BNL 7493

E-134 (BC)
BC02-O-L

80" Bubble Chamber
Expansion System
Preliminary Operating Procedures

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A. Foreword

These procedures are intended to be used for the initial operation of the expansion system and serve as a basis for a more complete and revised form to be written once operating experience has been gained.

An attempt has been made to offer a logical and systematic presentation to facilitate operation and maintenance of the system by the operating personnel. Thus, the sequence of valve actuations has been presented in matrix and Check list form to minimize errors; this also has the advantage of making it easier to adapt certain expansion system procedures to programmed control by a process control computer.

A schematic diagram of the valves and reservoirs that drive the piston and evacuate and purge the plumbing is shown in Figure 1. The supply lines L1 - L9 originate in the floor control panel. Figure 2 is a schematic of this panel. A description of the valves, regulators and pressure gauges used in this system is given in Table I.

These operating procedures cover the following:

1. Initial evacuation and purging of the system with hydrogen.
2. Setting up operating pressures on the floor control panel.
3. Filling valves and reservoirs to operating pressure.
4. Filling chamber, buffer volume and cylinder head to operating pressure.
5. Shutting down the system.

6. Procedures for boot valve disassemblies during operation.

7. Procedures for solenoid valve disassemblies during operation.

8. Suggested procedures for the initial operation.

B. Initial Evacuation of the System and Purging with Hydrogen

The system which consists of the control panel, valves, reservoirs, cylinder and chamber will be initially filled with atmospheric air. It is pumped to vacuum and filled with low pressure purified hydrogen as follows:

1. The control valve CV1 is assumed to be open and the piston position is pressurized at 100 psig. The valves are initially in the position shown on Valve Position Matrix B1.

2. Follow steps 1-23 on Check list B1 to evacuate and purge the system.

(a) Caution: when filling system with hydrogen in steps 9 and 17 check piston position to make sure that the piston is not being pushed downward by gas pressure past the first alarm position. If the piston goes down too far, reduce the rate of filling.

C. Setting Operating Pressures on Control Panel

Once the system has been filled with purified hydrogen gas at gas holder pressure, the operating pressures can be set up on the control panel as follows:

1. The valves should be in the positions shown on Matrix B1.
2. Perform steps 1-45 on Check list C1.
3. After completion of Check list C1, the valves are in the positions shown on valve position Mitrix C1 and the valves and reservoirs can be filled with hydrogen gas to their operating pressures.

D. Filling Valves and Reservoirs to Operating Pressure with Purified Hydrogen Gas

Once the control panel has been set up at the correct operating pressures with the valves in the positions shown on Matrix C1, the reservoirs and valves may be filled as follows:

1. Set the piston positioner pressure at 100 psig.
2. Perform steps 1-6 on Check list D1.
3. After completion of Check list D1 the valves are in the positions shown on Matrix D1 and the chamber, buffer volume and cylinder head can be brought up to operating pressure.

E. Filling Chamber, Buffer Volume and Cylinder Head with Purified Hydrogen at Operating Pressure

If the reservoirs and valves are at the correct pressures and the valves are in the positions shown on Matrix D1, then the chamber, buffer volume and cylinder head may be brought up to pressure as follows:

1. Perform steps 1-7 on Check list E1; note caution in filling chamber in step 7.

2. After completion of Check list E1, the system is ready for pulsing (provided the bottom piston rings are at operating temperature) and the valves should be in their normal operating positions as shown on Matrix D1.

F. Shutting Down the System

During operation of the expansion system the valves are normally in the positions shown on Matrix D1. If it is desired to stop pulsing and keep the chamber at pressure, the valves should remain in that position. If it is desired to bleed the chamber and reservoirs down and fill with gas holder nitrogen, proceed as follows:

1. Perform steps 1-34 on Check list F1. Observe the caution in step 2.

2. After completing step 34 the system is filled with hydrogen at gas holder pressure and the valves are in the positions shown on Matrix B1.

The system may now be put back into operation as in Section C or it may be pumped out and filled with gas holder nitrogen by performing steps 35-43 on Check list F1. At the completion of check list F1, the valves are still in the positions shown on Matrix B1.

G. Servicing Boot Valves During Operations

The bodies of the boot valves, V1, V2, V3 and V5 may be opened and reclosed while keeping the chamber at operating pressure by using the following procedures. In every case it is assumed that the valves are initially in their normal operating positions as shown on Matrix D1.

I. 6" Expansion Valve, V1

a. To open valve body

(1) Isolate the valve from the system and fill the case and core with gas holder nitrogen by performing steps 1-25 on Check list G1.

(2) After completion of Check list G1, the case of V1 may be opened and the valves are in the positions shown in Matrix G1.

b. Valve Reassembly

(1) After V1 has been reassembled with the valves in Matrix G1 position, it is filled with purified hydrogen gas and put back in service by performing steps 1-28 on Check list G2.

(2) When Check list G2 has been completed the system is ready for operation and the valves have been restored to their normal operating positions as shown on Check list D1.

II. 2 1/2" Inlet Boot Valve, V3

a. To open Valve Body

(1) Isolate the valve and reservoir and fill with gas holder nitrogen by performing steps 1-19 on Check list G3.

(2) After completion of Check list G3, the case of V3 may be opened and the valves are in the positions shown in Matrix G3.

b. Valve Reassembly

(1) After V3 has been reassembled with the valves in Matrix G2 position, it is filled with purified hydrogen gas and put back in service by performing steps 1-23 on Check list G4.

(2) When Check list G4 has been completed, the system is ready for operation and the valves have been restored to their normal operating positions as shown on Matrix D1.

III. 2 1/2" Exhaust Boot Valve

a. To Open Valve Body

(1) Isolate the valve, V5, from the system and fill with gas holder nitrogen by performing steps 1-22 on Check list G5.

(2) After completion of Check list G5, the case of V3 may be opened and the valves are in the positions shown in Matrix G5.

b. Valve Reassembly

(1) After V5 has been reassembled with the valves in Matrix G5 position, it is filled with purified hydrogen and put back in service by performing steps 1-25 on Check list G6.

(2) After completion of Check list G6, the system is ready for operation and the valves have been restored to their normal operating positions as shown on Matrix D1.

IV. 4" Recompression Boot Valve, V2

a. To Open Valve Body

(1) Isolate the valve from the system and fill with gas holder nitrogen by performing steps 1-17 on Check list G7.

(2) After completion of the procedure in Check list G7, the valves are in the positions shown on Matrix G7 and the case of V2 may be opened.

b. Valve Reassembly

(1) After V2 has been reassembled with the valves in Matrix G7 position, it is filled with purified hydrogen and put back in service by performing steps 1-19 on Check list G8.

(2) When Check list G8 has been completed, the system is ready for operation and the valves have been restored to their normal operating positions as shown on Matrix D1.

H. Servicing the Solenoid Valves During Operation

The three solenoid valves V1A, V1B and V2A may be disassembled while maintaining operating pressure in the chamber by following these procedures. In every case it is assumed that initially the valves are in their normal operating positions as indicated on Check list D1.

I. 3/4" Inlet Solenoid Valve, V1A

a. To open valve body

(1) Isolate the valve and its reservoir from the system and fill with gas holder nitrogen by performing steps 1-21 on Check list H1.

(2) After completion of the procedures on Check list H1, the valves are in the positions shown on Matrix H1 and the valve body may be opened.

b. Reassembly of V1A

(1) After V1A has been reassembled with the valves in Matrix H1 position, it is filled with purified hydrogen and put back in service by performing steps 1-15 on Check list H2.

(2) When Check list H2 has been completed the system is ready for operation and the valves have been restored to the normal operating positions shown on Matrix D1.

II. 3/4" Exhaust Solenoid Valve, V1B

a. To open valve body

(1) Isolate the valve and its reservoir from the system and fill with gas holder nitrogen by performing steps 1-21 on Check list H3.

(2) After completion of the procedures on Check list H3, the valves are in the positions shown on Matrix H3 and the body of V1B may be opened.

b. Reassembly of V1B.

(1) After V1B has been reassembled with the valves in Matrix H2 position, the valves and reservoirs are filled with purified hydrogen and put back into operation by performing steps 1-14 on Check list H4.

(2) When Check list H4 has been completed, the system is ready for operation and the valves have been restored to their normal operating positions as shown on Matrix D1.

III. 1 1/4" Recompression Solenoid Valve, V2A

a. To open valve body

(1) Isolate the valve and its reservoir from the system and fill with gas holder nitrogen by performing steps 1-19 on Check list H5.

(2) After completion of the procedures on Check list H5, the valves have been placed in the positions shown on Matrix H5 and the body of V2A may be opened.

b. Reassembly of V2A

(1) After V2A has been reassembled with the valves in Matrix H4 position, the valve and reservoir are filled with purified hydrogen and put back in operation by following steps 1-22 on Check list H6.

(2) When Check list H6 has been completed the system is ready for operation and the valves have been restored to their normal operation positions as shown on check list D1.

I. Suggested Procedures for Initial Operation

The first time that the piston is pulsed, the chamber may or may not be filled with liquid. However, if there is gas in the chamber the piston is not to be pulsed unless the bottom rings have been cooled to at least 80°K since they are not sized for room temperature operation.

If the bottom rings have been cooled to proper operating temperature and the solenoid valves have been tested for proper actuation, the following procedure is suggested for initial pulsing.

1. The system is pumped and purged with hydrogen according to these instructions.

2. The chamber, buffer volume and cylinder head are filled to 90 psia with the following cperating pressures:

P1 - 125 psig
P2 - 115 psig
P3 - 140 psig
P4 - 140 psig
P5 - 75 psig
P6 - 75 psig
P7 - 75 psig
P8 - Not Used
P9 - Not Used

Piston positioner - 100 psig

3. The piston is then moved up and down slowly from the control panel by venting and filling the cylinder head from L-5.

4. If the piston responds in a satisfactory manner to the pressure changes from the control panel, then proceed to pulse the piston with the solenoid valves. It is recommended that the initial expansion be slowed down by throttling the exhausts of V1A and V1B and the piston excursion limited by a short solenoid valve actuation time. Thus, make the following settings:

a. Close V17 about 3/4 of the way

b. Close V19 about 3/4 of the way

c. Time solenoid valves as follows:

(1)	Start expand	-	1ms
(2)	Stop expand	-	10ms
(3)	Start recompress	-	15ms
(4)	Stop recompress	-	25ms

5. Using manual trigger, pulse the piston once with the above settings. Examine the oscilloscope traces of the pulse and proceed accordingly.

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BY CLG DATE
CHKD. BY DATE
REV 1/8/63

SUBJECT SCHMATIC OF EXPANSION SYSTEM PIPING
DEPT. on PROJECT

SHEET No DF
JOB No

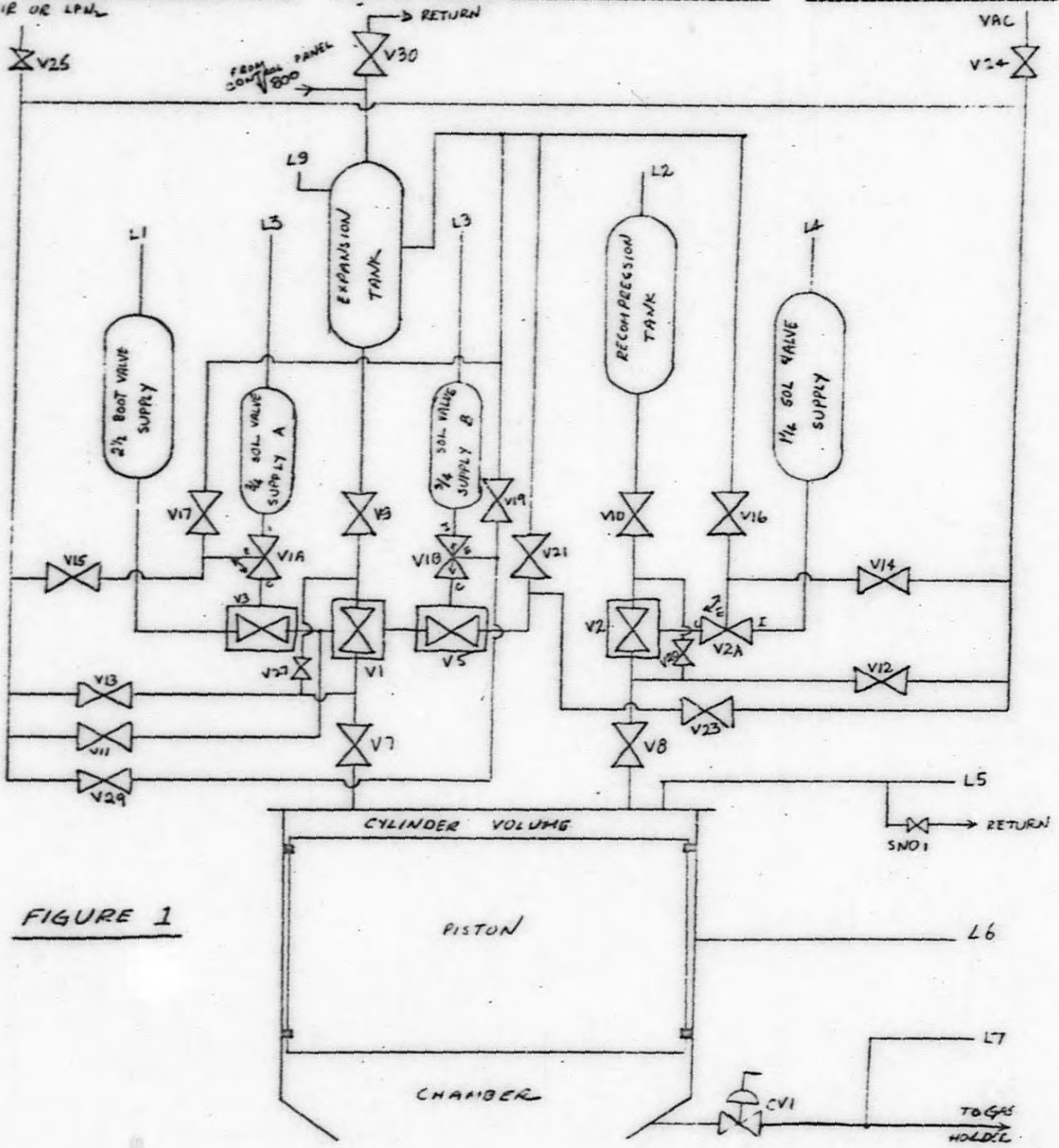

FIGURE 1

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BY CLG DATE 1/17/63 SUBJECT 80" EXP. SYST. SHEET No. OF

CHKD. BY DATE FLOOR CONTROL PANEL JOB No.

REV 2/5/63 DEPT. or PROJECT

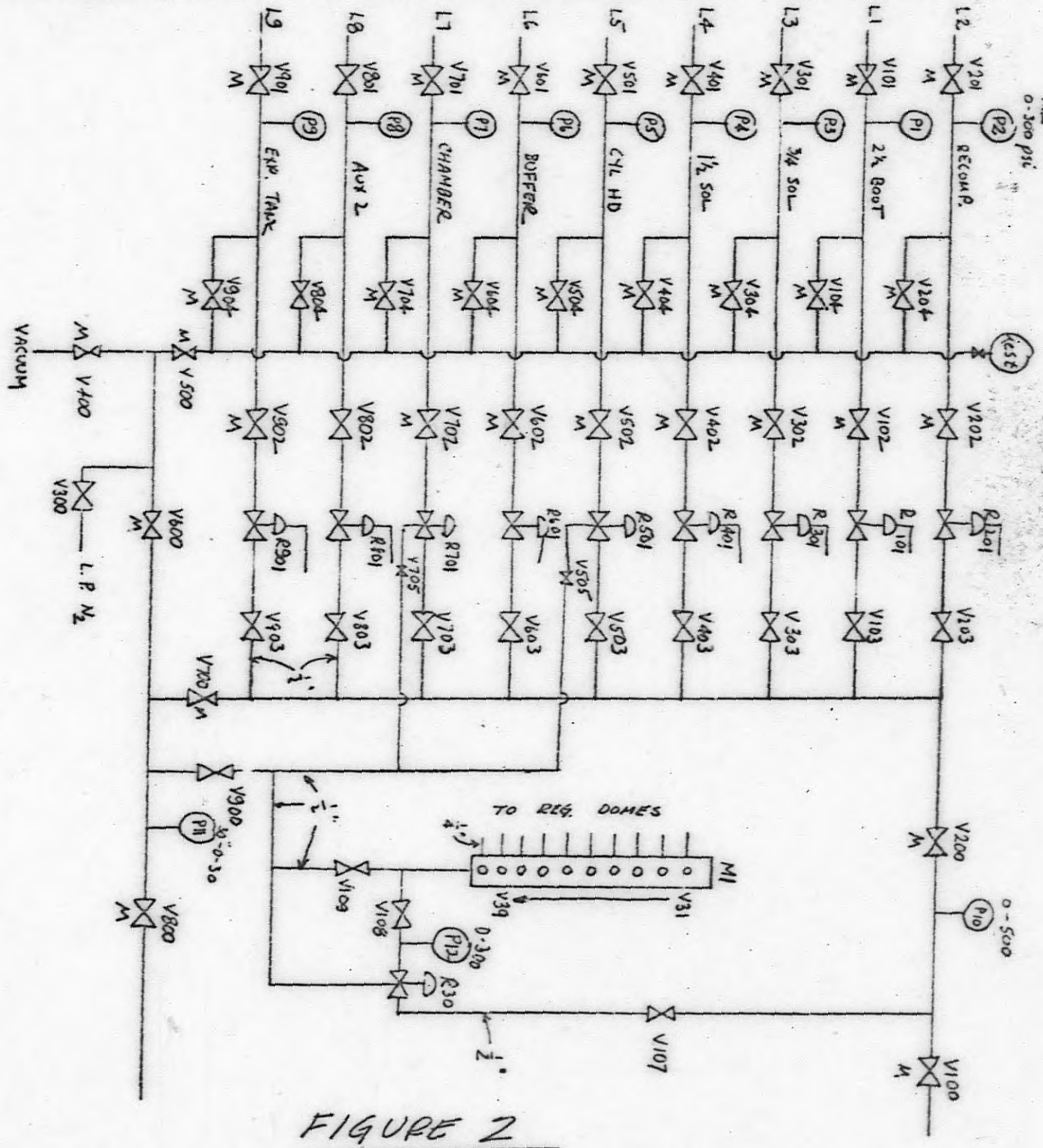

FIGURE 2

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17/53

BY_____ DATE_____ SUBJECT 80" BUBBLE CHAMBER - EXPANSION SHEET No. 1 OF_____

CHKD. BY_____ DATE_____ SYSTEM - VALVES - REGULATOR LIST JOB No._____

REV A 9/11/63 DEPT. or PROJECT_____

TABLE I

ITEM	DESCRIPTION	FUNCTION
V1	6" Boot Valve	Main Expansion Valve
V1A	3/4" N.C. 3-way Modified Ross Solenoid Valve	Operates V3
V1B	3/4" N.C. 3-way Modified Ross Sol. Valve	Operates V5
V2	4" Boot Valve	Main Recompression Valve
V2A	1 1/4" N.C. 3-way Modified Ross Sol. Valve	Operates V2
V3	2 1/2" Boot Valve	Closes V1
V5	2 1/2" Boot Valve	Opens V1
V7	6" Wafer LGP Ball Valve	Closes V1 Inlet
V8	4" Wafer LGP Ball Valve	Closes V2 Outlet
V9	6" Wafer LGP Ball Valve	Closes V1 Outlet
V10	4" Wafer LGP Ball Valve	Closes V2 Inlet
V11	1/2" Hoke Ball Valve	Purges Case of V1
V12	1/2" Hoke Ball Valve	Purges V2 Core
V13	1" LGP Ball Valve	Purges V1 Core
V14	1/2" Hoke Ball Valve	Purges V2A Exhaust
V15	1/2" Hoke Ball Valve	Purges V1A Exhaust
V16	1 1/2" LGP Ball Valve	Closes V2A Exhaust
V17	1" LGP Ball Valve	Closes V1A Exhaust
V19	1" LGP Ball Valve	Closes V1B Exhaust
V20	1/2" Hoke Ball Valve	Purges V2 Inlet
V21	2 1/2" LGP Ball Valve	Closes V5 Exhaust
V23	1" LGP Ball Valve	Purges V5 Exhaust
V24	1 1/2" LGP Ball Valve	Vacuum Line to Cyl.Hd.Plumbing
V25	1" LGP Ball Valve	Low Pressure N2 to Cyl. Hd. Plumbing
V27	1" LGP Ball Valve	Purges V1 Outlet
V29	1/2" Hoke Ball Valve	Purges V1B Exhaust
V30	3" LGP Ball Valve	Closes Main Return
V31	Circle Seal Plug Valve Manifold	Loads Dome of R101
V32	" " "	Loads Dome of R201
V33	" " "	Loads Dome of R301
V34	" " "	Loads Dome of R401
V35	" " "	
V36	" " "	Loads Dome of R601
V37	" " "	
V38	" " "	Loads Dome of R801
V39	" " "	Loads Dome of, R901

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BY _____ DATE _____ SUBJECT 80" BUBBLE CHAMBER - EXPANSION SHEET No. 2 OF _____

CHKD. BY _____ DATE _____ SYSTEM - VALVES - REGULATOR LIST JOB No. _____

REV A 9/15/63 DEPT. or PROJECT _____

TABLE I, CONT'D

ITEM	DESCRIPTION	FUNCTION
V100	1 1/2" LGP Ball Valve	Main Supply From Purifier
V101	1" LGP Ball Valve	Closes V3 Supply
V102	1" LGP Ball Valve	Closes R101 Outlet
V103	1" LGP Ball Valve	Closes R101 Inlet
V104	1" LGP Ball Valve	Manifolds L1
V107	1/2" Hoke Ball Valve	Closes R30 Supply
V108	1/2" Hoke Ball Valve	Closes R30 Outlet
V109	1/2" Hoke Ball Valve	Closes M1 Exhaust
V200	1 1/2" LGP Ball Valve	Closes Supply to Panel Feeds
V201	1 1/2" LGP Ball Valve	Closes V2 Supply
V202	1 1/2" LGP Ball Valve	Closes R201 Outlet
V203	1 1/2" LGP Ball Valve	Closes R201 Inlet
V204	1 1/2" LGP Ball Valve	Manifolds L2
V300	1/2" Hoke Ball Valve	Low Pressure N_2 to Panel
V301	1" LGP Ball Valve	Closes V1A & V1B Supply
V302	1" LGP Ball Valve	Closes R301 Outlet
V303	1" LGP Ball Valve	Closes R301 Inlet
V304	1" LGP Ball Valve	Manifolds L3
V400	1 1/2" LGP Ball Valve	Vacuum Line to Panel
V401	1" LGP Ball Valve	Closes V2A Supply
V402	1" LGP Ball Valve	Closes R401 Outlet
V403	1" LGP Ball Valve	Closes R401 Inlet
V404	1" LGP Ball Valve	Manifolds L4
V500	1 1/2" LGP Ball Valve	Closes Vacuum & Purge Manifold
V501	1" LGP Ball Valve	Closes Cyl.Hd.Supply
V502	1" LGP Ball Valve	Closes R501 Outlet
V503	1" LGP Ball Valve	Closes R501 Inlet
V504	1" LGP Ball Valve	Manifolds L5
V505	1/8" Circle Seal Plug Valve	Closes R501 Bleed
V600	1 1/2" LGP Ball Valve	Closes Return to Vac. & Purge Manifold
V601	1" LGP Ball Valve	Closes Buffer Volume Supply
V602	1" LGP Ball Valve	Closes R601 Outlet
V603	1" LGP Ball Valve	Closes R601 Inlet
V604	1" LGP Ball Valve	Manifolds L6
V700	1" LGP Ball Valve	Closes Supply Manifold Return
V701	1" LGP Ball Valve	Closes Chamber Supply

TABLE I CONT'D

ITEM	DESCRIPTION	FUNCTION
V702	1" LGP Ball Valve	Closes R701 Outlet
V703	1" LGP Ball Valve	Closes R701 Inlet
V704	1" LGP Ball Valve	Manifolds L7
V705	1/8" Circle Seal Plug Valve	Closes R701 Bleed
V800	1 1/2" LGP Ball Valve	Closes Panel Return
V801	1/2" Hoke Ball Valve	Shuts Aux. Supply
V802	1/2" Hoke Ball Valve	Shuts R801 Outlet
V803	1/2" Hoke Ball Valve	Shuts R801 Inlet
V804	1/2" Hoke Ball Valve	Manifolds L8
V900	1/2" Hoke Ball Valve	Closes Reg. Bleed Return
V901	1/2" Hoke Ball Valve	Closes Expansion Tank Supply
V902	1/2" Hoke Ball Valve	Closes R901 Outlet
V903	1/2" Hoke Ball Valve	Closes R901 Inlet
V904	1/2" Hoke Ball Valve	Manifolds L9
M1	Circle Seal 10 Plug Valve Manifold	Dome Pressure Dist.for Grove Regs.
	REGULATORS	
R30	1/2" Moore Nullmatic 42E-200	Dome Pressure of Grove Regulators
R101	Grove WB-206-K4	V3 Supply Pressure
R201	Grove WB-308-K6	Recompression Pressure (1/2 Supply)
R301	Grove WB-206-K4	V1A & V1B Supply Pressure
R401	Grove WB-206-K4	V2A Supply Pressure
R501	1/2" Moore Nullmatic 42HE-200	Cyl.Hd. Supply Pressure
R601	Grove WB-206-K4	Buffer Volume Supply Pressure
R701	1/2" Moore Nullmatic 42HE-200	Chamber Supply Pressure
R801	Grove WB-204-K3	Aux. Supply Pressure
R901	Grove WB-204-K3	Exp. Tank Supply Pressure

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BY _____ DATE _____ SUBJECT 60" BUBBLE CHAMBER - EXPANSION SHEET No. 4 OF _____

CHKD. BY _____ DATE _____ SYSTEM - VALVES - REGULATOR LIST JOB No. _____

REV A 4/15/63 DEPT. OR PROJECT _____

20/53

TABLE I CONT'D

ITEM	DESCRIPTION	FUNCTION
P0	Ashcroft Test Ga.	
P1	6" Helecoid Safe-T-Case 0-300 psi	
P2	" " 0-300 psi	
P3	" " 0-300 psi	
P4	" " 0-300 psi	
P5	" " 0-300 psi	
P6	" " 0-300 psi	
P7	" " 0-300 psi	
P8	" " 0-300 psi	
P9	" " 30"-0-30 psi	
P10	" " 0-500 psi	
P11	" " 30"-0-30 psi	
P12	" " 0-300 psi	

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BY _____ DATE _____ SUBJECT VALVE OPERATING SEQUENCE SHEET No 1 OF _____

CHKD. BY _____ DATE _____ 10" BUBBLE CHAMBER EXPANSION SYSTEM JOB No. _____

REV. A 4/15/63 DEPT. or PROJECT _____

CHECKLIST B1

INITIAL PUMPING AND PURGING

STEP NO.	OPERATION	REMARKS
1	OPEN V400	EVACUATES SYSTEM FROM CONTROL PANEL
2	OPEN V24	EVACUATES SYSTEM THRU. CYL. HD. PLUMBING
3	DO CHECKLIST B2	WHEN VACUUM < 100 μ. EVACUATES BALL VALVES
4	CLOSE V24	WHEN VACUUM < 100 μ } SHUTS OFF VACUUM
5	CLOSE V400	
6	CLOSE V200	}
7	CLOSE V107	} ADMIT SUPPLY PRESSURE
8	OPEN V100	
9	THROTTLE V200	SLOWLY FILL SYSTEM TO ≈ 15 psig. SEE CAUTION
10	CLOSE V200	WHEN SYSTEM IS ≈ 15 psig.
11	OPEN V30	DUMP EXCESS H_2 TO RETURN
12	CLOSE V30	
13	OPEN V400	} EVACUATE SYSTEM AGAIN
14	OPEN V24	
15	CLOSE V400	} WHEN VACUUM < 100 μ
16	CLOSE V24	
17	THROTTLE V200	AS IN STEP 9
18	CLOSE V200	WHEN SYSTEM PRESSURE IS ≈ 16 psig
19	OPEN V30	DUMP EXCESS H_2 TO RETURN.
20	CLOSE V100	
21	OPEN V200	
22	OPEN V107	
23	CLOSE V30	THE SYSTEM IS NOW FILLED WITH
24		PURIFIED H_2 AT GAS HOLDER PRESSURE
25		
26		
27		
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32		
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BY _____ DATE _____ SUBJECT VALVE OPERATING SEQUENCE SHEET No. 1 OF _____

CHKD. BY _____ DATE _____ 10" BUBBLE CHAMBER EXPANSION SYSTEM JOB No. _____

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CHECKLIST B2

BALL VALVE EVACUATION

STEP NO.	OPERATION	REMARKS
1	V7	MOMENTARILY OPEN AND THEN
2	V11	CLOSE EACH VALVE IN THE
3	V13	SEQUENCE SHOWN ON
4	V15	THIS LIST
5	V17	
6	V19	
7	V27	
8	V9	
9	V12	
10	V14	
11	V16	
12	V23	
13	V20	
14	V21	
15	V8	
16	V10	
17	V 201	
18	V 101	
19	V 301	
20	V 401	
21	V 501	
22	V601	
23	V701	
24	V801	
25	V901	
26	V 204	
27	V 104	
28	V 304	
29	V 404	
30	V 504	
31	V 604	
32	V 704	
33	V 804	
34	V 904	
35	V 202	
36	V 102	

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BY_____ DATE_____ SUBJECT VALVE OPERATING SEQUENCE SHEET No 2 OF_____

CHKD. BY_____ DATE_____ CHECKLIST, CONTINUED JOB No._____

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B2 CONT'D

STEP NO.	OPERATION	REMARKS
37	V302	
38	V402	
39	V502	
40	V602	
41	V702	
42	V802	
43	V902	
44	V203	
45	V103	
46	V303	
47	V403	
48	V503	
49	V603	
50	V703	
51	V803	
52	V903	
53	V200	
54	V107	
55	V108	
56	V109	
57	V800	
58	V700	
59	V600	
60	V500	
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BY _____ DATE _____ SUBJECT VALVE OPERATING SEQUENCE SHEET No. 1 OF _____

CHKD. BY _____ DATE _____ 80" BUBBLE CHAMBER EXPANSION SYSTEM JOB No. _____

REV. A 4/15/63 DEPT. or PROJECT _____

CHECKLIST C1

SETTING OPERATING PRESSURES ON CONTROL PANEL

STEP NO.	OPERATION	REMARKS
1	CLOSE V11	
2	CLOSE V13	
3	CLOSE V15	
4	CLOSE V27	
5	CLOSE V29	
6	CLOSE V12	
7	CLOSE V20	
8	CLOSE V14	
9	CLOSE V19	
10	CLOSE V23	
11	CLOSE V31 – V39	ALL M1 VALVES CLOSED
12	CLOSE V109	
13	CLOSE V700	
14	CLOSE V500	
15	CLOSE V201	
16	CLOSE V101	
17	CLOSE V301	
18	CLOSE V401	
19	CLOSE V502	
20	CLOSE V602	
21	CLOSE V702	
22	CLOSE V801	
23	CLOSE V901	
24	CLOSE V204	
25	CLOSE V104	
26	CLOSE V304	
27	CLOSE V404	
28	CLOSE V804	
29	CLOSE V904	
30	OPEN V30	PANEL IS NOW READY FOR SUPPLY H_2
31	OPEN V100	OPEN SLOWLY
32	ADJUST R30	TO READ ≈ 95 psig ON P12
33	OPEN V32	
34	ADJUST R30	TO READ 115 psig ON P2
35	CLOSE V32	RECOMPRESSION SUPPLY SET AT 115 psig
36	ADJUST R30	TO READ ≈ 105 psig ON P12

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BY_____ DATE_____ SUBJECT VALVE OPERATING SEQUENCE CHECKLIST, CONTINUED SHEET No. 2 OF_____

CHKD. BY_____ DATE_____ JOB No._____

REV. A 9/15/63 DEPT. or PROJECT_____

C1, CONT'D

STEP NO.	OPERATION	REMARKS
37	OPEN V31	
38	ADJUST R30	TO READ 125 psig ON P1
39	CLOSE V31	V3 SUPPLY SET AT 125 psig
40	ADJUST R30	TO READ ≈ 120 psig ON P12
41	OPEN V33	
42	ADJUST R30	TO READ 140 psig ON P3
43	CLOSE V33	V1A & V1B SUPPLY SET AT 140 psig
44	ADJUST R30	TO READ ≈ 120 psig ON P12
45	OPEN V34	
46	ADJUST R30	TO READ 140 psig ON P4
47	CLOSE V34	V2A SUPPLY SET AT 140 psig
48		
49		
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51		
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BY_____ DATE_____ SUBJECT VALVE OPERATING SEQUENCE SHEET No. 1 OF_____

CHKD. BY_____ DATE_____ 80" BUBBLE CHAMBER EXPANSION SYSTEM JOB No._____

REV. A 4/15/63 DEPT. or PROJECT_____

CHECKLIST D1

FILLING VALVES + RESERVOIRS TO OPERATING PRESSURES

STEP NO.	OPERATION	REMARKS
1	OPEN V301	FILL V1A + V1B SUPPLY TANKS
2	OPEN V101	FILL V3 SUPPLY TANK
3	OPEN V401	FILL V2A SUPPLY TANK
4	OPEN V201	FILL RECOMPRESSION TANK
5	CLOSE V802	AUX. SUPPLY CLOSED
6	CLOSE V902	EXP. TANK SUPPLY CLOSED
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BROOKHAVEN NATIONAL LABORATORY

BY _____ DATE _____
CHKD. BY _____ DATE _____
REV A 4/15/63

SUBJECT VALVE OPERATING SEQUENCE 10" BUBBLE CHAMBER EXPANSION SYSTEM
DEPT. or PROJECT _____

SHEET No 1 OF _____
JOB No _____

CHECKLIST E1

FILLING CHAMBER, BUFFER VOL, + CYL. HD.

STEP NO.	OPERATION	REMARKS
1	CLOSE V701	
2	CLOSE V704	
3	ADJUST R701	TO CHAMBER PRESSURE (~75 psig ON P7)
4	CLOSE V702	
5	OPEN V701	
6	OPEN V704	
7	THROTTLE V702	FILL CHAMBER, ETC. SEE CAUTION
8		
9		
10		CAUTION: IN STEP 7, OPEN V702
11		CAREFULLY AND CHECK PISTON POSITION.
12		IF PISTON HAS A TENDENCY TO BE
13		PUSHED DOWNWARD BY GAS PRESSURE,
14		THROTTLE V704 TO RESTORE
15		EQUILIBRIUM POSITION.
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BROOKHAVEN NATIONAL LABORATORY

BY_____ DATE_____
CHKD. BY_____ DATE_____
REV. A 4/15/63

SUBJECT VALVE OPERATING SEQUENCE 10" BUBBLE CHAMBER EXPANSION SYSTEM

DEPT. or PROJECT_____

SHEET No 1 OF_____
JOB No._____

CHECKLIST F1
BLEEDING SYSTEM DOWN & FILLING WITH N_2

STEP NO.	OPERATION	REMARKS
1	CLOSE V702	
2	THROTTLE V500	BLEED DOWN CHAMBER, SEE CAUTION
3	OPEN V500	WHEN CHAMBER IS AT GAS HOLDER PRESSURE
4	CLOSE V100	SUPPLY OFF
5	CLOSE V501	TO PROTECT PISTON FROM PRESSURE SURGES
6	CLOSE V601	
7	CLOSE V701	
8	OPEN V204	BLEED DOWN RECOMPRESSION TANK
9	OPEN V404	BLEED DOWN V2A SUPPLY TANK
10	OPEN V104	BLEED DOWN V3 SUPPLY TANK
11	OPEN V304	BLEED DOWN V1A + V1B SUPPLY TANKS
12	OPEN V804	BLEED L8
13	OPEN V904	BLEED L9
14	OPEN V701	
15	OPEN V601	
16	OPEN V501	
17	OPEN V702	
18	OPEN V602	
19	OPEN V502	
20	OPEN V801	UNLESS L8 IS OPEN
21	OPEN V901	
22	OPEN V700	BLEED DOWN SUPPLY LINE
23	OPEN V109	
24	OPEN V31 - V39	BLEED REG. DOMES FROM M1
25	OPEN V23	
26	OPEN V11	
27	OPEN V13	
28	OPEN V29	
29	OPEN V15	
30	OPEN V27	
31	OPEN V12	
32	OPEN V14	
33	OPEN V20	
34	CLOSE V30	SYSTEM NOW FILLED WITH H_2 AT G.H. PRESSURE
35	OPEN V400	TO EVACUATE SYSTEM
36	OPEN V24	

BROOKHAVEN NATIONAL LABORATORY

BY _____ DATE _____ SUBJECT VALVE OPERATING SEQUENCE CHECKLIST, CONTINUED SHEET No 2 OF _____

CHKD. BY _____ DATE _____ DEPT. or PROJECT _____ JOB No. _____

REV. A 4/15/63

F1, CONT'D.

STEP NO.	OPERATION	REMARKS
37	DO CHECKLIST B2	TO EVACUATE BALL VALVE CASES
38	CLOSE V400	WHEN VACUUM < 100μ.
39	CLOSE V24	
40	OPEN V300	FILL WITH GAS HOLDER N_2
41	OPEN V25	
42	CLOSE V300	
43	CLOSE V25	SYSTEM IS w) FILLED WITH G.H. N_2
44		
45		
46		
47		CAUTION: IN STEP 2, OPEN V500 SLOWLY
48		AND CHECK PISTON POSITION. IF PISTON
49		HAS A TENDENCY TO BE PUSHED
50		DOWNWARD, RESTORE EQUILIBRIUM POSITION
51		BY THROTTLING V504
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BROOKHAVEN NATIONAL LABORATORY

BY _____ DATE _____ CHKD. BY _____ DATE _____ REV. A 9/16/63

SUBJECT VALVE OPERATING SEQUENCE 20" BUBBLE CHAMBER EXPANSION SYSTEM.

DEPT. or PROJECT _____

SHEET No. 1 OF _____ JOB No. _____

CHECKLIST G1

TO OPEN CASE OF V1, 6" EXPANSION VALVE

STEP NO.	OPERATION	REMARKS
1	CLOSE V7	} ISOLATE V1
2	CLOSE V9	}
3	CLOSE V8	
4	CLOSE V17	
5	CLOSE V102	SHUTS OFF V3 SUPPLY
6	CLOSE V302	SHUTS OFF V1A + V1B SUPPLY
7	CLOSE V504	} TO MAINTAIN CHAMBER PRESSURE
8	CLOSE V604	}
9	CLOSE V704	}
10	OPEN V500	
11	OPEN V104	BLEED DOWN V3 SUPPLY
12	CLOSE V600	
13	OPEN V400	EVACUATE V3 SUPPLY TANK
14	OPEN V11	}
15	OPEN V15	} EVACUATE V1 & V3
16	CLOSE V21	}
17	OPEN V24	}
18	OPEN V13	}
19	OPEN V27	}
20	CLOSE V400	} WHEN VACUUM < 100 μ
21	CLOSE V24	}
22	OPEN V300	} FILL WITH G.H. N2
23	OPEN V25	}
24	CLOSE V300	
25	CLOSE V25	
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BROOKHAVEN NATIONAL LABORATORY

BY _____ DATE _____ SUBJECT VALVE OPERATING SEQUENCE SHEET No. 1 OF _____

CHKD. BY _____ DATE _____ 10" BUBBLE CHAMBER EXPANSION SYSTEM JOB No. _____

REV. A 9/15/62 DEPT. or PROJECT _____

CHECKLIST G2

V1, 6" EXPANSION VALVE REASSEMBLY

STEP NO.	OPERATION	REMARKS
1	OPEN V24	TO EVACUATE V1 AND ASSOCIATED PLUMBING
2	OPEN V400	
3	OPEN V104	TO EVACUATE V3 SUPPLY TANK
4	CLOSE V104	WHEN VACUUM < 100μ
5	CLOSE V24	
6	OPEN V17	TO PURGE INSIDE OF V1 WITH
7	CLOSE V17	HYDROGEN
8	OPEN V24	
9	CLOSE V500	WHEN VACUUM < 100μ
10	CLOSE V400	
11	OPEN V600	
12	OPEN V504	
13	OPEN V604	
14	OPEN V704	
15	OPEN V21	
16	CLOSE V11	
17	CLOSE V27	
18	CLOSE V13	
19	CLOSE V15	
20	CLOSE V24	
21	CLOSE V23	
22	OPEN V17	
23	OPEN V302	
24	OPEN V102	TO CLOSE V1
25	OPEN V7	
26	OPEN V9	
27	OPEN V8	THE SYSTEM IS READY FOR OPERATION
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BROOKHAVEN NATIONAL LABORATORY

BY _____ DATE _____ SUBJECT VALVE OPERATING SEQUENCE SHEET No. 1 OF _____

CHKD. BY _____ DATE _____ 10" BUBBLE CHAMBER EXPANSION SYSTEM JOB No. _____

REV. A 4/15/63 DEPT. or PROJECT _____

CHECKLIST G3

TO OPEN CASE OF V3, 2½" INLET BOOT VALVE

STEP NO.	OPERATION	REMARKS
1	CLOSE V7	ISOLATE V1 FROM CYLINDER HEAD
2	CLOSE V504	
3	CLOSE V604	
4	CLOSE V704	
5	CLOSE V102	SHUT OFF V3 SUPPLY
6	OPEN V500	BLEED DOWN V3 SUPPLY TANK
7	OPEN V104	
8	CLOSE V600	EVACUATE V3 SUPPLY TANK
9	OPEN V400	
10	OPEN V24	
11	CLOSE V17	EVACUATE V3 CASE
12	OPEN V15	
13	OPEN V11	
14	CLOSE V400	WHEN VACUUM < 100μ
15	CLOSE V24	
16	OPEN V300	
17	OPEN V25	FILL WITH GAS HOLDER NITROGEN
18	CLOSE V300	
19	CLOSE V25	
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BROOKHAVEN NATIONAL LABORATORY

BY _____ DATE _____ CHKD. BY _____ DATE _____ REV. A 4/15/63

SUBJECT VALVE OPERATING SEQUENCE 80" BUBBLE CHAMBER EXPANSION SYSTEM

DEPT. OR PROJECT _____

SHEET No. 1 OF _____ JOB No. _____

CHECKLIST G-1

V3, 2½" INLET BOOT VALVE REASSEMBLY

STEP NO.	OPERATION	REMARKS
1	OPEN V24	EVACUATE V3, ETC.
2	OPEN V400	
3	CLOSE V24	WHEN VACUUM < 100 μ
4	CLOSE V400	
5	OPEN V17	PURGE WITH HYDROGEN
6	OPEN V600	
7	CLOSE V17	
8	CLOSE V600	
9	OPEN V24	
10	OPEN V400	
11	CLOSE V24	WHEN VACUUM < 100 μ
12	CLOSE V400	
13	OPEN V17	FILL WITH HYDROGEN
14	OPEN V600	
15	CLOSE V11	
16	CLOSE V15	
17	CLOSE V500	
18	CLOSE V104	
19	OPEN V102	REFILL V3 SUPPLY TANK
20	OPEN V504	MANIFOLD CYL. HD. TO BUFFER VOLUME
21	OPEN V604	
22	OPEN V704	
23	OPEN V7	
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BROOKHAVEN NATIONAL LABORATORY

BY _____ DATE _____
CHKD. BY _____ DATE _____
REV. A 4/15/63

SUBJECT VALVE OPERATING SEQUENCE
80" BUBBLE CHAMBER EXPANSION SYSTEM
DEPT. or PROJECT _____

SHEET No. 1 OF _____
JOB No. _____

CHECKLIST G5

TO OPEN CASE OF V5, 2½ EXHAUST BOOT VALVE

STEP NO.	OPERATION	REMARKS
1	CLOSE V7	
2	CLOSE V504	
3	CLOSE V604	
4	CLOSE V704	
5	CLOSE V102	
6	CLOSE V302	
7	OPEN V500	
8	OPEN V104	BLEED DOWN V3 SUPPLY TANK
9	OPEN V304	BLEED DOWN V1A + V1B SUPPLY TANKS
10	CLOSE V600	
11	OPEN V400	
12	OPEN V24	
13	CLOSE V19	EVACUATE V1, V3 + V5, ETC.
14	CLOSE V21	
15	OPEN V23	
16	OPEN V11	
17	CLOSE V400	WHEN VACUUM < 100 μ
18	CLOSE V24	
19	OPEN V25	
20	CLOSE V25	FILL WITH GAS HOLDER NITROGEN
21	OPEN V300	
22	CLOSE V300	
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BROOKHAVEN NATIONAL LABORATORY

BY _____ DATE _____ SUBJECT VALVE OPERATING SEQUENCE SHEET No. 1 OF _____

CHKD. BY _____ DATE _____ 80" BUBBLE CHAMBER EXPANSION SYSTEM JOB No. _____

REV. A 4/15/63 DEPT. OR PROJECT _____

CHECKLIST G

V5, 2½" EXHAUST BOOT VALVE REASSEMBLY

STEP NO.	OPERATION	REMARKS
1	OPEN V400	EVACUATE V1, V3 + V5, ETC.
2	OPEN V24	
3	CLOSE V24	WHEN VACUUM < 100μ
4	CLOSE V400	
5	OPEN V15	
6	OPEN V600	
7	CLOSE V15	PURGE WITH HYDROGEN
8	CLOSE V600	
9	OPEN V400	
10	OPEN V24	
11	CLOSE V11	
12	CLOSE V23	WHEN VACUUM < 100μ
13	CLOSE V24	
14	CLOSE V400	
15	CLOSE V104	
16	CLOSE V304	
17	OPEN V21	FILL ~~LINE~~ V5 WITH HYDROGEN
18	OPEN V302	FILL V1A + V1B SUPPLY TANKS
19	OPEN V102	FILL V3 SUPPLY TANK
20	OPEN V600	
21	CLOSE V500	
22	OPEN V504	
23	OPEN V604	MANIFOLD CYL. HD. TO BUFFER VOLUME
24	OPEN V704	
25	OPEN V7	
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BROOKHAVEN NATIONAL LABORATORY

BY_____ DATE_____ CHKD. BY_____ DATE_____ REV. A 4/15/63

SUBJECT: VALVE OPERATING SEQUENCE to BUBBLE CHAMBER EXPANSION SYSTEM

DEPT. or PROJECT_____

SHEET No. 1 OF_____ JOB No._____

CHECKLIST G7.

TO OPEN CASE OF V2, 4" RECOMPRESSION VALVE

STEP NO.	OPERATION	REMARKS
1	CLOSE V8	ISOLATE V2
2	CLOSE V10	
3	CLOSE V504	
4	CLOSE V604	
5	CLOSE V704	
6	OPEN V500	
7	CLOSE V402	FOR SAFETY BLEED DOWN V2 & SUPPLY TANK
8	OPEN V404	
9	CLOSE V404	
10	OPEN V24	
11	CLOSE V16	
12	OPEN V12	EVACUATE V2
13	OPEN V14	
14	OPEN V20	
15	CLOSE V24	WHEN VACUUM < 100 μ
16	OPEN V25	FILL V2 WITH NITROGEN
17	CLOSE V25	
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BROOKHAVEN NATIONAL LABORATORY

BY _____ DATE _____ SUBJECT VALVE OPERATING SEQUENCE SHEET No. 1 OF _____

CHKD. BY _____ DATE _____ 20" BUBBLE CHAMBER EXPANSION SYSTEM JOB No. _____

REV. A 4/15/63 DEPT. or PROJECT _____

CHECKLIST GK

V2, 4" RECOMPRESSION VALVE, REASSEMBLY

STEP NO.	OPERATION	REMARKS
1	OPEN V24	EVACUATE V2
2	CLOSE V24	WHEN VACUUM < 100μ
3	OPEN V23	} FILL WITH HYDROGEN
4	CLOSE V23	}
5	OPEN V24	EVACUATE V2
6	OPEN V402	FILL V2A SUPPLY TANK
7	CLOSE V500	
8	OPEN V504	}
9	OPEN V604	} MANIFOLD CYL HD. + BUFFER VOLUME
10	OPEN V704	}
11	CLOSE V24	WHEN VACUUM < 100μ
12	OPEN V23	} FILL WITH HYDROGEN
13	CLOSE V23	}
14	CLOSE V20	
15	CLOSE V12	
16	CLOSE V14	
17	OPEN V16	
18	OPEN V8	
19	OPEN V10	
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BROOKHAVEN NATIONAL LABORATORY

BY _____ DATE _____ SUBJECT VALVE OPERATING SEQUENCE SHEET No. 1 OF _____

CHKD. BY _____ DATE _____ 10" BUBBLE CHAMBER EXPANSION SYSTEM JOB No. _____

REV. A 4/15/63 DEPT. or PROJECT _____

CHECKLIST H1

TO OPEN CASE OF V1A, 3/4" INLET SOL. VALVE

STEP NO.	OPERATION	REMARKS
1	CLOSE V7	ISOLATE V1 FROM CYL. H.D.
2	CLOSE V504	
3	CLOSE V604	
4	CLOSE V704	
5	CLOSE V302	
6	CLOSE V102	
7	OPEN V500	
8	OPEN V104	BLEED DOWN V3 SUPPLY TANK
9	OPEN V304	BLEED DOWN V1A SUPPLY TANK
10	CLOSE V104	ISOLATE V3 SUPPLY
11	CLOSE V600	
12	OPEN V400	EVACUATE V1A (AND V1B) SUPPLY TANKS
13	CLOSE V17	
14	OPEN V15	
15	OPEN V24	EVACUATE V1A + CASE OF V3
16	CLOSE V400	WHEN VACUUM ≤ 100μ
17	CLOSE V24	
18	OPEN V300	FILL V1A SUPPLY TANK WITH NITROGEN
19	CLOSE V300	
20	OPEN V25	FILL CASE OF V3 WITH NITROGEN
21	CLOSE V25	
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BROOKHAVEN NATIONAL LABORATORY

BY _____ DATE _____ SUBJECT VALVE OPERATING SEQUENCE SHEET No. 1 OF _____

CHKD. BY _____ DATE _____ 10" BUBBLE CHAMBER EXPANSION SYSTEM JOB No. _____

REV. A 4/15/63 DEPT. or PROJECT _____

CHECKLIST H2

VIA, 3/4" INLET SOL VALVE REASSEMBLY

STEP NO.	OPERATION	REMARKS
1	OPEN V400	EVACUATE VIA (AND VIB) SUPPLY TANKS
2	OPEN V24	EVACUATE CASE OF V3
3	CLOSE V400	WHEN VACUUM < 100 μ
4	CLOSE V24	
5	CLOSE V15	
6	OPEN V17	TO FILL CASE OF V3 WITH HYDROGEN
7	OPEN V600	
8	CLOSE V500	
9	CLOSE V304	
10	OPEN V302	FILL VIA SUPPLY TANK
11	OPEN V102	FILL V3 SUPPLY TANK
12	OPEN V504	
13	OPEN V604	
14	OPEN V704	
15	OPEN V7	
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BROOKHAVEN NATIONAL LABORATORY

BY _____ DATE _____ SUBJECT VALVE OPERATING SEQUENCE SHEET No. 1 OF _____

CHKD. BY _____ DATE _____ 10" BUBBLE CHAMBER EXPANSION SYSTEM JOB No. _____

REV. A 4/15/63 DEPT. or PROJECT _____

CHECKLIST H3

TO DISASSEMBLE V1B 3/4" EXHAUST SOL. VALVE

STEP NO.	OPERATION	REMARKS
1	CLOSE V7	ISOLATE V1 FROM CYL. HD.
2	CLOSE V19	
3	CLOSE V504	
4	CLOSE V604	
5	CLOSE V704	
6	CLOSE V102	
7	CLOSE V302	
8	OPEN V500	
9	OPEN V104	BLEED V3 SUPPLY TANK
10	OPEN V304	BLEED V1B SUPPLY TANK
11	CLOSE V600	
12	CLOSE V104	
13	OPEN V400	EVACUATE V1B SUPPLY TANK
14	OPEN V24	EVACUATE V1B EXHAUST
15	OPEN V29	
16	CLOSE V400	WHEN VACUUM < 100μ
17	CLOSE V24	
18	OPEN V300	FILL WITH GAS HOLDER NITROGEN
19	CLOSE V300	
20	OPEN V25	
21	CLOSE V25	
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BROOKHAVEN NATIONAL LABORATORY

BY _____ DATE _____
CHKD. BY _____ DATE _____
REV. A 4/15/63

SUBJECT: VALVE OPERATING SEQUENCE
10" BUBBLE CHAMBER EXPANSION SYSTEM
DEPT. or PROJECT _____

SHEET No. 1 OF _____
JOB No. _____

CHECKLIST H4

VIB, 3/4" EXHAUST SOL. VALVE REASSEMBLY

STEP NO.	OPERATION	REMARKS
1	OPEN V400	EVACUATE VIB (AND VIA) SUPPLY TANKS
2	OPEN V24	EVACUATE VIB EXHAUST
3	CLOSE V304	WHEN VACUUM < 100 μ
4	CLOSE V500	
5	CLOSE V400	
6	OPEN V600	
7	OPEN V302	FILL VIB + VIA SUPPLY TANKS
8	CLOSE V29	WHEN VACUUM < 100 μ
9	CLOSE V24	
10	OPEN V19	
11	OPEN V504	
12	OPEN V604	
13	OPEN V704	
14	OPEN V7	
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BROOKHAVEN NATIONAL LABORATORY

BY _____ DATE _____ SUBJECT VALVE OPERATING SEQUENCE SHEET No. 1 OF _____

CHKD. BY _____ DATE _____ 10" BUBBLE CHAMBER EXPANSION SYSTEM JOB No. _____

REV. A 4/15/63 DEPT. or PROJECT _____

CHECKLIST H5

V2A, 1¼" RECOMPESSION SOL. VALVE DISASSEMBLY

STEP NO.	OPERATION	REMARKS
1	CLOSE V6	} ISOLATE V2
2	CLOSE V10	
3	CLOSE V504	
4	CLOSE V604	
5	CLOSE V704	
6	CLOSE V40:	
7	OPEN V500	
8	OPEN V404	BLEED DOWN V2A SUPPLY TANK
9	CLOSE V600	
10	CLOSE V16	
11	OPEN V14	
12	OPEN V24	} EVACUATE V2A + SUPPLY TANK
13	OPEN V400	
14	CLOSE V24	} WHEN VACUUM < 100μ
15	CLOSE V400	
16	OPEN V300	} FILL WITH GAS HOLDER NITROGEN
17	CLOSE V300	
18	OPEN V25	
19	CLOSE V25	
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BROOKHAVEN NATIONAL LABORATORY

BY _____ DATE _____
CHKD. BY _____ DATE _____
REV. A 4/15/63

SUBJECT VALVE OPERATING SEQUENCE
80" BUBBLE CHAMBER EXPANSION SYSTEM
DEPT. OR PROJECT _____

SHEET No. 1 OF _____
JOB No. _____

CHECKLIST H6

V2A, 1¼" RECOMPRESSION SOL. VALVE REASSEMBLY

STEP NO.	OPERATION	REMARKS
1	OPEN V400	EVACUATE V2A + SUPPLY TANK
2	OPEN V24	
3	CLOSE V400	WHEN VACUUM < 100μ
4	CLOSE V24	
5	OPEN V23	
6	CLOSE V23	PURGE V2A + SUPPLY TANK WITH HYDROGEN
7	OPEN V600	
8	CLOSE V600	
9	OPEN V400	WHEN VACUUM < 100μ
10	OPEN V24	
11	CLOSE V500	
12	OPEN V600	
13	OPEN V504	MANIFOLD CYL. HD. TO BUFFER VOLUME
14	OPEN V604	
15	OPEN V704	
16	OPEN V402	FILL V2A SUPPLY TANK
17	CLOSE V14	
18	OPEN V16	
19	OPEN V10	
20	OPEN V8	
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BROOKHAVEN NATIONAL LABORATORY

BY_____ DATE_____ SUBJECT VALVE POSITION MATRIX SHEET No. 44 OF 53

CHKD. BY_____ DATE_____ 80" BUBBLE CHAMBER EXPANSION SYSTEM JOB No._____

DEPT. or PROJECT_____

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V1	O	O	O	O	O	O	O	O		O
V2	O	O		O	X	X		O		O
V3	X	O	O	O	O	O	O	O	O	O
V10	X	O	O	O	O			O	O	O
V20	O	O	O	O	O					
V30	X	O	O	O	O					
V40	X	O	O	O	O					
V50	O	O	O	O	O	O				
V60	O	O	O	O	O					
V70	O	O	O	O	O	O				
V80	O	O	O	O	O					
V90	O	O	O	O	O					

O - OPEN POSITION

X - CLOSED POSITION

MATRIX B1

VALVE POSITIONS BEFORE AND AFTER INITIAL PURGING

REV A

4/11/63

BROOKHAVEN NATIONAL LABORATORY

BY_____ DATE_____ SUBJECT VALVE POSITION MATRIX SHEET No. 45 OF 53

CHKD. BY_____ DATE_____ 80" BUBBLE CHAMBER EXPANSION SYSTEM JOB No._____

_____ DEPT. or PROJECT_____ _____

	0	1	2	3	4	5	6	7	8	9
V								O	O	O
V1	O	X	X	X	X	X	O	O		X
V2	X	O		X	X	X		X		X
V3	O	X	X	X	X	X	X	X	X	X
V10	O	X	O	O	X			O	O	X
V20	O	X	O	O	X					
V30	X	X	O	O	X					
V40	X	X	O	O	X					
V50	X	O	X	O	O	O				
V60	O	O	X	O	O					
V70	X	O	X	O	O	O				
V80	O	X	O	O	X					
V90	O	X	O	O	X					

O - OPEN POSITION
X - CLOSED POSITION

MATRIX C1

CONTROL PANEL SET AT OPERATING PRESSURES PRIOR TO FILLING SYSTEM

REV A
4/15/63

BROOKHAVEN NATIONAL LABORATORY

BY_____ DATE_____ SUBJECT VALVE POSITION MATRIX SHEET No. 46 OF 53

CHKD. BY_____ DATE_____ 80" BUBBLE CHAMBER EXPANSION SYSTEM JOB No._____

DEPT. or PROJECT_____

	0	1	2	3	4	5	6	7	8	9
V								O	O	O
V1	O	X	X	X	X	X	O	O		X
V2	X	O		X	X	X		X		X
V3	O	X	X	X	X	X	X	X	X	X
V10	O	O	O	O	X			O	O	X
V20	O	O	O	O	X					
V30	X	O	O	O	X					
V40	X	O	O	O	X					
V50	X	O	X	O	O	O				
V60	O	O	X	O	O					
V70	X	O	X	O	O	O				
V80	O	X	X	O	X					
V90	O	X	X	O	X					

O - OPEN POSITION
X - CLOSED POSITION

MATRIX D1

NORMAL OPERATING POSITION

REV A
9/15/63

BROOKHAVEN NATIONAL LABORATORY

BY.....DATE.....
CHKD. BY.....DATE.....

SUBJECT VALVE POSITION MATRIX
80" BUBBLE CHAMBER EXPANSION SYSTEM
DEPT. or PROJECT.....

JOB No.....

	0	1	2	3	4	5	6	7	8	9
V								X	X	X
V1	O	O	X	O	O	O	O	X		O
V2	X	X		O	X	X		O		X
V3	O	X	X	X	X	X	X	X	X	X
V10	O	O	X	O	X			O	O	X
V20	O	O	O	O	X					
V30	X	O	X	O	X					
V40	X	O	O	O	X					
V50	O	O	X	O	X	O				
V60	X	O	X	O	X					
V70	X	O	X	O	X	O				
V80	O	X	X	O	X					
V90	O	X	X	O	X					

O - OPEN POSITION
X - CLOSED POSITION

MATRIX G1

TO OPEN CASE OF V1, 6" EXPANSION VALVE

REV. A
4/11/63

BROOKHAVEN NATIONAL LABORATORY

BY_____DATE_____ SUBJECT VALVE POSITION MATRIX SHEET No. 48 OF 53

CHKD. BY_____DATE_____ 80" BUBBLE CHAMBER EXPANSION SYSTEM JOB No._____

_____ DEPT. or PROJECT_____ _____

	0	1	2	3	4	5	6	7	8	9
V								X	O	O
V1	O	O	X	X	X	O	O	X		O
V2	X	O		X	X	X		X		X
V3	O	X	X	X	X	X	X	X	X	X
V10	O	O	X	O	O			O	O	X
V20	O	O	O	O	X					
V30	X	O	O	O	X					
V40	X	O	O	O	X					
V50	O	O	X	O	X	O				
V60	X	O	X	O	X					
V70	X	O	X	O	X	O				
V80	O	X	X	O	X					
V90	O	X	X	O	X					

O - OPEN POSITION
X - CLOSED POSITION

MATRIX G3

TO OPEN CASE OF V3, 2½" INLET BOOT VALVE

REV. A
4/15/63

BROOKHAVEN NATIONAL LABORATORY

BY_____ DATE_____ SUBJECT VALVE POSITION MATRIX SHEET No. 49 OF 53

CHKD. BY_____ DATE_____ 20" BUBBLE CHAMBER EXPANSION SYSTEM JOB No._____

_____ DEPT. or PROJECT._____ _____

	0	1	2	3	4	5	6	7	8	9
V								X	O	O
V1	O	O	X	X	X	X	O	O		O
V2	X	X		O	X	X		X		X
V3	O	X	X	X	X	X	X	X	X	X
V10	O	O	X	O	O			O	O	X
V20	O	X	O	O	X					
V30	X	O	X	O	O					
V40	X	O	O	O	X					
V50	O	O	X	O	X	O				
V60	X	O	X	O	X					
V70	X	O	X	O	X	O				
V80	O	X	X	O	X					
V90	O	X	X	O	X					

O - OPEN POSITION

X - CLOSED POSITION

MATRIX G5

TO OPEN CASE OF V5 2½" EXHAUST BOOT VALVE

REV A

4/15/63

BROOKHAVEN NATIONAL LABORATORY

BY..... DATE.....
CHKD. BY..... DATE.....

SUBJECT VALVE POSITION MATRIX
80" BUBBLE CHAMBER EXPANSION SYSTEM
DEPT. or PROJECT.....

SHEET No. 50 OF 53
JOB No.....

	0	1	2	3	4	5	6	7	8	9
V								O	X	O
V1	X	X	O	X	O	X	O	O		O
V2	O	O		X	X	X		X		X
V3	O	X	X	X	X	X	X	X	X	X
V10	O	O	O	O	X			O	O	X
V20	O	O	O	O	X					
V30	X	O	O	O	X					
V40	X	O	X	O	X					
V50	O	O	X	O	X	O				
V60	O	O	X	O	X					
V70	X	O	X	O	X	O				
V80	O	X	X	O	X					
V90	O	X	X	O	X					

O - OPEN POSITION
X - CLOSED POSITION

MATRIX G7

TO OPEN CASE OF V2, 4" RECOMPRESSION VALVE

RON A
4/11/63

	0	1	2	3	4	5	6	7	8	9
V								X	O	O
V1	O	X	X	X	X	O	O	X		O
V2	X	O		X	X	X		X		X
V3	O	X	X	X	X	X	X	X	X	X
V10	O	O	X	O	X			O	O	X
V20	O	O	O	O	X					
V30	X	O	X	O	O					
V40	X	O	O	O	X					
V50	O	O	X	O	X	O				
V60	X	O	X	O	X					
V70	X	O	X	O	X	O				
V80	O	X	X	O	X					
V90	O	X	X	O	X					

O - OPEN POSITION
X - CLOSED POSITION

MATRIX HI

TO OPEN CASE OF V1A, 3/4" INLET SOL. VALVE

REV A
4/15/63

BROOKHAVEN NATIONAL LABORATORY

BY_____DATE_____ SUBJECT VALVE POSITION MATRIX SHEET No. 52 OF 53

CHKD. BY_____DATE_____ 80" BUBBLE CHAMBER EXPANSION SYSTEM JOB No._____

_____ DEPT. or PROJECT._____ _____

	0	1	2	3	4	5	6	7	8	9
V								X	O	O
V1	O	X	X	X	X	X	O	O		X
V2	X	O		X	X	X		X		O
V3	O	X	X	X	X	X	X	X	X	X
V10	O	O	X	O	X			O	O	X
V20	O	O	O	O	X					
V30	X	O	X	O	O					
V40	X	O	O	O	X					
V50	O	O	X	O	X	O				
V60	X	O	X	O	X					
V70	X	O	X	O	X	O				
V80	O	X	X	O	X					
V90	O	X	X	O	X					

O - OPEN POSITION
X - CLOSED POSITION

MATRIX H3

TO DISASSEMBLE V1B, 3/4" EXHAUST SOL. VALVE

REV A
4/15/63

BROOKHAVEN NATIONAL LABORATORY

BY_____DATE_____ SUBJECT VALVE POSITION MATRIX SHEET No. 53 OF 53

CHKD. BY_____DATE_____ 20" BUBBLE CHAMBER EXPANSION SYSTEM JOB No._____

_____ DEPT. OR PROJECT_____ _____

	0	1	2	3	4	5	6	7	8	9
V								O	X	O
V1	X	X	X	X	X	X	X	O		O
V2	X	O		X	X	X		X		X
V3	O	X	X	X	X	X	X	X	X	X
V10	O	O	O	O	X					
V20	O	O	O	O	X					
V30	X	O	O	O	X					
V40	X	O	X	O	O					
V50	O	O	X	O	X	O				
V60	X	O	X	O	X					
V70	X	O	X	O	X	O				
V80	O	X	X	O	X					
V90	O	X	X	O	X					

O - OPEN POSITION
X - CLOSED POSITION

MATRIX H5

V2A, 1¼": RECOMPRESSION SOL. VALVE DISASSEMBLY

REV A
4/15/63

END