

3,4

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Solutions of Induced Problems as per Wholesome Estimation and a Study on Reliability Improvement Schemes for HVAC System of Reactor and Service Building in Wolsong Unit #3 & 4

2

260

(Radiation Level)

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(Reliability improvement scheme)

(Proactive Maintenance)

Abstract

The essential functions of HVAC(Heating, Ventilation, Air Conditioning) system in nuclear power plant(NPP) are to keep the appropriate air temperature, moisture[or RH : Relative Humidity], freshness of each allotted area or room and to minimize radiation exposure to the environmental circumstances. So, an estimation of system wholesomeness and equipment status of HVAC system were performed to assure that the secure normal operation of every important facility and give comfortable working conditions to the operators on the bottom of basic design concept. And, this text describes a few solutions to solve the problems induced from the above estimation. Also, this text include the establishment of the remote vibration detection facilities for the high radiation exposure area cooling fans and remote watching system for the plant normal or emergency operation and last proactive maintenance methods will be illustrated as a reliability improvement schemes of HVAC

system in Wolsong unit #3,4 during the plant life time.

1.

(An Organism) 가

(living Circumstance)

(Environmental facility)

3,4

(Status of facilities)

(Wholesomeness)

가

가 ,

가

2. 3,4

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2.1

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가.

(R/B Cooling System)

35

(LAC), 4

R/B

40.6°C

Small/Large LOCA

MSLB

R/B

400Kpa(g)

65°C

(SDE)

LOCA

(R/B Ventilation System)

IACU 1 ,

2 ,

1 ,

/ /

,

R/B

-0.623Kpa(g)

-40°C(Dew Point)

13°C

26°C 가 ()

(S/B Ventilation, Cooling and Heating System)

32

,7

277,855CFM

HC(가)

S/B

100

가

,19

가

가

(MCR Ventilation and Emergency Ventilation System)

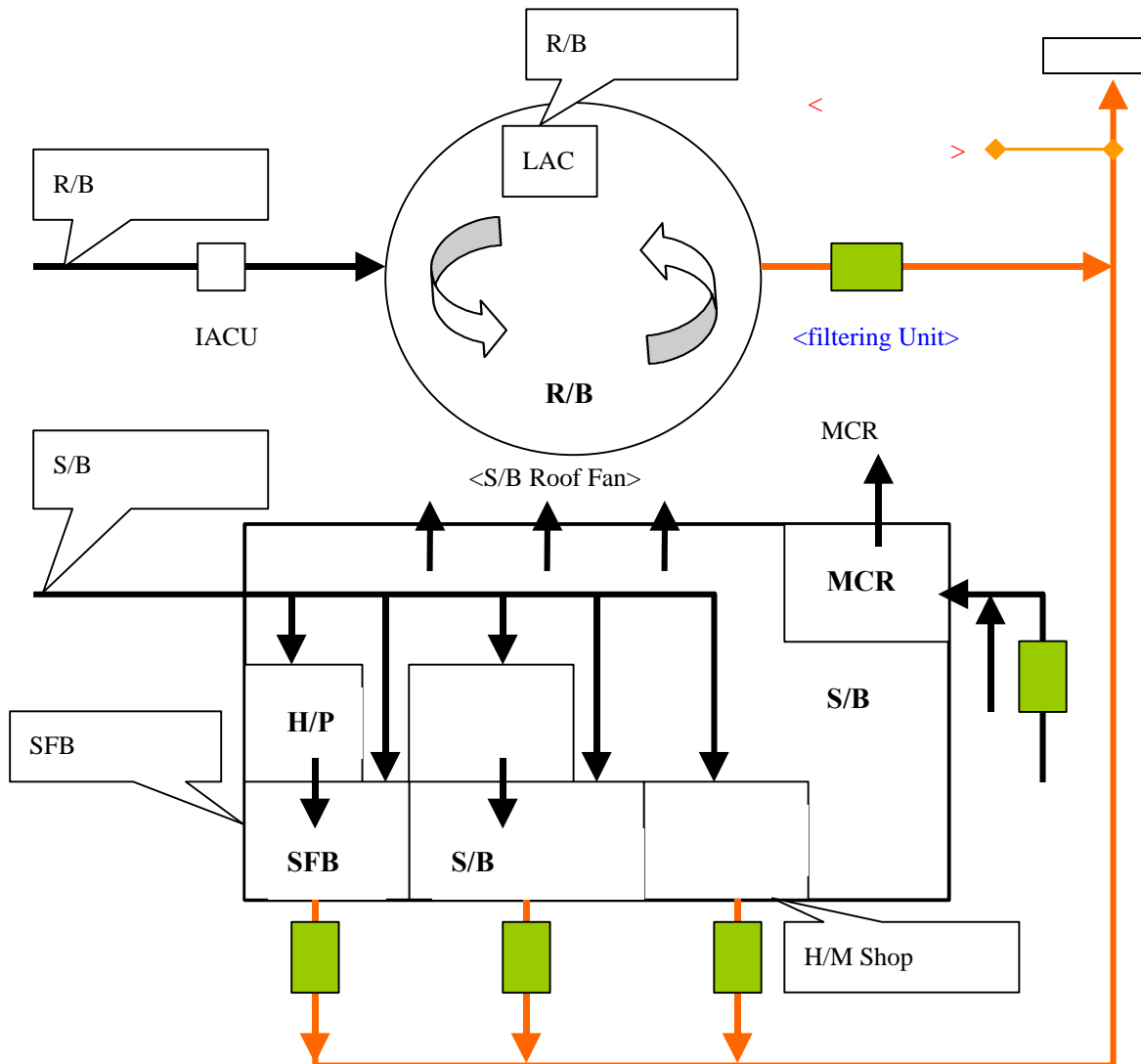
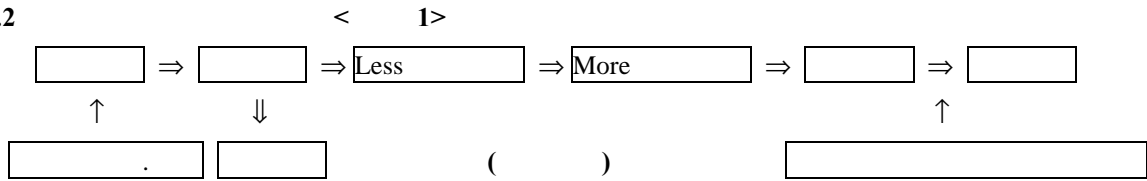
4 , 8 , / ,
 (MCR) (: 24°C ± 1°C, 50% ± 10% RH, : 22°C
 ± 1°C, Min. 35% RH)

(+)
 LOCA, MSLB 24

(SFB Ventilation System)

2 , , () , /
 (-)

2.2



3. 3,4 가

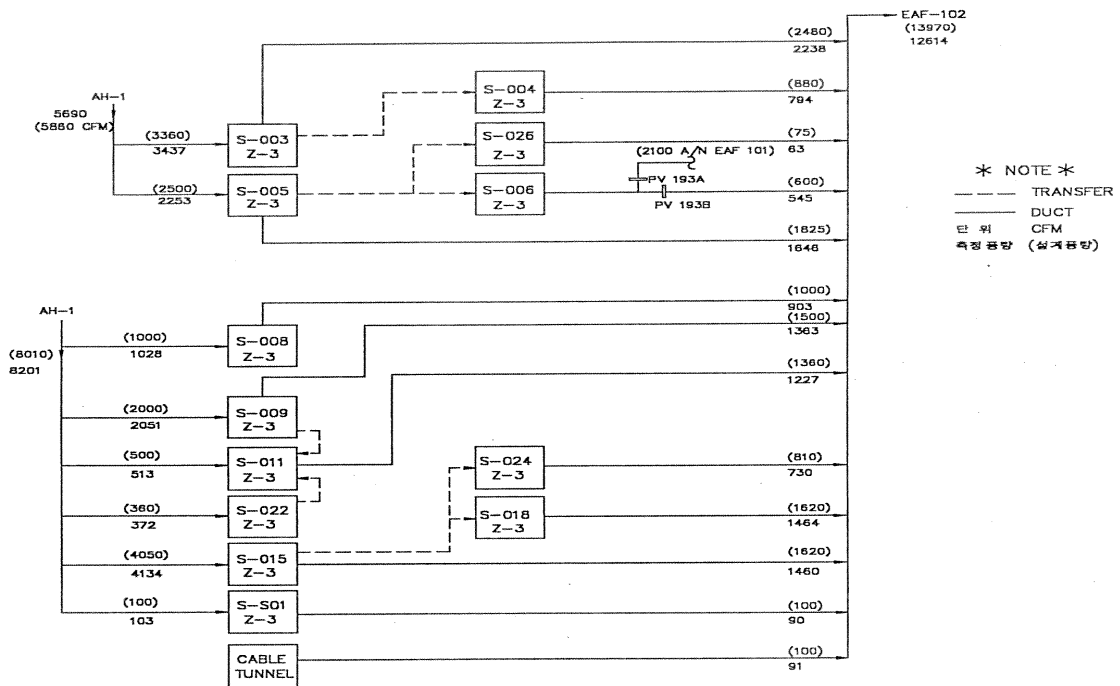
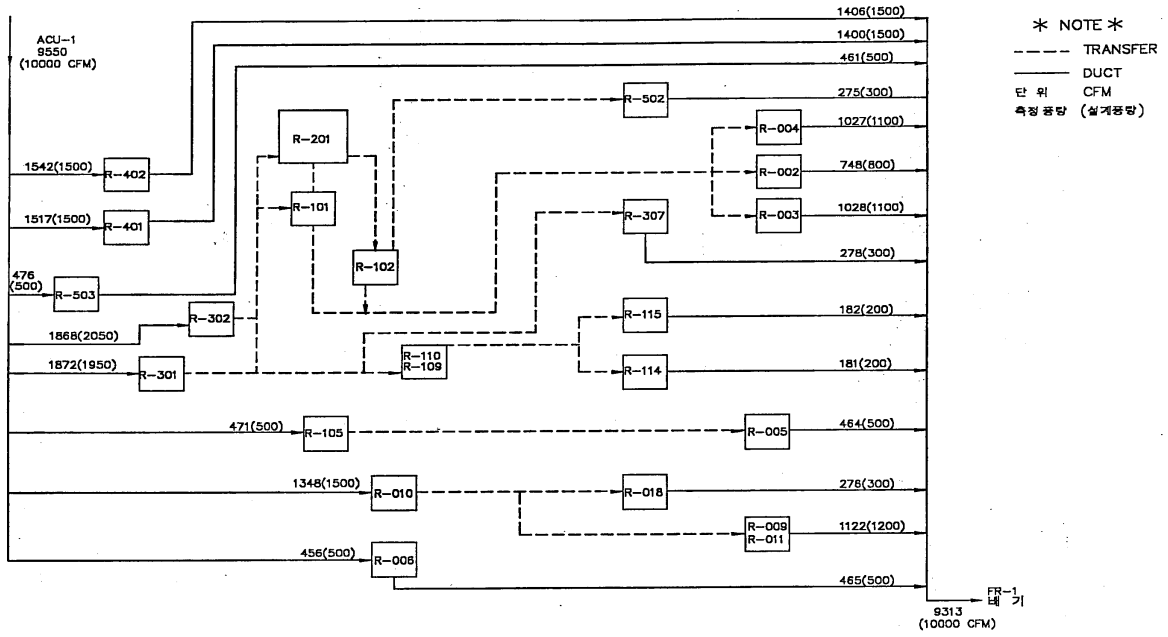
가

가

3.1 가

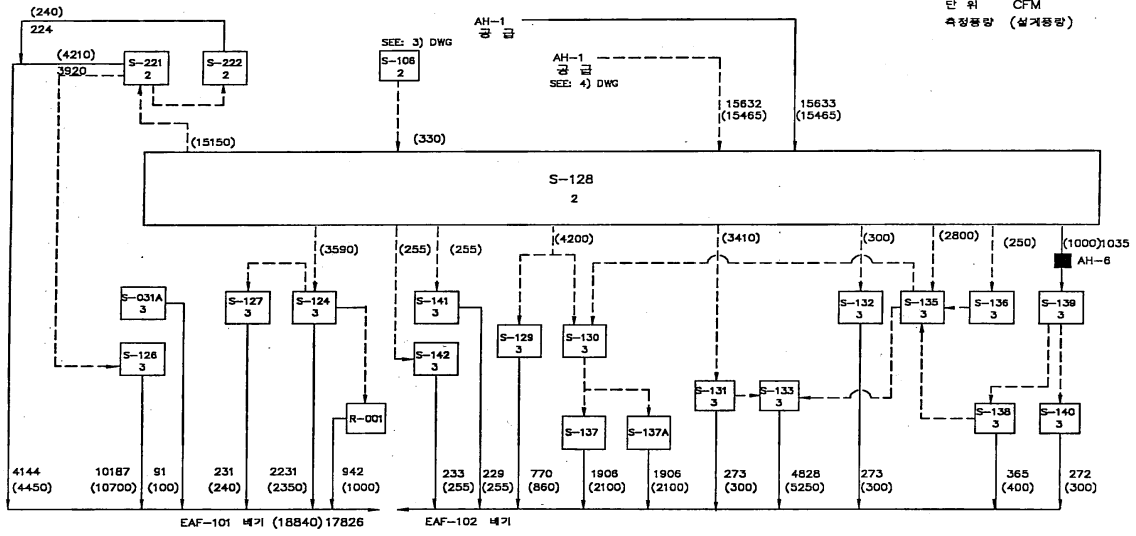
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: < 2 >



* NOTE *

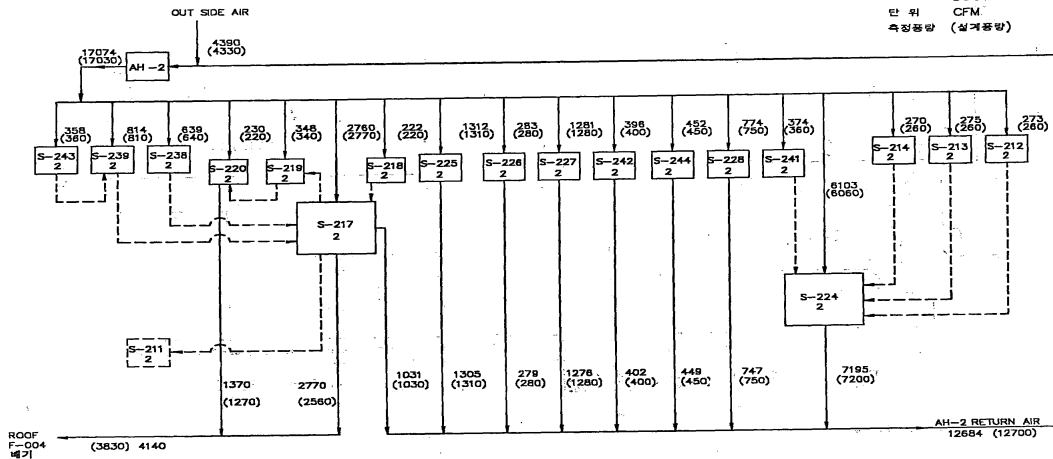
--- TRANSFER
 --- DUCT
 단 위 CFM
 측정용량 (설계용량)



< 4 : EL. 100.000 - 105.410m >

* NOTE *

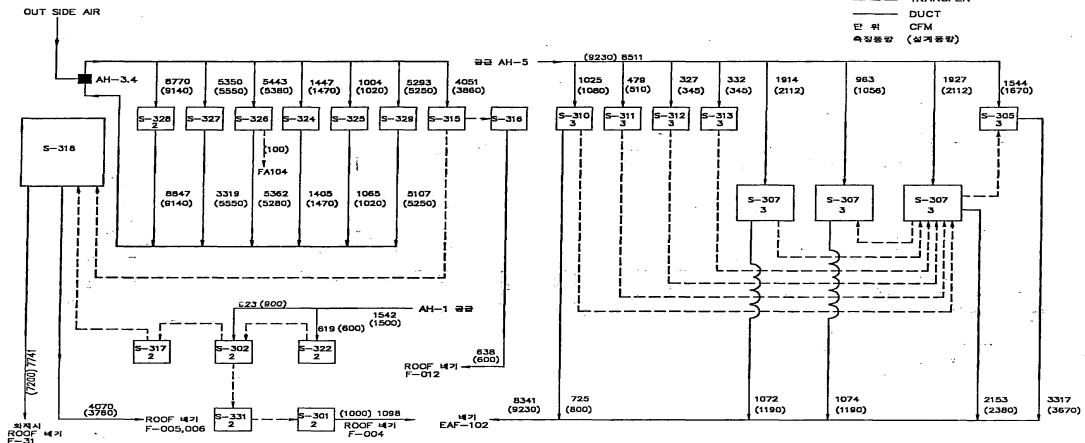
--- TRANSFER
 --- DUCT
 단 위 CFM
 측정용량 (설계용량)



< 5 : 105.410m >

* NOTE *

--- TRANSFER
 --- DUCT
 단 위 CFM
 측정용량 (설계용량)



< 6 : 109.220m >

· :
 : 20Pa(0.02Kpa) (-)
 : 20-25Pa(0.02-0.025Kpa) (+)

가 :
 GEM(R/B, S/B), SSRM(T/B), USM(D2O) , 34
 13 가

- H-3 : 4.05E15Bq/ (), I-131 : 7.82E9Bq/ () : 1/2
- : 8.24E14Bq/ (), : 1.89E10Bq/ () : 2/3

3.2 가

가. (Vibration) :

가

(Basement)

(Weight Unbalance)

(Air Turbulence)

(Clearance),

(Run Out)

(Face)

· :
 : (가 ,)
 : (가 가 ,)
 · (DR : Deficiency Report) 가

- 3 : 1998.11 - 2001.3
- 4 : 1999.4 - 2001.3

(DR) (1)

3		35	1	169	15	15	5	-	-	165	2	2	409	
		11	1	54	-	7	1	-	7	26	-	6	113	
		12	2	40	1	6	-	1	1	12	5	-	79	
		58	4	263	16	28	6	1	8	203	7	8	602	
4		26	1	134	1	26	1	-	6	109	-	4	308	
		7	1	64	-	1	1	-	2	28	-	4	108	
		3	-	36	3	2	2	-	2	6	2	2	58	
		36	2	260	4	29	4	-	10	143	2	10	474	

- 3 : (6,241) 9.65%
- 4 : (5,608) 8.45%

가 :

(Proactive Maintenance)

(DR)

3.3

, 가

(가)

4.

4.1

(49,575CFM)

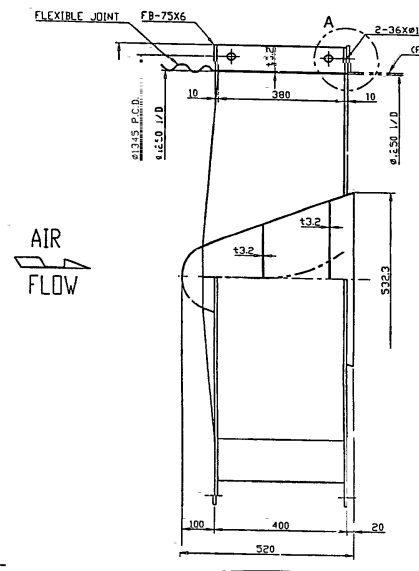
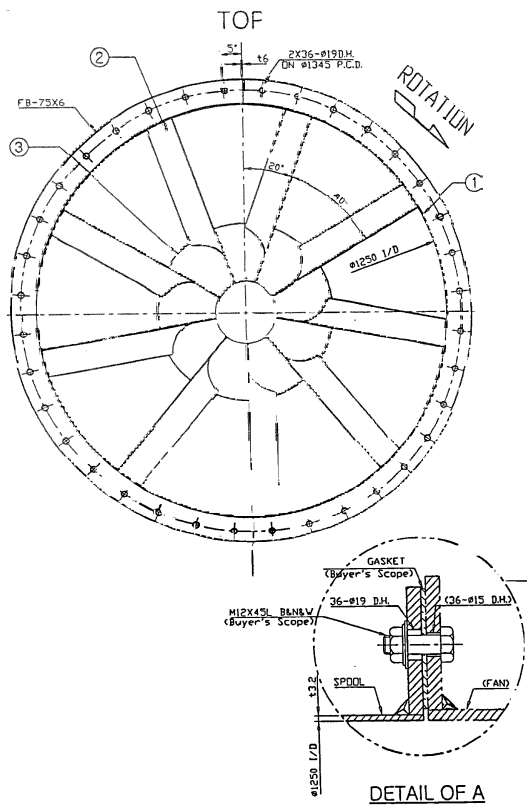
83% (± 10%)

가 .

가.

/

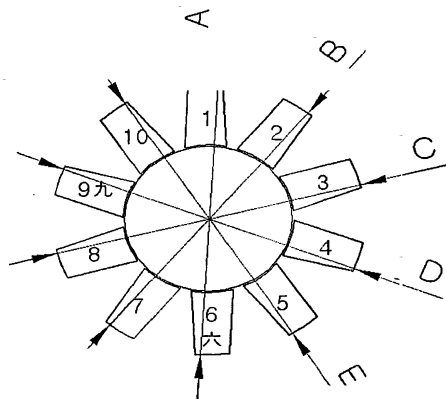
(→)



< 7 :

>

- / (→)
- 가



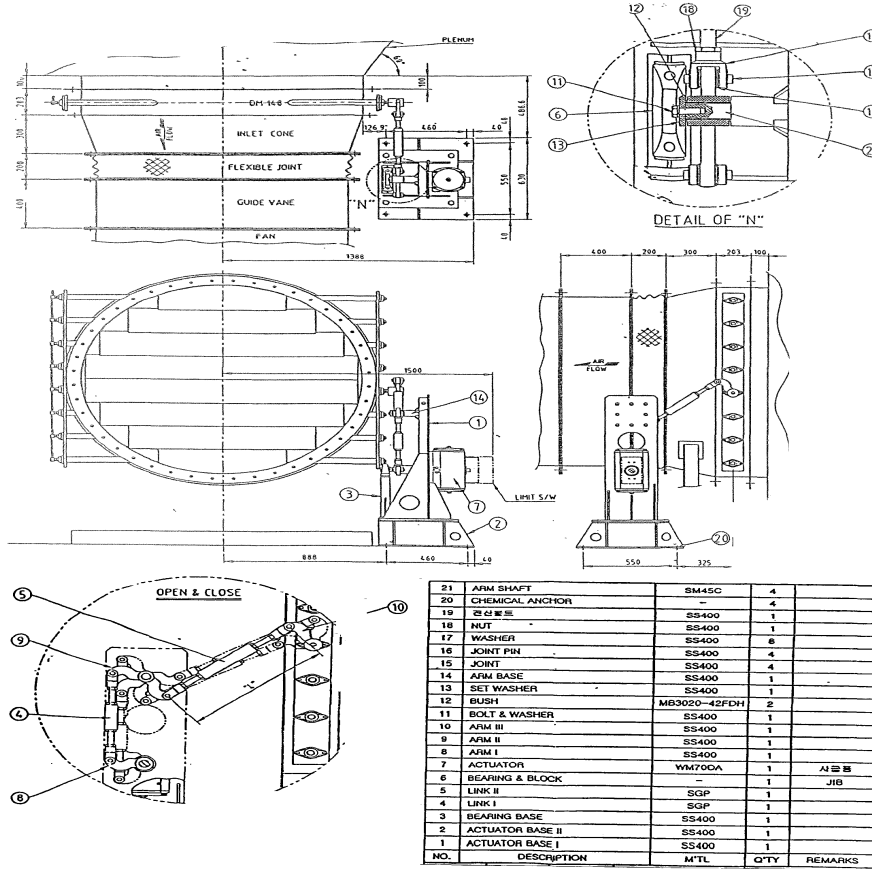
Unit : mm

의경 (날개번호) Diameter (Blade No.)	측정 치수 Measured Size	판정 1245 ±2.5 Results
A (1 - 6)	1245	Accept
B (2 - 7)	1245	Accept
C (3 - 8)	1245	Accept
D (4 - 9)	1245	Accept
E (5 - 10)	1245	Accept

< 8 : >

, (ON, OFF)

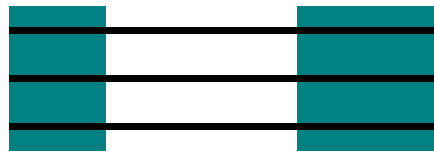
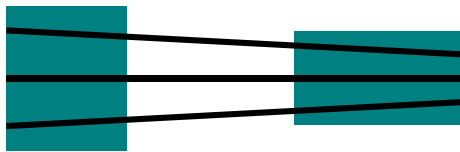




< 9 : >

4.2

/ 가

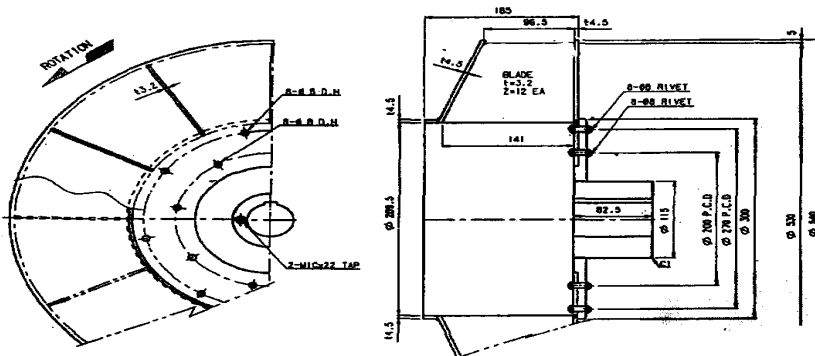


< 10> <가 >

< >

가 (Dia-Cut)

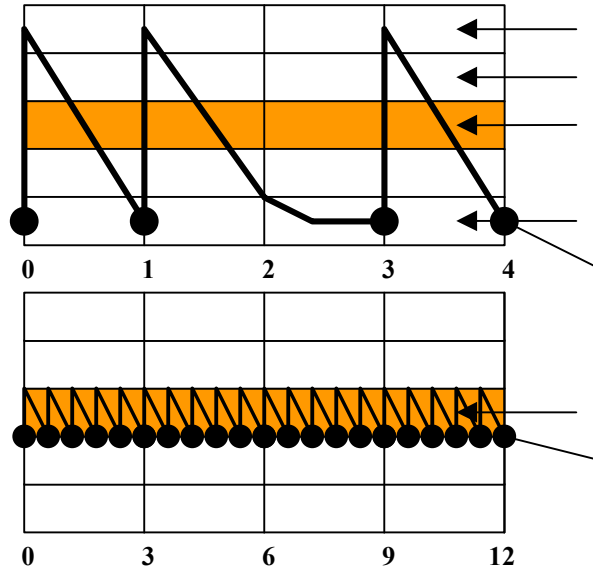
(Weight Balancing : 3g)



< 11 : 가 >

()
 (Support Reinforcement)

: ()
 “Engineered automated lubrication systems are no longer a luxury. Instead, they are becoming one of the key ingredients of many maintenance cost reduction and failure avoidance strategies.” -- By Heinz P. Block –



< 12 : () () >

4.3 (Proactive Maintenance) (Paradime Shift)

: 85%

: 가

5.

3,4 가

가

5.1

: 1 ,

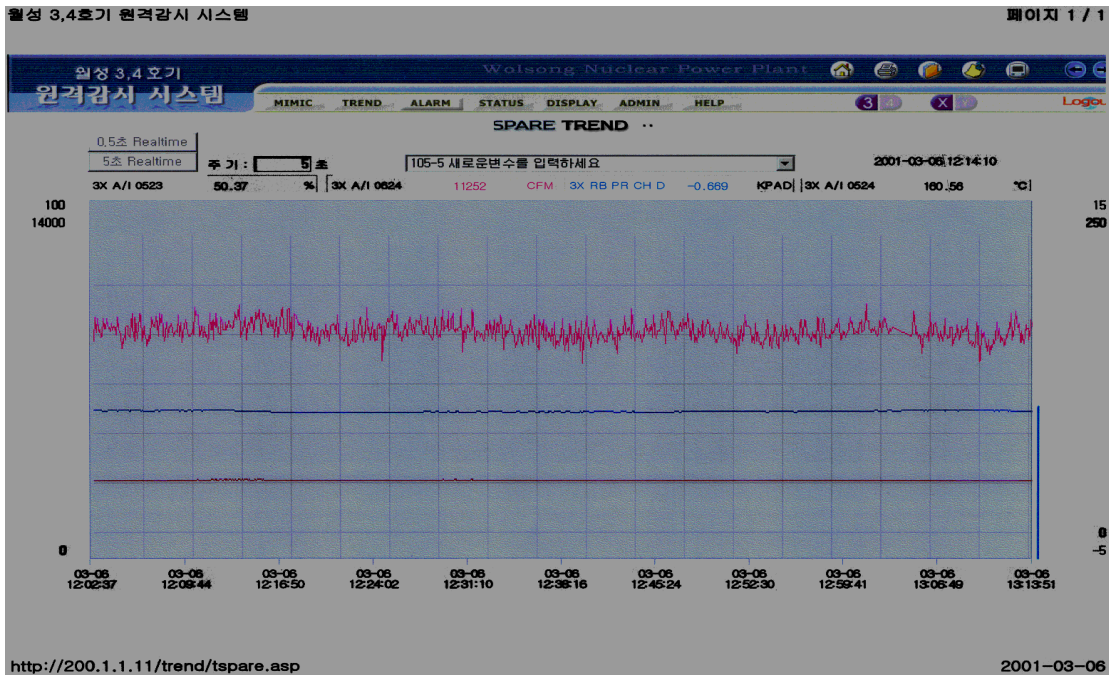
: Trend ,

:

5.2

: 1,2

: ()

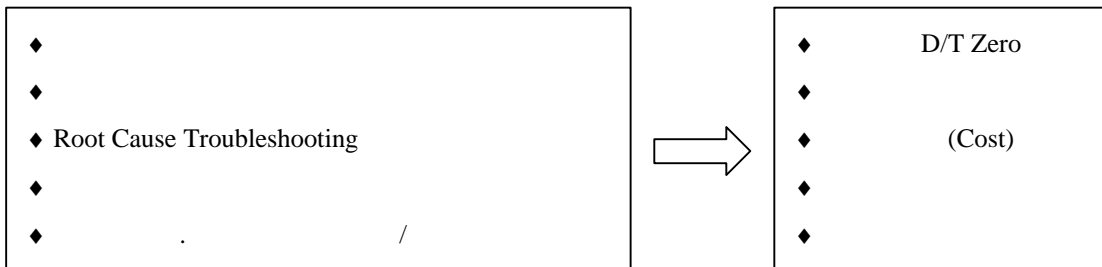


< 13 : , Trend >

5.3

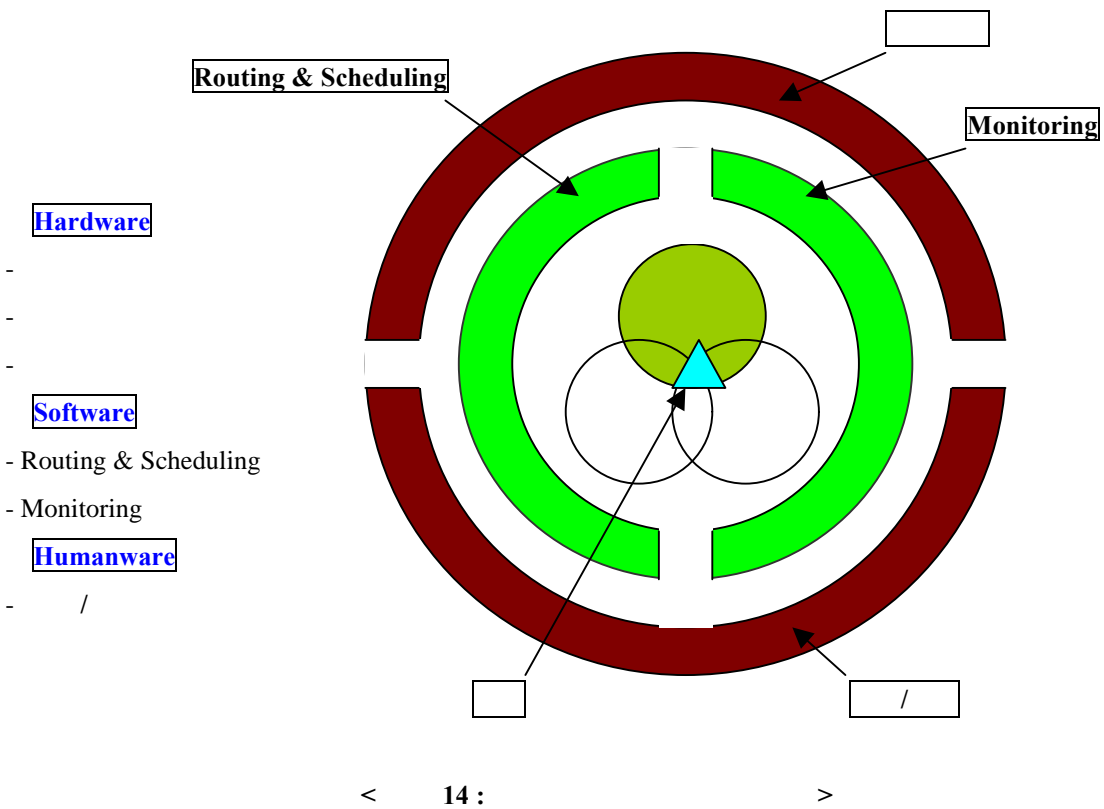
가 / 가 , (Base or Support) (Misalignment) 가 / (Proactive Maintenance)

가.

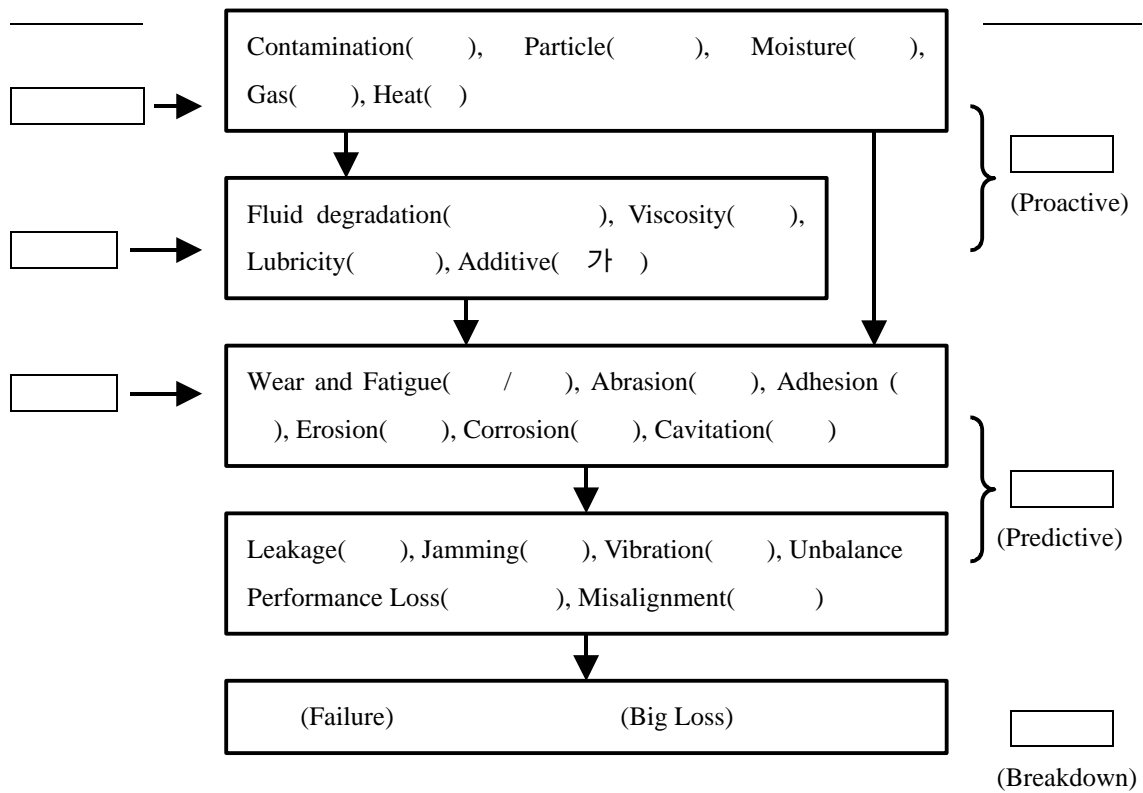


- 70% :
- 80% :
- 43% :

(Total Lubrication Management)



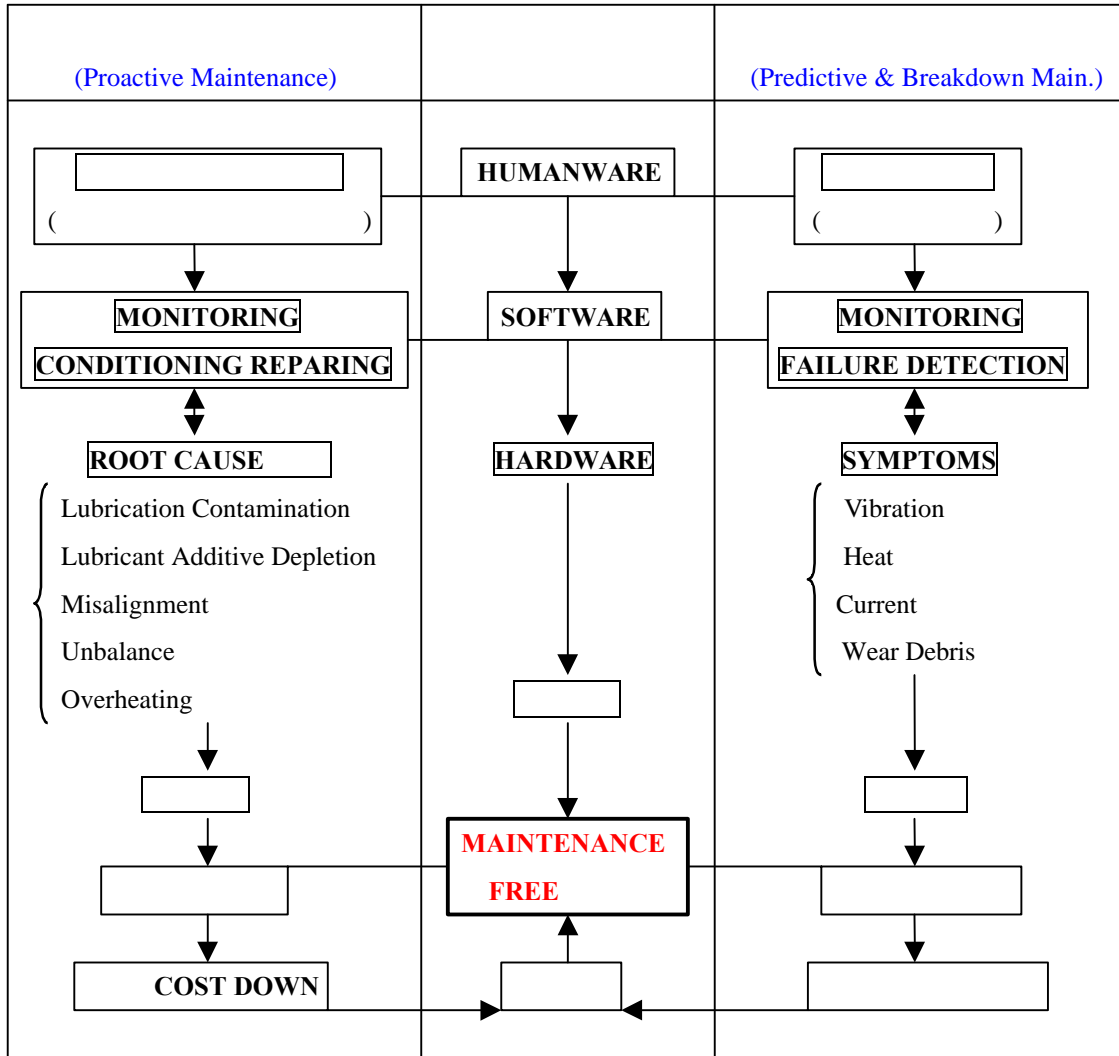
(2)



(Proactive)

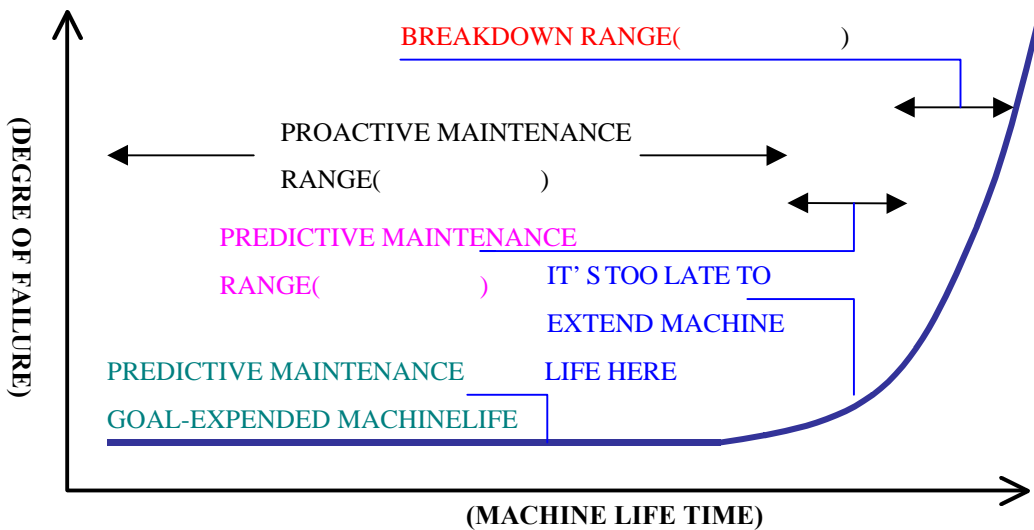
(Root Cause)

(Zero base D/T)



< 3 : , >

Machine Progress Towards Failure < 15 : >



- 25% 가
- (, ,)
- ()
- ()
- : 1966 JOST (GNP 1%), 1990 JOST (GNP 1.3 – 1.6%)
- : TRIBOLOGY R&D 0.8 , 62.5
- : 1976 “Strategy for Energy Conservation Through TRIBOLOGY” 62 Million Dollar
- : 1 6.5

6.

3,4 가 가

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References

1. ASHRAE STANDARD 52-76 “Method of Testing Air-Cleaning Devices Used in General Ventilation for Removing Particulate Matter”
2. Reg. Guide 1.520 “Design , Testing and Maintenance Criteria for Post Accident ESF Atmosphere Clean-up System Air Filtration and Adsorption Units of Light-Water-Cooled Nuclear Power Plants”
3. Reg. Guide 1.140 “Design , Testing and Maintenance Criteria for Normal Ventilation of Light-Water-Cooled Nuclear Power Plants”
4. ANSI/ASME N510-1989 “Testing of Nuclear Air-Cleaning System”
5. ANSI/ASME Standards NQA-1 “Quality Assurance Program for Nuclear Facilities”
6. ASTM D 3803-89 “Testing Method for Radioiodine Testing of Nuclear Grade Gas Phase Absorbents”
7. ANSI/ISA-S67-1988 “Set-Points for Nuclear Safety-Related Instrumentation”
8. Wolsong NPP Tech. Spec. Related to HVAC System of Reactor and Service Building
9. Maintenance Technology Magazine(By Heinz P. Block, PE, Process Machinery Consulting) “Automatic Lubrication as a Modern Maintenance Strategy”