Public Service
Electric and Gas
Company

Corbin A. McNeill, Jr.
Vice President -
Nuclear

Public Service Electric and Gas Company P.O. Box 236, Hancocks Bridge, NJ 08038 609 339-4800

December 23, 1985

Director of Nuclear Reactor Regulation
United States Nuclear Regulatory Commission
7920 Norfolk Avenue
Bethesda, Maryland 20814

Attention: Ms. Elinor Adensam, Director
Project Directorate 3
Division of BWR Licensing

Dear Ms. Adensam:

MANUAL/AUTOMATIC INITIATION DESIGN OF
BAILEY SOLID STATE LOGIC MODULE
HOPE CREEK GENERATING STATION
DOCKET NO. 50-354

As a result of the telecon held on December 17, 1985 between representatives of Public Service Electric and Gas Company (PSE&G), Bechtel, and the NRC concerning manual/automatic initiation design of Bailey Solid State Logic Module (SSLM); PSE&G notes the following:

1. The single failure criterion is satisfied for each safety-related system that utilizes the SSLMs since the minimum number of operable channels required to perform the safety function is less than the total number of channels provided. For each monitored variable, a list of the number of channels required to satisfy single failure criteria is provided in Table 3.3.2-1 of the Hope Creek Technical Specifications.

2. Channel Checks and Channel Functional Tests shall be performed in accordance with Technical Specifications. These tests are identical to those done on relay plants and will assess the operability of the instrument channels as per Technical Specifications. The operability of the SSLMs is assessed during Logic System Functional Testing. These tests are performed in accordance with Technical Specifications.

B001
1/1

ADD.

In the event you require further information on this subject, do not hesitate to contact us.

Sincerely,

CA McNeill Jr/JTB

C D.H. Wagner
USNRC Licensing Project Manager

R.W. Borchardt
USNRC Senior Resident Inspector

ATTACHMENT 1

QUESTION 210.56 (SECTION 3.9.6)

There are several safety systems connected to the reactor coolant pressure boundary that have design pressure below the rated reactor coolant system (RCS) pressure. There are also some systems which are rated at full reactor pressure on the discharge side of pumps but have pump suction below RCS pressure. In order to protect these systems from RCS pressure, two or more isolation valves are placed in series to form the interface between the high pressure RCS and the low pressure systems. The leak tight integrity of these valves must be ensured by periodic leak testing to prevent exceeding the design pressure of the low pressure systems.

Pressure isolation valves are required to be category A or AC per IWV-2000 and to meet the appropriate requirements of IWV-3420 of Section XI of the ASME Code except as discussed below.

Limiting Conditions for Operation (LCO) are required to be added to the technical specifications which will require corrective action; i.e., shutdown or system isolation when the final approved leakage limits are not met. Also, surveillance requirements which will state the acceptable leak rate testing frequency shall be provided in the technical specifications.

Periodic leak testing of each pressure isolation valve is required to be performed at least once per each refueling outage, after valve maintenance prior to return to service, and for systems rated at less than 50% of RCS design pressure each time the valve has moved from its fully closed position unless justification is given. The testing interval should average to be approximately one year. Leak testing should also be performed after all disturbances to the valves are complete, prior to reaching power operation following a refueling outage, maintenance, etc.

The staff's present position on leak rate limiting conditions for operation must be equal to or less than 1 gallon per minute (GPM) for each valve to ensure the integrity of the valve, demonstrate the adequacy of the redundant pressure isolation function and give an indication of valve degradation over a finite period of time. Significant increases over this limiting value would be an indication of valve degradation from one test to another.

The Class 1 to Class 2 boundary will be considered the isolation point which must be protected by redundant isolation valves.

In cases where pressure isolation is provided by two valves, both will be independently leak tested. When three or more valves provide isolation, only two of the valves need to be leak tested.

Provide a list of all pressure isolation valves included in your testing program along with four sets of Piping and Instrument Diagrams which describe your reactor coolant system pressure isolation valves.

Also discuss in detail how your leak testing program will conform to the above staff position.

RESPONSE

The reactor coolant pressure boundary has been reviewed for interconnecting safety-related low pressure systems. Table 210.56-1 summarizes the results of this review. The table identifies the reactor coolant system pressure isolation valves and details the extent of compliance with the staff's position. Also identified in Table 210.56-1 are those pressure isolation valves that are leakage tested.

The HCGS uses two isolation valves. The isolation valves are periodically leak rate tested as 10 CFR 50, Appendix J, Type C valves or ASME Section XI, Category A valves. In the event of isolation valve leakage a safety relief valve will further protect the low pressure system.

As an alternate to conducting a liquid leak rate test using reactor coolant operating pressure, PSE&G proposes to fulfill these leak rate test requirements using the results of the Appendix J, Type C, test program. ~~and assigning each valve an individual leak rate~~

In support of conducting Appendix J leak rate testing in place of a liquid test at reactor coolant system operating pressure, PSE&G ~~proposes to~~ conduct a program consisting of the analytical justification and ~~, if necessary,~~ physical testing. The intent of this program ~~is~~ to ensure that Appendix J testing in conjunction with the pressure relieving device installed in these systems supplies the assurance that the structural integrity of these systems is maintained. ~~In the event this program is unsuccessful, the pressure isolation valves will be leak rate tested in accordance with the NRC staff's position using liquid at reactor coolant system operating pressure. The results of this program will be submitted to the NRC for review prior to fuel load.~~

In addition to leak rate testing each refueling outage, each pressure isolation valve will be leak rate tested prior to returning to service after:

1. Maintenance has been performed that could affect the seat leakage rate;

INSERT FOR PAGE 210.56-2

The results of this program was submitted to Ms. E. Adensam from Mr. C.A. McNeill in a letter dated December , 1985.

2. The systems rated at <50% of RCS design pressure, each time the valve has moved from its fully closed position, except when the testing would put the plant in a limiting condition of operation, or provisions are made to monitor the low pressure side of the valve for leakage or pressure increases.

Four sets of full size P&IDs were submitted under separate cover.

The P&IDs that the NRC staff will need to review this response are identified in Table 210.56-2.

SAFETY-RELATED LOW PRESSURE SYSTEMS
CONNECTED TO THE RCPB

RPV Nozzle	Containment Penetration	Connecting Line Description	Pressure Isolation Valve	Leak Tested	Safety-Relief Protection
N1B	P-3	RHR Shutdown Cooling Suction	BC-V164(2)	(3)	(6)
			BC-V071(1)	(3)	
[illegible]-E	P-4A	RHR Shutdown Cooling Return	BC-V013(2)	(3)	(7)
			BC-V014(1)(5)	(3)	
			BC-V118(1)	(3)	
[illegible]B	P4B	RHR Shutdown Cooling Return	BC-V110(2)	(3)	(8)
			BC-V111(1)(5)	(3)	
			BC-V117(1)	(3)	
~~N4A-C~~	~~P2A~~	~~RCIC to Feedwater~~	~~BD-V005(14)~~	~~(4)~~	~~(9)~~
			~~AE-V002(2)(5)~~	~~(3)~~	
			~~AE-V003(1)(5)~~	~~(3)~~	
~~N4D-F~~	~~P2B~~	~~HPCI to Feedwater~~	~~BJ-V059(15)~~	~~(4)~~	~~(10)~~
			~~AE-V006(2)(5)~~	~~(3)~~	
			~~AE-V007(1)(5)~~	~~(3)~~	
N5A	P5A	Core Spray	BE-V003(2)	(3)	(11)
			BE-V002(1)(5)	(3)	
			BE-V072(1)	(3)	
N5B	P5B	Core Spray	BE-V007(2)	(3)	(12)
		HPCI to Core Spray	~~BJ-V001(2)~~	~~(3)~~	~~(10)~~
			BE-V006(1)(5)	(3)	
			BE-V071(1)	(3)	
N6A	P10	RHR, RPV Head Spray	BC-V020(2)	(3)	(7)
			BC-V021(1)	(3)	
N17A	P6A	RHR, LPCI	BC-V004(2)	(3)	(14)
			BC-V005(1)(5)	(3)	
			BC-V122(1)	(3)	
N17B	P6B	RHR, LPCI	BC-V016(2)	(3)	(7)
			BC-V017(1)(5)	(3)	
			BC-V120(1)	(3)	
N17C	P6D	RHR, LPCI	BC-V101(2)	(3)	(13)
			BC-V102(1)(5)	(3)	
			BC-V121(1)	(3)	

TABLE 210.56-1 (Cont'd) Page 2 of 2

RPV Nozzle	Containment Penetration	Connecting Line Description	Pressure Isolation Valve	Leak Tested	Safety-Relief Protection
N17D	P6C	RHR, LPCI	BC-V113(2)	(3)	(8)
			BC-V114(1)(5)	(3)	
			BC-V119(1)	(3)	

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(1) 1st pressure isolation valve.

(2) 2nd pressure isolation valve.

(3) Leak rate tested in accordance with 10 CFR 50, Appendix J.

(4) Leak rate tested in accordance with ASME, Section XI.

(5) Functionally tested as a Category C check valve in accordance with ASME, Section XI.

(6) Safety relief valve BC-PSV-F029 provides overpressure protection. It has a 170 psig setpoint and a 10 gpm capacity.

(7) Safety relief valve BC-PSV-F025B provides overpressure protection. It has a 410 psig setpoint and a 10 gpm capacity.

(8) Safety-relief valve BC-PSV-F025A provides overpressure protection. It has a 410 psig set pressure and a 10 gpm capacity.

(9) Safety relief valve BD-PSV-F017 provides overpressure protection. It has a 100 psig setpoint and a 10 gpm capacity.

(10) Safety relief valve BJ-PSV-F020 provides overpressure protection. It has a 100 psig setpoint and a 15 gpm capacity.

(11) Safety-relief valve BE-PSV-F012B provides overpressure protection. It has a 500 psig setpoint and a 100 gpm capacity.

(12) Safety-relief valve BE-PSV-F012A provides overpressure protection. It has a 500 psig setpoint and a 100 gpm capacity.

(13) Safety-relief valve BC-PSV-F025C provides overpressure protection. It has a 410 psig setpoint and a 10 gpm capacity.

(14) Safety-relief valve BC-PSV-F025D provides overpressure protection. It has a 410 psig setpoint and a 10 gpm capacity.

(15) 3rd pressure isolation valve. Two of the three valves are required to meet the leak rate acceptance criteria.

TABLE 210.56-2

P&IDS REVIEWED FOR INTERCONNECTING LOW PRESSURE SYSTEMS

M-01-1	Rev. 9
M-05-1, Sh. 3	Rev. 9
M-06-1	Rev. 6
M-08-0, Sh. 1	Rev. 11
M-08-0, Sh. 2	Rev. 11
M-23-1, Sh. 2	Rev. 5
M-38-0, Sh. 1	Rev. 2
M-41-1, Sh. 1	Rev. 8
M-41-1, Sh. 2	Rev. 7
M-42-1, Sh. 1	Rev. 5
M-43-1, Sh. 1	Rev. 8
M-44-1	Rev. 6
M-46-1	Rev. 6
M-47-1	Rev. 7
M-48-1	Rev. 4
M-49-1	Rev. 9
M-50-1	Rev. 9
M-51-1, Sh. 1	Rev. 9
M-51-1, Sh. 2	Rev. 10
M-52-1	Rev. 10
M-55-1	Rev. 10
M-56-1	Rev. 8
M-72-1	Rev. 2

ATTACHMENT 2

TEST PROCEDURE

WYLE LABORATORIES
SCIENTIFIC SERVICES & SYSTEMS GROUP
P. O. Box 1008, Huntsville, AL 35807
TWX (810) 987-0865, Phone (205) 837-4411

TEST PROCEDURE NO. ______

DATE: November 20, 19

Revision 2

**TEST PROCEDURE
TO
DEVELOP AIR VS. WATER CORRELATION
FOR LEAK TESTING OF
HOPE CREEK REACTOR COOLANT
BOUNDARY VALVES**

APPROVED BY: ______________________
FOR: ______________________

APPROVED BY: ______________________
FOR: ______________________

APPROVED BY: ______________________
FOR: ______________________

APPROVED BY PROJECT MANAGER: [signature] 5/10/85

APPROVED BY QUALITY ENGINEER: [signature] 5/10/85

PREPARED BY PROJECT ENGINEER: [signature] 5/10

DPt 8512260074

REVISIONS

FORM 1064-1 Rev. 4

REV. NO.	DATE	PAGES AFFECTED	BY	APP'L.	DESCRIPTION OF CHANGES
1	10/28/85	All	[initials]	[signatures]	Revised Lab Test System; Added info to Field Test; Revised wording of basic procedure.
2	11/20/85	2	[initials]	[signatures]	Additional information regarding test objectives.
		4		[signature]	Add'l information regarding field test
		6 through 18			Appendix I, new pages.

1.0 PURPOSE

The purpose of this procedure is to present the test methods to be used to develop correlation data for valve leakage with low pressure air or nitrogen in place of high pressure water.

The objective of the test program is to provide PSE&G with both analytical and empirical justification that satisfactory compliance to 10CFR50 Appendix J, Type C testing will meet or exceed the requirement that reactor or coolant pressure boundary isolation valves, at reactor coolant pressure, have an individual leakage of less than one gallon per minute for any valve. Rev 2

The establishment of such justification would eliminate a need to perform the high pressure leak test prior to returning to power after an outage, or after valve repairs. In other words, elimination of the high pressure leak tests could be justified on a correlation of Type C tests at 48.1 psig to high pressure leak tests with water at 1020 psig. Rev 2

2.0 REFERENCES

2.1 Public Service Electric & Gas P.O. #083496

2.2 PSE&G Specification for Acceptability of Using Air Versus Water for Leak Testing of Reactor Coolant Boundary Valves

2.3 10CFR50 Appendix J, Primary Reactor Containment Leakage Testing for Water Cooled Power Reactors

2.4 Flow of Fluids, Crane Technical Paper No. 410

2.5 Flowmeter Computation Handbook, prepared by the ASME Research Committee on Fluid Meters

3.0 GENERAL REQUIREMENTS

3.1 Test Specimen, Laboratory Tests

The test specimens shall consist of several locally made, very small diameter orifice fittings, and two or three micrometer valves.

3.2 Test Arrangement, Laboratory Tests

The test arrangement shall be a system as depicted schematically in Figure 1.

3.3 Test Instrumentation

Test instrumentation shall consist of two pressure gages, 0-100 or 150 psig and 0-1500 psi, an inlet temperature measurement thermocouple, a rotometer or mass flowmeter for measuring nitrogen flowrate and a flowmeter for measuring water flowrate. The instrumentation shall be as shown in Figure 1.

4.0 TESTS

4.1 Laboratory Tests

4.1.1 Each test specimen will be installed in the test system and subjected to a flow test first using nitrogen and then using water. Inlet pressure to the test specimen shall be regulated to 48.1 psig for the nitrogen test, and to 1020 psig for the water test. Water pressure will be obtained using nitrogen over water in the accumulator. The micrometer valves will each be tested over a range of openings (Turns Open). For each orifice and for each set valve opening the nitrogen flow test will immediately be followed by the water flow test. For each test, flowrate will be determined using the appropriate flowrate meter. Temperature of the test fluid will be recorded and will be maintained as near the original ambient temperature as reasonable time between tests will allow. A variation of several degrees fahrenheit during nitrogen or air tests is acceptable.

4.1.2 A large range from near zero to over 70,000 SCCM flowrate of nitrogen is desirable and the micrometer valve settings should be adjusted accordingly. Water flowrates from near zero to over 2 GPM are desirable and settings adjusted accordingly. Test sequence from nitrogen to water should always be maintained for each orifice and valve setting.

4.1.3 Data from the laboratory tests for each fluid will be plotted for the series of orifice tests and for each valve series of openings. This data as plotted should closely approximate a straight line which would indicate close agreement with the basic equations for fluid flow through orifices. If such agreement is found, then for each orifice area and for each valve and its series of openings, a plot of nitrogen flowrate versus water flowrate will be made. If the previous plots provided straight line relationships, this plot will also provide straight line relationships; and if the data is consistent for the various test specimens, the lines for each specimen will have nearly the same slope.

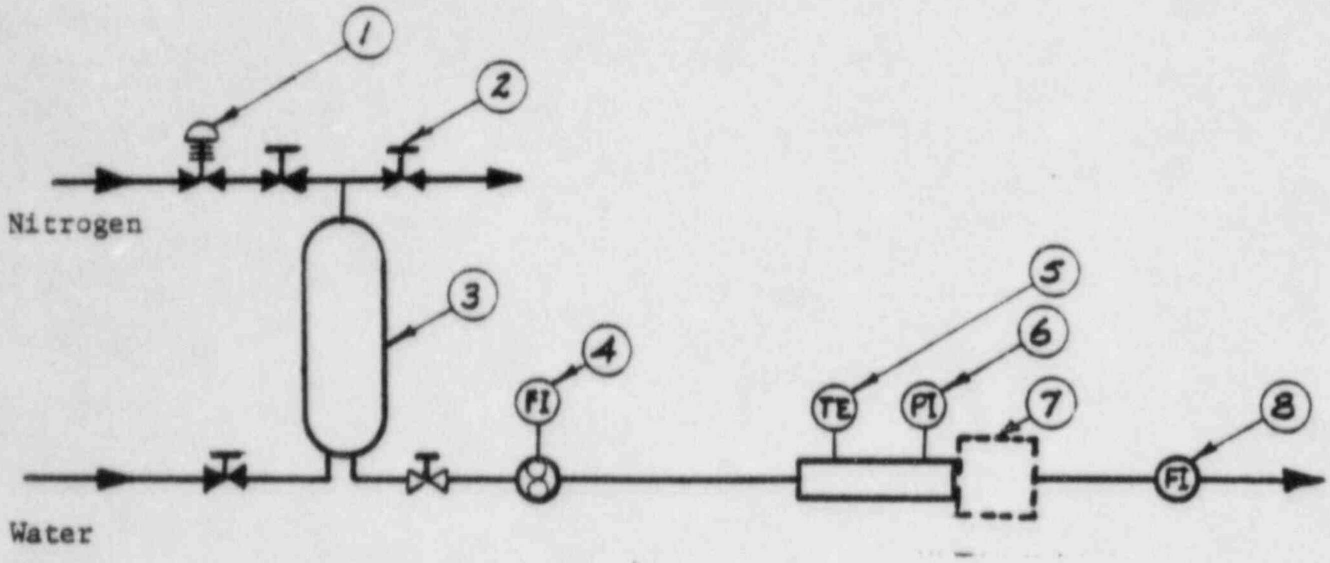
4.2 Field Tests

4.2.1 If analysis of the above laboratory tests indicate a consistent relationship for the various test specimen openings (i.e., a consistent slope for the nitrogen flowrate versus water flowrate plot), field testing will be performed by PSE&G.

4.2.2 Field testing will be accomplished in accordance with PSE&G, PSSUG-PTP-GP-2. Air will be used instead of nitrogen, and test pressures and temperatures will be held as close as possible to those of the laboratory tests. Valves to be tested will be selected from those listed in reference 2.2 above, and are installed valves at the Hope Creek Generating Station. Testing will be accomplished by PSE&G designated personnel. Copies of Appendices 4A and 4C of PSSUG-PTP-GP-2 are included in Appendix I of this Procedure. These two Appendices are the operating instructions for the Volumetrics Leak Rate Monitor and for the high pressure hydraulic leak rate monitor respectively. Diagrams of the test systems for these two leak rate monitors are also included in Appendix I. | Rev 2 | Rev 2

5.0 FINAL REPORT

5.1 The final report will be prepared upon completion of all laborataory and field testing. Data from the field tests will be compared with the laboratory test data and the extent of correlation noted for field water flowrates as compared to laboratory water flowrates for any given air or nitrogen flowrate.



LABORATORY TEST SYSTEM

LEGEND:

1. Pressure Regulator
2. Vent Valve
3. Accumulator
4. Water Flowmeter
5. Thermocouple
6. Pressure Gage
7. Orifice or Test Valve Installation
8. Rotometer or Massflow Meter for GN_2 Measurement

FIGURE #1

APPENDIX I

APPENDIX 4A

TEST EQUIPMENT OPERATING INSTRUCTIONS

LOCAL LEAK RATE MONITOR

1.0 Equipment

1.1 The local leak rate monitor is a portable self-contained instrument that pressurizes the test volume to a prescribed pressure. Using a pressure regulator to maintain test pressure, the make up fluid to the test volume required to maintain test pressure is measured using a flow meter which is a direct measurement of leakage rate.

1.2 Leak rate monitor will be operated in accordance to the manufacturer's operating manual.

1.3 Test tubing (High density polyethylene tubing 1/4" x 0.040" wall).

2.0 Leak Rate Test Procedure

2.1 Turn power switch on (120V AC) and allow 30 minute warmup.

2.2 Adjust pressure zero control potentiometer to indicate zero pressure (± 0.1 psig).

2.3 Connect the instrument to a supply of extra dry nitrogen and adjust nitrogen supply to 150 psig.

2.4 Flow calibration check (at least once every 24 hours).

2.4.1 Turn range value and range switch to low.

2.4.2 Turn mode valve to cal low. Directs flow through low range calibrated leak.

2.4.3 Adjust low zero flow transducer potentiometer to indicate zero flow (± 1.0% of low range).

2.4.4 Adjust pressure regulator to apply the calibrated leak check pressure (determined at least calibration).

2.4.5 Read flow rate and determine if within range of calibrated leak. Proceed to calibration check the various ranges by repeating step 2.4.

2.4.6 If any range is not within the Test Orifice Calibration Range criteria return for repair. All ranges are independent of each other. If one range (flow transducer) does not meet its calibration check this does not effect the other ranges and

2.5 Turn range valve to charge and mode value to set test. Adjust pressure regulator to the desired test pressure (-0, + 0.5 psig).

2.6 Connect instrument to the component being tested using the appropriate length tubing with shut off valve at end of test tubing. Valve in off position.

2.7 Turn range valve to low and mode valve to test. Adjust pressure regulator to test pressure and allow instrument to stabilize. Determine if test tubing and test setup leaks and eliminate if any.

2.8 Open test tubing valve and test component connection valve. Allow test component to pressurize to test pressure (-0, + 0.5 psig).

2.9 When test pressure is obtained allow system to stabilize for minimum of 15 minutes.

2.10 Maintain stable test conditions for test period minimum of 15 minutes.

2.11 Record data on test sheet.

3.0 System Shutdown

3.1 Close test component connection valve and test tubing valve.

3.2 Turn mode valve to set test.

3.3 Decrease pressure to zero with pressure regulator.

3.4 Close nitrogen tank valve.

3.5 Disconnect test tubing, test set to test component and test set to nitrogen tank.

3.6 Turn power switch off.

APPENDIX 4C

TEST EQUIPMENT OPERATING INSTRUCTIONS

HIGH PRESSURE HYDRAULIC LEAK RATE MONITOR

1.0 Equipment

1.1 The hydraulic leak rate monitor is a portable self-contained instrument that pressurizes the test volume to a prescribed pressure, using a hydraulic pressure regulator to maintain pressure. Makeup fluid (demin. water), to the test volume required to maintain test pressure, is measured. Using a liquid flow rate measuring transducer provides a direct measurement of in-flow leakage rate.

1.2 High pressure air driven liquid pump (0-1500 psi output pressure, 5 gpm liquid flow with 50 psi, 175 SCFM air pressure).

1.3 Hydraulic leak rate monitor and high pressure air driven liquid pump will be operated in accordance to the manufacturer's operation manual.

1.4 Hydraulic test hoses with shutoff quick connect (thermoplastic tube with double braid synthetic reinforcement) maximum operating pressure 2000 psi. Hose ends are to be capped at all times to prevent foreign material from entering test hoses.

1.5 Test hose shutoff-bleed valve and calibrated high pressure gage (0-1500 psig).

1.6 The hydraulic leak rate monitor shall be connected to the high pressure air driven liquid pump as follows:

1.6.1 Hydraulic leak rate monitor tank fill connection to hydraulic tank.

1.6.2 Hydraulic leak rate monitor drain-tank connection to hydraulic tank drain.

1.6.3 Hydraulic leak rate monitor high pressure connection to air pump liquid high pressure connection.

1.6.4 Hydraulic leak rate monitor air connection to air pump air connection.

2.0 Hydraulic leak rate monitor hook up.

2.1 Connect the instrument to a supply of demineralized water (60-100 psig) use only local leak rate hydraulic test hose.

2.2 Connect the instrument to a supply of station air (125 psig) use station air hoses.

2.3 Connect the instrument using hydraulic local leak rate hose to test component, with shutoff-bleed valve and calibrated test gage at test component end

3.0 Hydraulic Leak Rate Flow Calibration Check Procedure (At least once every 24 hours).

3.1 Turn power switch on (120V AC) and allow 30 minute warmup.

3.2 Adjust low pressure zero control potentiometer to indicate zero pressure (± 0.1 psig).

3.3 Connect the instrument to a supply of demineralized water (60-100 psig). Use only local leak rate hydraulic test hose.

3.4 Turn switch on low flow transducer to zero.

3.5 Adjust low flow transducer zero potentiometer to indicate zero flow (± 1.0% of flow range).

3.6 Turn switch on high flow transducer to zero.

3.7 Adjust high flow transducer zero potentiometer to indicate zero flow (± 1.0% of flow range).

3.8 Connect the instrument drain to suitable drain.

3.9 Turn DI-WATER valve on.

3.10 Turn FLOW-RANGE valve to low.

3.11 Turn CAL-CHECK valve to on.

3.12 Adjust hydraulic pressure regulator to apply the calibrated leak check pressure (determined at last calibration).

3.13 Read low flow rate and determine if within range of calibrated leak. If within tolerance proceed to calibration check the high low range by repeating steps 2.12-2.13 with flow range valve to high.

3.14 If any range is not within the acceptance criteria return instrument for repair and calibration. Ranges are independent of each other. If one range (flow transducer) does not meet its calibration check this does not effect the other range and may be used for certified testing.

3.15 Turn CAL-CHECK valve off.

3.16 Decrease hydraulic pressure regulator (turn counterclockwise).

4.0 Leak Rate Test Procedure

4.1 Maintain hydraulic tank at 1/2 - 3/4 full during complete test using the DIWATER tank needle valve.

4.2 Turn flow range valve to high flow and mode valve to test.

4.3 Turn switch to high pressure transducer.

4.4 Turn AIR valve on, air transducer, regulator decreased (counterclockwise).

4.5 Increase high pressure by increasing AIR pressure regulator and adjust high pressure relief regulator to the maximum high pressure. This will relieve pump pressure to tank and maintain test pressure flow by adjusting AIR regulator.

4.6 Crack bleed valve and purge hydraulic test hose of air. Turn valve to off position.

4.7 Turn test commmponent valve on and determine component head presure, record.

4.8 Adjust high pressure relief regulator to test pressure plus head pressure.

4.9 Open hydraulic test hose valve and allow test component to pressurize to test pressure plus head pressure.

4.10 When test pressure is obtained, allow system flow to stabilize. Stabilization is a steady flow rate at test pressure.

4.11 Record data on attached test sheets.

5.0 System Shutdown

5.1 Reduce high pressure by reducing air pressure regulator to air pump (counterclockwise) to the pretest head pressure turn mode valve to off.

5.2 Reduce high pressure by reducing air pressure regulator to air pump (counterclockwise).

5.3 Turn air valve off.

5.4 Turn test component valve off.

5.5 Turn test connection valve to bleed. Relieve test pressure from hydraulic test hoses.

5.6 Disconnect hydraulic test hoses DIWATER to instrument, instrument to test component. Cap all hydraulic test hose ends.

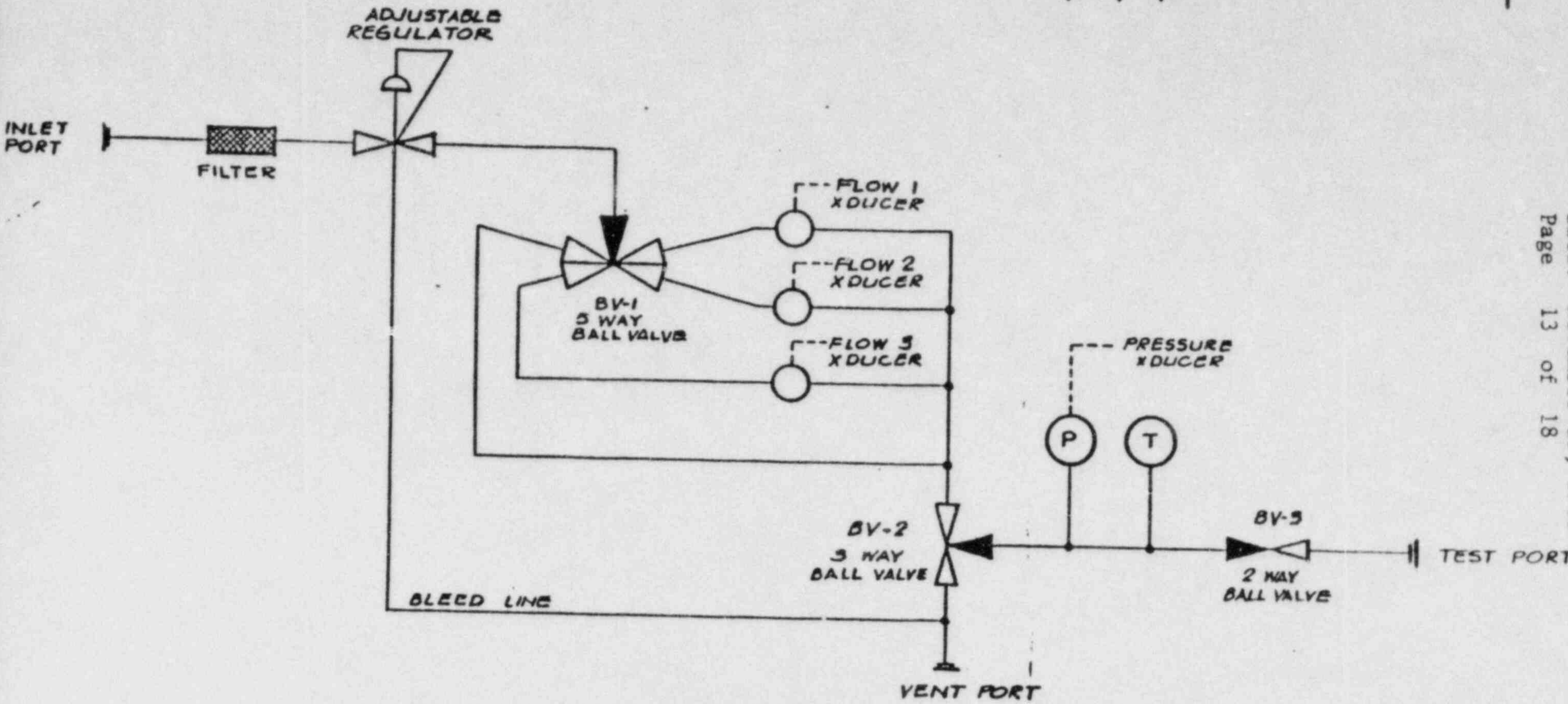
5.7 Turn station air off and disconnect station air hose to instrument.

5.8 Drain hydraulic tank and disconnect drain hose from instrument.

8200.B

REVISIONS

ZONE	LTR	DESCRIPTION	DATE	APPROVED



UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE: FRACTIONS ± DECIMALS .XX ± .XXX ± ANGLES ±

MATERIAL

FINISH

NEXT ASSY | USED ON

APPLICATION

DO NOT SCALE DRAWING

CONTRACT NO.

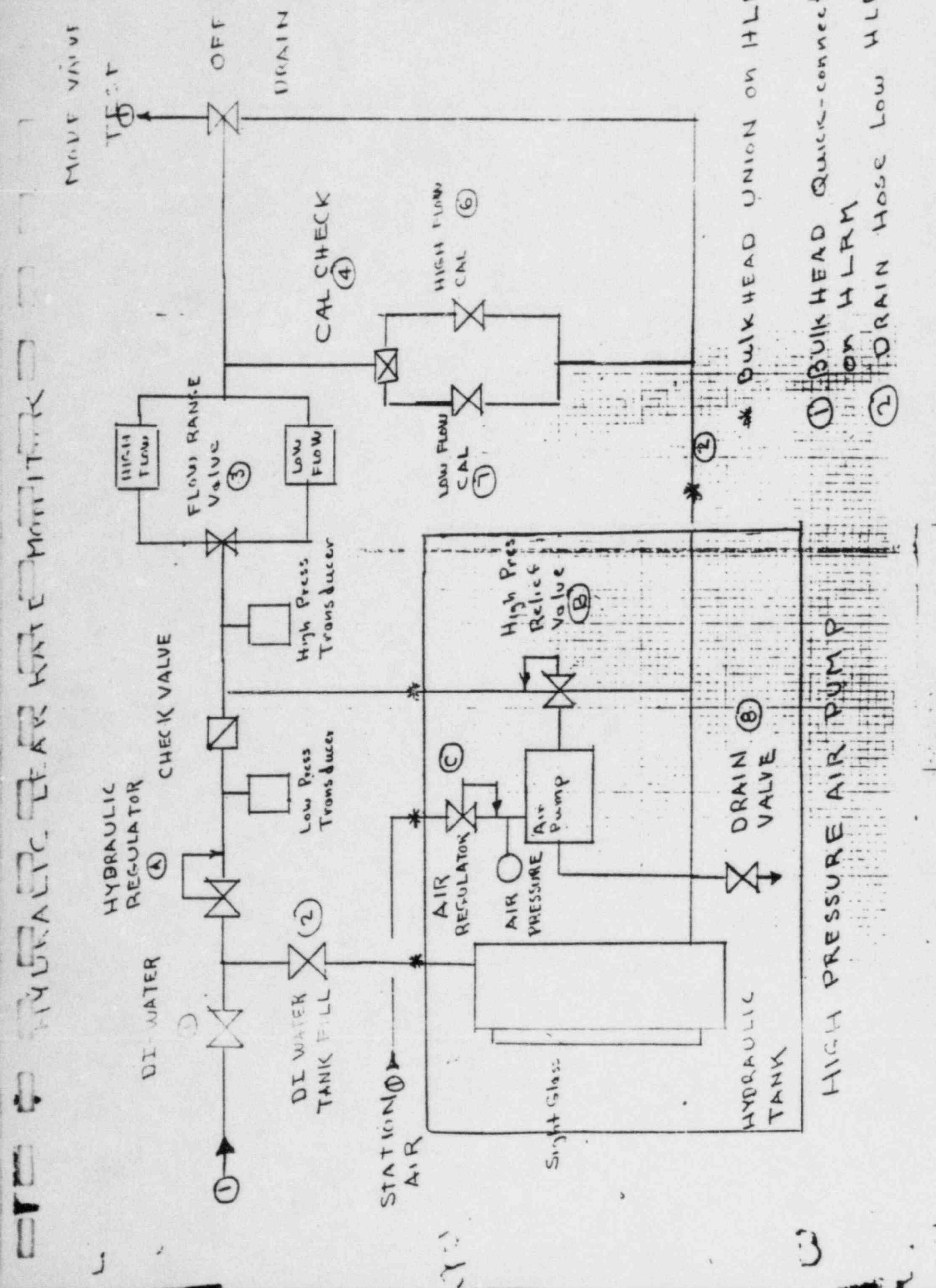
APPROVALS	DATE
DRAWN WASHBURN	2-3-82
CHECKED E BADGETT	2-3-82
L. GIBSON	2-3-82

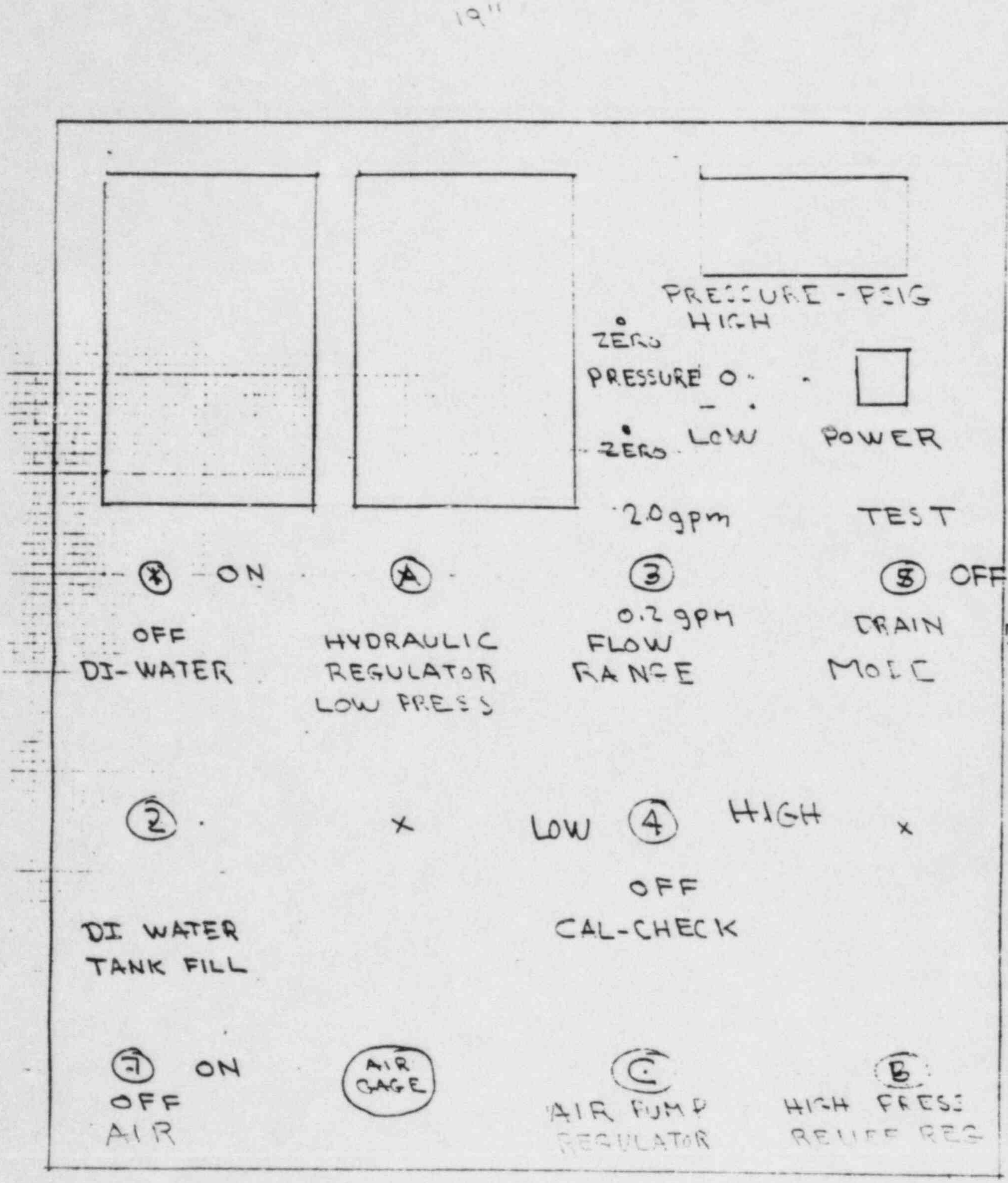
VOLUMETRICS PALO ROBLES CALIFORNIA

PNEUMATIC DIAGRAM
LEAK RATE MONITOR
MODEL NUMBER 14342

SIZE	CODE IDENT NO.	DRAWING NO.
B	20890	820018∅

SCALE — 00 SHEET 1 OF 1

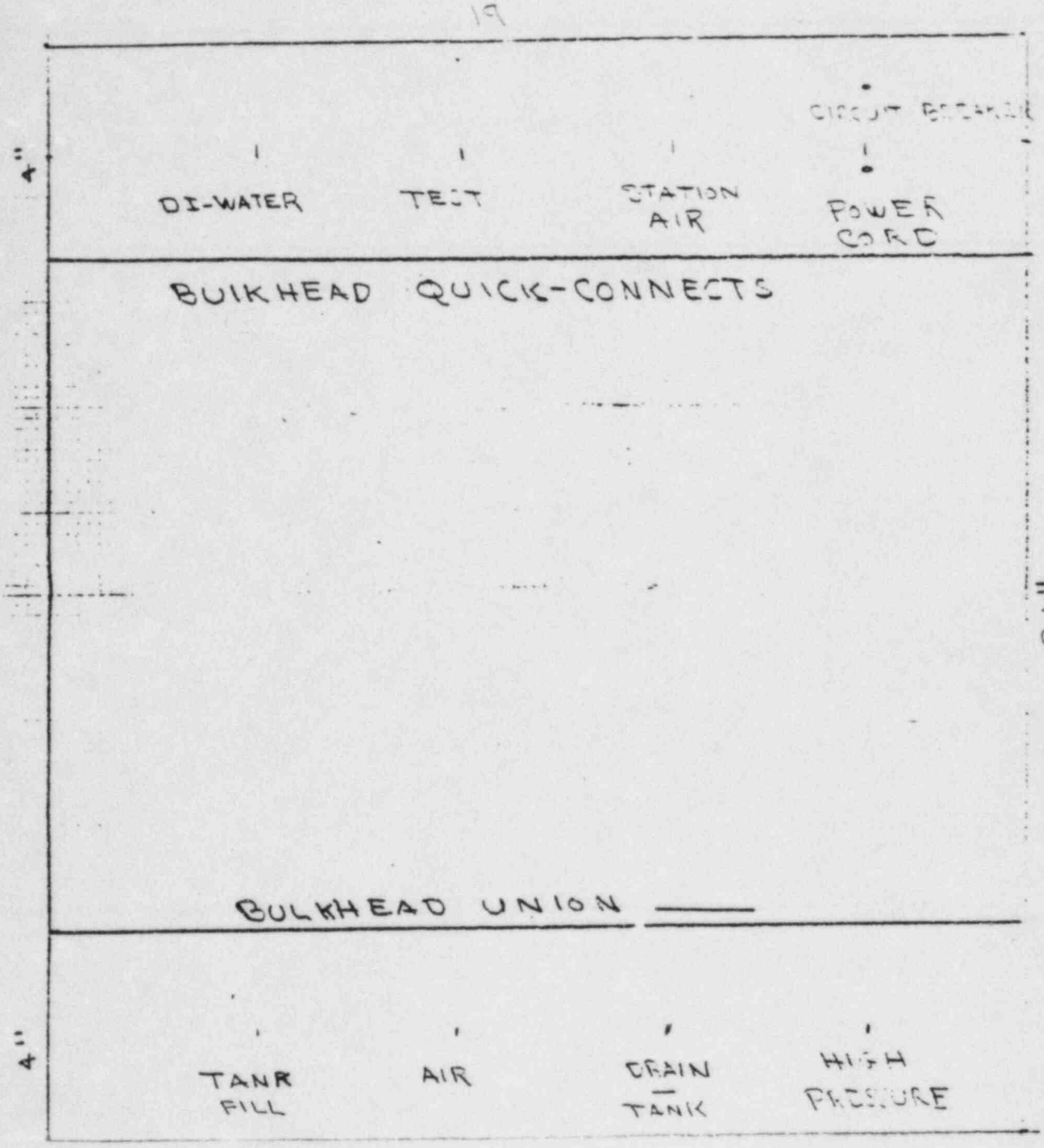

MODE VALVE (5)
TEST
OFF
DRAIN
DI-WATER
HYDRAULIC REGULATOR (A)
CHECK VALVE
High Flow
Low Flow
FLOW RANGE Valve (3)
CAL CHECK (4)
Low Press Transducer
High Press Transducer
DI WATER TANK FILL (2)
STATION (1) AIR
AIR REGULATOR (C)
AIR PRESSURE
Air Pump
High Press Relief Valve (B)
Low Flow CAL (7)
High Flow CAL (6)
Sight Glass
HYDRAULIC TANK
DRAIN VALVE (8)
HIGH PRESSURE AIR PUMP
* BULKHEAD UNION on HLRM
(1) BULKHEAD Quick-connect on HLRM
(2) DRAIN Hose Low HLRM



HYDRALIC LEAK RATE MONITOR

Valve No.	LABEL USE	Mfg
1	DI WATER ON OFF	Whitey Ball Valves SS-44S6
2	DI-WATER TANK FILL	Whitey Regulating & Shut-off SS-1RS6
3	FLOW RANGE HIGH - LOW	Whitey Ball Valve SS-44XS6
4	CAL-CHECK HIGH - LOW	Whitey Ball Valve SS-44XS6
5	MODE VALVE TEST OFF DRAIN	Whitey Ball Valve SS-44XS6
6	CAL LEAK HIGH	Whitey Regulating & Shut off valve SS-1RS6
7	CAL LEAK LOW	Whitey Micro-Metering SS-22RS4
8	DRAIN VALVE	Whitey Ball Valve SS-44S6

REGULATORS	Manufacturer
A Low Pressure HYDRAULIC REGULATOR	
B High Pressure Relief Valve	
C Air Pressure Regulator	



REAR
HYDRALUIC LEAK RATE MONITOR

ATTACHMENT 3

CERTIFICATION TEST REPORT OF AIR VS. WATER CORRELATION FOR LEAK TESTING OF HOPE CREEK REACTOR COOLANT BOUNDARY VALVES

DUPE 8512260075

REVISIONS

REVISION A

TEST REPORT NO. 17761-1

DATE: November 20, 1985

WYLE LABORATORIES
SCIENTIFIC SERVICES AND SYSTEMS GROUP

REV NO	DATE	PAGES AFFECTED	BY	APP'L	DESCRIPTION OF CHANGES
A	11/20/85	1 through 8	RC	JST 11/20/85	Changes in text and organization for
					customer clarity.
		9			New page, "Appendix I"
		10 through 29			Page number change only.
		30			New page, "Appendix II"
		31 through 36			Page number change only.
		37 through 71		BNH 11/26/85	New pages: Appendix III - Field Test
					Calibration Sheets.

Form 1054-3 Rev. 4/74

WYLE LABORATORIES
SCIENTIFIC SERVICES & SYSTEMS GROUP
Huntsville, Alabama 35807
TWX (810)726-2225 Phone (205)837-4411

CERTIFICATION TEST REPORT

Public Service Electric & Gas Company
Hope Creek Generating Station
P.O. Box A
Hancocks Bridge, NJ 08038

REPORT NO. 17761-1

CUSTOMER P. O. NO. 083496

CONTRACT

NUMBER OF PAGES

DATE November 6, 1985

A

1.0 REQUIREMENTS

The specimens for laboratory testing were subjected to tests in accordance with Wyle Test Procedure No. 17761-1, Rev. 1. The specimens for field testing were subjected to tests in accordance with PSE&G LLRT Procedure PSSUG-PTP-GP-2, as indicated in the Wyle Test Procedure.

The objective of the test program, which this report is intended to support, is to provide PSE&G with analytical and empirical justification that satisfactory compliance to 10CFR50 Appendix J, Type C testing will meet or exceed the requirement that reactor coolant pressure boundary isolation valves, at reactor coolant pressure, have an individual leakage of less than one gallon per minute for any valve.

The establishment of such justification would eliminate a need to perform the high pressure leak test prior to returning to power after an outage, or after valve repairs. In other words, elimination of the high pressure leak tests could be justified on a correlation of Type C tests at 48.1 psig to high pressure leak tests with water at 1020 psig.

STATE OF ALABAMA }
COUNTY OF MADISON } SS

James E. Thompson, being duly sworn, deposes and says: The information contained in this report of complete and carefully conducted tests and is to the best of his knowledge true and correct in all respects.

SEAL J. E. Thompson

SUBSCRIBED and sworn to before me this 8 day of Nov, 19 85

Robbie Cantrell
Notary Public in and for the State of Alabama at large.
My Commission expires 2 Apr, 19 89

PREPARED BY J. E. Thompson 11-8-85

APPROVED BY L. J. McIlwayne 11-8-85

QUALITY ASSURANCE G. W. Hight 11/8/85

FORM 1019A, Rev. Jan '84

2.0 SPECIMEN | A

For laboratory tests: six local prepared orifices with nominal diameters as follows: .012 in

.020 in.

.031 in.

.040 in.

.052 in.

.060 in.

and two 1/4 inch micrometer valves.

For field tests: identified penetrations as per PSEG.

3.0 PART NO. | A

There are no part numbers for the local prepared orifices. For the field tested valves, sufficient data for full identification is provided in the Field Test Data Sheet, Table 5, Appendix [illegible]. For the micrometer valves:

Mfgr. - HOKE P/N 1315G4Y

- NUPRO P/N SS-2M-S6

4.0 SERIAL NUMBERS - None. | A

5.0 PROCEDURES | A

The flow of fluids through an orifice may be expressed as follows (see reference 2.4 of the Test Procedure, "Crane Technical Paper No. 410"):

$$q = YCA\sqrt{\frac{2g \times \triangle P}{\rho}}$$

where q = rate of flow

Y = net expansion factor for compressible flow through orifices, nozzles, or pipe

C = flow coefficient for orifices and nozzles

A = cross sectional area of the orifice

2g = gravitational constant

$\triangle P$ = differential static pressure (head) across the orifice or nozzle

ρ = weight density of the fluid

The expansion factor (Y) for compressible flow is a function of:

1. The specific heat ratio k, which varies slightly with different pressures and temperatures. For air and nitrogen at $68^{\circ}F$ and 14.7 psia, the specific heat ratios are 1.4 and 1.41 respectively.
2. The ratio (β) of orifice or throat diameter to inlet diameter.
3. Ratio of downstream to upstream absolute pressures.

If all the above conditions were held fixed except for area, the flowrate through a set of similar orifices would be directly proportional to the area of the orifice, and a plot of flowrate versus area would be linear. R

For the laboratory tests, a series of six different sizes of orifices were prepared by drilling holes in metal plates. No particular attention was given to accurate sizing or to finishing the edges of those holes. These orifice plates along with two micrometer valves were used as specimens to gather correlated flowrate data for nitrogen at low pressure, and then water at high pressure over a range of areas and valve openings (valve turns).

For a meaningful correlation to exist between the laboratory data for the nitrogen versus water flowrates it was assumed that the laboratory data for each fluid would exhibit close correlation with the above linear relationship of flowrate versus area. This further assumed that variations in the finish of the edges of the six orifices, and that slight variations in temperature of the nitrogen (compressible) fluid would not be significant. The following analyses of the laboratory test data show these assumptions to be valid and that a close linear relationship exists for flowrate versus each set of specimen area variations.

5.1 Laboratory Tests

Six orifice sizes and two micrometer valves were installed and tested as required. The test data is included in Appendix I, Tables 1 through 4. Two runs were made using the HOKE micrometer valve. The first run provided good data but was considered insufficient in coverage of the lower range of fluid flow. A second run was made providing a greater range of data.

Test fluid temperatures were local ambient and varied slightly between tests. For the water (incompressible) test fluid, the temperature differences are considered insignificant. For the nitrogen (compressible) test fluid, temperatures varied not more than $2^{o}F$ throughout the duration of a given test. On an absolute temperature basis, the effect of this temperature variation is considered insignificant regarding flow variation.

Water flow data was recorded in gallons per minute (GPM) and nitrogen gas flow data was recorded in actual cubic centimeters per minute (ACCM) and converted to standard values (SCCM).

5.1.1 Analysis of the Laboratory Test Data

A

The flowrate data for each test orifice and valve versus the orifice area or number of turns opened (Valve Turns) for the micrometer valves was plotted using a linear plotting program. A least square fit was computed for each and a slope and intercept provided. In each case, the data plotted (Figures 1, 2, 3, 4, 9 and 10) shows a high linear correlation over significant range of the data.

The data plotted for the NUPRO micrometer valve appeared to be bilinear. Two fits were determined and two plots are provided for each test fluid. A straight line is plotted for a low range valve opening below 0.5 turns, Figures 5 and 6, and for a higher range above 0.5 turns, Figures 7 and 8.

The reason for the bilinear relationship is assumed to be a result of the non-linear relationship of the valve area opened with respect to valve turns. The decreased flowrate for the more "opened" valve setting supports this assumption. Regardless, the straight line relationships of the data as shown in all cases, figures 1 through 10 of Appendix I, exhibit the correlation desired.

5.1.2 Correlation of Nitrogen Versus Water Flowrates

The laboratory tests were conducted such that for each test condition with nitrogen at 48.1 psig and ambient temperature, an identical test was run using water at 1020 psig and ambient temperature. A plot of the nitrogen flowrate versus the water flowrate for each identical test specimen area or opening is shown in Figure 11, Appendix I. The best fitting straight line through each of the four sets of data points was determined by linear regression methods. The slope and intercept of each line was computed by the linear regression program used. The correlation of these lines with the data points was computed to be very high, over 99%. A

The four test specimen lines are shown on the correlation plot, Figure 11, and the slope and intercept for each is as follows:

		Slope	Intercept
Line 1	Orifices	38532	-1149
Line 2	HOKE Micrometer Valve, Run 1	34556	-2236
Line 3	NUPRO Micrometer Valve	38667	-8791
Line 4	HOKE Micrometer Valve, Run 2	33157	-1968

The equation of Line 3 is:

$$SCCM = 38667 \times GPM - 8791$$

or for conversion: $$GPM = \frac{SCCM + 8791}{38667} \qquad \text{Equation (1)}$$

The equation of Line 1 is:

$$SCCM = 38532 \times GPM - 1149$$

or for conversion: $$GPM = \frac{SCCM + 1149}{38532} \qquad \text{Equation (2)}$$

5.1.3 Equipment Certification and Calibration

Instrumentation equipment and calibration sheets for the laboratory test system are included in Appendix II. A photograph of the laboratory test system is shown in Figure 12, Appendix I.

5.2 Field Tests

In that a satisfactory correlation between the water and the nitrogen flowrates was shown by the laboratory tests, field tests were conducted in accordance with the Test Procedure (PSSUG-PTP-GP-2). These field tests are similar to the laboratory tests. Completed test procedures for each of the 20 valve sets selected and tested are available from Hope Creek Generating Station records. The data obtained in these field tests is shown in Table 5, Appendix I. Of the twenty data sets obtained in the field, none has a flowrate value greater than the least value recorded during the laboratory tests. Data for each air test in the field was converted to a water flowrate value using the Equations (1) and (2). The computed water flowrates are shown in Table 6, Appendix I as the Correlated Data. The two equations provide a most conservative and least conservative correlation.

The Line 1 correlated data is conservative for all but 4 of the actual field test data and is the least conservative of the two. Line 3 correlated data is conservative for all actual field test data and is the most conservative. A factor of conservatism is shown for each correlation shown in Table 6 and was obtained by dividing the Correlated Data by the Field Test Actual Water Flow.

5.2.1 Equipment Certification and Calibration

Instrumentation equipment and calibration sheets for the field test system are included in Appendix III.

6.0 RESULTS AND CONCLUSIONS

6.1 Results

The laboratory tests showed a high correlation of nitrogen and water flowrates versus area of orifice or valve opening over a significant range of the data (Figures 1-10). A

The flowrates for nitrogen versus water for identical orifice areas or valve settings were plotted using linear regression methods. Four lines were determined with very high linear correlation to the data. Two of these lines provide a bounds to the four lines determined within the ranges:

0 - 38000 SCCM Nitrogen at 48.1 psig

0 - 1.2 GPM Water at 1020 psig

These two lines represent a least conservative and a most conservative approach for correlation of nitrogen or air tests at low pressure to water tests at high pressure (see Figure 11).

The field tests provided lower flowrate data than any obtained during laboratory tests.

For each of the twenty field tests, the air test flowrate was used with Equations (1) and (2) to compute Correlated Data for Water flowrates. Using the least conservative approach, Equation (2), all but four of the correlated data obtained are conservative. Using the most conservative approach, Equation (1), all correlated data are very conservative.

6.2 Conclusions

A

6.2.1 Equation (1) of this report provides a conservative correlation from nitrogen or air flowrates to water flowrates for the fluids, pressures, and ranges below:

from: 0 - 38000 SCCM Nitrogen/Air at 48.1 psig

to: 0 - 1.2 GPM Water at 1020 psig.

6.2.2 Equation (1) of this report, applied as set forth in the above Conclusion, provides a valid and conservative correlation approach to eliminate the need to perform high pressure water leak testing on valves which have been satisfactorily tested at low pressure using air or nitrogen.

7.0 QUALITY ASSURANCE

All laboratory work performed on this test program was completed in accordance with Wyle Laboratories' Quality Assurance Program which complies with the applicable requirements of MIL-Q-9858A, MIL-I-45208A, and NASA's NHB 5300.4 (1B & 1C).

8.0 TEST EQUIPMENT AND INSTRUMENTATION

All laboratory instrumentation, measuring, and test equipment used in the performance of this test program were calibrated in accordance with Wyle Laboratories' Quality Assurance Program which complies with the requirements of Military Specification MIL-STD-45662. Standards used in performing all calibrations are traceable to the National Bureau of Standards by report number and date. When no national standards exist, the standards are traceable to international standards or the basis for calibration is otherwise documented.

APPENDIX I

AIR VERSUS WATER CORRELATION FOR LEAK TESTING
For Public Service Electric and Gas Company, Hope Creek Generating Station

TABLE I
APPENDIX I

LABORATORY TESTS Conducted 7/1/85 through 8/27/85
WYLE LABORATORIES, Huntsville, Alabama

Line	Test Specimen	Size-in^2/ Setting-Turns	Flowrate Nitrogen (Meter Type*)	^oF	psig	ACCM	SCCM	Flowrate Water (Meter Type*)	^oF	psig	GPM	Line
1	ORIFICE	0.012 in. dia.	2 (SS float)	72	48.1	4400	4301	5	78	1020	0.12	1
2	ORIFICE	0.020	3 (glass float)	72	48.1	9200	8992	5	78	1020	0.29	2
3	ORIFICE	0.031	1	72	48.1	22000	21504	5	78	1020	0.58	3
4	ORIFICE	0.040	1	72	48.1	36000	35188	5	78	1020	0.96	4
5	ORIFICE	0.052	1	72	48.1	63000	61579	5	78	1020	1.60	5
6	ORIFICE	0.060	1	72	48.1	79500	77707	5	78	1020	2.06	6

* Flowrate Meter Type - see item no., Instrumentation Equipment Sheet

NITROGEN FLOW (SCCM) VS. ORIFICE AREA (SQ IN.) LSQ FIT FOR 1.130974E-04 =<X<= 2.827434E-03 , SLP 2.763453E+07 INTRT 842.8265

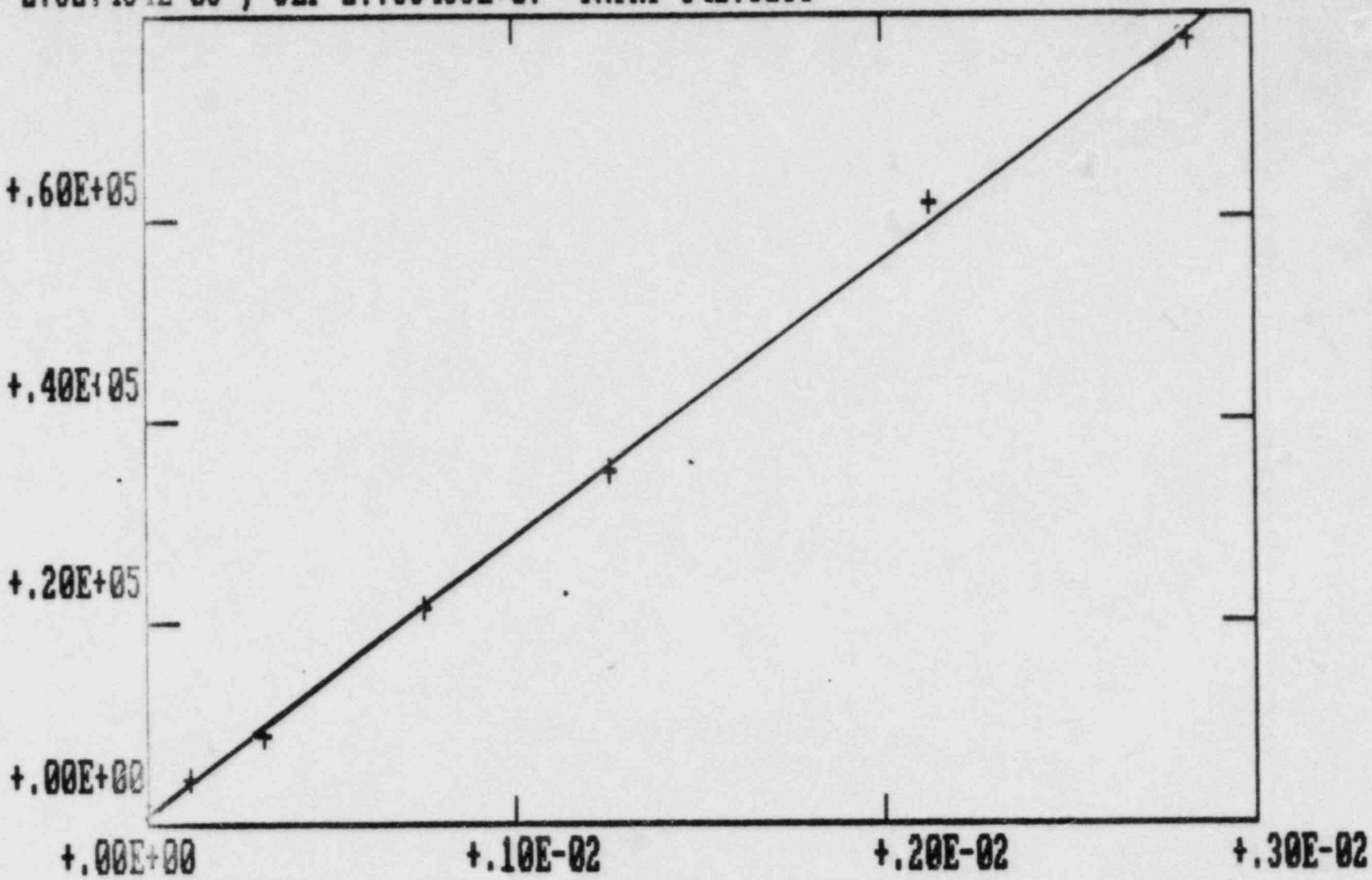


FIGURE 1
APPENDIX I

WATER FLOW (GPM) VS. ORIFICE AREA (SQ IN.) LSQ FIT FOR 1.130974E-04 =<X<= 2.827434E-03 , SLP 717.2145 INTRT 5.165318E-02

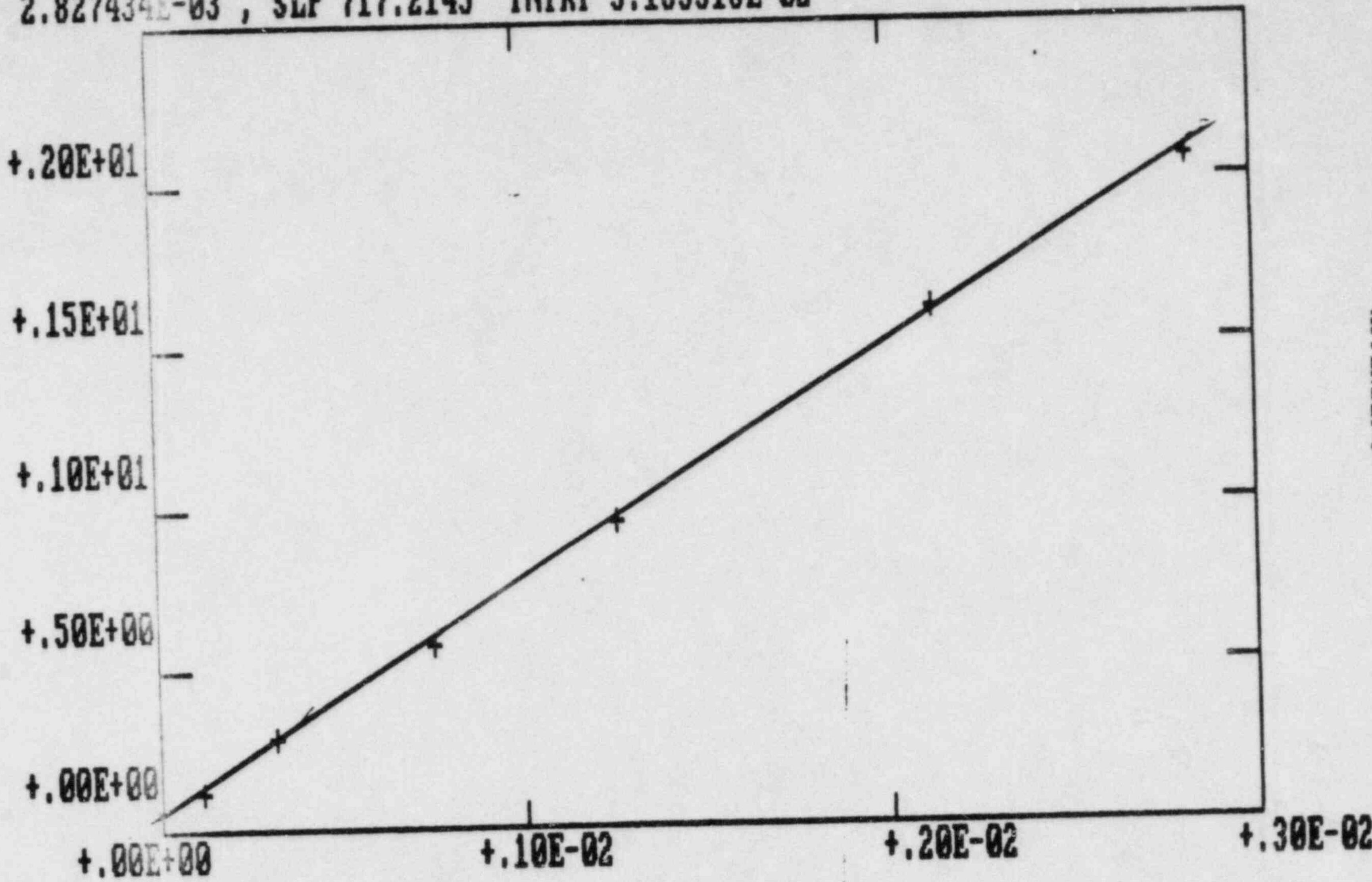


FIGURE 2
APPENDIX I

AIR VERSUS WATER CORRELATION FOR LEAK TESTING
For Public Service Electric and Gas Company, Hope Creek Generating Station

TABLE 2
APPENDIX I

LABORATORY TESTS Conducted 7/1/85 through 8/27/85
WYLE LABORATORIES, Huntsville, Alabama

Line	Test Specimen	Size-in^2/ Setting-Turns	Flowrate Nitrogen (Meter Type*)	^{o}F	psig	ACCM	SCCM	Flowrate Water (Meter Type*)	^{o}F	psig	GPM	Line
1	HOKE	2 Turns	—	—	—	—	—	5	68	1020	0.09	
2	1/4 inch	3	3	72	48.1	4600	4496	5	68	1020	0.18	2
3	Micrometer	4	3	72	48.1	5800	5669	5	68	1020	0.24	3
4	Valve	5	3	72	48.1	9200	8992	5	68	1020	0.32	4
5	(Run 1)	6	3	72	48.1	11400	11143	5	68	1020	0.38	5
6		7	3	72	48.1	13100	12804	5	68	1020	0.44	6
7		8	3	72	48.1	15500	15150	5	68	1020	0.51	7
8		9	3	72	48.1	17000	16616	5	68	1020	0.56	8
9		10	3	72	48.1	19400	18962	5	68	1020	0.62	9
10		11	3	72	48.1	21400	20917	5	68	1020	0.68	10
11		12	3	72	48.1	23400	22872	5	68	1020	0.73	11
12		13	3	72	48.1	25300	24729	5	68	1020	0.75	12
13		14	3	72	48.1	27800	27173					
14	↓	15	3	72	48.1	28820	28170					

* Flowrate Meter Type - see item no., Instrumentation Equipment Sheet

NITROGEN FLOW (SCCM) VS. VALUE TURNS LSQ FIT FOR 3 =<X<= 14 , SLP 2052.297
INTRT-1650.945

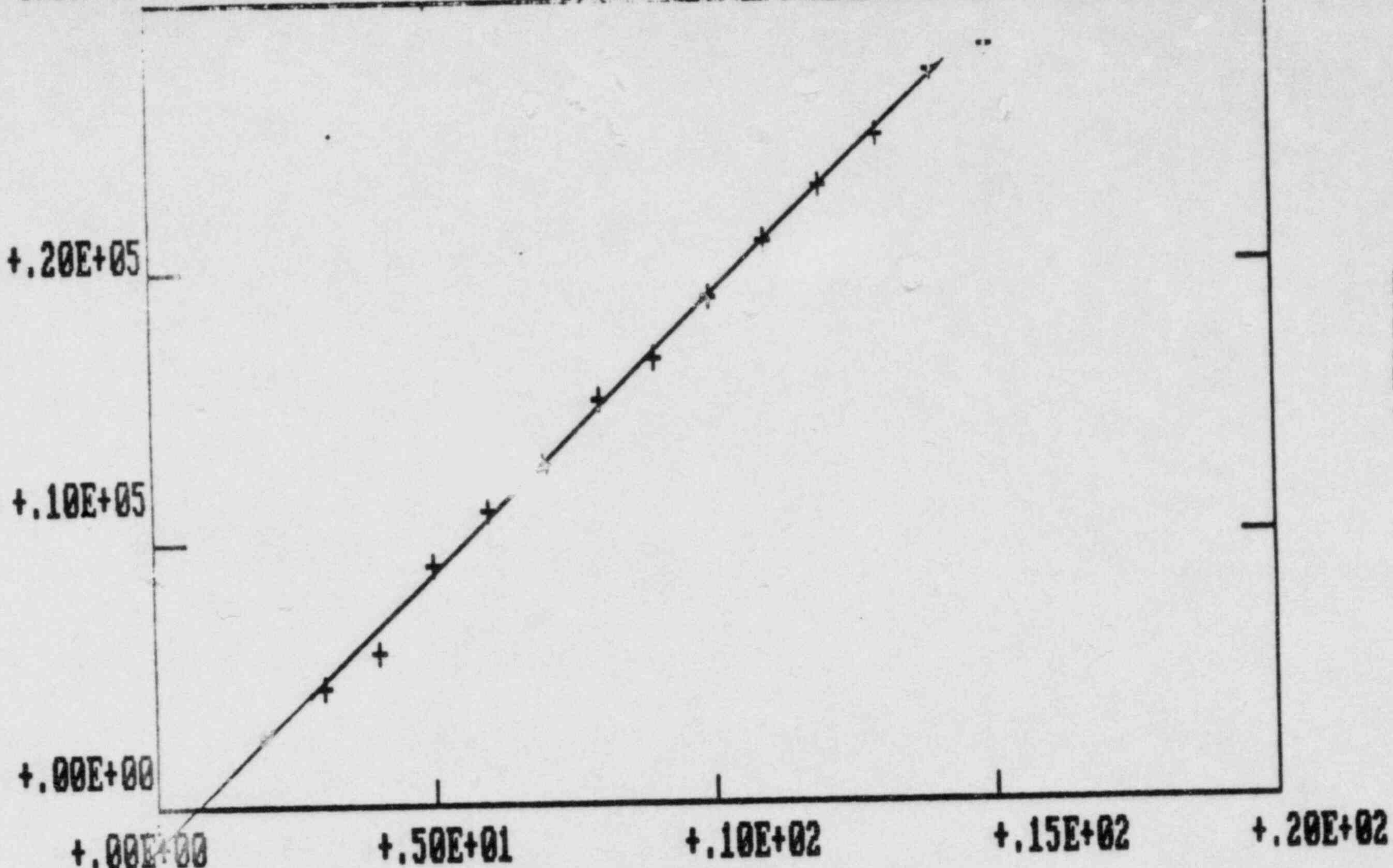


FIGURE 3
APPENDIX I

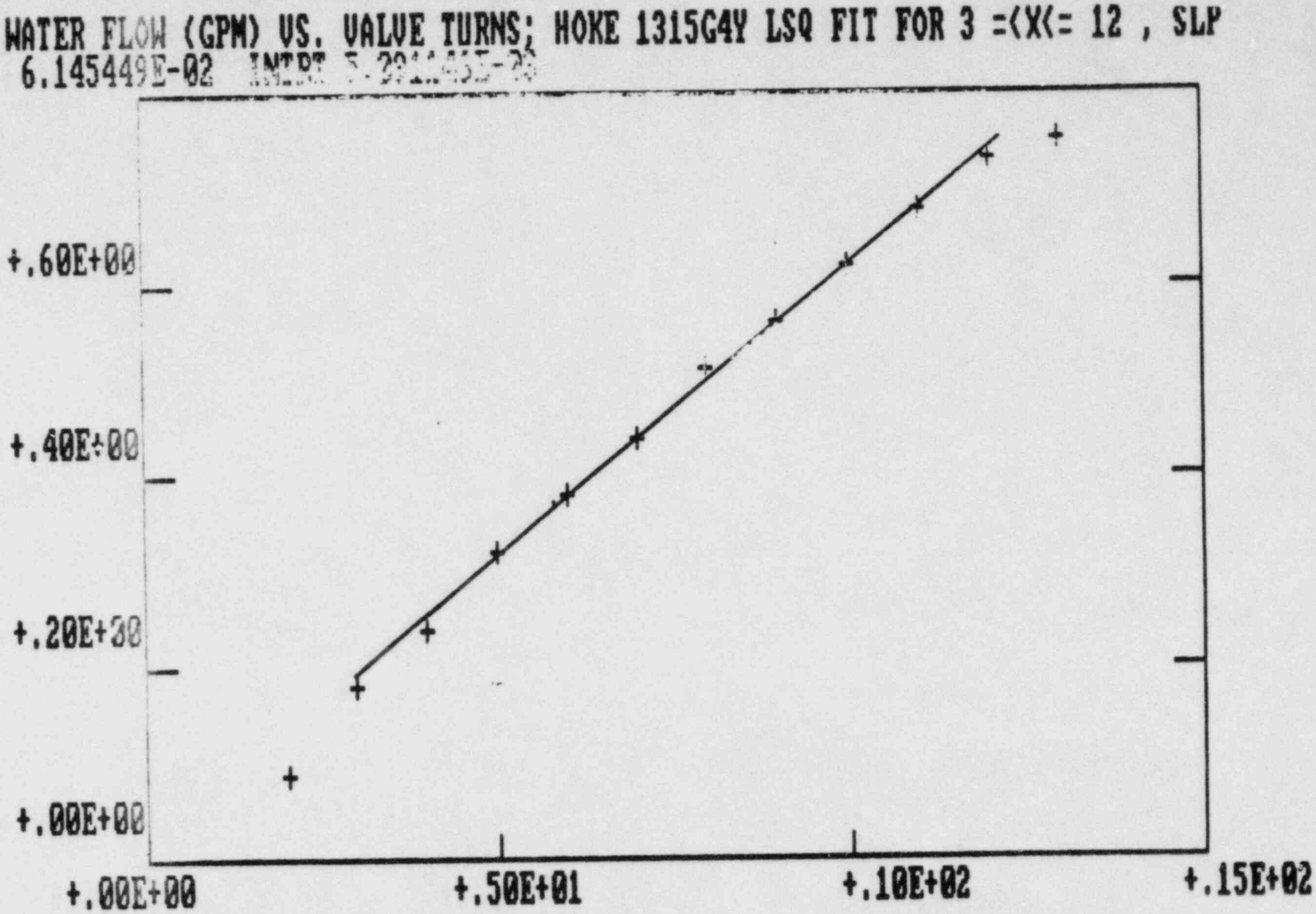


FIGURE 4
APPENDIX 1

AIR VERSUS WATER CORRELATION FOR LEAK TESTING
For Public Service Electric and Gas Company, Hope Creek Generating Station

TABLE 3
APPENDIX I

LABORATORY TESTS Conducted 7/1/85 through 8/27/85
WYLE LABORATORIES, Huntsville, Alabama

Line	Test Specimen	Size-in^2/ Setting-Turns	Flowrate Nitrogen (Meter Type*)	^{o}F	psig	ACCM	SCCM	Flowrate Water (Meter Type*)	^{o}F	psig	GPM	Line
1	NUPRO	0.04	—	—	—	—	—	5	73	1020	0.31	1
2	1/4 inch	0.08	1	72	48.1	18000	17593	5	73	1020	0.61	2
3	Micrometer	0.12	1	72	48.1	23000	22481	5	73	1020	0.77	3
4	Valve	0.16	1	72	48.1	28500	27857	5	73	1020	0.97	4
5	↓	0.20	1	72	48.1	34000	33233	5	73	1020	1.12	5
6		0.24	1	72	48.1	40000	39097	5	73	1020	1.35	6
7		0.28	1	72	48.1	45500	44473	5	73	1020	1.38	7
8		0.40	1	71	48.1	62500	61205	5	73	1020	1.85	8
9		0.60	1	71	48.1	76500	74915	5	73	1020	2.12	9
10		0.80	1	71	48.1	80000	78342	5	73	1020	2.20	10
11		1.00	1	71	48.1	84000	82259	5	73	1020	2.40	11
12		1.20	1	71	48.1	87500	85687	5	73	1020	2.50	12
13		1.40	1	71	48.1	89500	87645	5	73	1020	2.58	13
14		1.60	1	71	48.1	Note 1	—	5	73	1020	2.60	14
15		1.80	1	71	48.1	Note 1	—	5	73	1020	2.70	15
16		2.00	1	70	48.1	Note 1	—	5	73	1020	2.84	16

Note 1: Flow meter readings not on calibration curve; no data.

* Flowrate Meter Type - see item no., Instrumentation Equipment Sheet

NITROGEN FLOW (SCCM) VS. VALVE TURNS; NUPRO SS-2M-S6 LSQ FIT FOR .08 =<X<= .4
, SLP 137122.9 INTRT 5142.47

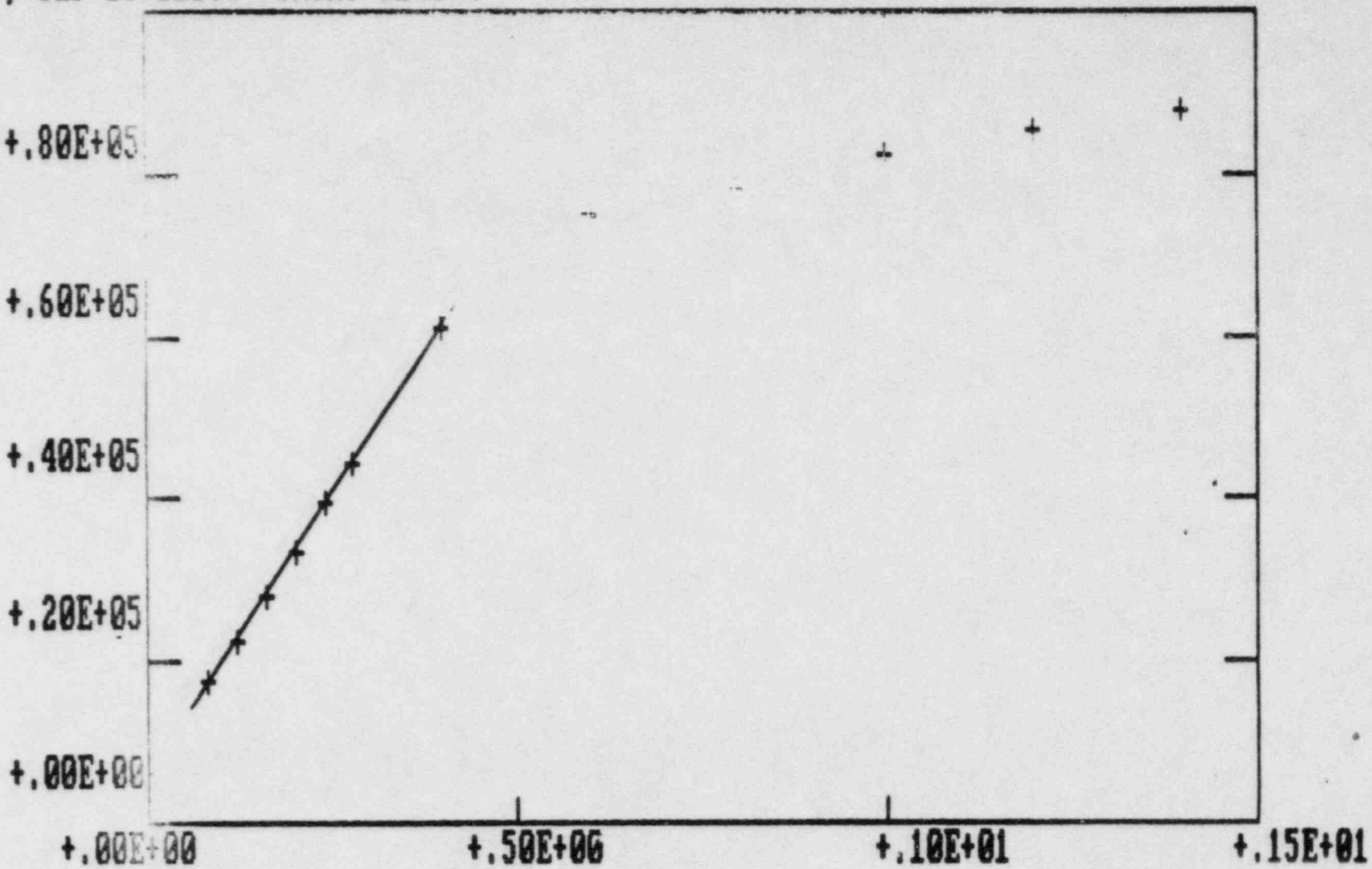


FIGURE 5
APPENDIX I

WATER FLOW (GPM) VS. VALVE TURNS; NUPRO SS-2M-S6 LSQ FIT FOR .04 =<X<= .24 , SLP 4.949999 INTRT .1620001

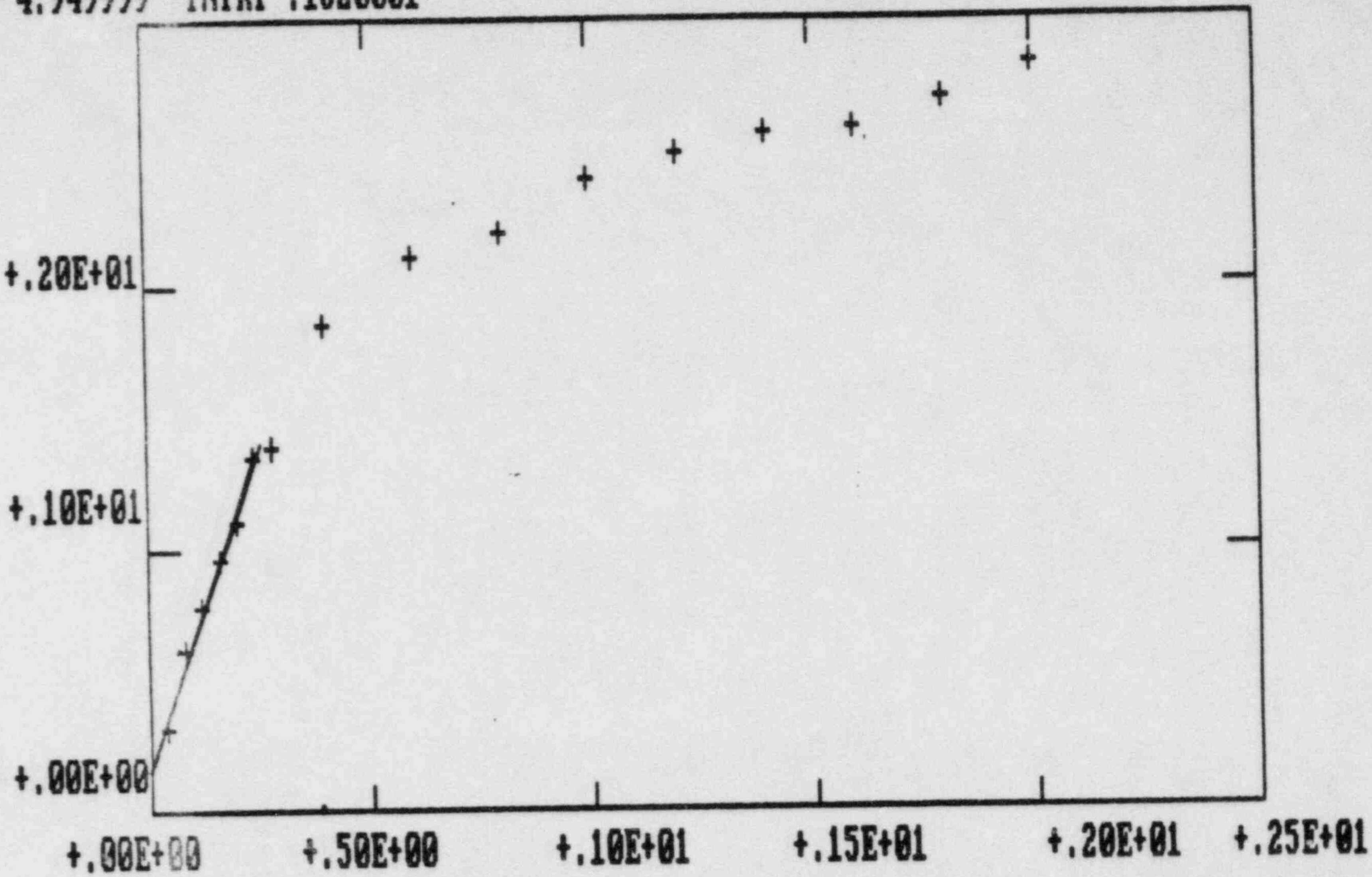


FIGURE 6
APPENDIX I

NITROGEN FLOW (SCCM) VS. VALVE TURNS; NUPRO SS-2M-S6 LSQ FIT FOR .6 =<X<= 1.4
, SLP 16402.5 INTRT 65367.13

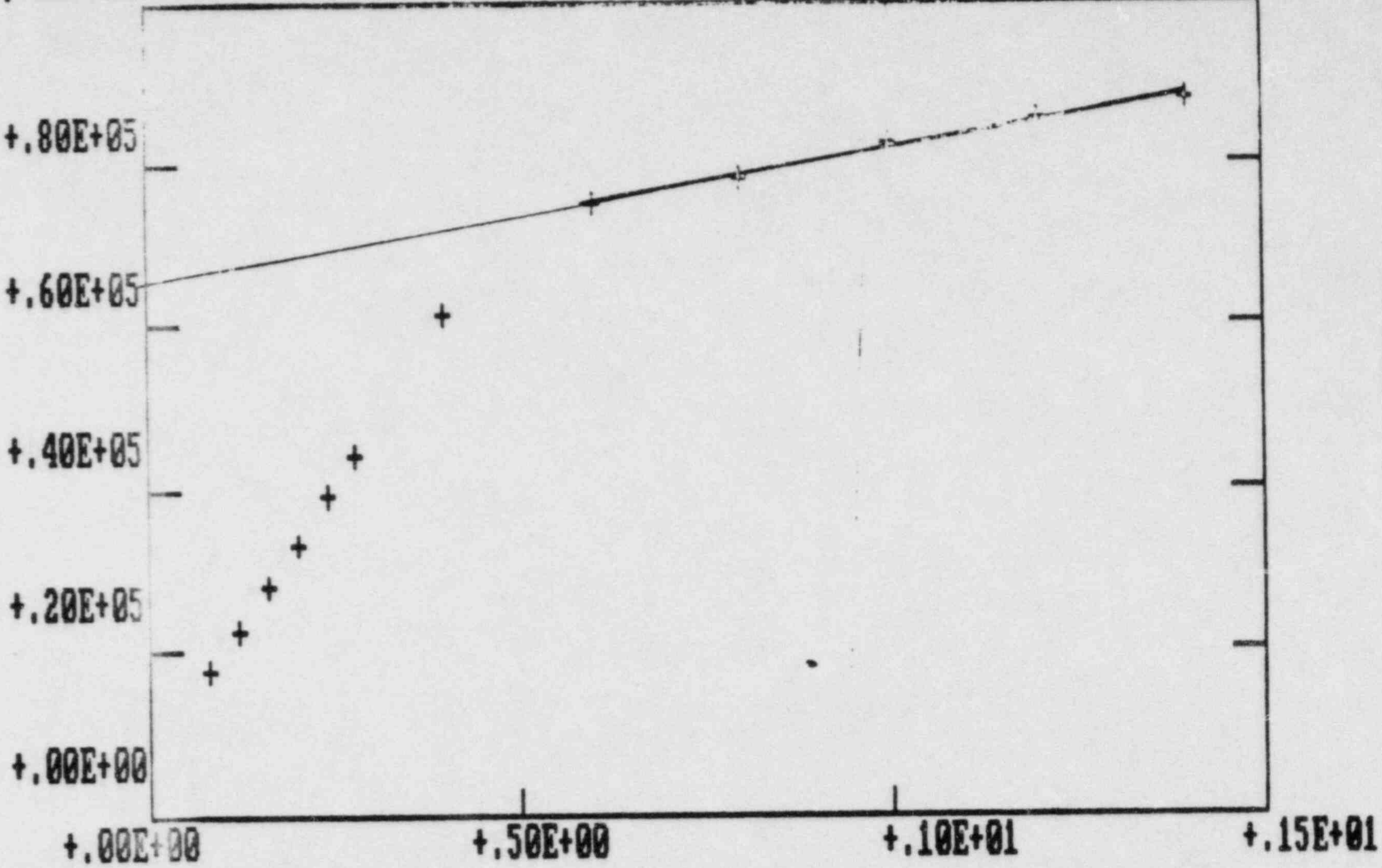


FIGURE 7
APPENDIX I

WATER FLOW (GPM) VS. VALVE TURNS; NUPRO SS-2M-S6 LSQ FIT FOR .4 =<X<= 2 , SLP .556667 INTRT 1.753111

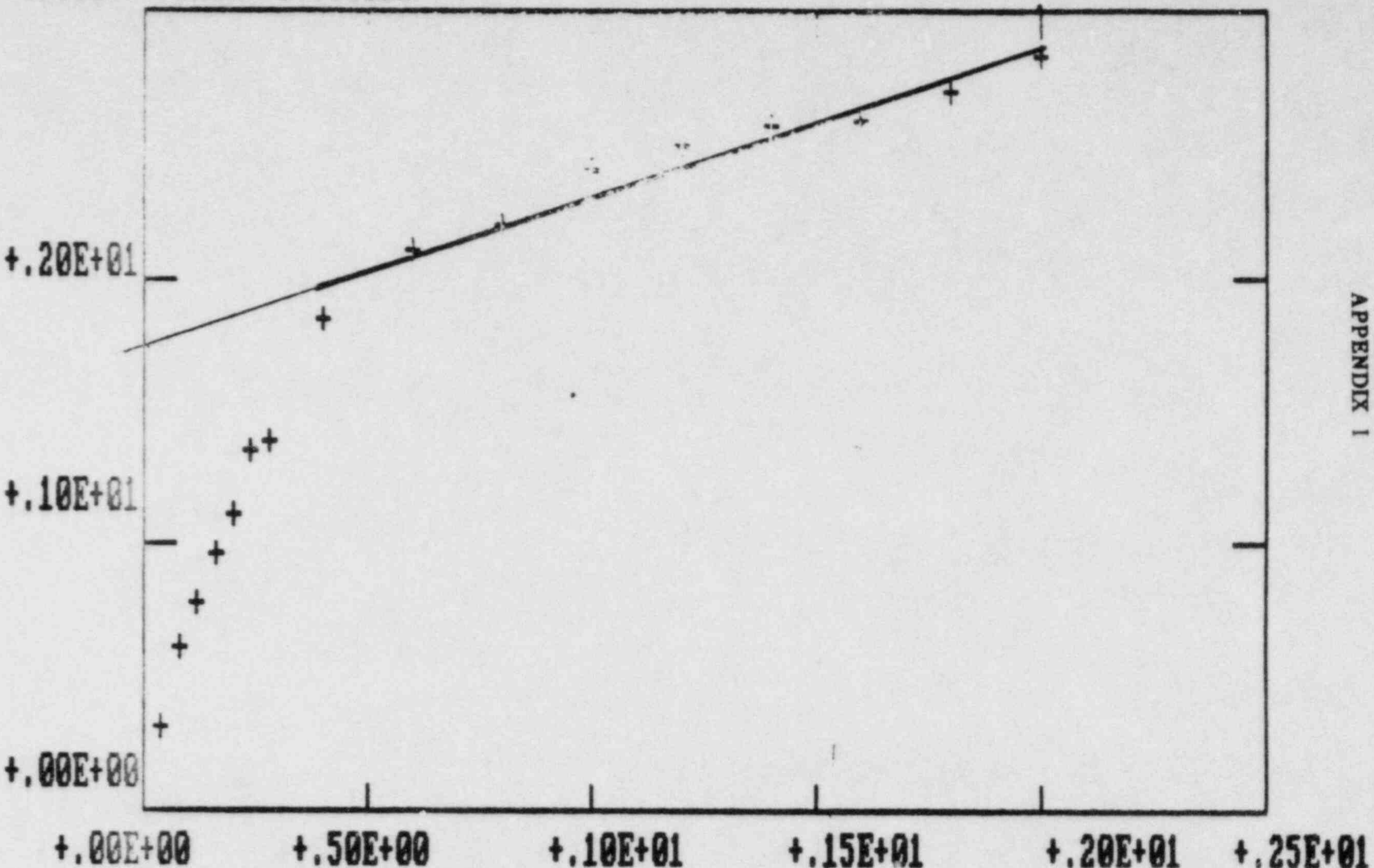


FIGURE 8
APPENDIX 1

AIR VERSUS WATER CORRELATION FOR LEAK TESTING
For Public Service Electric and Gas Company, Hope Creek Generating Station

TABLE 4 (pg. 1 of 2)
APPENDIX I

LABORATORY TESTS Conducted 7/1/85 through 8/27/85
WYLE LABORATORIES, Huntsville, Alabama

Line	Test Specimen	Size-in^2/ Setting-Turns	Flowrate Nitrogen (Meter Type*)	°F	psig	ACCM	SCCM	Flowrate Water (Meter Type*)	°F	psig	GPM	Line
1	HOKE	1	2A	78	48.1	440	425	—	—	—	—	1
2	1/4 inch	1-1/2	2A	78	48.1	1200	1160	—	—	—	—	2
3	Micrometer	2	2A	78	48.1	2200	2126	5	75	1020	0.08	3
4	Valve	2-1/2	2B	78	48.1	3360	3248	5	75	1020	—	4
5	(Run 2)	3	2B	78	48.1	4460	4311	5	75	1020	0.16	5
6		3-1/2	3A	78	48.1	4800	4639	5	75	1020	—	6
7		4	3A	78	48.1	6200	5992	5	75	1020	0.25	7
8		4-1/2	3A	78	48.1	6600	5379	5	75	1020	—	8
9		5	3A	79	48.1	8400	8104	5	75	1020	0.32	9
10		5-1/2	3A	79	48.1	9490	9069	5	75	1020	—	10
11		6	3A	79	48.1	10000	9647	5	75	1020	0.38	11
12		6-1/2	3A	79	48.1	11000	10612	5	75	1020	—	12
13		7	3A	79	48.1	12000	11577	5	75	1020	0.44	13
14		7-1/2	3A	79	48.1	12800	12349	5	75	1020	—	14
15		8	3A	79	48.1	14400	13892	5	75	1020	0.50	15

* Flowrate Meter Type - see item no., Instrumentation Equipment Sheet

AIR VERSUS WATER CORRELATION FOR LEAK TESTING
For Public Service Electric and Gas Company, Hope Creek Generating Station

LABORATORY TESTS Conducted 7/1/85 through 8/27/85
WYLE LABORATORIES, Huntsville, Alabama

Line	Test Specimen	Size-in^2/ Setting-Turns	Flowrate Nitrogen (Meter Type*)	^oF	psig	ACCM	SCCM	Flowrate Water (Meter Type*)	^oF	psig	GPM	Line
16	HOKE	8-1/2	3B	79	48.1	16200	15629	5	75	1020	—	16
17	1/4 inch	9	3B	79	48.1	16800	16208	5	75	1020	0.55	17
18	Micrometer	9-1/2	3B	80	48.1	18200	17525	5	75	1020	—	18
19	Valve	10	3B	80	48.1	19000	18296	5	75	1020	0.62	19
20	(Run 2)	10-1/2	3B	80	48.1	20200	19452	5	75	1020	—	20
21		11		80	48.1	—	—	5	75	1020	0.65	21
22		12		80	48.1	—	—	5	75	1020	0.69	22
23		13		80	48.1	—	—	5	75	1020	0.73	23
24		14	1	78	48.1	24500	23680	5	75	1020	0.77	24
25		15	—	—	—	—	—	5	75	1020	0.81	25
26		16	—	—	—	—	—	5	75	1020	0.85	26
27		17	1	78	48.1	28500	27546	5	75	1020	0.87	27
28		18	—	—	—	—	—	5	75	1020	0.89	28
29		19	—	—	—	—	—	5	75	1020	0.93	29
30		20	1	78	48.1	31000	29963	5	75	1020	0.94	30

* Flowrate Meter Type - see item no., Instrumentation Equipment Sheet

NITROGEN FLOW (SCCM) VS. VALVE TURNS; HOKE 1315G4Y LSQ FIT FOR 1 =<X<= 10.5
, SLP 2007.51 INTRT-2038.39

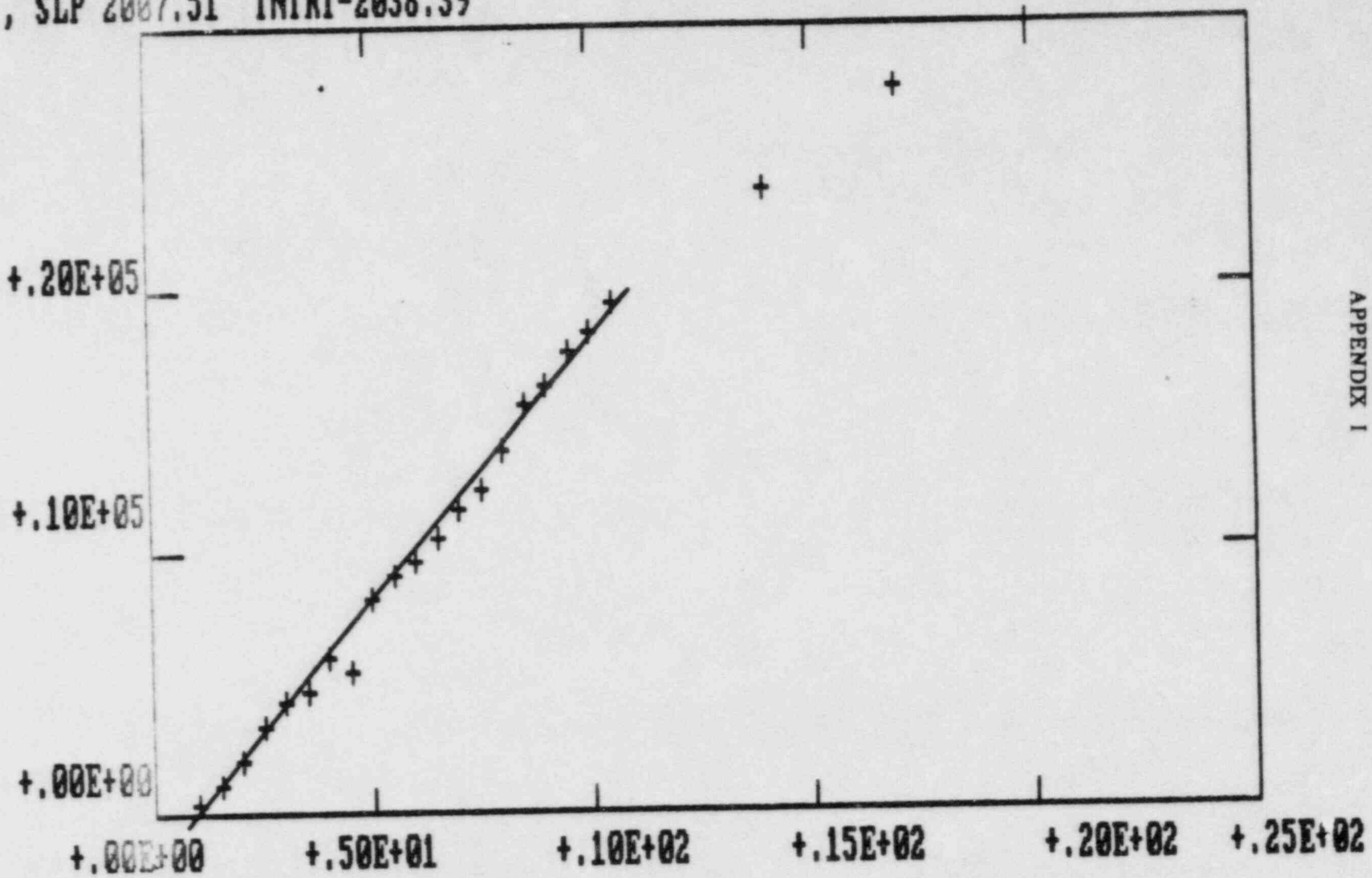


FIGURE 9
APPENDIX I

WATER FLOW (GPM) VS. VALVE TURNS LSQ FIT FOR 3 =<X<= 10 , SLP 6.333338E-02
INTRT-9.167262E-03

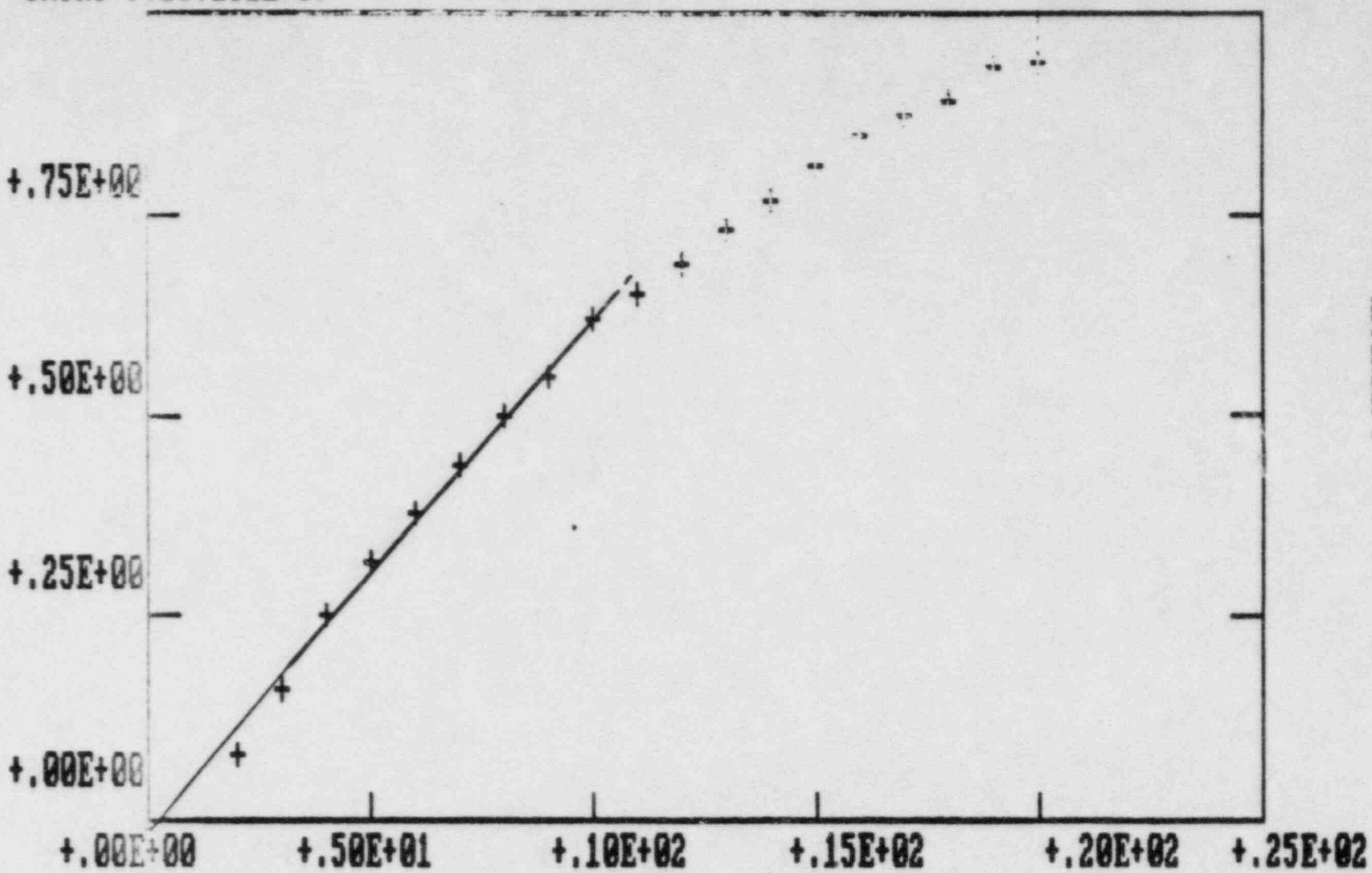


FIGURE 10
APPENDIX 1

AIR VERSUS WATER CORRELATION FOR LEAK TESTING
For Public Service Electric and Gas Company, Hope Creek Generating Station

TABLE 5 (pg. 1 of 2)
APPENDIX I

FIELD TESTS Conducted 7/09/85 through 10/17/85
WYLE LABORATORIES, Huntsville, Alabama

						LLRT DATA AIR TEST			WATER TEST			
Line	Penetration I.D.	Valve(s) No.	Valve Description	Valve Type	Valve Size	Pressure psig	Leakage SCCM	Date '85	Pressure psig	Leakage GPM	Date '85	Line
1	P3	BC-V164	RHR Shutdown Cooling Suction	Gate	20"	48.3	256	10/12	1020	0.04	10/13	1
2	P3	BC-V071	RHR Shutdown Cooling Suction	Gate	20"	48.5	470	10/12	1020	0.03	10/13	2
3	P4A	BC-V013	RHR Shutdown Cooling Return	Gate	12"	48.1	18	8/15	1015	0.005	8/15	3
4	P4A	BC-V014	↓	Stop Check	12"	48.2	15	8/08	1015	0.002	8/08	4
	P4A	BC-V118	↓	Globe	1"							
5	P4B	BC-V110	↓	Globe	12"	48.4	50	8/14	1020	0.005	9/10	5
6	P4B	BC-V111	↓	Stop Check	12"	48.3	165	9/03	1020	0.003	9/10	6
	P4B	BC-V117	↓	Globe	1"							
7	P5A	BE-V003	Core Spray	Gate	12"	48.2	- 0 -	7/20	1020	0.014	7/10	7
8	P5A	BE-V002	↓	Stop Check	12"	48.4	230	9/18	1020	0.013	9/10	8
		BE-V072	↓	Globe	1"							
9	P5B	BE-V007	↓	Gate	12"	48.3	2.78	9/17	1020	0.056	9/24	9

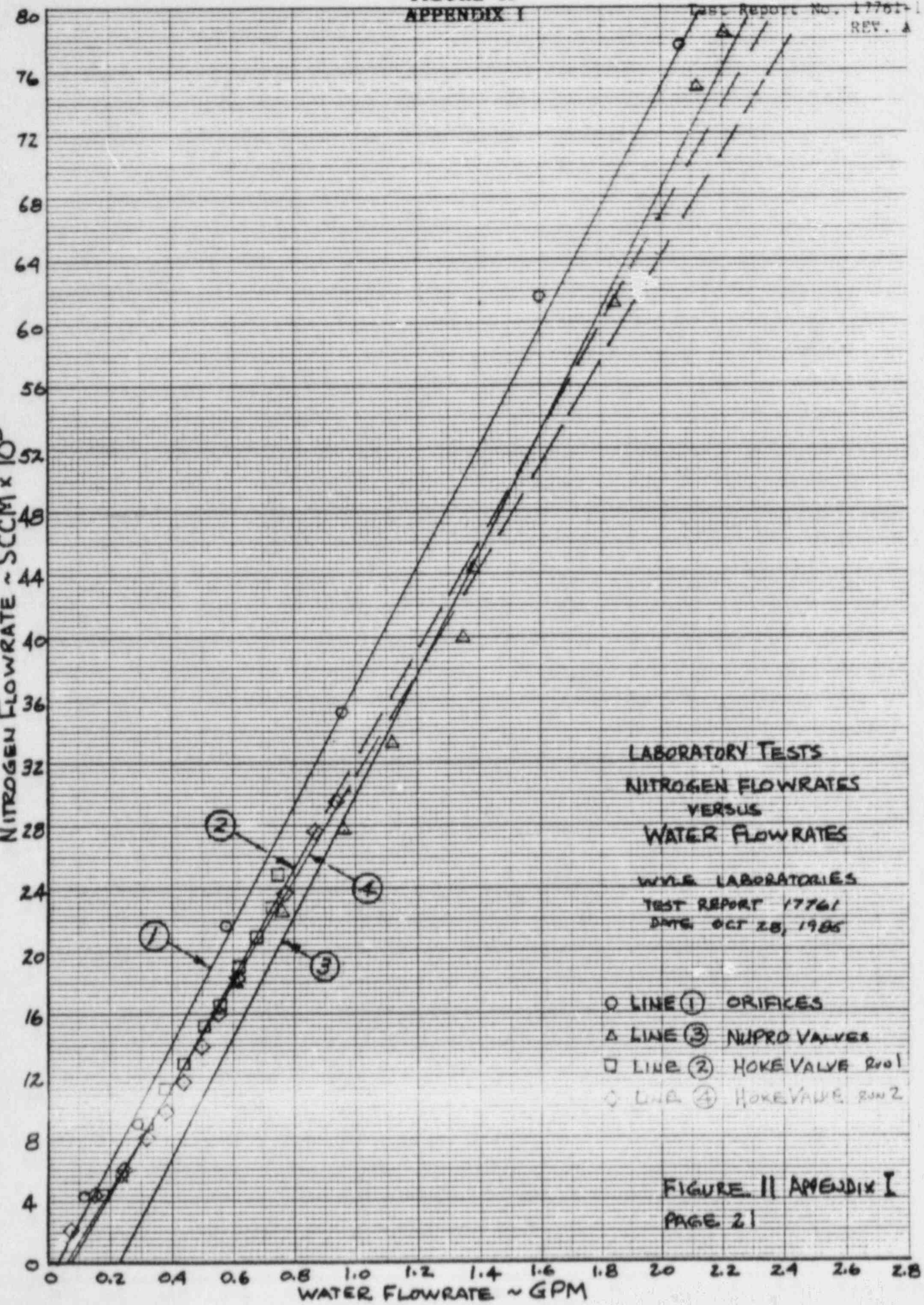
AIR VERSUS WATER CORRELATION FOR LEAK TESTING
For Public Service Electric and Gas Company, Hope Creek Generating Station

TABLE 5 (pg. 2 of 2)
APPENDIX I

FIELD TESTS Conducted 7/09/85 through 10/17/85
WYLE LABORATORIES, Huntsville, Alabama

Line	Penetration I.D.	Valve(s) No.	Valve Description	Valve Type	Valve Size	LLRT DATA AIR TEST Pressure psig	Leakage SCCM	Date '85	WATER TEST Pressure psig	Leakage GPM	Date '85	Line
10	P5B P5B	BE-V006 BE-V071	Core Spray	Stop Check Globe	12" 1"	48.3	2.78	9/17	1020	0.048	9/24	10
11	P10	BC-V020	RHR, RPV Head Spray	Globe	6"	48.3	27.1	10/01	1020	0.001	10/17	11
12	P10	BC-V021		Gate	6"	48.4	2.0	10/02	1020	0.001	10/17	12
13	P6A	BC-V004	RHR, LPCI	Gate	12"	48.1	0.9		1020	0.004		13
14	P6A P6A	BC-V005 BC-V122		Stop Check Globe	12" 1"	48.3	1267		1020	0.002	14	
15	P6B	BC-V016		Gate	12"	48.1	40.9	9/11	1020	0.04	9/10	15
16	P6B P6B	BC-V017 BC-V120		Stop Check Globe	12" 1"	48.3	437	9/09	1035	0.03	9/10	16
17	P6D	BC-V101		Gate	12"	48.4	315	9/11	1035	0.01	9/12	17
18	P6D P6D	BC-V102 BC-V121		Stop Check Globe	1" 1"	48.5	360	9/11	1035	0.004	9/12	18
19	P6C	BC-V113		Gate	12"	48.3	40.8	7/09	1020	0.05	8/30	19
20	P6C P6C	BC-V114 BC-V119		Stop Check Globe	12" 1"	48.5	305	7/29	1020	0.004	8/30	20

FIGURE 11
APPENDIX I



For Public Service Electric and Gas Company, Hope Creek Generating Station

FIELD TEST DATA COMPARISON TO LABORATORY TESTS' CORRELATION DATA

TABLE 6
APPENDIX I

WYLE LABORATORIES, Huntsville, Alabama

1 Line	Field Test[2] Actual Air Flow SCCM	Field Test[3] Actual Water Flow GPM	Lab Test[4] Correlated Data Most Conservative GPM	5 Factor	Lab Test[6] Correlated Data Least Conservative GPM	7 Factor
1	256	0.04	0.233	5.8	0.036	0.9
2	470	0.03	0.239	7.9	0.042	1.4
3	18	0.005	0.227	45.	0.030	6
4	15	0.002	0.227	113	0.030	15
5	50	0.005	0.228	45	0.031	6.2
6	165	0.003	0.231	77	0.034	11
7	- 0 -	0.014	0.227	16.2	0.030	2.1
8	230	0.013	0.233	17.9	0.036	2.8
9	2.78	0.056	0.227	4	0.030	0.6
10	906	0.048	0.250	5.2	0.053	1.1
11	21.7	0.001	0.228	228	0.030	30
12	2.0	0.001	0.227	227	0.030	30
13	0.9	0.004	0.227	56	0.030	7.5
14	1267	0.002	0.260	130	0.063	31.5
15	40.9	0.04	0.228	5.7	0.031	0.8
16	437	0.03	0.238	7.9	0.041	1.4
17	315	0.01	0.235	23.5	0.038	3.8
18	360	0.004	0.236	59	0.039	9.75
19	40.8	0.05	0.228	4.6	0.031	0.6
20	305	0.004	0.235	58	0.038	9.5

1. Line No. of Field Test Data, Table 5 Appendix I.
2. Actual Field Test Leakrate in SCCM
3. Actual Field Test Leakrate in GPM
4. Lab Test computed correlation using Field Test Air Flow Actual SCCM with equation (1), for most conservative correlation Line 3, Figure 11, Appendix I, in GPM.
5. Factor indicating conservatism = $\frac{\text{Correlated Data (computed)}}{\text{Actual Field Test Water Flow GPM}}$ GPM, most conservative.
6. Ditto 4 above, but for least conservative Line 1, equation (2), in GPM.
7. Ditto 5 above for least conservative.

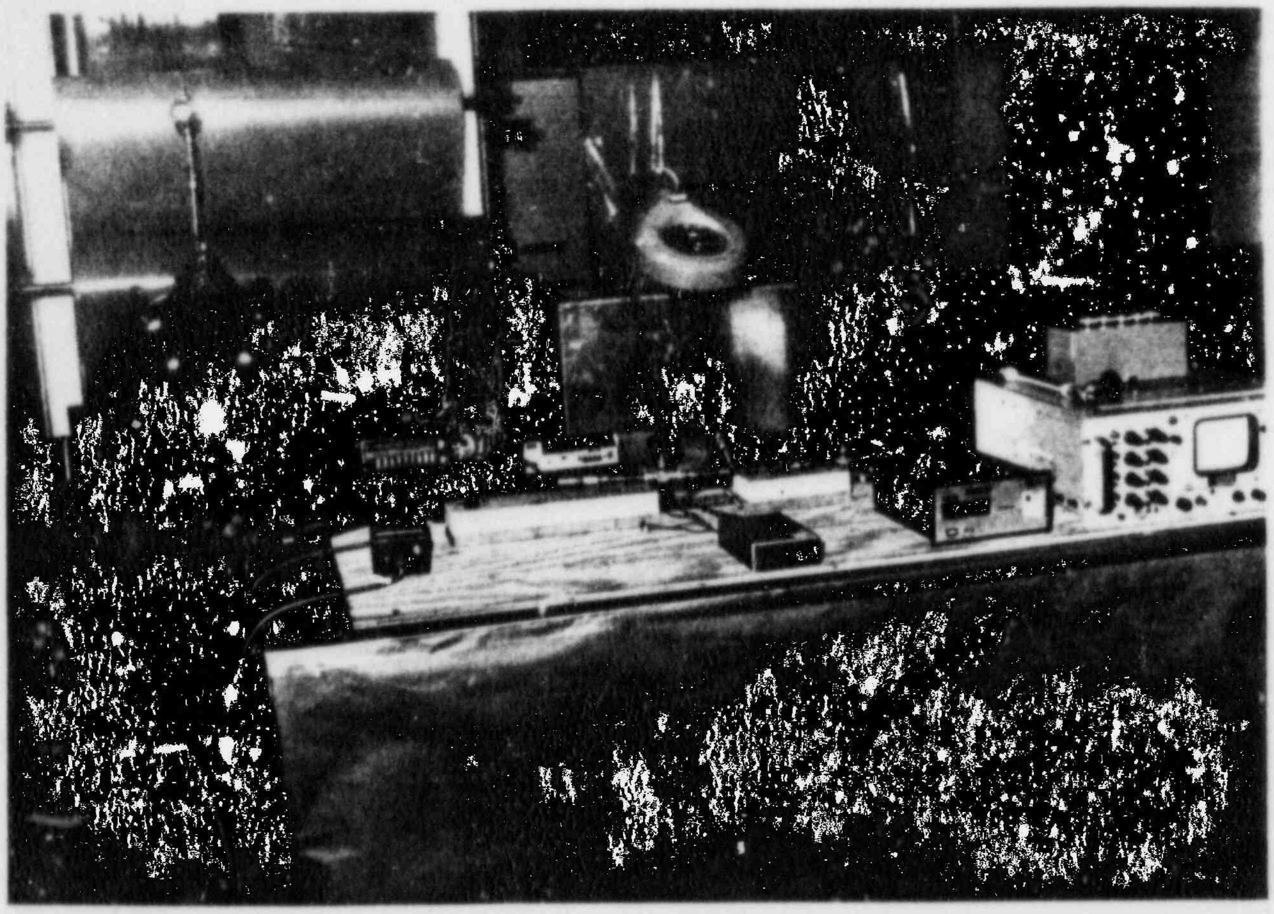


FIGURE 12
APPENDIX I

APPENDIX II

INSTRUMENTATION EQUIPMENT SHEET

Page 1 of 1

Date 7-1-85 Job No. 17761-15 Test Area SRV

Technician P. MORGAN Customer PSE&G Type Test GN_2 & WATER FLOW

No.	Instrument	Manufacturer	Model No.	Serial No.	Wyle or Gov't No.	Range	Accuracy	Calibration On	Calibration Due
1	GN_2 FLOWMETER	F&P	1/2"	7704A0 851A7-12	R7704A0 851A7-12	90,000 SCCM	±2% FS	6-28-85	6-28-86
2	GN_2 FLOWMETER	GILMONT	1/8"	B-8659	100358	4428 SCCM	±2% F.S.	1-3-85	1-3-86
3	GN_2 FLOWMETER	GILMONT	1/4"	C5715	100358	28820 SCCM	±2% F.S.	12-17-84	12-17-85
4	PRESS. GAUGE	HEISE	710A	N/A	C6534	0-1500 PSI	±1%	5-10-85	11-10-85
5	WATER FLOWMETER	BEARINGLESS	E-50	N/A	11550	0-2.86 GPM	±5%	11-30-84	11-30-85
6	TEMP INDICATOR	DORIC	402A	N/A	102675	-235 TO +2300°F	±1°F	6-7-85	12-7-85
7	FREQ COUNTER	FLUKE	1910A	N/A	100336	MULTI	MFG	6-6-85	12-6-85
8	DVM	HP	3465A	N/A	11319	MULTI	MFG	5-14-85	11-14-85
9	FREQ CONVERTER	DAYTRONIC	3240A	N/A	102031	0-5VDC	MFG	6-20-85	12-20-85
10	FUNCTION GEN.	DYNASCAN	3010	N/A	101014	MULTI	±5%	6-6-85	12-6-85
(2 Wyle A)	8/27/85								

(2 Wyle) 8/27/85

Instrumentation B.D. Chamberlain 7-1-85 Checked & Received By L. J. Millsaps 7-1-85

Earl Campbell
102724

Dick Munns Company

LIQUID AND GAS - FLOWMETER CALIBRATION SERVICE

Phone 596-1559 3335 Cerritos Avenue Los Alamitos, Calif. 90720

Certificate

DATE 1-3-85

SUBMITTED FOR CALIBRATION BY Wyle Laboratories

TYPE OF INSTRUMENT Flowmeter Tube

SERIAL NO. B-8659

MODEL NO. 1/8

MFGR. Gilmont

RATED ACCURACY ±2% F.S.

CALIBRATION INTERVAL 12 months

INDICATED	ACTUAL	REMARKS	
TUBE SCALE	S.C.C.M.	TUBE SCALE	S.C.C.M.
	Glass Flt.		S.S. Flt.
10	106	80	3443
30	504	100	4428
60	1258		
80	1751		
100	2260		
		GN2 @ 14.7 PSIA & 70°F.	

CALIBRATED BY COMPARISON WITH THE FOLLOWING STANDARDS

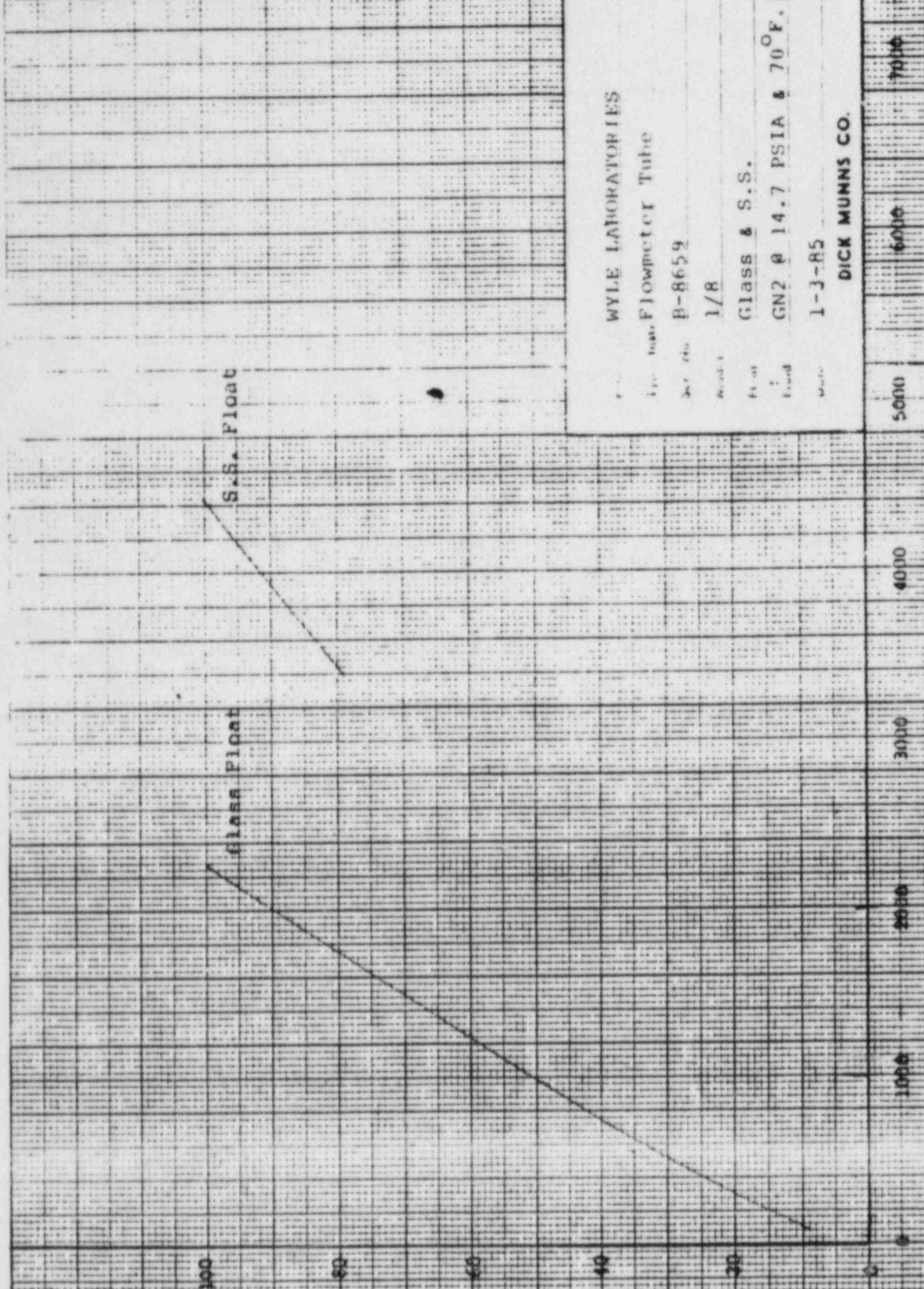
Test unit A-2 . N.B.S. Traceability #M-1859 .

As per MIL-STD-45662. Due Date 5-1-85.

ALL INSTRUMENTS USED TO ACCOMPLISH ABOVE CALIBRATION HAVE DIRECT TRACEABILITY TO THE NATIONAL BUREAU OF STANDARDS, WASHINGTON, D. C.

CALIBRATION BY RM APPROVED BY [signature]

Test Report No. 17761-1
REV. A



100358

Dick Munns Company

LIQUID AND GAS - FLOWMETER CALIBRATION SERVICE

Phone 596-1559 3335 Cerritos Avenue Los Alamitos, Calif. 90720

Certificate

DATE 12-17-84

SUBMITTED FOR CALIBRATION BY Wyle Laboratories

TYPE OF INSTRUMENT Flowmeter Tube

SERIAL NO. C5715

MODEL NO. 1/4"

MFGR. Gilmont

RATED ACCURACY ± 2% F.S.

CALIBRATION INTERVAL 12 months

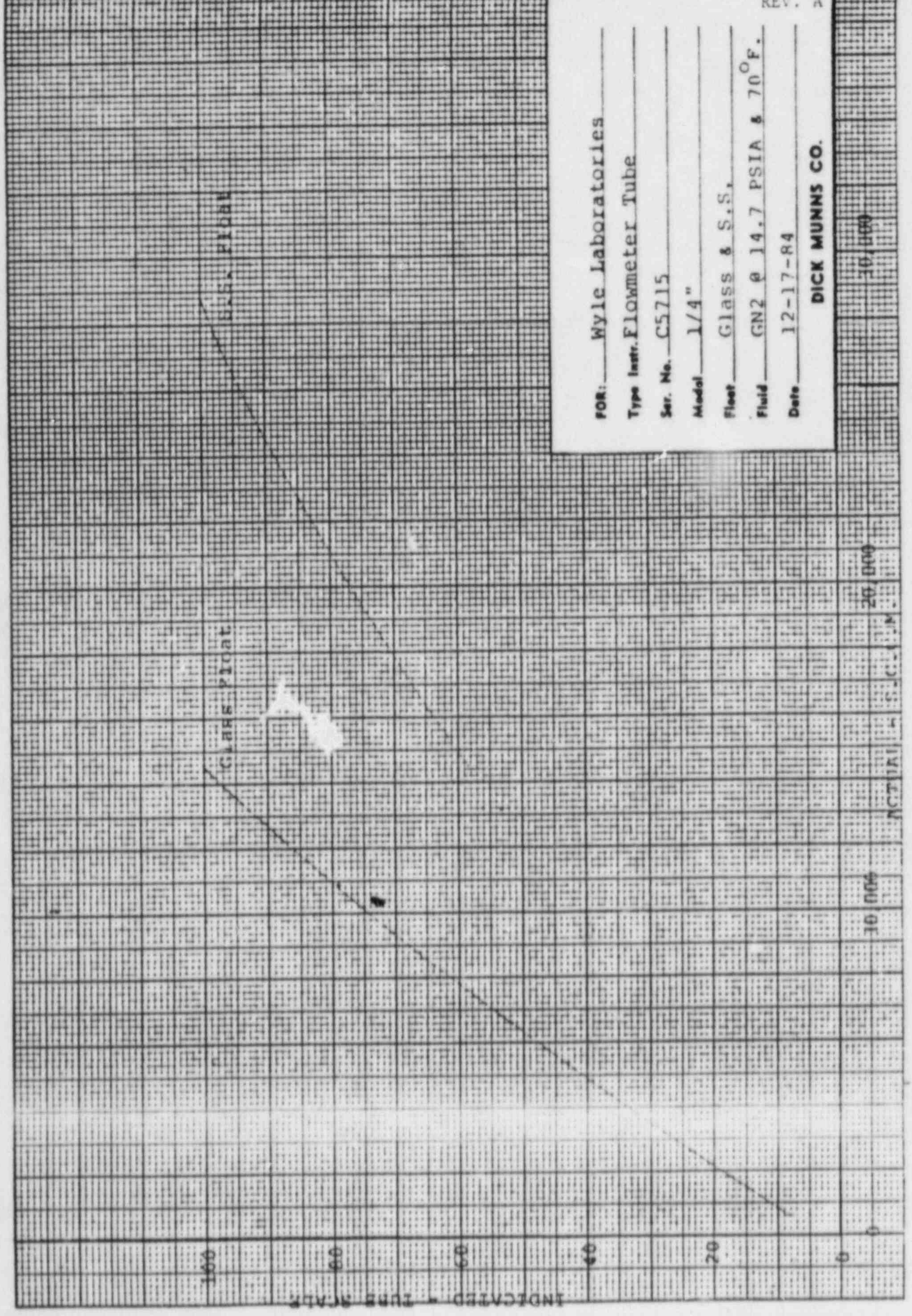
INDICATED	ACTUAL	REMARKS	
TUBE SCALE	S.C.C.M.	TUBE SCALE	S.C.C.M.
10	880	58.5	14517
30	3450	80	21200
60	7800	100	28820
80	11000		
100	14500	GN2 @ 14.7 PSIA & 70°F.	

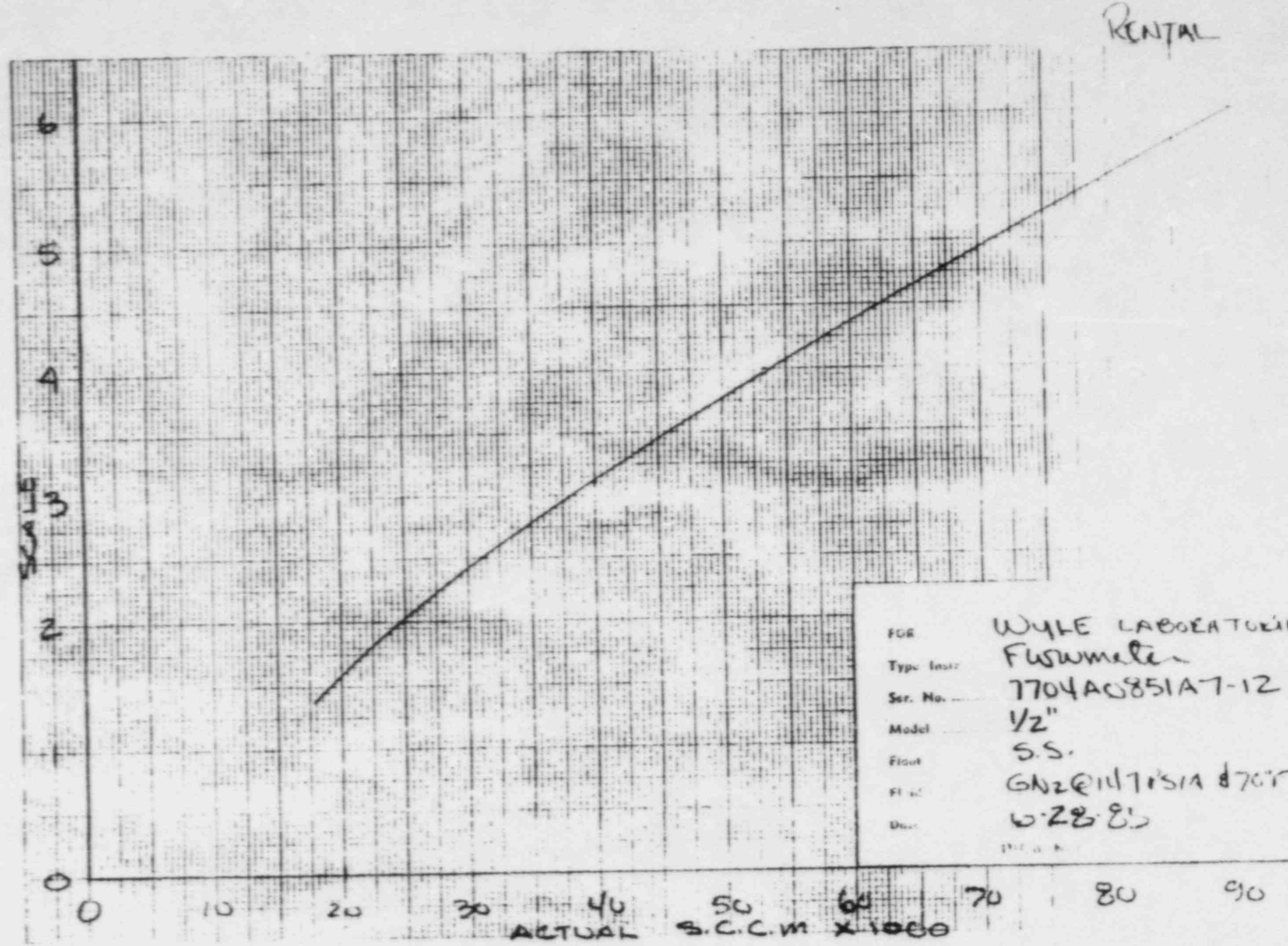
CALIBRATED BY COMPARISON WITH THE FOLLOWING STANDARDS

Test units A-2 & A-3, N.B.S. Traceability #M-1859.
As per MIL-STD-45662, Calibration Due Date 5-1-85.

ALL INSTRUMENTS USED TO ACCOMPLISH ABOVE CALIBRATION HAVE DIRECT TRACEABILITY TO THE NATIONAL BUREAU OF STANDARDS, WASHINGTON, D.C.

CALIBRATION BY RM APPROVED BY [signature]


REV. A
FOR: Wyle Laboratories
Type Instr. Flowmeter Tube
Ser. No. C5715
Model 1/4"
Float Glass & S.S.
Fluid GN2 @ 14.7 PSIA & 70°F.
Date 12-17-84
DICK MUNNS CO.
S.S. Float
Glass Float
INDICATED - TUBE SCALE
ACTUAL - S.C.C.M.
0
10,000
20,000
30,000
0
20
40
60
80
100


RENTAL
SCALE
0
1
2
3
4
5
6
0
10
20
30
40
50
60
70
80
90
ACTUAL S.C.C.M X 1000
FOR WYLE LABORATORIES
Type Instr Flowmeter
Ser. No. 7704A0851A7-12
Model 1/2"
Float S.S.
Fluid GN2@14.7PSIA &70°F
Date 6-28-85

APPENDIX III

PSEG Research Corporation

RESEARCH AND TESTING LABORATORY

INSTRUMENT CALIBRATION

PROCED. ______

PRESSURE CALIBRATION TEST NO. ______

FOR Leak Rate Monitor TYPE ______ PAGE ______

SERIAL NO. 115 CO. NO. 5806 DATE 8-2-85

MFR. VOL. CAP. 200; 2,000; SCCM RANGE ______ BY JSS

Pressure Standard				LRM		
Pressure Reading PSIA	Bar. Press PSIA		Pressure Reading PSIG	Pressure Reading PSIG	Error PSIG	% Error
24.710	14.710		10	9.8	0.2	0.33
34			20	19.7	0.3	0.50
44			30	29.7	0.3	0.50
54			40	39.8	0.2	0.33
64			50	49.8	0.2	0.33
74			60	60.0	0.0	0.0

Accuracy Required ± 1% F.S.

TI Pressure Standard -
- Serial No. Gage
- Serial No. Capsule
- Date Calibrated
- Date Calibration due

Barometric Pressure TI
- Serial No. 2686
- Date Calibrated 6-17-85
- Date Calibration due 6-17-86

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Reviewed [signature]

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PSE&G Research Corporation

RESEARCH AND TESTING LABORATORY

INSTRUMENT CALIBRATION

INTEGRITY CALIBRATION

PROCED. ______

TEST NO. ______

PAGE ______

FOR Leak Rate Monitor TYPE 5806

SERIAL NO. 115 CO. NO. 5806 DATE 8-5-85

MFR. Vol. CAP. 200; 2,000; sccm RANGES BY JSS

Flow Integrity				Electrical Integrity		
Range SCCM	Press PSIG	Flow Min	Flow Max	Range	Flow Min	Flow Max
200	4.8	92	108			
2,000	54.0	920	1080			

Flow checks + 4% fs

Page No. 39

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REV. A

Reviewed [signature]

L.259

PSE&G RESEARCH CORP
RESEARCH & TESTING LABORATORY

LRM FLOW CALIBRATION

MFG VOLUMETRICS SERIAL NO 115 PS NO 5806

TEMP F	BAR PRESS PSIA	TIME MIN	STANDARD FLOW SCCM	LRM FLOW SCCM	RESULTS %	
74.4	14.7	1.00	1978.9	1993.0	-.70	OK
74.4	14.7	1.00	1575.3	1592.0	-.83	OK
74.4	14.7	1.00	1183.3	1196.0	-.63	OK
74.4	14.7	1.00	988.1	998.0	-.49	OK
74.8	14.7	.99	794.3	800.0	-.28	OK
74.8	14.7	.99	596.6	599.0	-.11	OK
74.8	14.7	.99	398.7	399.0	-.01	OK
74.8	14.7	.95	207.4	208.0	-.02	OK
0.0	0.0	0.00	0.0	0.0	+0.00	
0.0	0.0	0.00	0.0	0.0	+0.00	

BROOKS FLOW RATE CALIBRATORS SERIAL NO. 8306H67406

BAR PRESS SERIAL NO. 2686

CALIBRATION PERFORMED BY J. SOBAN

DATE CALIBRATED 8/2/85

PSE&G RESEARCH CORP
RESEARCH & TESTING LABORATORY

LRM FLOW CALIBRATION

MFG VOLUMETRICS SERIAL NO 115 PS NO 5806

TEMP F	BAR PRESS PSIA	TIME MIN	STANDARD FLOW SCCM	LRM FLOW SCCM	RESULTS %	
76.6	14.7	.99	198.8	198.2	+.34	OK
76.6	14.7	.98	175.3	176.0	-.32	OK
76.6	14.7	1.00	148.4	150.3	-.92	OK
76.6	14.7	1.00	122.9	124.2	-.62	OK
76.6	14.7	.98	100.5	100.2	+.17	OK
76.6	14.7	.97	76.2	75.0	+.60	OK
76.6	14.7	.97	50.8	49.5	+.69	OK
76.6	14.7	.97	25.4	24.6	+.42	OK
0.0	0.0	0.00	0.0	0.0	+0.00	
0.0	0.0	0.00	0.0	0.0	+0.00	

BROOKS FLOW RATE CALIBRATORS SERIAL NO. 8306H67406

BAR PRESS SERIAL NO. 2686

CALIBRATION PERFORMED BY J.SOBAN

DATE CALIBRATED 8/5/85

ATTACHMENT II

File copy - JB

PSE&G Research Corporation

RESEARCH AND TESTING LABORATORY

INSTRUMENT CALIBRATION

PROCED. ______

PRESSURE ______ CALIBRATION TEST NO. ______

FOR Leak Rate Monitor TYPE ______ PAGE ______

SERIAL NO. 6981 CO. NO. 7038 DATE 9-6-85

MFR. Volumetric CAP. 0 - 60 PSIG BY H.W.

Pressure Standard			LFM		
Pressure Reading PSIA	Bar. Press PSIA	Pressure Reading PSIG	Pressure Reading PSIG	Error PSIG	% Error
14.528	14.528	0.0	0.0	0	0
24.528	"	10.0	10.1	.1	.16
34.528	"	20.0	20.1	.1	.16
44.528	"	30.0	30.2	.2	.33
54.528	"	40.0	40.2	.2	.33
64.528	"	50.0	50.2	.2	.33
74.528	"	60.0	60.2	.2	.33

Accuracy Required ± 1% F.S.

TI Pressure Standard - EL 5636

Serial No. Gage 2687

Serial No. Capsule 10159

Date Calibrated 8-26-85

Date Calibration due 8-26-86

Barometric Pressure

Serial No.

Date Calibrated

Date Calibration due

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Reviewed M Duffner

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PSE&G Research Corporation

RESEARCH AND TESTING LABORATORY

INSTRUMENT CALIBRATION

INTEGRITY CALIBRATION

PROCED. ______

TEST NO. ______

FOR Leak Rate Monitor

TYPE ______

PAGE ______

SERIAL NO. 6981

CO. NO. 7038

DATE 9-6-85

MFR. Velumetric CAP. 200, 2000, 20000 SCCM Ranges

BY H.W.

Flow Integrity				Electrical Integrity			
Range SCCM	Press PSIG	Flow Min	Flow Max	Range	Flow Min	Flow Max	
200	10.0	96	112	SCCM			
2000	10.0	745	905	SCCM			
20000	60.0	2.80	4.40	SLM			

Flow checks ± 4% fs

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REV. A

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PSEG Research Corporation

RESEARCH AND TESTING LABORATORY

INSTRUMENT CALIBRATION

FLOW CALIBRATION TEST NO. ______

FOR LEAK RATE MONITOR TYPE ______ PAGE ______

SERIAL NO. 6981 CO. NO. 7038 DATE 9-6-85

MFR Volumetric CAP. 20,000 SCCM Range BY H.W.

Brooks Volumeter				LRM			
Vol. cm	Time min.	Temp °C	Manometer in.—H_2O	Bar. Press. PSIG	Flow SCCM		
20000	.9736	24.6	3.6	14.525	19990		
18000	.9842	24.6	3.3	14.525	17950		
16000	.9838	24.6	3.0	14.525	16000		
14000	.9832	24.7	2.75	14.525	14000		
12000	.9792	24.7	2.5	14.525	12020		
10000	.9735	24.7	2.25	14.525	9990		
8000	.9613	24.7	2.0	14.525	8020		
6000	.9493	24.8	1.9	14.530	6020		
4000	.9354	24.8	1.75	14.530	4010		
2000	.9179	24.8	1.75	14.535	2010		

Accuracy Required ± 2%

Flask Serial No.

Barometric Pressure T/I EL5636

Serial No. 2687

Date Calibrated 8-26-85

Date Calibration Due 8-26-86

PSEG Research Corporation

RESEARCH AND TESTING LABORATORY

INSTRUMENT CALIBRATION

FLOW CALIBRATION TEST NO. ____

FOR LEAK RATE MONITOR TYPE ____ PAGE ____

SERIAL NO. 6981 CO. NO. 7038 DATE 9-6-85

MFR Volumetric CAP. 2000 SCCM Range BY H.W.

Brooks Volumeter				LRM			
Vol. cm	Time min.	Temp °F/C	Manometer in.—H_2O	Bar. Press. PSIG	Flow SCCM		
2000	.9658	24.0	1.9	14.533	1997		
1600	.9616	24.0	1.8	14.530	1602		
1200	.9540	24.0	1.8	14.530	1202		
1000	.9480	24.0	1.8	14.530	1001		
800	.9433	24.1	1.75	14.530	798		
600	.9263	24.1	1.75	14.525	602		
400	.9253	24.2	1.75	14.525	397		
200	.9071	24.2	1.75	14.525	199		

Accuracy Required ± 2%

Flask Serial No.

Barometric Pressure T/I FL 5636

Serial No. 2687

Date Calibrated 8-26-85

Date Calibration Due 8-26-86

Page No. 45

Test Report No. 17761-1
Rev. A

L.250

PSEG Research Corporation

RESEARCH AND TESTING LABORATORY

INSTRUMENT CALIBRATION

FLOW CALIBRATION TEST NO. ______

FOR LEAK RATE MONITOR TYPE ______ PAGE ______

SERIAL NO. 6981 CO. NO. 7038 DATE 9-6-85

MFR Volumetric CAP. 200 SCCM Range BY HW.

Brooks Volumeter					LRM
Vol. cm	Time min.	Temp °F/C	Manometer in.—H_2O	Bar. Press. PSIG	Flow SCCM
200.0	.9755	23.6	1.5	14.555	199.5
175.0	.9752	23.8	1.5	14.550	175.1
150.0	.9768	23.8	1.5	14.550	149.8
125.0	.9688	23.9	1.5	14.550	125.4
100.0	.9618	24.0	1.5	14.450	100.6
75.0	.9457	24.0	1.5	14.450	75.9
50.0	.9485	24.0	1.5	14.450	50.0
25.0	.9155	24.1	1.5	14.450	25.8

Accuracy Required ± 2%

Flask Serial No.

Barometric Pressure T/I EL 5636

Serial No. 2687

Date Calibrated 8-26-85

Date Calibration Due 8-26-86

PSE&G Research Corporation

RESEARCH AND TESTING LABORATORY

TEST DATA SHEET

TEST ORDER NO. ____________ TEST PROCEDURE IDENT. ____________

DATE OF TEST 9-6-85 PERFORMED AT ____________

DESCRIPTION OF MATERIAL Thermometer Calibration

MATERIAL RECEIVED FROM Leak Rate Monitor #6981 PS# 7038

TEST RESULTS

(Dia Thermometer) F°	(Standard) F°
72	74.53
72	74.73
72	74.86
72	74.91
73	74.99
73	74.99
73	74.99
73	74.99
73	74.99
73	74.97

Page No. 47

Test Report No. 17761-1
REV. A

Doric Platinum Resistance Thermometer
S/N 13913-(1023)
Cal. 1-4-85
Due. 1-4-86

TEST EQUIPMENT USED & CALIB. DUE DATE:

TESTED BY ____________

REVIEWED BY ____________
(SIGNATURES AND DATE)

L-477

PSE&G RESEARCH CORP

RESEARCH & TESTING LABORATORY

LRM FLOW CALIBRATION

MFG VOLUMETRICS SERIAL NO 6981 PS NO 7038

TEMP F	BAR PRESS PSIA	TIME MIN	STANDARD FLOW SCCM	LRM FLOW SCCM	RESULTS %	
76.2	14.5	0.97	20168.6	19990.0	+0.89	OK
76.2	14.5	0.98	17942.9	17950.0	-0.03	OK
76.2	14.5	0.98	15943.9	16000.0	-0.28	OK
76.4	14.5	0.98	13946.1	14000.0	-0.26	OK
76.4	14.5	0.97	11995.3	12020.0	-0.12	OK
76.4	14.5	0.97	10048.3	9990.0	+0.29	OK
76.4	14.5	0.96	8135.7	8020.0	+0.57	OK
76.6	14.5	0.94	6177.4	6020.0	+0.78	OK
76.6	14.5	0.93	4177.9	4010.0	+0.83	OK
76.6	14.5	0.91	2128.7	2010.0	+0.59	OK

BROOKS FLOW RATE CALIBRATORS SERIAL NO. 8306H67406

BAR PRESS SERIAL NO. 2687

CALIBRATION PERFORMED BY H.C.WORTHINGTON

DATE CALIBRATED 9/6/85

PSE&G RESEARCH CORP
RESEARCH & TESTING LABORATORY

LRM FLOW CALIBRATION

MFG VOLUMETRICS   SERIAL NO 6981   PS NO 7038

TEMP F	BAR PRESS PSIA	TIME MIN	STANDARD FLOW SCCM	LRM FLOW SCCM	RESULTS %	
74.4	14.5	.97	201.3	199.5	+.91	OK
74.8	14.5	.97	176.0	175.1	+.47	OK
74.8	14.5	.97	150.6	149.8	+.42	OK
75.0	14.5	.96	126.5	125.4	+.56	OK
75.2	14.4	.96	101.2	100.6	+.31	OK
75.2	14.4	.94	77.2	75.9	+.65	OK
75.2	14.4	.94	51.3	50.0	+.66	OK
75.3	14.4	.91	26.5	25.8	+.38	OK
0.0	0.0	0.00	0.0	0.0	+0.00	
0.0	0.0	0.00	0.0	0.0	+0.00	

BROOKS FLOW RATE CALIBRATORS SERIAL NO. 8306H67406

BAR PRESS SERIAL NO. 2687

CALIBRATION PERFORMED BY H.C.WORTHINGTON

DATE CALIBRATED 9/6/85

ATTACHMENT II

PSEG Research Corporation

RESEARCH AND TESTING LABORATORY

INSTRUMENT CALIBRATION

PROCED. ______

PRESSURE CALIBRATION TEST NO. ______

FOR Leak Rate Monitor TYPE ______ PAGE ______

SERIAL NO. 6981 CO. NO. 7038 DATE 11-6-85

MFR. Volumetric CAP. 0 - 60 PSIG BY RSR

Pressure Standard				LRM		
Pressure Reading PSIA	Bar. Press PSIA		Pressure Reading PSIG	Pressure Reading PSIG	Error PSIG	% Error
14.563	14.563		0.0	00.1	0.1	.16
24.563	"		10.0	10.1	0.1	.16
34.563	"		20.0	20.2	0.2	.33
44.563	"		30.0	30.2	0.2	.33
54.563	"		40.0	40.2	0.2	.33
64.563	"		50.0	50.2	0.2	.33
74.563	"		60.0	60.2	0.2	.33

Accuracy Required ± 1% F.S.

TI Pressure Standard - EL 5636
Serial No. Gage 2687
Serial No. Capsule 10159
Date Calibrated 8-26-85
Date Calibration due 8-26-86

Page No. 50

Test Report No. 17761-1
REV. A

Barometric Pressure
Serial No.
Date Calibrated
Date Calibration due

Reviewed [signature]

L.259

PSE&G Research Corporation

RESEARCH AND TESTING LABORATORY

INSTRUMENT CALIBRATION

PROCED. ______

INTEGRITY CALIBRATION

TEST NO. ______

FOR Leak Rate Monitor TYPE ______ PAGE ______

SERIAL NO. 6981 CO. NO. 7038 DATE 11-6-85

MFR. ______ CAP. ______ BY RSR

Flow Integrity				Electrical Integrity		
Range	Press	Flow		Range	Flow	
SCCM	PSIG	Min	Max		Min	Max
0-200	10	96.2	112.2			
200-200	10	815	975			
2000-29,000	60	3.04 K	4.64 K			

Flow checks + 4% fs

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Test Report No. 17761-1
REV. A

Reviewed [signature]

L.259

PSE&G RESEARCH CORP
RESEARCH & TESTING LABORATORY

LRM FLOW CALIBRATION

MFG VOLUMETRICS SERIAL NO 6981 PS NO 7038

TEMP F	BAR PRESS PSIA	TIME MIN	STANDARD FLOW SCCM	LRM FLOW SCCM	RESULTS %	
72.6	14.6	1.07	184.3	183.1	+0.64	OK
72.8	14.6	0.98	176.3	175.5	+0.43	OK
73.0	14.6	0.98	150.7	150.1	+0.34	OK
73.4	14.6	0.97	126.7	125.9	+0.42	OK
73.4	14.6	0.97	101.5	100.2	+0.67	OK
73.5	14.6	0.96	76.6	75.1	+0.78	OK
73.7	14.6	0.94	52.2	50.8	+0.72	OK
73.9	14.6	0.94	26.1	25.4	+0.39	OK
0.0	0.0	0.00	0.0	0.0	+0.00	
0.0	0.0	0.00	0.0	0.0	+0.00	

BROOKS FLOW RATE CALIBRATORS SERIAL NO. 8306H67406

BAR PRESS SERIAL NO. 2687

CALIBRATION PERFORMED BY R.I.R.

DATE CALIBRATED 11/4/85

~~FSE&C RESEARCH CORP~~

RESEARCH &TESTING LABORATORY

LRM FLOW CALIBRATION

MFG VOLUMETRICS SERIAL NO 6981 PS NO 7038

TEMP F	BAR PRESS PSIA	TIME MIN	STANDARD FLOW SCCM	LRM FLOW SCCM	RESULTS %	
82.2	14.6	0.97	1998.0	1986.0	+0.60	OK
82.2	14.6	0.96	1609.6	1601.0	+0.43	OK
82.2	14.6	0.95	1221.0	1204.0	+0.85	OK
82.2	14.6	0.94	825.5	803.0	+1.12	OK
82.2	14.6	0.93	627.0	603.0	+1.20	OK
82.2	14.6	0.91	425.7	402.0	+1.18	OK
82.2	14.6	0.94	206.1	191.0	+0.75	OK
0.0	0.0	0.00	0.0	0.0	+0.00	
0.0	0.0	0.00	0.0	0.0	+0.00	
0.0	0.0	0.00	0.0	0.0	+0.00	

BROOKS FLOW RATE CALIBRATORS SERIAL NO. 8306H67406

BAR PRESS SERIAL NO. 2687

CALIBRATION PERFORMED BY RJR

DATE CALIBRATED 10/31/85

~~PSE&C RESEARCH CORP~~

RESEARCH & TESTING LABORATORY

LRM FLOW CALIBRATION

MFG VOLUMETRICS SERIAL NO 6981 PS NO 7038

TEMP F	BAR PRESS PSIA	TIME MIN	STANDARD FLOW SCCM	LRM FLOW SCCM	RESULTS %	
81.8	14.6	1.00	19521.7	19530.0	-0.04	OK
81.8	14.6	0.97	18114.8	18200.0	-0.42	OK
81.8	14.6	0.98	15835.0	15980.0	-0.72	OK
81.8	14.6	0.98	13832.0	13940.0	-0.53	OK
82.0	14.6	0.97	12062.0	12130.0	-0.33	OK
82.0	14.6	0.97	10053.0	10030.0	+0.11	OK
82.0	14.6	0.95	8204.8	8130.0	+0.37	OK
82.2	14.6	0.95	6149.8	6010.0	+0.69	OK
82.2	14.6	0.92	4202.1	4050.0	+0.76	OK
82.2	14.6	0.92	2110.3	1990.0	+0.60	OK

BROOKS FLOW RATE CALIBRATORS SERIAL NO. 8306H67406

BAR PRESS SERIAL NO. 2687

CALIBRATION PERFORMED BY RJR

DATE CALIBRATED 10/31/85

PSEG Research Corporation

RESEARCH AND TESTING LABORATORY

INSTRUMENT CALIBRATION

PROCED. ______

PRESSURE CALIBRATION

TEST NO. ______

FOR Leak Rate Monitor TYPE ______ PAGE ______

SERIAL NO. 6874 CO. NO. EL 7235 DATE 9/17/85

MFR. PSE&G CAP. 0 - 80 PSIG BY GJW

Pressure Standard				LPM		
Pressure Reading PSIA	Bar. Press PSIA		Pressure Reading PSIG	Pressure Reading PSIG	Error PSIG	% Error
14.707	14.707		0.0	0	0	0
24. "	"		10.0	9.93	0.07	0.7
34. "	"		20.0	19.85	0.15	0.75
44. "	"		30.0	29.75	0.25	0.83
54. "	"		40.0	39.61	0.39	0.98
64. "	"		50.0	49.57	0.43	0.86
74. "	"		60.0	59.43	0.57	0.95
84. "	"		70.0	69.30	0.70	1.00
94. "	"		80.0	79.29	0.71	0.89

Accuracy Required ± 1% F.S.

TI Pressure Standard -

Serial No. Gage	2687
Serial No. Capsule	10159
Date Calibrated	8/20/85
Date Calibration due	8/20/86

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Test Report No. 17761-1
REV. A

Barometric Pressure

Serial No.

Date Calibrated

Date Calibration due

Reviewed [signature]

PSEG Research Corporation

RESEARCH AND TESTING LABORATORY

INSTRUMENT CALIBRATION

INTEGRITY CALIBRATION TEST NO. ______

FOR Leak Rate Monitor TYPE ______ PAGE ______

SERIAL NO. 6874 CO. NO. EL7235 DATE 9-17-85

MFR. PSE&G CAP. 200, 2000, 20 000 Sccm Ranges BY GJW

FLOW INTEGRITY

Range	Press	Flow	
Sccm	PSIG	Min	Max
200	4.30	92	108
2000	10.44	920	1080
20000	60.00	2705	4305

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Test Report No. 17761-1
REV.A

PSE&G RESEARCH CORP
RESEARCH & TESTING LABORATORY

LRM FLOW CALIBRATION

EL

MFG PSE&G SERIAL NO 687-1 PS NO 7235

TEMP F	BAR PRESS PSIA	TIME MIN	STANDARD FLOW SCCM	LRM FLOW SCCM	RESULTS %	
77.0	14.7	0.98	25.1	25.4	-0.10	OK
76.6	14.7	0.99	49.8	49.5	+0.19	OK
76.4	14.7	0.98	75.6	75.7	-0.03	OK
76.2	14.7	0.99	99.8	100.4	-0.27	OK
76.2	14.7	0.99	124.8	125.5	-0.34	OK
75.9	14.7	1.00	148.3	150.1	-0.86	OK
75.9	14.7	0.99	174.8	176.4	-0.77	OK
75.9	14.7	0.99	199.9	201.1	-0.63	OK
0.0	0.0	0.00	0.0	0.0	+0.00	
0.0	0.0	0.00	0.0	0.0	+0.00	

BROOKS FLOW RATE CALIBRATORS SERIAL NO. 0306H67406

BAR PRESS SERIAL NO. 2687

CALIBRATION PERFORMED BY WACHTER

DATE CALIBRATED 9/17/85

PSE&G RESEARCH CORP
RESEARCH & TESTING LABORATORY

LRM FLOW CALIBRATION

MFG PSE&G   SERIAL NO 687-1   PS NO 7235

TEMP F	BAR PRESS PSIA	TIME MIN	STANDARD FLOW SCCM	LRM FLOW SCCM	RESULTS %	
76.6	14.7	0.93	2126.8	2001.0	+0.62	OK
76.6	14.7	0.95	4164.1	3990.0	+0.87	OK
81.3	14.7	0.96	6127.7	6000.0	+0.63	OK
81.3	14.7	0.97	8086.0	8013.0	+0.36	OK
81.3	14.7	0.98	10004.4	9999.0	+0.02	OK
81.3	14.7	0.98	12005.3	12007.0	-0.00	OK
81.3	14.7	0.99	15845.4	15993.0	-0.73	OK
81.3	4.7	1.00	19608.7	19978.0	-1.84	OK
0.0	0.0	0.00	0.0	0.0	+0.00	
0.0	0.0	0.00	0.0	0.0	+0.00	

BROOKS FLOW RATE CALIBRATORS SERIAL NO. 8306H67406

BAR PRESS SERIAL NO. 2687

CALIBRATION PERFORMED BY WACHTER

DATE CALIBRATED 9/17/85

PSE&G RESEARCH CORP
RESEARCH & TESTING LABORATORY

LRM FLOW CALIBRATION

MFG PSE&G SERIAL NO 687-1 PS NO 7235

TEMP F	BAR PRESS PSIA	TIME MIN	STANDARD FLOW SCCM	LRM FLOW SCCM	RESULTS %	
77.0	14.7	0.93	212.2	200.0	+0.61	OK
77.0	14.7	0.94	4 0.0	400.0	+1.00	OK
77.0	14.7	0.95	623.4	599.0	+1.22	OK
77.0	14.7	0.96	822.6	800.0	+1.13	OK
77.0	14.7	0.96	1028.2	999.0	+1.46	OK
77.0	14.7	0.97	1221.1	1199.0	+1.10	OK
77.0	14.7	0.97	1628.2	1600.0	+1.41	OK
77.0	14.7	0.97	2035.3	2002.0	+1.66	OK
0.0	0.0	0.00	0.0	0.0	+0.00	
0.0	0.0	0.00	0.0	0.0	+0.00	

BROOKS FLOW RATE CALIBRATORS SERIAL NO. 8306H67406

BAR PRESS SERIAL NO. 2687

CALIBRATION PERFORMED BY WACHTER

DATE CALIBRATED 9/17/85

G Druffner

PSEG Research Corporation

RESEARCH AND TESTING LABORATORY

INSTRUMENT CALIBRATION

PROCED. ______

PRESSURE CALIBRATION | TEST NO. ______

FOR Leak Rate Monitor | TYPE LIQUID | PAGE ______

SERIAL NO. ______ | CO. NO. 687-2 | DATE 8-9-85

MFR. PSE&G CAP. .005-0.2 GPM 0.2-2.0 GPM | BY SSS

Pressure Standard				LRM		
Pressure Reading PSIA	Bar. Press PSIA		Pressure Reading PSIG	Pressure Reading PSIG	Error PSIG	% Error
24.670	14.670		10	10.12	0.12	0.15
34			20	20.17	0.17	0.21
44			30	30.21	0.21	0.26
54			40	40.19	0.19	0.24
64			50	50.14	0.14	0.18
74			60	60.06	0.06	0.08
84			70	69.98	0.02	0.03
94			80	79.81	0.19	0.24

Accuracy Required ± 1% F.S.

TI Pressure Standard -

Serial No. Gage 2 C

Serial No. Capsule

Date Calibrated 6-7-85

Date Calibration due 6-17-86

Barometric Pressure

Serial No.

Date Calibrated

Date Calibration due

Page No. 60

Test Report No. 17761-1
REV.A

Reviewed G Druffner

L.259

PSE&G Research Corporation

RESEARCH AND TESTING LABORATORY

INSTRUMENT CALIBRATION

INTEGRITY CALIBRATION

PROCED. ______

TEST NO. ______

FOR Leak Rate Monitor   TYPE LIQUID   PAGE ______

SERIAL NO. 687-2   CO. NO. PSE&G   DATE 8-23-85

MFR. PSE&G   CAP. 0.2-2.0GPM & .005-.25GPM   BY JSS

	Flow Integrity				Electrical Integrity		
	Range	Press	Flow		Range	Flow	
	~~SCCM~~GPM	PSIG	Min	Max		Min	Max
HIGH	0.2-2.0	58.55	0.92	1.08			
LOW	.005-.225	18.50	0.090	0.110			

Flow checks ± 2% fs

Page No. 61

Test Report No. 17761-1
REV. A

Reviewed [signature]

L.259

PASSED

PSEG Research Corporation

RESEARCH AND TESTING LABORATORY

TEST DATA SHEET

TEST ORDER NO. LLRM 687-2 TEST PROCEDURE IDENT. 378536 GPM/GAL

DATE OF TEST 8-23-85 PERFORMED AT R&T LAB

DESCRIPTION OF MATERIAL LIQUID LRM CALIBRATION OF THE

MATERIAL RECEIVED FROM HIGH RANGE SCALE: 0.2-2.0 GPM.

FLOWMETER S/N 30794 TEST RESULTS ELEC. S/N 23517

F_S = 2.0 GPM ±2% = ±0.04 GPM

RUN 2

WEIGHT (H2O) Gr	ACTUAL (FLOW)	METER (FLOW)	PRESS (PSIG)	TEMP (°F)	PRESS (TANK)	ERROR (GAL)
2103.0	.56	.55	33.4	75°	80#	-.01
3925.6	1.04	1.03	29.5	"	"	-.01
5739.8	1.52	1.50	49.7	"	"	-.02
7638.2	2.02	2.02	58.0	"	"	0.0

TEST EQUIPMENT USED & CALIB. DUE DATE:

TESTED BY [signature]

REVIEWED BY [signature]

(SIGNATURES AND DATE)

L-477

PASSED

PSE&G Research Corporation

RESEARCH AND TESTING LABORATORY

TEST DATA SHEET

TEST ORDER NO. LLRM 687-2 TEST PROCEDURE IDENT. 3785.36 Gr/GAL

DATE OF TEST 8-22-85 PERFORMED AT R&T LAB

DESCRIPTION OF MATERIAL LIQUID L.R.M. CALIBRATION OF THE

MATERIAL RECEIVED FROM LOW RANGE SCALE; 0.005-0.25 GPM

FLOW METER S/N 16685 TEST RESULTS ELEC S/N 16687

F_s = 0.25 GPM ± 2% = ± 0.005 G.

RUN #2

WEIGHT (H2O) Gr.	ACTUAL (FLOW)	METER (FLOW)	PRESS (PSIG)	TEMP (°F)	PRESS (PSIG TANK)	ERROR
195.7	0.052	0.050	10.8	75°	60#	-.002
371.1	0.098	0.099	22.2	"	"	+.001
567.0	0.150	0.150	35.4			.000
753.2	0.199	0.199	53.0		70#	.000
951.5	0.251	0.250	76.0		80#	-.001

Test Report No. 17761-1
REV. A

TEST EQUIPMENT USED & CALIB. DUE DATE:

TESTED BY [signature]

REVIEWED BY [signature]
(SIGNATURES AND DATE)

L-477

E Duffner

PSE&G Research Corporation

RESEARCH AND TESTING LABORATORY

INSTRUMENT CALIBRATION

INTEGRITY CALIBRATION

PROCED. ______

TEST NO. ______

FOR Leak Rate Monitor

TYPE LIQUID

PAGE ______

SERIAL NO. ______

CO. NO. 687-3

DATE 8-24-85

MFR. PSE&G CAP. .005-0.05GPM TO 0.2-2.0 GPM BY JSS

	Flow Integrity				Electrical Integrity		
	Range	Press	Flow		Range	Flow	
	GPM	PSIG	Min	Max		Min	Max
HIGH	0.2-2.0	56.55	0.92	1.08			
LOW	.005-.285	17.90	0.090	0.110			

Flow checks + 4% fs

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Test Report No. 17761-1
REV. A

Reviewed G.W. Duffner

L-259

ATTACHMENT II

PSIG Research Corporation

RESEARCH AND TESTING LABORATORY

INSTRUMENT CALIBRATION

PROCED. ______

PRESSURE ______ CALIBRATION TEST NO. ______

FOR Leak Rate Monitor TYPE LIQUID PAGE ______

SERIAL NO. 10891 CO. NO. 687-3 DATE 8-8-85

MFR. ~~Volumetric~~ PSG;6 CAP. ~~0 - 80 PSIG~~ 0-0.2GPM + 0.2-2.0GPM BY JSS OSW

Pressure Standard				LFM			
Pressure Reading PSIA	Bar. Press PSIA		Pressure Reading PSIG		Pressure Reading PSIG	Error PSIG	% Error
24.620	14.620		10		10.24	0.24	0.3
34.620			20		20.40	0.40	0.5
44.620			30		30.52	0.52	0.65
54.620			40		40.61	0.61	0.76
64.620			50		50.66	0.66	0.82
74.620			60		60.67	0.67	0.84
84.620			70		70.66	0.66	0.82
94.620			80		80.59	0.59	0.74

Accuracy Required ± 1% F.S.

TI Pressure Standard -

Serial No. Gage	2686
Serial No. Capsule	10158
Date Calibrated	6-17-85
Date Calibration due	6-17-86

Page No. 65

Test Report No. 17761-1
REV. A

Barometric Pressure

Serial No.

Date Calibrated

Date Calibration due

Reviewed [signature]

L-259

PASSED

PSEG Research Corporation

RESEARCH AND TESTING LABORATORY

TEST DATA SHEET

TEST ORDER NO. 687-3 TEST PROCEDURE IDENT. 3785.36 G/GAL

DATE OF TEST 8-23-85 PERFORMED AT R&T LAB

DESCRIPTION OF MATERIAL LIQUID LRM CALIBRATION OF THE

MATERIAL RECEIVED FROM HIGH RANGE SCALE; 0.2 - 2.0 GPM

FLOWMETER S/N 30795 TEST RESULTS ELEC. S/N 23518

F_S = 2.0 GPM. I 2% = I 0.04

Run 2

WEIGHT (H_2O) GR.	ACTUAL (FLOW)	METER (FLOW)	PRESS (PSIG)	TEMP (°F)	PRESS (PSIG TANK)	ERROR (GAL)
1965.5	.52	.51	18.2	N/A	80#	-.01
3847.3	1.02	1.01	34.3	"	"	-.01
5698.3	1.50	1.51	59.0	"	"	+.01
7497.9	1.98	2.00	71.3	"	"	+.02

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Test Report No. 17761-1
Rev. A

TEST EQUIPMENT USED & CALIB. DUE DATE:

TESTED BY [signature]

REVIEWED BY [signature]

(SIGNATURES AND DATE)

L-477

PASSED

PSE&G Research Corporation

RESEARCH AND TESTING LABORATORY

TEST DATA SHEET

TEST ORDER NO. 687-3 TEST PROCEDURE IDENT. 3785.36 Gr/GAL

DATE OF TEST 8-23-85 PERFORMED AT R&T LAB

DESCRIPTION OF MATERIAL LIQUID LRM CALIBRATION OF THE

MATERIAL RECEIVED FROM LOW RANGE SCALE; 0.005 - 0.25 GPM

FLOWMETER 16686 TEST RESULTS ELEC: 16688

F_S = 0.25 GPM ± 2% = ±.005

RUN 1

WEIGHT (H_2O) Gr.	ACTUAL (FLOW)	METER (FLOW)	PRESS (PSIG)	TEMP (°F)	PRESS (PSIG TANK)	ERROR (GAL)
188.7	.050	.049	16.0	N/A		-.001
390.2	.103	.100	28.2	"		-.003
570.0	.151	.150	44.4	"		-.001
749.9	.198	.200	68.2	"		+.002

Test Report No. 17761-1
REV. A

TEST EQUIPMENT USED & CALIB. DUE DATE:

TESTED BY [signature]

REVIEWED BY [signature]

(SIGNATURES AND DATE)

L-477

Ramapo

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DATA SHEET

Mark V Flow Meter

CUSTOMER Public Service Electric & Gas Research Corp. DATE 12/20/84

REFERENCE P.O.No. PPG6729'

MODEL Mark V-½-SJ SERIAL NO. 30795 SIZE ½"

MATERIALS: Sensing Element 17-4 PH Seal Teflon

Housing T304 S.S. Flange ______ Target T303 S.S.

LINE CONNECTIONS Threaded Pipe Housing ½" MNPT

NATURAL FREQUENCY (in air) 137.0 Hz; TARGET TYPE* ACR-604

VISCOSITY AT CALIBRATION 1.0 cps SPECIFIC GRAVITY 1.0

FLOW RANGE 0.2 - 2.0 Gallons/Minute FLUID Water

REYNOLDS NO. (R_D) RANGE, AT CALIBRATION 1,016 - 10,160

PRESSURE RATING 3000 psi Maximum Pressure Sensing Element

Element #39056

Schedule 40

TEMPERATURE RANGE - 65 to + 300 °F

BRIDGE RESISTANCE, Input 351.2 ohms, Output 351.2 ohms.

FORCE FACTOR 0.895 mV/V/kg

EXCITATION VOLTAGE Recommended 7½ Maximum 15 Volts AC or DC

FULL SCALE OUTPUT; standard piping (see "Installation")

1.009 Millivolts/Volt Excitation at 2.0 GPM

FULL SCALE OUTPUT; short straight run

______ Millivolts/Volt Excitation at ______, with

straight run pipe diameters ______ upstream, ______ downstream

Calibration Resistor ---- ohms across Pins A - B (or 1 - 2)

yields an output signal of ---- mV/V

Accuracy ½ % of full scale

Data based on: ( ) force calibration, (X) flow calibration

ELECTRICAL CONNECTIONS:

Terminals

A or 1 --- Bridge Excitation (+)

D or 4 --- Bridge Excitation (-)

B or 2 --- Bridge Output (+)

C or 3 --- Bridge Output (-)

E or 5 --- Case Ground

RIC-P1051B

Test Report No. 17761-1
REV. A

*Target type number is its diameter in thousandths of an inch.

Final Acceptance [signature]

REPAIR

DATA SHEET
MARK X FLOWMETER SYSTEM

CUSTOMER Public Service Electric & Gas Research Corporation DATE 4/11/85

FLOWMETER MODEL Mark X-000001 SERIAL NO. 16686 *

ELECTRONICS MODEL DTA-8401RD1S SERIAL NO. 16688 *

FLOWMETER DETAILS: Outline drawing 32076

MATERIALS: Metering Tube & Float Type 18-8 S.S. Core 17-4 PH

Housing T303-304 S.S. Seal Teflon Damper Teflon (Special)

FLUID Water SPECIFIC GRAVITY 1.00

FLOW RANGE 0.005 - 0.25 GPM METERING TUBE SIZE 253 X 3

MAXIMUM PRESSURE 3500 Psig; TEMPERATURE RANGE - 65 to 250 °F

VISCOSITY: Operating 1.0 cps ; at calibration 1.0 cps

FULL RANGE OUTPUT(Open Circuit) 256.856 mV/V at 3000 Hz(Approx.)

LVDT type K-220-002

ADDITIONAL FEATURES OR DATA: (X) None, ( ) See next page

For other details, see specification S 32110

ELECTRONIC DETAILS: Outline drawing 32738 System Wiring 33416-1

FUNCTION: (x) Flow rate transmitter, (x) Indicator, ( ) Totalizer, ( ) Controller ______ set point(s), contact rating ______

EXCITATION: 3.469 Volts, 3.033 KHz

OUTPUT: Flow Rate signal 4 to 20 mADC into 1K ohm load ( )min. (X)max.

DISPLAY: ( ) Analog meter, (X) Digital meter. Scale 0-1.999

TOTALIZING: Full scale count rate ______ counts per ______, equivalent to ______ ______ per ______, with scale factor of ______. (Example ______ reads ______.)

Counter ( ) included, ( ) remote, ( ) not supplied.
( ) Batch Control, contact rating ______
Counter reset: ( ) none, ( ) manual, ( ) electric, ( ) remote

POWER: (x) 105-125V, 50/60 Hz, ( ) 200-250V, 50/60 Hz, ( ) ______

ENCLOSURE TYPE: Rack Mount

ADDITIONAL FEATURES OR DATA: (X) None, ( ) See next page

For other details, see specification S 33375

CALIBRATION SIGNALS Switch position:	Set CAL 1	Set CAL 2	SCALE FACTOR	UNITS
Simulates Flowmeter Signal	68.339	188.416	-	mV/V
Equivalent Flow Rate	0.050	0.1875	-	GPM
Count Rate (Totalizer)	-	-	-	-
Output Signal	7.2	16.0	-	mADC
Meter Reading	0.400	1.500	-	-
Meter Reading (scaled)	—	0.188	-	GPM

*In all correspondence, refer to complete model designation and serial number.

Approved By [signature] RIC-F1156

PSEG Research Corporation

RESEARCH AND TESTING LABORATORY

PRESSURE GAGE CALIBRATION DATA

Performed for PSE+G RESEARCH CORP MAT DIV

Location of Test PSE+G RESEARCH CORP. ELD DIV Test No.

Test Procedure Identification ELD 6 REV 6 Test Date 5/14/85

Description of Test Item 0-3000 psig GAGE Gage No. PE 072

Manufacturer MATHESON Model 63-5633 Accuracy ±0.25% F.S.

Standard Pressure PSI	GAGE READING PSI Up	Down	Average	Correction
0	0	0	0	0
250	250	250	250	0
500	505	505	505	-5
750	750	755	752	-2
1000	1000	1005	1002	-2
1250	1250	1250	1250	0
1500	1500	1500	1500	0
1750	1745	—	1745	+5

* sufficient pressure not available for full scale reading

Permanent Set Test:

NOT Performed ✓ *

Not required

Calibrated by [signature]

Reviewed by [signature]

Date 5-20-85

Test Standard/Equipment HEISE DIGITAL GAGE 0-5000psi

Serial No. 7706

Date of Last Calibration 10/29/84

Date of Next Calibration 10/29/85

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PSEG Research Corporation

RESEARCH AND TESTING LABORATORY

PRESSURE GAGE CALIBRATION DATA

Performed for PSE+G RESEARCH CORP, MAT. DIV

Location of Test PSE+G RESEARCH CORP, EVA DIV. Test No. ______

Test Procedure Identification EVA-6 REV. 6 Test Date 5/14/85

Description of Test Item 0-3000 psig GAGE Gage No. PE073

Manufacturer MATHESON Model 63-5633 Accuracy ±0.25% F.S.

Standard Pressure PSI	GAGE READING PSI Up	Down	Average	Correction
0	0	0	0	0
250	250	250	250	0
500	500	500	500	0
750	750	750	750	0
1000	1000	1000	1000	0
1250	1245	1250	1248	+2.0
1500	1500	1500	1500	0
1750	1750	—	1750	0
* sufficient	pressure not	available for	full scale	reading

Permanent Set Test:

NOT Performed ✓ *

Not required ______

Calibrated by [signature]

Reviewed by [signature]

Date 5-20-85

Test Standard/Equipment HEISE DIGITAL GAGE 0-5000 psi

Serial No. 7766

Date of Last Calibration 10/29/84

Date of Next Calibration 10/29/85

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