





cpf"vqngtcpegu"ctg" fkhgtgpn"htq o"vjqug"ht"ektewnctkv{"kp"  
LCUU8."kp" y jkej"vjg"rtqkukqpu"eqpukfgt"vjg"nkpget" o ku  
cnki p o gpv" y jkej"qeewtu"kp" y gnfu"cv"rkrq"lqkpvu0

Vjku" fkhgtgpeg" dgeq o gu" rctvkewnctn{"nctig"kp"nctig/  
fkc o gvg" rkrqu0" Hqt" gzc o rng." kp" LKU." vjg"vqngtcpeg"ht"  
φ 4"222" o o" ku" 032" o o" d{" eqpxgtukqp" qh" vjg" qwvgt"

LCUU8." vjg"vqngtcpeg"ku" 05" o o" urgekLgf"cu"ektewnctkv{0"  
Vjwu."kp"dwnfkpi"htc o gu."eqpukfgtcvkqp"qh"LCUU8." y jkej"  
tgs wktgu"tgncvkggn{"uvtkev"ceewtce{"eqpvtn."ku"fg o c p f g f 0

## 2.4 Development Targets

Vjg"qdlgev"qh"vjku"fgxgnqr o gpv" y cu"tqwpf"uvgn"rkrqu"

ujqyp"kp"Hki0"5\*c+0"Kp"jki jgt"uvtgpi vj"uvggnu."nqy" [ T"qh"  
:2 ' "qt"nguu"ecp"dg"cejkgxgf"ykvj"7;2"Plo o  
\*UC662+."cpf":7 ' "qt"nguu"ecp"dg"cejkgxgf"9:2"Plo o  
encuu"uvgggn"\*nqy" [ T/J V9:2=LHG/JKVG P9:2V+d{"crrn{

kpenwfgu"kpvg/etkvecn"tgjgcvgf"swgpejkpi"\*Sø+."cu"ujqyp"  
kp" Hki0"5\*d+0" LHG" Uvggn" jcu" qdvckpgf" egtvkLecvkqp" htq o "  
vjg"Okpkuvgt"qh"Ncpf."Kphtcuvtwevtg"cpf"Vtcpurqtv"hqt"kvu"  
nqy" [ T"uvgggn"nkpgwr" ykvj"vgpukng" uvtgpi vju"kp"vjg"tcpig"

Tgegpvn{." LHG" Uvggn" guvcdnkujgf" cp" qp/nkpg" jgcvt  
vtgcvo gpv"vgejpqni {"vjcv"tgcnk|gu"Łpg"fkurgtugf" o ketq  
uvtwevtcn" eqpvtqn"qh"vjg"jctf" octvgpukvg" rjcug." yjkej"

f"c \_ utkeqwnf"qpnc"dg"cejkgxgf"ykvj"vjg"n"k ng"u# gu b

Table 2 Results of y-groove weld cracking tests

Uvggn" rncvg		Ygnfkpi "eqpfkvpku		

qtfgt"vq"ucvkuh{" vjg"nqy" [ T"urgekŁecvkqp" hqt" uvggn" rkr gu." vjg" vctigv" [ T"qh" vjg" rncvg" wugf" cu" vjg" dcug" o cvgtkn" ku" fgetgcugf" hwtvjgt." qt" c" rtqegu" yjkej" tgfwegu" yqtm" jctfgpkpi" ku" cr rnkf." uwej" cu" ycto" dgpfkpi" hqt okpi" qt" jgcv" vtgcvo gpv" chvgt" rkr go cmkpi." cu" fguetkdgf" kp" Ugevkqp"

Hkiwtg"6\*d+" ujqyu" vjg" ghhev" qh" vjg" coqwpv" qh" rtg uvtckp" qp" vjg" Ejctr{" htcewtg" vtcpukvkqp" vgo rgtcvwtg" \*xVtu+0" Cmm" qh" vjg" uvggn" rncvgu" ujqygf" go dtkvng" o gpv" cu" c" tguwnv" qh" uvtckp" cikpi." cpf" xVtu" kpetgcugf" d{" 52672ÅE0" Vjwu." ykvj" jgcx{" "uvggn" rncvgu" yjkej" ctg" vq" dg" cr rnkf" cu" o cvgtkn" hqt" rkr go cmkpi." kv" ku" pgeguuct{" "vq" qrvk ok|g" vjg"

ukfgtkpi" vjg" tgfwevkqp" qh" vqwi jpguu" ecwugf" d{" dgpfkpi"

**3.1.3 Weldability (Lowering P<sub>CM</sub>)**

LHG" Uvggn" jcu" fgxgnqrgf" jki j" uvtgpi vj." jki j" rgt hqt o cpeg" uvggn" rncvgu" yjkej" ugewtg" gzegngpv" ygnfcdknkv{" d{" tgfwekpi" vjg" ectdqp" gswkxcngpv" C<sub>gs</sub>" cpf" ygnf" etcem" ugpukvkvkv{" eqo rqukvkqp" P<sub>EO</sub>" wukpi" jki j" ceewtce{" VOER." vcmkpi" cfxcpvcig" qh" kvu" cfxcpvgf" ceegnctcvf" eqqkpi" fgxkeg." vjg" Super/QNCE0" Cu" cp" gzc o rng." **Table 2** ujqyu" vjg" tguwnvu" qh" { / i tqxg" ygnf" etcem" vguvu" qh" vjg" o ckp" nqy" [ T" uvggn" rncvgu" hqt" dwnkfkpi" eqpuvtwevkqp" \*772" Plo o encuu" uvggn" \*JDN5: 7+." jki j" ygnfcdknkv{" v{ rg" 7; 2" Plo o uvggn" \*UC662/W+7+ " cpf" nqy" [ T/9: 2" Plo o " encuu" uvggn+0" Ykvj" uvggn" ykvj" wpfgt" 7; 2" Plo o " nqy." vjg" rtgjcvkpi" vgo rgtcvwtg" hqt" rtgxgpvkpi" etcemkpi" kp" EQ cte" ygnfkpi" ycu" tqqo" vgo rgtcvwtg" qt" nqygt." ujqykpi" vjcv" vjgug" uvggnu" rquuguu" ygnfcdknkv{" qh" c" ngxgn" cv" yjkej" rtgjcvkpi" ku" igpgtcmm{" wppgeguuct{0

**3.2 Pipemaking**

**3.2.1 Bending forming**

rtqfwegf" d{" LHG" Uvggn." ykvj" jki j" uvtgpi vj." jgcx{" ycm" vjkempguu" rtqfwevu" uwej" cu" vjqug" yjkej" ygtg" vjg" qdlgev" qh" vjku" fgxgnqro gpv." rkr go cmkpi" ku" rgthqto gf" d{" vjg"

rtguu" dgpf" o gvjqf" \*Photo 2+0" Kp" vjg" rtguu" dgpf" o gvjqf."

kpi" cv" gswcn" kpvtxcnu" ykvj" c" rtguu" ocejkpg." cpf" vjg" tgswtg" ewtvcvwtg" ku" vjgp" qdvckpgf" wukpi" c" uvtckijvpggtl" Vjg" tguvtkevqp" qp" vjku" o gvjqf" ku" vjg" ecrcekv{" qh" vjg" rtguu" Jki j" rtguu" rqygt" ku" pgeguuct{" kp" rncuvke" dgpfkpi" hqt okpi" vj tqwi j" vjg" hwnn" vjkempguu" qh" jgcx{" icwi g" uvggn" rncvgu" Kp" ecugu" yjkej" gzeggf" vjg" ecrcekv{" qh" vjg" rtguu" ocejkpg." kv" ku" pgeguuct{" vq" rgthqto" ycto" hqt okpi" d{"

kpetgcugu." dwv" yqtm" jctfgpkpi" cnuq" ejcpi gu" Vjgtghqtg." kv" ku" pgeguuct{" vq" fgvt okpg" vjg" rtguu" dgpf" eqpfkvpku"

Hwtvjgt o qtg." kp" qtfgt" vq" ugewtg" fko gpukqpcn" ceewtce{" chvgt" rkr go cmkpi." eqpvtqn" qh" vjg" fko gpukqpcn" ceewtce{" qh" vjg" o cvgtkn" rncvg." c" itcur" qh" vjg" rtguu" ecrcekv{" cpf"

d{" ugc o" ygnfkpi." dgeq o g" kuuwgu" Rctkewnctn{" kp" jgcx{/ ycmgf" rkr gu." fwg" vq" vjg" nctig" coqwpv" qh" ygnfkpi" cpf" ykfg" ykfvj" qh" vjg" ugc o" dgcf." ygnfkpi" eqpfkvpku" uwej" cu" itqaxg" uk|g" cpf" ygnfkpi" jgcv" kprwv" fwtkpi" ygnfkpi" ctg" eqpvtqmgf" htqo" vjg" xkgy rkp" qh" ugewtkpi" fko gpukqpcn" ceewtce{0



kttgur gevkg"qh"uvtgpi vj."vj kempguu."qt"ewtxcwtg0

**Figure 6** uj qyu" vjg" fkutkdwkqp" qh" vjg" {kgnf" tcvkq"  
\* [ T+" qh" vjg" rkr gu" d{" t D