

The Design of HVAC System in the Conventional Facility of Proton Accelerator Research Center

G. P. Jeon, J. Y. Kim, B. H. Choi

PEFP, KAERI, 1045 Daedeokdaero, Yuseong, Daejeon, 305-353, Korea

e-mail : gpjeon@kaeri.re.kr

1. Introduction

The HVAC systems for conventional facility of Proton Accelerator Research Center consist of 3 systems : accelerator building HVAC system, beam application building HVAC system and miscellaneous HVAC system. We designed accelerator building HVAC system and beam application research area HVAC system in the conventional facilities of Proton Accelerator research center. Accelerator building HVAC system is divided into accelerator tunnel area, klystron area, klystron gallery area, accelerator assembly area. Also, Beam application research area HVAC system is divided into those of beam experimental hall, accelerator control area, beam application research area and Ion beam application building.

In this paper, We described system design requirements and explained system configuration for each systems. We presented operation scenario of HVAC system in the Conventional Facility of Proton Accelerator Research Center.

2. HVAC system Design

2.1 Accelerator Building HVAC system

2.1.1 System Summary

The Accelerator Building Heating, Ventilating and Air Conditioning (HVAC) System maintains suitable environmental conditions for personnel and operation of equipment, controls and instrumentation in the accelerator tunnel, klystron gallery, klystron gallery equipment area, and accelerator assembling area. This system consists of the following subsystems.

- Accelerator Tunnel HVAC Subsystem
- Klystron HVAC Subsystem
- Klystron Gallery Electric/HVAC Equipment room
- Accelerator Assembly Area HVAC Subsystem

2.1.2 Design Criteria

This system is designed to maintain the proper environmental conditions in the accelerator tunnel, klystron gallery and accelerator assembly area as shown in the following table.

	Accel. Tunnel	Klystron Gallery			Accelerator Assembly	
		Klystron	HVAC Equip	Office	Office	Equip
Temp.(°C)	26±1	22~27	10 ~ 40	20 ~ 27	20 ~ 27	10 ~ 30
Relative Humid.(%)	≤55	≤55	0 ~ 100	30 ~ 80	30 ~ 80	30 ~ 80

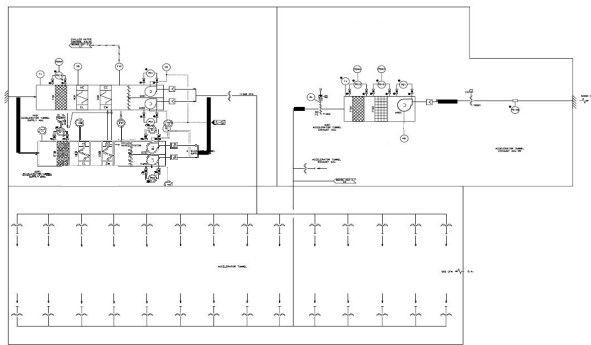
The accelerator tunnel, heat exchanger room and ACU room in the klystron gallery remains under slightly negative pressures with respect to outside and adjacent areas to inhibit uncontrolled leakage of contaminated air to outside. Fire dampers shall be installed in all HVAC penetrations of fire barriers. The components of the HVAC systems shall be placed and arranged to ensure functional reliability and also to minimize radiation exposures to personnel during operation, maintenance, and testing. The Exhaust ACU shall conform to ASME N509 and ASME AG-1. The controls for the ACU shall conform to ASME N509. The system components and related equipment shall be designed and fabricated in accordance with applicable codes and standards. Adequate clearance shall be provided to the equipment for ease access for maintenance and component removal. Tube pulling space for coil section removal shall be provided.

2.1.3 System Configuration

Accelerator Building HVAC subsystem consist of supply AHU(Air Handling Units), ACU(Air Cleaning Units), recirculation Fan, associated ductwork and ductwork accessories. AHU contained a prefilter, electric heat coil, cooling coil and exhaust fans (100% X 2). Also, ACU contained a prefilter, a HEPA filter and exhaust fans (100% X 2). The specification of Accelerator Building HVAC system is shown in the following table 1. For one thing, Fig 1. presented Piping & Instrumentation Diagram of Accelerator Tunnel HVAC system.

<Table 1> The specification of A/B HVAC system

System	Equipment	Quantity
Accelerator Tunnel	Supply AHU	50% * 2
	Exhaust AHU	100% * 1
	Ductwork and ductwork accessories	
Klystron Area	Supply AHU	100% * 1
	Exhaust AHU	100% * 1
	Recirculation fan	100% * 1
	Ductwork and ductwork accessories	
Klystron Gallery Electric/HVAC Equipment room	Supply AHU	100% * 1
	Exhaust AHU	100% * 1
	Recirculation fan	100% * 2
	Ductwork and ductwork accessories	
Accelerator Assembly Area	Supply AHU	100% * 1
	Exhaust AHU	100% * 1
	Recirculation fan	100% * 2
	Ductwork and ductwork accessories	



<Fig 1. P & ID of Accelerator Tunnel HVAC system.>

2.2 Beam Application Building HVAC system

2.2.1 System Summary

The Beam Application building HVAC system maintains suitable environmental conditions for personal comfort and operation of equipment, controls and instrumentation in the beam experiment hall, the accelerator control area, the beam application research area and the ion beam application building. This System consists of the following subsystems.

- Beam Experiment Hall Subsystem
- Accelerator Control Area Subsystem
- Beam Application Research Area Subsystem
- Ion Beam Application Building Subsystem

2.2.2 Design Criteria

This system maintains proper environmental conditions for the beam experiment hall, the accelerator control area, the beam application research area and the ion beam application building as shown in the following table.

	Beam Ex. Hal	Accel Con /BARA		Ion Beam Application Building		
		Equip	Office	Equip	Office	Special
Temp.(°C)	10 ~ 30	10 ~ 40	20 ~ 27	10 ~ 40	20 ~ 27	10 ~ 30
Relative Humid.(%)	≤55	0 ~ 100	30 ~ 80	0 ~ 100	30 ~ 80	≤55

The beam experiment hall shall remain under slightly negative pressures with respect to outside and adjacent areas to inhibit uncontrolled leakage of contaminated air to outside. Fire dampers shall be installed at all HVAC penetrations of fire barriers. Cubicle coolers are installed to maintain suitable room temperature in each equipment area, if necessary.

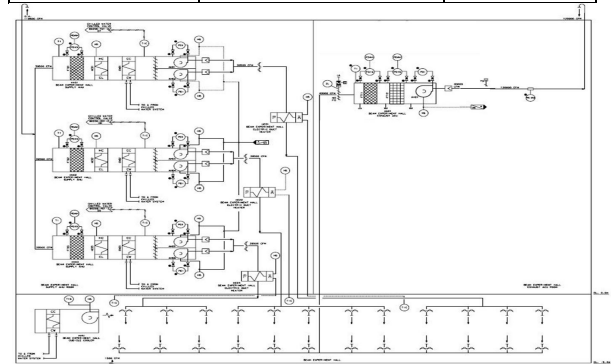
2.2.3 System Configuration

The Beam Application building HVAC system consist of supply AHU(Air Handling Units), ACU(Air Cleaning Units), recirculation Fan, associated ductwork and ductwork accessories. AHU contained a prefilter, electric heat coil, cooling coil and exhaust fans (100% X 2). Also, ACU contained a prefilter, a HEPA filter and exhaust fans (100% X 2). The specification of Accelerator Tunnel HVAC subsystem is shown in the following table 2. For one thing. Fig 2. presented

Piping & Instrumentation Diagram of Beam Experimental hall HVAC system.

<Table 2> The specification of B/A Building HVAC system

	Equipment	Quantity
Beam Experimental Hall	Supply AHU	33.3% * 3
	Exhaust AHU	100% * 1
	Recirculation fan	33.3% * 6
	Ductwork and ductwork accessories	
Accelerator Control Area	Supply AHU	100% * 1
	Exhaust AHU	100% * 1
	Recirculation fan	100% * 2
	Ductwork and ductwork accessories	
Beam Application Research Area	Supply AHU	100% * 1
	Exhaust AHU	100% * 1
	Recirculation fan	100% * 2
	Ductwork and ductwork accessories	
Ion Beam Application Building	Supply AHU	50% * 2
	Exhaust AHU	100% * 1
	Recirculation fan	50% * 4
	Ductwork and ductwork accessories	



<Fig 2. P & ID of Beam Experimental Hall HVAC system.>

3. Conclusion

We designed accelerator building HVAC system and beam application building HVAC system in the conventional facilities of Proton Accelerator research center. Accelerator Tunnel, klystron HVAC equipment room, Beam experimental hall and target rooms should be kept slightly negative pressure for radiation safety. Especially, HVAC system for each target room was designed to be access within a half hour since operation pause. These results are respected to use drawing up a operation scenario of HVAC system in the Conventional Facility of Proton Accelerator Research Center.

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REFERENCES

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