The Design of Compressed air system in the Conventional Facility of Proton Accelerator Research Center

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1. Introduction

The Compressed Air System (CA) supplies compressed air for all air operated devices and instruments, pneumatic equipments and other miscellaneous air user points in the Conventional Facilities of Proton Engineering Frontier Project. CA System consist of the Instrument Air System and the Service air System. The Instrument Air System supplies oil-free, dried, filtered, and compressed instrument air for the air operated control devices and instruments in the Accelerator & Beam Application Building, Ion Beam Application Building, Utility Building and etc.. The Service air System supplies compressed air for pneumatic equipment and other services

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2. Compressed Air System Design

2.1 Design Criteria

Air compressors are of the motor-driven, centrifugal type and consist of two (2) 100% capacity, supplying sufficient compressed air for the CA System. The standby compressor permits maintenance of the running compressor. The intake air to each compressor is filtered and is taken from indoors. The compressed air is cooled between compressor stages. The air from each compressor passes through an aftercooler and moisture separator before entering the air receiver.

Each air dryer and filtering units is sized for 150% capacity of the maximum instrument air flow. The air is dried to a dew point of -40°C (-40°F) or less at 8.8 $kg/cm^2.g$ (125 psig).

The air dryer is heatless, desiccant type. A timer and automatic controls are provided to alternate the air flow between the two chambers of each dryer to permit drying of the desiccant in one chamber while the other chamber is in service.

The filtering unit is provided with two prefilters in parallel and two after filters in parallel. The instrument air on the downstream of filtering unit can meet the requirements of ISA-S7.0.01.

The capacity of the air receivers is based on the amount of air needed during the time lag between one air compressor failure and the startup of the stand-by compressor. The air receivers are vertical cylindrical type, constructed from carbon steel.

The materials for all instrument air supply piping are type 304 Stainless Steel. There are no special requirements for fabrication. All service air supply piping is seamless carbon steel.

Pipe sizes are large enough to limit the pressure drop between the pressure control valve in the Instrument Air System and the instrument air using points and between the air receivers and the service air using points not to exceed 10 percent of the initial pressure.

Compressed air headers are provided with low point drain traps for removing any moisture

Service Air outlets are located such that all floor areas can be covered by a 15.24 m (50 ft) hose.

Tab.1. Instrumental Compressed air conditions

Bldg.	Item	Quant.	Allowable Press.		Remark
			Min.	Max.	
A/T	Pneumatic Valve	100	4	7	1 port per 5meters
Klystron gallery	Pneumatic Valve	50	4	7	1 port per 5meters
A/Assembly	Pneumatic Valve	20	4	7	1 port per 5meters
B.A. Hall	Pneumatic Valve	60	4	7	1 port per 5meters
	Target treat. Rm.	40	4	7	5 ports at each room
IBAB	Gas Ion Imp.	9	4	7	
	Semicon.l Ion Imp.	10	4	7	
	Metal Ion Imp.	9	4	7	
	Large-scaled Ion Imp	10	4	7	
	Sputtering Ion Imp	7	4	7	
	300KeV Ion Imp	12	4	7	
	1MV Tandem Ion Imp.	15	4	7	
	Spare	18	4	7	

2.2 Design Configuration

CA System consists of the Instrument Air System and the Service air System.

Instrument Air System is from the suction air filter connected with each air compressor to the isolation valves which are located at the air supply lines for the Service Air System and the instrument air user points throughout the plant.

The Service Air System begin at the service air supply isolation valve in the Instrument Air System and end at the connection point to the pneumatic equipments and other services. Service Air outlets are located such that all floor areas can be covered by a 15.24 m (50 ft) hose.

System Component

The system major components are Air Compressor, Air Receiver, Air Dryer, Prefilter and Afterfilter. The specification is as follows.

1) Air Compressor :
- Type : Turbo 2nd stage, Oil-free, water cooling
- Quantity : 100% × 2EA
- Capacity : 1,275 ㎥/h/set
- Aftercooler outlet air temp. : 40 °C

2) Mediumcooler
- fluidItube/shell) : air/cooling water
- Tube intlet coolng water temp. : 40 °C

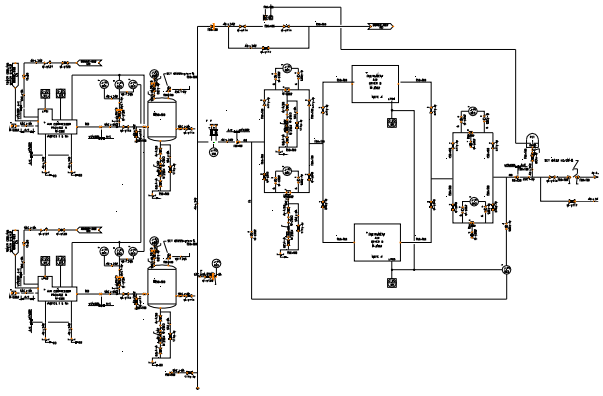
3) Aftercooler
- Quantity : 100% × 2EA
- Capacity : 1,275 ㎥/h/set
- fluidItube/shell) : air/cooling water
- shell intlet coolng water temp. : 40 °C

4) Air Receiver tank
- Type : Vertical Cylindrical Type
- Quantity : 100% × 2EA
- Capacity : 3.68m^3/EA
- Safety valve Pressure : 10.55kg/cm^2· g

5) Air Dryer
- Type : Dual tower, Dual heater regeneration
- Quantity : 150% × 2EA
- Capacity(㎥/h) : 850 ㎥/h/set
- Inlet pressure : 8.0kg/cm^2· g
- Inlet temp.: 40 °C

6) Prefilter
- Quantity : 150% × 2EA
- Capacity : 1,155(㎥/h /EA

7) Afterfilter
- Quantity : 150% × 2EA
- Capacity : 1,155(㎥/h /EA



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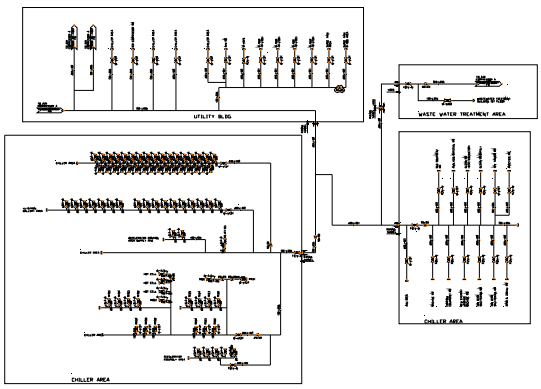

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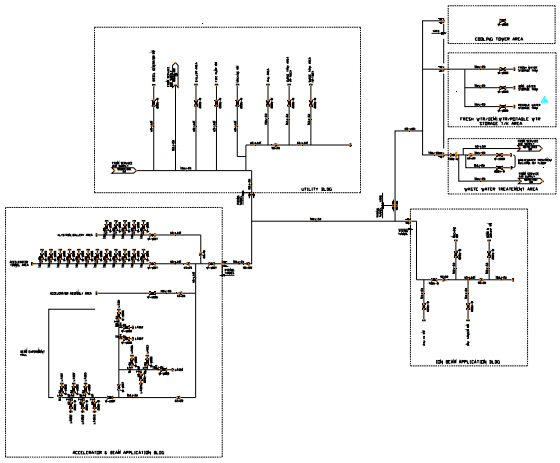

c)

Fig. 1. P&ID of compressed air system : a) Overall system configuration, b) Instrument air system, c) Service air system

4. Conclusion

There area a lot of components bringing about fire accidents in the PEFP site. In this paper, we designed the compressed air System in the conventional facility of proton accelerator research center.

Compressed air systems consist of the instrument air system and the service air System. The instrument air system supplies oil-free, dried, filtered, and compressed instrument air for the air operated control devices and instruments in the Accelerator & Beam Application Building, Ion Beam Application Building, Utility Building and etc., The Service air System supplies compressed air for pneumatic equipment and other services.

5. Acknowledgments

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