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C-A OPERATIONS PROCEDURES MANUAL

ATTACHMENT

7.1.65.d Safety Issues Associated with Cold Box 4 of the RHIC 24 kW Refrigerator

C-A-OPM Procedures in which this Attachment is used.		
7.1.65		

Hand Processed Changes

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 Collider-Accelerator Department Chairman Date

M. Sardzinski



SAFETY ISSUES ASSOCIATED WITH COLD BOX 4 OF THE RHIC 24 kW REFRIGERATOR

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This document describes the safety issues associated with working inside cold box 4 of the 24 kW RHIC cryogenic refrigerator. It is not meant to cover the details of every job. A job specific work permit reviewed by appropriate personnel is still required to complete any work inside the cold box.

MECHANICAL SAFETY ISSUES

Component details :

Cold Box 4 houses Heat exchanger 7A,7B, 7M, 5/6 and 8/18/9.

Confined Space.

Cold Box 4 is considered a confined space. Any work inside the box must adhere to the confined space regulations described in the BNL SBMS.

Trapped Helium Volumes

The potential exists for trapped pockets of high pressure helium inside the cold box. Prior to penetrating any process lines inside the box, contact the cryo-control room at X3837 to verify no trapped helium volumes exists.

Pressurized Helium Sources

Cold Box 4 is part of the RHIC cryogenic system and has the potential to see pressurized Helium gas sources. The table below is a list of potential sources and the valves associated with isolating them (Reference drawings 3A995009,3A995050 and RD3A995047.)

Low Pressure to HX-4 Main Process Line	Cold Box 3	“F” (interconnection letters from RD3A995047)
High Pressure from HX-4 Main Process Line	Cold Box 3	“Q”
Low Pressure from H38A	Turbine Pod 4	“H”
Low Pressure from H90A	Cold Box 5	“N”
High Pressure to H82M	Turbine Pod 4	“P”
Low Pressure from H410M	Turbine Pod 6A	“G”
Low Pressure from H810M	Turbine Pod 6B	“G”
From H399M	Cool-Down return	“K”
From H799M	Cool-Down return	“L”
High Pressure from H797M	Turbine Pod 6B	“C”
High Pressure From H397M	Turbine Pod 6A	“M”
H167M	Compressor Discharge line	“D”
H9115M H9114M	Regeneration system (for the rest of this table refer to 3A995009)	
H25A	From Cold Box 3 (Heat Shield Supply)	
H371A	Adsorber A outlet	
H771A	Adsorber B outlet	
H15A	Adsorber by-pass	
H426A	Inlet to Turbine Pod 3	
H826A	Inlet to Turbine Pod 4	
H82M	Inlet to Turbine Pod 7	
H86A	Ring Supply valve	
H100A	High Pot Level Control	
H144M	High Pot by-pass	
H802A	Inlet to Turbine Pod 6	
H402A	Inlet to Turbine Pod 5	
H153A	Return from HX3M	
H157M	Cool-down Return line	
H9158M	Inlet to filter	
H9150M	Inlet to filter	
H158M	Cool-down Return line	
H744A	Inlet to HX3B	
H344A	Inlet to HX 3A	
H9080M	Heat Shield By-Pass	
.H813M	Heat Shield Calorimeter Ckt.	
H380A	Outlet of Expander 4A	
H780A	Outlet of Expander 4B	
H9113M	Regeneration System	

Helium Tube Trailers

Trailers are occasionally used to pressurize piping for leak checking or ASME pressure checking. Inspect the area local to the cold box for any connections to trailers and verify with the cryogenic-control room (X3837) there are no hazards associated with tube trailers prior to working inside the cold box.

Vacuum Systems

The only issues associated with the vacuum system are locking out the vacuum pumps that are used to establish insulating vacuum. Details are in the electrical safety section. Before entering the cold box contact the C-AD vacuum group for assistance in isolating the vacuum system and breaking the vacuum space with air/nitrogen mixture.

Vacuum Isolation Valves: Cold Box 4 3V554A

Pneumatic Systems

Valves located on the top and associated with the cold box are supplied with pressurized nitrogen or air at approximately 100 psig. Valves can be isolated via manifolds located local to the cold box. Reference drawing RD3A995059.

Heights

Work inside the cold box may involve climbing on process piping and working at elevated heights. Use harnessing and temporary scaffolding as necessary. Also care should be taken not to get tangled up in loose instrumentation wiring and small tubing.

ELECTRICAL SAFETY ISSUES

An investigation of all potential electrical sources in Cold box 4 that could contribute to an accident occurrence was performed. Careful inspection of the Cold box indicates there are no feed-through(s) externally that contain high voltages that pass into Cold box 4. The only feed-through(s) that exist are for low-level instrumentation (temperature sensors). See the figure below for the instrumentation feed-through into Cold box 4.



Fig.1 Instrumentation feed through with five connectors – Cold box 4

There is a diffusion vacuum pump external to Cold box 4 that requires 480 volts AC. The pump for Cold box 4 is on a plug and when service is required it can simply be unplugged. No LOTO is required. The 480 volts for this vacuum system does not enter Cold box 4. See figures below.



480 volt plug for Diffusion pump can be unplugged for safe servicing.

Hot Surface



Another view of the vacuum system

Fig.2 diffusion pump

There are vacuum gauges external of Cold box 4 as shown in the pictures below. None of these gauges have voltages that enter internally into Cold box 4. Refer to the figures below for details.



Fig.3 Thermocouple gauge



Fig.4 vacuum ion gauge



Fig.5 Thermocouple and ion gauge

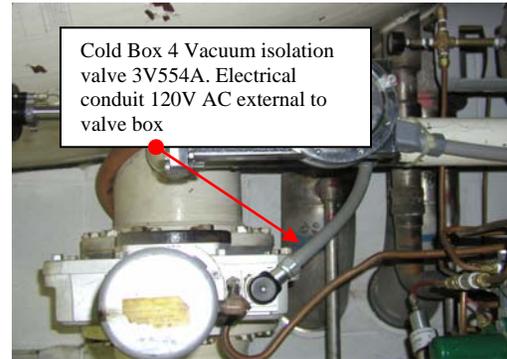


Fig.6 vacuum isolation valve

The figures below are pictures of Cold Box 4 process valves. They are on top of Cold Box 4 and are situated outside of the refrigerator building. Working on top of the cold box presents a hazard because of the curved surface. Also in the figures are details on the pneumatic lines and the conduit that supplies solenoid power to the process valves.

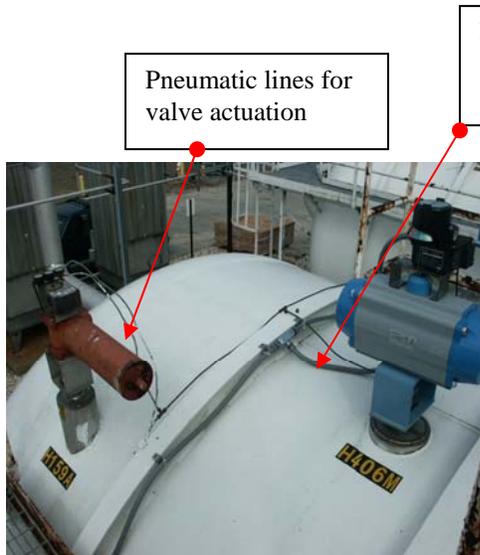


Fig. 7 H159A and H406A
northwest side of Cold Box 4



Fig.8 H398M and H166M (Southwest corner)
H798M (North east corner)



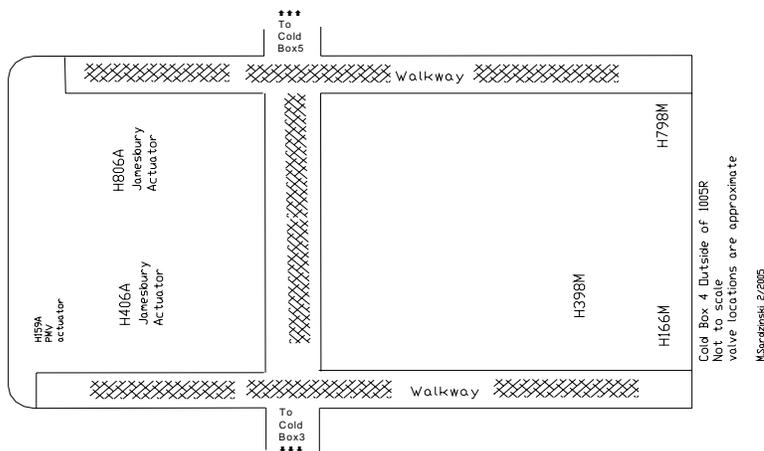
Fig.9 H806A Southwest corner of Cold Box 4



Fig.10 Man-hole cover (outside)

View of valve layout

Cold Box 4 (outside of 1005R)



Supporting Documents and drawings:

- RD3A995047 Interconnecting Piping Diagram
- RD3A995050 2-D Cold Box 4 P&ID
- 3A995009 RHIC 25Kw Helium Refrigerator P&ID