TEST PROCEDURE

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TEST PROCEDURE NO. 17761-1

DATE: November 20, 1985

Revision 2

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

APPROVED BY: _____
FOR: _____

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FOR: _____

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FOR: _____

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REVISIONS

FORM 1054-1 Rev. 4/74

REV. NO.	DATE	PAGES AFFECTED	BY	APP'L.	DESCRIPTION OF CHANGES
1	10/28/85	All	[illegible]	[illegible]	Revised Lab Test System; Added info to
				[illegible] 11/8/85	Field Test; Revised wording of basic
				[illegible]	procedure.
2	11/20/85	2	[illegible]	[illegible]	Additional information regarding test
				[illegible]	objectives.
		4		BMH 11/22/85	Add'l information regarding field tests.
		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.

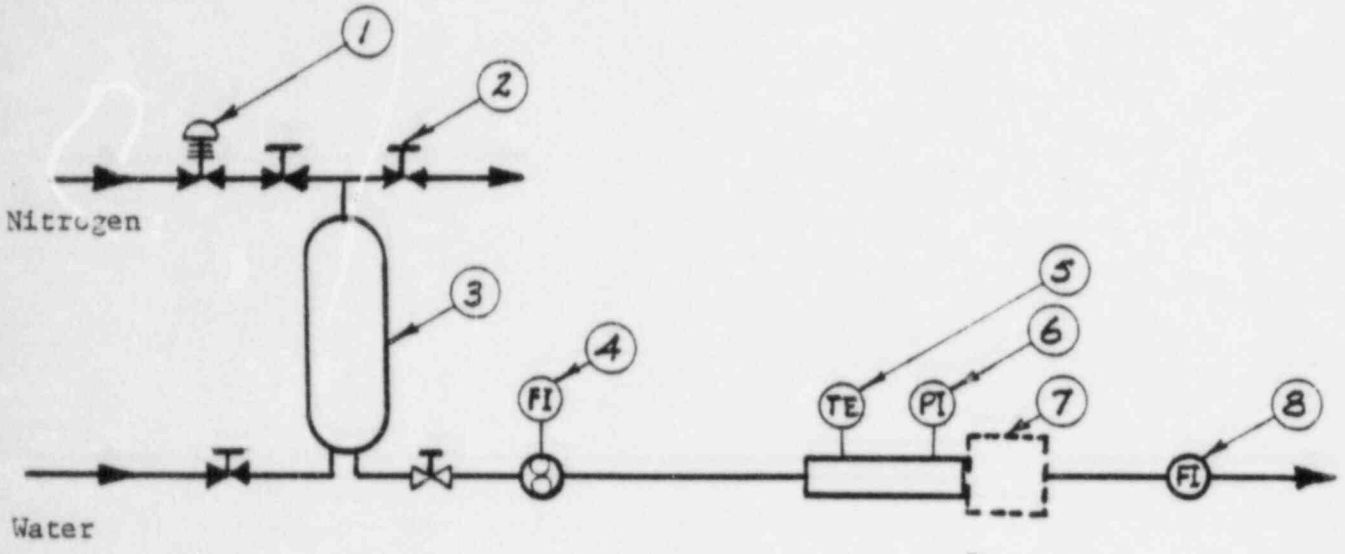
4.2 Field Tests

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 hock 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 commponent 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.

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REVISIONS				
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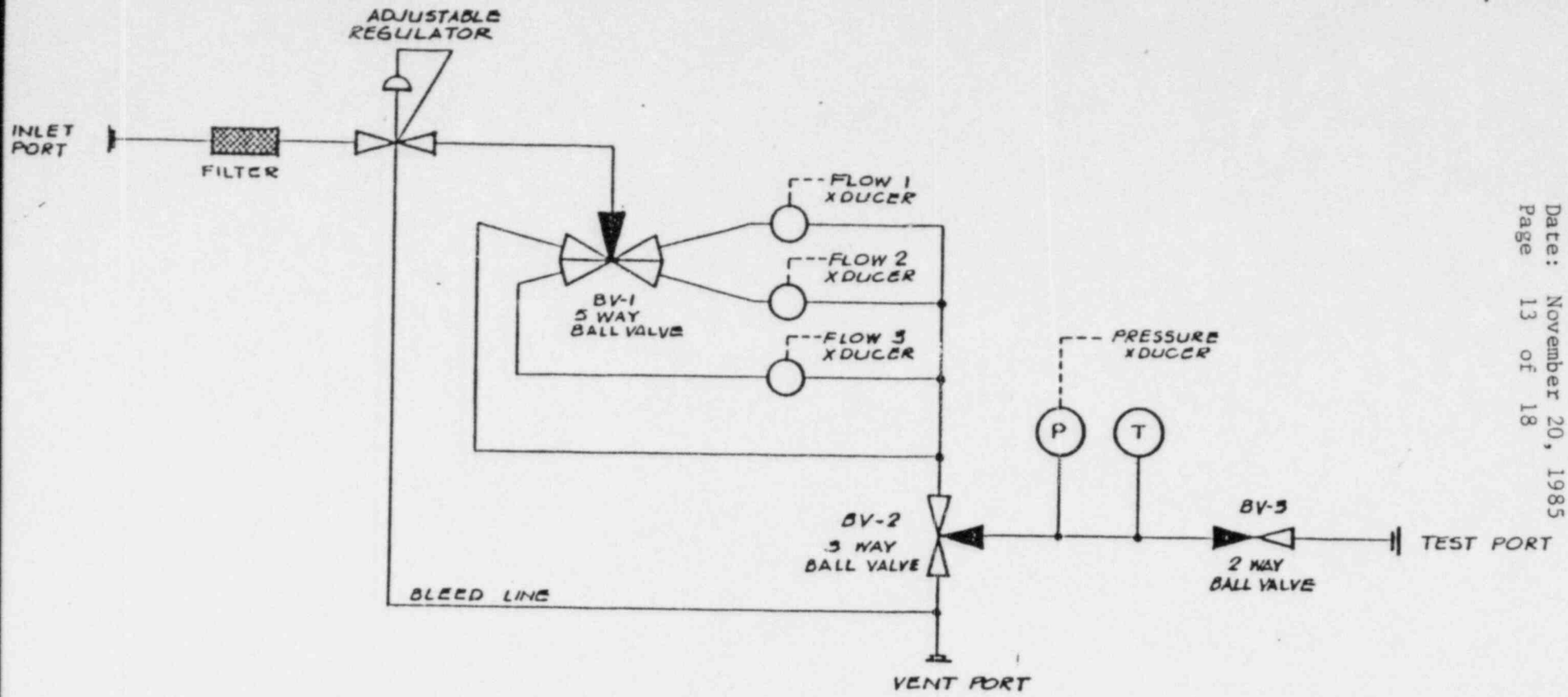


NEXT ASSY	USED ON
APPLICATION	

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

MATERIAL

FINISH

DO NOT SCALE DRAWING

CONTRACT NO.

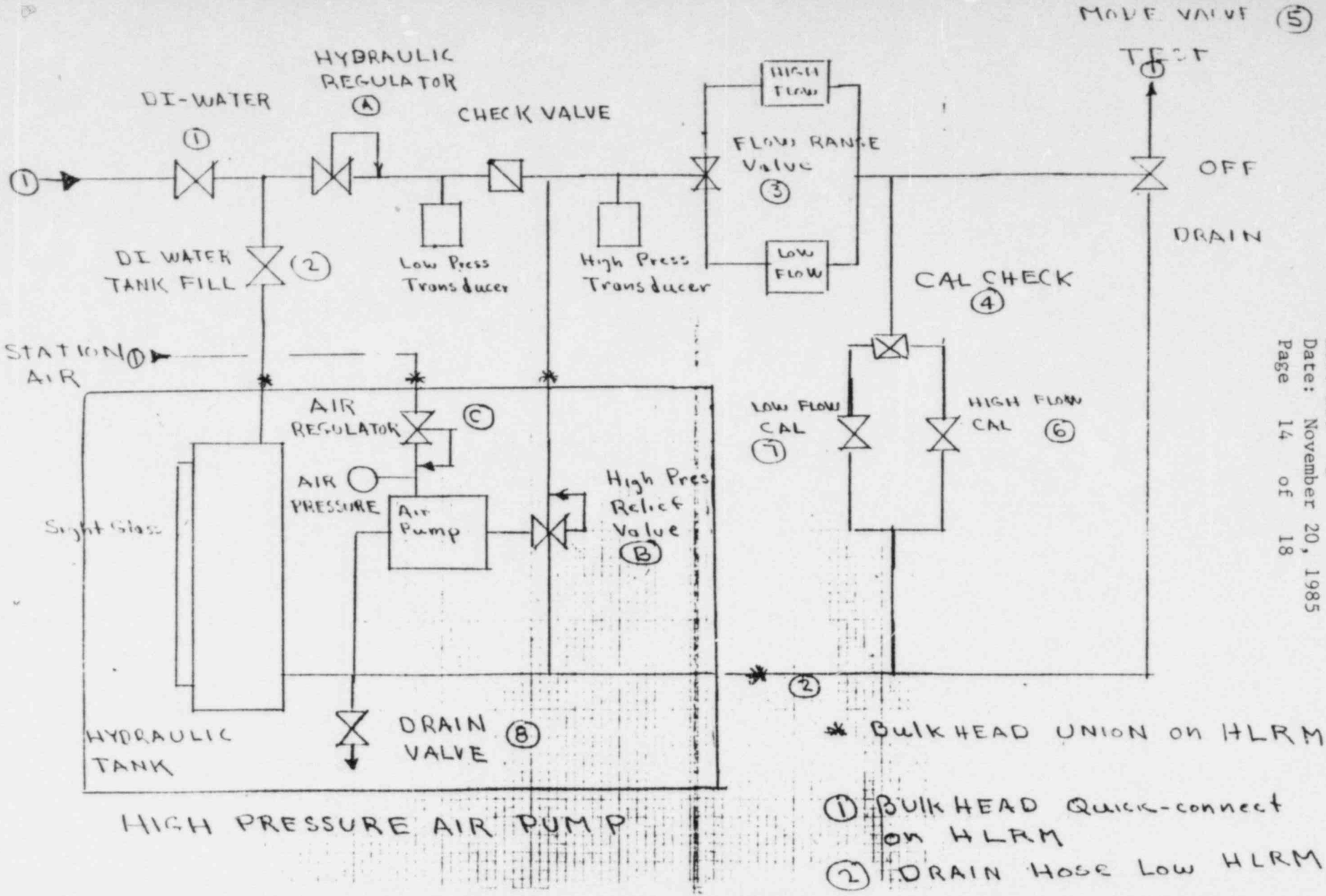
APPROVALS	DATE
DRAWN HASHLEN	2-3-82
CHECKED T. BADGETT	2-3-82
L. GIBSON	2-3-82

VOLUMETRICS PASO ROBLES CALIFORNIA

PNEUMATIC DIAGRAM
LEAK RATE MONITOR
MODEL NUMBER 14342

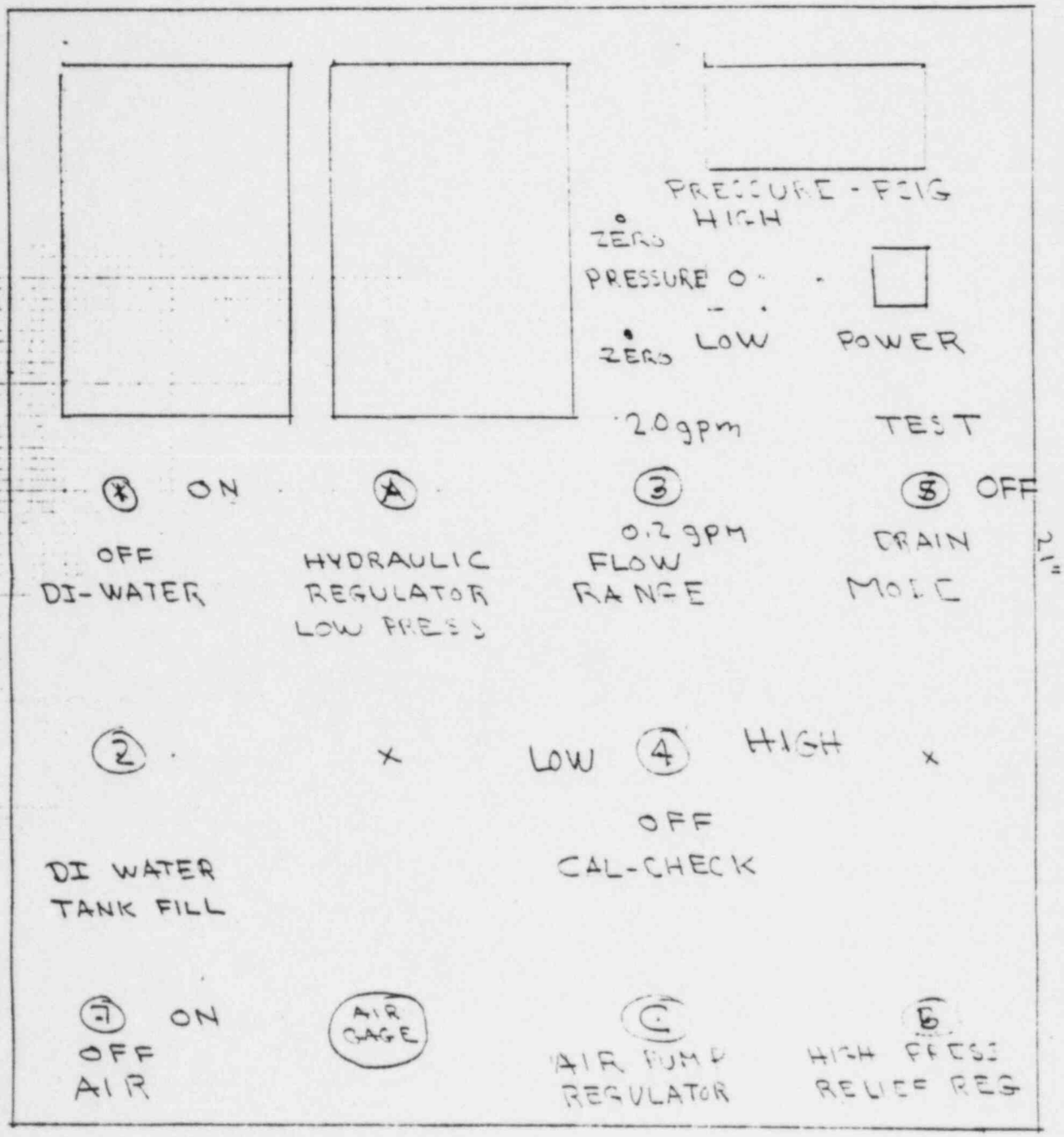
SIZE	CODE IDENT NO.	DRAWING NO.
B	20890	820018

SCALE — 00 SHEET 1 OF 1



HIGH PRESSURE AIR PUMP

19"



HYDRALIC LEAK RATE MONITOR

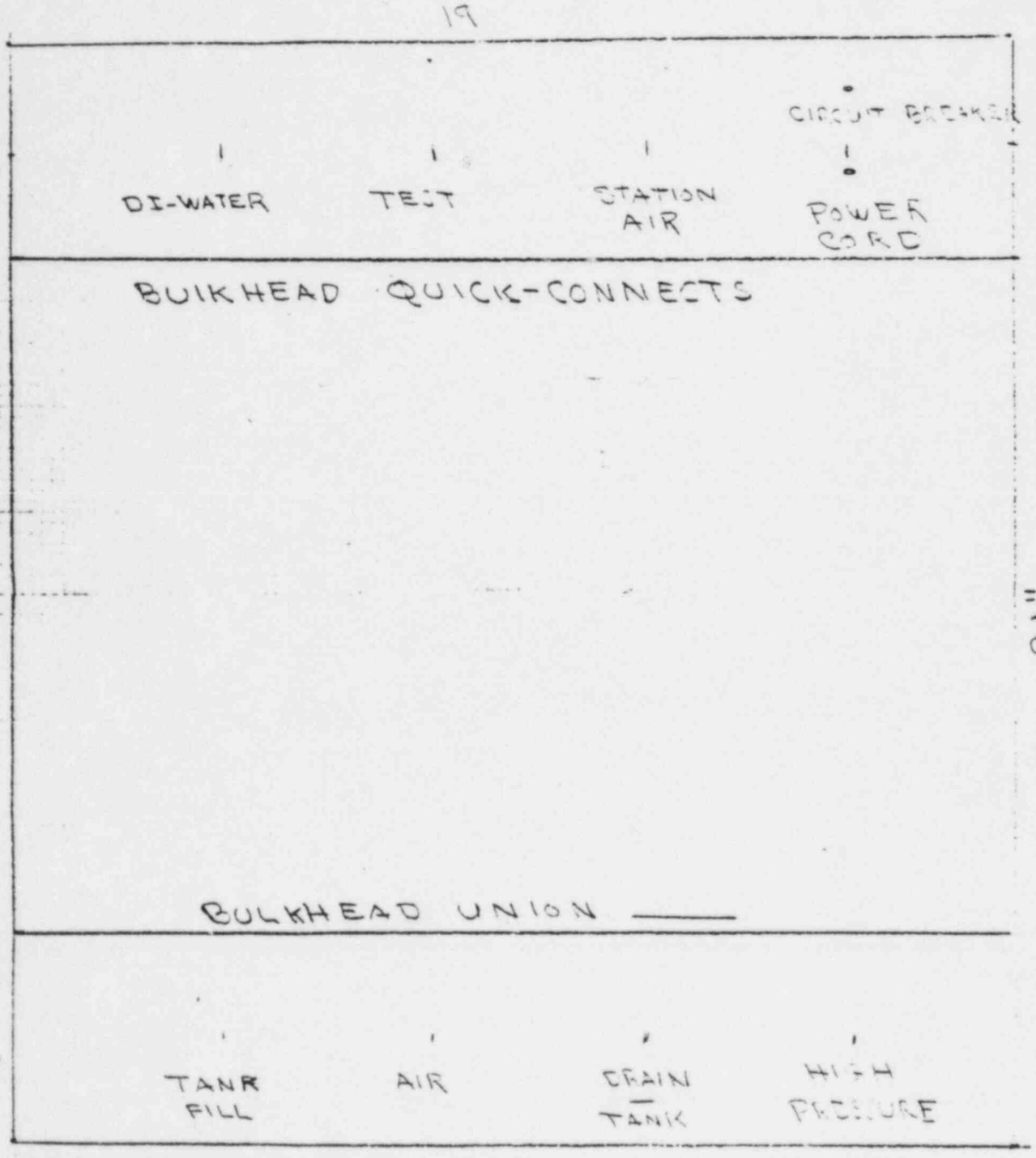
Valve No.	LABEL USE	Mfg
1	DI WATER ON OFF	Whitey Ball Valves SS-44S6
2	DI-WATER TANK FILL	Whitey Regulating & Shut-off SS-1RS6
3	FLOW RANGE HIGH - LOW	Whitey Ball Valve SS-44xS6
4	CAL-CHECK HIGH - LOW	Whitey Ball Valve SS-44xS6
5	MODE VALVE TEST OFF DRAIN	Whitey Ball Valve SS-44xS6
6	CAL LEAK HIGH	Whitey Regulating & Shut off value 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

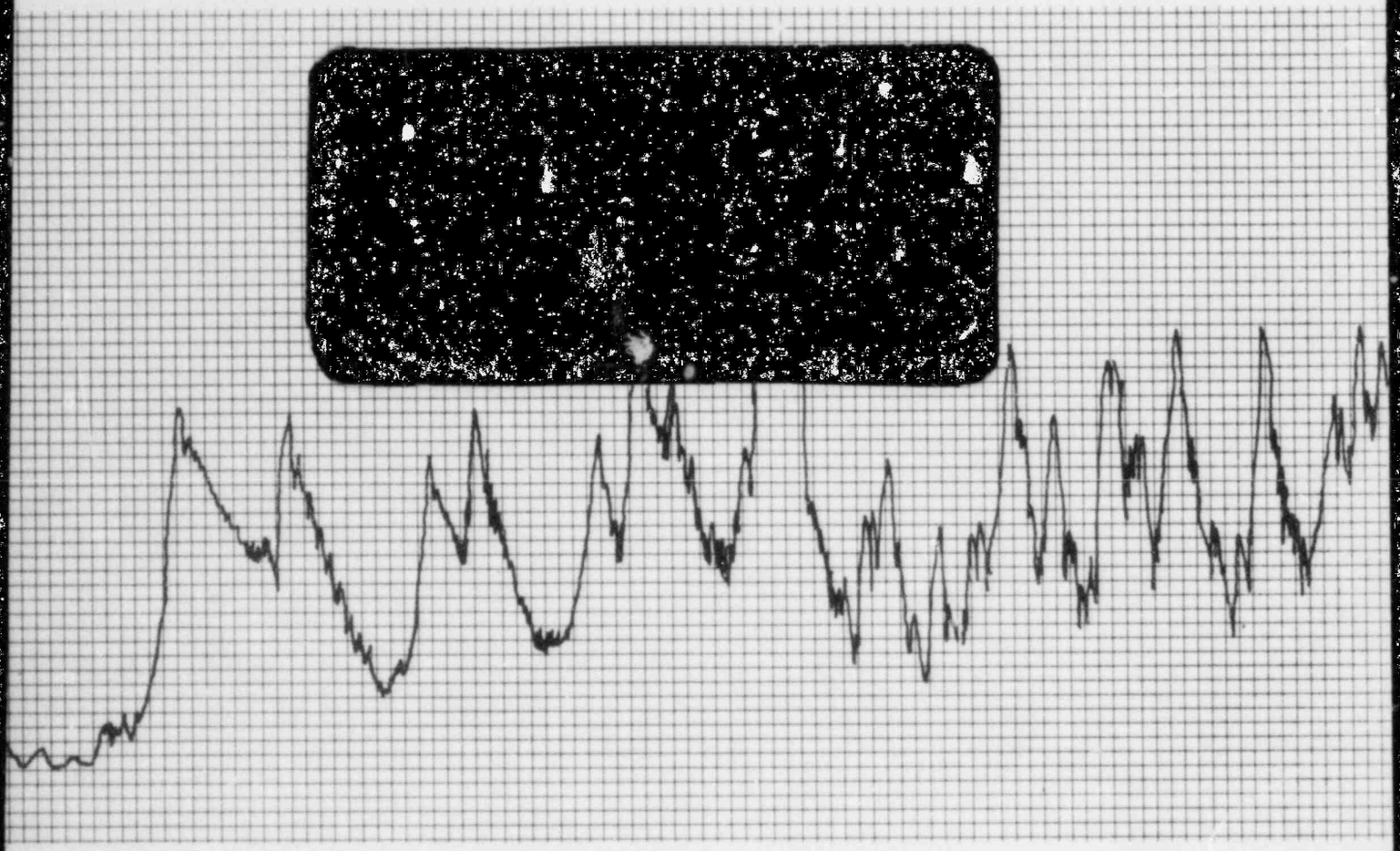


REAR

HYDRAULIC LEAK RATE MONITOR

FINAL

WYLE
LABORATORIES SCIENTIFIC SERVICES & SYSTEMS GROUP



test REPORT