32-E-107/108/201

1

D

2 : ( )

( ) 5

≥ 1200㎜

3

4

5

6

1

32-E-201

BIU1000-3.6-23/122579-19-4I

/ 10# Q345R

1

312

2		32-E-107 AES1200-3.60/2.77-507-6/19-2I 20# Q345R 507 2.51MPa 1.64MPa / 27/109 186/112 32-E-107	1	
3		32-E-108 AES1350-2.04/1.87-660-6/19-2I 10# Q345R 658.7 1.85MPa 1.69MPa / 107/177 264/183 32-E-108	1	

2,

12

13 18 12

1%

1		2C+1E	
2		2C+1E	
3		2C+1E	
4		2C+1E	
5		2C+1E	
6		2C+1E	
C— E—pdf			

1

2

1 2 3 4

B

C

D

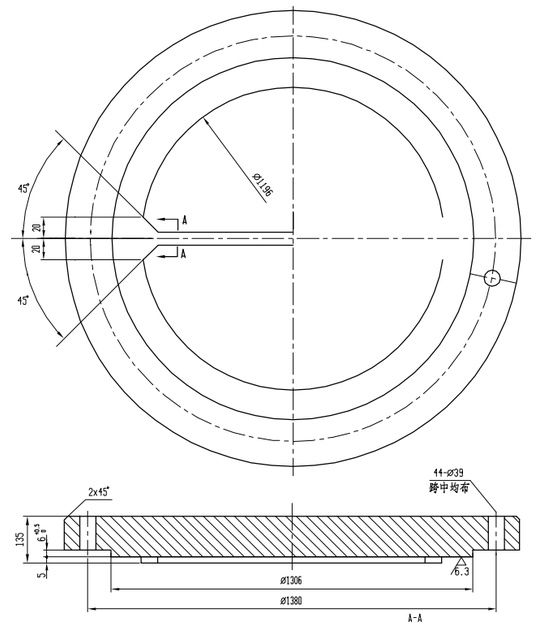
E

F

G

H

1 2 3 4 5 6



3. 除注明者外，机加工面的自由尺寸允许偏差按~~GB/T1804~~中的m

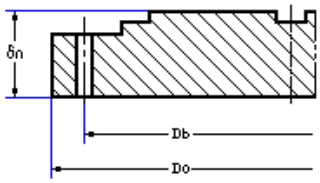
件号	名称
ITEM NO.	SCALE

:

1 . .....(1)
2 . .....(2)
3 . .....(4)
4 . .....(5)
5 . .....(6)
6 . .....(9)
7 . .....(10)
8 . 1.....(11)
9 . .....(13)
10 . .....(14)
11 . .....(15)
12 . .....(16)

Di	mm		1200
	P	MPa	3.6
	T		131
		ϕ	1
	C2	mm	3
	P	MPa	2.77
	T		207
		ϕ	1
	C2	mm	3

: 简



P MPa		3.6
MPa		0.000
Pc MPa		3.600
T		131
Di mm		1200
Do mm		1450.000
		16Mn[ ]
C1 mm		0
	mm	5.00
! " " # $		1
%		
& ' f mm		44
( ) * +		
, - dB mm		M36
, .p mm		4
, - / mm		31.67
, - 0 1 d mm		31.67
, - 2 db mm		39
, - 2 3 4 Db mm		1380
, - $ n 5		44
, -		35CrMoA
6 7 8 9 : ;		GB150 9-1 1a-3
6 7 * +		( )
6 7 # $ m		3.75
6 7 < = y MPa		52.4
6 7 " > 9 mm		1258
6 7 " > 9 mm		1306
6 7 ? @		
6 7 mm		

结果:

1. A B C D $:

E F G H I MPa		150.00
F G H I	MPa	148.14
F J B K E MPa		201140
F , - G H I	MPa	201.66
E F , - G H I MPa		228.00

2. 6 7 $

6 7 L < M bo mm		12.00
6 7 N < M b mm		8.76
6 7 8 O H 3 4 mm		1288.47

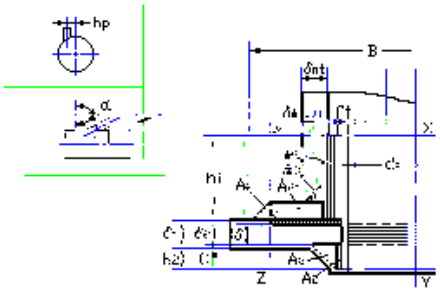
6 7 8 P Q mm	45.76
3. , - $	
R S , - 9 T Am mm	28012.39
U V , - 9 T mm	34643.24
, - 9 T	i j
W 8 ; X , - Y Z N =0.5(+)/	7142741.67
[O ; X , - Y Z N + p	5648978.98
W 8 \ ] ^ _ ` # $ K =1.78 /(Pc)	0.0756
[O \ ] ^ _ ` # $ K =0.3+1.78 /( )	0.3598
4.	
W 8 = [/( ) mm	54.87
[O = [/( ) mm	120.47
3 a b Y	1.5000
% = {[/( )][0.0435 +0.5 /]} mm	128.33
mm	128.33
& mm	134
( ) MPa	4.56
c kg	1737.00
d e f g Pmax MPa	3.68
] h	i j

:

:

简

	} 4 s 2 ~ •
~ • : n	~ • 圈
" 放 : n	插入 n
" Dti mm	255.000
"	20(GB9948)[ ]
" u Ct2	3.00
" Ct1	0.00
" ! " " # $ v	1.00
" U V 伸高 H1 mm	100.00
" U V 伸高 H2 mm	0.00
! 缝脚高K mm	1.000
" 轴线 q r 法线夹角 α	0
" 3 . hp mm	0.00
~ • 圈	Q345R[ ]
~ • 圈 M B mm	480.000
~ • 圈 & 'n mm	16.00
" & 'n mm	9.00



结果:

F " P G H I ! MPa	133.90
F q r P G H I ! MPa	163.00
F ~ • 圈 P G H I ! MPa	170.00
~ • 圈 & 'bn mm	16.00
2 a q r & " mm	20.00
2 a q r # mm	13.40
2 d mm	261.00
• 削弱 # $ fr(为 v)	0.82
q r N ~ • 范围B mm	522.0
" 侧 N ~ • 高 $=(% & ' mm	48.5
" 侧 N ~ • 高 (=(% & ' mm	0.0
q r N ~ • 9 T)=(* - %)(+ - #)-2 , (+ - #)(1- -) mm .	932.0
" N ~ • 9 T / =2 $ (, - 0) - +2 ((, - 1) - mm .	201.1
! 缝 截 9 T A3 mm .	1.0
~ • 圈 ~ • 9 T mm .	3312.0
总 ~ • 9 T Ae mm .	4446
所 R ~ • 9 T A mm .	3526
] h	~ •] ^ 安全

:

	207.00
E F G H I ! MPa	150.00
F G H I " # MPa	134.16
F J B K Ep MPa	195160
F G H I " $ MPa	121.18
F y z • % MPa	193.20
F J B K Et MPa	185580
2. DG,At,Dt,Al,a,β,Kt,&	
6 7 L < M bo mm	12.00
6 7 N < M b mm	8.76
6 7 8 9 3 4 ' mm	1288.47
% 而未被支撑 P 9 T Ad mm (	29250.00
布 区 9 T At mm (	946125.00
布 区当 Dt mm	1097.56
布 区 2 P 9 T A1 mm (	527996.32
一根 横截 9 T a mm (	112.29
# $) = * + / ,	0.3120
N w L mm	5777.00
束 K $ - = . * + / (/ 0)	4821.42
束无 纲刚 &	0.0618
刚 削弱 # $ η	0.4
• 削弱 # $ μ	0.4
3. 1,查图23得到C,查图24得到Gwe	
无 刚 1 = 2 / (1.5 3 " 4)	0.0447
5 / 6	1.8691
# $ 7 = 0 / '	0.8518
# $ 1/ρ t	1.1739
# $ C	0.4307
# $ Gwe	3.5802
4.	
8 = 0 9 6 mm	99.98
&	110
	i j
5. 轴向 I σ t, I 满足: σ t>0, σ t≤ " $; σ t<0, σ t≤[σ]cr	
# $: =(2 ; . / % <	137.70
回转半 = =[> +(? -2 @ A B /4 mm	6.0355
稳定 G H I [σ]cr MPa	57.66
轴向 I C=[D -(E - F)(G / ,) H]/) MPa	
q 同 \ O H	
只 , q 为零	
只 q , 为零	
轴向 I σ t	
6. 拉脱 q, I 满足q≤[q]	

G H拉脱 [q]	60.59
拉脱 I=J C +/K ? L J MPa	31.57
拉脱 q	i j
( ) MPa	5.03
q ( ) MPa	3.87
c kg	1156.75

] h i j

: 80 /

:

:

简

}4s 2~•

~•:n	~•圈
" 放 :n	插入n
" Dti mm	255.000
"	20(GB9948)[ ]
" u Ct2	3.00
" Ct1	0.00
" !"" #$v	1.00
" UV 伸高 H1 mm	100.0
" UV 伸高 H2 mm	0.00
!缝脚高K mm	1.000
" 轴线 qr法线夹角α	0
" 3.hp mm	0.00
~•圈	Q345R[ ]
~•圈M B mm	480.000
~•圈 & 'n mm	11.00
" & 'n mm	9.00

结果:

F" PGHI ! MPa	121.20	
Fqr PGHI ! MPa	…	
F~•圈 PGHI ! MPa		
~•圈 & 'bn mm		
2aqr & " mm		
2aqr # mm		
2 d mm		
• 削弱#$fr(为v)		
qr N~•范围B mm		
" 侧 N~•高 $=(%&' mm		
" 侧 N~•高 (=(%&' mm		
qr N~•9T)=(*-%)(+-#)-2,(+-#)(1--) mm.		
" N~•9T/=2$(,-0)-+2((,-1)- mm.		
!缝 截9TA3 mm.		
~•圈~•9T mm.		
总~•9TAe mm.		
所R~•9TA mm.		
]h		

带 凸形 (d) :

: 带 凸形 (d)简

m 1	
Pi MPa	3.6
MPa	0.000
Pic MPa	3.600
Po MPa	2.77
MPa	0.000
Poc MPa	2.770
T	207
	Q345R[ ]
	0
u C2 mm	6
球9部分 半	900.000
装入法兰深 l mm	30.000
法兰	16Mn[ ]
法兰 Di mm	1152.00
法兰 Do mm	1280.00
( ) * +	
法兰 & 'f mm	190.00
, - dB mm	M30
, .p mm	3.5
, - / mm	26.211
, - 0 1 d mm	26.211
, - 2 db mm	33
, - 2 3 4 Db mm	1230
, - $ n 5	56
, -	35CrMoA
6 7 8 9 : ;	GB150 9-1 1a-3
6 7 * +	( )
6 7 # $m	3.75
6 7 < = y MPa	52.4
6 7 " > 9 mm	1156
6 7 " > 9 mm	1190
6 7 ? @	
6 7 mm	

结果:

况			
F	P G H I ! " MPa	157.32	157.32
E F法兰	P G H I # MPa	150.00	150.00D (sh) Tj/F10+1
F法兰	P G H I ! " MPa		
F , -	P G H I ! " MPa		
E F , -	P G H I # MPa		

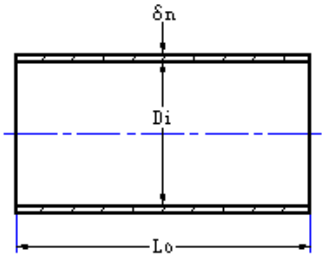
带 凸形 (d) :

& $ mm
6 7 8 O H 3 4 % mm
6 7 N < M b mm
6 7 L < M bo mm
流 r 引起 P 总轴向 MPa &=0.785 ' (
[O ; X F R S P d / 6 7 8 MPa)=6.28 % * + (
W 8 ; X F R S P d / , - Y Z N ,=3.14 * % -
[O ; X F R S P d / , - Y Z N .=&+)
W 8 ; X F R S P d / , - 9 T Am1 mm /
[O ; X F R S P d / , - 9 T 0=, / ! 1 mm /
所 R , - 9 T 2=./ ! 3 mm /
U V , - 9 T 4 mm /
W 8 ; X , - Y Z N 5=(6+4)/2 ! 1
球 q 9 切线语法兰 P 夹角 7=arcsin[0.58/(9+0.5:)] ( )
法兰环 侧 Y Z 引起 P 轴向分 N ;=0.785 < (
轴向 ; P 分 Q mm ==(>-8)/2
法兰环 侧 Y Z 引起 P 轴向分 矩 N.mm ?=; =
6 7 8 N @=)
6 7 8 Q mm A=(>-%)/2
6 7 8 矩 N.mm B=@ A
轴向 之 N C=&-;
C O H Q mm D=0.5(A+=)
C O H 产生 P 矩 N.mm E=C D
法兰环 侧 Y Z 引起 P 向分 N F=;ctg 7
向分 &r P Q mm G=H/2-:/2cos 7 - I
法兰环 侧 Y Z 引起 P 向分 矩 N.mm J=G F
[O ; X F 法兰总圈支转弱 H D 6 T 8 D Z F T 8 0 / + F H D 6 侧圈支 H 1 8 0 / + F 为圈支布圈轴束安安侧支球转弱

: 简

k l

4 s t H	容 q r	
P MPa	2.77	
MPa	0	
Pc MPa	2.770	
T	207	
4 s Di mm	1300.00	
	Q345R[ ]	
u C2 mm	3	
C1 mm	0	
! " " # $ v	1	
( ) * +		
4 s w L0 mm	200.000	
4 s & 'n mm	20.00	



结果:

E F P G H I [σ] MPa		163.00
F P G H I [σ]t MPa		157.30
4 s x ( ) F P y z { σ_s MPa		325.00
4 s N δ_e mm		17
( ) p_T MPa		3.59
4 s d e f g Pmax MPa		4.06
] |		i j
c kg		130.2

: 简

}4s 2~•

~•:n	增 " 壁
" 放 :n	插入n
" Dti mm	18.500
"	16Mn[ ]
" u Ct2	3.00
" Ct1	0.00
" !"" #$v	1.00
" UV 伸高 H1 mm	50.00
" UV 伸高 H2 mm	0.00
!缝脚高K mm	1.000
" 轴线 qr法线夹角α	0
" 3.hp mm	0.00
" & 'n mm	12.000

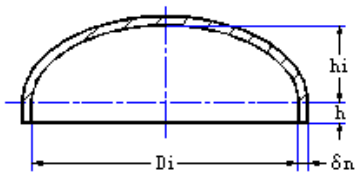
结果:

F" PGHI ! MPa
Fqr PGHI ! MPa
F~•圈 PGHI ! MPa
~•圈 & 'bn mm
2aqr & " mm
2aqr # mm
2 d mm
• 削弱#$fr(为v)

bd线环锋

椭 形 :

: 椭 形 简



* +	按	JB/T4746-EHA
P MPa		2.77
MPa		0
Pc MPa		2.770
T		207
椭 4 : Di mm		1300.00
椭 4 : : ; # $ K		1
椭 4 : 曲 9 深 hi mm		325.00
		Q345R[ ]
u C2 mm		3
C1 mm		0
! " " # $ v		1
( ) * +		
椭 4 : & 'n mm		18.00

结果:

E F P G H I $[\sigma]$ MPa		163.00
F P G H I $[\sigma]^t$ MPa		157.30
椭 4 : N δ_e mm		15
椭 4 : w k 轴 = @ 决定 P # $ K1		3.59
( ) p_T MPa		3.61
椭 4 : d e f g $[p_w]=2[\sigma]^t\delta_e\phi/(KD_i+0.5\delta_e)$ MPa		i j
] |		273.45

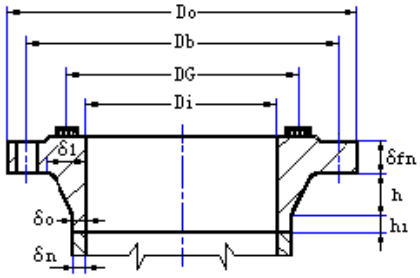
c

整 窄面 :

:

整 窄面 简

侧法兰



P MPa		3.600
MPa		0.000
Pc MPa		3.600
T		207.00
法兰		16Mn[ ]
u C2 mm		3
法兰 Di mm		1206
法兰 Do mm		1550
法兰颈部/端 N '0 mm		13.000
法兰颈部e端 N '1 mm		43.000
法兰颈部高 h mm		120.000
法兰相"4 s		Q345R[ ]
法兰相"4 s & 'n mm		16.000
( ) * +		
法兰 & 'f mm		137.00
, - dB mm		M36
, .p mm		4
, -/ mm		31.67
, -01 d mm		31.67
, -2 db mm		39
, -2 34 Db mm		1480
, -$ n 5		52
, -		35CrMoA
67 89:;		GB150 9-1 1a-3
67 * +		( )
67#$m		3.75
67< = y MPa		52.4
67"> 9 mm		1358
67"> 9 mm		1406
67?@		
67 mm		

紧面形 简

结果:

E F法兰 PGHI ! MPa		150.00
F法兰 PGHI "# MPa		134.16
Fsr PGHI "# MPa		168.04
F,- PGHI "# MPa		195.58
E F,- PGHI ! MPa		228.00
法兰 N $ mm		134.00
67 N< M b mm		8.76
67L < M bo mm		12.00

32-E-107.lan

:

1388.50
5448114.02
4110236.14
115.50
2002207.55
45.76
1031671.83

.7 18

整 窄面 :

切向I ^是否ij	ij
max{0.5(Y+\),0.5(Y+^)}≤"B	
综iI MPa 0.5(Y+^) 0.5(Y+\)Pe@	133.81
综iI 是否ij	ij
,-间.:	
,-允Gde间.Smax mm	267.18
,-允Gd/间.Smin mm	80.00
UV,-间.S mm	89.37
,-间.是否ij	ij
法兰允GfgPde Pmax MPa	3.60
]|	ij
法兰c W Kg	903

等长双头螺栓

1. 本壳体的直线度偏差不得大于"。"

3. 筒体同一截面上最大内径与最小内径之差不应大于筒体内径的0.5%。

4. 壳体内表面焊缝余高均应磨平。

25

A B C D E F G H

12 11 10 9 8 7 6 5

A B C D E F G H

12 11 10 9 8 7 6 5

A B C D E F G H

12 11 10 9 8 7 6 5

LANSYS PV1.2 ! " # $ % & ' (

) * + , - . : / 0 1 2 80 3 4 / 5 6 7 8 9 (PX) : ; <

= > - . : ? @ A B C D E F G # B

= > H I : 32-E-108

= > J I : FSHJ-9442-1

" # K L : 7 K

+ , $ -	+ , . / 0	+ , 1 2	) % .	) % 1 2	3 4
7			! 5 6 * :		
8 9					
: ;					
) %			< = *		

! > ? : @ A B C D E 7 3 F G H I J K

, M

& ' + - . :

1 . = & P Q ..... (1)
2 . R S T U ..... (2)
3 . R S V W ..... (4)
4 . X Y Z [\ ] ^ $ ..... (5)
5 . R S _ ` ..... (6)
6 . R S a _ ` ..... (9)
7 . b U c R d ..... (12)
8 . e f ..... (15)
9 . X Y Z [\ ] ^ $ ..... (16)
10 . b U g 1 ..... (17)
11 . h U g a _ ` ..... (19)
12 . h U g _ ` ..... (22)
13 . h U g V W ..... (25)
14 . h U g T U ..... (26)

= > = & P Q

" # K L	7 K
= > l m Di mm	1350
R * = & ! P MPa	2.04
R * = & n % T o	204
R * p q q U r s ϕ	1
R * ! t u K v	{
R * w x y z C2 mm	3
e * = & ! P MPa	1.87
e * = & n % T o	284
e * p q q U r s ϕ	1
e * ! t u K v	{
e * w x y z C2 mm	3

= & P Q :　　| g 简 J

! f 0 g	O
L h 7 S i P M	
L h R j k S j	000
L h	2.040
L h 7]	204
o p q J	1350
t u V	1595.000
t	16Mn[P ( ]
t u a	0
} ~ • ! % & ' mm	8.00
( )) O * +	1
L M V 7 Q , $	7 Q
t u 0 - y m . f mm	60
S i / 0 1 2	R S
3 4	M27
	3
	23.752
	23.752
	30
	1490
	60
	35CrMoA
	GB150 T 9-1 U 1a-3
	V W X Y Z [\ ] ^ (_ ` a b c d e)
	3
	69
	1387
	1427

l F G # | g & ' (& ' } c : ~ •

= > S ? i W i X mm	39.50
3. 3 4 + #	
Y Z 3 4 @ [Am mm	18502.88
\ ] 3 4 @ [mm	26571.82
3 4 @ [	p q
^ ? B _ 3 4 7 ` a N =0.5(+)/	5138516.00
b V B _ 3 4 7 ` a N + p	3622124.44
^ ? c d e f g * + K =1.78 /(Pc)	0.0630
b V c d e f g * + K =0.3+1.78 /( )	0.3444
4. t u y m	
^ ? = [/( ) mm	41.32
b V = [/( ) mm	101.98
t u U : h i m Y	
H , $ = {[/( )][0.0435 +0.5 /]} mm	
t u ! y m mm	
t u 0 - y m mm	
/ 0 S i MPa	
t u j ' kg	
t u k l m n S i Pmax MPa	
d o	

l X Y Z [& ' (& ' } c : ~ •

= & P Q : l X Y Z [简 J

! f 0 g	L M r s
; x y O ? Q	t O \ , U A L H W u \ o p q v w
7 S i P MPa	2.04
R j k S i MPa	0
! S i Pc MPa	2.040
7 l m T n	204
; x V s Di mm	1350
w x	Q345R[a $]
• z ' C2 mm	3
a w y m z { | C1 mm	0
( )) O * + {	1
S i / 0 1 2	R S
; x ! | m LO mm	620.000
; x 0 - y m . n mm	14.00

& ' 结果:

L l M w x W N O P i [σ] MPa

8 ; l m M w x W N O P i [σ]t MPa

; x w x } / 0 l m M W ~ • σ_s MPa

; x H U y m δ_e mm

S i / 0 S i p_T MPa

; x k l m n V S i Pmax MPa

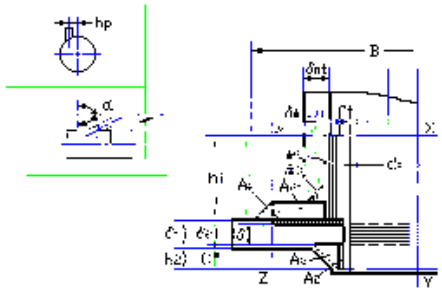
8 ; d

j k

l \ ] ^ $ & ' (& ' } c : ~ •

= & P Q : l \ ] ^ $ 简 J

! f 0 g	> ; x " 9
A \	&
) L Q A \	\
) L V s Dti mm	300.000
) L w x	20(GB8163)[a L]
) L • z ' Ct2	3.00
) L a w y m z { | Ct1	0.00
) L ( )) O * + {	1.00
) L \ ] v m H1 mm	120.00
) L \ ] V m H2 mm	0.00
(K mm	1.000
) L ! v w	0
) L { : 5 hp mm	0.00
w x	Q345R[a $]
T m B mm	550.000
0 - y m . n mm	6.00
) L 0 - y m . n mm	10.000



& ' 结果 :

7 l m M) L w x W N O P i ! MPa	122.00
7 l m M v w w x W N O P i ! MPa	168.90
7 l m M w x W N O P i ! MPa	168.90
0 - y m . bn mm	6.00
" 9 h v w 0 - y m " mm	14.00
" 9 h v w ! y m # mm	8.20
" 9 r s d mm	306.00
m * + fr(t u)	0.72
v w H U B mm	612.0
) L v H U m $ =(% & ' mm	55.3
) L V H U m (=(% & ' mm	0.0
v w H U @ [ ) =(* - %)(+ - #)-2 , (+ - #)(1- -) mm .	844.9
) L H U @ [/ =2 $ (, - 0) - +2 ((, - 1) - mm .	357.1
( ] ^ @ [A3 mm .	1.0
@ [mm .	1380.0
@ [Ae mm .	2583
Y @ [A mm .	2542
d o	d e

l　整ｆ窄面＿｀＆＇(　　＆＇}ｃ：～•

= & P Q :　　l　整ｆ窄面＿｀简Ｊ

! f 0 g	L M
7　S i P MPa	2.04
R j k S i MPa	0.000
! S i Pc MPa	2.040
7　l m T n	204
w x	16Mn[P ( ]
•　z ' C2 mm	3
V s Di mm	1356
v s Do mm	1545.000
6　H U y m . 0 mm	11.000
l　H U y m . 1 mm	29.000
m h mm	48.000
!) ; x w x	Q345R[a $]
!) ; x 0 - y m . n mm	14.00
S i / 0 1 2	R S
0 - y m . f mm	128.00
3 4 J g r s dB mm	M27
3 5 p mm	3
3 4 6 s mm	23.752
3 4 7 8 r s d mm	23.752
3 4 9 r s db mm	30
3 4 9 U : ; r s Db mm	1490
3 4 + ' n <	60
3 4 w x	35CrMoA
= > S ? @ A B	GB150 T 9-1 U 1a-3
= > w x 1 2	V_W`XaYbZc[d\e]) ^
= > * + m	3
= > C N D Sy MPa	69
= >) E @ V s mm	1387
= >) E @ v s mm	1427
= > F G	
= > y m mm	

& ' 结果:

L l M　w x W N O P i ! MPa
7　l m M　w x W N O P i " # MPa
7　l m M x w w x W N O P i " # MPa

l 整ｆ窄面_ ` & ' (

& ' } c : ~ •

S ? @ U : ; r s % mm
w k S i N &=0.785 ' (
w i N)=0.785 * (
i X + mm
^ ? B _ M Y Z W k 6 = > S ? i N ,=-=3.14 % . /
i X LG mm
b V B _ M Y Z W k 6 = > S ? i N 0=6.28 % . 1 (
i | N 2=&-)
i X LT mm
^ ? B _ M Y Z W k 6 3 4 ` a N 3=-=3.14 % . /
b V B _ M Y Z W k 6 3 4 ` a N 4=&+0
^ ? B _ M Y Z W k 6 3 4 @ [5=3 / " 6 mm 7
b V B _ M Y Z W k 6 3 4 @ [8=4 / " 9 mm 7
\ ] 3 4 @ [: mm 7
^ ? B _ 3 4 7 ` a ; N
b V B _ 3 4 7 ` a ; N
^ ? B _ i N.mm <= [0.5(=+:)] " 6 >
b V B _ i N.mm ?=) ++2 @+, >
7 i A=max{ < " B / " C ?} N.mm
A B L + D=(E F G mm
A B L + H=I / E
A B L + T
A B L + Z=(J+1)/(J-1)
A B L + Y
A B L + U
* + K
* + L
* + f
\ B L + M=K / D
A B L + N=O D P / L
Q G Q=R M+1
+1

l 整ｆ窄面_ ` & ' (& ' } c : ~ •

P i ^ p q	p q
max{0.5(Y+\),0.5(Y+^)} " B	
p P i MPa 0.5(Y+^)b0.5(Y+\)W l G	124.24
p P i p q	p q
3 4 5 :	
3 4 N k l 5 Smax mm	274.29
3 4 N k 6 5 Smin mm	62.00
\ ] 3 4 5 S mm	77.98
3 4 5 p q	p q
N m n W k l V S i Pmax MPa	2.14
8 ; d	8 ; p q
j ' W Kg	465

+ , - . : / 0 1 2 8 0 3 4 / 5 6 7 8 9

l 整ｆ窄面_｀＆'(

l 整 f 窄面 _ ` & ' (& ' } c : ~ •

```
S ? @ U : ; r s %  mm
  w k S      i N &=0.785 ' (
  w    i N )=0.785 * (
i X +  mm
^ ? B _ M Y Z W k 6 = > S ? i  N  ,= - =3.14 % . /
i X LG  mm
b V B _ M Y Z W k 6 = > S ? i  N  0=6.28 % . 1 (
   i  | N  2=& - )
i X LT  mm
^ ? B _ M Y Z W k 6 3 4 ` a  N  3= - =3.14 % . /
b V B _ M Y Z W k 6 3 4 ` a  N  4=& + 0
^ ? B _ M Y Z W k 6 3 4 @ [ 5=3 / " 6  mm 7
b V B _ M Y Z W k 6 3 4 @ [ 8=4 / " 9  mm 7
\ ] 3 4 @ [ :  mm 7
^ ? B _ 3 4 7  ` a ;  N
b V B _ 3 4 7  ` a ;  N
^ ? B _    i   N.mm  <= [0.5( = + : )] " 6 >
b V B _    i   N.mm  ?= ) + + 2 @ + , >
   7  i  A=max{ < " B / " C  ? }  N.mm
A B L +  D=( E F G  mm
A B L +  H=I / E
A B L +  T
A B L +  Z=( J +1)/( J -1)
A B L +  Y
A B L +  U
   * +  K
   * +  L
   * +  f
\ B L +  M=K / D
A B L +  N=O D P / L
Q G  Q=R M +1
+1
```

l 整ｆ窄面_ ` & ' (& ' } c : ~ •

P i ^ p q	p q
max{0.5(Y + \ ),0.5(Y + ^)} " B	
p P i MPa 0.5(Y + ^) b 0.5(Y + \ ) W l G	114.42
p P i p q	p q
3 4 5 :	
3 4 N k l 5 Smax mm	284.57
3 4 N k 6 5 Smin mm	62.00
\ ] 3 4 5 S mm	77.98
3 4 5 p q	p q
N m n W k l V S i Pmax MPa	2.14
8 ; d	8 ; p q
j ' W Kg	485

b U c F G # R d & ' (　　& ' } c : ~ •

= & P Q :　　b U c F G # R d 简 J

t O \ L $

a
2.04
0.000
2.040
1.87
0.000
1.870
204

b U c F G # R d & ' (& ' } c : ~ •

L $ 7 l m	284.00
L $ w x L l M N O P i ! MPa	150.00
L $ w x 7 l m M N O P i " # MPa	120.16
7 l m M L $ w x Q I R ' Ep MPa	187280
o p L w x 7 l m M N O P i " $ MPa	85.88
o p L w x 7 l m M ~ • m % MPa	137.48
7 l m M o p L w x Q I R ' Et MPa	180280
2. ! DG,At,Dt,Al,a, ,Kt,&	
= > S = C N T m b o mm	9.50
= > H U C N T m b mm	7.80
= > S ? @ U : ; r s ' mm	1409.40
} ~ , $ # W @ [Ad mm (	6500.00
L $ L @ [At mm (	1195250.00
L $ L ' r s Dt mm	1233.63
L $ L " 9 W @ [A1 mm (	653136.34
o p L @ [a mm (	112.29
* +) = * + / ,	0.3270
o p L H U | m L mm	5807.00
L R + - = . * + / (/ 0)	5374.86
L ' m &	0.0717
L $ m * +	0.4
L $ m * +	0.4
3. ! 1 , 23 C , 24 Gwe	
' S i 1 = 2 / (1.5 3 " 4)	0.0283
5 / 6	2.4703
* + 7 = 0 / '	0.8753
* + 1 / t	1.1425
* + C	0.3942
* + Gwe	4.8595
4. L $ y m	
L $! y m 8 = 0 9 6 mm	
L $ 0 - y m	
L $ y m 8 ;	
5. o p L P i t , P : t>0, t " $; t<0, t [ ]cr	
* + : = (2 ; . / % <	
o p L s = = [> + (? - 2 @ A B / 4 mm	
o p L N O S P i [ ]cr MPa	
o p L P i C = [D - (E - F) (G / ,) H] /) MPa	
L h 7 S i ! v h 7 S i c V O	
H L h 7 S i , v h 7 S i	
H v h 7 S i , L h 7 S i	
o p L P i t	
6. o p L i q , P q [q]	

85.88

b U c F G # R d & ' (& ' } c : ~ •

o p L N O i [q]	42.94
o p L i I = J C + / K ? L J MPa	25.73
o p L i q	p q
L h / 0 S i MPa	3.18
v h / 0 S i MPa	2.92
L $ j ' kg	1189.36
d o	L $ 8 ; p q

l X Y Z [& ' (& ' } c : ~ •

= & P Q : l X Y Z [简 J

! f 0 g	v w
; x y O ? Q	t O \ , U A L H W u \ o p q v w
7 S i P MPa	1.87
R j k S i MPa	0
! S i Pc MPa	1.870
7 l m T n	284
; x V s Di mm	1350
w x	Q345R [a $]
• z ' C2 mm	3
a w y m z { | C1 mm	0
( )) O * + {	1
S i / 0 1 2	R S
; x ! | m L O mm	5600.000
; x 0 - y m . n mm	14.00

l \ ] ^ $ & ' (& ' } c : ~ •

= & P Q : l \ ] ^ $ 简 J

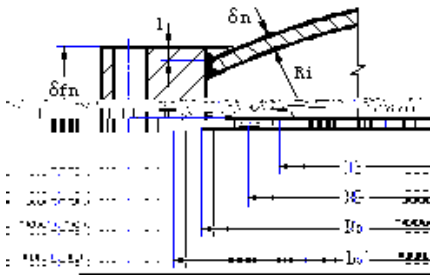
! f 0 g	> ; x " 9
A \	&
) L Q A \	\
) L V s Dti mm	253.000
) L w x	20(GB8163)[a L]
) L • z ' Ct2	3.00
) L a w y m z { | Ct1	0.00
) L ( )) O * + {	1.00
) L \ ] v m H1 mm	250.00
) L \ ] V m H2 mm	0.00
(K mm	1.000
) L ! v w	0
) L { : 5 hp mm	0.00
w x	Q345R[a $]
T m B mm	500.000
0 - y m . n mm	14.00
) L 0 - y m . n mm	10.000

& ' 结果 :

7 l m M) L w x W N O P i

带 _ ` 凸形 T U (K v d) & ' (　　& ' } c : ~ •

= & P Q :　　带 _ ` 凸形 T U (K v d) 简 J



! f 0 g	t O u 1
7 V S i Pi MPa	2.04
V R j k S i MPa	0.000
! V S i Pic MPa	2.040
7 v S i Po MPa	1.87
v R j k S i MPa	0.000
! v S i Poc MPa	1.870
7 l m T n	284
N O w x	Q345R [a $]
N O a w y m z { |	0
• z ' C2 mm	6
N O @ V s	900.000
N O m l mm	28.000
w x	16Mn [P ( ]
V s Di mm	1294.00
v s Do mm	1430.00
S i / 0 1 2	R S
0 - y m . f mm	160.00
3 4 J g r s dB mm	M27
3 5 p mm	3
3 4 6 s mm	23.752
3 4 7 8 r s d mm	23.752
3 4 9 r s db mm	30
3 4 9 U : ; r s Db mm	1375
3 4 + ' n <	60
3 4 w x	35CrMoA
= > S ? @ A B	GB150 T 9-1 U 1a-3
= > w x 1 2	V W X Y Z [\ ] ^ (_ ` a b c d e)
= > * + m	3
= > C N D Sy MPa	69
= >) E @ V s mm	1312
= >) E @ v s mm	1332
= > F G	
= > y m mm	

& ' 结果 :

C	V S	v S
7 l m M N O w x W N O P i ! " MPa	138.16	138.16
L l M w x W N O P i # MPa	150.00	150.00
7 l m M w x W N O P i ! " MPa	120.16	120.16
7 l m M 3 4 w x W N O P i ! " MPa	190.28	190.28
L l M 3 4 w x W N O P i # MPa	228.00	228.00

带 _ ` 凸形 T U (K v d) & ' (

& ' } c : ~ •

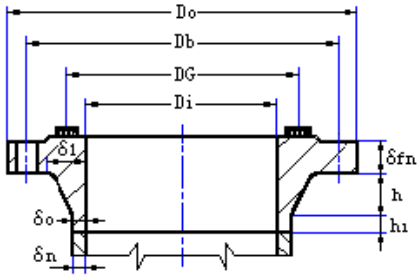
N O 0 - y m $ mm
= > S ? i V O U : ; r s % mm
= > H U C N T m b mm
= > S = C N T m b o mm
w W i MPa &=0.785 ' (
b V B _ M Y Z W k 6 = > S ? i MPa)=6.28 % * + (
^ ? B _ M Y Z W k 6 3 4 ` a N ,=3.14 * % -
b V B _ M Y Z W k 6 3 4 ` a N .=& +)
^ ? B _ M Y Z W k 6 3 4 @ [Am1 mm /
b V B _ M Y Z W k 6 3 4 @ [0 =, / ! 1 mm /
Y 3 4 @ [2 =. / ! 3 mm /
\ ] 3 4 @ [4 mm /
^ ? B _ 3 4 7 ` a N 5=(6+4)/2 ! 1
v U @ o r s W 7=arcsin[0.5 8 /(9+0.5 :)] (m)
V N O ` a W i N ;=0.785 < (
; W i i X mm ==(>-8)/2
V N O ` a W i i N.mm ?=; =
= > S ? i N @=)
= > S ? i i X mm A=(>-%)/2
= > S ? i i N.mm B=@ A
i | N C=& - ;
C V O i i X mm D=0.5(A+=)
C V O i W i N.mm E=C D
V N O ` a W s i N F=; ctg 7
s i & r W i X mm G=H /2- : /2cos 7 - I
V N O ` a W s i i N.mm J=G F
b V B _ M i Mp N.mm
^ ? 3 4 c W n i N &G =5
^ ? 3 4 c W n i i X mm A=(>-% 2 3 4 1 . W i 1 1 . 0 4 0 T D (-) T

l　整 f 窄面 _ ` & ' (　　& ' } c : ~ •

= & P Q :

! f 0 g	v O u
7　S i P MPa	1.87
R j k S i　MPa	0.000
! S i Pc MPa	1.870
7　l m T　n	284
w x	16Mn[P ( ]
•　z ' C2 mm	3
V s Di mm	1356
v s Do mm	1665.000
6　H U y m . 0 mm	11.000
l　H U y m . 1 mm	48.000
m h mm	90.000
!　) ; x w x	Q345R[a $]
!　) ; x 0 - y m . n mm	14.00
S i / 0 1 2	R S
0 - y m . f　mm	152.00
3 4 J g r s dB　mm	M30
3 5 p mm	3.5
3 4 6 s　mm	26.211
3 4 7 8 r s d　mm	26.211
3 4 9 r s db　mm	33
3 4 9 U : ; r s Db　mm	1605
3 4 + ' n　<	60
3 4 w x	35CrMoA
= > S ? @ A B	GB150 T 9-1 U 1a-3
= > w x 1 2	V W X Y Z [\ ] ^ (_ ` a b c d e)
= > * + m	3
= > C N D Sy　MPa	69
= >) E @ V s　mm	1488
= >) E @ v s　mm	1528
= > F G	
= > y m　mm	

l　整 f 窄面 _ ` 简 J



紧面形 c 简 J

& ' 结果 :

L l M　w x W N O P i !　MPa	150.00
7　l m M　w x W N O P i " #　MPa	120.16
7　l m M x w w x W N O P i " #　MPa	147.84
7　l m M 3 4 w x W N O P i " #　MPa	190.28
L l M 3 4 w x W N O P i !　MPa	228.00
H U y m $　mm	149.00
= > H U C N T m b　mm	8.00
= > S = C N T m bo　mm	10.00

l 整ｆ窄面_ ` & ' (& ' } c : ~ •

S ? @ U : ; r s % mm	1512.00
w k S i N &=0.785 ' (	3355940.09
w i N)=0.785 * (	2699172.51
i X + mm	100.50
^ ? B _ M Y Z W k 6 = > S ? i N ,=-=3.14 % . /	2620901.67
i X LG mm	46.50
b V B _ M Y Z W k 6 = > S ? i N 0=6.28 % . 1 (	426181.40
i | N 2=&-)	656767.58
i X LT mm	85.50
^ ? B _ M Y Z W k 6 3 4 ` a N 3=-=3.14 % . /	2620901.67
b V B _ M Y Z W k 6 3 4 ` a N 4=&+0	3782121.49
^ ? B _ M Y Z W k 6 3 4 @ [5=3 / " 6 mm 7	11495.18
b V B _ M Y Z W k 6 3 4 @ [8=4 / " 9 mm 7	19876.61
\ ] 3 4 @ [: mm 7	32358.48
^ ? B _ 3 4 7 ` a ; N	5954800.13
b V B _ 3 4 7 ` a ; N	3782121.49
^ ? B _ i N.mm <= [0.5(=+:)] " 6 >	276901555.66
b V B _ i N.mm ?=) ++2 @+, >	347238325.09
7 i A=max{ < " B / " C ?} N.mm	347238325.09
A B L + D=(E F G mm	122.13
A B L + H=I / E	1.23
A B L + T	1.82761
A B L + Z=(J+1)/(J-1)	4.93949
A B L + Y	9.57579
A B L + U	10.52
* + K	0.73617
* + L	0.07516
* + f	3.63219
A B L + M=K / D	0.00603
A B L + N=O D P / L	2069044.40
Q G Q=R M+1	1.89813
S G S=4 R M / 3+1	2.19750
T G T=Q / U	1.03858
V G V=W / N	1.59878
X G X=T+V	2.63736
Y 1.5 " B b 2.5 " #	
P i Y=Z A / (X [E) MPa	153.07
P i Y p q	p q
\ " B	
s P i \=(1.33 R M+1) A / (X] E) MPa	9.61
s P i \ p q	p q
^ " B	
P i ^=_ A / (] E)-` \ MPa	62.98

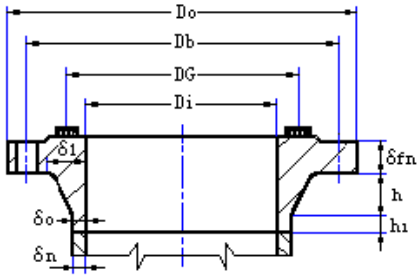
l 整ｆ窄面_ ` & ' (& ' } c : ~ •

P i ^ p q	p q
max{0.5(Y + \ ),0.5(Y + ^)} " B	
p P i MPa 0.5(Y + ^) b 0.5(Y + \ ) W l G	108.02
p P i p q	p q
3 4 5 :	
3 4 N k l 5 Smax mm	321.43
3 4 N k 6 5 Smin mm	70.00
\ ] 3 4 5 S mm	84.00
3 4 5 p q	p q
N m n W k l V S i Pmax MPa	2.07
8 ; d	8 ; p q
j ' W Kg	965

l　整 f 窄面 _ ` & ' (　　& ' } c : ~ •

= & P Q :

l　整 f 窄面 _ ` 简 J



! f 0 g	v O u
7　S i P MPa	1.87
R j k S i MPa	0.000
! S i Pc MPa	1.870
7　l m T n	284
w x	16Mn[P ( ]
•　z ' C2 mm	3
V s Di mm	1456
v s Do mm	1665.000
6　H U y m . 0 mm	13.000
l　H U y m . 1 mm	29.000
m h mm	48.000
!　) ; x w x	Q345R[a $]
!　) ; x 0 - y m . n mm	16.00
S i / 0 1 2	R S
0 - y m . f mm	138.00
3 4 J g r s dB mm	M30
3 5 p mm	3.5
3 4 6 s mm	26.211
3 4 7 8 r s d mm	26.211
3 4 9 r s db mm	33
3 4 9 U : ; r s Db mm	1605
3 4 + ' n <	60
3 4 w x	35CrMoA
= > S ? @ A B	GB150 T 9-1 U 1a-3
= > w x 1 2	V W X Y Z [\ ] ^ (_ ` a b c d e)
= > * + m	3
= > C N D S y MPa	69
= >) E @ V s mm	1488
= >) E @ v s mm	1528
= > F G	
= > y m mm	

紧面形 c 简 J

& ' 结果 :

L l M w x W N O P i ! MPa	150.00
7　l m M w x W N O P i " # MPa	120.16
7　l m M x w w x W N O P i " # MPa	147.84
7　l m M 3 4 w x W N O P i " # MPa	190.28
L l M 3 4 w x W N O P i ! MPa	228.00
H U y m $ mm	135.00
= > H U C N T m b mm	8.00
= > S = C N T m bo mm	10.00

l 整 f 窄面 _ ` & ' (& ' } c : ~ •

S ? @ U : ; r s % mm	1512.00
w k S i N &=0.785 ' (	3355940.09
w i N)=0.785 * (	3111960.05
i X + mm	60.00
^ ? B _ M Y Z W k 6 = > S ? i N , = - =3.14 % . /	2620901.67
i X LG mm	46.50
b V B _ M Y Z W k 6 = > S ? i N 0=6.28 % . 1 (	426181.40
i | N 2=& -)	243980.04
i X LT mm	60.50
^ ? B _ M Y Z W k 6 3 4 ` a N 3= - =3.14 % . /	2620901.67
b V B _ M Y Z W k 6 3 4 ` a N 4=& + 0	3782121.49
^ ? B _ M Y Z W k 6 3 4 @ [5=3 / " 6 mm 7	11495.18
b V B _ M Y Z W k 6 3 4 @ [8=4 / " 9 mm 7	19876.61
\ ] 3 4 @ [: mm 7	32358.48
^ ? B _ 3 4 7 ` a ; N	5954800.13
b V B _ a ; N	3782121.49
^ ? B _ i N.mm < = [0.5(= + :)] " 6 >	276901555.66
b V B _ i N.mm ? =) + + 2 @ + , >	
7 i A=max{ < " B / " C ? } N.mm	
A B L + D=(E F G mm	
A B L + H=I / E	
A B L + T	
A B L + Z=(J +1)/(J -1)	
A B L + Y	
A B L + U	
* + K	
* + L	
* + f	
A B L + M=K / D	
A B L + N=O D P / L	
Q G Q=R M +1	
S G S=4 R M /3+1	
T G T=Q / U	
V G V=W / N	
X G X=T + V	
Y 1.5 " B b 2.5 " #	
P i Y=Z A /(X [E) MPa	
P i Y p q	
\ " B	
s P i \=(1.33 R M +1) A /(X] E) MPa	
s P i \ p q	
^ " B	
P i ^ = _ A /( ] E)- ` \ MPa	

l 整 f 窄面 _ ` & ' (& ' } c : ~ •

P i ^ p q

max{0.5(Y+\),0.5(Y+^)} " B

p P i MPa 0.5(Y+^)b0.5(Y+\)W l G

p P i p q

3 4 5 :

3 4 N k l 5 Smax mm

3 4 N k 6 5 Smin mm

\ ] 3 4 5 S mm

3 4 5 p q

N m n W k l V S i Pmax MPa

8 ; d

j ' Pmaf BT /F1 11.04 Tf 0 0 0 rg 96 558.244 Tf 252

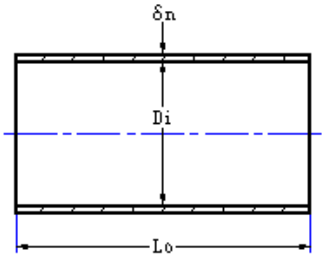
l X Y Z [& ' (

& ' } c : ~ •

= & P Q :

l X Y Z [简 J

! f 0 g	v O u r s
; x y O ? Q	q v w
7 S i P MPa	1.87
R j k S i MPa	0
! S i Pc MPa	1.870
7 l m T n	284
; x V s Di mm	1450.00
w x	Q345R [a $]
• z ' C2 mm	3
a w y m z { | C1 mm	0
( )) O * + {	1
S i / 0 1 2	R S
; x ! | m LO mm	300.000
; x 0 - y m . n mm	16.00



& ' 结果 :

L l M w x W N O P i [σ] MPa	170.00
8 ; l m M w x W N O P i [σ]t MPa	147.80
; x w x } / 0 l m M W ~ • σ_s MPa	345.00
; x H U y m δ_e mm	13
S i / 0 S i p_T MPa	2.69
; x k l m n V S i Pmax MPa	2.63
8 ; d	p q
j ' kg	173.5

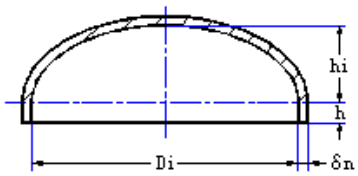
l 椭Z形T U & ' (

& ' } c : ~ •

= & P Q :

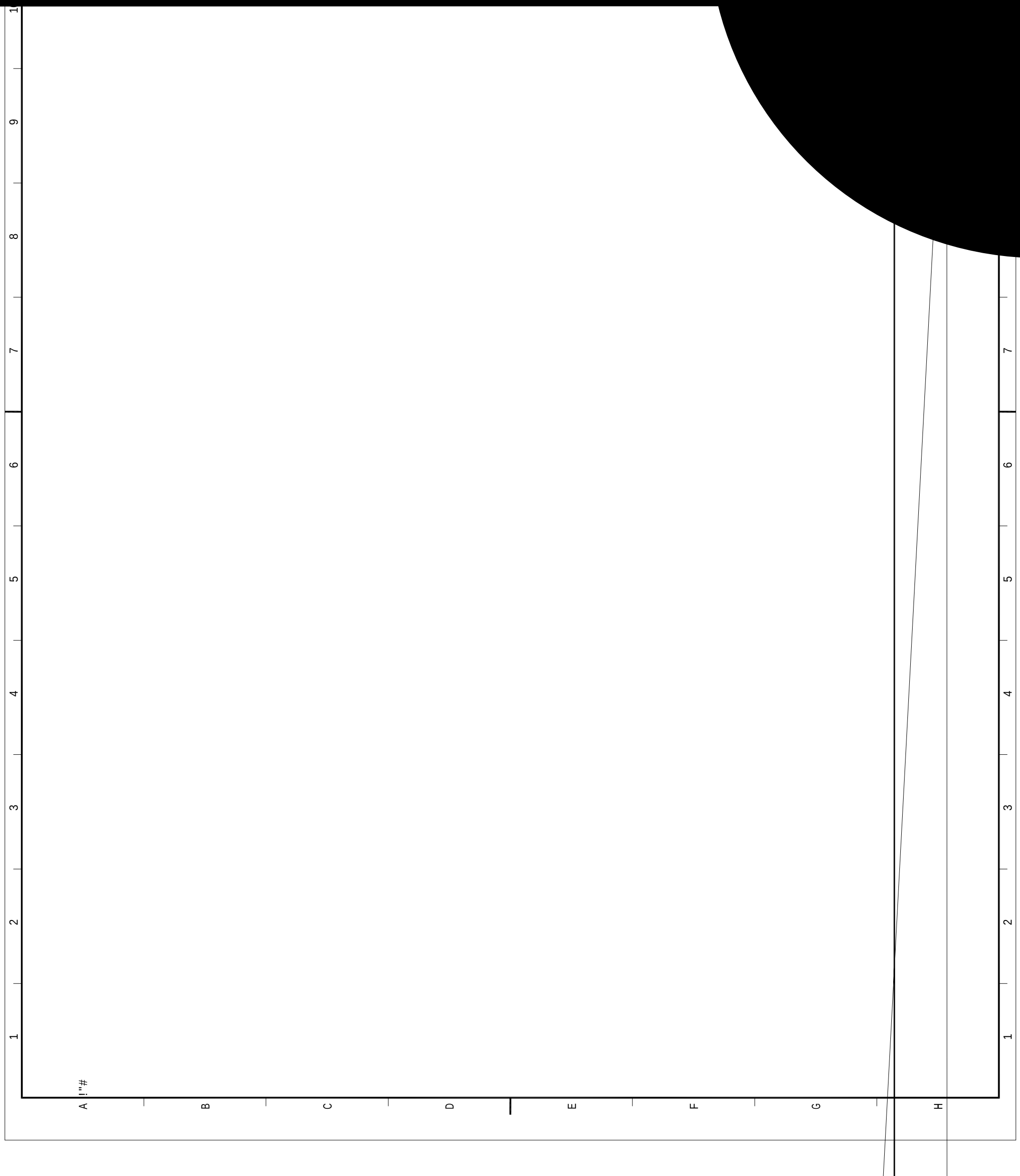
l 椭Z形T U简J

! f 0 g	v O u N O
N O 1 2	$ % JB/T4746-EHA
7 S i P MPa	1.87
R j k S i MPa	0
! S i Pc MPa	1.870
7 l m T n	284
; A N O V s Di mm	1450.00
; A N O A B * + K	1
; A N O @ m hi mm	362.50
w x	Q345R[a $]
• z ' C2 mm	3
a w y m z { | C1 mm	0
( )) O * + {	1
/ 0 1 2	R S
; A N O 0 - y m . n mm	14



& ' 结果:

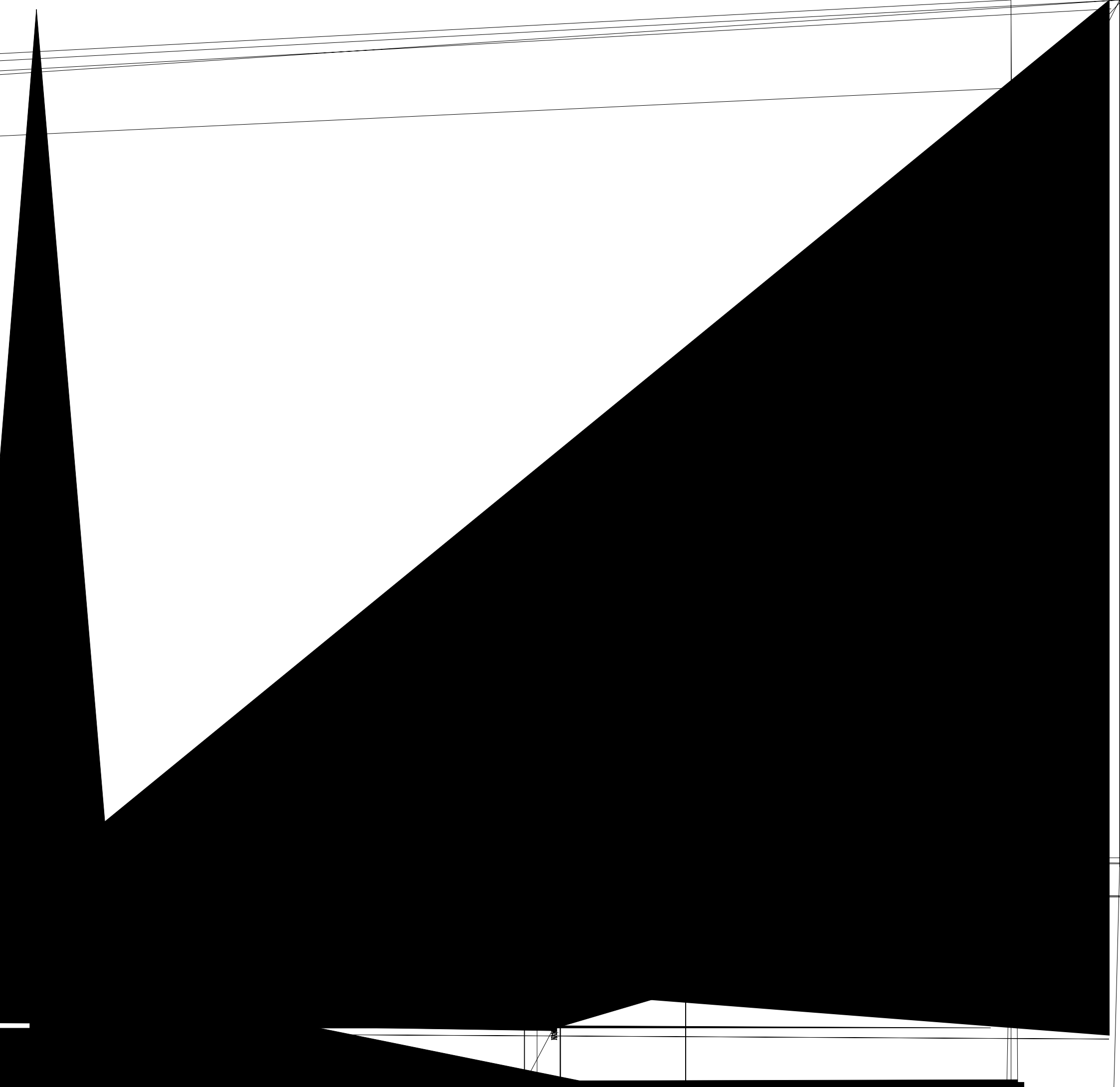
L l M w x W N O P i [σ] MPa	170.00
8 ; l m M w x W N O P i [σ]' MPa	147.80
; A N O H U y m δ_e mm	11
} ; A | r D G W * + K1	0.90
S i / 0 S i p_T MPa	2.69
; A N O k l m n V S i $[p_w]=2[\sigma]^t\delta_e\phi/(KD_i+0.5\delta_e)$ MPa	2.23
8 ; d	p q
j '	260.49

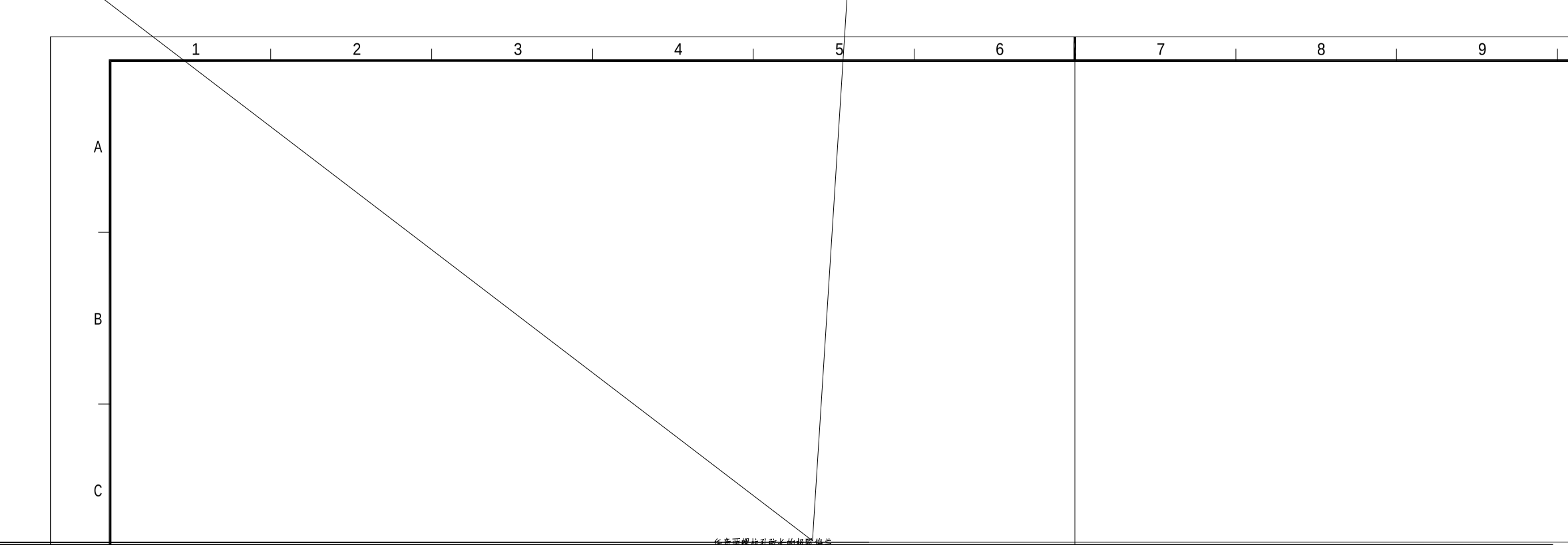

A
B
C
D
E
F
G
H
1
2
3
4
5
6
7
8
9
10

零部件图

FSHJ-9449-2

0





其余 25