Q/FJHD

Q/HF 1108-2022

Safety rules for the construction and installation of lifts

2022 07 22 19 27

2022 3 1 2022 3 1

...

GB/T 7588.1/2

2022 07 22 19 27

0

0.1

0.1.1

0.l.2

0.1.2.1

a)

b)

c)

d)

e)

f)

g)

h)

1)

2)

3)

0.1.2.2

a)

b)

c) ( )

0.1.2.3

a)

b)

c)

0.2

0.2.1

ΰ̃ ˜ 2 ŋ

0.2.3 ( )

a)

b) ( )

c)

0.2.4

0.2.5

a)

b)

c)

d)

0.3

0.3.1

a)

b)

c)

d)

0.3.2

0.3.3

0.3.4 0 100

0.3.5

0.3.6

0.3.7

( )

0.3.8

0.3.9

a) 300 N

b) 1000N

0.3.10

1

2

GB/T 786.1 1

GB/T 786.1 2009 ISO 1219-1:2006 IDT

GB/T 3639

GB 4053.1 1

GB 4053.2 2

GB/T 4208 (IP) GB/T 4208 2017 IEC 60529:2013 IDT

GB/T 4728 IEC 60617 database

GB/T 5013.5 450/750V 5

GB/T 5013.5 2008

IEC 60245-5:1994 IDT

GB/T 5023.6 450/750V 6

GB/T 5023.6 2006 IEC 60227-6:2001 IDT

GB/T 5226.1 2019 1

IEC 60204-1:2016

IDT

GB/T 5465.2 2008 2 IEC 60417DB:2007 IDT

GB/T 7588.2 2020 2

ISO

8100-2:2019 MOD

GB 8624

GB/T 8903 GB/T 8903 2018 ISO 4344:2004 MOD

GB/T 12668.502 2013 5-2 IEC 61800-5-2:2007 IDT

GB/T 13793

GB/T 14048.4 2010 4-1 IEC 60947-4-1:2009 Ed.3.0 MOD

GB/T 14048.5 2017 5-1 IEC 60947-5-1:2016 MOD

GB/T 14048.14 5-5 GB/T 14048.14 2019 IEC 60947-5-5:2016 IDT

GB/T 15706 2012 ISO 12100:2010 IDT

GB/T 16895.2 2017 4-42 IEC 60364-4-42:2010 IDT

GB/T 16895.21 2011 4-41 : IEC 60364-4-41:2005 IDT

GB/T 16895.23 2012 6 IEC 60364-6:2006 IDT

GB/T 16935.1 1 GB/T 16935.1 2008 IEC 60664-1:2007 IDT

GB/T 17889.2 2012 2

GB/T 18209.3 3 GB/T 18209.3 2010 IEC 61310-3:2007 IDT

GB/T 18775

GB/T 21711.1 1 GB/T 21711.1 2008 IEC 61810-1:2003 IDT

GB/T 23821 2009 ISO 13857:2008 IDT

GB/T 24475

GB/T 24476 2017
GB/T 24480
GB/T 24807
GB/T 24808
GB/T 27903
GB/T 32957
GB 50017
GA 494
JB/T 8734.6 450/750V 6

IEC 61810-3 — 3

[Electromechanical elementary relays - Part 3: Relays with forcibly guided (mechanically linked) contacts]
EN 50274

Low-voltage switchgear and controlgear assemblies - Protection against electric shock - Protection against unintentional direct contact with hazardous live parts

3

GB/T 7024

3.1 traction drive lift

3.2 ( ) positive drive lift

3.3 non-commercial vehicle lift

3.4 pulley room

3.5 available car area

1m

3.6 re-leveling

( )

3.7 minimum breaking load of a rope
(mm2) (N/mm2)

3.8 safety rope
( )

3.9 user

3.10 passenger

3.11 authorized and instructed user

a)

b)

3.12 lift machine

3.13 balancing weight

3.14 electric safety chain

3.15 inspection trap

3.16 emergency door to the well
11m

3.17 laminated glass

3.18 unintended car movement

4

4.1

(SI)

4.2

5

5.1

5.1.1

5.1.2 ( ) ( )

5.2

5.2.1 Ŏ ž

C

H

D

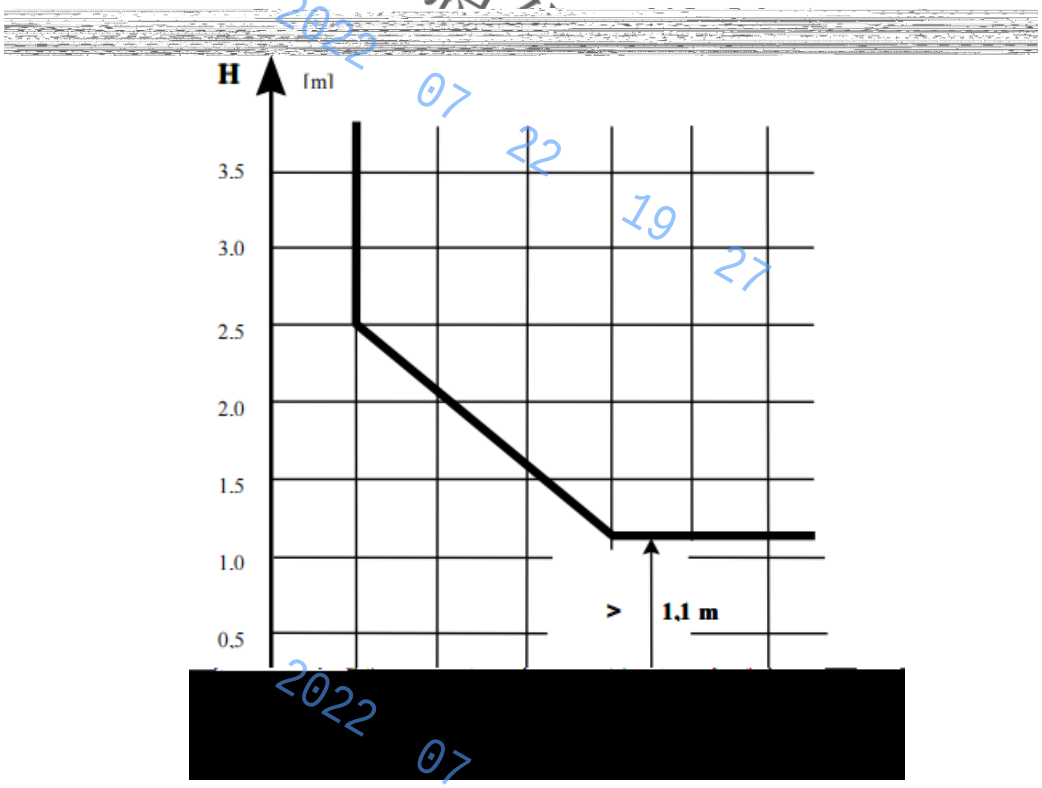
0.50m 0.50m

5.2.2.1.2 1lm

11m 8.12.3

5.2.2.2

5.2.2.2.1



2

5.2.2.2.2

14.1.2

(5.7.3.2)

( )

2m

5.2.2.3

5.2.3

1

5.3

5.3.1

5.3.1.1

300N 5cm^2

a)

b) 15mm

5.3.1.2

5.2.1.2

5.3.2

5.3.2.1 ( )

(N) [G( )G2.3 G2.4]

5.3.2.2 4

$4g_n(P+Q)$

P—— (

) kg

Q—— kg

g_n—— 9.81 m/s2

5.3.2.3 ( )

( ) 4

$4g_n(P+qQ)$

$4g_nqP$

:

q—

5.3.3

6.3.1 ( )6.4.1

G5.1

5.4

5.4.1

11

5.4.2

5.4.3

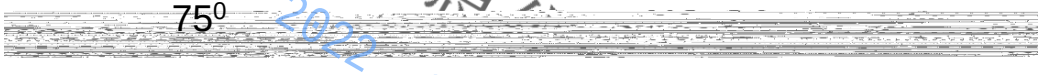
a) 1/2
50mm, 25mm

b)
5cm2 300N

1)

2) 10mm

c) 5mm 2mm



d)

1)

2) 600
20mm

5.5 ( )
( )
5000N/m2

a) ( )

b) ( )

5.6

5.6.1 ( )
0.30m 2.50m
( ) 0.10m
GB l2265.1—1997 4.5.1

5.6.2
GB l2265.1—1997 4.5.1

5.6.2.1 ( )
2.50m
5.2.2.2.2

5.6.2.2 [( )]
0.50m

0.10m

5.7

5.7.1

K( )

5.7.1.1

a) 0.1+0.035 υ ^{2}(m)

注：0.035 υ ^{2}表示对应于115%额定速度 υ 时的重力制停距离的一半。即 $\frac{1}{2}\times\frac{(1.15\upsilon)^2}{2g_n}=0.0337\ \upsilon^2$，圆整为0.035 υ ^{2}。

b) 8.13.2 [5.7.1.1c]] ( ) 1.0+0.035 υ ^{2} (m)

c)

1) [2]] 0.3+0.035 υ ^{2} (m)

2)

0.1+0.035 υ ^{2} (m)

d)

0.50m×0.60m×0.80m

( )

0.15 m

5.7.1.2

0.1+0.035 υ ^{2} (m)

5.7.1.3 12.8 5.7.1.1 5.7.1.2 0.035 υ ^{2}

a) 4m/s 1/2 0.25m

b) 4m/s 1/3 0.28m

5.7.1.4 ( )

0.035 υ ^{2} ( )

1/500 0.20m

5.7.2

5.7.2.1 0.50m

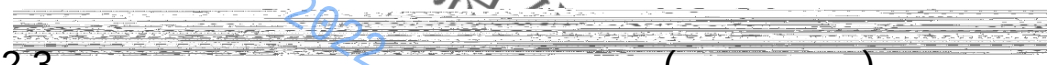
5.7.2.2

a) 8.13.2 [5.7.2.2b)] (

) 1m

b)

1) [2]
] 0.30 m
2)
0.10m
c)
0.50m×0.60m×0.80m
(
) 0.15 m



5.7.2.3 ( )
0.30 m
5.7.3
5.7.3.1

5.7.3.2 5.2.2
2.50m

5.7.3.3
a)
0.50m×0.60m×l.0m
b) 0.50m
0.15m 0.10m
1)
2)
c)
0.30m b)1) b)2)
5.7.3.4
a)
14.2.2 15.7
b) (13.6.2)
c) (5.9)
5.8

.

5.2.1.2

a)

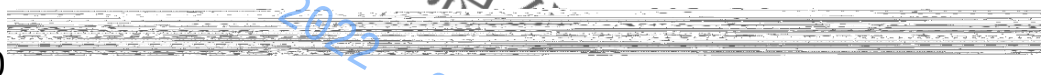
b) 1.50m (5.2.1.2)

5.9

1m 50 lx

0.50m

5.2.1.2



5.10

14.2.3.2 14.2.3.3

6

6.1

6.1.1

( ) (

)

a)

b)

c)

6.1.2

( )

6.1.3

a)

b)

6.2

6.2.1

a)

b)

6.2.2

a) 4m
b)
c) 1.50m 650 750

d) 0.35m 25mm
0.15m 1500N
e)
f) 1.50m
6.3
6.3.1
6.3.1.1

6.3.1.2
6.3.2
6.3.2.1

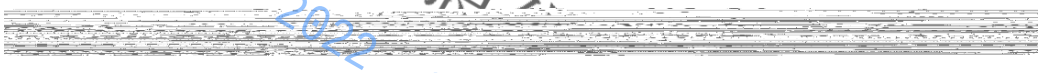
2m
a)
1) 0.70m
2) 0.50m
b)
(12.5.1) 0.50m×0.60m
6.3.2.2 1.80m
6.3.2.1 0.50m
0.40m

a)
b)
6.3.2.3 0.30m
6.3.2.4 0.50m

6.3.3.2 0.80m×0.80m

0.20m×0.2m 1000N

(



2022 07 22 19 27

6.4.2.2.2 6.3.2.1 6.3.2.2

6.4.3

6.4.3.1 0.60m 1.40m

6.4.3.2 0.80m×0.80m

0.20m×0.20m 1000N

( )

6.4.3.3

6.4.4

50mm

6.4.5

14.2.2 15.4.4

6.4.6

6.4.7

100 lx

13.6.1

13.6.2

6.3.6

7

7.1

6mm

8mm 10mm

7.2

7.2.1

7.2.2

GA 109 .

7.2.3

7.2.3.1

a 300 N

5 cm2

1 1 mm

2 15 mm

b 1000 N

100 cm2

[7.1 10 mm 7.7.3.1]

a b

7.2.3.2 150N (

) 7.1 6mm

a) 30mm

b) 45mm

7.2.3.3 /

7.2.3.4

7.2.3.5

a)

b)

c) [(8+0.76+8)mm]

7.2.3.6

7.6.2

a)

b) 1.10m

c)

d)

7.2.3.7

r ŏ η 3a)3 73∃

7.2.3.8 150 mm

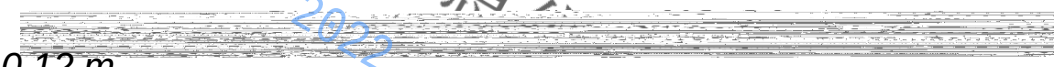
7

a J

7

1

2



0.12 m

3

4

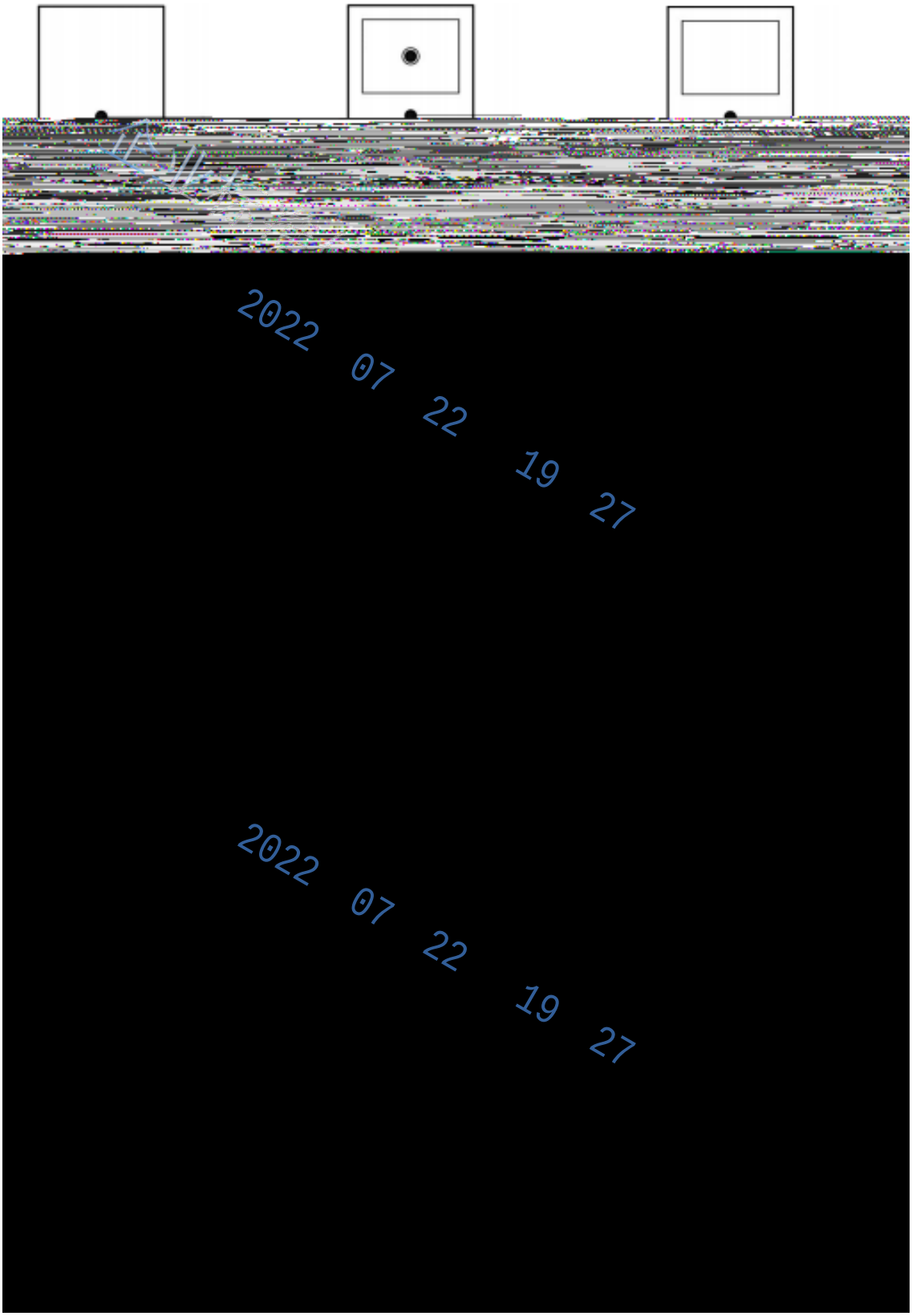
b J

7 7.6.2 a

1

2 2 mm

	800 mm	800 mm	500 mm	500 mm
	1.0 ± 0.1 m		1.0 ± 0.1 m	
[7a]	×			
[7b]	×	×		×
[7c]	×	×		×
[7d]	×		×	
1 m [7e]	×	×		×
1 m [7f]	×		×	
150 mm [7g]	×			
7.6. 2	×	×		
×				



2	1.00 m	± 0.10m

g)

[7a 7b)]

1 7e) 7f)
2

3 1 m ± 0.10 m

- ○

7 –

7.3
7.3.1

2m

7.3.2

50mm

7.4
7.4.1

7.4.2
7.4.2.1

7.4.2.2
7.4.2.3
7.4.3
7.4.3.1
7.4.3.2 8
7.4.3.3 25
7.4.3.4
7.5
7.5.1

3mm

B( )

7.5.2

7.5.2.1

7.5.2.1.1

7.5.2.1.1.1 150N

1/3

7.5.2.1.1.2

10J

a) 25mm

b) 50mm

25N/mm

7.5.2.1.1.3

(8.7.2.1.1.3)

50mm

7.5.2.1.1.2

4J

7.5.2.1.1.4 7.5.2.1.1.1 7.5.2.1.1.2

7.5.2.1.1.5 150N

( )

100mm

7.5.2.1.2

(

) 7.5.2.1.1.2 10J

0.3m/s

7.5.2.2

a)
b) o.3 m/s
c) 8.6.1
d) 2/3
7.5.2.3

7.6 “ ”
7.6.1
50 1x

(0.2.5)
7.6.2 “ ”

a) b)
a)
1) 7.2.3.1
2) 6mm
3) 0.015m2
0.01m2
4) 60mm 150mm 80mm
1m
b) “ ”

7.7
7.7.1
( )

0.2m

0.35m
7.7.2
7.7.2.1 7.7.2.2

7.7.2.2

a) 14.2.1.2

b) 8.4.3,8.14 14.2.1.5

1.65m

1) 2 m

2)

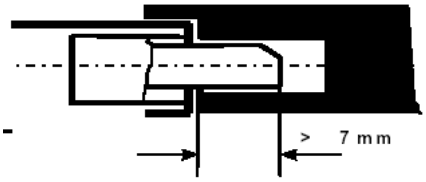
7.7.3

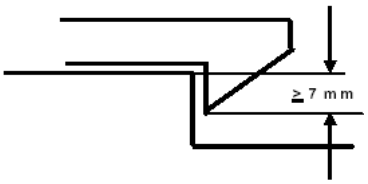
7.7.1

7.7.3.1

14.1.2

7.7.3.1.1 7mm 3





3

7.7.3.1.2

7.7.3.1.3

7.7.3.1.4

7.7.3.1.5 300N

7.7.3.1.6 F( )Fl

a) 1000N

b) 3000N

7.7.3.1.7

( )

(

)

7.7.3.1.8

7.7.3.1.9

7.7.3.1.10

7.7.3.2 B

( )

7.7.3.3 F1

7.7.4

7.7.4.1 14.1.2

7.7.2

7.7.4.2

7.7.4.3

7.7.5

7.7.5.1

7.7.5.2

7.7.6

7.7.6.1

a)7.7.4.1 7.7.4.2

b)

7.7.6.2 ( )

14.1.2

7.8

8 ( )

8.1

8.1.1 2m

8.1.2 2m

8.2

8.2.1

1

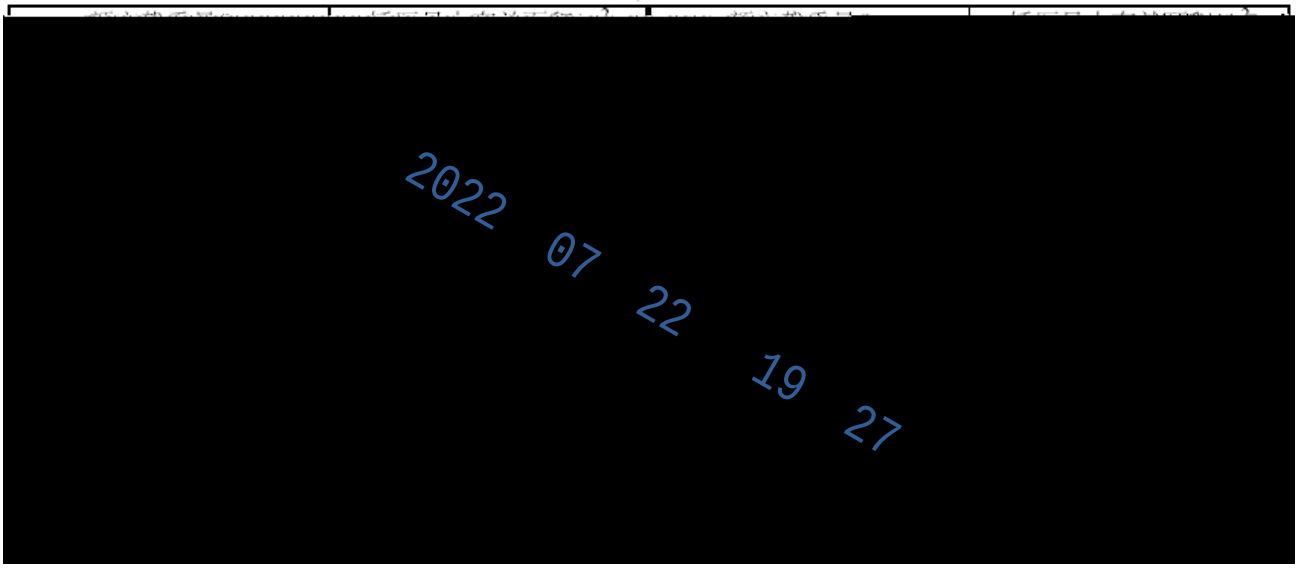
1m

1

5

14.2.5

1



8.2.2

1

1

1

“ ”

a) 1

(
)

b) 14.2.5
c)
(15.5.3)
d)
e)

a) b) c) d) e)

D( )D2h) D2j) D2l)

200kg/m2

8.2.3

a) 75/
b) 2

2

乘客人数/人	轿厢最小有效面积/m^2	乘客人数/人	轿厢最小有效面积/m^2

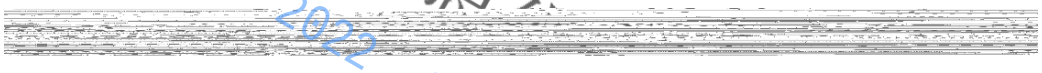
8.3
8.3.1
a)
b)
c)
8.3.2

8.3.2.1 300N 5cm2

a)

b) 15mm

8.3.2.2 J1 J



1.10m 0.90m 1.10m

8.3.2.3

8.3.2.4

a)

b)

c) [(8+0.76+8)mm]

8.3.2.5 8.13

8.3.3

8.4

8.4.1

60^0 20mm

8.4.2 0.75 m

8.4.3 (14.2.1.5) 0.10m

8.5

8.6

8.6.1

10mm 60mm

8.6.2

8.6.3

6mm

8mm 10mm

8.6.1

8.6.4

8.6.5 [7.6.2a)]

7.6.2a)

8.6.6

7.4

8.6.7

8.6.7.1 300N

5cm2

a)

b) 15mm

c)

8.6.7.2

7.6.2 J2

J

8.6.7.3

8.6.7.4

a)

b)

c) [(8+0.76+8)mm]

8.6.7.5

7.6.2

a)

b) 1.10m

c)

d)

8.7

8.7.1

3 mm

8.6.1

8.7.2

8.7.2.1

8.7.2.1.1

8.7.2.1.1.1 150N

1/3

8.7.2.1.1.2

10J

a) 25mm

b) 50mm

7.5.2.1.1.2 .

8.7.2.1.1.3

50mm

8.7.2.1.1.2

4J

8.7.2.1.1.4 150 N

( )

100mm

8.7.2.1.1.5

15 mm

8.7.2.1.2

( )

7.5.2.1.1.2 10J

0.3m/s

8.7.2.2

a)

b) 0.3 m/s

c) 8.6.1

d) 2/3

8.8

8.9

8.9.1 7.7.2.2 ( )

8.9.2 14.1.2
8.9.1

8.9.3 [11.2.1c)]
(7.7.3.1 7.7.3.3)

8.10

8.10.1

a) 8.9.2

1) ( )

2)

b) 11.2.1c)

8.10.2 ( )
8.9.2

a)

b)

8.11

8.11.1 7.7.1

8.12

8.12.1 12.5

8.12.2

0.35m×0.50m

8.12.3 0.75m(

5.2.2.1.2)

1.80m 0.35m

8.12.4 8.3.2 8.3.3

8.12.4.1

8.12.4.1.1 B

8.12.4.1.2 B

( )

( )

8.12.4.2 8.12.4.1 14.1.2

8.13

8.3

8.13.1

0.20m×0.20m 1000N

8.13.2 0.12m2

0.25m

8.13.3 0.30m

0.30m

8.13.3.1 0.10m

8.13.3.2

a) 0.85m 0.70m
b) 0.85m 1.10m
8.13.3.3 [( )
0.10m
8.13.3.4
8.13.3.5 0.15 m
8.13.4

8.13.5
8.13.6 ( ) 9.7
8.14

(
14.2.1.5)
8.15

a) 14.2.1.3 ( )
b) 14.2.2 15.3
c) 13.6.2
8.16
8.16.1
8.16.2
1

50
8.16.3 10mm

8.17
8.17.1 50
lx 50 1x
8.17.2
8.17.3
7.8
8.17.4
1W 1h

8.17.5 8.17.4 14.2.3

8.18

12.2.1

8.18.1 ( )

a)

b) 1m/s

8.18.2 ( ) ( ) 9.7

9

9.1

9.1.1 ( )

9.1.2

a) 8mm

b)

1) 1570MPa 1770MPa

2) 1370MPa 1770MPa

c) ( ) GB 8903

9.1.3

9.1.4

9.2

9.2.1

40

9.2.2 N( )

a) 12

b) 16

c) 12

(N) (N)

9.2.3 9.2.3.1

80

9.2.3.1 ( )

( )

9.2.3.2

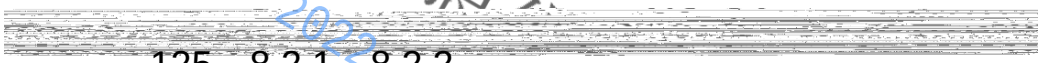
9.2.4 10

9.2.2

9.2.5 ( )

80

9.3



a) 125 8.2.1 8.2.2

b)

( ) 19 27

c)

M( )

9.4

9.4.1 12.2.1b)

9.4.2

9.4.3

9.4.4 ( ) 4^0

9.5

9.5.1

9.5.1.1

9.5.1.2

9.5.2

9.5.3 14.1.2

9.5.4

9.6

9.6.1

a)

b) 30

c) 9.7

d)

e) 14.1.2

9.6.2 3.5 m/s 9.6.1

14.1.2

9.7

9.7.1 3

a)

b)

c)

3

曳引轮、滑轮及链轮的位置		根据9.7.1的危险		
		a	b	c
轿厢上	轿顶上	×	×	×
	轿底下		×	×
对重或平衡重上			×	×
机房内		×[2)]	×	×[1)]
滑轮间内			×	

9.7.2

GB12265.1—1997 4

a)

b)

c)

9.8

9.8.1

9.8.1.1

9.10

9.8.1.2 5.5b) ( )
(9.8.3.1
) ( )

c) 1m/s 1.5m/s

d)对于额定速度大于1m/s的渐进式安全钳为$1.25\upsilon+\frac{0.25}{\upsilon}$ m/s)。

1m/s d)

9.9.2

9.9.1

9.9.3 ( ) 9.9.1

10

9.9.4

a)

b)300N

a)

b) M2.2.1

9.9.5

9.9.6

9.9.6.1

9.9.6.2

8

μ_{max}=0.2

9.9.6.3 6mm

9.9.6.4 30

9.9.6.5 ( )

9.9.6.6

9.9.6.7

9.9.7

(F3.2.4.1)

9.9.8

9.9.8.1

9.9.8.2

9.9.8.3 9.9.8.2

a) ( ) 9.9.9

b)

c) ( )

9.9.9

9.9.1

9.9.10

9.9.11

9.9.11.1

14.1.2 1m/s

9.9.11.2 (9.8.5.2)

14.1.2

14.2.1.4c)5)

9.9.11.3 14.1.2

9.9.12 F4

9.10

9.10.1

115 9.9.3

9.10.2

9.10.1

9.10.3 $1g_n$

9.10.4

a)

b)

c) ( )

d) ( )

9.10.5 14.1.2

9.10.6

9.10.7

9.10.8

9.10.9

9.10.10

a) 9.9

b) 9.9.1 9.9.2 9.9.3 9.9.7 9.9.8.1 9.9.9 9.9.11.2
9.9.4 9.9.6.1 9.9.6.2 9.9.6.5 9.9.10 9.9.11.3

9.10.11 F7

9.11

9.11.1

14.2.1.2
9.11.3 9.11.4

/

9.11.2

9.11.3

12.4.2

15
24

9.11.4

a

b

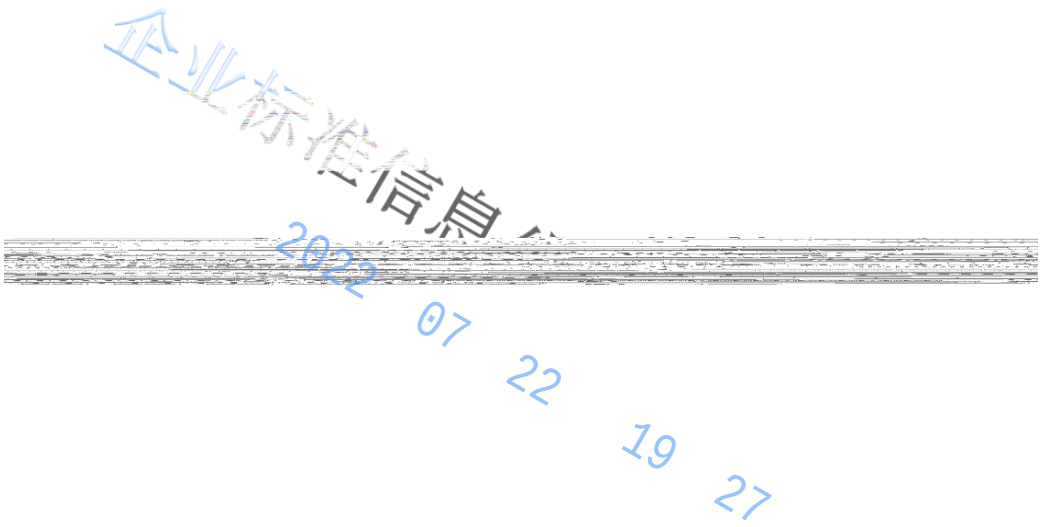
c

d

e

--

--



9.11.6
-- 1 gn
--
9.11.7 7.7.1 14.1.2

9.11.8 14.1.2
9.11.7
9.11.9

9.11.10
9.11.11
9.11.12

9.11.13 F8

10

10.1
10.1.1

a) ( )
b)
1)
2)
3)
G2 G3 G4
(0.2.5)
G
10.1.2
10.1.2.1

$$\sigma_{perm} = \frac{R_m}{S_t}$$

σ perm —— MPa
R_m—— MPa
S_t——

4

4

载荷情况	延伸率(A_5)	安全系数
正常使用	$A_5 \geq 12\%$	2.25
	$8\% \leq A_5 < 12\%$	3.75
安全钳动作	$A_5 \geq 12\%$	1.8
	$8\% \leq A_5 < 12\%$	3.0

8

JG/T 5072.1 (MPa) 5

5

载荷情况	R_m MPa		
	370	440	520
正常使用	165	195	230
安全钳动作	205	244	290

10.1.2.2 “T”

a) ( )

5mm

b) ( ) 10mm

10.1.3

10.2 ( )

10.2.1 ( )

10.2.2

a) 0.4m/s

b)

10.2.3 ( )

10.3

10.3.1

10.3.5
10.3.6 F5
10.4
L( )
10.4.1
10.4.1.1
10.4.1.1.1 115
0.135 υ 2 (m) 65mm
注：$\frac{2\times(1.15\upsilon)^2}{2g_n}=0.1348\upsilon^2$，取0.135 υ^2。
10.4.1.1.2 (
) 2.5 4 10.4.1.1
10.4.1.2
10.4.1.2.1
a) 115
1gn
b)2.5gn 0.04s
c) 1 m/s
d)
10.4.1.2.2 5.7.1.1 5.7.1.2 5.7.2.2 5.7.2.3 5.7.3.3 “
”
90
10.4.2 ( )
10.4.3
10.4.3.1 115
0.067 4 υ 2 (m)
10.4.3.2 12.8
10.4.3.1 ( )
a) 4m/s 10.4.3.1 50
0.42m
b) 4m/s 10.4.3.1 1/3
0.54 m
10.4.3.3
a) 115
1g_n
b)2.5 g_n 0.04s
c)
10.4.3.4

14.1.2

10.4.3.5

10.5

10.5.1

( )

10.5.2

10.5.2.1

10.5.2.2

a)

b) ( )

c)

10.5.2.3

a)

b)

14.1.2

10.5.3

10.5.3.1

a) 12.4.2.3.2

b)

1) a)

2) 14.1.2 12.4.2.3.1 12.7.1 13.2.1.1

c)

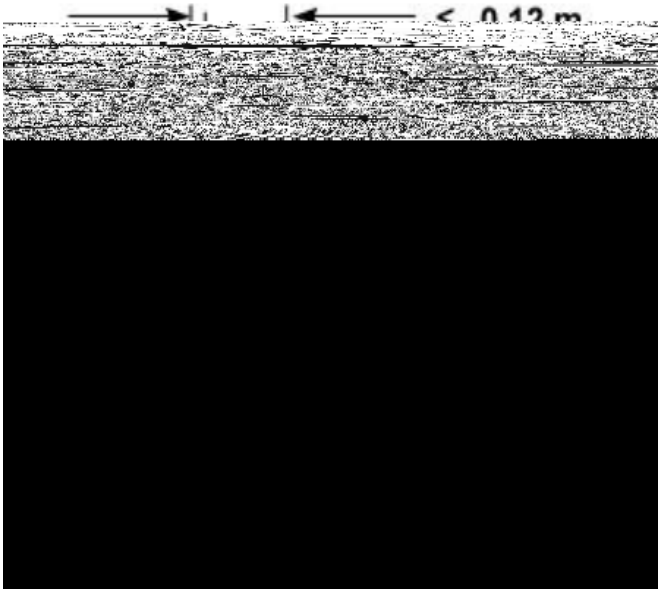
10.5.3.2

11 ( )

11.1

11.2

4 5



4

11.2.1

0.15 m

a) 0.20m 0.50m

b) 0.20m

c) 7.7.2.2

14.1.2

11.2.2 35mm

11.2.3

12

12.1

12.2 ( )

12.2.1

a) ( )

b)

1)

2) 0.63m/s

12.2.2 — (12.4.1.2)

12.3

9.7

12.4

12.4.1

12.4.1.1

a)

b)

12.4.1.2 — ( )

( )

12.4.2 —

12.4.2.1 125

12.4.2.2

12.4.2.3

12.4.2.3.1

12.4.2.3.2

12.4.2.3.3

12.4.2.4 (12.5.1)

12.4.2.5

12.4.2.6

12.4.2.7

12.5

12.5.1 400N

12.5.1.1

14.1.2

12.5.1.2

12.5.2 12.5.1 400N 14.2.1.4

12.6

( ) 105

92

105

a) [14.2.1.2b)]
b) [14.2.1.2c)]
c) [14.2.1.3d)]
d) [14.2.1.4e)]
e) [14.2.1.5c)]

12.7

14.1.2

12.7.1

12.7.2 —
12.7.2.1

a)
b)
c)

b) c)
( )
12.7.2.2

a) 12.7.2.1
b)
1)

2)
3)

(
)
12.7.3

a)

b)
1) ( )

2)
3)

12.7.4 12.7.2.2b)2) 12.7.3b)2) 12.7.2.2b)3) 12.7.3b)3) 14.1.2.3 14.1.1 12.7.3a)

12.8

12.8.1 10.4.3.2

12.8.2

12.8.3

12.8.4

a)

b)

c)

14.1.2

12.8.5

14.1.2

12.9

14.1.2

9.5.3

12.10

12.10.1

a)

b)

12.10.2

a)45s

b) 10s 10s 20s

12.10.3

12.10.4

12.11

a)
b)
c)
d)
e)

9.7

12.12 ± 10 mm ± 20 mm

± 20 mm ± 10 mm

13

13.1
13.1.1
13.1.1.1
a)
b)

13.1.1.2 13.1.1.1

13.1.1.3 EN 12015 EN 12016
13.1.2
IP2X
13.1.3 (HD384.6.61S1)

6

6

/V	( ) /V	/M
≤ 500 500	250 500 1000	≥ 0.25 ≥ 0.50 ≥ 1.00

13.1.4

250V

13.1.5

13.2

13.2.1

13.2.1.1 (12.7)

GB 14048.4

a)AC-3

b)DC-3

10

13.2.1.2

GBl4048.5

a)AC-15

b)DC-13

13.2.1.3 13.2.1.1 13.2.1.2

a) b) 13.1.1.1

a) ( )

b) ( )

13.2.2

13.2.2.1 13.2.1.2 13.2.1.3

13.2.2.2

14.1.1.1f)

13.2.2.3 ( ) 14.1.2.2.3

( )

13.2.1.1 13.2.1.2 13.2.2.1

GB l4048.4 GB l4048.5

H( ) H1(3.6)

13.3

13.3.1

13.3.2 (13.3.3)

13.3.3

13.3.6

13.3.4 13.3.2 13.3.3

13.3.5

13.3.6

13.4

13.4.1

a) ( )

b)

c)

d)

e)

f)

13.4.2 13.4.1

14.1.2

13.4.3

13.4.4

13.5

13.5.1

13.1.1.2 GB 5023.3 GB 5013.4

13.5.1.1 GB 5023.3—1997 2 [227IEC01(BV)] 3 [227IEC02(RV)] 4 [227IEC05(BV)] 5 [227IEC06(RV)]

( )

GB 5023.1—1997 A

13.5.1.2 GB 5023.4—1997 2

( ) .

13.5.1.3 GB 5013.4—1997 3 [245IEC53(YZ)] GB 5023.5—1997 5 [227IEC52(RVV)]

GB 5013.4—1997 5 [245IEC66(YCW)] 13.5.1.2

( )

GB 5023.6 GB 5013.5

13.5.1.4 13.5.1.1 13.5.1.2 13.5.1.3

a)

1) 100VA

2) ( ) ( ) 50V

b)

1)

2)

13.5.2

0.75mm^2

13.5.3

13.5.3.1

13.5.3.2 13.1.2

13.5.3.3

50V

13.5.3.4

13.5.3.5

13.5.3.6

13.5.4

13.6

13.6.1

13.4

13.6.2 13.6.1

a)2P+PE 250V

b) GBl4821.1

13.6.3

13.6.3.1

13.6.3.2

( )

13.6.3.3 13.6.3.1 13.6.3.2

14

14.1

14.1.1

14.1.1.1 14.1.1.2 ( )

H

14.1.2.3

14.1.1.1

a)

b)

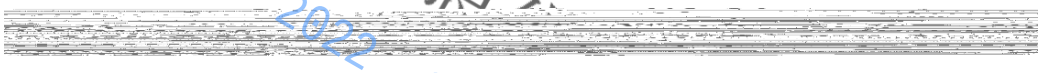
c) ( )

d)

e)

f)
g)
h)
i)
j)
14.1.1.2 14.1.2.2

14.1.1.3



a)
b)

14.1.2
14.1.2.1
14.1.2.1.1 A( )
14.1.2.4

a) 14.1.2.2 12.7

b) 14.1.2.3
1) 14.1.2.2 12.7

2) 14.1.2.2
3) H
14.1.2.1.2 ( )
14.1.2.1.3 (14.2.1.2 14.2.1.4 14.2.1.5)

14.1.2.3
14.1.2.1.4
14.1.2.1.5

14.1.2.1.6

14.1.2.1.7

14.1.2.1.8

14.1.2.2

14.1.2.2.1

( )

14.1.2.2.2 IP4X

250V IP4X 500 V

GBl4048.5

a)AC—15

b)DC—13

14.1.2.2.3 IP4X

3mm, 4mm 4mm

IP4X 3mm

14.1.2.2.4 2

mm

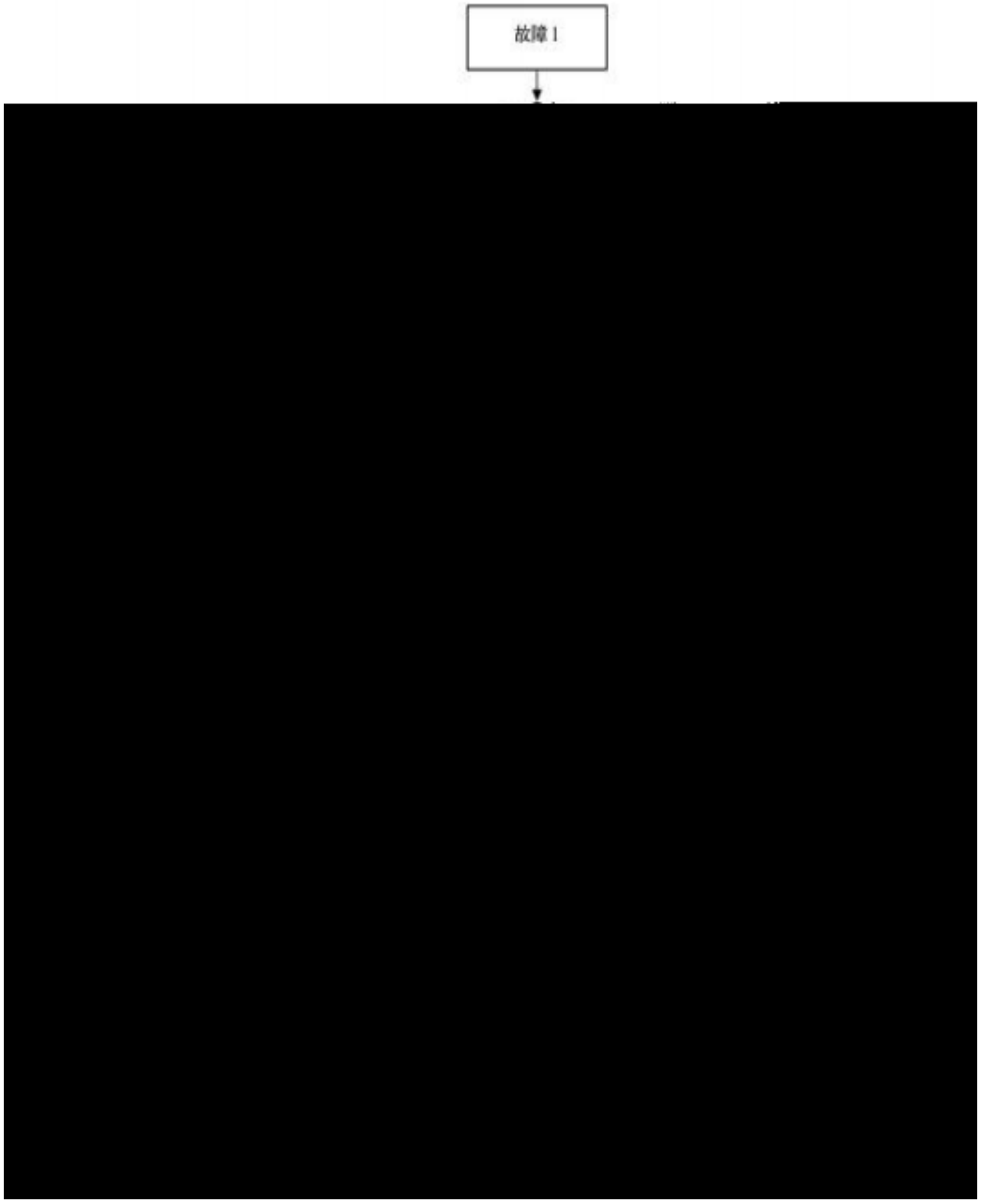
14.1.2.2.5

14.1.2.3

14.1.2.3.1 14.1.1

14.1.2.3.2 6

14.1.2.3.2.1 ( ) ( )

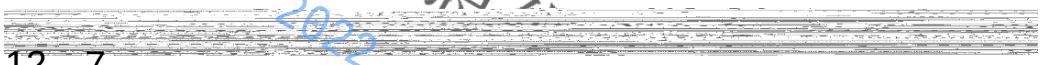


6

14.1.2.3.2.2

14.1.2.3.2.4 14.1.2.3.2.1
14.1.2.3.2.3
14.1.2.3.2.5

14.1.2.3.3 F6
14.1.2.4



12 7

14.1.2.5

F6.3.1.1

14.2
14.2.1

14.2.1.1

14.2.1.2
7.7.2.2a)

a) (7.7.1)
1)

2) 14.1.2.2
14.1.2.3
3)

14.1.2

4)

b) 0.8m/s

1)

2) 0.8m/s

c) 0.3 m/s

a)

b)

c) 14.1.2

1)9.8.8
2)9.9.11.1 9.9.11.2
3)9.10.5
4)10.5
5)10.4.3.4
d)

e) 0.63m/s
14.2.1.5
7.7.2.2b)

a) 1.65 m
b) 14.1.2
c) 0.3 m/s
d)
e)
f)

i) 114.2.2.1e)]

14.2.2

14.2.2.1

a) [5.7.3.4a)]

b) (6.4.5)

c) (8.15) 1 m

1 m

d) [14.2.1.3c)]

e) [14.2.1.5i)]

1 m

(15.2.3.1)

14.2.2.2 14.1.2

14.2.2.3 .

14.2.3

14.2.3.1

14.2.3.2 8.17.4

14.2.3.2 .

14.2.3.3

14.2.3.4 30m 8.17.4

14.2.4

14.2.4.1 2 s

14.2.4.2 2 s

14.2.4.3

.

14.2.5

14.2.5.1

14.2.5.2 10 75 kg

14.2.5.3

a) ( )

b)

c)

d) 7.7.2.1 7.7.3.1

15

15.1

( )

( )

15.2

15.2.1 ( )

8.2.3

“……kg…… ”

a)10mm

b)7 mm

15.2.2

15.2.3

15.2.3.1 ( ) “ ”

( )

“ ”

15.2.3.2

a) 2 I 0 1 2 3

b)

15.2.4

a)

b)

c)

15.3

a) “ ”

b) “ ” “ ”

c)

d)

15.4

15.4.1

“ ——
”

“ —— ”

15.4.2

( )

15.4.3

15.4.3.1

15.4.3.2

15.4.4 “ ”

15.4.5 (6.3.7)

15.5

15.5.1

“ ——
”

15.5.2

“ ”

15.5.3

15.6

a)
b)
c)
15.7

15.16

a)
b)
c)

15.17 F8.1

a
b
c

16

16.1

16.1.1

C( )

16.1.2 D

C

16.1.3

a)
b) ( )
c)
d)
e)
f)
g)
h)

A A1

9.11.7	
9.11.8	

16.2

a)
1)
2)
3) ( )
4) (16.1.3)
5)
6) (GB/T 4728)
.

b) .

1) [E( )]
2)
3)

16.3

16.3.1

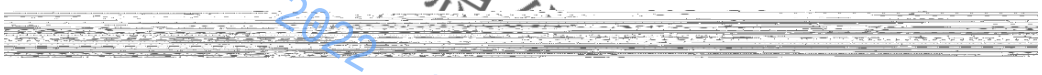
a)
b)
c)c

16.3.3.1

E

16.3.3.2

E



2022 07 22 19 27

A

( )

A1

A1

A1

5.2.2.2.2

5.7.3.4a)

6.4.5

7.7.3.1

7.7.4.1

7.7.6.2

8.9.2

8.12.4.2

8.15b)

9.5.3 (

)

9.6.1e)

9.6.2

9.8.8

9.9.11.1

9.9.11.2

9.9.11.3

9.10.5

10.4.3.4

10.5.2.3b) ( )

10.5.3.1b)2)

11.2.1c)

12.5.1.1

12.8.4c) ( )

12.8.5

12.9

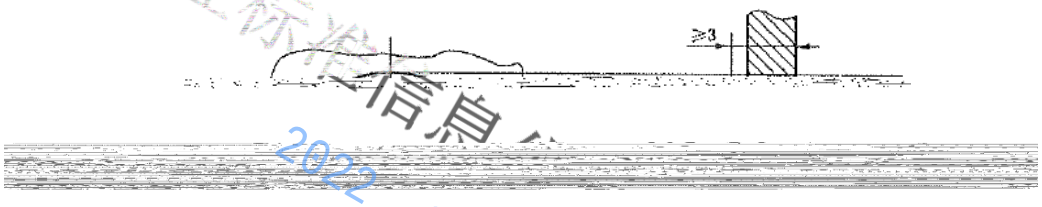
13.4.2

14.2.1.2a)2)

14.2.1.2a)3) ( )
14.2.1.3c)
14.2.1.5b)
14.2.1.5i)

B

(　　)



B1

C

( )

.

C1

C2

( )

( )

( ) (6.2)

C3

(11.2.3)

( )

( ) ( )

(N)

( )

( )

C4

a)

b)

GB/T 4728

C5

.

(

)

D

(　　)

D1

a)　　(　　C)
b)
c)
d)

D2

a)　　(　7.7)
b)　　(　　A)
c)
[　16.2a)];
d)　　(　12.4);
　　125

e)　　(　12.6)
f)
1)　　(　13.1.3)

2)
g)　　(　10.5)
h)　　(　9.3)
1)

——
——　　125
2)
3)
——
——

8.2.2 1 1) 2)
3) 125 1

8.2.2 150
i)
1) (9.9.1 9.9.2) ( )(9.9.3)

2)9.9.11.1 9.9.11.2
j) (9.8)
(F3)

1)

2) 125

8.2.2 1
1
125
1
8.2.2 150 125
.
( )

k) ( ) (9.8)
(F3)
( )

( )

1)

2)

( )

L) (10.3 10.4)

1)

( ) C3

C5

2)

(10.4.3.2)

8.2.2 1

1

m) (14.2.3)

n) (9.10)

o) 9.11

9.11

– –

– –

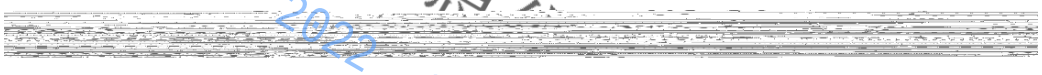
9.11.5

9.11.3

E

（ ）

E1



16.2

E2

16.2

a)

b)

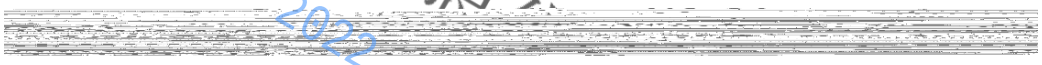
F

（ ）

F0

F0.1

F0.1.1



F0.1.2

F0.1.3

F0.1.4

F0.1.5

F0.1.6

a) ±1

b) ±2

c) ±5

d) ±5

e) 0.01s

F0.2

1.

2.

3.

4.

5.

6.

7.

8.

9.

10.

F1
F1.1
F1.1.1

F1.1.2

F1.1.3

F1.1.3.1

a)

b)
c)
d) [( )]
F1.1.3.2

F1.1.4

F1.2
F1.2.1

a) 7mm 7.7.3.1.1

b)

7.7.5.1

F1.2.2

b) 200V 2A

F1.2.4.2.1 5 10 s

110 50

0.5s

0.7±0.05

11

F1.2.4.2.2 5 10 s

110 20

0.5s

300ms

95 110

F1.2.4.2.3

F1.2.4.4

14.1.2.2.3

F1.2.4.5 14.1.2.2

F1.3

F1.3.1

7.7.6.1 7.7.6.2

F1.2

F1.3.2

F1.3.2.1

F1.2.2.2

F1.3.2.2

F1.4

F1.4.1

F1.4.2

a)F0.2

b)

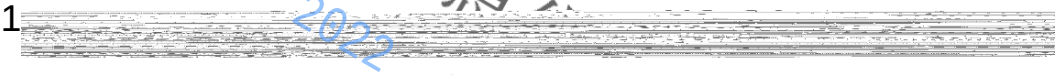
c) [ ]

d)

F2

F3

F3.1



a)

b)

F3.2

F3.2.1

F3.2.2

F3.2.2.1

a)

b)

F3.2.2.2

a)

b)

c)

F3.2.3

F3.2.3.1

a)

b)

F3.2.3.2 “ - ”

a)

b)

1)

2)

F3.2.4

F3.2.4.1

9.9.1

$h=\frac{v}{g_n}+0.10+0.03$

h – m

v_1 – m/s

0.10— m

0.03— m

$2K=(P+Q)_1\times g_n\times h$

$(P+Q)_1=\frac{K}{g_n\times}$

$(P+Q)_1$— kg

P—

kg

Q— kg

K— J

F3.2.4.2

a)

K F3.2.3.2.a)

2 (kg)

$(P+Q)_1=\frac{K}{g_n\times}$

b)

1)K_1 F3.2.3.2b)1) 2 (kg)

$(P+Q)_1=\frac{K}{g_n \times}$

2) K_2 F3.2.3.2b)2) 3.5 (kg)

$(P+Q)_1=\frac{K}{\times g_n \times}$

K_1 K_2— J

F3.2.5

F3.3

F3.3.1

F3.3.1.1 (kg) (m/s)

(N) 16 (kg) $0.6g_n$

F3.3.1.2

F3.3.2

F3.3.2.1

a)

b)

c)

d)

a) b)

1)

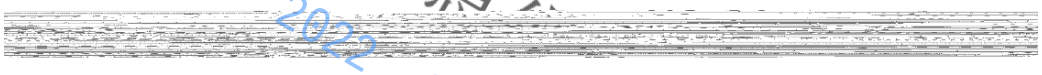
2)

3)

F3.3.2.2

F3.3.2.2.1

a) 4m/s
b) 4m/s



F3.3.2.2.2

a)
b)

(
)

F3.3.2.3
F3.3.2.3.1

25%

F3.3.2.3.2 ( )
F3.3.2.3.1

F3.3.2.4

a)

b) (
)
c)

F3.3.3
F3.3.3.1

(P+Q)1= /16

– – F3.3.2.3 N
F3.3.3.2
F3.3.3.2.1
F3.3.3.1
F3.3.3.2.2
F3.3.3.1

F3.3.4

20

F3.3.3.1

F3.4
a)1)

2) F3.3.3 ±
7.5
9.8.4
b)
c) ( )

d)
e)
F3.5
F3.5.1
F3.5.2

a)F0.2
b)
c) [F3.4a)];
d)
e)
f)
g)
h) ( )
i) ( )
F4
F4.1

a)
b)
c)

F4.2
F4.2.1

a)
b)

c)
F4.2.2
F4.2.2.1

a)
b) 9.9.11.1 (
)
c) 9.9.11.2

d)
F4.2.2.2
[F4.1b)]
20

1
2
3
F4.2.2.3
F4.2.2.3.1 20 9.9.1
20
F4.2.2.3.2 20 F4.2.2.1b) c) 9.9.11.1
9.9.11.2
F4.2.2.3.3 300N

1 180
2 .
F4.3
F4.3.1
F4.3.2
a)F0.2
b)
c)
d)
e)
f)
F5
F5.1
( )
a)

b)
F5.2

a)
b)
F5.3
F5.3.1
F5.3.1.1
F5.3.1.1.1

a) $\upsilon \leqslant \sqrt{\frac{Fl}{0.135}}$ (10.4.1.1.1)

υ ≤ 1 m/s(10.3.3)

FL – – m

b)

1) Cr/2.5

2) Cr/4

Cr – – k8

F5.3.1.1.2 ( )

F5.3.1.2

F5.3.1.2.1 ( )

( )

FO.1.6

F5.3.1.2.2

F5.3.1.2.3 ( )

F5.3.1.3 ( )

F5.3.1.4

F5.3.1.5

F5.3.2

F5.3.2.1

F5.3.2.2

F5.3.2.2.1

FO.1.6

F5.3.2.2.2

FO.1.6 (

) 1 000 Hz

F5.3.2.2.3

FO.1.6

F5.3.2.2.4

( )(5.3.2.1)

F0.1.6

F5.3.2.2.5

0.01 s F0.1.6

F5.3.2.3

(15 25)

F0.1.6

F5.3.2.4

F5.3.2.5

F5.3.2.6

F5.3.2.6.1

10.4.3.3

F5.3.2.6.2 ╕ η η ŏ

F5.3.2.7

F5.3.3

F5.3.3.1

F5.3.3.1.1

0.8m/s

F5.3.3.1.2

0.9 gn

F5.3.3.2

F5.3.2.2.2 F5.3.2.2.3 F5.3.2.2.4

F5.3.3.3

(15– 25)

F5.3.3.4

F5.3.3.5

a)

b)

(5 30)min

50

5

F5.3.3.6

F5.3.3.6.1

“ α ”

a) 115

1.0gn

(n)

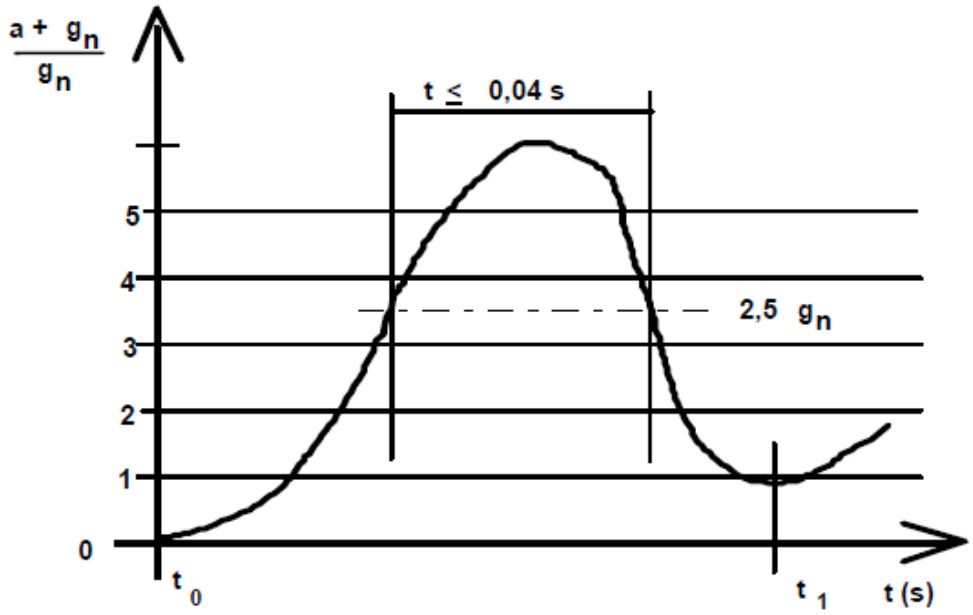
b) 2.5gn 0.04s

F5.3.3.6.2

F5.3.3.7

F5.4

F5.4.1



to－撞击缓冲器瞬间(第1个绝对值最小时)；t1－第2个绝对值最小时

图F1 减速图

F5.4.2

a)F0.2

b)

c)

d)

e)

f)

g) ( )

F6

F6.1

a)

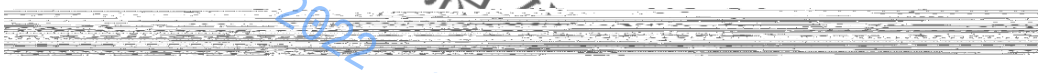
b)

c)

d)

f)
g)
F6.2

a)
b) ( )
F6.3
F6.3.1



F6.3.1.1

a)GB/T 2423.10 – 1995 C2
20 0.35mm 5gn 10 Hz 55 Hz
b)GB/T 2423.5 – 1995 1
1) 294m/s2 30g
2) 11 ms
3) 2.1 m/s

.

F6.3.1.2 (GB/T 2423.6)

a)
b)
.

F6.3.1.2.1
a)
b) 15 g
c) 11 ms
F6.3.1.2.2
a) 10g
b) 16ms
c)1) 1 ooo+10
2) 2/s
F6.3.2 (GB/T 2423.22)

0'C 65'C( )

a)
b)
c)
( )
d) (0 65) 4 h
e)

F6.4
F6.4.1
F6.4.2
a)F0.2
b)
c)GB/T 16935.1
d)
e)

.

F7

F3 F4 F6

F7.1

a)
b)
c)

a)
b)
c) (
)

F7.2
F7.2.1 (kg) (m/s)

F7.2.2

a)
b) F3 F4 F6

F7.3
F7.3.1

.

a)
b)
c)

F7.3.2

F7.1b)

20

F7.3.2.1

a) 4 m/s
b) . 4m/s

F7.3.2.2 ( )

( )

F7.3.2.3
F7.3.2.3.1

20

F7.3.2.3.2

20 9.10.1

F7.3.3

a)

b) (
)
c)
d) 1 zo
F7.4
20
F7.5

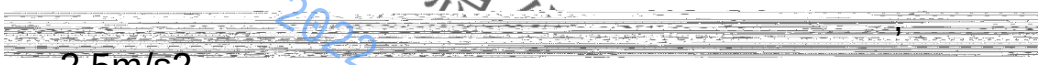
a)
b)
c)
d)
e)
f)
g)
F7.6
F7.6.1
F7.6.2
a)F0.2
b)
c)
d)
e)
F8
F8.1

–
–
–
– 1
–

– 2
–

1 1.5 m/s2²
2m/s

1.5 m/s2



2.5m/s2

2

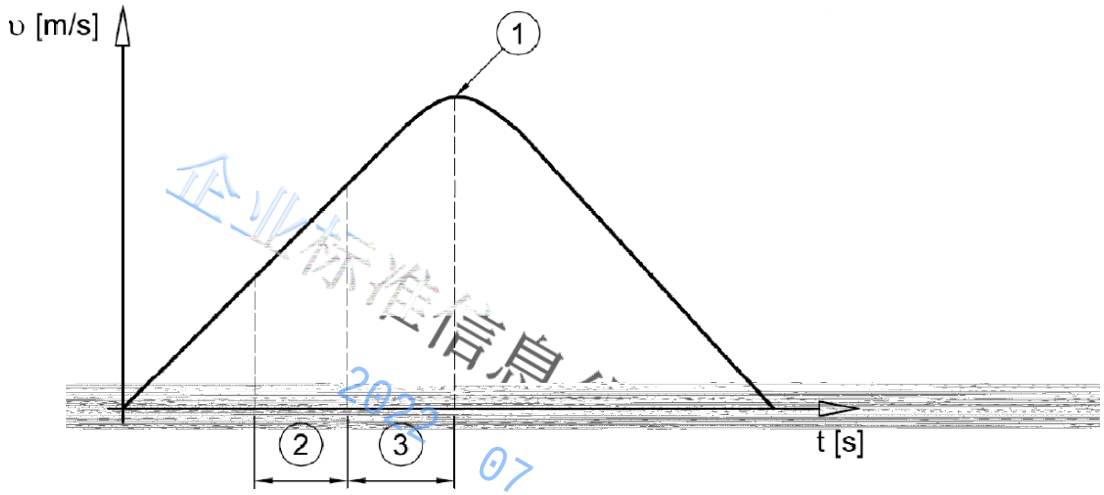
a
b
c

F8.2
F8.2.1
F8.2.2

F8.3
F8.3.1

–
–
– F2
–

–
–



– –
– –
– –

F2

F8.3.2

20

–
– ± 20 %

GB/T 24478-2009 4.2.2.4

F8.3.2.1

10

10

5

F8.3.2.2

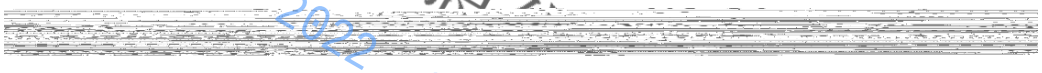
F8.3.2.3

10

F8.3.2.4
10

F8.3.3

a

b 

c

F8.4 20 %

F8.5

–
–
–
–
–
–
–

F8.6

a F0.2
b /
c
d
e
f
g)

G

( )

G1

G1.1 10.1.1

.

G1.1.1 Q G2.2

G1.1.2

G2 G2.1

( ) P

G2.2 〃 〃 〃 8.2

Q G7 3/4

(o.2.5)

G2.3 Fk

$$F_k = \frac{k_1 g_n (P+Q)}{n}$$

k1— — G2

n— —

G2.4 Fc

$$F_c = \frac{k_1 g_n (P+qQ)}{n} \quad 或 \quad F_c = \frac{k_1 g_n qP}{n}$$

q—

G2.5

Fs 0.4gnQ

2 500k8

Fs 0.6gnQ

2 500kg

Fs 0.85gnQ

2 500kS

G2.6 G

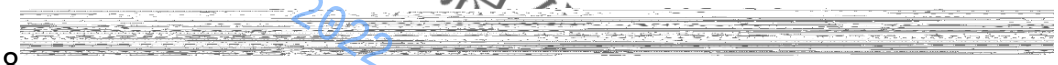
a)

b)

c) ( )

5 10

G2.7 M



G2.8 WL

(0.2.5)

G3

G3.1 Gl

表G1

工 况	载荷和外力	P	Q	G	F_s	F_k或F_c	M	WL

G3.2

G4

G4.1

K1

G4.2

(4 ’ (P+Q)

K2

G4.3

G2.6 K3

1gn

G4.4

G2

表G2

G5

G5.1

( )

G5.2

G5.2.1

a)

b)

c)

G5.2.2 (G1)

a) L

b)

c)

σm

σm— — N/mm2

Mm— — Nmm

W— — mm3

Fb— — N

l— — mm

〃 〃

G5.2.3

Wx Wy ( )

G5.2.4

G5.2.5 9.8.2.2

G5.2.5.1

G5.2.5.2 G2.3
G2.4
G5.3
“ ω ”

σk— — N/mm2 MPa
Fk— — N G2.3
Fc— — N G2.4
K3— — G2
M— — N
A— — mm2
ω ω
ω G3 370MPa ω G4 520MPa

$$\lambda = \frac{l_k}{i} \quad \text{和} \quad l_k = l$$

λ— —
lk— — mm
i— — mm
Rm 370 MPa
20≤λ≤60 ω 0.000 129 20×λ1.89 +1
60<λ≤85 ω 0.000 046 27×λ2.14 +1
85<λ≤115 ω 0.000 017 11×λ2.35 +1.04
115<λ≤250 ω 0.000 168 87×λ2.00

Rm 520MPa

20≤λ≤50 ω 0.000 082 40×λ2.06 +1.021

50<λ≤70 ω 0.000 018 95×λ2.41 +1.05

70<λ≤89 ω 0.000 024 47×λ2.36 +1.03

89<λ≤250 ω 0.000 253 30×λ2.00

370MPa 520MPa ω

$$\omega_R = \left[\frac{\omega_{520} - \omega_{370}}{520 - 370} \times (R_m - 370)\right] + \omega_{370}$$

ω

表G3

λ	0	1	2	3	4	5	6	7	8	9	λ
20	1.04	1.04	1.04	1.05	1.05	1.06	1.06	1.07	1.07	1.08	20
30	1.08	1.09	1.09	1.10	1.10	1.11	1.11	1.12	1.12	1.12	30

表G4

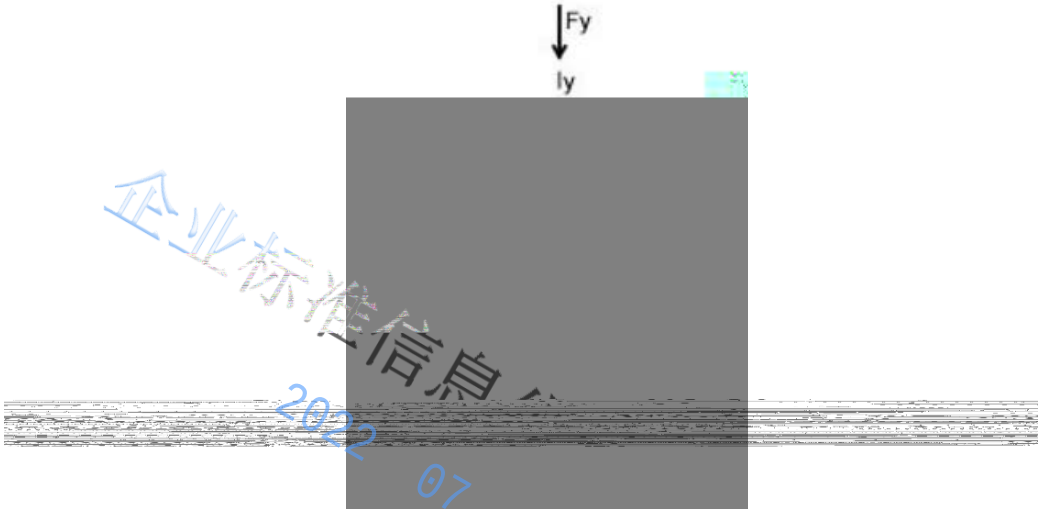
λ	0	1	2	3	4	5	6	7	8	9	λ
20	1.06	1.06	1.07	1.07	1.08	1.08	1.09	1.09	1.10	1.11	20
30	1.11	1.12	1.12	1.13	1.14	1.15	1.15	1.16	1.17	1.18	30
40	1.19	1.19	1.20	1.21	1.22	1.23	1.24	1.25	1.26	1.27	40

G5.4

σm σx+σy
≤ σperm

σ σ

σx ——X Mpa
σy——Y Mpa
σperm—— Mpa 10.1.2.1



G5.5

T

σF— — Mpa

Fx— — N

C— — mm G1

G5.6

G7

G5.7

$$\delta_y = 0.7\frac{F_y \cdot l^3}{48 \cdot E \cdot I_x}$$ Y—Y导向面

$$\delta_x = 0.7\frac{F_x \cdot l^3}{48 \cdot E \cdot I_y}$$ X—X导向面

x— —X mm

y— — Y mm

Fx— —X N

Fy— — Y N

E — — Mpa

Ix— — X mm4

Iy

— —Y mm4

G6

T 10.1.2.2

10.1.1

10.1.1

G7

( )

(G2)

Dx — —X

Dy — —Y

xc,yc — — C

xs,ys — — S

xp,yp — — P

xcp,ycp — — P

S — —

C — —

P — — — —

Q — — — —

→ — —

1,2,3,4 — — 1,2,3,4

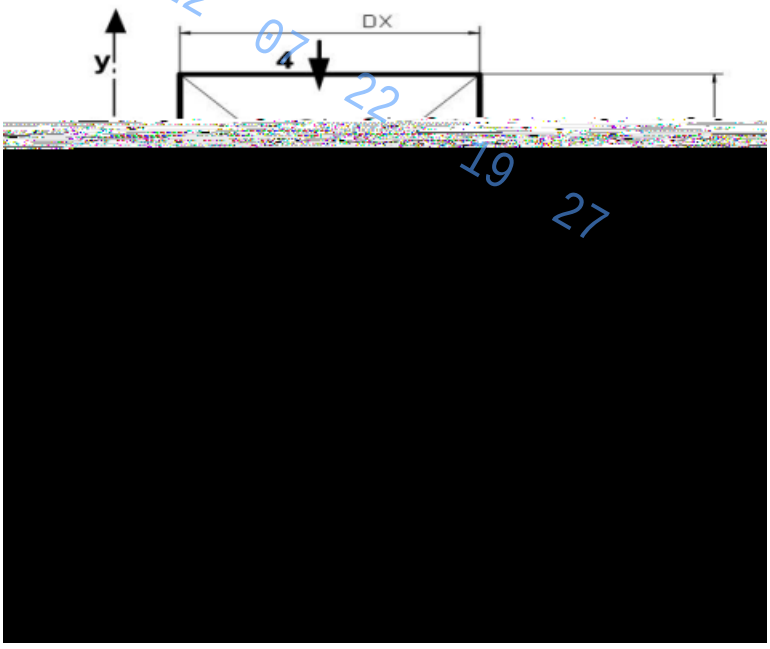
xi,yi — — i=1,2,3,4

n — —

h — —

xQ,yQ — — Q

xcQ,ycQ — — C Q X Y



G7.1

G7.1.1

G7.1.1.1

a) Y

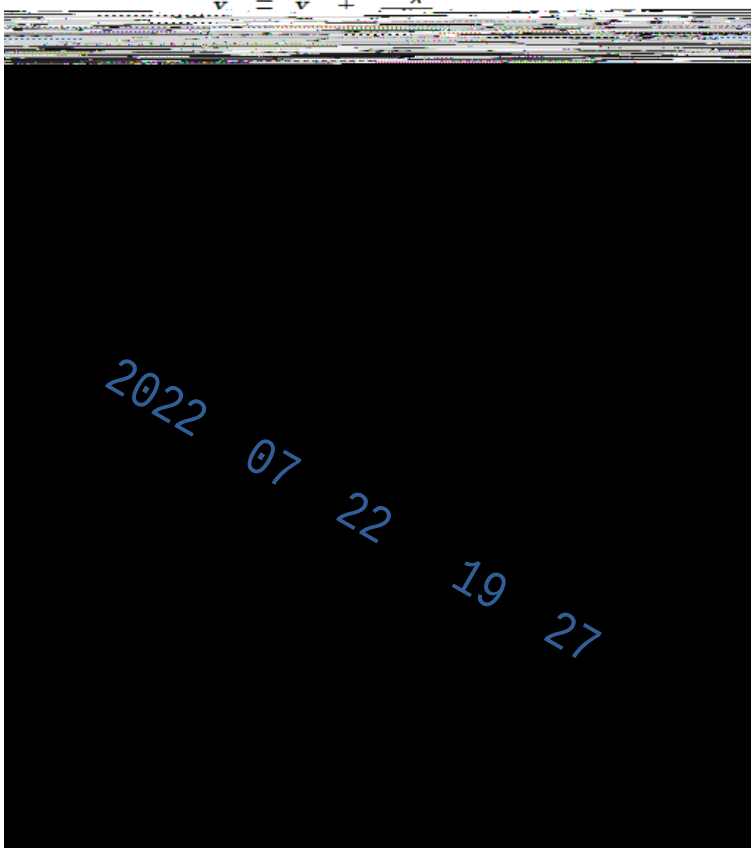
$$F_x = \frac{k_1 \cdot g_n \cdot (Q \cdot x_Q + P \cdot x_P)}{n \cdot h}, \quad M_y = \frac{3 \cdot F_x \cdot l}{16}, \quad \sigma_y = \frac{M_y}{W_y}$$

b) X

$$F_y = \frac{k_1 \cdot g_n \cdot (Q \cdot y_Q + P \cdot y_P)}{\frac{n}{2} \cdot h}, \quad M_x = \frac{3 \cdot F_y \cdot l}{16}, \quad \sigma_x = \frac{M_x}{W_x}$$

X (G3)

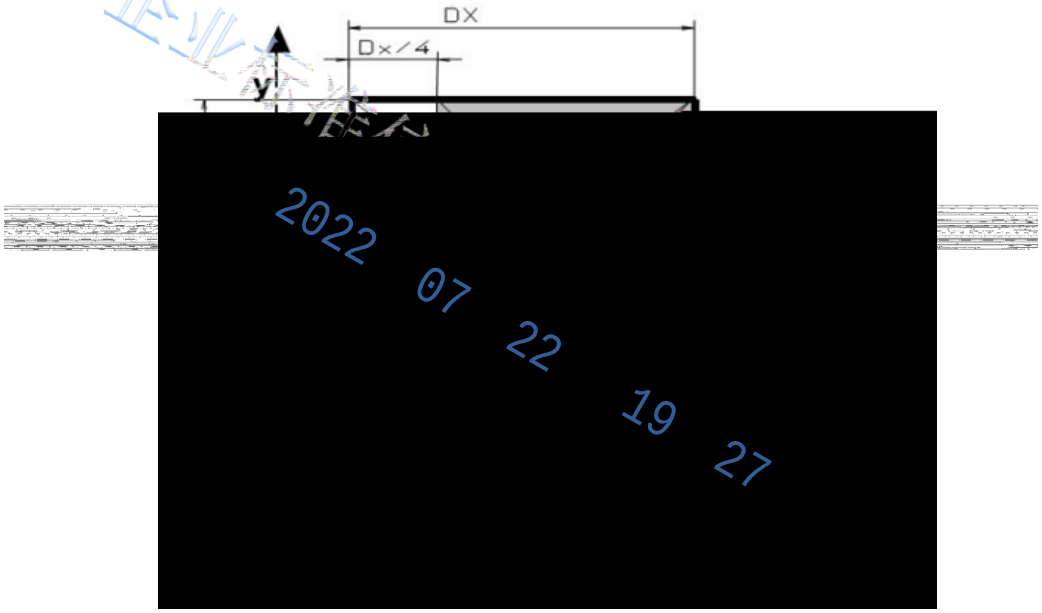
$$y_x = y + \frac{D_x}{}$$



Y (G4)

$$x_Q = x_c$$

$$y_Q = y_c + \frac{D_y}{8}$$



G7.1.1.2

$$k_1 \cdot g_n \cdot (P+Q) \qquad (F_k + k_3 \cdot M) \cdot \omega$$

G7.1.1.3 1)

$$\sigma = \sigma + \sigma \qquad < \sigma$$

G7.1.1.4 2)

$$\sigma = \frac{1{,}85 \cdot F_x}{} \qquad < \sigma$$

G7.1.1.5 3)

$$\delta = 0.7 \frac{F_x \cdot l^3}{} \qquad < \delta \qquad \delta = 0.7 \frac{F_y \cdot l^3}{} \qquad < \delta$$

G.1.2

G7.1.2.1

a) Y

b) X

$$F = \frac{k_2 \cdot g_n \cdot [Q \cdot (y_Q - y_S) + P \cdot (y_p - y_s)]}{M} \qquad M = \frac{3 \cdot F_y \cdot l}{\sigma} \qquad \sigma = \frac{M_x}{}$$

X (G7.1.1.1)

Y (G7.1.1.1)

G7.1.2.2

" "

G7.1.2.3 4)

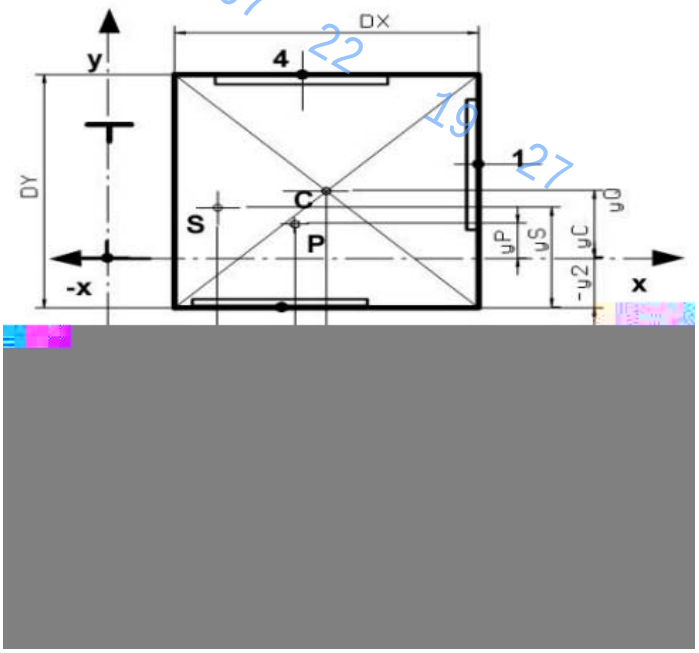
$$\sigma_m = \sigma_x + \sigma_y \leq \sigma_{perm}$$

$$\sigma = \sigma_m + \frac{k_3 \cdot M}{A} \leq \sigma_{perm}$$

G7.1.2.4 5)

G7.1.2.5 6)

G7.1.3 (G5)



G7.1.3.1

a) Y

b) X

G7.1.3.2

“ ”

G7.1.3.3 7(

$$\sigma_m = \sigma_x + \sigma_y \leq \sigma_{perm}$$

G7.1.3.4

$$\sigma_F = \frac{1{,}85 \cdot F_x}{c^2} \leq \sigma_{perm}$$

G7.1.3.5

$$\delta_x = 0{,}7\,\frac{F_x \cdot l^3}{48 \cdot E \cdot I_y} \leq \delta_{perm},\ \delta_y = 0{,}7\,\frac{F_y \cdot l^3}{48 \cdot E \cdot I_x} \leq \delta_{perm}$$

G7.2

G7.2.1

G7.2.1.1

a) Y

b) X

$$F_y = \frac{k_1 \cdot g_n \cdot (Q \cdot y_Q + P \cdot y_P)}{\frac{n}{2} \cdot h},\quad M_x = \frac{3 \cdot F_y \cdot l}{16},\quad \sigma_x = \frac{M_x}{W_x}$$

X (G6)

P Q Q X

$$x_Q = \frac{D_x}{8}$$

$$y_q = 0$$

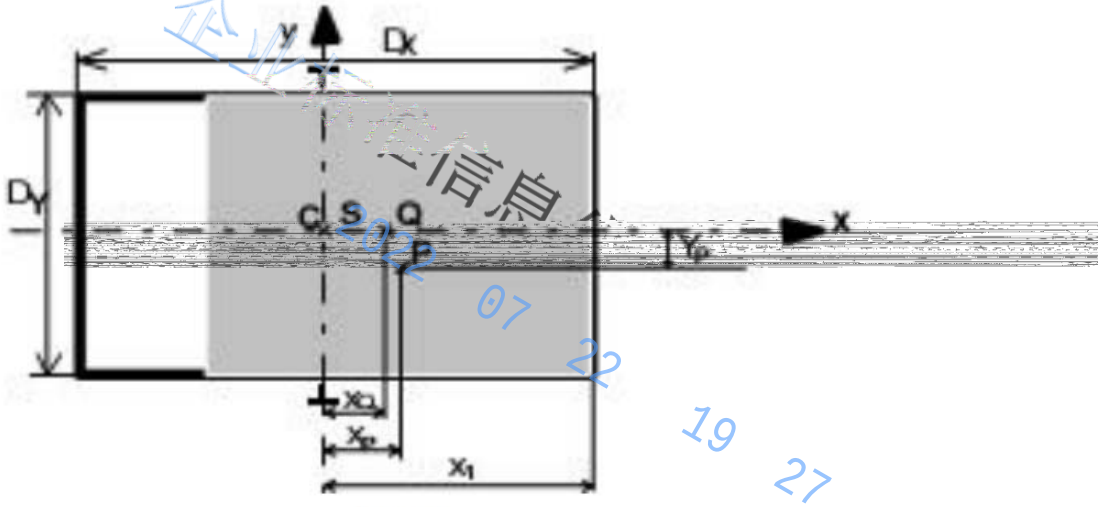


图 G6

Y (7)

$$x_0 = 0$$

G7.2.1.2

$$F_k = \frac{k_1 \cdot g_n \cdot (P+Q)}{2},\ \sigma_k = \frac{(F_k + k_3 \cdot M)}{A} \cdot \omega$$

G7.2.1.3 8)

$$\sigma_m = \sigma_x + \sigma_y \qquad \leq \sigma_{perm}$$

$$\sigma = \sigma_m + \frac{F_k + k_3 \cdot M}{A} \qquad \leq \sigma_{perm}$$

$$\sigma_c = \sigma_k + 0{,}9 \cdot \sigma_m \qquad \leq \sigma_{perm}$$

G7.2.1.4 9)

[redacted]

G7.2.1.5 10)

$$\delta_x = 0{,}7\frac{F_x \cdot l^3}{} \leq \delta_{perm} \quad \delta_y = 0{,}7\frac{F_y \cdot l^3}{} \leq \delta_{perm}$$

G7.2.2

G7.2.2.1

a) Y

$$\frac{k_2 \cdot g_n \cdot (Q \cdot x_Q + P \cdot x_P)}{} \quad \frac{3 \cdot F_y \cdot l}{} \quad M_x$$

b) X

$$F_y = \frac{k_2 \cdot g_n \cdot (Q \cdot y_Q + P \cdot y_P)}{\frac{n}{2} \cdot n}, \qquad M_x = \frac{3 \cdot F_y \cdot l}{16}, \qquad \sigma_x = \frac{M_x}{W_x}$$

X (G7.2.1.1)

Y (G7.2.1.1)

G7.2.2.2

" "

G7.2.2.3 11)

$$\sigma_m = \sigma_x + \sigma_y \qquad \leq \sigma_{perm}$$

$$\sigma = \sigma_m + \frac{k_3 \cdot M}{A} \qquad \leq \sigma_{perm}$$

G7.2.2.4 12)

$$\sigma_F = \frac{1{,}85 \cdot F_x}{c^2} \qquad \leq \sigma_{perm}$$

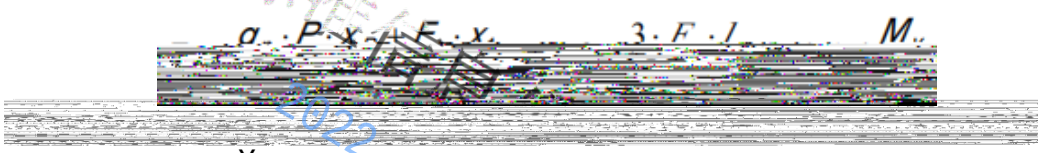
G7.2.2.5 13)

$$\delta_x = 0{,}7\frac{F_x \cdot l^3}{48 \cdot E \cdot I_y} \leq \delta_{perm},\ \delta_y = 0{,}7\frac{F_y \cdot l^3}{48 \cdot E \cdot I_x} \leq \delta_{perm}$$

G7.2.3

G72.3.1

a) Y



b) X

$$F_y = \frac{g_n \cdot P \cdot y_P + F_s \cdot y_1}{h},\ M_x = \frac{3 \cdot F_y \cdot l}{16},\quad \sigma_x = \frac{M_x}{W_x}$$

G7.2.3.2

" "

G7.2.3.3 14)

$$\sigma_m = \sigma_x + \sigma_y \leq \sigma_{perm}$$

$$\sigma = \sigma_m + \frac{k_3 \cdot M}{A} \leq \sigma_{perm}$$

G7.2.3.4

$$\sigma_F = \frac{1{,}85 \cdot F_x}{c^2} \leq \sigma_{perm}$$

G7.2.3.5

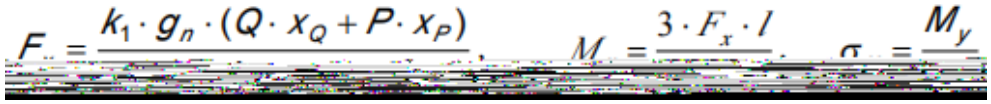
$$\delta_x = 0{,}7\frac{F_x \cdot l^3}{48 \cdot E \cdot I_y} \leq \delta_{perm},\ \delta_y = 0{,}7\frac{F_y \cdot l^3}{48 \cdot E \cdot I_x} \leq \delta_{perm}$$

G7.3

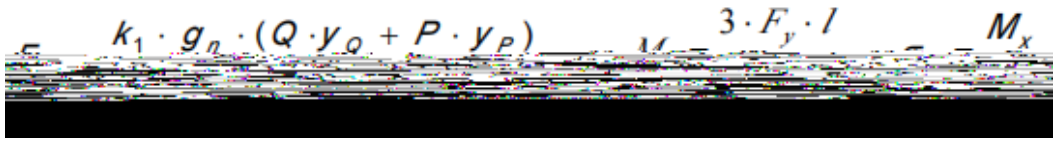
G7.3.1

G7.3.1.1

a) Y



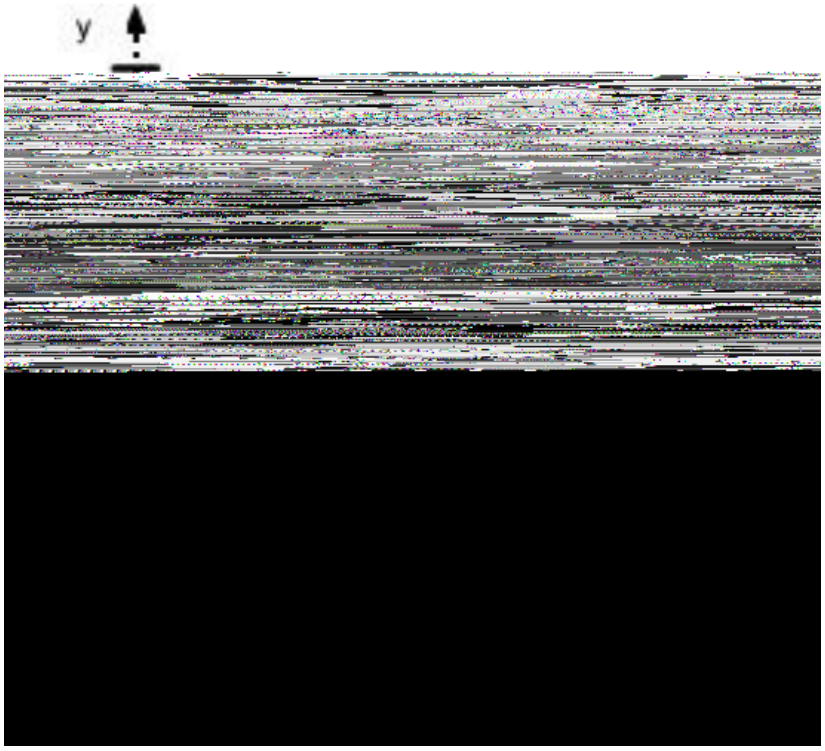
b) X



X (G8)

$$x_Q = x_C + \frac{D_x}{8}$$

$$y_P = y_C = y_Q = y_S = 0$$



Y (G9)

$$y_Q = \frac{D_y}{8}$$

$$x_C = x_Q$$

G7.3.1.2

$$k \cdot g_n \cdot (P+Q) \qquad (F_k + k_3 \cdot M) \cdot \omega$$

[redacted]

G7.3.1.3 15)

$$\sigma_m = \sigma_x + \sigma_y \leq \sigma_{perm}$$

$$\sigma = \sigma_m + \frac{F_k + k_3 \cdot M}{A} \leq \sigma_{perm}$$

$$\sigma_c = \sigma_k + 0{,}9 \cdot \sigma_m \leq \sigma_{perm}$$

G7.3.1.4 16)

$$185 \cdot F$$

[redacted]

G7.3.1.5 17)

$$\delta_x = 0{,}7 \frac{F_x \cdot l^3}{48 \cdot E \cdot I_y} \leq \delta_{perm}, \quad \delta_y = 0{,}7 \frac{F_y \cdot l^3}{48 \cdot E \cdot I_x} \leq \delta_{perm}$$

G7.3.2

G7.3.2.1

a) Y

$$F_x = \frac{k_2 \cdot g_n \cdot [Q \cdot (x_Q - x_S) + P \cdot (x_P - x_S)]}{n \cdot h} \quad M_y = \frac{3 \cdot F_x \cdot l}{16}, \quad \sigma_y = \frac{M_y}{W_y}$$

b) X

$$k_2 \cdot g_n \cdot [Q \cdot (y_Q - y_S) + P \cdot (y_P - y_S)] \qquad 3 \cdot F_y \cdot l \qquad M_x$$

[redacted]

X (G7.2.1.1)

Y (G7.2.1.1)

G7.3.2.2

〃 〃

G7.3.2.3 18)

$$\sigma_m = \sigma_x + \sigma_y \leq \sigma_{perm}$$

$$\sigma = \sigma_m + \frac{k_3 \cdot M}{\quad} \leq \sigma_{perm}$$

[redacted]

G7.3.2.4 19)

$$\sigma_F = \frac{1{,}85 \cdot F_x}{c^2} \leq \sigma_{perm}$$

G7.3.2.5 20)

G7.3.3 (G10)

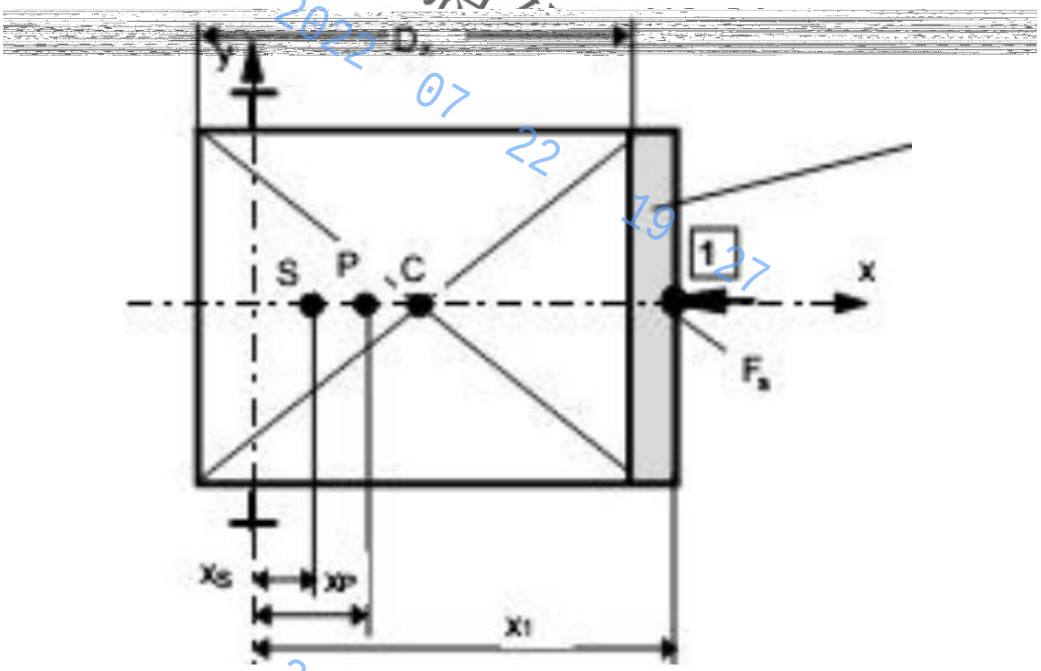
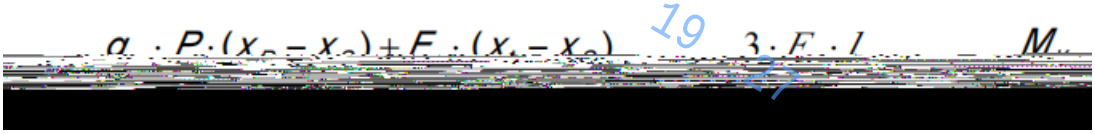


图 G10

G7.3.3.1

a) Y



b) X

Fy = 0

G7.3.3.2

〃 〃

G7.3.3.3 21)

$$\sigma_m = \sigma_y \leq \sigma_{perm}$$

$$\sigma = \sigma_m + \frac{k_3 \cdot M}{A} \leq \sigma_{perm}$$

G7.3.3.4

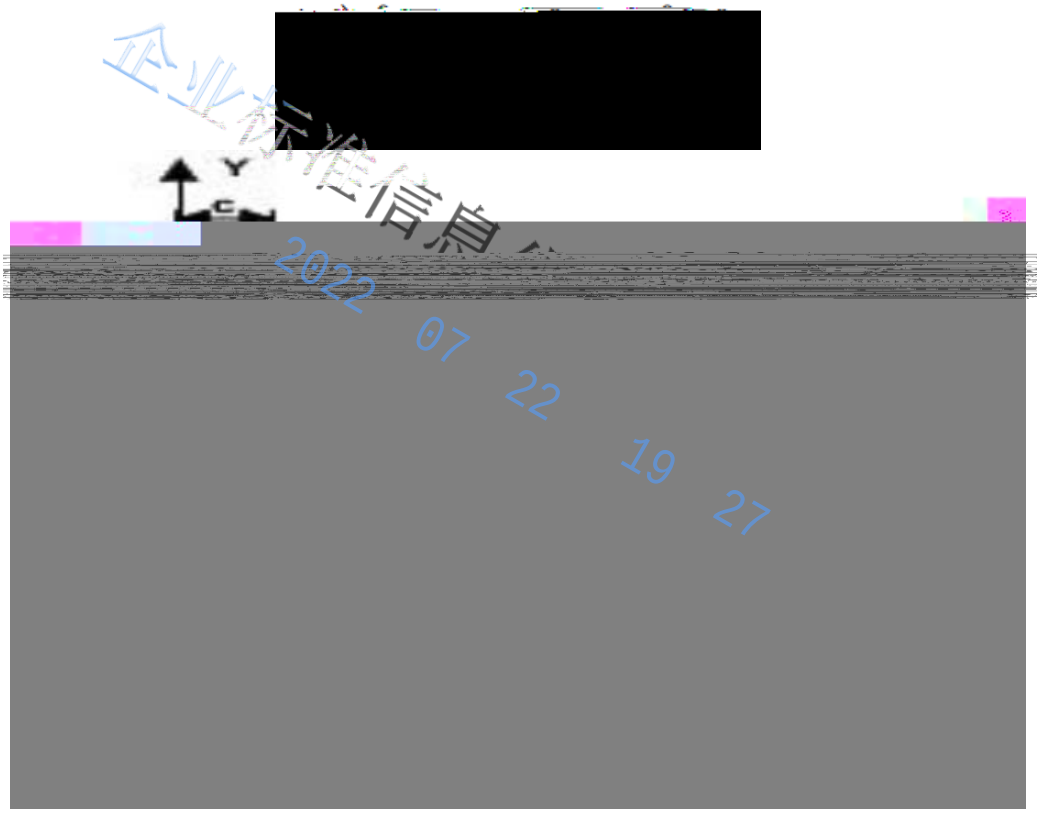
$$\sigma_F = \frac{1{,}85 \cdot F_x}{c^2} \leq \sigma_{perm}$$

G7.3.3.5

$$\delta_x = 0{,}7 \frac{F_x \cdot l^3}{48 \cdot E \cdot I_y} \leq \delta_{perm} \qquad \delta_y = 0$$

G7.4

Y (G12)



G7.4.1.2

$$F_k = \frac{k_1 \cdot g_n \cdot (P+Q)}{n}, \sigma_k = \frac{(F_k + k_3 \cdot M) \cdot \omega}{A}$$

G7.4.1.3 22)

$$\sigma_m = \sigma_x + \sigma_y \leq \sigma_{perm}$$

G7.4.1.4 23)

G7.4.1.5 24)

$$\delta_x = 0{,}7 \frac{F_x \cdot l^3}{[illegible]} \leq \delta_{perm},\quad \delta_y = 0{,}7 \frac{F_y \cdot l^3}{[illegible]} \leq \delta_{perm}$$

G7.4.2

G7.4.2.1

a) Y

[illegible]

b) X

[redacted]

X (G7.4.1.1)

Y (G7.4.1.1)

G7.4.2.2

“ ”

G7.4.2.3 25)

$$\sigma_m = \sigma_x + \sigma_y \leq \sigma_{perm}$$

[illegible]

G7.4.2.4 26)

$$\sigma_F = \frac{1{,}85 \cdot F_x}{c^2} \leq \sigma_{perm}$$

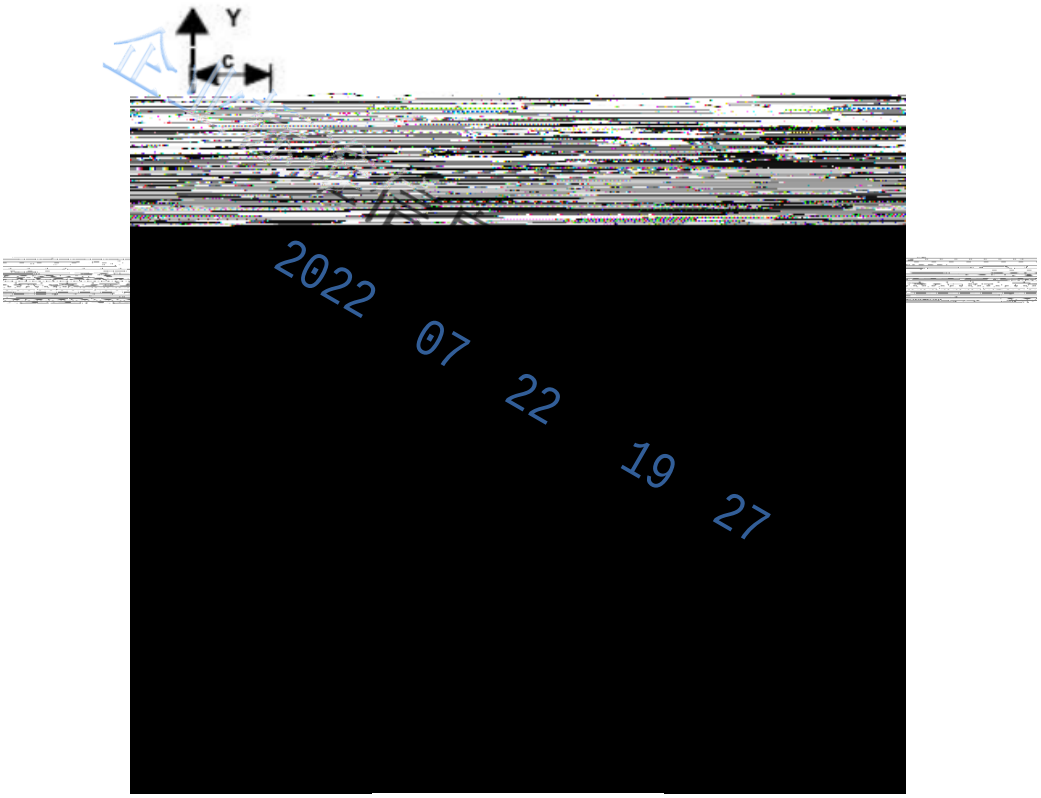
G7.4.2.5 27)

$$\delta_x = 0{,}7 \frac{F_x \cdot l^3}{48 \cdot E \cdot I_y} \leq \delta_{perm},\quad \delta_y = 0{,}7 \frac{F_y \cdot l^3}{48 \cdot E \cdot I_x} \leq \delta_{perm}$$

G7.4.3

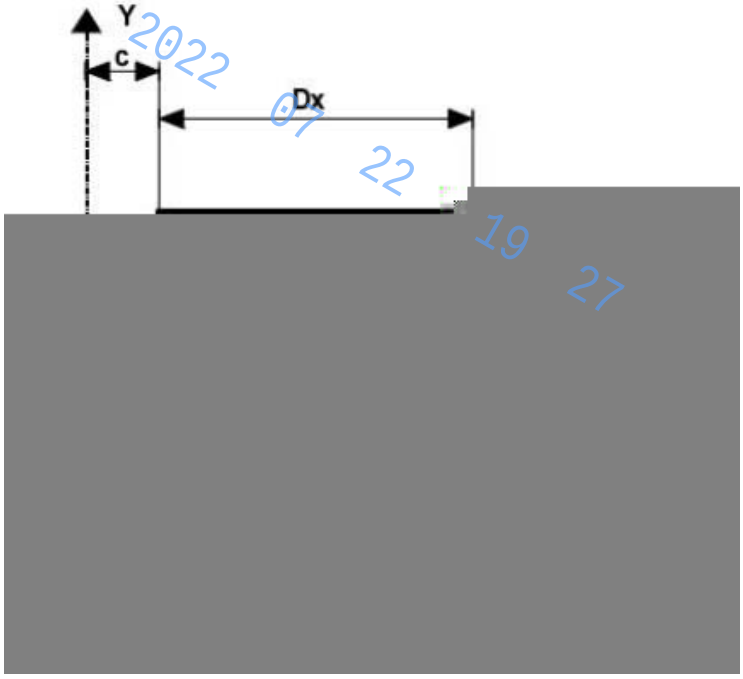
$x_P > 0 \quad y_P = 0$

$x_1 > 0 \quad y_1 = \frac{D_y}{2}$



$x_P > 0 \quad y_P = 0$

$x_2 > c + D_x \quad y_2 > 0$



G7.4.3.1

a) Y

$$F_x = \frac{g_n \cdot P \cdot x_P + F_s \cdot x_i}{n \cdot h}, \quad M_y = \frac{3 \cdot F_x \cdot l}{16}, \quad \sigma_y = \frac{M_y}{W_y}$$

b) X

$$F_y = \frac{F_s \cdot y_i}{\frac{n}{2} \cdot h}, \quad M_x = \frac{3 \cdot F_y \cdot l}{16}, \quad \sigma_x = \frac{M_x}{W_x}$$

G7.4.3.2

" "

G7.4.3.3

$$\sigma_m = \sigma_x + \sigma_y \leq \sigma_{perm}$$

$$\sigma = \sigma_m + \frac{k_3 \cdot M}{A} \leq \sigma_{perm}$$

G7.4.3.4

$$\sigma_F = \frac{1{,}85 \cdot F_x}{c^2} \leq \sigma_{perm}$$

G7.4.3.5

$$\delta_x = 0{,}7\frac{F_x \cdot l^3}{48 \cdot E \cdot I_x} \leq \delta_{perm} \quad \delta_y = 0{,}7\frac{F_y \cdot l^3}{48 \cdot E \cdot I_x} \leq \delta_{perm}$$

G7.5 — —

G7.5.1

G7.5.1.1

a) Y

$$\frac{k_1 \cdot g_n \cdot (Q \cdot x_Q + P \cdot x_P)}{\quad} \qquad \frac{3 \cdot F_x \cdot l}{\quad} \qquad \frac{M_x}{\quad}$$

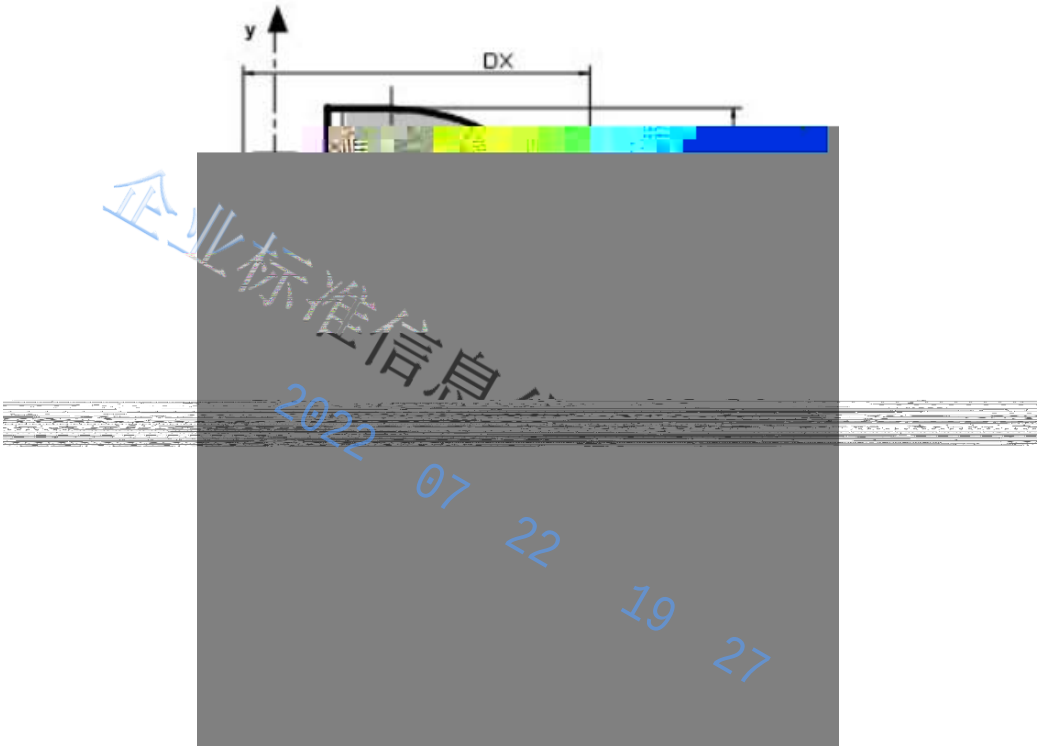
b) X

$$F_y = \frac{k_1 \cdot g_n \cdot (Q \cdot y_Q + P \cdot y_P)}{\frac{n}{2} \cdot h}, \quad M_x = \frac{3 \cdot F_y \cdot l}{16}, \quad \sigma_x = \frac{M_x}{W_x}$$

X (G15)

xQ 3/4

yQ 0



Y (G16)

xQ yQ 3/4

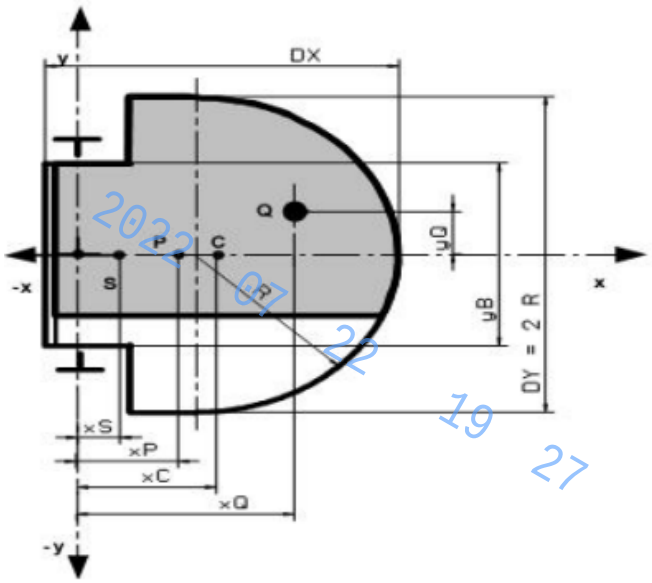


图 G16

G7.5.1.2

G7.5.1.3 29)

$$\sigma_m = \sigma_x + \sigma_y \qquad \leq \sigma_{perm}$$

$$\sigma = \sigma_m + \frac{F_k + k_3 \cdot M}{A} \leq \sigma_{perm}$$

$$\sigma_c = \sigma_k + 0{,}9 \cdot \sigma_m \leq \sigma_{perm}$$

G7.5.1.4 30)

$$\sigma_F = \frac{1{,}85 \cdot F_x}{c^2} \leq \sigma_{perm}$$

G7.5.1.5 31)

$$\delta_x = 0{,}7 \frac{F_x \cdot l^3}{48 \cdot E \cdot I_y} \leq \delta_{perm} \quad \delta_y = 0{,}7 \frac{F_y \cdot l^3}{48 \cdot E \cdot I_x} \leq \delta_{perm}$$

G7.5.2

G7.5.2.1

a) Y

[redacted]

b) X

[redacted]

X (G7.5.1.1)

Y (G7.5.1.1)

G7.5.2.2

" "

G7.5.2.3 32)

$$\sigma_m = \sigma_x + \sigma_y \leq \sigma_{perm}$$

$$\frac{k_3 \cdot M}{}$$

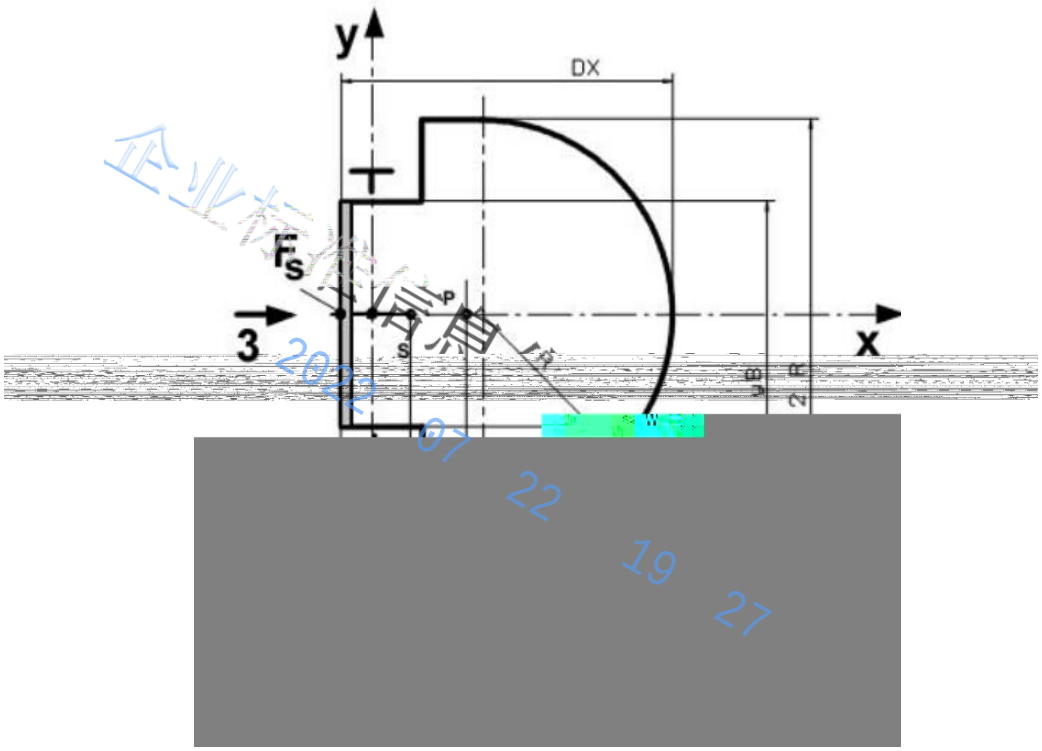
G7.5.2.4 33)

$$\sigma_F = \frac{1{,}85 \cdot F_x}{c^2} \leq \sigma_{perm}$$

G7.5.2.5 34)

$$\delta_x = 0{,}7 \frac{F_x \cdot l^3}{48 \cdot E \cdot I_y} \leq \delta_{perm} \quad \delta_y = 0{,}7 \frac{F_y \cdot l^3}{48 \cdot E \cdot I_x} \leq \delta_{perm}$$

G7.5.3 (G17)



G7.5.3.1

a) Y

$$F_x = \frac{g_n \cdot P \cdot (x_P - x_S) - F_s \cdot (x_i + x_S)}{n \cdot h}, \quad M_y = \frac{3 \cdot F_x \cdot l}{16}, \quad \sigma_y = \frac{M_y}{W_y}$$

b) X

Fy = 0

G7.5.3.2

" "

G7.5.3.3

$$\sigma_m = \sigma_y \leq \sigma_{perm}$$

$$k_3 \cdot M$$

G7.5.3.4 35)

$$\sigma_F = \frac{1{,}85 \cdot F_x}{c^2} \leq \sigma_{perm}$$

G7.5.3.5

$$\delta_x = 0{,}7 \frac{F_x \cdot l^3}{48 \cdot E \cdot I_y} \leq \delta_{perm}, \ \delta_y = 0$$

H

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14.1.1.1 14.1.1.1

H1 14.1.1.1e)

— — “ ”

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— — H1 3.1 3.6

— —

14.1.2.4

— — GB/T 16856 14.1.2.3

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— — GB 16895.3

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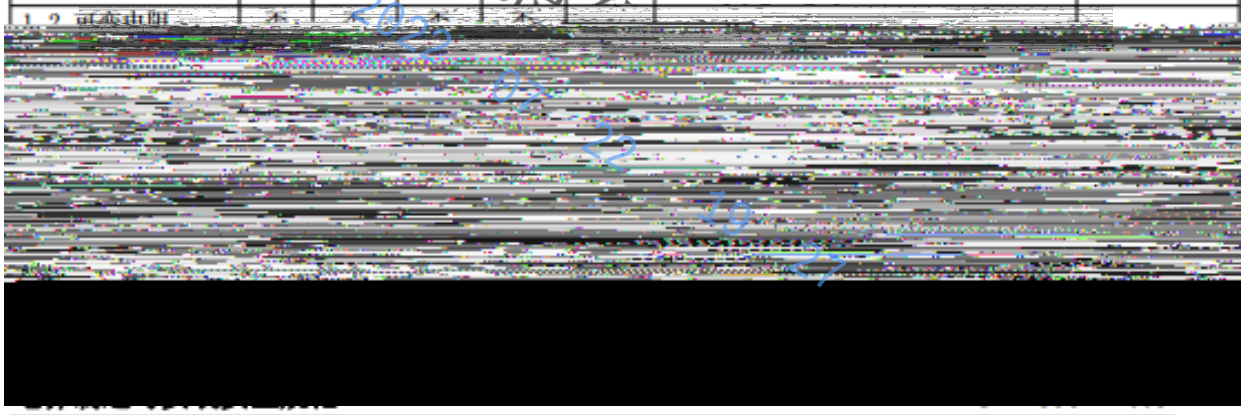
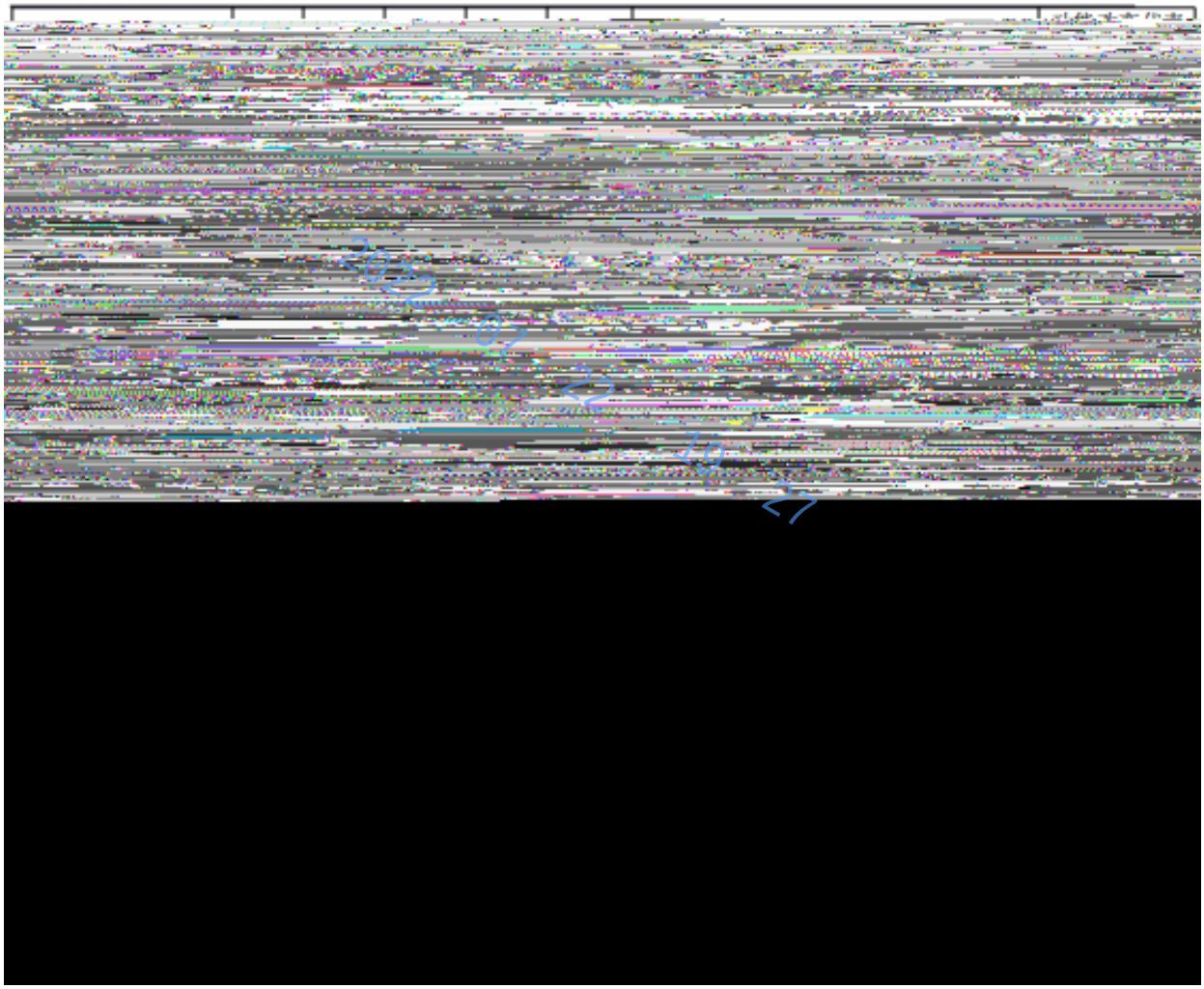
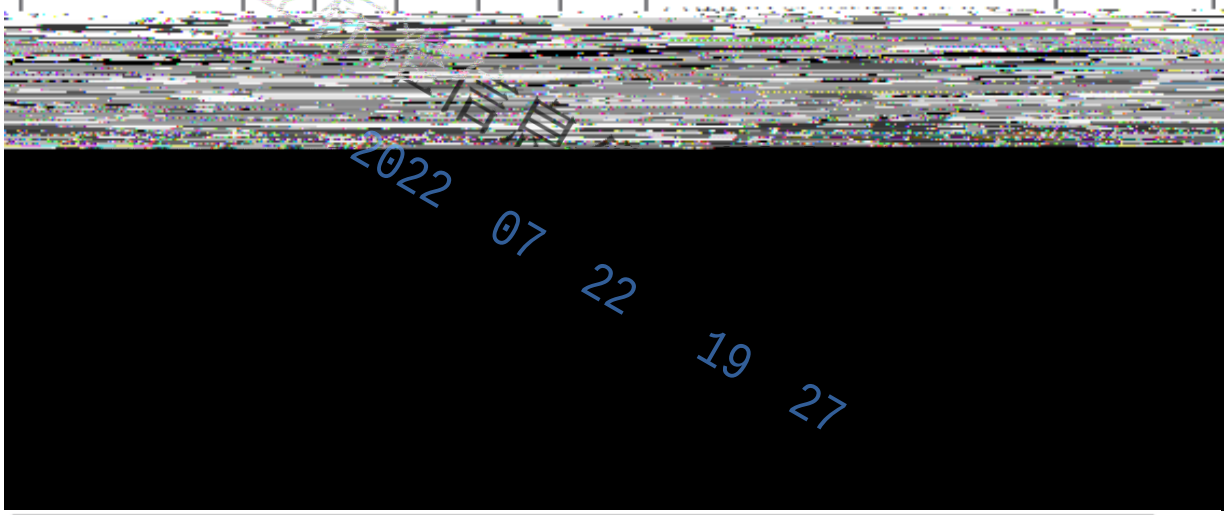
元　　件	可排除故障					条　　件	备　注
	断路	短路	改变为更高值	改变为更低值	改变功能		
1 无源元件							
1.1 定值电阻	否	(a)	否	(a)		(a)对根据国家标准进行轴向连接，且由涂漆或封闭处理的电阻膜制成的薄膜电阻器和由漆包线封闭保护的单层绕制的线绕电阻器	
1.2 可变电阻	否		否				

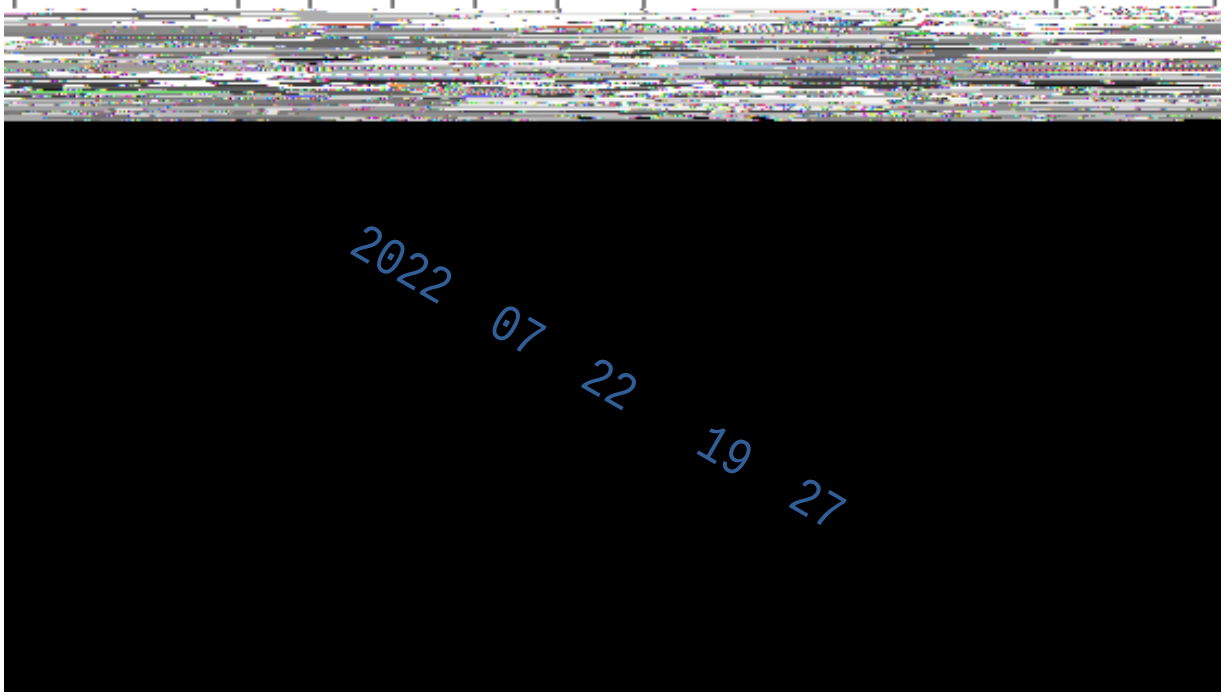


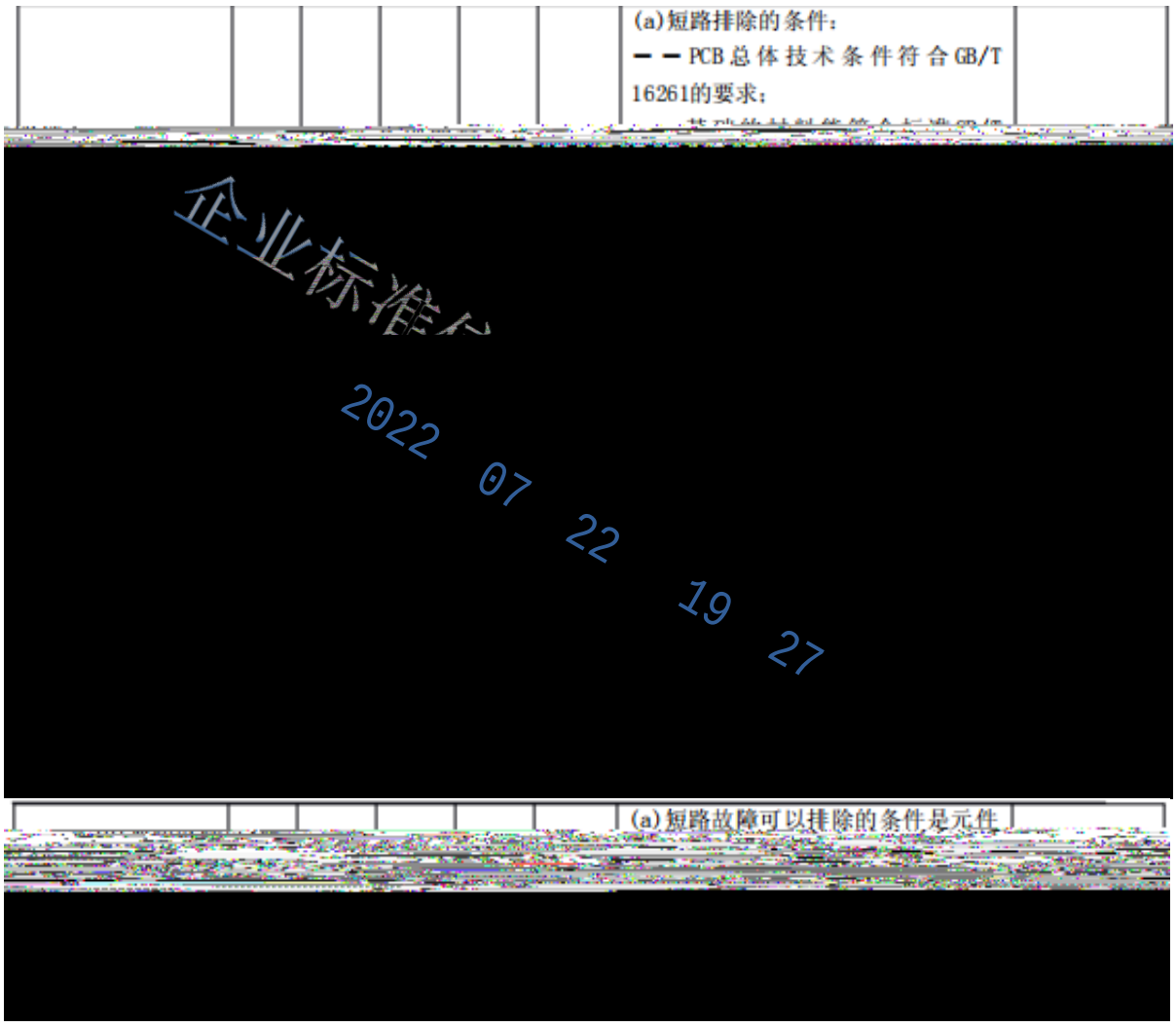


2.5 混合电路	否	否	否	否	否		
2.6 集成电路	否	否	否	否	否		功能改变成振荡，与门变成或门等
3 其他元件							



							短路包括初级




(a)短路排除的条件：
——PCB总体技术条件符合GB/T 16261的要求；
企业标准
2022 07 22 19 27
(a)短路故障可以排除的条件是元件
2022 07 22 19 27

J

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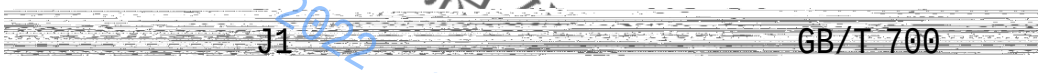
J1

7.2.3.1 8.3.2.1 8.6.7.1

J2

J2.1



J1 GB/T 700 Q235A GB/T 700 Q275 (3.5±0.25)mm (10±0.01)kg

J2.2

J2 (3.5±1)mm (45±0.5)kg

J2.3

3mm

15mm

（ ） 1.5m

J2.4

J4.2 J4.3

J3

（ ）

（ ）

J4

J4.1 (23±2)
4h
J4.2 J2.1 500mm(J3)

J4.3 J2.2
a) 800 mm J3
b) 700 mm J3
J4.4
1.0±0.1 m 7.2.3.8
J3

J4.5 J2.1 J2.2

J5
J5.1
a)
b)
c)
d)
e)
f) 2 mm

J5.2
a)
b)
c)

J6

a)
b)
c)
d)
e)
f)
g)

J7

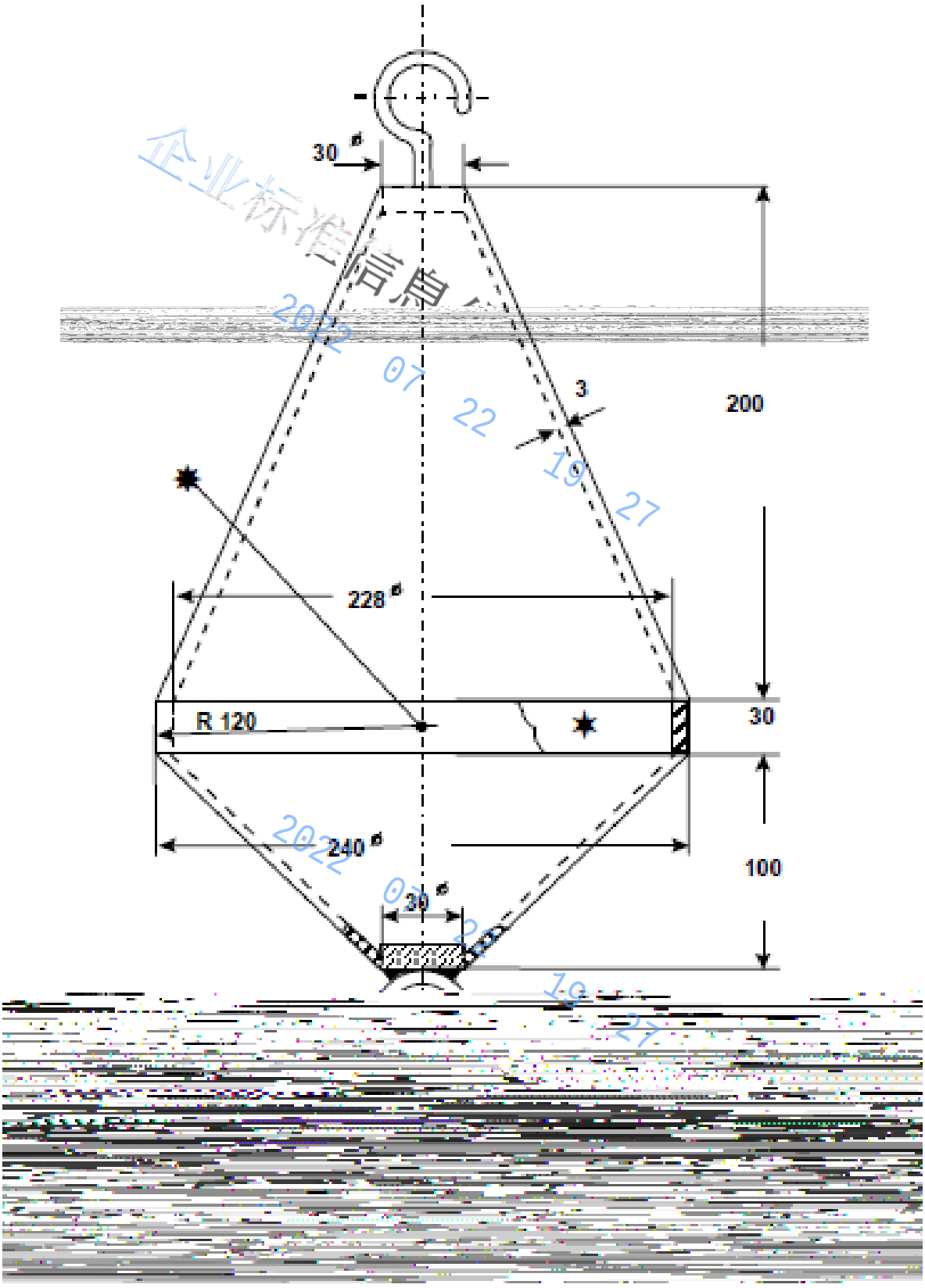
J1 J2

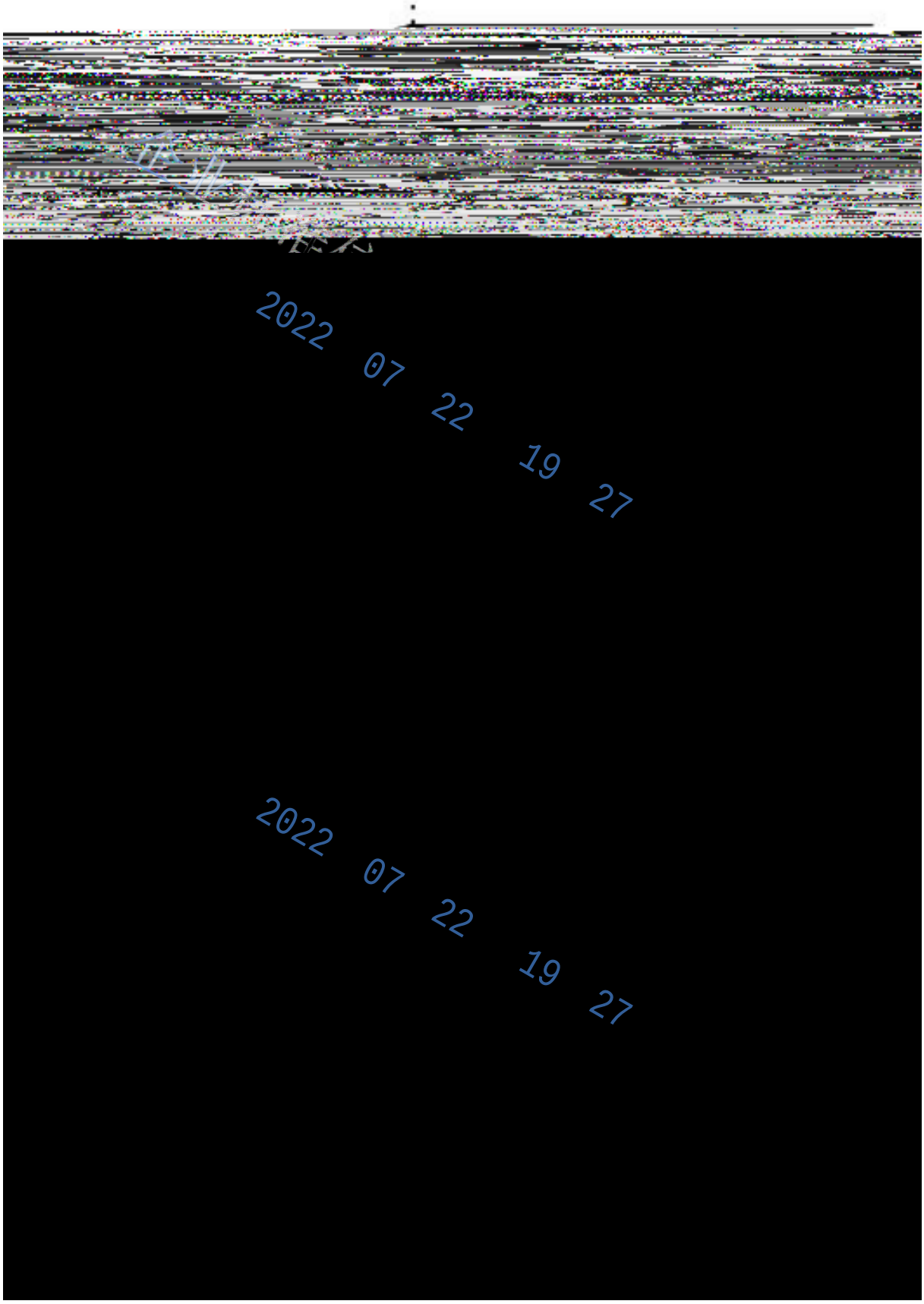
J1

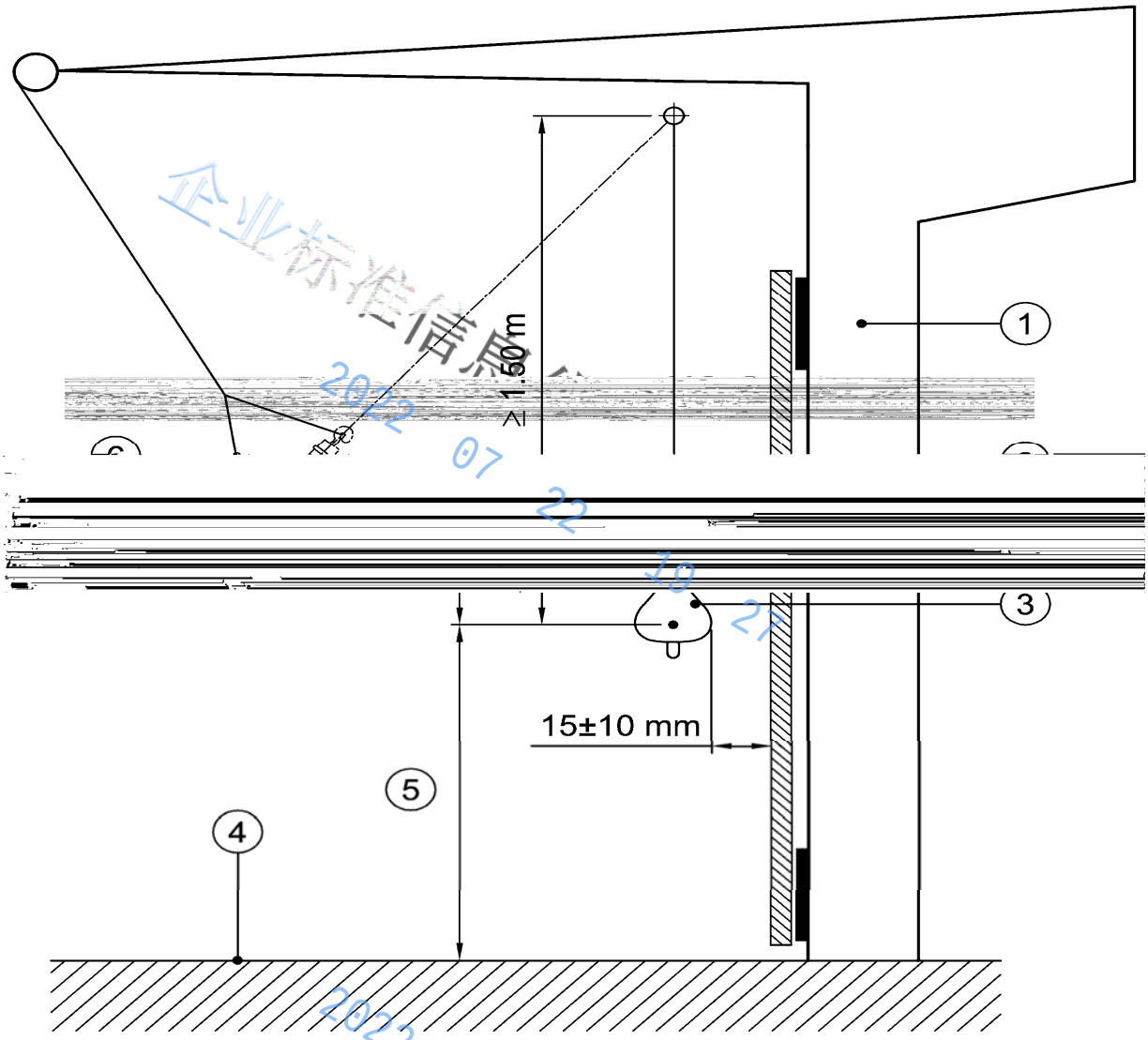
	1m	2m
	mm	mm
	8 4+0.76+4	10 5+0.76+5
	10 5+0.76+5	12 6+0.76+6

J2

	mm	mm	m	
	16 8+0.76+8	360~720	2.1	
	16 8+0.76+8	300~720	2.1	
	10 6+0.76+4 5+0.76+5	300~870	2.1	




2022 07 22 19 27
2022 07 22 19 27



H— —

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— — 1m 7.2.3.8

— — J2.4

J3

K

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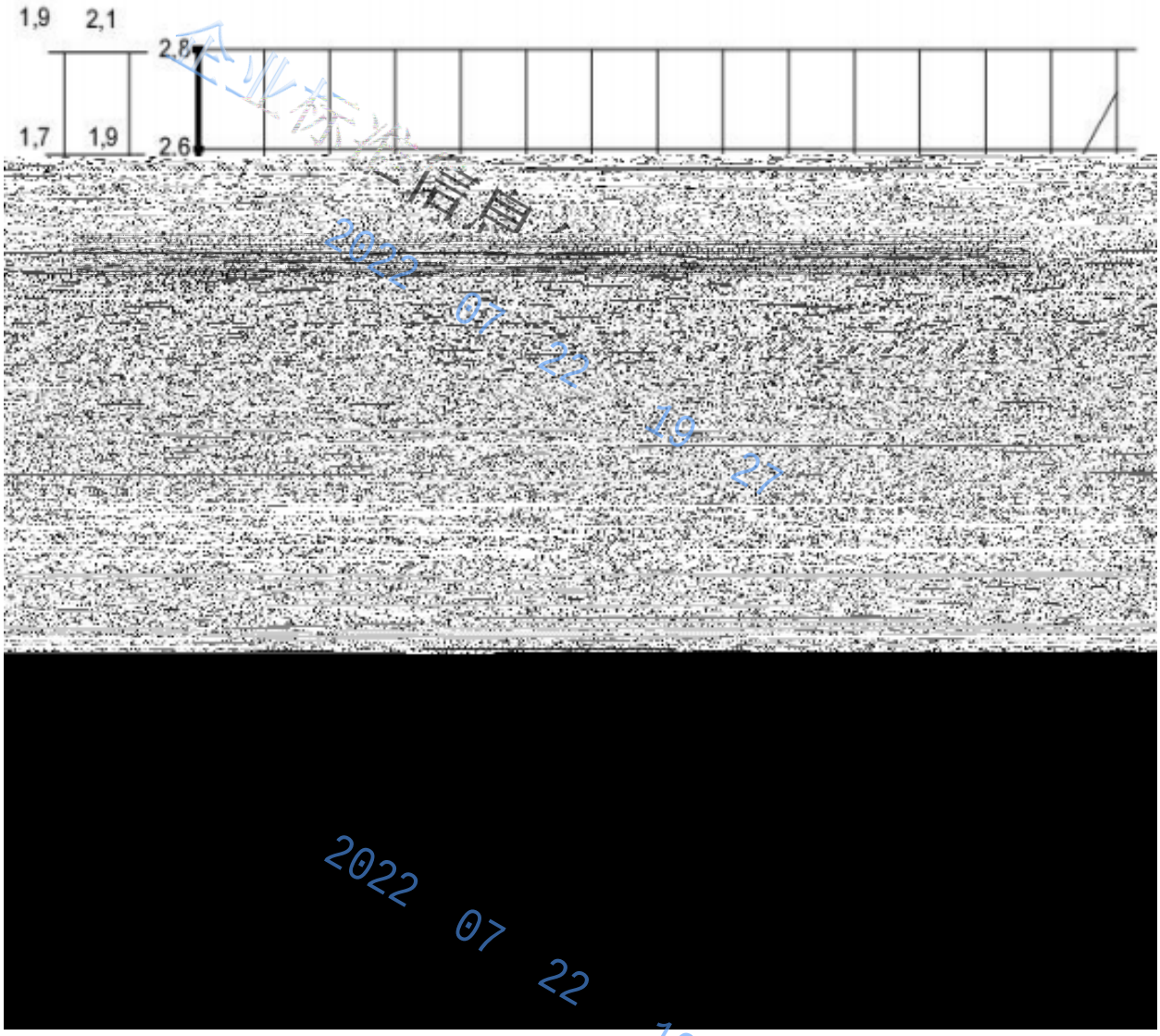


υ — — m/s

H— — m

*

5.7.3.1

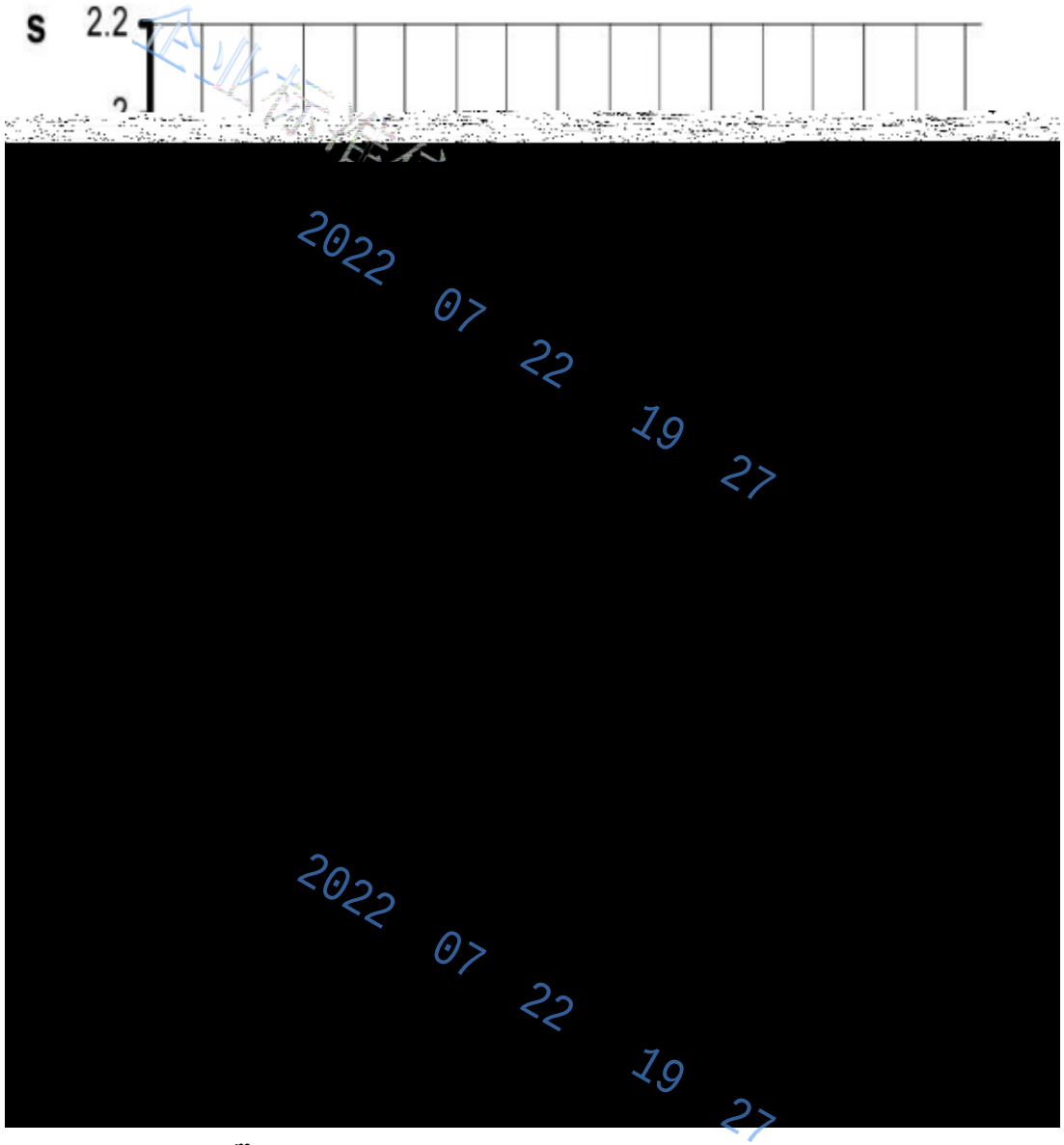
** 5.7.1.4

3.5m/s

K1 (5.7.1)

L

( )



S— — m

υ — — m/s

(10.4.1.1) ( )

(10.4.3.1)

50% [10.4.3.2a]] 1/3

[10.4.3.2b]]

10.4.3

L1 (10.4)

M

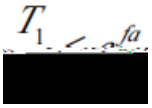
（ ）

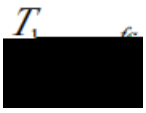
M1

a）
b）
c）

a）
b）
c）
d）

M2





（ ）

f——

a——

T1 T2——

M2.1 T1 T2

M2.1.1

T1/T2 125%

1.25 8.2.2 8.2.2

M2.1.2

T1/T2

a) 0.5m/s2

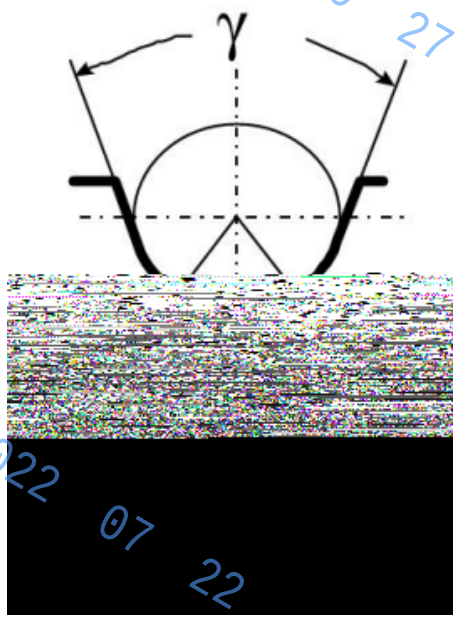
b) 0.8 m/s2

M2.1.3

T1/T2

M2.2

M2.2.1



$$f = \mu \cdot \frac{4\left(\cos\frac{\gamma}{2} - \sin\frac{\beta}{2}\right)}{\pi - \beta - \gamma - \sin\beta + \sin\gamma}$$

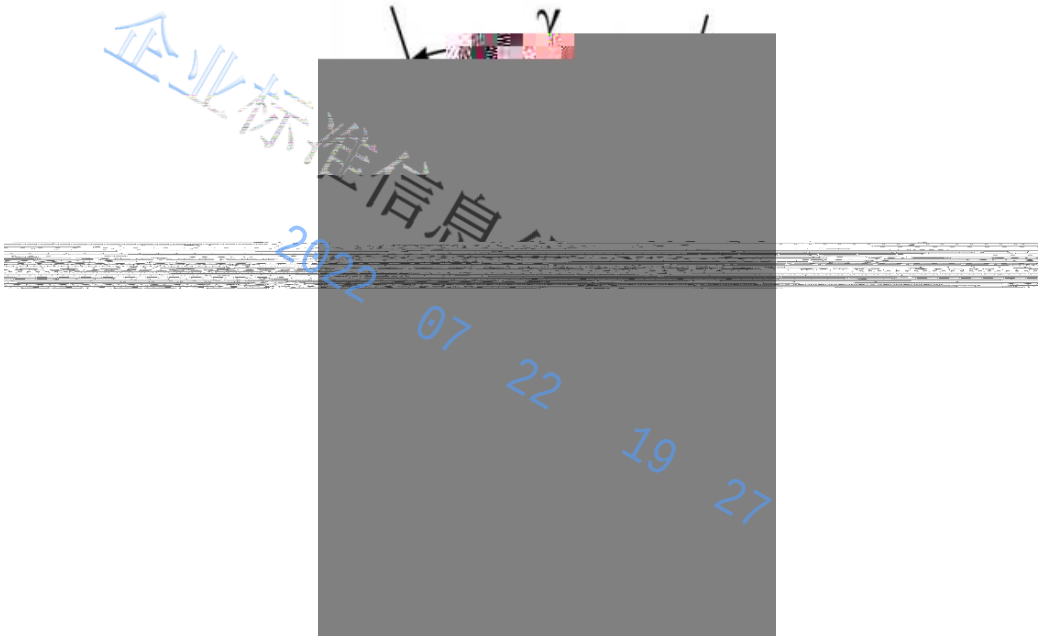
β — —

γ — —

μ — —

β 1060(1.83) 80%

γ 250(0.43
)
M2.2.1.2 V



— —

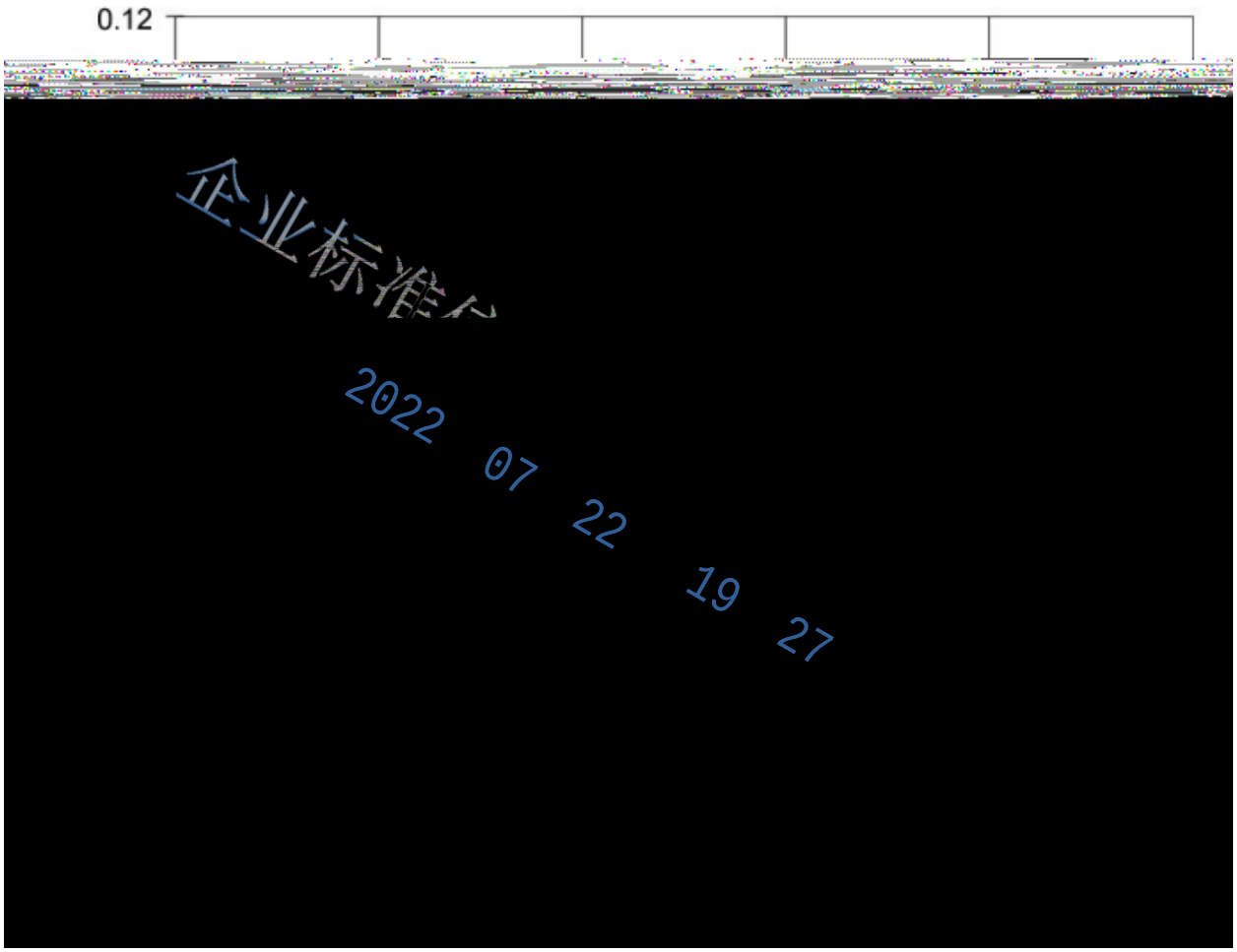
$$f = \mu \cdot \frac{4\left(1-\sin\frac{\beta}{2}\right)}{\pi-\beta-\sin\beta}$$ ，对于未经硬化处理的槽；

$$f = \mu \cdot \frac{1}{\sin\frac{\gamma}{2}}$$ ，对于经硬化处理的槽；

——轿厢滞留的工况：

β 1060(1.83) 80%

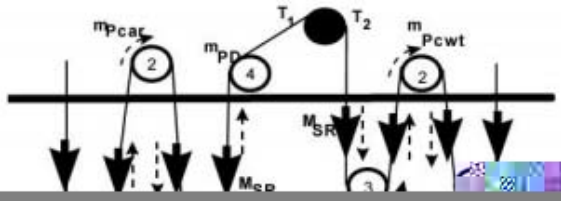
γ 350
M2.2.2



— —
μ = 0,2

υ — —
M3

m/s



— —
— —
— — 1
— —
— — 1

mPcar — — Jpcar/R2 kg
mPcwt — — JPcwt/R2 kg
mPTD — — (2)JPTD/R2 kg
mDP — — JDP/R2 kg

ns——

nc——（）

nt——

P——（）（）

kg

Q——kg

Mcwt——kg

MSR——[(0.5H±y)×ns×] kg

MSRcar——MSR

MSRcwt——MSR

MCR——（）[(0.5H±y) ×nc×] kg

MCRcar——MCR

MCRcwt——MCR

MTrav——[(0.25H±0.5y) ×nt×]

Mcomp——kg

FRcar——（）N

FRcwt——（）N

H——m

y——H/2 m

T1 T2——N

r——

α——（）m/s2

gn——m/s2

iPcar——（）

iPcwt——（）

→——

→——

f——

a——

N
（ ）

N1

9.2.2 St

a) （ ）
b)
c)

N2 Nequiv

（U V ）

5% 6%

Nequiv

Nequiv = Nequiv(t) + Nequiv(p)

Nequiv(t)— —
Nequiv(p)— —

N2.1 Nequiv(t)

Nequiv(t) N1 U Nequiv(t) 1

表 N1

N2.2 Nequiv(p)

200

$$N_{equiv(p)} = K_P \cdot (N_{ps} + 4 \cdot N_{pr})$$

Nps— —
Npr— —
Kp— —

Dt — —

Dp — —

N3

Dt/dr

N4

Nequiv N2

例 1.

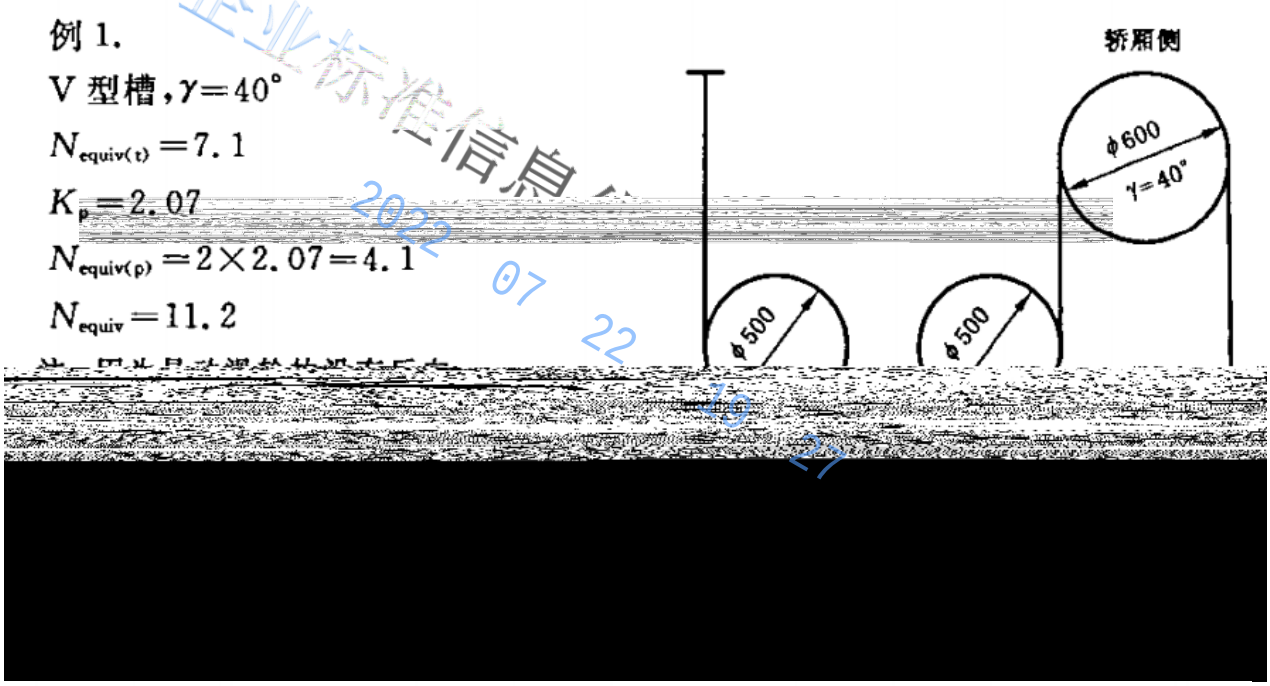
V 型槽，$\gamma=40°$

$N_{equiv(t)}=7.1$

$K_p=2.07$

$N_{equiv(p)}=2\times2.07=4.1$

$N_{equiv}=11.2$



例 2.

V 型带切口槽

$\gamma=40°$

$\beta=90°$

$N_{equiv(t)}=5.0$

$K_p=5.06$