RICH Cooling Circuit with Power Supply Interlocks – 05/05/2016

Purpose

The RICH detector electronics are sealed inside the detector. This package uses HV and LV Power, creating a heat load. This heat must be removed in order to prevent damage to the electronics package and the adjacent TOF panels. Air cooling was determined to be the only viable method.

The Cooling Circuit

High capacity air compressors supply clean dry air at room temperature to cool the electronics package inside the detector. The plan is to have 2 compressors in parallel charging a 1000 liter capacity air tank. Air pressure is reduced to supply manual valve flow meters, one per detector. In the case of a power outage, the air tank should contain sufficient air to remove the latent heat of the electronics package.

Cooling Circuit Power Supply Interlocks

Powering up the electronics package inside the RICH without cooling may result in severe damage or fire. Interlocking RICH HV and LV power supply operation to proper cooling circuit operation eliminates this hazard.

The interlocks perform two functions in the case of a cooling system fault
- Turn off power to the electronics package
- Prevent energizing the electronics package

There are 3cooling circuit interlocks
- Air Compressor Operation – Minimum one compressor operating (and/or)
- Minimum Air Pressure in Tank – Pressure in air tank must be > TBD psi
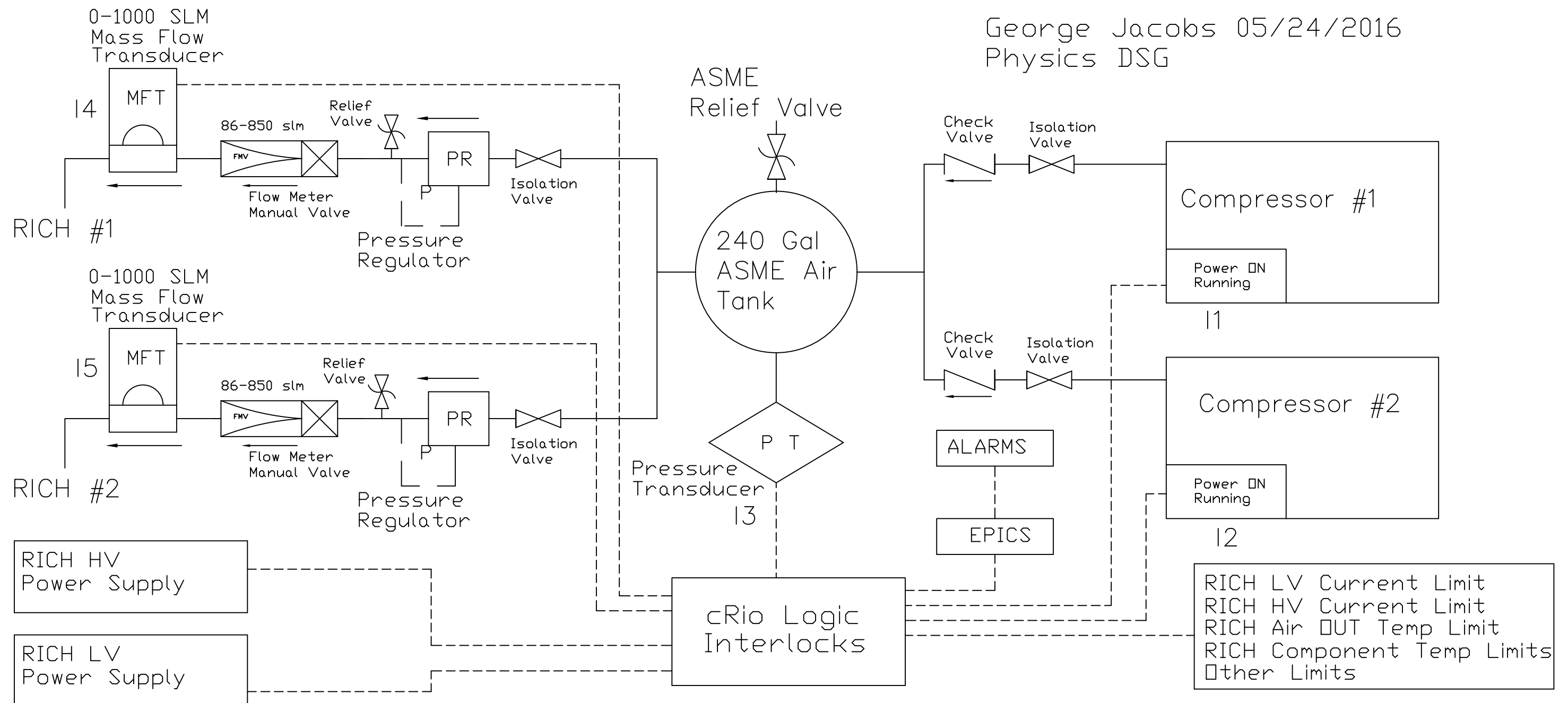- Minimum Cooling Air Flow – Flow to RICH must be >TBD slm

All three interlocks must be true in order for the electronics package to have power.

The following cooling circuit parameters have yet to be determined
- Minimum Air Pressure in Tank
- Minimum Cooling Air Flow

RICH Cooling Circuit Diagram with PS Interlocks (Preliminary)

George Jacobs 05/24/2016
Physics DSG

0-1000 SLM Mass Flow Transducer

MFT

I4

RICH #1

86-850 slm

FMV

Flow Meter Manual Valve

Relief Valve

PR

P

Pressure Regulator

Isolation Valve

0-1000 SLM Mass Flow Transducer

MFT

I5

RICH #2

86-850 slm

FMV

Flow Meter Manual Valve

Relief Valve

PR

P

Pressure Regulator

Isolation Valve

ASME Relief Valve

240 Gal ASME Air Tank

P T

Pressure Transducer

I3

Check Valve

Isolation Valve

Compressor #1

Power ON Running

I1

Check Valve

Isolation Valve

Compressor #2

Power ON Running

I2

ALARMS

EPICS

RICH HV Power Supply

RICH LV Power Supply

cRio Logic Interlocks

RICH LV Current Limit
RICH HV Current Limit
RICH Air OUT Temp Limit
RICH Component Temp Limits
Other Limits

Cooling Circuit Interlocks for RICH HV and LV Power to be Enabled
Air Compressor Power ON Interlock — I1 and/or I2 or PS Power is Disabled
Air Pressure Interlock — I3 > 100 psi (TBD) or Power Disabled
Air Flow Interlock RICH #1 Power — I4 > 250 slm (TBD) or Power to RICH #1 Disabled
Air Flow Interlock RICH #2 Power — I5 > 250 slm (TBD) or Power to RICH #2 Disabled