BS EN ISO 6892-1:2009

BS Br t Sta dard

Metallic materials — Tensile testing

Part 1: Method of test at ambient temperature

ra ta dard worldw de™

British Standards

Nat o al oreword

This British Standard is the UK implementation of EN ISO 6892-1:2009. It supersedes BS EN 10002-1:2001 which is withdrawn.

The UK participation in its preparation was entrusted by Technical Committee ISE/NFE/4, Mechanical testing of metals, to Subcommittee ISE/NFE/4/1, Uniaxial testing of metals.

A list of organizations represented on this committee can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

ISBN 978 0 580 56327 0

ICS 77.040.10

Compliance ith a British Standard cannot confer imm nit from legal obligations.

T Br t Sta dard wa ubl ed u der t e aut or ty o t e Sta dard Pol y a d Strate y Co ttee o 31 Au u t 2 9.

A e d e t ued e ubl at o

Date	Text a e ted

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄ SCHE NORM

EN SO 6892-1

Au u t 2 9

CS 77. 4 .1

Su er ede EN 1 2-1:2 1

E l er o

Metall ater al - Te le te t - Part 1: Met od o te t at roo te erature (SO 6892-1:2 9)

Matér aux étall que - E a de tra t o - Part e 1: Mét ode d'e a à te érature a b a te (SO 6892-1:2 9)

Metall e Werk to e - u ver u - Te l 1: Prü ver a re be Rau te eratur (SO 6892-1:2 9)

T Euro ea Sta dard wa a roved by CEN o 13 Mar 2 9.

CEN e ber are bou d to o ly w t t e CEN/CENELEC ter al Re ulat o w t ulate t e o d t o or v t Euro ea Sta dard t e tatu o a at o al ta dard w t out a y alterat o . U -to-date l t a d b bl o ra al re ere e o er u at o al ta dard ay be obta ed o a l at o to t e CEN Ma a e e t Ce tre or to a y CEN e ber.

T Euro ea Sta dard ex t t ree o al ver o (E l , Fre , Ger a). A ver o a y ot er la ua e ade by tra lat o u der t e re o b l ty o a CEN e ber to t ow la ua e a d ot ed to t e CEN Ma a e e t Ce tre a t e a e tatu a t e o al ver o .

CEN e ber are t e at o al ta dard bod e o Au tr a, Bel u , Bul ar a, Cy ru , Cze Re ubl , De ark, E to a, F la d, Fra e, Ger a y, Gree e, Hu ary, ela d, rela d, taly, Latv a, L t ua a, Luxe bour , Malta, Net erla d , Norway, Pola d, Portu al, Ro a a, Slovak a, Slove a, S a , Swede , Sw tzerla d a d U ted K do .

EUROPEAN COMM TTEE FOR STANDARD AT ON
COM TÉ EUROPÉEN DE NORMAL SAT ON
EUROPÄ SCHES KOM TEE FÜR NORMUNG

Ma a e e t Ce tre: Ave ue Mar x 17, B-1 Bru el

Re . No. EN SO 6892-1:2 9: E

Foreword

T do u e t (EN SO 6892-1:2 9) a bee re ared by Te al Co ttee SO/TC 164 "Me a al te t o etal " ollaborat o w t Te al Co ttee EC SS/TC 1 “Te le te t ” t e e retar at o w eld by AFNOR.

T Euro ea Sta dard all be ve t e tatu o a at o al ta dard, e t er by ubl at o o a de t al text or by e dor e e t, at t e late t by February 2 1 , a d o l t at o al ta dard all be w t draw at t e late t by February 2 1 .

Atte t o draw to t e o b l ty t at o e o t e ele e t o t do u e t ay be t e ube t o ate t r t . CEN a d/or CENELEC all ot be eld re o ble or de t y a y or all u ate t r t .

T do u e t u er ede EN 1 2-1:2 1.

A ord to t e CEN/CENELEC ter al Re ulat o , t e at o al ta dard or a zat o o t e ollow ou tr e are bou d to le e t t Euro ea Sta dard: Au tr a, Bel u , Bul ar a, Cy ru , Cze Re ubl , De ark, E to a, F la d, Fra e, Ger a y, Gree e, Hu ary, ela d, rela d, taly, Latv a, L t ua a, Luxe bour , Malta, Net erla d , Norway, Pola d, Portu al, Ro a a, Slovak a, Slove a, S a , Swede , Sw tzerla d a d t e U ted K do .

E dor e e t ot e

T e text o SO 6892-1:2 9 a bee a roved by CEN a a EN SO 6892-1:2 9 w t out a y od at o .

Co te t

Pa e

Foreword

SO (t e ter at o al Or a zat o or Sta dard zat o) a worldw de ederat o o at o al ta dard bod e (SO e ber bod e). T e work o re ar ter at o al Sta dard or ally arr ed out t rou SO te al o ttee . Ea e ber body tere ted a ub e t or w a te al o ttee a bee e tabl ed a t e r t to be re re e ted o t at o ttee. ter at o al or a zat o , over e tal a d o - over e tal, l a o w t SO, al o take art t e work. SO ollaborate lo ely w t t e ter at o al Ele trote al Co o (EC) o all atter o ele trote al ta dard zat o .

ter at o al Sta dard are dra ted a orda e w t t e rule ve t e SO/ EC D re t ve , Part 2.

T e a ta k o te al o ttee to re are ter at o al Sta dard . Dra t ter at o al Sta dard ado ted by t e te al o ttee are r ulated to t e e ber bod e or vot . Publ at o a a ter at o al Sta dard requ re a roval by at lea t 75 % o t e e ber bod e a t a vote.

Atte t o draw to t e o b l ty t at o e o t e ele e t o t do u e t ay be t e ub e t o ate t r t . SO all ot be eld re o ble or de t y a y or all u ate t r t .

SO 6892-1 wa re ared by Te al Co ttee SO/TC 164, *Me a al te t o etal* , Sub o ttee SC 1, *U ax al te t* .

T r t ed to o SO 6892-1 a el a d re la e SO 6892:1998.

SO 6892 o t o t e ollow art , u der t e e eral t tle *Metall ater al — Te le te t* :

— *Part 1: Met od o te t at roo te erature*

T e ollow art are u der re arat o :

— *Part 2: Met od o te t at elevated te erature*

— *Part 3: Met od o te t at low te erature*

T e ollow art la ed:

— *Part 4: Met od o te t l qu d el u*

trodu t o

Dur d u o o er t e eed o te t t e re arat o o SO 6892:1998, t wa de ded to re o e d t e u e o tra rate o trol uture rev o .

t art o SO 6892, t ere are two et od o te t eed ava lable. T e r t, et od A, ba ed o tra rate (lud ro ead e arat o rate) a d t e e o d, et od B, ba ed o tre rate . Met od A te ded to ze t e var at o o t e te t rate dur t e o e t w e tra rate e t ve ara eter are deter ed a d to ze t e ea ure e t u erta ty o t e te t re ult .

Metall ater al — Te le te t —

Part 1:
Met od o te t at roo te erature

1 S o e

T art o SO 6892 e e t e et od or te le te t o etall ater al a d de e t e e a al ro ert e w a be deter ed at roo te erature.

NOTE A ex A d ate o le e tary re o e dat o or o uter o trolled te t a e .

2 Nor at ve re ere e

T e ollow re ere ed do u e t are d e able or t e a l at o o t do u e t. For dated re ere e , o ly t e ed t o ted a l e . For u dated re ere e , t e late t ed t o o t e re ere ed do u e t (lud a y a e d e t) a l e .

SO 377, *Steel a d teel rodu t — Lo at o a d re arat o o a le a d te t e e or e a al te t*

SO 2566-1, *Steel — Co ver o o elo at o value — Part 1: Carbo a d low alloy teel*

SO 2566-2, *Steel — Co ver o o elo at o value — Part 2: Au te t teel*

SO 75 -1, *Metall ater al — er at o o tat u ax al te t a e — Part 1: Te o / o re o te t a e — er at o a d al brat o o t e or e- ea ur y te*

SO 9513, *Metall ater al — Cal brat o o exte o eter u ed u ax al te t*

3 Ter a d de t o

For t e ur o e o t do u e t, t e ollow ter a d de t o a ly.

3.1
au e le t

L

le t o t e arallel ort o o t e te t e e o w elo at o ea ured at a y o e t dur t e te t

SO/TR 25679:2 5 [3]

3.1.1
or al au e le t

L_o

le t betwee **au e le t** (3.1) ark o t e e e ea ured at roo te erature be ore t e te t

NOTE Ada ted ro SO/TR 25679:2 5 [3].

3.1.2
al au e le t a ter ru ture
al au e le t a ter ra ture

L_u

le t betwee **au e le t** (3.1) ark o t e te t e e ea ured a ter ru ture, at roo te erature, t e two e e av bee are ully tted ba k to et er o t at t e r axe le a tra t l e

NOTE Ada ted ro SO/TR 25679:2 5 [3].

3.2
arallel le t

L

le t o t e arallel redu ed e to o t e te t e e

SO/TR 25679:2 5 [3]

NOTE T e o e t o arallel le t re la ed by t e o e t o d ta e betwee r or u a ed te t e e .

3.3
elo at o

rea e t e **or al au e le t** (3.1.1) at a y o e t dur t e te t

NOTE Ada ted ro SO/TR 25679:2 5 [3].

3.4
er e ta e elo at o

elo at o ex re ed a a er e ta e o t e **or al au e le t** , L_o (3.1.1)

SO/TR 25679:2 5 [3]

3.4.1
er e ta e er a e t elo at o

rea e t e **or al au e le t** (3.1.1) o a te t e e a ter re oval o a e ed tre , ex re ed a a er e ta e o t e or al au e le t , L_o

SO/TR 25679:2 5 [3]

3.4.2
er e ta e elo at o a ter ra ture

A

er a e t elo at o o t e au e le t a ter ra ture, $(L_u - L_o)$, ex re ed a a er e ta e o t e **or al au e le t** , L_o

SO/TR 25679:2 5 [3]

NOTE For ro ort o al te t e e , t e or al au e le t ot equ vale t to $5{,}65\sqrt{S_o}$ [1)] w ere S_o t e or al ro - e t o al area o t e arallel le t , t e y bol A ould be u le e ted by a ub r t d at t e oe e t o ro ort o al ty u ed, e. . $A_{11,3}$ d ate a er e ta e elo at o o t e au e le t , L_o, o

$$A_{11,3} = 11{,}3\sqrt{S_o}$$

For o - ro ort o al te t e e (ee A ex B), t e y bol A ould be u le e ted by a ub r t d at t e or al au e le t u ed, ex re ed ll etre , e. . A_8 d ate a er e ta e elo at o o a au e le t , L_o, o 8 .

1) $5{,}65\sqrt{S_o} = $ [illegible] $\pi)$.

3.5
exte o eter au e le t

L_e

t al exte o eter au e le t u ed or ea ure e t o exte o by ea o a exte o eter

NOTE 1 Ada ted ro SO/TR 25679:2 5 3 .

NOTE 2 For ea ure e t o yeld a d roo tre t ara eter , L_e ould a a u o t e arallel le t o t e te t e e a o ble. deally, a a u , L_e ould be reater t a ,5 L_o but le t a a rox ately ,9L . T ould e ure t at t e exte o eter dete t all y eld eve t t at o ur t e te t e e. Furt er, or ea ure e t o ara eter "at" or "a ter rea " ax u or e, L_e ould be a rox ately equal to L_o.

3.6
exte o

rea e t e **exte o eter au e le t** , L_e (3.5), at a y o e t dur t e te t

SO/TR 25679:2 5 3

3.6.1
er e ta e exte o
" tra "

exte o ex re ed a a er e ta e o t e **exte o eter au e le t** , L_e (3.5)

3.6.2
er e ta e er a e t exte o

rea e t e exte o eter au e le t , a ter re oval o a e ed tre ro t e te t e e, ex re ed a a er e ta e o t e **exte o eter au e le t** , L_e (3.5)

SO/TR 25679:2 5 3

3.6.3
er e ta e y eld o t exte o

A_e

d o t uou y eld ater al , t e exte o betwee t e tart o y eld a d t e tart o u or work arde , ex re ed a a er e ta e o t e **exte o eter au e le t** , L_e (3.5)

NOTE Ada ted ro SO/TR 25679:2 5 3 .

See F ure 7.

3.6.4
er e ta e total exte o at ax u or e

A_t

total exte o (ela t exte o lu la t exte o) at ax u or e, ex re ed a a er e ta e o t e **exte o eter au e le t** , L_e (3.5)

See F ure 1.

3.6.5
er e ta e la t exte o at ax u or e

A

la t exte o at ax u or e, ex re ed a a er e ta e o t e **exte o eter au e le t** , L_e (3.5)

See F ure 1.

3.6.6
er e ta e total exte o at ra ture

A_t

total exte o (ela t exte o lu la t exte o) at t e o e t o ra ture, ex re ed a a er e ta e o t e **exte o eter au e le t** , L_e (3.5)

See F ure 1.

3.7 Te t rate

3.7.1
tra rate

$\dot{e}_{L_e}$

rea e o tra , ea ured w t a exte o eter, **exte o eter au e le t** , L_e (3.5), er t e

NOTE See 3.5.

3.7.2
e t ated tra rate over t e arallel le t

$\dot{e}_L$

value o t e rea e o tra over t e **arallel le t** , L (3.2), o t e te t e e er t e ba ed o t e **ro ead e arat o rate** (3.7.3) a d t e arallel le t o t e te t e e

3.7.3
ro ead e arat o rate

v

d la e e t o t e ro ead er t e

3.7.4
tre rate

$\dot{R}$

rea e o tre er t e

NOTE Stre rate ould o ly be u ed t e ela t art o t e te t (et od B).

3.8
er e ta e redu t o o area

ax u a e ro - e t o al area w a o urred dur t e te t, ($S_o - S_u$), ex re ed a a er e ta e o t e or al ro - e t o al area, S_o:

$$= \frac{S_o - S_u}{S_o} \times 1$$

3.9 Max u or e

NOTE For ater al w d lay d o t uou y eld , but w ere o work arde a be e tabl ed, F ot de ed t art o SO 6892 ee oot ote to F ure 8) .

3.9.1
ax u or e

F

〈 ater al d lay o d o t uou y eld 〉 e t or e t at t e te t e e wt ta d dur t e te t

3.9.2
ax u or e
F
〈 ater al d lay d o t uou y eld 〉 e t or e t at t e te t e e w t ta d dur t e te t a ter t e be o work arde

NOTE See F ure 8 a) a d b).

3.1
tre
at a y o e t dur t e te t, or e d v ded by t e or al ro - e t o al area, S_o, o t e te t e e

NOTE 1 Ada ted ro SO/TR 25679:2 5 [3].

NOTE 2 All re ere e to tre t art o SO 6892 are to e eer tre .

NOTE 3 w at ollow , t e de at o “ or e” a d “ tre ” or “exte o ”, “ er e ta e exte o ” a d “ tra ”, re e t vely, are u ed o var ou o a o (a ure ax label or ex la at o or t e deter at o o d ere t ro ert e). However, or a e eral de r t o or de t o o a well-de ed o t o a urve, t e de at o “ or e” a d “ tre ” or “exte o ”, “ er e ta e exte o ” a d “ tra ”, re e t vely, are ter a eable.

3.1 .1
te le tre t
R
tre orre o d to t e **ax u or e**, F (3.9)

SO/TR 25679:2 5 [3]

3.1 .2
y eld tre t
w e t e etall ater al ex b t a y eld e o e o , tre orre o d to t e o t rea ed dur t e te t at w la t de or at o o ur w t out a y rea e t e or e

NOTE Ada ted ro SO/TR 25679:2 5 [3].

3.1 .2.1
u er y eld tre t
R_{eH}
ax u value o **tre** (3.1) r or to t e r t de rea e or e

NOTE Ada ted ro SO/TR 25679:2 5 [3].

See F ure 2.

3.1 .2.2
lower y eld tre t
R_{eL}
lowe t value o **tre** (3.1) dur la t y eld , or a y t al tra e t e e t

SO/TR 25679:2 5 [3]

See F ure 2.

3.1 .3
roo tre t , la t exte o
R
tre at w t e la t exte o equal to a e ed er e ta e o t e **exte o eter au e le t** , L_e (3.5)

NOTE 1 Ada ted ro SO/TR 25679:2 5, " roo tre t , o - ro ort o al exte o ".

NOTE 2 A u x added to t e ub r t to d ate t e re r bed er e ta e, e. . $R_{,2}$.

See F ure 3.

3.1 .4
roo tre t , total exte o
R_t
tre at w total exte o (ela t exte o lu la t exte o) equal to a e ed er e ta e o t e **exte o eter au e le t** , L_e (3.5)

NOTE 1 Ada ted ro SO/TR 25679:2 5[3].

NOTE 2 A u x added to t e ub r t to d ate t e re r bed er e ta e, e. . $R_{t,5}$.

See F ure 4.

3.1 .5
er a e t et tre t
R_r
tre at w , a ter re oval o or e, a e ed er a e t elo at o or exte o , ex re ed re e t vely a a er e ta e o **or al au e le t** , L_o (3.1.1), or **exte o eter au e le t** , L_e (3.5), a ot bee ex eeded

SO/TR 25679:2 5[3]

See F ure 5.

NOTE A u x added to t e ub r t to d ate t e e ed er e ta e o t e or al au e le t , L_o, or o t e exte o eter au e le t , L_e, e. . $R_{r,2}$.

3.11
ra ture
e o e o w dee ed to o ur w e total e arat o o t e te t e e o ur

NOTE Cr ter a or ra ture w ay be u ed or o uter o trolled te t are ve F ure A.2.

4 Ter a d y bol

T e y bol u ed t art o SO 6892 a d orre o d de at o are ve Table 1.

Table 1 — Sy bol a d de at o

Sy bol	U t	De at o
Te t e e		
a_o, T [a]		or al t k e o a lat te t e e or wall t k e o a tube
b_o		or al w dt o t e arallel le t o a lat te t e e or avera e w dt o t e lo tud al tr take ro a tube or w dt o lat w re
d_o		or al d a eter o t e arallel le t o a r ular te t e e, or d a eter o rou d w re or ter al d a eter o a tube
D_o		or al exter al d a eter o a tube
L_o		or al au e le t
L'_o		t al au e le t or deter at o o A_w (ee A ex)
L		arallel le t
L_e		exte o eter au e le t
L_t		total le t o te t e e
L_u		al au e le t a ter ra ture
L'_u		al au e le t a ter ra ture or deter at o o A_w (ee A ex)
S_o	^{2}	or al ro - e t o al area o t e arallel le t
S_u	^{2}	u ro - e t o al area a ter ra ture
k	—	oe e t o ro ort o al ty (ee 6.1.1)
	%	er e ta e redu t o o area
Elo at o		
A	%	er e ta e elo at o a ter ra ture (ee 3.4.2)
A_w	%	er e ta e la t elo at o w t out e k (ee A ex)
Exte o		
A_e	%	er e ta e y eld o t exte o
A	%	er e ta e la t exte o at ax u or e, F
A_{t}	%	er e ta e total exte o at ax u or e, F
A_t	%	er e ta e total exte o at ra ture
ΔL		exte o at ax u or e
ΔL		exte o at ra ture
Rate		
$\dot{e}_{L_e}$	$^{-1}$	tra rate
$\dot{e}_{L}$	$^{-1}$	e t ated tra rate over t e arallel le t
$\dot{R}$	MPa $^{-1}$	tre rate
v	$^{-1}$	ro ead e arat o rate

Table 1 — Sy bol a d de at o *(o t ued)*

Sy bol	U t	De at o
For e		
F	N	ax u or e
Y eld tre t — Proo tre t — Te le tre t		
E	MPa [b]	odulu o ela t ty
	MPa	lo e o t e tre - er e ta e exte o urve at a ve o e t o t e te t
E	MPa	lo e o t e ela t art o t e tre - er e ta e exte o urve
R_{eH}	MPa	u er y eld tre t
R_{eL}	MPa	lower y eld tre t
R	MPa	te le tre t
R	MPa	roo tre t , la t exte o
R_r	MPa	e ed er a e t et tre t
R_t	MPa	roo tre t , total exte o

[a] Sy bol u ed teel tube rodu t ta dard .

[b] 1 MPa = 1 N $^{-2}$.

t e ela t art o t e tre - er e ta e exte o urve, t e value o t e lo e ay ot e e arly re re e t t e odulu o ela t ty. T value a lo ely a ree w t t e value o t e odulu o ela t ty o t al o d t o (re olut o , double ded, avera exte o eter , er e t al e t o t e te t e e, et .) are u ed.

CAUT ON — T e a tor 1 e e ary er e ta e value are u ed.

5 Pr le

T e te t volve tra a te t e e by te le or e, e erally to ra ture, or t e deter at o o o e or ore o t e e a al ro ert e de ed Clau e 3.

T e te t arr ed out at roo te erature betwee 1 °C a d 35 °C, u le ot erw e e ed. Te t arr ed out u der o trolled o d t o all be ade at a te erature o 23 °C ± 5 °C.

6 Te t e e

6.1 S a e a d d e o

6.1.1 Ge eral

T e a e a d d e o o t e te t e e ay be o tra ed by t e a e a d d e o o t e etall rodu t ro w t e te t e e are take .

T e te t e e u ually obta ed by a a a le ro t e rodu t or a re ed bla k or a t . However, rodu t o u or ro - e t o (e t o , bar , w re , et .) a d al o a - a t te t e e (.e. or a t ro a d o - errou alloy) ay be te ted w t out be a ed.

T e ro - e t o o t e te t e e ay be r ular, quare, re ta ular, a ular or, e al a e , o e ot er u or ro - e t o .

Pre erred te t e e ave a d re t relat o   betwee t e or al au e le t , L_o, a d t e or al ro - e t o al area, S_o, ex re ed by t e equat o $L_o = k\sqrt{S_o}$, w ere k a oe e t o ro ort o al ty, a d are alled ro ort o al te t e e . T e ter at o ally ado ted value or k 5,65. T e or al au e le t all be ot le t a 15 . W e t e ro - e t o al area o t e te t e e too all or t requ re e t to be et w t , k = 5,65, a er value (re erably 11,3) or a o - ro ort o al te t e e ay be u ed.

NOTE By u a or al au e le t aller t a 2 , t e ea ure e t u erta ty rea ed.

For o - ro ort o al te t e e , t e or al au e le t , L_o, de e de t o t e or al ro - e t o al area, S_o.

T e d e o al tolera e o t e te t e e all be a orda e w t t e A exe B to E (ee 6.2).

Ot er te t e e u a t o e e ed releva t rodu t ta dard or at o al ta dard ay be u ed by a ree e t w t t e u to er, e. . SO 3183[1] (AP 5L), SO 1196 [2] (AP 5CT), ASTM A37 [6], ASTM E8M[7], D N 5 125[1] , ACS W2[13], a d J S 22 1[14].

6.1.2 Ma ed te t e e

Ma ed te t e e all or orate a tra t o rad u betwee t e r ed e d a d t e arallel le t t e e ave d ere t d e o . T e d e o o t e tra t o rad u are orta t a d t re o e ded t at t ey be de ed t e ater al e at o   t ey are ot ve t e a ro r ate a ex (ee 6.2).

T e r ed e d ay be o a y a e to u t t e r o t e te t a e. T e ax o t e te t e e all o de w t t e ax o a l at o o t e or e.

T e arallel le t , L , or, t e a e w ere t e te t e e a o tra t o rad , t e ree le t betwee t e r , all alway be reater t a t e or al au e le t , L_o.

6.1.3 U a ed te t e e

 t e te t e e o t o a u a ed le t o t e rodu t or o a u a ed te t bar, t e ree le t betwee t e r all be u e t or au e ark to be at a rea o able d ta e ro t e r (ee A exe B to E).

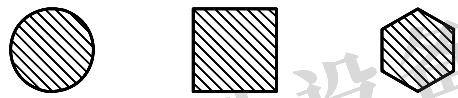
A - a t te t e e all or orate a tra t o rad u betwee t e r ed e d a d t e arallel le t . T e d e o o t tra t o rad u are orta t a d t re o e ded t at t ey be de ed t e rodu t ta dard. T e r ed e d ay be o a y a e to u t t e r o t e te t a e. T e arallel le t , L , all alway be reater t a t e or al au e le t , L_o.

6.2 Ty e

T e a ty e o te t e e are de ed A exe B to E a ord to t e a e a d ty e o rodu t, a ow Table 2. Ot er ty e o te t e e a be e ed rodu t ta dard .

Table 2 — Ma ty e o te t e e a ord to rodu t ty e

D e o ll etre

Ty e o rodu t		Corre o d A ex
S eet — Plate — Flat  T k e *a*	W re — Bar — Se t o  D a eter or de	
,1 ⩽ a < 3	—	B
—	< 4	C
a ⩾ 3	⩾ 4	D
Tube		E

6.3 Pre arat o o te t e e

T e te t e e all be take a d re ared a orda e w t t e requ re e t o t e releva t ter at o al Sta dard or t e d ere t ater al (e. . SO 377).

7 Deter at o o or al ro - e t o al area

T e releva t d e o o t e te t e e ould be ea ured at u e t ro - e t o er e d ular to t e lo tud al ax t e e tral re o o t e arallel le t o t e te t e e.

A u o t ree ro - e t o re o e ded.

T e or al ro - e t o al area, S_o, t e avera e ro - e t o al area a d all be al ulated ro t e ea ure e t o t e a ro r ate d e o .

T e a ura y o t al ulat o de e d o t e ature a d ty e o t e te t e e. A exe B to E de r be et od or t e evaluat o o S_o or d ere t ty e o te t e e a d o ta e at o or t e a ura y o ea ure e t.

8 Mark t e or al au e le t

Ea e d o t e or al au e le t , L_o, all be arked by ea o e ark or r bed l e , but ot by ot e w ould re ult re ature ra ture.

For ro ort o al te t e e , t e al ulated value o t e or al au e le t ay be rou ded to t e eare t ult le o 5 , rov ded t at t e d ere e betwee t e al ulated a d arked au e le t le t a 1 % o L_o. T e or al au e le t all be arked to a a ura y o ± 1 %.

t e arallel le t , L , u reater t a t e or al au e le t , a , or ta e, w t u a ed te t e e , a er e o overla au e le t ay be arked.

o e a e , t ay be el ul to draw, o t e ur a e o t e te t e e, a l e arallel to t e lo tud al ax , alo w t e au e le t are arked.

9 A ura y o te t a aratu

T e or e- ea ur y te o t e te t a e all be al brated a orda e w t SO 75 -1, la 1, or better.

For t e deter at o o roo tre t (la t or total exte o) t e u ed exte o eter all be a orda e w t SO 9513, la 1 or better, t e releva t ra e. For ot er ro ert e (w t er exte o) a SO 9513, la 2 exte o eter t e releva t ra e ay be u ed.

1 Co d t o o te t

1 .1 Sett t e or e zero o t

T e or e- ea ur y te all be et to zero a ter t e te t load tra a bee a e bled, but be ore t e te t e e a tually r ed at bot e d . O e t e or e zero o t a bee et, t e or e- ea ur y te ay ot be a ed a y way dur t e te t.

NOTE T e u e o t et od e ure , t at o e a d t e we to t e r y te o e ated or t e or e ea ure e t a d o t e ot er a d a y or e re ult ro t e la o erat o doe ot a e t t ea ure e t.

1 .2 Met od o r

T e te t e e all be r ed by u table ea , u a wed e , rewed r , arallel aw a e , or ouldered older .

Every e deavour ould be ade to e ure t at te t e e are eld u a way t at t e or e a l ed a ax ally a o ble, order to ze be d (ore or at o ve ASTM E1 12 8, or exa le). T o art ular orta e w e te t br ttle ater al or w e deter roo tre t (la t exte o), roo tre t (total exte o) or y eld tre t .

order to obta a tra t te t e e a d e ure t e al e t o t e te t e e a d r arra e e t, a rel ary or e ay be a l ed rov ded t doe ot ex eed a value orre o d to 5 % o t e e ed or ex e ted y eld tre t .

A orre t o o t e exte o ould be arr ed out to take to a ou t t e e e t o t e rel ary or e.

1 .3 Te t rate ba ed o tra rate o trol (et od A)

1 .3.1 Ge eral

Met od A te ded to ze t e var at o o t e te t rate dur t e o e t w e tra rate e t ve ara eter are deter ed a d to ze t e ea ure e t u erta ty o t e te t re ult .

Two d ere t ty e o tra rate o trol are de r bed t e t o . T e r t t e o trol o t e tra rate t el, $\dot{e}_{L_e}$, t at ba ed o t e eedba k obta ed ro a exte o eter. T e e o d t e o trol o t e e t ated tra rate over t e arallel le t , $\dot{e}_{L_c}$, w a eved by o troll t e ro ead e arat o rate at a velo ty equal to t e de red tra rate ult l ed by t e arallel le t .

a ater al ow o o e eou de or at o be av our a d t e or e re a o ally o ta t, t e tra rate, $\dot{e}_{L_e}$, a d t e e t ated tra rate over t e arallel le t , $\dot{e}_{L_c}$, are a rox ately equal. D ere e ex t t e ater al ex b t d o t uou or errated y eld (e. . o e teel a d AlM alloy t e y eld o t elo at o ra e, or ater al w ow errated y eld l ke t e Portev -Le C atel er e e t) or e k o ur . t e or e rea , t e e t ated tra rate ay be ub ta t ally below t e tar et tra rate due to t e o l a e o t e te t a e.

T e te t rate all o or to t e ollow requ re e t .

a) t e ra e u to a d lud t e deter at o o R_{eH}, R or R_t, t e e ed tra rate, $\dot{e}_{L_e}$ (ee 3.7.1), all be a l ed. t ra e, to el ate t e lue e o t e o l a e o t e te le te t a e, t e u e o a exte o eter la ed o t e te t e e e e ary to ave a urate o trol over t e tra rate. (For te t a e u able to o trol by tra rate, a ro edure u t e e t ated tra rate over t e arallel le t , $\dot{e}_L$, ay be u ed.)

b) Dur d o t uou y eld , t e e t ated tra rate over t e arallel le t , $\dot{e}_L$ (ee 3.7.2), ould be a l ed. t ra e, t o ble to o trol t e tra rate u t e exte o eter la ed o to t e te t e e be au e lo al y eld a o ur out de t e exte o eter au e le t . T e requ red e t ated tra rate over t e arallel le t ay be a ta ed t ra e u e tly a urately u a o ta t ro ead e arat o rate, v (ee 3.7.3);

$$v = L \dot{e}_L \quad (1)$$

w ere

$\dot{e}_L$ t e e t ated tra rate over t e arallel le t ;

L t e arallel le t .

) t e ra e ollow R or R_t or e d o y eld (ee 3.7.2), $\dot{e}_{L_e}$ or $\dot{e}_L$ a be u ed. T e u e o $\dot{e}_L$ re o e ded to avo d a y o trol roble w ay ar e e k o ur out de t e exte o eter au e le t .

T e tra rate e ed 1 .3.2 to 1 .3.4 all be a ta ed dur t e deter at o o t e releva t ater al ro erty (ee al o F ure 9).

Dur w t to a ot er tra rate or to a ot er o trol ode, o d o t u t e t e tre - tra urve ould be trodu ed w d tort t e value o R , A or A_t (ee F ure 1). T e e t a be redu ed by a u table radual w t betwee t e rate .

T e a e o t e tre - tra urve t e work arde ra e a al o be lue ed by t e tra rate. T e te t rate u ed ould be do u e ted (ee 1 .6).

1 .3.2 Stra rate or t e deter at o o t e u er y eld tre t , R_{eH}, or roo tre t ro ert e , R , a d R_t

T e tra rate, $\dot{e}_{L_e}$, all be ke t a o ta t a o ble u to a d lud t e deter at o o R_{eH} or R or R_t. Dur t e deter at o o t e e ater al ro ert e t e tra rate, $\dot{e}_{L_e}$, all be o e o t e two ollow e ed ra e (ee al o F ure 9).

Ra e 1: $\dot{e}_{L_e}$ = , 7 $^{-1}$, w t a relat ve tolera e o ±2 %

Ra e 2: $\dot{e}_{L_e}$ = , 25 $^{-1}$, w t a relat ve tolera e o ±2 % (re o e ded u le ot erw e e ed)

t e te t a e ot able to o trol t e tra rate d re tly, t e e t ated tra rate over t e arallel le t , $\dot{e}_L$, .e. o ta t ro ead e arat o rate, all be u ed. T rate all be al ulated u Equat o (1).

T e re ult tra rate o t e te t e e w ll be lower t a t e e ed tra rate be au e t e o la e o t e te t a e ot o dered. A ex la at o ve A ex F.

1 .3.3 Stra rate or t e deter at o o t e lower y eld tre t , R_{eL}, a d er e ta e y eld o t exte o , A_e

Follow t e dete t o o t e u er y eld tre t (ee A.4.2), t e e t ated tra rate over t e arallel le t , $\dot{e}_L$, all be a ta ed o e o t e ollow two e ed ra e (ee F ure 9) u t l d o t uou y eld a e ded.

Ra e 2: $\dot{e}_L$ = , 25 $^{-1}$, w t a relat ve tolera e o ±2 % (re o e ded, w e R_{eL} deter ed)

Ra e 3: $\dot{e}_L$ = , 2 $^{-1}$, w t a relat ve tolera e o ±2 %

1 .3.4 Stra rate or t e deter at o o t e te le tre t , R , er e ta e elo at o a ter ra ture, A, er e ta e total exte o at t e ax u or e, A t, er e ta e la t exte o at ax u or e, A , a d er e ta e redu t o area,

A ter deter at o o t e requ red y eld/ roo tre t ro ert e , t e e t ated tra rate over t e arallel le t , $\dot{e}_L$, all be a ed to o e o t e ollow e ed ra e (ee F ure 9).

Ra e 2: $\dot{e}_L$ = , 25 $^{-1}$, w t a relat ve tolera e o ±2 %

Ra e 3: $\dot{e}_L$ = , 2 $^{-1}$, w t a relat ve tolera e o ±2 %

Ra e 4: $\dot{e}_L$ = , 6 7 $^{-1}$, w t a relat ve tolera e o ±2 % (,4 $^{-1}$, w t a relat ve tolera e o ±2 %) (re o e ded u le ot erw e e ed)

t e ur o e o t e te le te t o ly to deter e t e te le tre t , t e a e t ated tra rate over t e arallel le t o t e te t e e a ord to ra e 3 or 4 ay be a l ed t rou out t e e t re te t.

1 .4 Te t rate ba ed o tre rate (et od B)

1 .4.1 Ge eral

T e te t rate all o or to t e ollow requ re e t de e d o t e ature o t e ater al. U le ot erw e e ed, a y o ve e t eed o te t ay be u ed u to a tre equ vale t to al o t e e ed y eld tre t . T e te t rate above t o t are e ed below.

1 .4.2 Y eld a d roo tre t

1 .4.2.1 U er y eld tre t , R_{eH}

T e rate o e arat o o t e ro ead o t e a e all be ke t a o ta t a o ble a d w t t e l t orre o d to t e tre rate Table 3.

NOTE For or at o , ty al ater al av a odulu o ela t ty aller t a 15 MPa lude a e u , alu u alloy , bra , a d t ta u . Ty al ater al w t a odulu o ela t ty reater t a 15 MPa lude wrou t ro , teel, tu te , a d kel-ba ed alloy .

Table 3 — Stre rate

Modulu o ela t ty o t e ater al E MPa	Stre rate $\dot{R}$ MPa $^{-1}$.	 ax.
< 15	2	2
⩾ 15	6	6

1 .4.2.2 Lower y eld tre t , R_{eL}

o ly t e lower y eld tre t be deter ed, t e tra rate dur y eld o t e arallel le t o t e te t e e all be betwee , 25 $^{-1}$ a d , 2 5 $^{-1}$. T e tra rate w t t e arallel le t all be ke t a o ta t a o ble. t rate a ot be re ulated d re tly, t all be xed by re ulat t e tre rate u t be ore y eld be , t e o trol o t e a e ot be urt er ad u ted u t l o let o o y eld.

o a e all t e tre rate t e ela t ra e ex eed t e ax u rate ve Table 3.

1 .4.2.3 U er a d lower y eld tre t , R_{eH} a d R_{eL}

bot u er a d lower y eld tre t are deter ed dur t e a e te t, t e o d t o or deter t e lower y eld tre t all be o led w t (ee 1 .4.2.2).

1 .4.2.4 Proo tre t (la t exte o) a d roo tre t (total exte o), R a d R_t

T e rate o e arat o o t e ro ead o t e a e all be ke t a o ta t a o ble a d w t t e l t orre o d to t e tre rate Table 3 w t t e ela t ra e.

W t t e la t ra e a d u to t e roo tre t (la t exte o or total exte o), t e tra rate all ot ex eed , 2 5 $^{-1}$.

1 .4.2.5 Rate o e arat o

t e te t a e ot a able o ea ur or o troll t e tra rate, a ro ead e arat o rate equ vale t to t e tre rate ve Table 3 all be u ed u t l o let o o y eld.

1 .4.2.6 Te le tre t , R , er e ta e elo at o a ter ra ture, A, er e ta e total exte o at t e ax u or e, A_t, er e ta e la t exte o at ax u or e, A , a d er e ta e redu t o area,

A ter deter at o o t e requ red y eld/ roo tre t ro ert e , t e te t rate ay be rea ed to a tra rate (or equ vale t ro ead e arat o rate) o reater t a , 8 $^{-1}$.

o ly t e te le tre t o t e ater al to be ea ured, a le tra rate a be u ed t rou out t e te t w all ot ex eed , 8 $^{-1}$.

1 .5 C o e o t e et od a d rate

U le ot erw e a reed, t e o e o et od (A or B) a d te t rate are at t e d ret o o t e rodu er or t e te t laboratory a ed by t e rodu er, rov ded t at t e e eet t e requ re e t o t art o SO 6892.

1 .6 Do u e tat o o t e o e te t o d t o

order to re ort t e te t o trol ode a d te t rate a abr d ed or , t e ollow y te o abbrev at o a be u ed:

SO 6892 A , or SO 6892 B

w ere 'A' de e t e u e o et od A (tra rate o trol), a d 'B' t e u e o et od B (tre rate ba ed). T e y bol ' ' are a er e o u to 3 ara ter t at re er to t e rate u ed dur ea a e o t e te t, a de ed F ure 9, a d ' ' ay be added to d ate t e tre rate (MPa $^{-1}$) ele ted dur ela t load .

EXAMPLE 1 SO 6892-1:2 9 A224 de e a te t ba ed o tra rate o trol, u ra e 2, 2 a d 4.

EXAMPLE 2 SO 6892-1:2 9 B3 de e a te t ba ed o tre rate, er or ed at a o al tre rate o 3 MPa $^{-1}$.

EXAMPLE 3 SO 6892-1:2 9 B de e a te t ba ed o tre rate, er or ed at a o al tre rate a ord to Table 3.

11 Deter at o o t e u er y eld tre t

R_{eH} ay be deter ed ro t e or e-exte o urve or eak load d ator a d de ed a t e ax u value o tre r or to t e r t de rea e or e. T e latter obta ed by d v d t or e by t e or al ro - e t o al area o t e te t e e, S_o (ee F ure 2).

12 Deter at o o t e lower y eld tre t

R_{eL} deter ed ro t e or e-exte o urve a d de ed a t e lowe t value o tre dur la t y eld , or a y t al tra e t e e t . T e latter obta ed by d v d t or e by t e or al ro - e t o al area o t e te t e e, S_o (ee F ure 2).

For rodu t v ty o te t , R_{eL} ay be re orted a t e lowe t tre w t t e r t ,25 % tra a ter R_{eH}, ot tak to a ou t a y t al tra e t e e t. A ter deter R_{eL} by t ro edure, t e te t rate ay be rea ed a er 1 .3.4. U e o t orter ro edure ould be re orded o t e te t re ort.

NOTE T lau e o ly a le to ater al av y eld e o e a a d w e A_e ot to be deter ed.

13 Deter at o o roo tre t , la t exte o

13.1 R deter ed ro t e or e-exte o urve by draw a l e arallel to t e l ear ort o o t e urve a d at a d ta e ro t equ vale t to t e re r bed la t er e ta e exte o , e. . ,2 %. T e o t at w t l e ter e t t e urve ve t e or e orre o d to t e de red roo tre t la t exte o . T e latter obta ed by d v d t or e by t e or al ro - e t o al area o t e te t e e, S_o (ee F ure 3).

t e tra t ort o o t e or e-exte o urve ot learly de ed, t ereby reve t draw t e arallel l e w t u e t re o , t e ollow ro edure re o e ded (ee F ure 6).

W e t e re u ed roo tre t a bee ex eeded, t e or e redu ed to a value equal to about 1 % o t e or e obta ed. T e or e t e rea ed a a u t l t ex eed t e value obta ed or ally. To deter e t e de red roo tre t , a l e draw t rou t e y tere loo . A l e t e draw arallel to t l e, at a d ta e ro t e orre ted or o t e urve, ea ured alo t e ab a, equal to t e re r bed la t er e ta e exte o . T e ter e t o o t arallel l e a d t e or e-exte o urve ve t e or e orre o d to t e roo tre t . T e latter obta ed by d v d t or e by t e or al ro - e t o al area o t e te t e e, S_o (ee F ure 6).

NOTE 1 Several et od a be u ed to de e t e orre ted or o t e or e-exte o urve. O e o t e e to o tru t a l e arallel to t at deter ed by t e y tere loo o t at t ta e tal to t e or e-exte o urve. T e o t w ere t l e ro e t e ab a t e orre ted or o t e or e-exte o urve (ee F ure 6).

NOTE 2 T e la t tra at t e tart o t o or e redu t o o ly l tly er t a t e e ed la t exte o o R . Start o t at u er tra value redu e t e lo e o t e l e t rou t e y tere loo .

NOTE 3 ot e ed rodu t ta dard or a reed by t e u to er, t a ro r ate to deter e roo tre t dur a d a ter d o t uou y eld .

13.2 T e ro erty ay be obta ed w t out lott t e or e-exte o urve by u auto at dev e (ro ro e or, et .), ee A ex A.

NOTE A ot er ava lable et od de r bed GB/T 228 [12] .

14 Deter at o o roo tre t , total exte o

14.1 R_t deter ed o t e or e-exte o urve, tak 1 .2 to o derat o , by draw a l e arallel to t e ord ate ax (or e ax) a d at a d ta e ro t equ vale t to t e re r bed total er e ta e exte o . T e o t at w t l e ter e t t e urve ve t e or e orre o d to t e de red roo tre t . T e latter obta ed by d v d t or e by t e or al ro - e t o al area o t e te t e e, S_o (ee F ure 4).

14.2 T e ro erty ay be obta ed w t out lott t e or e-exte o urve by u auto at dev e (ee A ex A).

15 Met od o ver at o o er a e t et tre t

T e te t e e ube ted to a or e orre o d to t e e ed tre or 1 to 12 . T or e obta ed by ult ly t e e ed tre by t e or al ro - e t o al area o t e te t e e, S_o. A ter re ov t e or e, t t e o r ed t at t e er a e t et exte o or elo at o ot ore t a t e er e ta e e ed or t e or al au e le t , ee F ure 5.

NOTE T a a /a l te t, w ot or ally er or ed a a art o t e ta dard te le te t. T e tre a led to t e te t e e a d t e er ble er a e t et exte o or elo at o are e ed et er by t e rodu t e at o or t e reque ter o t e te t. Exa le: Re ort "$R_{r\ ,5}$ = 75 MPa Pa " d ate t at a tre o 75 MPa wa a led to t e te t e e a d t e re ult er a e t et wa le t a or equal to ,5 %.

16 Deter at o o t e er e ta e y eld o t exte o

For ater al t at ex b t d o t uou y eld , A_e deter ed ro t e or e-exte o urve by ubtra t t e exte o at R_{eH} ro t e exte o at t e tart o u or work arde . T e exte o at t e tart o u or work arde de ed by t e ter e t o o a or zo tal l e t rou t e la t lo al u o t, or a re re o l e t rou t e ra e o y eld , r or to u or work arde a d a l e orre o d to t e e t lo e o t e urve o urr at t e tart o u or work arde (ee F ure 7). t ex re ed a a er e ta e o t e exte o eter au e le t , L_e.

T e et od u ed ee F ure 7 a) or b) ould be do u e ted t e te t re ort.

17 Deter at o o t e er e ta e la t exte o at ax u or e

T e et od o t o deter t e exte o at ax u or e o t e or e-exte o urve obta ed w t a exte o eter a d ubtra t t e ela t tra .

Cal ulate t e er e ta e la t exte o at ax u or e, A , ro Equat o (2):

$$A = \left(\frac{\Lambda}{L_e} \qquad {}_{E} \right) \times 1 \tag{2}$$

w ere

L_e t e exte o eter au e le t ;

${}_E$ t e lo e o t e ela t art o t e tre - er e ta e exte o urve;

R t e te le tre t ;

ΔL t e exte o at ax u or e.

NOTE For ater al w ex b t a lateau at ax u or e, t e er e ta e la t exte o at ax u or e t e exte o at t e d- o t o t e lateau, ee F ure 1.

18 Deter at o o t e er e ta e total exte o at ax u or e

T e et od o t o deter t e exte o at ax u or e o t e or e-exte o urve obta ed w t a exte o eter.

Cal ulate t e er e ta e total exte o at ax u or e, A_t, ro Equat o (3):

$$A_t = \frac{\Delta L}{L_e} \times 1 \tag{3}$$

w ere

L_e t e exte o eter au e le t ;

ΔL t e exte o at ax u or e.

NOTE For ater al w ex b t a lateau at ax u or e, t e er e ta e total exte o at ax u or e t e exte o at t e d- o t o t e lateau, ee F ure 1.

19 Deter at o o t e er e ta e total exte o at ra ture

T e et od o t o deter t e exte o at ra ture o t e or e-exte o urve obta ed w t a exte o eter.

Cal ulate t e er e ta e total elo at o at ra ture, A_t, ro Equat o (4):

$$A_t = \frac{\Delta L}{L_e} \times 1 \tag{4}$$

w ere

L_e t e exte o eter au e le t ;

ΔL t e exte o at ra ture.

2 Deter at o o er e ta e elo at o a ter ra ture

2 .1 Per e ta e elo at o a ter ra ture all be deter ed a orda e w t t e de t o ve 3.4.2.

For t ur o e, t e two broke e e o t e te t e e all be are ully tted ba k to et er o t at t e r axe l e a tra t l e.

S e al re aut o all be take to e ure ro er o ta t betwee t e broke art o t e te t e e w e ea ur t e al au e le t . T art ularly orta t or te t e e o all ro - e t o a d te t e e av low elo at o value .

Cal ulate t e er e ta e elo at o a ter ra ture, A, ro Equat o (5):

$$A = \frac{L_u - L_o}{L_o} \times 1 \tag{5}$$

w ere

L_o t e or al au e le t ;

L_u t e al au e le t a ter ra ture.

Elo at o a ter ra ture, $L_u - L_o$, all be deter ed to t e eare t ,25 or better u a ea ur dev e w t u e t re olut o .

t e e ed u er e ta e elo at o le t a 5 %, t re o e ded t at e al re aut o be take (ee A ex G). T e re ult o t deter at o val d o ly t e d ta e betwee t e ra ture a d t e eare t au e ark ot le t a L_o/3. However, t e ea ure e t val d, rre e t ve o t e o t o o t e ra ture, t e er e ta e elo at o a ter ra ture equal to or reater t a t e e ed value.

2 .2 W e exte o at ra ture ea ured u a exte o eter, t ot e e ary to ark t e au e le t . T e elo at o ea ured a t e total exte o at ra ture, a d t t ere ore e e ary to dedu t t e ela t exte o order to obta er e ta e elo at o a ter ra ture. To obta o arable value w t t e a ual et od, add t o al adu t e t a be a l ed (e. . e ou dy a a d reque y ba dw dt o t e exte o eter, ee A.3.2).

T e re ult o t deter at o val d o ly ra ture a d lo al zed exte o (e k) o ur w t t e exte o eter au e le t , L_e. T e ea ure e t val d re ardle o t e o t o o t e ra ture ro - e t o t e er e ta e elo at o a ter ra ture equal to or reater t a t e e ed value.

t e rodu t ta dard e e t e deter at o o er e ta e elo at o a ter ra ture or a ve au e le t , t e exte o eter au e le t ould be equal to t le t .

2 .3 elo at o ea ured over a ve xed le t , t a be o verted to ro ort o al au e le t , u o ver o or ulae or table a a reed be ore t e o e e e t o te t (e. . a SO 2566-1 a d SO 2566-2).

NOTE Co ar o o er e ta e elo at o are o ble o ly w e t e au e le t or exte o eter au e le t , t e a e a d area o t e ro - e t o are t e a e or w e t e oe e t o ro ort o al ty, k, t e a e.

21 Deter at o o er e ta e redu t o o area

Per e ta e redu t o o area all be deter ed a orda e w t t e de t o ve 3.8.

e e ary, t e two broke e e o t e te t e e all be are ully tted ba k to et er o t at t e r axe l e a tra t l e.

Cal ulate t e er e ta e redu t o o area, , ro Equat o (6):

$$= \frac{S_o - S_u}{S_o} \times 1 \qquad (6)$$

w ere

S_o t e or al ro - e t o al area o t e arallel le t ;

S_u t e u ro - e t o al area a ter ra ture.

Mea ure S_u to a a ura y o ± 2 % (ee F ure 13).

NOTE Mea ur S_u w t a a ura y o ± 2 % o all d a eter rou d te t e e , or te t e e w t ot er ro - e t o al eo etr e , ay ot be o ble.

22 Te t re ort

T e te t re ort all o ta at lea t t e ollow or at o u le ot erw e a reed by t e art e o er ed:

a) re ere e to t art o SO 6892 exte ded w t t e te t o d t o or at o e ed 1 .6, e. . SO 6892-1:2 9 A224;

b) de t at o o t e te t e e;

) e ed ater al, k ow ;

d) ty e o te t e e;

e) lo at o a d d re t o o a l o te t e e , k ow ;

) te t o trol ode( ) a d te t rate( ) or te t rate ra e( ) (ee 1 .6) d ere t ro t e re o e ded et od a d value ve 1 .3 a d 1 .4;

) te t re ult .

Re ult ould be rou ded to t e ollow re o or better, ot ot erw e e ed rodu t ta dard :

— tre t value , e a a al , to t e eare t w ole u ber;

— er e ta e y eld o t exte o value , A_e, to t e eare t ,1 %;

— all ot er er e ta e exte o a d elo at o value to t e eare t ,5 %;

— er e ta e redu t o o area, , to t e eare t 1 %.

23 Mea ure e t u erta ty

23.1 Ge eral

Mea ure e t u erta ty a aly u e ul or de t y a or our e o o te e o ea ured re ult .

Produ t ta dard a d ater al ro erty databa e ba ed o t art o SO 6892 a d earl er ed t o o SO 6892 ave a ere t o tr but o ro ea ure e t u erta ty. t t ere ore a ro r ate to a ly urt er ad u t e t or ea ure e t u erta ty a d t ereby r k al rodu t w o l a t. For t rea o , t e e t ate o u erta ty der ved by ollow t ro edure are or or at o o ly, u le e ally tru ted ot erw e by t e u to er.

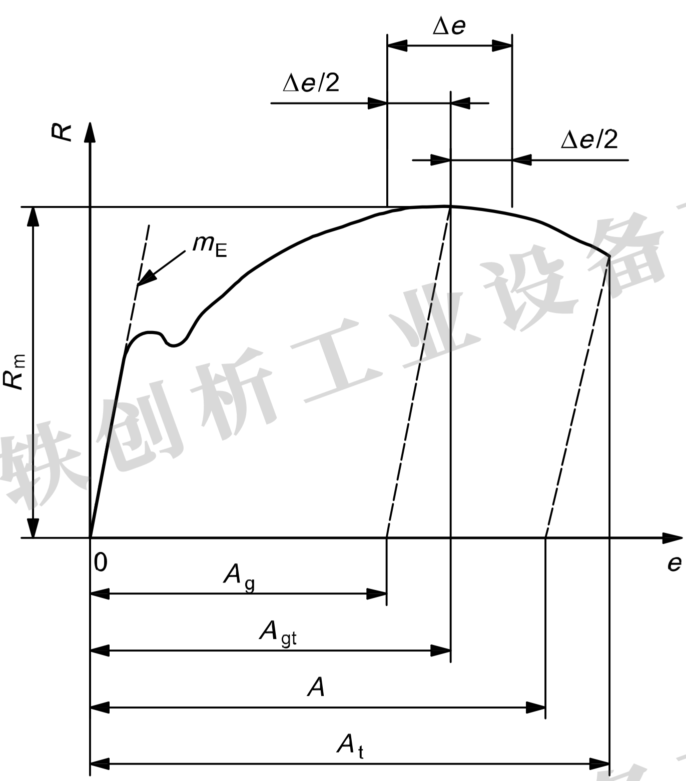
23.2 Te t o d t o

T e te t o d t o a d l t de ed t art o SO 6892 all ot be ad u ted to take a ou t o u erta t e o ea ure e t, u le e ally tru ted ot erw e by t e u to er.

23.3 Te t re ult

T e e t ated ea ure e t u erta t e all ot be o b ed w t ea ured re ult to a e o l a e to rodu t e at o , u le e ally tru ted ot erw e by t e u to er.

For o derat o o u erta ty, ee A exe J a d K, w rov de u da e or t e deter at o o u erta ty related to etrolo al ara eter a d value obta ed ro t e terlaboratory te t o a rou o teel a d alu u alloy .



Key

A er e ta e elo at o a ter ra ture deter ed ro t e exte o eter al or d re tly ro t e te t e e (ee 2 .1)

A er e ta e la t exte o at ax u or e

A_t er e ta e total exte o at ax u or e

A_t er e ta e total exte o at ax u ra ture

e er e ta e exte o

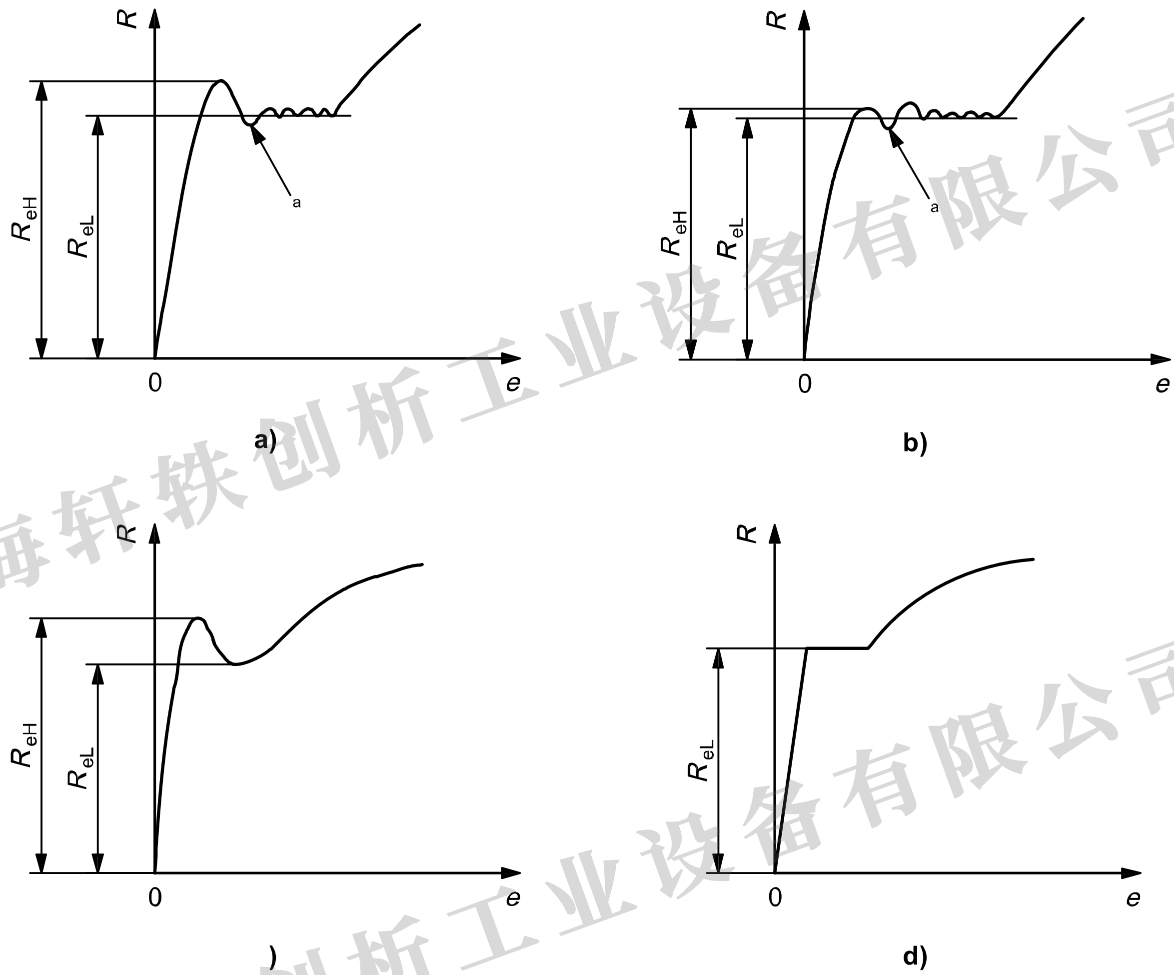
$_E$ lo e o t e ela t art o t e tre - er e ta e exte o urve

R tre

R te le tre t

Δe lateau exte t (or deter at o o A , ee Clau e 17, or deter at o o A_t, ee Clau e 18)

F ure 1 — De t o o exte o



Key

e er e ta e exte o

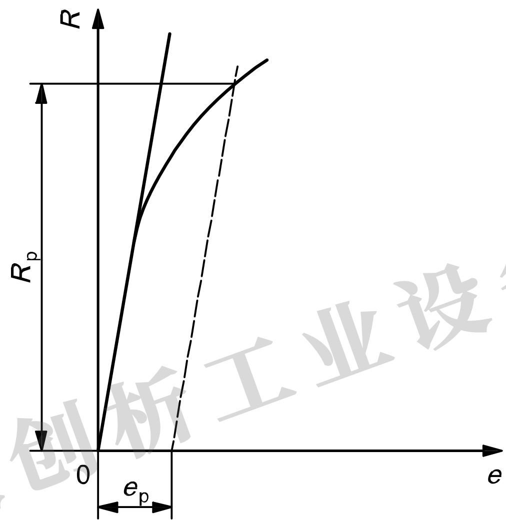
R tre

R_{eH} u er y eld tre t

R_{eL} lower y eld tre t

a t al tra e t e e t.

F ure 2 — Exa le o u er a d lower y eld tre t or d ere t ty e o urve



Key

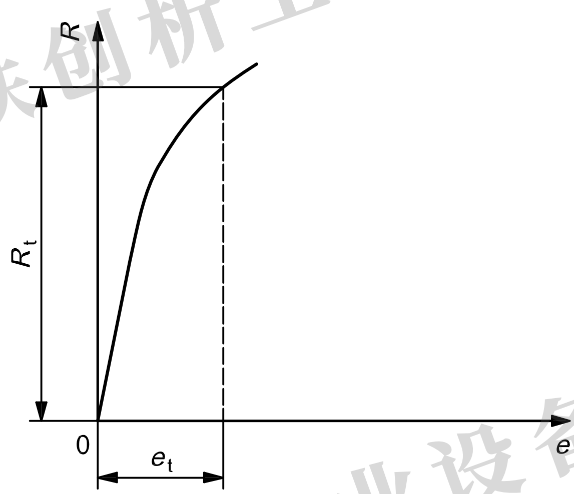
e er e ta e exte   o

e e ed er e ta e la t exte   o

R tre

R roo tre t , la t exte   o

F   ure 3 — Proo   tre   t , la t exte   o , R **(ee 13.1)**



Key

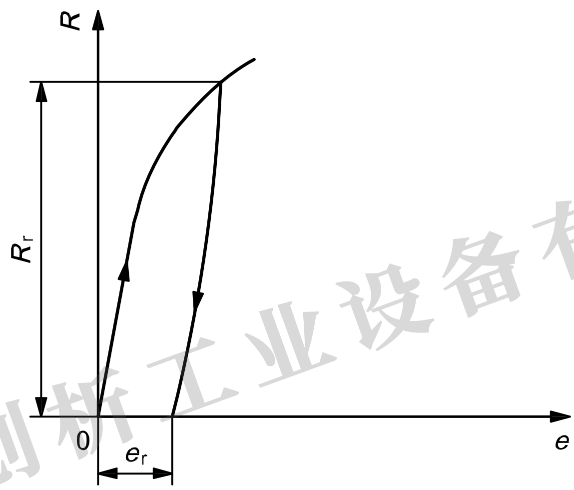
e er e ta e exte   o

e_t er e ta e total exte   o

R tre

R_t roo tre t , total exte   o

F   ure 4 — Proo   tre   t , total exte   o , R_t



Key

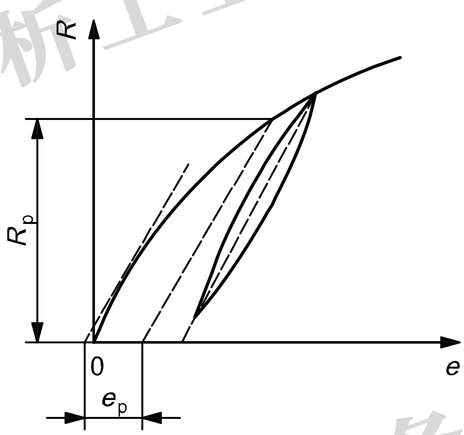
e er e ta e elo at o or er e ta e exte o

e_r er e ta e er a e t et exte o or elo at o

R tre

R_r e ed er a e t et tre t

F ure 5 — Per a e t et tre t , R_r



Key

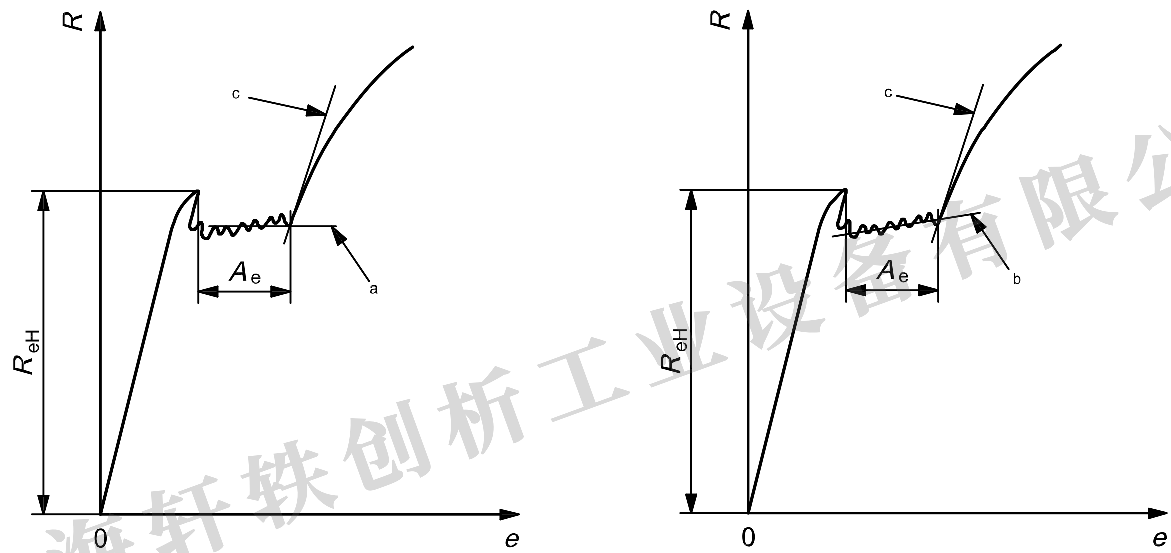
e er e ta e exte o

e e ed er e ta e la t exte o

R tre

R roo tre t , la t exte o

F ure 6 — Proo tre t , la t exte o , *R* **, alter at ve ro edure (ee 13.1)**



a) Hor zo tal l e et od

b) Re re o et od

Key

A_e er e ta e y eld o t exte o

e er e ta e exte o

R tre

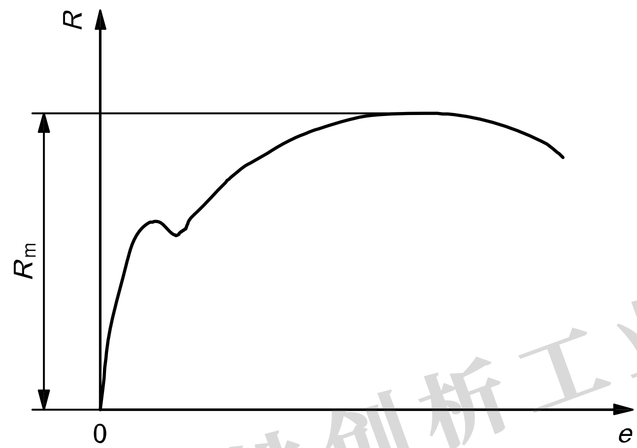
R_{eH} u er y eld tre t

[a] Hor zo tal l e t rou t e la t lo al u o t, r or to u or work arde .

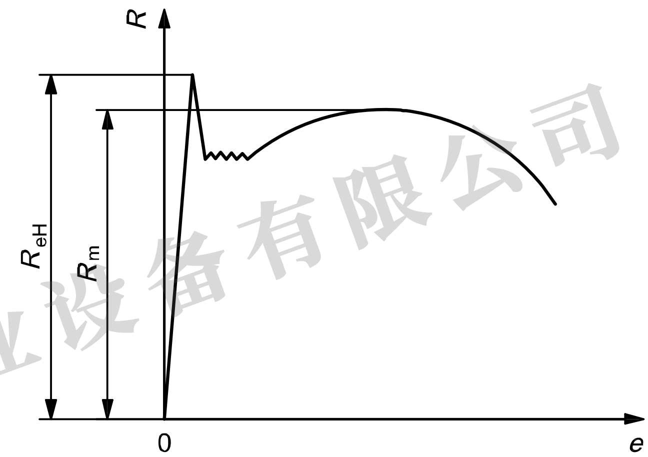
[b] Re re o l e t rou t e ra e o y eld , r or to u or work arde .

L e orre o d to t e e t lo e o t e urve o urr at t e tart o u or work arde .

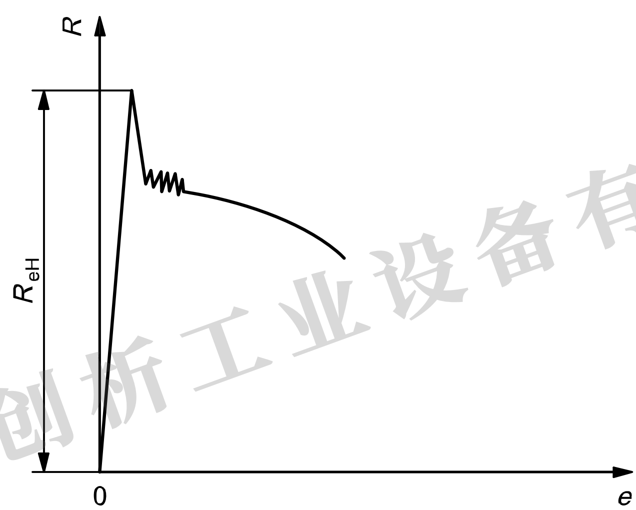
F ure 7 — D ere t evaluat o et od or er e ta e y eld o t exte o , A_e



a) $R_{eH} < R$



b) $R_{eH} > R$



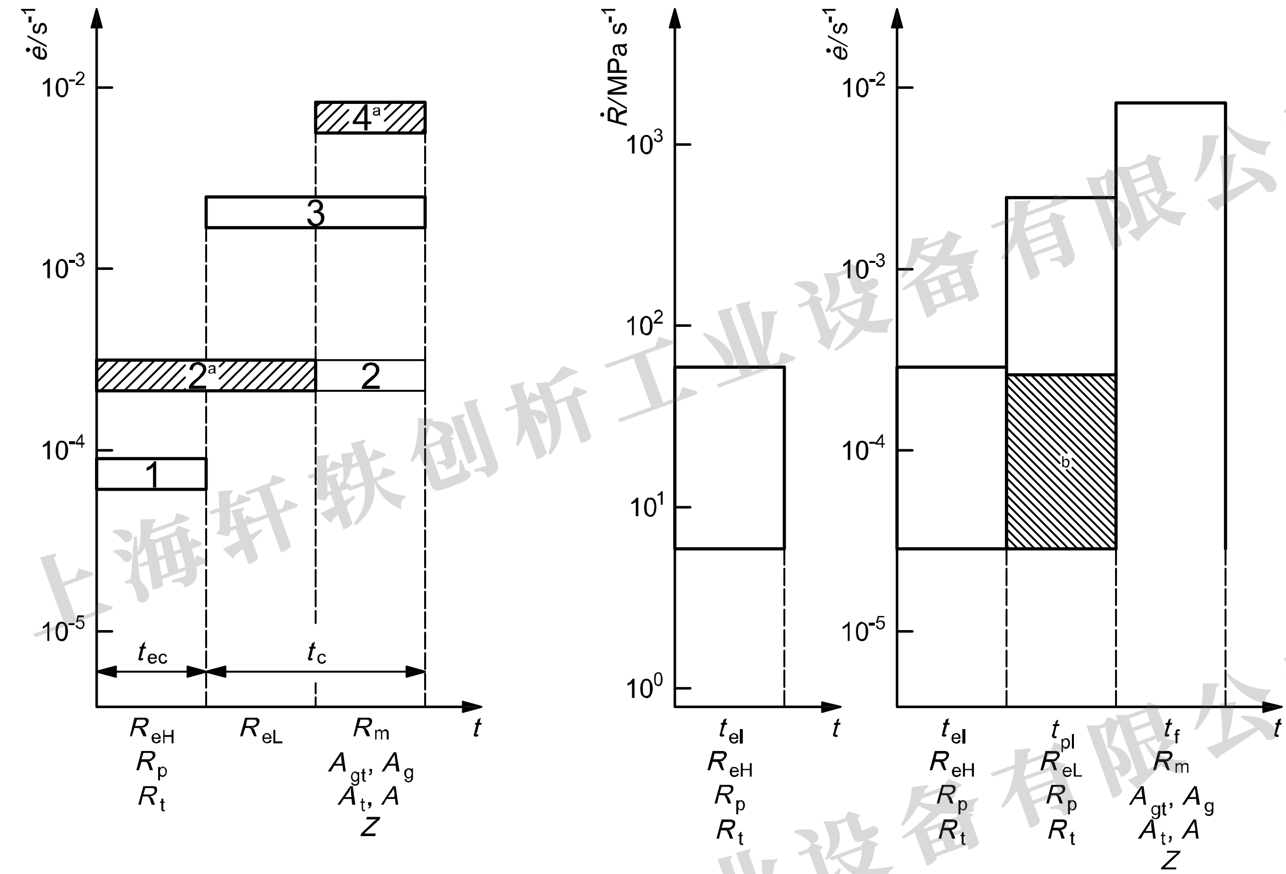
) S e al a e o tre - er e ta e exte o be av our[a]

Key

e er e ta e exte o
R tre
R_{eH} u er y eld tre t
R te le tre t

[a] For ater al w d lay t be av our, o te le tre t de ed a ord to t art o SO 6892. e e ary, e arate a ree e t a be ade betwee t e art e o er ed.

F ure 8 — D ere t ty e o tre -exte o urve or deter at o o te le tre t , *R*



a) Met od A **b) Met od B**

Key

$\dot{e}$ tra rate

$\dot{R}$ tre rate

t t e ro re o t e te le te t

t ro ead o trol t e

t_e exte o eter o trol t e or ro ead o trol t e

t_{el} t e ra e (ela t be av our) or deter at o o t e ara eter l ted (ee Table 1 or de at o)

t t e ra e (u ually u to ra ture) or deter at o o t e ara eter l ted (ee Table 1 or de at o)

t_l t e ra e (la t be av our) or deter at o o t e ara eter l ted (ee Table 1 or de at o)

1 ra e 1: $\dot{e}$ = , 7 $^{-1}$, w t a relat ve tolera e o ±2 %

2 ra e 2: $\dot{e}$ = , 25 $^{-1}$, w t a relat ve tolera e o ±2 %

3 ra e 3: $\dot{e}$ = , 2 $^{-1}$, w t a relat ve tolera e o ±2 %

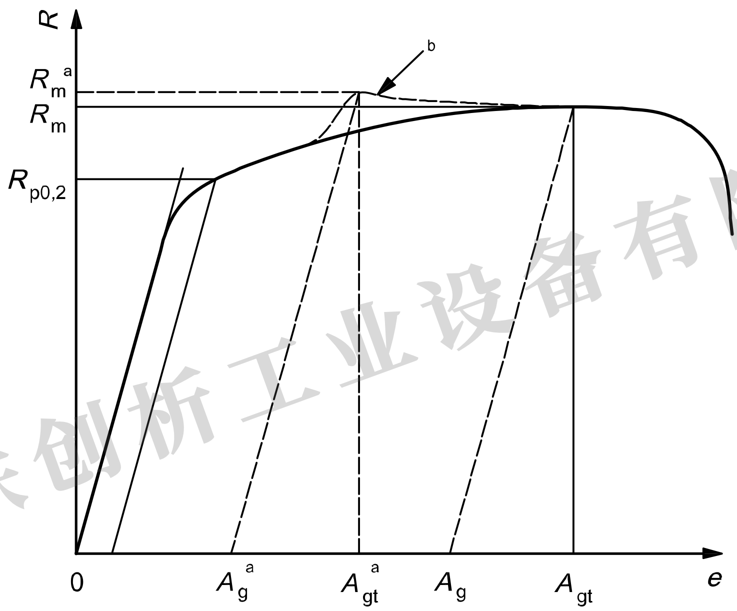
4 ra e 4: $\dot{e}$ = , 6 7 $^{-1}$, w t a relat ve tolera e o ±2 % (,4 $^{-1}$, w t a relat ve tolera e o ±2 %)

a Re o e ded.

b Ex a ded ra e to lower rate , te t a e ot a able o ea ur or o troll t e tra rate (ee 1 .4.2.5).

NOTE Stra rate t e ela t ra e or et od B al ulated ro tre rate u a You odulu o 21 MPa (teel).

F ure 9 — Illu trat o o tra rate to be u ed dur t e te le te t, R_{eH}, R_{eL}, R , R_t, R , A , A $_t$, A, A_t a d are deter ed



Key

e er e ta e exte o

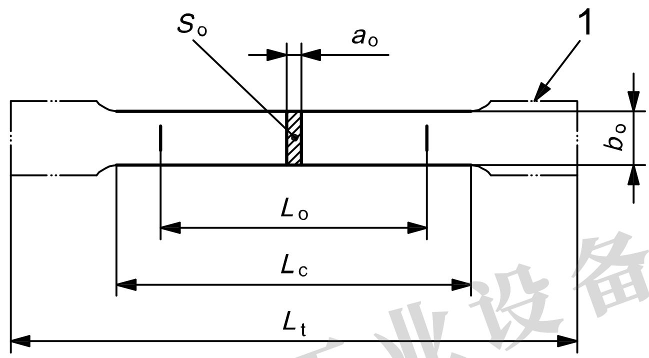
R tre

[a] Fal e value , re ult ro a abru t tra rate rea e.

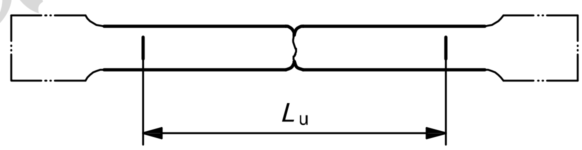
[b] Stre - tra be av our, tra rate abru tly rea ed.

NOTE For ara eter de t o , ee Table 1.

F ure 1 — Illu trat o o a ad ble d o t u ty t e tre - tra urve



a) Be ore te t



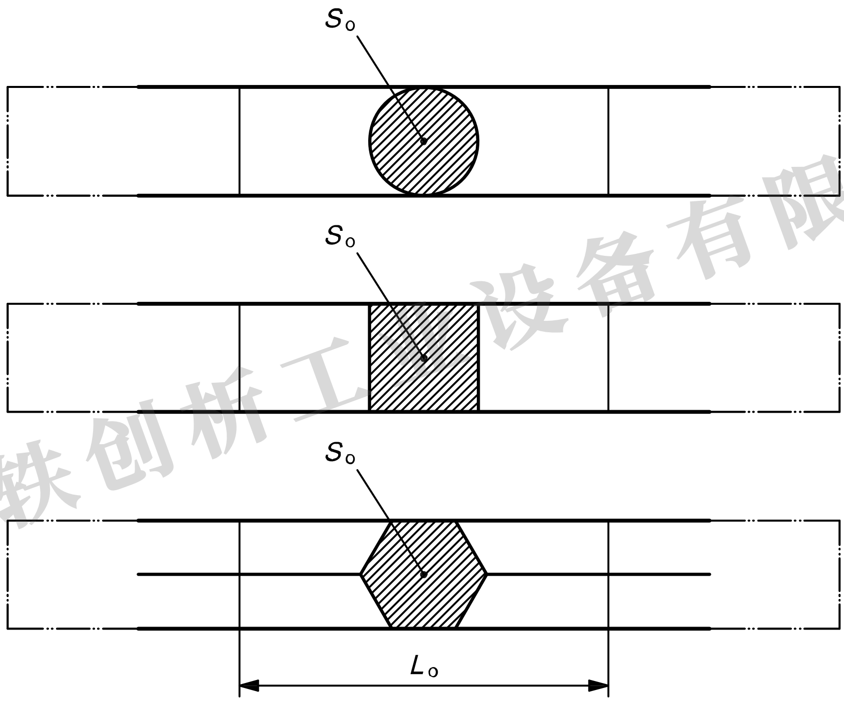
b) A ter te t

Key

a_o or al t k e o a lat te t e e or wall t k e o a tube
b_o or al w dt o t e arallel le t o a lat te t e e
L arallel le t
L_o or al au e le t
L_t total le t o te t e e
L_u al au e le t a ter ra ture
S_o or al ro - e to al area o t e arallel le t
1 r ed e d

NOTE T e a e o t e te t- e e ead o ly ve a a u de.

F ure 11 — Ma ed te t e e o re ta ular ro - e to (ee A exe B a d D)

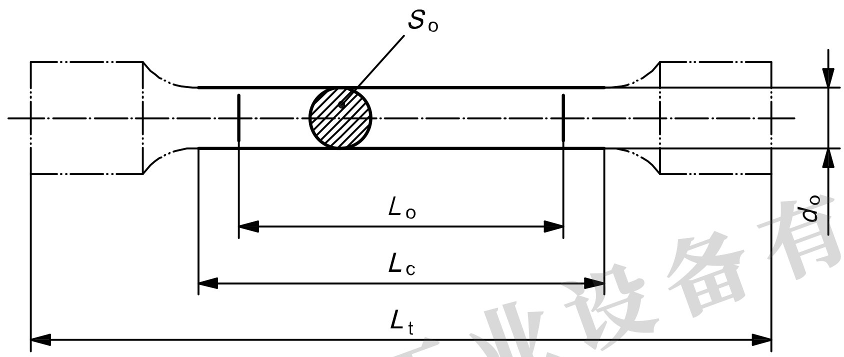


Key

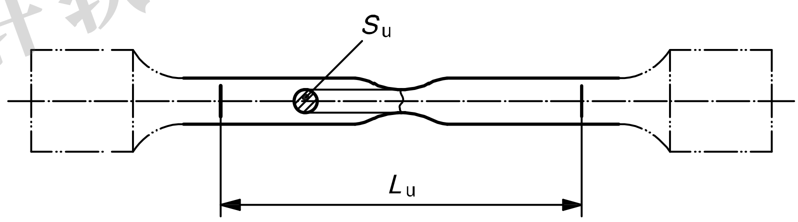
L_o or al au e le t

S_o or al ro - e t o al area

F ure 12 — Te t e e o r a u a ed ort o o t e rodu t (ee A ex C)



a) Be ore te t



b) A ter te t

Key

d_o or al d a eter o t e arallel le t o a r ular te t e e

L arallel le t

L_o or al au e le t

L_t total le t o te t e e

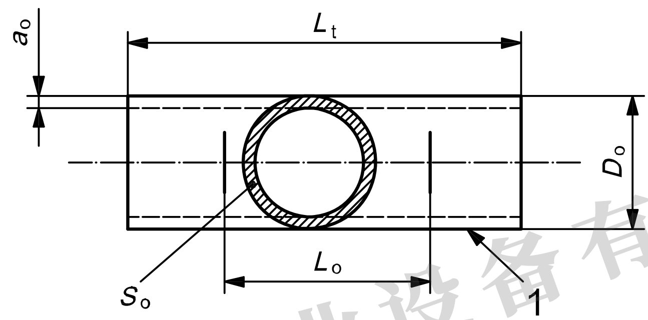
L_u al au e le t a ter ra ture

S_o or al ro - e t o al area o t e arallel le t

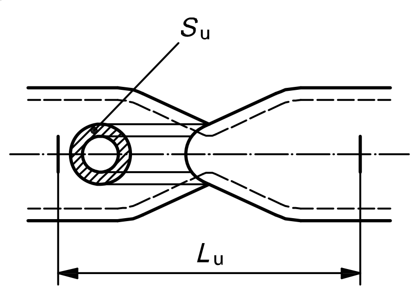
S_u u ro - e t o al area a ter ra ture

NOTE T e a e o t e te t- e e ead o ly ve a a u de.

F ure 13 — Ma ed te t e e o rou d ro - e t o (ee A ex D)



a) Be ore te t

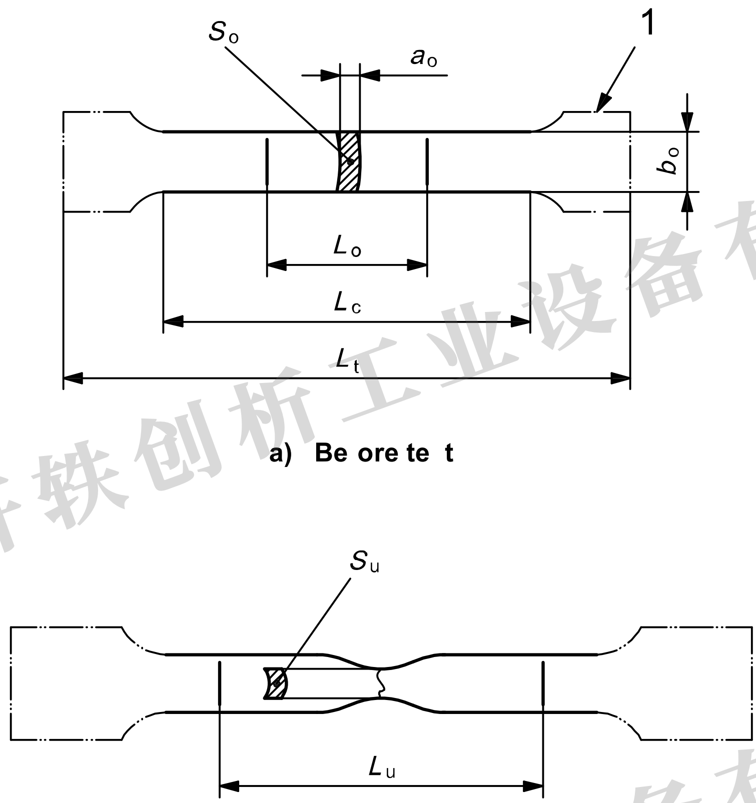


b) A ter te t

Key

a_o or al wall t k e o a tube
D_o or al exter al d a eter o a tube
L_o or al au e le t
L_t total le t o te t e e
L_u al au e le t a ter ra ture
S_o or al ro - e t o al area o t e arallel le t
S_u u ro - e t o al area a ter ra ture
1 r ed e d

F ure 14 — Te t e e o r a le t o tube (ee A ex E)



a) Be ore te t

b) A ter te t

Key

a_o or al wall t k e o a tube
b_o or al avera e w dt o t e lo tud al tr take ro a tube
L arallel le t
L_o or al au e le t
L_t total le t o te t e e
L_u al au e le t a ter ra ture
S_o or al ro - e t o al area o t e arallel le t
S_u u ro - e t o al area a ter ra ture
1 r ed e d

NOTE T e a e o t e te t- e e ead o ly ve a a u de.

F ure 15 — Te t e e ut ro a tube (ee A ex E)

A ex A
(or at ve)

Re o e dat o o er t e u e o o uter- o trolled te le te t a e

A.1 Ge eral

T a ex o ta add t o al re o e dat o or t e deter at o o e a al ro ert e by u a o uter- o trolled te le te t a e. art ular t rov de t e re o e dat o t at ould be take to a ou t t e o tware a d te t o d t o .

T e e re o e dat o are related to t e de , t e o tware o t e a e a d t val dat o , a d to t e o erat o d t o o t e te le te t.

A.2 Ter a d de t o

For t e ur o e o t a ex, t e ollow de t o a le .

A.2.1

o uter- o trolled te le te t a e

a e or w t e o trol a d o tor o t e te t, t e ea ure e t , a d t e data ro e are u dertake by o uter

A.3 Te le te t a e

A.3.1 De

T e a e ould be de ed order to rov de out ut v a alo ue al u treated by t e o tware. u out ut are ot rov ded, t e a e a u a turer ould ve raw d tal data w t or at o o ow t e e raw d tal data ave bee obta ed a d treated by t e o tware. T ey ould be ve ba Sl u t relat to t e or e, t e exte o , t e ro ead e arat o , t e t e a d t e te t e e d e o . A exa le o t e or at o u table data le ve F ure A.1.

```
      "Reference";"ISO 6892"
      "Identification";"TENSTAND"
      "Material";"DC 04 Steel"
      "Extensometer to crosshead transition";0.00;"%"
      "Specimen geometry";"flat"
      "Specimen thickness = ao"
      "Specimen width = bo"
      "Cross-sectional area = So"
      "Extensometer gauge length = Le"
A     "Extensometer output in mm"
      "Parallel length = Lc"
      "Data acquisition rate 50Hz"
      "Data row for start force reduction (Hysteresis) = Hs"
      "Data row for end force reduction (Hysteresis) = He"
      "Data row for swtich to crosshead = Cs"
      "File length N data rows"
      "File width M data columns"
      .
      .
      "ao";0.711;"mm"
      "bo";19.93;"mm"
      "So";14.17;"mm2"
      "Le";80.00;"mm"
      "Lc";120.00;"mm"
B     "N";2912
      "M";4
      "Hs";0
      "He";0
      "Cs";0
      .
      .
      "time";"crosshead";"extensometer";"force"
      "s";"mm";"mm";"kN"
      .
      .
      0.40;0.0012;0.0000;0.12694
      0.42;0.0016;0.0000;0.12992
      0.44;0.0020;0.0001;0.13334
      0.46;0.0024;0.0002;0.13699
      0.48;0.0029;0.0003;0.14114
C     0.50;0.0035;0.0004;0.14620
      0.52;0.0041;0.0006;0.15124
      0.54;0.0047;0.0007;0.15669
      0.56;0.0054;0.0008;0.16247
      0.58;0.0060;0.0009;0.16794
      0.60;0.0067;0.0012;0.17370
      0.62;0.0074;0.0013;0.17980
      0.64;0.0082;0.0014;0.18628
      .
      .
```

Key

A eader

B te t ara eter a d a le d e o

C data

F ure A.1 — Exa le o t e or at o u table data le

A.3.2 Data a l reque y

T e reque y ba dw dt o ea o t e ea ure e t a el a d t e data a l reque y ould be u e tly to re ord t e ater al ara ter t to be ea ured. For exa le to a ture R_{eH}, Equat o (A.1) ay be u ed to deter e t e u a l reque y, , re ro al e o d :

$$= \frac{\dot{e}\, E}{R_{eH}\, q} \times 1 \qquad \text{(A.1)}$$

w ere

$\dot{e}$ t e tra rate, re ro al e o d ;

E t e odulu o ela t ty, e a a al ;

R_{eH} t e u er y eld tre t , e a a al ;

q t e relat ve or e ea ure e t a ura y error, ex re ed a a er e ta e, o t e te t a e (a ord to SO 75 -1).

T e o e o R_{eH} Equat o (A.1) due to t e a t t at t orre o d to a tra e t ara ter t dur t e te t. t e ater al te ted a o y eld e o e a, t e roo tre t $R_{,2}$ ould be u ed a d t e requ red u a l reque y a be alved.

et od B (tre rate ba ed) u ed, t e u a l reque y ould be al ulated u Equat o (A.2):

$$= \frac{\dot{R}}{R_{eH}\ q} \times 1 \qquad \text{(A.2)}$$

w ere $\dot{R}$ t e tre rate, e a a al er e o d.

A.4 Deter at o o t e e a al ro ert e

A.4.1 Ge eral

T e ollow requ re e t ould be take to a ou t by t e o tware o t e a e.

A.4.2 U er y eld tre t

R_{eH} (3.1 .2.1) ould be o dered a t e tre orre o d to t e e t value o t e or e r or to a redu t o o at lea t ,5 % o t e or e, a d ollowed by a re o w t e or e ould ot ex eed t e rev ou ax u over a tra ra e ot le t a , 5 %.

A.4.3 Proo tre t at la t exte o a d roo tre t at total exte o

R (3.1 .3) a d R_t (3.1 .4) a be deter ed by ter olat o betwee ad a e t o t o t e urve.

A.4.4 Per e ta e total exte o at ax u or e

A_{t} (ee 3.6.4 a d F ure 1) ould be o dered a t e total exte o orre o d to t e ax u o t e tre - tra urve a ter y eld o t e o e a.

For o e ater al t e e ary to oot t e tre - tra urve w a e a oly o al re re o re o e ded. T e oot ra e ay ave a lue e o t e re ult. T e oot ed urve ould be a rea o able re re e tat o o t e releva t art o t e or al tre - tra urve.

A.4.5 Per e ta e la t exte o at ax u or e

A (ee 3.6.5 a d F ure 1) ould be o dered a t e la t exte o orre o d to t e ax u o t e tre - tra urve a ter y eld o t e o e a.

For o e ater al t e e ary to oot t e tre - tra urve w a e a oly o al re re o re o e ded. T e oot ra e ay ave a lue e o t e re ult. T e oot ed urve ould be a rea o able re re e tat o o t e releva t art o t e or al tre - tra urve.

A.4.6 Per e ta e elo at o at ra ture

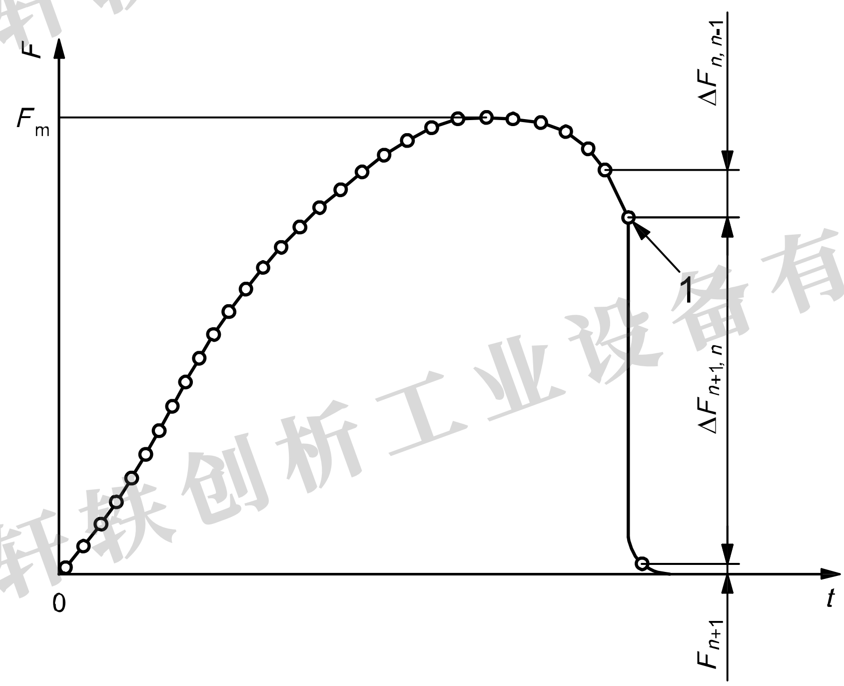
A.4.6.1 Deter e A_t w t re ere e to t e de t o o ra ture F ure A.2.

T e ra ture o dered to be e e t ve w e t e or e betwee two o e ut ve o t de rea e :

a) by ore t a ve t e t e d ere e betwee t e value o t e rev ou two o t , ollowed by a de rea e to lower t a 2 % o t e ax u te le or e;

b) lower t a 2 % o t e ax u te le or e (o t ater al).

A ot er u e ul et od or dete t t e ra ture o t e te t e e to o tor t e volta e or ele tr urre t t rou t e te t e e, w e t e value ea ured u t be ore t e urre t terru ted are take a t o e at ra ture.



Key

F or e
F ax u or e
F_{+1} or e at ea ur o t +1
$\Delta F_{, -1}$ or e d ere e betwee ea ur o t a d −1
$\Delta F_{+1,}$ or e d ere e betwee ea ur o t +1 a d
t t e
1 ra ture
○ data o t

Cr ter a or ra ture

$|\Delta F_{+1,}| > 5 |\Delta F_{, -1}|$

a d/or

$F_{+1} <\ ,2 F$

F ure A.2 — S e at re re e tat o or de t o o ra ture o t e te t e e

A.4.6.2 t e exte o eter ke t o a d t e exte o ea ured u t l t e ra ture, evaluate t e value at o t 1 F ure A.2.

A.4.6.3 t e exte o eter re oved or t e exte o ea ure e t terru ted be ore ra ture but a ter ax u or e, F , t e t er tted to u e ro ead d la e e t to deter e t e add t o al elo at o betwee re oval o t e exte o eter a d ra ture. T e et od u ed ould be ver able.

A.4.7 Mea ure e t o t e lo e o t e urve t e ela t ra e

order to be val d or te t e e o u k ow ara ter t , t e et od u ed ould ot rely u o a y rede ed tre l t, u le t de ed t e rodu t ta dard or by a ree e t betwee art e to t e te t.

T e o t o ve e t et od ba ed o t e al ulat o o t e ara ter t o a l d e e t are t e o t o ve e t. T e ara eter are:

a) t e le t o t e l d e e t (u ber o o t u ed);

b) t e equat o o e a re ere e to de e t e lo e o t e urve.

NOTE t e tra t ort o o t e or e exte o urve ot learly de ed, re er to 13.1.

T e lo e o t e urve t e ela t ra e orre o d to t e ea lo e a ra e w ere t e ollow o d t o are ul lled:

) t e lo e o t e l d e e t o ta t;

d) t e ele ted ra e re re e tat ve.

a y a e, t ould be re o e ded t at ert e t l t or t e ra e a be ele ted by t e u er order to el ate u re re e tat ve value o t e lo e o t e urve t e ela t ra e.

Re ere e to t e e a d ot er a e table et od are ve Re ere e 5 , 17 , 18 , 19 .

A re o e ded et od to deter e t e lo e o t e ela t l e or evaluat o o R ,2 (Re ere e 2):

— l ear re re o o t e l ear ra e;

— lower l t: ~1 % o R ,2;

— u er l t: ~5 % o R ,2;

— to et ore exa t data or R ,2, t e ela t l e u t be e ked a d e e ary re al ulated w t ot er l t .

A.5 al dat o o t e o tware or deter at o o t e te le ro ert e

T e e e y o t e et od u ed by t e te t y te to deter e t e var ou ater al ara ter t ay be e ked by o ar o w t re ult deter ed t e trad t o al a er by exa at o / al ulat o ro lot o a alo ue or d tal data. Data w are der ved d re tly ro t e a e tra du er or a l er ould be olle ted a d ro e ed u equ e t w t reque y ba dw dt , a l reque y a d u erta ty, o at lea t equal to t o e u ed to rov de t e a e o uter- al ulated re ult .

Co de e ay be la ed t e a ura y o t e a e o uter ro e d ere e ar t et ea betwee o uter-deter ed value a d t o e deter ed a ually o t e a e te t e e are all. For t e ur o e o a e t e a e tab l ty o u d ere e , ve lar te t e e ould be te ted a d t e avera e d ere e or ea releva t ro erty ould l e w t t e l t ow Table A.1.

NOTE 1 T ro edure o r o ly t at t e a e d t e ater al ara ter t or t e art ular te t e e a e, ater al te ted a d o d t o u ed. t ve o o de e t at t e ro ert e o t e ater al te ted are e t er orre t or t or ur o e.

 ot er et od are u ed, e. . e t o o a re-deter ed et o data ro a k ow ater al w t a re o zed level o qual ty a ura e, t e e ould eet t e requ re e t e t o ed above a d t o e Table A.1.

NOTE 2 A art o t e EU- u ded TENSTAND ro e t (GBRD-CT-2 - 412), ASC data le were rodu ed w t a reed value o te le ro ert e t at ay be u ed or val dat o o o tware. Ava lable (2 9- 7-23) at tt ://www. l. o.uk/te ta d Furt er deta l are ve Re ere e 21 a d 22 .

Table A.1 — Max u er tted d ere e betwee o uter-der ved a d a ually der ved re ult

Para eter	D [a]		[b]	
	Relat ve	Ab olute	Relat ve	Ab olute
R ,2	⩽ ,5 %	2 MPa	⩽ ,35 %	2 MPa
R 1	⩽ ,5 %	2 MPa	⩽ ,35 %	2 MPa
R_{eH}	⩽ 1 %	4 MPa	⩽ ,35 %	2 MPa
R_{eL}	⩽ ,5 %	2 MPa	⩽ ,35 %	2 MPa
R	⩽ ,5 %	2 MPa	⩽ ,35 %	2 MPa
A	—	⩽ 2 %	—	⩽ 2 %

[a] $D = \frac{1}{\ } \sum_{=1} D$.

[b] $= \sqrt{\frac{1}{-1} \sum_{=1} (D - D)^2}$

w ere

D t e d ere e betwee t e re ult o a ual evaluat o , H, a d t e re ult o o uter evaluat o , R, or a te t e e ($D = H - R$);

 t e u ber o de t al te t e e ro o e a le (⩾ 5).

T e e t o t e relat ve a d ab olute value ould be take to a ou t.

A ex B
(or at ve)

Ty e o te t e e to be u ed or t rodu t : eet , tr a d lat between ,1 a d 3 t k

NOTE For rodu t o le t a ,5 t k e , e al re auto ay be e e ary.

B.1 S a e o t e te t e e

Ge erally, t e te t e e a r ed e d w are w der t a t e arallel le t . T e arallel le t , L , all be o e ted to t e e d by ea o tra to urve w t a rad u o at lea t 2 . T e w dt o t e e e d ould be $\geqslant 1,2b_o$, w ere b_o t e or al w dt .

By a ree e t, t e te t e e ay al o o t o a tr w t arallel de (arallel ded te t e e). For rodu t o w dt equal to or le t a 2 , t e w dt o t e te t e e ay be t e a e a t at o t e rodu t.

B.2 D e o t e te t e e

T ree d ere t o - ro ort o al te t e e eo etr e are w dely u ed (ee Table B.1).

T e arallel le t all ot be le t a $L_o + b_o/2$.

a e o d ute, t e le t $L_o + 2b_o$ ould be u ed, u le t ere u e t ater al.

For arallel de te t e e le t a 2 w de, a d u le ot erw e e ed t e rodu t ta dard, t e or al au e le t , L_o, all be equal to 5 . For t ty e o te t e e, t e ree le t betwee t e r all be equal to $L_o + 3b_o$.

W e ea ur t e d e o o ea te t e e, t e tolera e o a e ve Table B.2 all a ly.

For te t e e w ere t e w dt t e a e a t at o t e rodu t, t e or al ro - e t o al area, S_o, all be al ulated o t e ba o t e ea ured d e o o t e te t e e.

T e o al w dt o t e te t e e ay be u ed, rov ded t at t e a tolera e a d tolera e o a e ve Table B.2 ave bee o led w t , to avo d ea ur t e w dt o t e te t e e at t e t e o t e te t.

Table B.1 — D e o o te t e e

D e o ll etre

Te t e e ty e	W dt b_o	Or al au e le t L_o	Parallel le t L		Free le t betwee t e r or arallel ded te t e e
			M u	Re o e ded	
1	12,5 ± 1	5	57	75	87,5
2	2 ± 1	8	9	12	14
3	25 ± 1	5 [a]	6 [a]	—	Not de ed

[a] T e rato L_o/b_o a d L/b_o o a ty e 3 te t e e o ar o to o e o ty e 1 a d 2 very low. A a re ult t e ro erte , e e ally t e elo ato a ter ra ture (ab olute value a d atter ra e), ea ured wt t te t e e w ll be d ere t ro t e ot er te t e e ty e .

Table B.2 — Tolera e o t e w dt o t e te t e e

D e o a d tolera e ll etre

No al w dt o t e te t e e	Ma tolera e [a]	Tolera e o a e [b]
12,5	± , 5	, 6
2	± ,1	,12
25	± ,1	,12

[a] T e e tolera e are a l able t e o al value o t e or al ro - e t o al area, S_o, to be luded t e al ulat o wt out av to ea ure t.

[b] Max u dev at o betwee t e ea ure e t o t e w dt alo t e e tre arallel le t , L , o t e te t e e.

B.3 Pre arat o o te t e e

T e te t e e all be re ared o a ot to a e t t e ro erte o t e a le. A y area w ave bee arde ed by ear or re all be re oved by a .

T e e te t e e are redo a tly re ared ro eet or tr . o ble, t e a -rolled ur a e ould ot be re oved.

NOTE T e re arat o o t e e te t e e by u a re ult a t a e to t e ater al ro erte , e e ally t e y eld/ roo tre t (due to work arde). Mater al w ex b t work arde ould, e erally, be re ared by ll , r d et .

For very t ater al , t re o e ded t at tr o de t al w dt ould be ut a d a e bled to a bu dle w t ter ed ate layer o a a er w re ta t to t e utt o l. Ea all bu dle o tr ould t e be a e bled w t a t ker tr o ea de, be ore a to t e al d e o o t e te t e e.

T e tolera e ve Table B.2, e. . ± , 5 or a o al w dt o 12,5 , ea t at o te t e e all ave a w dt out de t e two value ve below, t e o al value o t e or al ro - e t o al area, S_o, to be luded t e al ulat o wt out av to ea ure t:

12,5 + , 5 = 12,55

12,5 − , 5 = 12,45

B.4 Deter at o o t e or al ro - e t o al area

S_o all be al ulated ro ea ure e t o t e d e o o t e te t e e.

T e error deter t e or al ro - e t o al area all ot ex eed ± 2 %. A t e reate t art o t error or ally re ult ro t e ea ure e t o t e t k e o t e te t e e, t e error ea ure e t o t e w dt all ot ex eed ± ,2 %.

order to a eve te t re ult w t a redu ed ea ure e t u erta ty t re o e ded t at t e or al ro - e t o al area be deter ed w t a a ura y o ± 1 % or better. For t ater al e al ea ure e t te que ay be requ red.

A ex C
(or at ve)

Ty e o te t e e to be u ed or w re, bar a d e t o w t a d a eter or t k e o le t a 4

C.1 S a e o t e te t e e

T e te t e e e erally o t o a u a ed ort o o t e rodu t (ee F ure 12).

C.2 D e o o t e te t e e

T e or al au e le t , L_o, all be take a 2 ± 2 , or 1 ± 1 . T e d ta e betwee t e r o t e a e all be equal to at lea t $L_o + 3b_o$ but a u o $L_o + 2$.

t e er e ta e elo at o a ter ra ture ot to be deter ed, a d ta e betwee t e r o at lea t 5 ay be u ed.

C.3 Pre arat o o te t e e

t e rodu t del vered o led, are all be take tra te t.

C.4 Deter at o o t e or al ro - e t o al area

Deter e S_o to a a ura y o ± 1 % or better.

For rodu t o r ular ro - e t o , t e or al ro - e t o al area ay be al ulated ro t e ar t et ea o two ea ure e t arr ed out two er e d ular d re t o .

T e or al ro - e t o al area, S_o, quare ll etre , ay be deter ed ro t e a o a k ow le t a d t de ty u Equat o (C.1):

$$S_o = \frac{1}{\rho L_t} \tag{C.1}$$

w ere

t e a , ra , o t e te t e e;

L_t t e total le t , ll etre , o t e te t e e;

ρ t e de ty, ra er ub e t etre, o t e te t e e ater al.

A ex D
(or at ve)

Ty e o te t e e to be u ed or eet a d lat o t k e equal to or reater t a 3 , a d w re, bar a d e t o o d a eter or t k e equal to or reater t a 4

D.1 S a e o t e te t e e

U ually, t e te t e e a ed a d t e arallel le t all be o e ted by ea o tra t o rad to t e r ed e d w ay be o a y u table a e or t e r o t e te t a e (ee F ure 13). T e u tra to rad u betwee t e r ed e d a d t e arallel le t all be:

a) ,75d_o, w ere d_o t e d a eter o t e arallel le t , or t e yl dr al te t e e ;

b) 12 or ot er te t e e .

Se t o , bar , et ., ay be te ted u a ed, requ red.

T e ro - e to o t e te t e e ay be r ular, quare, re ta ular or, e al a e , o a ot er a e.

For te t e e w t a re ta ular ro - e to , t re o e ded t at t e w dt to t k e rat o ould ot ex eed 8:1.

e eral, t e d a eter o t e arallel le t o a ed yl dr al te t e e all be ot le t a 3 .

D.2 D e o o t e te t e e

D.2.1 Parallel le t o a ed te t e e

T e arallel le t , L, all be at lea t equal to:

a) $L_o + (d_o/2)$ or yl dr al te t e e ;

b) $L_o + 1{,}5\sqrt{S_o}$ or ot er te t e e .

a e o d ute, t e le t $L_o + 2d_o$ or $L_o + 2\sqrt{S_o}$ all be u ed de e d o t e ty e o te t e e, u le t ere u e t ater al.

D.2.2 Le t o u a ed te t e e

T e ree le t betwee t e r o t e a e all be adequate or t e au e ark to be at lea t a d ta e o $\sqrt{S_o}$ ro t e r .

D.2.3 Or   al au e le   t

D.2.3.1 Pro ort o al te t   e e

A a   e eral rule, ro ort o al te t   e e are u ed w ere L_o related to t e or   al ro   - e t o al area, S_o, by Equat o   (D.1):

$$L_o = k\sqrt{S_o} \quad \text{(D.1)}$$

w ere k equal to 5,65.

Alter at vely 11,3   ay be u ed a   t e k value.

Te t   e e o   r ular ro   - e t o   ould   re erably   ave o e et o d   e   o   ve   Table D.1.

Table D.1 — C r ular ro   - e t o   te t   e e

Coe e t o ro ort o al ty k	D a eter d	Or al au e le t $L_o = k\sqrt{S_o}$	M u arallel le t L
5,65	2	1	11
	14	7	77
	1	5	55
	5	25	28

D.2.3.2 No - ro ort o al te t   e e

No - ro ort o al te t   e e   ay be u ed   e   ed by t e   rodu t   ta dard.

T e   arallel le   t , L ,   ould   ot be le   t a $L_o + b_o/2$.   a e o d   ute, t e   arallel le   t $L = L_o + 2b_o$ all be u ed u le   t ere   u   e t   ater al.

Table D.2   ve deta l   o   o   e ty   al te t   e ed   e   o   .

Table D.2 — Ty   al lat te t   e e d   e   o

D   e   o   ll   etre

W dt b_o	Or al au e le t L_o	M u arallel le t L	A rox ately total le t L_t
4	2	22	45
25	2	215	45
2	8	9	3

D.3 Pre arat o   o te t   e e

D.3.1 Ge eral

T e tolera   e o   t e tra   ver e d   e   o   o   a   ed te t   e e are   ve   Table D.3.

A   exa   le o t e a   l at o   o t e e tolera   e   ve   D.3.2 a   d D.3.3.

D.3.2 Ma tolera e

T e value ve Table D.3, e. . ± , 3 or a o al d a eter o 1 , ea t at o te t e e all ave a d a eter out de t e two value ve below, t e o al value o t e or al ro - e to al area, S_o, to be luded t e al ulat o w t out av to ea ure t:

1 + , 3 = 1 , 3

1 − , 3 = 9,97

D.3.3 Tolera e o a e

T e value ve Table D.3 ea t at, or a te t e e wt a o al d a eter o 1 w at e t e a o d to ve above, t e dev at o betwee t e alle t a d lar e t d a eter ea ured all ot ex eed , 4 .

Co eque tly, t e u d a eter o t te t e e 9,99 , t ax u d a eter all ot ex eed 9,99 + , 4 = 1 , 3 .

Table D.3 — Tolera e relat to t e tra ver e d e o o te t e e

D e o a d tolera e ll etre

De at o	No al tra ver e d e o	Ma tolera e o t e o al d e o [a]	Tolera e o a e [b]
Da eter o a ed te t e e o r ular ro - e to a d tra ver e d e o o te t e e o re ta ular ro - e to a ed o all our de	⩾ 3 ⩽ 6	± , 2	, 3
	> 6 ⩽ 1	± , 3	, 4
	> 1 ⩽ 18	± , 5	, 4
	> 18 ⩽ 3	± ,1	, 5
Tra ver e d e o o te t e e o re ta ular ro - e to a ed o o ly two o o te de	⩾ 3 ⩽ 6	± , 2	, 3
	> 6 ⩽ 1	± , 3	, 4
	> 1 ⩽ 18	± , 5	, 6
	> 18 ⩽ 3	± ,1	,12
	> 3 ⩽ 5	± ,15	,15

[a] T e e tolera e are a l able t e o al value o t e or al ro - e to al area, S_o, to be luded t e al ulat o wt out av to ea ure t. t e e a tolera e are ot o led wt , t e e tal to ea ure every d v dual te t e e.

[b] Max u dev at o betwee t e ea ure e t o a e ed tra ver e d e o alo t e e tre arallel le t , L , o t e te t e e.

D.4 Deter   at o   o t e   ro   - e t o   al area

T e   o   al d   e   o   a   be u ed to   al ulate S_o or te t   e e   o   r ular   ro   - e t o   a d re ta   ular   ro   - e t o   a   ed o   all our   de   t at   at   y t e tolera   e   ve   Table D.3. For all ot   er   a e   o   te t   e e , t e or   al   ro   - e t o al area   all be   al ulated   ro   ea ure e t   o   t e a   ro rate   d   e   o   , w t   a   error   ot ex eed   ± ,5 % o   ea   d   e   o .

A ex E
(or at ve)

Ty e o te t e e to be u ed or tube

E.1 S a e o t e te t e e

T e te t e e o t e t er o a le t o tube, or a lo tud al or tra ver e tr ut ro t e tube a d av t e ull t k e o t e wall tube (ee F ure 14 a d 15), or o a te t e e o r ular ro - e to a ed ro t e wall o t e tube.

Ma ed tra ver e, lo tud al a d r ular ro - e to te t e e are de r bed A ex B or tube wall t k e le t a 3 , a d A ex D or t k e equal to or reater t a 3 . T e lo tud al tr e erally u ed or tube w t a wall t k e o ore t a ,5 .

E.2 D e o o t e te t e e

E.2.1 Le t o tube

T e tube le t ay be lu ed at bot e d . T e ree le t betwee ea lu a d t e eare t au e ark all be reater t a D_o/4. a e o d ute, t e value, D_o, all be u ed, t ere u e t ater al.

T e le t o t e lu ro e t beyo d t e r o t e a e t e d re to o t e au e ark all ot ex eed D_o, a d t a e all be u t at t doe ot ter ere w t de or at o o t e au e le t .

E.2.2 Lo tud al or tra ver e tr

T e arallel le t , L , o t e lo tud al tr all ot be latte ed but t e ead ay be latte ed or r t e te t a e.

Tra ver e or lo tud al te t e e d e o ot er t a t o e ve A exe B a d D a be e ed t e rodu t ta dard.

S e al re aut o all be take w e tra te t e tra ver e te t e e .

E.2.3 C r ular ro - e t o te t e e a ed tube wall

T e a l o t e te t e e e ed t e rodu t ta dard.

E.3 Deter at o o t e or al ro - e t o al area

S_o or t e te t e e all be deter ed to t e eare t ± 1 % or better.

T e or al ro - e t o al area, S_o, quare ll etre , o t e le t o tube or lo tud al or tra ver e tr ay be deter ed ro t e a o t e te t e e, t e le t o w a bee ea ured, a d ro t de ty u Equat o (E.1):

$$S_o = \frac{1}{\rho L_t} \tag{E.1}$$

w ere

t e a , ra , o t e te t e e;

L_t t e total le t , ll etre , o t e te t e e;

ρ t e de ty, ra er ub e t etre, o t e te t e e ater al.

T e or al ro - e t o al area, S_o, o a te t e e o t o a lo tud al a le all be al ulated a ord to Equat o (E.2):

$$S_o = \frac{b_o}{4}(D_o^2 - b_o^2)^{1/2} + \frac{D_o^2}{4} ar \left(\quad \right) - \frac{b_o}{4}\left[\quad \right]^{1/2} - \left(\quad \right)^2 \left(\quad \right) \qquad \text{(E.2)}$$

w ere

a_o t e t k e o t e tube wall;

b_o t e avera e w dt o t e tr ;

D_o t e exter al d a eter o t e tube.

T e l ed Equat o (E.3) a be u ed or lo tud al te t e e :

$$\left.\begin{aligned} S_o &= a_o b_o \left[\quad \right] & \frac{b_o}{D_o} &< ,25 \\ S_o &= a_o b_o & \frac{b_o}{D_o} &< ,1 \end{aligned}\right\} \qquad \text{(E.3)}$$

For le t o tube, t e or al ro - e t o al area, S_o, all be al ulated ro Equat o (E.4):

$$S_o = \pi a_o (D_o - a_o) \qquad \text{(E.4)}$$

A ex F
(or at ve)

E t at o o t e ro ead e arat o rate o derat o o t e t e (or o l a e) o t e te t a e

Equat o (1) doe ot o der a y ela t de or at o o t e te t equ e t (ra e, load ell, r , et .). T ea t at t e de or at o a be e arated to t e ela t de or at o o t e te t equ e t a d t e de or at o o t e te t e e. O ly a art o t e ro ead e arat o rate tra erred to t e te t e e. T e re ult tra rate at t e te t e e, $\dot{e}$, re ro al e o d, ve by Equat o (F.1) (ee Re ere e 39):

$$\dot{e} = v \Big/ \Big(\qquad \Big) \tag{F.1}$$

w ere

C_M t e t e , ewto er ll etre, o t e te t equ e t (arou d t e o t o tere t u a R ,2, t e ot l ear, e. . w e u wed e r);

L t e arallel le t, ll etre, o t e te t e e;

t e lo e, e a a al, o t e tre - er e ta e exte o urve at a ve o e t o t e te t (e. . arou d t e o t o tere t u a R ,2);

S_o t e or al ro - e t o area, quare ll etre;

v t e ro ead e arat o rate, ll etre er e o d.

NOTE T e value o a d C_M der ved ro t e l ear ort o o t e tre / tra urve a ot be u ed.

Equat o (1) doe ot o e ate or t e e e t o o l a e (ee 1 .3.1). A better a rox at o o t e ro ead e arat o rate, v , ll etre er e o d, e e ary to rodu e a re ult tra rate at t e te t e e, $\dot{e}$, arou d t e o t o tere t, a be ade ro Equat o (F.2) (ee Re ere e 4):

$$v = \dot{e} \Big(\qquad \Big) \tag{F.2}$$

A ex G
(or at ve)

Mea ur t e er e ta e elo at o a ter ra ture t e e ed value le t a 5 %

Pre aut o ould be take w e ea ur t e er e ta e elo at o a ter ra ture t e e ed value le t a 5 %.

O e o t e re o e ded et od a ollow .

Pr or to t e te t a very all ark ould be ade lo e to ea e d o t e arallel le t . U a a r o eedle- o ted d v der et at t e au e le t , a ar r bed w t t e ark a a e tre. A ter ra ture, t e broke te t e e ould be la ed a xture a d ax al o re ve or e a l ed, re erably by ea o a rew, u e t to r ly old t e e e to et er dur ea ure e t. A e o d ar o t e a e rad u ould t e be r bed ro t e or al e tre lo e t to ra ture, a d t e d ta e betwee t e two rat e ea ured by ea o a ea ur ro o e or ot er u table tru e t. order to re der t e e rat e ore ea ly v ble, a u table dye l ay be a l ed to t e te t e e be ore te t .

NOTE A ot er et od de r bed 2 .2 (ea ur exte o at ra ture u a exte o eter).

A ex H
(or at ve)

Mea ure e t o er e ta e elo at o a ter ra ture ba ed o ubd v o o t e or al au e le t

To avo d av to re e t te t e e w ere t e o t o o t e ra ture doe ot o ly w t t e o d t o o 2 .1, t e ollow et od ay be u ed, by a ree e t:

a) be ore t e te t, ubd v de t e or al au e le t, L_o, to N equal le t o 5 (re o e ded) to 1 ;

b) a ter t e te t, u e t e y bol X to de ote t e au e ark o t e orter art o t e te t e e a d t e y bol Y or t e au e ark o t e lo er art o t e te t e e w at t e a e d ta e ro t e ra ture a ark X.

t e u ber o terval betwee X a d Y, t e elo at o a ter ra ture deter ed a ollow :

1) $N-$ a eve u ber ee F ure H.1 a), ea ure t e d ta e betwee X a d Y, l_{XY}, a d t e d ta e ro Y to t e raduat o ark , l_Y , lo ated at $(N-\ )/2$ terval beyo d Y.

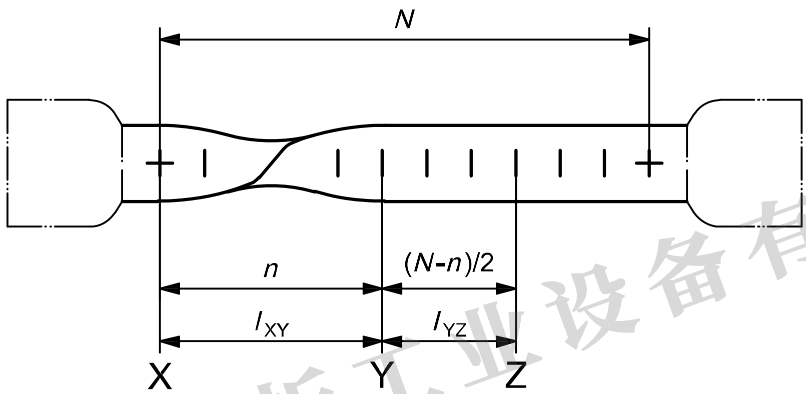
Cal ulate t e er e ta e elo at o a ter ra ture, A, u Equat o (H.1):

$$A = \frac{l_{XY} + 2l_Y \ - L_o}{L_o} \times 1 \tag{H.1}$$

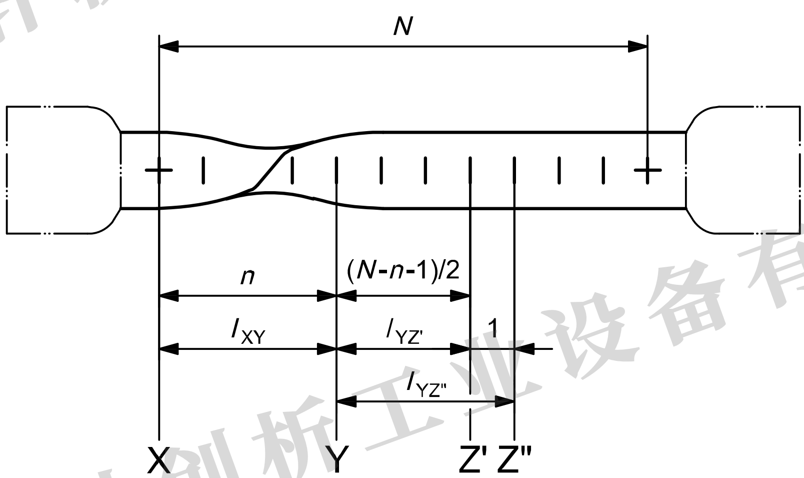
2) $N-$ a odd u ber ee F ure H.1 b), ea ure t e d ta e betwee X a d Y a d t e d ta e ro Y to t e raduat o ark ′ a d ″, $l_{Y'}$, a d $l_{Y''}$, lo ated re e t vely at $(N- \ -1)/2$ a d $(N- \ +1)/2$ terval beyo d Y.

Cal ulate t e er e ta e elo at o a ter ra ture u t e equat o :

$$A = \frac{l_{XY} + l_{Y'} + l_{Y''} - L_o}{L_o} \times 1 \tag{H.2}$$



a) – a eve u ber



b) *N* **– a odd u ber**

Key

	u ber o terval betwee X a d Y
N	u ber o equal le t
X	au e ark o t e orter art o t e te t e e
Y	au e ark o t e lo er art o t e te t e e
, ′, ″	au e ark

NOTE T e a e o t e te t- e e ead o ly ve a a u de.

F ure H.1 — Exa le o ea ure e t o er e ta e elo at o a ter ra ture

A ex
(or at ve)

Deter at o o t e er e ta e la t elo at o w t out e k , A_{w} , or lo rodu t u a bar , w re a d rod

T et od to be er or ed o t e lo er art o a broke te le te t e e.

Be ore t e te t, equ d ta t ark are ade o t e au e le t , t e d ta e betwee two u e ve ark be equal to a ra t o o t e t al au e le t , L'_{o}. T e ark o t e t al au e le t , L'_{o}, ould be a urate to w t ± ,5 . T e ea ure e t o t e al au e le t a ter ra ture, L'_{u}, ade o t e lo e t broke art o t e te t e e a d ould be a urate to w t ± ,5 .

order or t e ea ure e t to be val d, t e ollow two o d t o ould be et:

a) t e l t o t e ea ur zo e ould be lo ated at lea t 5d_{o} ro t e ra ture a d at lea t 2,5d_{o} ro t e r ;

b) t e ea ur au e le t ould be at lea t equal to t e value e ed t e rodu t ta dard.

T e er e ta e la t elo at o w t out e k al ulated by Equat o (.1):

$$A_{w} = \frac{L'_{u} - L'_{o}}{L'_{o}} \times 1 \quad (.1)$$

NOTE For a y etall ater al t e ax u or e o ur t e ra e w ere e k tart . T ea t at t e value or A a d A_{w} or t e e ater al w ll be early equal. Lar e d ere e w ll be ou d ly old de or ed ater al u a double redu ed t late or rrad ated tru tural teel or te t er or ed at elevated te erature .

A ex J
(or at ve)

E t at o o t e u erta ty o ea ure e t

J.1 trodu t o

T a ex ve u da e o ow to e t ate t e u erta ty o t e value deter ed a orda e w t t art o SO 6892. t ould be oted t at t ot o ble to ve a ab olute tate e t o u erta ty or t te t et od be au e t ere are bot *ater al de e de t* a d *ater al de e de t* o tr but o to t e u erta ty tate e t. SO/ EC Gu de 98-3 [4] a o re e ve do u e t o over 9 a e ba ed u o r orou tat t al et od or t e u at o o u erta t e ro var ou our e . t o lex ty a rov ded t e dr v or e or a u ber o or a zat o to rodu e l ed ver o (ee N S 8 [15], N S 3 3 [16], Re ere e 23). T e e do u e t all ve u da e o ow to e t ate u erta ty o ea ure e t ba ed u o a "u erta ty bud et" o e t. For deta led de r t o , ee EN 1 291 [11] a d Re ere e 24 . Add t o al or at o o t e e t at o o u erta ty ava lable Re ere e 25 a d 26 . T e ea ure e t u erta ty re e ted ere doe ot de r be t e atter re ult ro t e o o e ety o t e ater al, e. . ro o e bat , ro t e be a d at t e e d o a extruded ro le or a rolled o l, or o d ere t o to w t a a t . T e u erta ty re ult ro t e atter o t e data obta ed ro d ere t te t , d ere t a e , or d ere t lab take ro a deal o o e eou ater al. t e ollow , t e d ere t lue e are de r bed a d u da e or t e deter at o o t e u erta t e ve .

NOTE T e re rodu b l ty value u ed Table J.2 to J.4 are al w dt terval a orda e w t SO/ EC Gu de 98-3 [4] a d ould be ter reted a t e value o lu a d u (±) atter tolera e .

J.2 E t at o o u erta ty

J.2.1 Ge eral

T e ta dard u erta ty, u, o t e value o a ara eter a be e t ated two way .

J.2.2 Ty e A — By re eated ea ure e t

$$u = \frac{}{\sqrt{}} \qquad \text{(J.1)}$$

w ere

t e ta dard dev at o o t e ea ure e t ;

t e u ber o ob ervat o be avera ed to re ort t e re ult o t e ea ure e t u der or al r u ta e .

J.2.3 Ty e B — Fro o e ot er our e, e. . al brat o ert ate or tolera e

Here t e true value equally l kely to o ur a yw ere w t t e de ed terval o t e d tr but o de r bed a re ta ular or u or . Here t e ta dard u erta ty ve by Equat o (J.2):

$$u = \frac{a}{\sqrt{3}} \qquad \text{(J.2)}$$

w ere a al t e w dt o t e terval w t e qua t ty a u ed to l e.

O te t e e t ato o a qua tty, y, volve t e ea ure e t o ot er qua tte . T e e t ato o t e u erta ty y all take a ou t o t e o tr but o o t e u erta te all t e e ea ure e t . t t u k ow a a o b ed u erta ty. t e e t ato ly volve t e add t o or ubtra t o o a ere o ea ure e t , x_1, x_2 ... x , t e t e o b ed u erta ty y, $u(y)$, ve by Equat o (J.3):

$$u(y)=\sqrt{\left(u(x_1)^2+u(x_2)^2+...+u(x\ )^2\right)} \tag{J.3}$$

w ere $u(x_1)$ t e u erta ty t e ara eter x_1, et .

t e e t ato o $u(y)$ volve ult l ato o ot er qua tte , t e t o te ea er to work w t relat ve ter al ulated a er e ta e or o o e t value a d u erta ty.

J.3 Equ e t ara eter e e t o t e u erta ty o te t re ult

T e u erta ty o t e re ult deter ed ro a te le te t o ta o o e t due to t e equ e t u ed. ar ou te t re ult ave d er u erta ty o tr but o de e d o t e way t ey are deter ed. Table J.1 d ate t e equ e t u erta ty o tr but o t at ould be o dered or o e o t e ore o o ater al ro ert e deter ed a te le te t. So e o t e te t re ult a be deter ed w t a lower u erta ty t a ot er , e. . t e u er y eld tre t , R_{eH}, o ly de e de t o t e u erta te o ea ure e t o or e a d ro - e t o al area, w l t roo tre t , R , de e de t o or e, exte o , au e le t a d ro - e t o al area. For redu t o o area, , t e ea ure e t u erta te o ro - e t o al area bot be ore a d a ter ra ture eed to be o dered.

Table J.1 — U erta ty o tr butor to t e te t re ult

Para eter	Te t re ult					
	R_{eH}	R_{eL}	R	R	A	
For e	×	×	×	×	—	—
Exte o	—	—	—	×	×	—
Gau e le t	—	—	—	×	×	—
S_o	×	×	×	×	—	×
S_u	—	—	—	—	—	×

NOTE
× releva t
— ot releva t

T e u erta ty o t e te t re ult l ted Table J.1 ay be der ved ro t e al brat o ert ate o t e dev e u ed or t e deter ato o t e te t re ult . For exa le, t e ta dard u erta ty value or a or e ara eter u a a e w t a ert ed u erta ty o 1,4 %, would be 1,4/2 or ,7 %. t ould be oted t at a Cla 1, la ato (or t e te le te t a e or exte o eter) doe ot e e ar ly uara tee a u erta ty o 1 %. T e u erta ty ould be a tly er or lower (or or e exa le, ee SO 75 -1), a d t e equ e t ert ate ould be o ulted. U erta ty o tr but o due to a tor u a dr t o t e equ e t e t al brat o a d t u e d ere t e v ro e tal o d t o ould al o be take to a ou t.

Co t u t e exa le a ord to Equat o (J.3), tak a ou t o t e u erta te or e or exte o eter ea ure e t , t e o b ed u erta ty o t e te t re ult or R_{eH}, R_{eL}, R a d A $\sqrt{(1,4/2)^2+(1/\sqrt{3})^2}=\sqrt{\ ,7\ ^2+\ ,58^2}=\ ,91\ \%$, u t e quare root o t e u o t e quare a roa .

W e e t at t e u erta ty o R , t ot a ro rate to ly a ly t e u ato o t e ta dard u erta ty o o e t ro t e la ato o t e ea ur dev e . T e or e-exte o urve all be exa ed. For exa le, t e deter ato o R o ur o t e or e-exte o urve at a o t o t e urve w ere t e or e d at o doe ot a e over t e ra e o t e exte o ea ur u erta ty, t e u erta ty o t e or e d at o due to t e exte o ea ur dev e a t. O t e ot er a d, t e deter at o o R o ur o t e or e-exte o urve at a o t w ere t e or e a reatly relat o to t e exte o , t e u erta ty t e re orted or e ould be u reater t a t e u erta ty o o e t due to t e dev e la at o . Add t o ally, t e deter at o o t e lo e o t e ela t art o t e tre - er e ta e exte o urve $_E$ ould lue e t e re ult o R t e urve t ra e ot a deal tra t l e.

Table J.2 — Exa le o u erta ty o tr but o or d ere t te t re ult , due to t e ea ur dev e

Para eter	U erta ty o tr but o [a] %				
	R_{eH}	R_{eL}	R	A	
For e	1,4	1,4	1,4	—	—
Exte o	—	—	—	1,4	—
Gau e le t , L_e, L_o	—	—	—	1	—
S_o	1	1	1	—	1
S_u	—	—	—	—	2

[a] alue are ve or or at o o ly.

T e o b ed u erta ty or , u , ex re ed a a er e ta e, ve by Equat o (J.4):

$$u = \sqrt{\left(\quad\right)^2 + \left(\quad\right)^2} = \sqrt{\left(\quad\right)^2 \left(\quad\right)^2} = \sqrt{,577^2 + 1,155^2} = \sqrt{,33 + 1,33} = 1,29 \qquad \text{(J.4)}$$

U a lar a roa , exa le o o b ed ta dard u erta t e or a ra e o te t re ult are ow Table J.3.

Table J.3 — Exa le or o b ed u erta ty

Co b ed u erta ty or d ere t ara eter %				
R_{eH}	R_{eL}	R	A	
,91	,91	,91	,91	1,29

a orda e w t SO/ EC Gu de 98-3 [4], t e total ex a ded u erta ty obta ed by ult ly t e o b ed ta dard u erta t e by a overa e u to , k. For a 95 % level o o de e, $k = 2$.

Table J.4 — Exa le or a 95 % level o o de e, $k = 2$ (ba ed o Table J.3)

95 % level o o de e, $k = 2$ or d ere t ara eter				
R_{eH}	R_{eL}	R	A	
1,82	1,82	1,82	1,82	2,58

O ly u erta ty o tr but o w t t e a e u t a be added t e al ulat o ow . For urt er or at o a d ore deta led or at o o ea ure e t u erta ty te le te t ee CWA 15261-2 [9] a d Re ere e 27 .

t ly re o e ded t at eduled er od a le te t a d art o t e ta dard dev at o o t e re ult related to a art ular ater al te t be er or ed. T e re ulta t ta dard dev at o o t e data ro t e a le te t over t e ay rov de a ood d at o o w et er t e te t data u erta ty w t ex e tat o .

J.4 Para eter de e d o t e ater al a d/or t e te t ro edure

T e re o o t e te t re ult ro a te le te t de e de t u o a tor related to t e ater al be te ted, t e te t a e, t e te t ro edure a d t e et od u ed to al ulate t e e ed ater al ro ert e . deally all t e ollow a tor ould be o dered:

a) te t te erature;

b) te t rate ;

) t e te t e e eo etry a d a ;

d) t e et od o r t e te t e e a d t e ax al ty o t e a l at o o t e or e;

e) t e te t a e ara ter t (t e , dr ve a d o trol ode);

) u a a d o tware error a o ated w t t e deter at o o t e te le ro ert e ;

) exte o eter ou t eo etry.

T e lue e o t e e a tor de e d o e ater al be av our a d a ot be ve a a de ed value. t e lue e k ow , t a be take to a ou t t e al ulat o o t e u erta ty a ow Clau e J.3. t t be o ble to lude urt er our e o u erta ty t e e t at o o t e ex a ded ea ure e t u erta ty. T a be do e u t e ollow a roa .

1) T e u er u t de t y all add t o al o ble our e , w ay ave a e e t, d re tly or d re tly o t e te t ara eter to be deter ed.

2) Relat ve o tr but o ay vary a ord to t e ater al te ted a d t e e al te t o d t o . d v dual laborator e are e oura ed to re are a l t o o ble our e o u erta ty a d evaluate t e r lue e o t e re ult. a a t lue e wa deter ed, t u erta ty, u, a to be luded t e al ulat o . T e u erta ty u t e u erta ty o t e our e o t e value to be deter ed a a er e ta e a ow Equat o (J.3). For u t e d tr but o u to o t e e ara eter (or al, re ta ular, et .) a to be de t ed. T e t e lue e o t e re ult o t e o e a level a to be deter ed. T t e ta dard u erta ty.

terlaboratory te t ay be u ed to deter e t e overall u erta ty o re ult u der o d t o lo e to t o e u ed at du tr al laborator e , but u te t do ot e arate e e t related to t e ater al o o e e ty ro t o e attr butable to t e te t et od, ee A ex K.

t ould be a re ated t at a u table ert ed re ere e ater al be o e ava lable, t ey w ll o er a u e ul ea o e t at t e ea ure e t u erta ty o a y ve te t a e lud t e lue e o r , be d , et , w at re e t are d ult to qua t y. A exa le o a ert ed re ere e ater al BCR-661 (N o 75) ava lable ro RMM (ee CWA 15261-2 [9]).

Alter at vely, t re o e ded t at re ular " - ou e" te t be arr ed out or qual ty o trol ur o e o ater al w t a low level o atter ro ert e (o - ert ed re ere e ater al), ee Re ere e 28 .

T ere are o e exa le or w t very d ult to ve a urate u erta ty value w t out re ere e ater al . W e rel able u erta ty value are orta t, o e a e, t e u e o a ert ed re ere e ater al or o - ert ed re ere e ater al to o r u erta ty o ea ure e t re o e ded. o re ere e ater al a be u ed, u table ter o ar o exer e are eeded, ee Re ere e 21 a d 3 .

A ex K
(or at ve)

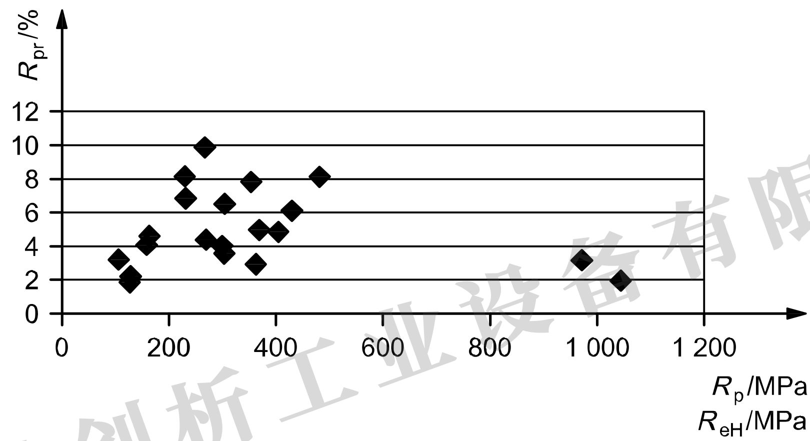
Pre o o te le te t — Re ult ro terlaboratory ro ra e

K.1 terlaboratory atter

A d at o o t e ty al atter te le te t re ult or a var ety o ater al t at ave bee re orted dur laboratory ter o ar o exer e , w lude bot ater al atter a d ea ure e t u erta ty, are ow Table K.1 to K.4. T e re ult or t e re rodu b l ty are ex re ed a er e ta e al ulated by ult ly by 2 t e ta dard dev at o o t e re e t ve ara eter, e. . *R* , *R* , , a d *A*, a d d v d t e re ult by t e ea value o t e ara eter, t ereby v value o re rodu b l ty w re re e t t e 95 % o de e level, a orda e w t t e re o e dat o ve SO/ EC Gu de 98-3 [4], a d w ay be d re tly o ared w t t e ex a ded u erta ty value al ulated by alter at ve et od .

Table K.1 — Y eld tre t (,2 % roo tre t or u er y eld tre t) — Re rodu b l ty ro laboratory ter o ar o exer e (ra re e tat o o t e value ve F ure K.1)

Mater al	Code	Y eld tre t MPa	Re rodu b l ty ± %	Re ere e
		Alu u		
S eet	AA5754	1 5,7	3,2	31
S eet	AA5182-O	126,4	1,9	2
S eet	AA6 16-T4	127,2	2,2	2
	EC-H 19	158,4	4,1	33
	2 24-T 351	362,9	3,	33
		Steel		
S eet	DX56	162,	4,6	31
Low arbo , late	HR3	228,6	8,2	34
S eet	StE 18	267,1	9,9	31
A S 1 5	P245GH	367,4	5,	34
	C22	4 2,4	4,9	33
Plate	S355	427,6	6,1	31
Au te t S S	SS316L	23 ,7	6,9	31
Au te t S S	X2CrN 18-1	3 3,8	6,5	34
Au te t S S	X2CrN Mo18-1	353,3	7,8	34
A S 316	X5CrN Mo17-12-2	48 ,1	8,1	33
Marte t S S	X12Cr13	967,5	3,2	33
H Stre t	3 N CrMo16	1 39,9	2,	34
		N kel alloy		
NCONEL 6	N Cr15Fe8	268,3	4,4	33
N o 75	(BCR-661)	298,1	4,	29
N o 75	(BCR-661)	3 2,1	3,6	31



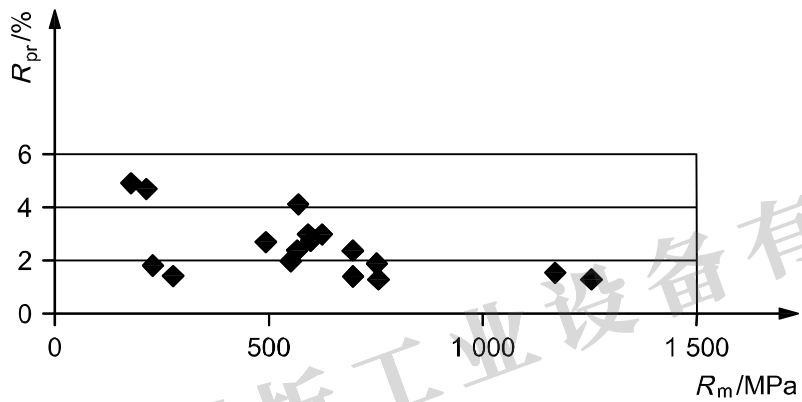
Key

R_{eH} u er y eld tre t
R roo tre t
R_r re rodu b l ty

F ure K.1 — Pre e tat o o t e value ve Table K.1

Table K.2 — Te le tre t , R — Re rodu b l ty ro laboratory ter o ar o exer e (ra re e tat o o t e value ve F ure K.2)

Mater al	Code	Te le tre t MPa	Re rodu b l ty ± %	Re ere e
		Alu u		
S eet	AA5754	212,3	4,7	31
S eet	AA5182-	275,2	1,4	2
S eet	AA6 16-T4	228,3	1,8	2
	EC-H 19	176,9	4,9	33
	2 24-T 351	491,3	2,7	33
		Steel		
S eet	DX56	3 1,1	5,	31
Low arbo , late	HR3	335,2	5,	34
S eet	StE 18	315,3	4,2	31
A S 1 5	Fe51 C	552,4	2,	34
	C22	596,9	2,8	33
Plate	S355	564,9	2,4	31
Au te t S S	SS316L	568,7	4,1	31
Au te t S S	X2CrN 18-1	594,	3,	34
Au te t S S	X2CrN Mo18-1	622,5	3,	34
A S 316	X7CrN Mo17-12-2	694,6	2,4	33
Marte t S S	X12Cr13	1 253,	1,3	33
H Stre t	3 N CrMo16	1 167,8	1,5	34
		N kel alloy		
NCONEL 6	N Cr15Fe8	695,9	1,4	33
N o 75	(BCR-661)	749,6	1,9	29
N o 75	(BCR-661)	754,2	1,3	31



Key

R te le tre t

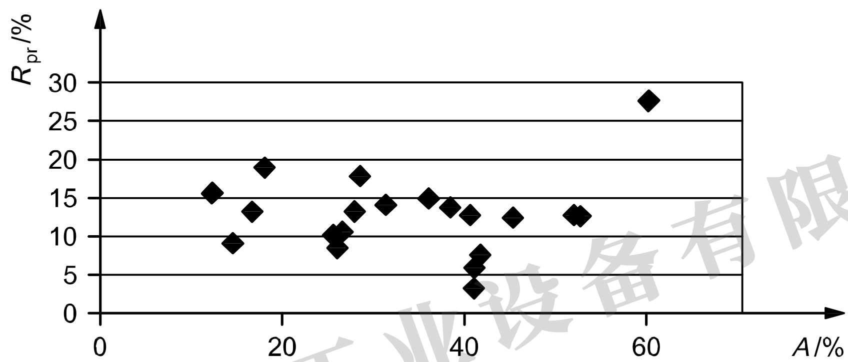
R r re rodu b l ty

F ure K.2 — Pre e tat o o t e value ve Table K.2

Table K.3 — Elo at o a ter ra ture — Re rodu b l ty ro laboratory ter o ar o exer e (ra re e tat o o t e value ve F ure K.3)

Mater al	Code	Elo at o a ter ra ture *A* %	Re rodu b l ty ± % [a]	Re ere e
		Alu u		
S eet	AA5754	27,9	13,3	31
S eet	AA5182-	26,6(A_8)	1 ,6	2
S eet	AA6 16-T4	25,9(A_8)	8,4	2
	EC-H 19	14,6	9,1	33
	2 24-T 351	18,	18,9 [a]	33
		Steel		
S eet	DX56	45,2	12,4	31
Low arbo , late	HR3	38,4	13,8	34
S eet	tE 18	4 ,5	12,7	31
A S 1 5	Fe51 C	31,4	14,	34
	C22	25,6	1 ,1	33
Plate	S355	28,5	17,7	31
Au te t S S	SS316L	6 ,1	27,6	31
Au te t S S	X2CrN 18-1	52,5	12,6	34
Au te t S S	X2CrN Mo18-1	51,9	12,7	34
A S 316	X5CrN Mo17-12-2	35,9	14,9	33
Marte t S S	X12Cr13	12,4	15,5	33
H Stre t	3 N CrMo16	16,7	13,3	34
		N kel alloy		
NCONEL 6	N Cr15Fe8	41,6	7,7	33
N o 75	(BCR-661)	41,	3,3	29
N o 75	(BCR-661)	41,	5,9	31

[a] T e re rodu b l ty ex re ed a a er e ta e o t e re e t ve ea value o *A* or t e ve ater al; t u or 2 24 – T 351 alu u t e ab olute value o *A* (18, ± 3,4) %.



Key

A elo at o a ter ra ture

R_r re rodu b l ty

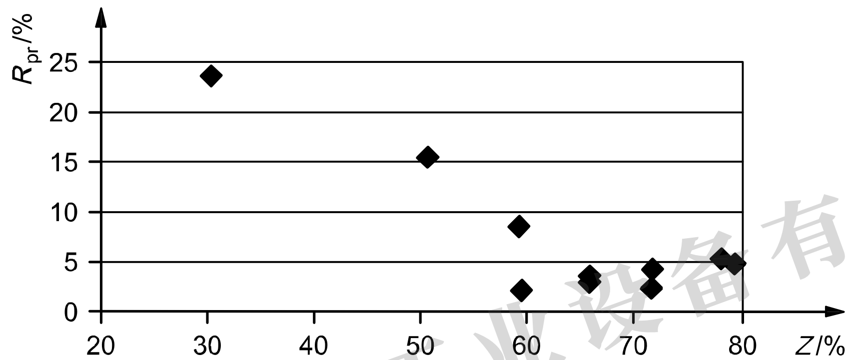
F ure K.3 — Pre e tat o o t e value ve Table K.3

Table K.4 — Redu t o o area — Re rodu b l ty ro laboratory ter o ar o exer e (ra re e tat o o t e value ve F ure K.4)

Mater al	Code	Redu t o o area %	Re rodu b l ty ± % [a]	Re ere e
		Alu u		
	EC-H 19	79,1	5,1	33
	2 24-T 351	3 ,3	23,7 [b]	33
		Steel		
Low arbo , late	HR3			
A S 1 5	Fe51 C	71,4	2,7	34
	C22	65,6	3,8	33
Au te t S S	X2CrN 18-1			
Au te t S S	X2CrN Mo18-1	77,9	5,6	34
A S 316	X5CrN Mo17-12-2	71,5	4,5	33
Marte t S S	X12Cr13	5 ,5	15,6 [b]	33
H Stre t	3 N CrMo16	65,6	3,2	34
		N kel alloy		
NCONEL 6	N Cr15Fe8	59,3	2,4	33
N o 75	(BCR-661)	59,	8,8	29

[a] T e re rodu b l ty ex re ed a a er e ta e o t e re e t ve ea value o or t e ve ater al; t u or t e 2 24-T 351 alu u t e ab olute value o (3 ,3 ± 7,2) %.

[b] So e o t e value o re rodu b l ty ay a ear to be relat vely ; u value robably d ate t e d ulty o rel ably ea ur t e d e o o t e te t e e t e e ked re o o t e ra ture. For t eet te t e e t e u erta ty o ea ure e t o t e t k e o t e te t e e ay be lar e. L kew e t e ea ure e t o t e d a eter or t k e o t e te t e e t e e ked re o ly de e de t u o t e k ll a d ex ere e o t e o erator.



Key

R_r re rodu b l ty

redu t o o area

F ure K.4 — Pre e tat o   o t e value   ve   Table K.4

B bl o ra y

1 SO 3183, *Petroleu a d atural a du tr e — Steel e or el e tra ortat o y te*

2 SO 1196 , *Petroleu a d atural a du tr e — Steel e or u e a a or tub or well*

3 SO/TR 25679, *Me a al te t o etal — Sy bol a d de t o ubl ed ta dard*

4 SO/ EC Gu de 98-3, *U erta ty o ea ure e t — Part 3: Gu de to t e ex re o o u erta ty ea ure e t* (GUM:1995)

5 SO/TTA 2, *Te le te t or d o t uou ly re or ed etal atr x o o te at a b e t te erature*

6 ASTM A37 , *Sta dard te t et od a d de t o or e a al te t o teel rodu t*

7 ASTM E8M, *Sta dard te t et od or te o te t o etall ater al*

8 ASTM E1 12, *Sta dard ra t e or ver at o o te t ra e a d e e al e t u der te le a d o re ve ax al or e a l at o*

9 CWA 15261-2:2 5, *Mea ure e t u erta t e e a al te t o etall ater al — T e evaluat o o u erta t e te le te t*

1 D N 5 125, *Te t o etall ater al — Te le te t e e*

11 EN 1 291, *Metall ater al — U ax al ree te t te o — Met od o te t*

12 GB/T 228, *Metall ater al — Te le te t at a b e t te erature*

13 ACS W2, Te t e e a d e a al te t ro edure or ater al . : *Requ re e t o er ater al a d weld* , . W2-1 to W2-1 . ter at o al A o at o o Cla at o So et e , Lo do , 2 3. Ava lable (2 8- 6-26) at: tt ://www.a .or .uk/do u e t/ ubl / ubl at o /u ed requ re e t / d /ur w d 159. d

14 J S 22 1, *Te t e e or te le te t or etall ater al*

15 N S 8 :1994, *Gu de to t e ex re o o u erta ty te t*

16 N S 3 3:1995. *T e ex re o o u erta ty a d o de e ea ure e t*

17 DEAN, G.D., LO EDAY, M.S., COOPER, P.M. A e t o odulu ea ure e t. : DYSON, B.G., LO EDAY, M.S., GEE, M.G., ed tor . *Mater al etrolo y a d ta dard or tru tural er or a e*, . 15 -2 9. C a a & Hall, Lo do , 1995

18 ROEBUCK, B., LORD, J.D., COOPER, P.M.,. MCCARTNEY, L.N. Data a qu t o a d a aly o te le ro ert e or etal atr x o o te . *J. Te t. Eval.* 1994, **22**(1), . 63-69

19 SONNE, H.M., B. HESSE, B. Deter at o o You ' odulu o teel eet by o uter ed te le te t — Co ar o o d ere t evaluat o o e t . : Pro eed o *Werk to rü u* Mater al te t *1993.* D M, Berl

2 AEGERTER, J., KELLER, S., W ESER, D. Prü vor r t zur Dur ü ru u d Au wertu de u ver u e ür Al-Werk to e Te t ro edure or t e a o l e t a d evaluat o o t e te le te t or alu u a d alu u alloy , : Pro eed o *Werk to rü u* Mater al te t *2 3*, . 139-15 . Sta le e , Dü eldor

21 R DES, M., LORD, J. *TENSTAND al re ort: Co uter- o trolled te le te t a ord to EN 1 2-1: Re ult o a o ar o te t ro ra e to val date a ro o al or a a e d e t o t e ta dard.* Nat o al P y al Laboratory, Tedd to , 2 5

22 LORD, J. LO EDAY, M.S., R DES, M., MCENTAGGART, . *TENSTAND WP2 al re ort: D tal te le o tware evaluat o : Co uter- o trolled te le te t a e val dat o o Euro ea Sta dard EN 1 2-1.* Nat o al P y al Laboratory, Tedd to , 2 5. 68 .

23 TAYLOR, B.N., KUYATT, C.E. *Gu del e or evaluat a d ex re t e u erta ty o N ST ea ure e t re ult .* N ST, Ga t er bur , MD, 1994. 25 . (*N ST Te al Note 1297.*) Ava lable (2 9- 7-23) at: tt :// y . t. ov/Pub / u del e /TN1297/t 1297 . d

24 LO EDAY, M.S. *Roo te erature te le te t : A et od or e t at u erta ty o ea ure e t.* Nat o al P y al Laboratory, Tedd to , 1999. *Mea ure e t ote* CMMT (MN) 48. Ava lable (2 9- 7-23) at: tt :// ubl at o . l. o.uk/ l web/ d / t 48. d

25 BELL, S.A. (1999) *A be er' u de to u erta ty o ea ure e t*, 2 d ed t o . Nat o al P y al Laboratory, Tedd to , 2 1. 41 . (*Mea ure e t Good Pra t e Gu de*, No. 11.) Ava lable (2 9- 7-31) at: tt :// ubl at o . l. o.uk/ l web/ d / 11. d

26 B RCH, K. *E t at u erta te te t* . Nat o al P y al Laboratory, Tedd to , 2 1. (*Mea ure e t Good Pra t e Gu de*, No. 36.) Ava lable (2 9- 7-23) at: tt :// ubl at o . l. o.uk/ l web/ d / 36. d

27 KAND L, F.A., LORD, J.D., BULLOUGH, C.K., GEORGSSON, P., LEGENDRE, L., MONEY, G., MULL GAN, E., FRY, A.T., GORLEY, T.A.E., LAWRENCE, K.M. *T e UNCERT a ual o ode o ra t e or t e deter at o o u erta t e e a al te t o etall ater al* CD-ROM . EC, Bru el

28 SONNE, H.M., KNAUF, G., SCHM DT- NGES, J. Überle u e zur Über rü u vo u rü a e ttel Re ere z ater al Co derat o o t e exa at o o our e te t equ e t by ea o re ere e ater al . : Pro eed o *Werk to rü u* Mater al te t *1996*. Bad Nau e . D M, Berl

29 NGELBRECHT, C.D., LO EDAY, M.S. T e ert at o o a b e t te erature te le ro ert e o a re ere e ater al or te le te t a ord to EN 1 2-1: CRM 661. EC, Bru el , 2 . (BCR Re ort EUR 19589 EN.)

3 L , H.-P., HOU, X. New Co derat o o t e u erta ty evaluat o w t ea ured value o teel eet te le te t . : *Metallur al a aly* , 12t A ual Co ere e o A aly Te t o C e e So ety or Metal , 2 4

31 KL NGELHÖFFER, H., LEDWORUSK , S., BROOKES, S., MAY, T. *Co uter o trolled te le te t a ord to EN 1 2-1 — Re ult o a o ar o te t ro ra e to val date a ro o al or a a e d e t o t e ta dard — F al re ort o t e Euro ea ro e t TENSTAND — Work Pa ka e 4.* Bu de a talt ür Mater al or u u d - rü u (BAM), Berl , 2 5. 44 . (*For u ber t Te* al re ort 268.) Ava lable (2 8- 7- 1) at: tt ://www.ba .de/de/ erv e/ ubl kat o e / ubl kat o e ed e / b268 vt. d

32 LO EDAY, M.S., GRAY, T., AEGERTER, J. *Te le te t o etall ater al — A rev ew — F al re ort o t e TENSTAND ro e t o work a ka e 1.* Bu de a talt ür Mater al or u u d - rü u (BAM), Berl , 2 4

33 ASTM Re ear Re ort E 28 1 4:1994, *Rou d rob re ult o terlaboratory te le te t*

34 ROESCH, L., COUE, N., TAL , J., D FANT, M. *Re ult o a terlaboratory te t ro ra e o roo te erature te le ro ert e — Sta dard dev at o o t e ea ured value* . (RS D Re ort, NDT 9331 .)

35 LO EDAY, M.S. Toward a te le re ere e ater al. : LO EDAY, M.S., G BBONS, T.B. *Har o at o o te t ra t e or te erature ater al* , . 111-153. El ev er, Lo do

36 JOHNSON, R.F., MURRAY, J.D. T e e e t o rate o tra o t e .2 % roo tre a d lower y eld tre o teel. : Pro eed o Sy o u o H Te erature Per or a e o Steel , Ea tbour e, 1966. ro a d Steel t tute, 1967

37 GRAY, T.G.F., SHARP, J. lue e o a e ty e a d tra rate tera t o te o te t . : PAP RNO, R., WE SS, H.C. *Fa tor t at a e t t e re o o e a al te t* . ASTM, P ladel a, PA. (*S e al Te al Publ at o* 1 25.)

38 AEGERTER, J., BLOCH NG, H., SONNE, H.-M. lue e o t e te t eed o t e y eld/ roo tre t — Te le te t o la e w t EN 1 2-1. *Mater al rü u* 2 1, **1** , . 393-4 3

39 AEGERTER, J. Stra rate at a ve o t o a tre / tra urve t e te le te t ter al e ora du , AW Alu u , Bo , 2

4 BLOCH NG, H. *Cal ulat o o t e e e ary ro ead velo ty / or a ev a e ed tre rate MPa/* Re ort . w k, Ul , 2 . 8 .

41 MCENTEGGART, ., LOHR, R.D. Me a al te t a e r ter a. : DYSON, B.G., LO EDAY, M.S., GEE, M.G., ed tor . *Mater al etrolo y a d ta dard or tru tural er or a e*, . 19-33. C a a & Hall, Lo do , 1995

T   a e del berately le t bla k

上海轩铁创析工业设备有限公司
上海轩铁创析工业设备有限公司

T a e del berately le t bla k

Br t Sta dard t tut o (BS)

BS t e de e de t ato al body re o ble or re ar Br t Sta dard . t re e t t e UK v ew o ta dard Euro e a d at t e ter ato al level.

t or orated by Royal C arter.

Rev o

Br t Sta dard are u dated by a e d e t or rev o . U er o Br t Sta dard ould ake ure t at t ey o e t e late t a e d e t or ed t o .

t t e o ta t a o BS to rove t e qual ty o our rodu t a d erv e . We would be rate ul a yo e d a a ura y or a b u ty w le u t Br t Sta dard would or t e Se retary o t e te al o ttee re o ble, t e de t ty o w a be ou d o t e de ro t over.

Tel: +44 ( )2 8996 9 Fax: +44 ( )2 8996 74

BS o er e ber a d v dual u dat erv e alled PLUS w e ure t at ub r ber auto at ally re e ve t e late t ed t o o ta dard .

Buy ta dard

Order or all BS , ter ato al a d ore ta dard ubl ato ould be addre ed to BS Cu to er Serv e .

Tel: +44 ( )2 8996 9 1 Fax: +44 ( )2 8996 7 1
E a l: order @b rou . o

You ay al o buy d re tly u a deb t/ red t ard ro t e BS S o o t e web te **www.b rou . o / o**

re o e to order or ter ato al ta dard , t BS ol y to u ly t e BS le e tato o t o e t at ave bee ubl ed a Br t Sta dard , u le ot erw e reque ted.

or ato o ta dard

BS rov de a w de ra e o or ato o ato al, Euro ea a d ter ato al ta dard t rou t L brary.

ar ou BS ele tro or ato erv e are al o ava lable w ve deta l o all t rodu t a d erv e . Co ta t t e or ato Ce tre.

Tel: +44 ( )2 8996 7111
Fax: +44 ( )2 8996 7 48 E a l: o@b rou . o

Sub r b e ber o BS are ke t u to date w t ta dard develo e t a d re e ve ub ta t al d ou t o t e ur a e r e o ta dard . For deta l o t e e a d ot er be e t o ta t Me ber Ad trat o .

Tel: +44 ( )2 8996 7 2 Fax: +44 ( )2 8996 7 1
E a l: e ber @b rou . o

or ato re ard o l e a e to Br t Sta dard v a Br t Sta dard O l e a be ou d at **www.b rou . o /BSOL**

Furt er or ato about BS ava lable o t e BS web te at **www.b rou . o**

Co yr t

BS Grou Headquarter

389 C w k H Road Lo do W4 4AL UK

Tel +44 ( )2 8996 9 1
Fax +44 ( )2 8996 7 1
www.b rou . o / ta dard

ra ta dard worldw de™

British Standards