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**Н.И. МАМОНТОВ**, qe.-dhjj . Bg` . ZdZ^ MdjZbgu; ]eZguc bg`\_g\_j NbebZeZ OZjvdhkdh \_PD; «Wg\_j]hijh]j\_kk » HHH «Dhlelmj [hi jhf », ]. OZjvdh\  
**О.М. КОБЦЕВ**, gZqZevgbd[xjh , ]eZguc dhgkljmdlhj ijh\_dIZ NbebZeZ OZjvdhkdh \_PD; «Wg\_j]hijh]j\_kk » HHH «Dhlelmj [hi jhf », ]. OZjvdh\  
**Ю.Т. ВОЕВОДИН**, ]eZguc ki\_pbZebkl NbebZeZ OZjvdhkdh \_PD; «Wg\_j]hijh]j\_kk » HHH «Dhlelmj[hijhf », ]. OZjvdh\  
**Т.Н. ПУГАЧЕВА**, klZjrbc ij\_ihZl\_ev MBI: , ]. OZjvdh\

**НІВБЕ ВА:РВУ ДІЕННД:РВНГГНС КОЕУ**  
**ІВРД НС ДВРВ ОН ГННН ДМВГГННН**  
**ННМ НІВУ ЕУ ІКРВВУ ВЕДННН:РВВ**

OZjdkvdb f PD; «?g\_j] hi jh] j\_k» j hajh[e\_g Z lZ j\_dhf \_g^h\ZgZ h ijhZ^ggy hi lb f aZpy l\_je h nEZpegh €ko\_fb L?P, \ ydm^h^lv aZfgZ kgmxqbo lj m[hi jh h f\_j\_` gh€h ^b gZ gh a [evrbf ijhimkdh f h ^b. < h[kya•j\_dhgklj mdp€L?P jha]eyZebky ZjZglb fh ^j gaZp€ kgmxqh ]h hkghg h]h h[eZgZggy lZ fhèb ZjZglb jharb j\_g gy ghbf \_g\_j]\_lbqgbf h[eZgZggyf . GZi\_jr hfm \_IZi• j\_dhgklj mdp€L?P bdhgm]vky l\_ogqg\_ i\_j\_h [eZgZggy lmj[gb IL -60-90 kl. < 7, Z lZdh` fZehbl j Zlg•jh [h]b ih l\_i ehè ko\_f• L?P. GZ^ m]hfm\_Izi• klZghèx }lvky lmj[ hnklZghdZ J-25-1,45, jZpvhZgZ izj Zydh dhjb klhm }lvky èy pe\_c l\_i ehaZ[\_ai\_q\_ggy.

Kharkov Central Design Office «Energoprogress» has developed and recommended to the application the optimization of the HPP extraction scheme, which contains the replacement of the existing piping for the delivery water with new ones for the greater water pass. In the framework of HPP reconstruction modifications of existing main equipment modernization and possible modifications of new power equipment installation were considered. At the first stage of HPP reconstruction technical re-equipment of the turbine IL -60-90 (PT-60-90) st. < 7 and also economy-type works by the HPP extraction scheme are provided. At the second stage the turboset P-25-1,45 (R-25-1.45) is installed. The terminal steam of the turboset is used for the providing with heat.

>ZjgbpdZy LWP (]. Db\_) khhj m ZeZkv \ ^ \_ hq\_j\_è : i\_jZy hq\_j\_è kljhbl\_evklZ ij\_m kfZljbZeZ khhj\_m`\_gb\_ we\_dljhklZgpbb fhsghklvx 100 F<l (q\_luj\_ lmj[bgu IL -25-90 b iyv dhleh \ LI -170), Z lhjZy hq\_j\_è – fhsghklvx 150 F<l (ljb lmj[bgu <IL -50-2).

<^gb\_ Zlj\_Zlh\ [ueh ijhba^gh \ 1954–1965 ]hZo . < kyab k nbabq\_kdbf b fhjZevguf baghkhf i\_jvo q\_luj\_o lmj[bg fhsghklvx ih 25 F<l hgb [ueb ^fhglbjhZgu .

Lmj[bgu <IL -50-2 (IL -60-90/13 EFA) jZkkqblZgu èy jZ[hlu ijb ke^mxsb o ghfbgZevguo izjZf\_ljZo k\_\]h izjZ:

í □ Zè\_gb\_ izjZ i\_j^ klhijguf deZiZghf – 8,82 FIZ (90 d]k/kf<sup>2</sup>);

í □□□ izjZ i\_j^ klhijguf deZiZghf – 535 ° ;

í □□ jZkq\_lgh\_ Zè\_gb\_ \ dhg^gkZlhj\_ – 5 dIZ (0,05 ZIZ) \ hlhibl\_evduc i\_jbh^ b 8 dIZ (0,08 ZIZ) \ e\_lgbc i\_jbh^ ;

í □□□ □□□ jZkoh^ k\_\]h izjZ q\_j\_a klhijguc deZiZg – 110,55 d]k (398 l/q);

í ghfbgZevguc jZkoh^ hoeZ^ Zxs\_c pbjd nœyphgghc hù q\_j\_a dhg^gkZlhj lmj[bgu khklZèy\_l 8000 f<sup>3</sup>/q.

Lmj[bgZ bf \_lZ j\_]mebjm\_fuo hl[hjZ izjZ:

í **iauc**  $\Xi_{e\_gb\_f}$  0,98–1,57 FIZ (10–16 ZIZ),  $ij\_gZagZq\_gguc$   
 $\acute{e}y\_g\_rg\_lh$   $ijhba\grave{h}kl\_ggh]h$   $b$   $ibdh\grave{h}]h$   $l\_iehnbdZpbhggh]h$   
 $ihlj\_e\_gby$   $b$   $\acute{e}y\_j\_g\_jZlbggh]h$   $ih\grave{h}]j\_Z$   $iblZl\_evghc$   $\grave{h}u$  .  
 $GhfbgZevguc$   $jZkoh^{\wedge}$   $iZjZ \setminus ijhba\grave{h}kl\_gguc$   $hl[hj$   $khklZ\acute{e}y\_l$  43,05 d]/k  
 (155 l/q)  $ijb$   $P_n = 1,274$  FIZ (13 ZIZ),  $fZdkbfZevguc$   $jZkoh^{\wedge}$   $iZjZ$  – 73,89 d]/k  
 (230 l/q);

í **inuc**  $\Xi_{e\_gb\_f}$  0,069–0,245 FIZ (0,7–2,5 ZIZ),  
 $ij\_gZagZq\_gguc$   $\acute{e}y$   $hkghgh]h$   $l\_iehnbdZpbhggh]h$   $ihlj\_e\_gby$   $b$   $\acute{e}y$   
 $j\_g\_jZlbggh]h$   $ih\grave{h}]j\_Z$   $dhg^{\wedge}gkZIZ$  .  $GhfbgZevguc$   $jZkoh^{\wedge}$   $iZjZ \setminus$   
 $l\_iehnbdZpbhggh]h$   $hl[hj$   $khklZ\acute{e}y\_l$  36,11 d]/k (130 l/q)  $ijb$   $P_n = 0,118$  FIZ  
 (1,2 ZIZ),  $fZdkbfZevguc$   $jZkoh^{\wedge}$  – 44,44 d]/k (160 l/q).

>ey  $m\_ebq\_gby$   $l\_iehhc$   $fhsghklb$   $b$   $m\grave{e}m\grave{q}\_gby$   $l\_ogbdh$  -wdhghfbq\_kdbo  
 $ihdZaZl\_e\_c$  LWP  $jZg\_ [ueZ$   $ijh\setminus^{\wedge}gZ$   $ke\_^{\wedge}mxsZy$   $j\_dhgkljm$   $dpby$   $dhl\_evgh]h$   $b$   
 $lmj[bggh]h$   $h[hjm\grave{h}Zgby$  :

í **II**  $klZgpbhggu\_ <$  1 b 2  $j\_dhgkljm$   $bjhZgu$   $gZ\grave{h}h]j\_cgu\_ ;$

í **III**  $<$  3 b 4  $j\_dhgkljmbjhZgu$   $gZ$   $\grave{u}jZ[hldm$   $iZjZ$   $kgb\_gguo$   
 $iZjZf\_ljh\$  1,3 FIZ , 300 ° ;

í **IIII** IL -60-90/13 EFA  $kl. <$  6 b 7  $i\_j\_ \setminus ^{\wedge}gu$   $gZ$   $j\_bf$   $jZ[hlu$   $k$   
 $m\grave{o}m\grave{f}\_gguf$   $\setminus Zdmmfif$   $b$   $bkihevahZgb\_f$   $dhg^{\wedge}gkZl$   $hjZ$   $\acute{e}y$   $ih^{\wedge}h]j\_Z$   
 $k\_l\_hc$   $\grave{h} \acute{u}$  .  $Ijb$   $wlhf$   $mZe\_gu$   $jZ[hqb\_ ehiZldb$   $b$   $\grave{b}ZnjZ]fu$   $ihke\_gb$   $o$   
 $klm\_g\_c$ ;

í **IIII**  $kl. <$  5  $ijhreZ$   $l\_ogbq\_kdh\_ i\_j\_hhjm\_gb\_ k$   $aZf\_ghc$   
 $\grave{u}khdhl\_fi\_jZl$   $mjguo$   $m\grave{a}h\setminus b$   $\setminus lZe\_c : P<>$  ,  $klhijgh]h$   $deZiZgZ$   $I<>$   $b$   
 $iZjhijh\grave{h}h\setminus ;$

í **IIIPG>**  $lmj[bgu$   $kl. <$  5  $\grave{u}iheg\_ gZj\_dhgkljm$   $dpby$   $ih$   $m\_ebq\_gb$   $x$   $ijhimkdZ$   
 $iZjZ$   $q\_j\_a$   $qZklv$   $kj\_^{\wedge}g\_]h$   $\Xi_{e\_gby}$   $b \setminus l\_iehnbdZpbhggh]h$   $hl[hj$   $aZ$   $kq\_l$   
 $mf\_gvr\_gb$   $y$   $ijhba\grave{h}kl\_ggh]h$   $hl[hjZ$  .

LWP  $jZ[hIZ\_l$   $ih$   $ljZnbd$   $ml\_iehuo$   $b$   $we\_dljbq\_kdbo$   $gZ]jmahd$ .

$Ko\_fZ$   $l\_iehuo$   $k\_l\_c$   $aZdjulZy$  ,  $\acute{h}$   $mdjm[gZy$  ;  $jZkq\_lguc$   $l\_fi\_jZl$   $mjguc$   $ljZnbd$   
 115/58 ° ,  $jZkoh^{\wedge}$   $k\_l\_hc$   $\grave{h}u$  11250 f<sup>3</sup>/q,  $jZkq\_lgZy$   $l\_iehZy$   $gZ]jmadZ641 = dZe/q$ .

<  $gZklhys\_ j\_fy$   $ih$   $mkeh\setminus byf$   $hafhghkl\_c$   $nklZgh\grave{e}\_ggh]h$   $h[hjm\grave{h}Zgby$   
 $hli$   $nkd$   $l\_ieZ$   $hl$  LWP  $ijhba\grave{h}klky$   $kh$   $kj\_adhc$   $\grave{h}$  95 °  $b$   $nZdlbq\_kdbf$   $hli$   $mkdhf$   
 $ihjy\grave{d}Z$  448 = dZe/q  $l\_ieZ$  .

$Ijb$   $wlhf$   $fZdkbfZevguc$   $hli$   $nkd$   $l\_ieZ$   $hl$   $lmj[bggh]h$   $h[hjm\grave{h}Zgby$   $khklZ\acute{e}y\_l$   
 400–410 = dZe/q  $b$   $hkms\_kl\acute{e}y\_lky$   $ke\_^{\wedge}mxsbf$   $h[jZahf :$

–  $hl$   $dhg^{\wedge}gkZlhjh\setminus$   $L = 6$  b 7 ..... 67 = dZe/q;

–  $hl$   $l\_iehnbdZpbhggh]h$   $hl[hjh\setminus$   $lmj[bg$   $L = 5, 6$  b 7 ..... 232 = dZe/q;

$\setminus$   $lhf$   $qbke\_gZhkghgu\_ k\_l\_u\_ ih\grave{h}]j\_Zl\_eb$  ..... 190 = dZe/q;

–  $hl$   $ijhba\grave{h}kl\_gguo$   $hl[hjh\setminus$   $lmj[bg$  ..... 135 = dZe/q;

$\setminus$   $lhf$   $qbke\_gZibdh\grave{u}\_ [hce\_ju$  ..... 108 = dZe/q.

$Blh]h$   $\grave{u}j$   $Z[hIZggZy$   $l\_iehZy$   $wg\_j]by$   $\acute{e}y$   $p\_e\_c$   $hlhie\_gby$   $b$   $]hjyq\_]h$   
 $h\grave{h}kgZ[\_gby$  (=K)  $hl$   $lmj[bg$   $L = 5, 6$  b 7 ..... 407 = dZe/q;

–  $hl$   $ibdh\setminus uo$   $h\grave{h}]j\_cguo$   $dhle$   $h\setminus (<D)$  ..... 41 = dZe/q.

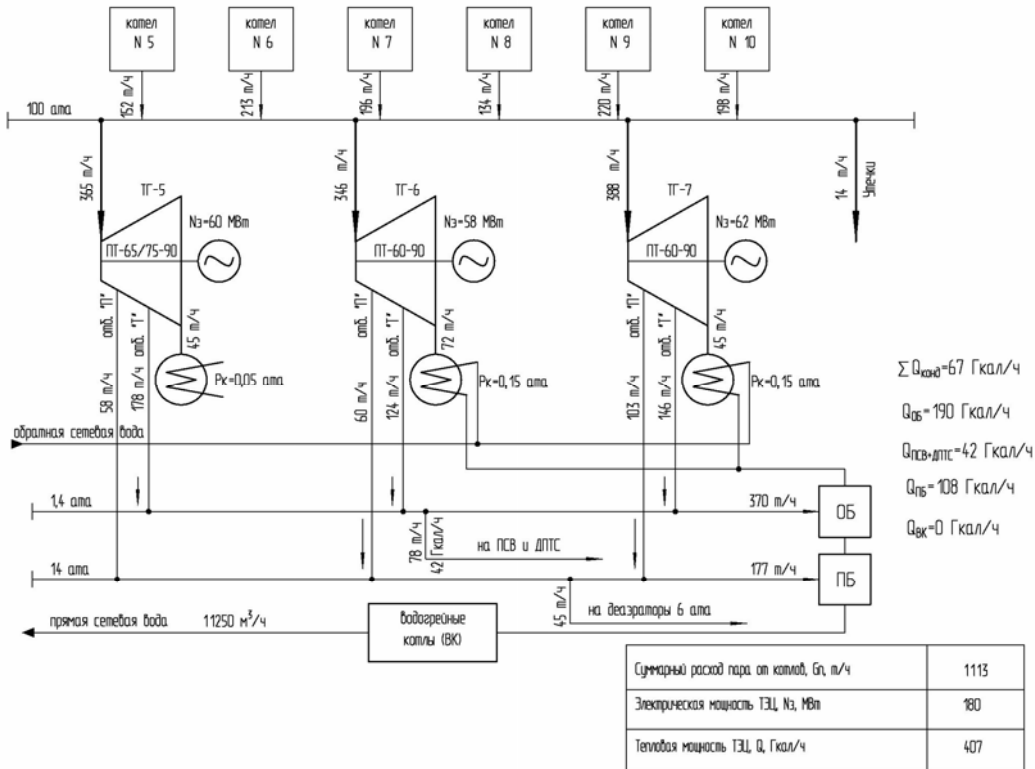
$Blh]h$   $l\_ie$   $hZy$   $wg\_j]by$   $\acute{e}y$   $p\_e\_c$   $hlhie\_gby$   $b = <K$   $hl$  LWP ..... 448 = dZe/q.

$Ijb$   $wlhf$   $we\_dljbq\_kdZyfhsghkl$   $v$  LWP  $khklZ\acute{e}y\_l$  ..... 180 F<l .

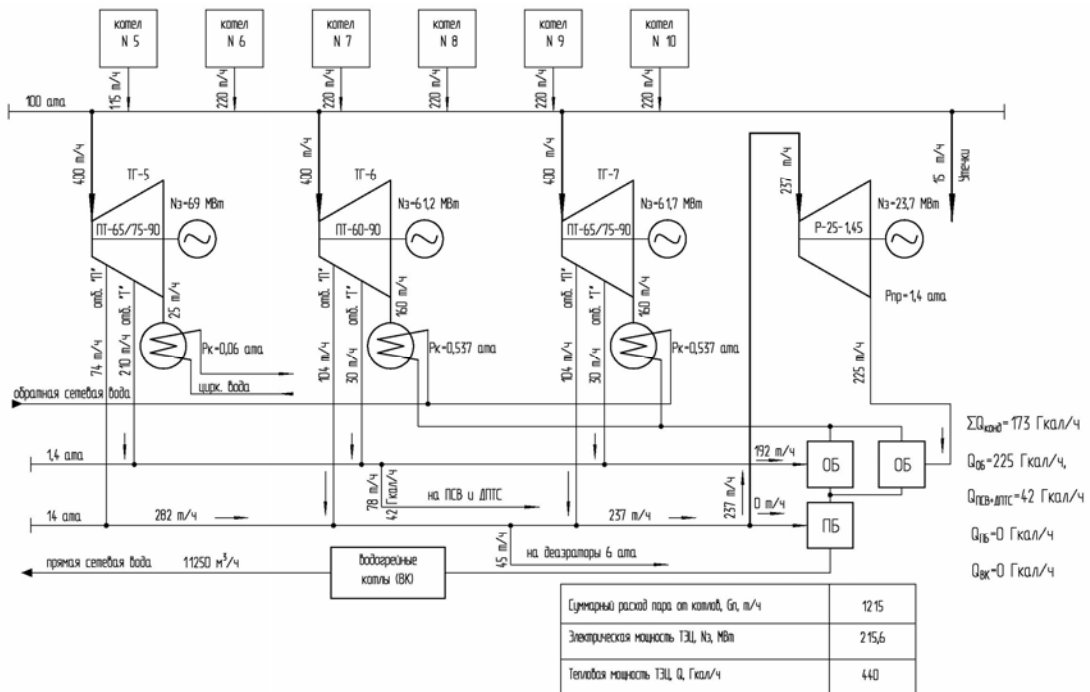
$M^{\wedge}evguc$   $jZkoh^{\wedge}$   $l\_ieZ$   $gZ\grave{u}jZ[hIZgguc$   $d<l \cdot q$  ..... 1389,4 ddZe/(d<l · q);

$M^{\wedge}evguc$   $jZkoh^{\wedge}$   $mkeh]gh]h$   $lhiebZ$   $gZ\grave{u}jZ[hIZgguc$   $d<l \cdot q$  ..... 282,4 ]/(d<l · q).

IjbgpbibZevgZy l\_iehZy ko\_fZ ħ j\_dhgkljm dpbb >Zjgbdhc LWP ijb\^gZ gZjbk . 1.



Jbk . 1. Ij bgpbibZevgZy l\_iehZy ko\_f Zħ j\_dhg klj mdpbb >Zj gbdhc LWP (fZdk. hlh ibl\_ evguc j\_` bf )



IK < -ih ħ lj\_Zl ev kujhc ħû ; >ILK - ^ZwjZl hj ih ħbl db l\_ ie ħk\_l b ;  
H; - ħkghg ħc [ħce\_j ; I; - ibdh \ uc [ħce\_j

Jbk . 2. Ij bgpbibZevgZy l\_iehZy ko\_f Z>Zj gbdhc LWK ih ke\_j\_dhgklj mdpbb k mklZgh ħ c lmj[ bgu J-25-1,45 (fZdk. hl ħi bl\_ evguc j\_` bf )

< gZklhys\_\_ j\_fy jZkoh^ iZjZ ijhbañkl\gguo iZjZf\_ljh\ éy g\_rgbo ihlj\_[bl\_e\_c agZqbl\_evgh khdjZlbeKy. NZdlbq\_kdbc jZkoh^ k mçlhf kh[kl\\_gguo gm^ khklZëy\_l 11-22 d]/k (40-80 l/q).

< kyab k wlb f l mj[bg u jZ[hIZxl \ g\_wdhghfbqghf j\_b f\_, Zbf\_ggh :  
 í □ k\\_h iZjZ gZ l mj[ bgu agZqbl\_evgh f\_g vr\_ jZkq\_lgh]h, qlh h[nkeZëbZ\_l kgb`gb\_ DI> ijh lhqghc qZklb b we\_dlj b q\_kdhc fhs ghklb P<> ;  
 í □ iZjZ ba ijhbañ ^kl\\_ggh]h hl[hjZ gZ l\_iehnb dZpbx \ ibdhüo [hce\_jZo ijbñbl d ñihegbl\_evghfm kgb`\_gbx we\_dlj b q\_kdhc fhsghklb l mj[bg u .

K p\_evx m\_ëbq\_gby hli nkdZ l\_ieZ b we\_dlj b q\_kdhc wg\_j]bb hl LWP b mçq\_gby wdghghfbq\_kdbo ih dZaZl\_e\_c jZkkfhl j\_gu ñafhgu\_ ZjbZgl u j\_dhgkljm dpbb kns\_klñ xs\_lh hkghgh]h h[hjmñZgby b jZkrbj\_gby LWP ghüf wg\_j]\_lbq\_kdbf h[hjmñZgb\_f .

1. □ mkZgh\db l\_iehnb dZpbhgguo l mj[ bg lbiZ L-40/55-1,5 beb L-76-90 k dhg^gkZpbhgguf mñj hckl\hf lj\_ [mx l [hevrbo dZiblZevguo èh ` \_gbc aZ kq\_l klhbñklb dZd kZfhc l mj[ hmñZghdb , lZd b g\_h[ohñfhklb jZkrbj\_gby kbkl\_fu l\_ogbq\_kdh]h hñkgZ[\_gby (kljhbl\_evklñ ghñc ljZñjg , pbjdñ^ hñh\ , mkZgh\dZpbjdgZkhkh\ b ñ .).

Kjhd hdm Z\_fhklb dZiblZevguo aZljZl khklZëy\_l hdheh 12 e\_l, qlh ^e Z\_l ZjbZglu g\_j\_gZ[\_ev gufb .

2. □ p\_e\_khh[jZaguf yëy\_lky ZjbZgl mñZgh\db \ aZgbb i\_jhc hq\_j\_b LWP ghñc ij hlbñZë\_gq\_kdhc l mj[h nklZgh\db lbiZ J-25-1,45 k ùoehihf gZlghghfg mx [hce\_j gnx mkZgh\dm ù^e\_ggm x ba gug\_ kns\_klñxsbo (jkb . 2).

Lmj[bgZ J-25-1,45 jZkkqblZgZ gZ fZdkbfZ evguc jZkoh^ k\\_h iZjZ 69-77 d]/k (250-280 l/q) b bf\_l iZjZf\_lju ijhlnñZë\_gby 0,05-0,15 FIZ .

IhZq Z jZ[hq\_]h iZjZ gZ l mj[ bgm J-25-1,45 hkns\_klëy\_lky ba dhee\_dlhjZ 0,98-1,57 FIZ (hl ijhbañkl\gguo hl[hjh\ L=-5, 6 b 7). Ijb wlhf Zë\_gb\_ gZ ùoehi\_ l mj[bg u J-25-1,45 \ hlhibl\_evduc i\_jbh^ khhl\klñ \_l Z\ e\_gbx \ l\_iehnb dZpbhgguo hl[ hjZo l mj[ bg IL -60-90.

< e\_lgbc i\_jbh^ ijb l\_iehñc gZ]mad\_ =<K gZ mjhg\_ 63 =dZe/q ijhlnñZë\_gb\_ l mj[bg u J-25-1,45 kgbZ\_lky ñ 50-60 dIZ , qlh ijbñbl d m\_ëbq\_gb x we\_dlj b q\_kdhc fhsghklb b ihür\_gbx wdghghfbqghklb jZ[hlu LWP.

JZ[hIZ LWP ih ij\_èh\_gghfm ZjbZglm ihañebl fZdkbfZevgh bkihevahZlv iZjh\ mx fhsghklv dhl\_evgh]h h[hjmñZgby , m\_ëbqbl v we\_dlj b q\_kdnx b l\_ieh\ mx fhsghklv LWP b mçq bl v l\_ogb dh-wdghghfbq\_kdb\_ ihdZaZl\_eb we\_djhklZgpbb .

J\_dhgkljm dpbx LWP p\_e\_khh[jZagh ùihegy l v ihwlZigh .

GZ i\_jhf wlZi\_ ke^m\_l ijh\klb l\_ogbq\_kdh\_ i\_j\_hhjm ` \_gb\_ l mj[ bg u IL -60-90 kl. < 7 k aZf\_ghc P<> gZ ghñc , ZlZd\_ ùihegblv fZehaZljZlgu\_ jZ[hlu ih l\_iehñc ko\_f\_ LWP.

M\_ëbq\_gb\_ we\_dlj b q\_kdhc fhs ghklb l mj[bg u kl. < 7 aZ kq\_l l\_ogbq\_kdh]h i\_j\_hhjm ` \_gby khklZbl ihjyñZ 500-600 d<l .

GZlhjh f wlZi\_ ij\_è ZjZ\_lky mkZgh\bl v l mj[bgm J-25-1,45 k ]\_g\_jZlhjh f . Ijb wlhf iZj ijhlnñZë\_gby (éy p\_e\_c l\_iehkgZ[\_gby ) hl l mj[bg u ihZ\_lky gZhg mba kns\_klñ xsbo [hce\_jguo mkZgh\hd.

Ijb wlhf knff ZjgZy we\_dlj b q\_kdZy fhsghklv LWP m\_ëbqblky gZ 20-25 F<l b khklZbl 215 F<l , fZdkbfZe vgZy l\_iehZy fhsghklv hlimkdZ\_fZy hl l mj[bggh]h h[hjmñZgby m\_ëbqblky ñ 440 =dZe/q.

Kj\_gbc m^evguc jZkoh^ lhibZ aZhlhbl\_evduc i\_jbh^ gZ\ujZ[Zl u\Z\_fm x we\_dljhwg\_j]bx khklZbl 246,5 ]/(d<1·q).

HbZ\_fh\_ m\_ebq\_gb\_ ijb[ueb \ l\_q\_gb\_ ]hZ (ih p\_gZf b lZjbnZf 2009 ).) ihahebl hdmblv dZiblZevgu\_ aZljZlu aZ3-4 ]hZ .

LZd` [ueb jZkkfhlj \_gu j\_bfu jZ[hlu lmj[bg >Zjg bpdhc LWP k\_ujZ[hldhc fZdkbfZ evgh hafhg hc we\_dljbq\_kdhc fh\_sghklb ih dhg^gkZpbhgghfm pbdem \ e\_lgbc i\_jbh^ b \ l\_ieh\_ j\_fy hlhibl\_evgh ]h i\_jbhZ .

< gZklhys\_ j\_fy ihdjulb\_ kns\_klm xsbo e\_lgbo l\_ieh\_uo gZ]mahd gZ=<K \ dhebq\_kl\_ 63=dZe/q hkms\_kley\_lky hl L=-5 ijb hoeZ^gbb dhg^gkZlhjZ pbjd neypbhgg hc hhc k m^evguc f jZkoh^f mkeh\gh]h lhibZ gZ\_ujZ[hldm we\_dljhwg\_j]bb 422 ]/(d<1·q).

HilbfaZpby hli nkdZ l\_ieZ hl lh]h ` h[hjm^Zgby [ \_a dZdbo eb[h j\_dhgkljm dpbc hafhgZ aZ kq\_l mf\_gvr\_gby dhg^gkZpbhggh]h jZkohZ iZjZ, ihdjulby k\_c l\_ieh\_c gZ]madb ba l\_iehnbdZpbhggh]h hl[hjZ b mf\_gvr\_gby jZkohZ k\` ]h iZjZ gZ]mj [ bgm

Ijb wlhf m^evguc jZkoh^ mkh\gh]h lhi ebZ gZ\_ujZ[hldm we\_dljhwg\_j]bb fh\_l khklZblv 370 ]/(d<1·q). HgZdh gZlZdhf j\_bf\_ jZkoh^ iZjZ gZ]mj [ bgmhe`g [ulv hdheh 83,4 d]/k (300 l/q), qlh g\_hafhg hc ih mkeh\bx fZdkbfZevghc jZa] madb dhleh\ , jZ[ hlZxsbo gZ m\_ebq\_gb\_ . Ih wlhc ijbqbg\_ g\_ba[\_gZ baebryy dhg^gkZpbhgghZy fhsghklv , \_ujZ[ZluZ\_ fZy \ e\_lgbc i\_jbh^ b mon^t Zx s Zy wdhgfbq\_kdb\_ ihdZaZl\_eb.

LZdbf h[jZahf , mkZgh\dZ]mj[bgu J-25-1,45 k hafhg hklvx jZ[hlu \ e\_lgbc i\_jbh^ k ihgb`gguf ijhlbhZ\_e\_gb\_f h 50-60 dIZ (0,5-0,6 ZIZ) Zkl hihegbl\_evgh\_ m\_ebq\_gb\_ we\_dlj bq\_kdhc fhsghklb gZ 3,7-4 F<1 b ihahebl bf\_lv \ e\_lgbc i\_jbh^ m^evguc jZkoh^ mkeh\gh]h lhibZ gZ\_ujZ[hldm we\_dljhwg\_j]bb gZ mjhg\_ 370 ]/(d<1·q).

KjZgbl\_evgu\_ jZkq\_lu jZ[hlu LWP ih dhg^gkZpbhgghfm pbdem (k hli nkdhf 63=dZe/q l\_ieZ gZ=<K b fZdkbfZevgh hafhg hc \_ujZ[hldhc we\_dljhwg\_j]bb), \ ZjbZglZo k mkZgh\dhc lmj [ bg L-40/55-1,5 b J-25-1,45 ihdZaZeb, qlh we\_dlj bq\_kdZy fhsghklv LWP \ e\_lgbc i\_jbh^ fh\_l [ulv m\_ebq\_gZ h 263 F<1 b 176 F<1 khhl\lkl\_ ggh. HgZdh ijb wlhf m^evguc jZkoh^u lhibZ gZ\_ujZ[hldm we\_dljhwg\_j]bb khklZyl 439-465 ]/(d<1·q), qlh agZqbl\_evgh ur\_ , q\_f gZ djmigu o iue\_m]hevguo LWK(lZdbo dZd LjbihevkdZy , EZubgkdZy , Afb\_kdZy b f^ ). LZd` g\_wdhghfbqgZ\_ujZ[h] dZ dhg^gkZpbhgghc fhsghklb \ l\_ieh\_ j\_fy hlhibl\_evgh]h i\_jbhZ , dh]Z ihyey\_lky j\_a\_j\ ih iZjm hl[hj\ .

< kyab k ur\_baeh`gguf mkZgh\dZ dhg^gkZpbhgghuo lmj [ bg gZ>Zjg bpdhc LWP, Z lZd` \_jZ[h]Z gZ dhg^gkZpbhgghf j\_bf\_ k kns\_klm xsbf b iZjZf\_ljZfb k\` ]h iZjZ 90 ZIZ, 535 ° g\_j\_dhf\_gm\_lky .

:gZeba ij\_eZ]Z\_fuo f\_jhijbylbc ih m\_ebq\_gbx ihdjulby l\_ieh\_uo b we\_dljbq\_kdbo gZ]mahd hl hkghgh]h lmj[bggh]h h[hjm^Zgby LWP ihahey\_ l k^eZlv ke^mxsb\_ uhu :

1. □ □ LWPp\_e\_khh[jZagh uiegy lv ihwlZigh .
2. G□i\_jhf wZi\_ \ [ebZcr\_ j\_fy p\_e\_khh[jZagh ijh\klb l\_ogbq\_kdh\_ i\_j\_hjm ` \_gb\_ lmj [ bgu IL -60-90 kl. < 7 k aZf\_ghc P<> gZ ghuc , Z lZd` uieghblv fZehaZljZl gu\_jZ[hlu ih l\_ieh\_c ko\_f\_LWP.
3. G□lhjhf wZi\_ ij\_e Z]Z\_lky mkZgh\blv lmj[bgm J-25-1,45 k ]\_g\_jZlhjhf . Ijb wlhf iZj ijhlbhZ\_e\_gby (ey p\_e\_c l\_iehkGZ[ \_gby) hl lmj[bgu ihZ\_lky gZ hg mba kms\_kl\ nxsbo [hce\_jg u o mkZgh\hd.

4.  $\square$   $hkghgu\_l\_ogbdh-wdhghfbq\_kdb\_ihdZaZl\_eb\_ihke\_j\_dhgkljm\_dpbb\_LWP:$
- 4.1  $\square$   $\square l\_iehhc\_fhsghklb\_lmj[bggh]h\_h[hjm]Zgby - 33 = dZe/q.$
- 4.2  $\square$   $\square we\_dljbq\_kdhc\_fhsghklb\_LWP - 35 F < 1 .$
- 4.3  $\square$   $m^{\wedge} evgh]h\_jZkohZ\_mkeh\ gh]h\_lhie\_bZ :$
- 4.3.1  $\square$   $i\_jbh^{\wedge} - 107,7 ]/(d < 1 \cdot q);$
- 4.3.2  $\square$   $i\_jbh^{\wedge} - 43,4 ]/(d < 1 \cdot q).$
- 4.4  $\square$   $hdmi\_Z\_fhklb\_aZljZl - hdheh\ 3\ e\_1.$

Kibkhd  $eb \square \square \square \square$  : 1.LK107-013. :gZeba  $l\_i\_ehhc\_ko\_fu,$  [ZeZgkh\ izj Z b  $l\_ieZ\_k\_u[hjh\_f\_hibfZevgh]h\_ZjbZglZ\_hli\_nkdZ\_l\_ieZ\_b\_l\_ogbq\_kdh]h\_i\_j\_hh\_jnigby >Zjgbdhc\_LWP // nbebZe\_OPD; \langle Wg\_j]hih]j\_kk \rangle$  HHH «Dhlehlmj[hijhf». – 2009. 2. 41L292-1320 IA. JZaj Z[hldZ jZ[hq\\_c  $\hbar$  dmf\\_glZpbb ih j\\_dhgklj mdpbb lmj[bgu IL -60-90/13 kl. < 5 >Zjgbdhc LWP k p\\_evx m\\_ebq\\_gby we\\_dljbq\\_kdhc fhsghklb b wdghfbqgkklb lmj[bgu iml\\_f m\\_ebq\\_gby ijhi nkdgkci hkh[ghklb QK] b jZkohZ izj Z \ l\\_ieh nbdZpbhguc hl[hj // nbebZe\\_OPD; \langle Wg\\_j]hih]j\\_kk \rangle HHH «Dhlehlmj[hijhf». – 2009. 3. 38L292-1293 IA. JZajZ[hldZ jZ[hq\\_c  $\hbar$  dmf\\_glZpbb ih j\\_dhgklj mdpbb lmj[bgu IL -60-90/13 EFA kl. < 5 >Zjgbdhc LWP k p\\_evx i\\_j\\_h  $Z\_gZ\_j\_bf\_jZ[hlu\_k\_momf\_gguf\_Zdmmfhf\_b\_bkih\_evahZgb\_f\_dhg^{\wedge}gkZl\_hjZ\_dZq\_H\_ihh] j\_Zl\_eyk\_l\_hc\_h^{\wedge}u // nbebZe\_OPD; \langle Wg\_j]hih]j\_kk \rangle$  HHH «Dhlehlmj[hijhf». – 2007. 4. =D> 34.09.108-98. Jh ai h^e  $\hbar ljZ\_lb\_iZebZ\_gZ\_l\_ieh\_bo\_e\_dljhklZg\_pyo\_gZ\_ms\_gm\_e\_dljbqgm\_i\_l\_iehm\_g\_j] \times ij\_b \in dhf[ghZghfm\_bj\_h[gbpl \_F\_lh\_bdZ // G>I?g\_j\_l\_bdb . - Db€. - 1998.$

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