



()
dipark007@hanmail.net



2000 ()
85 ,
가 5 4165 0.16%

(Severe Acute Respiratory Syndrome, SARS),
(Avian Influenza, AI),
(Pandemic Influenza, PI),

2007 87.1%
2008 87.9%, 2009 95.5% 가 ,
가

2009 (Pandemic Influenza, PI) 가

BIO CLEAN ROOM(BCR)

BCR
GMP(Good Manufacturing Practice),
GLP(Good Laboratory Practice),
HACCP(Hazard Analysis Critical Control Points)

2009 가 10 가

가

(Nosocomial Infection)

1966

2000

. 19

가

, 2

가

가

SOP

(NASA) [2]

(Standard Operating Procedure)가

HEPA

Filter

가

2.1 BIO CLEAN ROOM

[3]

ICR BCR

(FED-STD-209E)

(1) ICR(Industrial Clean Room)

가

(2) BCR(Bio Clean Room)

2.2 HEPA Filter

BCR

[2] NHB 5340.2()

[1] 5 ()

(: EA/ff³)

| | | | (%) |
|--------------------|--------|-------|------|
| Clean | 18,090 | 329 | 1.8 |
| Clean-Contaminated | 4,106 | 367 | 8.9 |
| Contaminated | 770 | 166 | 21.5 |
| Dirty | 683 | 262 | 38.3 |
| Total | 23,649 | 1,124 | 4.8 |

| Class | 1ff ³ 0.5 μ m | 1ff ³ 5.0 μ m | 1ff ³ | 1 1ff ³ |
|---------|---------------------------------|---------------------------------|------------------|-----------------------|
| 100 | 100 | | 0.1 | 1,200 |
| 10,000 | 10,000 | 65 | 0.5 | 6,000 |
| 100,000 | 100,000 | 700 | 2.5 | 30,000 |

[3] FED-STD-209E()
(: EA/ft³)

| CLASS | 0.1μm | 0.2μm | 0.3μm | 0.5μm | 5.0μm |
|---------|-------|-------|-------|---------|-------|
| 1 | 35 | 7.5 | 3 | 1 | |
| 10 | 350 | 75 | 30 | 10 | |
| 100 | | 750 | 300 | 100 | |
| 1,000 | | | | 1,000 | 7 |
| 10,000 | | | | 10,000 | 70 |
| 100,000 | | | | 100,000 | 700 |

HEPA Filter(High Efficiency Particulate Air Filter) . HEPA Filter D.O.P

0.3μm

99.97%

HEPA Filter

가 0.3μm

0.3μm

. ICR

D.O.P 0.1μm

99.99997%

ULPA Filter

BCR

HEPA Filter

가 .
1 Pre

Filter(AFI 40~80%), 2 Medium Filter(NBS 80~90%)

Filter

HEPA

2.3

(BMT ; Bone Marrow Transplantation)

가 Air Balance

가

가

$$C_R = C_{EA} = C_{RA}, \quad Q_{EA} = Q_{OA}$$

$$C_{SA}Q_{SA} = [C_{OA}Q_{OA} + C_{RA}Q_{RA}] (1 - CR)$$

$$[C_{OA}Q_{OA} + C_{RA}Q_{RA}] (1 - CR) + G = C_R Q_{EA} + C_R Q_R$$

$$CR = \frac{G + C_{OA}Q_{OA}(1 - CR)}{Q_{RA} + Q_{OA}}$$

- , C : [mg/h]
 G : [mg/m³]
 Q : [m³/h]
 : [%]

2.4

가

가

가

2.5

가

가

가 가

CLASS 100,000

HEPA Filter가

[4]

0.5mmAq

1.5mmAq

CLASS 100,

A CLASS 10,000,

B CLASS 100,000

가

$$Q = A \times C_v \times 3600 \times \sqrt{\frac{2 \times g \times P}{\rho}} \quad [m^3/h]$$

- , A : [m²]
 C_v :
 g : 가 [m/s²]
 P : [mmAq]
 : [kg/m³]

가 9.8m/s²,

1.2

kg/m³,

0.5

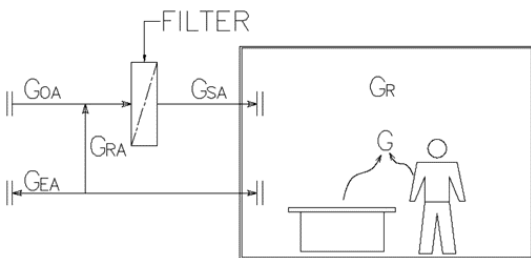
1,500×2,200

$$= (1.5+2.2) \times 2 \times 0.005 = 0.037m^3$$

$$G_{SA} + G = G_{EA} + G_R$$

$$, G = CQ$$

$$C_{SA}Q_{SA} + G = C_{EA}Q_{EA} + C_RQ_R$$



[1]

SYSTEM

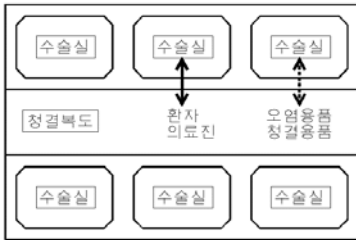
$$Q = 0.037 \times 0.5 \times 3600 \times \sqrt{\frac{2 \times 9.8 \times 1.5}{1.2}} = 329 \text{ m}^3/\text{h}$$

-329

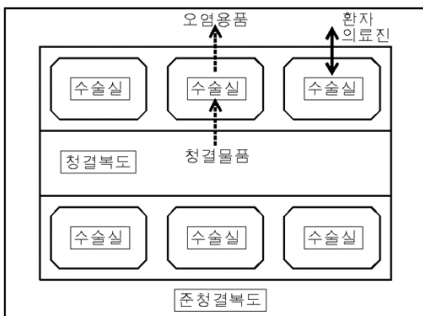
가 1.5mmAq

3.1

(1) (Layout)



[2]



[3]

가

(2)

HCU

HFU

HEPA Filter가

HFU

, HCU

HEPA Filter

Fan

(3)

HCU

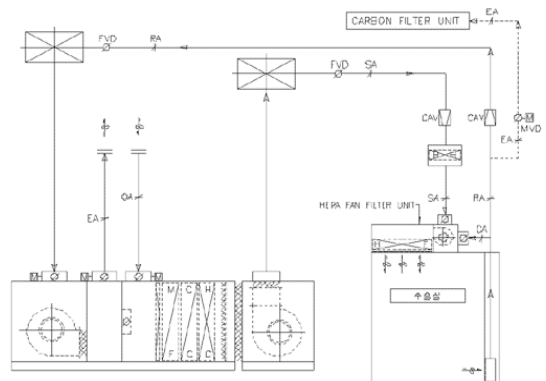
HFU

가

가
가

가 DB 24 , RH 50%

가



[4]

가 DB 22 가
 가
 kcal/hm²
 190 ~ 220

[5]

HEPA Filter가
 +
 가 [5]
 가
 (CLASS 10,000) : 40 /h
 (CLASS 100) : 100 /h
 (CLASS 10,000) : 40 /h
 (CLASS 100,000) : 20 /h

CLASS

(5) (Air Balance)

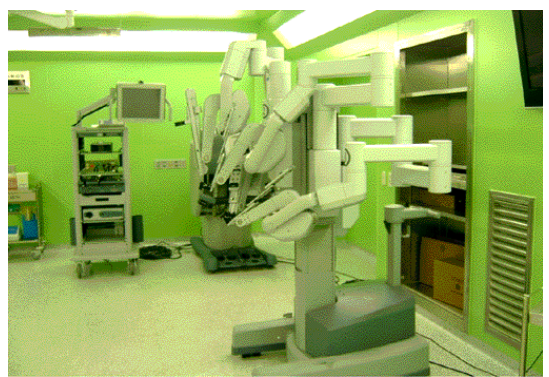
18
 10
 가
 22 ~ 24
 15 가 25 /h
 12 ~ 13
 가
 가 5
 가
 (4)
 +
 &
 +
 가 가

[5]

| | | | |
|-----------|-----|----|----|
| () \ () | 18 | 22 | 24 |
| 10 | 26 | 17 | 15 |
| 12 | 35 | 21 | 17 |
| 14 | 52 | 24 | 21 |
| 16 | 105 | 33 | 26 |



[5]



[6] ROBCT

(, ,)

3.2 (ICU ; Intensive Care Unit)

(1) (Layout)

(MICU),

(SICU),

(CCU)



[8]

(HEPA Filter)

(2)

가 HFU

FFU

FFU

가

FFU

가

Nurse Station

FFU가

가

/

가

Filter

가

HEPA

(4)

CLASS 100,000

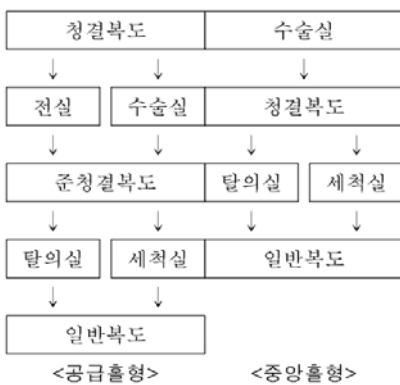
+

20 /h

3.3

(1)

(Layout)



[7]

BMT(Blood and Marrow Transplantation)

가

가

FFU

FFU

가

FFU

가

가 20~30

(3)

END-OPEN

Fan Coil Unit(

FCU)

가

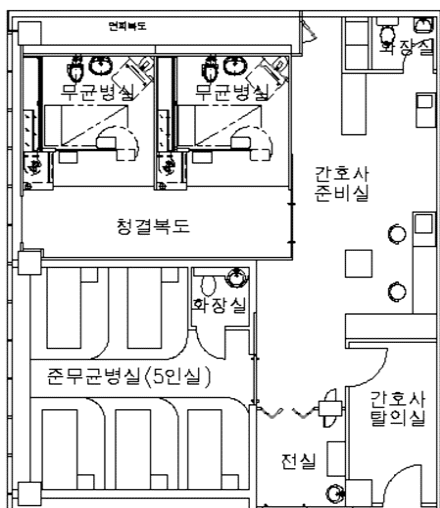
가

FCU

(2)

(4)

CLASS 100



CLASS 10

Access Floor

+

가

+

가

[9]

CLASS가

가 ,

CLASS 10,000

+

가 ,

FFU

+

가

(CLASS 100) : 0.18 ~ 0.35m/s

(CLASS 10,000) : 40 /h

(CLASS 10,000) : 40 /h

(CLASS 100,000) : 20 /h



[11] ISOLATOR

가

가

가

가

ISOLATOR
Access Curtain

가

Fan

Access Curtain

가

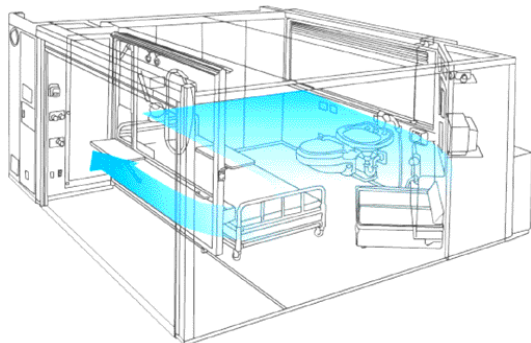
TV,

(5) ISOLATOR
ISOLATOR

END-OPEN

.1

Hepa Filter Fan



[10] ISOLATOR

3.4

가

가

가

(23.2%)

가

가?

가

가?

가?

가?

(RI)

24

가

3.5

3

(Bio Safety Level 3 : BL3)

가

A(H1N1)

biohazard(

[6]

1972 ~ 1984

22

142

1

10

B

malburug

1,296/5,641

| | |
|---|--------|
| 1 | |
| 2 | (LMO) |
| 3 | (LMO) |
| 4 | (LMO) |

[7] (TAC 1.0%)

| | | | | | |
|--|-------|------|------|---------|---------|
| | () | () | () | (kg/kg) | (KJ/kg) |
| | 34.2 | 29.4 | 70.5 | 0.0242 | 96.434 |
| | -14.1 | -15 | 65.1 | 0.0007 | -12.39 |

[8] (URS)

| | | | | | |
|--|-----|-----|-----|-----|-----|
| | | | | | |
| | () | (%) | () | (%) | |
| | 23 | 50 | 23 | 50 | 24h |
| | 23 | 50 | 23 | 50 | |

3

3 (BSL 3, Bio-safety Level 3)

(1)

[6]

(2)

가

(NIH)

(CDC)

18~27 ±1 , OECD

22±3 ,

21~25

45~55%,

50~60%,

(NIH)

40~60%

()

(URS

: Use Requirement Sheet)

[8]

BCR

/

(3)

가

[9]

가

3

[9] 가

| | 가 |
|--|---|
| | <ul style="list-style-type: none"> • , 2006 • 3 , • , 2008 • , |
| | <ul style="list-style-type: none"> • CDC/NIH, BioSafety in Biomedical and Microbiological Laboratories • ANSI, Standard Z9.5 Laboratory Ventilation • ILAR, Guide for the care and use of Laboratory Animals • NIH, Vivarium Design Policy and Guidelines • ASHRAE, HandbookHVAC Application • ASTM, American Society for Testing and Materials |

, BCR

BCR
가

1. クリーンルームハンドブック,
, 1989. 1.

2. , 2006. 7.

3. ,

4. , 2000. 1.

5.

, , 2010.

(: 02-851-9998))