

## The Investigation on Compressed Air Quality Analysis Results of Nuclear Power Plants

. NRC GL88-14 "Instrument air supply system problems affecting safety-related equipment" ISA-S 7.3

### Abstract

The compressed air system of nuclear power plants provides pneumatic power for both operation and control of various plant equipment, tools, and instrumentation. Included in the air supply systems are the compressors, coolers, moisture separators, dryers, filters and air receiver tanks that make up the major items of equipment. The service air system provides oil-free compressed air for general plant and maintenance use and the instrument air system provides dry, oil-free, compressed air for both nonessential and essential components and instruments. NRC recommended the periodic checks on GL88-14 "Instrument air supply system problems affecting safety-related equipment". To ensure that the quality of the instrument air is equivalent to or exceeds the requirements of ISA-S7.3(1975), air samples are taken at every refueling outage and analyzed for moisture, oil and particulate content. The overall results are satisfied the requirements of ISA-S7.3.

1.

가

1980 , CATAWBA 2, YANKEE-ROWE 3  
"Instrument Air System Failures" (SOER 88-1)가  
, NRC Generic Letter 88-14 "Instrument air supply system problems  
affecting safety-related equipment" [3]

NRC Standard Review Plan(1981) ISA-S  
7.3(1975)  
ISA-S7.3 3,4  
(FSAR) 9.3 [1]  
1,2,3,4 1,2 FSAR Dry, Clean, Oil-free compressed air

ISA  
가

2.

B  
D ISA-S 7.3  
(1975) -40  
가  
3.4  
0.9 $\mu$ m 99.5% 0.7% 99%, 0.9%  
100% /  
150% 125psig -40

가  
가  
ISA-S7.3  
가

3.

Instrument Society of America (ISA)

Measurement and control

ANSI MC 11.1

, 1981 ISA-S7.3-1975(R 1981)

1996

ISA-S7.0.01 "Quality

Standard for Instrument Air"

ISA-S 7.3

가. ISA-S 7.3

ISA-S7.3 Purpose, Scope, Definitions Instrument air, quality standard

, Standards

quality

4가

1) (at line pressure)

- ( 가 )  
line pressure

10 (18 )

- ( 가 )  
가

pressure

10 (18 )

line pressure

line

2 ( 35 )

2)

3 micrometer

3)

1 ppm(w/w) (v/v)

가 0 가

4)

, , 가

Cross connection

Process connection

가

. ISA - S7.0.01

1996 ISA - S7.0.01  
. ISA - S7.3

, Scope, Purpose, Definitions,

Instrument Air Design Instrument air, quality standard

1) (Pressure dew point)

가 10 (18 ) Pressure  
4 ( 39 )

2) 40 micrometer

3) 가 0 가  
1 ppm (w/w) (v/v)

4) , , 가

, 가

. ISA S - 7.3. ISA S7.0.01

1) 10 2  
4 가 -10 -15  
-20 -25

2) 3µm 40µm 가 가  
1µm 99% 가  
3µm 가 5µm  
가 가

3)

가 0 가 , 1 ppm(w/w) (v/v)

4)

(NFPA)

가

가

4.

가.

ISA-S7.0.01

가

가

가

( )

가

가

ISA-S7.0.01

(NUREG 1275, Volume 2

)

가

가

United States

actuator

in-line

가

Actuator assembly

)

, 가 , 가 National Fire Protection Association (NFPA) 70, the National Electrical Code, Chapter 5, Article 500 Hazardous Location 가

scrubber

. 가

가

cross connection

process connection

phosphate ester

가

가

scrubber

5.

가

가.

가

가

dewcup, chilled

mirror, cloud chamber, hygroscopic salts, electrical hygrometers, psychrometers, capacitance, spectroscopy, thermal conductivity 가 가

line pressure

가 40 micrometer

가

가

가 40 micrometer

가

가

가

microscopic technique

laser analyzer

가 0 가

1 ppm(w/w) v/v

가 가

가

Microscopic techniques, infrared

spectrometer

ultraviolet molecular emission

Gas chromatography

가

. Painting, Chemical cleaning, Engine exhaust

### 6.

가.

[2]

ISA

-40

5

1

4

8

15

/

5

ISA

-10

-28

.(

-40

가

3 $\mu$ m

11

, 5 $\mu$ m

4

37 $\mu$ m

가

가 ISA

S7.0.01

ISA S7.3

6

. 3 $\mu$ m

가

6

2

4

6

3

1

IAS

1.0 ppm

GC

6

(Detector

tubes), Johnson control oil indicators,

가

가

ISA-S7.3, 3,4  
 (FSAR) 9.3, 1  
 FSAR -40, 2 FSAR Dry, Clean, Oil-free  
 compressed air, 3,4 1,2 FSAR dried, filtered, and  
 essentially oil-free compressed air 90 120psig  
 -40, 0.9µm 99.5%, 0.7µm  
 99% 1,2,3,4  
 가

1.

			( )	(nm)	(ppm)	
1	'00.3.9		-27.5		ISO S7.01.1	ISO S7.3 S7.01.1
		ESW	-40.6	0.3		
4	'00.3.21		-47.1	0.3	( 2 )	FSAR
		ESW	-41.0	0.3		
		2	-41.3			
5	'00.3.21		-41.5	0.3	N <sub>2</sub> , O <sub>2</sub> CO <sub>2</sub>	GC
3	'99.8.11	2	-37.7			
3	'99.6.25		-43.0			
		ESW	-41.9	0.7		
		2	-41.8			



가	(ppm)	ESW (ppm)
H <sub>2</sub>	0	0
C <sub>2</sub> H <sub>4</sub>	0	0
C <sub>2</sub> H <sub>6</sub>	0	0
C <sub>2</sub> H <sub>2</sub>	0	0
CH <sub>4</sub>	0	0
CO	0	0
CO <sub>2</sub>	163	168
O <sub>2</sub>	172,918	175,423
N <sub>2</sub>	598,711	598,067
全 GAS 量	771,792	773,658
	- : G/C(Varian 3600) - : Gas sample valve - Carrier gas : Ar - Detector : TCD, FID	

7.

ISA S7.3

- 10

- 40

ISA

3.0 $\mu$ m0.7 $\mu$ m

Gas Chromatography

Oil-free

1. FSAR 9. 3. 1. "Compressed Air Systems"
2. EPRI TR- 103595 " Report of the Instrument Air Group " 1994.
3. NMAC EPRI TR- 108147 "Compressor and Instrument Air System Maintenance Guide", 1998
4. ISA Standards, Recommended Practices, and Technical Reports, 1997 "Environmental Conditions, Instrument Air Quality, and Control Centers.