

GEORGIA TECH RESEARCH REACTOR

Chapter  
6  
Maintenance CONTAINMENT BUILDING PRESSURE TEST  
& Testing

Procedure 4000  
Approved 3-10-72  
Latest Rev. 4-19-84  
Page 1 of 19

Objective

Month and Year

The objective of this test is to ascertain the ability of the building containment system to withstand an internal pressure of 2 psig and to measure the rate at which leakage occurs from the building.

I. Required Equipment and/or Material

Initial Date

A. Building Test

- |  |       |       |
|--|-------|-------|
| 1. Air Filter cartridges, 10 micron  | _____ | _____ |
| 2. Two twenty and two eighty gallon reference tanks  | _____ | _____ |
| 3. Tubing and fittings for reference tank system   | _____ | _____ |
| 4. Recording Hygrothermograph (7 day)  | _____ | _____ |
| 5. Recorder and chart for 72 hour (3 day) run with eight iron-constantan (IC) thermocouples and wire lead. | _____ | _____ |
| 6. 150-200 cfm air compressor  | _____ | _____ |
| 7. Known leak rotameter (0-60 scfh)  | _____ | _____ |
| 8. Soap solution or a "leak check" product   | _____ | _____ |
| 9. Light in pipe chase at test panel (equipment room side)   | _____ | _____ |
| 10. Signs. (airlock and visitor corridor)  | _____ | _____ |
| 11. Scaffolding under containment building air intake louver (PPD)   | _____ | _____ |

B. Vacuum Breaker Test

- |                           |       |       |
|---------------------------|-------|-------|
| 1. Test flange for valves | _____ | _____ |
| 2. Portable vacuum pump   | _____ | _____ |
| 3. Water manometer        | _____ | _____ |
| 4. Tubing and fittings    | _____ | _____ |

GEORGIA TECH RESEARCH REACTOR

Chapter  
6

Maintenance CONTAINMENT BUILDING PRESSURE TEST  
& Testing

Procedure 4000  
Approved 3-10-72  
Latest Rev. 4-19-84  
Page 2 of 19

5. Air supply PRV, block valve,  
soap solution

6. Hg manometer

II. Initial Preparation

1. Check filter cartridges in supply air filter  
in tank pit. Use clean 10 micron units if  
required

2. Locate and install reference tanks as follows:  
(See Figure 1, page 10). Lockout and tag crane.

Tank 1 80 gal, hung from crane at reactor top  
level (south)

Tank 2 80 gal, first floor (north)

Tank 3 20 gal, basement floor (north)

Tank 4 20 gal, process room

3. Locate I.C. thermocouples as follows after  
calibration at room temperature: (Let all T/C's  
print for 5 min at room temperature. Verify  
correct polarity hook up of T/Cs. Note on  
recorder chart).

<u>T. C.</u>	<u>Recorder Point</u>	<u>Location</u>
TC 1	1	Tank 1
TC 2	2	Tank 2
TC 3	3	Tank 3
TC 4	4	Tank 4
TC 5	5	Light (ECCS)
TC 6	6	Recorder
TC 7	7	Basement (ambient)
TC 8	8	Placed in vacuum breaker (outside, ambient)

GEORGIA TECH RESEARCH REACTOR

Chapter  
6

Procedure 4000  
Approved 3-10-72  
Latest Rev. 4-19-84  
Page 3 of 19

Maintenance CONTAINMENT BUILDING PRESSURE TEST  
& Testing

---

4. Pressurize reference tank system to 2 psig using an accurate gauge (Heise). Maintain the test a minimum of 24 hours. Read and record the pressure once/hour on data sheet 1, page 11. \_\_\_\_\_
5. Check that equalizer valve system is installed inside large personnel airlock. \_\_\_\_\_
6. Make arrangements for acquiring 150 to 200 cfm air compressor and 100 ft. of 3/4-inch air hose. \_\_\_\_\_
7. Notify campus security and Physical Plant Department that test is to be run. \_\_\_\_\_
8. Cancel or reschedule any tours of the Nuclear Research Center. \_\_\_\_\_
9. Notify all NRC personnel and all experimenters so that they are aware of the test and can remove equipment, etc. \_\_\_\_\_
10. Hook up T/C's to recorder and check them out. Locate recorder so that it is visible and readable from the visitor's side of the containment building viewing window. \_\_\_\_\_
11. Check out individual catwalk heater thermostats for operability. Adjust to 65 degrees F. \_\_\_\_\_
12. Notify building air conditioning mechanic of test and have him check out air handling unit on top of control room. Verify that building A/C unit is performing without large variations in chilled water temperature. \_\_\_\_\_
13. At building test panel, flush water reservoir tank and lines. Fill tank with water. \_\_\_\_\_

III. Test Procedure

A. Vacuum Relief Valves

Note: A pressure test is run prior to the vacuum test on these valves. They are not to be tested again before the containment building test itself.

1. Hook up to air source as shown in Figure 2, page 12. \_\_\_\_\_

2. Pressurize relief valve to 2.1 to 2.2 psig. \_\_\_\_\_

3. Close block valve H1 and remove air supply source. Take readings on data sheet 2. Read every 5 minutes for 20 minutes, then every 20 minutes for 1 hour. \_\_\_\_\_

4. Close outside isolation valve and continue to take readings on data sheet 2, page 13, every 5 minutes for an additional 30 minutes. \_\_\_\_\_

5. Report test results to supervisor. \_\_\_\_\_

Note: The maximum allowable pressure loss during this test is 1.2 psi per hour per valve. This loss rate would be equivalent to an air leak of 6.7 ft per 24 hrs. per valve. The total allowable air loss for the entire containment building is 2676 ft per 24 hours @ 2 psig.

6. Open isolation valve. \_\_\_\_\_

7. Relocate set-up on other valve and repeat steps 2,3,4,5 and 6. \_\_\_\_\_

8. Report results to supervisor. \_\_\_\_\_

9. Hook up vacuum system as shown in Figure 2, page 12. \_\_\_\_\_

10. Create vacuum in valve and observe and record on data sheet 2 where valve relieves. Note: Valve, is designed to open at a vacuum of 0.12 psi or 3.32 in of water. \_\_\_\_\_

GEORGIA TECH RESEARCH REACTOR

Chapter  
6

Maintenance CONTAINMENT BUILDING PRESSURE TEST  
& Testing

Procedure 4000  
Approved 3-10-72  
Latest Rev. 4-19-84  
Page 5 of 19

- 11. Report results to supervisor. \_\_\_\_\_
- 12. Relocate setup on other valve and repeat. \_\_\_\_\_
- 13. Remove flanges and test equipment and store.  
Note: Do not store mercury manometer in  
containment building. \_\_\_\_\_

B. Containment Building Test

- 1. Make a careful survey of containment building  
for equipment subject to damage by a 2 psig  
external pressure so it can be either vented or  
or removed. \_\_\_\_\_
- 2. Check that cap is removed inside containment  
building on building pressure sensing line. \_\_\_\_\_
- 3. Verify that the reference tanks have been  
checked and positioned and that the water  
manometer valves are set to connect the tanks  
to the containment building. \_\_\_\_\_
- 4. Verify that T/C recorder is visible from  
viewing window, all T/C's are hooked up and  
responding and that enough chart paper is on  
recorder for the 3-day test. \_\_\_\_\_
- 5. Disconnect control room annunciator bell and  
tag console to this effect. \_\_\_\_\_
- 6. Reset relative humidity control above control  
room to 70%. Verify building thermostat is set  
at 68 degrees F. \_\_\_\_\_
- 7. Remove current console log book from containment  
building. \_\_\_\_\_
- 8. Place telltale on air handling unit over control  
room. Verify air flow by movement of telltale. \_\_\_\_\_
- 9. Position viewing mirror so that entire annunciator  
panel is visible from viewing window. \_\_\_\_\_
- 10. Check ink supply, hair humidity element, and  
verify that clock is wound on hygrothermograph.  
Place where visible from viewing window. \_\_\_\_\_

GEORGIA TECH RESEARCH REACTOR

Chapter  
6

Maintenance CONTAINMENT BUILDING PRESSURE TEST  
& Testing

Procedure 4000  
Approved 3-10-72  
Latest Rev. 4-19-84  
Page 6 of 19

11. Check and record pressure on inflatable gaskets.

Main airlock \_\_\_\_\_

Personnel airlock \_\_\_\_\_

Truck Door \_\_\_\_\_

12. Set up Helium blanket at gas holder (min.  
of 20%)

a. Remove all personal items, ladders, soap  
solution, brushes, wrenches, clipboard,  
master procedure, fork lift truck, and  
other equipment needed for the test from  
the containment building.

b. Make P.A. announcement before isolation

c. Turn "DO NOT ENTER" to manual.

d. Read Kanne just before isolation.  
Kanne reading \_\_\_\_\_

e. Isolate the building. Physically check  
the following valves closed:

1) 4 isolation valves

2) 8 rabbit valves

3) vacuum valve

4) Position the Emergency Air Lock doors  
so that INNER DOOR-OPEN  
OUTER DOOR-CLOSED

f. Make any necessary adjustments to the  
building security system.

g. Start compressor and pressurize building  
to 4.7 in. Hg pressure as indicated on  
containment building pressure manometer  
in pipe chase. (approx. 3 to 4 hours  
required).

GEORGIA TECH RESEARCH REACTOR

Chapter  
6

Maintenance CONTAINMENT BUILDING PRESSURE TEST  
& Testing

Procedure 4000  
Approved 3-10-72  
Latest Rev. 4-19-84  
Page 7 of 19

h. Stop compressor and start building test.

- 1) Allow at least 1 hour for pressure in reference tanks and building to equalize by leaving both valves on the differential pressure manometer open (see Figure 3) \_\_\_\_\_
- 2) Open equalizer valve to pressurize water reservoir tank \_\_\_\_\_
- 3) Slowly open both valves at bottom of manometer and flush out lines and reservoir or manometer \_\_\_\_\_
- 4) Carefully close manometer drain valve and let water fill both legs of manometer. When level reaches zero mark close both valves at the bottom of the manometer. If necessary, drain this water to remove any contamination, (rust, dirt, etc.) in the manometer tube and repeat step 4. \_\_\_\_\_
- 5) Close equalizer valve to start pressure test. \_\_\_\_\_

i. Check each item for air leakage; use leak-check as required. If leakage is detected, estimate the magnitude.

- 1) Both vacuum relief valves (remove screens, soap test, clean off soap) \_\_\_\_\_
- 2) Viewing window \_\_\_\_\_
- 3) Main air-lock \_\_\_\_\_
- 4) Emergency air lock \_\_\_\_\_
- 5) Truck door \_\_\_\_\_
- 6) Intake 24" butterfly (scaffold) \_\_\_\_\_
- 7) Outlet 24" butterfly \_\_\_\_\_
- 8) 4" valve and fittings in tank room \_\_\_\_\_

GEORGIA TECH RESEARCH REACTOR

Chapter  
6

Procedure 4000  
Approved 3-10-72  
Latest Rev. 4-19-84  
Page 8 of 19

Maintenance CONTAINMENT BUILDING PRESSURE TEST  
& Testing

- |   |      |      |
|---|------|------|
| 9) All joints, fittings and valves at manometer test panel  | ____ | ____ |
| 10) Both beam tube extension penetrations   | ____ | ____ |
| 11) Cooling tower sump  | ____ | ____ |
| 12) ECCS valves 690, 691 and line drain (jumper removed)  | ____ | ____ |
| 13) Rabbit station in Lab 149 (H15)   | ____ | ____ |
| 14) Rabbit station in Lab 127 (H16)   | ____ | ____ |
| 15) 4-Rabbit isolation valves at containment wall   | ____ | ____ |
| 16) All electrical penetrations @ containment wall.   | ____ | ____ |
| j. Record data on data sheet 4.   | ____ | ____ |
| k. Start log, page 19, of general checks, work, problems found and how corrected etc.   | ____ | ____ |
| l. Start known leak by installing 0-60 scfh rotameter on flange at 3-inch blow down valve. Set leak rate to 50 scfh.  | ____ | ____ |
| m. <u>CAUTION</u><br><br>Prior to depressuring the building, <u>OPEN</u> main air lock outer door. Notify police dispatcher that a false fire alarm may be received during de-pressurization. | ____ | ____ |
| n. Depressurize when notified by supervision that the test is completed by opening 3 inch valve in tank farm pit.   | ____ | ____ |
| 14. Securing Containment Building after test  |      |      |
| a. Secure fire alarm system, if it goes off, by disabling in the cold equipment room. Rewind box in containment and reset panel.  | ____ | ____ |
| b. Check air supply filters. If dirty, order replacements.  | ____ | ____ |



GEORGIA TECH RESEARCH REACTOR

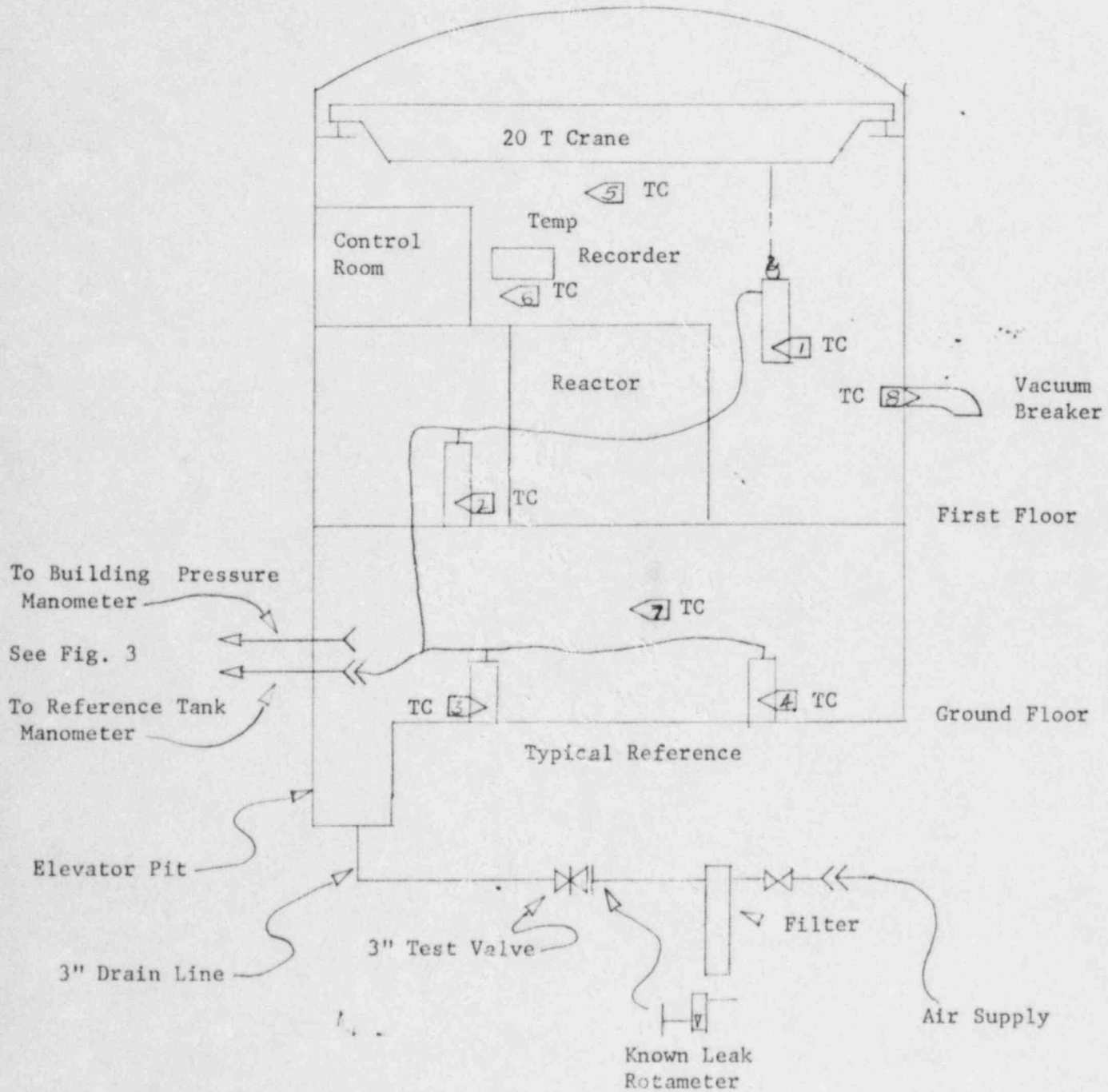
Chapter  
6

Procedure 4000  
Approved 3-10-72  
Latest Rev. 4-19-84  
Page 9 of 19

Maintenance CONTAINMENT BUILDING PRESSURE TEST  
& Testing

- |  |       |       |
|--|-------|-------|
| c. Install blind flange on 4 inch valve in tank farm pit.  | _____ | _____ |
| d. Remove and store reference tanks, T/C's and recorder.   | _____ | _____ |
| e. Reinstall check valve at airlocks   | _____ | _____ |
| f. Make arrangements for returning air compressor and have the scaffold disassembled.  | _____ | _____ |
| g. Drain manometers and water supply tank at test panel in pipe chase. Close valves and isolate building pressure sensing line and reference tank pressure line. | _____ | _____ |
| h. Carefully clean any soap residue from gaskets of vacuum relief valves and lightly lubricate gasket with silicone oil.   | _____ | _____ |
| i. Set up on PM charts to manually lift vacuum relief valves and inspect gaskets six months from date of check.  | _____ | _____ |
| j. Clean and grease seats on 24 inch butterfly isolation valves.   | _____ | _____ |
| k. Wipe seals on airlocks. Open truck door clean out groove at bottom, wipe and carefully inspect seal.  | _____ | _____ |
| l. Reset containment building humidity control to 50%.   | _____ | _____ |
| m. Reset security system to normal   | _____ | _____ |
| n. Reconnect console alarm bell and test for proper function.  | _____ | _____ |

**FIGURE 1**  
**ARRANGEMENT OF EQUIPMENT FOR**  
**CONTAINMENT BUILDING LEAKAGE TEST**



Reference Tanks 1 & 2 80 Gal.  
 Reference Tanks 3 & 4 20 Gal.  
 Thermocouple Locations TC [1] → TC [8]

Data Sheet 1--Reference Tank Pressure Test

<u>Time</u>	<u>Pressure</u>	<u>Time</u>	<u>Pressure</u>

Pressure Conversion Chart

Psig	=	In. of Hg.	=	Ft. of H <sub>2</sub> O	=	In. of H <sub>2</sub> )
1.0		2.036		2.307		27-11/16 (.6875)
0.1		0.2036		0.2307		2-49/64 (.7656)
0.2		0.4072		0.4614		5-17/32 (.5312)
0.3		0.6108		0.6921		8-5/16 (.3125)
0.4		0.8144		0.9228		11-5/64 (.0781)
0.5		1.018		1.1535		13-27/32 (.8437)
0.6		1.2216		1.3842		16-39/64 (.6094)
0.7		1.4252		1.6149		19-3/8 (.3751)
0.8		1.6288		1.8456		22-9/64 (.1406)
0.9		1.8324		2.0763		24-59/64 (.9219)

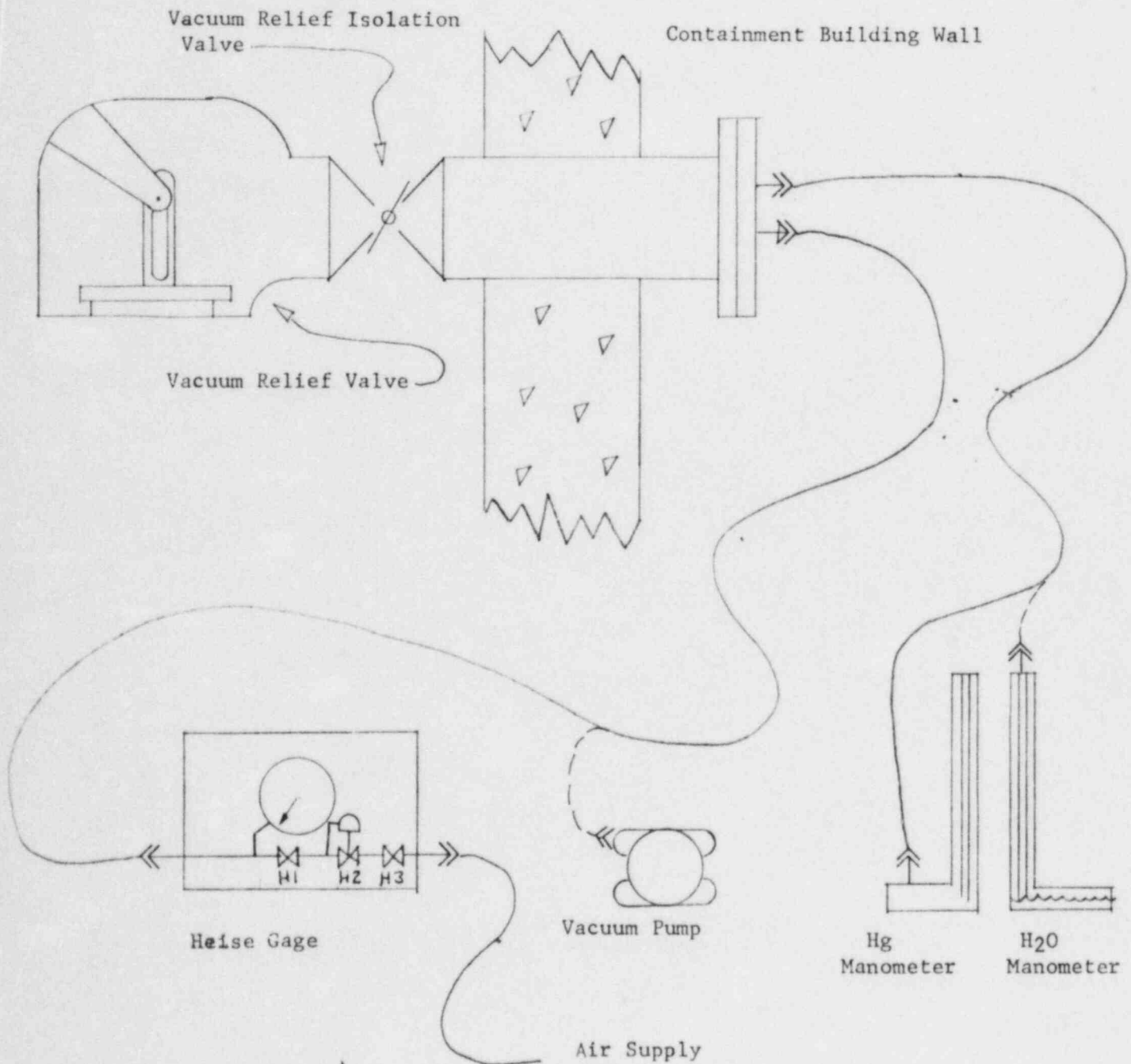
Date Started \_\_\_\_\_

\_\_\_\_\_ Shift Supervisor

Date Terminated \_\_\_\_\_

FIGURE 2

ARRANGEMENT OF EQUIPMENT FOR  
VACUUM RELIEF VALVE TEST

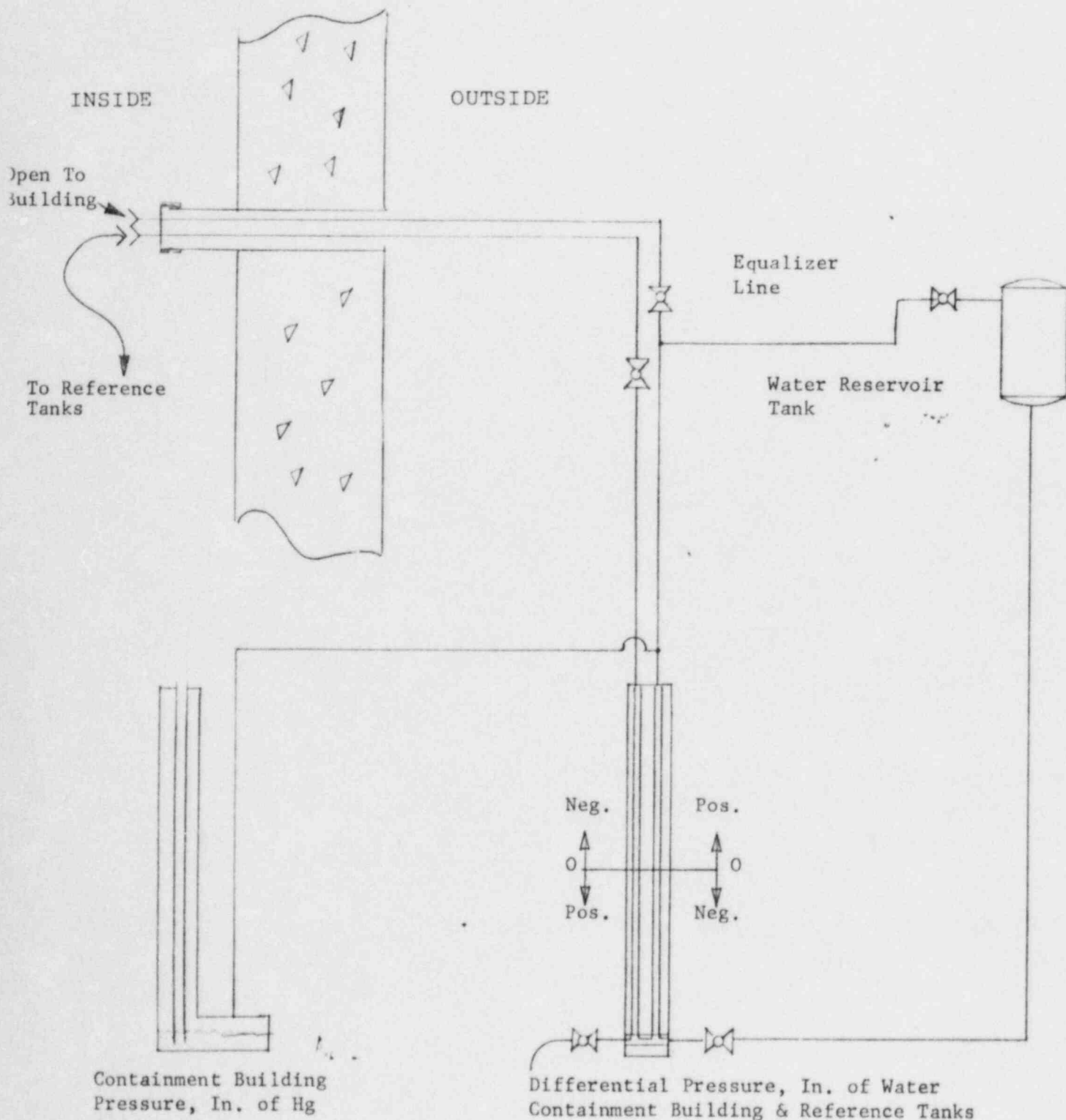


Notes:

1. Both setups cannot be made simultaneously as shown.
2. Valves should open at 0.12psi or 3. in. of water.
3. Leakage of 0.1 psi/hour =  $\frac{1}{2}$  cu. ft./day @ 2 psig.



FIGURE 3  
TEST PANEL LAYOUT



Chapter 6  
Maintenance and  
Mechanical Testing

GEORGIA TECH RESEARCH REACTOR

Procedure 4000  
Approved: 3-10-72  
Latest Rev. 4-19-84

Containment Building Pressure Test Page 15 of 19

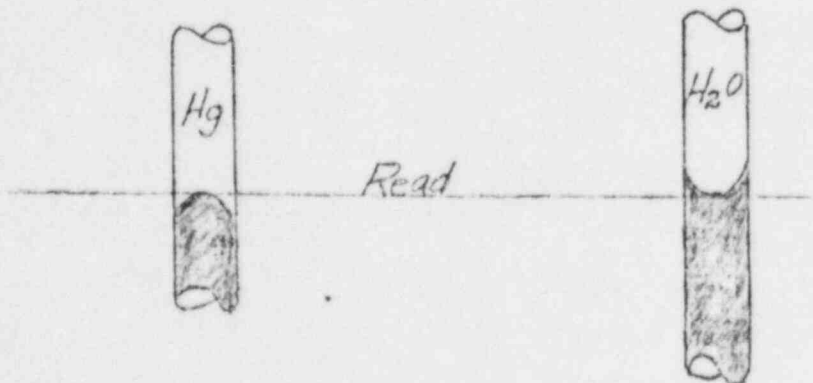
Data Sheet 3--Personnel Assignment Sheet

Date \_\_\_\_\_

Containment Building Pressure Test

General Instructions for Data Taking at Test Panel

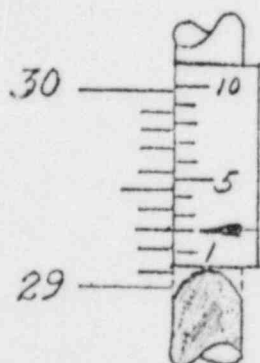
1. Take a set of data once every hour.
2. Every hour, or if abnormalities occurs, check the visitors gallery. Check:
  - a. The main fan is blowing air (tell-tale)
  - b. No significant temperature change as recorded by the hygrothermograph. There may be a very gradual change but anything greater than 1° F per hour is significant. Note that a large temperature increase could cause an over-pressure in the containment building.
  - c. General observation of building interior.
3. Record the chilled water supply temperature--taken from the in-line thermometer in the chilled water supply line.
4. Walk around the outside of the containment building at least once every 2 hours. Look for evidence of air leaks.
5. Read the top of a mercury meniscus and the bottom of a water meniscus:





Containment Building Pressure Test

6. Always check zero prior to reading barometer.
  - a) If necessary adjust plunger on cistern of barometer until tip of cone touches surface of mercury pool.
  - b) Read barometer by sliding vernier along scale until the bottom is just over meniscus. Read main scale and vernier.



Note: "Zero" hash-mark is the bottom of the vernier.

Read 29.12 in. Hg.

7. If Containment Building Internal Pressure reaches 4.80 inches Hg. call Reactor Supervisor. If the pressure ever reaches 4.90 inches Hg., immediately open the 3-inch blowdown valve in the tank pit. Bring pressure down to approximately 4.7 in Hg.
8. No valve manipulations at instrument panel are required. Do not make any.
9. Record any pertinent information on the Work Log page of the data sheets. Also record work on general problems and how corrected etc. Time, date, and initial your entries.
10. For any problem or difficulty with the test (equipment, data, etc.) contact Reactor Supervisor.



Date \_\_\_\_\_

Work Log

Sheet \_\_\_\_ of \_\_\_\_

Date, Time  
Observer \_\_\_\_\_

Description of work, check, etc. done.

Blank lined area for recording work log entries.



Georgia Institute of Technology  
SCHOOL OF NUCLEAR ENGINEERING AND HEALTH PHYSICS  
ATLANTA, GEORGIA 30332

NEELY NUCLEAR RESEARCH  
CENTER

(404) 894-3600

April 26, 1984

MEMORANDUM

TO: L.D. McDowell, M.V. Davis, W.H. Downs, J.F. Hendricks  
FROM: R.S. Kirkland *RSK*  
SUBJECT: Console Logbook Entries

Effective this date, please sign or initial any console logbook entries that you make regardless of the operating status of the reactor.