( )

1

2

3

( )

( )

( )

( )

1%

Ca( ) Na CO =Na( ) CaCO

1 1.05 1000ml (
2.20g/cm)

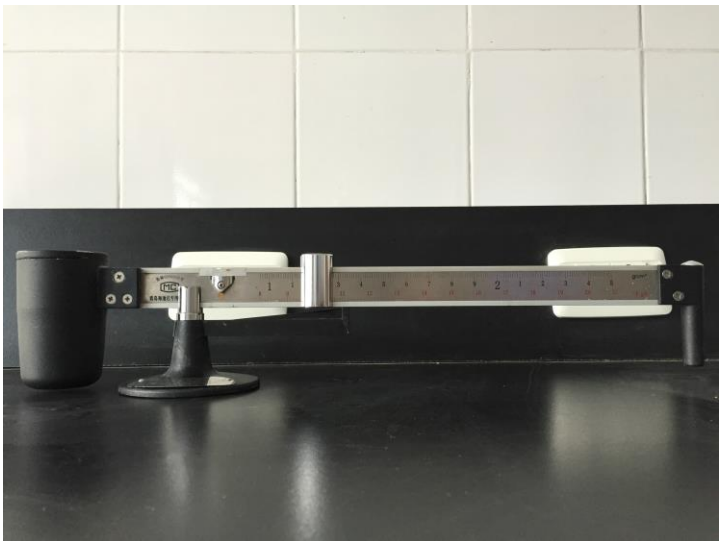
m_c kg

ρ_c g/cm

ρ_m g/cm

V_m L

$V_w \quad V_m \rho_m$



1-2 ZNB

1.

( )

( ) 1.00g/cm

(³ ´ 1.00 û

)

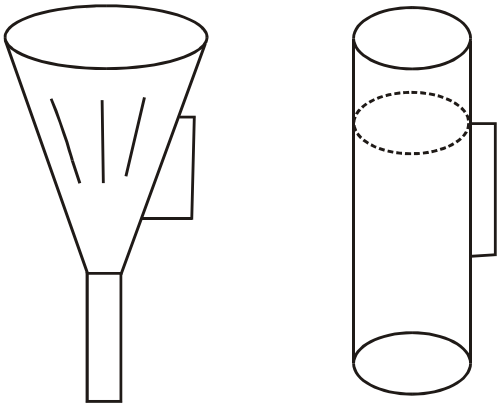
2.

( )

API 1500ml 946ml ( )

( ) 26±0.5 700ml (

2) 500ml ( )



2-1 ZNN

2-2 ZNN

1.

500ml

200ml 500ml

(500ml)

(15±0.5)

2. 700ml

500ml

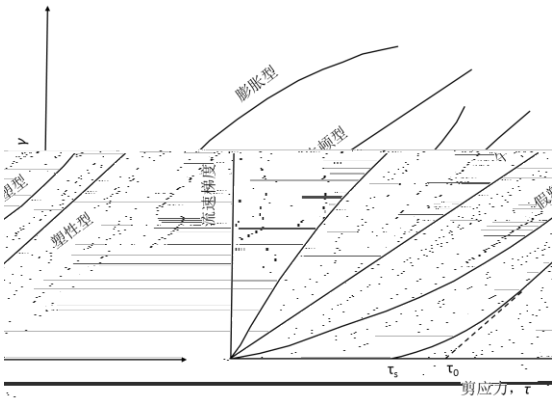
( )

( ) ZNN-D6

3 ZNN-D6

(3)

( )



4

1.

2.

(220V 50Hz) (5)

95

3.

6 3 ´

200 6 600 r/min 3 ´

100 3 300 r/min

5

6

300 600

0 0 0

(350ml)

(1.3cm)

600 (300 /) 600 2 300 1

( )

600 1

3 3

a. 600 1 1 10s 3

b. 600 1 10 3

4.

A (1)

r/min	600	300	200	100	6	3
s	1022	511	340	170	10	5

B.

μ_a θ_{600} /2 *mPa·s*

C.

μ_a θ_{600} /2 *mPa·s*

μ_p θ_{600} θ_{300} *mPa·s*

2 0.511 θ_{300} μ_p *Pa*

2 0.511θ_3 (1) *Pa*

2 0.511θ_3 (10) *Pa*

D.

( )

Pa·s^n

350ml

600 / 1

( )

1. 800ml 20

2. 800ml 20

?

1.

	!	*g/cm³*	±0.05			
	T	*s*	±0.5			
	3					
	2s1	*Pa*				
	3					
	2s10	*Pa*				
				û		

1	**/** ***r/min***		600	300	200	100	6	3
2	***s-1***		1022	511	340	170	10	5
3					**/**	/	/	/
4								

5	2=0.511 ***Pa***						
6	2= 2+ ***Pa***						
7	2=***K*** ***Pa***						
8	2=[2+]2 ***Pa***						
9	= 2+***K*** ***Pa***						
10	2=0.511(2 -) ***Pa***						
11	0.001( ) 3 D ‡ V						
12	***n***=3.322lg(/)						
13	***K***=(0.511)/511 ***Pa·s***						
14	2=0.493[(6)-] ***Pa***						
15	=1.195×10-3(-) ***Pa s***						
16	2=0.511 3 ***Pa***						
17	***n*** =3.322lg - 3 / - 3						
18	***K*** = 0.511 - 3)/511 ***Pa·s***						

2. 6 7 8 9 10 11 12 13
14 2 4 16 17 18 5 6 7 8 9
-

3. 2 5

( ) 3 /

4. 6 7 8 9
-

5.

(1) 700 300 100
50

(2)

(3) ?

(4) ?

(5) ?

(6)

(7)

(8) ?

API

W/C

W/C W C

W C API

1 API

	A	B	C	D	E	F	G	H
g/cm^3	1.87	1.87	1.78	1.97	1.96			

1.00

20

3

(2)

2

API

2

a.

1/4 6.4

.

c.

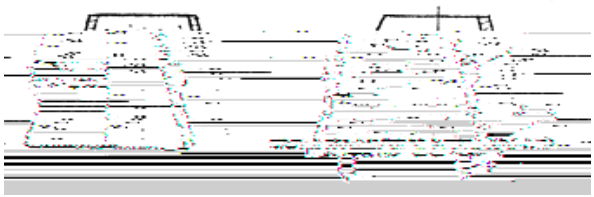
d.

50 225

e.

f.

(cm) 3



3

3

20

( )

4 ZNN-D6

ZNN-D6

1.

2.

(220V 50Hz) (5)

95

3.

ZNN-D6 600 300 200 100 6 3

1

300 200 100

300 200 100 6 3

300

1

300 / 300 /

60 20

4.

1

F F 300 200 100 /

$$F = \frac{T_{200} - T_{100}}{T_{300} - T_{100}}$$

F=0.5±0.03

2

$$\begin{cases} K_P = 0.0015(T_{300} - T_{100}) \\ W_0 = 0.511T_{300} - 511K_P \end{cases}$$

3

$$\begin{cases} n = 2.0922\lg(\frac{T_{300}}{T_{100}}) \\ K = \frac{0.5111T_{300}}{511^n} \end{cases}$$

K_P (*Pa.s*)

W_0 *Pa*

(*Pa.s*^{n})

T_{300} 300

T_{200} 200

T_{100} 100

3

50 1.1±0.04

40 65±0.5 75 300±2

5

20 ,

(80) (40min)

1.0

1.0

20 1min

250

23±1 0 250 232

250 2

250ml

%

1

6

3±0.07 76.8±1.8 2.5

63.5

7.1 4580 ^{2}

325 60

6 OWC-9508D

a. API 20 27 20

b.

c. 3/4 19

d. 100 700

e. 1/4 1/2 1 2 5

30 30

$$Q_{30} \quad Q_t \, \mathrm{u} \, \frac{5.47}{\sqrt{t}}$$

Q_{30} ----30 /30

Q_t 2 2

t -----

f.

2

2.130±0.005 54.1±0.01

2.5 (63.5) 8.5 215.9 3.5

2258 2

194° 90

a.

b. 20

c. 3/4 19

d. 100 700

15 1000 2 6900

e.

2

f.

194°F(90) 250°F(121)

a. 194°F 90

b. API

c.

d. 2

e. 10

f.

1

1:5 160×40×40

$$F \quad \frac{3PKL}{2bh^2}$$

:

F 2

L ----

h

2

2580 2

1/4

a.

b.

API

BHCT BHCT

60

c. 2.0°F 1.1

TCCT 194°F 90

$$T \quad \frac{BHTT \quad TCCT}{2.0^{\circ}F(1.1^{\circ}C)}$$

d.

e.

25

f.

[TCST±3°F ±] [3000±500 2 2700±3400

] 45 60

200°F 93 45

80°F 27 35

g

24 48 72

h

j 400

2 16000 71.7 500 2 3.5

1000 2 4000 17.9

k [2580 2]

2.00 50.8 1/16 1.6

0.1

1.

	!	*g/cm*^{3}						
		mm						

1	/ ***r/min***		300	200	100	6	3
2	***s*$^{-1}$**		511	340	170	10	5
3			/	/	/	/	/
4							
5	2 =0.511 ***Pa***						
6	2 = 2 + $_p$ ***Pa***						
7	2 = . ^{n} ***Pa***						
8	2=0.511 $_{300}$-511 $_p$ ***Pa***						
9	$_p$						

$$N_{\mathrm{Re}} \quad \frac{12 \,\mathrm{u}\, 10^{3}\, U \mathrm{u} V^{2\ n} (D_{2} \quad D_{1})^{n}}{1200^{n} K (\frac{2n \quad 1}{3n})^{n}}$$

V ---- (V =1.2m/s)

U ---- g/cm^3

D_2 --- (cm) D_2 =215mm

D_1 ---- (cm) D_1=154.8mm

$K_{P\ 2\ 2}$ Pa.s

W_0

( )

1 PDC

2

3 PDC PDC

PDC

1.

PDC

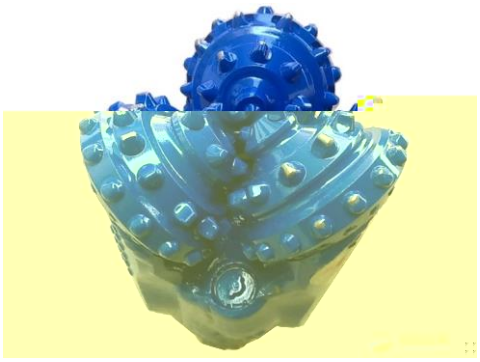
1 2

PDC

,

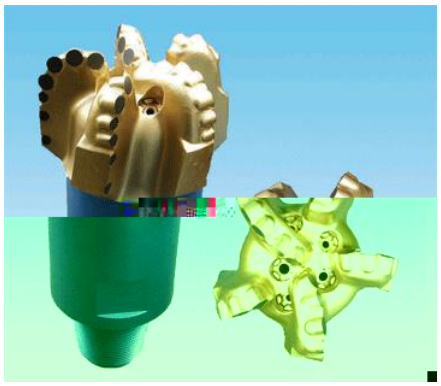
PDC

3



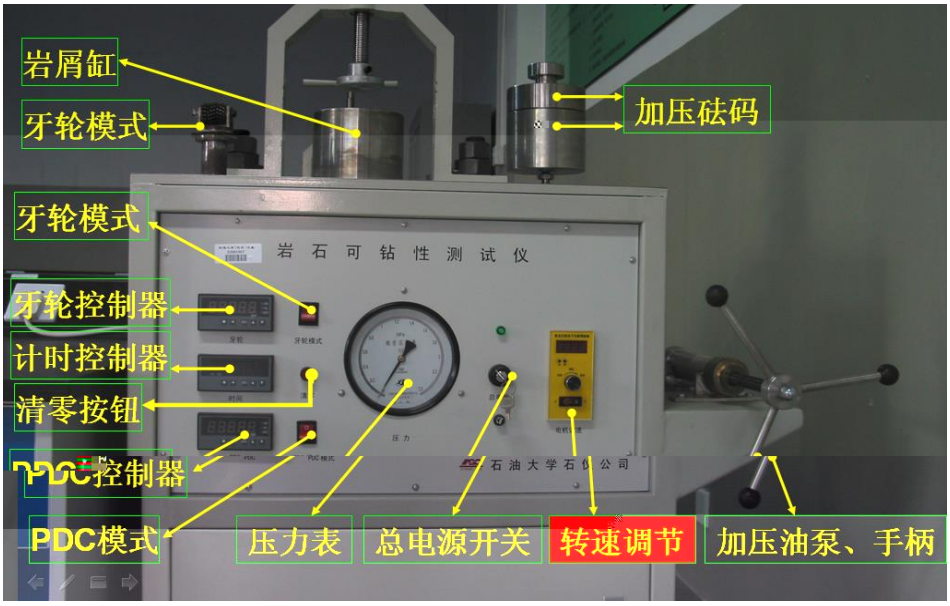
1-1

1-2



2-1 PDC

2-2 PDC



3

2.

1MPa PDC 0.8MPa

3 ´

3.

2 PDC 1

1MPa PDC 0.8MPa

PDC

S mm

1.

2.

3.

4. PDC

5.