h]h f_klZ aZdj_i-e_gby dhfie_dlmxlky \ kljh]hf khhl_lkl\bb k ijh_dlhf gZ <EB b k mq_lhf l_ogbq_kdbo oZjZdl_jbklbd mklZgZ\eb\Z_fuo djhgrl_cg\, ijb\h^bfuo \ dZlZeh]_ ij_^ijbylby-ijhba\h^bl_ey.



Jbk. 1.13. JZkieh`_gb_ dj_i` _guo mkljhckl\, k ihfsvx dhlhjuo bahebjh\Zggu_ aZ`bfu k KBI dj_iylky d hihj_ beb d nZkZ^m a^Zgby:
1, 3, 4, 5 - djhgrl_cg Zgd_jguc; 2 - djhgrl_cg ih^^_j`b\Zxsbc;
6, 7 - djhgrl_cg gZ nZkZ^_ beb gZ kl_g_

E_glhqguc ma_e dj_ie_gby djhgrl_cgZ ^ey KBI d hihj_ \uihe-gy_lky ba e_glu fhglZ`ghc lbiZ EF 20 (beb F2007), ba]hlh\e_gghc ba g_j`Z_xs_c klZeb, dhgpu dhlhjhc aZdj_ieyxlky k ihfsvx kdj_iu fhglZ`ghc lbiZ KF 20 (beb :200) k ijbfg_gb_f ki_pbZevgh]h bgkl-jmf_glZ – e_glhgZly`bl_ey.

GZ jbk 1.14 ihdZaZgZ ihke`h\Zl_evghklv h^gh\bldh\h]h fhglZ`Z gb`g_lh ohfmlZ. FhglZ` _jog_lh \uihegy_lky ZgZeh]bqguf h[jZahf).



Жбк. 1.14. I hke^h\Zl_evghk l v fhglZ ` Z e_glh qgh]h maZ dj_ie_g by djh grl_cgZ: 1 - nbdkZpby gZqZeZe_glu; 2 - hlj_adZ g mighc^eb gu; 3 - aZi j Z dZ djhgr l_cgZ b gZly`dZ e_glu^h m ihjZ; 4 - a Z]b[e_gl u \h[jZlg m kklhjg mb __ hlj_adZ; 5 - nbdkZpby dhgpZ e_glu «mkbd Zf b» kdj_i u k ihfhs vx fhehl dZ

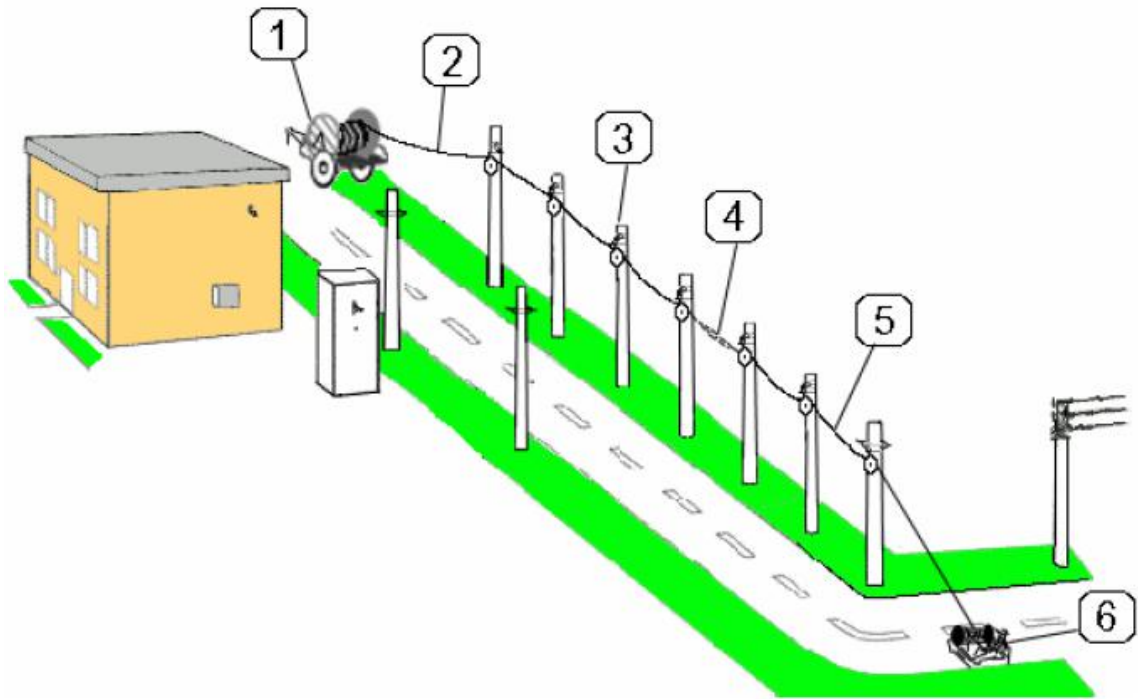
1.3.4. JZafhldZ KBI

JZafhl dZ `]mlZ kZfhg_km`_]h ij h\h^Z ij _^klZ\e_g Z gZ jbk. 1.15. HgZ hkms_kl\ey_lky g_ihkj^ kl_ggh k [ZjZ[ZgZ 1, aZq_ie_ggh]h gZ jZkdZlhqghc l_e`d_ (jbk. 1.1 6), k ihf hsvx f _oZgbq_kdhc e_[^db 6, mklZh\e_ggh c k ijhl b\hiheh ` gh]h hl [ZjZ[ZgZdhgpZ ebgb, k bki hev-ah\Zgb_f jZk dZlhqgu o jhebdh\ 3, aZdj_i e_gguo gZ hihjZ o fhglbj m_fh-]h mZkldZ.

>ey k[h[h^gh]h ijhoh ` ^_gby `]mlZ KBI q_j_a j hebdb ij bf_gyxl ky:

- \kih f h]Zl_evghc ljhk (iha. 5), dhlhjuc ijb jZa f hld_ KBI gZ-fZl u\Z_lky gZ\Ze f_o Zgbq_kdhc e_[^db (iha. 6);

- dhfi e_dl «_j lex]-fh glZ`gu_ qmedb» ^ey ijhly ` db KBI (iha. 4) q_j_a jhe bdb, h[_ki _qb\Z_l m^_j`Zgb_ dhgpZ`]mlZ KBI \ k ` Zlhf khklhygbb b g_ iha\he y_l`]ml mi_j_djm qb\Zlvky ijb _]h i jhly`d_ .



*Jbk. 1.15. @]ml KBI \ ijhp_kk_jZafhldb:
 1 - [ZjZ[Zg; 2 - ijh\h^ KBI; 3 - jZkdZlhqguc jhebd 4 - _jlex];
 5 - \kihfh]Zl_evduc ljhk; 6 - f_oZgbq_kdZy e[_^dZ*

JZafhldZ KBI \uihegy_lky \ ke_^mxs_c ihke_^h\Zl_evghklb:

- k h^gh]h dhgpZ fhglbjm_fh]h mqZkldZ mklZgZ\eb\Z_lky [ZjZ[Zg k KBI gZ jZkdZlhqguc l_e`d_,
- k ^jm]h]h dhgpZ mqZkldZ mklZgZ\eb\Z_lky f_oZgbq_kdZy e[_^dZ kh \kihfh]Zl_evduc ljhkhf,
- aZdj_ieyxlky gZ hihjZo jZkdZlhq gu_ jhebdb, gZqbgZy k hihju kh kljhgu e[_^db, h^gh]j_f_ggh \ gbo aZijZ\ey_lky \kihfh]Zl_evduc ljhk, jZafZlu\Z_fuc k [ZjZ[ZgZ e[_^db,
- ihke_ ih^ly]b\Zgby ljhkZ d [ZjZ[Zgm k KBI gZ dhgp_ ljhkZ aZdj_iey_lky fhglZ`guc qmehd ^ey ljhkZ ba dhfie_dlZ «_jlex]-fhglZ`gu_qmedb»,
- gZ dhgp_`]mlZ KBI aZdj_iey_lky fhglZ`guc qmehd ^ey aZsb-lu KBI ba dhfie_dlZ «_jlex]-fhglZ`gu_qmedb»,
- k ihfsvx f_oZgbq_kdhc e[_^db`]ml KBI ijhly]b\Z_lky q_-j_a \k_ jhebdb b jZafhldZ ij_djZsZ_lky, dh]^Z`]ml ijhc^_l ihke_^gbc jhebd b g_fgh]h himklblky \ kljhgm e[_^db.

J_dhf_g^Zpbb b ij^hkl_j`gby:

1. Ijbf_g_gb_ jZkdZlhqguo jhebdh\ h[yaZl_evgh, ihkdhevdm, bf_y jZ[hqb_ ih_joghklb, ihdjulu_ ieZklbdhf, hgb ij^hljZsZxl

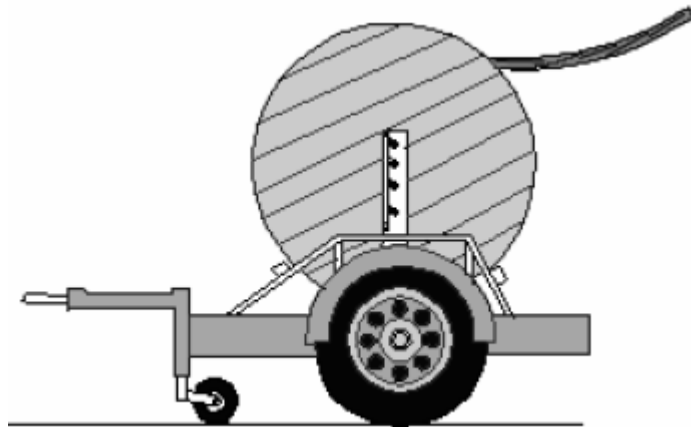
ih\j_`^_gb_ baheypbb jZkdZlu\Z_fuo ijh\h^h\ G_`himklbfZ jZafhl-
dZ KBI gZ a_fgbc ih_joghklb, ihkdhevdm wlh fh`_1 ijb_klb d ih-
\j_`^_gbx b aZ\jyag_gbx baheypbb ijh\h^h\ < kemqZ_ ihke^g_jh ijb
fhglZ`_ ijhdZeu\Zxsbo aZ`bfh\ we_dljbq_kdh_ khijhlb\`e_gb_ dhg-
lZdlZ f_`^m am[vyfb aZ`bfZ b ijh\h^gbdZfb KBI [m^_1 [hevr_ jZk-
q_lgh]h, Z wlh ijb_`_1 d ^hihegl_evuf we_dljbq_kdbf ihl_jyf b d
ij_`^_`j_f_gghfm \uoh^m ba kljhy <EB.

2. H[yaZl_evgh_ ijb_f_g_gb_ _jlex]Z ijb jZafhld_ KBI ij_`hl-
\jZsZ_1 kZfhijhba\hevgh_ jZkdjmqb\Zgb_ ijh\h^h\ \ `]ml_ ?keb ^ey
jZafhldb g_ ijb_f_gylv _jlex], lh \ hl^_evguo f_klZo f_`^m ijh\h^g-
bdZfb fh]ml ihy\blvky aZf_lgu_ ijhk _lu, \ dhlhjuo ijb g_ jZkq_l-
guo f_oZgbq_kdbo \ha^_ckl\byo gZ <EB (kbevguc _1_j, iZ^_gb_ ^_j_ -
\Z b l. ^.) \hagbdZ_1 hiZkghklv h[ju\Z hl^_evgh]h ijh\h^Z.

3. H[yaZl_evgh ijb_f_gylv fhglZ`guc qmehd ^ey `]mlZ KBI, ih-
kdhevdm wlh mkdhjy_1 ijhp_kk jZkdZldb b ij_`hojZgy_1 baheypbx KBI
hl f_oZgbq_kdbo ih\j_`^_gbc aZ kq_1 jZ\ghf_jgh]h jZkij_`_e_gby f_-
oZgbq_kdhc gZ]jmadb \^hev `]mlZ KBI ijb _]h jZafhld_.

Bgkljmf_glu ^ey jZafhldb

JZkdZlhqgZy l_e_`dZ (jbk. 1.16) – i_j_`b`gZy ieZlnhjZ , mklZ-
gh\`e_ggZy gZ g_[hevrhf Z\lhfh[bevghf ijb_p_i_, bf_xsZy ki_pbZev-
gh_ mkljhckl\h ^ey nbdkZpbb \ZeZ b _]h lhjfh`_gby, \ dhlhjh aZdj_i-
ey_lky \jZsZxsbecky [ZjZ[Zg k cZfhg_kmsbf ijh\h^hf.



Jbk. 1.16. JZkdZlhqgZy l_e_`dZ

JZkdZlhqgu_ jhebdb, gZijbf_j, lbiZ EDD 1000 b EDD 1700 (jbk.
1.17) bf_xl ieZklbdh\h_ ihdjulb_ b h[mkljh_gu mkljhckl\hf ^ey ih^
_rb\Zgby k e_glhc b aZ`bfhf.

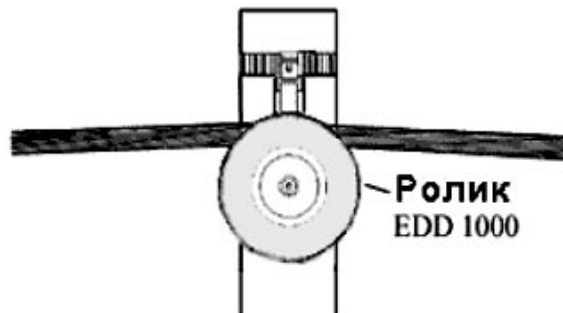
FZdkbfZevgh ^himklbfuc ^bZf_lj `]mlZ KBI - 50 ff.

FZdkbfZevgZy gZ]jmadZ ^ey jhebdh\:

EDD 1000 – 1000 d]k,
 EDD 1700 – 1700 d]k.

<_k jhebdh\:

EDD 1000 – 5,2 d],
 EDD 1700 – 10,7 d].



Jbk. 1.17. JZkdZlhqguc jhebd

<_jlex] lbiZ EMD15 (jbk.1.18) – kludh\hqqguc we_f_gl, mklZgZ\eb\Z_fuc k ihfhsvx qmedh\ f_`^m jZafZlu\Z_fuf KBI b \kihfh]Z-l_evquf ljkhkf b ij_`hl\jZsZxsbc j Zkdjmqb\Zgb_`]mlZ KBI. <_jlex] \u^_j`b\Z_l fZdkbfZevgm x gZ]jmadm – 1500 d]k.



Jbk. 1.18. <_jlex]

Ljhk \kihfh]Zl_evquc

<kihfh]Zl_evquf ljkhkf fh`_l kem`blv ex[hc ^hklZlhqgh ijhqqguc ljhk k k_q_gb_f g_f_g__ 10 ff ², \u^_j`b\Zxsbc kbem jZkly-`_gby g_f_g__ 400 d]k. Dhgkljmdpby ljhkZ b fZl_jbZe, ba dhlhjh]h hg k^_eZg, ^he`gu h[_ki_qb\Zlv m^h[k l\h hi_jbjh\Zgby k gbf. Hg g_ ^he-`_g aZimlu\Zlvky ijb _]h jZafhld_ k [ZjZ[ZgZ e_[^db, Z lZd`_ ijb kemqZcghf _]h hk\h[h^_gbb.

F_oZgbq_kdZy e[_^dZ

F_oZgbq_kdZy e[_^dZ bkihevam_lky ^ey jZkdZldb ijh\h^h\ KBI iml_f gZfZlu\Zgby gZ __ jZ[hqbc [ZjZ[Zg \kihfh]Zl_evgh]h ljhkZ, kh-
_ ^bg_ggh]h k KBI ihkj_^kl\hf dhf ie_dlZ «\jlex]-fhglZ`gu_ qme-
db». WlZ e[_^dZ ijb gZly`_gbb b jZkdZld_ ijh\h^Z h[_ki_qb\Z_l ih-
klhyggh_ gZly`_gb_ \kihfh]Zl_evgh]h ljhkZ \h \j_fy \k_c ijhp_^mju
jZkdZldb. <hafh`gh bkihevah\Zgb_ e[_^hd jZaebqguo fh^bnbdZpbc b
aZdj_iey_fuo, d ijb_fjm, gZ hihjZo, gZ Z\lhfh[bevguo ijb_p_iZo, \ dm-
ah_ ljmah\h]h Z\lhfh[bey.



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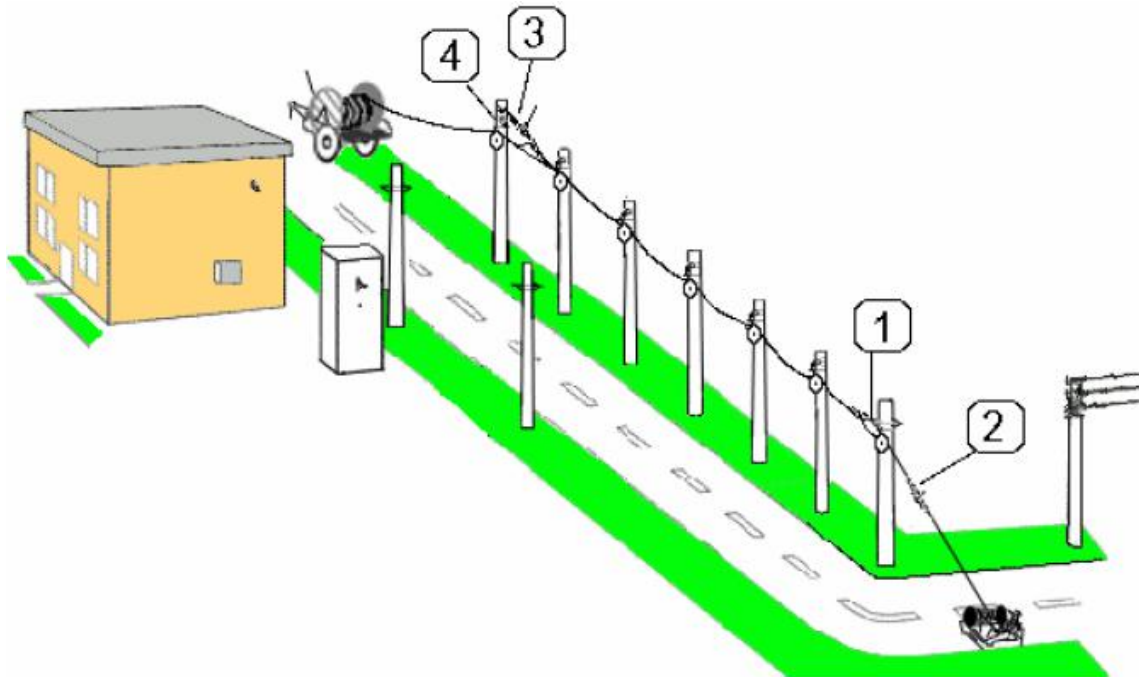
Jbk. 1.19. AZsblguc fhglZ`guc qm ehd b \kihfh]Zl_evduc ljhk:
Z - lbiZ TCSB38, TCSB50^ey aZo\ZlZ b ijhly]b\Zgby dhgpZ`]mlZ KBI;
[- lbiZ TCSB15, TCSB20 ^ey aZo\ZlZ \kihfh]Zl_evgh]h ljhkZ;
\ - ljhk \kihfh]Zl_evduc

GZly`_gb_ <EB b __ Zgd_jgh_ aZdj_ie_gb_ (jbk 1.20).

Ihke_jZafhldb`_]mlZ kZfhg_kms_]h ijh\h^Z gZ jhebdZo, aZdj_i-
e_gguo gZ hihjZo, g_h[oh^bfh gZ d hg_qghc hihj_ aZdj_iblv g_kmsbc
ijh\h^ Zgd_jguf aZ bfhf (iha. 1). Ijb wlhf f_oZgbq_kdZy e[_^dZ q_-
j_a dhfie_dl «\jlex]-fhglZ`gu_ qmedb» (iha. 2) ^he`gZ m^_j`b\Zlv
ebgbx \ gZlygmlhf iheh`_gbb. >Ze__ k ihfhsvx dhfie_dlZ bgkljm-
f_glh\ ^ey gZly`_gby: jmqghc e[_^db, aZdj_ie_gghc gZ [eb`g_c hihj_
(iha. 3), b gZly`gh]h mkljhckl\Z ebgby gZly]b\Z_lky ^h lj_[m_fh]h ijh-
_dlghc ^hdmf_glZpb_c agZq_gby kbeu gZly`_gby, qlh dhgljhebjm_lky k
ihfhsvx ^bgZfhf_ljZ.

GZlygmlZy jmqghc e[_^dhc ebgby gZ [eb`g_c (gZqZevghc) hihj_
aZdj_iey_lky k ihfhsvx Zgd_jgh]h aZ`bfZ (iha. 4).

KBI gZ dhg_qghc hihj_ hk\h[h^Z_lky ba fhglZ`gh]h qmedZ, b, _keb wlh g_h[oh^bfh, dhgpu ijh\h^gbdh\ dZd nZaguo, lZd b g_cljZevgh]h bahebjmxlky k ihfhsvx gZdhg_qgbdh\ beb dheizqdh\ (bo _s_ gZau\Z-xl dhgp_\ufb dZiZfb) lbiZ CECT (weZklhf_jgu_) eb[h 102L (l_jfh-mkZ`b\Z_fu_).

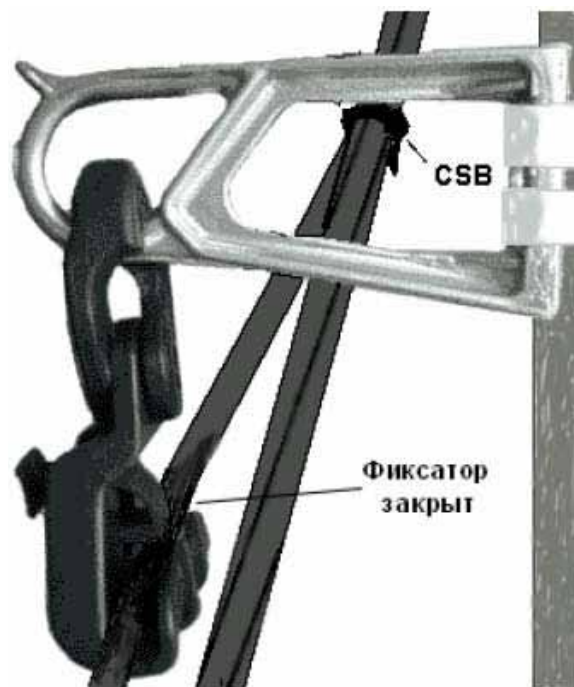
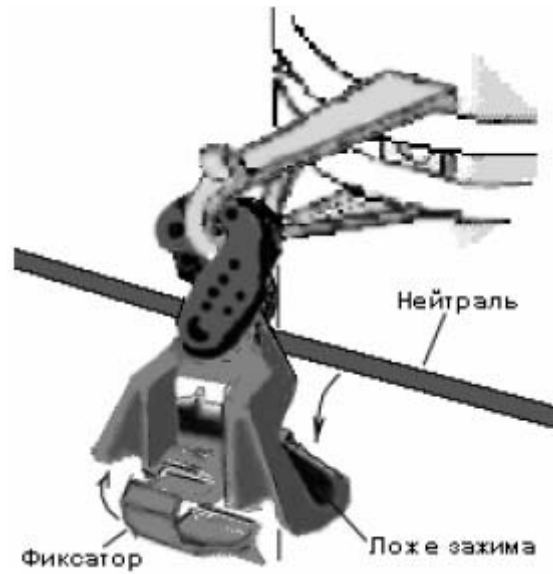


*Jbk. 1.20. GZly`_gb_ b Zgd_jgh_ aZdj_ie_gb_ ijh\h^Z KBI:
1,4 - gZqZevgZy b dhg_qgZy hihju mqZkldZ; 2 - \jlex]; 3 - jmqgZy e[_^dZ*

GZ [eb`g_c hihj_ hklZ\ey_lky aZ^Zgguc aZiZk ijh\h^Z KBI, hk-lZevghc ijh\h^ hlj_aZ_lky k ihfhsvx k_dlhjguo gh`gbp.

AZf_gZ jhebdh\ gZ ijhf`mlhqgu_ aZ`bfu (jbk. 1.21).

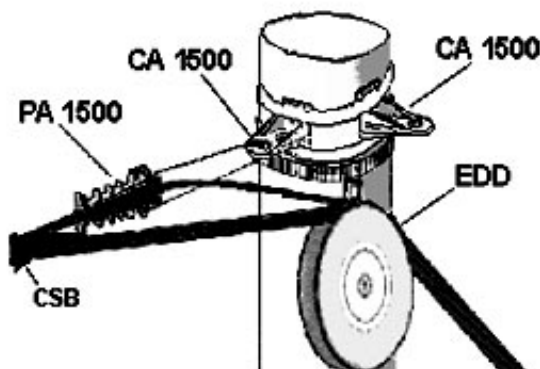
Ihke_ \uiheg_gby gZly`_gby KBI b aZdj_ie_gby _]h Zgd_jgufb aZ`bfZfb gZ dhgp_\uo hihjZo g_h[oh^bfh aZf_gblv jhebdb gZ ijhf`-mlhqgu_ aZ`bfu gZ hihjZo ijhf`mlhqguo b, ijb g_h[oh^bfhklb, gZ m]eh\uo.



*Жбк. 1.21. Икхе_^h\Zl_evghklv aZf_gu jhebdh\ gZ
ijhf_`mlhqgu_ aZ`bfu*

>ey aZdj_ie_gby g_cljZeb KBI \ ijhf_`mlhqghf aZ`bf_, gZ-
ijbf_j, lbiZ ES 1500 (jbk. 1.21) g_h[oh^bfh ij_^\Zjbl_evgh jZkdjulv
nbdkZlhj aZ`bfZ b \ hldju\r__ky eh`_ aZ`bfZ \klZ\blv g_cljZevguc
ijh\h^. AZl_f wlhl ijh\h^ ijb`bfZ_lky d eh`m aZ`bfZ nbdkZlhjhfh, dh-
lhjuc ^h`bfZ_lky ^h mihjZ.

:gd_jguc aZ' bf J: 1500 ihkj_ ^kl\hf klZevgh]h dZgZlbdZ dj-
iblkY d Zgd_jghfm djhgrl_cgm K: 1500 (jbk. 1.22), Z aZl_f gZlygmIuc
g_cljZevguc ijh\h^ aZdebgb\Z_lky ^\mfy debgvfyb Zgd_jgh]h aZ' bfZ.



Jbk. 1.22. AZdj_ie_gb_g_cljZeb KBI \ Zgd_jghf aZ`bf_

K h[_bo klhjhg hl aZ`bfh\ (dZd ijhf_`mlhqgh)h, lZd b Zgd_jgh-
jh) gZ jZkklhygbb 20...30 kf hl gbo `)ml KBI g_h[oh^bfh klygmlv dZ-
[_evgufb j_f_rdZfb, qlh \ ^Zevg_cr_f ij_`hl\jZlbl kf_s_gb_ ijh-
\h^gbdh\ KBI ^jm] hlghkbl_evgh ^jm]Z ih^ \ha^_ckl\b_f \g_rgbo
nZdlhj)\(_lih\hc gZ]madb b ij.).

Hl_l\|e_gby hl fZ]bkljZeb <EB \|b^_ ebg_cgh]h hl_l\|e_gby
 beb hl_l\|e_gby hl <EB d \\\h^m hkms_kl\eyxlky \|ke^mxs_c ihke_-
 ^h\Zl_evghklb:

- jZafhldZ KBI ^ey hl_l\bl_evghc ebgb;
- aZdj_ie_gb_ ijh\h^h\ \ gZqZe_ hl_l\bl_evghc ebgb;
- gZly`_gb_ hl_l\bl_evghc ebgb b aZdj_ie_gb_ __ dhgpZ;
- aZdj_ie_gb_ hl_l\bl_evghc ebgb gZ hihjZo;
- ih^dexq_gb_ hl_l\bl_evghc ebgb d ihlj_[bl_ex;
- ih^dexq_gb_ hl_l\bl_evghc ebgb d fZ|bklijZevghc <EB.

AZdj_ie_gb_ ijh|h^h| | gZqZe_ hl|l|bl_evghc ebgb hkms-
kl\ey_lky k ihfhsvx dhfie_dlZ Zgd_jgh|h dj_ie_gby: aZ^bfZ b djhg-

rl_cgZ. M aZ`bfZ PA 25x100 2 beb 4 ijh\h^Z KBI aZdebgb\Zxlky debgv-
yfb aZ`bfZ, m aZ`bfZ HEL-5505 \k_ q_l uj_ g_kmsbo ijh\h^Z kly]b\Zxlky
f_`^m ihebf_jgufb ieZklbgZfb [helh\uf kh_^bg_gb_f (jbk. 1.23).



Jbk. 1.23. :gd_jgu_ aZ`bfu PA 25x100 b HEL-5505

GZly`_gb_hl_l\bl_evghc ebgb b aZdj_ie_gb_ __ dhgpZ.

<uihegyxlky ih ZgZeh]bb k fZ]bk ljZevx. Hlebqb_ fh`_l khklZ]-
eylv kemqZc, dh]^Z dhg_p hl_l\bl_evghc ebgb aZdj_iey_lky gZ kl_g_
beb nZkZ^_ a^Zgby. Djhgrl_cg gZ nZkZ^_ a^Zgby dj_iblky k ihfhsvx
rmjmih\ beb ^x[_e_c, Z m`_ d g_fm ijbdj_iey_lky q_j_a ^m`dm beb
i_lex Zgd_jguc aZ`bf k ijh\h^hf.

***AZdj_ie_gb_hl_l\bl_evghc ebgbg gZ ijhf`mlhqguo hih-
jZo.***

< lhf kemqZ_ (iha. 4), _keb \ hl_l\bl_evghc ebgbg _klv ijhf`m-
lhqgu_ hihju, ^ey aZdj_ie_gby KBI k bahebjh\Zggghc g_cljZevx bk-
ihevamxlky ijhf`mlhqgu_ aZ`bfu lbiZ ES 1500 beb Zgd_jgu_ aZ`b-
fu ?:1500, _keb bf__lky agZqbl_evghc ba]b[ebgbg.

>ey aZdj_ie_gby KBI kZfhg_kms_c kbbk_fu (2 beb 4 ijh\h^Z)
bkihevamxlky ijhf`mlhqgu_ ih^^_j`b\Zxsb_ dj_ie_gby lbiZ RA 25
beb aZ`bfu lbiZ DUL (jbk.1.24).



Z



l

*Jbk. 1.24. Ijhf`mlhqgu_ ih^^_j`b\Zxsb_ dj_ie_gby:
Z - lbiZ RA 25; l - lbiZ DUL*

Ih^dexq_gb_hl_l\bl_evghc ebgbg d ihlj_lbl_ex \uihe-
gy_lky k ihfhsvx]_jf_lbqguo bahebjh\Zggguo gZdhg_qgbdh\ (jbk.
1.25), hij_kkh\u\Z_fuo jmqguf ij_kkhf (jbk. 1.26.). Ij_^Zjbl_evgh
ijh\h^ hl_l\bl_evghc ebgbg ijhdeZ^u\Z_lky ^h f_klZ ih^dexq_gby b
ihke_ lsZl_evgh]h jZkq_lZ hklZxsboky dhgph\ ebrgbc ijh\h^ hlj_aZ-
_lky k ihfhsvx jmqguo k_dlhjguo gh`gbp.



Жбк. 1.25. =_jf_lbqgu_bahebjh\Zggu_gZdhg_qgbdb.



Жбк. 1.26. Jmqghc ij_kk ^ey fhglZ`Z gZdhg_qgbdh\ KBI

LbihjZaf_j gZdhg_qgbdZ (jбк. 1.25) \u[bjZ_lky \ kljh]hf khhl-
 _lkl\bb k k_q_gb_f fhglbjm_fh]h ijh\h^Z. LZd, gZijbf_j, ^ey f^guo
 de_ff \ rdZnm ihlj_[bl_ey b ^ey KBI k k_q_gb_f `beu 16 ff² g_h[-
 oh^bfh \u[jZlv gZdhg_qgbd lbiZ CPTAU 16 D16.

K dhgph\ fhglbjm_fh]h ijh\h^Z kj_aZ_lky baheypby ^ebghc, ^hk-
 lZlhqghc ^ey h[_ki_q_gby]_jf_lbqghklb aZ^_edb ijh\h^Z \ gZdhg_qgb-
 d_ihke_hij_kkh\db.

H]he_gguc dhg_p dZ^h]h ba ijh\h^ gbdh\ KBI \klZ\ey_lky \
 k\hc gZdhg_qgbd b k ihfhsvx jmqgh]h beb]b^jZ\ebq_kdh]h ij_kkZ b
 r_klb]jZgguo fZljbp lbiZ 4E140 - E83, 4E173, 5E21 aZij_kkh\u\Z_lky
 \gmljb gZdhg_qgbdZ.

GZdhg_qgdbd aZdj_ieyxlky gZ de_ffZo rdZnZ k ihfhsvx jZ_d k
rZc[Zfb. Ih^dexq_gb_ hl_l\bl_evghc ebgbb d fZ]bkljZevghc <EB
\uihegy_lky k ihfhsvx ijhdZeu\Zxsbo aZ`bfh\.

AZsblZ <EB hl i_j_gZijy`_gbc . AZa_fe_gb_ (jbk. 1.27).

AZsblm <EB hl i_j_gZijy`_gbc g_h[oh^bfh \uihegylv \h \k_o
kemqZyo, ij_^mkfhlj_gguo \ IMW.

Hkh[h]h \gbfZgby lj_[mxl mqZkldb <EB:

- ijhoh^ysb_ ih hldjulhc beb \ukhdhc f_klghklb,
- \ ahgZo kh kj_^g_]h^h\hc ijh^he`bl_evghklvx ljha 40 qZkh\ b

[he__,

- \ gZk_e_gghc f_klghklb b \ f_klZo kdhie_gby ex^_c,
- ih^dexqZ_fu_ d ljZgknjhfZlhjguf ih^klZgpbyf,
- kludmxsb_ky k ih^a_fgufb dZ[_eyfb beb k dZ[_evgufb
- \klZ\dZfb,
- aZdZgqb\Zxsboky \h^hf \ a^Zgb_ k ^hjh]hklhysbf we_dljh-

h[hjm^h\Zgb_f.

>ey aZsblu hl i_j_gZijy`_gbc, \ua\Zgguo ljhah\ufb jZajy^Z
fb, ijb fhglZ`_ <EB g_h[oh^bfh bkihevah\Zlv:

• AZa_feyxsb_ mkljhckl\Z, khklhysb_ ba aZa_febl_ey, jZaf_-
s_ggh]h \ a_fe_, b aZa_feyxsbo ijh\h^gbdh\ (kimkdh\)^ey ^_j_\yg-
guo hihj (iha. 1 b 3) beb aZa_feyxsbo \uimkdh\ ZjfZlmju `^_e_ah[_-
lhgguo klh_d.

• :iiZjZlu aZsblu hl i_j_gZijy`_gbc: jZajy^gdbd b h]jZgbqb-
l_eb i_j_gZijy`_gbc (HIG).

AZa_feyxsb_ mkljhckl\Z (\uihegy_fu_ kh]eZkgh lj_[h\Zgbyf
]e. 1.7 b 2.4.25...2.4.26 IMW) g_h[oh^bfh ijbfgylv, djhf_ mdZaZggh]h
\ur_, lZd`_ ^ey:

- ih\lhjgh]h aZa_fe_gby g_kms_]h gme_\h]h ijh\h^Z,
- aZa_fe_gby we_dljhh[hjm^h\Zgby, mklZgh\^_ggh]h gZ hihjZo

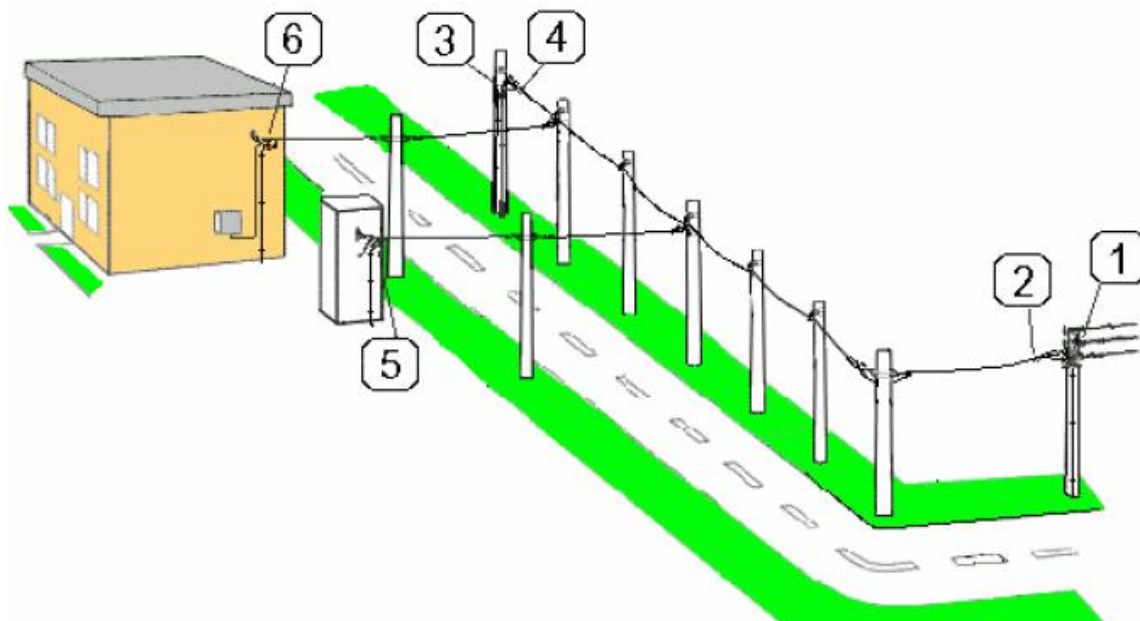
<EB,

- ^ey aZa_fe_gby jZajy^gbdh\ b HIG.

< dZq_kl\ aZa_feyxsbo ijh\h^gbd h\ gZ hihjZo <EB j_dhf_g^m-
_lky ijbfgylv hpbgdh\Zggmx djm]emx klZev ^bZf_ljhf g_ f_g__ 6 ff.

>himkdZ_lky ijbfgylv g_hpbgdh\Zggmx djm]emx klZev ^bZf_l
jhf g_ f_g__ 6 ff, bf_xsmx Zglbdhjjhabhggh_ ihdjulb_.

JZajy^gdbd b HIG, mklZgZ\eb\Z_fu_ gZ hihjZo <EB ^ey aZsblu
dZ[_evguo \klZ\hd hl ljhah\uo i_j_gZijy`_gbc, ^he`gu [ulv ijbkh_-
^bg_gu d aZa_febl_ex hl^_evguf kimkdhf.



Jbk. 1.27. Ko_fZ k_lb k jZaf_s_gb_fmkl jhckl\ aZsblu hl i_j_gZijy` - gbc: 1 - iblZxsZy <E; 2 - f_klh ijbkh^bg_gby <EB d <E; 1, 3, 5, 6 - f_klZ mklZ-gh\db HIG b jZajy^gbdh\ d aZa_feyxsbf kimkdZf; 4 - dhgp_\hc Zgd_jguc aZ`bf

HljZgbqbl_eb i_j_gZijy`_gbc y\eyxlky [he__ kh\j_f_ggufb aZsblgufb ZiiZjZlZfb hl i_j_gZijy`_gbc ih kjZ\g_gbx k jZajy^gb-dZfb. Djhf_ lh]h, ihdZ lhevdh hl^evgu_ lbiu HIG ijbkihkh[e_gu ^ey ijbfg_gby \ ihghklvx bahebjh\Zgghc <EB. D gbf hlghkylky HIG nbjfu TYCO lbiZ LVA-280A-AS b LVA-440A-AS. F_g__ ijb-kihkh[e_gu ^ey <EB HIG hl_q_kl_ggh]h ijhba\h^kl\Z lbiZ HIG-II-0,38MOE1, m dhlhjh]h h[Z \u\h^Z g_ bahebjh\Zgu, ihwlhfm ihke_ ih^dexq_gby d g_fm ijh\h^gbdh\ lj_[m_lky g_bahebjh\Zggu_ \u\h^u wlh-]h HIG aZbahebjh\Zlv ki_pbZevghc 1_jfhmkZ`b\Z_fhc e_glhc, gZijb-f_j lbiZ SSRK-60-100, SSRK-100-200.

Kh]eZkgh «IM <EB ^h 1 d<» \ gZqZe_ b \ dhgp_ dZ^hc fZ]bkljZ-eb <EB ^he`gu [ulv mklZgh\e_gu gZ ijh\h^Zo aZ`bfu ^ey ijbkh^b-g_gby ijb[hjh\ dhgljhey gZijy`_gby b i_j_gkhkgh]h aZsblgh]h aZa_f-e_gby (iha. 2 b 4).

AZsblZ <EB hl dhjhldbo aZfudZgbc

AZsblm <EB hl dhjhldbo aZfudZgbc b hl i_j_ljmahd ih fhsgh-klb g_h[oh^bfh \uihegylv ih ZgZeh]bb k aZsblhc <E k g_bahebjh\Zg-gufb ijh\h^Zfb, \uihegy_fhc k mq_lhf lj_[h\Zgbc IMW.

Hkgh\guf we_f_glhf aZsblu <EB hl dhjhldbo aZfudZgbc y\ey-_lky ijhoh^ghc ij^hojZgbl_ev ^ey Z[hg_glkdbo hl_l\e_gbc lbiZ CCFBD (jbk. 1.28, 1.29). Ijhoh^gu_ ij^hojZgbl_eb fhglbjmxlky gZ

hihjZo, gZ dhlhjuo d fZ]bkljZeb <E B ih^dexqZxlky ebg_cgu_ hl_l_-
e_gby (gZijbf_j, iha. 1, jbk. 1.27), ijb wlhf \uihegy_lky aZsblZ:

- fZ]bkljZeb <EB b \k_o hl_l_-e_gbc hl dhjhldh]h aZfudZgby b
hl i_j_]jmadb ih fhsghklb, \hagbdrbo \ h^ghf ba ebg_cgguo hl_l_-
gbc (k_dpbgbjh\Zgb_),

- hl_l_-e_gby hl dhjhldh]h aZfudZgby b hl i_j_]jmadb ih fhs-
ghklb, \hagbdrbo \ <E k g_bahebjh\Zggufb ijh\h^Zfb, ih^dexq_gghc
d hl_l_-e_gbx,

- \j_f_gguo ih^dexq_gbc d <EB.

Ijbf_g_gb_ ijhoh^guo ij_^hojZ gbl_e_c CCFBD gZ kfhglbjh-
\Zgguo Z[hg_glkdb o hl_l_-e_gbyo, djhf_ lh]h, iha\hey_1 j_Zebah\Zlv
\hafh`ghklv ih^Zqb gZijy`_gby ihlj_[bl_ex ihke_ hieZlu bf mkem]
ij_^ijbylby, h[_ki_qb\Zxs_fm we_dljhkgZ[_gb_. >ey wlh]h ieZ\dZy
\klZ\dZ \klZ\ey_lky \ dhjimk ij _^hojZgbl_ey lhevdh \ gm`guc fhf_gl
(ih nZdlm hieZlu).

Ijhoh^ghc ij_^hojZgbl_ev lbiZ CCFBD ij_^klZ\ey_1 kh[hc jZa-
[hjgmh dhgkljmdpbx, khklhysmx ba dhjimkZ ba ^\mo qZkl_c b ieZ\dhc
\klZ\db, \klZ\ey_fhc \ dhjimk ij_^hojZgbl_ey. Dhgkljmdpbx ij_^hojZ-
gbl_ey CCFBD iha\hey_1 \uihegylv kh_^bg_gb_ b jZat_^bg_gb_ ebgb
ih^ gZ]jmadhc ^h 60 :.

Ijhoh^ghc ij_^hojZgbl_ev lbiZ CCFBD bkiulZg gZ]_jf_lbq-
ghklv gZijy`_gb_f 6 d< ih^ \h^hc.



Jbk. 1.28. Ijhoh^ghc ij_^hojZgbl_ev lbiZ CCFBD

Dhjmk ij_^hojZgbl_ey ba]hlh_-e_g ba ih]h^hmevljZnbhe_lhklhc-
dh]h ihebf_jZ. Hg e_]dh kh[bjZ_lky b]_jf_lbabjm_lky ijb k[hjd_. GZ
g_f aZdj_ie_gZ]_jf_lbabjmxsZy aZ]emrdZ, dhlhjZy iha\hey_1 aZsb-
lby hldexq_ggmh ebgbx kh kljhgu k_lb. GZ dhjimk_ bf_xlky i_leb
^ey iehf[bjh\Zgby ih^dexq_ggh]h ij_^hojZgbl_ey, qlh iha\hey_1 j_-
]bklbjh\Zlv nZdlu g_kZgdpbgbjh\Zggghc jZkkludh\db ij_^hojZgbl_ey
b aZf_gu ieZ\dhc \k lZ\db gZ [hevrhx fhsghklv.

Ijhoh[^] ghc ij_^ hojZgbl_^ev fhgl bjm_lky \ jZaju\ KBI [_a g_km-
s_] h ijh\h[^] Z khklhys _]h ba 2-o beb ba 4-o bahebjh\Zg guo ijh \h[^]h\,
f_^ m hl_l\ bl_^evgu f ijhdZe u\Zxsb f aZ`bfh f b Zgd_j guf aZ`bfhf
[^]ey i jh\h[^]h\ Z[hg_glh\ lbiZ H EL-5505 , PA 25x100.



Жбк. 1.29. K[hjdZ ijhoh[^]gh]h ij_^ho j Zgbl_^ey

Ij_^ho j Zgbl_^ev ijbf_g y_lky [^]ey ijh\h[^]Z k_q_gb_f 16 ff ² – fh-
[^]bn bdZpby CCFBD 16-16, b 25 f f ² – fh [^]bnbdZpby CCFBD 25-25.

DhglZdl gh_ kh[^]bg_gb_ i j_^hojZ gbl_^ey k dhgpZfb ijh\h[^]Z KBI
\ui hegy_lky hij_kkh \dhc k h[_bo klhjhg k ih f hsvx j nqgh]h i j_kkZ
IMPI, SIMECA beb SIMABLOC k h[^]ghc fZljbp_ c ?140.

H[nkl j hckl\h mebgguo k_lbev gbdh

Ih ZgZeh]bb k <E k g_bahebjh\Z ggufb i j h\h^Zfb mebggu_ k_lbev gbdb, fh glbjm_f u_ gZ <EB, fh]ml dj_ibl vky gZ li hj_ k_j om gZ ^hi hegbl_ev ghc \ukl mZxs_c rlZg]_ b k[hdm k ihfh s vx [hel h\h]h kh_^bg_gby beb fhgl Zghc e _glu ba g_j`Z_ x s_c kl Zeb (jbk. 1.30). :gZ eh]bqgu f kihkh[h f \uihe gy_lky aZa_fe_gb_ dhjimkZ k_lbev g bdZ.

FhglZ ` mebgqh]h k_lb evgbdZ gZqbgZ_lky k aZdj_i e_gby _]h gZ hihj _.

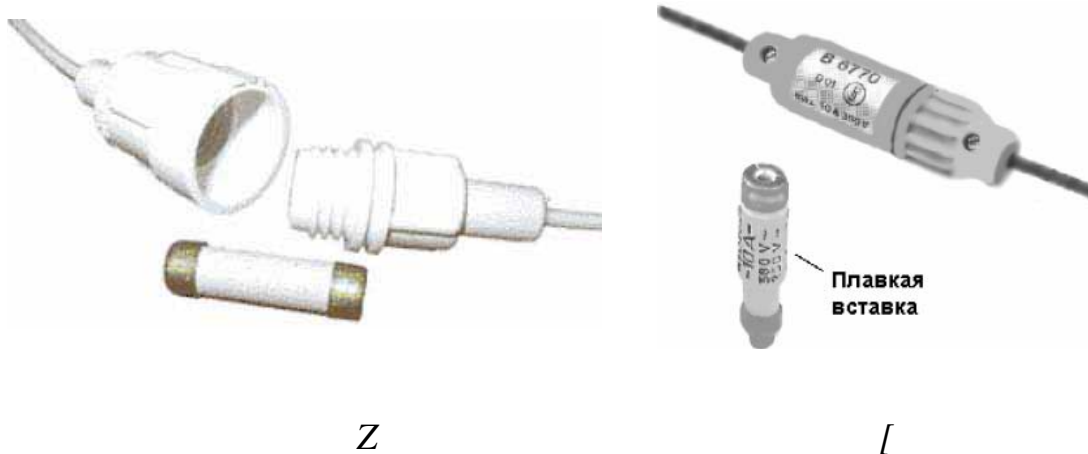
K_lbe vgbd, bf _xsbc ^ _ ijhj_ ab ^ey e_glu, dj_ i blky k[h dm gZ hihj _ k ihfh s vx e_g lu fhgl Zghc lb i Z EF 2 0 (beb F2007) b kdj_iu fhg lZ`ghc K F 20 (beb :200) ^\mfy mæZfb dj_ i e_gby f _lh^hf, Z gZeh-]bqgu f k aZdj_ie_gb_ f djhgr l_cggh\ ^e y KBI.

>ey aZgme_gby dhjimkZ k_lbev g bdZ \ui hegy_lky hl^_evguc aZ-a_fe yxsbc k imkd ba klZevghc hpbgdh\ Zgghc i j h\hehdb ^bZf_lj hf g_f_g __ 6 ff, d hlhjuc ^ ey`_e_a h[_lhggh c hihju lZd`_fh ` gh aZdj_iblv k ihf hsvx e _glu b k dj_iu. > ey ^_j_ ygguo hi hj lZdhc \b^ aZdj_ie_gby kimkdZ gZhihj_ g _ijb_fe _f, ihkd hevdm \ w hf kemqZ_ ^_j_h \gml-jb e _glhqgh] h dhevpZi hkl_i_g gh \u]hj Z_l.



Jbk. 1.30. Fhg l Z` mebgq h]h k_l bev gbdZ

>ey aZsblu <EB hl dhjhldbo aZfudZgbc, \hagbdZxsbo \ k_lbevghd_, \ dhjimk_ k_lbevghdZ fhglbjm_lky ijhoh^ghc ij_^hojZgbl_ev lbiZ II-1 (beb < 6770), dhlhjuc ih^dexqZ_lky \ jZaju\ nZaghjh ijh\h^Z (jbk. 1.31).



Jbk. 1.31. Dhgkljmdpbb ij_^hojZgbl_e_c ^ey hl_l_e_gbc <EB:
 Z - ij_^hojZgbl_ev II-1 GhfbgZevgu_lhdb ieZ\dhc \klZ\db: 6 ;, 10 ;;
 I - ij_^hojZgbl_ev < 6770 GhfbgZevgu_lhdb ieZ\dhc \klZ\db: 2 ;, 4 ;, 6 ;, 10 ;

K ihfhsvx hl_l_l_bevghd ijhdZeu\Zxsbo aZ`bfh\ ijbkh_^b-gyxlky:

- gme_hc ijh\h^ k_lbevghdZ d g_kms_fm gme_hfm ijh\h^m fZ-jbkljZeb <EB (aZ`bf lbiZ KZEP 13),
- nZaguc ijh\h^ k_lbevghdZ (hl ij_^hojZgbl_ey II-1) d ijh\h^m mebgghjh hk_s_gby <EB (_keb lZdh_hc_klv) beb d nZaghfm ijh\h^m <EB (aZ`bf lbiZ KZEP 13),
- ijh\h^ hl dhjimkZ k_lbevghdZ d aZa_feyxs_fm kimkdm (aZ`bf lbiZ RDP25/CN).

Ih^dexq_gb_ ijh\h^h\ hl k_lbevghdZ d ijh\h^Zf KBI \uihe-gy_lky ih ZgZeh]bb k fhglZ`hf hl_l_e_gbc, hibkZgguf \ jZa^_e_ h ih^dexq_gbb hl_l_e_gbc d fZ]bkljZeb <EB.

?klv jZaebqby \ fhglZ`_ ij_^hojZgbl_e_c:

- m ij_^hojZgbl_ey II-1 _klv fhglZ`gu_ ijh\h^Z ^ebghc ih 50 kf, \uoh^ysb_ ba iheh\bghd dhjimkZ b ih^dexqZ_fu_ d \g_rgbf ijh\h^Zf de_fgbdhf beb kdjmlhdc k ihke^mxs_c baheypb_c,
- m ij_^hojZgbl_ey < 6770 \ iheh\bgdZo dhjimkZ _klv]g_a^Z k
- dj_i`gufb \bglZfb, \ dhlhju_ \klZ\eyxlky ijbkh_^bgbl_ev-gu_ ijh\h^Z b aZdj_ieyxlky \bglZfb.

H[mkljhckl\h ljZgknhjfZlhjguo \\\h^h\ (jbk. 1.32)

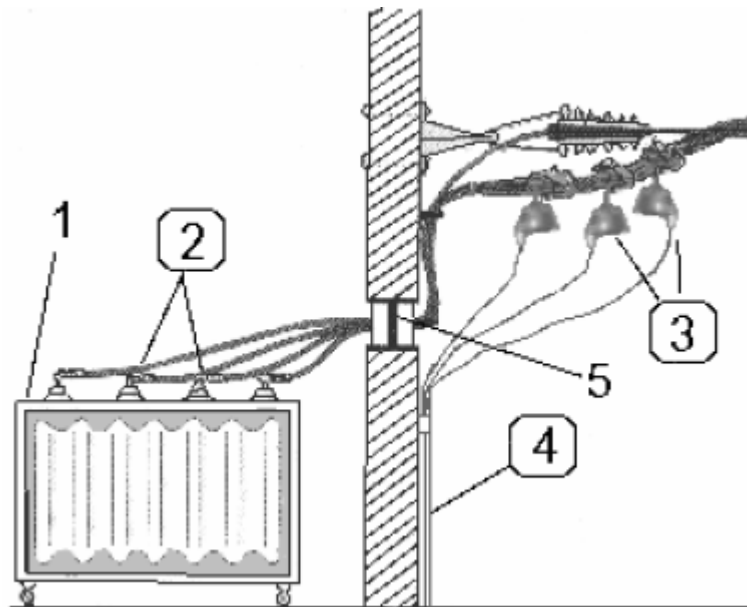
>ey \uiheg_gby ljZgknhjfZlhjguo \\\h^h\ hdhgqZgb_ <EB aZ-dj_iey_lky gZ nZkZ^_ ljZgknhjfZlhjghc ih^klZgpbb dhfie_dlhf Zg-d_jgh]h dj_ie_gby b aZ\h^blky q_j _a dZ[_evguc ijhoh^ \ kl_g_ \gmljv a^Zgby. M ijh\h^h\ hklZ\eyxlky dhgpu gm`ghc ^ebgu, gZ dhlhju_ h^_- \Zxlky bahebjh\Zggg_ gZdhg_qgdb lbiZ CPTAU beb CPTA b aZij_kkh-\u\Zxlky jmqguf ij_kkhf k fZljbp_c. WlZ hi_jZpby ZgZeh]bqgZ ih^dexq_gbx hl_l\bl_evghc ebgb d ihlj_[bl_ex, hibkZgghfm \ jZa^_e_h ih^dexq_gbb hl_l\l_e_gbc.

GZdhg_qgdb (iha. 2) aZdj_ieyxlky [helh\uf kh_^bg_gb_f gZ de_ffZo ljZgknhjfZlhjZ (iha. 1).

>ey aZsblu ljZgknhjfZlhjZ hl i_j_gZijy`_gbc kh klhjhggu <EB d dZ^hfm nZaghfm ijh\h^m <EB i_j_^ kl_ghc a^Zgby ih^dexqZ_lky h]jZgbqbl_ev i_j_gZijy`_gby lbiZ LVA (iha. 3) k ihfhsvx hl_l\bl_evguo aZ`bfh\ ih ZgZeh]bb k ijhp_^mjhc, hibkZgghc \ jZa^_e_h aZ-sbl_ <EB hl i_j_gZijy`_gbc.

AZa_feyxs_b_ \u\h^u HIG ih^dexqZxlky d aZa_feyxs_fm kimk-dm (iha. 4)

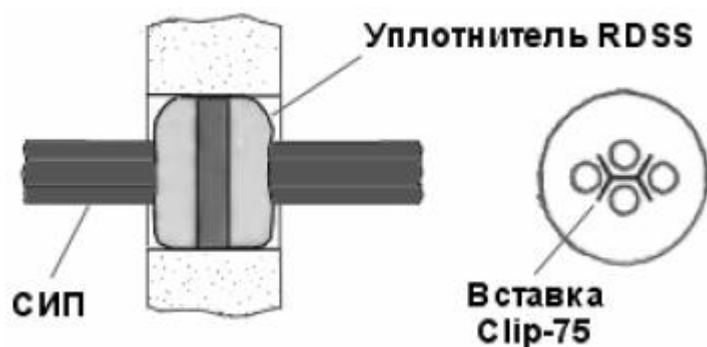
=_jf_lbaZpbx dZ[_evgh]h ijhoh^Z (iha. 5) fh`gh \uihegblv, gZ-ijbf_j, k ihfhsvx gZ^m\gh]h miehlgl_ey lbiZ RDSS, jZajZ[h]Zggh]h nbjfhc «JZco_f» (jbk. 1.33...1.35).



Jbk. 1.32. LjZgknhjfZlhjguo \\\h^ <EB:

1 - ljZgknhjfZlhj; 2 - gZdhg_qgdb de_ff\h^h; 3 - h]jZgbqbl_ev i_j_gZijy`_gbc; 4 - aZa_feyxsbc kimkd; 5 - dZ[_evguc ijhoh^

Miehlglbl_ev lbiZ RDSS khklhlbl ba gZ^m\ghc dZf_ju, ba]hlh\ - e_gghc ba]b[dhc f_lZeebabjh\Zgghc nhev]hc ie_gdb. GZ h[_bo klhjhgZo dZf_ju gZg_k_g kehc]_jf_lbdZ. DZf_jZ h[hjZqb\Z_lky \hdjm] KBI b e_]dh \klZ\ey_lky \ hl_jklb_ dZ[_evgh]h \h^Z \ kl_g_. AZl_f ijb gZ^m\Zgbb dZf_ju k ihfhsvx ki_pbZevgh]h mkljhckl\Z]_jf_lbd ih^ ^Z\ e_gb_f miehlgy_l f_klZ ijb fudZgby dZf_ju k ijh\h^Zfb b kl_gdhc ijhoh^Z (jbk. 1.33, 1.34).



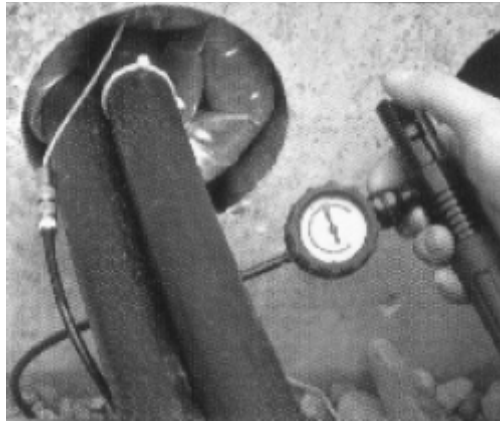
Жbk. 1.33. <g_rgbс \b^ b ko_fZ jZkihe h`_gby we_f_glh\ miehlglbl_ey lbiZ RDSS

>ey miehlg_gby ijh\h^gbdh\ KBI \ `]ml_ ijb f_gy_lky miehlgb_l_ev gZy \klZ\dZ lbiZ Clip, dhlhjZy ij_iylkl\m_l ijhgbdgh_gb_ \eZ]b \gmljv a^Zgby f_`^m ijh\h^gbdZfb KBI.

Miehlglbl_ev fh`gh mklZgh\blv k ihfhsvx ex[h]h mkljhckl\Z ^ey gZ^m\Zgby, dhlhj_h fh`_l h [_ki_qblv ^Z\ e_gb_ 3,0 + 0,2 [Zj.

Bgkljmf_gl, j_dhf_g^m_fuc nbjfhc «JZco_f»:

- mkljhckl\h ^ey gZ^m\Zgby - RDSS-IT-16,
-]Zah\u_ [Zeehgqbdb - E7512-0160.



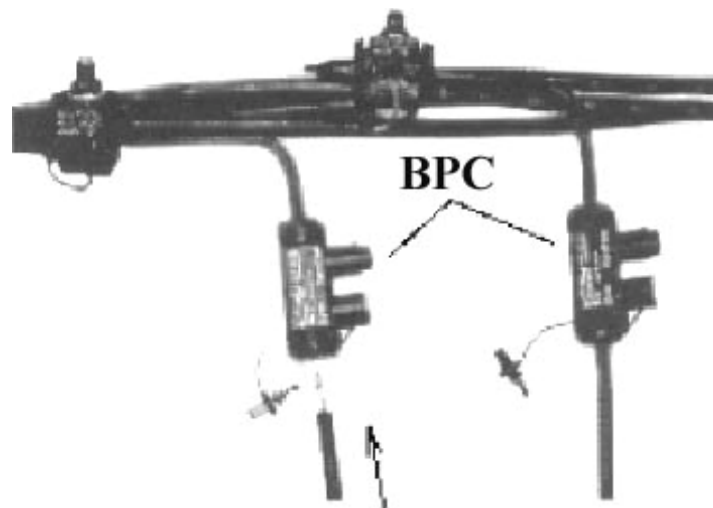
Jbk.1.34. Ijhp_kk fhglZ`Z miehlglb_ey lbiZ RDSS

Ijb gZ^m\Zgbb dZf_ju miehlglb_ey ihke_ ^hklb`_gby aZ^Zggh]h
^Z\e_gby \u^_j]b\Z_lky ljm[dZ ^ey gZ^m\Zgby b Z\lhfZlbq_kdb aZibjZ-
_lky]_e_\uc deZiZg kbb_l fu miehlgl_ gby. Ihke_ wlh]h gZ ^he]h_ \j_fy
\gmljb dZf_ju gZ^`_gh ih^^_j`b\Z_lky gm`gh_ ^Z\e_gb_.

Ijbf_g_gb_bahebjh\Zgguo kh_ ^bgbl_e_c:

<h \j_fy fhglZ`Z <EB \ g_dhlhjuo __ f_klZo fh`_l \hagbdgmlv
ihlj_[ghklv \ ^hihegl_evghf kh_ ^bg_gbb ijh\h^h]:

- ^ey ijh\h^h\ mebggh]h k_lbevghdZ,
- ^ey \uiheg_gby ih^dexq_gby Z[hg_glZ ihke_ hieZlu,
- ^ey hkms_kl\e_gby aZf_gu Z[hg_gldhc ebgb.



MdZaZggmx aZ^Zqm fh`gh ohjrh \uiheglv, bkihevamy]_jf_-
lbqgu_ bahebjh\Zgguo_ kh_ ^bgbl_eb lbiZ BPC, dhlhju_ ijbf_gyxlky
^ey \k_o lbih\ KBI ^h 1 d<.

Kh_ ^bgbl_eb BPC bf_xl fh^bnbdZpbb dZd ^ey ijhdZeu\Zgby
baheypbb, lZd b ^ey kgylby baheypbb.



Kh^bgy_fu_ i j h\h^Z i j himkdZ lky \ ij hlb\hih eh`gu_ hl_j-
klby \ kh^bg bl_e_ b aZbfZx lky [helZf b. >ey] _jf_lbaZ pbb hldj u lh]h
dhgl ZdlZ bki hevam_lky\luqgZy aZ]emrdZ, ijbdj_ i e_ggZy d dhjimk m



;helu (13 ff) b f_xl kj u\gmX]h eh\dm. F h^bnbdZpby k ijh dZeu-
\Zgb_f bahey pbb g_ l j _[m_l aZqbkldb b aheypbb gZ ijh\h^ _; \ lh` _\j_-
fy h gZ g_ ^himkdZ_l h\lhjguc fhglZ`.

Fh^bn bdZpby kh kgylb_f baheypbb fh`_ l [ulv mklZgh\e_gZ beb
m^ZegZ ih^ gZ]jmadhc (fZdkbf mf 90 :). WlZf h^bnbdZpby ^hi nkdZ_l
ih\l hjguc f hglZ`.

>jm]b_^hklhbg kl\Z kh_ ^bgbl_e_ c:

- hgb i jbf_gy x lky ^ey h^ghijh \hehqgu o b fgh] hijh\he hqguo
Zexf bgb_\u o b f_^g u o `be,

- [hel ihdjul baheypb_c, qlh h[_ki_qb\Z_1 [_ahiZkghklv ijb fhglZ`_ih^ gZijy`_gb_f,
 - hgb bkiulZgu gZ]_jf_lbqghklv gZijy`_gb_f 6 d< \l_q_gb_ 30 fbgml ih^ \h^hc,
 - dhjimk \uiheg_g ba baheypbhggh]h fZl_jbZeZ – ih]h^h- b mevl-jZnbhe_lhklhcdh]h ihebf_jZ, mkbe_ggh]h kl_deh\hehdghf.
- M^Zqgu_j_r_gby \fhglZ`_KBI (jbk. 1.35, 1.36).***
- I_j\h_j_r_gb_ – \h^ \ ih^klZgpbx.
- GZ ih^klZgpb ^ey dj_ie_gby Zgd_jguo aZ`bfh\ J: 1500, k ih-fhsvx dhlhjuo aZdj_ieyxlky \h^u \ ih^klZgpbx, mklZgh\e_gZ jZfZ ba f_lZeebq_kdh]h ijhnbey, d dhlhjhc dj_iylky ohfmlbdb aZ`bfh\.
- Dhgkljmdpby iha\hey_1 gZ^`_gh b [_ahiZkgh aZdj_iblv [hevrh_ dheb-q_kl\h Zgd_jguo aZ`bfh\ (\ ^Zgghf kemqZ_ aZdj_ie_gh 8 aZ`bfh\).



Jbk. 1.35. AZdj_ie_gb_ \h^h\ gZ ih^klZgpbx

<lhjh_j_r_gb_ – aZdj_ie_gb_ ijh\h^Z «LhjkZ^Z» gZ nZkZ^_ a^Z-gby, Z lZd`_ \h^ \ a^Zgb_.

<uiheg_gh k ihfsvx djhgrl_cgZ, klhcdb dhlhjh]h \fmjh\Zgu
 \ kl_gm a^Zgby, b Zgd_jgh]h aZ`bfZ. <b^gh, gZkdhevdh qZklh bkihevam-
 xlky dZ[_evgu_ j_f_rdb b dZd iehlgh meh`_g `]ml KBI gZ mqZkld_ k
 ijhdZeu\Zxsfbf aZ`bfZfb. <g_rg_ ma_e dj_ie_gby \u]ey^bl \iheg_
 wkl_lbqgh.



J_r_gby k ij_l_gab_c gZ j_dhj^



GZ hihj_, klhys_c \hae_ ih^klZ gpbb, gZkqblZgh 20 ohfmlh\ ba
 klZevghc e_glu, dhlhju_ dj_iyl d hihj_: Zgd_jguo djhgrl_cgh\ K:
 1500 – 16 rlmd, Zgd_jguo aZ`bfh\ J: 1500 – 16 rlmd, Zgd_jguo Z[h-
 g_glkdbo aZ`bfh\ J: 250 100 – 2 rlmdb, k_lbevghd – 1.

=E:<: 2. WDKIEM:L:PB Y <HA>MRGUO EBGBC WE?DLJHI?J?>:QB

2.1. Hkfhlj \ha^mrguo ebgbc

Ijb l_ogbq_kdhf h[kem`b\Zgbb \ha^mrguo ebgbc (<E) i_jbh^b-q_kdb ijh\h^ylky bo hkfhlj. Hkfh lj – wlh h[oh^ <E k \bamZevghc ijh_jdhc khklhygby ljZkku b \k_o we_f_glh\ <E. =jZnbd hkfhlj\ <E ml_j^Z_lky l_ogbq_kdbf jmdh\h^bl_e_f ij^ijbylby \ khhl_lkl\bb k lj_h\Zgbyfb [2]:

- hkfhlj <E ih \k_c ^ebg_ – g_j_`_ 1 jZaZ \ Jh^;
- hl^_evgu_ mqZkldb <E, \dexqZy mqZkldb, ih^e_`Zsb_ j_fhg-lm, g_j_`_ 1 jZaZ \ Jh^ ^he`gu hkfZlj\Zlvky Z^fbgkkljZlb\gh-l_ogbq_kdbf i_jkhgZehf;
- ^ey <E gZijy`_gb_f 35 d< b \u r_ g_j_`_ 1 jZaZ \ 10 e_l ^he`gu ijh\h^blvky _joh\u_ hkfhlj (hkfhlj k ih^t_fhf gZ hih-jm);
- ^ey <E gZijy`_gb_f 35 d< b \ur_, ijhoh^ysbo \ ahgZo k \u-khdhc kl_i_gvx aZ\jyag_gby beb ih hldjulhc f_klghklb, Z lZd`_ ^ey <E gZijy`_gb_f 35 d< b \ur_, wdk iemZljb_m_fuo 20 b [he__ e_l, _joh-\u_ hkfhlj ^he`gu ijh\h^blvky g_j_`_ 1 jZaZ \ 5 e_l;
- ^ey <E gZijy`_gb_f 0,38...20 d< _joh\u_ hkfhlj ^he`gu ijh\h^blvky ijb g_h[oh^bfhklb.

Ih f_j_ g_h[oh^bfhklb hkfhlj <E ijh\h^ylky \ l_fgh_ _jfy kmlhd ^ey \uy\e_gby dhjhgbyh\Zgby b hiZkghklb i_j_djulby baheypbb b \ha\hjZgby ^_j_ygguo hihj. <g_hq_j^gu_ hkfhlj <E beb bo mqZ-kldh\ ^he`gu ijh\h^blvky ijb h[jZah\Zgbb gZ ijh\h^Zo b ljhkZo Jheh-e_`Z, ijb ieykd_ ijh\h^h\, \h _jfy e_`hoh^Z b jZaeb\Z j_d b ihke_klbobcguo [_^kl\bc ([mjv, mjZ]Zgh\, ih`Zjh\) \ ahg_ ijhoh`^_gby <E, Z lZd`_ ihke_ hldexq_gby <E j_e_cghe aZsblhc b g_mki_rgh]h :I<.

LjZkkZ <E. Ijb hkfhljZo <E, ijhoh^ysbo \ e_kguo fZkkb\Zo, h[jZsZxl \gbfZgb_ gZ aZjZklZgb_ ijhk_d, bo rbjbgm b ijhlb\hih`Zj-gh_ khklhygb_. IjZ\beZfb hojZgu we_dljbq_kdbo k_l_c ^ey <E mklZgZ\eb\Z_lky hojZggZy ahgZ \ \b^_ a_f_evgh]h mqZkldZ b \ha^mrgh]h ijh-kljZgkl\Z, h[jZgbq_ggZy _jlbdZevgufb iehkdhklyfb, hklhysbfb ih h[_ klhjgu ebgbb hl djZcgbo ijh\h^h\ ijb g_hldehg_gghf bo iheh`_gbb gZ jZkklhygbb:

- ^ey ebgbc gZijy`_gb_f ^h 1000 < – 2 f;
- ebgbc ^h 20 d< \dexqbl_evgh – 10 f;
- ebgbc 35 d< – 15 f;

- ebgbc 110 d< – 20 f;
- ebgbc 220 d< – 25 f.

< hojZgghc ahg_ [_a ibkvf_ggh]h kh]eZkh\Zgby k hj]ZgbaZpb_c, wdkiemZlbjmxs_c <E, g_ ^he`gu ijh\h^blvky dZdb_-eb[h jZ[hlu, kdeZ^bjh\Zgb_ fZl_jbZeh\, k\Zedb fm khjZ b lhfm ih^h[gh_. Ijb ijh-oh`^_gbb <E \ gZk_e_gghc f_klghklb jZkklhygby ih]hjbahglZeb hl djZcgbo ijh\h^h\ ijb gZb[hevr_f bo hldehg_gbb ^h [eb`Zcrbo a^Z gbc b khhjm`_gbc ^he`gu [ulv g_ f_g__:

- 2 f – ^ey <E gZijy`_gb_f ^h 20 d<;
- 4 f – ^ey <E gZijy`_gb_f 35...110 d<;
- 6 f – ^ey <E gZijy`_gb_f 220 d<.

Hihju . Ijb hkfhlj_ hihj h[jZsZxl \gbfZgb_ gZ bo hldehg_gby hl _jlbdZevgh]h iheh`_gby, jZa[hjhl b mdehg ljZ_jk, ijh]b[u (djb-\bagm) we_f_glh\ hihj. < f_klZo aZ]em[e_gby hihj g_ ^he`gh [ulv ijh-k_^Zgby beb \kimqb\Zgby]jmg]Z. M `^_e_ah[_lhgguo nmg^Zf_glh\ f_-lZeebq_kdbo hihj b `^_e_ah[_lhgguo ijbklZ\hd ^_j_ygguo hihj g_ ^he`gh [ulv lj_sbg b kdheh\ [_lhgZ k h[gZ`_gb_f klZevghc ZjfZlmju.

GZ hihjZo ^he`gu ijbkmlkl\h\Zlv bo ihjy^dh\u_ ghf_jZ, bg-nhjZpbhgg_u agZdb k mdZaZgb_f rjbgbu hojZgghc ahgu, Z \ gZk_e_gghc f_klghklb – ij_^mij_^bl_evgu_ ieZdZlu [_ahiZkghklb. Ghf_j beb mkeh\gh_ h[hagZq_gb_ <E ^he`gu [ulv mdZaZgu gZ dhgp_\uo hihjZo ebgb, i_j_uo hihjZo hl_l_e_gbc, hihjZo \ f_klZo i_j_k_q_gbc <E h^bgZdh\h]h gZijy`_gby, hihjZo i_j _k_q_gby k `^_e_agufb ^hjh]Zfb, hihjZo mqZkldh\ iZjZee_evgh b^msbo ebgbc ijb jZkklhygbb f_`^m gb-fb f_g__ 200 f.

M ^_j_ygguo hihj g_ ^he`gh [ulv \b^bfh]h aZ]gb\Zgby ^_j_-_ygguo qZkl_c, ke_`h\ h[]hjZgby beb jZks_ie_gby. <g_rg__ aZ]gb\Zgb_ hihj hij_^_ey_lky \bamZevgh, gZebqb_ \gmlj_gg_]h aZ]gb\Zgby – iml_f ijhklmdb\Zgby ^j_kbgu fhehldhf \ kmomx b g_fhjhagmx ih]h-^m. A\hgdbc a\md mdZau\Z_l gZ a^hjh\mx ^j_kbgm, jemohc – gZ gZebqb_ \ g_c \gmlj_gg_]h aZ]gb\Zgby.

Ijh_jy_lky khklhygb_ [Zg^Z`_c (ohfmlh\), khqe_gyxsbo ^_j_-_yggmx klhcdm k `^_e_ah[_lhggc ijbklZ\dhc. G_ ^he`gh [ulv hkeZ[e_gby [Zg^Z`_c, ihjZ`_gby bo dhjjhab_c.

Mf_lZeebq_kdbo hihj ijh_jyx]lky k\Zjgu_r\ u b [helh\u_ kh-^bg_gby, khklhygb_ Zglbdhjjhabcgh]h ihdjulby b kl_i_gv ihjZ`_gby we_f_glh\ hihj dhjjhab_c \ f_klZo gZjmr_gby w]h]h ihdjulby. G_ ^h-imkdZ_lky kd\hagh_ ihjZ`_gb_ dhjjhab_c f_lZeebq_kdbo we_f_glh\ hihj, ihy\ e_gb_ lj_sbg \ f_lZee_ b k\Zjguo r\Zo. M nmg^Zf_glh\ f_-

lZeebq_kdbo hihj g_ ^he`gh [ulv aZahjZ f_`^m iylhc hihju b`_e_ah-
[_lhgguf nmg^Zf_glhf.

M`_e_ah[_lhgguo hihj ijh_jy_lky khklhygb_ Zglbdhjjhabcgh-
]h ihdjulby b kl_i_gv ihjZ`_gby dhjjhab_c f_lZeebq_kdbo ljZ_jk.
Hkh[h_ \gbfZgb_ m^_ey_lky hkfhlm `^_e_ah[_lhgghe klhcdh hihju,
dhlhjhc g_ ^he`gh [ulv lj_sbg b ^jm]bo ih_j_`^_gbc [_lhgZ. Lj_sb-
gu kihkh[kl\mxl dhjjhabb ZjfZlmju b, ke_`h\Zl_evgh, mf_gvr_gbx
ijhqghklb hihju.

Ijh\h^Z b ljku . M ijh\h^h\ b ljkh\ g_ ^he`gh [ulv h[ju\h\
b hieZ[e_gbc hl^_evguo ijh\hehd, gZ[jhkh\ gZ ijh\h^Z ihklhjhgbo
ij_`f_lh\ . M <E k bahebjh\Zggufb ijh\h^Zfb ijh_jy_lky khklhygb_
baheypbb ijh\h^h\ \ f_klZo bo khijbdhkhg_gby k ^_j_vyfb b hl^_ev-
gufb kmqvyfb, khklhygb_ bahebjmxs_c h[hehqd b kh_`bgb_l_evguo b hl-
_l\bl_evguo aZ`bfh\.

Baeylhju b ZjfZlmjZ . Baeylhju <E g_ ^he`gu bf_lv lj_-
sbg, h`h]h\ hl i_j_djulby b ^jm]bo \b^bfuo ih_j_`^_gbc jeZamjb.
<k_ baeylhju \]bjeyg^Zo ^he`gu [ul v qbklufb b p_eufb. Ih bgl_g-
kb\ghklb dhjhgjbh\Zgby baeylhjh\ hij_`^_ey_lky kl_i_gv bo aZ]jya-
g_gghklb. M <E kh rluj_ufb baeylhjZfb g_ ^he`gh [ulv kju\h\
baeylhjh\ kh rluj_c beb djxqv_ , h[ju\Z \yadb ijh\h^Z d baeylhjm,
g_ ^he`gh [ulv \uiZ^_gby b hkeZ[e_gby djxqv_ (rluj_c) beb bo ba-
ehfh\.

Ijb hp_gd_ khklhygby ZjfZlmju h[jZsZxl \gbfZgb_ gZ __ dhf-
ie_dlghklv (gZebqb_ \k_o [helh\,]Z_d, riebg[h\, aZfdh\), hlkmlkl\b_
lj_sbg, ^_nhjfZpbb, \b^bfuo ke_`h\ dhjjhabb. GZ ih_joghklb h\Zev-
guo b hij_kkh\Zgguo kh_`bgb_l_e_c g_ ^he`gh [ulv ke_`h\ dhjjhabb,
lj_sbg b ^jm]bo f_oZgbq_kdbo ih_j_`^_ gbc. =Zkbl_eb \b[jZpbb ^he`-
gu [ulv gZ mklZgh\ e_gghf ijb fhglZ`_ f_kl_.

M **ljm[qZluo jZajy^gbdh** ijh_jy_lky gZijZ[e_gb_ ahgu \u-
oehiZ, khklhygb_ ih_joghklb jZajy^gbdZ, dhlhjZy g_ ^he`gZ bf_lv
h`h]h\ we_dlj bq_kdhc ^m]hc, lj_sbg, jZkkeh_gbc b]em[hdbo pZjZibg.

M **aZa_feyxsbo mkljhckl** ijh_jy_lky khklhygb_ (p_ehklghklv
b kl_i_gv ihjZ`_gby dhjjhab_c) aZa_feyxsbo ijh\h^gbdh\ b bo kh_`b-
g_gbc k aZa_feb_l_eyfb.

Ijb hp_gd_ khklhygby ijh\h^h\, baeylhjh\, ZjfZlmju b ^jm]bo
we_f_glh\ <E, jZkiheh`_gguo ^hklZlhq gh \ukhdh, p_e_khh[jZagh bk-
ihvah\Zlv [bghdev.

<k_ aZf_q_ggu_ ijb hkfhljZo ^_n_dlu b g_bkijZ\ghklb <E aZgh-
kylky \ ebklhd hkfhljZ, nhjfZ dhlhj]h ijb\h^blky gb`_.

I j ^i j byl b _____

J Zchg (mqZklhd) _____

EBKLHD HKF HLJ:

<E _____d<

<b^ hkf hl j Z _____

Ghf _j hi hj u , i j he _lZ	AZf _q_ggu _g_bki j Z ghkl b

Hkfhlj ijhba_^_g hl hihju < _____^h hihju < _____

«_____» _____20_____].

n.b.h. _____ ih^ibkv _____

Ebklhd hkfhljZ ijbgye. ^ZIZ _____ ih^ibkv _____

<k_ ^_n_dlu b g_bkijZ\ghklb \ aZ\bkbfhklb hl bo oZjZdl_jZ mkl-
jZgyxlky ijb l_ogbq_kdhf h[kem`b\Zgbb beb ieZgh\hf j_fhgl_ <E.
Ih\j_`^_gby Z\jbcgh]h oZjZdl_jZ ^he`gu [ulv mkljZg_gu g_f_`e_ggh.

2.2. IjhnbeZdlbq_kdb_ baf_j_gby b bkiulZgby

Ijb l_ogbq_kdhf h[kem`b\Zgbb <E i_jbh^bq_kdb ijh\h^ylky
ijhnbeZdlbq_kdb_ ijh_jdb, baf_j_gby b bkiulZgby, i_jbh^bqghklv
dhlhjuo ^he`gZ khhl_lkl\h\Zlv lj_[h\Zgbyf [2, 4, 5].

Hihju . Hldehg_gb_ hl _jlbdZevgh]h iheh`_gby f_lZeebq_kdbo,
`_e_ah[_lhgguo b ^_j_ygguo hihj ^he`gh [ulv g_ [he__ 1:200, 1:150
b 1:100 khhl_lkl_ggh. Hldehg_gb_ hl]hjbahglZeb (mdehg) ljZ_jk`_-
e_ah[_lhgguo b ^_j_ygguo hihj ^he`_g [ulv g_ [he__ 1:100 b 1:50. M
^_j_ygguo hihj jZa\hjhl ljZ_jk hlghkbl_evgh ebgb, i_ji_g^bdm-
eyjghc hkb <E, g_ ^he`_g ij_urZlv 5 %; m`_e_ah[_lhgguo b klZev-
guo hihj – 100 ff.

< ahgZo k \ukhdhc kl_i_gvx aZljyag_gghklb Zlfhkn_ju baf_jy_l-
ky ihi_j_qgh_ k_q_gb_ f_lZeebq_kdbo we_f_glh\ hihj, mf_gvrb\r__ky
\ j_amevlZl_ dhjjhabb. >ey wlhc p_eb bkihevamxlky mevljZa\mdh\u_
lhesbghf_ju, iha\heyxsb_ baf_jylv hklZlhqgh_ k_q_gb_ we_f_glZ [_a
ij_`^Zjbl_evghc _]h hqbklb hl ljj ab b j`Z\qbg. >himklbfuc dhjjh-
abgcuc baghk ihi_j_qgh]h k_q_gby f_lZeebq_kdbo we_f_glh\ hihj b
ljhkh\uo hlly`_d g_ ^he`_g ij_urZlv 20 % hl iehsZ^b i_j\hgZqZev-
gh]h k_q_gby.

M klh_d `e_ah[_lhgguo hihj baf_jy_lky rbjbgZ jZkdjulby lj_sbg. Lj_sbg rbjbghe ^h 0,3 ff ^ he`gu aZdjZrb\Zlvky \eZ]hklhcdhc djZkdhc; 0,3...0,6 ff – aZlbjZlvky ihebf_jp_f_glguf jZkl\hjhf. Klhc-db hihj ijb rbjbg_jZkdjulby lj_sbg [he__ 0,3 ff b bo dhebq_kl_ [he__ ^\mo \ h^ghf k_q_gbb ^he`gu [ulv mkbe_gu `e_ah[_lhgguf [Zg^Z`hf, Z ijb ^ebg_lZdbo lj_sbg [he__ 3 f g_h[oh^bfZ aZf_gZ hih-ju.

< ljhkh\uo hlly`dZo `e_ah[_lhgguo Zgd_jgh-m]eh\uo hihj baf_jy_lky ly`_gb_. Baf_j_ggu_ ly`_gby g_ ^he`gu hlebqZlvky hl ijh_dlguo agZq_gbc [he__ q_f gZ 20 %.

H^bg ba f_lh^h\ baf_j_gby, g_ lj_[mxsbc ki_pbZevguo ijb[h-jh\, hkgh\Zg gZ aZ\bkbfhklb f_`^m i_jbh^hf kh[kl_gguo dhe_[Zgbc hlly`db b_ebqbghe ly`_gby \ g_c. < hlly`d_jmdhc \ha[m^`Zxlky dhe_[Zgby b k ihfhsvx k_dmg^hf_jZ hij_`_ey_lky i_jbh^__ kh[kl_gguo dhe_[Zgbc. <ebqbgZ ly`_gby L jZkkqblu\Z_lky ih nhjfme_[3]

$$L = \frac{4lm}{\tau^2}, G, \quad (2.1)$$

j^_ l – ^ebgZ hlly`db, f; m – fZkkZ hlly`db, d]; τ – i_jbh^ kh[kl_guo h^gh\hegh\uo dhe_[Zgbc, k.

Ly`_gby \ hlly`dZo fh`gh hij_`_eblv ih mijm]hc ^_nhjfZpbb (ijh]b[m] gZlygmlh]h klZevgh]h dZgZlZ, ihkdhevdm kms_kl\m_l ijyfZy aZ\bkbfhklv f_`^m ly`_gb_f L b kbehc J, \uau\Zxs_c ijh]b[f dZ-gZlZ: $J = Lf$. <uiheg_ggu_ ih mdZaZgghfm ijbgbpim baf_jbl_eb ly`_gby \ hlly`dZo (BLH) iha\heyxl hkms _kl\eylv baf_j_gby k ih]j_rgh-klvx, g_ ij_\urZxs_c 2 %.

Kl_i_gv \g_rg_]h beb \gmlj_gg_]h aZ]gb\Zgby ^_j_\ygguo hihj hij_`_ey_lky ijb[hjZfb, ijbgbpi ^_ckl\by dhlhjuo hkgh\Zg gZ baf_-j_gbb oh^Z b mkbeby, k dhlhjuf b]eZ ijhdZeu\Z_l ^j__kgmx klhcdm. =jZgbpZ f_`^m a^hjh\hc b aZ]gb\r_c qZklyfb ^j__kbgm hij_`_ey_lky ih j_adhfm baf_g_gbx wlh]h mkbeby. AZ]gb\rmx ^j__kbgm b]eZ ijhdZeu\Z_l k mkbeb_f f_g__ 300 G.

< j_amevlZl_ baf_j_gbc hij_`_ey_lky ^bZf_lj a^hjh\hc qZklb ^j__kbgm ijb \g_rg_f aZ]gb\Zgbb (beb wd\b\Ze_glguc ^bZf_lj ijb \gmlj_gg_f aZ]gb\Zgbb). KlhcdZ ^_j_\ygghe hihju [jZdm_lky b ih^e_-`bl aZf_g_ ijb ^bZf_lj_ a^hjh\hc qZklb f_g__:

- 12 kf (<E ^h 35 d<);
- 15 kf (<E 35 d< b \ur_k ijh\h^Zfb k_q_gb_f ^h 120 ff ²);
- 18 kf (<E 35 d< b \ur_k ijh\h^Zfb k_q_gb_f [he__ 120 ff ²).

Ijh\h^Z b ljhku . Klj_eu ijh_kZ ijh\h^h\ b ljhkh\ ^he`gu hl-
ebqZlvky hl ijh_dlguo agZq_gbc g_ [he__ q_f gZ 5 %. JZkklhygby hl
ijh\h^h\ <E ^h ih_joghklb a_feb ^he`gu [ulv g_ f_g__:

- 5 f – ^ey <E ^h 1 d< k kZfhg_kmsbfb bahebjh\Zggufb ijh\h-
^Zfb;
- 6 f – lh `_, gh k]heufb ijh\h^Zfb;
- 6 f – ^ey <E \ur_ 1 d< k bahebjh\Zggufb ijh\h^Zfb;
- 7 f – ^ey <E gZijy`_gb_f ^h 110 d< \ gZk_e_gghc f_klghklb;
- 6 f – lh `_, gh \ g_gZk_e_gghc f_klghklb;
- 5 f – lh `_, gh \ ljm^gh^hklmighc f_klghklb;
- 8 f – ^ey <E gZijy`_gb_f 220 d< \ gZk_e_gghc f_klghklb;
- 7 f – lh `_, gh \ g_gZk_e_gghc f_klghklb;
- 6 f – lh `_, gh \ ljm^gh^hklmighc f_klghklb.

JZkklhygby hl ijh\h^h\ <E ^h jZaebqguo h[t_dlh\ b khhjm`_gbc
\ f_klZo i_j_k_q_gbc b k[eb`_gbc <E k wlbfb h[t_dlZfb ^he`gu [ulv
g_ f_g__ mklZgh\ e_gguo [4, 6].

Ijb mf_gvr_gbb iehsZ^b ihi_j_qgh]h k_q_gby ijh\h^h\ \ke_^-
kl\b_h[ju\Z, bklbjZgby beb hieZ\ e_gby hl^_evguo ijh\hehd [he__ q_f
gZ 16% (Zexfbg_u_ ijh\h^Z) b [he__ q_f gZ 33 % (klZe_Zexfbg_ -
\u_ ijh\h^Z) ^_n_dlguc mqZklhd ijh\h^Z ^he`g [ulv aZf_g_g.

M bahebjh\Zgguo ijh\h^h\ hij_^_eyxlky jZaf_ju ih\j_^_gby
baheypbb. F_klZ g_agZqbl_evgh]h ih\j_^_gby baheypbb j_fhglbjmxl-
ky k ihfhsvx 1_jfhmkZ`b\Z_fuo j_fhglguo e_gl beb fZg`_1. Ijb
agZqbl_evguo ih\j_^_gbyo baheypbb ^_n_dlguc mqZklhd \uj_aZ_lky b
aZf_gy_lky gh\uf.

Baheylhju b ZjfZlmjZ . Khijhlb\ e_gb_ h^gh]h nZjnhjh\h]h
baheylhjZ]bjeyg^u, baf_j_ggh_ f_]Zhff_ljhf, ^he`gh [ulv g_ f_g__
300 FHf. LZdb_ baf_j_gby fh]ml \uihegylvky lhevdh gZ hldexq_gghc
ebgbb. ;_a hldexq_gby ebgbb baf_jy_lky jZkij_^_e_gb_ gZijy`_gby ih
baheylhjZf]bjeyg^u. >ey wlh]h bkihevam_lky baf_jbl_evgZy baheb-
jmxsZy rlZg]Z. GZijy`_gby gZ nZjnhjh\uo baheylhjZo]bjeyg^u kh-
klZ\eyxl hl 5 ^h 20 d< gZ h^ghf baheylhj_. GZb[hevr_ gZijy`_gb_
ijbeh`_gh d baheylhjm kh klhjghu ijh\h^Z, Z gZbf_gvrb_ gZijy`_gby
– d baheylhjZf \ k_j_^bg_]bjeyg^u. KmffZ gZijy`_gbc gZ baheylhjZo
]bjeyg^u g_ ^he`gZ hlebqZlvky hl nZagh]h gZijy`_gby <E [he__ q_f
gZ +10 % m f_lZeebq_kdbo b `_e_ah[\lhgguo hihj b [he__ q_f gZ + 20%
m ^_j_ygguo hihj.

< dZq_kl_ ijb_jZ \ lZ[e. 2.1 ij b_^_gh mkj_^g_ggh_ jZkij_^_e_ -
gb_ gZijy`_gby ih]bjeyg^_ ba 7 nZjnhjh\uo baheylhj\ ^ey <E gZijy-
`_gb_f 110 d<. Gmf_jZpby baheylhj\ gZqbgZ_lky hl ljZ_jku hihju.

GZijy`_gb_, d<, gZ h^ghf baheylhj_						
1	2	3	4	5	6	7
9	6	5	7	8,5	10	18,5

Baheylhj [jZdm_lky, _keb gZijy`_gb_ gZ g_f f_gvr_ 50 % mdZ-aZggh]h.

BkiulZgby b baf_j_gby mklZgh\ e_gguo gZ <E kl_deygguo ih^_kguo baheylhj\, baheylhj\ \k_o lbih\ ^ey ih^_kdb ljhahaZsblgh-jh ljhkZ b ihebf_jguo baheylhj\ g_ ijhba\h^ylky; bo dhgljhev hkm-s_kl\ey_lky lhevdh \g_rgbf hkfhljhf. Kl_deyggu_ baheylhju [jZdm-xlky b ih^e_Zl aZf_g_ ijb ihy\ e_gbb gZ ih_joghklb kl_deZ \hehkyg-guo lj_sbg.

Kp_igZy ZjfZlmjZ [jZdm_lky, _keb __ ih_joghklv kiehrv ihjZ-_gZ dhjjhab_c, gZ ih_joghklb _klv lj_sbg, ke_^u hieZ\ e_gby b f_oZgbq_kdhc ^_nhjfZpbb, rZjgbjgu_ kh_^bg_gby bf_xl baghk [he__ 10 %.

M *ljm[qZluo jZajy^gbdh* baf_jyxlky \g_rgbc b \gmlj_ggbc bkdjh\ u_ ijhf_mldb b ^bZf_lj ^m]h]Zkbl_evgh]h dZgZeZ. >ebgZ \g_r-g_lh bkdjh\h]h ijhf_mldZ ^he`gZ khhl_lkl\h\Zlv ijh_dlghfm agZq_-gbx, ^ebgZ \gmlj_gg_lh bkdjh\h]h ijhf_mldZ g_ ^he`gZ hlebqZlvky hl ijh_dlgh]h [he__ q_f gZ 5 f f. >bZf_lj ^m]h]Zkbl_evgh]h dZgZeZ \ aZ\bkbfhklb hl lbiZ jZajy^gbdZ g_ ^he`g ij_urZlv gZqZevguc ^bZ-f_lj [he__ q_f \ 1,3...1,5 jZaZ.

AZa_feyxs_b mkljhckl\Z . Baf_j_gby khijhlb\ e_gbc AM \uihe-gyxlky __h^gh \ i_jbh^ gZb[hevr_lh \ukuoZgby ljmglZ. Khijhlb\ e_gby ih_lhjguo aZa_fe_gbc gme_h]h ijh\h^Z <E gZijy`_gb_f ^h 1 d< ^he`gu [ulv g_ [he__ 30 Hf. < k_lyo lZdh]h gZijy`_gby, jZ[h-lZxsbo k jemohaZa_fe_gghc g_cljZevx, baf_jy_lky ihegh_ khijhlb\ e_-gb_ i_leb «nZaZ-gmev» b jZkkqblu\Z_lky lhd h^ghnZagh]h dhjhldh]h aZ-fudZgby. Ih_ebqbg_wlh]h lhdZ ijh_jy_lky gZ^`_ghklv kjZ[Zlu\Zgby aZsblgh]h ZiiZjZlZ, mklZgh\ e_ggh]h \ gZqZe_ ebgbb.

GZ <E gZijy`_gb_f \ur_ 1 d< khijhlb\ e_gby AM mklZgZ\eb\Z-xlky \ aZ\bkbfhklb hl m^_evgh]h khijhlb\ e_gby ljmglZ ρ b ^he`gu [ulv g_ [he__ _ebqbg, mdZaZgguo \ lZ[e. 2.2.

$M_{\text{evgh}}^{\text{khijhlb}} \rho, H_f \times f$	$\text{Khijhlb} \backslash e_{\text{gb}} \text{ AM, } H_f$
$^h 100$	10
$[\text{he}_{100}^h 500]$	15
$[\text{he}_{500}^h 1000]$	20
$[\text{he}_{1000}^h 5000]$	30
$[\text{he}_{5000}]$	$6 \times 10^{-3} \rho$

J_amevlZlu baf_j_gbc hnhjfeyxky khhl_lkl\mxsbfb ijhlhdh-eZfb. Ijh_jdZ AM kh_kdju lb_f ljmglZ ijhba\h^blky g_f_g_ q_f m 2 % hihj hl h[s_]h qbkeZ hihj k aZa_febl_eyfb. M dZaZggmx ijh_jdm ke_m_l ijh\h^blv \ gZk_e_gghc f_klghklb b gZ mqZkldZo k gZb[he_ Z]-j_kkb\gufb b iehoh ijh\h^ysbfb ljmglZfb. We_f_gl aZa_febl_ey ^he_g [ulv aZf_g_g, _keb dhjjhab_c jZajmr_gh [he_ 50 % _]h k_q_gby.

2.3. Hij_^e_gb_f_klZ ih_j_^_gby

Ijh_^_gb_ i_jbh^bq_kdbo hkfhljh\, ijhnbeZdlbq_kdbo baf_j_gbc b bkiulZgbc g_]ZjZglbjm_l [_ahldZaghc jZ[hlu <E. < ijZdlbq_kdhc wdkiemZlZpbb [k_]^Z bf_xl f_klh kemqZcgu_ ih_j_^_gby <E: h^ghnZagu_ b fgh]hnZagu_ aZfudZgby, h[ju_u ijh\h^h\ b ^jm]b_ ih_j_^_gby. H^ghc ba \Z^guo aZ^Zq w dkiemZlZpbb <E y_ey_lky [ukljh_ hi j_^_e_gb_ f_klZ ih_j_^_gby b ijh_^_gb_ j_fhglgh_ \hkkZgh_bl_evguo jZ[h]. Ijb [hevrhc ijhly_gghklb b jZa_l_e_g_ghklb jZkij_^_ebl_evguo k_l_c mdZaZggZy aZ^ZqZ fh_l wnn_dlb_gh j_rZlvky lhevdh ijb bkihevah_Zgbb ki_pbZevguo l_ogbq_kdbo kj_^kl\, hij_^_eyxsbo ih_j_^_ggmx ebgbx b jZkklhygb_ ^h f_klZ ih_j_^_gby.

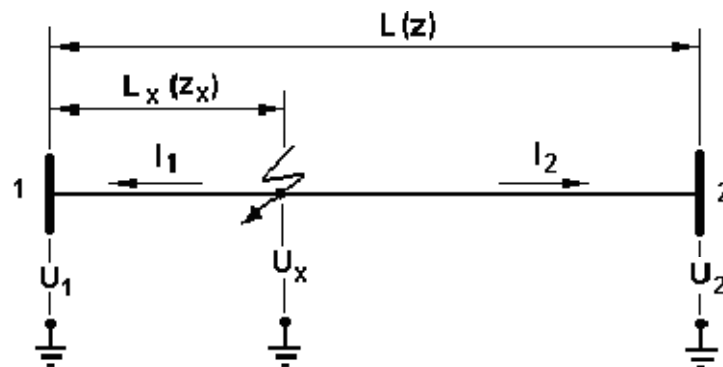
L_ogbq_kdb_ kj_^kl\Z ^ey hij_^_e_gby f_klZ ih_j_^_gby (HFI) rbjhdh bkihevamxlky ijb wdkiemZlZpbb <E [k_o deZkhh\ gZijy_gbc. < aZ\bkbfbhklb hl deZkkZ gZijy_gby kj_^kl\Z HFI fh_gh jZa_^_eblv gZ ^\Z \b^Z: kj_^kl\Z HFI \ k_l yo k [hevrhfb lhdZfb aZfudZgby gZ a_fex (110-220 d<) b kj_^kl\Z HFI \ k_lyo k fZeufb lhdZfb aZfudZgby gZ a_fex (6...35 d<).

Ebgbb we_dljbq_kdbo k_l_c k [hevrhfb lhdZfb aZfudZgby gZ a_fex oZjZdl_jbamxlky ^hklZlhqgh [hevrhc ijhly_gghklvx. F_lh^u b kj_^kl\Z HFI a_kv hkggh_Zgu gZ baf_j_gbb b aZihfbgZgbb izjZf_l-

jh\ Z\Zjbcgh]h j_`bfZ (lhdh\ b gZijy`_gbc ijyfhc, h[jZlghe b gme_-
\hc ihke_`h\Zl_evghklb) b \uqbke_gbb jZkklhygby `h f_kl ihj_`^_
gby. < lZdbo k_lyo bkihevamxlky, dZd ijZ\beh, ^\mklhjhggb_ f_lh^u,
hkgh\Zggu_ gZ nbdkZpbb lhdh\ b gZijy`_gbc ih dhgpZf <E.

>ey baf_j_gby b aZihfbgZgby lhdh\ b gZijy`_gbc bkihevamxlky
ihemijh\h^gbdh\u_ b fbdjihjhp_kkhjgu_ nbdkbjmxsb_ ijb[hju. Ih
kjZ\g_gbx k ihemijh\h^gbdh\ufb, fbdjihjhp_kkhjgu_ nbdkbjmxsb_
ijb[hju iha\heyxl j_Zebah\Zlv [he__ keh`gu_ Ze]hjbIfu HFI, [he__
ijbkikh[e_gu d i_j_ijh]jZffbjh\Zgbx ijb baf_g_gbb iZjZf_ljh\
k_lb, [he__ lhqgu_. Hiul wdkiemZlZpbb fbdjihjhp_kkhjguo ijb[hjh\
HFI ihdZaZe, qlh ih]j_rghklv hij_`^e _gby jZkklhygby `h f_klZ ih-
j_`^_gby g_ ij_\urZ_1 5 %.

Ijb ihj_`^_gbb gZ dhgljhebjm_fhc ebgb k_j_`kl\Z HFI hkm-
s_kl\eyxl \ l_fi_ ijhp_kkZ ebrv nm gdpbb baf_j_gby b aZihfbgZgby
lhdh\ b gZijy`_gbc Z\Zjbcgh]h j_`bfZ. H[jZ[hldZ j_amevlZlh\ baf_-
j_gby \uihegy_lky m`_ ihke_ hldexq_gby ebgb j_e_cghe aZsblhc.



Jbk. 2.1. GZijy`_gby b lhdh \ ebgb \fhf_gl ihj_`^_gby

Imklv \ g_dhlhjhc lhqd_ ebgb, kh _`bgyxs_c ih^klZgpbb 1 b 2,
(jbk. 2.1), ijhbko^hl ihj_`^_gb_, gZijbf_j h^ghnZagh_ dhjhldh_ aZ-
fudZgb_. Bg^bdZlhju, mklZgh\e_ggu_ ih dhgpZf ebgb, nbdkbjmxl \
Z\Zjbcghf j_`bf_ lhdh b gZijy`_gby. IZjZf_lju Z\Zjbcgh]h j_`bfZ
k\yaZgu khhlghr_gbyfb:

$$U_1 + I_1 z_x = U_x; \quad U_2 + I_2 (z - z_x) = U_x, \quad (2.2)$$

]^_ U_1, U_2 b U_x - gZijy`_gby gme_\hc ihke_`h\Zl_evghklb ih dhg-
pZf ebgb b \ f_kl_ ihj_`^_gby; I_1, I_2 - lhdh gme_\hc ihke_`h\Z-

l_evghklb ih dhgpZf ebgb; z, z_x – khijhlb\e_gby gme_\hc ihke_\^h\Z-
l_evghklb ebgb b mqZkldZ ^h f_klZ ih\j_\^_gby.

IjbjZ\gb\Zy e_\u_ qZklb \ujZ`_gbc (2.2), ihemqbf:

$$z_x = \frac{I_2 z + U_2 - U_1}{I_1 + I_2}. \quad (2.3)$$

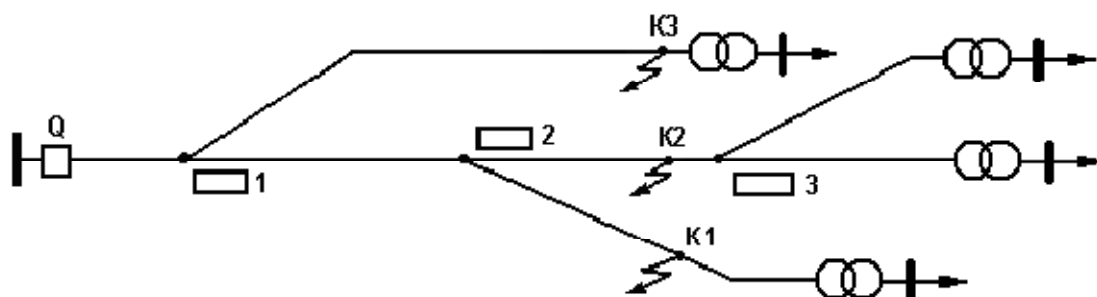
Ih^_eb\ ijZ\mx b e_\mx qZklb ihk e_\^g_h \ujZ`_gby gZ m^_ev-
gh_ khijhlb\e_gb_ ijh\h^h\ ebgb z_0 , ihemqbf bkdhf_ jZkklhygb_ ^h
f_klZ ih\j_\^_gby:

$$L_x = \frac{I_2 z + U_2 - U_1}{z_0(I_1 + I_2)}. \quad (2.4)$$

IZjZf_lju ebgb z b z_0 \h^ylky k deZ\bZlmju mkljhckl\Z ijb
jh mklZgh\d. <_ebqbgZ L_x \ dbehf_ljZo \u^Z_lky gZ ^bkie_c mkljhc-
kl\Z.<hafh`ghklv bkdexq_gby ba jZkq_lguo \ujZ`_gbc gZijy`_gby U_x
ihdZau\Z_1 g_aZ\bkbfhklv j_amevlZlZ HFI hl khijhlb\e_gby \ f_kl_
ih\j_\^_gby.

Kms_kl_gghc hkh[_gghklvx kljmdlmju jZkij_\^_ebl_evguo k_l_c
6...35 d< y\ey_lky bo jZa_l\l_e_gghklv. jZkklhygby ^h f_kl fgh]hnZaguo
aZfudZgbc \ wlbo k_lyo hij_\^_ey xlky kj_\^kl\Zfb HFI, mklZgh\l_e_ggu-
fb gZ iblZxsbo ih^klZgpbyo (h^ghklhjhggb_ kj_\^kl\Z HFI). H^gZdh
^Z_\ \ukhdZy lhqghklv wlbo kj_\^kl\ g_ iha\hey_l mdZaZlv f_klh ih\j_-
_\^_gby \ke_\^kl\b_ jZa_l\l_e_gghklb k_l_c.

GZ jbk. 2.2 ihdZaZgZ jZa_l\l_e_ggZy we_dljbq_kdZy k_lv. Ihke_ hl-
dexq_gby ih\j_\^_gby \udexqZl_e_f Q b hij_\^_e_gby jZkklhygby ^h
f_klZ ih\j_\^_gby \hagbdZ_l aZ^ZqZ hij_\^_e_gby Z\Zjbcgh]h mqZkldZ
jZa_l\l_e_gghc k_lb, ihkdhevdm ih\j_\^_gby \ lhqdZo D_1, D_2 beb D_3 y_
eyxlky jZ\ghm^Ze_ggufb hl iblZxs_c ih^klZgpbb.



Jbk. 2.2. jZkklZgh\dZ mdZaZl_e_c ih\j_\^_ggh]h mqZkldZ\
jZa_l\l_e_gghc k_lb

>ey hjb_glbjh\Zgby ijb ihbkd_f_klZ ih\j_`^_gby \ f_klZo jZa-
 _l\e_gby k_lb mklZgZ\eb\Zxlky mdZaZl_eb ih\j_`^_ggh]h mqZkldZ,
 nbdkbjmxsb_nZdl ijhl_dZgby lhdZ dhjhldh]h aZfudZgby. Ih iheh`_-
 gbyf mdZaZl_e_c 1, 2 b 3 wdkiemZlZpbhgguc i_jkhgZe ijZ\bevgh hij_-
 ^_ey_l gZijZ\e_gb_ ihbkdZ f_klZ ih\j_`^_gby. < qZklghklb, ijb aZfu-
 dZgbb \ lhqd_ D₁ nZdl ijhl_dZgby lhdZ dhjhldh]h aZfudZgby [m^_l aZ-
 nbdkbjh\Zg lhevdh mdZaZl_e_f 1.

< we_dlj_bq_kdbo k_lyo k bahebjh\Zgghe g_cljZevx (6...35 d<) lhd
 h^ghnZagh]h aZfudZgby gZ a_fex bf__l _fdhklghc oZjZdl_j, Z ih _eb-
 qbg_ agZqbl_evgh (gZ h^bg-^Z ihjy^dZ) f_gvr_ lhdZ gZ]jmadb. FZeZy
 _ebqbgZ lhdh\ aZfudZgby gZ a_fex bkdexqZ_l \hafh`ghklv ijb f_g_-
 gby jZkkfhlj_gguo \ur_f_lh^h\ b kj_`^kl\ HFI.

< khhl_lkl\bb k [2] ^himkdZ_lky jZ[h]Z k_lb k aZa_fe_gghe nZahc
 ^h mkljZg_gby ih\j_`^_gby; ijb wlhf wdkiemZlZpbhgguc i_jkhgZe h[y-
 aZg hlukdZlv b mkljZgblv ih\j_`^_gb_ \ djZlqZcrbc kjhd. HlukdZgb_
 f_klZ h^ghnZaguo aZfudZgbc gZ a_fex hkms_kl\ey_lky k ihfhsvx i_-
 j_ghkguo ijb[hjh\, baf_jyxsbo \[ebab <E mjh_gv fZ]gblgh]h ihey
 lhdh\ gme_hc ihke_`h\Zl_evghklb.

Ijbgbpi hij_`^_e_gby f_klZ aZfudZgby gZ a_fex \ jZa_l\e_gghe
 k_lb beexkljbjm_lky ko_fhc (jbk. 2.3), khklhys_c ba ebgb W₁, W₂, W₃ b
 W₄. Ijb aZfudZgbb \ lhqd_ D q_j_a f_klh ih\j_`^_gby ijhl_dZxl _f-
 dhklgu_ lhdh gme_hc ihke_`h\Zl_evghklb, aZfudZxsby q_j_a jZk-
 ij_`^_e_ggu_ _fdhklb ebgb, ij_`^klZ\e_ggu_ gZ jbk. 2.3 khkj_`^hlhq_g-
 gufb _fdhklyfb K₁, K₂, C₃, C₄ b K₄. JZkij_`^_e_gb_ wlbo lhdh\ \ ebgyo
 k_lb ihdZaZgh wixjZfb.

<_ebqbg lhdh\, jZkl_dZxsby ih ebgb W₄\e_h (I_{0,4}) b \ijZ-
 \h (I_{0,4}) hl f_klZ aZfudZgby ijhihjpbgZevgu kmffZjguf _fdhklyf gZ
 a_fex:

$$I'_{0,4} = k(C'_4 + C_1 + C_2 + C_3); I''_{0,4} = k(C''_{0,4}), \quad (2.5)$$

]^_k - dhwnnbpb_gl ijhihjpbgZevghklb.

GZb[hevrbc mjh_gv _fdhklguo lhdh\ gme_hc ihke_`h\Zl_evgh-
 klb bf__l f_klh \ ih\j_`^_gghc ebgb ^h f_klZ aZfudZgby, ihke_ dh-
 lhjh]h mjh_gv wlbo lhdh\ j_adh mf_gvrZ_lky.

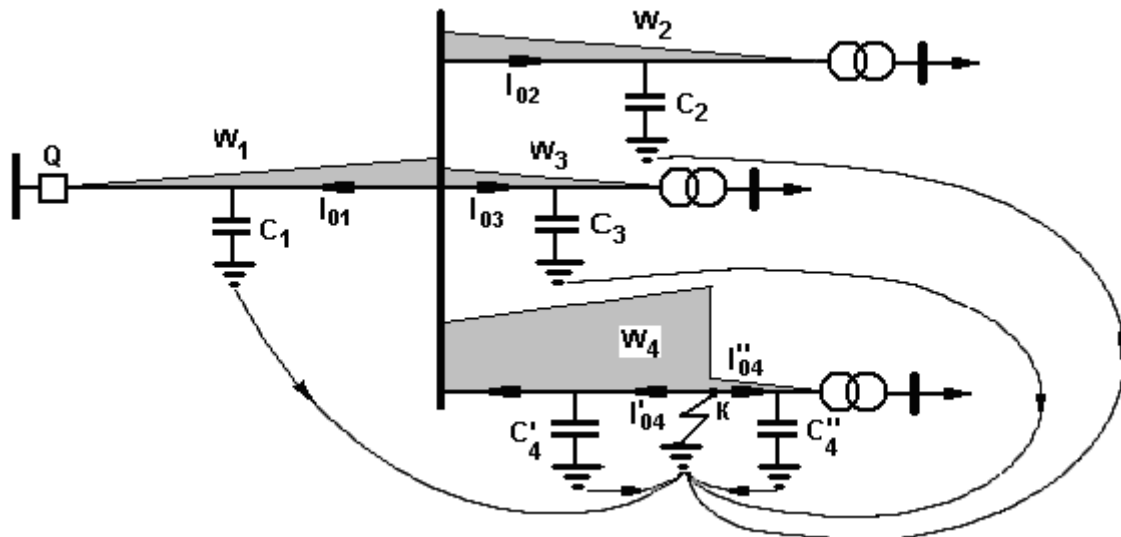


Fig. 2.3. Diagram of a four-wire cable with a central shield and its equivalent circuit.

The capacitance of the cable is determined by the formula: $C = \frac{Q}{U}$, where Q is the charge of the conductors and U is the voltage between them. The capacitance of the cable is determined by the formula: $C = \frac{Q}{U}$, where Q is the charge of the conductors and U is the voltage between them.

2.4. Calculation of the capacitance of a cable with a central shield

The capacitance of the cable is determined by the formula: $C = \frac{Q}{U}$, where Q is the charge of the conductors and U is the voltage between them. The capacitance of the cable is determined by the formula: $C = \frac{Q}{U}$, where Q is the charge of the conductors and U is the voltage between them.

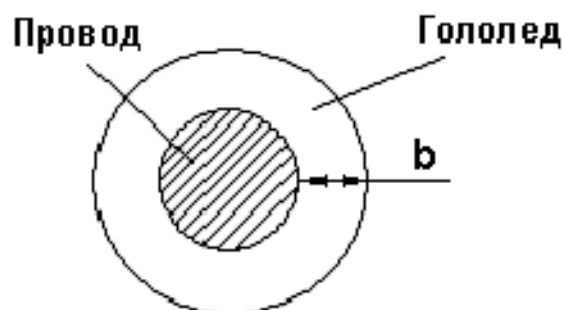


Fig. 2.4. Diagram of a cable cross-section with a central shield and its equivalent circuit.

Ih lhesbg_ kl_gdb]hehe_^Z ijb ih\lhjy_fhklb 1 jZa \ 25 e_1
l_jjblhjby kljZgu ^_eblky gZ 8 jZchgh\:

- I jZchg $b = 10$ ff;
- II jZchg $b = 15$ ff;
- III jZchg $b = 20$ ff;
- IV jZchg $b = 25$ ff;
- V jZchg $b = 30$ ff;
- VI jZchg $b = 35$ ff;
- VII jZchg $b = 40$ ff;
- hkh[uc $b \bullet 45$ ff.

DZjlu jZchgbjh\Zgby kljZgu ijb\h^ylky \ [6].

=hehe_^ h[mkeZ\eb\Z_1 ^hihegbl_evgu_ f_oZgbq_kdb_ gZ]jmadb
gZ \k_ we_f_glu <E. Ijb agZq bl_evguo]hehe^guo hleh`_gbyo \ha-
fh`gu h[ju\ u ijh\h^h\, ljhkh\, jZajmr_gby ZjfZlmju, baheylhjh\ b
^Z_ hihj <E. =hehe_^ fh`_l hldeZ^u\Zlvky ih nZaguf ijh\h^Zf ^hk-
lZlhqgh g_jZ\ghf_jgh. Klj_eu ijh_kZ ijh\h^h\ k]hehe^hf b [_a]h
ehe_^Z fh]ml hlebqZlvky gZ g_kdhevdh f_ljh\ . LZdZy jZaj_]mebjh\dZ
klj_e ijh_kZ, Z lZd`_ g_h^gh\j_f_gguc k[jhk]hehe_^Z ijb _]h lZy-
gbb, \uau\Zxsbc «ih^kdhd» hl^_evguo ijh\h^h\, fh]ml ijb_klb d i_-
j_djulbx \ha^mrghc baheypbb. =hehe_^ y\ey_lky h^ghc ba ijbqbg
«ieykdb» ijh\h^h\, kihkh[ghc ijb_klb d bo koe_klu\Zgbx.

GZ g_[hevrbo mqZkldZo <E ijhba\h^blky, dZd ijZ\beh, f_oZgbq_
kdh_ m^Ze_gb_]hehe_^Z. >ey wlhc p_eb bkihevamxlky r_klu, _j_db b
^jm]b_ ih^jmqgu_ kj^kl\Z. Ijb f_oZgbq_kdhf m^Ze_gbb]hehe_^Z [_a
hldexq_gby <E ^he`gu bkihevah\Zlvk y r_klu ba [Zd_eblZ, kl_dehieZ-
klbdZ b ^jm]h]h baheypbhggh]h fZl_jbZeZ.

Hkgh\guf f_lh^hf [hjv[u k]hehe^hf ijb wdkiemZlZpbb ijhly-
`_gguo <E y\ey_lky _]h ieZ\dZ aZ kq_1 gZlj_\Zgby ijh\h^h\ ijhl_dZx-
sbf ih gbf lhdhf. Kms_kl\m_1 ^hklZlhqgh [hevrh_ dhebq_kl\h ko_f
ieZ\db]hehe_^Z, hij^_ey_fuo ko_fhc we_dljbq_kdhc k_lb, gZ]jmadhc
ihlj_[bl_e_c, \hafh`ghklvx hldexq_gby ebgbc b ^jm]bfb nZdlhjZfb.

Ko_fZ ieZ\db]hehe_^Z i_j_f_gguf lhdhf bkdmkkl_ggh]h dhjhl-
dh]h aZfudZgby ihdZaZgZ gZ jbk. 2.5, Z.

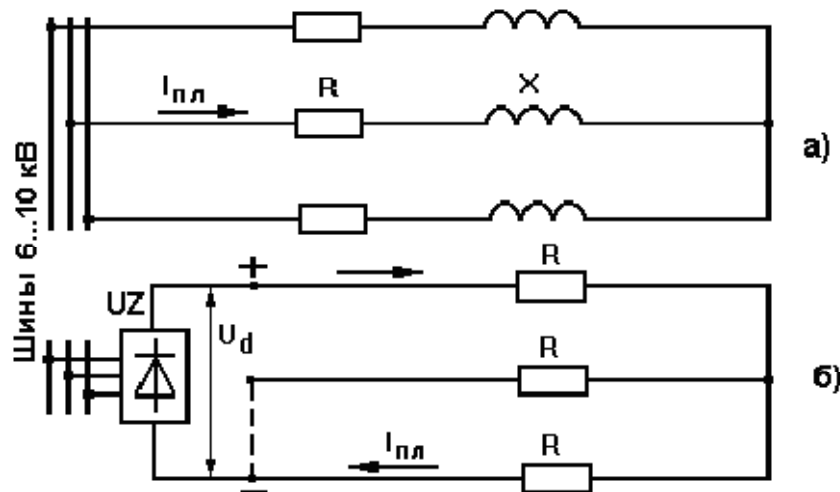


Рис. 2.5. Структурная схема системы питания (а) и схема системы питания (б)

В настоящее время в промышленности широко применяются системы питания, состоящие из трансформатора, выпрямителя и системы фильтрации. В настоящее время в промышленности широко применяются системы питания, состоящие из трансформатора, выпрямителя и системы фильтрации. В настоящее время в промышленности широко применяются системы питания, состоящие из трансформатора, выпрямителя и системы фильтрации.

Кроме того, в настоящее время в промышленности широко применяются системы питания, состоящие из трансформатора, выпрямителя и системы фильтрации. В настоящее время в промышленности широко применяются системы питания, состоящие из трансформатора, выпрямителя и системы фильтрации.

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FZjdZ ijh- h^Z	Lhd ieZ\db, :, ijb ijh^he`bl_evghklb, fbg			Lhd ij_^mij., :
	30	60	100	
:K 50	330	270	240	160
:K 70	410	330	290	205
:K 95	510	400	350	245
:K 120	565	450	400	275
:K 150	660	525	460	325
:K 185	750	600	520	375
:K 240	860	690	610	440

IjbgpbibZevgZy ko_fZ ieZ\db]hehe_^Z \uijyfe_gguf lhdhf
ihdZaZgZ gZ jbk. 2.5, /. <uijyfb_l_ev UZ ih^dexqZ_lky d rbgZf
6...10 d< ih^klZgpbcb beb hl^_evghfm ljZgknjhZlhjm. Bkihevamxiky,
dZd ijZ\beh, ^_ ko_fu ieZ\db]hehe _^Z \uijyfe_gguf lhdhf: «nZaZ –
nZaZ» b «nZaZ – ^_ nZau».

IZjZf_lju \uimkdZ_fuo hl_q_kl_gghc ijhfure_gghklvx g_j_-
]mebjm_fuo \uijyfb_l_evguo [ehdh\, ih^dexqZ_fuo d i_j_f_gghfm
gZijy`_gbx 10 d<:

- \uijyfe_ggh_gZijy`_gb_ 14 d<;
- \uijyfe_gguc lhd 1200 ::
- fhsgghklv gZ \uoh^_ 16800 d<1.

>ey ihemq_gby [hevr_c fhsgghklb \uijyfb_l_evgu_ [ehdb fh`gh
\dexqZlv ihke_^h\Zl_evgh beb iZ jZee_evgh. H:H GBBIL jZajZ[hlZgZ
gZ [Za_ mijZ\ey_fh]h lj_onZagh]h fhklh\h]h \uijyfb_l_ey mklZgh\dZ
^ey ieZ\db]hehe_^Z, ih^dexqZ_fZy d k_jbcghfm kbeh\hfm ljZgknjhZ-
lhjm beb rbgZf khhl_lkl\mxs_]h gZijy`_gby (^h 35 d<). < hlebqb_hl
g_j_]mebjm_fuo \uijyfb_l_evguo [ehdh\ wLZ mklZgh\dZ iha\hey_l ijb
ieZ\d_]hehe_^Z ieZ\gh baf_gylv \uoh^gu_ iZjZf_lju \ ^bZiZahg_:

- \uijyfe_ggh_gZijy`_gb_ 0...50 d<;
- \uijyfe_gguc lhd 0...1200 ::
- fhsgghklv gZ \uoh^_ 0...60000 d<1.

WdkiemZlZpbhgguc i_jkhgZe <E ^he`_g dhgljhebjh\Zlv ijhp_kk
]hehe_^hh[jZah\Zgby b h[_ki_qb\Zlv k\h_j_f_ggh_ \dexq_gb_ ko_f
ieZ\db]hehe_^Z. <E, gZ dhlhjuo ijhba\h^blky ieZ\dZ]hehe_^Z, ^he`-
gu [ulv hkgZs_gu kb]gZebaZlhjZfb]hehe_^Z, jZ[hkhkihkh[ghklv dhlh-
juo ^he`gZ ijh_jylvky _`_]h^gh i_ j_^ gZklmie_gb_f abfg_]h i_jbh-
^Z.

Ke^m_1 hlf_lblv, qlh ieZ\dZ]hehe^Z ^he`gZ ijh\h^blvky \ jZchgZo bgl_gkb\gh]h]hehe^hh[jZah\Zgby (b > 20 ff) k qZklhc iey-kdhc ijh\h^h\ . < ^jm]bo kemqZyo ijbfg_gb_ ieZ\db]hehe^Z ^he`gh h[hkgh\u\Zlvky l_ogbdh-wdhghfbq_kdbfb jZkq_lZfb.

2.5. J_fhgl\ha^mrguo ebgbc

Ijb j_fhglZo <E \uihegy_lky dhfie_dk f_jhijbylbc, gZijZ\ - e_gguo gZ ih^^_j`Zgb_ beb \hklZgh\e_gb_ i_j\hgZqZevguo wdkiemZ - lZpbhgguo oZjZdl_jbklbd <E iml_f j_fhglZ beb aZf_gu hl^_evguo __ we_f_glh\.

>ey <E gZijy`_gb_f ^h 10 d< kljmdlmjZ j_fhglgh]h pbdeZ ij^klZ\ey_1 kh[hc q_j^h\Zgb_ l_dms_]h b dZiblZevgh]h j_fhglh\ : L-D-L-D... Ijh^he`bl_evghklv j_fhglgh]h pbdeZ ^ey <E gZ ^_j_\ygguo hihjZo khklZ\ey_1 5 e_1, gZ`_e _ah[_lhgguo hihjZo - 10 e_1.

>ey <E gZijy`_gb_f 35 d< b \ur_ ij^mkfZljb\Zxlky lhevdh dZiblZevgu_j_fhglu k i_jbh^bqghklvx:

- g_j`_ 1 jZaZ \ 5 e_1 ^ey <E gZ ^_j_\ygguo hihjZo;
- g_j`_ 1 jZaZ \ 10 e_1 ^ey <E gZ`_e_ah[_lhgguo b f_lZeeb-q_kdbo hihjZo.

I_j_q_gv jZ[hl, hlghkysboky d l_dmsbf b dZiblZevguf j_fhglZf <E, mklZgZ\eb\Z_lky lbih\ufb bgkljmdpbyfb ih wdkiemZlZpbb <E [4]. H[t_f j_fhglguo jZ[hl hij^_ey_lky ih j_amevlZlZf ij^r_kl\mxsbo hkfhljh\, bkiulZgbc b baf_j_gbc. Ihwlhfm ^ey ieZgbjh\Zgby j_fhglh\ <E \^_lky ke^mxsZy wdkiemZlZpbhggh-l_ogbq_kdZy ^hdmf_glZ-pby:

- iZkihjlZ <E;
- ebklbd hkfhljh\;
- \^hfhklb ijh_jdb aZ]gb\Zgby ^_j_\ygguo hihj;
- \^hfhklb ijh_jdb ebg_cghe baheypbb;
- \^hfhklb baf_j_gbc]Z[Zjblh\ b klj_e ijh_kZ ijh\h^h\ b ljhkh\;
- \^hfhklb baf_j_gbc khijhlb\e_gb_ aZa_feyxsbo mkljhckl\;
- `mjgZeu g_bkijZ\ghkl_c <E;
- `mjgZeu mq_lZ jZ[hl gZ <E b ^jm]b_ ^hdmf_glu.

GZ hkgh\Zgbb wlbo ^hdmf_glh\ kh klZ\ey_lky fgh]he_lgbc ljZnbd jZ[hl, \ dhlhjhf mdZau\Z_lky i_j_q_gv \k_o <E b]h^u bo \u\h^Z \ j_- fhgl \ khhl_lkl\bb k l_ogbq_kdbf khklhygb_f. GZ hkgh\Zgbb fgh]h-e_lg_]h ljZnbdZ khklZ\ eyxlky]h^h\u_ ljZnbd jZ[hl. Ih nhjf_hj]Z-gbaZpbb dZiblZevguc j_fhgl <E fh`_1 \uihegylvky ^_p_gljZebah\Zg-

gh, p_gljZebah\Zggh b ih kf_rZgghc nhjf_. Ijb ^_p_gljZebah\Zgghc
nhjf_ j_fhgl \uihegy_lky kbeZfb ij_^ijbylby, wdkiemZlbjmxs_]h
<E.

GZb[he__ijh]j_kkb\ghc nhjfhc dZiblZevgh]h j_fhglZ <E y\ey-
_lky p_gljZebah\Zgguc j_fhgl, \uihegy_fuc ih ^h]h\hjm ih^jy^Z
kljhbl_evgh-fhglZ`ghc hj]ZgbaZpb_c, ki_pbZebabjmxs_cky gZ kljhb-
l_evkl_ <E. ;jb]Z^u p_gljZebah\Zggh]h j_fhglZ fh]ml [ulv dhf-
ie_dkgufb, \uihegyxsfbf \k_ \b^u j_fhglguo jZ[h], beb ki_pbZeb
abjh\Zggufb, \uihegyxsfbf hij_^_e_ggu_ \b^u jZ[h], gZijbf_j aZ-
f_gm hihj.

Hkgh\gufb ij_bfms_kl\Zfb p_ gljZebah\Zggh]h j_fhglZ y\eyxl-
ky \ukhdh_ dZq_kl\h b khdjZs_gb_ kjhdh\ j_fhglguo jZ[h]. Wlh ^hklb-
]Z_lky \ukhdhc d\ZebnbdZpb_c i_jkhgZeZ, bkihevah\Zgb_f i_j_^h\uo
f_lh^h\ hj]ZgbaZpbb b ijh_^_gby jZ[h] l, \ukhdhc kl_i_gvx bo f_oZgb-
aZpbb.

AZdhgq_ggu_ jZ[hlu ih dZiblZevghfm j_fhglm <E ^he`gu ijb-
gbfZlvky l_ogbq_kdbf jmdh\h^bl_e_f ij_^ijbylby, h q_f ^_eZ_lky hl-
f_ldZ \ ieZg_-]jZnbd_ jZ[h]. <k_ jZ[hlu, ijhba_^_ggu_ gZ <E, ^he`-
gu hnhjfeylvky khhl_lkl\mxsfbf ZdlZfb k mdZaZgb_f h[t_fZ \uihe-
g_gguo jZ[h], ^Zlu \uiheg_gby, nZfbebb ijhba\h^bl_ey jZ[h]. <iZk-
ihjl_ <E ^he`gu hljZ`Zlvky \k_ hkgh\gu_ \uiheg_ggu_ jZ[hlu (aZf_-
gZ hihj, ijh\h^h\, baheylhjh\) b baf_g_gb_ oZjZdl_jbklbd <E , gZijb-
f_j ihy\e_gb_ gh\uo i_j_k_q_gbc.

=E:<: 3. FHGL:@ D;?EVGUO EBGBC
G:IJY@?GB?F >H 35 d<

3.1. Ih^]hlh\bl_evgu_jZ[hlu

< gZklhys__ \j_fy ijb fhglZ`_ gh\uo b j_dhgkljmdpbb kms_kl-
\mxsbo DE gZjy^m k ljZ^bpbhggh ij bf_gy_fufb dZ[_eyfb k [mfZ`ghc
ijhiblZggghc, ieZklfZkhh\hc b j_abgh\hc baheypb_c gZqbgZxl rbjhdh
ijbf_gylvky dZ[_eb k baheypb_c ba krlh]h ihebwlbe_gZ (KIW). WIZ
baheypby bf__l \ukhdb_ ^bwe_dljbq_kdb_ b f_oZgbq_kdb_ oZjZdl_jb-
klbdb, [hevrbc, q_f m ^jm]bo dZ[_evguo baheypbhgguo fZl_jbZeh\,
^bZiZahg jZ[hqbo l_fi_jZlmj.

< aZ\bkbfbhklb hl mkeh\bc ijhdeZ^db KIW dZ[_eb ^himkdZxl ^eb-
l_evgu_ lhdb gZljmadb gZ 15...30 % [hevr_, q_f dZ[_eb k [mfZ`ghc
ijhiblZggghc baheypb_c. KIW dZ[_eb bf_xl ^ebl_evduc kjhd kem`[u
(^h 50 e_l), ih\j_`^Z_fhklv lZdbo dZ[_e_c gZ 1...2 ihjy^dZ gb`_, q_f
dZ[_e_c k [mfZ`ghc baheypb_c. Hq_\b^gh, qlh ijbf_g_gb_ KIW dZ[_-
e_c klZgh\blky g_ lhevdh l_ogbq_kdb p_e_khh[jZaguf, gh b wdghghfbq_-
kdb \u]h^guf.

GZ f_klh fhglZ`Z dZ[_ev ihklZ\ey_lky gZ ki_pbZevguo [ZjZ[ZgZo.
Kljhbl_evgy ^ebgZ dZ[_ey gZ [Zj Z[Zg_ khklZ\ey_l 200...2000 f \ aZ\b-
kbfbhklb hl \g_rg_]h ^bZf_ljZ dZ[_ey b ghf_jZ (jZaf_jZ) [ZjZ[ZgZ. >ey
jZa]jmadb dZ[_evguo [ZjZ[Zgh\ ^he`gu bkihevah\Zlvky Z\lhdjZgu beb
ki_pbZevgu_ ljZgkih]lgu_ kj_`^klZ - dZ[_evgu_ ljZgkih]l_ju.

Ijb ijhdeZ^d_ DE \ a_fe_ (\ ljZgr_yo, ljm[Zo, [ehdZo) ij_`^Zjb-
l_evgh hnhjfey_lky jZaj_r_gb_ gZ ijh\`^_gb_ jZkdhihd b \uihegy_lky
jZaf_ldZ dZ[_evghc ljZkku. Ijb i_ j_k_q_gbb dZ[_evghc ljZkhhc ^jm]bo
ih^a_fgguo dhffmgbdZpbc \uihegyxlky kh]eZkh\Zgby [m^msbo i_j_k_-
q_gbc k hj]ZgbaZpbyfb, wdkiemZljbmxsbf wlb dhffmgbdZpbb.

>ey ij_`^hl]Zs_gby ih\j_`^_gby i_j_k_dZ_fuo ih^a_fgguo dhf-
fmgbdZpbc \jmqgmj jhxlky rmjnu (g_[hevrbc_ljZgr_b) ^ey h[gZjm-
`_gby wlbo dhffmgbdZpbc. JZ[hlu \uihegyxlky \ ijbkmlkl\bb ij_`^-
klZ\bl_ey hj]ZgbaZpbb, wdkiemZljbmxs_c i_j_k_dZ_fu_ dhffmgbdZpbb.

Ijb hldjulhc ijhdeZ^d_ dZ[_ey ijh\jyxlky dZ[_evgu_ khhjm`_-
gby, ijhba\h^kl_ggu_ ihf_s_gby b mklZgh\`e_ggu_ \ gbo hihjgu_
dhgkljmdpbb ^ey dZ[_e_c.

< aZ\bkbfbhklb hl lbiZ baheypbb dZ[_ey mklZgZ\eb\Zxlky
gZb[hevrbc_ ^himklbfu_ jZaghklb mjh\g_c dZ[_evghc ljZkku. >ey dZ[_-
e_c gZijy`_gb_f 10 (35) d< k [mfZ`ghc ijhiblZggghc baheypb_c wlZ

jZaghklv mjh\g_c khklZ\ey_l 15 f, ^ey dZ[_e_c k j_abgh\hc, ieZklfZkhh-
\hc b KIW-baheypb_c jZaghklv mjh\g_c g_h]jZgbq_gZ.

I_j_^ fhglZ`hf ijhba\h^blky hkfhlj dZ[_ey gZ [ZjZ[ZgZo. G_
^he`gh [ulv gZjm`guo f_oZgbq_kdbo ih\j_`^_gbc, h[Z dhgpZ dZ[_ey
gZ [ZjZ[Zg_ ^he`gu [ulv]_jf_lbqgh aZ^_eZgu. Ih j_amevlZlZf hkfh-
jZ dZ[_ey khklZ\ey_l ky khhl_lkl\mxsbc Zdl.

FhglZ` dZ[_e_c k [mfZ`ghc ijhiblZgghc baheypb_c ijb gbadbo
l_fi_jZlmjZo (gb`_ -5° K) \uihegy_lky ihke_ bo ij_^Zjbl_evgh]h ih-
^hlj_\Z, ihkdhevdm ijb hljbZl_evguo l_fi_jZlmjZo wlZ baheypby hl-
j^\Z_l, klZgh\blky g_weZklbqghc b ijb ijhdeZ^d_ dZ[_ey fh`_l [ulv
ih\j_`^_gZ. GZb[he__ ijhklhc kihkh[ijh]j_\Z dZ[_ey - _l_iehfh ih-
f_s_gbb. Ijh^he`bl_evghklv ijh]j_\Z aZ\b kbl hl l_fi_jZlmju \ha^moZ
_ihf_s_gbb b khklZ\ey_l 72 q ijb 5...10° K, 24 q ijb 10... 25° K b 18 q
ijb 25...40° K.

Ijb g_h[oh^bfhklb khdjZs_gby mdZaZggh]h \j_f_gb bkihevamxl f_lh^
ijh]j_\Z dZ[_ey we_dlj_bq_kdbf lhdhf ijyfh gZ [ZjZ[ZgZo, ke_^y aZ
l_fi_jZlmjhc gZjm`gh]h ihdjh\Z dZ[_ey gZ \g_rgbo \bldZo [ZjZ[ZgZ,
dhlhjZy g_ ^he`gZ ij_\urZlv 20° K. Ijb wlhf mkeh\bb l_fi_jZlmjZ
baheypbb dZ[_ey \h \gmlj_ggbo \bldZo [ZjZ[ZgZ g_ ij_\ukbl ^himklb
fh]h agZq_gby.

H^gbf ba ij_bfms_kl\ KIW dZ[_e_c y\ey_lky \hafh`ghklv bo
ijhdeZ^db [_a ij_^Zjbl_evgh]h ih^h]j_\Z ijb l_fi_jZlmjZo ^h -20° K
^ey dZ[_e_c k ihebwlbegh\hc aZsblghc h[hehqdhc b ijb l_fi_jZlmjZo
^h -15° K ^ey dZ[_e_c k iheb\bgbeohjb^ghc aZsblghc h[hehqdhc. LZ-
dZy \hafh`ghklv ^hklb]Z_lky [eZ]h^Zjy bkihevah\Zgbx dZq_kl_gguo
ihebf_jguo fZl_jbZeh\ ^ey baheypbb b h[hehqdb KIW dZ[_ey.

3.2. IjhdeZ^dZ dZ[_e_c \ ljZgr__

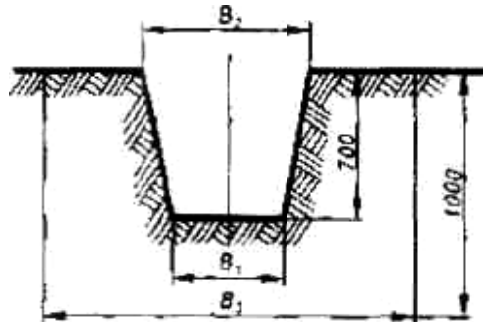
GZb[he__ ^_r_uc kihkh[dZgZebaZpbb we_dljhwg_j]bb -
jZaf_s_gb_ dZ[_e_c \ ljZgr__. LZdhc kihkh[g_ lj_[m_l [hevrh]h
h[t_fZ kljhbl_evguo jZ[hl b kh a^Z_l ohjhrb_mkeh\by ^ey hoeZ`-
^_gby dZ[_e_c. G_ ^hklZlhd wlh]h kihkh[Z - \hafh`ghklv f_oZgbq_kdbo
ih\j_`^_gbc dZ[_e_c \h \j_fy jZaebqguo jZkdhihd, ijh\h^bfuo
ijb wdkiemZlZpbb khhjm`_gbc.

3.2.1. Ih^]hlh\dZ ljZgr_b d ijhdeZ^d_ dZ[_ey

LjZgr_b [hevrhc ijhly`_ gghklb jhxl ki_pbZevgufb dh\rh-
_ufb, jhlhjgufb beb p_igufb a_fe_ jhcgufb fZrbgZfb. GZ mqZ-
kldZo dZ[_evghc ljZkku, ijhoh^ysbo \ g_ihkj_^kl_gghc [ebahklb
hl ih^a_fgguo b gZa_fgguo khhjm`_gbc, a_ezguo g ZkZ`^_gbc b jZk-
ihch`_ggguo \ a_fe_ dhffmgbdZpbc, bkihevamxl fZ eh]Z[Zjblgu_

f_o Zgbafu, gZijbf_j wdkdZ\Zhj W-153 k dh\rh f _fdhkl vx 0,15 f³ beb hl[h cgu_ fh ehldb, eh f u b ehi Zlu.

LjZgr_ b ^ey ij hdeZ^db dZ[_e_c hlju\ Zxl]em[bghc g_ f_g_ 700 f f, ZjZaf_ju bo ih ^gm aZ\bkyl hl qbkeZ ij hdeZ ^u\Z_fuo o dZ[_e_c. < f_ klZo,]^_ [m^ml j ZkiheZ]Zvky dZ[_evgu_ kh^bgbl_evgu_ fmnlu ^ey m^h[kl\Z \ uiheg_g by kh^bg_gbc dZ[_e_c, ljZgr_x jZkrbj yxl, h[j Zamy dfeh\Zg (^ey h^ghc fmnlu 2,5 f ^eb ghc b 1,5 f rjbgh c iexk 0 ,4 f ^ey dZ^hc i hke_ ^nx s_c fm nlu). F mlu jZki heZ]Zxl \ rZof Zghf i hjy^d_.



Jbk. 3.1. JZaf_j u ljZgr _b ^ey ij hdeZ^db dZ[_e_c 1...10 d<:

<1 - jZaf_j gZ^g_ljZg r_b; <2 - jZaf_j m ih_j oghklb a_fe b;
<3 - jZaf_j ahgu hl\h^Z

< h^ghc ljZgr_ _j_dhf_ g^m_lky j Zaf_sZlv g_ [he__ 6 dZ[_e_c. JZaf_ju ljZ gr_c \ a Zbkbfhk lb hl qb keZ jZaf_sZ_fuo \ gbo dZ[_e_c ijb \ _^_gu \ 1Z[e. 3.1.

LZ[ebpZ 3.1

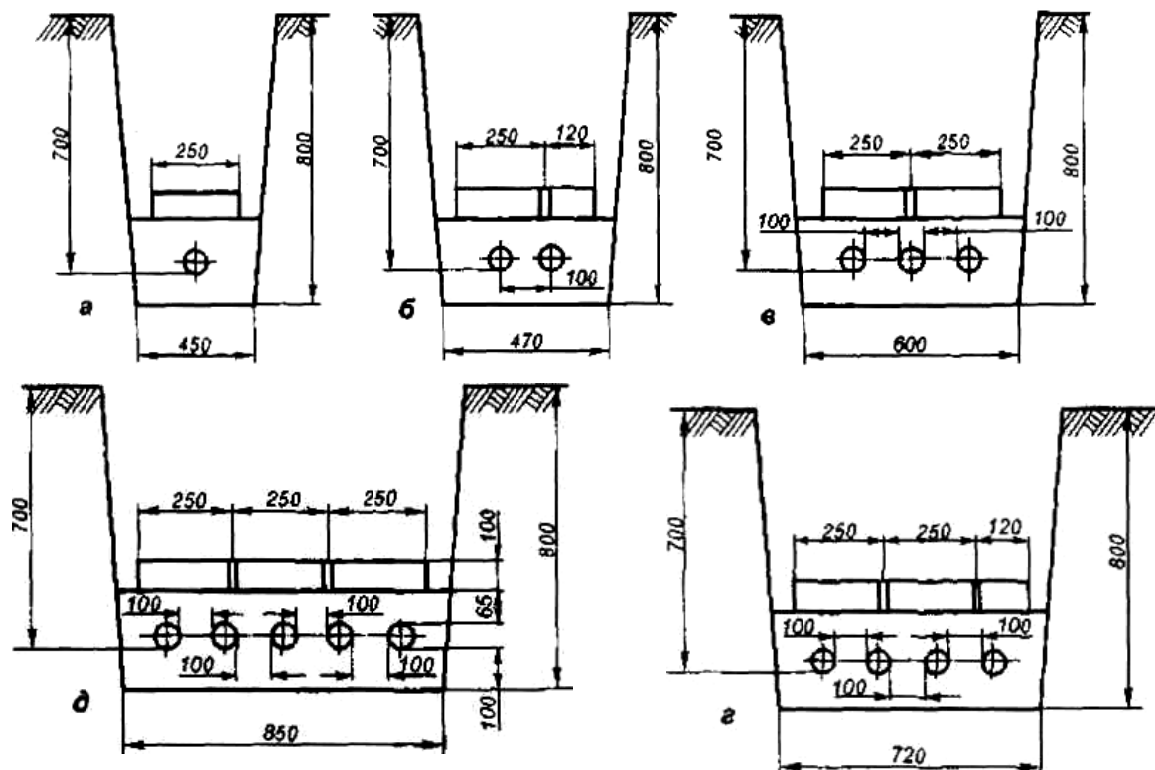
Lbi ljZg r _b	JZaf_j u, ff			Qbkeh ijhd eZ^u-\Z_fuo kbe h\uo dZ[_e_c *
	<1	<2	<3	
L-1	300	350	2150	1
L-2	300	500	2300	1-2
L-3	400	600	2400	2-3
L-4	600	700	2500	3-4
L-5	750	830	2600	4-5
L-6	800	1000	2800	5-6
* < h^ghc ljZg r _jZaf_sZxl g_ [he__ 2-o dZ[_e_c gZijy` _gb_f 20-35 d<.				

Ijbzfd mljZgr_ c hl kljhb 1_evghc hj]ZgbaZpbb \uihe gyxl ihk e_ hk-fhlj Z b ih^l _j^_gb y, qlh: 1 j ZkkZ \ui heg_gZ kljh]h ih]_h^_abq_kdhc jZa[b\d_ k kh[ex^_gb_f _jlbd Zevguo hl f _lhd ^g ZljZgr_ b, k ijb\y adZfb

ljZgr _b d jZaebqguf hjb_glbj Zf, m]eu i h\hjhlh \ ljZgr_ b ^he`gu khhl-
 lkl\mxl lj [h\Zgby f ^ey jZ^bmkh\ ba]b[Z dZ[_e_c. Ijb ijb_fd_h kh[h_
 \gb f Zgb_h[j ZsZxl gZ ieZgbjh \hqug_ hl f_ldb ih \k_c ^ebg_ ljZkku.

=em[bgZ ljZgr_ b hl ieZ gbjh\hqug hc hlf_ ldb ^ey dZ[_e_c gZijy-
 ^_g b_f ^h 10 d< ^he` gZ [ul v g_ f_g __ 0,7 f, ijb i_j_ k_q_gbb nēbp,
 ieh s Z^_c - 1 f. F_g vrZy]em[bgZ ljZgr_b (^h 0,5 f) ^ himkdZ_lky ijb
 \h^ _ dZ[_e_c \ a^Zgby, khjhm`_gby, Z lZd` \ f_ klZo i_j_ k_q_gbc kih^
 a_fg ufb khh j m`_gbyf b ijb mk eh\bb aZs blu dZ[_e_c hl f_oZgbq_kdbo
 ih\j _^_gbc gZ mqZkdZo ^ebghc ^h 5 f.

Rbjbgm ljZgr_ b ijb ij hdeZ^d_ \ g_c kbeh\uo dZ[_e_c ^h 10 d<
 ijb gbfZxl g _f_g_, mZaZggk gZ jbk. 3.2.



Jbk. 3.2. JZaf _ju dZ[_e vguo ljZ gr_c b jZ af_s_gb_ \ gbo dZ[_e_c
 k aZsblhc d bjibqhf hl f_oZg bq_kdbo ih\j_ ^_ gbc:
 Z - h^gh]h, [- ^mo, \ - lj_o,] - q_luj_o, ^ - iylb

I_j_ ^ i j hdeZ^dhc dZ[_e_c \ ljZ gr_x ij _^klZ\bl_ eb wdkiemZlb-
 jmx s _c hj]Z gbaZpbb hkfZlj b \ Zxl]hl h\ghklv ljZkku ^ey ijhd eZ^db
 dZ[_e_c:

- deZ^dm b dj_i e_gb_ (i j b g_h[oh^bfhkl b) ljm[;
- ^bZf_lju lj n[b bo k hhl_lkl \ b_ ^ey i jh_dlgh c fZjdb dZ[_
 ey;

- aZ]hlh\dm dbjibqZ beb iebL ^ey f_oZgbq_kdhc aZsblu dZ[_e_c ih \k_c ljZkk_ beb gZebqb_ kb]gZevghc e_glu;
- hlkmkl\b_ \h^u \ ljZgr__;
- hlkmkl\b_ dZfg_c b ijhqbo ij_^f_lh\ \ ljZgr__;
- m]eu ih\hjhlh\ ljZgr_b;
-]em[bgm ljZgr_b ih \k_c ljZkk_;
- aZ^_edm ljm[\ ijhoh^u ijb \h^_ \ a^Zgby q_j_a nmg^Zf_glu b kl_gu;
- jZkkIzgh\dm ih \k_c ljZkk_ ebg_cgguo b m]eh\uo jhebdh\ (m]eh\u_ jhebdb ^he`gu [ulv aZdj_ie_gu);
- gZ dZ[_eb, dhlhju_ [m^ml ijheh`_gu \ ^Zgghe ljZgr__, ij^ty\eyxl ijhlhdheu bkiulZgbc dZ[_e_c gZ aZ\h^_, Zdlu hkfhIjZ [ZjZ[ZgZ b dZ[_ey gZ g_f, Z ^ey aZjm[_`gh]h dZ[_ey - ^hihegbl_evgh ijhlhdhe \kdjulby b gZjm`gh]h hkfhIjZ h[jZapZ.

>gh ljZgr_b ih \k_c ^ebg_ ^ he`gh [ulv ijbkuiZgh i_kdhf beb f_edhc a_fe_c, g_ kh^_j`Zs_c dZfg_c, kljhbl_evgh]h fmkhjZ, reZdZ b l. i. LhesbgZ ih^kuidb ^he`gZ khklZ\eylv g_f_g__ 100 ff.

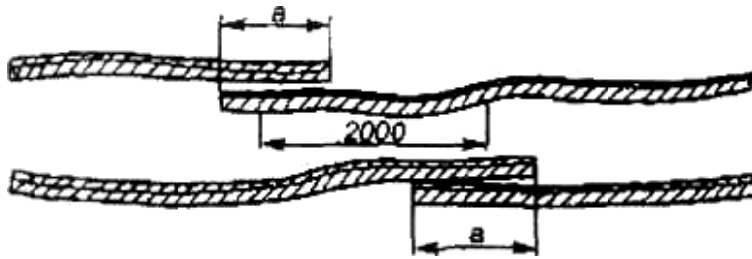
<^hev \k_c ljZgr_b ^he`gu [ulv aZ]hlh\e_gu ^ey aZkuidb dZ[_ey i_khd beb f_edZy a_fey.

AZsblgu_ ljm[u ^he`gu [ulv meh`_gu gZ ijbkuiZgguc i_khd beb a_fex. JZkkIhygb_ \ k_lm f_`^m ljm[Zfb ^he`gh [ulv g_f_g__ 100 ff.

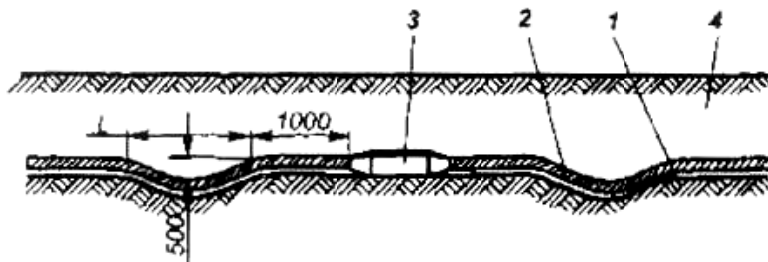
Ihke_ \uiheg_gby i_j_qbke_gguo lj_[h\Zgbc jZaj_rZxl ijh-deZ^dm dZ[_ey b khklZ\eyxl Zdl gZ kdjulu_ jZ[hlu b Zdl ijb_fdb ljZgr_c, dZgZeh\, lmgg_e_c b [ehdh\ ih^ fhglZ` dZ[_e_c.

3.2.2. JZkiheh`_gb_ dZ[_e_c \ ljZgr__

DZ[_eb mdeZ^u\Zxl gZ ^gh ljZ gr_b, hqbs_ggh_ hl dZfg_c b g_jh\ghkl_c, dm^Z gZkuiZxl kehc fy]dhc a_feb beb i_kdZ lhesbghc g_f_g__ 100 ff. DZ[_eb mdeZ^u\Zxl k kh[ex^_gb_f lj_[h\Zgbc ijb_^_ggguo \ur_. Ijb ijhdeZ^d_ g_kdhevdb dZ[_e_c \ ljZgr__ dhgpu dZ[_e_c, ij^gZagZq_ggu_ ^ey ihke^mxs_]h fhglZ`Z kh^bgbl_evguo b k lhihjguo fmnl, ke^m_l jZkiheZ]Zlv kh k^b-]hf f_kl kh^bg_gby g_f_g__ q_f gZ 2 f. Ijb wlhf ^he`_g [ulv hk-lZ\e_g aZiZk dZ[_ey k ^ebghc, g_h[oh^bfhc ^ey ijh_jdb baheypbb gZ \eZ`ghklv b fhglZ`Z fmnl, Z lZd`_ mdeZ^db ^m]b dhfi_gkZ lhjZ (^ebghc gZ dZ^`hf dhgp_ g_f_g__ 350 ff ^ey dZ[_e_c gZijy`_gb_f ^h 10 d<). < kl_kg_gguo mkeh\byo ijb [hevrbo ihlhdZo dZ[_e_c ^himkdZ-_lky jZkiheZ]Zlv dhfi_gkZlhju \ \jIbdZevghc iekdhklb gb`_ mjh\gy ijhdeZ^db dZ[_e_c. FmnlZ ijb wlhf hk lZ_lky gZ mjh\g_ ijhdeZ^db dZ-_e_c (jbk. 3.3 b 3.4).



Jbk. 3.3. JZkihe h`_gb_d hgph\ dZ[_e_c\ f_k l _fhglZ ` Z^mo
kh^bgbl_evgu ofmnl. JZaf_j (Z) khklZ\ey _l hl 0,5 ^h 1 f



Jbk 3.4. <_j lbdZevg h_jZkiheh ` _gb_dlf i_gkZlh j h\
\ f _kl_fhg l Z`Z kh_ ^bgbl_ev ghc fmn l u \ ljZg r __:
1 - dZ[_ev; 2 - dhfi _gkZlhj; 3 - fmn l Z; 4 - l jZgr_y

Ij b f _q Z g b _*. >eb gZ dhfi _gkZlhjZ, aZ\bkbl hl fZ j db b
^bZf _ljZ dZ[_ey.

3.2.3. I _j_k_q_gby b k[eb`_gb y

H[uqgh dZ[_eb \ ljZgr __ mdeZ^u\Zxl \ h^bg jy ^ gZ mkZgh\
e_gguo jZkklhygbyo hl a^Zgbc b khjhm`_gbc (jb k. 3.5...3.17).
GZbf _gvr__ jZkklhygb_f_`^ mdZ[_eyf b b g_n l _ beb]Zahijh\h ^hf -
g_f_g__ 0,5 f. Ijb i _j_k_q_gbyo dZ[_eb ^h 1 d< ijhdeZ ^u\Zxl i h\jo
dZ[_e_c [he__ \ukhdh]h gZijy ` _gby, lZd dZd \j hylghkl v ih\j_` ^_gby
\ dZ[_eyo ^h 1 d< [he vr_ b ij b lZdhf j Zaf_s_g bb \ kemqZ_ Z\Zjbc \ dZ-
[_eyo ^h 1 d< g_ [m^m ih\j_ ` ^Zlvky dZ[_eb [he__ \u khdh]h gZijy-
`_g by. Ijb i _j_k_q_gbyo dZ[_e_c ^j m]bfb dZ[_evgu fb ebg byfb
f_` ^m gbfb ^he`_g [ulv ke hc]jmgl Z lhesb ghc g_f_g__ 500 ff.
?keb wlh jZkklhygb_ kh[exkl b g_evay, lh f_` ^m dZ[_eyfb ^h 35 d<
ijh deZ^u\Zxl [_lhg gu_ ieb lu (dbj i bq b) beb dZ[_ev ihf_s Zxl \
ljm[m beb]hnjbh\Z gguc r eZg]. Dbj ibqb be b [_lhg gmx ieb lm md-
eZ^u\Zxl gZ kehca_f eb l h e s bg hc g_f_g__ 150 ff, d hlhjuc gZku-
iZxl ih\jo dZ[_e_c. Ijb i _j_k_q_gbb ` _e_ agh^hjh ` guo im l_c b
rhk k_cg uo ^hjh] d Z[_eb i j hdeZ^u\Zxl \ l m gg_eyq [ehdZo beb
ljm[Zo ih \k_c rb j bg_ ahgu hlqm` ^_gby gZ jZkklhygbb g_f_g__
1 f hl ihehl gZ^hjh] b b g_f_g__ 0,5 f hl ^gZ \ h^hhl\h ^ghc dZgZ\u.

< f_klZo i_j_k_q_gbc b k[eb`_gbc k ij_iylkl\byfb ^ey aZsb-
lu, dZ[_e_c ke^m_l ijb_f_glv Zk[hp_f_glg_u, ieZklfZkklh\u_, [-
lhgg_u, d_jZfbq_kdb_, qm]mggu_ b]hnjbjh\Zgg_u ieZklfZkklh\u_
ljm[u. Ijb_f_g_gb_ klZevguo ljm[^himkdZ_lky lhevdh ^ey ijhoh-
^h\, \uihegy_fuo f_lh^hf ijhdhe Z]jmgZ. >ey ij^hojZg_gby hl
kdhie_gby \ ljm[Zo \h^u bo ke^m_l ijhdZ^u\Zlv k mdeghf g_
f_g__ 0,2 %. <gmlj_ggbc ^bZf_lj ljm[^ebghc [he__ 5 f ^he`_g
[ulv g_ f_g__ ihemlhjZdjZlgh]h gZjm` gh]h ^bZf_ljZ dZ[_ey, gh g_
f_g__ 100 ff. G_ ^himkdZ_lky ijheh`_gguc \ ljZgr__ dZ[_ev hk-
lZeylv [_a gZ^ahjZ, _keb hg g_ ijbkuiZg a_fe_c b g_ aZsbs_g
ieblZfb beb dbjibqhf. DZ[_eb, ij^gZagZq_ggu_ ^ey gZijy`_gbc
\ur_ 1 d<, ^he`gu [ulv, aZ j_`d bfb bkdexq_gbyfb, aZdjulu k\j-
om djZkguf [_ks_e_\uf dbjibqhf beb ki_pbZevguf ieblZfb
(j bk. 3.3). LjZkkZ dZ^hc ebgbb ^he`gZ [ulv gZg_k_gZ gZ ieZg f_-
klghklb.

Ijb i_j_k_q_gbb mebp, iehsZ^_c, rhkk_cg_uo b ` _e_agh^h-
jh`guo iml_c]em[bgm mdeZ^db m_ebqb\Zxl^h 1 f. Mf_gvr_gb_
]em[bgu mdeZ^db ^h 0,5 f ^himkdZ_lky ijb \h^_ dZ[_e_c \ a^Zgb_,
Z lZd`_ ijb i_j_k_q_gbb ebgbc ih ^a_fg_uo khhj_m`_gbc ijb mkeh-
\bb aZsblu dZ[_e_c hl f_oZgbq_kd bo ih\j_`^_gbc (gZijbf_j, ijb
ijhdZ^d_ \ ljm[Zo). IjhdZ^dm dZ[_evguo ebgbc 6...10 d< ih iZ-
ohlguf a_feyf ijhba\h^yl gZ]em[bg_ g_ f_g__ 1 f, ijb wlhf a_f-
ex gZ^ ljZkkhc bkihevamxl ih^ ihk_\u.

RbjbgZ ^gZ ljZgr_b ^ey ijhdZ^db kbeh\uo dZ[_e_c ^h 10 d<
^he`gZ [ulv g_ f_g__: 300 ff – ^ey h^gh]h-^mo dZ[_e_c; 400 ff –
^ey ^mo-lj_o dZ[_e_c; 500 ff – ^ey lj_o-q_luj_o dZ[_e_c; 630 ff
– ^ey q_luj_o-iyfb dZ[_e_c b 800 ff – ^ey iylb-r_klb dZ[_e_c. <
kemqZ_ jZajZ[hldb ljZgr_b a_fe_jhcguf f_oZgbafhf ^himkdZ_lky
khdjZs_gb_ rbjbg_u ljZgr_b ^e y ijhdZ^db h^gh]h dZ[_ey ^h
10 d< ^h rbjbg_u nj_au, gh g_ f_g__ 150 ff. G_kh[ex^_gb_ jZk-
klhygbc f_`^m dZ[_eyfb \uau\Z_l \h \j_fy bo wdkiemZlZpbb g_`h-
imklbfuc gZ]j_, qlh fh`_l ihkem`blv ijbqbghe \uoh^Z dZ[_e_c
ba kljhy.

GZ ih\hjhlZo ljZgr_ x jhxl lZd, qlh[u ijb ba]b[_ dZ[_e_c g_
ih\j_`^ZeZkv bo baheypby. >himklbfu_ jZ^bmku ba]b[Z dZ[_e_c
ijb_^_gu \ ghjfZlb\Zo. DZ[_eb \ Zexfbgb_hc h[hehqd_, hkh[_g-
gh [hevrbo k_q_gbc, ^h\hevgh ljm^gh bah]gmlv ih g_h[oh^bfhfm
jZ^bmkm; ^ey wlh]h ihevamxlky ki_pbZevguf ijbkihh[e_gb_f,
ZgZeh]bqguf jmqghfm ljm[h]b[m.

IjhdZ^dm dZ[_e_c ijb i_j_k_q_gbyo Z\lhfh[bevguo b ` _e_a-
guo ^hjh] \uihegyxl hldjuluf (julv_ ljZgr_b) beb aZdjuluf

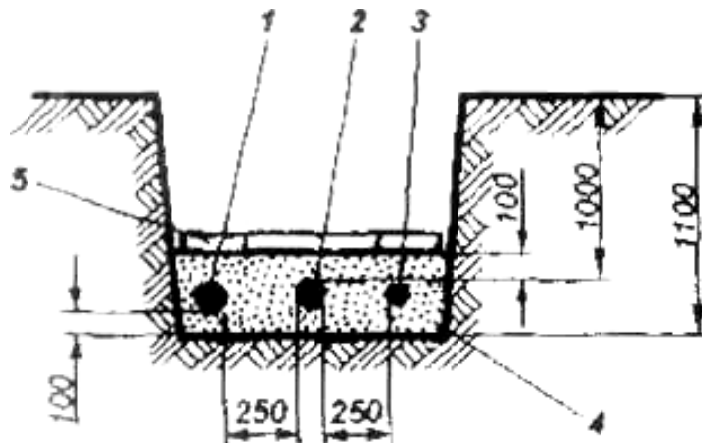
(ijhdhe,]hjbahglZevgh_ [mj_gb_) kihkh[hf. Ijhdhe]jmglZ ^ey
ijhoh^Z dZ[_e_c ih^ khhjm`_gbyfb [_a julvy hldjulhc ljZgr_b
ijhba\h^yl kihkh[Zfb]hjbahglZevgh]h [mj_gby, ijh^Z\eb\Zgby
beb ig_\fhijh[hcgbdhf lbiZ >-4601.

LjZgr_y i_j_^ ijhdZ^dhc dZ[_ey ^he`gZ [ulv hkfhlj_gZ ^ey \u-
y\e_gby f_kl gZ ljZkk_, kh^_j`Zs bo _s_kl\Z, jZajmrbl_evgh ^_ckl-
\mxsb_ gZ f_lZeebq_kdbc ihdj\ b h[hehqdm dZ[_ey (khehgqZdb, ba-
_klv, \h^Z, gZkuighc]jmgl, kh^_j `Zsbc reZd beb kljhbl_evduc fm-
khj, mqZkldb, jZkiheh`_ggu_ [eb`_2 f hl \u]j_guo b fmkhjguo yf, b
l. i.). Ijb g_\hafh`ghklb h[oh^Z wlbo f_kl dZ[_ev ^he`_g [ulv ijh-
eh`_g \ qbklhf g_cljZevghf]jmgl_.

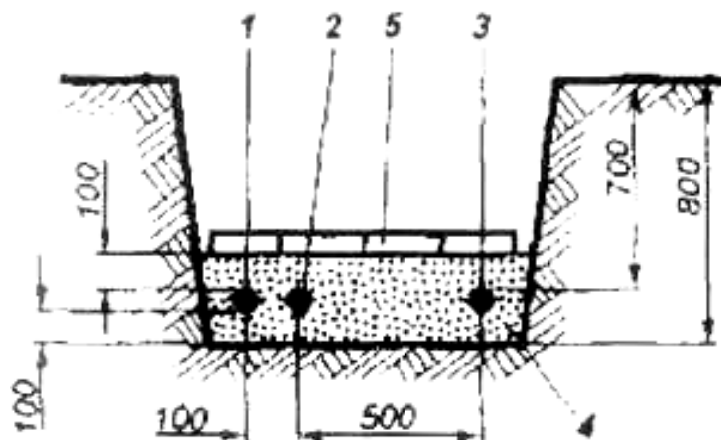
Ijb ijhdZ^d_ \ a_fe_ iZjZee_evgh k ^jm]bfb wdkiemZlb-
jm_fufb dZ[_eyfb beb bg`_g_jgufb dhffmgbdZpbyfb \[ebab
a^Zgbc b khhjm`_gbc ^he`gu kh[ex^Zlvky j Zkklhygby \ k_lm (g_
f_g__):

- f`^m dZ[_eyfb ^h 10 d< - 0,1 f (wlh`_ jZkklhygb_ ijb iZjZe-
e_evghc ijhdZ^d_ \gh\v ijhdZ^u\Z_fuo dZ[_e_c);
 - hl dZ[_e_c 35 d< - 0,25 f (jbk. 3.6);
 - hl dZ[_e_c, wdkiemZlbjm_fuo ^jm]bfb hj]ZgbaZpbyfb, b dZ-
[_eyfb k\yab - 0,5 f (jbk. 3.7);
 - hl kl\heh\ ^_j_\v_\ - 2 f b hl dmklZjgbdh\uo ihkZ^hd - 0,75 f
(jbk. 3.8);
 - hl nmg^Zf_glh\ a^Zgbc b khhjm`_gbc - 0,6 f (jbk. 3.9);
 - hl]jm[hijh\h^h\, \h^hijh\h^Z, dZgZebaZpbb, ^j_gZ`Z,]Z-
ahijh\h^h\ gbadh]h b kj_^g_]h ^Z\e_gby - 1 f (jbk. 3.10);
 - hl]Zahijh\h^h\ \ukhdh]h ^Z\e_gby b l_iehijh\h^h\ - 2 f (jbk.
3.13);
 - hl we_dljbnbpbjh\Zgghe`_e_aghc ^hjh]b - 10,75 f (jbk. 3.11);
 - hl ljZf\Zcguo iml_c - 2,75 f (jbk. 3.12);
 - hl Z\lhfh[bevghc ^hjh]b: hl [jh\db - 1 f, hl [hj^xjgh]h dZf-
gy - 1,5 f (jbk. 3.14);
 - hl djZcg_]h ijh\h^Z <E 110 d< - 10 f (jbk. 3.15);
 - hl hihju <E. ^h 1 d< - 1 f (jbk. 3.16);
- >himkdZ_lky mf_gvr_gb_ i_j_qbke_gguo jZkklhygbc \ kl_k-
g_gguo mkeh\byo, gh wlh ^he`gh [ulv h]h\hj_gh \ ijh_dl_ b
^he`gu [ulv ij_^mkfhlj_gu f_ju ih aZsbl_ dZ[_e_c \]jm[Zo
beb [ehdZo. Ijb i_j_k_q_gbb ^]m]bo dZ[_evguo ebgbc beb bg`_-
g_jguo dhffmgbdZpbc b khhjm`_gbc jZkklhygby \ k_lm ^he`gu
[ulv g_f_g__:
- hl dZ[_e_c gZijy`_gb_f ^h 10 d< - 0,25 f (jbk. 3.17);

- hl lj m[hijh\ h^h\, l_i ehijh\h^ h\,]Zahi jh\h^h\ – 0,5 f (jbk. 3.18);
- hl ih ehlgZ`_ e_aguo ^hjh], lj Z\Zcguo iml_c, Z\lhfh[b evguo ^hjh] – 0,6 f.

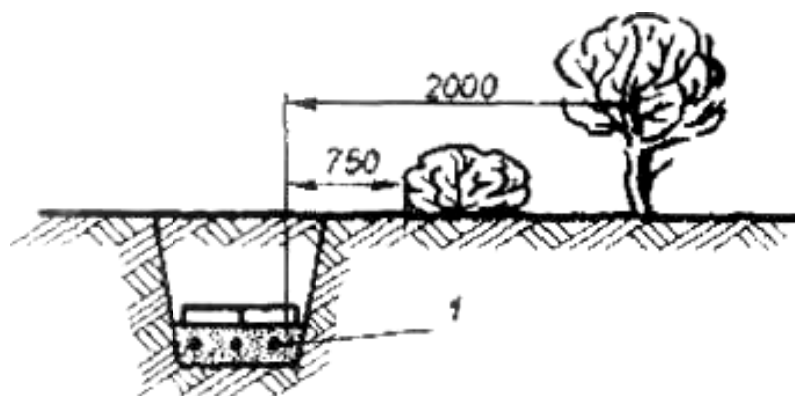


Jbk. 3.5. I jhdeZ^dZ dZ[_e_c 1...10 d<i ZjZee_evgh k dZ[_eyfb 35 d < (20 d<); 1 – dZ[_ev 20 d<; 2 – dZ[_ev 35 d<; 3 – dZ[_ev 10 d<; 4 – i_khd; 5 – ` _ e_ah[_lhgu _ieblu

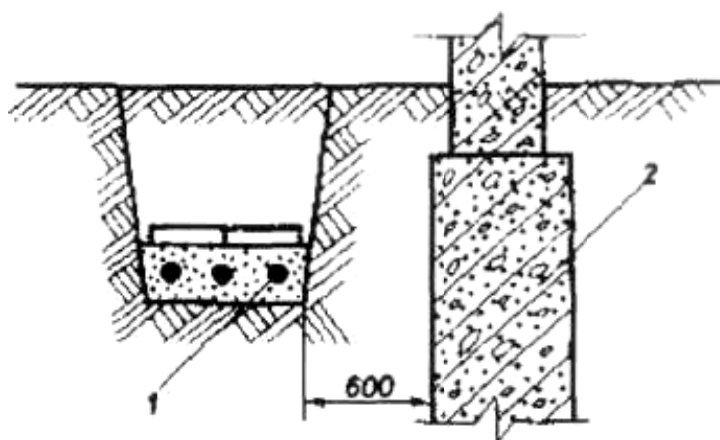


Jbk. 3.7. I jhdeZ^dZ dZ[_e_c 1...10 d<k dZ[_eyf b k\yab b k kbeh\uf b dZ[_eyf b ^h 10 d<, wdkiemilbj n_fu f b ^jm]bf b hj]Zgb dZpbyfb: 1 – dZ[_ev 10 d<; 2 – dZ[_ev 1 d<; 3 – dZ[_ev k\yab beb kbeh\hc dZ[_ev ^jm]hc hj]ZgbaZpbb; 4 – i_khd; 5 – dbjibqb b eb ieblu

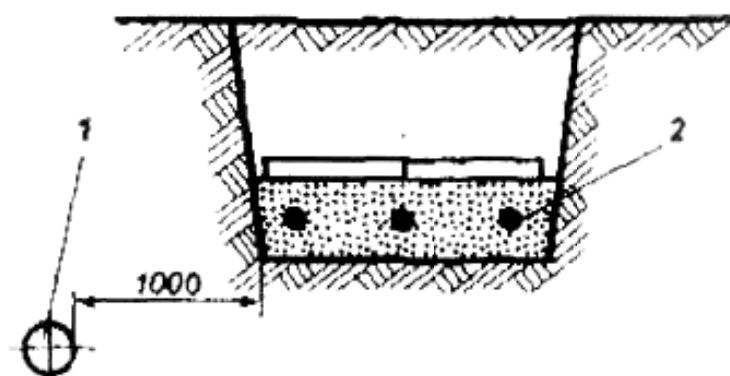
Ijbf_q Zgb_*. JZkklhygb_ f _^m dZ[_eyfb, wdkiemZljb m_fufb j Zaebq-guf b hj]ZgbaZpbyf, ^h e`gh [ul v g_ f_g _ 500 f f . ?keb lj_[m_fh _ jZk-klhygb_ g_ f h`_l [u l v \u^_j ` Zgh, f` ^m dZ[_eyf b mklZgZeb\Zxl i _j_]h-jh^d b ba g_k]hjZ_fuo f Zl_jbZeh\ (dbjibq , [_lhg) b eb h^bg ba dZ[_e_c gZ mZ-kld_g_ ^hklmigh]h k[eb` _gby.



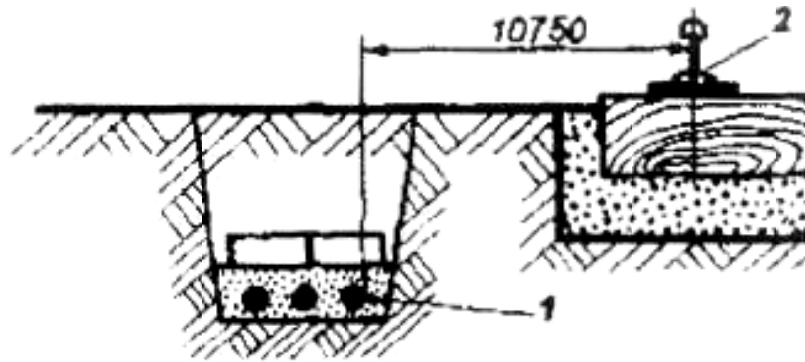
Jbk. 3.8. Ij hdeZ^{dZ} dZ[_e_c jy^{hf} k dmklZjgbdZ f b
b ^j_v yfb: 1 – dZ[_ev 1...10 d<



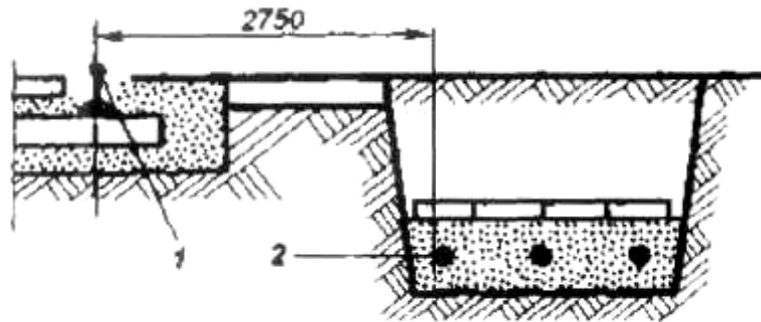
Jbk. 3.9. I jhd eZ^{dZ} dZ[_e_c jy^{hf} k nmg^{Zf} _glhf a ^Zgby
b khhj n`_gbc : 1 – dZ[_ev 1...10 d<; 2 – n mg^{Zf} _gl



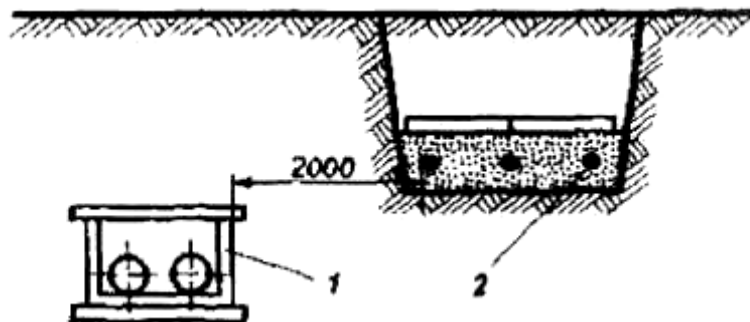
Jbk. 3.10. Ijh deZ^{dZ} dZ[_e_c iZj Zee_evgh l jm[hijh \h^{Zf},
\h^h ij h\h^{Zf}, dZgZebaZpb, ^j_gZ` m,]Zahj h\h^{Zf} g badh]h
b kj_^g_] h ^Z_e_gby: 1 – ljm[h ij h\h^h; 2 – dZ[_ev 1...10 d<



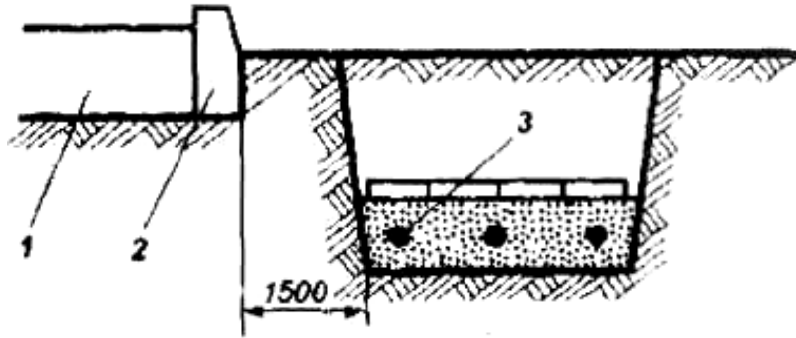
Jbk.3.11. IjhdēZ[^] dZ dZ[_e_c iZjZee_e vgh k we dljbnbp bjh\Zggh c
 _e_aghc ^hjh]hc: 1 – dZ[_ev 1...10 d<; 2 – jheh\dZ j_ev kZ



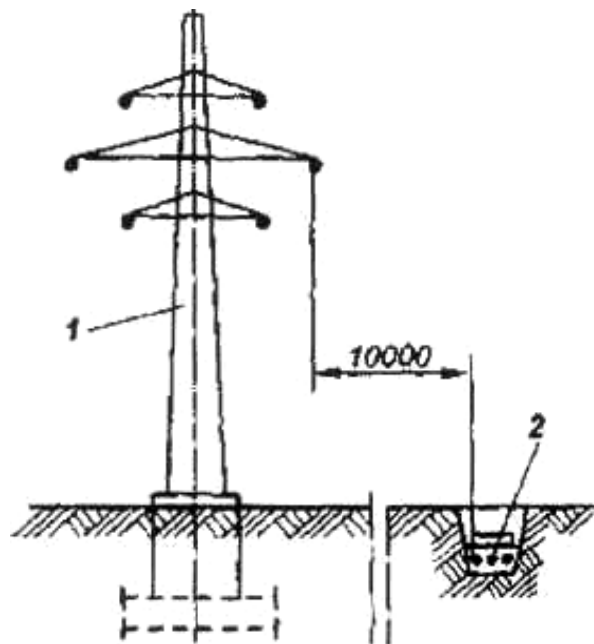
Jbk. 3.12. IjhdēZ[^] dZ dZ[_e_c iZjZee_evgh k lj Zf\Zcguf b imlyfb :
 1 – jheh\dZ j_evkZ; 2 – dZ[_ev 1...10 d<



Jbk. 3.13. I j hdeZ[^]dZ dZ[_e_c jy ^hf k l_i ehlyZkkZ f b b
]Zahi jh\h^Zf b \ukhdh] h ^Z\e_gby: 1 – ehlhd ; 2 – dZ[_ev 1...10 d<

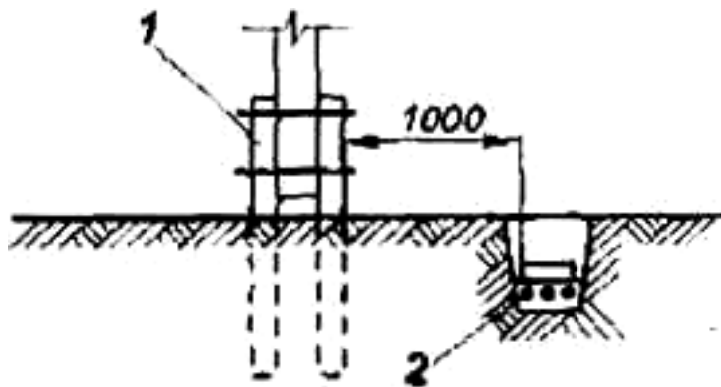


Jbk. 3.14. I jhdeZ^dZ dZ[_e_c iZjZee_evgh Z\l hfh[bevg hc ^hjh]_:
1 – ihehlgh ^hjh]b; 2 – [hj^xjguc d Zf_gv; 3 – dZ[_ev 1...10 d<

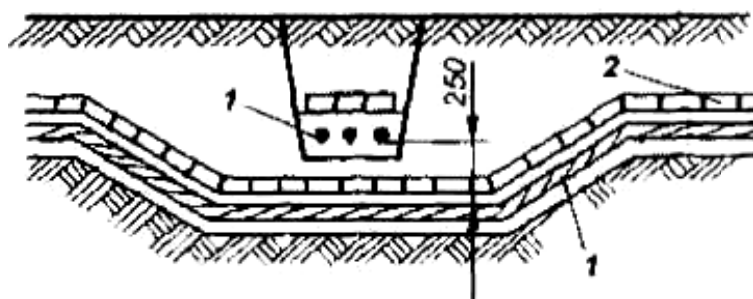


Jbk. 3.15. I jhdeZ^dZ dZ[_e_c jy ^hf k\ha ^nrghc eb gb_c
we_d jhi_j_^ Zqb gZijy ` _gb_f 1 10 d<:
1 – hihjZ <E; 2 – dZ[_ev 1...10 d<

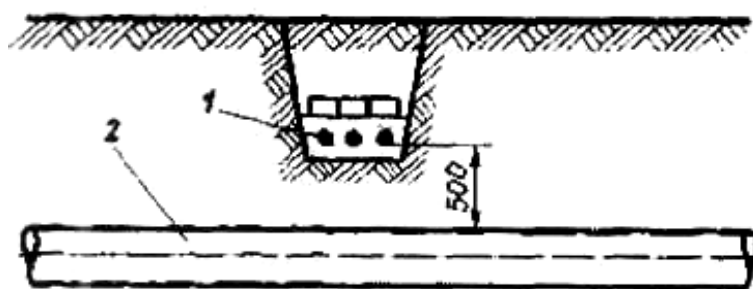
Ijbf_q Zgb_*. I j b ijhde Z^d_dZ[_e_c jy^h f k hihj Zfb <E 2 20 d<
b \u r _, jZkklhygb_ ^h gbo ijb gbfZxl i h ijh_d l m dZ[_evghc ebg b beb
ih i j h_dlm <E (\ aZ\b kbfhklb hl lh]h, d ZdZy ebgby ihkljh _gZ iha` _).



Jbk. 3.16. Ij hdeZ^d dZ[_e_c jy ^hf k\ha ^nrghc eb gb_c
we_dljhi_ j_^Zqb ^h 1d<: 1 - hi hjZ <E; 2 - dZ[_ev 1...10 d<



Jbk. 3.17. I_j_k_ q_gb_ dZ[_evguo l j Zkk gZij y`_gb_f ^h 10 d<:
1 - dZ[_ev ^h 10 d<; 2 - dbjibqb



Jbk. 3.18. I_j_k_q _gb_ dZ[_e_c k ljm [h-ijh\h^ h- b]Zahij h\h^Zfb:
1 - dZ[_ev ^h 10 d<; 2 - l jm[hijh\h ^

Ijb ijh deZ^d dZ[_e_c ih fhklZf g_h[oh^b f h bkihe vah\Zlv dZ[_eb
\ Zex fbgb_\ hc beb i eZklfZkhh\hc h[h ehqd_, i h^ i_r_ oh^ghc q Zklvx
fhk l h\ \ ljm [Zo ba g_k]hjZ_fh]h fZl_j bZeZ. DZ[_eb ^he` gu [ulv we_d-
ljbq _kdb bahebjh\Zg u hl f_1Z eebq_kdbo qZkl_c fhklh\.

GZ dZ[_eyo \ f_k lZo i_j oh^Z q_j_a l_fi_j Zlmjgu_ r\ u fh klh\ b k dhgkljmdp_b_c fhkl h\ gZ mklhb ^he` gu [ulv \uiheg_ gu dhfi _gkZ-lhj u \ \b^_ i hemdjmZ

Ijb keh ` guo ki nkdZo kf hklh\ gZ mklhb ij h_dlghe hj]ZgbaZpb_c ^he` gu [ul v jZajZ[hlZgu wkdbau gZ keh`gu_ f_klZ.

Ijb ih^ \h^ghc i jhdeZ^d_ ijbfg yxl dZ[_ eb k djm]ehc b ie hkdhc [jhg _c. MklZgh\ dZ kh^bgbl_e vguo fmn l \ \h^_ aZij_s_ gZ, l. _ i j b i_- j_k_q_gbb j_d g_h[oh^bfh ij hdeZ^u\ Zlv dZ[_ev h^ghc kljhbl_ evghc ^eb gu.

Ih^h^ gmx ijhd eZ^dm d[_e_c ^he`gZ \u i hegylv ki_pbZeb abjh-\ZggZy fhgl ZgZy hj]ZgbaZpby ih i j _^Zjbl _evgh kh]eZkh\Zgghfm ijh_ dlm ijhb a\h^kl\Z jZ[hl.

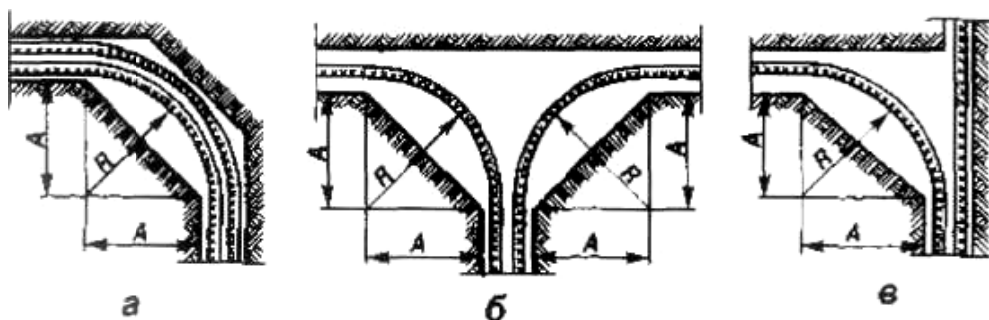
Ijb ijh deZ^d_ dZ[_e_c \ f_klZo,]^_ ihq\Z ih^_j` _gZ kf_s _gbx (\ l hf qbke_ b \ gZku iguo]j nglZo), dZ[_eb ^h e`gu bf _lv ijh\ hehq-gmx [jhgx.

< f_klZ o ih\hjh lZ, jZa_l\ e_gby dZ[_e_c l j Zgr_b \ u ihegyx l lZd, qlh[u jZ^bmkbab[Z dZ[_e_c [u e_g_f_gvr_ ^hi nklbfh]h (jbk. 3.1 9).

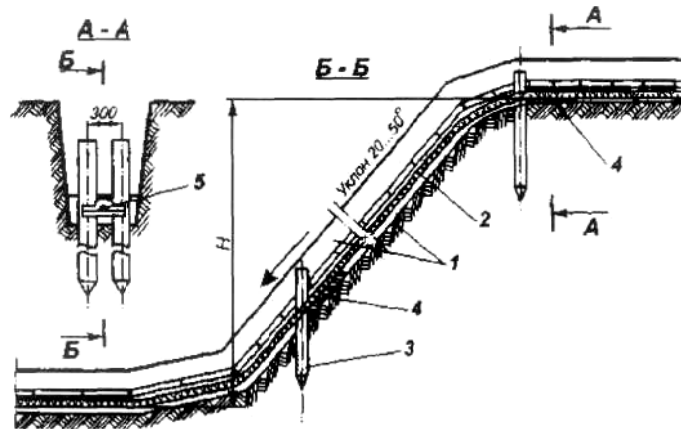
GZ mdegZo hl 20° ^h 50° ijhdeZ^ dm dZ[_e_c \ ljZg r _yo ij hba\h-^yl k dj_ie_ gb_f dZ[_ey d` _e_ah[_lh gguf k\ Zyf.

GZ jbk. 3.20 ih dZaZg ijbfg ijh deZ^db dZ[_ey gZ mdegZc JZk-klhygb_ : f_ ` ^m dj_ie_gbyfb ^he`gh [ulv g_ [he_ 15 f ^ey dZ[_e_c k [jh g_c ba ie hkdbo e_gl b 50 f ^ey dZ[_e_c k ij h\hehqgh c [jhg_c . JZa-f_j G g_ ij _\urZ_l gZb[hevr bo ^hi nklbfuo j Zaghkl_c mjh\g_c ^ey dZ[_e_c. F_k lZ dj_ie _gby dZ[_e_c d ie bl_ aZeb\Zxl [bl nfghe f Zkkhc. <f_klh`_e_ ah[_lhgg u o k\Zc f h]ml ij bf_gylv klhe[u b a^_j_\Z o\hc-guo ihjh^, h [jZ[hlZg gh]h Zglbk_ilbq_ kdbf khk lZ\hf.

DZ[_eb mdeZ^u\Zxl k aZiZkhf 1...2 % («af_cdhc») hl _]h ^ebgu ^ey bkdex q_gby \hafh`gh klb \hagb dgh_gby hiZkguo f_oZgbq_kdbo gZij y` _-gbc i jb kf_s _gbb i hq\ u b l _fi_jZl njguo ^_ nhjfZp byo, hkh[_ggh \ _ k_ggbc i _jbh^ ij b hllZb\ Zgbb a_fe b.



Jbk. 3.19. I h\hjhl b j Za_l\ e_gb_ dZ[_evguo lj Zkk:
Z - ih\hjhl dZ[_e_c; [- j Za_l\ e_gb_ dZ[_e_c; \ - hl_l\ e_g b_



*Jbk. 3.20. Dj_ie_gb_ dZ[_ey gZjZafu\Z _fuo eb\g yfb b lZe ufb \h^Z f b
kdehgZo k mdhghf hl 2 0 ^h 50°: 1 - ijhk_rb c ljmgl beb i_khd;
2 - dbjibq beb ie blu; 3 - k\Zy `e_ah[_l hggZy;
4 - iebl Zk[hp_f_g l gZy; 5 - kdh[Z^ey dj_ie _gby dZ[_ey*

MdeZ^dr dZ[_ey «af_cdhc» ijb ij hdeZ^d_k ihfhsv x f_oZgbafh\
\ui hegyxl\ ijhp_kk _i_j_deZ ^db _jh k jhebdh\ gZ ^gh lj Zgr_b.

Ihke_ h kfhljZ dZ[_evghc ljZkku ij_^klZ \bl_e_f wdkiemZlbjmx-
s_c hj]ZgbaZpbb jZaj_rZ_lky i jhba\h ^blv aZkui dm dZ[_ey i_kdhf ieb
f_e dhc a_fe_c, g_kh^j`Zs_c dZfg_c, kljhbl_e vgh]h fm khjZ b re ZdZ.

< lhf k emqZ_, _eb ijh_d lhf ij_^ nkfhlj_g ZaZsblZ dZ[_e_c djZk-
guf jebgyg uf dbjib qhf beb Zk[hp_f_glgufb ieblZfb, lh ijb kuidZ
gZ^dZ[_e_f ^he`gZ [ulv g_f_g__ 100 ff. Ijb i jhdeZ^d_gZ^ dZ[_eyfb
kb]gZevgh-ij _^mij_ ^bl_evghc e_glu, q lh lZd` ^he`gh [ulv mdZaZgh\
ijh_ dl_, ijb kuidZ ^h e`gZ [ul v g_f_g__ 300 ff, l. _e_glZ ^he` gZ gZ-
oh^blvky gZ jem[bg_ 400 ff hl ieZgbjh \hqghc hlf_ldb. F_gvrZy jem-
[bg ZijhdeZ ^db e_glu ^himkdZ_lky gZmqZkldZo^ebghc ^h 5 f ij b \h-
^_ dZ[_ey \ a ^Zgb_, ZlZd` \ f_klZo i_j_k_q_gby k ih^a_f gufb k hhjm-
`_g byfb b d hffmgbd Zpbyfb i jb mkeh\bb aZsb lu dZ[_e_c hl f_oZgb-
q_kdbo ih\j _^_gbc (\ ljm[Zo, `e_ah[_lhgg ufb ieb lZfb). < wlbo
kemcZyo e_glZ^he`gZ [ulv \ _^_gZ gZ300 ff \ ljm[m beb ih^ ie blm k
dZ^ ^hc klhj hgu i_j_ k_q_gby.

Kb]gZevgh-ij_^mij_ ^bl_e vgZy e_glZ ba iheb\b gbeohjb ^gh]h
ieZklbdZlZ ^he`gZ [u lv djZkgh]h p\lZ lhesbgh c 0,5...1 ff b rb jbghe
g_f_g__ 150 ff. H^g me_glm f h`gh i j hdeZ^u\Zlv gZ^ ^mfy dZ[_ey-
fb. Ijb [hev r_f qbke _dZ[_e_c g_h[oh^bfh mdeZ^u\Zlv ^hihegbl_evgh-
qbkeh e_gl k lZdbf jZkq_lhf, qlh[u dj Zy e_glu aZdjueb dZ[_ev k mq_-
lhf «af_cdb».

Ihke_ i j bkuidb dZ[_e_c b mdeZ^dbjibq Z(iebl) beb kb]gZevgh-
ij_^ mij_ ^bl_evghc e_glu ij_ ^klZ\bl_eb kljhb l_evghc b we_dljhfhg-
lZ`ghc hj]ZgbaZpbc kh_klg h k ij_ ^klZ\bl_e yfb wdkiemZlbjmx s_c

hJ]ZgbaZpbb khklZ\eyxl Zdl gZ kdjul u_jZ[hlu, dhlhjuc y\ey_lky hnb-
pbZevguf ^hdmf_glhf, jZaj_rZxsbf aZkuidm ljZgr_c ljmglhf. AZ-
kuidZ ljZkk [_a mdZaZggh]h ^hdmf_glZ aZij_sZ_lky. A Zkuidm ljZkk ijh-
ba\h^yl kjZam _`ihke_ ih^ibkZgby ZdlZ. HdhgqZl_evngx aZkuidm dhl-
eh\Zgh\ g_h[oh^bfh ijhba\h^blv ihke_ fhglZ`Z kh^bgbl_evguo fmnI
b bkiulZgby dZ[_evghc ebgb ih\ur_gguf gZijy`_gb_f. AZij_sZ_lky
aZkuidZ ljZgr_c ljmglhf, kh^_j`Zsbf dZfgh, hloh^u f_lZeeZ b l. i.

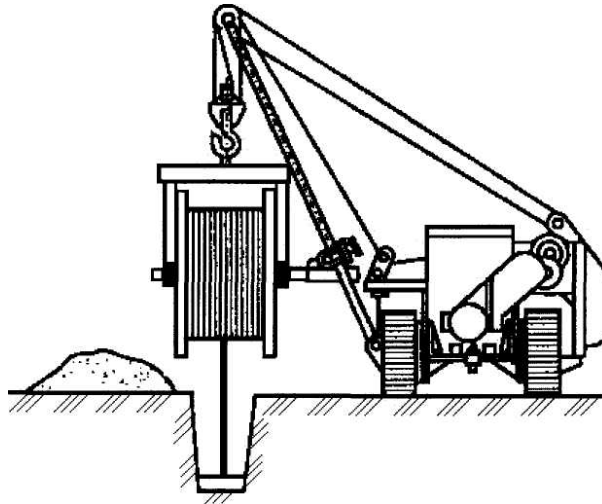
IjhdeZ^dZ dZ[_evghc ebgb \ ljZgr__ khklhbl ba ke^mxsbo
hkgh\guo hi_jZpbc: julv_ ljZgr_b, ^hklZ\dZ, jZkdZldZ b jZaf_s_gb_
dZ[_e_c \ ljZgr__; kh^bg_gb_`be dZ[_e_c; fhglZ` kh^bgbl_evghc dZ-
[_evghc fmnlu; aZ_sblZ dZ[_ey hl f_oZgbq_kdbo ih\j_`^_gbc b aZkuidZ
ljZgr_b; dhgp_\Zy aZ^edZ dZ[_ey.

DZ[_eb ^hklZ\eyxl d f_klm mdeZ^db \ [ZjZ[ZgZo gZ ki_pbZevguo dZ-
[_evguo ljZgkihj_ljZo beb Z\lh fZrbgZo, h[hjm^h\Zgguo mkljhckl\hf
^ey bo ihljmadb, ljZgkihjlbjh\db b \uljmadb.

<u]jm`Zlv [ZjZ[Zg k dZ[_e_f gZ^h hkljh`gh, qlh[u g_ ih\j_-
^blv dZ[_ev b g_ ljZ\fbjh\Zlv jZ[hqbo. DZl_]hjbq_kdb aZij_sZ_lky
k[jZku\Zlv [ZjZ[Zgu k dZ[_e_f k Z\lhfZrbg beb dZ[_evguo ljZgkihj-
l_jh_. DZ[_ev \ulj`Zxl gZ fZdkbfZevgh [ebadhf jZkkIhygbb hl f_k-
lZ jZkdZldb, gh lZd, qlh[u hg g_ f_rZe ^\b`_gbx jZ[hqbo b g_ fh]
miZklv \ ljZgr_x.

Kms_kl\m_l ^\Z kihkh[Z f_oZgbabh\Zgghe jZkdZldb dZ[_ey ijb
ijhdeZ^d_]h \ ljZgr__: k ^\b`ms_]hky [Zj Z[ZgZ k dZ[_e_f ^hev
ljZgr_b beb k g_ih^b`gh mklZgh\e_ ggh]h [ZjZ[ZgZ k dZ[_e_f gZ h^
ghf ba dhgph\ ljZkku beb \ f_kl _ hdhgqZgby_]h kljhbl_evghc ^ebgu
gZ ljZkk_.

I_j\uc kihkh[ijb_fgyxl \h \k_o kemqZyo, dh]^Z f_oZgbaf (ljZgk-
ihjl_j, Z \lhfh[bev, ljm[hmdeZ^qbd, i_j_^\b]Z_fu_ ljZdljhfh kZgb)
fh`_l k\h[h^gh i_j_^\b]Zlvky ^hev ljZkku b dh]^Z \ ljZgr__ g_l ij_-
iylkl\bc, lj_[mxsbo ijhly`db q_j_a gbo dZ[_ey (gZijbf_j, ihi_j_q-
gu_ ih^a_fgu_ khjm`gby). JZ[hqb_ ijb wlhf kihkh[_ i_j_^\b]Zxlky
\ke^ aZ f_oZgbafhf ih ^gm beb [jh\d_ ljZgr_b, ijbgbfZxl kfZ-
lu\Z_fuc k [ZjZ[ZgZ dZ[_ev b mdeZ^u\Zxl_]h gZ ^gh ljZgr_b
(jbk. 2.21). < l_o kemqZyo, dh]^Z lZdhc kihkh[jZkdZldb dZ[_ey ijb_f-
gblv g_evay, jZkdZldm dZ[_ey ijhba\h^yl k [ZjZ[ZgZ, mklZgh\e_ggh]h \
dhgp_ ljZgr_b beb gZ lj Zkk_. JZkdZldm \uihegyxl \ wlhf kemqZ_ ih
jhebdZf l y`_gb_f dZ[_ey ljkhf k ihfhsvx ijb\h^ghc e[_^db beb
jmghc e_[z^db, beb Z\lhfh[be_f.



Jbk. 3.21. JZkdZldZ dZ[_ey dZ[_e_mdeZ^qbdhf

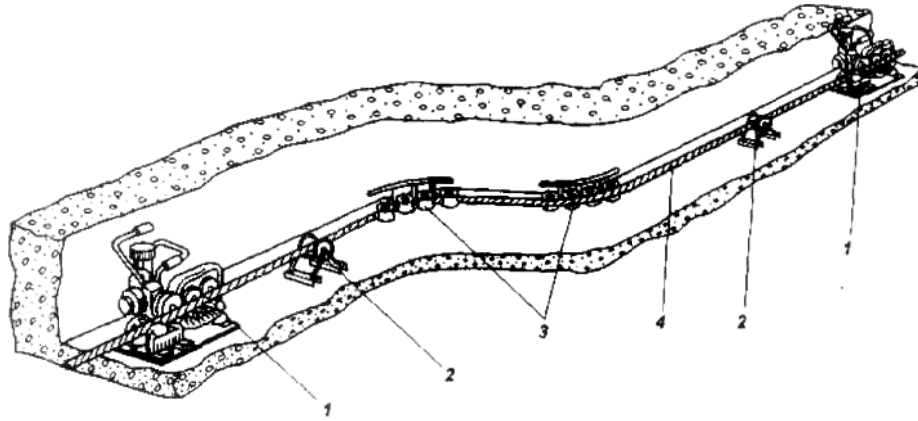
JZkdZldm dZ[_ey b mdeZ^dm _]h \ Zgr_ ijb ihfhsb e_[z^db k ljh-
khf b jZkdZlhqguo jhebdh\ \uihegyxl ke_^mxsf h[jZahf. KfZlu-
\Zxl ljhk k [ZjZ[ZgZ e_[^db b d _]h dhgpm dj_iyl dhg_p dZ[_ey ijb
ihfhsb ijb\hehqgh]h qmedZ (aZdj_ie y_fh]h gZ h[hehqd_ dZ[_ey) beb
dZ[_evgh]h aZ`bfZ (k aZo\Zlhf aZ lhd hijh\h^ysb_ `beu dZ[_ey).
AZl_f, jZkk1Z\b\ ih ^gm ljZgr_ b jZkdZlhqgu_ jhebdb, ijb\h^yl \
^b`_gb_ [ZjZ[Zg e_[^db , ijb wlhf ljhk g ZfZlu\Z_lky gZ [ZjZ[Zg b
ijhlZkdb\Z_l dZ[_ev ih jhebdZf gZ lj_[m_fh_ jZkk1hygb_, ihke_ q_]h
dZ[_ev kgbfZxl k jhebdh\ b mdeZ^u\ Zxl gZ ^gh ljZgr_b, Z jhebdb
m^Zeyxl.

Ijb aZkuid_ dZ[_evguo ljZgr_c ijbfg_yxl [mev^ha_ju, dZldb b
ljZf[h\db.

>ey f_oZgbaZpbb ijhdeZ^db dZ[_e_c \ ljZgr_yo, dZgZeZo,]Ze_-
j_yo, \ aZdjuluo ihf_s_gbyo ijbfg_yxl dhfie_dk MDID (jbk. 3.22).

L_ogbq_kdb_ oZjZdl_jbklbdb dhfie_dkZ MDID:

GZb[hevrZy ^ebgZ ljZkku ijhdeZ^db, f	600
Dhebq_kl\h ijb\h^h\ bg^b\b^mZevguo ^ey ly`_gby dZ[_e_c	
IBD-4M ijb ^ebg_ ljZku ^h 200 f	1
=jmahih^tzfghklv, d]	2000
GZb[hevr_b jZaf_ju ljZgkihjlbjm_fh]h	
h[hjm^h\Zgby, ff	3600x1600x2800
=Z[Zjblu (^ebgZ - rbjbgZ - \ukhlZ), ff:	
i_j_^g_c hlkh_^bgy_fhc qZklb l_e_`db	934x2000x1100
aZ^g_c qZklb l_e_`db	1217o2000o 1100
FZkkZ, d]	238



*Jbk. 3. 22. Mgb\jkZevguc dhfie dk MDID: 1 – bg^b\b^mZevguc ijb\h^
I BD-4M; 2 – ebg_cgu_j Zkihgu_jhe bdb (fh^_jg babjh\Zgg_u_);
3 – mgb\jkZevgh_h\h^gh_ mkljhckl\h ; 4 – ijhdeZ^ u\Z_fuc dZ [_ev*

Ijb\h^ IBD-4M hkgZs_g ^\mfy kf_gguf b ijb\h^ Zfb: [_g ahfh-
lhj guf ^ey j Z[hlu g Zhldju lhf \ha^ m_ ; we_djbq_kdbf ^ey j Zhlu
\ aZdjuluo i hf_s_gb yo. ?keb ^ebgZ lj Zkku g_i j_urZ_ l 180 f b bf_-
l h^bg m]he ih\hjhl Z bkihev amxl h^g h mkljhckl\h; ijb ^ebg lj Zkku
200...300 f k ih\hjhl Zfb ijb f_gyxl ^ \Z ijb\h ^Z, Z ijb ^ebg_ lj Zkku
500 f k ih\h j hlZfb – ljb-q_lu j _ ijb\h ^Z. DZ[_eb gZijy ` _gb_f^ h l d<
aZsbsZxl lZ f,]^_ \ hafh`gu f_oZgbq_kdb_ ih\j_`^_ gby: \ f _klZo
qZkluo jZkdhihd, \ f_klZo i_j_oh^ Z q_j_a mebpu, ^hjh]b, \ ^hev
ijh_ a`_c qZklb. DZ[_eb gZijy ` _gb_f\ ur_ l d< aZsbsZ x l hl f_ oZgb-
q_kdbo ih\j _`^_gb c djZkguf dbji bqhf be b [_lhgg ufb ie blZfb
gZ\k_f ijhl y`_gbb ljZkku.

3.3. IjhdeZ ^dZ dZ[_e_c \ lj n[Zo

< l_o kemqZyo, h] ^Z g_h[oh^bfh aZsbsZ lv dZ[_eb hl f_oZ gbq_-
kdbo ih\j_` ^_gbc, hl \ha^_ckl \by Zlj_kkb\guo ljmglh\ b [em`^Z x sbo
lhdh\, bo g_h[oh^bfh ijhdeZ^ u\Zlv \ ljm[Zo. >ey wlhc p_eb ijb f_gy-
xlk y klZevgu_, qm]mgu_, Zk[hp_f_glg u_, d_jZf bq_kdb_ b ieZkl f Zkhh-
\u_ ljm[u.

FZl_jb Ze ljm[h i j_`_ey_lky \ ijh _dl_. JZaj_rZ_lky aZf_gZ h^gbo
lbih \ ljm[g Z^jm]b_, gh wlh ^he`gh [ulv h]h\ hj_gh \ i jh_dl_. <gml-
j_gg bc ^bZf _lj ljm[^ey ijhd eZ^db dZ_ey k h^ghijh\h ehqgufb Zex-
fbg b_\ufb ` beZfb k kbfb\heh f «h`», g Zijbf_j : ::e (h `), Z lZd _`ey
dZ[_e_c fZj db ::R \ ^he`g [ulv g _ f_g_ ^\mdjZlg]h gZjm` gh]h
^bZf _ljZ dZ[_ey. >ey hklZevguo fZjhd dZ[_ey ^bZf_lj l j m[- g_f_g_`
ihe nlhjZdjZl gh]h ^bZf _ljZ dZ[_ey. Lj m[u ^he ` gu m^h\ e_l\hjyl v ke_-
^mxs bf lj_ h\Zgbyf:

- \gmlj_ggyy ih_joghklv bo ^he`gZ [ulv]eZ^dhc;
- lhjpu ljm[k \gmlj_gg_c klhjhgu ^he`gu [ulv kdjm]e_gu k jZ^bmkhf g_ f_g__ 5f b g_ bf_lv \uklmih\, baehfh\, aZmk_gp_;
- kh_^bg_gby ljm[^he`gu [ulv kljh]h khhkgu;
- lhjpu ljm[\ f_klZo \oh^Z (\uoh^Z) \ lmgg_eb, dZgZeu ^he`gu [ulv aZ^_eZgu aZih^ebph k \gmlj_ggbfb ih_joghklyfb kl_g.

Ljm[u ^he`gu [ulv meh`_gu k mdeghf g_ f_g__ 0,2 %. Kh_^bg_-gb_ ljm[^he`gh \uihegylvky k ihfhsvx f_lZeebq_kdbo, ieZklfZkklh_uo beb j_abgh\uo fZg`_l beb Zk[hp _f_glguo fmnL. Ijb h[jZah\Zgbb ljm[\ [ehdb, jZkklhygb_ \ k_lm f`^m ljm[Zfb ih _jlbZeb b]hjb-ahglZeb ^he`gh [ulv g_ f_g__ 100 ff . < k\yab k wlbfb gb`gb_ ljm[u [ehdZ ^he`gu mdeZ^u\Zlvky gZ [hevrnx]em[bgm k lZdbf jZkq_lhf, qlh[u _jogb_ ljm[u [ehdZ gZoh^bebkv hl ieZgbjh\hqghc hlf_ldb gZ]em[bg_ 0,7 f. KhjlZf_gl ljm[, j_dhf_g^m_fuo ^ey ijhdeZ^db \ gbo dZ-_e_c, ijb_^_g \ lZ[e. 3.2.

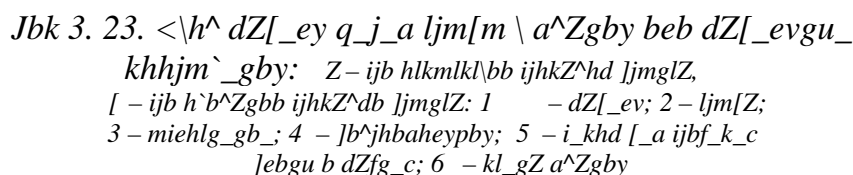
DZ[_eb k ieZklfZkklh_ufb aZsblgufb ihdjh\Zfb lbiZ ::R\ ijh-deZ^u\Zxlky \ ljm[Zo lhevdh gZ iyyfhebg_cgguo mqZkldZo ^ebghc g_[he__ 40 f b gZ \h^Zo \ a^Zgby b dZ[_evgu_ khhj m`_gby. Ijb ijhdeZ^d_ dZ[_e_c lbiZ ::R\ \ a_fe_ ^ey dZ `^h]h hlj_adZ dZ[_ey, g_aZ\bkbfb hl _]h ^ebgu, ^himkdZ_lky g_ [he__ q_luj_o i_j_oh^h\ \ ljm[Zo kmf-fZjghc ^ebghc ^h 20 f beb [he__ q_f ^\mo i_j_oh^h\ \ ljm[Zo ^ebghc [he__ 40 f.

Dhgpu ljm[ihke_ ijhdeZ^db \ gbo dZ[_e_c miehlgysl gZfhldhc gZ dZ[_ev g_kdhevdb kehd_ kfheyghc e_glu beb dZ[_evghc ijb`b (^ml) k ihke_^mxs_c ih^[b]dhc __ DZ[_evgu_ \h^u \ a^Zgby b kh-hjm`_gby]_jf_lbabjmxl kh]eZkgh mdZaZgbyf, ijb_^_gguf \ ijh_dl_. Miehlgb_ ljm[ijb ljZgr_cgghc ijhdeZ^d_ ijb \h^_ dZ[_ey b dZ-_evgh_ khhj m`_gb_ ihdZaZgh gZ jbk. 3.23.

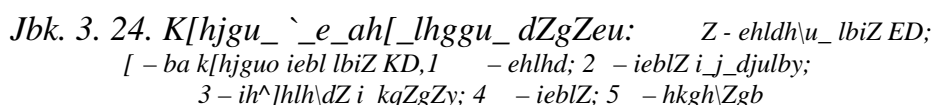
L Z [e b p Z 3.2

Ljm[u ^ey dZ[_evguo ijhdeZ^hd

Ljm[Z	=HKL, LM
KlZevgZy \h^h]Zahijh\h^gZy	=HKL 3262-75
KlZevgZy we_dljhk\ZjbZy	=HKL 10704-76
Qm]mggZy	=HKL 6942 3-80
:k[hp_f_glgZy	=HKL 1839-80
D_jZfbq_kdZy	=HKL 286-82
Ihebwlb_e_gh\Zy	=HKL 18599-83
Iheb\bgbeohjb^gZy	LM 6-05-1791-76
<bgbieZklh\Zy	LM 1573-77



DZ[_evgu_ dZgZeu ke^m_l ijb_f_gylv ijb \gmljbp_oh\hc b \gml-
jbaZ\h^kdhc ijhdeZ^dZo dZ[_e_c DZgZeu \uihegyxlky ba mgbnbpbjh-
\Zgguo ` _e_ah[_lhgguo ehldh\uo dZgZ eh\ k i_j_djulbyfb, ba mgbnb-
pbjh\Zgguo ` _e_ah[_lhgguo kl_gh\uo ieb l k hkgh\Zgbyfb b i_j_dju-
lbyfb ba fhgheblgh]h ` _e_ah[_lhgZ, Z lZd`_ ba dbjibqZ. Kihkh[ijh-
deZ^db dZ[_e_c \ dZgZeZo iha\hey_l h [_ki_qblv hkfhllu b j_fhglu dZ-
[_evguo ebgbc \ ijhp_kk_ wdkiemZlZpbb, Z lZd`_ ijhdeZ^u\Zlv gh\uc
beb aZf_gylv ^_ckl\mxsbc dZ[_ev [_a ijhba\h^kl\Z a_feyguo jZ[hl.
Djh_f_lh]h, ijb ijhdeZ^d_ dZ[_e_c \ dZg ZeZo h[_ki_qb\Z_lky gZ^`gZy
aZsblZ hl f_oZgbq_kdbo ih\j_`^_gbc.

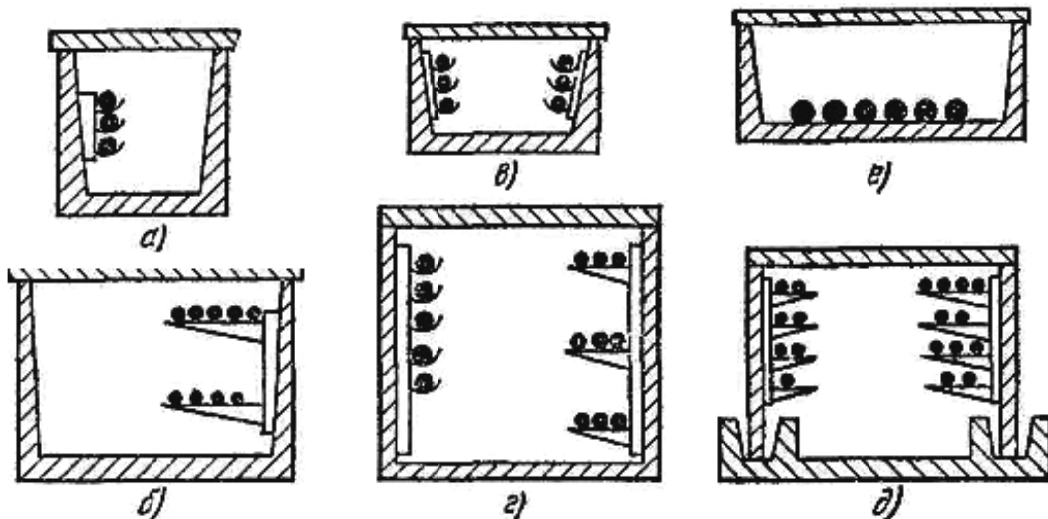


GZ jbk. 3.24 ij_ ^klZ\ e_g u ijyfu _ mqZkldl mgbnbpbjh\Zgg u o dZ-
gZeh\ ehldh\ h]h lbiZ b ba k[hj guo we_f _glh\ . H kgh\gu_ i jyfu_ ehldh-
\u_ dZgZeu, i _j_djul by d gbf, Z lZd` _ hkgh\gu_ we_f_glu k[hjg u o dZ-
gZeh\ bf_xl ^ebgm 3 f. K[hj gu_ we_f_glu d e hldh\uf b k[hjg u f dZ-
gZeZf \ f_kl Zo ih\h j hlh\ b hl_l\ e_ gbc bf_xl ^ebgm b rbjb gm ba
jZkq_lZ gZ \ hafh`gh klv ijhd eZ^db \ gbo dZ[_e_c gZjy`_gb _f ^h
10 d< k_q_gb_f 3 o 2 40 ff ^2 k j Z^bmkhf ba]b[Z dZ[_ey R = 25d. < dZgZ-
eZo ^he`gu [ulv \ui heg_gu f_jhijby lby ih i j _^hl\jZ s _gbx i hiZ^Z-
gby \ gbo l_ogheh]bq_kdbo \h^ b fZk_e, Z lZd` _ h[_ki_q_g hl\h ^ ihq-
gg uo b eb\ g\uo \ h^ . Iheu \ dZgZeZo ^he`g u bf_lv mdehg g_ f _g_
0,1 % \ klh j hgm \h^hk[hjgbd h\ beb eb\g_\hc dZgZeb\pbb. DZgZeu,
jZki heh`_gg u _ \h \e Z guo] j mglZo teb gb` _ njh\gy] j mglh\ u o \h^,
^he`gu bf_l v]b^jhb aheypbx ^gZ b kl_ghd.

GZ mqZldZo,]^_fh]ml [ulv ijhe blu jZki eZ\ e_ggu c f_lZee, `b^
dhklb k \ukh dhc l_fi _jZlmjhc beb _s_ kl\Z, jZaj mrZxs _ ^_ckl\mx sb_
gZ h[hehqdb dZ[_e_c, khhjm`_g b_ dZ[_evguo dZgZeh\ g_jZ aj_rZ_lk y.

DZ[_evgu_ dZgZau \g_ a^Zgbc,]^_ wlh \ua u \Z_lky khh[jZ`_ gbyfb
hojZgu, ^he`gu [ulv aZkuiZgu ih\jo kt_fg u o iebl a _f_e_c k l hesb-
ghc kehy 300 ff b [he_. GZ h]jZ`^ _gguo l_jjblhjb yo, ^hklmguo
lhev dh ^ey h[kem`b\ Zxs_jh i_jkhgZeZ, gZijbf _j gZ ih ^klZgpbyo, aZ-
kui dZ dZ[_evguo dZgZeh\ ih\ _j o kt_fg u o iebl a _fe_c aZ i j_sZ_lk y.

< we_dlj hfZrb gg uo ih f_s_gby o dZgZeu fh]ml i _j_dju \Zlvky
jbn e_guf` _e_ahf, Z \ ihf_ s_gbyo s blh\ mi j Z\ e_gby k iZjd_l gufb
iheZf b - ^_j _ygguf b sblZfb k iZjd_l hf.



Jbk. 3.25. <ZjbZgl u ijhd eZ^ db dZ[_e_c \ ehldZ o:

Z - jZk i heh`_gb_d Z[_e_c gZ h^ghc kl_gd_g Z ih^_kdZo; [- lh`_g Z ihedZo;
\ - lh`_gZ hf_bo kl_gd Zo gZ ih^_k Zo;] - lh`_gZ h^ghc kl_gd_g Z ih^_kZo, gZ ^jmjhc
gZ ihe dZo; ^ - lh`_gZ hf_bo kl_gdZo gZ i hedZo; _ - l h`_gZ ^g_ dZgZeZ

AZkuidZ kbeh\uo dZ[_e_c, ijheh`_gguo \ dZgZeZo, aZij_sZ_lky. JZkiheh`_gb_ dZ[_e_c gZ dhgkljmdpbyo \ aZ\bkbfhklb hl lbihjZaf_jh\ dZgZeh\ fh`_l [ulv ke`^mxsf: Z) gZ h^ghc kl_gd_ dZgZeZ gZ ih^`_kZo; [) gZ h^ghc kl_gd_ dZgZeZ gZ ihedZa \) gZ h[_bo kl_gdZo dZgZeZ gZ ih^`_kdZo;]) gZ h^ghc kl_gd_ dZgZeZ gZ ih^`_kdZo, gZ ^jm]hc kl_g_ gZ ihe-dZo; ^) gZ h[_bo kl_gdZo dZgZeZ gZ ihedZo; _) gZ ^g_ dZgZeZ ijb]em[bg_ _]h g_ [he__ 0,9 f. <hafh`gu_ \Zjb Zglu ijhdeZ^db dZ[_e_c \ dZgZeZo ij^klZ\`e_gu gZ jbk. 3.25.

DZ[_evgu_ dZgZeu ^he`gu jZkkqblu\Zlvky k mq_lhf \hafh`ghklb ^hihegl_evghc ijhdeZ^db dZ[_e_c g_ f_g__ 10 % hl ijheh`_gguo.

=hjbahglZevgh_ jZkklhygb_ \ k_lm f_`^m dhgkljmdpbyfb ijb ^\moklhjhgg_f bo jZkiheh`_gbb (rbjbgZ ijhoh^Z) ^he`gZ [ulv g_ f_- g__ 300 ff ^ey dZgZeh\]em[bghc ^h 600 ff b g_ f_g__ 400 ff ^ey dZ-gZeh\]em[bghc 900 ff b 1200 ff.

>ey ijhdeZ^db \ dZgZeZo ijb_f_gyxl dZ[_eb k h[hehqdZfb, g_ jZk-ijhkljZgyxsfb]hj_gb_. JZkiheh`_gb_ dZ[_e_c b bo dj_ie_gb_ gZ dhgkljmdpbyo \ aZ\bkbfhklb hl bo gZijy`_gby, k_q_gby b lbiZ, Z lZd`_ \uiheg_gb_]hjbahglZevguo Zk[hp_f_glguo i_j_]hjh^hd b mklZgh\dZ kh^bgbl_evguo fmnl lZdb_ `_, dZd b \ lmgg_eyo. MklZgh\dZ dZ[_evguo dhgkljmdpbc, jZkklhygb_ f_`^m gbfb lZdb_ `_, dZd b ijb mklZgh\d_ \ lmgg_eyo.

3.5. IjhdeZ^dZ dZ[_e_c \ [ehdZo

IjhdeZ^dZ dZ[_e_c \ [ehdZo j_dhf_g^m_lky ^ey f_kl i_j_k_q_gbc k ` _e_agufb b Z[lhfh[bevgufb ^hjh]Zfb, \ mkeh\byo kl_kg_gghklb ih lJZkk_ (ijb [hevrhf qbke_ ^jm]bo ih^a_fg_uo dhffmgbdZpbc b khhjm-`_gbc), ijb _jhylghklb jZaeb\Z f_lZeeZ beb Z]j_kkb\guo `b^dhkl_c \ f_klZo ijhoh`^_gby dZ[_evguo lJZkk, ijb ijhdeZ^d_ dZ[_evguo ebgbc \ Z]j_kkb\guo ih hlghr_gbx d h[heh qd_ dZ[_e_c]jmgIZo, ijb g_h[oh-^bfhklb aZsblu dZ[_e_c hl [em`^Zxsbo lhdh\.

>ey khhjm`_gby [ehdh\ ijb_f_gyxlky ^\mo- b lj_odZgZevgu_ ` _e_-ah[_lhgg_u iZg_eb, ij^gZagZq_ggu_ ^ey ijhdeZ^db \ kmobo, \eZ`guo b gZkus_gguo \h^hc]jmgIZo, Zk[hp_f_glg_u]jm[u ^ey aZsblu dZ[_e_c hl [em`^Zxsbo lhdh\, d_jZfbq_kdb_]jm[u ^ey aZsblu dZ[_e_c \ Z]j_kkb\guo b gZkus_gguo \h^hc]jmgIZo (ijb g_h[oh^bfhklb fh`gh b \ kmobo]jmgIZo). Ijb \u[hj_ fZl_jbZeh\ dZ[_evguo [ehdh\ ke`^m_l mqblu\Zlv mjh_gv]jmgIh\uo \h^ b bo Z]j_kkb\ghklv, Z lZd`_ gZebqb_ [em`^Zxsbo lhdh\.

< f_klZo baf_g_gby gZijZ\`e_gby lJZkku beb]em[bgu aZeh`_gby [ehdh\, Z lZd`_ gZ ijyfhebg_cg_uo mqZkldZo [hevrhc ^ebgu \uihegyxl-ky dZ[_evgu_ dheh^pu. Qbkeh dheh^p_ \ gZ ijyfuo mqZkldZo [ehdZ ^he`-

gh [ulv fbgbfZevguf, ijb wlhf j Zkklhygb_f_`^m khk_`gbfb dheh^pZ-fb ke_`m_l ijbgbfZlv fZdkbfZevgh \h afh`guf k mq_lhf kljhl_evguo ^ebg dZ[_e_c, ^himklbfuo mkbebc ly`_gby b mkeh\bc ijhdeZ^db.

=Z[Zjblu dZ[_evguo dheh^p_\ ^he`gu h[_ki_qb\Zlv ghjfZevgu_mkeh\by ijhly`db dZ[_e_c k fZdkbfZevguf k_q_gb_f 3 o 240 ff ² k jZ-^bmkhf ba]b[Z dZ[_ey R = 25d, aZf_gm bo \ kemqZ_gZ^h[ghklb, mklZgh\dm kh_`bgbl_evguo fmnl k aZsblgufb f_lZeebq_kdbfb dh`moZfb ^eb-ghc 1250 ff.

DZ[_evgu_ dheh^pu \uihegyxlky ba dbjibqZ beb k[hjgh]h`_e_-ah[_lhgZ b [u\Zxl ke_`mxsbo lbih\ : ijhoh^ghc ijyfh]h lbiZ; m]eh\hc - ^ey baf_g_gby gZijZ\`e_gby [ehqghc dZgZebaZpbb k m]eZfb ih\hjhlZ 90°, 120°, 135° b 150°; ljhcgbdh\uc ijyfhc b k m]ehf ih\hjhlZ 120° b 150°; dj_klhh[jZaguc.

Mdehg iheZ dheh^pZ ^he`g [ulv 0,3 % \ kljhjgm \h^hk[hjgbdZ. J_r_ldZ \h^hk[hjgbdZ ^he`gZ [ulv f_lZeebq_kdhc. MklZgh\dZ aZdeZ^guo ^_lZe_c ih^ dZ[_evgu_ dhgkljmdpbba ijhba\h^blky \ ijhp_kk_ fhg-lZ`Z dheh^p_\.

=hjeh\bgu (eZau) dZ[_evguo dheh^p_\ ^he`gu [ulv djm]eufb beb h\Zevgufb b bf_lv ^\hcg_u f_lZeebq_kdb_ djurdb, ba dhlhjao gb`gyy ^he`gZ bf_lv ijbkihh[e_gby ^ey bo kgylby. Exdb djm]ehc nhjfu jZkkqblZgu lhevdh gZ h^ghkljhjggxx ijhly`dm dZ[_e_c b ^he`gu bf_lv ^bZf_lj g_ f_g 700 ff, exdb h\Zevghc nhjfu jZkkqb-lZgu gZ ^\mkljhjggxx ijhly`dm dZ[_e_c [hevrhc ^ebgu k_q_gb_f ^h 185 ff ² b bf_lv rbjbgm 800 ff, ^ebgm 1800 ff. DZ[_eb k_q_gb_f 240 ff ² b \ur_ ke_`m_l ijhly]b\Zlv [_a i_leb \ h^gm kljhjgm. Dheh^pu ^he`gu [ulv kgZ[_gu klZevgufb kdh[Zfb beb f_lZeebq_kdhc e_klgb-p_c ^ey kimkdZ.

< k\yab k l_f, qlh dZ[_evgu_ d heh^pu y\eyxlky gZb[he__ ^hj]hc qZklvx [ehqghc dZgZebaZpbb, j_dhf_g^m_lky ijb i_j_oh^_ k [ehqghc dZgZebaZpbb gZ ljZgr_cgm x ijb f_gylv dZ[_evgu_ dZf_ju.

Ijb \uiheg_gbb [ehdh\ ba Zk[hp_f_glguo ljm[\gmlj_ggb_ ih-_joghklb ljm[b bo kludb ^he`gu [ulv kfZaZgu [blmfhf fZjdb

;G-IV, jZa_^_gguf \ d_jhkb_g (2 fZkhh\u_qZklb [blmfZ b 1 fZk-kh\Zy qZklv d_jhkb_gZ). Ijb kmobo ljmglZo \k_ gZjm`gu_ ih_joghklb ljm[b bo kludb ^he`gu [ulv ihdjulu hdjZkhqghc]b^jhbaheypb_c \ ^\Z kehy, Z ijb \eZ`guo b gZkus_gguo \h^hc ljmglZo ^he`gZ [ulv mkljh_gZ hde__qgZy]b^jhbaheypby \ ^\Z kehy.

M [ehdh\ ba d_jZfbq_kdbo ljm[^ey Z]j_kkb\guo ljmglh\ aZiheg_-gb_ imklhl f_`^m ljm[Zfb ^he`gh [ulv \uiheg_gh [_lhghf, ^ey g_Z]-j_kkb\guo ljmglh\ - [_lhghf, gh lhevdh \ f_klZo kh_`bg_gby ljm[, Z hklZevgZy qZklv ^he`gZ aZkuiZlvky i_kdhf beb ijhk_ygguf ljmglhf.

Ijb iZjZee_evghc ijhdeZ^d_ [ehdZ k ljm[hijh\h^Zfb f_`^m ljm-
[hijh\h^Zfb b [eb`Zcrbf dZ[_e_f jZkklhygb_ ^he`gh [ulv g_ f_g__
250 ff, Z ijb iZjZee_evghc ijhdeZ^d_ k l_iehijh\h^hf - g_ f_g__ 2 f.

Khhjm`_gg_ [ehdb i_j_ ^ aZkuidhc a_fe_c ^he`gu [ulv ijbgylu
we_dljfhglZ`ghc b wdkiemZlbjmxs_c hj]ZgbaZpbyfb. ;ehqgZy dZgZ-
ebaZpby ^he`gZ khhl_kl\h\Zlv ijh_dlm. =em[bgZ aZeh`_gby dZ[_ev-
guo [ehdh\ (kqblZy hl _jog_]h dZ[_ey) ^he`gZ [ulv g_ f_g__ 1 f ijb
i_j_k_q_gbb mebp b iehsZ^_c b 0,7 f \h \k_o hklZevguo kemqZyo. <
ijhba\h^kl_gguo ihf_s_gbyo b gZ aZdjuluo l_jjblhjbyo]em[bgZ g_
ghjfbjm_lky.

LjZkkZ dZ[_evguo [ehdh\ ^he`gZ [ulv ijyfhebg_cgZy. Ijb i_j_-
k_q_gbb bg`_g_jguo khhjm`_gbc ljZkkZ ^he`gZ [ulv i_ji_g^bdmeyjgZ
bo hkb. < hl^_evguo kemqZyo ^himkdZ_lky hldehg_gb_ hl ijyfh]h m]eZ,
gh g_ [he__ q_f gZ 45°, dh]^Z g_h[oh^bfhklv \ wlhf \ua\ZgZ hkh[_ggh-
klyfb jZkiheh`_gby f_klZ \h^Z [ehdh\ \ a^Zgb_ beb gZebqb_f khhjm-
`_gbc, ihkljh_gguo gZ ljZkk_.

DZ^uc dZ[_evguc [ehd ^he`g bf_lv 10 % j_a_j\guo dZgZeh\,
gh g_ f_g__ h^gh]h dZgZeZ.

?keb [ehqgZy dZgZebaZpby \uiheg_gZ k hldehg_gbyfb hl ijh_dIZ,
lh ijb ijb_fd_ ih^ fhglZ` kljhbl_evghc qZklb we_dljfhglZ`ghc hj-
]ZgbaZpbb ^he`gu [ulv i_j_ ^Zgu bkijZ_e_ggu_ bkihegbl_evgu_ q_j-
l`b. Hlklmie_gby hl ijh_dIZ ^he`gu [ulv kh]eZkh\Zgu k Z\lhjhf
we_dljbq_kdhc qZklb ijh_dIZ.

AZkuidm [ehdh\ ^himkdZ_lky ijhba\h^blv lhevdh ihke_ bo ijb_f-
db. DZgZeu dZ[_evguo [ehdh\ b ljm[, \uoh^u ba gbo, Z lZd`_ f_klZ bo
kh_^bg_gby ^he`gu bf_lv h[jZ[hIZggmx b hqbs_ggmh ih_joghklv ^ey
ij_`hljZs_gby f_oZgbq_kdbo ih\j_`^_gbc h[hehq_d dZ[_e_c dZd ijb
ijhly`d_, lZd b \mkeh\byo wdkiemZlZpbb.

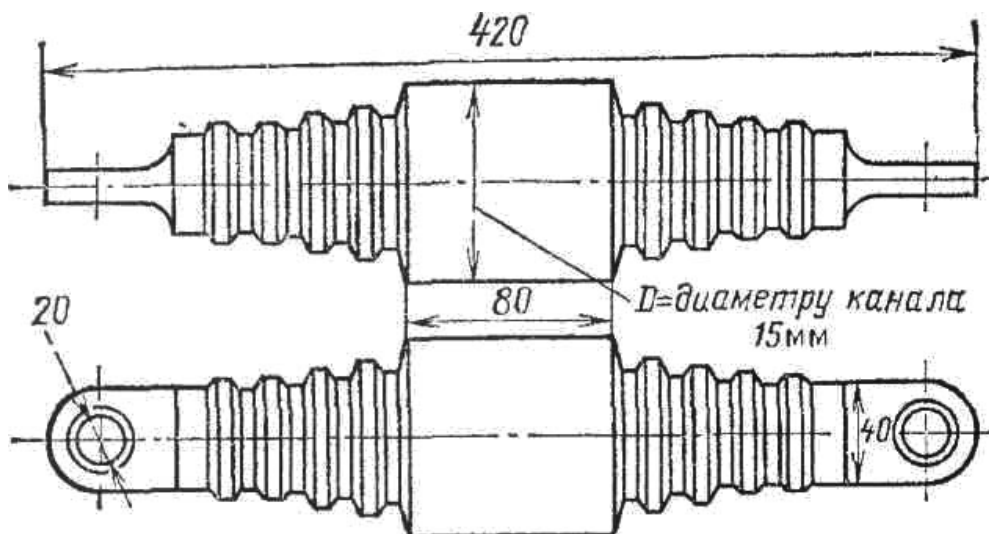
<gmlj_ggb_ ^bZf_lju hl_jklbc (dZgZeh\) `_e_ah[_lhgguo [eh-
dh\ ^he`gu [ulv g_ f_g__ 90 ff, \gmlj_ggb_ ^bZf_lju ljm[[ehqghc
dZgZebaZpbb - g_ f_g__ 100 ff. DZ[_evgu_ [ehdb ^he`gu bf_lv mdehg
g_ f_g__ 0,2 % \kljhgm dheh^p_.

GZbf_gvrb_ jZkklhygby \ k_lm f_`^m ljm[Zfb [ehqghc dZgZeb-
aZpbb, ijheh`_ggufb g_ihkj_`kl_ggh \ a_fe_, ^he`gu [ulv lZdbfb
`_, dZd b ^ey dZ[_e_c, ijheh`_gguo [_a ljm[.

Ijb \h^_ [ehdh\ \ a^Zgby b dZ[_evgu_ khhjm`_gby (lmggEb, dhe-
e_dlhju, ih^Ze b l. i.) ^he`gu [ulv ijbgylu f_ju, bkdexqZxsb_
ijhgbdg\gb_ q_j_a ljm[u beb ijh_fu \h^u,]ZaZ b f_edbo `b\hlguo
ba ljZgr_c \ a^Zgby b khhjm`_gby.

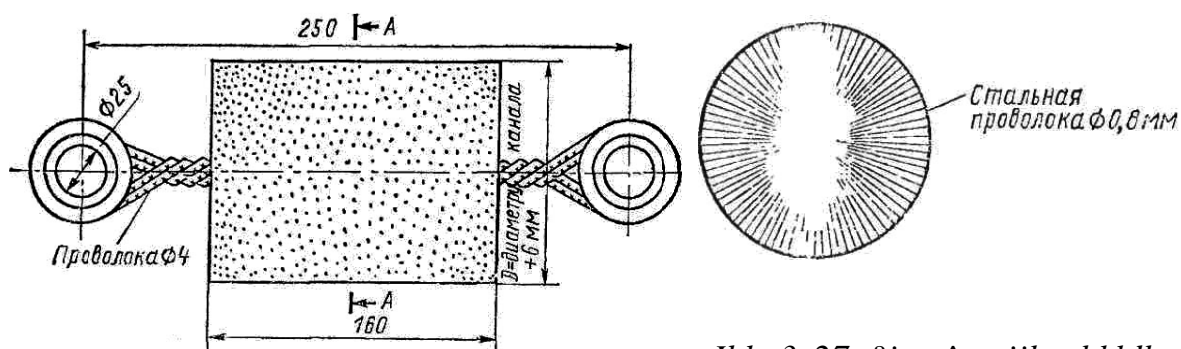
>h aZly`db dZ[_ey \ dZgZe [e hdZ g_h[oh^bfh ijhba_klb_]h hqb-
kldm hl [_lhggh]h jZkl\hjZ ijb kludh\Zgbb [ehdh\ b kljhbl_evgh]h fm-

khjZ. Wlh ^hklb]Z_lky ijhly]b\Zgb_f q_j_a dZgZe k ihfhsvx e_[^db dZgZlZ k ijb_dj_ie_gguf d g_fm ijbkihkh[e_gb_f\ \b^_ klZevgh]h dhgljhevgh]h pbebg^jZ (jbk. 3.26) b _jr_c (jbk. 3.27). GZjm`guc ^bZ-f_lj dhgljhevghc ih_joghklb pbebg^jZ ^he`_g [ulv gZ 15 ff f_gvr_ ^bZf_ljZ dZgZeZ, Z ^bZf_lj _jrZ – gZ 6ff [hevr_ ^bZf_ljZ dZgZeZ. Ko_fZ ijhqbklb dZgZeZ ihdZaZgZ gZ jbk. 3.28. >ey wlh]h d h^ghfm dhgpm ij_^[Zjbl_evgh aZlygmlhc \ dZgZe klZevghc ijh\hehdb ijbkh_`bgy-xl klZevghc dZgZl b ijhly]b\Zxl _]h q_j_a dZgZe, ihke_ wlh]h dh \lhjh-fm dhgpm dZgZlZ ijb_dj_ieyxl dhgljhevghc pbebg^j k _jrZfb. < dh-eh^p_ ([eb`Zcr_f d e_[^d_) aZdj_ieyxl gZijZeyxsb_jhebdb, q_j_a dhlhju_ ijhimkdZxl ijhlygmluc dZgZl, b, ijb_dj_ib_ _]h d dZgZlm e_-[_^db, ijhba\h^yl hqbklm dZgZeZ. Ijb ijhqbklb_ljZkku d ihke`_g_fm _jrm ijb_dj_ieyxl klZevghc dZgZl, dhlhjuc h^gh\j_f_ggh aZly]b\Zxl \ dZgZe ^ey ihke`_mxs_c ijhly`db dZ[_ey. AZly`dm ijh\hehdb \ dZgZ-eu [ehdh\ j_dhf_g^m_lky ijhba\h^blv \ ijhp_kk_ khhjm`_gby dZ[_evghc dZgZebaZpbb. AZly`dZ ijh\hehdb \ [ehdb aZdhgq_gghc kljhbl_evkl-\hf dZgZebaZpbb gZ mqZkldZo ljZkku ^ebghc ^h 50 f ijhba\h^blky im-l_f g_ikhj_`kl_ggh]h ijhlZedb\Zgby djm]ehc ijh\hehdb ^bZf_ljhf 4...5 ff k aZ]gmluf dhgphf, qlh[u hg g_ fh] mi_j_lvky \ kl_gdb dZgZeZ.



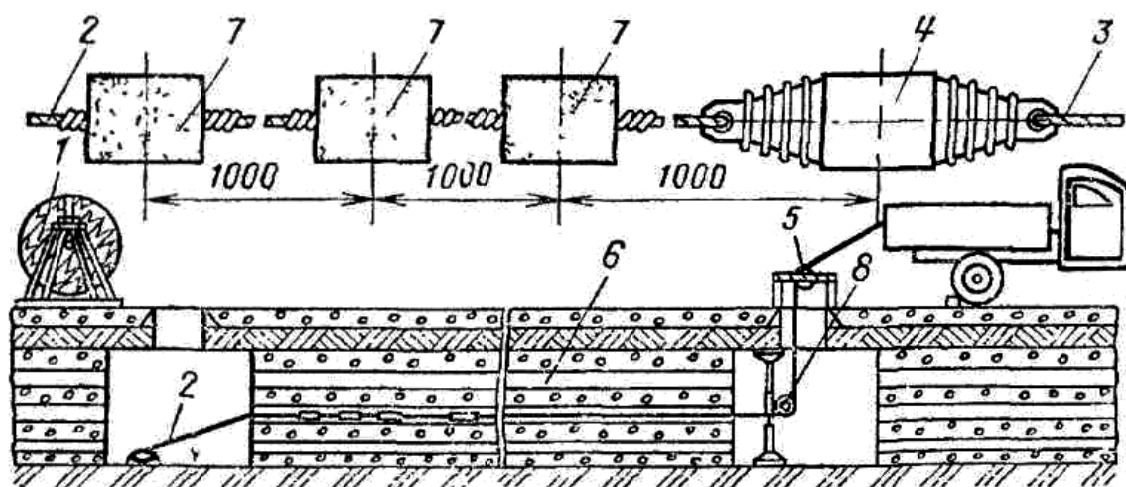
Jbk. 3.26. Dhgljhevghc pbebg^j

⋮



Жбк. 3.27. ?jr ^ey ijhq bkldb

dZgZeZ



Жбк. 3.28. Ko_fZ ij hqbkldb [ehqghc dZgZeBaZpbb:

1 - [ZjZ [Zg k dZ[_e_f; 2 - dZgZl ^ey aZly`d b dZ[_eb, 3 - dZgZl ^ey i j hqbkldb dZgZeZ; 4 - dhgl j hevguc pbe bg^j; 5 - jh ebd; 6 - dZgZe [ehdZ; 7 - jr; 8 - j Zkihjguc j hebd

GZ mqZl dZo ^ebghc [he_ _ 50 f kl Zevghc dZgZl ke_ ^m_l aZly]b\Zlv h^gbf ba kih kh[h\ Z) i jhlZedb \Zgb_f i j h\hehdb k ^\mo dhgph\ lj m_ h^ghj _f_ggh k ij_ ^Zj bl_evgh k^ _eZgguf gZ dZ^ ^hf dhgp_ dxqdh f; ijb \klj _q_ \ lj m_ dhgph u ij\he hd kp_ie yxl b ij h\hehdm \ulZkdb\ Zxl k h^ghc klhjhg u gZklhevdh, qlh[u gZjm` m\ureh f_klh kp_ie_gby i jh\hehd; D) ijb ih fhsb kp _iguo be b k\bgqb \Zxsbok yrlZg) (kl_j`g_c).

>ey ijh deZ^db \ [ehqghc dZgZeBa^pbb ke_ ^m_l ijb _gylv dZ[_eb k]hehc k\bgph \hc h[h ehqdhc f Zjhd K= b :K=, Z lZd` dZ[_eb k]hehc ihe b\bgbeoe hjb^ghc h[hehqd hc fZjhd <<=, : <<=, <=J b :<J =. GZ mqZl dZo [ehdh\ ^ebg hc ^h 50 f ^himkdZ_lky lZd` _ijhd eZ^dZ [jhgbjh-\Zgguo dZ[_e_c \ k\b gph\hc b eb Zexf bgb_\hc h [hehqd_ [_a gZjm` gh]h ihdj h\Z ba dZ[_evghc i jy`b k i hdjZkdhc [jhgb ^ey aZsb l u hl dhj j habb [blmfuf iZ dhf fZjd b ;L-577 ih =HK L 5631-79.

FZjdb dZ[_e_c ^ey dZ^h]h dhgdj_lgh]h kemqZy hij_^eyxlky ijh_d-
lh. Ijb ijhly`d_ dZ[_ey fZjdb K= \ [ehdb k dj_ie_gb_f dZgZlZ d h[hehq-
d_ dZ[_ey qmedhf h[sZy ^ebgZ dZgZeZ [ehdZ ih mkeh\byf ij_^evgh ^himk-
lbfo mkbebc ly`_gby g_ ^he`gZ ij_\urZlv 145 f ^ey dZ[_e_c k_q_gb_f
^h 3 o 50ff ², 115f k_q_gb_f 3 o 70ff ², 108 f k_q_gb_f 3 o 95ff ² b \ur_.

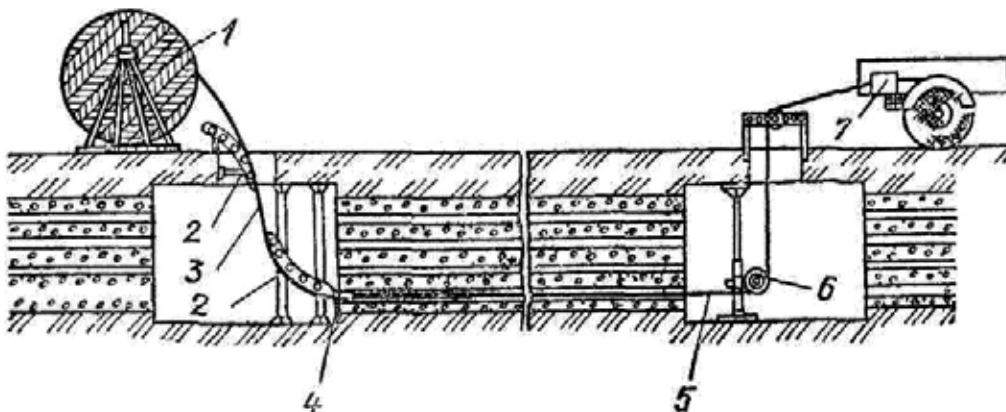
?keb kd\hagmx ijhly`dm dZ[_ey gZ ^\mo beb [he__ mqZkldZo hkm-
s_kl\blv g_\hafh`gh, lh dZ[_ev fh`gh ijhlygmlv ba ijhf`mlhqgh]h
dheh^pZ \ h[_ kljhgu lJZkku ijb mkeh\bb, qlh jZaf_ju exdZ iha\h-
eyxl \ dhgp_ ijhly`db himklblv \ dheh^_p i_lex dZ[_ey k kh[ex^_gb-
_f ^himklbfh]h jZ^bmkZ ba]b[Z.

< wlhf kemqZ_ [ZjZ[Zg k dZ[_e_f mklZgZ\eb\Zxl m ijhf`mlhqgh]h
dheh^pZ b ijhly]b\Zxl dZ[_ev gZ [he__ ^ebgghf mqZkld_ lJZkku. AZl_f
k [ZjZ[ZgZ kfZlu\Zxl b hlj_aZxl ih aZf_jm dZ[_ev gZ ^ebgm \lhjh]h
mqZkldZ (k ijbimkdhf gZ kh_^bg_gb_ dZ[_e_c) b jZkdeZ^u\Zxl i_leyfb
gZ a_fe_. Ij_^Zjbl_evgh aZdj_ib\ dhg_p dZ[_ey d dZgZlm, aZlygmlhfm \
dZgZe [ehdZ, ijhba\h^yl ijhly`dm _] h gZ \lhjhf mqZkld_ lJZkku, lsZ-
l_evgh gZ[ex^Zy aZ l_f, qlh[u ijb aZ_jr_gbb ijhly`db b himkdZgbb
i_leb \ dheh^_p jZ^bmk ba]b[Z dZ [_ey g_ [ue f_gvr_ ^himklbfh]h

Ijhly`dm dZ[_ey j_dhf_g^m_lky ijhba\h^blv kh kdhjhklvx
0,6...1 df/q b ih \hafh`ghklb [_a hklZgh\hd, qlh[u ijb ljh]Zgbb dZ[_-
ey k f_klZ ba[_Zlv [hevrbo mkbebc ly`_gby.

Ihke_ ijhly`db dZ[_ev ke_^m_l meh`blv \ dheh^p_ gZ hihjgu_
dhgkljmdpb, _]h dhgpu _]f_lbabjh\Zlv , Z \h \k_o f_kl Zo \uoh^Z dZ[_-
ey ba dZgZeh\ [ehdZ ijheh`blv weZklbqgu_ ijhdeZ^db (gZijbf_j, ebk-
lh\hc Zk[_kl) ^ey aZsblu h[hehqdb hl bklbjZgby.

Kh_^bgbl_evgu_fmnlu \ dheh^p_ ihke_ bo fhglZ`Z ^he`gu [ulv
ihf_s_gu \ aZsblguc ijhlb\hih`Zjguc dh`mo.

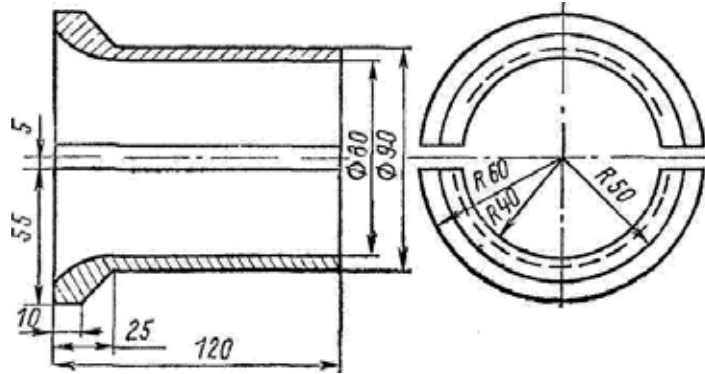


Jbk. 3.29. Ko_fZ ijhly`db dZ[_ey gZ h^ghf mqZkld_:

1 - [ZjZ[Zg k dZ[_e_f; 2 - m]eh\hc jhebd; 3 - dZ[_ev; 4 - jZat_fgZy \jhgdZ;
5 - dZgZl; 6 - jhebd ^ey dZgZlZ; 7 - mklZgh\dZ ^ey dhgljhey ly`_gby

GZ \h^Zo [ehdh\ \ a^Zgby, lmgg_eb hl_jklby \ [ehdZo ihke_ ijh-
deZ^db dZ[_e_c ^he`gu [ulv aZ^_eZgu g_k]hjZ_fuf b e_]dh ijh[b\Z_-
fuf fZl_jbZehf.

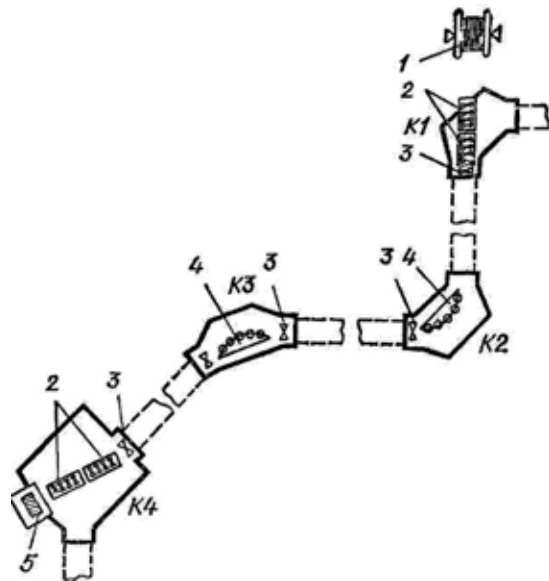
FZdkbfZevgZy h[sZy ^ebgZ dZgZeZ [ehdZ ^ey dZ[_e_c fZjdb :K=
k_q_gb_f hl 3 o 95 ff ^2 b \ur_g_ ^he`gZ ij_\urZlv 150 f.



Jbk. 3 30. JZat_fgZy klZevgZy \hjhgdZ

>ey dhgljhey mkbeby ly`_gby
gZ e[_^d_ mklZgZ\eb\Z_lky ^bgZfh-
f_lj beb ^jm]h_ dhgljhevgh_ mkl-
jhckl\h.

Ijhly`dZ dZ[_ey gZ mqZkld_
f_`^m ^\mfy khk^_gbfb dheh^pZfb
ijhba\h^blky ih ko_f_, ijb_^_gghc
gZ jbk. 3.29. >ey wlh]h g_h[oh^bfh \
dheh^pZo mklZgh\blv m]eh\u_ jheb-
db k \bglh\uf h[bfguf b jZkihj-
guf dj_ie_gb_f bo d kljhbl_evuf
dhgkljmdpbyf dheh^p_, ijbdi_blv
klZevghc dZgZl, aZlygmluc \ dZgZe
[ehdZ, d dZ[_ex, mklZgh\blv jZat_f-
gmx \hjhgdM (jbk. 3.30) \h \oh^gh_
hl_jklb_ dZgZeZ [ehdZ, aZiZkh\Zlv
dZgZl q_j_a jhebdb, ijbkh_`bgblv
]h d dZgZlm e[^db b ijbklmiblv d
aZly`d_ dZ[_ey.



Jbk. 3.31. Ko_fZ jZkklZgh\db f_-
oZgbafh\ b ijbkiikh[e_gbc ^ey
ijhdeZ^db dZ[_e_c \ [ehdZo:

1 - [ZjZ[Zg k dZ[_e_f; 2 - m]eh\u_ jhebdb
\h \oh^ghf b \uoh^ghf dheh^pZo; 3 - ebg_c-
gu_ jhebdb; 4 - m]eh\u_ jhebdb \ ijhf_`m-
lhqguo dheh^pZo; 5 - ly]h\Zy e[_^dZ;
KI-D4 - dheh^pu [ehqghc dZgZebaZpbb

Kd\hagZy ijhly`dZ dZ[_ey gZ ^\mo b [he__ mqZkldZo, [_a jZaj_adb
jh \ ijhf`mlhqguo dheh^pZo, \hafh`gZ ijb mkeh\bb, qlh ihke_ ijh-
ly`db \ dheh^pZo [m^_l kha^Zg g_h[oh^bfuc aZiZk dZ[_ey ih ^ebg_ ^ey
mdeZ^db _jh gZ hihjgu_ dhgkljmdpbb . >ey ijhly`db dZ[_ey ke_^m_l \
khhl_lkl\bb k ijh_dllhf ijhba\h^kl\Z jZ[h1 ij_^Zjbl_evgh mklZgh-
\blv \k_ g_h[oh^bfu_ m]eh\u_ b gZijZ\eyxs_b jhebdb dZd \ djZcgbo,
lZd b \ ijhf_`mlhqguo dheh^pZo.

GZ jbk. 3.31. ihdZaZgZ ijb_fjgZy lJZkkZ b ko_fZ jZkk1Zgh\db \ g_c
f_oZgbafh\ b ijbkihhk[e_gbc.

3.6. IjhdeZ^dZ dZ[_e_c \ lmgg_eyo b dhee_dlhjZo

DZ[_evgu_ lmgg_eb b dhee_dlhju j_dhf_g^m_lky khhj_m`Zlv \]h-
jh^Zo b gZ ij_^ijbylbo k miehl_ggghc aZkljhcdhc l_jjblhjbb beb ijb
[hevrhf gZkus_gbb l_jjblhjbb ih^a_fgufb bg`_g_jgufb dhffmg-
dZpbyfb, Z lZd`_ gZ l_jjblhjbyo [hevrbo f_lZeemj]bq_kdbo, fZrbgh-
kljhbl_evguo b ^jm]bo ij_^ijbylbc.

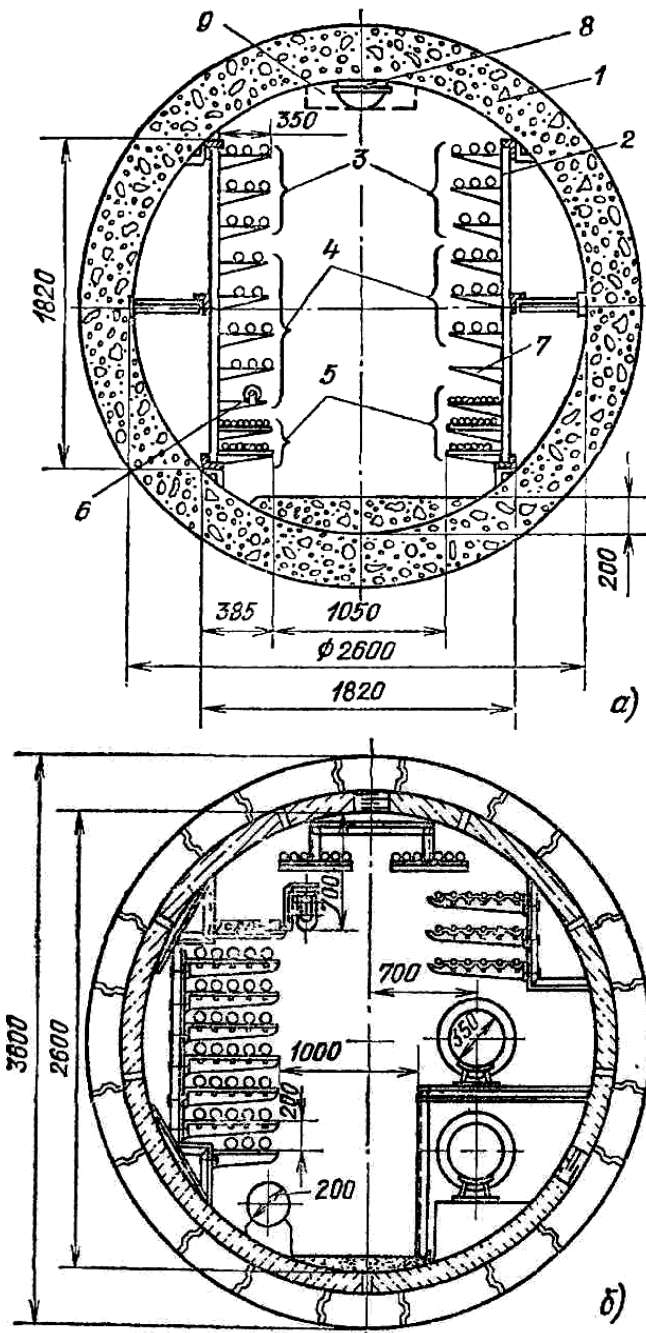
< [hevrbo]jh^Zo \ bo klZjuo jZ chgZo, dZd ijZ\beh, khhj_m`_gu
dhee_dlhju. < gh\uo jZchgZo [hevrbo]jh^h\ dZ[_eb ijhdeZ^u\Zxlky
\ lmgg_eyo.

Lmgg_eb b dhee_dlhju djm]eh]h k_q_gby ijhoh^gh]h bkiheg_gby
bf_xl \gmlj_ggbc ^bZf_lj 2,6 f b ij_^gZagZq_gu ^ey ^\mkljhjgg_c
ijhdeZ^db dZ[_e_c (jbk. 3.32). DZ[_evgu_ dhee_dlhju b lmgg_eb iijyf-
m]hevgh]h k_q_gby ij_^gZagZq_gu ^ey ^\mkljhjgg_c b h^ghkljhjgg_c
mdeZ^db dZ[_e_c b [u\Zxl ijhoh^gh]h b ihemijhoh^gh]h bkiheg_gbc.
Ijb [hevrhf qbke_ dZ[_e_c dhee _dlhju b lmgg_eb iijyf_m]hevgh]h k_-
q_gby fh]ml [ulv lj_okl_ggufb (k^h_ggufb).

GZ jbk. 3.33 ihdZaZgh jZaf_s_gb_ dZ[_e_c \ lmgg_eyo b dhee_dlh-
jZo iijyf_m]hevgh]h k_q_gby.

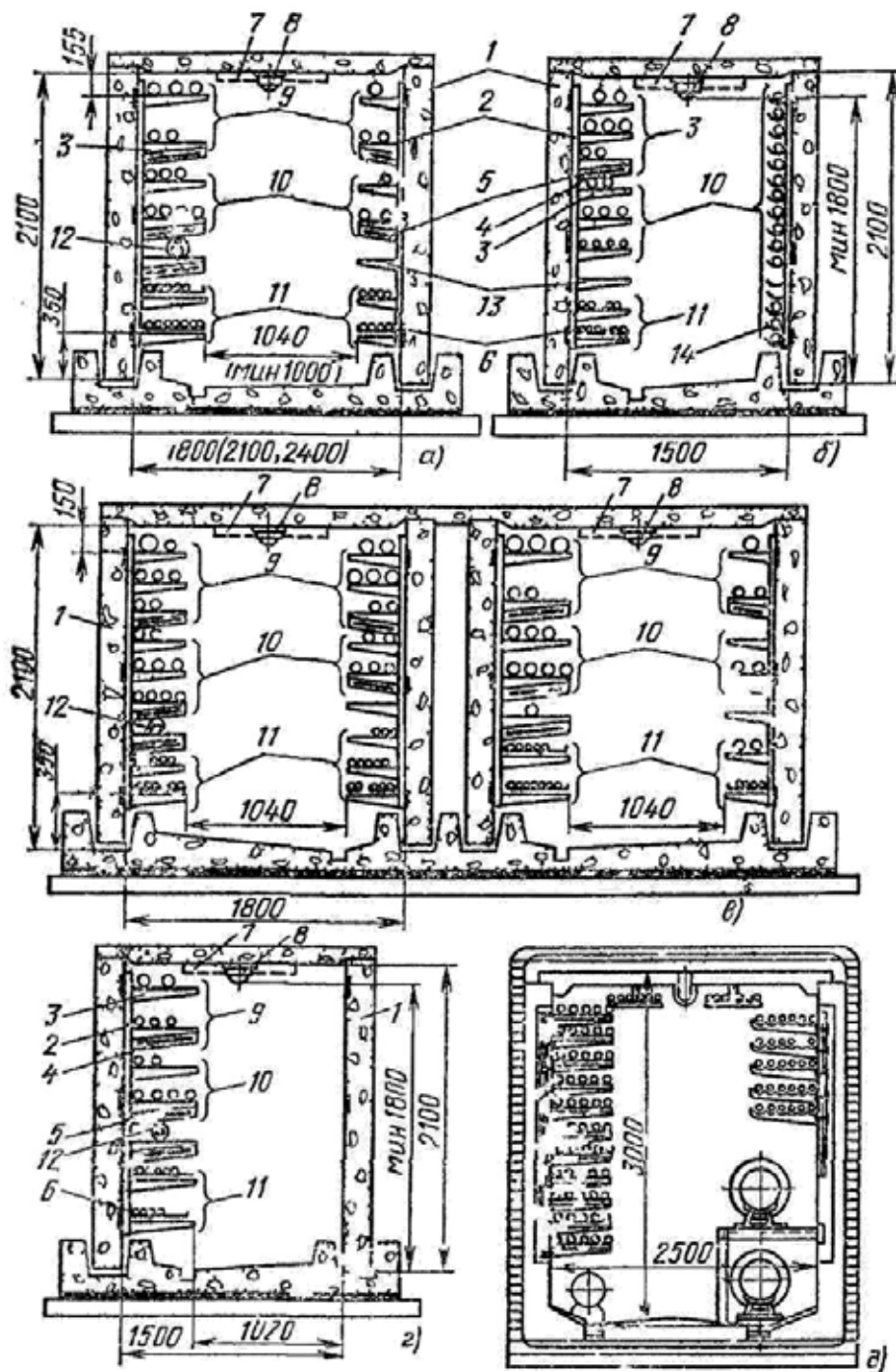
Ijb_f_g_gb_ ihemijhoh^guo lmgg_e_c ^himkdZ_lky \ f_klZo,]^_
ih^a_fgu_ dhffmgbdZpbb f_rZxl \uihegblv ijhoh^ghc lmgg_ev, ijb
wlhf ihemijhoh^ghc lmgg_ev ijbgbfZxl ^ebghc g_ [he__ 15 f b ^ey
dZ[_e_c gZijy`_gb_f g_ \ur_ 10 d<.

Ijhoh^u \ dZ[_evguo dhee_dlhjZo b lmgg_eyo, dZd ijZ\beh, ^he`-
gu [ulv g_ f_g__ 1 f, h^gZdh ^himkdZ_lky mf_gvr_gb_ ijhoh^h\ ^h
800 ff gZ mqZkldZo ^ebghc g_ [he__ 500 ff. Ihe lmgg_ey beb dhee_dlh-
jZ ^he`_g [ulv \uiheg_g k mdeghf g_ f_g__ 1 % \ kljhjgm \h^hk[hj-
gbdh\ beb eb\g_\hc dZgZebaZpbb. Ijb hlklmlkl\bb ^j_gZ`gh]h mkljhc-
kl\Z q_j_a dZ^u_ 25 f ^he`gu [ulv mkljh_gu \h^hk[hjgu_ dheh^pu
jZaf_jhf 0,4 o 0,4 o 0,3 f, i_j_dj u\Z_fu_ f_lZeebq_kdbfb j_r_ldZfb.
Ijb g_h[oh^bfhklb i_j_oh^Z k h^ghc hlf_ldb gZ ^jm]mx ^he`gu [ulv



Jb k. 3.32. JZaf_s_gb_ dZ[_e_c \ lmgg_eyo b dhee_dl hjZo djm]eh]h k_q_gby:

Z - lmg g_ev; [- dhee_dlhj; 1 - [ehd lmgg_ey; 2 - [ehd dZ[_evguo dhgkl jmdpbc;
 3 - dZ[_eb \u r_1 d<; 4 - dZ[_eb ^h 1 d<; 5 - dhgl j hevgu_ dZ[_eb;
 6 - fmnIz kh_ ^bgbl_ev gZy; 7 - k\h [h^gZy ihedZ ^ey mdeZ^db kh_ ^bgbl_ evguo fmnI;
 8 - k_lbev g bd; 9 - dhgZ ih^Zjhba_ sZl_ e_c b l jm[hijh\h^ h\
 f_oZgb abjh\Zgghc nfhjdb iue b b ih^Zjh l mr_gby



Jbk 3.33. JZaf_s_gb_dZ[_e_c \ lm gg_eyo b dhee_dlhjZo ijyfhm]hev gh]h
k_q_gbyZ, [- ijhoh^ghc k ^mklhjhggbfjZkiheh`_gb_f dZ[_e_c, \ - ijhoh^ghc lj_okl_gguc k
q_luj_oklhjhggbfjZkiheh`_gb_f dZ[_e_c,] - ijhoh^ghc k h^ghklhjhggbfjZkiheh`_gb_f
dZ[_e_c, ^ - ijhoh^ghc ^mklhjhggbf dhee_dlhj; 1 - [ehd lm gg_ey; 2 - klhcdZ; 3 - ihedZ;
4 - ih^_kdZ; 5 - i_j]hjh^dZ h]g_klhcdZy; 6 - ehlhd k\Zjghc; 7 - ahgZ ih`Zjhba`sZl_e_c
b ljm[hijh^h^h\ f_oZgbabjh\Zgghe m[hjdb iueb b ih`Zjhlmr_gby; 8 - k_lbevghd;
9 - kbeh_u_dZ[_eb \ur_1d<; 10 - kbeh_u_dZ[_eb ^h 1 d<; 11 - dhgljhevgu_dZ[_eb;
12 - fmnlZ kh ^bgbl_evgy \ aZsblghf dh`mo_;
13 - ihedZ ^ey mdeZ^db kh ^bgbl_evguo fmnl; 14 - ih^_kdZ

mkljh_gu iZg^mku k mdeghf g_ [he__ 15°. < lmgg_eyo (dhee_dlhjZo) ^he`gu [ulv \uiheg_gu f_jhijbylby ih ij_^hljZs_gbx ihiZ^Zgby \ gbo ljmglh\uo b l_ogheh]bq_kdbo \h^ b h[_ki_q_g hl\h^ ihq_gguo b eb\g_\uo \h^ . Lmgg_eb (dhee_dlhju) ^he`gu [ulv h[_ki_q_gu \ i_j- \mx hq_j_^v _kl_kl_gghc _glbeypb_c. <u[hj kbbkl_fu _glbeypb b jZkq_l _glbeypbhgguo mkljhckl\ ijhba\h^ylky gZ hkgh\Zgbb l_ieh_- ^_e_gbc, mdZaZgguo \ kljhbl_evguo aZ^Zgbyo. I_j_iZ^ l_fi_jZlmju f_`^m ihklmiZxsbf b m^Zey_fuf \ha^mohf \ lmgg_e_ g_ ^he`g ij_- \urZlv 10° K. <_glbeypbhggu_ mkljhckl\Z ^he`gu Z\lhfZlbq_kdb hl-dexqZlvky, Z \ha^moh\h^u ^he`gu kgZ[\Zlvky aZkehgdZfb k ^bklZgpb- hgguf beb jmqguf mijZ\e_gb_f ^ey ij_djZs_gby ^hklmiZ \ha^moZ \ dhee_dlhj beb lmgg_ev \ kemqZ_ \hagbdgh_gby ih`ZjZ.

< lmgg_e_ b dhee_dlhj_ ^he`gu [ulv ij_^mkfhj_gu klZpbhgZj- gu_ kj_^kl\Z ^ey ^bklZgpbhggh]h b Z\lhfZlbq_kdh]h ih`Zjhlmr_gby. Bklhqgbdhf \hagbdgh_gby ih`ZjZ fh]ml [ulv dZ[_eb, kh_^bgbl_evgu_ dZ[_evgu_ fmnlu, Z lZd`_ g_[j_`gh_ hlghr_gb_ k h]g_f b e_]dh \hk- ieZf_gyxsbfbky fZl_jbZeZfb ijb fhglZ`guo beb j_fhglguo jZ[h]Zo. <u[hj ih`Zjh]Zkysbo kj_^kl\ ijhba\h^blky ki_pbZebabh\Zgghc hj-]ZgbaZpb_c. < dhee_dlhjZo b lmgg_eyo ^he`gu [ulv mklZgh\e_gu ^Zl- qbdb, j_Z]bjmxsb_ gZ ihy\e_gb_ ^ufZ b ih\ur_gb_ l_fi_jZlmju hd- jm`Zxs_c kj_^u \ur_ 50° K. Dhee_dlhju b lmgg_eb ^he`gu [ulv h[h- jm^h\Zgu we_dljbq_kdbf hk_s_gb_f b k_lv x iblZgby i_j_ghkguo k_ - lbevghdh\ b bgkljmf_glZ.

Ijhly`_gg_u dZ[_evgu_ lmgg_eb b dh ee_dlhju jZa^_eyxl ih ^eb- g_ h]g_klhcd bfb i_j_]hjh^dZfb gZ hlk_db ^ebghc g_ [he__ 150 f k mkl- jhckl\hf \ gbo ^_j_c rbjbghe g_ f_g__ 0,8 f. >_jb ba djZcgbo hlk_- dh\ ^he`gu hldju\Zlvky \ ihf_s_gb_ beb gZjm`m. >_jv \ ihf_s_gb_ ^he`gZ hldju\Zlvky dexqhf k ^\mo kljhjg. GZjm`gZy ^_jv ^he`gZ [ulv kgZ[_gZ kZfhaZdju\Zxrbfky aZfdhf, hldju\Zxsbfky dexqhf kgZjm`b. >_jb \ kj_^gbo hlk_dZo ^he`gu hldju\Zlvky \ kljhjgm e_kl- gbpu b ^he`gu [ulv kgZ[_gu mkljhckl\Zfb, nbdkbjmxsbfb bo aZ- djulh_ iheh`_gb_. Hldju\Zxlky wlb ^\ _jb k h[_bo kljhjg [_a dexqZ.

IjhdeZ^dZ dZ[_e_c \ dhee_dlhjZo b lmgg_eyo jZkkqblu\Z_lky k mq_- lhf \hafh`ghklb ^hihegbl_evghc ijhdeZ^db dZ[_e_c \ d hebq_kl_ g_ f_g__ 15 %. AZdhgq_ggu_ kljhbl_evkl\hf lmgg_eb b dhee_dlhju ^he`gu [ulv ^h gZqZeZ ijhdeZ^db dZ[_e_c ijbgyly ih Zdml we_dljhfhglZ`ghc b wdkiemZlbjmxs_c hj]ZgbaZpbyfb. Ijb ijb_fd_ ijh_jy_lky khhl_lkl- \b_khhjm`_gby ijh_d lm, Z lZd`_ lj_[h\Z gbyf IMW b KGBI.

F_lZeebq_kdb_ hihjgu_ dZ[_evgu_ dhgkljmdpb ^he`gu [ulv mk- lZgh\e_gu gZ jZkklhygbb 0,8...1 f h^gZ hl ^jm]hc gZ]hjbahglZevguo ijjfhebg_cg_uo mqZkldZo. < f_klZo ih\jhhlh\ ljZkku jZkklhygb_ f_`^m

dhgkljmdpbyfb \u[bjZ_lky ih f_klm k mq_lhf ^himklbfh]h jZ^bmkZ ba-
]b[Z dZ[_e_c, gh g_ [hevr_ q_f ^ey ijyfuq mqZkldh\ . <k_ f_lZeebq_-
kdb_ dhgkljmdpbb ^he`gu bf_lv Zglbdhjjhabhggh_ ihdjulb_.

I_j_ ^ ijhdeZ^dhc dZ[_e_c \ khjm`_gbyo ij_ ^klZ\bl_eb wdkiemZ-
lbjmxs_c hj]ZgbaZpbb hkfZlj\Zxl]hlh\ghklv ljZkku ^ey ijhdeZ^db
dZ[_e_c:

- dj_ie_gb_ aZ^_eZgguo \ kl_gu ljm[;
- ^bZf_lj ljm[b bo khhl_lkl\b_ ^ey ijh_dlghe fZjdb dZ[_ey;
- dj_ie_gb_ dhgkljmdpbc (klh_d, ihehd) b jZkklhygb_ f_`^m gbfb
ih]hjbahglZeb b _jlbdZeb;
- hdjZkdm f_lZeehdhgkljmdpbc (hkh[_ggh \ f_klZo ijb\Zjdb);
- hlkmkl\b_ l_qb \h^u b \h^u \ ijbyfdZo;
- bkijZ\ghklv we_dljhih\h^db b gZebqb_ eZfi (ijb g_h[oh^bfh-
klb gZ ih\hjhlZo mklZgh\blv ^hihegbl_evgh_ hk_s_gb_);
- hlkmkl\b_ ihklhjhgbo ij_ ^f_lh\ ih \k_c ljZkk_;
- jZkklZ_e_ggu_ ih \k_c ljZkk_ ebg_cgu_ b m]eh\u_ jhebdb (m]eh-
\u_ jhebdb ^he`gu [ulv aZdj_ie_gu).

Ihke_ \uiheg_gby i_j_qbke_gguo lj_[h\Zgbc jZaj_rZ_lky ijh-
deZ^dZ dZ[_ey b khklZ\ey_lky Zdl gZ kdjulu_ jZ[hlu b Zdl ijb_fdb
coopy`_gby ih^ fhglZ` dZ[_e_c. >ey ijhdeZ^db \ lmgg_eyo jZaj_rZ_l-
ky ijb_f_gylv lhevdh dZ[_eb k g_]hjxqbfh h[hehqdzfb. Ijb ^\mklhjhg-
g_f jZkiheh`_gbb dZ[_evguo dhgkljmdpbc dhgljhevgu_ dZ[_eb ke_ ^m_l
jZaf_sZlv ih \haf`ghklb gZ ijhlb\hiheh`ghc klhjhg_ hl kbeh\uo
dZ[_e_c. Ijb h^ghklhjhg_g_f jZkiheh`_gbb dhgkljmdpbc dhgljhevgu_
dZ[_eb ke_ ^m_l jZaf_sZlv ih^ kbeh\ufb dZ[_eyfb b jZa^_eylv bo]hjb-
ahglZevghc i_j_]hjh^dhc.

Ijb ijb_f_g_gbb Z\lhfZlbq_kdh]h ih`Zjhlmr_gby k bkihevah\Z-
gb_f \ha^mrgh-f_oZgbq_kdhc i_gu beb jZkiue_gghc \h^u i_j_]hjh^db
^himkdZ_lky g_ mklZgZ\eb\Zlv.

Kbeh\u_ dZ[_eb gZijy`_gb_f ^h 1 d< ke_ ^m_l ijhdeZ^u\Zlv ih^
dZ[_eyfb gZijy`_gb_f \ur_ 1 d< b jZa^_eylv bo]hjbahglZevghc i_j_-
]hjh^dhc. JZaebqgu_ ljmiu dZ[_e_c, Z bf_ggh, jZ[hqb_ b j_a_j]gu_
gZijy`_gb_f \ur_ 1 d<, j_dhf_g^m_lky ijhdeZ^u\Zlv gZ jZaguo ihe-
dZo k jZa^_e_gb_f bo]hjbahglZevgufb g_k]hjZ_fufb i_j_]hjh^dZfb. <
dZq_kl_ i_j_]hjh^hd j_dhf_g^mxlky Zk[hp_f_glg_u_ ieblu ij_kkh\Zg-
gu_ g_hdjZr_ggu_ lhesbghc g_ f_g__ 8 ff.

IjhdeZ^dm [jhgbjh\Zgguo dZ[_e_c \k_o k_q_gbc b g_[jhgbjh\Zg-
guo k_q_gb_f `be 25 ff2 b \ur_ ke_ ^m_l \uihegylv ih dhgkljmdpbyf
(ihedZf), Z g_[jhgbjh\Zgguo dZ[_e_c k_q_gb_f `be 16 ff2 b f_g__ -
gZ ehldZo, meh`_gguo gZ dZ[_evgu_ dhgkljmdpbb.

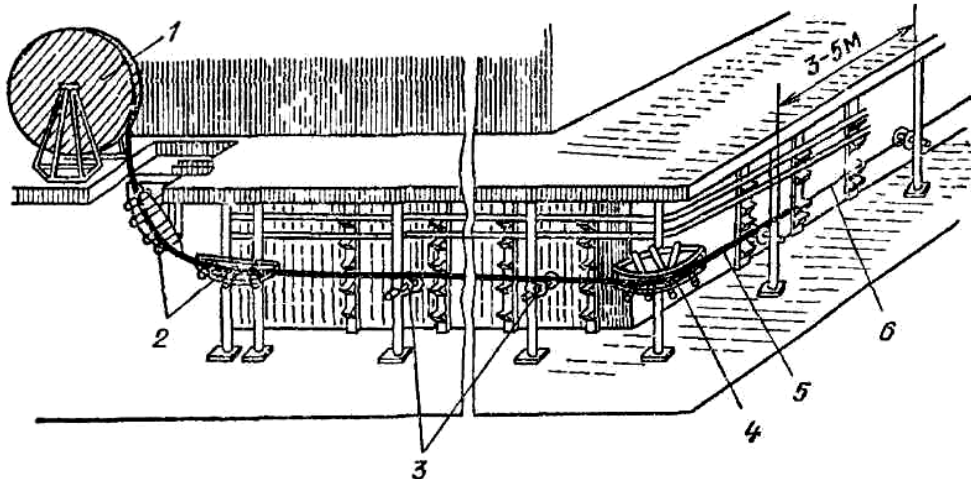
DZ[_eb, ijheh`_ggu_ \ dhee_dlhjZo b lmgg_eyo, ^he`gu [ulv`_-
kldh aZdj_ie_gu \ dhg_qguo lhqdZo , k h[_bo klhjhg ba]b[h\ b m kh_^b-
gbl_evguo fmnI. <h ba[_`Zgb_ mklZgh\db ^hihegbl_evguo kh_^bgb-
l_evguo fmnI ke_^m_l \u[bjZlv ij_^ihqbl_evgmX kljhbl_evgmX ^eb-
gm dZ[_e_c. DZ`^mx kh_^bgb_l_evgmX fmnIm gZ kbeh\uo dZ[_eyo ke_^m-
_l mdeZ^u\Zlv gZ hl^_evghc ihed_ hihjguo dhgkljmdpbc b aZdexqZlv \
aZsblguc ijhlb\hih`Zjguc dh`mo, dhlhjuc ^he`_g [ulv hl^_e_g hl
_jogbo b gb`gbo dZ[_e_c ih \k_c rbjbg_ ihehd aZsblgufb Zk[hp_-
f_glgufb i_j_]hjh^dZfb. < dZ`^hf lmgg_e_ b dZgZe_ ^he`gu ij_^m-
kfZljB\Zlvky k[h[h^gu_ jy^u ihehd ^ey mdeZ^db kh_^bgb_l_evguo fmnI.

>ey ijhoh^Z dZ[_e_c q_j_a i_j_]hjh^db, kl_gu b i_j_djulby
^he`gu [ulv mklZgh\e_gu iZljm[db ba g_k]hjZ_fuo ljm[. < f_klZo
ijhoh^Z dZ[_e_c \ ljm[Zo aZahju \ gbo ^he`gu [ulv lsZl_evgh miehlg-
g_gu g_k]hjZ_fuf fZl_jbZehf. FZl_jbZe aZiheg_gby ^he`_g h[_ki_-
qb\Zlv ko\Zlu\Zgb_ b e_]dh ih^^Z\ Zlvky jZajmr_gbx \ kemqZ_ ijhdeZ^db
^hihegbl_evguo dZ[_e_c beb bo qZklbqghc aZf_gu. G_k]hjZ_fuc
fZl_jbZe ^ey miehlg_gby fh`_l [ul v ijbgyI ih ke_^mxs_c j_p_ilmj_:
Z) p_f_gl k i_kdhf \ hlghr_gbb 1:10; () jebgZ k p_f_glhf b i_kdhf \
hlghr_gbb 1,5:1:1; \) jebgZ k i_kdhf \ hlghr_gbb 1:3;) i_jebl k Ze_-
[Zkljhf \ hlghr_gbb 1:2.

?keb dZ[_ev h^ghc kljhbl_evghc ^ebgu ih^e`bl qZklbqghc ijh-
deZ^d_ \ dhee_dlhj_ beb lmgg_e_, Z gZ ^jm]hc qZklb ljZkku - \ a_fe_, lh \
lZdbo kemqZyo ke_^m_l ijbfgylv dZ[_ev k gZjm`guf ihdjh\hf. K]hjZ_-
fuc ihdjh\ m^Zey_lky lhevdh gZ mqZkl d_ \k_c ljZkku \gmIjb lmgg_ey ^h
kZfh]h f_klZ \uoh^Z ba g_]h aZih^ebph k aZ^_edhc ljm[u beb ijh_fZ.
Ijbfg_gb_ \ dZ[_evguo lmgg_eyo g_]jhgbjh\Zgguo dZ[_e_c k ihebwlb-
e_g]\hc h[hehqdhc ih mkeh\byf ih`Zj ghc [_ahiZkghklb aZij_sZ_lky.

I_j_^ ijhdeZ^dhc dZ[_ey lj_[m_lky baf_jblv ^ebgm dZ[_evghc eb-
gbb \ khhl_lkl\bb k ijh_dlhf. >ey ijhdeZ^db dZ[_ey \ ijhly`guo
lmgg_eyo g_h[oh^bfh lZd`_ mlhqgblv jZkiheh`_gb_f_kl, hldm^Z fh`_l
ijhba\h^blvky aZly`dZ dZ[_ey \ lmgg_ev beb dhee_dlhj (dheh^pu, _g-
lbeypbhggu_rZolu b l. ^.), b hij_^_eblv nZdlbq_kdh_ jZkklhygb_f`-
^m gbfb.

F_oZgbabjh\ZggZy jZkdZldZ dZ[_ey \ lmgg_eyo, dZd ijZ\beh, ijh-
ba\h^blky ly`_gb_f k ihfhsvx e[_^db. Ijb jZafhld_ [ZjZ[Zg k dZ[_-
e_f_g_h[oh^bfh mklZgh\blv gZ ^hfdjZlZo gZ h^ghf dhgp_ ljZkku (jbk.
3.34), Z gZ ^jm]hf dhgp_ - ly]h\mx e[_^dm, jZkklZ\blv \^hev ljZkku
ebg_cgu_ b m]eh\u_ jhebdb (jZkihjgh]h beb \bgIh\h]h dj_ie_gby),
jZkdZlZlv dhg_p e[_^db b, ijb_dj_ib_]h d dhgpm dZ[_ey, ijhlygmIv dZ-
[_ev ih ljZkk_, ihke_wlh]h \jm_qgmX i_j_eh`blv _]h gZ hl_^_ggh_f_-
klh gZ dZ[_evguo dhgkljmdpbyo.



Jbk. 3.34. JZkdZldZ dZ[_ey \ lmg g_e_:

1 - [ZjZ[Zg k dZ[_e_f; 2 - m]eh\u_jh ebd; 3 - ebg_cgu_jhebd b;
4 - m]eh\hc jhe bd gZ ih\hjh l _ljZkku; 5 - dZ[_ev; 6 - dZgZl e _^db

?keb g_evay jZkdZldZ dZ[_ev gZ \kx g_h[oh^bfmx ^ebgm, lh i hke_aZf_j Z _]h \j m]qgm x kf Zlu\Zxl k [ZjZ[ZgZ gZ g_hklZxsm x ^ebgm, hlj_aZxl b \jmqg mx aZ[_j r Zxl ijh deZ^dm _]h k ijbf_ g_gb_f f _]h^Z «i_l eb».

IjhdeZ^ dm fZeh]h qbkeZ dZ[_e_c \ lmgg_eyo b dhee_dlhjZo g _]hev-rhc ijhly`_ gghklb (^h 50 f), hkh[_ggh ijb j_f hglguo j ZhlZo, p_e_kh-h[jZ agh ijhb a^h^blv \jmqgm x. >ey wlh]h ih ij _^Zjbl_ evghfm aZf_jm ljZkku hlj_a Zxl dZ[_e v g_h[oh^bfhc ^e bgu, hlj _aZgguc m]Zklhd dZ[_ey \jmqgm x i_j _ghkyl b mdeZ^u\Zxl gZ i j _^gZagZ_ggh_ ^ey g _]h f_klh. DZ[_ev gZ ihedZo beb Zk[hp_f glguo i _j _]hjh^d Zo ^he`_ g [ulv meh`_g [_a gZly`_gb y, lZd`_ [_a gZly`_gby hg ^he`_g [ulv meh`_g \ljm[Zo.

DZ[_eb, ijheh`_ ggu_] hjbahglZ evgh ih f_lZeeh dhgkljmdpbyf, ^he`_ gu [ulv _kldh aZdj_ie_gu g_ikh j _^kl_g gh m dhggu_uo aZ^_ehd, gZ ih\hjhZo ljZkku k h[_bo kl hjhg ba] b[h\ b m kh^bgbl_evguo f mnl k h[_bo klhjhg. Ijb _j lbdZevghc ijhde Z^d dZ[_eb ^he`_ gu [ulv aZdj_ie_gu aZ dZ ^mx dZ[_evgm x dhgkljmdpbyf. JZ kklhygby f`^m _]jlb-dZewgufb dh gkljmdpbyf ^he`_ gu [ul v mdZaZg \ijh_d l_. F`^m g _]j h gbjh\Zgg ufb dZ[_eyfb kh k\bgph\h c beb Zex fbgb\h c h[hehq dhc b f_lZ eebq_kdbfb hihj gufb d hgkljmdpbyf ^h e`gu [u lv ijheh`_gu weZl bqgu_ i jhdeZ^db ba g _]hjxq _]h f Zl_jbZeZ (gZijb f_j, ebklh\hc Zk[_kl, ebklh \hc iheb \bgbeoe hjb^) lhe s bghc g _f_g_ 2 ff, ij^ hojZ-gyx s b _]h[he hqdm hl f _oZgbq_kdbo ih\ j _^_gb c. G _]jhg bjh\Zgg u _dZ[_eb k ieZkl f Zkklh\hc h[hehq dhc ^himkdZ_lky dj_iblv kd h[Zfb (oh f mlZ-fb) [_a ijhd eZ^hd. F_lZeebq_kdZy [jhgy dZ[_e_c, ijhd eZ^u\Z_fuo \ lmgg_eyo, ^he`gZ bf_ lv Zglbdhjjhabhg gh_ihdj ulb_.

JZkklhygb_f`^ mihedZf b dZ[_evguo dhgkljmdpbc i jb ijhd eZ^d_kbeh\uo dZ[_e_c gZij y`_gb_f ^h 10 d< ^he`gh [ulv g _f_g_ 200 ff.

JZkklhygb_ f_`^m ihedZfb ijb mklZgh\ d_ h]g_klhcdhc i_j_lhjh^db ijb ijhdeZ^d_ dZ[_e_c ^he`gh [ul v g_ f_g__ 200 ff, Z ijb mdeZ^d_kh_`bgbl_evghc fmnlu 250 ff beb 300 ff – \ aZ\bkbfbhklb hl lbihjZa-f_jZ fmnlu.

3.7. IjhdeZ^dZ dZ[_e_c gZ ehldZo

Ehldb ij_`gZagZq_gu ^ey hldjulhc ijhdeZ^db dZ[_e_c lZf,]^_ ih^_ckl\mxsbf ijZ\beZf ijhdeZ^dZ dZ[_e_c \ klZevguo ljm[Zo g_h[yaZ-l_evGZ. Ehldb mklZgZ\eb\Zxlky \ kmobo, kujuo b `Zjdbo ihf_s_gbyo, \ ihf_s_gbyo k obfbq_kdb Zdlib\ghc kj_`hc.

J_dhf_g^m_lky ijb_f_gylv ehldb aZ\h^kdh]h ba]hlh\`e_gby lbiZ GE.

GZ ehldZo jZaj_rZ_lky ijhba\h^blv ijhdeZ^dm g_[jhgbjh\Zgguo kb]h\uo dZ[_e_c gZijy`_gb_f^h 1 d< b k_q_gb_f g_ [he__ 16 ff².

Ehldb mklZgZ\eb\Zxlky gZ hihjguo dhgkljmdpbyo ih kl_gZf b ih^i_j_djulbyfb gZ \ukhl_ g_ f_g__ 2 f hl mjh\gy iheZ beb gZ iehsZ^dZo h[kem`b\Zgby \ f_klZo,]^_ g_l hiZkghklb f_oZgbq_kdbo ih\j_`^_gbc dZ[_e_c. < we_dljhl_ogbq_kdbo ihf_s_ gbyo, h[kem`b\Z_fuo ki_pbZevgh h[mq_gguf i_jkhgZehf, \ukhlZ jZki heh`_gby ehldh\ g_ ghjfbjm_lky.

Ijb mklZgh\ d_ ehldh\ iZjZee_e vgh k ljm[hijh\h^Zfb jZkklhygb_ f_`^m ehldZfb beb dhjh[Zfb b ljm[hijh\h^Zfb ^he`gh [ulv g_ f_g__ 100 ff, Z hl ljm[hijh\h^h\ k]hjxbfb `b^dhkl yfb b]ZaZfb – g_ f_g__ 250 ff.

Ijb i_j_k_q_gbb ehldZfb ljZkk]hjyqbo ljm[hijh\h^h\, Z lZd`_ ijb iZjZee_evghc ijhdeZ^d_ k gbfb ^he`gu [ulv ijbgylu f_ju ih aZ-sbl_ dZ[_e_c hl \ha^_ckl\by \ukh dhc l_fi_jZlmju. F_ju aZsblu ^he`gu [ulv mdZaZgu \ ijh_dl_.

IjhdeZ^dm dZ[_e_c gZ ehldZo ke_`m_l \uihegylv ly`_gb_f dZgZlZ ih jhebdZf k ihfhsvx e[_^db. DZ[_eb jZkdZlu\Zxlky ih jhebdZf \^hev ehldh\ k ihke_`mxs_c mdeZ^dhc gZ hl_`^_ggh_ f_klh. Jhebdb mk-lZgZ\eb\Zxlky gZ jZkklhygbb g_ [he__ 2 f ^jm] hl ^jm]Z, Z lZd`_ gZ dhgpZo b \ f_klZo ih\hjhlZ ljZkku, ijbq_f jhebdb, mklZgZ\eb\Z_fu_ \ f_klZo ih\hjhlZ ljZkku, ^he`gu h[_ki_qb\Zlv ba]b[dZ[_e_c k jZ^bm-khf g_ f_g__ ^himklbfh]h. IjhdeZ^dm g_[jhgbjh\Zgguo dZ[_e_c k ieZ-klfZkklh\hc h[hehqdhc gZ ijyfhebg_cgao mqZkldZo ljZkku ^himkdZ_lky ijhba\h^blv [_a jhebdh\. Ih^t_f b mdeZ^dm dZ[_e_c gZ ehldb gZ dhjhl-dbo mqZkldZo ljZkku ke_`m_l \uihegylv k i_j_`^b`guo \ur_d, ieZl-nhj, ih^fhkl_c, klj_fyghd b l. i. DZ[_eb gZ ehldZo ke_`m_l mdeZ^u-\Zlv h^ghkehcgh (h^ghjy^gh) k ijhf_`mldZfb f_`^m gbfb \ k_lm ih-jy^dZ 5 ff, imqdZfb \ h^bg kehc (jy^) k jZkklhygbyfb f_`^m imqdZfb \ k_lm 20 ff, h^ghkehcgh [_a ijhf_`mldh\ f_`^m dZ[_eyfb b fgh]h-kehcgh. Qbkeh dZ[_e_c, mdeZ^u\Z_fuo gZ ehldZo, mdZaZgh \ lZ[e. 3.3.

FZdkbfZevgh_ qbkeh dZ[_e_c, mdeZ^u\Z_fuo gZ ehldZo
imqdZfb b \ h^bg jy^, \ aZ\bkbfhklb hl gZjm`gh]h ^bZf_ljZ

Lbi dZ[_ey	Lbi ehldZ	RbjbgZ ehldZ, ff	GZjm`guc ^bZf_lj dZ[_ey, ff	Qbkeh imqdh\, rl.	Qbkeh dZ[_e_c, rl.	
					\ imqd_	\k_]h*
Kbeh\hc lj_o`bevguc k_q_gb_f ^h 16 ff ²	DE40	400	^h 16 hl 11 ^h 12 hl 13 ^h 15 hl 16 ^h 9 hl 20 ^h 23 hl 24 ^h 30	10 9 8 7 6 5	4 4 4 4 4 4	40/26 36/24 32/19 28/15 24/13 20/11
	DE20	200	^h 10 hl 11 ^h 15 hl 16 ^h 24 hl 25 ^h 30	5 4 3 2	4 4 4 4	20/12 16/9 12/6 8/5
	DE10	100	hl 10 ^h 15	2	4	8/1
	DE5	50	hl 10 ^h 15	1	4	4/1
Kbeh\hc h^gh`bevguc k_q_gb_f ^h 16 ff ²	DE40	400	^h 8 hl 9 ^h 11 hl 12 ^h 14 15	8 7 6 5	12 12 12 12	96/30 84/24 72/20 60/19
	DE20	200	^h 8 hl 9 ^h 12 hl 13 ^h 15	4 3 2	12 12 12	48/14 36/10 24/9
	DE10	100	^h 8 hl 9 ^h 11 hl 12 ^h 14 15	2 2 1 1	12 9 12 10	24/12 18/9 12/7 10/6
	DE5	50	^h 8 hl 9 ^h 12 hl 13 ^h 15	1 1 1	12 9 4	12/6 9/5 4/3

* < qbkebl_e_mdZaZgh qbkeh dZ[_e_c \ imqd_, \ agZf_gZl_e_ – ijb mdeZ^d_ \ h^bg jy^.

Dj_ie_gb_ dZ[_e_c, ijhdeZ^u\Z_fuo gZ ehldZo gZ ijyfuo mqZkl-dZo ljZkku ijb]hjbahglZevghc mklZgh\d_ ehldh\, g_ lj_[m_lky, aZ bk-dexq_gb_f kemqZ_ \ jZkiheh`_gby ehldh\ ieZrfy gZ hihjguo ih\jo-ghklyo. < ihke^g_f kemqZ_ dj_ie_gb_ dZ[_e_c ^ he`gh \uihegylvky k bgl_j\Zehf g_ [he__ 1 f. Ijb _jlbdZevghf jZkiheh`_gbb ehldh\ dj_ie_gb_ dZ[_e_c lZd` ^he`gh \uihegy lvky k bgl_j\Zehf g_ [he__ 1 f.

Ijb ijhdeZ^d_ dZ[_e_c gZ ehldZo imqdZfb dZ[_eb \ dZ^hf imqd_ ^he`gu [ulv kdj_ie_gu f_`^m kh[h c b k ehldZfb [Zg^Z Zfb. JZkklhygb_f_`^m [Zg^Z Zfb gZ]hjbahglZevguo ijyfhebg_cg_uo mqZkldZo ljZkku ^he`gh [ulv g_ [he__ 4,5 f, Z gZ _jlb dZevguo – g_ [he__ 1 f. < f_klZo ih-

\hjhlZ lJZkku ^ey \k_o kemqZ_\ jZkiheh`_gby ehldh\ dZd ijb ijhdeZ^d_ hl-
 ^_evguo dZ[_e_c, lZd b ij b ijhdeZ^d_ \ imqdZo dj_i e_gb_ dZ[_e_c ^he`gh
 ijhba\h^blvky ^h b ihke_ ih\hjhlZ gZ jZkklhy gbb g_ [he__ 0,5 f. Dj_ie_gb_
 dZ[_e_c gZ ehldZo ke^m_l \uihegy l v ihehkdhc k iij`dhc, ohfmlhf, kdh[hc
 b l. i. Ijb dj_ie_gbb g_[jhgbjh\Zgggu o dZ[_e_c b ijh\h^h\ f_lZeebq_kdbfb
 [Zg^Z Zfb b kdh[Zfb g_h[oh^bfh \ f_klZo dj_ie_gby dZ[_ev h[_jlu\Zlv
 fy]dhc ijhdeZ^dhc lhesbghe g_f_g__ 2 ff ba Zk[_klZ, iheb\bgbeohjb^Z b
 l. i. FZjdbjh\dm dZ[_e_c, ijheh`_gguo \ ehldZo fgh]hkehch gh beb imqdZfb,
 j_dhf_g^m_lky ijhba\h^blv lhev d h m dhgp_\uo aZ^_ehd.

3.8. IjhdeZ^dZ dZ[_e_c gZ wklZdZ^Zo b \]Ze_j_yo

IjhdeZ^dZ dZ[_e_c gZijy`_gb_f ^h 10 d< k_q_gb_f ^h 240 ff ² gZ
 wklZdZ^Zo b \]Ze_j_yo ijb_f_gy_lky ^ey \gmljbaZ\h^kdbo we_dlj_bq_kdbo
 k_l_c ih l_jjblhjbyf ijhfure_gguo ij_`ijbylbc. Ijb_f_g_gb_ ki_pb-
 Zevguo dZ[_evguo wklZdZ^ j_dhf_g^m_lky \ dZq_kl_ hkgh\gh]h \b^Z
 ijhdeZ^db dZ[_e_c ih l_jjblhjbyf obfbq_kdbo b g_nl_obfbq_kdbo
 ij_`ijbylbc,]^_ g_ bkdexq_gZ \haf h`ghklv jZaeb\db _s_kl\, jZajm-
 rbl_evgh ^_ckl\mxsbo gZ h[hehqdb dZ[_e_c. >himkdZ_lky lZd`_ bk-
 ihevah\Zlv l_ogheh]bq_kdb_ wklZdZ^u ^ey kh\f_s_gghc ijhdeZ^db ljm-
 [hijh\h^h\ b dZ[_e_c. Hkgh\gu_ lbiu dZ[_evguo wklZdZ^ \uihegyxlky
 g_ijhoh^gufb`_e_ah[_lhggufb b f_lZeebq_kdbfb, ijhoh^gufb`_e_-
 ah[_lhggufb, f_lZeebq_kdbfb b dhf[bgbjh\Zggufb. G_ijhoh^gu_
 wklZdZ^u \uihegyxlky lZdbf h[jZahf, qlh[u [ueZ \hafh`ghklv h[kem-
 `b\Zgby bo kh ki_pbZevgh h[hjm^h\Zgguo fZrbg.

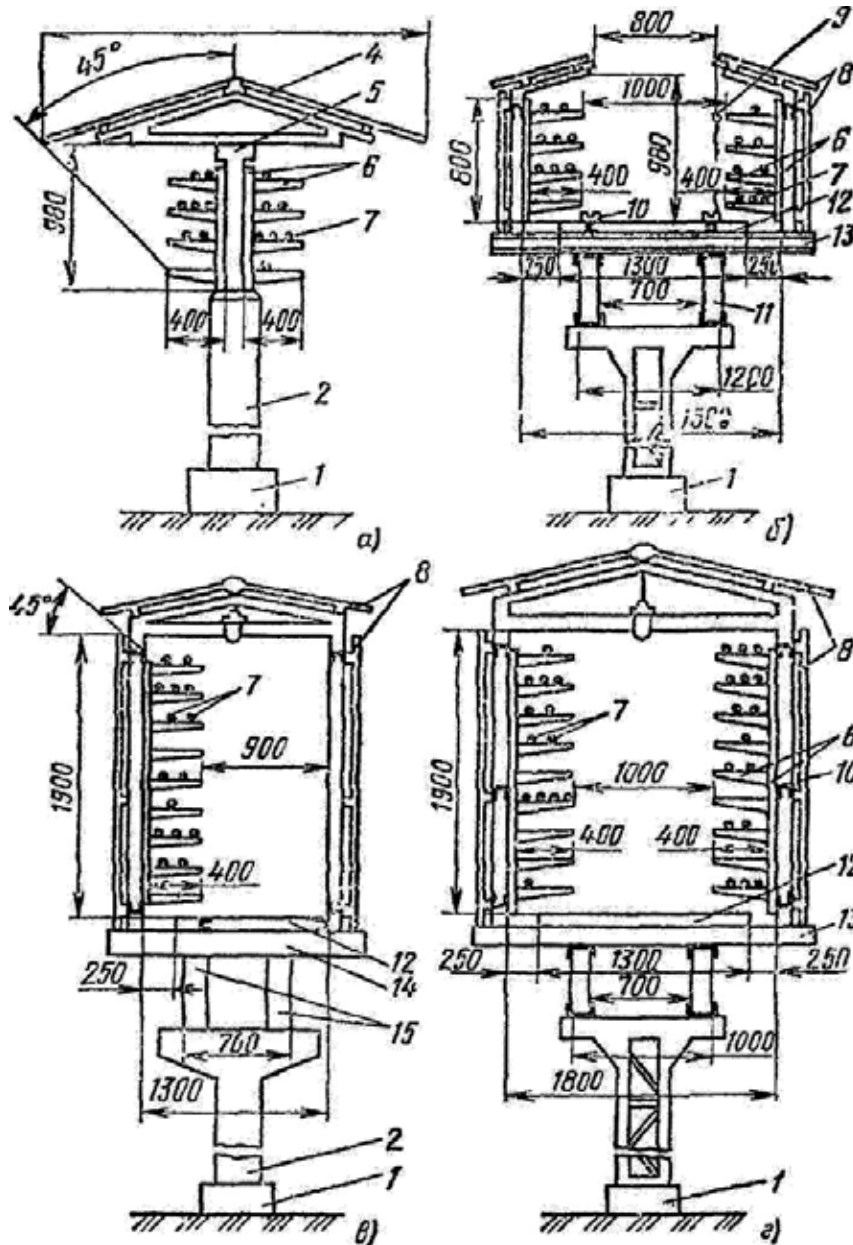
GZ jbk. 3.35 ij_`klZ\e_gu]Ze_j_ b, dZ[_evgu_ wklZdZ^u k khegp_-
 aZsblgufb dhaujvdZfb b [_a gbo jZaebqguo bkiheg_gbc ba mgbnbpb-
 jh\Zgguo we_f_glh\]. Ijb kh\f_s_gghc ijhdeZ^d_ ljm[hijh\h^h\ b dZ-
 [_e_c wklZdZ^u ^he`gu bf_lv bg^b\b^mZevgh_ bkiheg_gb_. Ih dZ[_ev
 guf wklZdZ^Zf ijbgyly hkgh\gu_ jZkklhygby f_`^m hihjZfb 6 b 12 f.
 GZ hl^_evguo mqZkldZo lJZkku ijb g_h[oh^bfhklb jZkklhygb_ f_`^m
 hihjZfb fh`_l [ulv 9 f.

Hkgh\gZy \ukhlZ khhj_m`_gby wklZdZ^ hl ihehl_gZ Z\lh^hjh]b ijb-
 gylZ jZghc 5 f. GZ l_jjblhjbyo,]^_ hl_kmlkl\mxl i_j_k_q_gby k ^hjh-
]Zfb, \ukhlZ ^he`gZ [ulv 2,5 f (hl ieZgbjh\hqghc hlf_ldb a_feb) k
 i_j_oh^Zfb \ f_klZo i_j_k_q_gby k ^hjh]Zfb gZ \ukhlm:

5 f – ijb i_j_k_q_gbb k Z\lh^hjh]Zfb;

6 f – ijb i_j_k_q_gbb k g_we_dljbnbpbjh\Zggufb`_e_agufb ^h-
 jh]Zfb (hl]heh\db j_evkZ);

7,1 f – ijb i_j_k_q_gbb k we_dljbnbpbjh\Zggufb`_e_agufb ^h-
 jh]Zfb (hl]heh\db j_evkZ).



Jbk. 3.35. IjhdeZ^dZ dZ[_e_c gZ dZ[_evguo wklZdZ^Zo

k khegp_aZsblgu f b [_a khegp_aZsblguo dhaujvdh\;

Z - wklZdZ^Z g_ijhoh^gZy`_e_ah[_lhggZy; [- wklZdZ^Z ijhoh^gZy f_lZeebq_kdZy;

\ -]Ze_j_y h^ghkljhgggy; _ -]Ze_j_y ^mkljhgggy f_lZeebq_kdZy;

^ -]Ze_j_y lj_okl_ggZy dhf[bgbjh\ZggZy; _ - wklZdZ^Z g_ijhoh^gZy`_e_ah[_lhggZy [_a khegp_aZsblguo dhaujvdh\; ^ - wklZdZ^Z ijhoh^gZy [_a khegp_aZsblguo dhaujvdh\; 1 -`_e_ah[_lhgh_hkgh\Zgb_; 2 -`_e_ah[_lhggZy dhehggZ; 3 -f_lZeebq_kdZy dhehggZ; 4 -khegp_aZsblguc dhauj_d; 5 -`_e_ah[_lhggZy [ZedZ; 6 -dZ[_evgZy dhgkljmdpby (klhcdZ b ihedb);

7 -dZ[_eb; 8 -klZpbhgZjgu_khegp_aZsblgu_iZg_eb;

9 -kt_fgu_khegp_aZsblgu_iZg_eb; 10 -ijhnbev klZevghc (lhev dh f_klZo kludZ

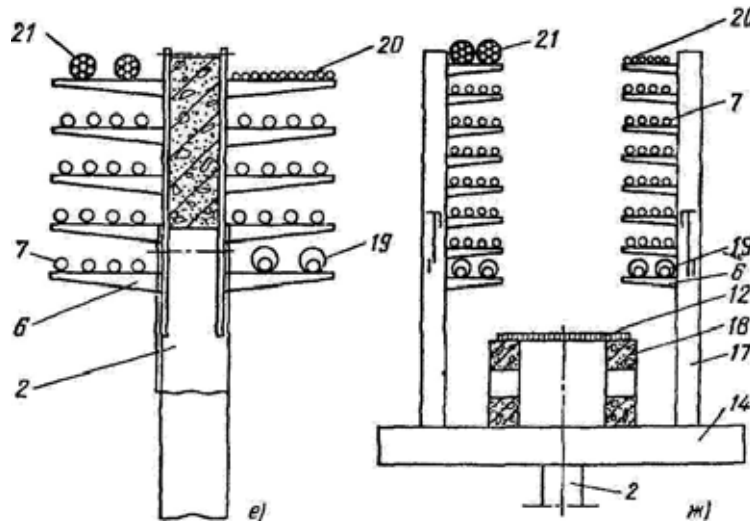
khegp_aZsblguo iZg_e_c); 11 -hkgh\gu_g_kmsb_f_lZeebq_kdb_n_jfu;

12 -f_lZeebq_kdbc gZklbe; 13 -f_lZeebq_kdZy ljZ_jkZ; 14 -`_e_ah[_lhggZy ljZ_jkZ;

15 -hkgh\gu_g_kmsb_`_e_ah[_lhggZy [Zedb; 16 -kiehrgZy h]g_aZsblgZy i_j_jhjh^dZ;

17 -klhcdZ; 18 -eblZ; 19 -kh^bgb_l_evgZy fmnI; 20 -dhgljhevgu_dZ[_eb;

21 -imqhd dZ[_e_c k_q_gb_f 16 ff²



Jbk. 3.35. (Ijh[^]he`_gb_). IjhdeZ[^]dZ dZ[_e_c gZ dZ[_evguo wklZdZ[^]Zo
k khegp_aZsblgufb d haujvdZfb b [_a khegp_aZsblguo dhaujvdh\

M]eu ih\hjhlh\ wklZdZ[^], hl_l\e_gby, i_j_oh[^]u k h[^]ghc hlf_ldb
gZ ^jm]mx, ijbfudZgby d a[^]Zgbyf, \jlbdZevgu_ rZolu b e_klgbpu
\uihegyxlky bg[^]b\b[^]mZevgh \ dZ[^]hf dhgdj_lghf kemqZ_ \ aZ\bkbfbh-
klb hl f_klguo mkeh\bc.

;_a khegp_aZsblguo dhaujvdh\ wklZdZ[^]u [u\Zxl g_ijhoh[^]gu_ b
ijhoh[^]gu_: g_ijhoh[^]gu_ ijbf_gyxlky ^ey ijhdeZ[^]db 16, 24 b 40 dZ[_
e_c k ijhe_lZfb f_[^]m hihjZfb 6f, Z ^ey ijhdeZ[^]db 24 b 40 dZ[_e_c -
12 f; ijhoh[^]gu_ h[^]gh- b ^\mok_dpbggu_ wklZdZ[^]u ^gy ijhdeZ[^]db 64 b
128 dZ[_e_c k ijhe_lZfb 6 b 12 f.

JZkklhygb_ f_[^]m ihedZfb ih \jlbdZeb gZ g_ijhoh[^]guo wklZdZ-
^Zo 200 ff, gZ ijhoh[^]guo 250 ff.

JZkklhygb_ ih]hjbahglZeb f_[^]m ihe dZfb 1 f, gh hgh fh`_l [ulv
m_ebq_gh ijb jZajZ[hld_ dhgdj_lgh]h ijh_dlZ k mq_lhf g_kms_c kih-
kh[ghklb dZ[_evguo dhgkljmdpbc. Ijb ijhdeZ[^]d_ dZ[_e_c \ Zexfbgb_-
\hc h[hehq_d_k_q_gb_f`_be 50 ff2 b [he__ jZkklhygb_ f_[^]m dZ[_ev-
gufb dhgkljmdpbyfb ^himkdZxlky ^h 6f. Klj_eZ ijh_kZ dZ[_e_c f_[^]-
^m dhgkljmdpbyfb ^he`gZ [ulv 0,4 f.

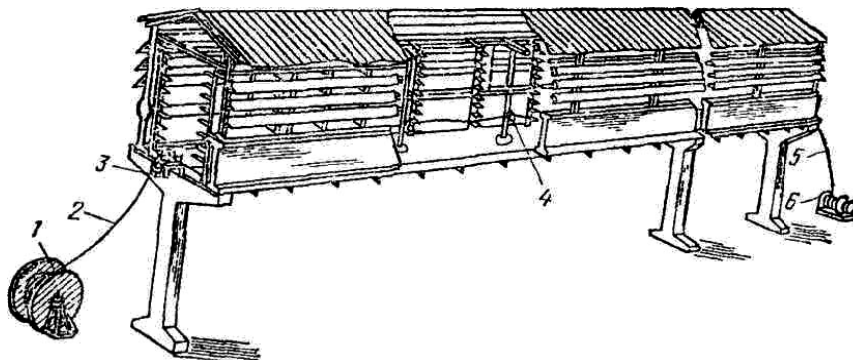
>ey ijhdeZ[^]db ih wklZdZ[^]Zf ^he`gu ijbf_gylvky dZ[_eb [_a gZ-
jm`gh]h]hjxq_]h ihdjh\Z, bf_xsb_Zglbdhjhabhgmx aZsblm, beb k
gZjm`guf aZsblguf ihdjh\hf ba g_]hjxqbo fZl_jbZeh\.

JZkiheh`_gb_ dZ[_e_f gZ ihedZo, jZkklhygby f_[^]m dZ[_eyfb, mk-
lZgh\dZ kh[^]bgbl_evguo fmnl b ^jm]b_ mkeh\by lZdb_`, qlh b ijb
ijhdeZ[^]d_ dZ[_e_c \ lmgg_eyo.

F_oZgbabjh\ZggZy jZkdZldZ dZ[_ey \ aZdjuluo wklZdZ[^]Zo lmgg_evgh-
]h lbiZ (jbk. 3.36) ijhba\h[^]blky k ihfhsvx we_dljhe[_^db ly`_gb_f dZ-

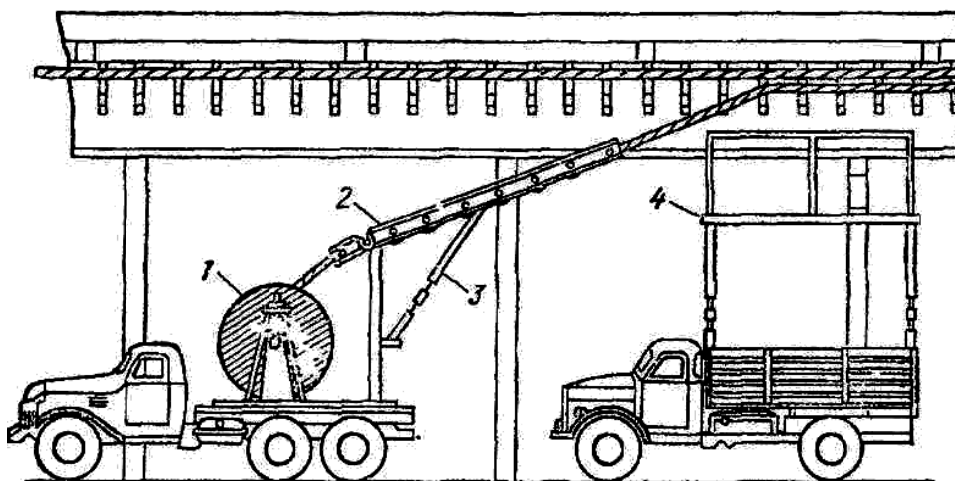
[_ey dZgZlhf k ijb_ g_gb_f e bg_cguo b m]eh\ u o jhebdh \ ij_bfm s _kl_ \gg h jZkihj gh]h lbiZ ih lhf n` _ijbpg bim, qlh b \ h[uqg u o lmgg_eyo.

I_j_deZ ^dZ dZ[_e_c k jhe bdh\ gZ hi hjgu_ d hgkljmdpbb ijhba \ h^bl_ ky \ j m qgm x. JZkdZldm dZ[_ey ih hldjulu f dZ[_ev guf b l_ ogheh]bq_kdbf wklZ^Zf j_dhf_g^m_lky ijhb a\h^blv k ihfhsv x ki_pbZevgh h[hjm^h_ \Zgghc Z\lhf Zrbgu (jbk. 3.37) ijb gZ ebqbb mkeh\bc _ ijhoh^b f hklb \^he v ljZkku. < dmah\ Z\lhfZ r bgu ^h e`gu [u l v mklZg\ e_gu g Z^hf_ djZl Zo [ZjZ[Zg k dZ[_e_f b gZi j Z\eyxs _ jhebdh \ h_ mkljhckl\h. I j b hl_ kml\bb ki_ pbZevgh h[hjm^h\Zgghc fZ r bgu ijh deZ^dZ fh`_l [ul v ijh_ ba_ ^_gZ k ihfhsvx w e_dljhe_ [_^db ly` _gb_f d Z[_ey dZgZlhf ih jheb_ dZf (jbk. 3.38). >ey wlh]h mkljhckl\h k j hebdZfb ^ey jZkdZl db mklZgZ\eb_ \Z_lky gZ klhc dZo dZ[_evguo dh gkljmdpbc (_keb i hke_ ^gb_ jZkkqblZgu gZ jZkdZldm ih gbf dZ[_ey) k jZkkl hygb_f 3...5 f ^j m] hl ^j m]Z. < gZqZe_, dhgp_ b gZ ih\ hjhlZo l jZkku ^he`gu [ul v mklZghe_gu m]eh\ u_ jhe bdb.



Jbk. 3.36. JZkdZldZ dZ[_ey gZ wklZdZ^Zo lmgg_evgh]h lbiZ:

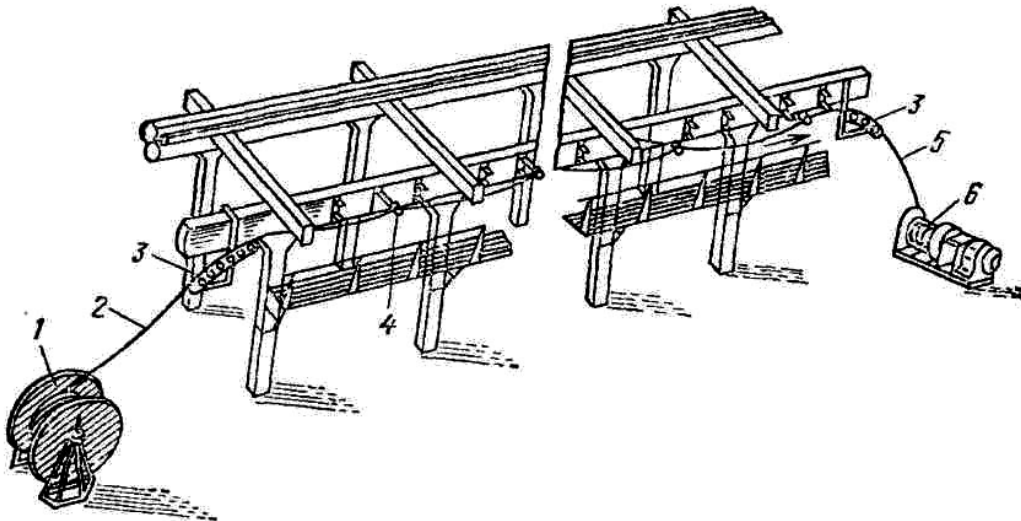
1 - [Zj Z[Zg k dZ[_e_f; 2 - dZ[_ev; 3 - m]eh\hc jhebd;
4 - ebg_cguc j hebd; 5 - dZgZl; 6 - e[_^dZ



Jbk. 3.37. I jh deZ^dZ dZ[_e_c gZ hl djulhc g_ijhoh^ ghc wklZ dZ^_k ihf hsvx

ki_pbZevgh h[hjm^h\Zgghc f Zrbgu: 1 - [ZjZ[Zg k dZ[_e_f; 2 - ijhly`gh_ ijb\h ^gh_ mkljhc kl\h; 3 - \bg lh\h_mihjg h_ mkljhckl \h ^ey j_]mebjh\db\ukh l u ih^t_fZ dZ[_ey;
4 - ieZlnhifZ ^ey jZaf_s _gby fhglZ ` gbdh\ ijb mdeZ^d_ dZ[_ey

DZ[_ev ihke_ jZkdZldb i_j_deZ^u\Zxl gZ hl_^_ggh_ _fm f_klh gZ ihedZo dZ[_evguo dhgkljmdpbc. JZkdZl dZ dZ[_ey lZd`_ fh`_l ijhba\h-^blvky ih ebg_cguf b m]eh\uf jhebdZf, mklZgh\e_gguf gZ mjh\g_ a_f-eb, k ihke_^mxsf ih^t_fhf b mdeZ^dhc dZ[_ey gZ hihjgu_ dhgkljmdpbb g_ijhoh^guo wklZdZ^_. Ijb dj_ie_ gbb dZ[_e_c, ijheh`_gguo ih]h-jbahglZeb gZ dhgkljmdpbyo, ^he`gu kh[ex^Zlvky l_`_ lj_[h\Zgby, qlh b ^ey dZ[_e_c, ijheh`_gguo \ lmgg_eyo.

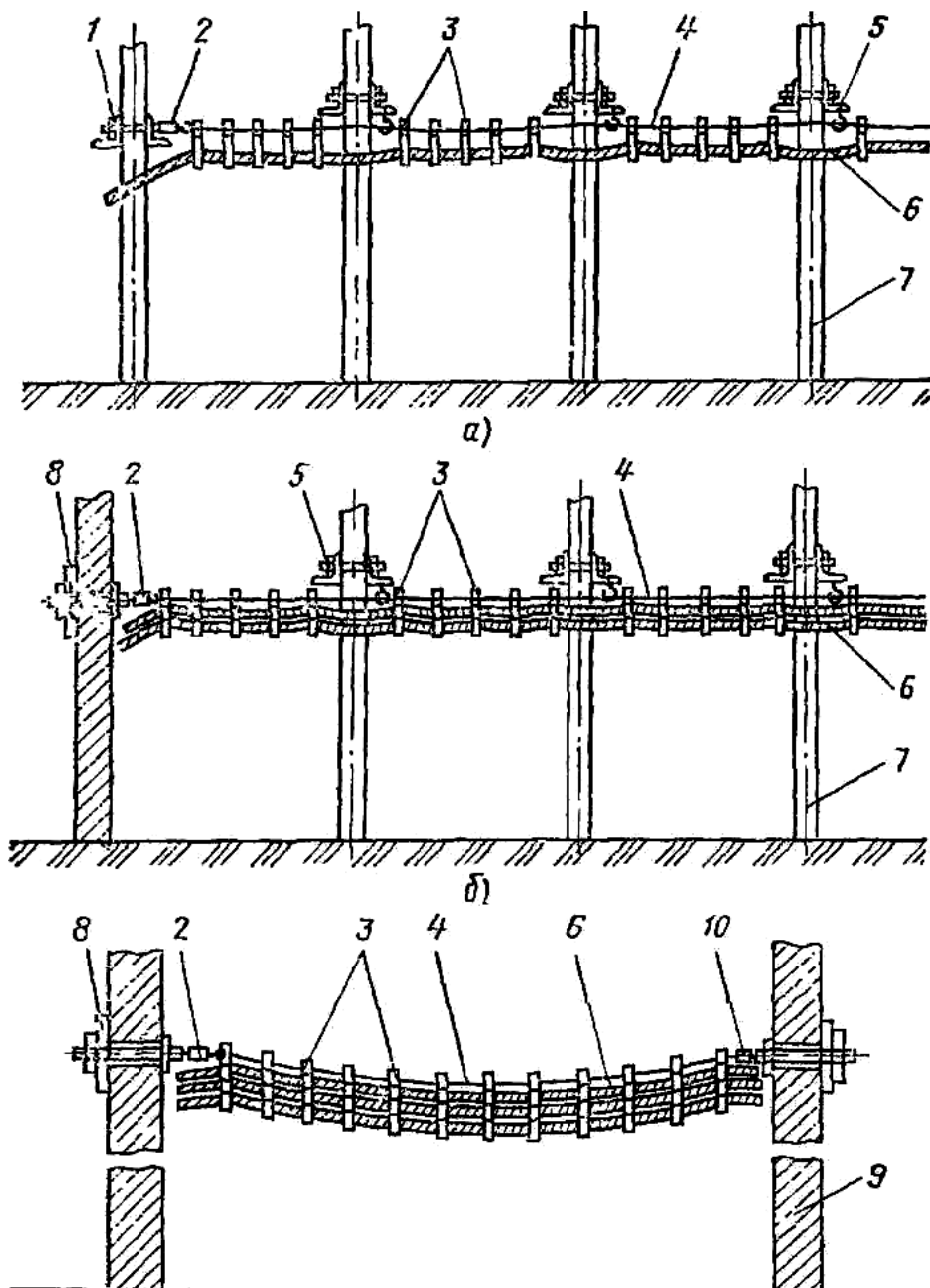


Jbk. 3.38. JZkdeZ^dZ dZ[_ey gZ hldjuluo wklZdZ^Zo ly`_gb_f
we_dljhe _[_^dhc: 1 - [ZjZ[Zg k dZ[_e_f; 2 - dZ[_ev; 3 - m]eh\hc jhebd;
4 - ebg_cguc jhebd; 5 - dZgZl; 6 - e_]^dZ

3.9. IjhdeZ^dZ dZ[_e_c gZ ljhkZo

FhglZ` dZ[_e_c gZ ljhkZo j_dhf_g ^m_lky \uihegylv \ l_o kemqZ-
yo, dh]^Z ^jm]b_ \b^u ijhdeZ^db dZ[_e_c g_ fh]ml [ulv ijbf_g_gu ih
l_ogheh]bq_kdbf, dhgkljmdlb\guf beb wdhghfbq_kdbf khh[jZ`gbyf.
IjhdeZ^dZ kbeh\uo dZ[_e_c gZ ljhkZo ijbf_gy_lky \ k_lyo gZijy`_gb-
_f ^h 1 d< dZd \gmljb ihf_s_gbc, lZ d b \g_ bo. DZ[_evgu_ ijh\h^db gZ
ljhkZo \gmljb ihf_s_gbc (p_oh\)\uihegyxlky ih dhehggZf ^hev b
ihi_j_d a^Zgby, Z lZd`_f`^m kl_g Zfb (jbk. 3.39), Z \g_ ihf_s_gbc,
dZd ijZ\beh, f`^m kl_gZfb a^Zgbc.

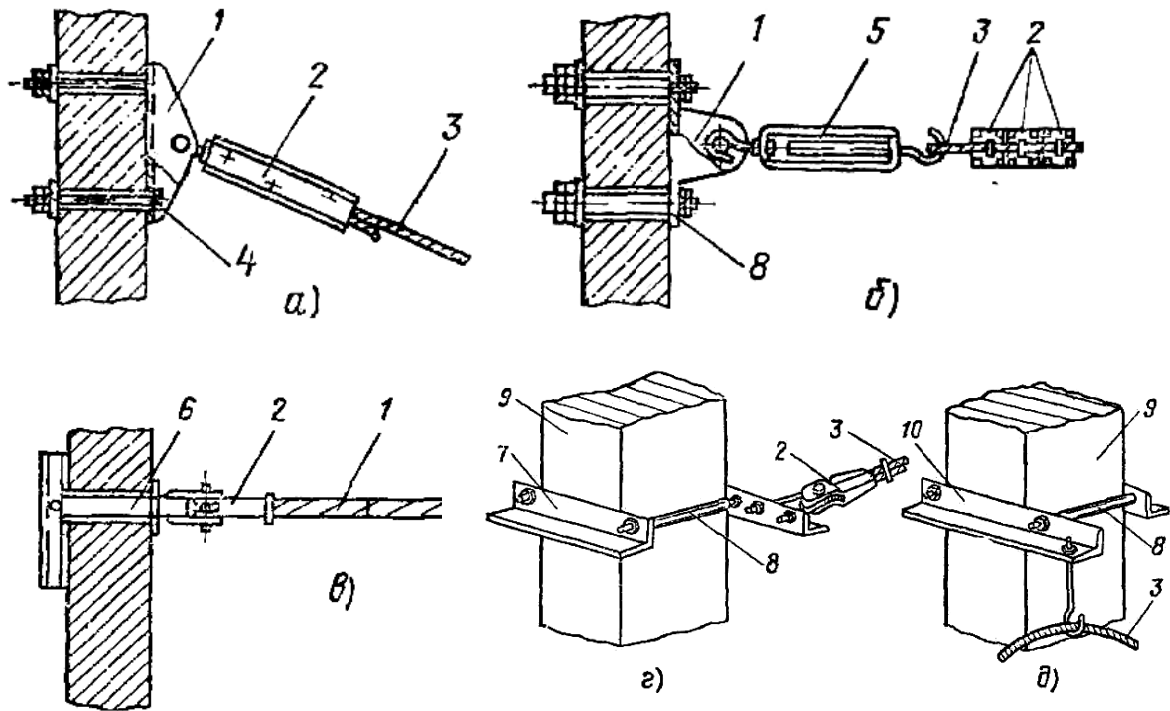
>ey kbeh\uo ebgbc, ijhdeZ^u\Z_fuo gZ ljhk_, ijbf_gyxlky lZdb_
`_ dZ[_eb, dZd b ^ey ijhdeZ^db \gmljb a^Zgbc b khhjm`_gbc. <u[hj
fZjdb dZ[_ey hij`_ey_lky ijh_d lhf. DZ[_eb, ijhdeZ^u\Z_fu_ \g_ a^Z-
gbc, \ lhf qbke_ b ih^ hldjulufb gZ_kZfb, ^he`gu bf_lv aZsblgh_
g_]hjxq_ gZjm`gh_ ihdjulb_.



Jbk. 3.39. Ijh deZ^dZ dZ[_ey gZ l j hkZo: Z-ih dheggZf; [-lh`_ k dj_ie_gb_f ljhkZ
 b kl_g_;\-f_` ^m kl_gZfb, 1-h[o\Zl d hg_qguc; 2-f mnlZ gZly `gZy;
 3-dZ[_evguc ih^_k; 4-ljhk g_ kmsbc; 5-h[o\Zl ijhf_ `mlhqguc; 6-dZ[_ev;
 7-dheggZ; 8-Zgd_j; 9-kl_gZ; 10-aZ^bf ljhkh\uc

<u[hj ljhkZ ij hba\h^bl ky \ aZ\bkbfbhklb hl g_kms_c gZlj madb.
 < dZq_kl_ g_kms_]h ljhkZ ijb f_gyxlk y kie_l_ggu_ba klZevguo hpbg-
 dh\Zgguo ij h\hehd dZgZlu i h =HKL 3062-80 beb =HKL 3063-80,]h-
 jyq_dZlZgZyklZev djm]eZy ih =HKL 2590-71. JZkklhygb_f_`^m Zgd_j-
 guf b dj_ie_gbyfb g_kms_]h ljhkZ hi j_^ey_lky \ ijh_dl_b ^he`gh
 [ul v g_[he__ 100 f. JZkklhygb_f_`^m ijhf_` mlhguf b dj_ie_gbyfb

$\Delta h_{gh} [ulv \ g_{[he_{30} f_{ij} \ b_{ijhdeZ} \Delta d_{h^{gh}}] h^{-} \Delta mo \ dZ_{e_c} \ k_{q_{gb}} \ f_{h} 70 \text{ ff}^2, 12 f_{ij} \ b_{ijhdeZ} \Delta d_{[hevr \ ^{-} \Delta mo \ dZ_{e_c} \ k_{q_{gb}} \ f_{70} \text{ ff}^2} \ b_{\backslash h} \ \backslash k_o \ kemqZyo \ ijh \ deZ^{db} \ dZ_{e_c} \ k_{q_{gb}} \ f_{95} \text{ ff}^2 \ b_{\backslash ur}].$ JZ kklhy-
 $gb_{f_{\Delta} m} \ dZ_{evgu} \ f_{b_{ih^{kdZfb} \ ^{he^{gh}} [u_{lv} 0,8 \dots 1 \text{ f.} :gd_{jgu} \ dhgp_{\backslash u} \ dh} \ gkljmdpb} \ b_{\Delta he^{g} \ u_{dj_{ibl} \ vky \ d_{kl_{gZf} \ beb} \ dhehggZf} \ a^{Zgbc}; \ dj_{ie_g} \ b_{bo} \ d_{[ZedZf \ b_n \ _{jfZf} \ g_{\Delta} \ himkdZ_{lky}.$



Jbk. 3.40. MklZ gh\ dZ Zgd_j h\ gZ kl _g_ b h[o\ Zlh\ gZ dhehgg_:

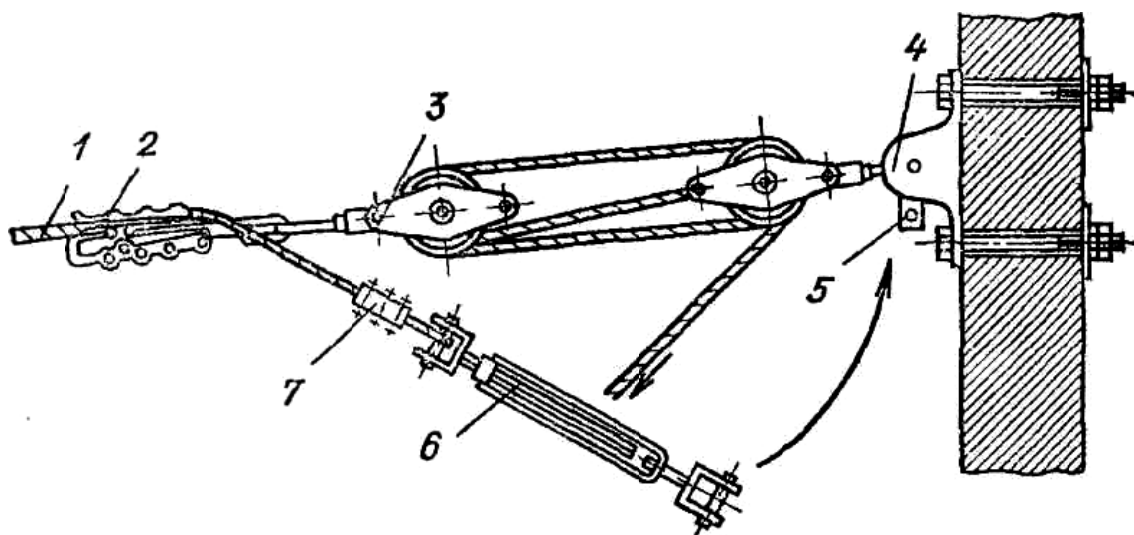
$Z, [- gZ \ kl_g \ k_{dj_{ie_{gb}} \ f_g \ Z[helZ_o; \ \backslash - gZ \ kl_g \ k_{hldb^{ghc} \ ie \ Zgdhc};$
 $] , ^{-} gZ \ dhehgg_{gZ} \ rib \ evdZ_o; \ 1 - Zgd_j; \ 2 - \Delta Z_{bf_{ljkh} \ uc} \ ;$
 $3 - g_{kms} \ bc \ ljkh; \ 4 - [hel; \ 5 - f_{mlZ} \ gZly \ \backslash \ gZy; \ 6 - Zgd_j \ k_{hldb^{gh} \ c \ ieZgdhc};$
 $7 - h[o\ Zl \ dhgp_{\backslash h} \ c; \ 8 - ribev \ dZ; \ 9 - dhehggZ; \ 10 - h[o\ Zl \ ijhf_{\Delta} \ mlhguc$

AZ]hlh\dm g_kmbo ljkh \ b dZ[_e_c, dhf i e_dlh\Z gb_ aZ\h^kdbo
 ba^_ebc b ba]hlh\ e_g b_ dhgklj mdpbc ih q_jl_` Zf ke^m_l ijhba\ h^blv
 gZ fhglZ gh -aZ]hlh\ b l_evguo mqZkldZo AZ]hlh\ e_ggu_ hlj_adb l j hkh\
 b dZ[_e_c g_h[oh^bf h aZfZjdbj h\Zlv b gZfhZl v gZ bg_glZjgu_ [ZjZ-
 [Zgu. :gd_j gu_ mkljhckl\Z ^ he^gu i j bdj_ey l vky d kl_gZf a^Zgbc k
 ihf hsvx ri be_d b [helh\, eb [h ih\hj hlghc hl db^ghc i eZgdb, dhl hjZy
 aZdeZ^u\Z_lk y q_j_a aZ]hlh\ e_ggh_ hl\ _jklb_ \ kl_g_ (jb k. 3.40). Dhg-
 p_{\backslash u} b ijh f_{\Delta} mlhg u_{h[o\ Zl u dj_{iy} l ky gZ dhehggZo a^Zgbc kly`gu-
 fb r ibevdZf b. Ih^t _f b aZdj_ie_gb _ g_kms_]h ljkhZ, jZkdZlZggh]h
 \^he v ljZkku, ijhba\ h^blky k Zlh\ur _d,]b^j hih^t_fg bdh\, ih ^fhk-
 l_c, e_kh\ b l.^

MklZgh\dm gZ Zgd_j_ gZly` ghc fmnl u, aZdj_ie_ggh c gZ dhgp_ g_kms_jh ljhkZ, dh]^Z \lhjhc d hg_p ljh kZ aZdj_ie_g gZ ^jm]hf Zgd_j_, ke_^m_l ijhb a\h^blv gZly`dh c ljhkZ f hglZ`g u fb [ehd Zfb (ihe bkiZ-klhf). >ey wlh]h ljhk ke_^m_l i j_^Zj bl_evgh \ u lygmlv \jmqgmxb aZdj_ie blv _jh \ [ehd_ (j bk. 3.41).

HdhgqZl_evgh_ gZly`_gb _ g_kms_jh ljhkZ b j_]mehjh\dZ klj_eu ijh\ _kZ ijhb a\h^ylky gZly`gu f b fmnl Zfb. Klj _eZ ijh\ _kZ ljhkZ i hke_ijh deZ^db dZ[_e_c ^he`gZ [ulv jZ \ghc 1/40...1/60 ^ebgu ij he_lZ, qlh ^ey ijh e_lZ \ 6f khklZ\ey_l 100...150 ff, Z ^ey ijhe_lZ 12 f 200...300 ff.

JZkdZldm ih^t_f b mdeZ^dm dZ[_e_c \ ih^ \ _kgu_ dZ[_evgu_ dhgkl-jmdpb j_dh f _g^m_lky \uiheg ylv k ijb f _g_gb_f ki_pbZevguo f_ oZgba-fh\ b ijbkih kh[e_gb c. FhglZ` h^gh]h dZ[_ey f h`_l [ul v hkms_kl\ _e_g kh\ f _klgh k f hglZ`h f g_kms_jh ljhkZ. K wlhc p_evx dZ[_ev d ljh km aZdj_ie ey_lky g_ihkj_^k l_ggh gZ a_fe_, k ihfhs vx fhgl Zguo [ehdh\ beb e[_^db hkms_kl\ ey_lky ih^t_f \ f_ kl_k dZ[_e_f b gZly`dZ g_kms_jh ljhkZ, Z Zl_f b d j_ie_gb_ ljhkZ \ Zgd_jguo mkljhckl\Zo. <k_ g_bf_x sb_ hd j Zkdb beb]Zev\Zghihdjul by f_lZe ebq_kdb_ b h]he_ggu_f_kl ZklZevgh]h ljhkZ \gmljb i hf_s_gb c, Z lZd` _klZevghc ljhk g Z\k_f ijhl y`_gbb ijb ijhd eZ^d_ \g_ ihf_s_ gbc g_aZ\ bkbfb hl gZebqby ih-dju lby ^he` gu [ulv i hdjulu kfZadh (gZijbf _j, kheb^ hehf). < gmljb ihf _s_gby klZevghc ljhk, b f_xsbc]Zev\Zghi hdjulb_, ihdju \Z_lky kfZadhc lhev dh \ l_o kemqZyo_ keb hg f h`_l ih ^_j]Zlv ky jZajmr_gbx ih^ ^_ckl\b_ f Zlj_kkb\ghc hdj mZxs_c kj_^u \ i jhp_kk_ wdkiemZZpb.



Jbk. 3.41. MklZgh\d Z gZ Zgd_j_ gZly`g hc fmnl u:
1 - ljhk g_kms bc; 2 - aZ`b f fhglZ`g u c; 3 - ihebk iZkl; 4 - Zgd_j;
5 - kh^bgbl_evgy i eZgdZ_fmnl u; 6 - fmnl Z gZly`gZy ; 7 - aZ`bf l jhkh\uc

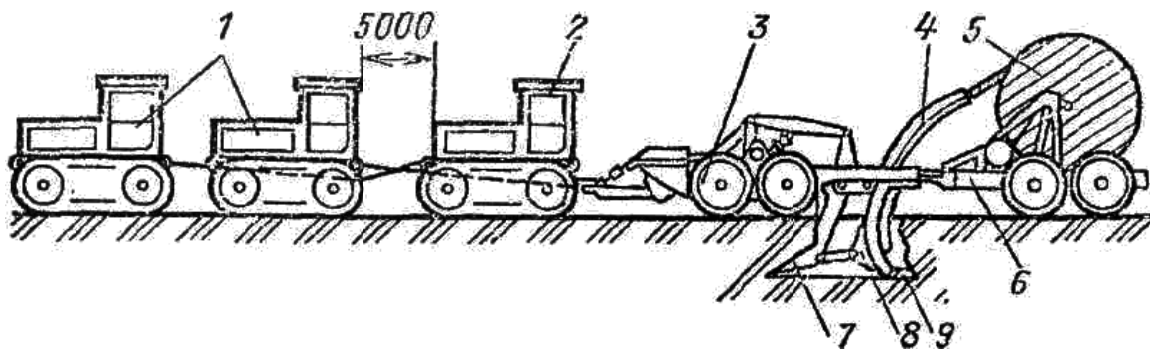
AZsblZ dZ[_e_c, ijheh`_ gguo hl djulh gZ \ha^mo_, hl kheg _qguo emq_c ^he`g Z hkms_kl\eylvky \ khhl_ lkl\bb k mdZaZgyfb, ijb_ ^_g-guf b \ ijh_d l_.

3.10. ;_klj Zgr_cg Zy ijhde Z^dZ dZ[_ey \ a_f e_

;_kljZg r _cgZy ijhdeZ^dZ kbeh\h]h [jh gbjh\Zgg h]h dZ[_ey \ k\bg ph\hc b eb Zexfb gb_hc h [hehq_d_ gZijy`_ gb_f ^h 1 0 d< ^hi mkdZ-_lky kh ki_pbZevguo kZfhoh^guo beb i _j_^b] Z_fuo l y]h\ufb f_oZ-gbaf Zfb dZ[_e_mdeZ^qbdh\ gh` _\h]h lb i Z.

Kihkh[[_kljZg r _cghc ijhdeZ^db dZ[_ey k ihfh s vx dZ[_e_md-eZ^qbdZ gh` _\h]h lb i Z j_dhf_g^m_lky ijb ijh deZ^d_ gZ mqZklZ dZ-[_evguo ljZk k, m^Ze_gguo hl i h^a_fgu o khhj m` _gbc, \] j mglZo i_j\hc, \lhj hc b lj_ lv_c dZl_hjbc (i_kqZguo b]ebgb kluo) [_ a h]jZgb q_gbc f_kl ijb f_g_ gby b ^ebgu ijhd eZ^u\Z_fuo dZ[_e_c.

JZa[b\d ZljZkku gZ f_klg hklb ^he` gZ ijh ba\h^blv ky \ khhl_ lkl-\bb k ijh_dl hf b jZa f_qZlvky_oZfb, j Zkklhygb_f`^m dhlhju f b hi-j_^_ey_lky i j_^ehf\ b^bfhkl b b j_ev_nhf f_k l ghklb. > h gZqZeZj Z[h] ih i j hdeZ^d_ ljZkkZ ^he`gZ [ulv hqb s _gZ hl i g_c, \uj h\g_gu [m]ju]jmg]Z, \uih eg_gu kt _a^u q_j _a h]jZ] b ^ey ih ^]hlh\db jZ[hq_c ahgu ijh oh^Z dZ[_e_mdeZ^bdZ.



Jbk. 3.42. IjhdeZ^ dZ dZ[_ey dZ[_e_mæZ^qbdhf:

1 – lj Zdlhj lbiZ 100 F; 2 – l jZdlhj lb i Z 100 F; 3 – dZ[_e_mæZ^qbd lbiZ DM-150; 4 – \oh^ghc ehld dZkk_lu; 5 – [ZjZ[Zg k d Z[_e_f; 6 – dZ[_evguc l j Zgkihjl_j l biZ LD; 7 – gh`; 8 – dZkk_lZ ^ey dZ [_ey; 9 – dZ[_ev

JZ[h]Z dZ[_e_mæZ^qbdZ gh` _\h]h lbiZ hkgh\ZgZ gZi jbgpbi _jZk-debgb\Zgby]j mglZ b l[jZah\Zg by \ g_f s_eb rb j bghc ^h 100 ff b]em-[bg hc ^h 1,2 f hl mj h\gy ih_ joghklb a_feb. < h[jZah\ Zrmxky s_ev ih f_j_ ijh ^b`_gb y dZ[_e_mdeZ^qbdZ q_j_a i jbdj_ie _ggmx d gh`m dZkk_lm mdeZ^u\Z_lky dZ[_ev, kfZlu\Z_fuc k [Zj Z[ZgZ, iklZgh\ e_ggh]h gZ dZ[_evghf ljZgki hjl_j_. Mkljhckl \h «ihkl _eb», ij bkuidZ dZ[_ey

f_edhc a_fe_c b f_oZgbq_kdZy aZsblZ dZ[_ey ijb wlhf g_ lj_[mxlky. AZkuidZ dZ[_ey ijhba\h^blky ljmglhf, jZaj_aZ_fuf gh`hf dZ[_e_md-eZ^qbdZ ijb _lh i_j_^b`_gbb.

GZ jbk. 3.42 ihdZaZgZ [_kljZgr_cgZy ijhdeZ^dZ dZ[_ey dZ[_e_md-eZ^qbdhf lbiZ DM-150. < aZ\bkbfbhklb hl dZl_]hjbb ljmglZ b j_ev_nZ f_klghklb i_j_^b`_gb_ dZ[_e_mdeZ^qbdZ b dZ[_evgh]h ljZgkihjl_jZ lbiZ LD;-5 beb LD;-6 k [ZjZ[Zghf k dZ[_e_f fh`_l hkms_kl\eylvky lj_fy-k_fvx ljZdlhjZfb lbiZ L-100F beb L-100F;=

Kj_^gyy kdhjhklv ijhdeZ^db dZ[_ey jZgZ 2,4 df/q. <h ba[_`Zgb_ ih\j_`^_gby dZ[_ey dZ[_e_mdeZ^qbd ^he`_g ieZ\gh i_j_^b]Zlvky ih ljZkk_ [_a j_adbo lheqdh\ b lhjfh`_gbc.

Ijb ijhdeZ^d_ ke^m_l f_jghc ieZgdhc dhgljhebjh\Zlv aZ]em[e_-gb_ dZ[_ey \ ljmgl q_j_a dZ^u_ 20...50 f. ?keb]em[bgZ aZeh`_gby dZ[_ey hdZ`_lky g_ ^hklZlhqghc, lh ijhdeZ^dZ ^he`gZ [ulv ijbhklZgh\ e_-gZ b ijh^he`_gZ lhevdh ihke_ mk ljZg_gby ijbqbgv \ua\Z_r_c hldeh-g_gb_ hl ghjfu (hqbklZ hl dhjg_ c, m^Ze_gb_ ihkljhggbo ij^f_lh\, [hevrh_ gZly`_gb_ dZ[_ey, g_h[oh^bfhklv kf_gu gh`_c b l. i.). Hl-dehg_gb_]em[bgu aZeh`_gby dZ[_ey hl ijh_dlghe ^himkdZ_lky \ ij_^eZo 50 ff.

Ijb ijhdeZ^d_ g_h[oh^bfh mqblu\Zlv kljhbl_evngx ^ebgm dZ[_e_c gZ [ZjZ[ZgZo, qlh[u kh^bgbl_evgu_ fmnlu ijbh^bebkv \ f_k-lZo m^h[guo ^ey fhglZ`Z b wdkiemZlZpbb, b g_ hdZaZebkv \ aZ[hehq_g-guo f_klZo, h\jZ]Zo b l. ^. I_j_^ hdhgqZgb_f jZafhldb dZ[_ey k h^gh]h [ZjZ[ZgZ dhg_p _]h \gZoe_kl kdj_ie y_lky k dhgphf dZ[_ey ^jm]h]h [ZjZ-[ZgZ. <]hj^Zo beb ihk_edZo gZ mqZklZ, bf_xsbo ih^a_fgu_ dhffm-gbdZpbb b i_j_k_q_gby k bg`_g_jgufb khjm`_gbyfb, [_kljZgr_cgZy ijhdeZ^dZ dZ[_e_c aZij_sZ_lky.

3.11. AZa_fe_gb_ dZ[_e_c b dZ[_evguo dhgkljmdpbc

AZa_fe_gb_ f_lZeebq_kdbo h[hehq_d b [jhgb dZ[_ey, f_lZeebq_-kdbo dhjimkh\ fmn l b dhgkljmdpbc, gZ dhlhjuo jZkiheh`_gu dZ[_eb b fmnlu, ijhba\h^blky ^ey [_ahiZkghklb h[kem`b\Zxs_]h i_jkhgZeZ, Z lZd`_ ^ey ij^hojZg_gby k\bgph\hc beb Zexfbg_b\hc h[hehqdb hl \u-ieZ\ e_gby \ jy^_ lhq_d ijb ijh[h_ baheypbb dZ[_ey gZ a_fex.

< dZ[_evguo ebgyo d qZklyf, ih^e`Zsbf aZa_fe_gbx, hlghkylky f_lZeebq_kdb_ h[hehqdb b [jhgy kbeh\uo b dhgljhevguo dZ[_e_c, f_lZe-ebq_kdb_ dZ[_evgu_ kh^bgbl_evgu_ b dhgp_\u_ fmnlu, f_lZeebq_kdb_ dZ[_evgu_ dhgkljmdpbb, ehldb, dhjh[Z, ljhku, gZ dhlhjuo mdj_ie_gu dZ[_eb, klZevgu_ ljm[u, \ dhlhjuo ijheh`_gu dZ[_eb (\ ihf_s_gbyo).

;jhgy b f_lZeeb q_kdb_ h[hehqdb dZ_e_c ^ he`gu b f_lv gZ^` gu_ kh^bg_gby i h \k_c ^e bg_ dZ[_evghc eb gbb f_` ^m kh[hc b k f_lZe ebq_- kdbf b dhjimk Zfb kh^bgbl_ev guo b dhg p_\uo f mml.

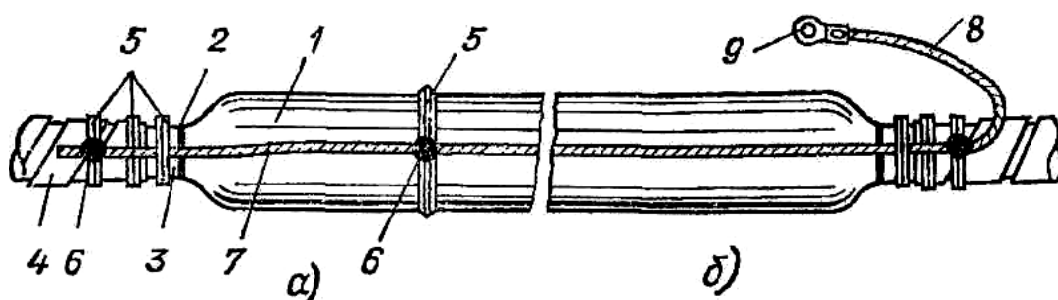
Kh^bg_gb_ [jh gb b h[h ehqdb k kh^bgbl_ev guf b dhgp_\ufb fmn1Zfb \ui hegy_lky k ihfhs vx]b[d bo fgh] hijh\heh qguo f ^guo ijh\ h^gbdh\ GZ dhgrZo dZ[_evguo eb gbc f^g u_ ijh\h ^gbdb i j bkh_- ^bgyslky d f ZjkljZe b aZa_fe_gby.

K_q_gb_ aZa_feyxsbo f gh]hijh \hehqguo f^guo ijh\h^ gbdh\ ^ey kbeh\uo dZ[_e_c i j b hlkml kl\bb ^j n]bo mdZZgbc \ i j h_dl_ ^he`gh [ul v g_f_g_:

K_q_gb_`be dZ[_e_c, ff ²	K_q_gb_ ijh\ h^gbdZ aZa_fe_gby, ff ²
^h 10	6
16, 25, 35	10
50, 70, 95, 120	16
150, 185, 240	25

<uiheg _gb_ g_ij_ju\gh klb aZa_fe_gby dZ_ey \ f_klZo kh^bg_- gby kljhbl_e vguo ^e bg dZ[_ey k ihfh s vx k\bg ph\uo k h^bgbl_ev guo fmn1 hkms_kl\ey_lky ihke^h \Zl_evgu f kh^bg_gb_f i j h\h^gb dZ aZ- a_fe_gby k i hfhsvx i Zcdb d [j hg_ b h[hehqdb dhgpZ h^gh]h dZ[_ey, aZ- l_f d k\bgph \hc fmn1 _(\ p_gl j _ _), Z Z_l_f d h[hehqdb [jhg_ ^j n]h]h dhgpZ dZ[_ey(jbk. 3.4 3).

< l_o kemqZyo, h]^Z k\bgph\Zy f mnlZ aZ bsZ_lky]_jf_lb qguf dh`nohf, ij h\h^ aZa_f e_gby ^he`g [u lv ijbk h^bg_g d [jhg_ 1Zdbf h[jZ ahf, qlh [u hklZe bkv k[h h^gu_ dhg pu ^ey i j bkh^bg_gby d [helZf aZa_f e_gby dh`moZ.



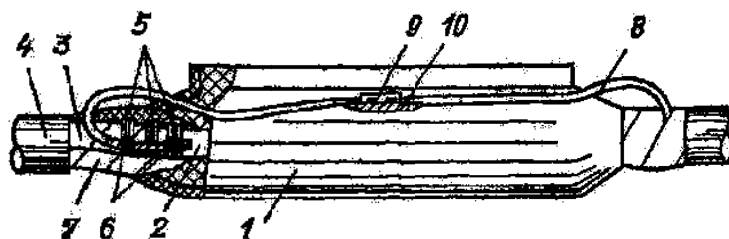
Jbk. 3.43. AZa_fe_gb_k \bgph\hc kh^bgbl _evghc fmn lu:

Z-f mnlZ ij^g ZagZq_gZ^eymdeZ^db \ g_]_jf_lbqgu c dh`mo lbi ZDaQ;

[-f mnlZ ij^g ZagZq_gZ^eymdeZ^db \]_jf_lbqguc dh`mo lbiZ DaQ=;

1 - f mnlZ k\bgph\Zy f Zjdb KK; 2 - f_klh i j biZcdb f m lu d h[he hqd_ dZ[_ey;
3 - h[hehqdb dZ[_ey; 4 - [j hgy ba iehkdbo klZevg u o e_gl; 5 - [Zg^Z^b ba hpbgdh\Zgghc
ij h\hehdb; 6 - f_klh ijb i Zcdb ijh\ h^gbdZ aZa_f e_gby; 7 - f ^guc fg h]hijh\hehq guc
ij h\h^gbd aZa_fe_gby; 8 - dhg_p ijh \h^gbdZ aZa_fe_gby ^e y ijbkh^bg _gby ih^ [h el;
9 - hij_k kh\Zgguc g Zd hg_qgbd

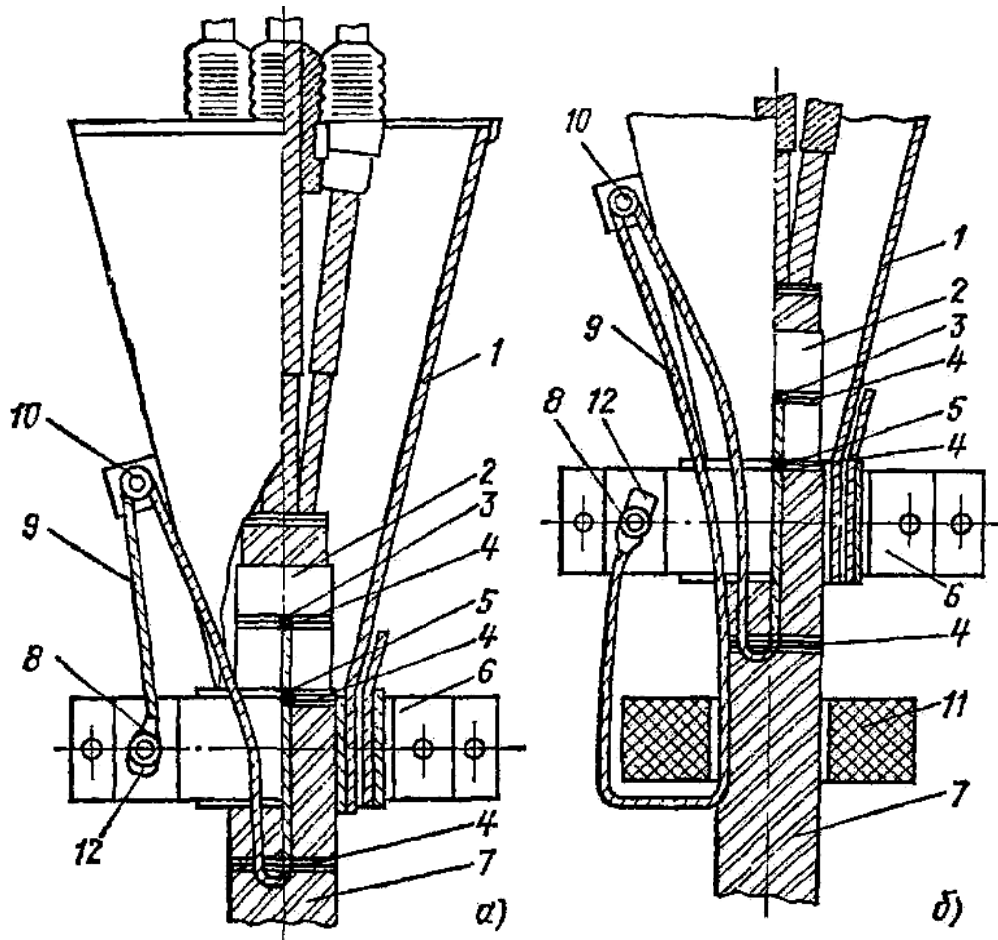
<uiheg _gb_ g_i j _ju\ghk l b aZa_fe_gby \ f _klZo kh^bg_gby dZ[_e_c k ihfhs vx wihdkb^guo kh^bgbl_evguo fm n l \uih egy lky k i hfh-svx kh^bg_gby ijh\ h^gbdZ aZa_fe_gb y, khklhys _]h ba ^\mo hlj _adh\, dhlhj u_ ijb i Zb\Zxlk y d h[he hqdZf b [jhg_e_g lZf h[hb o dhgph\ dZ[_e_c k ihfhs vx iZcd b. Kh^bg_gb_ hlj_adh\ i jh\h^gb dZ aZa_fe_gby f_ ^m kh[hc hkms_kl\ey_lky \ kh^bgbl_evghc f^ghc]beva_ k i hfh-svx hij_kkh \db. Ijh \h^ aZa_f e_gby ^he`g [u l v \ ihe b\bgbeoe hjb^ghc baheypbb beb k gZ^_lhc gZ g_]h ihe b\bgbeo ehjb^ghc ljm[dhc, eb[h g_bahebjh\Z gguf k i h^fhldhc ba oehi qZlh[mfZ`ghc e_glu, ijh f ZaZg-ghc whdkb^g u f dhfi Zmg^hf (j bk. 3.44).



Jb k. 3 44. Kh^bg_gb_ i jh\h^gb dhf aZa_f e_gby dhgph\ dZ[_ey \ wihdkb^ghc kh^bgbl_evghc f m l _: 1 – dhjimk f m l _ u, 2 – f_lZe ebq_kdZy h[hehqdZ dZ[_ey; 3 – [jhy ba i ehkdbo e_gl; 4 – ^mlh \uc ihdjh; 5 – [Zg^Z`b ba hpbgdh\Zgguo ijh\heh d, 6 – f_k l h ijb iZcd b ijh\h^gbdZ aZa_fe_gby; 7 – _jff_lb abjmxsZy ih ^fhldZ; 8 – ijh\h^gbd aZa_fe_gby \ iheb\bgbeo ehjb^ghc h[hehqd_ ; 9 – hij_kkh\ZggZy f^gZy]bev aZ, 10 – bahebjmxsZy ih^f hldZ ijh\h^ gbdZ aZa_fe_gby b]bevau

>ey dhg p_\uo f m l b dhg p_\uo aZ^_ehd ^ebgZ ijh\ h^Z aZa_fe_gby \u[bjZ_lky lZdhc, ql h[u h[_k i _qblv _]h ijbkh ^bg_gb_ d h[heh qd_ b [jhg_ dZ[_ey b d aZa_f eyxs_ f m [helm f_lZeebq_kdh]h dhjimkZ f mlu. K\h[h^guc dhg_p ij h\h^Z aZa_fe_gby, hdhgph\Zgguc gZdhg_ogbdhf iml_f k\Zjdb, iZcdb beb hij_kkh\db, i j bkh^bgy_lky d aZa_feyx s_fm [hel mhihjgh c dhgklj mdpbb f mlu beb aZ^_edb (j bk. 3.4 5). Ijh\h ^ ^ey aZa_f e_gby i j bkh^bgy_lky d k\bgph\h c beb Zex fbgb_\h c h[heh qd_ dZ[_ey ijb ih f hsb [Z g^Z`Z ba hpbgdh\Zgguc kl Zevghc i j h\hehd b ^bZ-f_lj hf 1...1, 5 ff k i hke^mxs_c ijb i Zcdhc ij bih_f I HKK m 30...0,5. Ij_ ^\Zjbl_e vgh f_kl h ijb iZc db d h[heh qd_ ^he`gh [u l v l s Z l _evgh hqbs _gh b h[em`gh : k\bgph\Zy h[heh qdZ – ij bih_f f Zjdb I HKK m 30...0,5, Z Zx fbgb_\ Zy – ijb i h_f fZjd b :.

Ijbkh ^bg_gb_ i jh\h^Z d [jhg_ i j hba\h^b lky ^ey e_glhqgh c [jh-gb d h[_bf [j hg_e_g l Zf, Z ^ey i jh\heh qghc [jh gb — ih hdjm`gh klb dh \k_f ijh\he hdZf. F_klZ ijbk h^bg_gby ^he`g u [ulv i j _^\Zjbl_evgh hqbs _gu ^h [e_kdZ b h[em`g u ijb i h_f I HK K m 30...05, ihke_wlh]h ijh\ h^ ^ey aZa_fe_gb y dj_ibl ky [Zg^Z`hf ba hpbgdh\Zgguc klZevghc ijh\ hehd b ^bZf_ljh f 1...1,5 ff b ijb i Zb\Z_lky l_f`_ i j bih_f. Em`_gb_ b iZcdZ i j hba\h^y lky k ijb f_g_gb_ f iZyevgh]h `bjZ.



Jbk. 3 45. AZa_fe_gb_dhgp_uo aZ^_ehd D<;:

Z - [a l]Zg knhjfZlhj Z lhdZ; [- k l]Zgknhjf Zlhjfh lhd Z;
 1 - f_l Zeebq_kdbcdhjimk aZ^_edb; 2 - h[hehq_d h^gh` bevguo dZ_e_c \ k_lyo
 aZa_fe_gby d h[hehq_d; 4 - [Zg^Z; 5 - f_klh iZcdb ijh \h^ghdZ aZa_fe_gby d [jhg_ - kdh[Z;
 7 - [jhgy; 8 - f_klh ijbkh ^bg_gby ijh \h^ghdZ aZaf_e_gby d kdhf_ ; 9 - ijh \h^ghd aZa_fe_gby;
 10 - f_klh ijbkh ^bg_gby ijh \h^ghdZ aZaf_e_gby
 d dhjimkm aZ^_edb; 11 - l jZgknhjf l hj lhdZ; 12 - gZdhg_qghd

AZa_fe_gb_f_lZ eebq_kdbo h[hehq_d h^gh` bevguo dZ_e_c \ k_lyo
 i_j_f_ggh]h lhdZ \ui hegy_lky \ khhl_ lkl\bb k mdZaZgyfb, ijb\ _^_g-
 guf b \ ijh_ dl. AZaf_e_gb_klZevguo ehldh\ b dhjh[h\ ^he`gh i jhba-
 \h^b lvky g_f_g__q_f \ ^\mo f_klZo, dZd ijZ\b eh, gZ h[hbo dhgpZo eb-
 gbc. Djhf_l h]h, dZ^ h_hl_l \e_gb_ ^hihegl_ evgh aZaf_ey_lky \ dhg-
 p_ _]h. < l_o kemqZyodh]^Z ehldb beb dhjh[Z b kihevamx lky \ dZq_kl_
 aZaf_eyxsbo ijh\h^ gbdh\, ^he`gZ [ulv h[k_i_q_gZ g_ij_ju\ ghklv
 we_djbq_kdhc p_ib.

<k_f_l Zeebq_kdb_qZklb, ijb_fgy _fu_ ij b ijhdeZ ^d_ dZ[e_c gZ
 ljhk Zo, \dex qZy b g_kmsbc l jhk, ^he`gu [ul v aZa_fe_gu. G_kn_sbc
 ljhk g_h[oh^bfh aZa_f_eylv \ ^\mo f_klZo - k ij hlb\hihe h`guo d hgph\
 - iml_f_jZat_fgh]h k h^bg_gby _]h]b[dbfb i_ j_fuqdZ f b k aZaf_eyx-
 sbf b ijh\h^ gbdZfb b eb k ihf_hsvx k\ Zjdb.

:gd_jgu_, ijhf_`mlhqgu_, hihjgu_ b ih^`kgu_ dZ[_evgu_ dhg-
kljmdpbb aZa_feyxlky q_j_a ljhk iml_f iehlgh]h b gZ^`gh]h dhglZdlZ
f_`^m gbfb. F_klZ dj_ie_gby ljhkZ b dhgkljmdpbc ^he`gu [ulv aZqb-
s_gu ^h f_lZeebq_kdh]h [e_kdZ b kfZaZgu khklZ\hf PB:LBF.

KlZevgu_ ljm[u, bkihevam_fu_ ^ey aZa_fe_gby, ^he`gu bf_lv gZ-
^`gu_ kh_`bg_gby. Ijb hldjulhc ijhdeZ^d_ fh]ml ijbf_gylvky ohjh-
rh aZlygmlu_ fmnlu gZ kmjbd_ k dhglj]Zcdhc gZ klhjhg_ ^ebggh]h mqZ-
kldZ j_av[u (k]hg) beb bgu_ dhgk ljmmdpbb, ^Zxsb_ gZ^`guc dhglZdl.
Ijb kdjulhc ijhdeZ^d_ ^he`gu ijbf_gylvky lhevdh fmnlu gZ kmjbd_,
ijbq_f hgb ^he`gu [ulv ^hihegbl_evgh ijb\Zj_gu k dZ^`hc klhjhg
\ h^ghc-^`mo lhqdZo.

Ijb lhgdhkl_gguo ljm[dZo g_evay j_dhf_g^h\Zlv ijb\Zjdm fmnl
beb ^jm]bo kh_`bgbl_e_c g_ikhj_`^kl`_ggh gZ fhglZ`_ ba-aZ \hafh`gh-
]h ijh`h]Z lhgdhc kl_gdb ljm[u. Ihwlhfm ijb ijhdeZ^d_ wlbo ljm[p_-
e_khh[jZagh ij_`^Zjbl_evgh \ fhglZ`guo fZkl_jkdbo m dhgph\ hl`ev-
guo ljm[ijb\Zjb\Zlv klZevgu_ neZ`db, Z aZl_f gZ f_kl_ fhglZ`Z ijb-
\Zjb\Zlv f_`^m neZ`dZfb i_j_fuqdb beb k\Zjb\Zlv neZ`db f_`^m kh-
[hc. Dhjhldb_ hlj_adb ljm[, ij_`gZagZq_ggu_ ^ey f_oZgbq_kdhc aZsb-
lu dZ[_evguo ebgbc b ijhoh^ysb_ q_j_a kl_gu beb i_j_djulby, ^himk-
dZ_lky g_ aZa_feylv, _keb \k_ ijheh`_gggu_ \ gbo dZ[_eb bf_xl f_lZe-
ebq_kdmx h[hehqdm beb _keb ihf_s_gby, \ dhlhju_ \oh^yl dhgpu ljm[,
hlghkylky d dZl_lhjbb [_a ih\ur_gghc hiZkghklb.

3.12. FZjdbjh\dZ dZ[_evguo ebgbc

I_j_` k^Zq_c \ wdkiem ZlZpbx gZ \k_o ijheh`_ggguo dZ[_eyo, Z lZd-
`_ gZ \k_o fmnlZo b dhgp_\uo aZ^_edZo ^he`gu [ulv mklZgh\`e_gu fZj-
dbjh\hqgu_ [bjdb. ;bjdb ^he`gu mklZgZ \eb\Zlvky gZ dhg_qguo imgdlZo
m dhgp_\uo aZ^_ehd, \ dheh^pZo b dZf_jZo [ehqghc dZgZebaZpbb.

GZ hldjulh ijheh`_ggguo dZ[_eyo \ dZgZeZo, ijhba\h^kl`_ggguo
ihf_s_gbyo, dhee_dlhjZo, lmgg_eyo [bjdb ^he`gu [ulv mklZgh\`e_gu m
dhgp_\uo aZ^_ehd, kh_`bgbl_evguo fmnlu, \ f_klZo ih\hjhlZ ljZkku, k
h[_bo klhjhg ijhoh^Z q_j_a f_`wlZ`gu_ i_j_djulby b kl_gu, \ f_klZo
\oh^Z dZ[_e_c \ ljZgr_b b ^jm]b_ bg`_g_jgu_ khhj_m`_gby, Z lZd`_ gZ
ijyfhebg_cgguo mqZkldZo q_j_a dZ^`u_ 50...70 f_ljh\.

GZ [bjdZo h[hagZqZxl fZjdm dZ[_ey, ghfbgZevgh_ gZijy`_gb_,
qbkeh b k_q_gb_ `be, ghf_j beb gZbf_gh\Zgb_ dZ[_evghc ebgb, Z gZ
[bjdZo m fmnlu b aZ^_ehd - lZd`_ ghf_j fmnlu, ^Zlm fhglZ`Z b nZfb-
ebx dZ[_evsbdZ, fhglbjh\Z\r_]h fmnlu.

=E:<: 4. WDKIEM:L:PB Y B J?FHGL D:;?EVGUO EBGBC

4.1. WdkiemZlZpby dZ[_evguo ebgbc

4.1.1. Hkfhlj

Ijb l_ogbq_kdhf h[kem`b\Zgbb dZ[_evguo ebgbc (DE) i_jbh^b-q_kdb ijh\h^yl bo hkfhlju k p_evx \bamZevgh]h h[gZjm`_gby g_bk-ijZ\ghkl_c b ^_n_dlh\ . DE gZ gZijy`_gb_ ^h 35 d<, ijheh`_ggu_ hl-djulh, ^he`gu hkfZljb\Zlvky g_ j_`_ 1 jZaZ \ 6 f_kyp_\; ijheh`_ggu_ \ a_fe_ - g_ j_`_ 1 jZaZ \ 3 f_kypZ.

G_ j_`_ 1 jZaZ \ 6 f_kyp_\ \u[hjhqgu_ hkfhlju DE ^he`gu ijh-\h^blvky Z^fbgbkljZlb\gh-l_ogbq_kdbf i_jkhgZehf. <g_hq_j_`_gu_hkfhlju DE ^he`gu ijh\h^blvky \ i_ jbh^ iZ\h^dh\ b ihke_ eb\g_\uo ^h^_c, dh]^Z \hafh`gu k^b]b ihq\ u b ihiZ^Zgb_ ljmglh\uo \h^ \ ih^a_fgu_ dZ[_evgu_ khhjm`_gby, Z lZd`_ ihke_ hldexq_gby DE j_-e_cghe aZsblhc. Ijb hkfhljZo ljZkk DE, ijheh`_gguo \ a_fe_, ijh_-jy_lky gZebqb_ agZdh\ ijb\yadb ebgbb d ihklhygguf hjb_glbjZf (beb ibd_lh\ gZ g_aZkljh_gghc l_jjblhjb), h[hagZqZxsbo ljZkkm. GZ ljZkk_ DE g_ ^he`gh [ulv \kimqb\Zgby beb ijhk_`Zgby ljmglZ, g_ ^he`gh ijhba\h^blvky dZdbo-eb[h jZ[h], jZkdhihd, kdeZ^bjh\Zgby kljhbl_ev-guo fZl_jbZeh\, k\Zehd fmkhjZ.

IjZ\beZfb hojZgu we_dljbq_kdbo k_l_c ^ey DE, ijheh`_gghc \ a_f-e_, mklZgZ\eb\Z_lky hojZggZy ahgZ \ jZaf_j_ 1f k dZ`^hc klhjgu hl djZcgbo dZ[_e_c. Ex[u_ jZ[hlu \ hojZ gghc ahg_ DE ^he`gu \uihegylvky k jZaj_r_gby b ih^ gZ[ex^_gb_f hj]ZgbaZpbb, wdkiemZlbjmxs_c DE.

< f_klZo \uoh^Z dZ[_ey ba a_feb, gZijbf_j gZ kl_gm a^Zgby beb hih-jm <E, ^he`gZ [ulv aZsblZ dZ[_ey hl f_oZgbq_kdbo ih\j_`^_gbc. Hkfhlj-ju DE, ijheh`_gguo \ dZ[_evguo khhjm`_gbyo (lhgg_eyo, wklZdZ^Zo b ^jm]bo), ^he`gu ijh\h^blv ^Z q_eh\ _dZ. < i_j\mx hq_j_`^v ijh\jy_lky k ihfhsvx jZahZgZebaZlhjZ hlkmlkl\b_ \ dZ[_evguo khhjm`_gbyo jZah\, kh-klhygb_ hk_s_gby b \glbeypbb. Ijh\jy_lky h[s_ khklhygb_ dZ[_ev-guo khhjm`_gbc, gZebqb_ kj^kl\ ih `Zjhlmr_gby, hlkmlkl\b_ ihklhjhg-gbo ij_`f_lh\ . <k_ f_lZeebq_kdb_ dhgkljmdpbb dZ[_evguo khhjm`_gbc ^he`gu [ulv ihdjulu g_hjxqbf Zglbdhjjhabcguf khklZ\hf.

DZ[_evgu_ lmgeeb ^he`gu [ulv h[hjm^h\Zgu kj_`kl\Zfb ^ey hl-\h^Z eb\g_\uo b ihq_gguo \h^ . Wlb kj_`kl\Z ^he`gu gZoh^blvky \ bk-ijZ\ghf khklhygbb.

Ih l_fi_jZlmj_ \gmljb dZ[_evguo khhjm`_gbc dhk_ggh dhgljh-ebjm_lky l_ieh\hc j_`bf dZ[_e_c. L_fi_jZlmjZ \ha^moZ \gmljb khhjm-`_gbc ^he`gZ ij_\urZlv l_fi_jZ lmjm gZjm`gh]h \ha^moZ g_ [he_ q_f gZ 10 °K.

GZ hldjulh ijheh`_gguo dZ[_eyo ^he`gu [ulv klhcdb_ d \ha^_c-
kl\bx hdjm`Zxs_c kj_^u [bjdb, ijbdi_iey_fu_ \ gZqZe_ b \ dhgp_ dZ-
[_ey b q_j_a 50 f. GZ wlbo [bjdZo mdZau\Zxlky: fZjdZ b k_q_gb_ dZ[_ey,
gZijy`_gb_, ghf_j beb ^jm]h_ mkeh\gh_ h[hagZq_gb_ ebgb. GZ [bjdZo
fmnl ^he`gu [ulv hlf_q_gu gh f_j fmnl b ^ZlZ __ fhglZ`Z .

Ijh_jy_lky khklhygb_ Zglbdhjjhabcgh]h ihdjh\Z f_lZeebq_kdbo
h[hehq_d dZ[_e_c, jZkkhygby f_^m dZ[_eyfb, khklhygb_ kh_^bgbl_ev-
guo b dhgp_\uo dZ[_evguo fmnl, hlkmkl\ b_ ke_^h\ \ul_dZgby fZkeZ
beb dZ[_evghc fZklbdb.

<k_ aZf_q_ggu_ ijb hkfhljZo ^_n_dlu b g_bkijZ\ghklb DE aZgh-
kylky \ ebklhd hkfhljZ. Wlb ^_n_dlu b g_bkijZ\ghklb \ aZ\bkbfhklb hl
bo oZjZdl_jZ mkljZgyxk y ijb l_dms_f l_ogbq_kdhf h[kem`b\Zgbb. Ih-
j_^_gby Z\Zjbcgh]h oZjZdl_jZ ^ he`gu [ulv mkljZg_gu g_f_^e_ggh.

4.1.2. >himklbfu_ gZ]jmadb ijb wdkiemZlZpbb

>ey dZ`^hc DE ijb \h^_ \ wdkiem ZlZpbb mklZgZ\eb\Z_lky ^himk-
lbfZy lhdh\Zy gZ]jmadZ. WlZ gZ]jmaZ hij_^_ey_lky ih mkeh\bx, qlh l_f-
i_jZlmjZ `be dZ[_ey [m^_l g_ \u r_^ebl_evgh ^himklbfhc ghjfbjm_fhc
l_fi_jZlmju , ^hi (2, 14) >ey dZ[_e_c k [mfZ`ghc ijhiblZgghc baheypb-
_c \ebqbgZ , ^hi aZ\bkbl hl ghfbgZevgh]h gZijy`_gby U_{ghf} (lZ[e. 4.1).

L Z [e b p Z 4.1

$U_{ghf}, d<$	$^h 3$	6	10	20	35
, ^hi, ° K	80	65	60	55	50

>ey dZ[_e_c:

- k baheypb_c ba ihebwlbe_gZ b iheb\bgbeohjb^Z , ^hi = 70° K;
- k baheypb_c ba krbhl]h ihebwlbe_gZ , ^hi = 90° K;
- k j_abgh\hc baheypb_c , ^hi = 65° K.

I_j_j_ baheypbb dZ[_ey \ur_ , ^hi aZf_lgh mkdhjy_l ijhp_kk __
klZj_gby b, ke_^h\Zl_evgh, khdjZsZ_l kjhd kem`[u dZ[_ey.

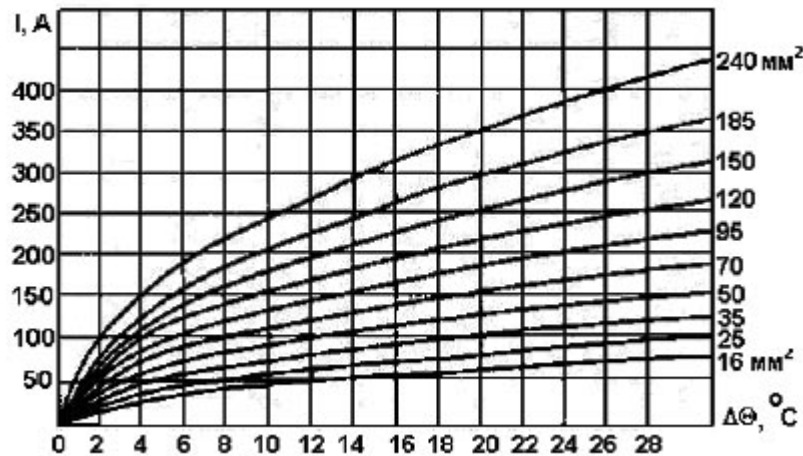
G_ihkj_^kl_ggh_ baf_j_gb_ l_fi_jZlmju `beu dZ[_ey ij_^klZ_-
ey_l agZqbl_evgu_ ljm^ghklb. Ihwlhfm ^ey ijh_jdb l_ieh[h]h j_bfZ
dZ[_ev gZ]jm`Zxl lhdhf b kgbfZxlky ihdZaZgby l_jfh^Zlqbdh\, mklZ-
gh\egguo gZ klZevghc [jhg_ (h[hehqdb beb reZg]_) dZ[_ey. L_fi_jZ-
lmjZ `beu dZ[_ey , jZkkqblu\Z_lky ih nhjfme_:

$$, \cdot = , [+'', \quad (4.1)$$

]^_ , [- l_fi_jZlmjZ [jhgb (h[hehqdb beb reZg]Z), baf_j_ggZy ijb bk-
iulZgbb; ", - ij_ur_gb_ l_fi_jZlmju `beu dZ[_ey gZ^ l_fi_jZlm-
jhc [jhgb h[hehqdb beb reZg]Z).

<_ebqbgZ", jZkkqblu\Z_lky ih wfibjbq_kdhc nhjfme_ beb hij_-
^_ey_lky ih ghfh]jZffZf (7, 24). H^gZ ba lZdbo ghfh]jZff ^ey dZ[_e_c
k Zexfbgb_\ufb`beZfb, gZoh^ysboky \ wdkiemZlZpbb hl 5 ^h 25 e_l,
ijb_^_gZ gZ jbk. 4.1.

Lhdh\Zy gZ]jmadZ DE, ijb dhlhjhc, $\Delta\theta =$, $\Delta\theta_{hi}$, khhl_lkl_m_1 ^himk-
lbfhc ^ebl_evghc gZ]jmad_.



Jbk. 4.1. JZaghklv l_fi_jZlmj f_ ^m [jhgc b
Zexfbgb_\ufb`beZfb dZ[_e_c gZijy`_gb_f 10 d<

< ijZdlbq_kdhc wdkiemZlZpbb ^_ckl_bl_evghmx lhdh_mx gZ]jmadm
dZ[_ey I khihklZ\eyxl k ^ebl_evgh ^himklbfuf lhdhf $I_{\Delta\theta_{hi}}$, ijb\h^bfuf
\ kijZ\hqghc ebl_jZlmj_ [2]. >ebl_evghc j_`bf jZ[hlu dZ[_ey kqblZ-
_lky ^himklbfuf ijb \uiheg_gbb mkeh\by:

$$I < kI_{\Delta\theta_{hi}}, \quad (4.2)$$

]^_k – ihijZ\hqguc dhwnnbpb_gl.

IjbgbfZ_fu_ ih kijZ\hqguf ^Zgguf [2] ihijZ\hqgu_ dhwnnbpb-
_glu mqblu\Zxl j_Zevghmx l_fi_jZlmjm hoeZ^Zxs_c kj_ ^u, dhebq_kl-
\h dZ[_e_c \ a_feyghc ljZgr_, m^_evgh_ l_ieh\h_ khihhlb\^_gb_ ljmg-
lZ, kjhd kem`[u dZ[_ey b ^jm]b_nZdlhju.

Ijb wdkiemZlZpbb DE ^himkdZxlky djZldh\j_f_ggu_ i_j_ljmadb,
gZijbf_j, gZ i_jbh^ ebd\b^Zpbb Z\Zj bb [1]. >himklbfu_ i_j_ljmadb dZ-
[_e_c gZijy`_gb_f ^h 10d< \ aZ\bkbfhklb hl \b^Z baheypbb khklZ\eyxl:

- dZ[_eb k [mfZ`ghc baheypb_c – gZ 30 %;
- baheypb_c ba ihebwlb_e_gZ b iheb\bgb_eohjb^Z – gZ 15 %;
- j_abgu – gZ 18 %;
- krbhljh ihebwlb_e_gZ – gZ 25 %;

>ey dZ[_e_c kh \k_fb \b^Zfb baheypbb, gZoh^ysboky \ wdkiemZlZ-
pbb [he__ 15 e_l, i_j_]jmadb ^he`gu [ulv kgb`_gu ^h 10 %. MdZaZg-

gu_ i_j_]jmadb ^himkdZxlky ijh^he`bl_evghklvx g_ [he__ 6 qZkh\ \ kmlldb \ l_q_gb_ 5 kmlhd. KmffZjgZy ijh^he`bl_evghklv i_j_]jmadb \]h^ g_ ^he`gZ ij_\urZlv 100 q.

>ey dZ[_e_c gZijy`_gb_f 20...35 d< k [mfZ`ghc baheypb_c i_j_-]jmadb g_ ^himkdZxlky [1].

Dhgljhev gZ]jmahqgh]h j_`bfZ DE hkms_kl\ey_lky kgylb_f ljZ-nbdh\ gZ]jmadb, \uihegy_fuf g_ j_`_ 2 jZa \]h^ . Ijbq_f h^bg jZa dhgljhev hkms_kl\ey_lky \ i_jbh^ abfg_]h fZdkbfmfZ gZ]jmadb.

4.1.3. IjhnbeZdlbq_kdb_ baf_j_gby b bkiulZgby

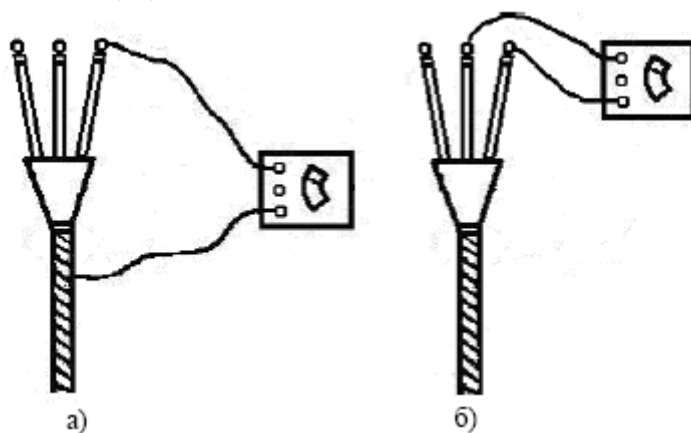
Hkh[h_ \gbfZgb_ ijb l_ogbq_kdhf h[kem`b\Zgbb DE m^_ey_lky dZ[_evghc baheypbb. H^gbf ba kj_`kl\ dhgljhey khklhygby baheypbb y\ey_lky baf_j_gb_ __ khijhlb\e_gby, \uihegy_fh_ f_]Zhff_ljhf.

Ko_fu baf_j_gby nZaghc b f_`^mnZaghc baheypbb dZ[_ey ihdZaZgu gZ jbk. 4.2. Hlkq_1 _ebqbg khijhlb\e_gby baheypbb hkms_kl\ey_lky ijb[ebabl_evgh q_j_a 1 fbgmlm ihke_ gZqZeZ ijhp_kkZ baf_j_gby.

Khijhlb\e_gb_ baheypbb dZ[_e_c gZ gZijy`_gb_ ^h 1 d< ^he`gh [ulv g_ f_g__ 0,5 FHf. Khijhlb\e_gb_ baheypbb dZ[_e_c gZ gZijy`_gb_ \ur_ 1 d< g_ ghfbjm_lky.

We_dljbq_kdZy ijhqghklv baheypbb DE ijh_jy_lky bkiulZgb_f ih_ur_gguf \uijyfe_gguf gZijy`_gb_f. <_ebqbgZ bkiulZl_evgh]h gZijy`_gby U_{bki} b ^ebl_evghklv_]h ijbheh`_gby $t \setminus aZ \setminus bkbfbhklb$ hl \b-^Z dZ[_evghc baheypbb ijb_^_gu \ lZ[e. 4.2.

BkiulZl_evgh_ gZijy`_gb_ ijbdeZ^u\Z_lky ihhq_j_`gh d dZ^`hc `be_ dZ[_ey, ijb wlhf ^_ ^jm]b_ `beu dZ[_ey b_]h f_lZeebq_kdZy h[hehdZ (wdjZg) ^he`gu [ulv aZa_fe_gu. BkiulZl_evgh_ gZijy`_gb_ ih^gbfZ_lky ieZ\gh kh kdhjhklvx 1... 2 d</c ^h lj_[m_fh]h agZq_gby b ih^^_j`b\Z_lky g_baf_gguf \ l_q_gb_ \j_f_gb, mdZaZggh]h \ lZ[e. 4.2. Ijb ijh_^_gbb bkiulZgbc ih_ur_gguf gZijy`_gb_f baf_jyxlky lh-db ml_qdb b bo g_kbff_ljby ih nZaZf.



Jbk. 4.2. Baf_j_gb_ khijhlb\e_gby nZaghc (Z) b f_`^mnZaghc (l) baheypbb dZ[_ey

$U_{ghf}, d<$	$\wedge h 1$	3	6	10	20	35
;mfZ`gZy ijhiblZggZy baheypby						
$Ubki, d</ t, fbg$	2,5/5	15...25/5	36/5	60/5	100/5	175/5
IeZklfZkhh\Zy b KIW baheypby						
$Ubki, d</ t, fbg$	2,5/5	7,5/5	36/5	60/5		
J_abgh\Zy baheypby						
$Ubki, d</ t, fbg$		6/5	12/5	20/5		

Baheypby dZ[_ey kqblZ_lky m^h\ e_l\ hjbl_evghc, _keb g_ ijh-
bahreh __ ijh[hy, Z lhdb ml_qdb b dhwnnbpb_gl g_kbff_ljbb wlbo lh-
dh\ ih nZaZf g_ ij_\ukbeb agZq_gbc, ijb_ ^_gguo \ lZ[e. 4.3.

$U_{ghf}, d<$	6	10	20	35
$I_{ml}, f:$	0,2	0,5	1,5	1,8
$I_{ml} \max / I_{ml} \min$	2	3	3	3

M dZ[_e_c k ieZklfZkhh\hc aZsblghc h[hehqdhc (reZg]hf) ^h-
ih egbl_evghf bkiulZgbyf ih\ur_gguf \uijyfe_gguf gZijy`_gb_f
ih^[_j]Z_lky aZsblgZy h[hehqdZ. BkiulZl_evgh_ \uijyfe_ggh_ gZijy-
`_gb_ - 10 d< \ l_q_gb_ 1 fbg ih^Z_lky f_`^m f_lZeebq_kdhc h[hehq-
dhc (wdjZghf) b a_fe_c. Ijb g_mki_rguo bkiulZgbyo hlukdb\Z_lky f_-
klh ih\j_`^_gby ieZklfZkhh\hc h[hehqdb b \uihegy_lky __ j_fhgl.

GZ _jlbdZevguo mqZkldZo dZ[_e_c gZijy`_gb_f 20...35 d< k [m-
fZ`ghc baheypb_c dhgljhebjm_lky hk mr_gb_ baheypbb. Wlhl dhgljhev
hkms_kl\ey_lky k ihfhsvx l_jfhf_ljh\, mdj_ie_gguo gZ [jhg_ dZ[_ey \
_jog_c, kj^_g_c b gb`g_c qZklyo _jlbdZevgh]h mqZkldZ. JZaghklv ihdZ-
aZgbc l_jfhf_ljh\ [he__ q_f gZ 2...3 °K k\b^_l_evkl\m_l h kbevghf hkm-
r_gbb baheypbb b gZqZ\r_fky ijhp_kk_ __ ijh[hy. < wlhf kemqZ_ _jlb-
dZevguc mqZklhddZ[_ey ^he`_g [ulv \u_ ^_g ba wdkiemZlZpbb b aZf_g_g.

M h^gh`bevguo dZ[_e_c, kh[jZgguo \ lj_onZagmx]jmiim, baf_jy-
_lky lhdhjZkij^_e_gb_. G_jZghf_jghklv jZkij^_e_gby lhdh\ ih nZ-
aZf ^he`gZ [ulv g_ [he__ 10 %.

Ihke_ hlkh^bg_gby dZ[_ey hl h[hjm^h\Zgby, ijhnbeZdlbq_kdbo
bkiulZgbc, fhglZ`Z beb i_j_fhglZ`Z dZ[_evguo fmnI ^he`gu [ulv
ijh_j_gu nZabjh\dZ dZ[_ey b p_eklgghklv _]h `be. Kmsgghklv nZab
jh\db aZdexqZ_lky \ ijh_jd_ khhl_lk \by nZa :, < b K dZ[_ey nZaZf
:, < b K, gZijbf_j, jZkij^_ ebl_evgh]h mkljhckl\Z, d rbgzf dhljh]h
ih^dexqZ_lky dZ[_ev ihke_ hlkh^bg_gby.

Hij_^_e_gb_ p_ekhlghklb `be \uihegy_lky f_]Zhff_ljhf. Baf_-
j_gby khijhlb\^_e_gb_ ijh\h^yl f_`^m dZ`^hc iZjhc nZa k h^gh]h dhgpZ
dZ[_ey. @beu dZ[_ey gZ ^jm]hf dhgp_ aZfudZxlky f_`^m kh[hc. Ijb
p_euo `beZo dZ[_ey f_]Zhff_lj ijb \ k_o baf_j_gbyo ^he`_g ihdZaZlv
gme_\h_ khijhlb\^_e_gb_.

4.1.4. Hij_^_e_gb_ f_kl ih\j_`^_gby

G_kfhly gZ i_jbh^bq_kdbc hkfhly dZ[_evguo ljZkk b ijh_^_-
gb_ ijhnbeZdlbq_kdbo bkiulZgbc, ijb wdkiemZlZpbb bf_xl f_klh ih-
\j_`^_gby (kemqZcgu_ hldZau) DE. DZd ijZ\beh, wlh ijh[hc baheypbb,
j_`_ - jZaju\ nZa.

Ih\j_`^_gguc dZ[_ev hlkh_`bgy_lky k h[hbo dhgph\ hl h[hjm^h-
\Zgby b k ihfhsvx f_]Zhff_ljZ hij_^_ey_lky oZjZdl_j ih\j_`^_gby:
baf_jy_lky khijhlb\^_e_gb_ baheypbb f_`^m dZ`^hc nZahc b aZa_fe_g-
ghc f_lZeebq_kdhc h[hehqdhc b f_`^m dZ`^hc iZjhc nZa.

Baf_j_gby ijh\h^yl k h^gh]h dhgpZ dZ[_ey. NZagu_ `beu ^jm]h]h
dhgpZ dZ[_ey jZahfdgmlu (^ey hij _^_e_gb_ aZfudZgbc) beb aZfdgmlu b
aZa_fe_gu (^ey hij_^_e_gb_ h[ju\h).

J_amevlZlu baf_j_gbc fh]ml g_ \uy\blv oZjZdl_j ih\j_`^_gby,
ihkdhevdm i_j_oh^gh_ khijhlb\^_e_gb_ \ f_kl_ ih\j_`^_gby fh`_l [ulv
^hklZlhqgh \ukhdbf, \ qZklghklb , ba-aZ aZl_dZgby f_klZ ijh[hy bahey-
pbb fZkehdZgbnhevguf khklZ\hf (aZieu\Zxsbc ijh[hc) \ dZ[_eyo k
[mfZ`ghc ijhiblZggbc baheypb_c. >ey kgb`_gby i_j_oh^gh]h khijh-
lb\^_e_gb_ baheypby dZ[_ey \ f_kl_ ih\j_`^_gby ijh`b]Z_lky.

>ey wlh]h gZ dZ[_ev ih^Z_lky gZijy`_gb_, ^hklZlhqgh ^ey ijh[hy
baheypbb \ f_kl_ ih\j_`^_gby. Ihke_ g_dhlhjh]h \j_f_gb ih\lhj_gby
ijh[h_ \ i_j_oh^gh_ khijhlb\^_e_gb_ \ f_kl_ ih\j_`^_gby mf_gvrZ_lky,
jZajy^gh_ gZijy`_gb_ kgb`Z_lky, Z lhd jZajy^Z m\ebqb\Z_lky. Bahey-
pby ijh`b]Z_lky wlb f_lhdhf, i_j_oh^gh_ khijhlb\^_e_gb_ \ f_kl_ ih\j_-
`^_gby mf_gvrZ_lky.

Ihke_ hij_^_e_gb_ oZjZdl_jZ ih\j_`^_gby \u[bjZ_lky kihkh[b
ZiiZjZlmjZ ^ey hij_^_e_gb_ f_klZ ih\j_`^_gby dZ[_ey. Ih lhqghklb
hij_^_e_gb_ f_klZ ih\j_`^_gby jZaebqZxl hlghkbl_evgu_ b Z[khexl-
gu_f_lh^u.

Hlghkbl_evgu_ f_lh^u bf_xl hij_^_e_ggmix ihlj_rghklv b ih-
a\heyxl hij_^_eblv ebrv ahgm ih\j_`^_gby. Wlh bfimevkguc, i_le_-
\hc b _fdhklghc f_lh^u. Lhqgh_ f_klh ih\j_`^_gby iha\heyxl gZclb
Z[khexlgu_f_lh^u lZdb_, dZd bg^mdpbhgguc b Zdmklbq_kdbc.

Bfimevkguf f_lh^hf hij_^_ey_lky ahgZ h^ghnZagh]h beb fgh]h-
nZagh]h aZfudZgby, ahgZ h[ju\Z ex[h]h dhebq_kl\Z nZaguo `be.

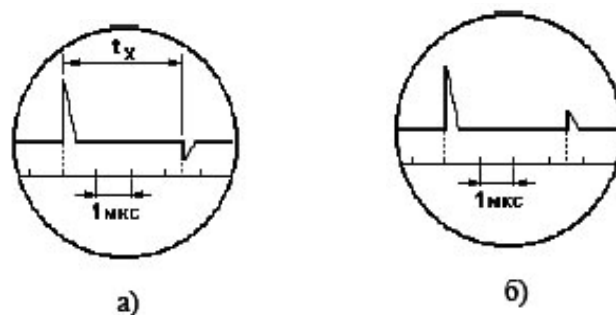
< ih\j_`^_ggmx ebgbx ihkueZ_lky wlZehgguc we_dlj_bq_kdbc bf-
imevk. Ih wdjZgm baf_jbl_evgh]h ijb[hjZ, ijh]jZ^mbjh\Zgghfm \ fdk,

baf_j y_lky bgl_j\Ze \ j_f_gb t_x f_`^m f hf_glhf ih^Zqb bfimevkZ b fh-f_g lhf ijbo h^Z bfimevkZ, hljZ`_ggh]h hl f_klZ i h\j_`^_ gby (jbk. 4.3).

Kdhjhkl v jZkij hkljZg_g by we_dj hfZ]gbl guo \h eg \ kb eh\uo dZ[_eyo ijZ dl bq_kdb g_ aZ\bkl hl k_q_gby b f Z_jbZeZ `be b k hklZ\ey_l 160 ± 3 f/fdk. JZklhygb_ ^h f_klZ ih\ j_`^_gby \uqbky ey_lky dZd

$$l_0 = 80 t_0, f.$$

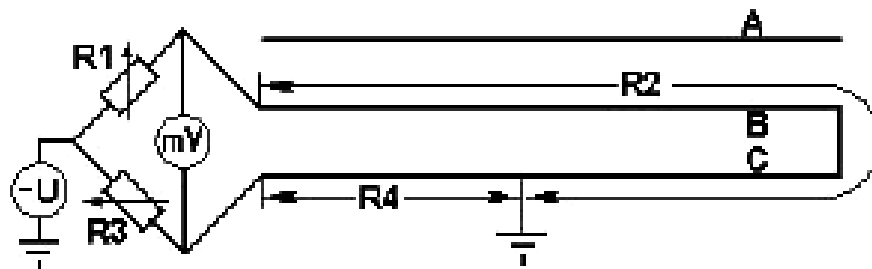
>ey kemqZy, ijb\ _^_ggh]h gZ jbk. 4.3, ahgZi h\j_`^_ gby gZoh^blky gZ jZklhygbb $l_0 = 80 \text{ o } 3,5 = 280 f$ hl f _klZ baf_j_gby.



Jbk. 4.3. WdjZg ij b[hjZ ijb hij_`^_ gbb ahgu i h\j_`^_ gby dZ[_ey bfimevk u f f_lh^ hf: Z-ijb aZfudZgbb; l-ijb h[ju _

Ih agZd mhljZ`_g gh]h bf i mevkZ k^yl h oZj Zdl_j_ ih \j_`^_g by. ?k-eb i hkeZgguc b hljZ`_gguc bfimevk jZagh]h agZdZ -i h\j_`^_ gb_lbiZ aZfudZgb_ (jbk. 4.3, Z), _keb h^gh]h agZdZ- ih\j_`^_ gb_lbiZ h[-ju\ (jbk. 4.3, f).

I_le_\h c f_lh^ i jbf_gy_ lky ^ey hij_`^_ gby ahgu h^ghnZaguo b ^\monZaguo aZfudZgbc gZ a_f ex. Wlh l f_lh^ hkgh\Zg gZ baf_j_gbb hfb q_kdh]h khijhlb\e _gby `b e dZ[_ey ^h f_klZ i h\j_`^_ gby. GZ h^ghf dhgp_ dZ[_ey aZfudZx lky ghj f ZevgZy bih\j_`^_ ggZy `beu (h[j Zam_lky i_ley). Baf_j_gby i jh\h^yl ky k ^jm]h]h dhgpZ dZ[_ey (jbk. 4.4). >ey baf_j_gby khijhlb\e _gbc R_2 b R_4 fh`_l bki hevah\Zl vky, gZij bf_j, fhkl ihklhyg gh]h lhd Z



Jbk. 4.4. Ko_fZ hi j_`^_ gb_ ahgu ih\ j_`^_ gby i_le_\u f f_lh^h f

< h^gm ^bZ]hgZev fhklZ \dexqZ_lky bklhqgbd ihklhyggh]h gZijy-
 ^_gby - U, \ ^jm]mx - baf_jbl_evduc ijb[hj, gZijbf_j fbeeb\hevl-
 f_lj mV. J_]mobjm_fufb khijhlb\^_gbyfb R_1 b R_3 ^hklb]Z_lky jZ\gh-
 kb fhklZ - gme_h_ ihdZaZgb_ fbeeb\hevlf_ljZ. Ba_klgh, qlh jZ\gh_kb_ fhklZ [m^_1 ^hklb]Zlvky ijb \uiheg_gbb khhlghr_gby

$$\frac{R_1}{R_3} = \frac{R_2}{R_4}, \quad (4.3)$$

]^_ R_2 - khijhlb\^_gb_ ghjfZevghc `beu b mqZkldZ ih\j_^_gghc `b-
 eu hl dhgpZ dZ[_ey ^h f_klZ ih\j_^_gby; R_4 - khijhlb\^_gb_ mqZkldZ
 ih\j_^_gghc `beu hl gZqZeZ dZ[_ey ^h f_klZ ih\j_^_gby.

Ihkdhvdm khijhlb\^_gb_ `beu dZ[_ey ijhihpbhgZevgh_]h ^eb-
 g_, ahgZ ih\j_^_gby ihke_ ^hklb`_ gby jZ\gh_kby fhklZ hij_ ^_ey_lky
 g_keh`gufb \uqbke_gbyfb

$$l_x = \frac{2lR_3}{R_1 + R_2}, \quad (4.4)$$

]^_ l - ^ebgZ dZ[_ey.

?fdhklghc f_lh^ iha\hey_1 hij_ ^_eblv ahgm h[ju\Z nZaguo `be
 dZ[_ey. F_lh^ [Zabjm_lky gZ baf_j_gbb _fdhklb f_ ^m dZ^hc `behc b
 aZa_fe_gghc f_lZeebq_kdhc h[hehqdhc dZ[_ey.

Imklv baf_j_ggZy _fdhklv h[hj\Zgghc `beu khklZ\ey_1 K_o , Z baf_-
 j_ggZy _fdhklv p_ehc `beu - K . JZkklhygb_ ^h f_klZ h[ju\Z khklZ\ey_1

$$l_x = l \frac{C_x}{C} \quad (4.5)$$

Ijb h[ju_lj_o nZaguo `be _fdhklv dZ[_ey jZkkqblu\Z_lky ih
 ba_klghfm \ujZ`gbx

$$C = \frac{b_0 l}{314} \quad (4.6)$$

]^_ b_0 - m^_evgZy _fdhklgZy ijh\h^bfhklv dZ[_ey, hij_ ^_ey_fZy ih
 kijZ\hqguf ^Zgguf.

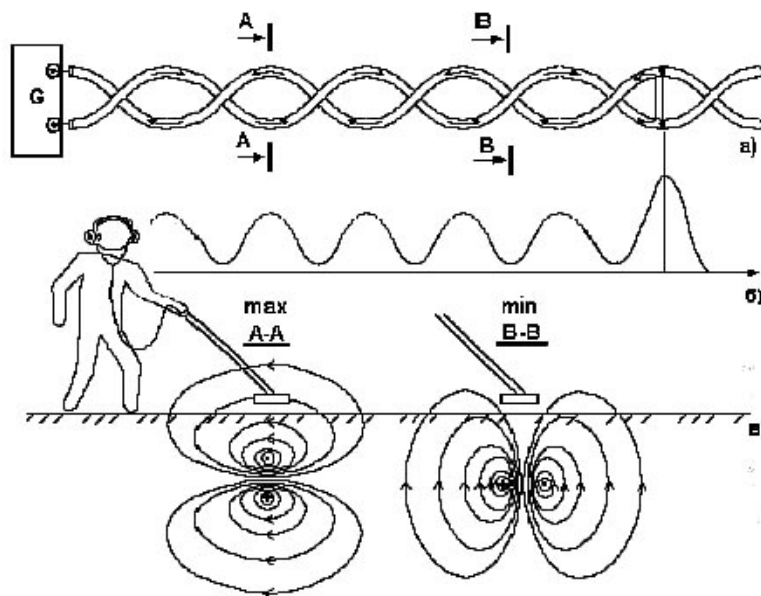
Bg^mdpbhgguc f_lh^ iha\hey_1 hij_ ^_eblv f_klh fgh]hnZaguo
 aZfudZgbc \ dZ[_e_ ihke_ mki_rgh]h ijh`b]Z baheypbb \ f_kl_ ih\j_-
 ^_gby. F_lh^ hkgh\Zg gZ meZ\eb\Z gbb fZ]gblgh]h ihey, kha^Z\Z_fh]h
 \hdjm] dZ[_ey ijhl_dZxsbf ih g_fm lhdhf. MeZ\eb\Zgb_ ihey ijhba-
 \h^blky k ihfhsvx ki_pbZevghc ihbkdh\hc dZlmrdb, bf_xs_c fZ]-
 gblguc k_j^_qgbd ^ey dhgp_gljZpbb ihey.

Ih ^mf ih\j_^_gguf `beZf dZ[_ey ijhimkdZ_lky lhd \ukhdhc
 qZklhlu (800...1000 =p) hl a\mdh[h]h]_g_jZlhjZ G (j bk. 8.5). <hdjm] dZ-
 [_ey h[jZam_lky fZ]gblgh_ ihe_ \ukhdhc qZklhlu. Ihf_klb\ \ wlh ihe_
 ihbkdh\mx dZlmrdb, kh_ ^bg_ggm x q_j_a mkbebl_ev k gZmrdbdZfb, fh`-

gh ijhkemrb\Zlv a\mdh\hc kb]gZe. H [kem`b\Zxsbc i_jkhgZe, ijh^b-
]Zykv ih ljZkk_DE, ijhkemrb\Z_l wlhl a\mdh\hc kb]gZe.

Keurbfhklv kb]gZeZ \^hev dZ[_evghc ebgb [m^_l i_jbh^bq_kdb
baf_gylvky hl max ^h min. Wlh h[tykgy_lky kibjZevguf ih\b\hf `be
dZ[_ey. Ij_h[eZ^Zgb_ gZ^ ih_joghklvx a_feb fZ]gblgh]h ihey h^ghc
`beu i_jbh^bq_kdb f_gy_lky gZ ij_h[eZ^Zgb_ ijhlb\hiheh`gh]h fZ]-
gblgh]h ihey ^jm]hc `beu.

< f_kl_ dhjhldh]h aZfudZgby lhd hl]_g_jZlhjZ G f_gy_l k\h_ gZ-
ijZ\e_gb_, bgl_gkb\ghklv fZ]gblgh]h ihey b, ke_^h\Zl_evgh, keurb-
fhklv kb]gZeZ \ wlhf f_kl_ mkbeb\Zxlky. AZ f_klhf ih\j_`^_gby a\mdh-
\h]h kb]gZeZ g_ [m^_l. Bkihevah\Zgb_ lhdZ \ukhdhc qZklhlu g_h[oh^b-
fh ^ey hkljhcdb a\mdh\h]h kb]gZeZ hl nhgZ ijhfure_gghc qZklhlu 50
=p khk_^gbo dZ[_e_c.



Jbk. 4.5. BeexkljZpby bg^mdpbhggh]h f_lh^Z hlukdZgby ih\j_`^_gby

:dmklbq_kdbc f_lh^ iha\hey_l hij_^eblv f_klh h^ghnZaguo b
fgh]hnZaguo aZfudZgbc \ dZ[_e_ ijb aZieu\Zxs_f ijh[h_.

< ih\j_`^_ggmx `bem (\ ih\j_`^_ggu_ `beu) i_jbh^bq_kdb ih-
^Zxlky bfimevku ihklhyggh]h gZij y`_gby, gZijbf_j, hl gZdhibl_evgh-
]h dhg^_gkZlhjZ. < f_kl_ ih\j_`^_ gby \hagbdZxl jZajy^u, \uau\Zxsbc
Zdmklbq_kdbc rmf. Mjh_gv wlh]h rm fZ ijhkemrb\Z_lky k ih_joghklb
a_feb, gZijbf_j, k ihfhsvx kl_lhkdhZ beb ijb[hjZ k iv_ah^Zlqbdhf-
ij_h[jZah\Zl_e_f f_oZgbq_kdbo dhe_[Zgbc \ we_dlj_bq_kdb_.

Ijb ijZdlbq_kdhf ihbkd_f_kl ih\j _^_gby DE bkihevam_lky kh-q_lZgb_hlghkbl_evguo b Z[khexlguo f_lh^h\ K ihfhsvx hlghkb-l_evgh]h f_lh^Z hij_^_ey_lky ahgZ ih\j_^_gby, Z aZl_f \ wlhc ahg_hlukdb\Z_lky f_klh ih\j_^_gby Z[khexlguf f_lh^hf.

4.2. J_fhgl dZ[_evguo ebgbc

4.2.1. H[sb_mdZaZgby ih j_fhglm

<h \j_fy wdkiemZlZpbb dZ[_evguo ebgbc ih hij_^_e_gguf ijbqb-gZf dZ[_eb, Z lZd^_ kh^bgbl_evgu_ fmnlu b dhgp_\u_ aZ^_edb \uoh-^yl ba kljhy. Hkgh\gu_ ijbqbg_u ih\j_^_gby dZ[_evguo ebgbc gZ-ijy`_gb_f 1...10 d< ke^mxsb_:

- ij^r_kl\mxsb_f_oZgbq_kdb_ ih\j_^_gby – 43 %;
- g_ihkj^kl_gg_u f_oZgbq_kdb_ ih\j_^_gby kljhbl_evgu-fb b ^jm]bfb hj]ZgbaZpbyfb – 16 %.
- ^_n_dlu \ kh^bgbl_evguo fmnluZo b dhgp_\u_ aZ^_edZo \h \j_fy fhglZ`Z - 10 %;
- ih\j_^_gb_ dZ[_ey b fmnlu \j_amevlZl_ hkZ^db ljmgZ – 8 %;
- dhjjhaby f_lZeebq_kdbo h[hehq_d dZ[_e_c – 7 %;
- ^_n_dlu ba]hlh\^_gby dZ[_ey gZ aZ\h^_ – 5 %;
- gZjmr_gby ijb ijhdeZ^d_ dZ[_ey – 3 %;
- klZj_gb_ baheypbb ba-aZ ^ebl_evghc wdkiemZlZpbb beb i_j_-ljmahd – 1 %;
- ijhqb_ b g_mklZgh\^_gg_u ijbqbg_u – 7 %.

Ijb_^_gu kj^_gb_ ^Zgg_u aZ ihke^_gb_ ^_kylv e_l \ Fhkdh\kdhc dZ[_evghc k_lb.

< khhl_lkl\bb k lj_[h\Zgbyfb «Bgkljmdpbb ih wdkiemZlZpbb kb-eh\uo dZ[_evguo ebgbc. Q 1. DZ[_evgu_ ebgb gZijy`_gb_f ^h 35 d<» dZ^Zy dZ[_evgZy ebgby ^he`gZ ih^_\j]Zlvky l_dms_fm beb dZiblZev-ghfm j_fhglm. L_dmsbc j_fhgl fh`_l [ulv Z\Zjbcguf, kjhqguf b ieZgh\uf.

: \Zjbcguf j_fhglhf gZau\Z_lky lZdhc, dh]^Z ihke_ hldexq_gby dZ[_evghc ebgb ihlj_[bl_eb \k_o dZl_]hjbc hklZebkv [_a gZijy`_gby b g_l \hafh`ghklb ih^Zlv gZijy`_gb_ ih dZ[_eyf \ukhdh]h beb gbadh-]h gZijy`_gby, \ lhf qbke_ ih \j _f_gguf reZg]h\uf dZ[_eyf, beb dh-]^Z j_a_j\gZy ebgby, gZ dhlhjmx i_j^ZgZ gZ]jmadZ, g^himklbfh i_j_-]jm`Z_lky b g_l \hafh`ghklb ^Zevg_cr_c jZa]jmadb beb lj_[m_lky h]-jZgbq_gb_ ihlj_[bl_e_c.

D Z\Zjbcghfm j_fhglm ijbklmiZxl g_f^_e_ggh b \uihegyxl _]h g_ij_ju\gh \fbgbfZevgh djZlqZcrbc kjhd b \dexqZxl dZ[_evgmxb-

gbx \ jZ[hlm. < [hevrbo]hjh^kdbo dZ[_evguo k_lyo b gZ djmigu
ijhfure_gguo ij_^ijbylbyo ^ey wlh]h knhjfbjh\Zgu Z\Zjbcgh-
\hkkZgh\bl_evgu_ kem`[u ba [jb]Z^u beb g_kdhevdb [jb]Z^, dhlhju_
^_`mjyl djm]ehkmlhqgh b ih mdZaZgbx ^bki_lq_jkdhc kem`[u g_f^_
e_ggh \u_a`Zxl gZ f_klh Z\Zjbb.

Kjhqguf j_fhghf gZau\Z_lky lZdhc, dh]^Z ijb_fgdbd i_j\hc
beb hkh[h \Z gu_ \lhjhc dZl_]hjbb ebrZxlky Z\lhfZlbq_kdh]h j_a_j_
gh]h iblZgby, Z ^ey ijb_fgbdh\ \k_o dZl_]hjbc gZ]jmadZ gZ hklZ\rboky
dZ[_evguo ebgbyo \uau\Z_l bo i_j_]jmadm beb h]jZgbq_gb_ ihlj_[bl_-
e_c. D kjhqghfm j_fhglm dZ[_evguo ebgbc ijbklmiZxl j_fhglgu_ [jb-
]Z^u ih mdZaZgbx jmdh\h^kl\Z wg_j]hkem`[u \ l_q_gb_ jZ[hq_c kf_gu.

IeZgh\uc j_fhgl - wlh j_fhgl \k_o dZ[_evguo ebgbc, g_ mdZaZg-
guo \ur_, dhlhjuc \uihegy_lky ih ieZgm-jZnbdm, ml_j`^_gghfm jm-
dh\h^kl\hf wg_j]hkem`[u. IeZg-jZnbd j_fhgh\ dZ[_evguo ebgbc kh-
klZey_lky _`f_kyqgh gZ hkgh\ aZ ibk_c \ `mjgZeZo h[oh^h\ b hkfhl-
jh\, j_amevlZlh\ bkiulZgbc b baf_j_gbc, Z lZd`_ ih ^Zgguf ^bki_lq_j-
kdbo kem`[

DZiblZevguc j_fhgl dZ[_evguo ebgbc ijhba\h^blky ih]h^h\hfm
ieZgm, jZajZ[Zlu\Z_fhfm _`_]h^gh \ e_lgbc i_jbh^ ^ey ke_^mxs_]h
]h^Z gZ hkgh\ ^Zgguo wdkiemZlZpbb.

Ijb khklZ\e_gbb ieZgZ dZiblZevgh]h j_fhglZ mqblu\Z_lky g_h[-
oh^bfhklv \g_^j_gby gh\uo, [he__ kh\j_f_gguo lbih\ dZ[_e_c b dZ-
[_evghc ZjfZlmju. IeZgbjm_lky j_fhgl dZ[_evguo khhj_m`_gbc b \k_o
jZ[h], k\yaZgguo k bkijZ\ghklvx hk_s_gby, \glbeypbb, ijhlb\hih-
`Zjguo kj_^kl\, mkljhckl\ ih hldZqd_ \h^u. Mqblu\Z_lky lZd`_ g_h[-
oh^bfhklv qZklbqghc aZf_gu dZ[_e_c gZ hl^_evguo mqZkldZo, efbfblb-
jmxsbo ijhimkdgm kikh[ghklv ebgbc beb g_ m^h\e_l\hjyxsbo lj_-
[h\Zgbyf l_jfbq_kdhc klhcdhklb \ baf_gb\rboky mkeh\byo jZ[hlu k_lb
ijb \hajhkrbo lhdZo dhjhldh]h aZfudZgby

J_fhgl gZoh^ysboky \ wdkiemZ lZpbb dZ[_evguo ebgbc \uihegy_l-
ky g_ihkj_^kl_ggh kZfbf wdkiemZlZpbhguf i_jkhgZehf beb i_jkhgZ-
ehf ki_pbZebabjh\Zgguo we_dljfhghlZ` guo hj]ZgbaZpbc.

Ijb j_fhgl_ wdkiemZlbjm_fuo dZ[_evguo ebgbc \uihegyxlky
ke_^mxsb_ jZ[hlu:

- ih^]hlh\bl_evgu_ - hldexq_gb_ dZ[_evghc ebgbb b __ aZa_fe_-
gb_, hagZdhfe_gb_ k ^hdmf_glZpb_c b mlhqg_gb_ fZjdb b k_q_gby dZ[_-
ey, \uibkdZ gZjy^Z-^himkdZ ih l_ogbd_ [_ahiZkghklb, ih]jmadZ fZl_-
jbZeh\ b bgkljmf_glZ, ^hklZ\dZ [jb]Z^u gZ f_klh jZ[hlu;

- ih^]hlh\dZ jZ[hq_]h f_klZ - \uiheg_gb_ rmjnh\, jZkdhidZ dhl-
eh\Zgh\ b ljZgr_c hij_^_e_gb_ j_fhglbjm_fh]h dZ[_ey, h]jZ`^_gb_
jZ[hq_]h f_klZ b f_kl jZkdhihd, hij_^_e_gb_ dZ[_ey \ JI (LI) beb \

dZ[_evguo khhj m`_gbyo, ijh_jdZ hlkmlkl\by]hjqbo b \aju\hhiZk-
guo]Zah\, ihemq_gb_jZaj_r_gby gZ h]g_u_jZ[hlu;

- ih^]hlh\dZ d fhglZ`m – ^himkd [jb]Z^u, ijhdhe dZ[_ey, jZaj_aZ-
gb_ dZ[_ey beb \kdjlb_ fmnlu, ijh_jdZ baheypbb gZ gZebqb_ \eZ]b
hlj_aZgb_ mqZkldh\ ih_j`^_ggh]h dZ[_ey, mklZgh\dZ iZeZldb;

- ijhdheZ^dZ j_fhglghc dZ[_evghc \klZ\db;

- j_fhgl dZ[_evghc fmnlu – jZa^_edZ dhgph\ dZ[_ey, nZabjh\dZ
dZ[_e_c, fhglZ` kh_`bgb_l_evguo fmnlu (beb fmnlu b aZ^_edb);

- hnhjfe_gb_ hdhgqZgby jZ[h] – aZdjulb_ ^_j_c JM, LI, dZ[_ev-
guo khhj m`_gbc, k^ZqZ dexq_c, aZkuidZ dhleh\Zgh\ b ljZgr_c, m[hjdZ
b ih]jmadZ bgkljmf_g]Z, ^hklZ\dZ [jb]Z^u gZ [Zam, khklZ_e_gb_ bkihe-
gbl_evgh]h wkdbaZ b \g_k_gb_ baf_g_gbc \ ^hdmf_g]Zpbx dZ[_evghc
ebgbb, hlq_l h[hdhgqZgbb j_fhglZ;

- baf_j_gby b bkiulZgby dZ[_evghc ebgbb.

< p_eyo mkdhj_gby j_fhglguo j Z[h] gZ dZ[_evguo ebgbyo ^he`gZ
rbjh dh ijbf_gylvky f_oZgbaZpby ijb \uiheg_gbb a_feyguo jZ[h]:
ig_fZlbq_kdb_ hl[hcgu_ fhehldb, we_dljhfhehldb, [_lhghehf, wdk-
dZ[Z]hju, kj_`klZ ^ey h]h]j_Z f_jaeh]h ljmg]Z.

>ey i_j_hadb j_fhglguo [jb]Z^ ijbf_gyx]ky ki_pbZevgu_ i_j_-
^b`gu_ dZ[_evgu_ fZkl_jkdb_.

J_fhglu dZ[_evguo ebgbc [u\Zxl ijhklu_, g_ lj_[mxsb_ [hev
rbo ljm^haZljZl b \j_f_gb, b keh`gu_, dh]^Z j_fhgl ijh^he`Z_lky g_-
kdhevdh ^g_c.

D ijhkluf j_fhglZf hlghkylky, gZijbf_j, lZdb_, dZd j_fhgl gZ-
jm`guo ihdj h\h\ (^mlh\h]h ihdj h\Z, iheb\bgbeohjb^gh]h reZg]Z),
ihdjZkdZ b j_fhgl [jhg_e_gl, j_fhgl f_lZeebq_kdbo h[hehq_d, j_fhgl
dhgp_uo aZ^_ehd [_a ^_fhglZ`Z dhjimkZ b l. i. I_j_qbke_ggu_ j_fhgl-
lu \uihegyx]ky \ h^gm kf_gm h^ghc [jb]Z^hc (a_ghf).

D keh`guf hlghkylky lZdb_ j _fhglu, dh]^Z ijboh^blky aZf_gylv
[hevr_b_ ^ebgu dZ[_ey \ dZ[_evguo khhj m`_gbyo k ij_`^Zjbl_evgu
^_fhglZ`_f \ur_`r_]h ba jZ[hlu dZ[_ey beb ijhdheZ^u\Zlv \ a_fe_
gh\uc dZ[_ev gZ mqZkld_ ^ebghc g_kdhevdh ^_kyldh\ f_ljh\ (\ j_`dbo
kemqZyo \ khlgf f_ljh).

<uiheg_gb_ j_fhglh\ mkeh`gy_lky \ [hevrbgkl_ kemqZ_ l_f,
qlh dZ[_evgZy ljZkkZ ijhoh^bl ih keh`guf mqZkldZf kh fgh]bfb ih[h-
jhlZfb, k i_j_k_q_gb_f rhkk_cg_uo ^hjh] b bg`_g_jguo dhffmgbdZ-
pbc, ijb [hevrhc]em[bg_ aZe_]Zgby dZ[_ey, Z lZd`_ \ abfg_ _fy,
dh]^Z g_h[oh^bfh hlh]j_Zlv a_fex. Ijb \uiheg_gbb keh`guo j_fhgl-
h\ ijhdheZ^u\Z_lky gh\uc mqZklhd dZ[_ey (\klZ\dZ) b fhglbjmx]ky ^_
kh_`bgb_l_evgu_ fmnlu.

Keh`gu_ j_fhglu \uihegyxlky h^ ghc beb g_kdhevdbfb [jb]Z^Z-fb, Z ijb g_h[oh^bfhklb djm]ehkmlhq gh, k ijb_f_g_gb_f a_fe_jhcguo f_oZgbafh\ b ^jm]bo kj_^kl\ f_oZgbaZpbb.

Keh`gu_ j_fhglu \uihegyxlky beb kbeZfb wg_j]hkem`[u ij_^ijbylby ([jhj^kdbo k_l_c), beb k ijb\ e_q_gb_f ki_pbZebabjh\Zgguo hj]ZgbaZpbc ih fhglZ`m b j_fhglm dZ[_evguo ebgbc.

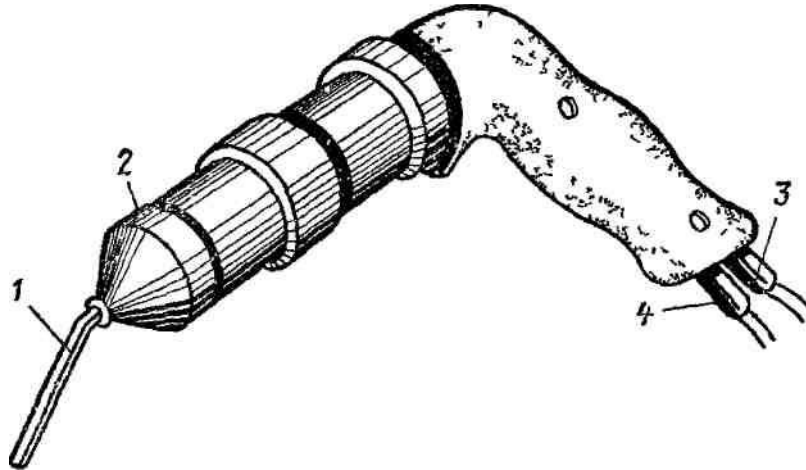
4.2.2. J_fhgl aZsblguo ihdjh\h\

J_fhgl gZjm`gh]h ^`mlh\h]h ihdjh\Z. Ijhlygmluc q_j_a ljm[u, [ehdb beb ^jm]b_ ij_iykl\by dZ[_ev, bf_xsbc kh^jZggmx ijhiblZg-gmx dZ[_evgmx ijj`m b hklZevgu_ gZjm`gu_ ihdjh\ u ^h klZevghc [jhgb, g_h[oh^bfh \hkkZgh\blv. J_f hgl \uihegy_lky ih^fhldhc kfh-eyghc e_glhc \ ^\Z kehy k 50 %-f i_j_djulf_f k ihke_^mxs_c ijhfZa-dhc wlh]h mqZkldZ jZah]j_lhc [blmfghc fZklbdhc F; 70 (F; 90).

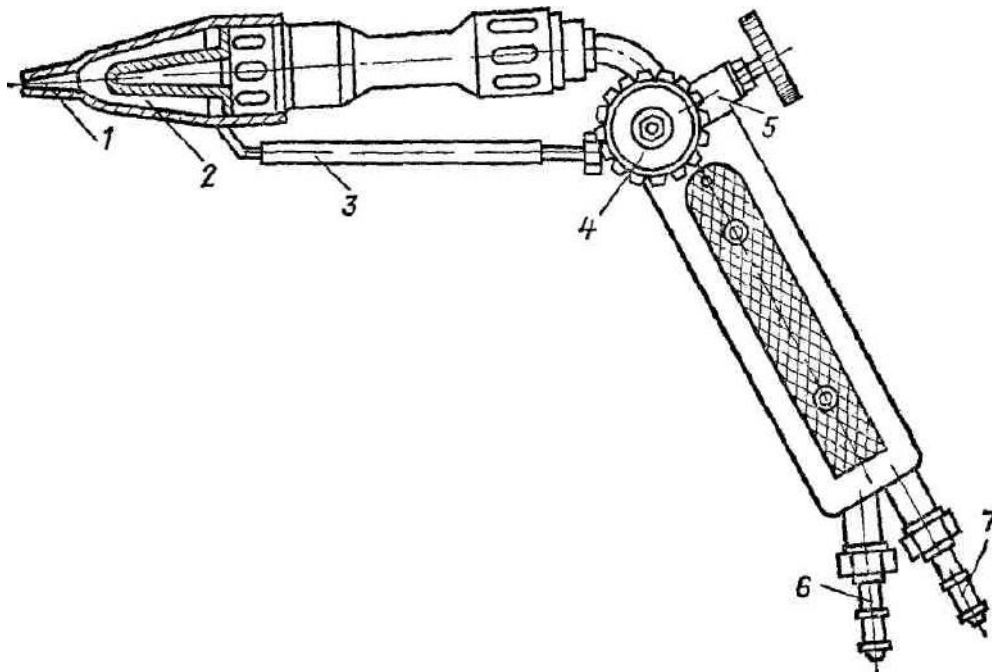
J_fhgl iheb\bgbeohjb^gh]h reZg]Z b h[hehq_d. I_j\uc kihkh[j_fhglZ iheb\bgbeohjb^gh]h reZg]Z beb h[hehq_d - k\ZjdZ, dhlh-jZy \ kljm_]hjyq_]h \ha^moZ (ijb l_fi_jZlmj_ 170...200° K) ijhba\h-^blky k ijb_f_g_gb_f k\Zjhqgh]h ibklhe_lZ k we_dljbq_kdbf ih^h]j_- \hf \ha^moZ (jbk. 4.6) beb \ha^mrguf ibklhe_lhf (jbk 4.7). K`Zluc \ha^mo ijb wlhf ih^h^blky hl dhfij_kkhjZ, [ZeehgZ kh k`Zluf \ha^m-ohf, i_j_ghkgh]h [ZeehgZ k jmqguf gZkhkhf.

< dZq_kl\ ijbkZ^db ijb k\Zjd_ ijb_f_gy_lky iheb\gbeohjb^guc ijmlhd ^bZf_ljhf 4...6 ff.

I_j_^ k\Zjdhc f_klZ, ih^e`Zsb_ j_fhglm, g_h[oh^bfh hqbklblv b h[_a`bjblv [_gabghf, dZ[_evguf gh` hf \uj_aZlv ihkljhgg_b_ \dex-q_gby b kj_aZlv \ f_klZo ih\j_`^_gby reZg]Z \uklmiZxsb_ djZy b aZ-^bj. >ey j_fhglZ ijhdheh\ g_[hevrbo hl\ _jklbc b jZdh\bg f_klh ih-\j_`^_gby \ reZg]_ beb h[hehq_d b dhg_p ijbkZ^hqgh]h ijmlldZ ijh]j_- \Zxl \ l_q_gb_ 10...15 kh kljm_c]hjyq_]h \ha^moZ, aZl_f kljmx hl\h-^yl, Z dhg_p ijmlldZ ijb`bfZxl b ijb\Zjb\Zxl d reZg]m \ f_kl_jZ-ah]j_\Z.



Jbk 4.6. K\Zjhqguc ibklhe_l IK-1 k we_dlj_bq_kdbf ih^h]j_\hf:
 1 – khieh^ey\ uoh^Z jhyq_\h \ha^moZ; 2 – gZlj_\Zl_evGZy \ha^mrgZy dZf_jZ;
 3 – rlmp_j^ey ih^Zqb k^Zlh]h \ha^moZ; 4 – ijh\h^ we_dlj_hjh\h^db



Jbk. 4.7. =Zah\ha^mrguc ibklhe_l:
 1 – khieh^ey\ uoh^Z jhyq_\h \ha^moZ; 2 – gZlj_\Zl_evGZy \ha^mrgZy dZf_jZ; 3 – j_abgh\Zy ljm[dZ;
 4 – djZg^ey \ha^moZ; 5 – djZg^ey ijhiZg-[mlZgZ; 6 – rlmp_j^ey ih^Zqb k^Zlh]h \ha^moZ;
 7 – rlmp_j^ey ih^Zqb ijhiZg-[mlZgZ

Ihke_ hoeZ^_gby, m[_^b\rbkv \ ijhqghklb ijb\Zjdb ijmlDZ e_-
 dbf ih^_j]b\Zgb_f_\h, ijmlhd hlj_aZxl.

>ey]_jf_lbaZpbb b \ujZgb\Zgby k\Zjhqgh]h r\Z f_klh j_fhglZ
 ijhlj_\Zxl ^h ihy\e_gby ijbagZdh\ ieZ\e_gby, ihke_ wlh]h d jZah]j_-
 lhfm f_klm ijb^bfZxl jmdhc dmkhd dZ[_evghc [mfZ]b, keh`_gghe \
 ljb-q_luj_ kehy. >ey gZ^_`ghklb hi_jZpbx ih\lhjyxl 3...4 jZaZ.

>ey j_fhglZ reZg]Z beb h[hehqdb, bf_xs_]h s_eb, ijhj_ab b \u-
j_au, dhg_p ijbkZ^hqqh]h ijmlDZ ijb\Zjb\Zxl d p_ehfm f_klm reZg]Z
gZ jZkklhygbb 1...2 ff hl f_klZ ih\j_`^_gby.

M[_^b\rbkv \ ijhqghklb ijb\Zjdb, gZijZ\eyxl kljmx \ha^moZ
lZd, qlh[u h^gh\j_f_ggh ijh]j_\Zebkv gb`gyy qZklv ijbkZ^hqqh]h
ijmlDZ b h[_ klhjghu ijhj_ab beb s_eb. E_]dbf mkbeb_f, gZ`bfZy gZ
ijmlhd , ihke_^gbc mdeZ^u\Zxl b ijb\Zjb\Zxl \^hev s_eb beb ijhj_ab.
Ijb\Zjdm ijmlDZ aZdZgqb\Zxl gZ p_ehf f_kl_ gZ jZkklhygbb 1...2 ff hl
ih\j_`^_gby. AZl_f gh`hf kj_aZxl \uklmiZxsb_ ih_joghklb ijmlDZ
b ijhba\h^yl \ujZ\gb\Zgb_ k\Zj_ggh]h r\Z.

JZaju\ u reZg]Z beb h[hehqdb j_fhglbjmxl k ijb_f_g_gb_f iheb\b-
gbeohjb^guo aZieZl beb jZaj_aZggu o fZg`_1. AZieZlZ ba]hlh\ey_lky ba
ieZklbdZlZ lZd, qlh[u djZy __ gZ 1,5...2 ff i_j_ dju\Zeb f_klh jZaju\Z.
AZieZlm ih \k_fm i_jbf_ljm ijb\Zjb\Zxl d reZg]m, Z aZl_f \^hev h[jZah-
\Zr_]hky r\Z ijb\Zjb\Zxl ijbkZ^hqqguc ijmlhd, Z \uklmiZxsb_ ih-
_joghklb ijmlDZ kj_aZxl b ijhba\h^yl \ujZ\gb\Zgb_ r\Z \ f_kl_ k\Zjdb.

>ey j_fhglZ reZg]Z beb h[hehqdb k ijb_f_g_gb_f jZaj_aghc fZg-
`_lu hlj_aZxl dmkhd iheb\bgeohjb^ghc ljm[db gZ 35...40 ff [hev-
r_ ^ebgu ih\j_`^_ggh]h f_klZ, jZaj_aZxl ljm[dm \^hev b gZ^_\Zxl __
gZ dZ[_ev kbff_ljbqgh f_klm ih\j_`^_gby. FZg`_lm \j_f_ggh aZdj_i-
eyxl iheb\bgeohjb^ghc beb fbldZe_hc e_glhc k rZ]hf 20...25 ff,
ijb\Zjb\Zxl dhg_p ijmlDZ \ f_kl_ kludZ fZg`_lu kh reZg]hf (h[hehq-
dhc), Z aZl_f mdeZ^u\Zxl b ijb\Zjb\Zxl ijmlhd \hdjm] lhjpZ fZg`_lu.
Ihke_ ijb\Zjdb h[hbo lhjph\ fZg`_lu d reZg]m (h[hehqd_) kgbfZxl
e_glu \j_f_ggh]h dj_ie_gby, ijb\Zj b\Zxl ijmlhd \^hev jZaj_aZ fZg-
`_lu, kj_aZxl \uklmiZxsb_ ih_joghklb ijmlDZ b ijhba\h^yl hdhgqZ-
l_evgh_ \ujZ\gb\Zgb_ \k_o k\Zjguo r\h\.

Ih \lhjhfm kihkh[m j_fhgl iheb\bgeohjb^guo reZg]h\ b h[h-
ehq_d dZ[_e_c fh`gh \uihegylvky k ijb_f_g_gb_f wihdkb^gh]h dhfiZmg-
^Z b kl_dehe_glu. Ih_joghklv reZg]Z beb h[hehqdb ij_^\Zjbl_evgh h[-
jZ[Zlu\Z_lky, dZd mdZaZgh \ur_, b ^hihegbl_evgh gZ g_c kha^Z_lky r_-
jhoh\Zlhklv k ihfhsvx ^j Zq_\h]h gZibevgbdZ. F_klh ih\j_`^_gby b aZ
]h djZyfb gZ jZkklhygbb 50...60 ff \ h[klhjghu kfZau\Z_lky wihd-
kb^guf dhfiZmg^hf D-I5 beb D-I6 k _\^_gguf \ g_]h hl_j^bl_e_f.
Ih kehx wihdkb^gh]h dhfiZmg^Z gZdeZ^u\Zxlky q_luj_-iy lv keh_ kl_d-
ehe_glu, dZ`^uc ba dhlhjuo lZd`_ ijhfZau\Z_lky keh_f dhfiZmg^Z.

<j_f_gguc j_fhgl reZg]h\ b h[hehq_d \ p_eyo ij_^\hl\jZs_gby
ijhgbdg\gby \eZ]b ih^ h[hehqdm dZ[_ey, Z lZd`_ ^ey ij_^\hl\jZs_gby
\ul_dZgby [blmfgh]h khklZ\Z ba-ih^ reZg]Z jZaj_rZ_lky \uihegylv k
ihfhsvx ebidhc iheb\bgeohjb^ghc e_glu k 50 %-f i_j_djulb_f \
ljb kehy k ijhfZadh c_jog_]h kehy iheb\bgeohjb^guf eZdhf < 1.

Ih \lhjhf m kihkh[m \j_f_gguc j_fhgl \uihegy_lky e_glhc EWLK:J \lj b kehy k 50 %-f i_j_djulg_f.

IhdjZkdZ [jhg_e_gl. Ijb h[gZjm`_gbb \h \j_fy h[oh^h\ \dZ[_evguo khjm`_gbyo gZ hldjulh ijheh`_gguo dZ[_eyo jZajmr_gbc [jhg_ihdjh\h\ dZ[_ey dhjjhab_c \uihegy_lky bo ihdjZkdZ. J_dhf_g-^m_lky ijb_f_gylv l_jfhklhcdh_i_glZnlZe_\u_ eZdb IN-170 beb IN-171 (=HKL 15907-70) beb l_jfhklhcdmx fZkeh[blmfgmx djZkdm ;L-577 (=HKL 5631-79). Emqrbf kihkh[hf ihdjZkdb y\ey_lky ijb_f_g_gb_djZkdhjZkiuebl_ey, Z ijb _]h hlkmkl\bb - dbklb.

J_fhgl [jhg_e_gl. GZ hldjulh ijheh`_gguo dZ[_eyo h[gZjm`_ggu_mqZkldb jZajmr_gguo [jhg_e_gl h[j_aZxlky b m^Zeyxlky. < f_klZo hlj_aZgguo e_gl \uihegyxlky \j_f_ggu_ [Zg^Z`b. Jy^hf k \j_f_gguhf [Zg^Z`Zfb h[_e_glu lsZl_evgh aZqbsZxlky ^h f_lZeebq_kdh]h [e_kdZ b h[em`b\Zxlky ijbih_f IHKKm 30-2, ihke_q_]h ijh\h^ aZa_fe_gby dj_iblky [Zg^Z`Zfb ba hpbgdh\Zgghc ijh\hehdb ^bZf_ljhf 1...1,4 ff b ijbizb\Z_lky wlb_f`_ ijbih_f. K_q_gb_ ijh\h^gbdZ aZa_fe_gby \u[bjZ-_lky \aZ\bkbfbklb hl k_q_gby `be dZ[_ey, gh g_f_g_ 6 ff ².

Ijb h[em`b\Zgbb b iZcd_ [jhg_e_ gl ijb_f_gy_lky iZyevguc `bj. Ijh^he`bl_evghklv dZ^hc iZcdb ^he`gZ [ulv g_ [he_ 3 fbg. <j_-f_ggu_ [Zg^Z`b m^Zeyxlky. GZ h]he_gguc mqZklhd h[hehqdb gZghkblky Zglbdhjhabhggh_ihdjulg_.

< l_o kemqZyo, dh]^Z \hafh`gu f_oZgbq_kdb_ \ha^ckl\by gZ j_-fhglbjm_fhf mqZkld_ dZ[_ey, gZ g_]h ^hihegbl_evgh gZfZlu\Z_lky ih ih\b\m h^bg kehc [jhg_e_glu, ij_`^Zjbl_evgh ^_fhglbjm_fuc k hlj_a-dZ dZ[_ey k g_ihj_`^_gghc [jhg_c. E_glZ gZfZlu\Z_lky k 50 %-f i_-j_djulg_f b aZdj_iey_lky [Zg^Z`Zfb ba hpbgdh\Zgghc ijh\hehdb. Ijh\h^gbd aZa_fe_gby \wlhf kemqZ_ ih \k_c ^ebg_i_j_fuqdb ^he`g [ulv jZkimr_g \p_eyo kha^Zgby iehlgh]h h[e_]Zgby [jhgb \hdjm] mqZ-kldZ j_fhglbjm_fh]h dZ[_ey.

4.2.3. J_fhgl f_lZeebq_kdbo h[hehq_d

Ijb ih\j_`^_gbb h[hehqdb dZ[_ey (lj_sbg, ijhdheu), dh]^Z bf_lky l_qv fZkehdZgbnhevgh]h khklZ\Z gZ wlhf mqZkld_, ih h[_kljh-gu hl f_klZ ih\j_`^_gby gZ jZkklhygbb ih 150 ff hl f_klZ ih\j_`^_-gby m^Zey_lky h[hehqdb k dZ[_ey. KbfZ_lky \jogbc kehc ihykghe bah-eypb b ijh_jy_lky gZ \eZ`ghklv \jZah]j_lhf iZjZnbg_.

< lhf kemqZ_, _keb \eZ]Z hlkmkl\m_l b baheypby g_jZajmr_gZ, j_-fhglbjm_lky k\bghp\Zy beb Zexfbg_\Zy h[hehqdb. Ba ebklh\h]h k\b-gpZ lhesbghe 2...2,5 ff \uj_aZ_lky ihehkZ rbjbghe gZ 70...80 ff [hevr_h]he_ggh]h mqZkldZ dZ[_ey b ^ebghe gZ 30...40 ff [hevr_ ^eb-gu hdjm`ghklb dZ[_ey ih h[hehqdb. < ihehk_ ^_eZxlky ^\Z aZeb\hgguo

hl_jklby k lZdbf jZkq_lhf, qlh[u hgb jZkiheZ]Zebkv gZ^ h]he_gghc qZklvx dZ[_ey. IhehkZ lsZl_evgh hqbsZ_lky hl iueb b l_jyab _lhrvx, kfhq_gghc \ _gabg_. M^Ze_ggu_ ihemijh\h^ysbc kehc [mfZ]b b _jo-gyy e_glZ ihykgghc baheypbb \hkkIZg Z\eb\Zxlky b aZdj_ieyxlky [Zg^Z-\`Zfb ba oehiqZlh[mfZ`guo gblhd. IjhriZjb\Z_lky mqZklhd dZ[_evghc fZkkhc FI-1. Ihekhc k\bgpZ h[_jlu\Zxl h]he_ggh_f_klh dZ[_ey lZd, qlh[u hgZ aZoh^beZ jZghf_jgh gZ djZy h[hehqdb dZ[_ey, Z djZy h[jZah-\Z_r_cky k\bghp\hc ljm[u i_j_dju\Zeb ^jm] ^jm]Z g_f_g_ q_f gZ 15...20 ff. <gZqZe_ ijhba\h^yl ijhiZcdm ijbih_f IHKKm 30-2 ijh-^hevgh]h r\Z, Z aZl_f lhjpu ljm[u ih^]b[Zxl d h[hehq_ dZ[_ey b ijb-izb\Zxl d g_c.

>ey dZ[_e_c k Zexfbgb_hc h[hehqdhc \ f_kl_ ijbizcdb k\bghp-\hc ljm[u h[hehqdz dZ[_ey h[em`b\Z_l ky ijbih_f fZjdb :. AZeb\Z_lky fmnIZ]hjq_c dZ[_evghc fZkkhc FI-1. Ihke_ hkl\Zgby b ^heb\db aZ-izb\Zxlky aZeb\hqu_ hl_jklby. GZ aZiZyggh_ gZ lhjpZo f_klh gZdeZ-^u\Z_lky [Zg^Z` ba f_ghc ijh\hehdb \blhd d \bldm ^bZf_ljhf lff k \uoh^hf 10ff gZ h[hehqdm dZ[_ey b ijbizb\Z_lky d h[hehq_d. Hlj_fhglbjh\Zggh_f_klh ihdju\Z_lky kfheyghc e_glhc \ ^\Z kehy k 50 %-f i_j_djulb_f.

< lhf kemqZ_,_keb \eZ]Z ijhgbdeZ ih^ h[hehqdm beb ih_j_`^_gZ ihykgZy baheypby, Z lZd`_ baheypby `be, mqZklhd dZ[_ey \uj_aZ_lky gZ \k_c ^ebg_,]^_bf_lky \eZ]Z beb ih_j_`^_gby baheypbb. <f_klh g_]h \klZ\ey_lky g_h[oh^bfhc ^ebgu hlj_ahd dZ[_ey b \uihegy_lky fhglZ` ^\mo kh_^bgbl_evguo fmnI. K_q_gb_ b gZijy`_gb_ dZ[_ey ^he`gu kh-hl_lkl\h\Zlv \uj_aZgghfm mqZklhd.

FZjdm dZ[_ey ^ey \klZ\db fh`gh ijb_f_gylv ^jm]mx, gh ih k\h_c dhgkljmdpb ZgZeh]bqghc \uj_aZgghfm mqZklhd.

4.2.4. <hkkIZgh\e_gb_ [mfZ`ghc baheypbb

< l_o kemqZyo, dh]^Z lhdhijh\h^ysb_`beu g_ ih_j_`^_gu, Z bah-eypby `be b ihykgZy baheypby ih_j_`^_gu, gh \ g_c hlkmlkl_m_l \eZ]Z, \uihegy_lky \hkkIZgh\e_gb_ baheypbb k ihke_mxsf fhglZ`hf jZa-j_aghc k\bghp\hc kh_^bgbl_evghc fmnlu.

Ijhba\h^blky jZkdhidZ dZ[_ey ^h lZdhc ^ebgu, qlh[u fh`gh [ueh kha^Zlv ^hklZlhqgmX keZ[bgm dZ[_ey ^ey jZa_`^_gby `be f_`^m kh[hc. Ihke_ jZa_`^_gby `be b m^Ze_gby klZjhc baheypbb \hkkIZgZ\eb\Z_lky baheypby `be k ihfhsvx gZeh`_gby [mfZ`guo jhebdh\ beb e_glhc EWLK:J k ij_`^Zjbl_evghc h[jZ[hldhc ijhriZjhqghc fZkkhc FI-1. MkIZgZ\eb\Z_lky jZaj_agZy k\bghp\Zy fmnIZ b ijhiZb\Z_lky kgZqZeZ ijh^hevguc rh\, Z aZl_f fmnIZ ijbizb\Z_lky d h[hehq_d dZ[_ey.

MdZaZgguc j_fhgl fh`gh \uihegylv gZ jhjbahglZevguo mqZkldZo dZ[_evguo ljZkk,]^_ hlkmlkl\m_l ih\ur_ggh_ ^Z\e_gb_ fZkeZ, lZd dZd fmnZ k ijh^hevghc iZcdhc bf__l f_gvrnx f_oZgbq_kdmx ijhqghklv.

4.2.5. J_fhgl lhdhijh\h^ysbo `be

Ijb jZaju_ `be dZ[_ey gZ g_agZqbl_evghc ^ebg_ b \hafh`ghklb ih^lygmlv dZ[_ev aZ kq_l «af_cdb», \uiheg_gghc ijb ijhdeZ^d_, ijhba_h^blky h[uqguc j_fhgl kh_bgb_evghc k\bghp\hc beb wihdkb^ghc kh_bgb_evghc fmnlu. < lhf kemqZ_, _keb aZiZkZ dZ[_ey g_hklZlhqgh, fh]ml ijb_gylvky m^ebg_ggu_ kh_bgb_evgu_ jbevau b fmnlu. J_- fhgl \ wlhf kemqZ_ ijhba_h^blky k h^ghc kh_bgb_evghc k\bghp\hc fmnlh. <h \k_o hklZevguo kemq Zyo ijb j_fhgl_ lhdhijh\h^ysbo `be dZ[_ey ijb_gy_lky \klZ\ dZ dZ[_ey b \uihegy_lky fhglZ` ^\mo kh_bgb_evguo k\bghp\uo beb wihdkb^guo fmnlu.

4.2.6. J_fhgl kh_bgb_evguo fmnlu

G_h[oh^bfhklv j_fhglZ kh_bgb_evghc fmnlu beb fhglZ` \klZ\db dZ[_ey b ^\mo kh_bgb_evgu o fmnlu mklZgZ\eb\Z_lky ihke_ hk-fhljZ fmnlu b __jZa[hjdb.

< lhf kemqZ_, _keb ijh[hc ijhbahr_e k f_klZ iZcdb `beu beb k jbevau gZ dhjimk k\bghp\hc fmnlu b jZajmr_gb_ hl ijh[hy bf__l g_- [hevr_jZaf_ju b baheypby g_ m\ez`g_gZ, ijhba_h^blky ihke_ ^h\Z l_evgZy jZa[hjdZ fmnlu b jZa[hjdZ ih\j_`^_ggghc qZklb baheypbb. AZ-l_f \hkkZgZ\eb\Z_lky baheypby [mfZ`gufb jhebdZfb beb e_glhc EWLK:J b ijhriZjb\Z_lky fZkkhc FI-1. MklZgZ\eb\Z_lky jZaj_aghc dhjimk fmnlu, b \uihegyxlky \k_ ^Zevg_crb_ hi_jZpbb ih fhglZ`m fmnlu.

< kemqZ_ _keb ijh[hc ijhbahr_e \ r_cd_ fmnlu k `beu gZ djZc h[hehqdb b baheypby g_ m\ez`g_gZ, ijhba_h^blky jZa[hjdZ fmnlu. AZ-l_f hlj_aZ_lky mqZklhd [jhgb b h[hehqdb gZ ^ebgm, g_h[oh^bfmx ^ey m^h[gh]h jZa_`^_gby `be. <hkkZ ZgZ\eb\Z_lky baheypby m ih\j_`^_ggghc `beu, b \uihegy_lky ijhriZjdZ. MklZgZ\eb\Z_lky m^ebg_gguc jZaj_aghc dhjimk k\bghp\hc fmnlu, b \uihegyxlky \k_ hi_jZpbb ih fhglZ`m fmnlu.

?keb g_hafh`gh \uihegblv m^ebg_ggmX fmnlm ba-aZ [hevrbo jZajmr_gbc, lh ijb_gy_lky \klZ\dZ dZ[_ey k fhglZ`hf ^\mo fmnlu ih l_ogheh]bb, ij_mkfhlj_ggghc l_ogbq_kdhc ^hdmf_glZpb_c.

< [hevrbgkl_ kemqZ_ ih\j_`^_gby \ kh_bgb_evguo fmnluZo ijhbko^yl ijb ijhnbeZdlbq_kdbo bkiulZgbyo ih\ur_gguf gZijy`_- gb_f. B _keb d j_fhglm g_ijbklmibeb kjZam`_ ihke_ hij_`^_gby f_k-lZ ih\j_`^_gby, \ fmnlm gZqbgZ_l ih klmiZlv \ez]Z. < wlhf kemqZ_ j_-

fhgl ih\j_`^_gghc kh^bgbl_evghc fmnlu hkms_kl\ey_lky \uj_aZgb_f
 ^_n_dlghe fmnlu b mqZkldh\ dZ[_ey. DZd ijZ\beh, q_f [hevr_e_`bl \
 a_fe_ ih\j_`^_ggZy b g_ hlj_fhglbjh\ZggZy fmnZ, l_f ^ebgg_ ijb-
 oh^blky ^_eZlv \klZ\dm dZ[_ey ^ey \hkkZgh\e_gby ijb j_fhgl_ dZ[_ev-
 ghe ebgb.

4.2.7. J_fhgl dhgp_\uo fmnZ gZjm`ghc mklZgh\db

Dhgp_\u_ fmnlu gZjm`ghc mklZgh\db \ [hevrbgkl_ kemqZ_\ \u-
 oh^yl ba jZ[hlu \ ^h^eb\u_ i_jbh^u \j_f_gb]h^Z beb ijb [hevrhc
 hlghkbl_evghc \eZ ghklb \ha^moZ b, dZd ijZ\beh, bf_xl [hevr_ ^_n_d-
 lu b jZajmr_gby \gmljb fmnlu. Ihwl hfm ih\j_`^_ggZy fmnZ h[j_aZ_l-
 ky, ijh_jy_lky baheypby dZ[_ey gZ \eZ `ghklv, b, _keb [mfZ`gZy bahey-
 pby g_ m\ez_g_gZ, \uihegy_lky fhglZ` fmnlu \ khhl_lkl\bb k lj_h\Z-
 gbyfb l_ogbq_kdhc ^hdmf_gZpbb. ?keb ^ebgZ dZ[_ey \ dhgp_ ebgb
 bf_l ^hklZlhqguc aZiZk, lh j _fhgl hZjZgbqb\Z_lky fhglZ`hf lhevdh
 dhgp_\hc fmnlu. ?keb ` _aZiZkZ dZ[_ey g_ ^hklZlhqgh, lh gZ dhgp_ dZ-
 [_evghc ebgb \uihegy_lky \klZ\dZ dZ [_ey g_h[oh^bfhc ^ebgu. < wlhf
 kemqZ_ g_h[oh^bfh fhglbjh\Zlv kh^ ^ bgbl_evghmx b dhgp _\mx fmnlu.

>_fhglbjh\Zgg_ fmnlu fh]ml bkihevah\Zlvky ^ey ih\lhjgh]h
 fhglZ`Z. Gh ^ey wlh]h g_h[oh^bfh hqbkblv dhjimk b \k_ ^_lZeb fmnlu
 hl kZ`b, ijhfulv bo [_gabghf b ijhkmrbv.

< dhgp_\uo fmnZ gZjm`ghc mklZgh\db k f_lZeebq_kdbf dhjim-
 khf 1 jZa \]h^ \ l_q_gb_ \k_]h \j_f_gb wdkiemZlZpbb ijh_jyxl miehl-
 g_gby b ih^ly]b\Zxl]Zcdb. H^gh\j_f_ ggh hkfZljb\Zxl dhglZdlgu_
 kh^bg_gby b \ kemqZ_ g_h[oh^bfhklb hqbsZxl dhglZdlgu_ ih_jogh-
 klb b ih^ly]b\Zxl [helu.

Kbkl_fZlqb_kdb (ih f_j_ gZ^h[ghklb kh]eZkgh j_amevlZlZf hkfh]jZ)
 hdjZrb\Zxl f_klZ iZcdb, r\ u Zjf bjh\db b miehlg_gbc wfZevx O<-124.

Ih_joghklv dhgp_\uo wihdkb^guo fmnZ gZjm`ghc mklZgh\db g_-
 h[oh^bfh \ ijhp_kk_ wdkiemZlZpbb (1 jZa \ 3...5 e_l \ aZ\bkbfhklb or
 f_klguo mkeh\bc) djZkblv wfZe yfb \ha^mrghe kmrdb WI-51 beb =N-
 92OK. HdjZkdm \uihegyxl \ kmomx ih]h^m, ij_ ^\Zjbl_evgh hqbkbl\ ih-
 _joghklv fmnlu b baheylhjh\

Baheylhju dhgp_\uo fmnZ gZjm`ghc b \gmlj_gg_c mklZgh\hd, Z
 lZd`_ baheypbhgg_ ih_joghklb dhgp_\uo aZ^_ehd g_h[oh^bfh i_jbh-
 ^bq_kdb hqbsZlv hl iueb b]jyab ldZgvx, g_ hklZ\eyxs_c \hjkZ, b kfh-
 q_gghe \ [_gabg_ beb Zp_lhg_. :he_ qZklhc hqbkl_ ^he`gZ ih^_j-
]Zlvky dhgp_\Zy dZ[_evgZy ZjfZlmjZ \ p_oZo ijhfure_gguo ij_ ^ijb-
 ylbc b ahgZo k ijh\h^ys_c iuevx. I_jbh^bqghklv ijhlbjdb b hqbklb
 dhgp_\hc dZ[_evghc ZjfZlmju gZ ^Zgghe we_dljhmklZgh\d_ mklZgZ\eb-
 \Z_l]eZ\guc bg`_g_j f_klgh]h wg_j]hij_ ^ijbylby.

4.2.8. J_fhgl dhgp_\uo aZ^_ehd

Ijb jZajmr_gbb dhjimkZ aZ^_edb b \u]hjZgbb `be \ dhj_rd_ j_- fhgl aZ^_ehd \uihegy_lky lZd `_, dZd b j_fhgl dhgp_\uo fmnI, aZ bkdexq_gb_f lh]h, qlh dhjimk aZ^_edb b ^_lZeb g_evay bkihevah\Zlv ih\lhjgh.

J_fhgl dhgp_\uo aZ^_ehd \ klZevguo \hjhgdZo ijb jZajmr_gbb baheypbb `be \uihegy_lky \ ke_^mxs_c ihke_^h\Zl_evghklb:

- jZajmr_ggmX baheypbx `be beb ijbr_^rmx \ g_]h^ghklv (aZ-ljyag_gb_, m\ez_g_gb_) m^Zeyxl k `be;

- kfZlu\Zxl h^bg kehc [mfZ`ghc baheypbb;

- ijhba\h^yl ih^fhldm \ iylv keh_\ k 50 %-f i_j_djulb_f ebi-dhc iheb\bgbeohjb^ghc e_glhc beb lj_fy kehyfb ijhj_abg_gghc e_g-lu k ihke_^mxsbF ihdjulb_f baheypbhggufb e_glZfb beb djZkdZfb. <f_klh mdZaZgguo e_gl j_fhgl fh`_l [ulv \uiheg_g k ijbf_g_gb_f e_glu EWLK:J (^Z kehy) b e_glu I<O (h^bg kehc).

Ijb jZklj_kdb\Zgbb, hlkeZb\Zgbb, qZklbqghf moh^_ b agZqbl_ev-ghf aZljyag_gbb aZeb\hqgh]h khklZ\Z, hkh[_ggh dh]^Z wlb ^_n_dlu kh-ijh\h^Zxlky aZf_lguf kf_s_gb_f `be f_^m kh[hc beb d dhjimkm \hjhgd b (qlh fh`_l \ k\hx hq_j_^v \uau\Zlvky g_ijZ\bevuf iheh`_-gb_f beb hlkmkl\b_f jZkihjghc ieZklbgu), ke^m_l k^_eZlv ihegmX i_j_aZeb\dm klZevghc \hjhgd b.

KlZjuc aZeb\hqguc khklZ\ m^Zey_lky (\uieZey_lky), \hjhgdZ himkdZ_lky \gba b hqbsZ_lky hl dhihlb b _ljyab. Ijhba\h^blky ih^fhldZ gh\h]h miehl_gby (ih^ \hjhgd m), b \hjhgdZ klZ\blky gZ f_klh.

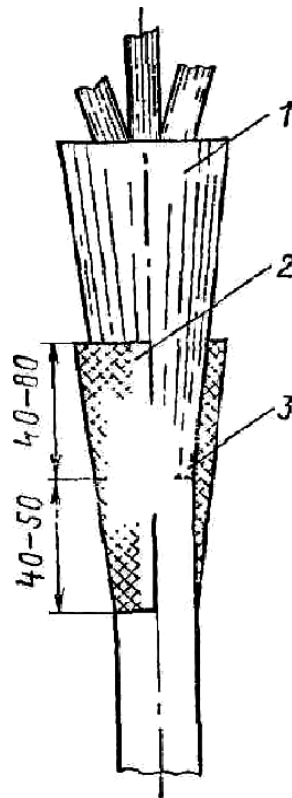
=hjeh\bgZ \hjhgd b ih^fZlu\Z_lky kfheyghc e_glhc, b \hjhgdZ \f_kl_ k dZ[_e_f dj_ iblky d hihjghc dhgkljmdpbb ohfmlhf. Ijh_jy_l-ky ijZ\bevghklv iheh`_gby nZjnhj\uo \lmehd. Ijhba\h^blky aZeb\dZ \hjhgd b aZeb\hqguf khklZ\hf (F;-70, F;-90).

J_fhgl dhgp_\uo aZ^_ehd ba iheb\bgbeohjb^guo e_gl ijhba\h^blky ijb gZebqbb ijhiblhqgh]h khklZ\Z \ dhj_rd_ beb gZ `beZo, ijb jZklj_kdb\Zgbb b h[ju\Zo e_gl. L_ogheh]by j_fhglZ aZdexqZ_lky \ ^_-fhglZ`_ klZjuo e_gl b ih^fhld _ gZ `beZo gh\uo e_gl I<O beb EWLK:J.

J_fhgl wihtkb^guo dhgp_\uo aZ^_ehd ijb jZajmr_gbb ih^fhld gZ `beZo \uihegy_lky k ^_fhglZ`_f klZjuo e_gl, \hklZgh\e_gb_f gh-\uo e_gl EWLK:J b ^hihegb_l_evghc ih^eb\dhc wihtkb^gh]h dhfiZmg-^Z k lZdbf jZkq_lhf, qlh[u e_glu aZ oh^beb \ aZeb\Z_fuc dhfiZmg^ g_f_g__ q_f gZ 15 ff.

Ijb l_qb ijhiblu\Zxs_]h khklZ\Z ih dZ[_ex \ dhj_rd_ aZ^_edb h[_a`bjb\Zxlky gb`gyy qZklv aZ^_edb gZ mqZkld_ 40...50 ff b gZ lZdhf`_ jZkklhygbc mqZklhd [jhgb beb h[hehqdb (^ey g_[jhgbjh\Zgguo dZ-

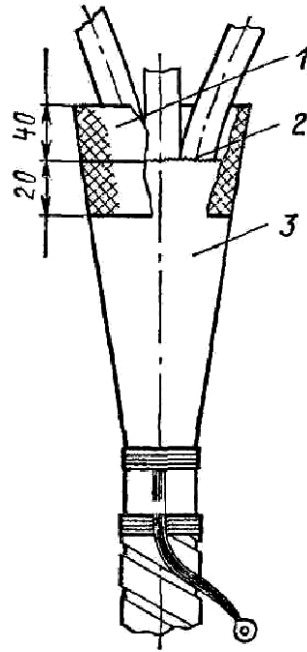
[_e_c). GZ h[_a`bj_g guc mqZklhd dhj i mkZ aZ^edb b ij bfudZx s bc d g_fm mqZklhd dZ[_ey r bjbghc 15...20 ff gZde Z^u/Z_lk y ^\mokehcgZy ih^f hldZ ba kfZaZgghc wihdkb^guf dhfiZmg^hf oehi qZlh[mfZghc e_glu. MklZgZ\eb\Z_lky j_fh glgZy nhj fZ (j bk. 4.8), aZeb\dZ dhlhjhc ijh ba\h^blky wihdkb^guf dhf i Zmg^hf.



Jbk. 4.8. MklZg h\dZ j_fh glghc n hjfu^ey nkljZg_g by l_qb
ijhibl u\Zxs_jh khklZ\Z \ f_kl_ \ h^Z dZ[_ey \ dhjim k aZ^edb:
1 - dhjimk aZ^edb; 2 - j_fhglgZy nhj fZ; 3 - f_klh l_qb

Ijb gZj mr_gbb]_jf_lbq ghklb \ f_kl_ \u oh^Z `be ba dhjim kZ aZ^_edb h[_a` bjb\Zxlk y _jogy y iehkdZy qZklv dhjimkZ aZ^_edb b mqZkl-db ljm[hd beb ih^fh ldb `be ^ebghc 30 ff, ij bfudZx s b_d dhjimkm. MklZgZ\eb\Z_lky kt_f gZy j_fh glgZy nhj fZ (j bk . 4.9), jZaf_ju dh lhjhc \u[bjZxlky \ aZ\bkbh hklb h1 lbi hjZ af_jZ aZ^_edb. AZeb\dZ n hjfu dhf i Zmg^hf i jhba\h^ blky lZd `_, dZd b\ ij_u^ n_s_f ke mqZ_.

Ijb gZj mr_gbb]_jf_lbq ghklb gZ `beZo h [_a`bjb \Z_lky ^_n_dl-guc mqZklhd ljm[db beb ih^f hldb `beu gZdeZ^u/Z_lky j_fh glgZy ^\mokehcgZy i h^fhld Zba oehi qZlh[mfZguo e_gl b h[b evghc kf Zadhc wihdkb^guf dhfiZmg^hf dZ^ h]h \bld Zh[fhld b beb e_glZ EWIK:J \ ljb keh.



*Jbk. 4.9. MklZgh\ dZ j_fhglg hc nhifu ^ey mkl j Zg_gby
l_qb \f_kl_ \uoh^Z` be ba dhji nkZ aZ^_adb:
1-j_f hglgZy nh jfZ; 2-f_k l h l_qb, 3- dhjimk aZ^_edb*

Ijb gZ j mr_gbb]_jf_lb qghklb \ f_kl_ i j bfudZg by ljm[db beb
ih^f hldb d pbebg^j bq_kdhc qZklb gZdhg_qgbdZ h[_a`bjb\Zxlk y ih-
_jo ghklv [Zg^Z`Z b nqZklhd ljm[db beb ih^fhl db`beu ^ebghc 3 0 ff.
GZ h[_a`bj_ ggu_ mqZklb gZdeZ^u\Z_lky ^\mokehcgZy ih^fhl dZ ba
oehi qZlh[mfZguo e _gl k h[bevghe h[fZadhc dhfiZmg^hf dZ`^h]h
\bld Z ih^fh ldb. Ih\ _jo ih^f hldb gZdeZ^u\Z_lky iehlg uc [Zg^Z ba
djmq_gh]h r i Z]ZlZ b lZd`_ h[f Zau\Z_lky wiHdkb^guf dh f iZmg^hf.

KH>?J@:GB?

<<?>?GB?	3
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Mq_[gh_ ba^Zgb_

L:J:KH< ?\]_gbc <eZ^bfbjh\bq

**FHGL:@, G:E:>D:,
WDKIEM:L:PBW WE?DLJHH;HJM>H<:GBY**

QZklv I

<HA>MRGU? B D:;?EVGU? EBGBB WE?DLJHI?J?>:QB

Mq_[gh_ ihkh[b_

Ba^Zgh \ Z\hjdkdhc j_^Zdpbb


GZmqguc j_^Zdlhj
^hdlhj nbabdh-fZI_f Zlbq_kdbo gZmd,
ijhn_kkhj :.<. DZ[ur_\
>baZcg h[eh`db :.B. Kb^hj_gdh

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