Commonwealth Edison
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Address Reply to: Post Office Box 767
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April 26, 1984

Mr. James G. Keppler
Regional Administrator
U.S. Nuclear Regulatory Commission
Region III
799 Roosevelt Road
Glen Ellyn, IL 60137

Subject: Byron Station Units 1 and 2
Steam Generator Snubber Qualification
Testing Program
IE Inspection Report Nos. 50-454/84-08 and
50-455/84-06
NRC Docket Nos. 50-454/455

References (a): E. D. Swartz letter to J. G. Keppler
dated February 23, 1984

(b): W. S. Little letter to Cordell Reed
dated February 6, 1984

(c): W. S. Little letter to Cordell Reed
dated March 8, 1984

Dear Mr. Keppler:

Reference (a) provided the Region with our preliminary specification for testing of our steam generator snubbers for your review and comment in response to the Region's concerns expressed in Reference (b). Reference (c) provided Commonwealth Edison with an acknowledgement in this matter and requested (1) an opportunity to review the testing procedures, after contract award, but prior to conducting the tests, and (2) sufficient notification to allow the Region an opportunity to observe the testing and the test facility. The purpose of this letter is to address these matters.

An award has been made to ITT Grinnel in Warren, Ohio to perform the requisite testing. Enclosed for your immediate review and comment is an advance copy of the test procedure. Our tentative schedule in this matter is as follows:

Receipt of test procedure	4/27
Ship Braidwood snubbers	5/04
Start testing	5/13
(Desired)	5/06
Issue Test Report	6/01

MAY 2 1984

IE01

May we please receive your comments on the test procedure in order that we may begin testing on or about May 6. A detailed test schedule will be sent to you as soon as it is available.

Please address any questions that you or your staff may have in this matter to this office.

Very truly yours,

E. Douglas Swartz
Nuclear Licensing Administrator

cc: RIII Inspector - Braidwood
I. T. Yin

8531N

ITT GRINNELL CORPORATION
PIPE HANGER DIVISION
FIELD OPERATIONS DEPARTMENT
SPECIAL SERVICES SECTION

PRELIMINARY

TEST PROCEDURE

FUNCTIONAL AND SPRING RATE TESTING OF

STEAM GENERATOR SNUBBERS

COMMONWEALTH EDISON'S

BYRON AND BRAIDWOOD NUCLEAR POWER STATION

SPS-8416-1-0

PREPARED BY:_____ DATE_____

APPROVED BY:_____ DATE_____

APPROVED BY:_____ DATE_____

Q.A. APPROVAL:_____ DATE_____

PRELIMINARY

1.0 INTRODUCTION

1.1 This procedure covers the functional and static spring rate testing of Steam Generator snubbers manufactured by Boeing and owned by Commonwealth Edison Company and used at the Byron and Braidwood Stations.

1.2 The testing is to be performed to meet the requirements of Sargent and Lundy Engineers Specification No. 120.

1.3 Testing will be conducted under the Quality Assurance Program of ITT Grinnell as specified in Quality Assurance Manual and Engineering Services Quality Assurance Manual.

1.4 The provision of Title 10, Chapter 1, Code of Federal Regulations, Part 21, Report of Detects and Noncompliance apply to this work.

1.5 The snubber temperature shall be maintained at 120±5 F during the testing by use of an enclosure with heaters and thermocouple controllers.

1.6 Functional testing of each complete snubber assembly will include the determination in both tension and compression of the following:

1.6.1 The lockup Velocity shall be between 5 and 7 in/min.

1.6.2 The bleed rate shall be equal to or less than the numbers shown below at the loads indicated.

Load lbs	Maximum Bleed Rate, in/min
260,000	.25
770,000	.30
1,950,000	.37

1.7 The static spring rates measured from end block to end block shall be determined in both the tension and compression directions at the hot piston setting at loads of 260, 770 and 1950 kips. The acceptable spring rate in both directions shall be 9000 kips/in ± 20%.

1.8 Testing will be conducted at ITT Grinnell's Warren Ohio plant at facility No. 1420R.

1.9 Data shall be analyized as the testing proceeds with a final data issued following completion of the testing.

2.0 TEST SPECIMEN

2.1 Two steam generator snubbers shall be tested, they will include attached end blocks and structural bolting.

2.2 The snubbers are defined by Boeing Engineering Drawings:

	Rev.
D275-N0200	B Sht. 1 of 2
D275-N0200	C Sht. 2 of 2
D275-N0201	E Sht. 1 of 2
D275-N0201	E Sht. 2 of 2
D275-N0202	C Sht. 1 of 1
D275 N0203	C Sht. 1 of 1
N0204	- Sht. 1 of 1
N0205	B Sht. 1 of 1
N0206	B Sht. 1 of 1
N0207	A Sht.
N0208	A Sht.
N0209	D Sht. 1 of 3
N0209	A Sht. 2 of 3
N0209	B Sht. 3 of 3

As provided by Sargent and Lundy.

2.3 A remote reservoir will be attached to the snubbers during testing. The reservoir will be provided by ITT Grinnell.

3.0 TEST EQUIPMENT AND INSTRUCTION

3.1 Testing will be conducted at ITT Grinnell's test facility 1420R. A detailed description and schematic are given in Appendix 1.

3.2 Snubber displacement shall be measured using a Schaevitz and Schaevitz CAS-025 LVDT Signal Conditioners.

3.3 Snubber velocity shall be measured using a Schaevitz 7L20VT-Z velocity transducer or equivalent. As a back up a displacement transudcer can be used and the slope measured.

3.4 Snubber load shall be determined by use of pressure transducers on the actuator. These shall be Setra Systems Model 204 transducers.

3.5 A Honeywell 1858 Visicorder will be used to record pressure, displacement and velocity data where required.

3.6 If signal filtering is required a Wavetek Rockland Model 852 or equivalent will be used.

3.7 An insulated thermal enclosure, heater/blower system (41,000 BTU/hr) and temperature controller will be used to bring the snubber temperature to 120 F.

3.8 Calibration procedures for the velocity and displacement transducers are given in Appendix 2.

4.0 SNUBBER HANDLING

4.1 Decontamination, if required, will be done by the utility.

4.2 The snubber shall be packaged by the utility before pick-up by ITT Grinnell. Each assembly will be shipped in a closed wooden crate.

4.3 The snubbers shall be lifted using only the lifting eyes on the end blocks. The four eyes are located over the pin centerlines. The lifting cables should attach to the lifting eyes at an angle not less then 45 relative to the horizontal plane. The total assembly weight will be approximately 13,000 lbs.

4.4 Dust and dirt should be cleaned from the snubber surface. Caution should be used when cleaning the piston rod to prevenbt damage to the rod surface.

5.0 SNUBBER INSTALLATION AND TEST SETUP

5.1 Set the movable platen to the appropriate position for the snubber length and fully retract the actuator cylinder.

5.2 Withdraw the snubber ~~end~~ attach bolts into the end blocks to protect thread ends from damage.

5.3 Lower snubber into test machine with piston rod towards the test machine actuator.

5.4 Thread the four snubber attach bolts into the test machine movable platen adapter plate (SP84007) (See Figure 50-1), torque the bolts to _____ ft-lbs.

5.5 Extend the actuator piston rod until the end plates and the cylinder adapter plate just clear one another. Loosely thread four attach bolts into the adapter plate.

5.6 Extend the actuator piston rod until contact is made between the end blocks and adapter plates (See 5.7 below). Torque the bolts to _____ ft-lbs.

5.7 Care should be taken not to extend or retract the snubber piston rod before the remote reservoir is installed.

5.8 Remove the shipping reservoir and install the line from the remote reservoir using an EP O-ring on the 1" SAE tube fitting.

5.9 The remote reservoir should be elevated above the snubber so that any air in the reservoir line will rise to the reservoir tank. Shake the line to loosen any bubbles attached to the surface of the reservoir line.

5.10 Install one velocity transducer from the snubber rod eye to the snubber head using magnetic bases.

5.0 SNUBBER INSTALLATION AND TEST SETUP (Continued)

5.11 Place the thermal enclosure around the snubber and reservoir and begin heating the assembly to 120 ±5 F.

5.12 Install one displacement transducer (LVDT) longitudinally across each of four corners of the end brackets (See Figure 5.0-1) using magnetic bases.

6.0 TEST SEQUENCE

6.1 The test sequence will be as shown in Figure 6.1-1.

7.0 TEST PROCEDURE - TEST MACHINE WITHOUT PRESSURE AMPLIFICATION

7.1 Thermal Soak

The test specimen and remote reservoir shall be thermally soaked at 120 F±5 for a period of 12 hours minimum to insure temperature equilibrium throughout the assembly. The ambient termperature will be maintained throughout the testing.

7.2 Lock-Up Velocity

The lock-up velocity shall be determined in both the tension (extension) and compression (retraction) directions of the snubber.

7.2.1 Move the snubber piston rod to a position 1/4 inch from fully retracted.

7.2.2 Set the system pressure to develope approximately 100,000 lbs. of load in the tension direction (See Table 7.0-1).

7.2.3 Turn on the recorder, velocity and pressure measurements only need to be recorded.

7.2.4 Stroke the snubber in tension, gradully increasing the test machine velocity while observing the velocity on the recorder. The lock-up velocity is the velocity immediately preceeding a rapid decrease in the velocity and an increase in System pressure. Record this velocity on the test data form. (Appendix 3)

7.2.5 Continue to stroke for 5 seconds after the pressure has stabilized to determine bleed rate at this load. This will be used during the spring rate testing. Record this value on the test data form. (Appendix 3)

7.2.6 Increase system pressure to develop 260,000 lbs of load (Table 7.0-1) and record for 5 seconds.

7.0 TEST PROCEDURE (Continued)

7.2.7 Increase system pressure to develop 777,000 lbs of load and record for 5 seconds.

7.2.8 Shut off the recorder.

7.2.9 Set the sytem pressure to develop 100,000 lbs in the compression direction.

7.2.10 Unlock the valve and move the piston rod to 1/4" from fully exended.

7.2.11 Repeat steps 7.2.3 thru 7.2.9 for the compression direction, except the bleed rate at 1,950,000 lbs will also be run.

7.2.12 Repeat steps 7.2.1 thru 7.2.12 two additional times.

7.2.13 Record lockup velocity and bleed rate with associated system pressure on the Test Data Form (Appendix 3)

7.3 Spring Rate

The end block to end block spring rates shall be determined by measuring the displacement between those positions as a function of load. The displacment due to bleed rate shall be subtracted from the measured displacement to generate the static spring rate of the load carrying components of the snubber. Data from four displacement transducers will be averaged to eliminate any test bracket bending or looseness phenomena. ~~(See Figure 7.3-1)~~

7.3.1 Position the snubber at the hot piston setting.

7.3.2 Set up the recorder to record the four displacement transudcers and the pressure transducers.

7.3.3 With the velocity control value fully off and the directional control value in the tension position adjust system pressure to develope 260,000 lbs load in the tension direction. (Table 7.0-1)

7.3.4 Put the directional control value in the off position.

7.3.5 Fully open the velocity control valve.

7.3.6 Turn on the recorder.

7.3.7 Quickly turn the directional control valve to the tension direction.

7.3.8 Wait until pressure stabilizes, then shut the test machine down.

7.3.9 Shut off the recorder.

7.0 TEST PROCEDURE (Continued)

7.3.10 If the force was not within 5% of the target, adjust the pressure and repeat steps 7.3.1 - 7.3.10.

7.3.11 Repeat steps 7.3.1 thru 7.3.10 with the pressure adjusted to develop 770,000 lbs of load. (Table 7.0-1)

7.3.12 Position the snubber at the hot piston position.

7.3.13 With the velocity control valve fully off and the directional control value in the compression direction adjust system pressure to develope 260,000 lb load in the compression direction. (Table 7.0-1)

7.3.14 Put the directional control valve in the off position.

7.3.15 Fully open the velocity control valve.

7.3.16 Turn on the recorder.

7.3.17 Quickly turn the directional control valve to the compression direction.

7.3.18 Wait until pressure stabilizes, then shut the test machine down.

7.3.19 Shut off the reocrder.

7.3.20 If the load was not within 5% of the target adjust and repeat steps 7.3.12 and 7.3.20.

7.3.21 Repeat steps 7.3.12 thru 7.3.20 with the pressure adjusted to develop 770,000 lbs of load. (Table 7.0-1)

7.3.22 Repeat steps 7.3.12 thru 7.3.20 with pressure adjusted to develop 1,950,000 lbs of load.

7.3.23 Preliminary reduction of data will be done on site during the testing.

7.3.24 Calculated loads and spring rates will be recorded on the Test data forms. (Appendix 3)

8.0 TEST PROCEDURE/TEST MACHINE WITH PRESSURE AMPLIFICATION

8.1 Thermal Soak

Maintain the snubber environment at 120F ±5 F.

8.2 Pressure Amplifiers

The pressure amplifier circuit amplifies supply pressure by a factor of 1.33:1. This developes approximately 6,650 psi from the 5000 psi supply pressure.

8.2.1 Replace the direct line form the directional control value to the tension machine actuator with the hoses from the pressure amplifier.

8.3 Tension Spring Rate and Bleed Rate at 1950 Kips

8.3.1 Position the snubber at the hot piston setting.

8.3.2 Set up the recorder to record the four displacement transducers and the pressure transducers.

8.3.3 Setup the pressure amplifiers to provide maximum volume displacement (cylinders fully retracted).

8.3.4 Close solenoid controlled valve A Appendix 1 ~~value A~~ (Figure 1) A.

8.3.5 Close Hand values B and C ~~close~~.

8.3.6 Place the directional control value to the tenstion direction.

8.3.7 Fully close the velocity control valve.

8.3.8 Adjust the supply pressure to develop 1,950,000 lbs of load in the tension directon (Table 7.0-1).

8.3.9 Place the directional control valve in the off position.

8.3.10 Fully open the velocity control valve.

8.3.11 Open hand valves B and C allow pressure to stabilize.

8.3.12 Close valve C.

8.3.13 Turn the directional control valve to the tension direction, allow pressure to stabilize.

8.3.14 Turn on recorder.

8.3.15 Open valve A.

8.3.16 Allow flow to continue for a short duration after pressure stabilizes, for the determination of bleed rate.

8.3.17 Shut down the test machine.

8.3.18 Shut off the recorder.

8.3.19 If the force is not within 5% of the target, adjust the pressure and repeat steps 8.3.1 thru 8.3.19.

8.3.20 Preliminary data reduction will be done on site during the testing.

8.0 TEST PROCEDURE/TEST MACHINE WITH PRESSURE AMPLIFICATION (Continued)

8.3.21 Calculated load spring rate and bleed rate will be recorded on the test data form. (Appendix 3)

8.3.22 Following final shut down of the test machine open valves B and C to relieve amplifier pressure.

9.0 TEST REPORT

9.1 Test data report forms are found in Appendix 3.

9.2 The final test report shall include these forms and copies of original data where possible, along with acceptance criteria and pass or fail indication.

APPENDIX 1

A1-1.0 DESCRIPTION OF TEST FACILITY 1420R WITHOUT PRESSURE AMPLIFICATION

A schematic of the 1420R test facility is shown in Figure A1-1.0-1. Motion and/or force may be applied to the snubber piston rod utilizing a hydraulically actuated drive ram. Fluid flow and pressure to the drive ram is provided by a 20.5 GPM, 5,000 psi pump through a manually operated direction control valve which opens to either the tension or compression direction.

Ram velocity is controlled using a flow control valve. Applied load is controlled through a remotely operated pressure relief valve. System pressure is measured by a 10,000 psi pressure gage. Ram pressure after snubber locking has occured is measured by pressure transducers on each side of the drive ram determining load being applied.

A1-2.0 DESCRIPTION OF TEST FACILITY 1420R WITH PRESSURE AMPLIFICATION

A schematic of 1420R test facility with pressure amplification is shown on Figure A1-2.0-1 and A1-2.0-2.

Motion and/or force may be applied to the snubber piston rod utilizing a hydraulically actuated drive ram. Fluid flow and pressure to the drive ram is provided by a 20.5 GPM, 5,000 psi pump through a manually operated direction control valve which opens to either the tension or compression direction. The tension pressure is amplified by a factor of 1.333.

Ram velocity is controlled using a flow control valve. Applied load is controlled through a remotely operated pressure relief valve. System pressure is measured by a 10,000 psi pressure gage. Ram pressure after snubber locking has occured is measured by pressure transducers on each end of the drive ram determining load being applied.

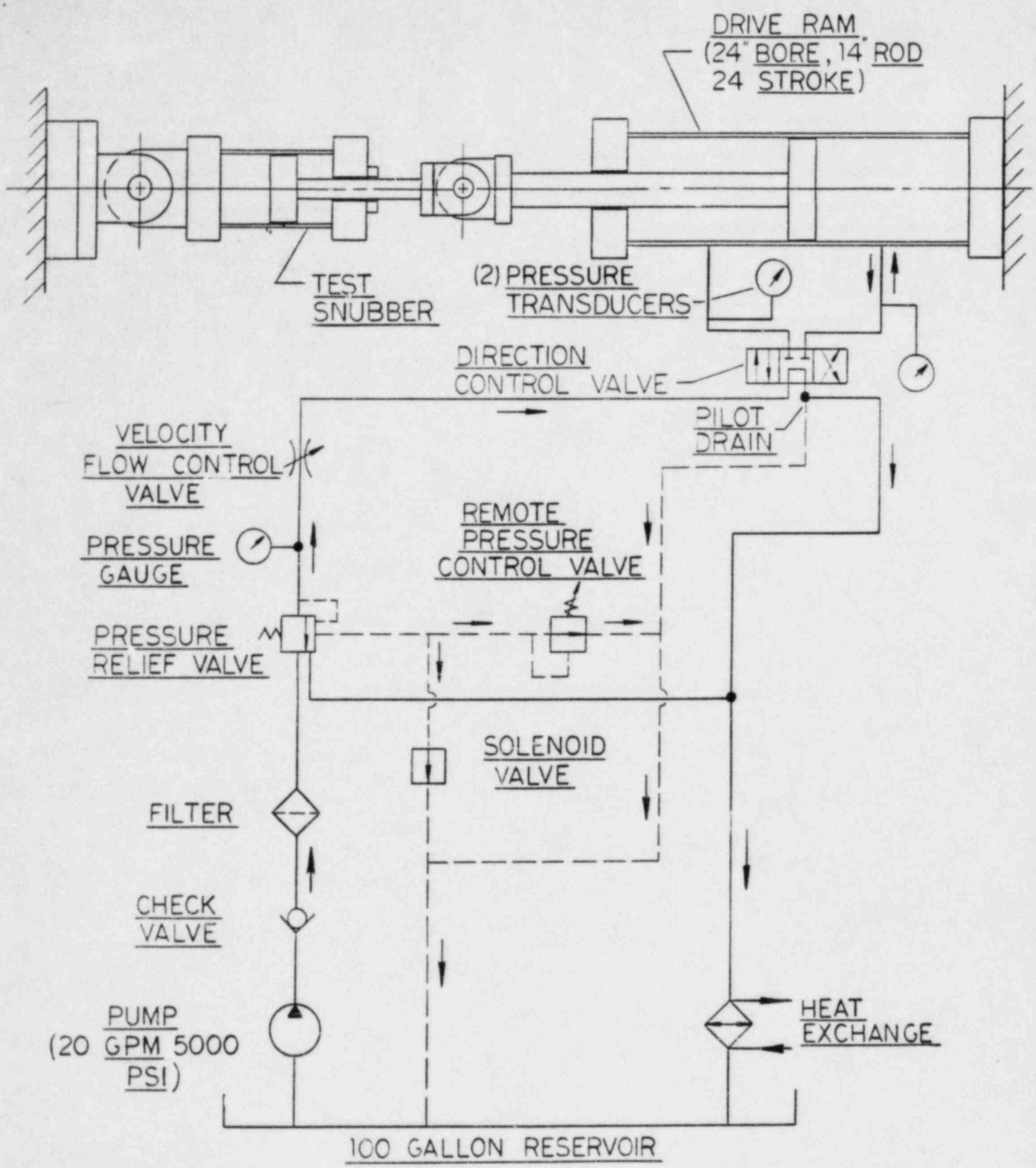


FIG. A1-1.0-1 - 1420R TEST FACILITY SCHEMATIC WITHOUT PRESSURE AMPLIFICATION

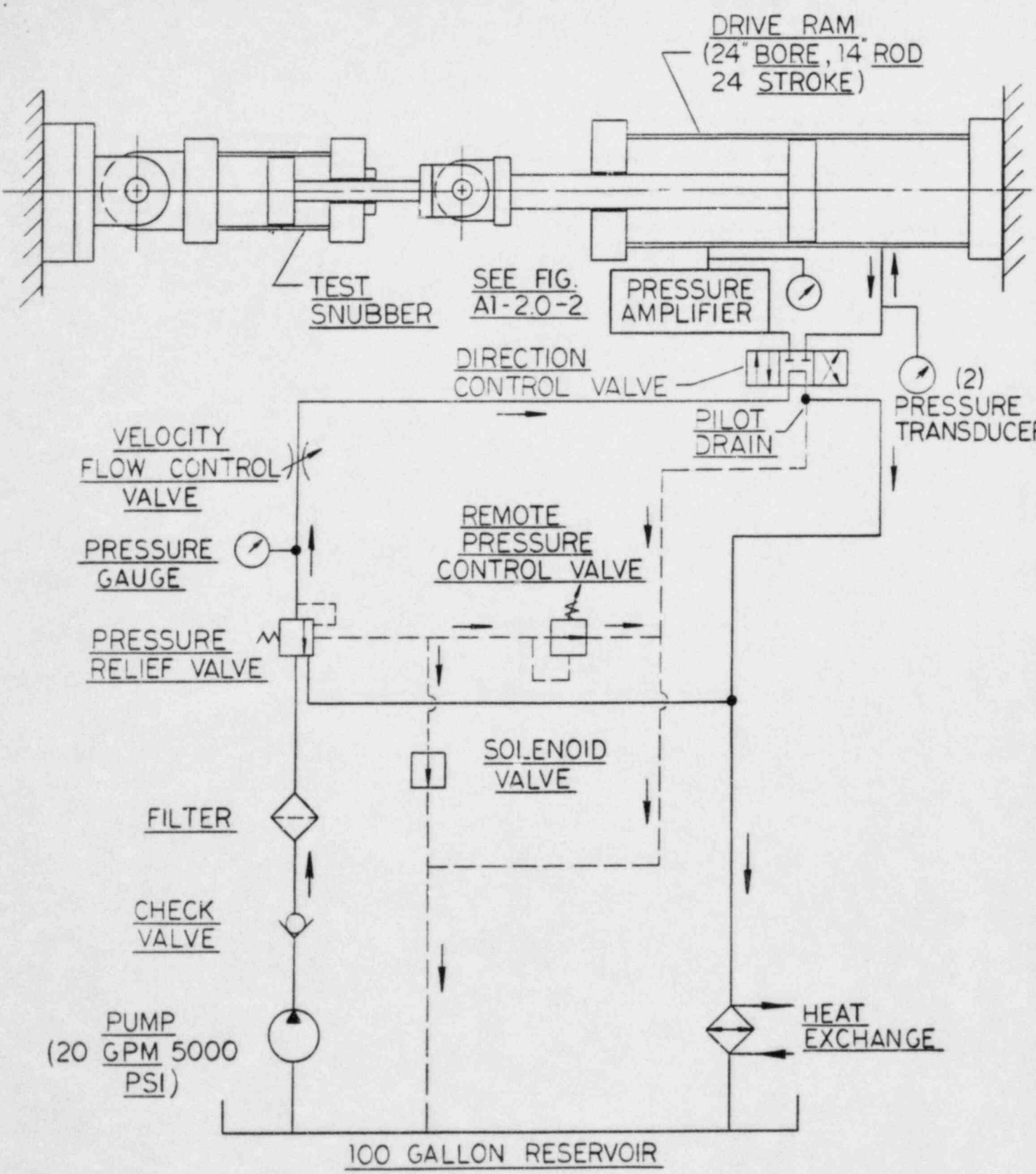
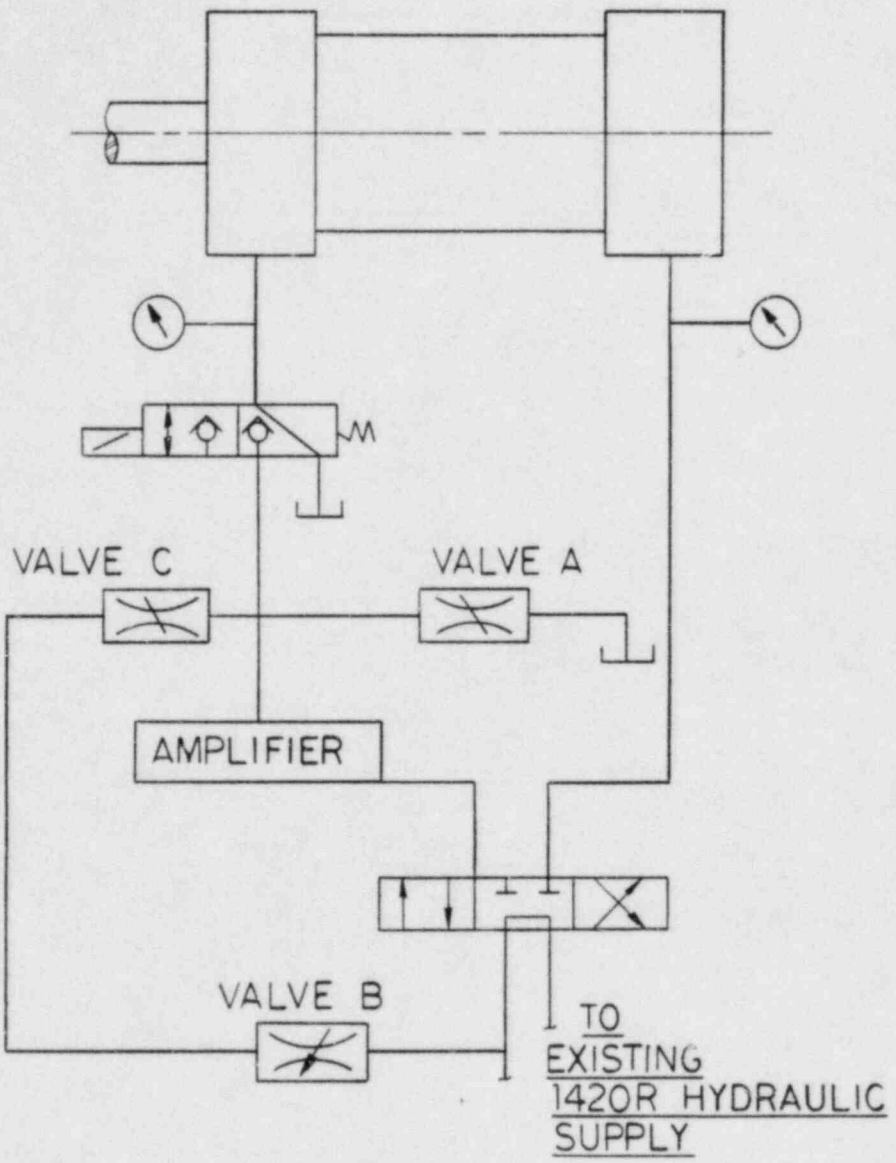


FIG. A1-2.0-1 1420R TEST FACILITY SCHEMATIC WITH PRESSURE AMPLIFICATION



PRESSURE AMPLIFIER SCHEMATIC

FIGURE: A1-2.0-2

APPENDIX 2

INSTRUMENTION CALIBRATION

The velocity and displacement transducers shall be calibrated immediately preceding and at one week intervals during the testing.

1.0 VELOCITY TRANSDUCER

1.1 Install the velocity transducer on a suitable constant velocity stroking apparatus.

1.2 Attach the lead wires to the recorder to be used. Set the recorder to the sensitivity to be used (Approximately 1 in/min/in).

1.3 Turn the recorder on and allow it to heat up for 15 minutes.

1.4 Adjust the recorder to zero to place the output in a convient location on the chart paper.

1.5 Record information required on calibration form ~~A1.0-1~~ SPS-8416-VT

1.6 Place a calibrated dial indicator at a convenient location for measuring transducer stroke.

1.7 Start the stroking apparatus in the tension (extension) direction and set at a readout indicating 6 in/min.

1.8 Using a calibrated stop watch measure the time requred to move the transducer 3 inches.

1.9 Stop stroking.

1.10 Divide the distance moved by the time taken to determine the true velocity. Record on the calibration sheet.

1.11 Record the trace displacement (in.) on the calibration sheet.

1.12 Divide the results of section 1.9 by that of 1.10 this is the calibration for in/min/in. Insert on the calibration sheet and on the test data form ~~Recorder~~.

1.13 Repeat the procedure for the compresson (retraction direction).

1.14 The amplifier/recorder/transducer combination shall be maintained throughout the test program.

2.0 DISPLACEMENT TRANSDUCER

2.1 Install the displacement transducer on a suitable stroking apparatus.

2.2 Attach the lead wires to the signal conditioning unit and recorder to be used.

2.0 DISPLACEMENT TRANSDUCER (Continued)

2.1 Install the displacement transducer on a suitable stroking apparatus.

2.2 Attach the lead wires to the signal conditioning unit and recorder to be used.

2.3 Turn the power supply and rcorder on and allow to warm up for 15 minutes.

2.4 Adjust the signal conditioner and recorder ~~set~~ So that the sensitivity is set to out put approximately 1 in. of motion on the recorder for every .1 of transducer motion.

2.5 Record information required on calibration sheet ~~A2.0.1~~. SPS 8416-DT

2.6 Place a calibrated dial indicator at a convenient location for measuring transducer stroke.

2.7 Move the stroking apparatus .500 inches in tension (extension).

2.8 Adjust the signal conditioner gain to have 5 inches of displacement on the recorder.

2.9 Move the stroking apparatus back to the zero position.

2.10 Adjust the signal conditioner zero to the zero line on the chart.

2.11 Repeat steps 2.7 thru 2.10 until .500 inches of transducers motion equal 5.00 inches of recorder displacement.

2.12 Lock the gain and zero screws and recheck the calibration.

2.13 The ~~signed~~ Signal conditioner/amplifier/recorder/transducer combination shall be maintained throughout the test program.

CALIBRATION FORM SPS-8416-VT

Velocity Transducer Calibration

TRANSDUCER INFORMATION

Manufacturer:_____ Model:_____

S/N:_____ Published Sensitivity:_____

RECORDER INFORMATION

Manufacturer:_____ Model:_____

S/N:_____ Calibration Date:_____

AMPLIFIER INFORMATION

Manufacturer:_____ Model:_____

S/N:_____ Calibration Date:_____

DIAL INDICATOR Calibration Date:_____

STOP WATCH Calibration Date:_____

CALIBRATION DATA

Tension

Time to Move 3 inches _____ sec, A
Velocity = 3 inches/ A _____ in/min, B
Recorder Trace Displacement _____ in, C
Tension Calibration Factor = B/C = _____ in/min/in

Compression

Time to Move 3 inches _____ sec, D
Velocity = 3 inches/ D _____ in/min, E
Recorder Trace Displacement _____ in, F
Compression Calibration Factor = E/F = _____ in/min/in
Amplifier Gain _____

Calibration by:_____ Date:_____

Q.C.:_____ Date:_____

CALIBRATION FORM SPS-8416-DT
DISPLACEMENT TRANSDUCER CALIBRTION

TRANSDUCER INFORMATION

Manufacturer:_____ Model:_____

S/N:_____ Published Sensitivity:_____

SIGNAL CONDITIONING

Manufacturer:_____ Model:_____

S/N:_____

RECORDER INFORMATION

Manufacturer:_____ Model:_____

S/N:_____ Calibration Date:_____

AMPLIFIER INFORMATION

Manufacturer:_____ Model:_____

S/N:_____ Calibration Date:_____

DAIL INDICATOR: Calibration Date:_____

CALIBRATION DATA:

Q. Are zero and gain adjustment locked on the signal conditioner? Yes ☐ No ☐

Q. Does .500 inches of transducer motion equal 5.00 of recorder trace displacement. Yes ☐ No ☐

Amplifier Gain:_____

Calibration By:_____ Date:_____

Q.C. By:_____ Date:_____

TEST SYSTEM PRESSURES

TABLE 7.0-1

SNUBBER LOAD	ACTUATOR PRESSURES COMPRESSION	TENSION	SUPPLY PRESSURE TO AMPLIFIER PSI
100 Kip	221	335	N.A.
260	57.5	87.1	N.A.
770	1702	2580	N.A.
1950	4310	6534*	4913*

TEST SEQUENCE - FIGURE 6.1-1

THERMAL SOAK
120 F ±5 F

TENSION LOCK-UP VELOCITY
AND BLEED RATE
100,260 AND 770 KIPS

COMPRESSION LOCK-UP VELOCITY
AND BLEED RATE
100,260,770 and 1950 KIPS

TENSION, SPRING RATE
260 AND 770 KIPS

COMPRESSION, SPRING RATE
260,770 AND 1980 KIPS

TENSION, SPRING RATE"
AND BLEED RATE
1950 KIPS

APPENDIX 3

TEST DATA FORMS

Incomplete