

Sign-Off Procedure Required
before Flowing Flammable Gas To
or Turning High Voltage on the
CDF Detector Subsystems
(this is a Safety Procedure)

This procedure outlines the steps to be taken to gain approval for flammable gas and high voltage initiation for individual detector subsystems.

Approvals:

(RD/CDF Department Head)

(Date)

(Research Division Head)

(Date)

(Accelerator Division Head)

(Date)

1.0 Controlled Copies of this procedure.

Four controlled copies of this procedure will exist:

1. At the CDF Gas Tech bench in the CDF Assembly Building
2. In the RD / CDF Department Office
3. In the Research Division Office
4. In the Accelerator Division Office

All other copies will be marked, " INFORMATIONAL COPY ONLY"

2.0 The Procedure

This procedure has three parts.

Part A is executed by a CDF Gas Tech with reporting requirements to the CDF Gas Systems Engineer.

Part B is executed by the CDF Gas Systems Engineer and contains restrictions on the detector subsystems in the event of flammable gas leak or higher than normal oxygen concentration in a subsystem.

Part C is executed by the CDF Operations Manager.

2.1. Procedure Part A:

A trained CDF Gas Technician executes Part A of this procedure for each detector subsystem before the CDF Gas Systems Engineer will give permission for flammable gas flow or high voltage.

NOTE: This procedure represents a minimal requirement for flammable gas and high voltage initiation. The Gas Technician or Gas Systems Engineer may conduct any additional checks and should note those checks in the comments section of the check list.

A.1. The Gas Tech completes a copy of the "CDF Gas System: Detector Start-Up Checklist" in section 3.0.
The Gas Tech notes each exception to the check list along with the reason for the exception.
(A CDF Experimenter may assist the Gas Tech, but the Gas Tech is in charge and is responsible for the checklist.)

A.2. After completing the checklist, the Gas Tech obtains the CDF Gas Systems Engineer's signature before initiating flammable gas flow.

A.3. The Gas Tech posts copies of the completed check list as follows:
a) on associated subsystem gas control panel on the gas platforms,
b) in the CDF Gas System log book.

The Gas Tech places the original check list in the RD/CDF Department Office with the "Operational Readiness Clearance" documentation.

A.4. The Gas Tech must inform the CDF Gas Systems Engineer if **any** of the following conditions occur:

- a) O₂ concentration greater than 500 ppm,
- b) Leak rate greater than 25% of the detector volume per hour or greater than 20 SCFH (unless detector is in an inerted area),
- c) Lack of return bubbler bubbles,
- d) LEL > 20% and this detector system found to be the cause.

(Report to the CDF Operations Manager if the CDF Gas Systems Engineer can't be contacted immediately.)

2.2. Procedure Part B:

The CDF Gas Systems Engineer is responsible for this part of the procedure.

- B.1. The CDF Gas Systems Engineer must not authorize any gas flow until the "Initial Systems Turn-On Checklist" is signed by the CDF Department Head.
A new signature and checklist is required following any major gas system work and each time the detector is moved to or from the Collision Hall.
Put the completed checklist in the CDF Gas Systems Logbook.

- B.2. After the Gas Tech completes each "Detector Start-Up Checklist", the CDF Gas Systems Engineer signs the checklist form before allowing flammable gas flow and signs a second time before allowing high voltage on the detector subsystem.
Notify the CDF Operations Manager of allowed high voltage conditions.

- B.3. If any of the conditions in Part A, step A.4. are subsequently reported by the Gas Tech, the CDF Gas Systems Engineer makes a **written determination** concerning the operating safety of the detector subsystem in question.

B.3.a. Such a determination may allow continued gas flow and continued high voltage during investigation, or continued gas flow with administrative shutdown of the high voltage on the detector. The Gas Systems Engineer should contact the CDF Operations Manager for administrative shutdowns.

B.3.b. The written determination should be placed in the CDF Gas System logbook and a report of the situation should be made to the CDF Operations Manager. An email copy should be sent to the CDF Flammable Gas Committee.

B.3.c. If the CDF Gas Systems Engineer cannot verify the safety of the system, then permission to run the high voltage for the detector subsystem must be withdrawn.

B.3.d. Permission to operate is withdrawn by having the CDF Department Operations Electrical Group Leader (or designee) turn off the High Voltage to the detector subsystem, electrically disable the HV to the detector subsystem, and tag out the HV to the detector subsystem. In

some circumstances it may also be appropriate to turn off and tag out low voltage power systems. (also see Part C, Step C.2.)

- B.4. The CDF Gas Systems Engineer reinstates permission to reenergize high voltage only after the oxygen level or leak rate is reduced to acceptable levels and the Gas Tech completes a new checklist.

2.3. Procedure Part C:

The CDF Operations Manager is responsible for this part of the procedure.

C.1. Once Flammable gas flow begins, the CDF Operations Manager enforces administrative control of the detector subsystem High Voltages in accordance with proper sign-offs from the CDF Gas Systems Engineer.

C.2. **If the Gas Tech reports any of the conditions listed in step A.4. when the CDF Gas Systems Engineer is not available, then the CDF Operations Manager must execute HV shutdown as described in step B.3.d.**

E-mail should be sent to the CDF Flammable Gas Committee summarizing the situation.

3.0 Checklists

3.1

The Gas Tech Checklist is on the following page. Copies of the checklist can be found inside the front pocket of the CDF Gas Systems Log Book.

Checklist Section Explanations:

1. Check Mechanical And Electrical Connections:

Verify that all mechanical and electrical connections to the system have been completed.

2. Verify Inerting Flow:

If the system requires an inerting flow, verify that the inerting flow has been established.

Note: The CTC and CDT require inerting flows before flammable gas flow may be initiated.

The CMU inerting flow is not required before flowing flammable gas, but is required before high voltage is engaged.

All other chambers have no inerting system.

3. Verify System Purging:

Verify that the system has been purged with at least three volume changes of an inert gas.

4. Check Oxygen Concentration

Measure the oxygen concentration in the system using the gas computer in the relay rack RRG01. The detector output bubbler must be bubbling or the oxygen concentration cannot be properly measured. Oxygen concentration must be less than 500 ppm.

5. Check Leak Rate:

If the detector system has an output flow meter, measure the system leak rate by subtracting the output flow from the input flow and record it below.

If the system does not have an output meter, reduce the inerting flow until the output bubbler just stops bubbling to get a rough measurement of the leak rate.

Note: The maximum allowable system leak rate is 25% of the detector system volume per hour, but in no case shall exceed 20 SCFH.

6. Ignition Sources:

Double check there is no unusual activity (e.g., welding, soldering, brazing, grinding, etc.) is being conducted in the vicinity of the detector subsystem.

Note: as long as the oxygen level is less than 500 ppm, high voltage may be turned on at any time after the initial three volume changes of nitrogen.

CDF Gas System: Detector Start-Up Checklist

This Checklist Is For Which Detector Subsystem (Circle):

Group	Subsystems								
Guts:	CTC	CDT	VTX/SVX						
Arches:	CMU								
Plug:	PEM	PHA							
Forward:	FMU	FEM	FHA						
Muon:	NWA	SWA	TOP	BOT	NWX	SWX	NEX	SEX	

1. **Check Mechanical And Electrical Connections**
 System inspection completed.

2. **Verify Inerting Flow**
 Inerting flow established
 System does not require inerting flow

3. **Verify System Purging**
 System was sufficiently purged with three volume changes of
 Argon Nitrogen

4. **Check Oxygen Concentration**
 Gas return line measured oxygen level was _____ ppm O2

5. **Check Leak Rate**
 System input flow = output flow (i.e., no leaks found)
 System leak rate was measured and found to be _____ SCFH.
 Above number (in SCFH) is less than 25% of the detector volume and less than 20 SCFH.

6. **Ignition Sources**
 No unusual ignition sources are present.

COMMENTS:

CHECK LIST EXCEPTIONS: (List each exception and state reason)

Checklist completed by: _____ Date: _____

Permission for Detector
 Gas Flow given by: _____ Date: _____
 (CDF Gas Systems Engineer)

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Permission for Detector
High Voltage given by: _____ Date: _____
(CDF Gas Systems Engineer)

3.2

The Gas Systems Engineer Checklist is on the following page.

**CDF Gas System:
Initial System Turn-On Checklist**

1. **The Crash Button Testing Sign-Off Sheet has been completed**
2. **The Shunt Trip Testing Sign-Off Sheet has been completed.**
3. **The Flammable Gas Head Sign-Off Sheet has been completed.**
4. **The FIRUS Testing Sign-Off Sheet has been completed.**
5. **Items 1 - 4 have been placed in the CDF Gas System logbook.**

6. **Approval has been given by the Flammable Gas Safety Committee.**
7. **Approval has been given by the Research Division Head.**
8. **Approval has been given by the Accelerator Division Head.**
9. **Items 6 - 8 have been placed in the CDF Operational Readiness Clearance documentation.**

10. **The following CDF Group Supervisors have been notified of Flammable Gas Flow and reminded of the restrictions on ignition sources (welding, soldering, brazing, grinding, etc)** in the areas affected:
 - CDF Operations Manager**
 - CDF Building Manager**
 - CDF Assistant Building Manager**
 - CDF Gas Technician Supervisor**
 - CDF Department T&M Rigging Supervisor**
 - CDF Operations Mechanical Group Leader**
 - CDF Operations Electrical Group Leader**
 - CDF Rigging Crew Supervisor**

COMMENTS:

CHECK LIST EXCEPTIONS: (List each exception and state reason)

Checklist

CDF PROC -13 "Sign-Off Procedure Required before Flowing Flammable Gas To or Turning High Voltage On the CDF Detector Subsystems"

April 8, 1992 10:41 PM

Completed by: _____ Date: _____
(CDF Gas Systems Engineer)

Permission for Gas
Systems Flow given by: _____ Date: _____
(CDF Department Head)

4.0 Deviations

None are allowed.

5.0 Required Training and Authorized Training Personnel.

A. Gas Tech training.

Training is required.

Authorized training personnel:

John Pawlak, ID# 9381

Don Mizicko, ID# 704

Both are qualified by experience in the design and implementation of the CDF Gas System.

The training should be documented on a standard Fermilab Training Form and the Training Expiration date should be tied to the end date of the Collider Run (e.g. "the end of Collider Run Ia").

The completed forms must be inserted in the CDF Department Office copy of this procedure.

B. CDF Gas Systems Engineer and CDF Operations Manager training.

Read Sections 2 and 3 of this procedure with a CDF Department Head.

The training should be documented on a standard Fermilab Training Form and the Training Expiration date should be tied to the end date of the Collider Run (e.g. "the end of Collider Run Ia").

The completed forms must be inserted in the CDF Department Office copy of this procedure.

6.0 Training Materials.

No written materials exist.

One of the authorized training personnel must give a training lecture using sections 2 and 3 of this procedure.

This lecture must include a tour with stops and instruction at:

1. CDF Gas Computer and oxygen analyzer.
2. CDF 720' and 730' Gas Platforms.

7.0 List of Trained People for this procedure.

Eventually the list may reside in a lab-wide database.

Until that time, a list of trained personnel for this procedure should be kept in the CDF Department copy of the procedure in a separate section at the end of the procedure.

8.0 References and Supporting Documentation.

none.