

**INTERFACE CONTROL DOCUMENT TITLE AND APPROVAL PAGE**

**(Page 1)**

<b>ICD Number:</b> ICD-123-64-0001-00 VV Cooling/heating requirements	<b>Primary Author:</b> P. Goranson
---	------------------------------------

<b>Impacted WBS Elements:</b> WBS-121, WBS-123, WBS 64	<b>Type of Interface:</b> Functional/mechanical Interface
---	--

**Description of Interface:** The Vacuum Vessel Subassembly (VVSA) exterior surface includes tubes which circulate helium gas to provide heating during bake out of the vacuum vessel and during idle periods when the vacuum vessel is on standby. The helium gas provides cooling of the vessel after operational shots. This ICD defines the operational parameters for the pressurized helium supplied by WBS 64 and defines the requirements for the hookup interface between WBS 123 and WBS 64.

**Record of Revisions**

Revision Number	Description	Date
0	Initial issue	12/13/2004
1	Revision includes update in heating requirements due to insulation design changes	5/24/06

**Approvals**

<b>WBS Manager:</b>	<b>WBS Manager:</b>
<b>Project Engineer:</b>	<b>Project Engineer:</b>
<b>Systems Engineering Support Manager:</b>	

## **ICD DETAIL SHEET**

**(Page 2)**

**(Use Continuation Sheets as Necessary to Include the Following Applicable Information)**

### **Scope of Interface:**

This interface impacts the operational requirements for the Helium Bakeout System.

### **Equipment and Responsibility List:**

Vacuum Vessel Heating and Cooling Distribution Systems (WBS 123): Goranson

Helium Bake out System (WBS64): Dudek

Vacuum Vessel (WBS 121): Goranson

### **Related ICDs:**

ICD-123-400-0001 VV Port Resistance Heaters

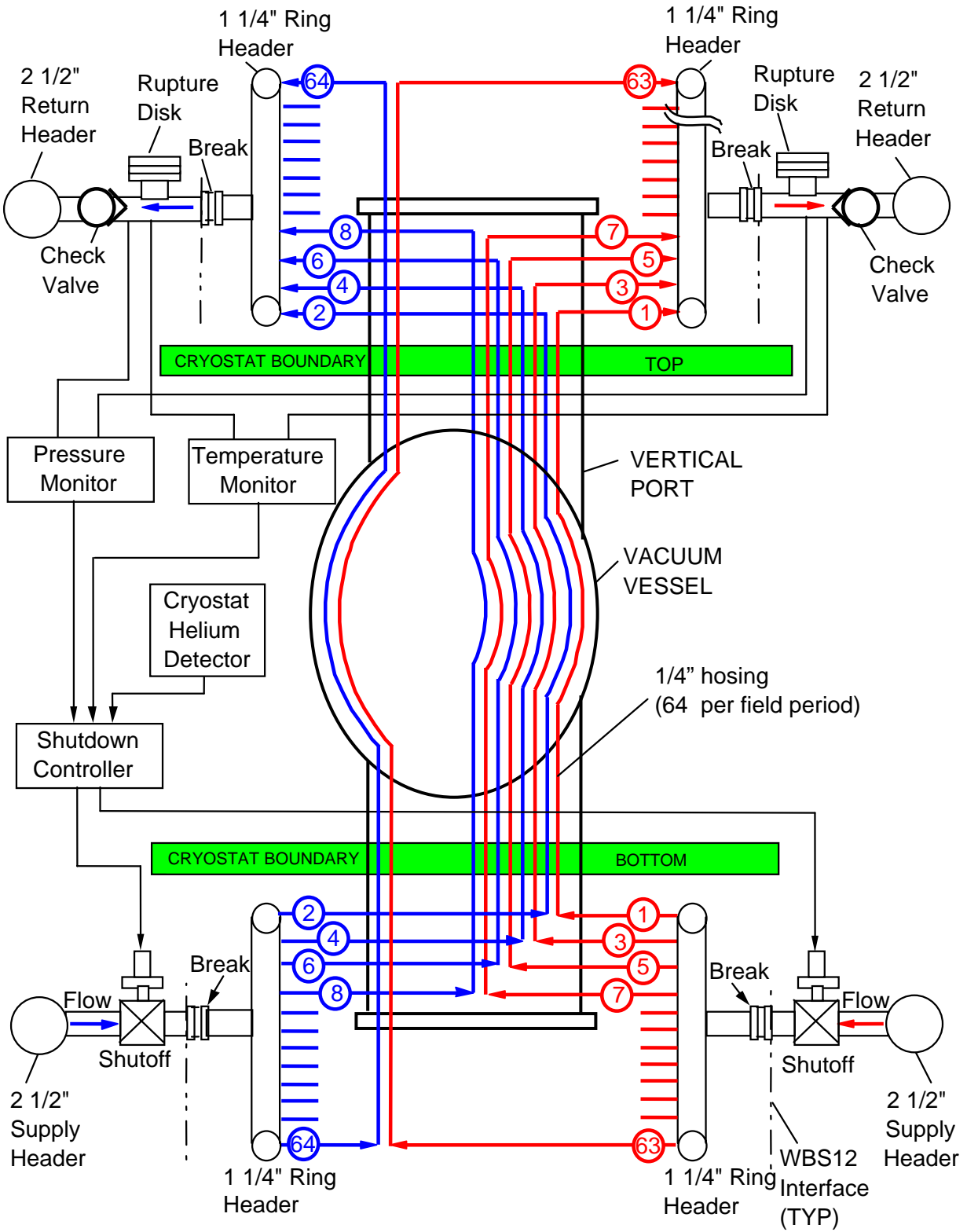
### **Notes and Abbreviations:**

### **Interface Block Diagrams:**

Diagram is included on the following page.

# VACUUM VESSEL HELIUM HEATING/COOLING SCHEMATIC

Diagram is for full Field Period



**Installation/Operation Information:**

The coolant tubes are fed by two supply and two return ring headers located around the vertical ports on each VVSA. Gas input is at the lower ports and gas return is at the upper ports. The ring header design is the responsibility of WBS 123. WBS 123 is responsible for coordinating the location and design of ring header interfaces where headers supplied by WBS 64 will connect.

The coolant system must be electrically isolated at the same potential as the vessel by electric breaks. The electrical breaks are the responsibility of WBS 123.

The port extensions are independently heated by resistance heaters during baking and idle operation.

A summary of the **nominal** required operational parameters for a 20 atmosphere VV helium system is shown below: A more complete summary showing a range of acceptable operating conditions may be referenced in NCSX-CALC-12-002.

**Bake at 350 C**

Heat load	8.17 kW
Helium inlet temperature	367 C
Pressure drop across VV	1.2 atmosphere
Helium flow rate	290 cfm

**Cooling load after operational pulse**

Average heat load	16 kW
Helium bulk temperature rise	6.4 C
Pressure drop across VV	0.74 atmosphere
Helium flow rate	400 cfm

The present Helium blower skid is only marginally capable of bakeout of the vacuum vessel to 350 C. During future 14.4 MJ operation it may be necessary to upgrade the Helium system or augment the bakeout with an additional heat input means such inductive heating.

The coolant heating load required to maintain the VV at idle (room temperature) is 1.02 kW.

During initial operation the VV will be baked at 150 C. This reduces the coolant load to 4.75 kW and it is anticipated that hot air or nitrogen may be used in lieu of helium.

**Other Pertinent Information:**

Detailed flow characteristics and heating requirements for the helium system are defined in:

Vacuum Vessel Heating/Cooling Distribution System Thermo-hydraulic Analysis - NCSX-CALC-12-002

Additional information on the heat balance of the VV may be found in:

Vacuum Vessel Heat Balance Analysis NCSX-CALC-12-003