

FACET-II Hydrogen Safety Authorization

Revised 14th March 2022

Hydrogen gas bottle cannot be connected until Authorization to Operate is given.

Hydrogen gas bottles may only be changed by authorized personnel. Personnel shall be trained in course 122 and also in course 172 (or have equivalent experience and supervisor approval). Authorization to Operate is not affected by a gas bottle change.

Hydrogen gas bottles must be removed from operation outside of experimental run periods or if the hardware or software that comprises the safety system is altered. To re-connect a hydrogen gas bottle, new Authorization to Operate must be established.

Gallery Installation

1. Verify

	Ok/Not Ok	Date	Tester	Notes
Hydrogen gas bottle is not connected. If this is not true, do not proceed with the check-out.				
All valving and pneumatic tubing is rated for service at a minimum of 2000 psi				
An ASME pressure relief valve is set to 1500 psi				
Exhausts from roughing pumps at penetration 20-11 are fixed above reach				
Signage by pump exhaust is appropriate to warn against ignition sources				

2. Test roughing pump isolation valves by switching off roughing pumps. A steady rise in pressure indicates a failure of isolation valve.

	Ok/Not Ok	Date	Tester	Notes
Isolation valve functions on Plasma Scroll				
Isolation valve functions on Picnic Basket Roots				

Tunnel Installation

1. Verify

	Ok/Not Ok	Date	Tester	Notes
A burst disk <15 psi is installed in the same vacuum volume as the gas jet				

Incident/Fault Tests

1. Incident: Hydrogen added to chamber before beamline vacuum established

Conditions of test: Permitted access, chamber filled to 1 atm, pumps off

Verify detection:

	Ok/Not Ok	Date	Tester	Notes
EPICS:Vacuum Display:VGCM:LI20:M3201 PSTAT1 (Relay 9) = FAULT				
EPICS:Vacuum Display:VGCM:LI20:M3203 PSTAT1 (Relay 5) = FAULT				

Verify response:

	Ok/Not Ok	Date	Tester	Notes
EPS screen indicates that electro-solenoid valve at gas bottle is closed				

Note: It is not possible to verify that the EPS screen reports the correct status in these conditions. However this is verified in the next part of the test.

2. Incident: Leak to air (slow) / Over-pressurization of H2 / Fill valve stuck open

- Set SP as 5.0 Torr on VGCM:LI20:M3201. Disable VGCM:LI20:M3203 (using Force Set)
- Using the EPICS display, close the angle valve and the beryllium window valve 3208
- Close the Picnic Basket foreline valve and turn off the turbo
- Open the manual valve behind the Picnic Basket on the high pressure gas line
- Using the IOTA controller, pulse the gas jet. This can be controlled by an external trigger on EPICS.

Verify detection:

	Ok/Not Ok	Date	Tester	Notes
EPICS:EPS Status:Input: Pressure too High Latched = FAULT				
EPICS:Vacuum Display:VGCM:LI20:M3201 PSTAT1 (Relay 9) = FAULT				
EPICS:Vacuum Display:VGCM:LI20:M3203 PSTAT1 (Relay 5) = OK				
Maximum pressure in beamline Enter value: 				This needs to be between 5 Torr and 8 Torr to pass

Verify response:

	Ok/Not Ok	Date	Tester	Notes
EPS screen indicates that electro-solenoid valve at gas bottle is closed				
Gas pressure stops rising on 1000 Torr CM gauge VGCM:LI20:M3201				
Gas pressure stops rising on 10 Torr CM gauge VGCM:LI20:M3203				

Note: this verifies that the EPS fault has closed the valve securing the gas source

Enable M3203 and disable (Force Set M3201). Pump down and repeat test.

Verify detection:

	Ok/Not Ok	Date	Tester	Notes
--	-----------	------	--------	-------

EPICS:EPS Status:Input: Pressure too High Latched = FAULT				
EPICS:Vacuum Display:VGCM:LI20:M3201 PSTAT1 (Relay 9) = OK				
EPICS:Vacuum Display:VGCM:LI20:M3203 PSTAT1 (Relay 5) = Fault				
Maximum pressure in beamline Enter value: 				This needs to be between 5 Torr and 8 Torr to pass

Verify response:

	Ok/Not Ok	Date	Tester	Notes
EPS screen indicates that electro-solenoid valve at gas bottle is closed				
Gas pressure stops rising > 5 Torr on 1000 Torr CM gauge VGCM:LI20:M3201				
Gas pressure stops rising on 10 Torr CM gauge VGCM:LI20:M3203				

Note: this verifies that the EPS fault has closed the valve securing the gas source

Authorization to Operate

I confirm that the controls perform as required for operation of hydrogen in FACET. I authorize the hydrogen bottle to be attached to the system and plasma experiments to proceed.

Tester name:

Signature: _____

Safety Officer name:

Signature: _____

Facility Manager name:

Signature: _____