Examination and Test of Crystal River Unit No. 3 Power-Operated Relief and Safety Valves

PWR Safety and Relief Valve Test Program

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ELECTRIC POWER RESEARCH INSTITUTE

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EPRI PERSPECTIVE

PROJECT DESCRIPTION

The project described by this report is part of the overall Pressurized Water Reactor (PWR) Safety and Relief Valve Test Program and focuses on the examination and testing of valves that actuated under transient conditions in a nuclear unit. On February 26, 1980, Crystal River Unit No. 3 experienced an electrical system malfunction that led to power operated relief valve (PORV) actuation, a reactor trip, initiation of high-pressure safety injection, and eventually activation of a pressurizer safety valve. Analysis of these transient and resultant conditions shows that the primary system was indeed "solid," i.e., no steam bubble in the pressurizer, and that the safety valve discharged water for approximately two hours. Actuation of the pressurizer safety valves under any condition is rare; and, according to a rather extensive literature search, this event was the first where liquid flowed through a safety valve. This project examined the internal portions of the affected valves and "pop" tested the safety valves to determine if the setpoints in the plant were reproducible.

PROJECT OBJECTIVES

The main objective, of course, was to determine if there were any deleterious effects to the safety valve due to the discharge of liquid effluent. The safety valve that opened during the transient actuated approximately 100 psi below its normal setpoint; we wanted to determine if this point of actuation was reproducible under controlled conditions. During the transient, primary system pressure never reached 2475 psig, the lower limit for safety valve setpoints; it was an objective of this program to find out where the second safety valve would have actuated had primary system pressure continued to rise. Another objective was to determine the condition of the PORV via detailed examination and an assessment of the discharge piping.

PROJECT RESULTS

The objectives of the project were successfully met in all aspects. There were no signs of damage to any of the valves attributable to the transient, specifically the liquid discharge. The safety valve that actuated performed under controlled conditions as it did in the plant. The safety valve that did <u>not</u> actuate would have, had the primary pressure increased to around 2470 psig. No evidence of damage was found during the inspection of the discharge piping.

The cooperation of Florida Power Corporation, particularly the staff of Crystal River Unit No. 3, is gratefully acknowledged.

J. D. E. Jeffries, Project Manager
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ABSTRACT

The PWR Safety and Relief Valve (S/RV) Test Program was developed to respond to NRC requirements placed on the utility industry via Section 2.1.2, NUREG 0578. The Program is focused on determining the operability of safety and relief valves found on the primary side of PWRs by full scale prototypical testing. In addition to testing valves under controlled conditions, the Program established an objective to utilize applicable nuclear plant operating events to assist in evaluating S/RV performance. On February 26, 1980 a transient occurred at Florida Power Corporation's Crystal River Unit 3. This event caused the power operated relief valve to open; and later, led to lifting a safety valve. This report describes the transient and the subsequent valve actuations. Moreover, it provides the results of a comprehensive examination of the valves and the associated overpressure protection piping.

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I. INTRODUCTION

In February 1980, an abnormal transient occurred at the Crystal River Unit No. 3 (CR-3) Nuclear Generating Station. The cause of this transient was an electrical system malfunction which opened the power operated relief valve (PORV) on the pressurizer and held it open electrically for approximately 5 to 7 minutes until the PORV was isolated by closing the upstream block valve. A reactor trip, system blowdown to about 1350 psig, and automatic initiation of high pressure injection into the reactor coolant system occurred within the first few minutes of the transient. The addition of high pressure injection flow filled the pressurizer, increased reactor coolant system pressure, and eventually resulted in actuation of one of the two spring-loaded safety valves installed on the pressurizer. This safety valve subsequently cycled open and closed over a period of up to 2 hours. During the course of the transient, the PORV opened and discharged saturated steam (and possibly water) and the safety valve opened on steam and/or water and subsequently discharged solid water.

The transient was terminated without damage or other adverse effects. However, because of the fact that the safety valve (and possibly the PORV) discharged water flows for which they were not designed, a program was undertaken by EPRI to

evaluate the effect of these conditions on the valves and connecting piping.

The purpose of this report is to present the results of these investigations. Specifically, this report describes (1) the safety and relief valves and overpressure protection system installed at Crystal River Unit No. 3, (2) the transient which occurred at Crystal River Unit No. 3, and (3) the results of examinations and tests of the Crystal River Unit No. 3 PORV, safety valves and discharge piping.

The cooperation and the assistance of representatives of Florida Power Corporation, Babcock and Wilcox, Dresser Industries, and Wyle Labs, who participated in this effort are gratefully acknowledged.

II. SUMMARY AND CONCLUSIONS

During the February 26, 1980, transient at Crystal River Unit No. 3 (CR-3), the PORV was opened and held open as a result of an electrical system malfunction. The PORV remained open for approximately 5 to 7 minutes at which time it was isolated by closing the upstream block valve. The PORV was actuated at a system pressure of approximately 2200 psig on saturated steam, discharged steam (and possibly water) and was isolated at a reactor coolant pressure of approximately 1350 psig. During subsequent re-pressurization of the reactor coolant system by means of the high pressure injection pumps, one of the two installed safety valves, RCV-8, opened by self-actuation at a reactor coolant system pressure of about 2400 psig. This pressure is approximately 100 psi, or 4 percent below its specified set pressure. Safety valve RCV-8 subsequently cycled open and closed a number of times (or remained partially open) between 2400 and 2300 psig over the next 2 hours until the reactor coolant system pressure was reduced below this pressure range. Since the pressurizer was solid (i.e., filled with water) during this period, it is believed that RCV-8 discharged water for a significant period of time. The other safety valve, RCV-9, did not open during this transient.

The evaluation of the effect of those transient flow conditions on the CR-3 PORV and safety valves consisted of the following:

- Inspection of the valves, piping and pipe supports at CR-3 after the transient.

- Disassembly and inspection of the PORV and safety valves for signs of abnormal wear or other distress.

- Steam testing of safety valves RCV-8 and RCV-9 at Wyle Laboratories.

- Post test inspection of safety valves RCV-8 and RCV-9.

The main results and conclusions of these investigations and tests can be summarized as follows:

1. PORV and Safety Valve Discharge Piping and Supports

   - Visual examination of the discharge piping for the PORV and adjacent spring-loaded safety valves RCV-8 and RCV-9 revealed no damage or deformation in the piping or piping supports.

2. PORV

   - Visual examination and electrical actuation tests of the PORV solenoid operator prior to removal of the PORV from the system confirmed that the solenoid operator and linkages to the valve pilot operated properly when energized and de-energized repeatedly from the control room.

   - Examination of the PORV after disassembly by Babcock and Wilcox, Dresser and EPRI representatives indicated that the PORV assembly and internal parts were normal in every respect and showed no evidence of malfunction or damage as a result of the February 1980 transient or previous CR-3 operation.

3. Safety Valves RCV-8 and RCV-9

   - Inspection of safety valves RCV-8 and RCV-9 after disassembly indicated that RCV-8 had been leaking

for some time in service, but there was no evidence of damage or abnormal wear due to the February 1980 transient. Specifically, RCV-8 showed no evidence of instability or excessive loads due to the water discharge which occurred during the February transient.

- Steam tests at Wyle Laboratories showed that safety valve RCV-9 had a lift pressure within approximately 1 percent of the specified set pressure as received by Wyle. Safety valve RCV-8 exhibited a lift pressure on tests approximately 100 psi low in the same manner that it operated during the February 1980 transient at Crystal River Unit No. 3. While the reason for the low set pressure was not specifically identified, it does not appear that it was in any way related to the February transient. Instead, it is likely that the valve operated at a low lift pressure as a result of either improper adjustment of the set pressure initially, the effect of leakage through the valve, or both. Valve RCV-8 had a history of seat leakage in the plant, and also leaked during the steam tests at Wyle.

In summary, the steam and water discharge through the CR-3 PORV and safety valve RCV-8 during the February 1980 transient did not result in damage, abnormal wear, unstable operation, or other distress.

III. DISCUSSION

The CR-3 overpressure protection system, the transient which occurred at Crystal River in February 1980 and results of subsequent examinations and tests of the CR-3 PORV and safety valves are described below.

A. Crystal River-3 Overpressure Protection System

The Crystal River-3 nuclear generating station is a pressurized water reactor designed by Babcock and Wilcox and owned and operated by Florida Power Corporation. The reactor system includes a single power operated relief valve (PORV) and two spring-loaded safety valves which are mounted on top of the pressurizer. The safety valves are designated RCV-8 and RCV-9; the PORV is designated RCV-10. The PORV is provided with a remotely operable steam isolation (block) valve. The PORV and safety valves discharge to a drain tank inside containment. The arrangement of these valves and discharge piping at the top of the pressurizer are shown in Figure 1.

The specific types and characteristics of the PORV and safety valves are as follows:

1. PORV

Manufacturer - Dresser Industries

Model No. - 31533VX-3 Electromatic Relief Valve

Size - 2-1/2" x 4"

Orifice Size - 1-5/16"

Capacity - 150,000 lbs/hr of saturated steam

Set Pressure - 2450 psig

A cross-section of the Dresser Electromatic PORV is shown in Figure 2.

2. Safety Valves

Manufacturer - Dresser Industries

Model - 2-1/2 - 31-39A

Size - 2-1/2" x 4"

Orifice Size - 2.545"

Capacity - 318,000 lbs/hr of saturated steam

Set Pressure - 2500 psig

Specified Blow-down - 2% to 4%

A cross-section of the Dresser safety valves is shown in Figure 3.

B. Description of February 1980 Transient

A reactor coolant system transient occurred at CR-3 on February 26, 1980, as a result of an instrument and control system electrical malfunction. This malfunction caused a reduction in feedwater flow to the steam generators, a slight increase in reactor power, and a resulting increase in the reactor coolant system pressure. The electrical system malfunction also produced a signal which opened the PORV and held its pilot valve operator

open. Under these conditions, the reactor coolant system pressure continued to rise for approximately 23 seconds, at which time both reactor and turbine trips were initiated automatically at the overpressure trip point of 2300 psig. The reactor coolant system pressure peaked at 2320 psig and as a result of the reactor trip and the open PORV, dropped to 1500 psig within 3 minutes of the beginning of the transient. At this point, two additional high pressure injection pumps automatically initiated injection into the reactor coolant system (one high pressure injection pump was already operating for normal system make-up) and provided a total injection flow into the system of about 1100 gpm. At this point in time, the plant operators secured the reactor coolant pumps and isolated the open PORV using the upstream isolation valve. It is estimated that the PORV was isolated at about 5 to 7 minutes after initiation of the transient.

With the high pressure injection pumps still on and the PORV isolated, the reactor coolant system pressure increased. After approximately 9-1/2 minutes into the transient, safety valve RCV-8 opened at a pressure of about 2400 psig. For the next 20 minutes, it appears that RCV-8 remained open and then reclosed at approximately 2300 psig. A portion of the transient is shown in Figure 4.

Subsequently, the operators throttled the high pressure injection flow rate and opened let-down system isolation

valves to permit let-down flow from the reactor system; however, the recorded system pressure traces indicate that safety valve RCV-8 cycled open and closed a number of times (or perhaps remained in a partially open condition) over the next two hours. The reactor coolant system pressure during this period is shown in Figure 5. (Note that power to the strip chart recorder was lost during the first 20 minutes of the transient. Figure 4 should be referred to for pressures during this time period.) During this two hour period, the pressurizer was solid.

Eventually, the operators re-established a steam bubble in the pressurizer and pressure was reduced to the 1800 - 2000 psi range. At this time, RCV-8 remained closed. At no time during the transient did RCV-9 open.

During the course of the transient, approximately 43,000 gallons of reactor coolant were dumped into the reactor building via the reactor coolant drain tank (RCDT) overflow.

The fluid conditions to which the PORV and safety valve were subjected during this transient are as follows:

1. PORV - The PORV was opened by the electrical signal due to the instrumentation and control system malfunction about 2200 psig and was isolated by the upstream block valve at approximately 1350 psig. It is most likely that the PORV opened on and discharged

saturated steam during the approximately 5 to 7 minutes that it was discharging. This is consistent with the pressure trace given in Figure 4. However, there is a possibility that the pressurizer could have filled solid while the PORV was still open (at about 6 minutes into the transient) and that the PORV was isolated at about 9 minutes into the transient. In this eventuality, the PORV could have discharged saturated or slightly sub-cooled water.

3. Safety Valve RCV-8 - Safety valve RCV-8 opened initially at 2400 psig, which is about 100 psi below its initial set pressure. A reasonable interpretation of the pressure trace given in Figure 4 is that after PORV isolation, at about 6 minutes after transient initiation, the pressurizer filled solid at about 9 minutes. Safety valve RCV-8 opened after about 9-1/2 minutes. In this case, RCV-8 would have opened on water and discharged saturated and sub-cooled water over the next two hours. It is possible that a small amount of steam was present in the pressurizer nozzle under safety valve RCV-8 during its initial "pop." It is very likely, however, that the second and any subsequent "pops" of RCV-8 occurred with only water in the pressurizer and safety valve nozzle and that RCV-8 discharged water for essentially all of the time it was open.

3. Safety Valve RCV-9 - Valve tail pipe thermocouple measurements during this transient indicate that safety valve RCV-9 did not open or leak during the event. These measurements are considered valid since individual discharge lines run from each valve to the RCDT.

C. On-Site Examinations and Tests

In April 1980, PORV RCV-10 and safety valves RCV-8 and RCV-9 were removed from the CR-3 plant. During this operation, a number of inspections and tests were performed by representatives of Florida Power Corporation, Babcock and Wilcox, Dresser and EPRI. The results of these examinations and tests are as follows:

1. Visual examination of the PORV and its operator, including the solenoid linkages, showed no abnormal conditions or evidence of damage. The operator linkages were in the normal, closed position.

2. Electrical actuation tests were made which confirmed that the solenoid and linkage to the PORV pilot operated properly when energized and de-energized repeatedly from the control room.

3. Visual examinations of the discharge piping for the PORV and the adjacent spring-loaded safety valves (RCV-8 and -9) indicated no damage or deformation to the piping or supports. A portion of this piping and supports is shown in Figure 1.

4. There was no evidence of cold spring in the discharge piping when the valves were removed.

The PORV was removed to the radioactive machine shop for disassembly at CR-3. Examination of the valve inlet and outlet ports prior to disassembly showed no signs of leakage in the form of steam cutting or boric acid crystal accumulation.

The following observations were made during PORV disassembly and subsequent examination of valve internal parts.

1. The valve pilot guide (Part 12) was discolored on its OD, but showed no signs of damage. The ID of the pilot disc guide had slight circumferential wear marks at the top of the guide. These marks were visible, but could not be identified by feel, and are considered normal wear marks. The mating surfaces of the pilot disc showed no wear of any kind.

2. The pilot valve bellows (Part 14A) were intact and appeared undamaged.

3. The pilot disc (Part 10) had a 1/8-inch long discoloration on its seating surface. The discolored area could not be felt by hand, but could be the result of slight pilot leakage at some time in the past.

4. The main disc retaining plate and locking devices were in place and undamaged. It was noted that the central

screw in the retainer locking screw was twisted off. It is apparent that this had happened on a prior disassembly of the valve, as the intact part of the screw was staked in place and the lock wire had been attached to a rib in the valve cage.

5. The main disc (Part 3) and seat showed no evidence of leakage.

6. There was no metal upsetting on the disc, the seat or the disc stop, indicating the valve had not chattered or been subjected to excessive opening or closing loads.

7. The main disc guide (Part 5) showed no significant scoring or wear.

Photographs of selected parts as-disassembled are shown in Figures 6 through 10.

It was concluded by Babcock and Wilcox, Dresser Industries and EPRI representatives that the PORV assembly and internal parts were normal in every respect and showed no evidence of malfunction or damage as a result of the February 1980 transient or previous operation.

The safety valves (RCV-8 and -9) were removed for testing, disassembly and refurbishment at Wyle Laboratories, Huntsville, Alabama, and were not examined at CR-3. However, it is signficant that Florida Power Corporation representatives indicated that safety valve RCV-8 had a history of

leakage problems since its installation and had been refurbished by Florida Power Corporation maintenance personnel one or more times at CR-3 during the previous years of operation. Specifically, valve RCV-8 was reportedly leaking prior to the CR-3 transient in February 1980.

D. Laboratory Examinations and Tests of Safety Valves RCV-8 and RCV-9

The inspections and tests of safety valves RCV-8 and RCV-9 were performed at Wyle Laboratories in accordance with the Inspection and Test Guidelines given in Appendix A. These guidelines require the following:

- Disassembly and inspection of RCV-8 as received at Wyle. A special disassembly procedure was specified to remove the valve bonnet assembly without removing the main spring or changing the main spring preload.

- Reassembly and test of RCV-8 without refurbishment or change in any settings. The test was performed at rated temperature and pressure on steam, but at reduced capacity and valve lift.

- Complete disassembly and reinspection of RCV-8 after steam test.

- Refurbishment and re-certification test of RCV-8.

- Test of RCV-9 as received at Wyle.

- Disassembly and inspection of RCV-9 after steam test.
- Refurbishment, reassembly and re-certification test of RCV-9.

The main results of these inspections and tests are summarized below.

1. Inspection of RCV-8

Safety valve RCV-8 was examined and photographed as received, was cleaned sufficiently to permit handling and was disassembled for further examination. Results of these inspections indicated the following:

- The internal surfaces of the valve showed evidence of leakage. A black deposit, believed to be magnetite, was apparent over the majority of the internal surfaces of the valve. Photographs of RCV-8 prior to disassembly are presented in Figures 11 through 13.
- The valve seat and disc mating surfaces were extensively steam cut. Steam cutting resulted in several hundred radial marks across the seating faces with depths of several mils. The lower surface of the disc holder (Part 11) adjacent to the disc also showed erosion damage. Liquid penetrant examination of the seating surfaces of the seat and disc and the lower surface of the disc holder showed fine radial cracks 30-60 mils deep, scattered around the lower surface of the disc holder. These cracks were not visible to the unaided eye. The seat and disc were steam cut, but not cracked.
- Inspection of the adjusting rings, inlet nozzle, back pressure balancing bellows, disc guide and spindle revealed no evidence of damage, upset metal, galling or scoring. In particular, the mating surfaces which guide the spindle and disc assembly and the back stop area which limits the stroke of the valve showed no evidence of excessive loads, unstable operation or banging of internal parts.

- Two abnormal conditions were found. First, the anti-rotation pin (identified as Part 8d in Figure 3) was found dislodged inside the bonnet cavity. This pin was bent and had become disengaged from the upper spring washer and fallen into the valve bonnet cavity. This anti-rotation pin serves no functional purpose in the valve. Rather, its purpose is to prevent rotation of the upper spring washer (Part 8c) during adjustment of the set pressure compression screw (Part 9). Since the upper spring washer does not move during valve operation, the deformation of the pin had to have occurred due to improper alignment of the pin and the mating slot in the bonnet during the initial assembly and compression of the main spring. According to the Dresser representative (Mr. Bolger), this problem has occurred in a number of applications and this feature of the valve design has been changed in later valves. Binding of this anti-rotation pin on the bonnet during set pressure adjustment could lead to misalignment of parts and thereby promote leakage (which obviously did occur), but it would not appear that this pin would have any effect on valve operation (subsequent tests of the valve without the pin confirmed this). Second, the clearances between the disc holder (Part 11), disc (Part 5) and disc nut (Part 6B) were incorrect. Figure 14 shows the bellows assembly and indicates the clearances that are specified between the disc, disc holder and disc nut to permit slight movement or rocking of the disc on top of the disc nut in order that the disc can self-align with the seat. Inspection of this assembly showed that insufficient clearance was available to permit any rocking or self-aligning of the disc. The inspection showed that assembly of the disc holder on the disc nut firmly retained the disc in the assembly. As a result, the disc was not able to self-align readily on the seat. The differences between the specified and actual clearances could be due to initial assembly errors or deformation of the parts in service. This dimensional discrepancy could explain the observed valve leakage history, but would have no effect on the operation of the valve or its response to steam or water flow.

  Results of dimensional measurements of this assembly are shown in Figure 14 and explain why there was insufficient clearance to prevent motion of the disc in the assembly.

- The set pressure compression screw on valve RCV-8 did not have the standard lock wire and Dresser seal normally installed to certify that the valve has been adjusted. Also, a piece of wire similar to bailing wire was installed to lock the adjusting ring pins. No Dresser certification seal was used.

Photographs of RCV-8 parts after disassembly are given in Figures 15 through 18.

Following the inspection of the parts of RCV-8, the valve was assembled without refurbishment in the same condition as received by Wyle. As discussed above, care was taken not to disturb the spring preload (set pressure) or adjusting rings.

2. Test of RCV-8

Reassembled valve RCV-8 was installed in the Wyle low capacity test facility for set pressure tests. The procedure used for these tests is the standard Wyle procedure for set pressure verification of Dresser safety valves and is included in Appendix B. In these tests, the safety valve is installed in the test facility, is allowed to heat up due to steam at the valve inlet at approximately 2200 psi and 650°F until temperatures recorded at the valve inlet, valve body, and the valve bonnet reach temperatures specified in the procedure and stabilize. This procedure takes 3 to 4 hours. Following temperature stabilization, valve RCV-8 was popped three times. The lift pressures were 2392 psig, 2388 psig and 2388 psig. Opening and closing of the

valve was normal during these tests with the exception that simmering of the valves occurred 1-2 seconds before each lift, due to the leakage from the valve. Measured valve lift and pressure traces are shown in Figures 19, 20, and 21. The leakage rate over the 4-hour period that the valve was installed on the test loop at approximately 2200 psi was between 1 and 1-1/2 gpm. The name plate set pressure for this valve is 2500 psig. It was noted that the lift pressure of about 2390 psig is approximately the same pressure at which this valve lifted during the transient at CR-3 in February 1980. The reason for the depressed lift pressure could not be determined as a result of these inspections, however, the most likely explanations are:

a. The valve lifted prematurely because of the effect of the leakage of steam through the valve, or

b. The valve was not adjusted properly initially.

In any case, the repeatable performance of the valve at CR-3 and in the test loop indicates that the lower than specified lift pressure was not related to the steam-water transient at CR-3.

3. Post-Test Inspection of RCV-8

Following completion of the performance test of RCV-8 it was completely disassembled and inspected. This inspection showed no change in the appearance of any

parts as compared to their condition prior to test. Photographs of RCV-8 parts following steam testing are presented in Figures 22 through 30.

In summary, there was no evidence of any damage due to the test or previous operation in the plant, except for the steam cutting and erosion of the seat, disc and adjacent surfaces due to the 1 to 1-1/2 gpm leak rate.

Following these inspections, RCV-8 was completely refurbished and reassembled for set pressure adjustment and verification test.

4. Steam Test of RCV-9

Safety valve RCV-9 was inspected and photographed as received and was installed on the test loop for set pressure test. Photographs of RCV-9 as received are shown in Figures 31 through 33. The test procedure and facility used were the same as for RCV-8. The tests of RCV-9 resulted in lift pressures of 2472 psig, 2466 psig and 2466 psig. There was no steam leakage before, during or after these tests. Operation of the valve was normal in every respect.

5. Inspection of RCV-9

Safety valve RCV-9 was removed from the test facility, disassembled and inspected. Results of these inspections showed no evidence of distress, leakage or abnormal

operation. The one problem noted was that, similar to the situation in the case of valve RCV-8, the anti-rotation pin (Part 8D) was missing from the upper spring washer (Part 8C). While this pin could not be located, it was apparent from the elongation of the hole in the upper spring washer that this pin had also been bent and dislodged at some point, probably during assembly of the valve. The lack of this pin obviously had no effect on the performance of RCV-9. Following these inspections, valve RCV-9 was decontaminated, lightly lapped and reassembled for set pressure adjustment and verification tests. Photographs of RCV-9 parts after disassembly are shown in Figures 34 through 37.

6. Decontamination of RCV-8 and RCV-9

During disassembly, inspection and reassembly work on valves RCV-8 and 9, all parts were decontaminated by wiping and, in the case of the valve internal parts and trim, by the use of an ultrasonic bath. Following cleaning of the valves, the valves retained sufficient contamination to preclude unrestricted shipment. For this reason, refurbished and re-certified valves RCV-8 and RCV-9 were returned to Florida Power Corporation for use as plant spares.

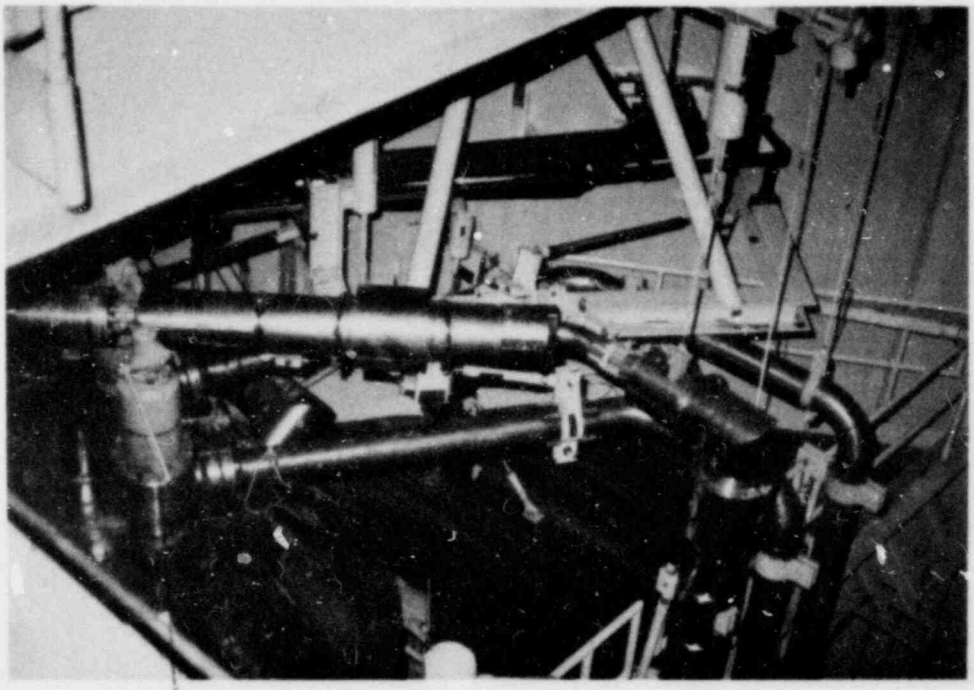
Pertinent data from the Wyle Laboratories report of the testing of RCV-9 and RCV-9 are included in Appendix C.

The results of the inspections and tests of RCV-8 and RCV-9, as summarized above, indicated the following:

a. Inspection of valves RCV-8 and RCV-9 revealed no evidence of damage or abnormal wear due to the plant transient or shop tests. Specifically, RCV-8 showed no evidence of instability or excessive loads due to the steam or water discharge which occurred during the February 1980 transient.

b. Safety valve RCV-9 had a lift pressure approximately within tolerance as received by Wyle. Valve RCV-8 exhibited a lift pressure approximately 100 psi low in the same manner that it operated during the February 1980 transient at CR-3. While the reason for the low set pressure was not specifically identified, it does not appear that it was in any way related to the circumstances of the February 1980 transient. Instead, it is likely that the valve operated at a low lift pressure as a result of either improper adjustment of the set pressure initially, the effect of the leakage through the valve, or both.

c. Contamination levels of the valves after decontamination by Wyle are still such that the valves are not suitable for unrestricted shipment. As a result, it will probably not be possible to test valve RCV-8 or RCV-9 in the EPRI full flow safety and relief valve test program.



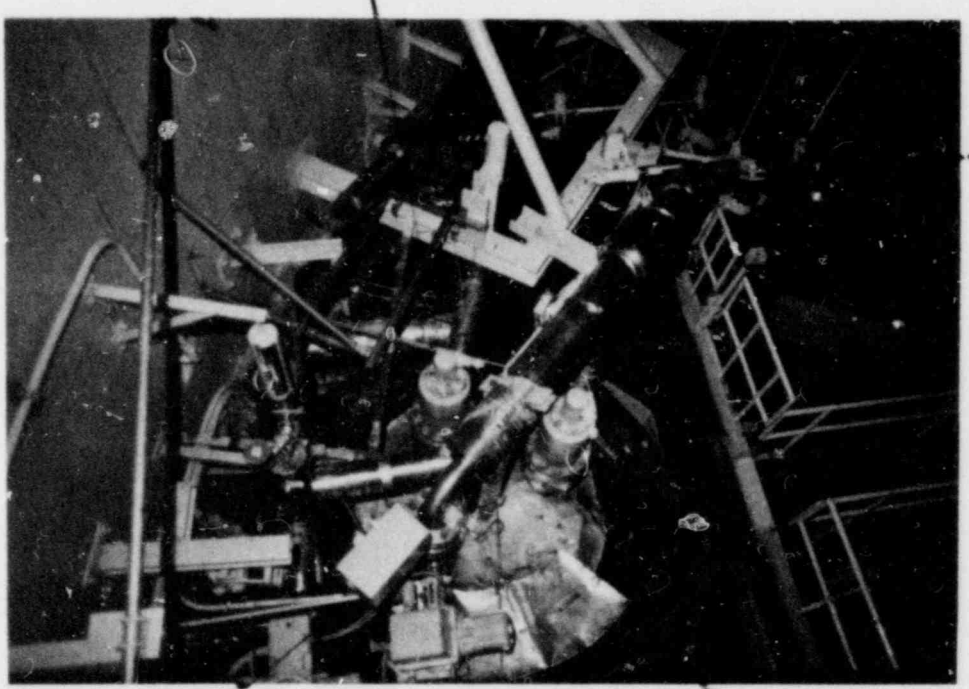


Figure 1. SAFETY VALVE AND PORV INSTALLATION ON PRESSURIZER

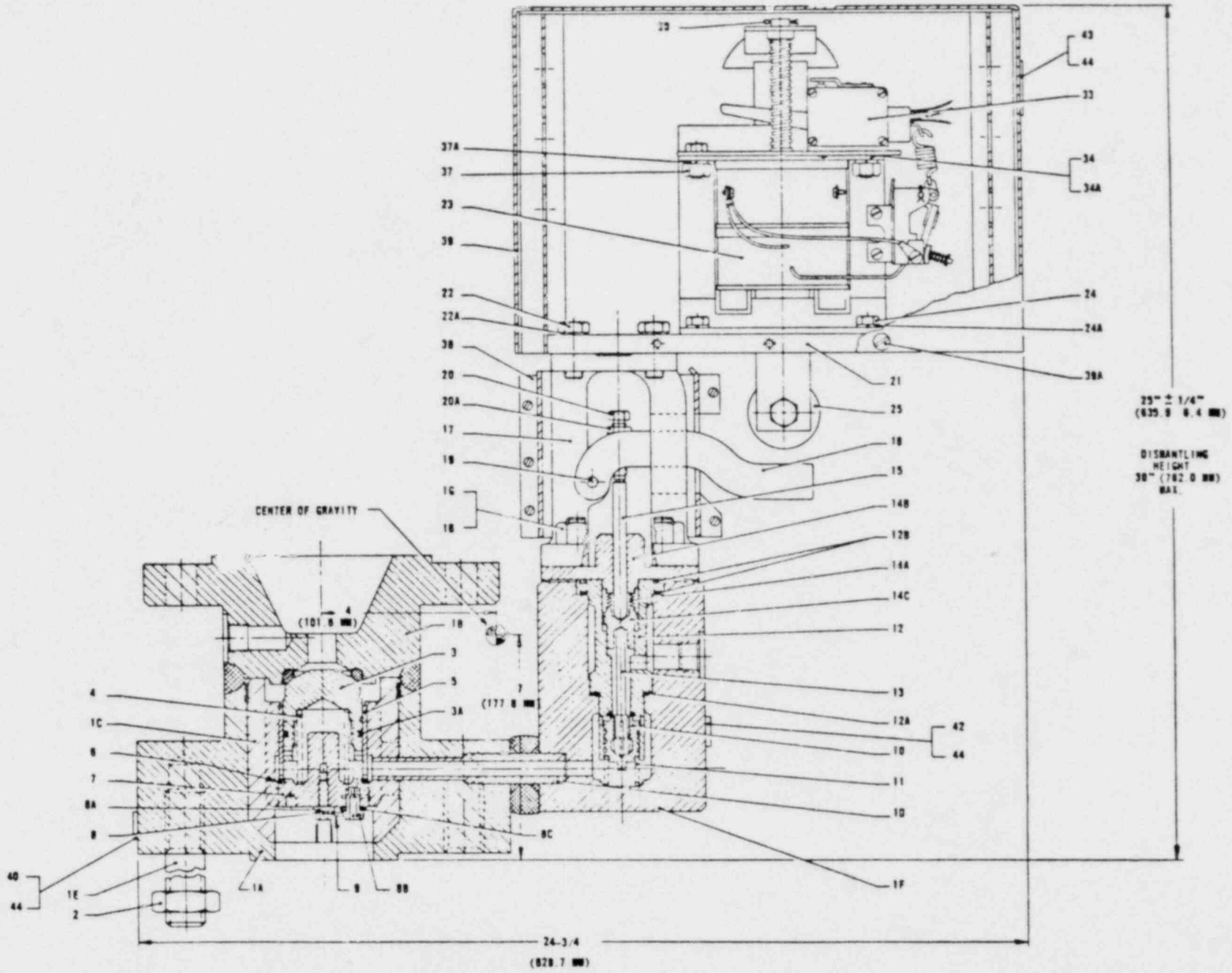


FIGURE 2 - DRESSER ELECTROMATIC PORV (RCV-10)

REF. NO.	QTY.	NOMENCLATURE
1	1	MAIN BASE-PILOT BASE ASSEM. (WELDED, INTEGRAL ASSEM.)
1A	1	INLET FLANGE
1B	1	OUTLET FLANGE
1C	1	CAGE
1D	1	TUBE INSERT
1E	8	MAIN BASE INLET STUD
1F	1	PILOT BASE
1G	4	PILOT BASE STUD
2	8	INLET STUD NUT
3	1	MAIN DISC
3A	1	PISTON RING
4	1	MAIN DISC SPRING
5	1	GUIDE
6	1	GUIDE GASKET
7	1	GUIDE RETAINER PLUG
8	1	RETAINER PLUG CAP SCREW
8A	1	CAP SCREW LOCKWASHER
8B	1	LOCK SCREW
8C	1	LOCK SCREW LOCKWASHER
9	1	SEAL WIRE
10	1	PILOT DISC
11	1	PILOT DISC SPRING
12	1	SEAT BUSHING
12A	1	LOWER GASKET
12B	2	UPPER GASKET
13	1	LOWER SPINDLE
14	1	BELLOWS ASSEM. (WELDED, INTEGRAL ASSEM.)
14A	1	BELLOWS
14B		FLANGE
14C	1	PISTON
15	1	UPPER SPINDLE
16	4	PILOT STUD NUT
17	1	SOLENOID BRACKET
18	1	LEVER
19	1	LEVER PIN ASSEM.
19A	1	SHOULDER SCREW
19B	1	NUT

Figure 2 (Cont'd)

REF. NO.	QTY.	NOMENCLATURE
19C	1	BRACKET BUSHING
19D	2	LEVER BUSHING
19E	1	COTTER PIN
20	1	ADJUSTING SCREW
20A	1	LOCKNUT
21	1	BRACKET PLATE
22	4	BRACKET PLATE CAP SCREW
22A	4	LOCKWASHER
23	1	SOLENOID
24	4	SOLENOID CAP SCREW
24A	4	LOCKWASHER
25	1	PLUNGER HEAD
26	1	LEFT HAND SPRING GUIDE
27	1	RIGHT HAND SPRING GUIDE
28	2	PLUNGER SPRING
29	2	PLAIN SPRING WASHER
30	2	SPRING COTTER PIN
31	2	GUIDE BRACKET
32	1	GUIDE BRACKET BOLT
32A	1	LOCKWASHER
32B	1	NUT
33	1	SWITCH
34	2	SWITCH MACHINE SCREW
34A	2	LOCKWASHER
35	3	SPRING GUIDE CAP SCREW
36	1	SPECIAL SPRING GUIDE SCREW
37	4	SPRING GUIDE NUT
37A	4	LOCKWASHER
38	1	BRACKET COVER ASSEM.
38A	1	LEFT HAND COVER
38B	1	RIGHT HAND COVER
38C	5	MACHINE SCREW
38D	5	LOCKWASHER
38E	5	NUT
39	1	SOLENOID COVER
39A	6	MACHINE SCREW
40	1	NAMEPLATE
41	1	TAG PLATE
42	1	CAUTION PLATE
43	1	SOLENOID NAMEPLATE
44	10	NAMEPLATE SCREW

Figure 2 (Cont'd)

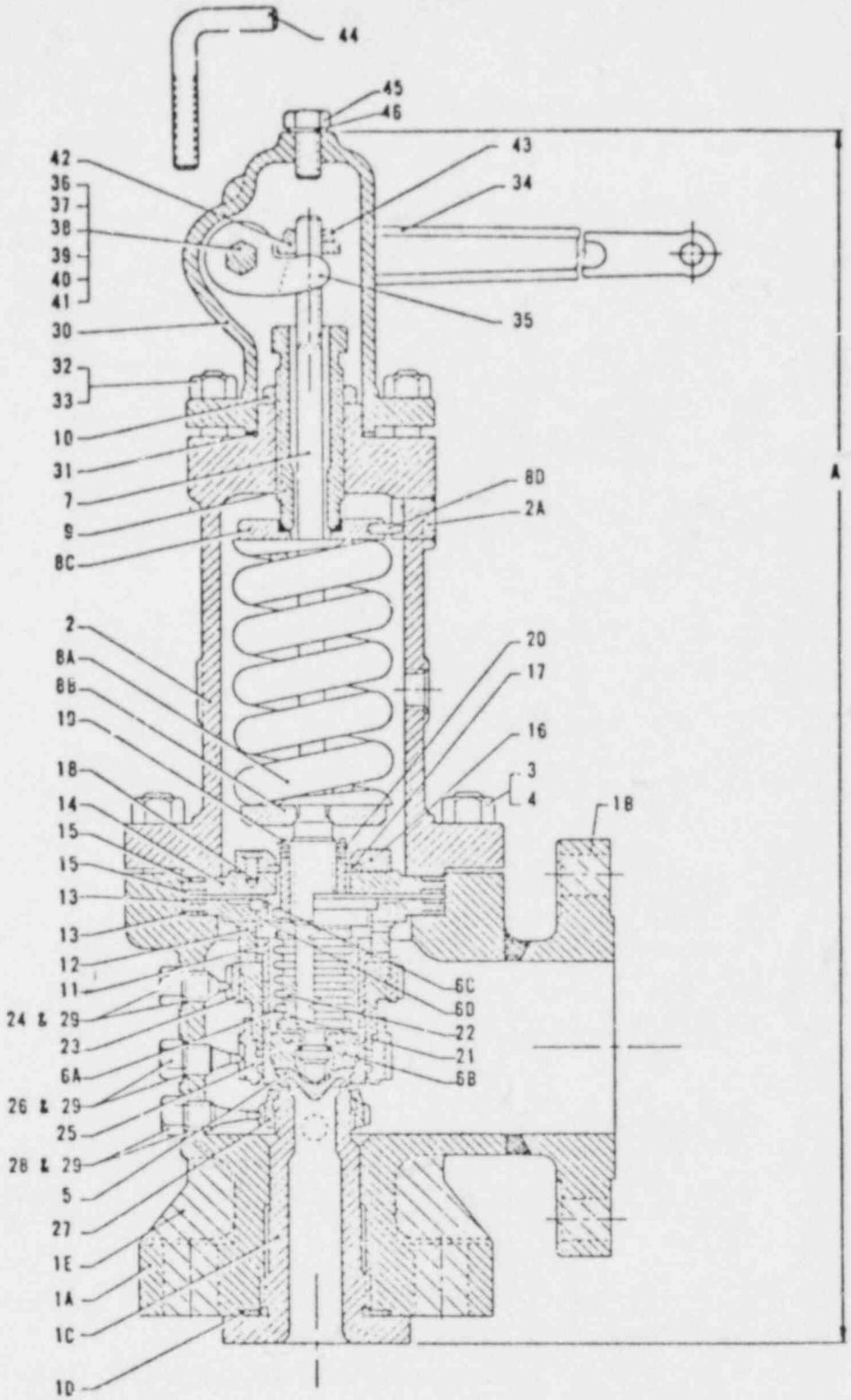


Figure 3. DRESSER SAFETY VALVE

TYPE 2-1/2-31739A-1 - X Rev 8 ¢ 9
3-31739A-1
3-31759A-1
4-31749A-1

TYPE	A IN MM	DISMANTLING HEIGHT IN MM
31739A-1	41-5/8 1057.3	66-1/4 1682.8
31749A-1	45-1/2 1155.7	70 1778.0
31759A-1	45-1/2 1155.7	70 1778.0

TYPE 2-1/2 - 31739A-1
3 - 31739A-1
3 - 31759A-1
4 - 31749A-1

REF NO	QTY	NOMENCLATURE
1		BASE ASSEMBLY
1A	1	BASE
1B	1	OUTLET FLANGE
1C	1	NOZZLE
1D	1	C Seal or gasket
1E	4	WEB
2	1	BONNET
2A	1	BONNET PLUG
3	12	BONNET STUD
4	12	BONNET STUD NUT
5	1	DISC
6		BELLOWS ASSEMBLY
6A	1	BELLOWS
6B	1	DISC NUT
6C	1	FLANGE
6D	1	FLANGE ADAPTOR
7	1	SPINDLE
8		SPRING & WASHER ASSEMBLY
8A	1	SPRING
8B	1	BOTTOM SPRING WASHER
8C	1	TOP SPRING WASHER
8D	1	PIN
9	1	COMPRESSION SCREW
10	1	COMPRESSION SCREW NUT
11	1	DISC HOLDER
12	1	GUIDE
13	2	GUIDE GASKET
14	1	SUPPORT PLATE
15	2	SUPPORT PLATE GASKET
16	1	WASHER RETAINER
17	1	FLOATING WASHER
18	1	RETAINER CAP SCREW
19	1	LIFT STOP
20	1	LIFT STOP COTTER PIN
21	1	DISC COLLAR
22	1	DISC COLLAR COTTER PIN
23	1	UPPER ADJUSTING RING
24	1	UPPER ADJUSTING RING PIN

Figure 3 (Cont'd)

25	1	MIDDLE ADJUSTING RING
26	1	MIDDLE ADJUSTING RING PIN
27	1	LOWER ADJUSTING RING
28	1	LOWER ADJUSTING RING PIN
29	4	PIN GASKET
30	1	CAP
31	1	CAP GASKET
32	6	CAP STUD
33	6	CAP STUD NUT
34	1	LEVER
35	1	LIFTING FORK
36	1	LEVER NUT
37	1	LEVER SHAFT
38	1	PACKING
39	1	PACKING NUT
40	1	COLLAR
41	1	RETAINING RING
42	1	RELEASE NUT
43	1	RELEASE NUT COTTER PIN
44	1	GAG
45	1	GAG PLUG
46	1	GAG PLUG GASKET

Figure 3 (Cont'd)

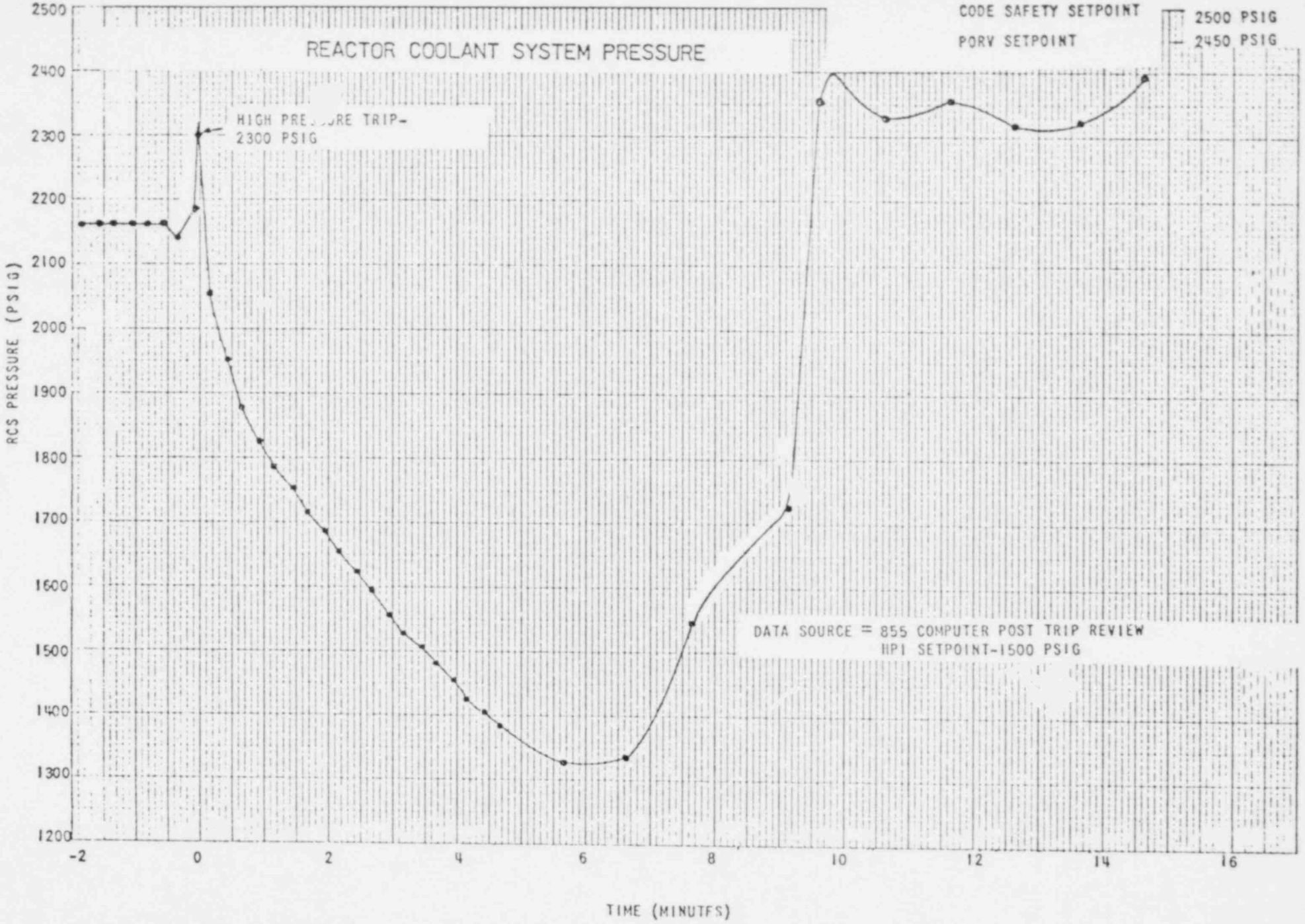

REACTOR COOLANT SYSTEM PRESSURE
CODE SAFETY SETPOINT
2500 PSIG
PORV SETPOINT
2450 PSIG
HIGH PRESSURE TRIP-
2300 PSIG
DATA SOURCE = 855 COMPUTER POST TRIP REVIEW
HPI SETPOINT-1500 PSIG
RCS PRESSURE (PSIG)
TIME (MINUTES)
2500
2400
2300
2200
2100
2000
1900
1800
1700
1600
1500
1400
1300
1200
-2
0
2
4
6
8
10
12
14
16

Figure 4.

CONTROL ROOM STRIP CHART OF
RC PRESSURE - (WIDE RANGE)

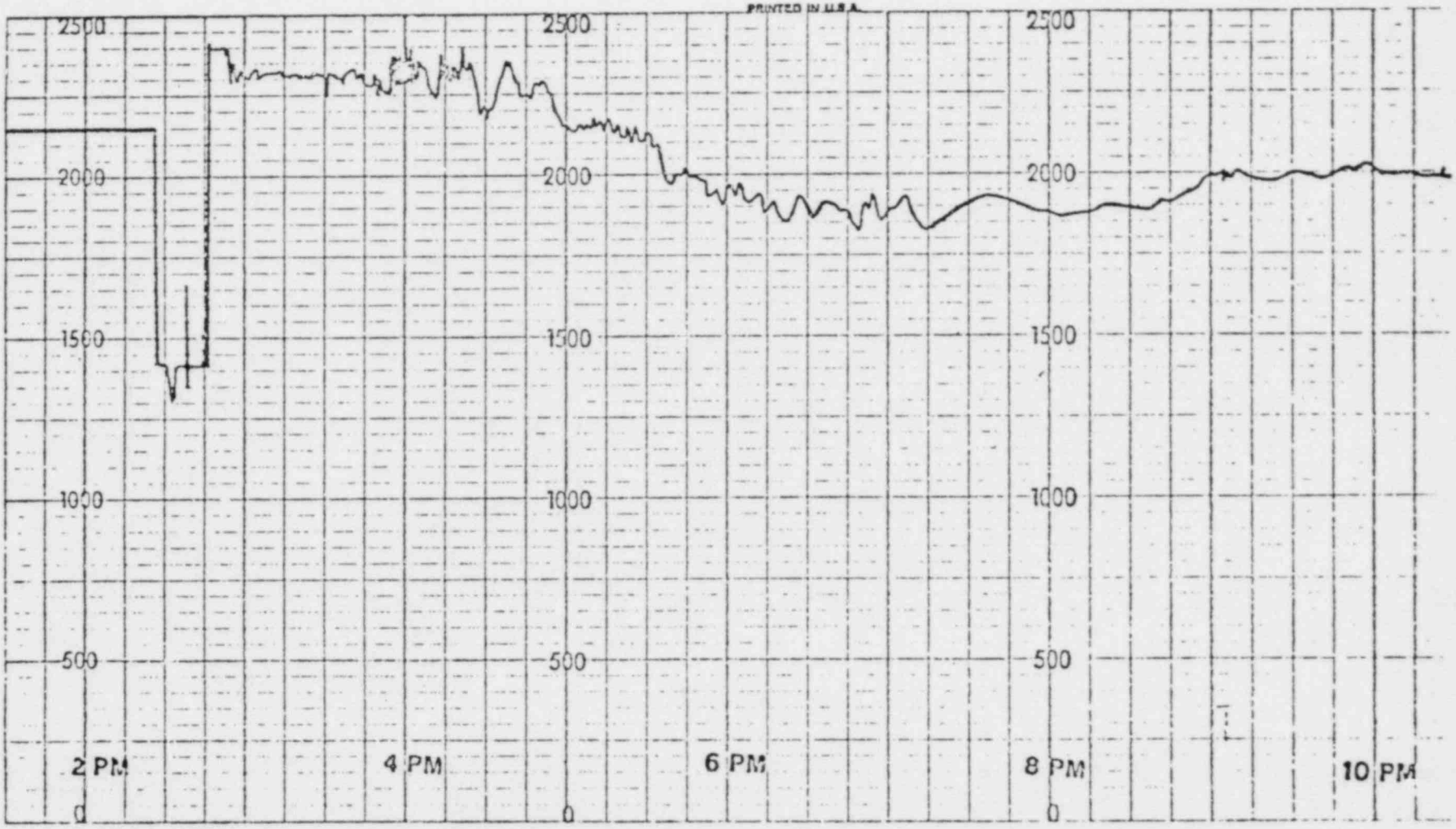


Figure 5.

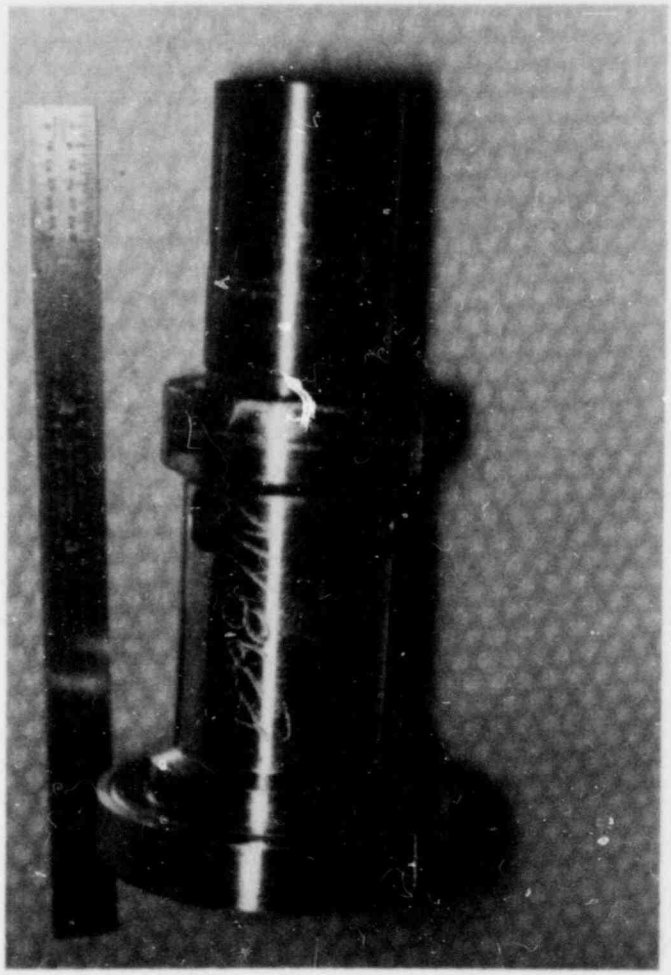


Figure 6. VALVE PILOT GUIDE (Part 12)

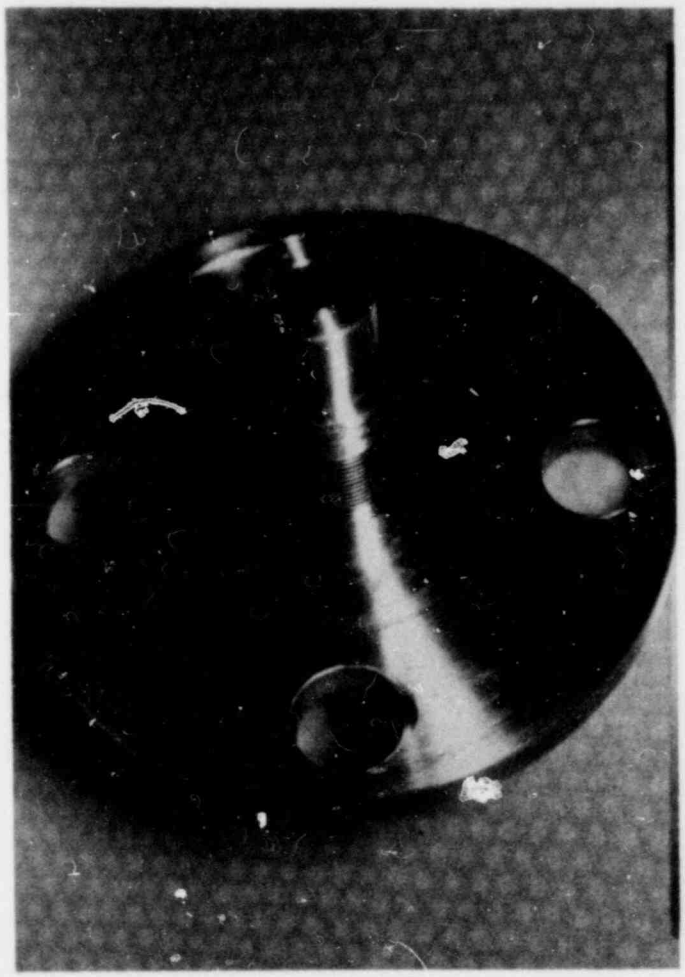


Figure 7. PILOT BELLOWS ASSEMBLY (Part 14)

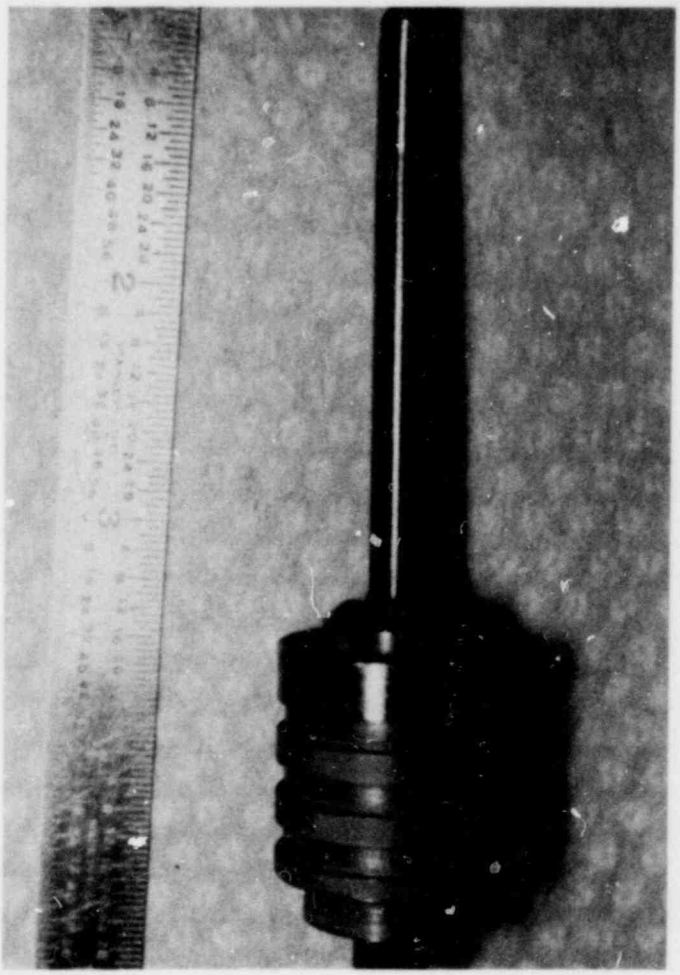


Figure 8. PILOT DISC (Part 10)

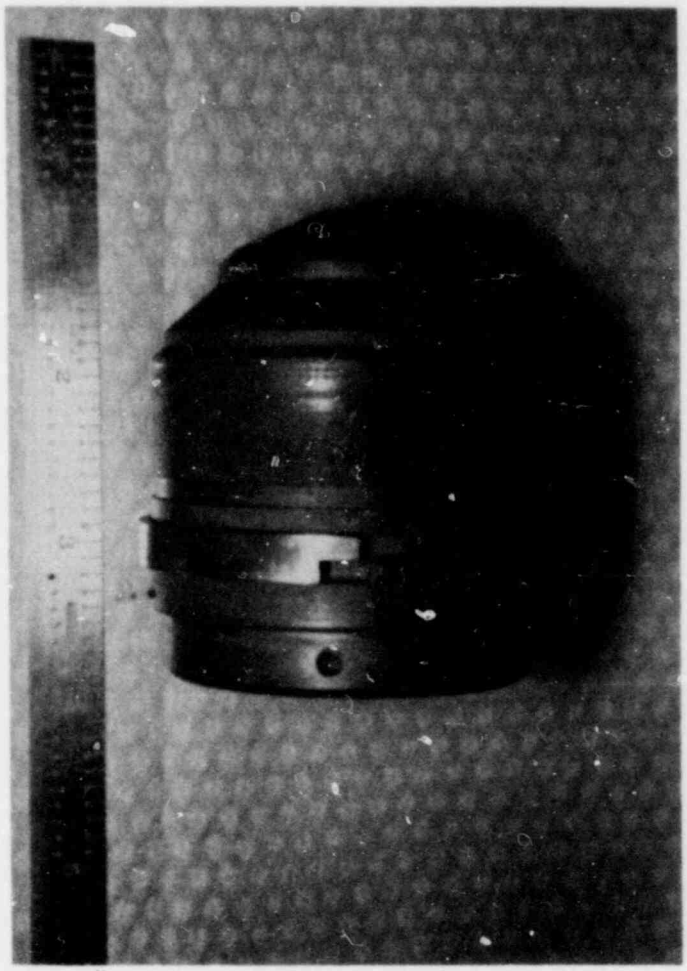


Figure 9. MAIN DISC (Part 3)

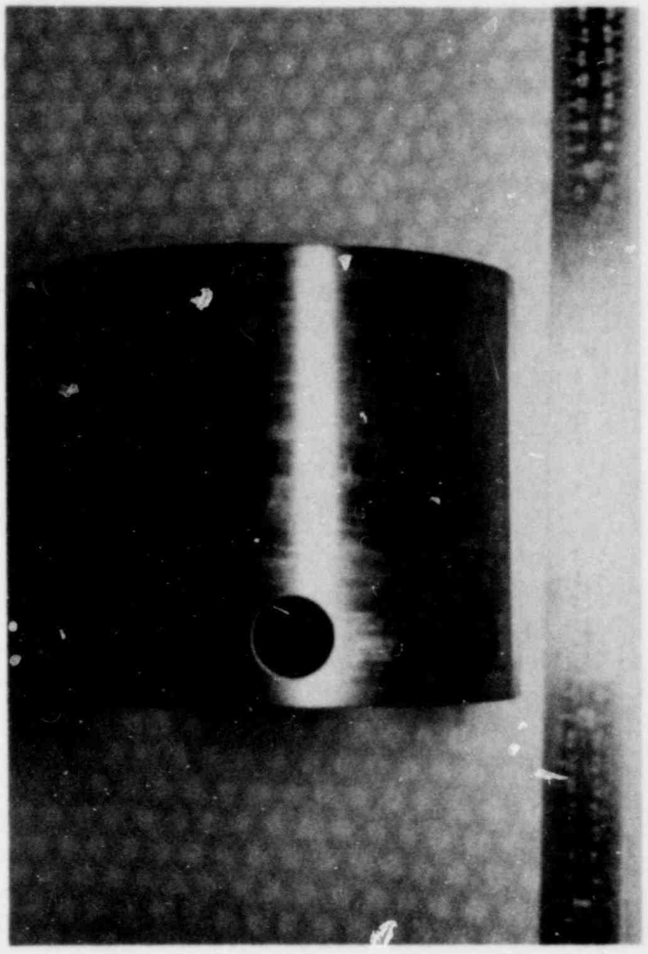


Figure 10. MAIN DISC GUIDE (Part 5)

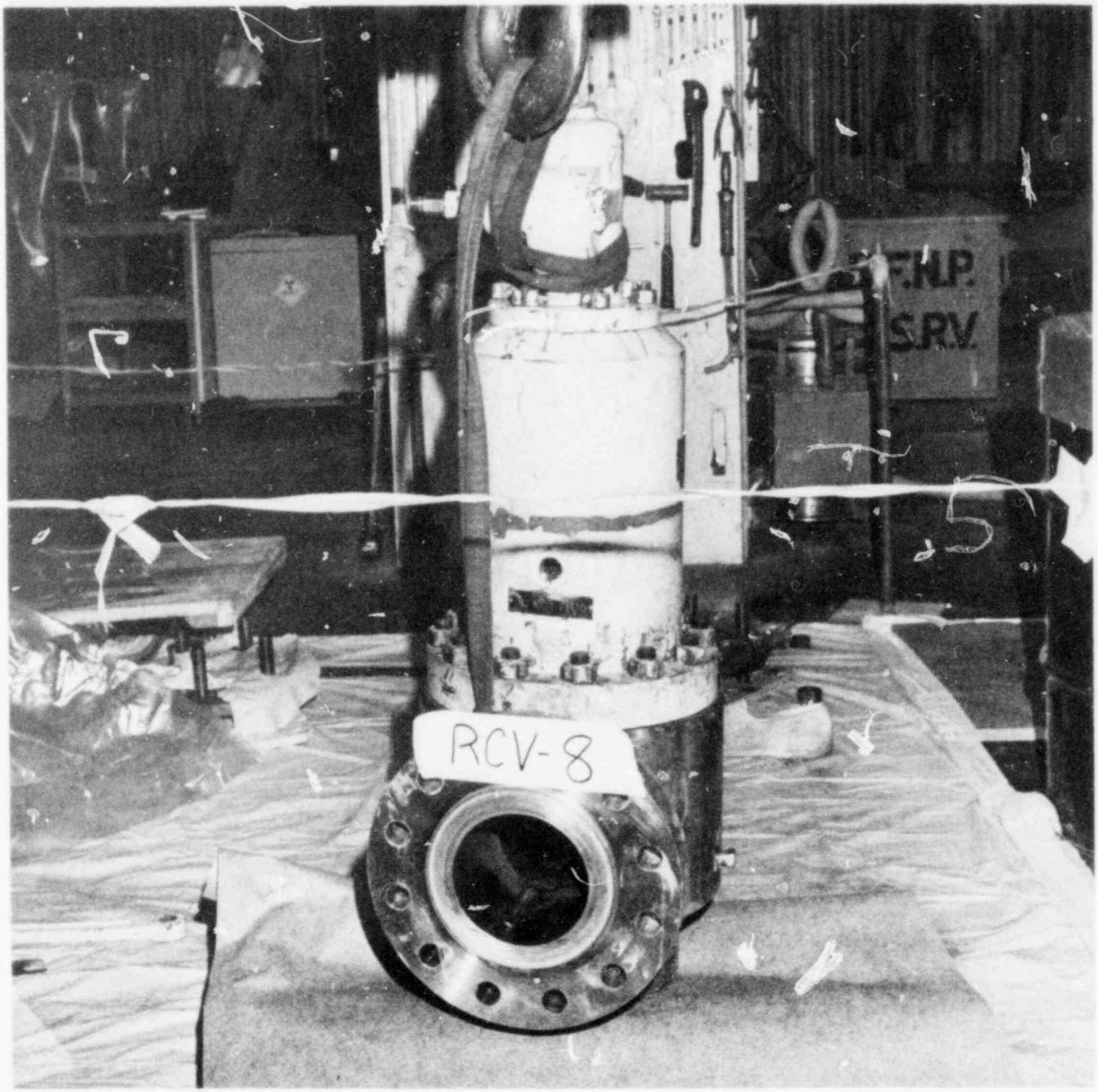


Figure 11. RECEIPT INSPECTION
OF RCV-8

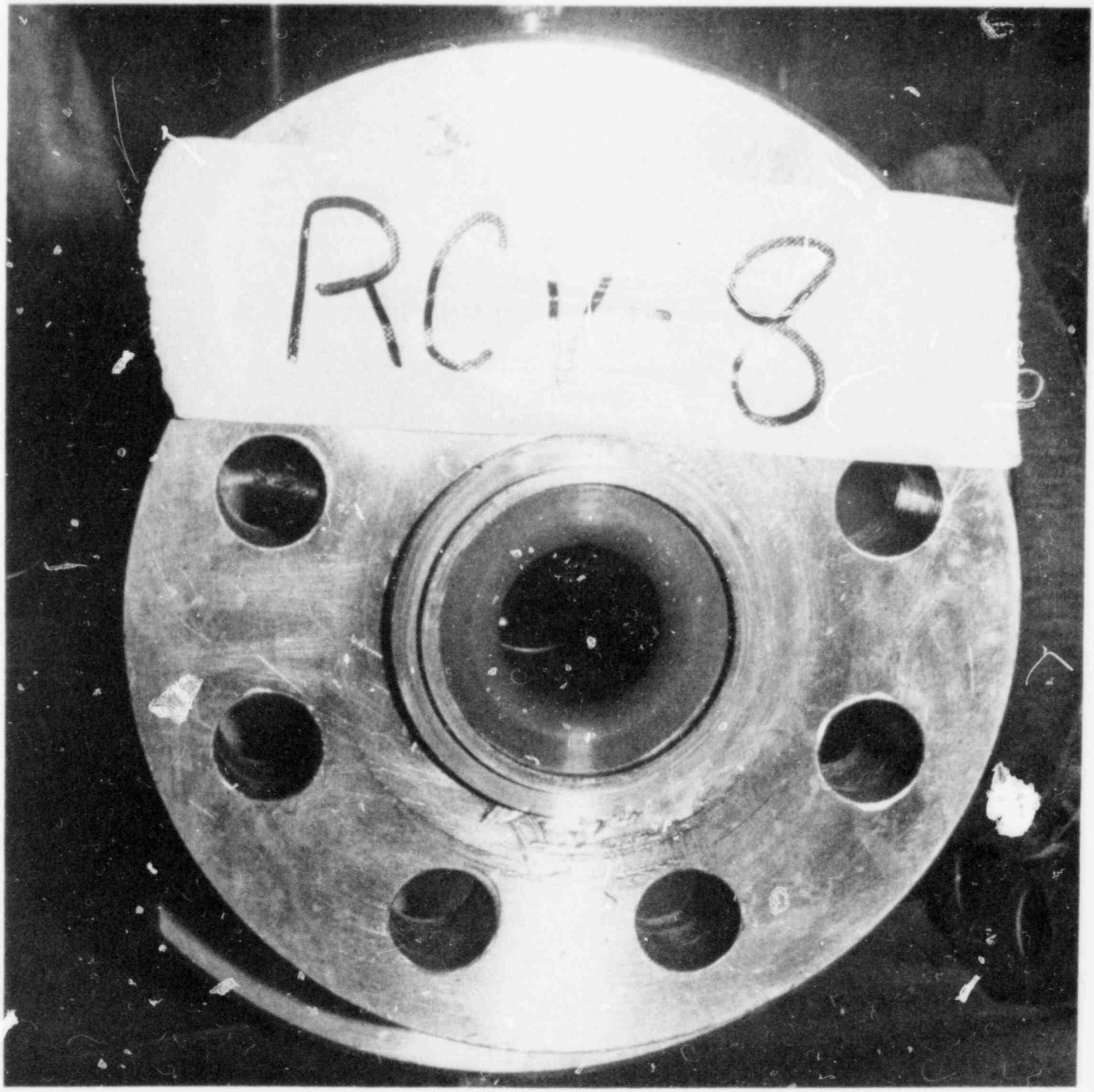


Figure 12. RECEIPT INSPECTION
OF RCV-8

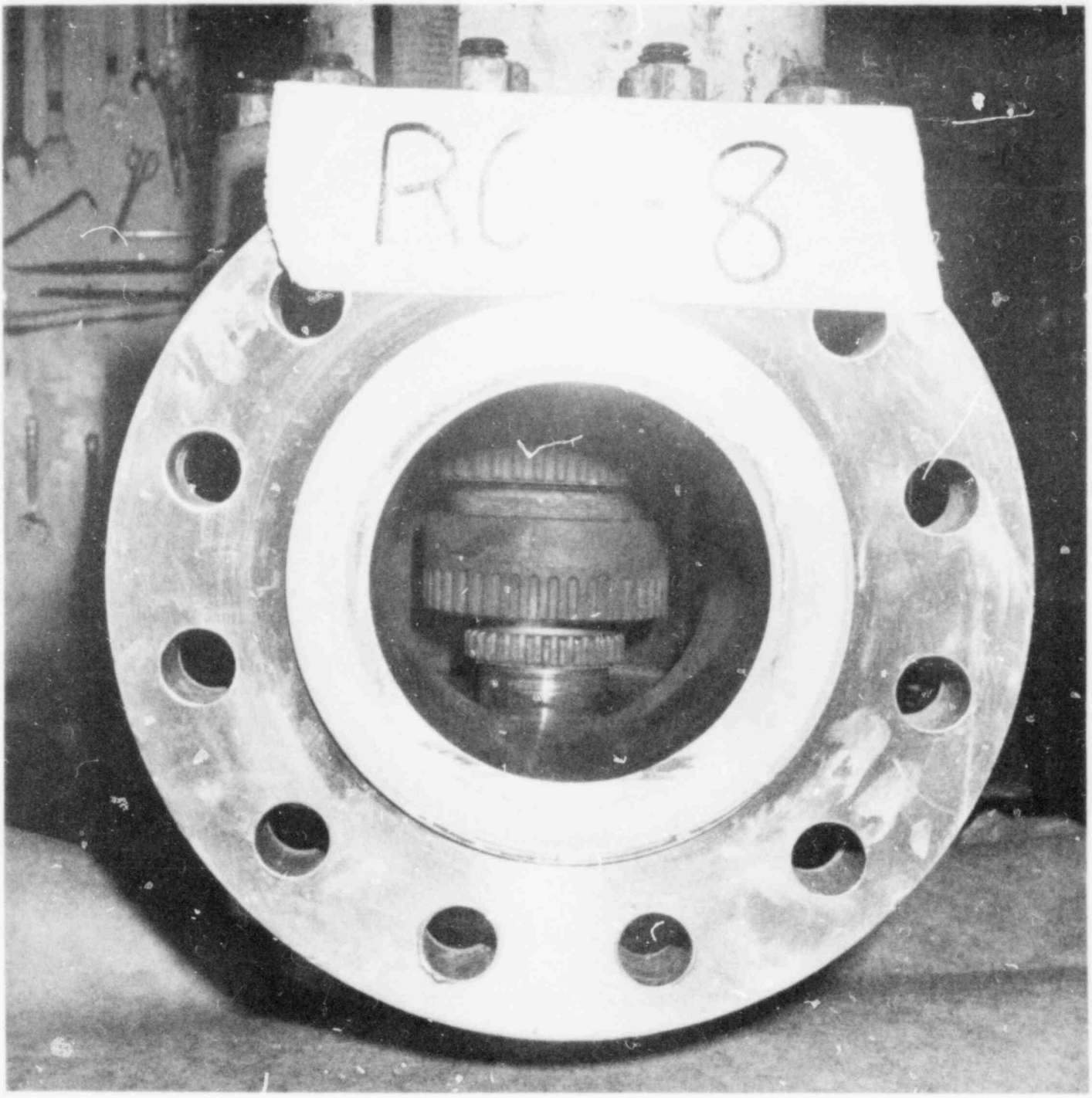


Figure 13. RECEIPT INSPECTION
OF RCV-8

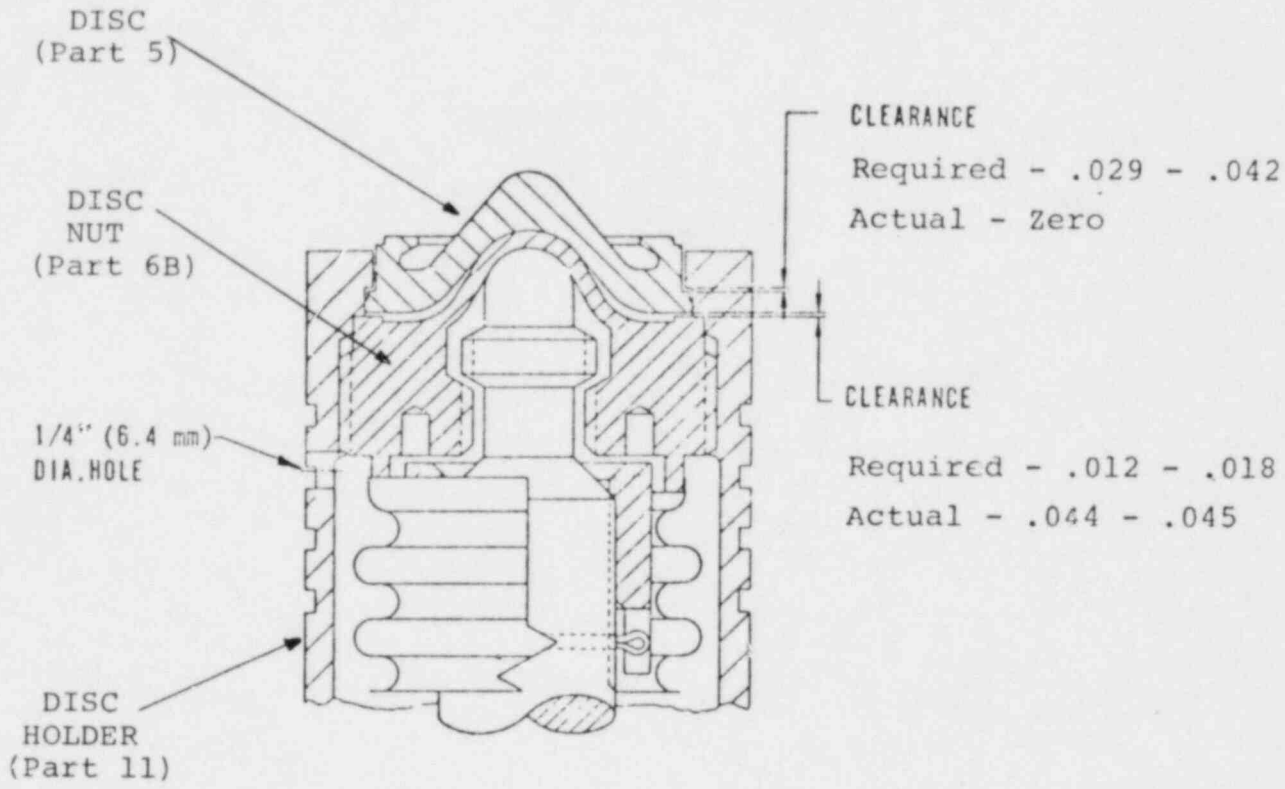


Figure 14. DISC TO BELLOWS CLEARANCE

Figure 15. PRE-TEST INSPECTION
OF RCV-8

Figure 16. PRE-TEST INSPECTION
OF RCV-8

Figure 17. PRE-TEST INSPECTION
OF RCV-8

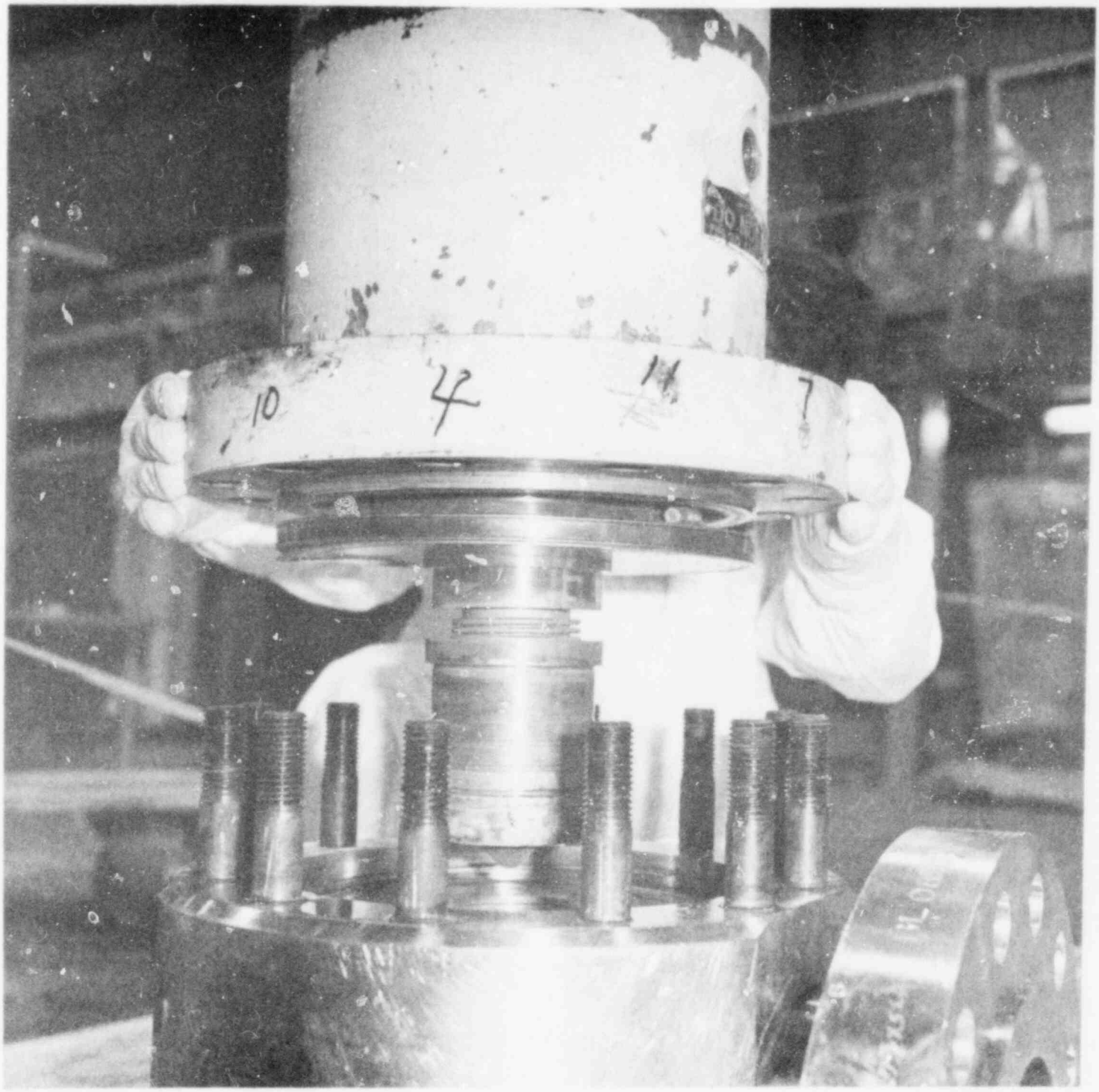


Figure 18. PRE-TEST INSPECTION
OF RCV-8

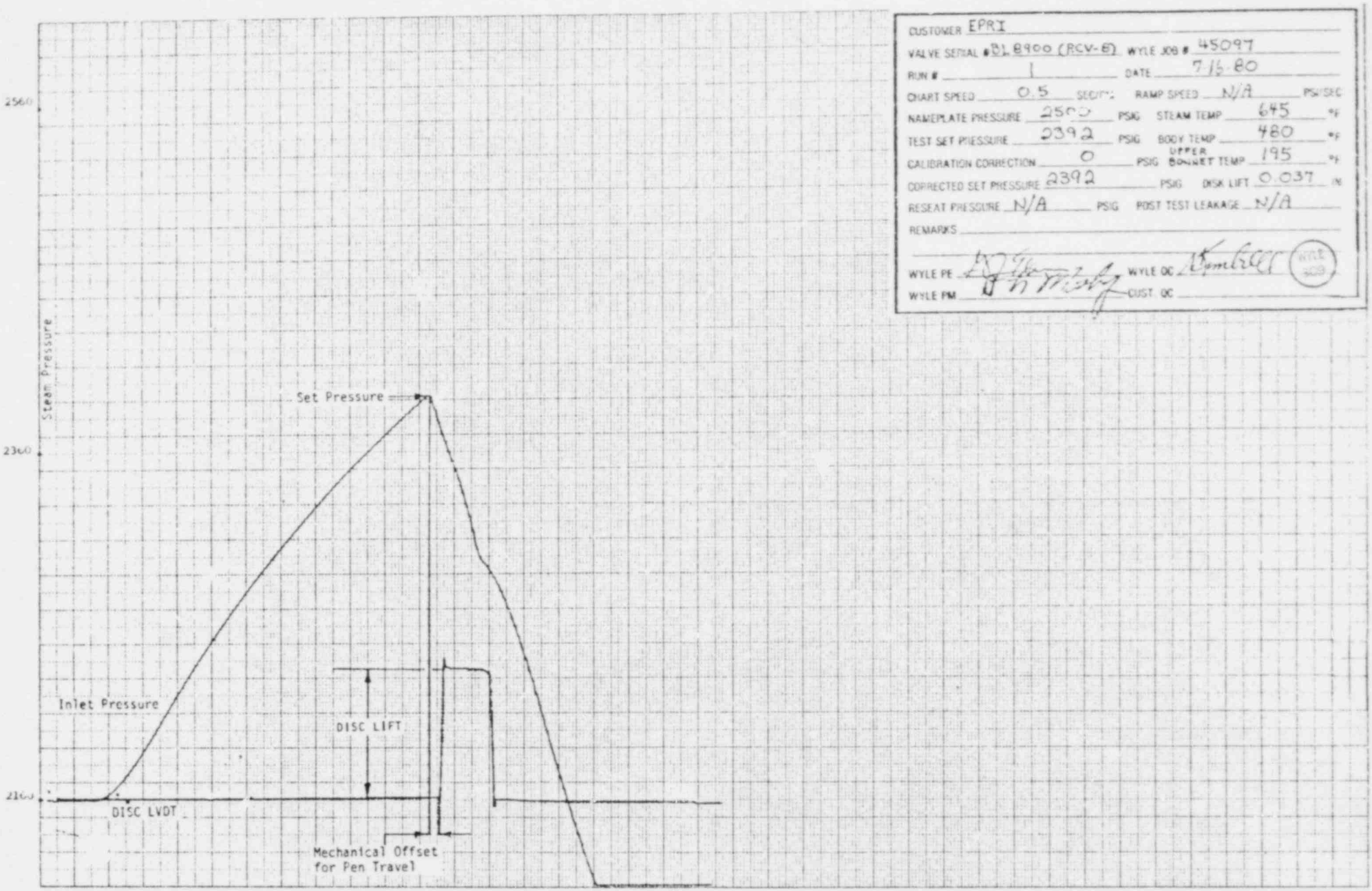


Figure 19. Lift and Pressure vs. Time - Test of RCV-8 - Run 1

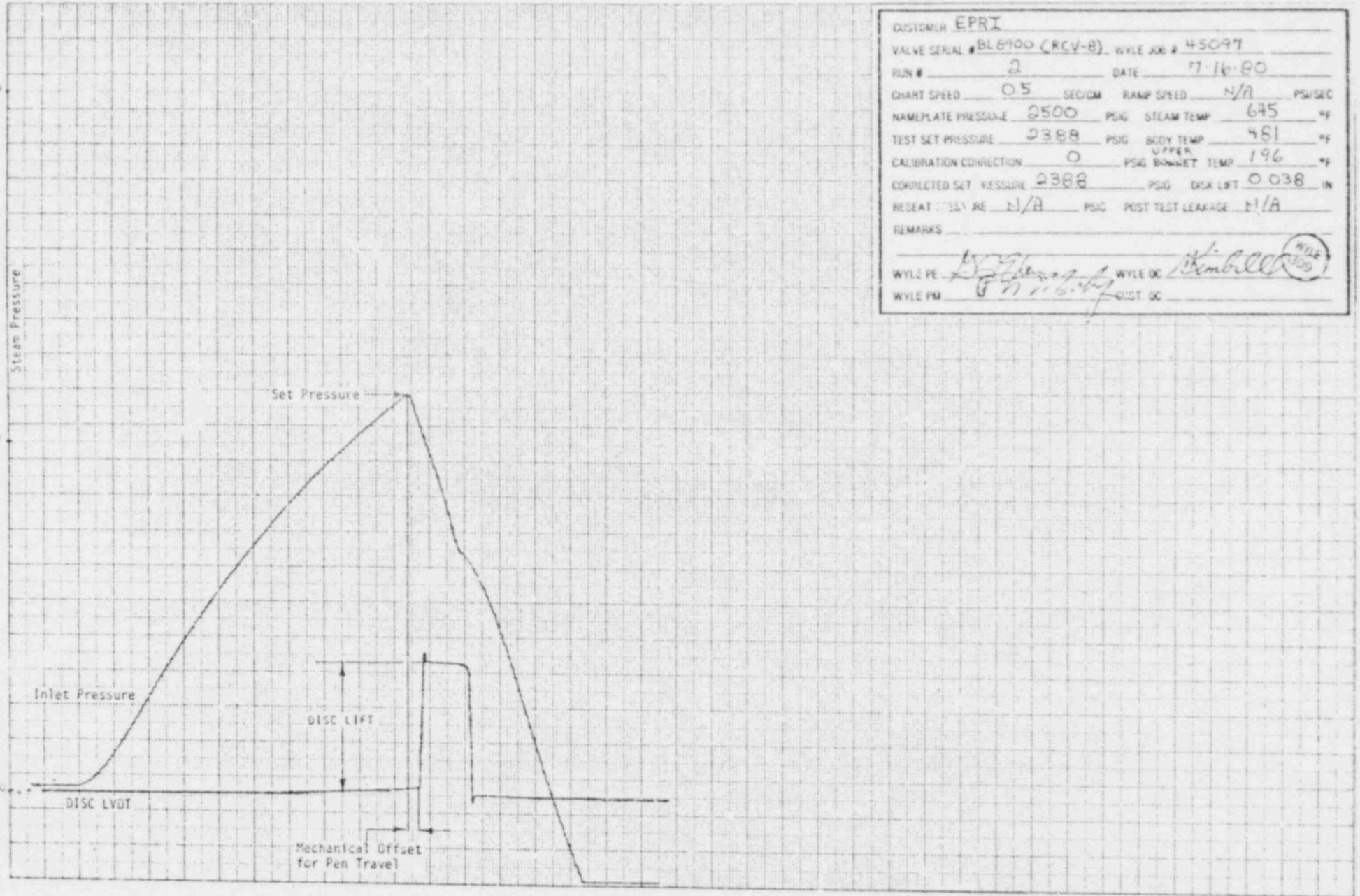


Figure 20. Lift and Pressure vs. Time - Test of RCV-8 - Run 2

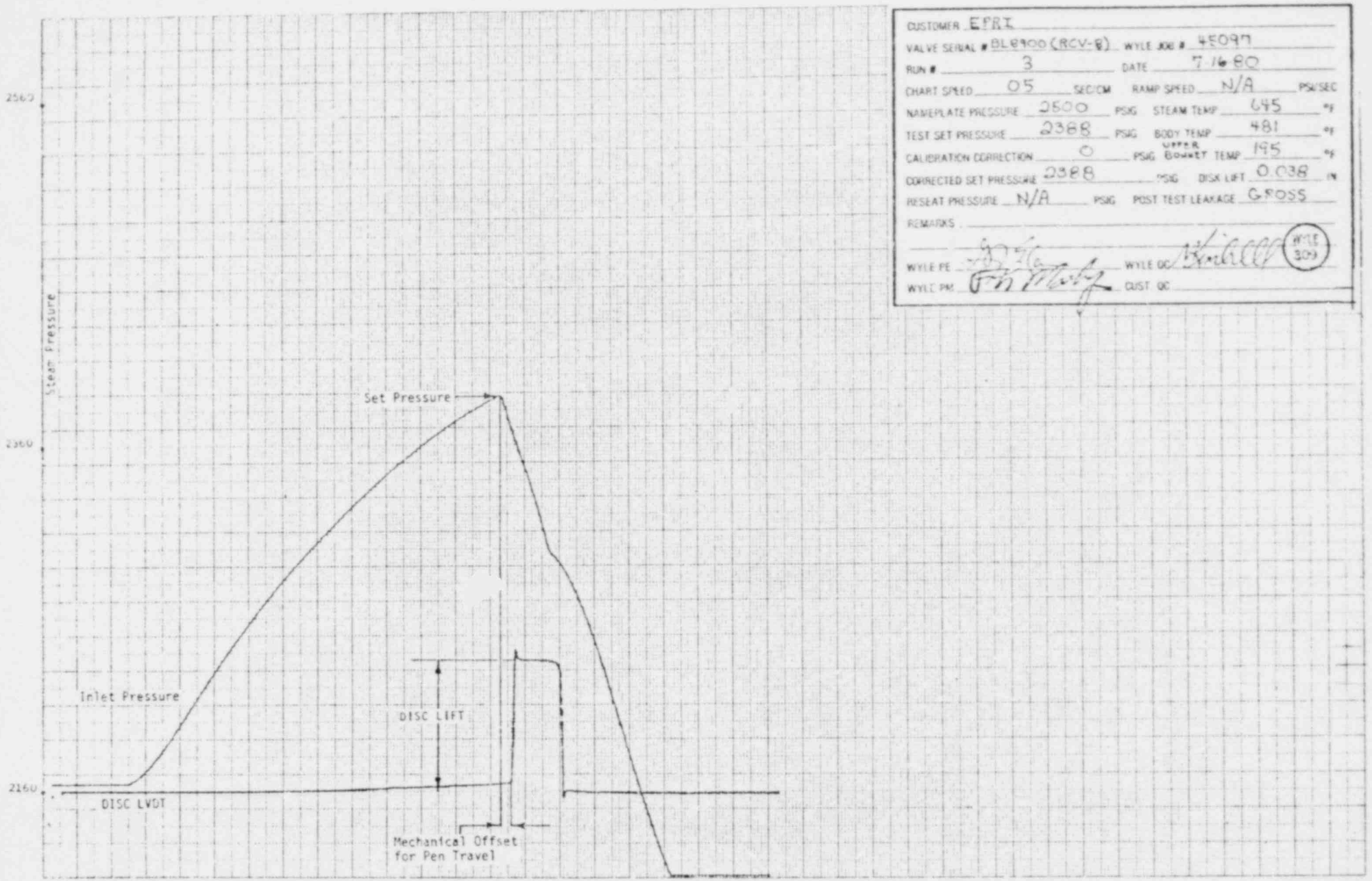


Figure 21. Lift and Pressure vs. Time - Test of RCV-8 - Run 3

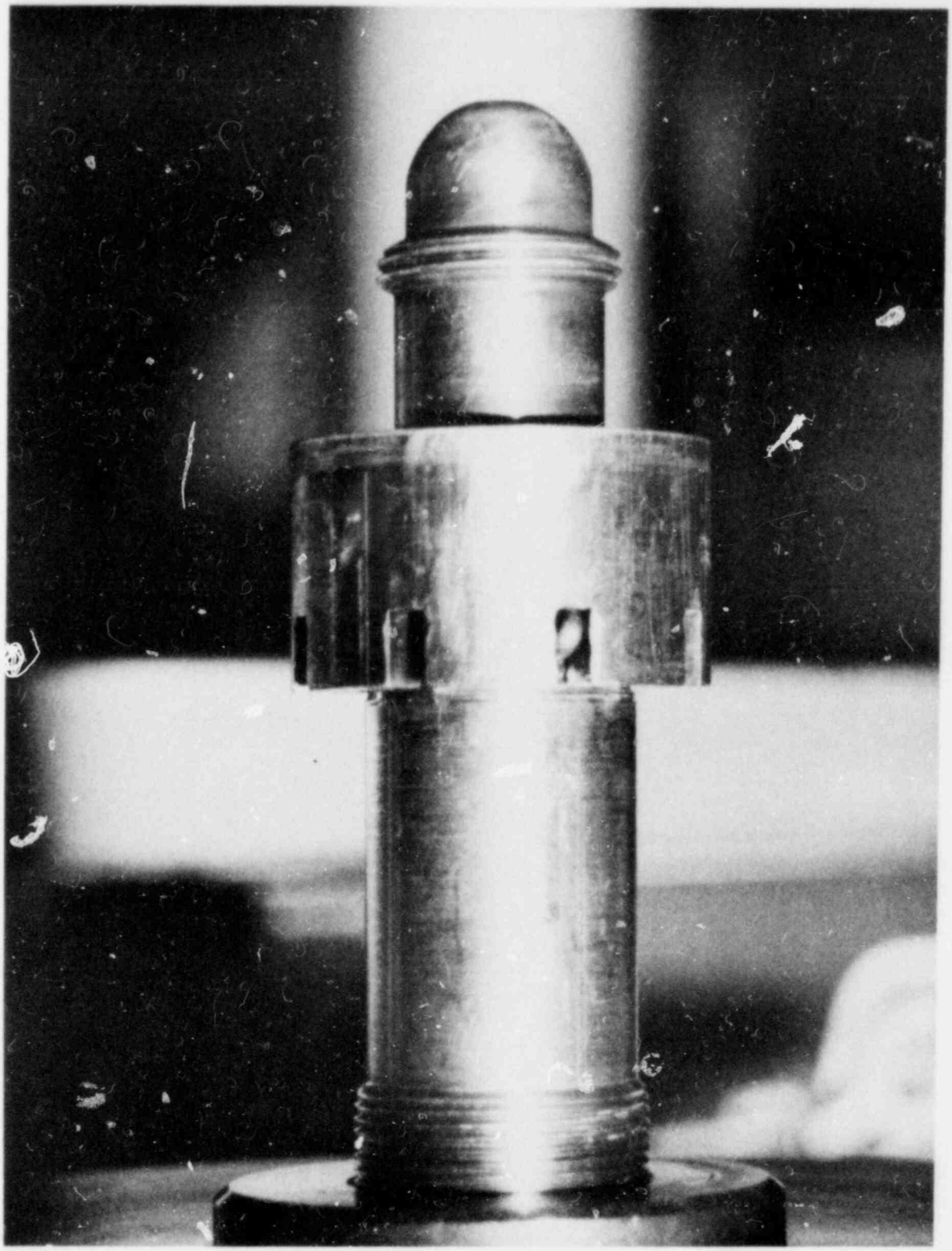


Figure 22. POST-TEST INSPECTION
OF RCV-8

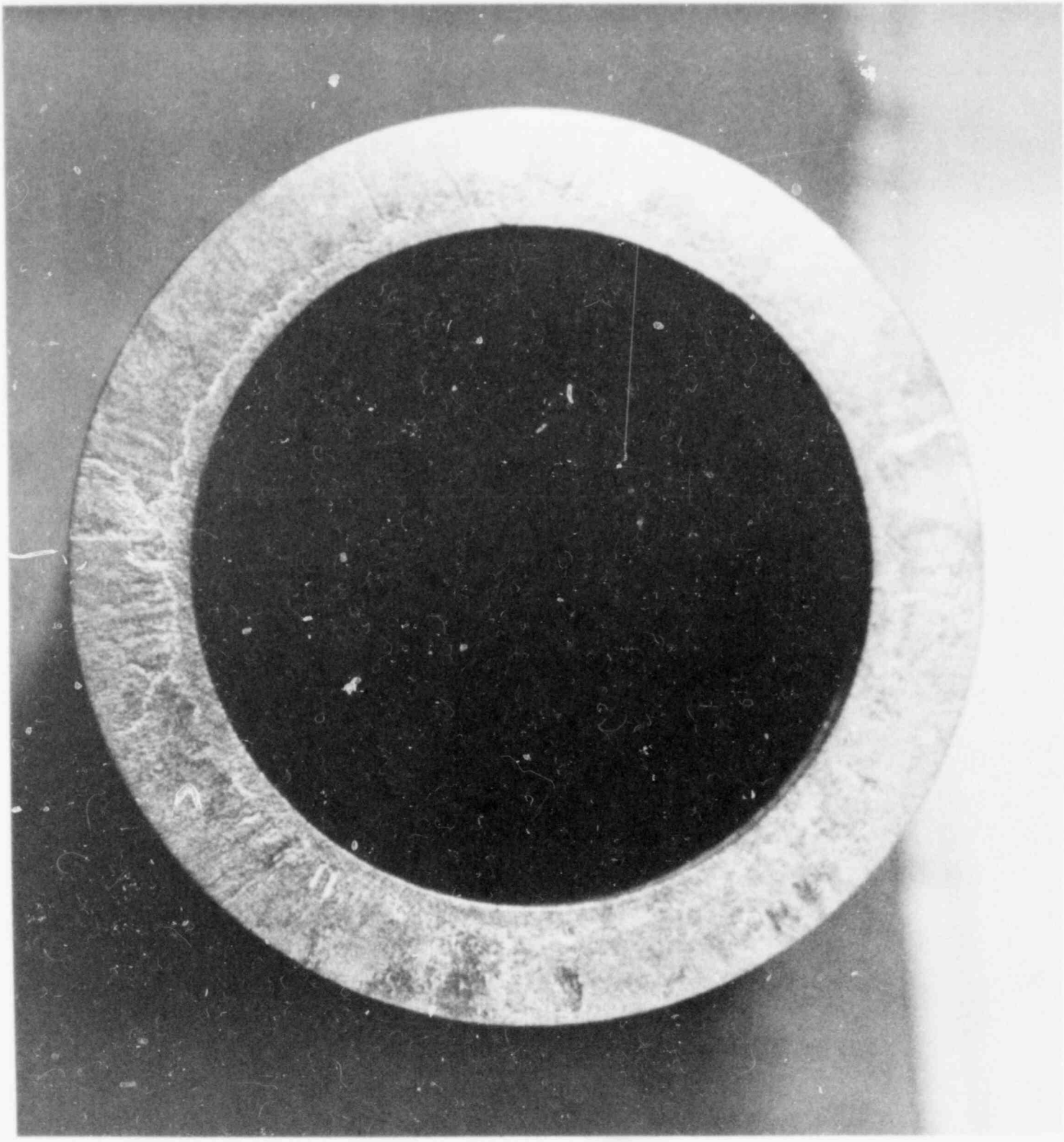


Figure 23. POST-TEST INSPECTION
OF RCV-8

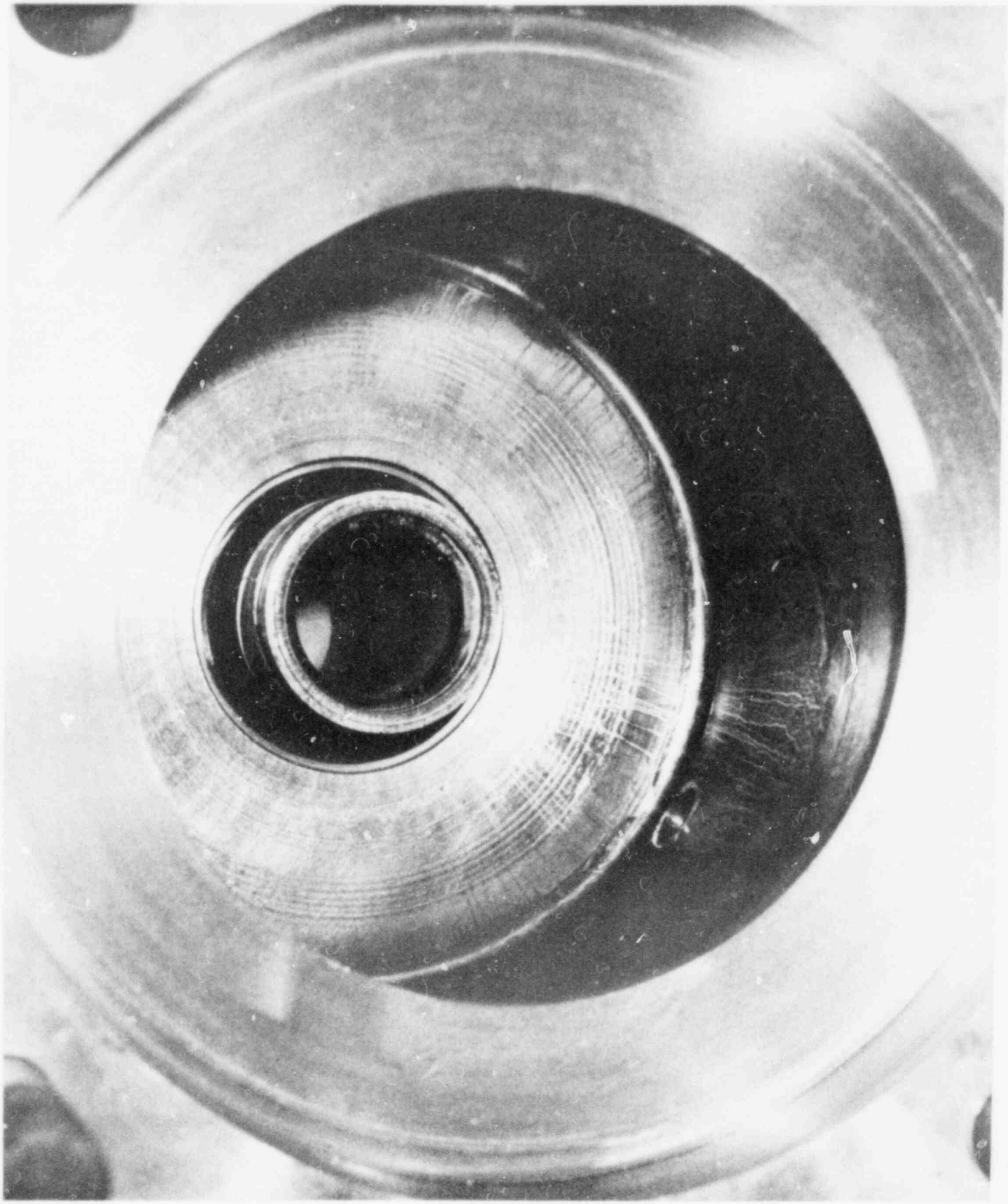


Figure 24. POST-TEST INSPECTION
OF RCV-8

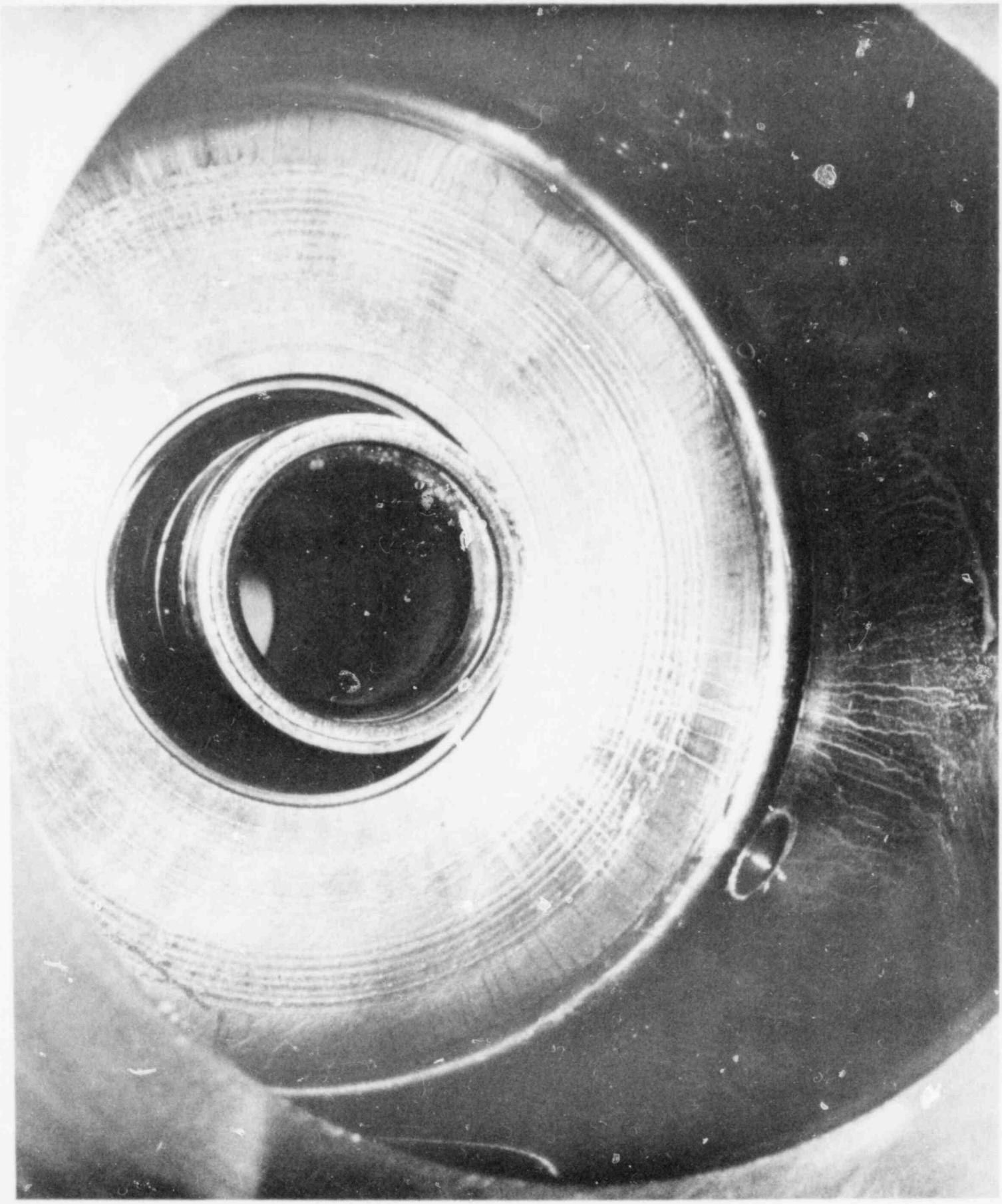


Figure 25. POST-TEST INSPECTION
OF RCV-8

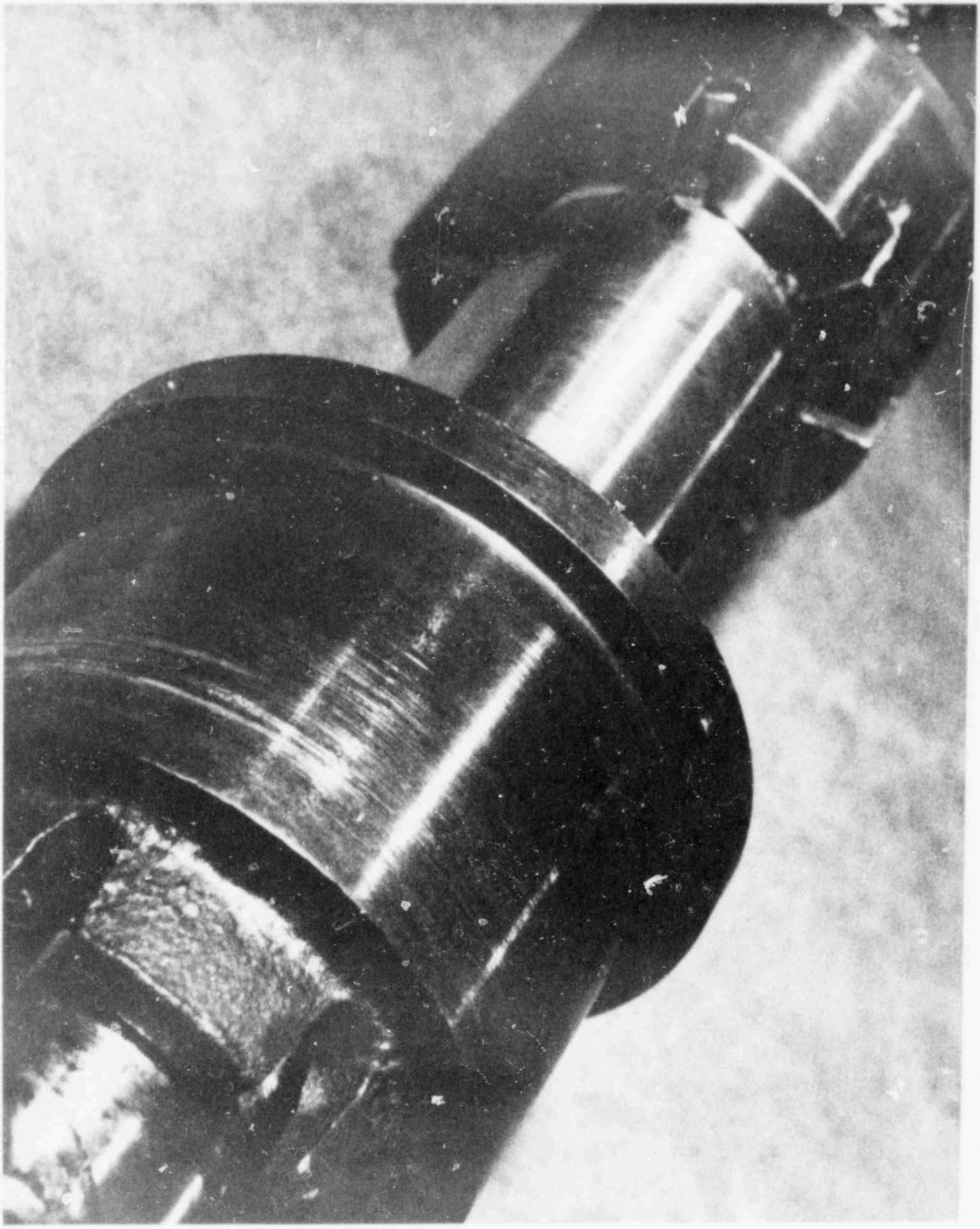


Figure 26. POST-TEST INSPECTION
OF RCV-8

Figure 27. POST-TEST INSPECTION
OF RCV-8

Figure 28. POST-TEST INSPECTION
OF RCV-8

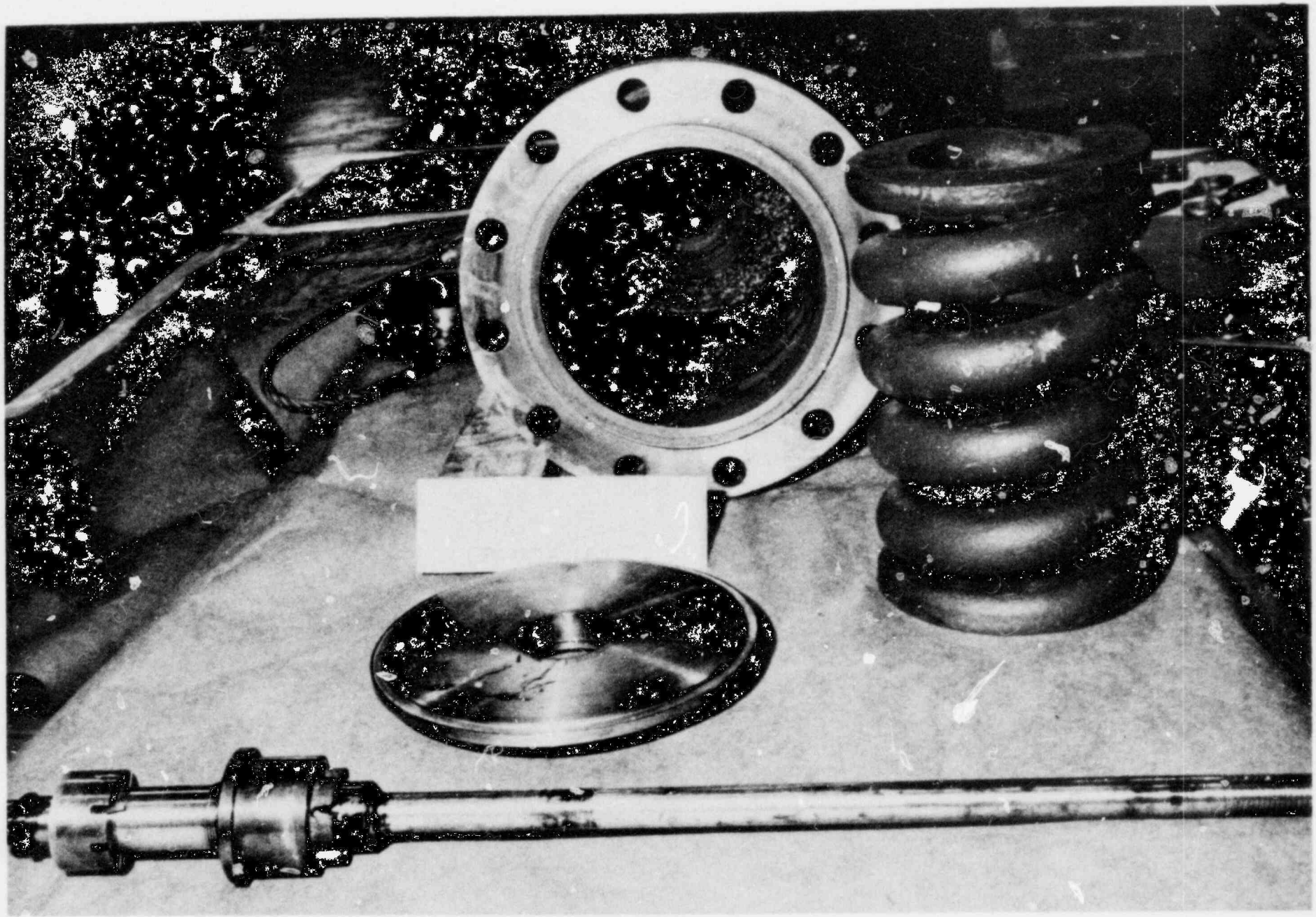


FIGURE 29
POST-TEST INSPECTION OF RCV-8

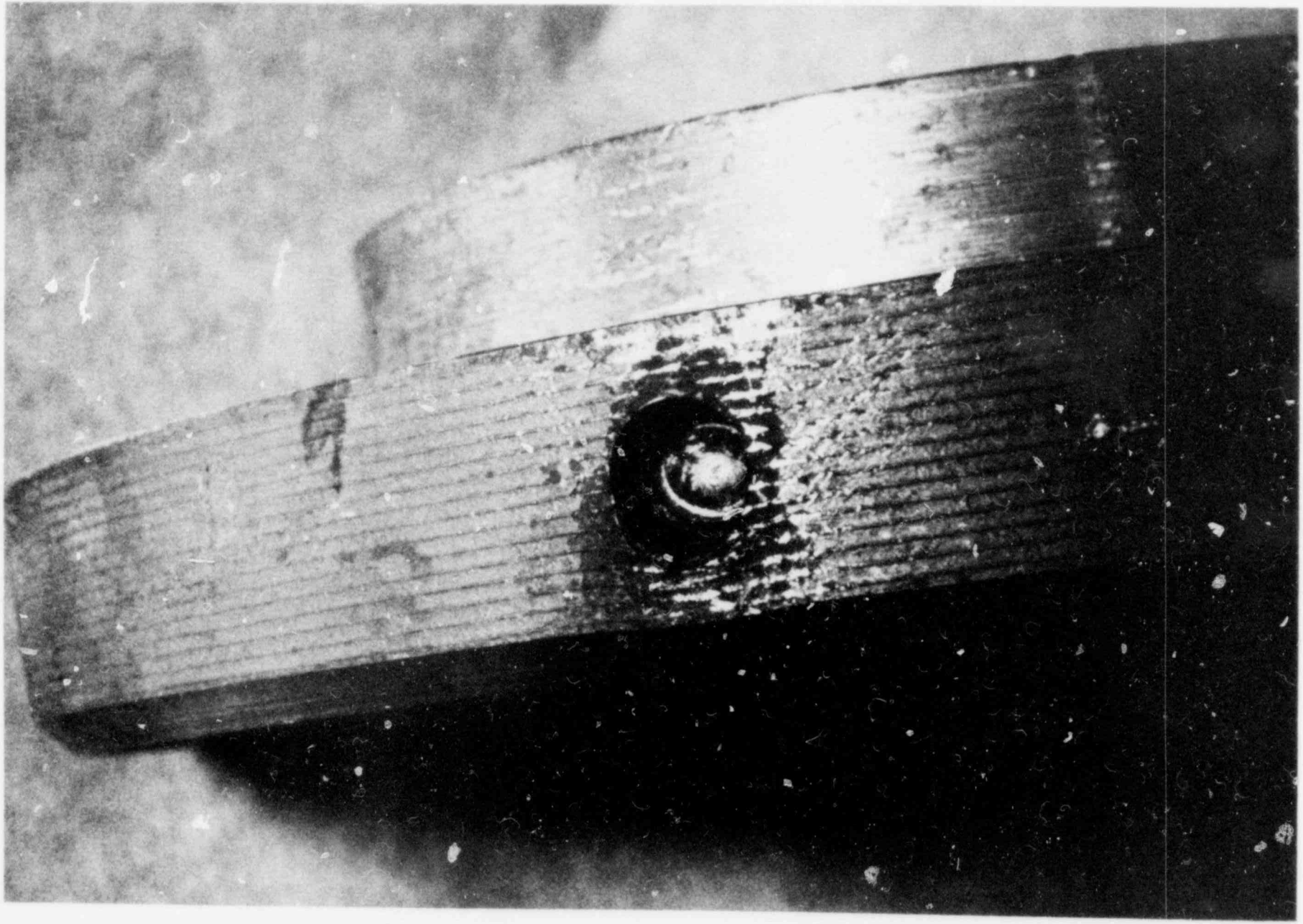


FIGURE 30
POST-TEST INSPECTION OF RCV-8

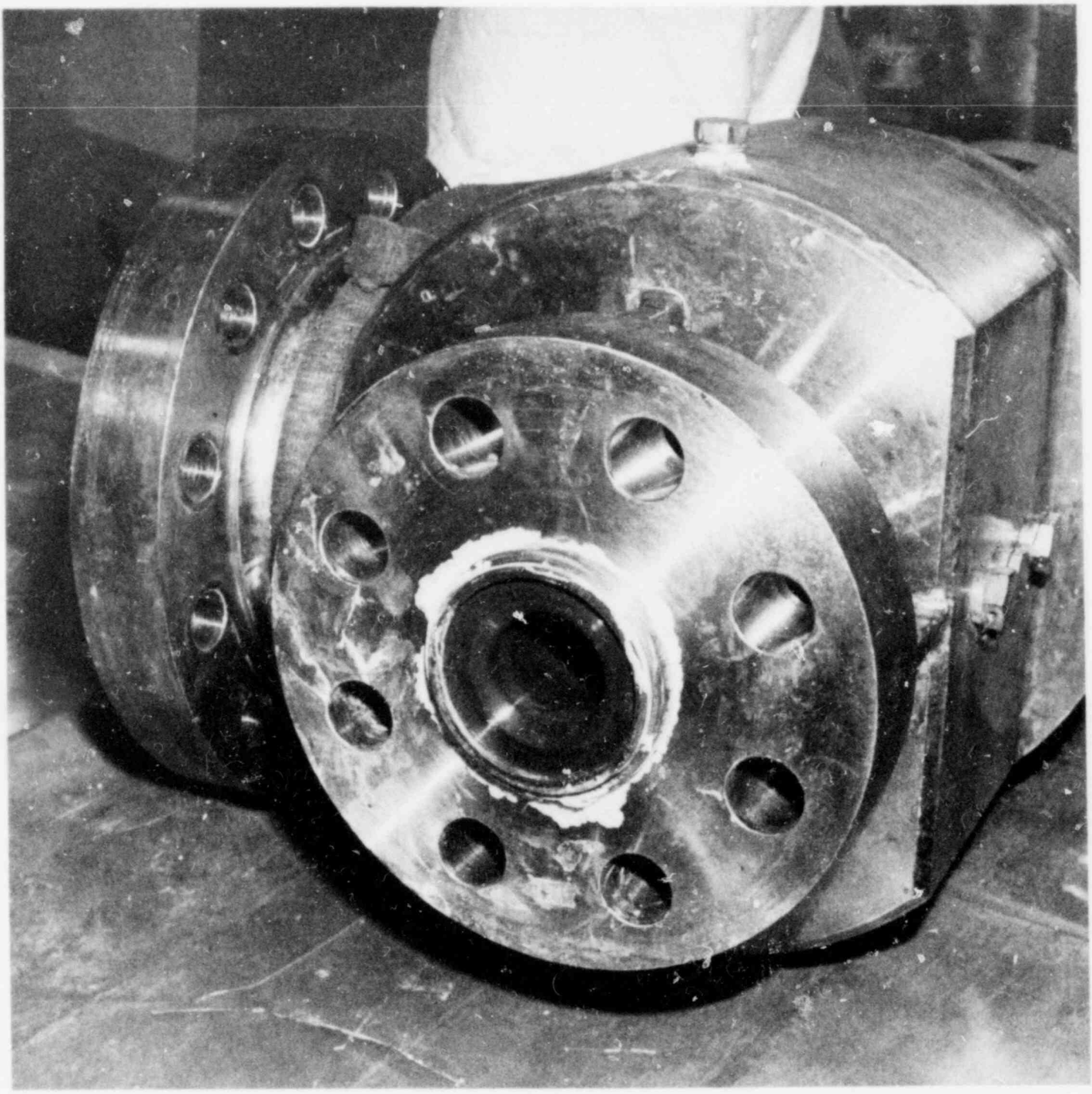


Figure 31. RECEIPT INSPECTION
OF RCV-9

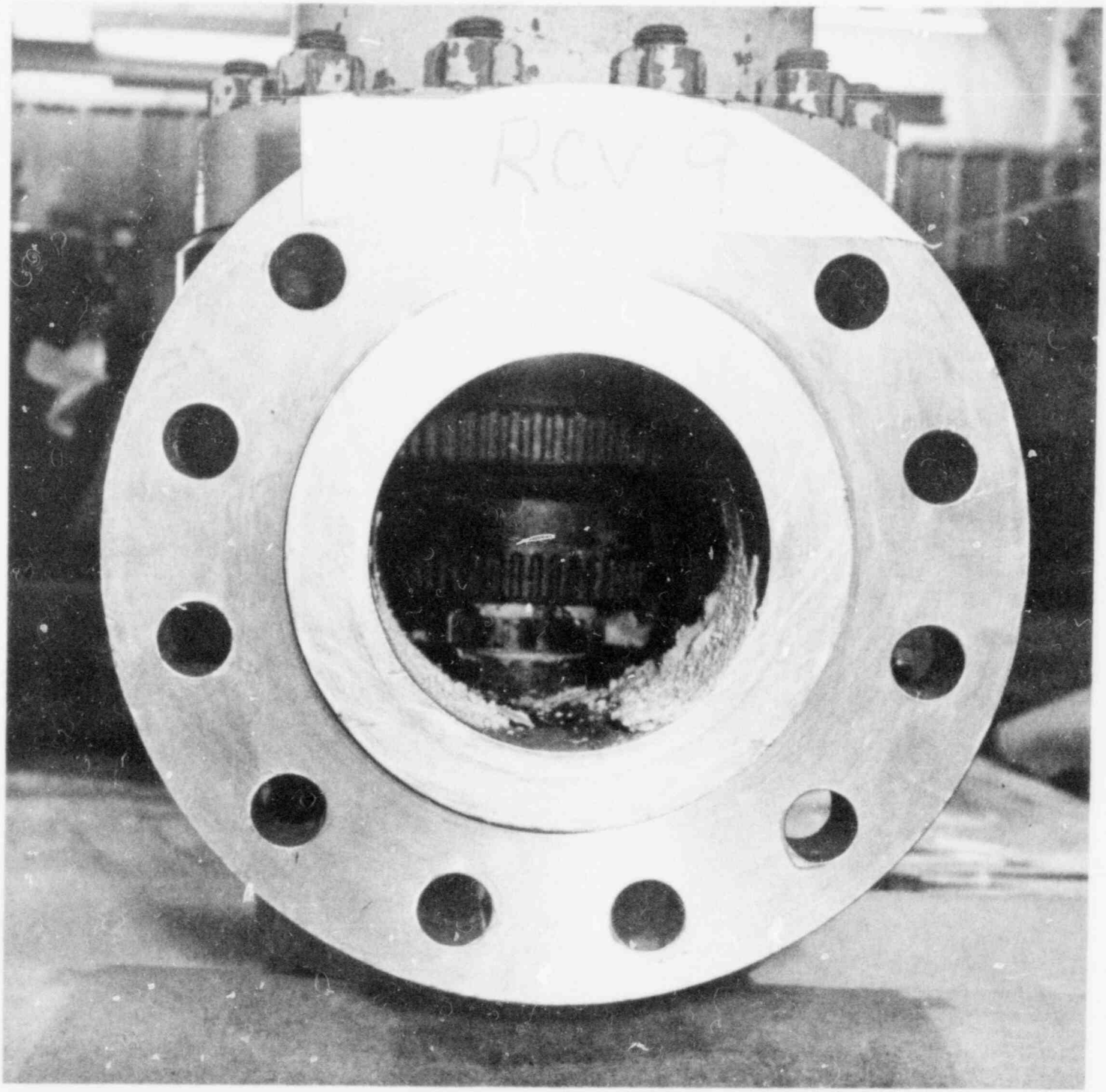


Figure 32. RECEIPT INSPECTION
OF RCV-9

Figure 33. RECEIPT INSPECTION
OF RCV-9

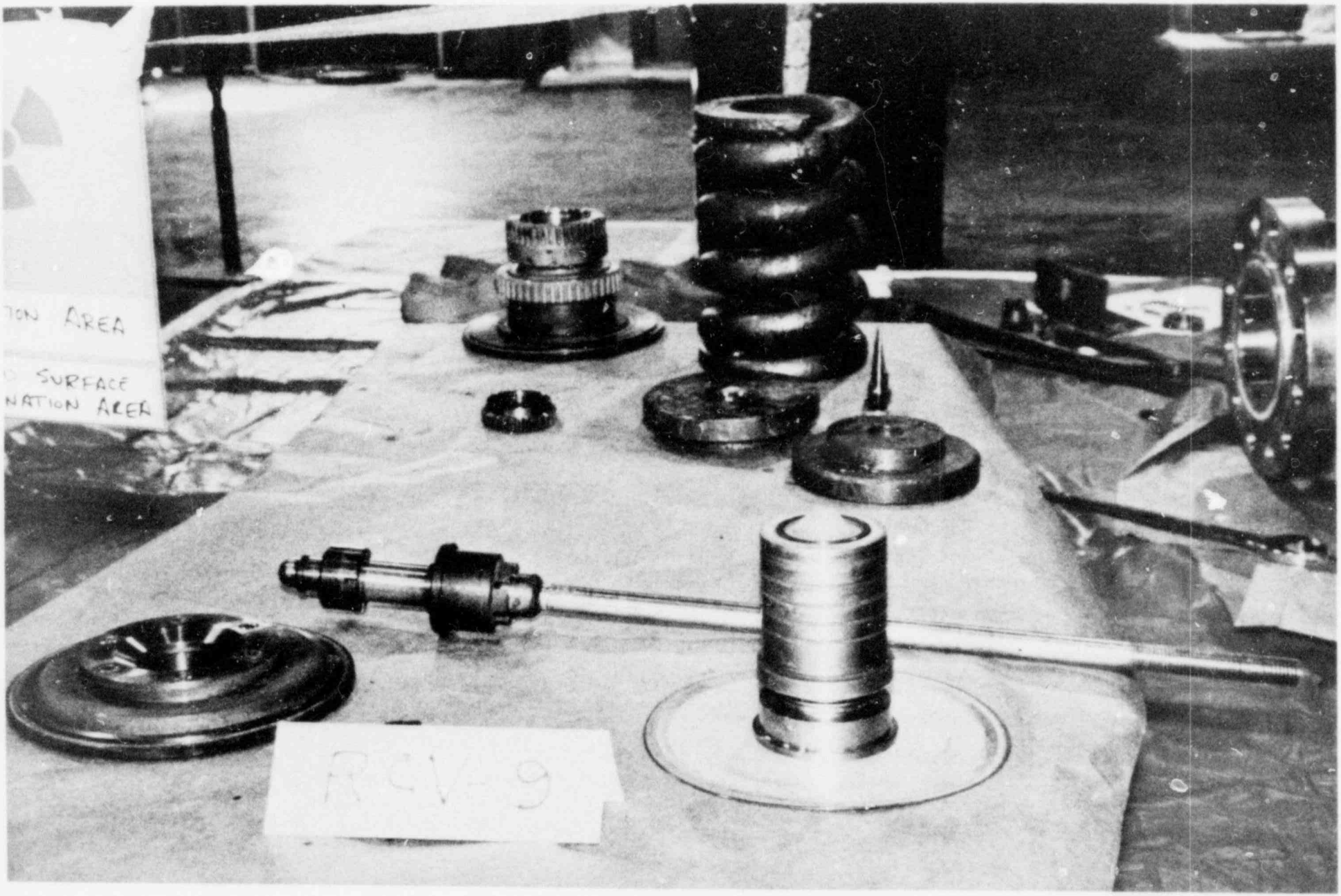


FIGURE 34
POST-TEST INSPECTION OF RCV-9

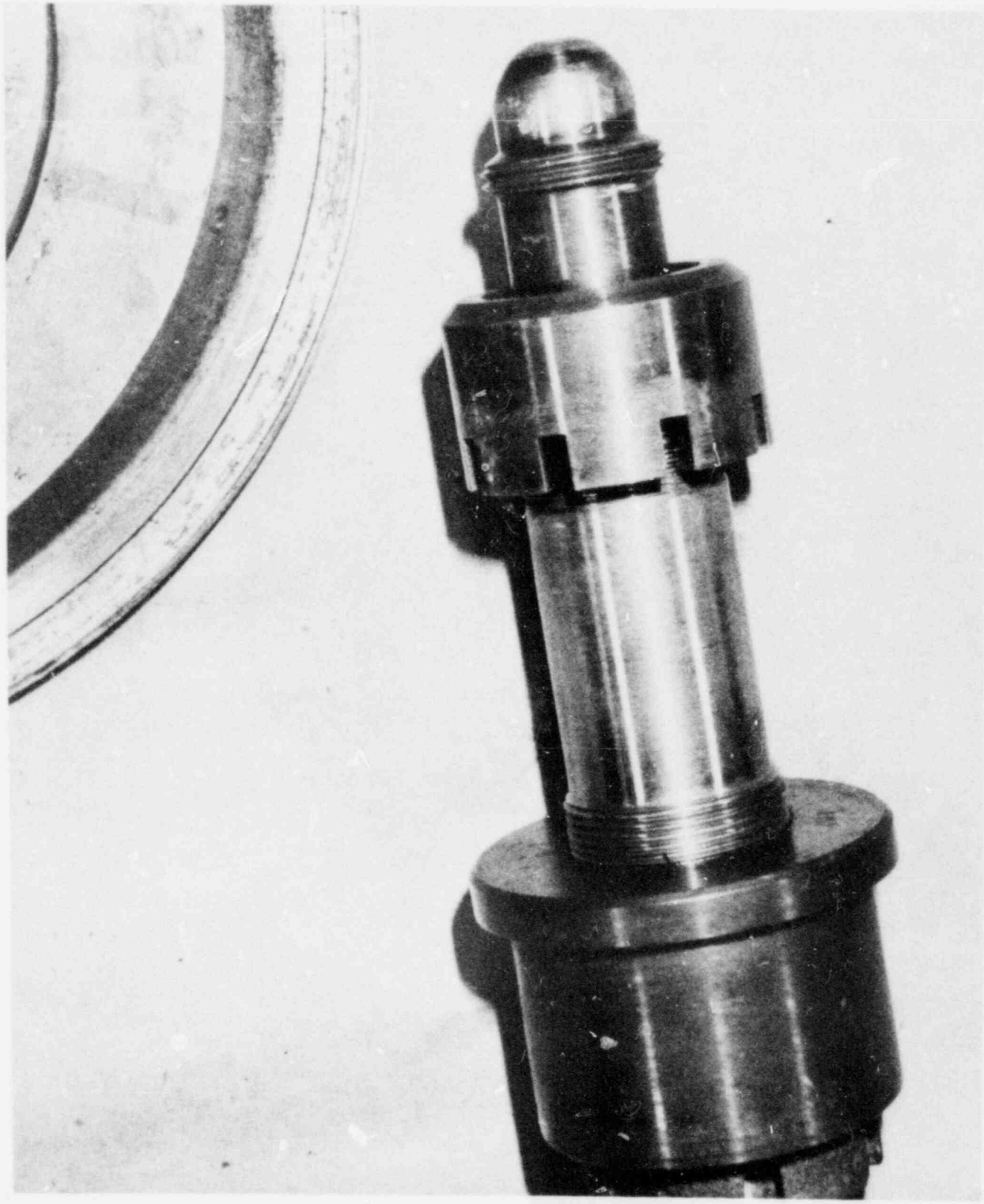


Figure 35. POST-TEST INSPECTION OF RCV-9

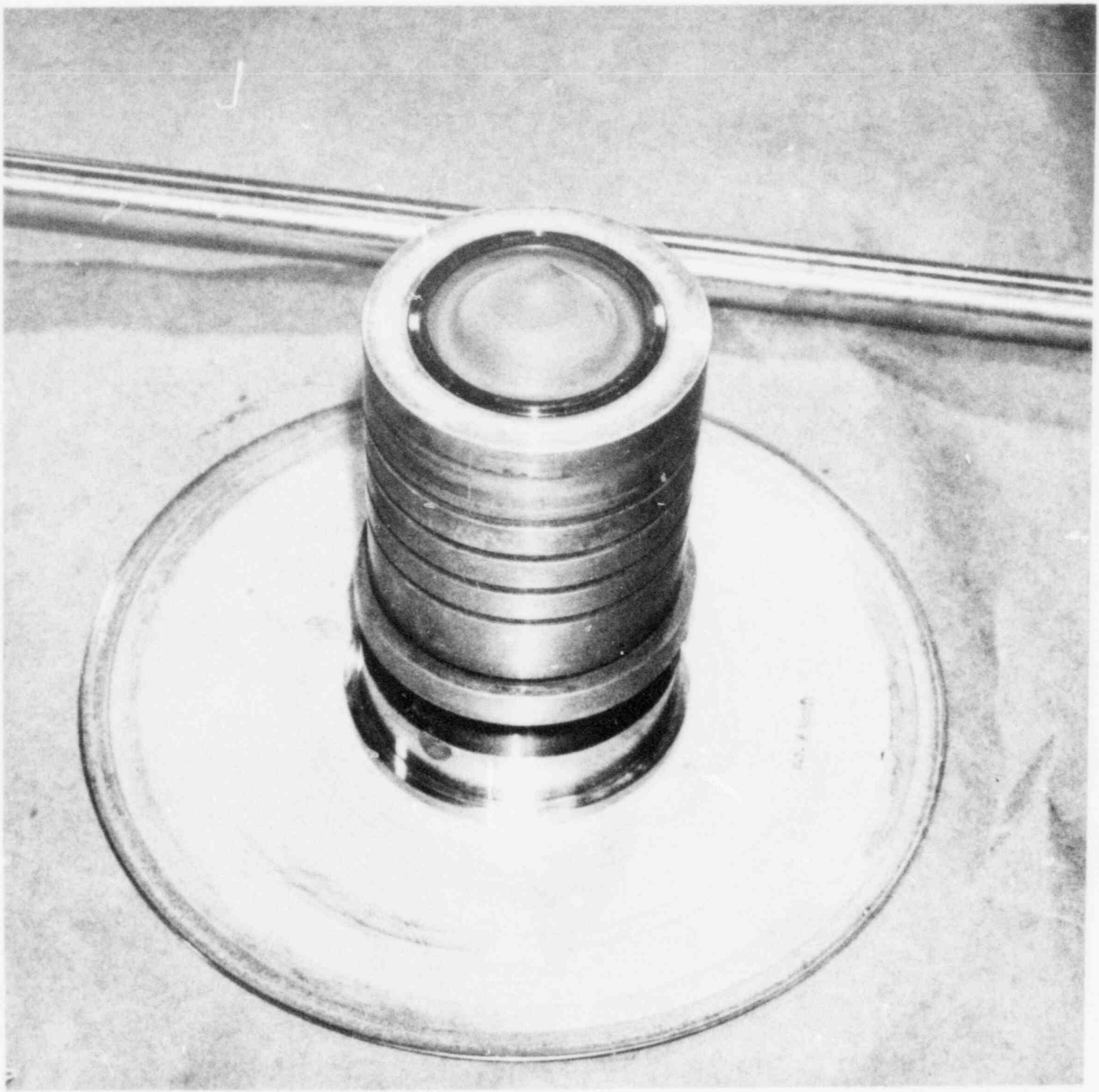


Figure 36. POST-TEST INSPECTION
OF RCV-9

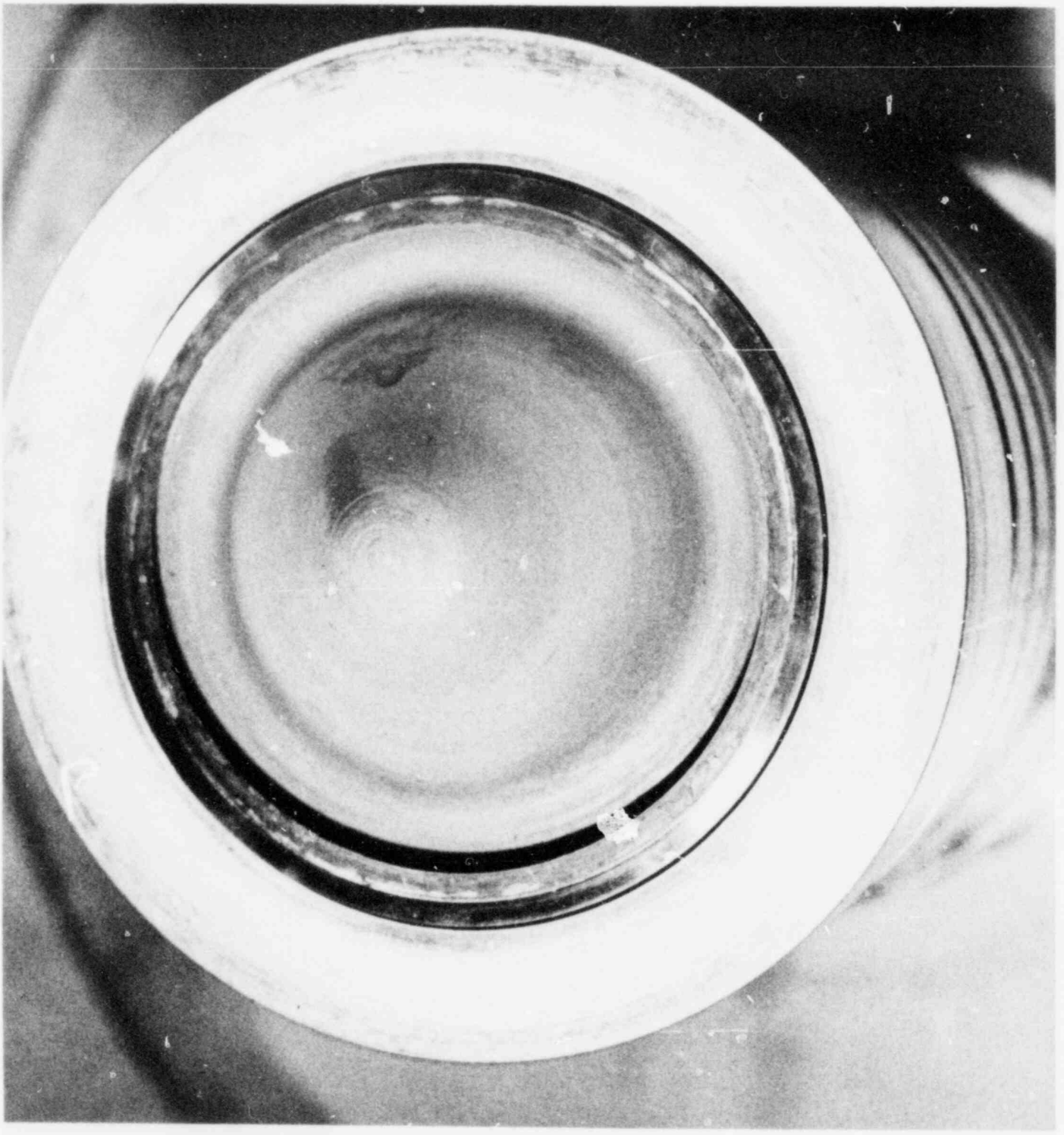


Figure 37. POST-TEST INSPECTION
OF RCV-9

IV. REFERENCES

1. Babcock and Wilcox, Nuclear Power Generator Division. Transient Assessment Report, Reactor Trip at Crystal River - 3 Nuclear Station on February 26, 1980 (Preliminary Report), Lynchburg, Va., March 9, 1980.

2. Institute of Nuclear Power Operations and Nuclear Safety Analysis Center. Analysis and Evaluation of Crystal River - Unit 3 Incident, March 1980.

3. Wyle Laboratories, Scientific Services and Systems Group. Dresser Pressurizer Safety Valve Inspection, Refurbishment and Test Report, Huntsville, Alabama, 1980

4. Report of MPR Visit to Crystal River Unit No. 3 on April 23 and 24, 1980.

5. Report of MPR Visit to Wyle Laboratories on July 16 and 17, 1980.

V. APPENDICES

A. EPRI. Inspection and Test Guidelines for Crystal River-3 Safety Valves, 1980, pp. 1-4.

B. Wyle Laboratories. Test Procedure for Steam Set Pressure and Leakage Testing of Spring-Operated Safety Valves, February 1980, pp. 1-14.

C. Wyle Laboratories. Dresser Pressurizer Safety Valve Inspection, Refurbishment and Test Report, 1980, title page through page 29.

ELECTRIC POWER RESEARCH INSTITUTE
INSPECTION AND TEST GUIDELINES FOR
CRYSTAL RIVER -3 SAFETY VALVES

1.0 Purpose:

The purpose of this document is to specifiy and define the requirements associated with tests and inspections of Crystal River Unit 3 (CR-3) safety valves RCV-8 and RCV-9. These valves were installed and functional during a system transient that took place at CR-3 February 26, 1980. During this transient, RCV-8 opened and closed, perhaps several times, and discharged steam and water. RCV-9 apparently did not open during the transient.

2.0 Objectives:

The objective of these inspections and tests is to determine the present condition of the valves and to identify any effects of the transient - and specifically, the effects of steam and water flow through RCV-8 - on the integrity and operability of the valves. It is also desired to determine the reason that valve RCV-8 opened at an indicated system pressure of about 2400 psig in lieu of the specified valve set pressure of 2500 psig.

3.0 Prerequisites:

The inspections and tests are considered part of the PWR Safety and Relief Valve Test Program. Therefore EPRI will direct the various parts of this project either through an EPRI staff member or other authorized agent at the Wyle facilities. All work accomplished during this effort will be done by qualified Wyle or Dresser Industries personnel in accordance with standard approved procedures. No valve modifications or refurbishment will be done unless approved by EPRI and under the direct supervision of a qualified Dresser Industries representative. Qualified Wyle personnel may alter or modify a valve if approved by EPRI and authorized in writing by Dresser Industries.

4.0 References

4.1 Technical Service Agreement with Wyle Laboratories.

4.2 Wyle Quotation No. 544/4002/CP.

4.3 Letter J.D.E. Jeffries (EPRI) to Ray Scates (Wyle) dated March 24, 1980.

4.4 Wyle Test Procedure No. 1009 for Steam Set Pressure and Leakage Testing of Spring Operated Safety Valves.

4.5 Wyle Laboratories Quality Assurance Policies and Procedures Manual.

4.6 Instruction Manuals for Dresser Spring Operated Safety Valves Model 31739A.

4.7 Dresser Special Procedures for Disassembly of Spring Operated Safety Valves (to ensure original set pressure and spring preload).

5.0 Time Required

(To be estimated by Wyle later).

6.0 Overview

6.1 Inspection - both safety valves, RCV-8 and RCV-9, will be inspected prior to having any work performed. Exterior condition will be noted and photographs will be taken. The valves will then be disassembled and the internal components will be examined and critical dimensions checked. Extensive photographs will be made of the disassembled valves. All facets of the inspection will be documented. RCV-8 will be reassembled as close to the "as received" condition as possible. (Note: a special procedure is to be used in the disassembly of RCV-8 - a procedure that will maintain the original spring preload and set pressure adjustment). RCV-9 will be refurbished as required to restore it to a condition where it can be returned to CR-3 as a spare pressurizer safety valve.

6.2 Tests - RCV-9 will be tested for leakage and set pressure before disassembly and inspection. Both RCV-8 and RCV-9 will

be checked for set pressure and leakage after refurbishment/ reassembly.

NOTE:

Be careful not to change set pressures or blowdown ring adjustments during the inspection or photography sequence.

7.0 Inspections and Tests

7.1 Pre-disassembly Inspections - On receipt the valves are to be removed from their packaging, all protective covering is to be removed and the valves set up for inspections and photographs. Placards are to be made for each valve identifying the valve and orientation. These placards are to be utilized to describe the photographs as pictures are taken of the front, both sides, back, and inlet & outlet ports (looking into the valves). Close-up photographs are to be taken of any abnormalities and/ or deposits of foreign material in the valve ports.

7.2 Test of RCV-9 - Following completion of the inspections outlined in 7.1 above, but without valve disassembly, valve RCV-9 is to be installed in a steam test facility for set pressure verification tests. Set pressure (and, if possible, blowdown) should be measured along with seat leakage (before and after each pop) in accordance with reference 4.4 or approved variation thereof. All results are to be documented in accordance with reference 4.5.

7.3 Disassembly and Inspection of RCV-8 - Valve RCV-8 is to be disassembled in accordance with a special disassembly procedure (by Dresser) in which the valve spring, set pressure adjusting nut and yoke assembly are removed without changing set pressure adjustment or the main spring preload. Special tools and/or fixtures may be required for this operation. It is the intent of this procedure that the same set pressure of the valve be retained during valve disassembly and inspection so that the valve can be reassembled in the same configuration (and with the same spring preload) as-received at Wyle. Visual examination shall be made and documented (by written notation and photographs) of each part removed at each major stage of disassembly. Positions

of blowdown adjusting rings shall be noted for subsequent reassembly. Of particular interest are any signs of distress (galling, scoring, pitting, or unusual wear marks) and any signs of binding, chattering or leakage. Close-up photographs shall be taken of any such abnormalities.

Following disassembly, the valve ports shall be laid out on a suitable surface (without any cleaning or decontamination) labelled and photographed.

7.4 Disassembly and Inspection of RCV-9 - Valve RCV-9 shall be disassembled in accordance with standard Technical Manual procedures and inspected in the same manner as valve RCV-8, specified in paragraph 7.3 above. Note: The special procedure utilized to disassemble the valve maintaining spring preload, etc., is not required for RCV-9. After completion of inspection, valve RCV-9 shall be refurbished and reassembled under the direction of the Dresser representative.

7.5 Re-assembly of RCV-8 - Unless valve RCV-8 is determined to be in a damaged condition by Dresser and EPRI representatives, it is to be re-assembled without re-work or seat reconditioning. Photographs, measurements and match marks should be used (as appropriate) to assemble and set RCV-8 as closely as possible in the same configuration as received.

7.6 Final Testing of Both Valves - Both RCV-8 and RCV-9 are to be installed in the steam test facility and have set pressure verification and seat leakage tests in accordance with reference 4.4.

7.7 Results of all inspections and tests will be evaluated by EPRI, Dresser, Wyle, and B&W representatives and the need for any additional inspections or tests determined. If additional actions are considered necessary, supplemental procedures will be prepared. After completion of all inspections and tests, valves RCV-8 and RCV-9 shall be protected from the environment by storage in a dry, water proof area. RCV-9 will be prepared for transportation and return to Florida Power Corporation's Crystal River - Unit 3.

8.0 Final Report

A report of all inspections and tests, including photographs, shall be prepared and transmitted to EPRI; 5 copies are required.

TEST PROCEDURE

WYLE LABORATORIES
SCIENTIFIC SERVICES AND SYSTEMS GROUP
P. O. BOX 1008 • HUNTSVILLE, ALABAMA 35807
TWX (810) 726-2225 • TELEPHONE (205) 837-4411

TEST PROCEDURE NO. 1009

DATE: February 22, 1980

TEST PROCEDURE
FOR
STEAM SET PRESSURE AND LEAKAGE TESTING
OF
SPRING-OPERATED SAFETY VALVES

APPROVED BY: _____
FOR: _____

APPROVED BY: _____
FOR: _____

APPROVED BY: _____
FOR: _____

APPROVED BY PROJECT MANAGER: F. H. Mosby

APPROVED BY QUALITY ENGINEER: Kimbrell

PREPARED BY PROJECT ENGINEER: D. J. Elam

REVISIONS

FORM 1064-1 Rev. 4/74

REV. NO.	DATE	PAGES AFFECTED	BY	APP'L.	DESCRIPTION OF CHANGES

1.0 PURPOSE

The purpose of this test procedure is to present the methods and procedures used in handling and calibrating safety valves.

2.0 REFERENCES

2.1 ASME Boiler and Pressure Vessel Code, as applicable.

2.2 American National Standard ANSI/ASME N45.2-1977 "Quality Assurance Program Requirements for Nuclear Facilities".

2.3 Nuclear Regulatory Commission Regulation 10CFR50, Appendix B.

2.4 Nuclear Regulatory Commission Regulation 10CRF21.

2.5 American National Standard ANSI/ASME PTC 25.3-1976, "Safety and Relief Valves".

2.6 Customer's Purchase Order and Special Instructions.

3.0 TEST EQUIPMENT AND INSTRUMENTATION

3.1 All test equipment and instrumentation used for the performance of this test program complies with the requirements of Wyle Laboratories' Quality Assurance Policies and Procedures Manual, which conforms to the applicable portions of ANSI-N45.2 and Military Specification MIL-C-45662. Wyle Laboratories has the option to substitute equivalent test equipment in lieu of listed equipment, if required.

3.2 Calibration of Test Equipment and System Calibration

All test equipment is calibrated on a periodic basis and the calibration interval is displayed on a decal. This decal is affixed to the equipment indicating the last calibration date, the next calibration due date, accuracy, and by whom calibrated. In addition to individual component calibration, prior to and immediately following test, an end-to-end system calibration is performed on equipment used to establish valve set pressure.

3.3 Measurements and Tolerances

Unless specified otherwise, the maximum allowable tolerance on test condition measurements shall be as follows:

	Parameter	Tolerance
A.	Temperature:	+/- 4°F
B.	Pressure:	
	Heise Gauge	+/- 0.1% F. S.
	Deadweight Tester or Digigage	+/- 0.03%
	Pressure Transducer	+/- 1.0 psi

4.0 PERSONNEL CERTIFICATION

Wyle certifies that all personnel assigned to the steam valve facility are qualified for the tasks assigned. Personnel certification is achieved through personnel education levels, vocational training, and practical experience as outlined in ANSI-N45.2.

5.0 STORAGE

During any prolonged non-testing period, the test specimens shall be stored in a controlled storage area. The storage shall be maintained in accordance with good laboratory practices, i.e., being properly protected from grease, oil, solvents, and any surface dirt that could influence the results of the test program. The storage area shall bein compliance with ANSI-N45.2.2, Level C.

6.0 REQUIREMENTS AND PROCEDURES

6.1 Set Pressure Test Procedure

6.1.1.1 A visual inspection shall beconducted for shipment damage and correct receipt of valves. Each valve shall beidentification coded by its serial number. Special attention shall be given to the inlet and outlet flanges. Any condition which would affect the steam tightness at these areas shall be criteria to prevent test until the flanges are repaired.

6.1.1.2 Each valve shall beinstalled in its normal operating position on a steam header.

6.1.1.3 The cap assembly and release nut of the safety relief valve shall be removed. A fixture to restrict the lift of the valve shall be installed.

Nominal lift restriction values are as follows:

VALVE TYPE	MANUFACTURER	SERVICE	LIFT RESTRICTION (IN)
3700 Series	Dresser	Main Steam Safety	0.100
Style HA	Crosby	Main Steam Safety	0.050
Style HB	Crosby	Pressurizer Safety	0.030
31700 Series	Dresser	Pressurizer Safety	0.030

6.0 REQUIREMENTS AND PROCEDURES (Continued)

6.1.2 Instrumentation

6.1.2.1 A linear variable-differential transformer (LVDT) shall be installed on the spindle to measure the lift of the disc.

6.1.2.2 The instrumentation used to determine set pressure (pressure transducer, X-Y plotter) shall be subjected to an in-system calibration as required to achieve the desired accuracies prior to and subsequent to testing by use of a deadweight tester.

6.1.2.3 Thermocouples and a pressure transducer shall be mounted to the test valve as shown in Figure 1.

6.1.3 Set Pressure Test

6.1.3.1 Saturated steam at 90% of the set pressure shall be applied to the valve inlet. The steam pressure shall be maintained until the spring temperature is stabilized at 140 +/- 5°F or as otherwise directed by the customer and the valve inlet neck temperature is at least 350°F for Dresser 3700 and Crosby HA valves and 400°F for Dresser 31700 and Crosby HB valves.

6.1.3.2 A coiled steam line may be placed around the spring housing to assist temperature stabilization of the spring. Insulation blankets may also be wrapped around the valve to assist in heating the valve.

6.1.3.3 After temperature stabilization of the valve spring for 15 minutes and with steam pressure maintained at 90% of set pressure, the steam pressure shall be increased until the valve disc lifts off its seat. The valve set pressure established at this point shall be recorded. The valve set pressure must be within its nameplate set pressure +/- 1%. A total of three consecutive valid set pressure tests shall be performed.

6.1.3.4 The spring stabilization temperature shall be maintained during the test by adjusting the insulation and/or the amount of steam through the coil. If the spring temperature rises above the tolerance, after removing the insulation and turning off the steam coil, testing may continue and data shall be marked "Natural temperature of spring".

6.1.3.5 If the measured set pressure does not meet the criteria of paragraph 6.1.3.3, the valve shall be adjusted and checked again.

6.1.3.6 Wait times between valve actuations shall be a minimum of five minutes.

6.1.4 Leak Check

6.1.4.1 At the completion of the set pressure calibration, the valve shall be pressurized to 90% +/- 10 psi of nameplate set pressure. A leak check shall then be conducted.

6.0 REQUIREMENTS AND PROCEDURES (Continued)

6.1.4 Leak Check (Continued)

6.1.4.2 The leak check shall be performed as follows:

A cold ($< 100^{o}F$) mirror about 2 inches square and 1/8 inch thick shall be passed around the disc to seat interface and the mirror inspected. If no moisture or a faint fogging is detected, it may be concluded that essentially zero steam leakage is present. If the mirror surface shows condensation droplets, the leakage is unacceptable and the valve must be repaired per Reference 2.6. If in doubt about whether the condensation is leakage or faint fogging, holding the mirror at the suspect area for a longer period of time will produce increased condensation droplets if steam leakage exists. The mirror shall not be allowed to heat up.

6.1.5 Documentation

6.1.5.1 Test Log

A test log shall be maintained and shall include a daily description of the testing performed and any pertinent information regarding status of the test specimen. The log shall be a complete chronological log including details of all test setups and calibration, specimen handling and setup, installation, and test data summaries.

6.1.5.2 Test Data

The recording and chart paper shall be reviewed for accuracy and quality after each test. The test data shall be clearly identified with the valve serial number, Wyle job number, test date, customer, chart speed, remarks, or any other pertinent information required for data analysis or data retrieval.

6.1.5.3 Test Report

Three copies of a certification test report shall be issued subsequent to completion of calibration. The certification test report shall consist of:

- A brief summary of the valve's history during the calibration process, and calibration data points.
- The set pressure recordings.
- The instrumentation list indicating the instruments used and the instruments' calibration dates.

A sample report is presented in Appendix I.

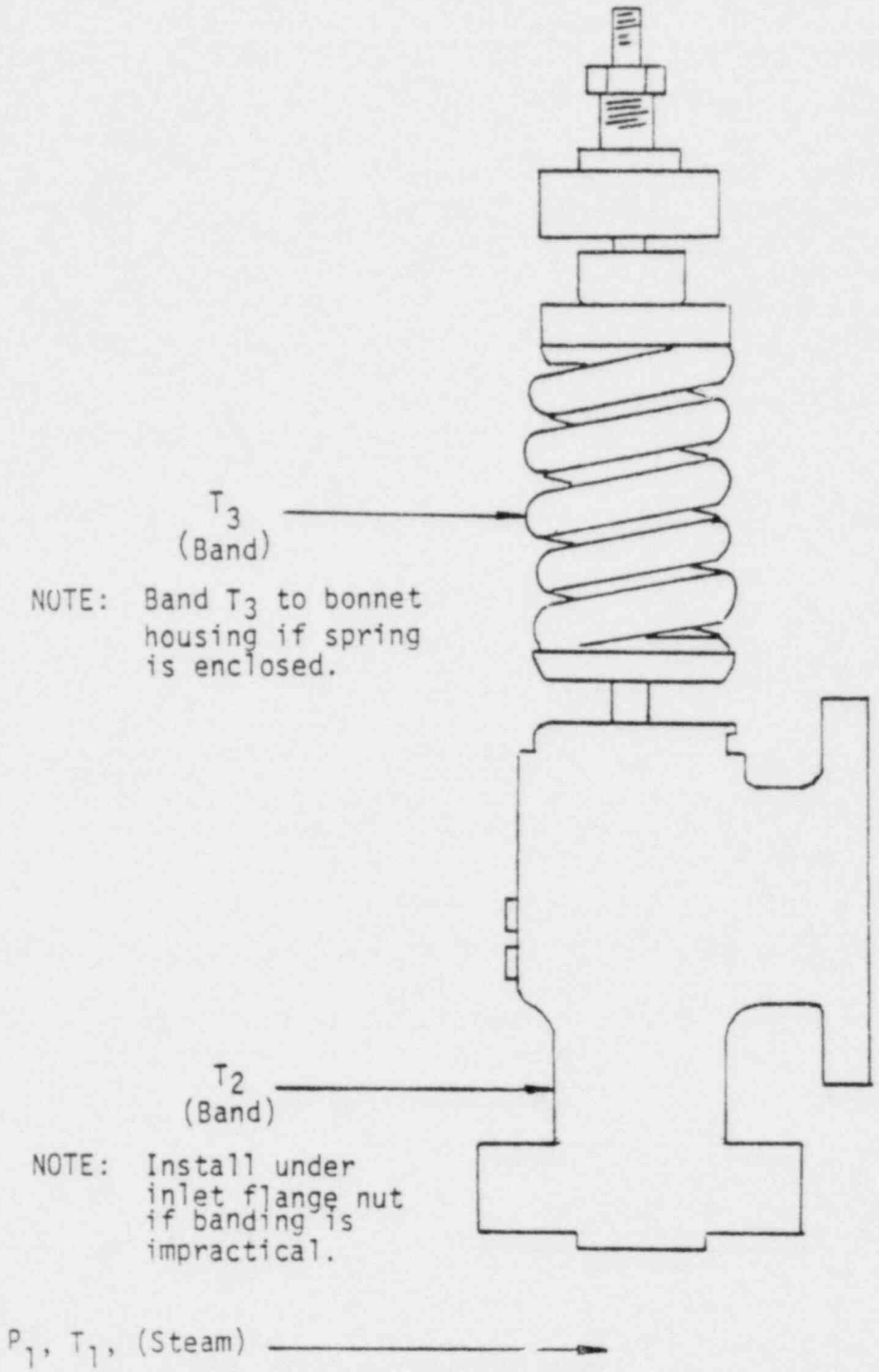


Figure 1

Thermocouple and Pressure Transducer Locations

APPENDIX I

WYLE LABORATORIES' CERTIFICATION TEST REPORT SAMPLE

Test Report No. 45097-0

CERTIFICATION TEST REPORT

WYLE LABORATORIES

SCIENTIFIC SERVICES AND SYSTEMS GROUP
HUNTSVILLE, ALABAMA

ABC Corporation
P.O. Box 2222
Anytown, USA 22222

REPORT NO.	44976-1
WYLE JOB NO.	44976
CUSTOMER P. O. NO.	21192-22
CONTRACT	N/A

MANUFACTURER Dresser Industries

DATE February 14, 1980

5 PAGE REPORT

1. SPECIMEN Main Steam Safety Valve
2. SET PRESSURE: 1212 +/- 1%
3. PART NO. 3777
4. SERIAL NO. BK6528

5. SUMMARY

On February 14, 1980, Valve Serial Number BK6528 was calibrated for set pressure and tested for leakage with steam as the test medium. Testing was in accordance with Wyle Laboratories Test Procedure 1007, Revision B, dated January 12, 1980. The following table lists four certification test runs and the leakage test results.

Set Pressure Test

Run No.	Set Pressure (psia)	Lift (In)	Valve Spring Temp (°F)	Valve Body Temp (°F)	Steam Temp (°F)
2	1217	0.106	137	360	559
3	1218	0.106	136	363	555
4	1215	0.106	138	366	561
5	1218	0.106	138	369	556

Leakage Test

Steam Pressure (psia)	Post Test Leakage
1090	Zero

STATE OF ALABAMA
COUNTY OF MADISON } ss

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

Larry E. Frazier

SUBSCRIBED and sworn to before me this 22 day of February, 1980

Notary Public in and for the County of Madison State of Alabama

June 12, 83

Wyle shall have no liability for damages of any kind to person or property, including special or consequential damages, resulting from Wyle's providing the services covered by this report.

Steam Services

TEST BY

PROJ. ENGINEER

WYLE Q. A. J. Kimbrell


Customer ABC CORP.
Valve Serial #
Hut #
Chart Speed 0.25
Nameplate Pressure 1213
Test Set Pressure 1217
Calibration Correction 0
Corrected Set Pressure 1217
Reseat Pressure N/A
Remarks
Wyle PE
Wyle PM
Wyle Job #
Date 2-14-80
SEC/CR Ramp Speed N/A
PSIG Steam Temp 557
PSIG Body Temp 360
PSIG Spring Temp 131
PSIG Disc Lift 0.166
PSIG Post Test Leakage N/A
Wyle QC
Cust QC
SET PRESSURE-PSIG
INLET PRESSURE-PSIG
DISC LIFT
MECHANICAL OFFSET FOR PEN TRAVEL
DISC LVDT
STEAM PRESSURE-PSIG
1300
1200
1100

INSTRUMENTATION EQUIPMENT SHEET

Date 2-14-80 Job No. 44926 Test Area SRV Building Cell 1

Technician Kirkland Customer ABC Corp. Type Test Recert

No.	Instrument	Manufacturer	Model No.	Serial No.	Wyle or Gov't No.	Range	Accuracy	Calibration On	Calibration Due
1	XY Recorder	H-P	7046A	—	96318	.25-5 VDC/cm	± 2%	11-21-79	2-21-80
2	DVM	H-P	3465A	—	11555	multiple	mfg spec	9-11-79	3-11-80
3	DVM	Keithley	178	—	11478	multiple	mfg spec	7-26-79	7-26-80
4	Pressure Gauge	Heise	21139A	—	11024	0-1500 PSI	± .1%	10-24-79	4-24-80
5	Dead Weight Tester	Mansfield & Green	TQ20	—	95414	0-2000 PSI	± .03%	7-16-79	7-16-80
6	Signal Cond	Schaevitz	CAS100	—	92328	0-10 VDC	± 2%	1-23-80	7-23-80
7	Signal Cond	Vishay	2120	—	11173	0-12 VDC	± 2%	2-6-80	5-6-80
8	Power Supply	Vishay	2110	—	11516	0-12 VDC	± 2%	2-6-80	5-6-80
9	Data Logger	Monitor Labs	9300	—	11622	multiple	mfg spec	11-12-79	5-12-80
10	LVDT	Schaevitz	HC125	366	—	± 0.125 in	± .25%	2-14-80	Prior to use
11	Pressure Xducer	Bell & Howell	CEC1000	—	11847	0-1500 PSIG	± .25%	10-11-79	4-11-80

Page No. 77
Test Report No. 45097-0

Instrument Test Engineer [signature]

Checked & Received By W W Bond

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APPENDIX II

OPTIONAL TESTS

1.0 SCOPE

1.1 This addendum to Wyle Laboratories Test Procedure 1009 is to define testing to be accomplished on pressurizer safety valves by direction of the customer.

2.0 REFERENCES

2.1 Dresser Engineering Instruction PT-66, steam testing and valve setting instructions for 31700 pressurizer safety valves.

2.2 Dresser Engineering Instruction PT-43, Pneumatic Backpressure Testing of 31700 Pressurizer Safety Valves.

3.0 ELEVATED TEMPERATURE TEST

3.1 The elevated temperature test shall be performed as stated in the preceding basic test procedure, except as stated in the following paragraphs.

3.2 Install thermocouples as shown on Figure 2-1.

3.3 Wrap valve in insulation blankets. A steam coil may be used to accelerate heat-up. The in-service temperatures to be approximated during this test are:

T_2 - 465-485°F
T_3 - 200-225°F
T_4 - 175-185°F

3.4 Temperatures shall be considered stabilized when no changes greater than 10°F occur in a 1 hour interval.

3.5 Perform leak test at 90% of set pressure as described in the basic procedure.

3.6 Verify set pressure as described in the basic procedure.

3.7 Perform leak test at 90% of set pressure as described in the basic procedure.

4.0 BACKPRESSURE TEST

4.1 Before set pressure testing, a backpressure test shall be performed.

4.2 Apply 800 psig (Dresser Series 31700) or 500 psig (Crosby, Style HB) of gaseous nitrogen to the valve discharge port. Maintain pressure for 30 minutes minimum.

4.3 Install a pipe plug very loosely in the bonnet vent.

4.4 Brush or spray "Leak Test Solution" (soap solution) over the valve external surface, the valve body to bonnet interface, and the bonnet vent plug.

4.5 "Bubble" evidence of leakage through the body wall shall be cause for rejection. Bubbling around ring pins, body drain, or bonnet body joint, shall require further tightening or gasket replacement, or acceptance of leakage as determined by the cognizant Wyle engineer.

4.6 Any bubbles around the bonnet vent plug is indicative of a leaking bellows or other leakage into the bonnet chamber. Leakage is not acceptable.

4.7 Bleed off test pressure.

4.8 Rinse the external surfaces with demineralized water.

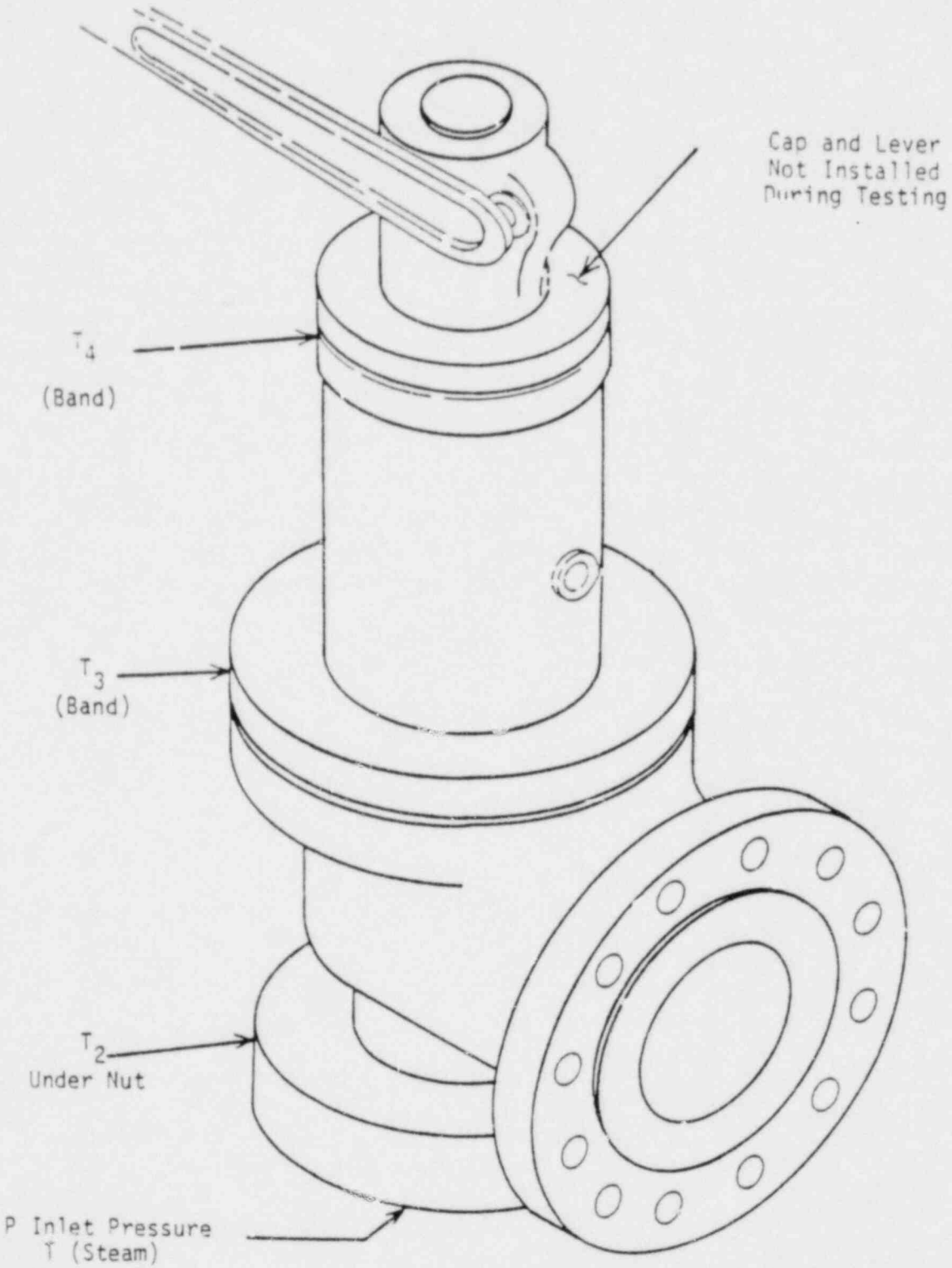

Figure 2-1

THERMOCOUPLE AND PRESSURE TRANSDUCER LOCATIONS

Excerpts From

Dresser Pressurizer Safety Valve Inspection, Refurbishment and Test Report

For
Electric Power Research Institute
Palo Alto, California

For
Crystal River Nuclear Power Plant
Crystal River, Florida

TABLE OF CONTENTS

TEST REPORT

WYLE LABORATORIES
SCIENTIFIC SERVICES AND SYSTEMS GROUP
HUNTSVILLE, ALABAMA

Electric Power Research Institute
P. O. Box 10412
Palo Alto, CA 94303

REPORT NO. 45097-0
OUR JOB NO. 45097
YOUR P. O. NO. 11414
CONTRACT N/A
PAGE 1 of 119 PAGE REPORT
DATE August 5, 1980

1.0 PURPOSE

The purpose of this report is to present the test procedures used and the test results obtained during the performance of an inspection, refurbishment and certification test program. The program was conducted to determine the conformance of two pressurizer safety valves to the requirements specified in References 2.1 through 2.3.

2.0 REFERENCES

2.1 Wyle Laboratories Test Procedure Number 1009, dated February 22, 1980, including Appendix II, Elevated Temperature Test.

2.2 EPRI Purchase Order Number 11414.

2.3 EPRI Inspection and Test Guidelines (Refer to Exhibit I).

3.0 TEST SPECIMEN DESCRIPTION

Two Dresser Pressurizer Safety Valves, Type Number 31739A, Serial Numbers BL8899, and BL8900, F.P.C. Tag Numbers RCV-9 and RCV-8, respectively.

4.0 TEST CONDITIONS, SYSTEMS AND EQUIPMENT

Refer to References 2.1 through 2.3 and Appendix II.

5.0 TEST PROGRAM SUMMARY

Two pressurizer safety valves, FPC Tag Numbers RCV-8 and RCV-9 were tested in the "as received" condition, inspected, decontaminated, refurbished and certification tested. The test program was conducted in accordance with the EPRI Inspection and Test Guidelines presented in Exhibit I.

STATE OF ALABAMA
COUNTY OF MADISON } ss.

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

SEAL

Larry G. Frazier

SUBSCRIBED and sworn to before me this 29 day of August, 19 80

Notary Public in and for the State of Alabama at large.

My Commission expires June 13, 19 83

Wyle shall have no liability for damages of any kind to person or property, including special or consequential damages, resulting from Wyle's providing the services covered by this report.

TEST BY Steam Services

G. Elam

WYLE Q. A. M. Kimbrell

TEST PROCEDURE

WYLE LABORATORIES
SCIENTIFIC SERVICES AND SYSTEMS GROUP
P. O. BOX 1008 • HUNTSVILLE, ALABAMA 35807
TWX (810) 726-2225 • TELEPHONE (205) 837-4411

TEST PROCEDURE NO. 1009

DATE: February 22, 1980

TEST PROCEDURE
FOR
STEAM SET PRESSURE AND LEAKAGE TESTING
OF
SPRING-OPERATED SAFETY VALVES

APPROVED BY: _____
FOR: _____
APPROVED BY PROJECT MANAGER: F. Mosby

APPROVED BY: _____
FOR: _____
APPROVED BY QUALITY ENGINEER: Kimbrell

APPROVED BY: _____
FOR: _____
PREPARED BY PROJECT ENGINEER: D. J. Elam

REVISIONS

FORM 1054-1 Rev. 4/74

REV. NO.	DATE	PAGES AFFECTED	BY	APP'L.	DESCRIPTION OF CHANGES

5.0 TEST PROGRAM SUMMARY (Continued)

Testing was performed per Wyle Laboratories Test Procedure 1009, dated February 22, 1980, which is presented in Appendix VIII. The inspections were performed by personnel from EPRI, Dresser, Babcock and Wilcox, M.P.R. and Wyle. Decontamination and cleaning were performed by Wyle personnel. The valves were refurbished by Dresser personnel with Wyle assistance.

Detailed discussions of the work performed during the test program are presented in Paragraphs 5.1 through 5.4 and Exhibit III. Representative photographs of the inspection and refurbishment of the valves are presented in Appendix V.

5.1 Receiving Information

The valves were received from Crystal River Nuclear Power Plant on June 24, 1980. An initial receiving inspection was performed and the results are detailed in Table I and Appendix V.

5.2 Testing and Refurbishment, Valve FPC Tag No. RCV-9

The valve, FPC Tag No. RCV-9, was initially tested in the "as received" condition for set pressure and leakage. The initial set pressure of the valve was 2472 psig, which was 3 psi below the nameplate set pressure range of 2475 to 2525 psig. The valve exhibited zero leakage both before and after test. Complete test data is presented in Appendix I.

Subsequent to its initial test, the valve was disassembled, decontaminated, inspected and refurbished. There were no new parts, other than gaskets, required for refurbishment.

The valve was successfully retested after refurbishment. A Certification Test Report is presented in Appendix III.

5.3 Testing and Refurbishment, Valve FPC Tag No. RCV-8

The valve, FPC Tag No. RCV-8, was disassembled for inspection with the spring compression retained. The major anomalies noted during the inspection were: 1) The nozzle seat and disc exhibited gross steam cutting, 2) The anti-rotating pin had been broken from the top spring washer and was laying on top of the support plate, 3) The disc holder exhibited considerable surface wear and numerous linear indications when examined by dye penetrant, 4) There was no movement or "rock" in the disc. After inspection, the valve was reassembled without repair for an "as received" set pressure and leakage test.

5.3 Testing and Refurbishment, Valve FPC Tag No. RCV-8 (Continued)

The valve's initial set pressure was 2392 psig, which was approximately 100 psi low. The valve exhibited a significant leakage rate throughout the test of approximately 1.1 gpm (550 lb/hr), but still actuated and performed well. Complete test data is presented in Appendix II.

Subsequent to testing, the valve was disassembled, decontaminated, inspected and refurbished. Replacement parts required for refurbishment were a new disc, disc holder, bellows, and gaskets. Refer to Exhibit II for part certification.

The valve was successfully retested after refurbishment. A certification Test Report is presented in Appendix IV.

5.4 Shipment Information

Both valves were shipped to the Crystal River Nuclear Power Plant on July 29, 1980.

TABLE I

RECEIVING INSPECTION SUMMARY

Valve Tag No.	Remarks
RCV-8	1. Valve cap not wired and sealed. 2. Some small deposits of boric acid crystal on valve inlet flange. 3. Adjusting ring pins not sealed and not properly wired. 4. One non-standard nut on valve cap. 5. No cap gasket. 6. One non-standard nut on valve bonnet flange. 7. Ring pins appear to have been leaking.
RCV-9	1. Valve cap not wired or sealed. 2. Boric acid crystals present on inlet flange and internals of valve (primarily in outlet side).

TABLE II

CHRONOLOGICAL SUMMARY OF TESTING

Date	Valve Tag No.	Description of Test	Pass/Fail	Remarks
7-16-80	RCV-9	As Received Test	N/A	Information Only
7-16-80	RCV-8	As Received Test	N/A	Information Only
7-18-80	RCV-9	Certification Test	P	None
7-18-80	RCV-8	Certification Test	P	None

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APPENDIX I

AS RECEIVED TEST REPORT

FOR

VALVE FPC TAG NO. RCV-9

CERTIFICATION TEST REPORT

WYLE LABORATORIES

SCIENTIFIC SERVICES AND SYSTEMS GROUP
HUNTSVILLE, ALABAMA

Electric Power Research Institute
P. O. Box 10412
Palo Alto, CA 94303

REPORT NO. 45097-1
WYLE JOB NO. 45097-0
CUSTOMER P. O. NO. 11414
CONTRACT N/A

MANUFACTURER Dresser Industries

DATE July 16, 1980

4 PAGE REPORT

1. SPECIMEN Pressurizer Safety Valve

2. SET PRESSURE: 2500 +/- 1% psig

3. PART NO. 31739A

4. SERIAL NO. BL8999
FPC Tag No. RCV-9

5. SUMMARY

Valve Serial Number BL8899 was tested in the "As Received" condition for set pressure and leakage with steam as the test medium per Wyle Laboratories Test Procedure 1009, dated February 22, 1980, with Elevated Temperature Test per Appendix II. The test results are presented below:

Set Pressure Test

Run No.	Set Pressure (psig)	Disc Lift	Steam Temp (°F)	Inlet Flange Temp (°F)	Lower Bonnet Temp (°F)	Upper Bonnet Temp (°F)
1	2472	0.031	651	476	244	185
2	2456	0.032	651	480	245	184
3	2466	0.031	651	477	246	182

Seat Leakage Test

Pretest leakage at 2250 psig = zero

Post-Test leakage at 2220 psig = zero

STATE OF ALABAMA
COUNTY OF MADISON } ss.

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

JEH Larry E. Frazier

SUBSCRIBED and sworn to before me this 23rd day of July, 1980

Virginia K. Hart
Notary Public in and for the County of Madison, State of Alabama.

My Commission expires Jan 13, 1983

Wyle shall have no liability for damages of any kind to person or property, including special or consequential damages, resulting from Wyle's providing the services covered by this report.

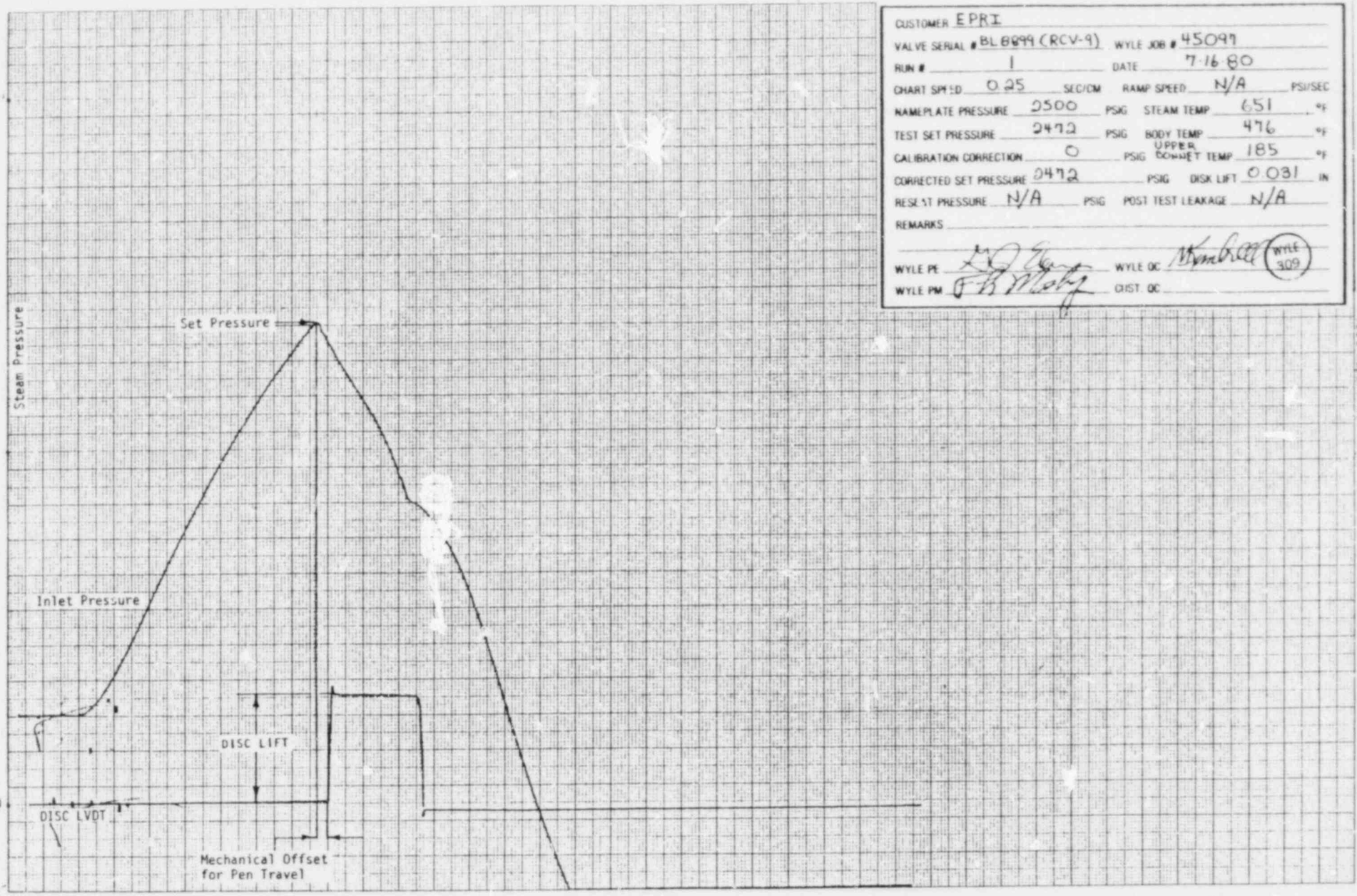
TEST BY Steam Services

PROJ. ENGINEER G. J. Elam

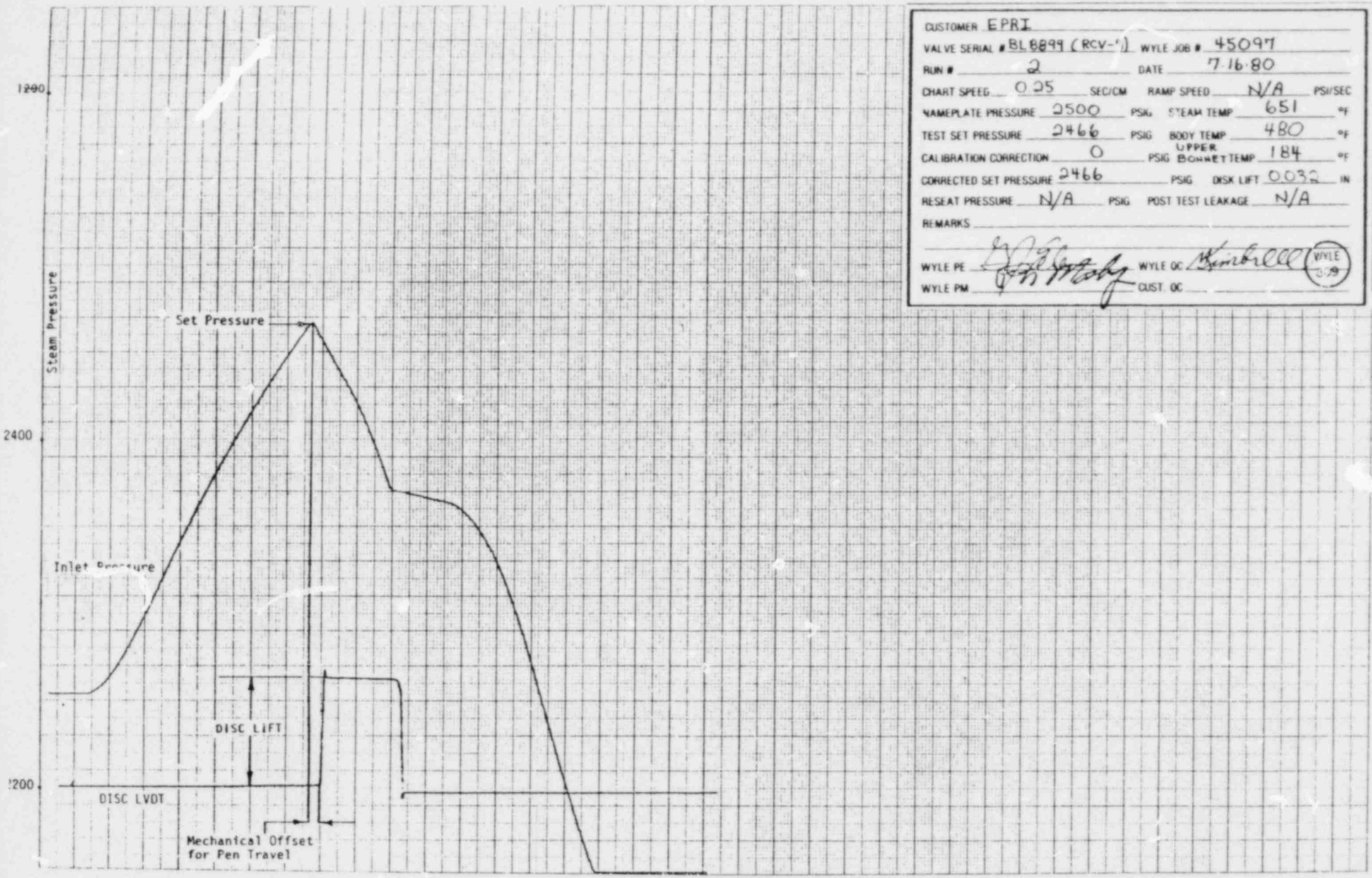
WYLE Q. A. M. Kimbrell

CUSTOMER EPRI
VALVE SERIAL # BL8899 (RCV-9) WYLE JOB # 45097
RUN # 1 DATE 7-16-80
CHART SPEED 0.25 SEC/CM RAMP SPEED N/A PSI/SEC
NAMEPLATE PRESSURE 2500 PSIG STEAM TEMP 651 °F
TEST SET PRESSURE 2472 PSIG BODY TEMP 476 °F
CALIBRATION CORRECTION 0 PSIG UPPER BONNET TEMP 185 °F
CORRECTED SET PRESSURE 2472 PSIG DISK LIFT 0.031 IN
RESEAT PRESSURE N/A PSIG POST TEST LEAKAGE N/A
REMARKS

WYLE PE [signature] WYLE QC [signature] Wit 309
WYLE PM [signature] CUST QC



CUSTOMER EPRI
VALVE SERIAL # BL8899 (RCV-1) WYLE JOB # 45097
RUN # 2 DATE 7-16-80
CHART SPEED 0.25 SEC/CM RAMP SPEED N/A PSI/SEC
NAMEPLATE PRESSURE 2500 PSIG STEAM TEMP 651 °F
TEST SET PRESSURE 2466 PSIG BODY TEMP 480 °F
CALIBRATION CORRECTION 0 PSIG UPPER BONNET TEMP 184 °F
CORRECTED SET PRESSURE 2466 PSIG DISK LIFT 0.032 IN
RESEAT PRESSURE N/A PSIG POST TEST LEAKAGE N/A
REMARKS
WYLE PE [signature] WYLE QC [signature]
WYLE PM [signature] CUST. QC



CUSTOMER EPRI

VALVE SERIAL # BL 8899(RCV-9) WYLE JOB # 45097

RUN # 3 DATE 7-16-80

CHART SPEED 0.5 SEC/CM RAMP SPEED N/A PSI/SEC

NAMEPLATE PRESSURE 2500 PSIG STEAM TEMP 651 °F

TEST SET PRESSURE 2466 PSIG BODY TEMP 477 °F

CALIBRATION CORRECTION 0 PSIG UPPER BONNET TEMP 182 °F

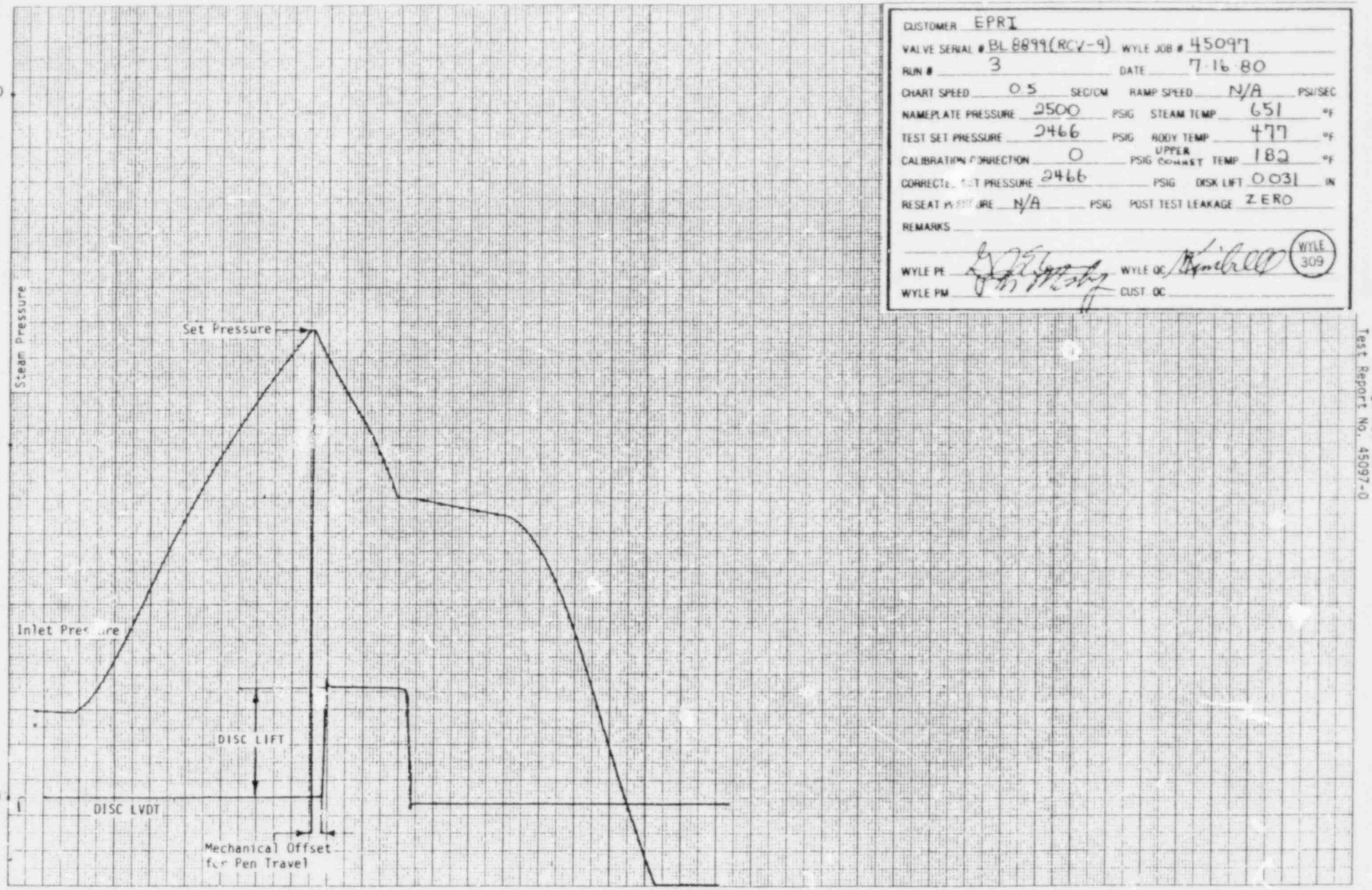
CORRECTED SET PRESSURE 2466 PSIG DISK LIFT 0.031 IN

RESEAT PRESSURE N/A PSIG POST TEST LEAKAGE ZERO

REMARKS

WYLE PE [signature] WYLE QC [signature] WYLE 309

WYLE PM [signature] CUST. QC



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APPENDIX II

AS RECEIVED TEST REPORT

FOR

VALVE FPC TAG NO. RCV-8

CERTIFICATION TEST REPORT

WYLE LABORATORIES

SCIENTIFIC SERVICES AND SYSTEMS GROUP
HUNTSVILLE, ALABAMA

Electric Power Research Institute
P. O. Box 10412
Palo Alto, CA 94303

REPORT NO. 45097-2
WYLE JOB NO. 45097-0
CUSTOMER P. O. NO. 11414
CONTRACT N/A

MANUFACTURER Dresser Industries

DATE July 16, 1980

4 PAGE REPORT

1. SPECIMEN Pressurizer Safety Valve

2. SET PRESSURE: 2500 ± 1% psig

3. PART NO. 31739A

4. SERIAL NO. BL8900
FPC Tag. No. RCV-8

5. SUMMARY

Valve Serial Number BL8900 was tested for set pressure and leakage with steam as the test medium per Wyle Laboratories Test Procedure 1009, dated February 22, 1980, with Elevated Temperature Test per Appendix II. Prior to test, the valve was disassembled for inspection with spring compression retained and reassembled for test. The test results are presented below:

Set Pressure Test

Run No.	Set Pressure (psig)	Disc Lift	Steam Temp (°F)	Inlet Flange Temp (°F)	Lower Bonnet Temp (°F)	Upper Bonnet Temp (°F)
1	2392	0.037	645	480	212	195
2	2388	0.038	645	481	213	196
3	2388	0.038	645	481	213	195

Seat Leakage Test

Pretest Leakage at 2160 psig = gross

Post-Test Leakage at 2150 psig = gross

By measuring condensate collected during test, valve leakage was 1.0-1.2 GPM or approximately 550 lb/hr.

STATE OF ALABAMA
COUNTY OF MADISON } ss

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

SEAL

Larry E. Frazier

SUBSCRIBED and sworn to before me this 28th day of July, 1980

Virginia K. Reed

Notary Public in and for the County of Madison, State of Alabama.

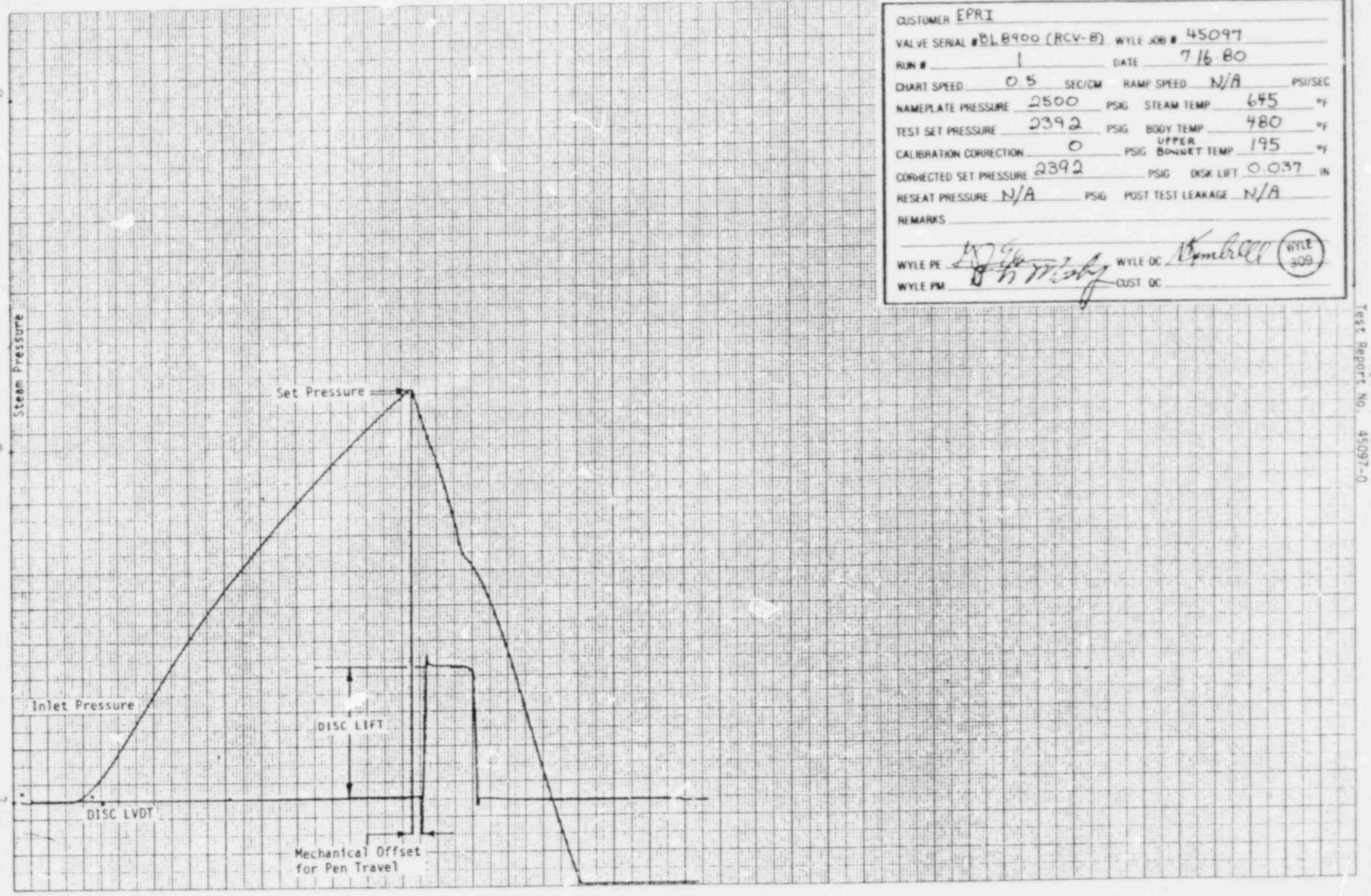
My Commission expires June 13, 1983

Steam Services
TEST BY

PROJ. ENGINEER G. J. Elapt

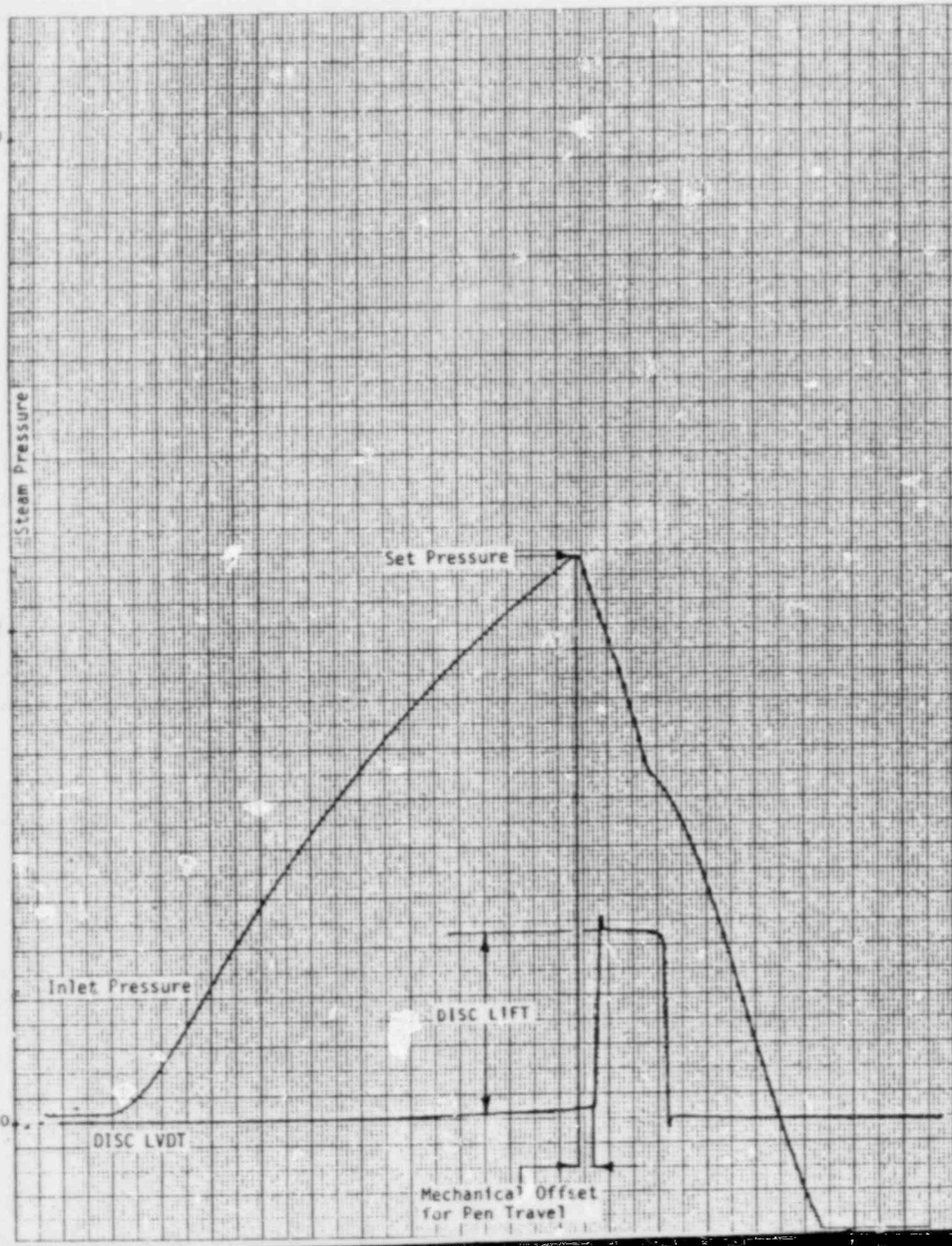
WYLE Q. A. M. Kimbrell

CUSTOMER EPRI
VALVE SERIAL # BL8900 (RCV-B) WYLE JOB # 45097
RUN # 1 DATE 7/16/80
CHART SPEED 0.5 SEC/CM RAMP SPEED N/A PSI/SEC
NAMEPLATE PRESSURE 2500 PSIG STEAM TEMP 645 °F
TEST SET PRESSURE 2392 PSIG BODY TEMP 480 °F
CALIBRATION CORRECTION 0 PSIG UPPER BONNET TEMP 195 °F
CORRECTED SET PRESSURE 2392 PSIG DISK LIFT 0.037 IN
RESEAT PRESSURE N/A PSIG POST TEST LEAKAGE N/A
REMARKS
WYLE PE [signature] WYLE QC [signature] WYLE 309
WYLE PM [signature] CUST QC

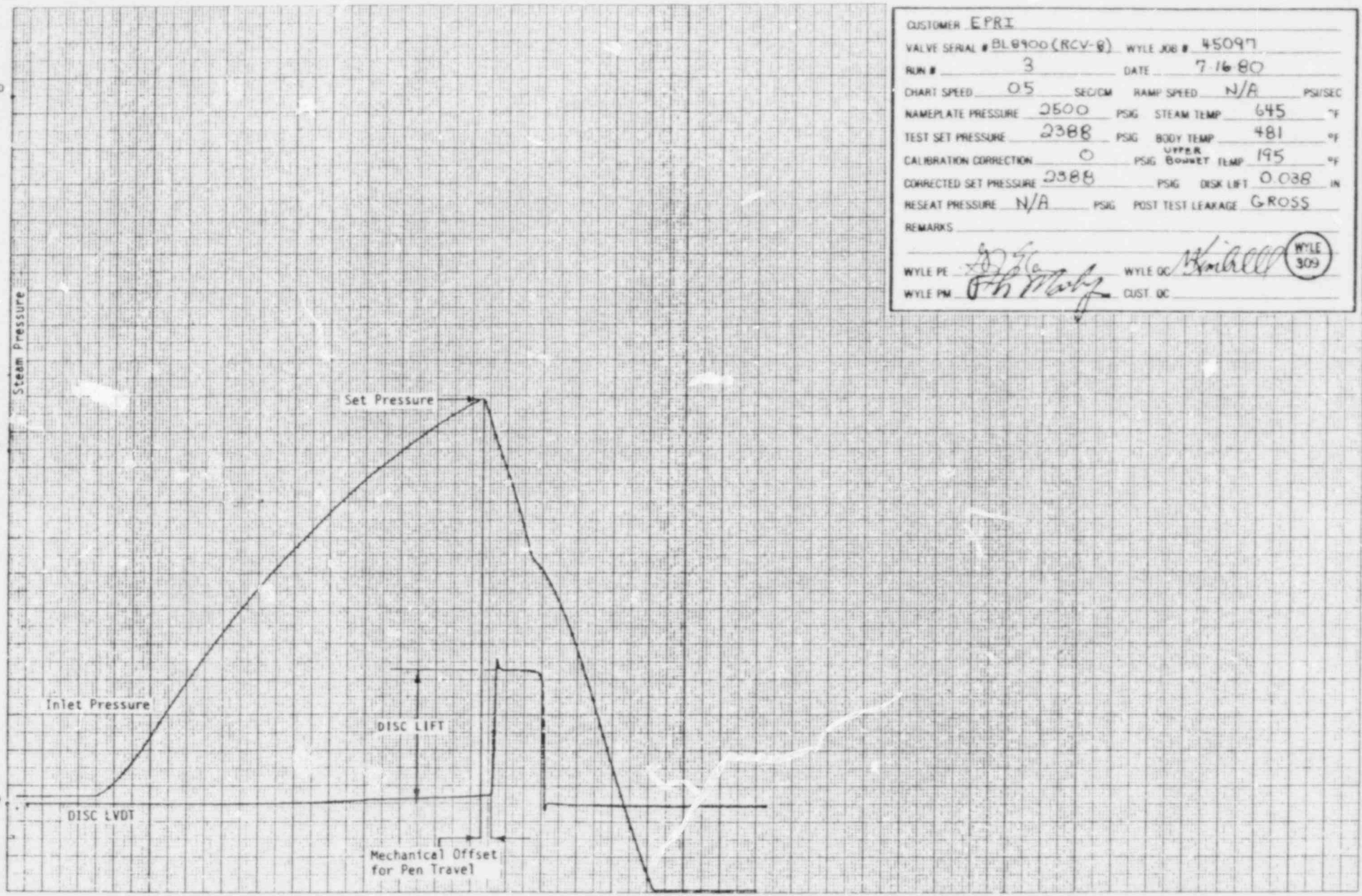


CUSTOMER EPRI
VALVE SERIAL # BL8900 (RCV-8) WYLE JOB # 45097
RUN # 2 DATE 7-16-80
CHART SPEED 0.5 SEC/CM RAMP SPEED N/A PSI/SEC
NAMEPLATE PRESSURE 2500 PSIG STEAM TEMP 645 °F
TEST SET PRESSURE 2388 PSIG BODY TEMP 481 °F
CALIBRATION CORRECTION 0 PSIG UPPER BONNET TEMP 196 °F
CORRECTED SET PRESSURE 2388 PSIG DISK LIFT 0.038 IN
RESEAT PRESSURE N/A PSIG POST TEST LEAKAGE N/A
REMARKS

WYLE PE [signature] WYLE QC [signature]
WYLE PM [signature] CUST QC



CUSTOMER EPRI
VALVE SERIAL # BL8900 (RCV-8) WYLE JOB # 45097
RUN # 3 DATE 7-16-80
CHART SPEED 05 SEC/CM RAMP SPEED N/A PSI/SEC
NAMEPLATE PRESSURE 2500 PSIG STEAM TEMP 645 °F
TEST SET PRESSURE 2388 PSIG BODY TEMP 481 °F
CALIBRATION CORRECTION 0 PSIG UPPER BONNET TEMP 195 °F
CORRECTED SET PRESSURE 2388 PSIG DISK LIFT 0.038 IN
RESEAT PRESSURE N/A PSIG POST TEST LEAKAGE GROSS
REMARKS
WYLE PE [signature] WYLE QC [signature] WYLE 309
WYLE PM [signature] CUST. QC



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APPENDIX III

CERTIFICATION TEST REPORT

VALVE FPC TAG NO. RCV-9

CERTIFICATION TEST REPORT

WYLE LABORATORIES
SCIENTIFIC SERVICES AND SYSTEMS GROUP
HUNTSVILLE, ALABAMA

Electric Power Research Institute
P. O. Box 10412
Palo Alto, CA 94303

REPORT NO. 45097-3
WYLE JOB NO. 45097-0
CUSTOMER P. O. NO. 11414
CONTRACT N/A

MANUFACTURER Dresser Industries

DATE July 18, 1980

4 PAGE REPORT

1. SPECIMEN Pressurizer Safety Valve
2. SET PRESSURE: 2500 ± 1% psig
3. PART NO. 31739A
4. SERIAL NO. BL8899
   FPC Tag No. RCV-9
5. SUMMARY

Valve Serial Number BL8899 was tested for set pressur and leakage with steam as the test medium per Wyle Laboratories Test Procedure J09, dated February 22, 1980, with Elevated Temperature Test per Appendix II. The valve was reworked prior to test. The test results are presented below.

Set Pressure Test

Run No.	Set Pressure (psig)	Disc Lift	Steam Temp (°F)	Inlet Flange Temp (°F)	Lower Bonnet Temp (°F)	Upper Bonnet Temp (°F)
6	2496	0.027	651	474	215	177
7	2506	0.027	651	476	217	177
8	2497	0.027	651	476	218	178

Seat Leakage Test

Pretest leakage at 2250 psig = zero

Post-Test leakage at 2250 psig = zero

STATE OF ALABAMA
COUNTY OF MADISON } ss

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

Larry E. Frazier

SUBSCRIBED and sworn to before me this 22 day of July, 1980

Virginia K. Abbott

Notary Public in and for the County of Madison, State of Alabama

My Commission expires June 13, 1983

FORM 1019A, Rev. Feb. '74

Wyle shall have no liability for damages of any kind to person or property, including special or consequential damages, resulting from Wyle's providing the services covered by this report.

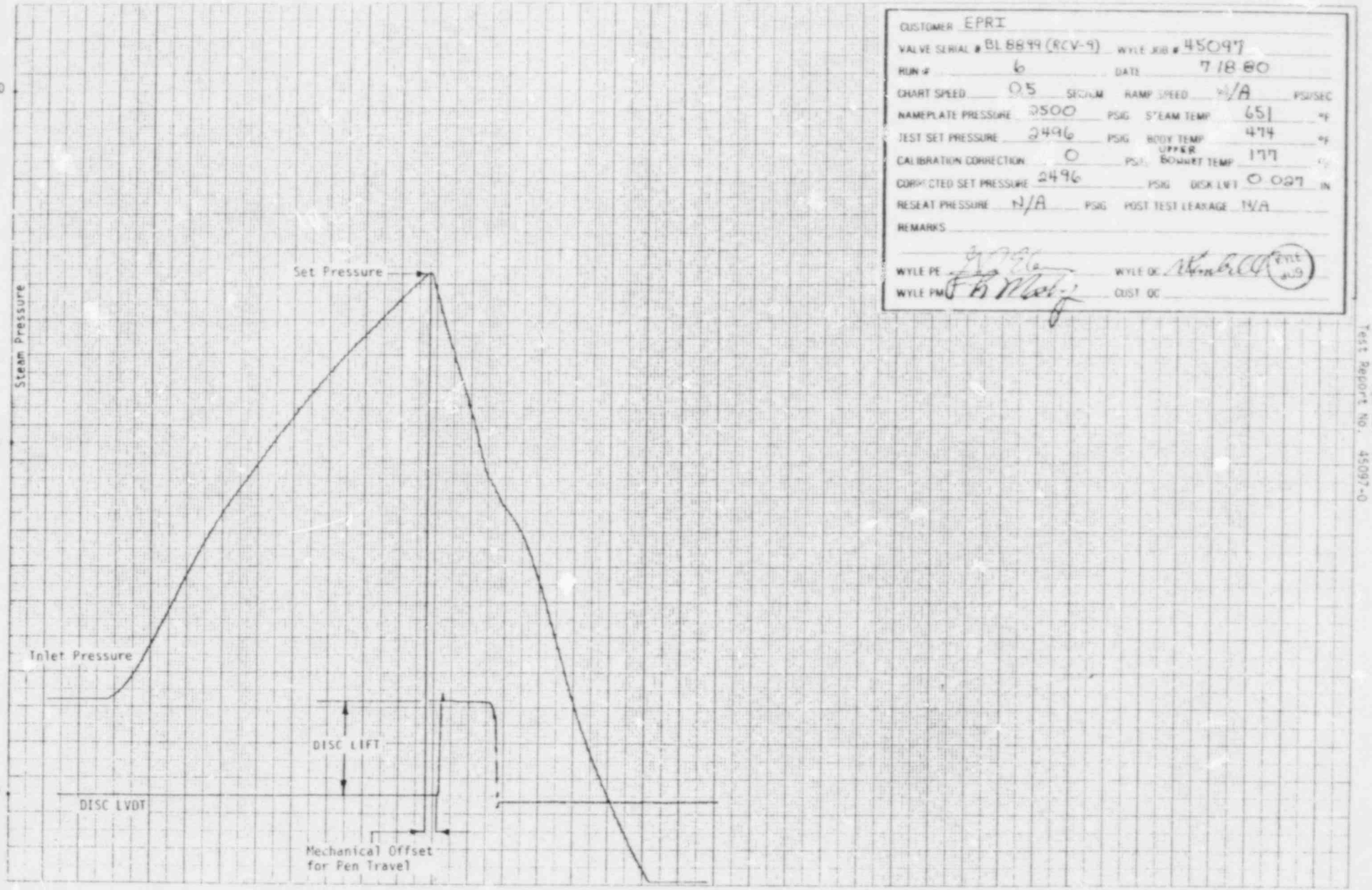
TEST BY Steam Services

PROJ. ENGINEER B. J. Elam

WYLE Q. A. M. Kimbrell

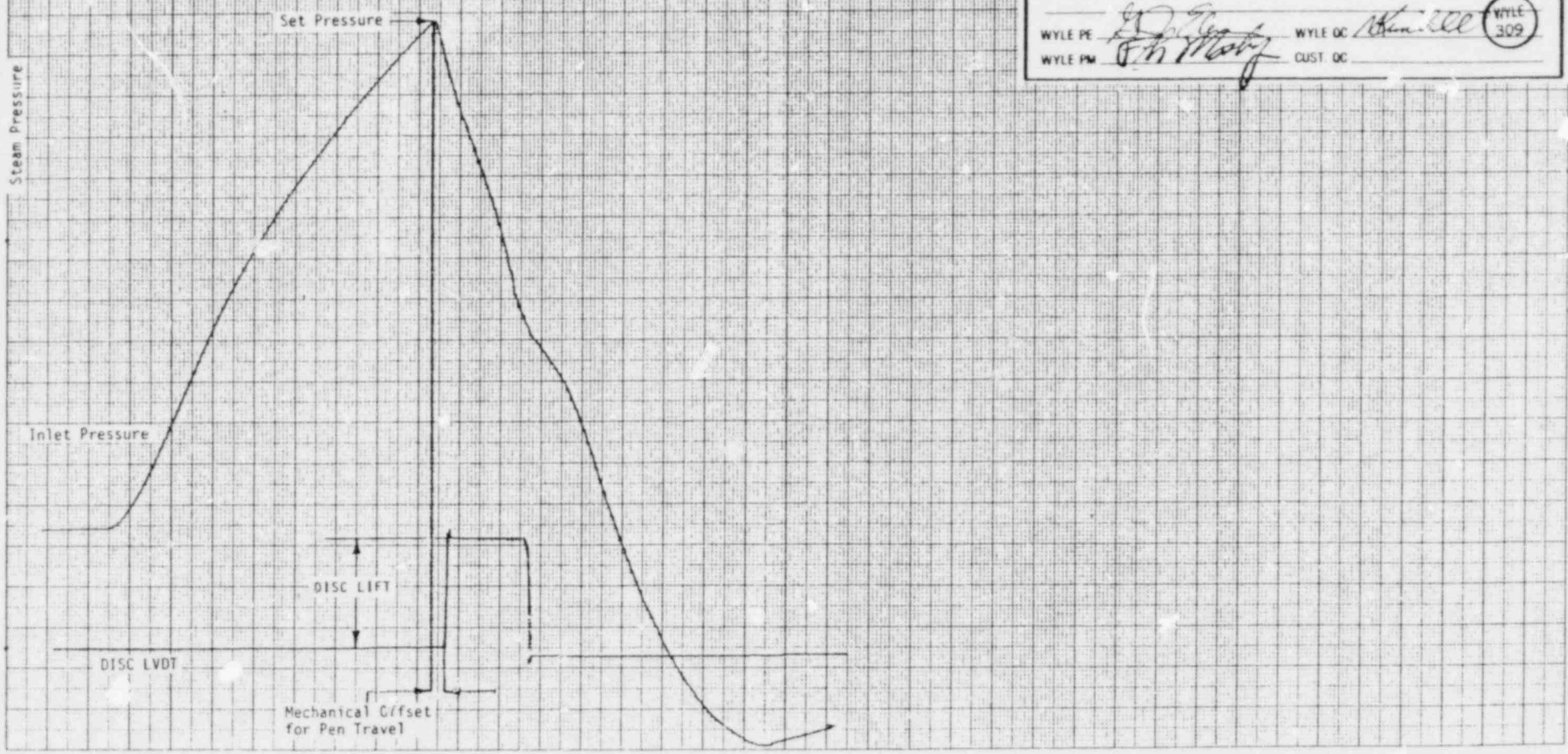
CUSTOMER EPRI
VALVE SERIAL # BL 8899 (RCV-9) WYLE JOB # 45097
RUN # 6 DATE 7 18 80
CHART SPEED .05 SEC/IN RAMP SPEED N/A PSI/SEC
NAMEPLATE PRESSURE 2500 PSIG STEAM TEMP 651 °F
TEST SET PRESSURE 2496 PSIG BODY TEMP 474 °F
CALIBRATION CORRECTION 0 PSI UPPER BONNET TEMP 177 °F
CORRECTED SET PRESSURE 2496 PSIG DISK LVDT 0.027 IN
RESEAT PRESSURE N/A PSIG POST TEST LEAKAGE N/A
REMARKS

WYLE PE [signature] WYLE QC [signature] (Init 8/9)
WYLE PM [signature] CUST QC



CUSTOMER EPRI
VALVE SERIAL # BL 8899 (RCV-9) WYLE JOB # 45097
RUN # 7 DATE 7.18.80
CHART SPEED .05 SEC/CM RAMP SPEED N/A PSI/SEC
NAMEPLATE PRESSURE 2500 PSIG STEAM TEMP 651 °F
TEST SET PRESSURE 2506 PSIG BODY TEMP 476 °F
CALIBRATION CORRECTION 0 PSIG UPPER BONNET TEMP 177 °F
CORRECTED SET PRESSURE 2506 PSIG DISK LIFT 0.027 IN
RESEAT PRESSURE N/A PSIG POST TEST LEAKAGE N/A
REMARKS

WYLE PE [signature] WYLE QC [signature] WYLE 309
WYLE PM [signature] CUST. QC



CUSTOMER EPRI

VALVE SERIAL # BL8899 (RCV-9) WYLE JOB # 45097

RUN # 8 DATE 7-18-80

CHART SPEED 0.5 SEC/CM RAMP SPEED N/A PSI/SEC

NAMEPLATE PRESSURE 2500 PSIG STEAM TEMP 651 °F

TEST SET PRESSURE 2497 PSIG BODY TEMP 476 °F

CALIBRATION CORRECTION 0 PSIG UPPER BONNET TEMP 178 °F

CORRECTED SET PRESSURE 2497 PSIG DISK LIFT 0.027 IN

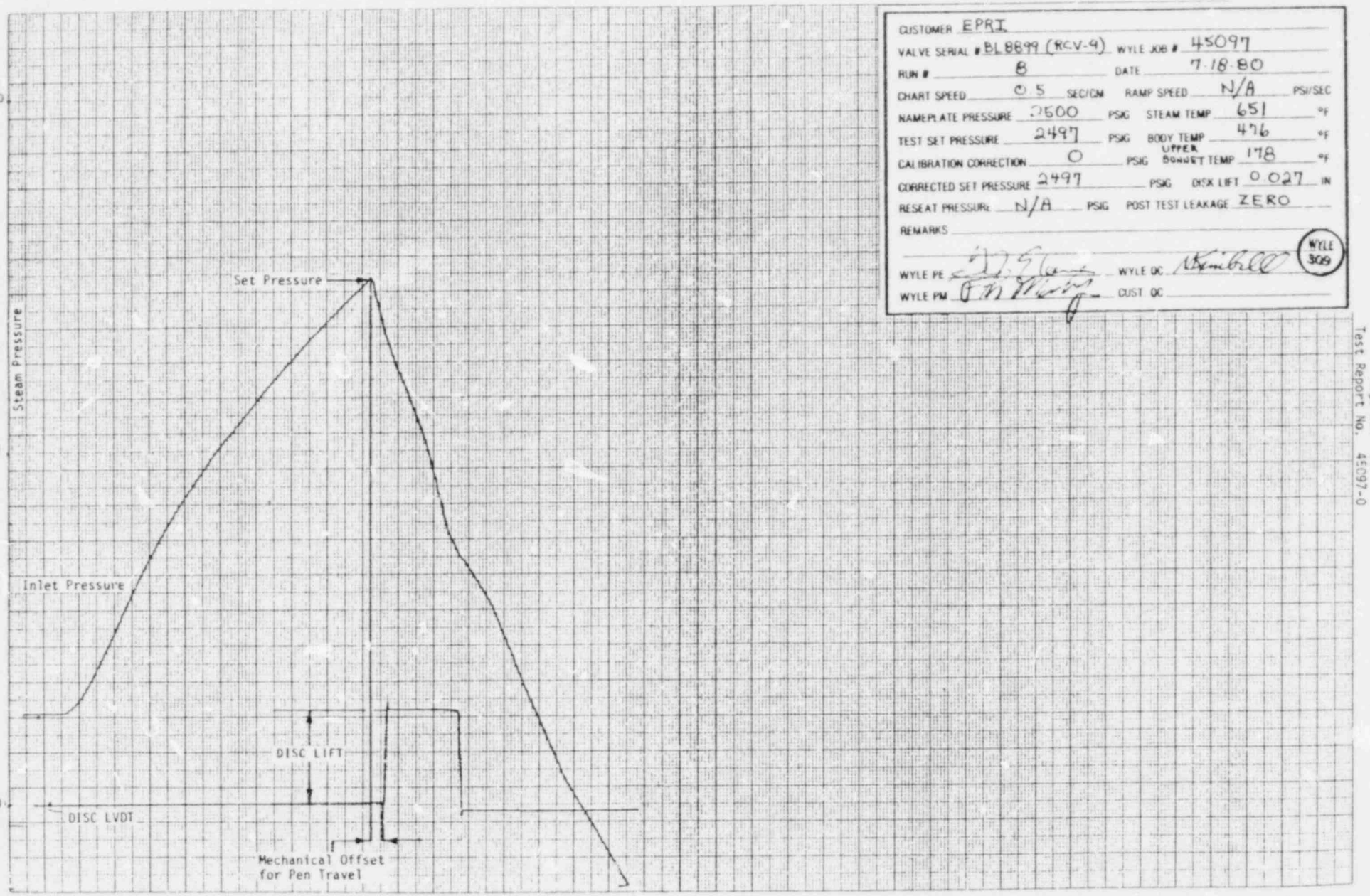
RESEAT PRESSURE N/A PSIG POST TEST LEAKAGE ZERO

REMARKS

WYLE PE D.J. Clem WYLE QC Kimball

WYLE PM Tom Wong CUST QC

WYLE 3069



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APPENDIX IV

CERTIFICATION TEST REPORT

VALVE FPC TAG NO. RCV-8

CERTIFICATION TEST REPORT

WYLE LABORATORIES

SCIENTIFIC SERVICES AND SYSTEMS GROUP
HUNTSVILLE, ALABAMA

Electric Power Research Institute
P. O. Box 10412
Palo Alto, CA 94303

REPORT NO. 45097-4
WYLE JOB NO. 45097-0
CUSTOMER P. O. NO. 11414
CONTRACT N/A

MANUFACTURER Dresser Industries

DATE July 18, 1980

4 PAGE REPORT

1. SPECIMEN Pressurizer Safety Valve

2. SET PRESSURE: 2500 ± 1% psig

3. PART NO. 31739A

4. SERIAL NO. BL8900
FPC Tag No. RCV-8

5. SUMMARY

Valve Serial Number BL8900 was tested for set pressure and leakage with steam as the test medium per Wyle Laboratories Test Procedure 1009, dated February 22, 1980, with Elevated Temperature Test per Appendix II. The valve was reworked prior to test. The test results are presented below:

Set Pressure Test

Run No.	Set Pressure (psig)	Disc Lift	Steam Temp (°F)	Inlet Flange Temp (°F)	Lower Bonnet Temp (°F)	Upper Bonnet Temp (°F)
2	2480	0.028	651	470	213	178
3	2485	0.029	651	473	214	178
4	2489	0.028	651	474	215	178

Seat Leakage Test

Pretest leakage at 2250 psig = zero

Post-Test leakage at 2250 psig = zero

STATE OF ALABAMA
COUNTY OF MADISON } ss

Larry E. Frazier being duly sworn deposes and says: The information contained in this report is the result of completed and carefully conducted tests and is to the best of his knowledge true and correct in all respects.

Larry E. Frazier

SUBSCRIBED and sworn to before me this 22nd day of July, 1980

Notary Public in and for the County of Madison, State of Alabama

My Commission expires June 13, 1983

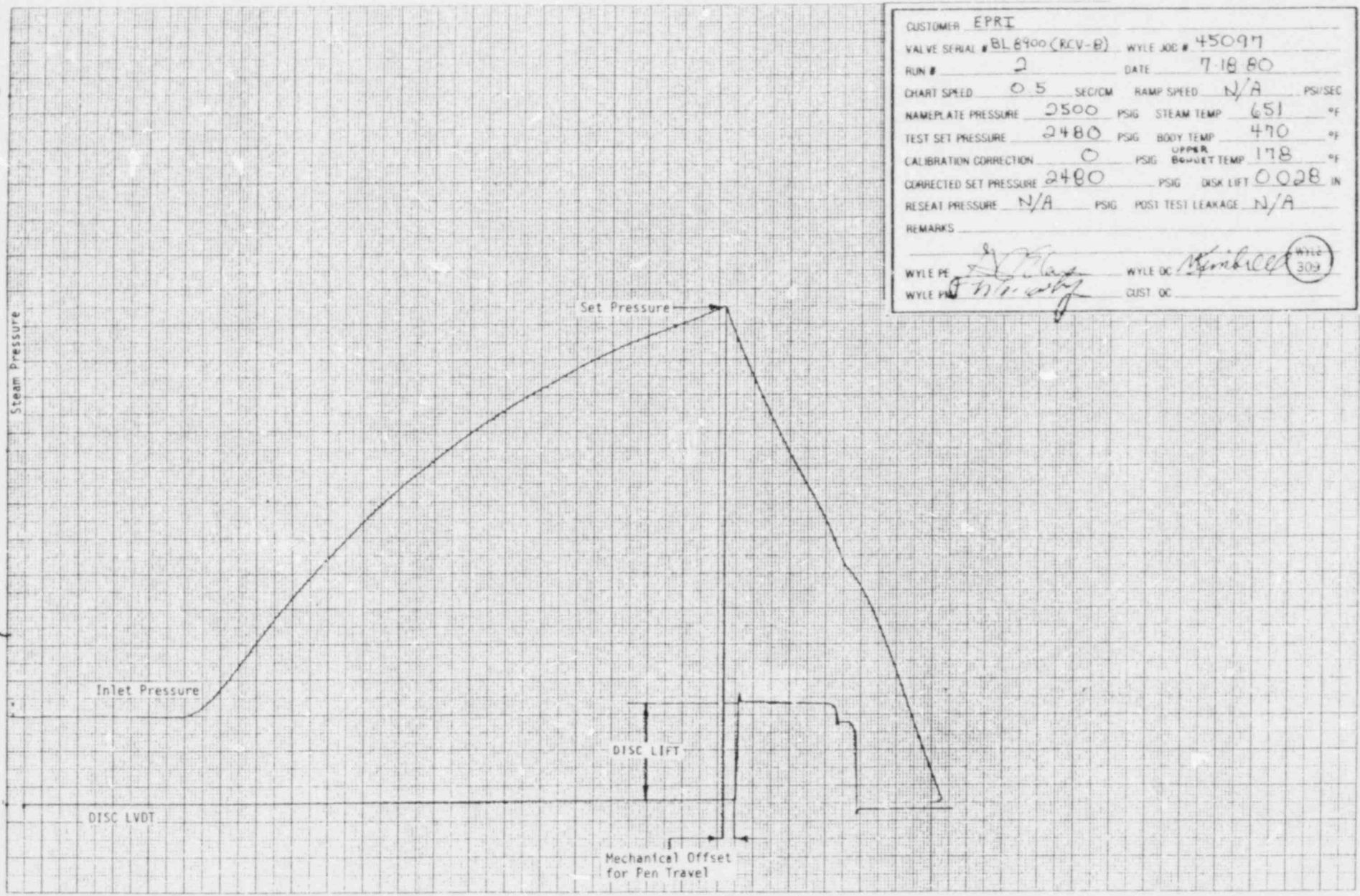
FORM 1019A, Rev. Feb. '74

Steam Services
TEST BY

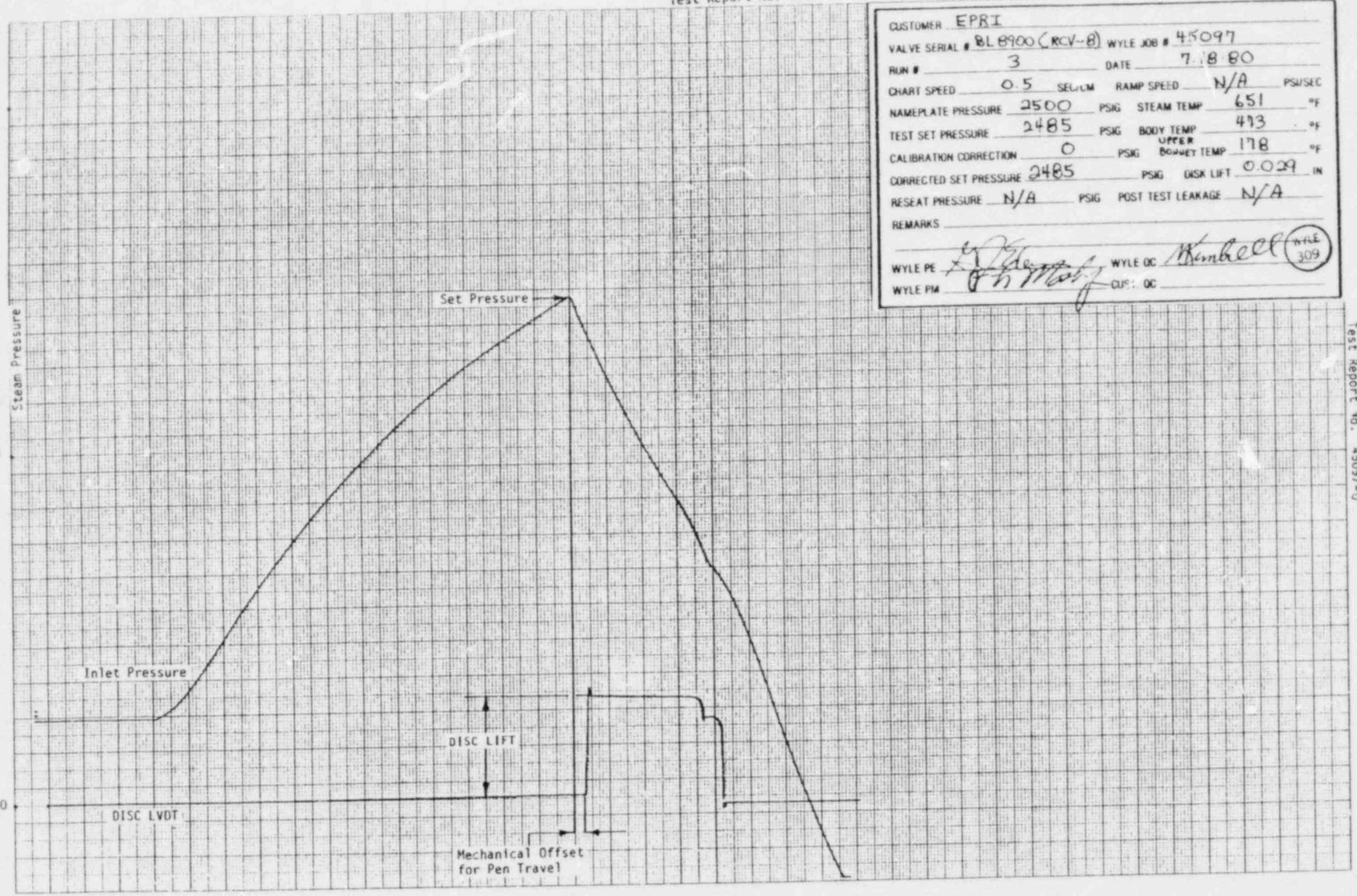
PROJ. ENGINEER G. J. Elam

WYLE Q. A. M. Kimbrell

CUSTOMER EPRI
VALVE SERIAL # BL8900 (RCV-B) WYLE JOB # 45097
RUN # 2 DATE 7 18 80
CHART SPEED 0 5 SEC/DM RAMP SPEED N/A PSI/SEC
NAMEPLATE PRESSURE 2500 PSIG STEAM TEMP 651 °F
TEST SET PRESSURE 2480 PSIG BODY TEMP 470 °F
CALIBRATION CORRECTION 0 PSIG UPPER BONNET TEMP 178 °F
CORRECTED SET PRESSURE 2480 PSIG DISK LIFT 0028 IN
RESEAT PRESSURE N/A PSIG POST TEST LEAKAGE N/A
REMARKS
WYLE PE [signature] WYLE QC [signature] WYLE 309
WYLE PM [signature] CUST QC



CUSTOMER EPRI
VALVE SERIAL # BL8900 (RCV-8) WYLE JOB # 45097
RUN # 3 DATE 7.8.80
CHART SPEED 0.5 SEC/CM RAMP SPEED N/A PSI/SEC
NAMEPLATE PRESSURE 2500 PSIG STEAM TEMP 651 °F
TEST SET PRESSURE 2485 PSIG BODY TEMP 493 °F
CALIBRATION CORRECTION 0 PSIG UPPER BONNET TEMP 178 °F
CORRECTED SET PRESSURE 2485 PSIG DISK LIFT 0.029 IN
RESEAT PRESSURE N/A PSIG POST TEST LEAKAGE N/A
REMARKS
WYLE PE [signature] WYLE QC [signature] WYLE 309
WYLE PM [signature] CUST. QC



CUSTOMER EPRI
VALVE SERIAL # BL 6900 (RCV-8) WYLE JOB # 45097
RUN # 4 DATE 7 18 80
CHART SPEED 0.5 SEC/DIV RAMP SPEED N/A PSI/SEC
NAMEPLATE PRESSURE 2500 PSIG STEAM TEMP 651 °F
TEST SET PRESSURE 2489 PSIG BODY TEMP 474 °F
CALIBRATION CORRECTION 0 PSIG UPPER BONNET TEMP 178 °F
CORRECTED SET PRESSURE 2489 PSIG DISK LIFT 0.028 IN
RESEAT PRESSURE N/A PSIG POST TEST LEAKAGE ZERO
REMARKS
WYLE PE [signature] WYLE QC [signature] WYLE 309
WYLE PM [signature] CUST QC