

Steel Products for Construction, Industrial Machinery and Plant†

G@X@RGH Jdmih⁰ JNRDJH Sn lnx¹ NF@V@S`j`n² HJDC@ Qhmrh³ G@S@JDX@L@ Jns`qn⁴

steel pipes having improved high-temperature strength and resistance to oxidation have been developing and manufacturing for the heat recovery steam generator. With high appreciation in the market, the production amount of these products have been increasing. This paper describes the product design and the properties.

1. Introduction

Hm sgd bnmrsqtbsnm l`bghmdqx hmctp tb x/ I dmsr rtbg `r bq`mdr+ ct lo sqtbjr `mc onvdq rgnudkr sn qdctbd vdhfgs- IED Rsddk g`r cdudknodc `mc l`mt

rhkd rsqdmfsg `qd eqdptdmskx trdc hm o`qsr rtbg `r bq`md ann l r `mc ntsqffdq- Sgd qdpthqd l dmsr ok`bdc nm sgdrd ghfg rsqdmfsg rsddk ok`sdr g`ud chudqrh@dc hm qdbdms xd`qr+ `r dwd l okh@dc ax knv sd l odq`stqd sn tfgmdrr sn dm`akd oqnr d`dr bnc chrsqhsr `mc h l oqnuce vdkc`ahkhsx ax knvdq, hm f oqgd`shmf sd l odq`stqd enq vdkchmf- H l oqnuce enq l , `ahkhsx hr `krn qdpthqdc hm l`mx b`rdr- Etqsgdq l nqd+ sgd bnrs ne r`shrexhmf sgdrd qdpthqd l dmsr ne odqenq l`mbd g`r `krn adbn l d` l`inq oqd l hrd-

Sn l dds sgdrd mddcr+ IED Rsddk g`r cdudknodc `mc bn l l dqbh`khydc ` 67/ L O` rsddk ok`sd+ IED, GHS DM 67/KD vhsq fnnc vdkc`ahkhsx `mc knv sd l odq`stqd sn tfgmdrr ft`q`msddc `s -3/âB vghbg `qd rtodqhnq sn sg`s ne bnmudmshnm`k oqnc tbsr-

† Nqhfhm`kkx otakhrgcd hm JFE GIHO Mn- 1 'Mnu- 1//2(+ o- 34°4/



⁰ Rdmhnq Qdrd`qbgdq Cdot sx L`m`fdq-
Ok`sd % Rg`odr Qdr- Cdos+
Rsddk Qdr- K`a+
IED Rsddk



¹ Rs`ee Cdot sx Fdmdq`k L`m`fdq-
Oqnc tbsr Rdquibd % Cdudkno l dms Rdb+
Bghs` Vnqjr+
IED Rsddk



² Rs`ee Cdot sx Fdmdq`k L`m`fdq-
Rsddk A`q % Vhq Qnc Atrhmdrr Ok`mmhmf Cdos+
IED Rsddk



³ Rdmhnq Qdrd`qbgdq L`m`fdq-
Inhmmf % Rsqdmfsg Qdr- Cdos+
Rsddk Qdr- K`a+
IED Rsddk



⁴ Rs`ee Fdmdq`k L`m`fdq-
Ok`sd Atrhmdrr Ok`mmhmf Cdos+
IED Rsddk

4.

'@RLD R@102 S12: rgnv m hm **Table 7**(- Sghr l`sdqh`k hr ` 1-14 \$Bq, Ma, U rsddk vhsq ` ghfg V bnmsdms `mc g`r rhfmh@b`msk h l oqnudc ghfg sd l odq`stqd rsqdmfsg hm bn l , o`qhrnm sn sgd bnmudmshnm`k 1-14 \$Bq, 0 \$ L n rsddk-

IED Rsdck `ookhdc ` o`sdms⁰ enq sgd bgd l hb`k bn l on, rhshnm ne sghr rsddk hm 0875- Sgd bn l o`mx adf`m rstcxhmf rs`mc`qchydc oqnc tbslnm hm sgd 088/r `mc hr mnv fq`ct, `kx hmbqd`rhmf hsr qdbnqc ne rgho l dmsr- Sgd ed`stqdr ne sgd rsddk stad l `mte`bstqdc ax IED Rsdck `qd `r enknvr9 '0(Fnnc vdkc`ahkhsx vhsqnts oqgd`shmf nq onrs,gd`s sqd`s l dms nv hmf sn knv B bn l onrhshnm-

'1(Ghfg qdrhrs`mbd sn bq`bjhmf hm gd`s `eedbsdc ynm d 'G@Y(nv hmf sn knv B , knv M bn l onrhshnm-

'2(Ghfg bqddo qtostqd rsqdmfsg `s dkdu`sdc sd l odq`stqdr nv hmf sn l hmi l hydc @k bnmsdms-

Rhmbd sgd u`qin tr ogxrhb`k oqnodqshdr ne sghr l`sd, qh`k rtbg `r sgdq l`k bnmctbshuhsx+ bnde@bhdms ne khmd`q dwo`mrhnm+ dsb- `qd nm sgd r` l d nqcdq `r sgd bnmudmshnm`k 1-14 \$Bq, 0 \$ L n rsddk+ `mc hs g`r sgd chrshmbshud ed`stqdr ne ghfg rsqdmfsg `s qnn l sd l odq`stqd.`s dkdu`sdc sd l , odq`stqd **Table 8**(`mc ghfg sd l odq`stqd bqddo rsqdmfsg+ vgd m `ookhdc sn sgd r` l d o`qsr `r bnmudmshnm`k rsddk stad r+ sghm, v`kk.khfgsvdhfgs rsddk stad r b`m ad trdc- @r ` qdrtk+ rtars`msh`k dbnmn l hb admd@sr b`m ad dwodbsdc+ hmbktchmf qdctbshnm ne bnrsr ne vdkchmf+ rsddk oqnc tbs otqbg`rhmf `mc hmrs`kk`shnm.sq`mronqs`shnm-

IED Rsdck`r ghfg Bq `kknx rsddk stad r `qd oqnc t bdc nm ` l `mte`bstqhmf khmd vghbg g`r qdrodbshud `cu`ms`fdr `mc rtodqhnqhsx hm sgd rsddk l`j hmf `mc b`rshmf oqnbdr r enq ohod, l`j hmf l`sdqh`k+ gns qnkkmf oqnbdr r+ `mc pt`k, hsx `rrtq`mbd rxrsd l+ `mc `qd ghfg pt`khsx oqnc tbsr vhsq ghfg qdkh`ahkhsx-

4.2 Bainitic Microalloyed Steels for Hot Forging

Sgd l`bghmd rsqtbstq`k o`qsr l`cd ne b`qanm `mc`kknx rsddkr `qd bnmudmshnm`kkx l`mte`bstqdc ax ptymbg, hmf `mc sd l odqhmf- Eqn l sgd uhdvonhmsr ne qdrntqbd r`u, hmf+ bnrs qdctbshnm `mc dmdqfx r`uhmf+ gnvduq+ IED Rsdck cdudknodc a`hmshb l hbqn`kknxdc rsddkr `r r tarshstsd l`sdqh`kr vghbg dm`akd n l hrrhnm ne sgdrd gd`s sqd`s l dms oqnbdrdr- Sgdx `qd sgd l hbqn`kknxdc rsddkr vhsq a`hmhsd rsqtbstqd hm sgd `r, gns enqfde `mc `hq bnnkdc bnmchshnm- Ghfg sntfgmdrr hr nas`hmdc ax qdctbhmf tb ac a _ ms

vdkchmf+ sgd `cchshnm ne J `bghdudr ro`ssdq,kdrr vdkchmf-
 Enq BN₁ f`r rghdkcdc vdkchmf+ IED Rsddk cdudknode
 `ghfg eqdptdmbx otkrd vdkchmf l dsgnc vghbg qdctbdr
 ro`ssdq ax `ooqnh l`sdqx 6/\$+ `r rgnvm hm **Fig. 7-** Sghr
 cdubd `bghdudr tksq`,knv ro`ssdq ax b`trhmf uhaq`shnm
 ne sgd rtrodmedc cqnokds trhmf `ghfg eqdptdmbx otkrd
 hm sgd vdkchmf btqqdms `mc nosh lhy`shnm ne sgd bgd lhb`k
 bn l onrshnm ne vhdq+ `mc etqsgdq+ ax qd@mhmf sgd rhyd ne
 sgd sq`mredqqdc cqnokds ax `ookxhmf `rsqnmf dkdbsqn l`f,
 mdshb ohmbg enqbd ctqhmf sgd otkrd od`j odqhnc-

6. Conclusions

@kk ne sgd oqnc tbsr cdrbqhadc gdqdhm g`ud addm ghfgkx
 du`kt`sdc hm sgd I`o`mdrd `mc enqdhfm l`qjdsr enq sgdhq
 tmhptd oqnc tbs cdrhfm l`sbgdc sn btrsn l dq mddcr+ ghfg
 odqenq l`mbd `mc ghfg pt`khsx- @r `qdrtkst+ sgdhq oqnc tb,
 shnm unkt l dr `qd hmbqd`rhmf- Sgd sdq l r ne bnmrsqtbshnm,
 hmc trsqh`k l`bghmdqx `mc ok`ms oqnc tbsr dmbn lo`rr `v
 hcd q`mfd ne naidbsr vhsq chudqrd qdpthq l dmsr- Enq
 sgd etstqd+ IED Rsddk hr bn l l hssdc sn cdudknohmf oqnc,
 tbsr vhsq `ghfg cdfqdd ne tmhptdmdrr vghbg l dds sgd rd
 chudqrd l`qjds mddcr ax `ookxhmf rs`sd,ne,sgd,`qs dptho,
 l dms `mc `m`cu`mbdc pt`khsx bnmsqnr xrsd l-

Reference

0(

oqdrhmf bmbdmsq`shnm ne `qb `s sgd anssn l ne `cqnokds
 ' l nksdm o`qs ne sgd vhdq sho enq l dc ax gd`s ne sgd vdkc,
 hmf `qb(+ vghbg qdctbdr ro`ssdq- J L,4/RG hr trdc hm
 @q,BN₁ f`r rghdkcdc `qb vdkchmf- Sgd `cchshnm ne J oqn,
 l nsdr roq`x sq`mredq+ qd`khyhmf knv ro`ssdq vdkchmf- Vhsq
 J L,4/R+ vghbg hr trdc hm otkrd @q,BN₁ f`r rghdkcdc `qb