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UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

SGRT:RBM
50-410

MEMORANDUM FOR: James H. Joyner, Chief
Nuclear Material Safety and Safeguards Branch
Region I

FROM: George W. McCorkle, Chief
Safeguards Reactor and Transportation
Licensing Branch
Division of Safeguards, NMSS

SUBJECT: SALP INPUT - NINE MILE POINT UNIT 2
(FEBRUARY 1, 1985 - JANUARY 31, 1986)

Enclosed is our annual SALP report for the subject facility.

George W. McCorkle, Chief
Safeguards Reactor and Transportation
Licensing Branch
Division of Safeguards, NMSS

Enclosure:
As stated

cc: H. Berkow, NRR
M. Haughey, NRR

CONTACT:
R. B. Manili, NMSS
42-74709

SGRT:RBM
50-410

SALP REPORT
NINE MILE POINT UNIT 2

CRITERIA	CATEGORY
1. Management Involvement and Control in Assuring Quality	
There was consistent evidence of prior planning by utility (including corporate level) management. Responses regarding safeguards matters were technically sound and consistent, demonstrating the existence of well developed policies and procedures for control of security related activities.	1
2. Approach to Resolution of Technical Issues From a Safety/Safeguards Standpoint	
Solutions to technical safeguards problems were sound, timely and conservative, indicating a clear understanding of the issues.	1
3. Responsiveness to NRC Initiatives	
Resolutions were submitted promptly, and in most cases were acceptable the first time.	1
4. Enforcement History	N/A
5. Reporting and Analysis of Reportable Events	N/A
6. Staffing (Including Management)	
Security Organization positions and responsibilities are well defined. The security staff is considered to be more than ample to implement the facility physical protection program.	1
7. Training and Qualification Effectiveness	
The facility guard training and qualification plan is effectively implemented on a continuing basis at all levels of the security organization.	1

ENCLOSURE

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

October 9, 1986

Docket No. 50-410

APPLICANT: Niagara Mohawk Power Corporation

FACILITY: Nine Mile Point, Unit 2

SUBJECT: MEETING SUMMARY FOR SEPTEMBER 24, 1986, MEETING ON MAIN STEAM ISOLATION VALVES

On September 24, 1986, the staff met with representatives of Niagara Mohawk Power Corporation (NMPC) and their consultants from Stone and Webster Engineering Corporation (SWEC) to discuss problems with the main steam isolation valves (MSIVs) at Nine Mile Point, Unit 2 (NMP-2). In the last several months NMPC has discovered major problems with the MSIV actuator latching mechanism and galling of the valve ball.

On August 27, 1986, the staff met with NMPC to discuss the August 22, 1986, exemption request on the MSIV actuator problem. Subsequently, the exemption request for the actuators was revised and resubmitted on August 28, 1986. While the staff was in the process of reviewing the revised exemption request the MSIV actuators, NMPC identified an additional problem concerning the leakage rates of the MSIVs. In the process of performing some additional leak rate tests in late August 1986, NMPC discovered these valves were leaking at a rate significantly higher than during tests performed in spring of 1985, and spring of 1986. Upon disassembly, NMPC discovered galling of the tungsten carbide coating on the valve ball. When the ball was rotated during opening and closing of these valves, the galled tungsten carbide was passing over the stellite valve seats and scoring them. This scoring resulted in the much higher valve leakage rates.

NMPC then embarked on a testing program of these valves. The one successful test invloved a spare valve ball, a modified spring arrangement for the valve seat, and a modified valve operator which used hydraulics rather than a latching mechanism to hold the valve open. The valve was cycled 75 times. Leak tests were performed after 5, 15, 25, 35, 45, 55, 65 and 75 cycles. The leak rate for all tests was below the 6 SCFH allowable leakage rate.

At the time of the September 24, 1986, meeting, NMPC had scheduled additional testing with an MSIV with a "blended" ball (i.e., the galled surface had been machined to smooth out the rough edges), the new seat assembly, and a modified actuator. This test was completed on September 26, 1986. This valve assembly did not pass the leakage test after 2 cycles. After disassembly it was determined that the galling problems were continuing and that a blended ball was not acceptable.

NMPC has stated in discussions with the staff, that it is proceeding with removing the old tungsten carbide coating and recladding the valves. A revised exemption request was submitted October 2, 1986, and is under review. The complete report is scheduled for submittal October 10, 1986.

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ENCLOSURE 2

ATTENDEES

MSIV MEETING 9/ 24/ 86

NAME	ORGANIZATION
R. A. Cushman	NMPC
A. F. Zallnick	NMPC
C. E. Crocker	SWEC
C. D. Terry	NMPC
M. A. Durka	SWEC
M. A. Fachada	SWEC
E. R. Klein	NMPC
T. D. Fay	NMPC
D. L. Hill	NMPC
K. F. Roenick	NYS PSC
H. K. Shaw	NRC/DBL/EB
J. D. Page	NRC/NRR//DSRO/EIB
R. M. Bernero	NRC/DBL
E. G. Adensam	NRC/DBL
F. J. Witt	NRC/DBL/PSB
A. J. Fiorente	SWEC
J. Lombardo	NRC/DBL/EB
B. Miller	BNL
R. G. LaGrange	NRC/DBL/EB
B. Turovlin	NRC/DBL/EB
Jack Kudrick	NRC/DBL/PSB
Gus Lainas	NRC/DBL
T. J. Perkins	NMPC
C.Mangan	NMPC
Jerry Hulman	NRC/DBL/PSB
Wayne Hodges	NRC/DBL/RSB
Owen Rothberg	NRC/NRR/DSRO
H. F. Conrad	NRC/DBL/EB
R. A. Hermann	NRC/DBL/EB

rel

(6)

Nine Mile Point 2 10/15/86 (MSIV) Meeting Summary

- NMPC position is that they understand the root cause of both problems and have demonstrated an acceptable fix for one cycle.
  - Actuator - mechanical latch won't release quick enough to permit closure in 5 seconds so it has been removed and hydraulic system will be modified to hold valve open continuously.
  - Leakage - tungsten carbide coating flaking off due to high friction force as valve starts to open has been fixed by changing the seat ring spring forces and restoring the balls to original code acceptable condition.
- Final 10 CFR 50.55(e) report will be submitted by 10/24/[illegible]
- In addition to having four leak tested valves in place before license issuance per their exemption request and having all valves fully operable prior to heat-up the licensee made the following additional commitments which will be included as a license condition:

J/5

1 Provide program description, objectives and schedule for full scale confirmatory prototype testing to be completed by March 1987 to include further justification for between the seats LLRT in lieu of between valve testing.

2 Provide results of prototype testing.

3 Perform an additional LLRT to that required by Appendix J during the midcycle outage ~~during~~ at about the time of the MSIV closure trip from full power at the conclusion of the power ascension testing program.

MSIV BALL VALVES
NRC MEETING – OCTOBER 15, 1986
AGENDA

- BACKGROUND .... C.D. TERRY
- OVERVIEW .... C.D. TERRY
- RESOLUTION OF LEAKAGE PROBLEMS .... E.R. KLEIN
- ACTUATOR MODIFICATIONS .... E.R. KLEIN
- LONG RANGE PROGRAMS .... J. HUTTON
- CONCLUSIONS .... C.D. TERRY

NMMSIVMP29

BACKGROUND

- ACTUATOR PROBLEMS
  - DISCOVERED EARLY AUGUST

- LEAKAGE PROBLEMS
  - DISCOVERED LATE AUGUST

- INTERIM MEETING WITH NRC
  - SEPTEMBER 24

- INTERIM 10CFR50.55(e) REPORT
  - LEAKAGE PROBLEMS – OCTOBER 8

NMMSIVMP30

OVERVIEW

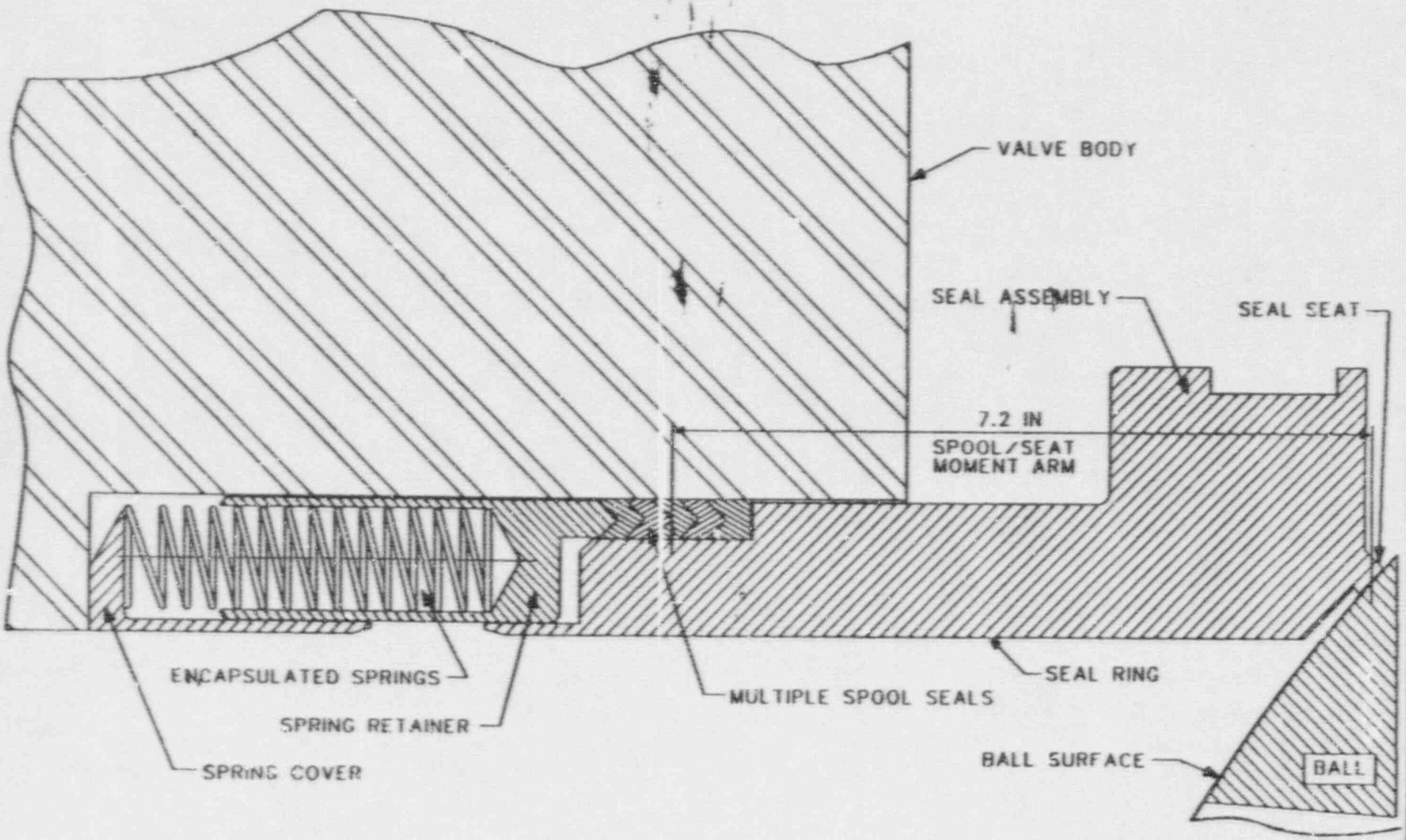
- RESOLUTION OF LEAKAGE PROBLEMS
  - TESTING/ANALYSIS OF PROBLEMS
  - ROOT CAUSE DETERMINATION
  - EVALUATION OF OPERATING CONDITIONS
  - STATUS OF REPAIRS
- ACTUATOR MODIFICATIONS
  - DESCRIPTION
  - CONFIRMATORY TESTS
  - SCHEDULE
- LONG RANGE PROGRAMS
  - PROGRAM DESCRIPTION
  - SCHEDULE/STATUS
- CONCLUSION

NMMSIVMP31

- RESOLUTION OF LEAKAGE PROBLEMS
  - REVIEW OF PREVIOUS DATA
  - REVIEW OF IN PLANT TEST DATA
  - MATHMATICAL ANALYSIS
  - TESTING
    - SITE RESULTS
    - LABORATORY RESULTS
    - METALLURGICAL CONCLUSIONS
  - SCHEDULE

HMMSIVMP44

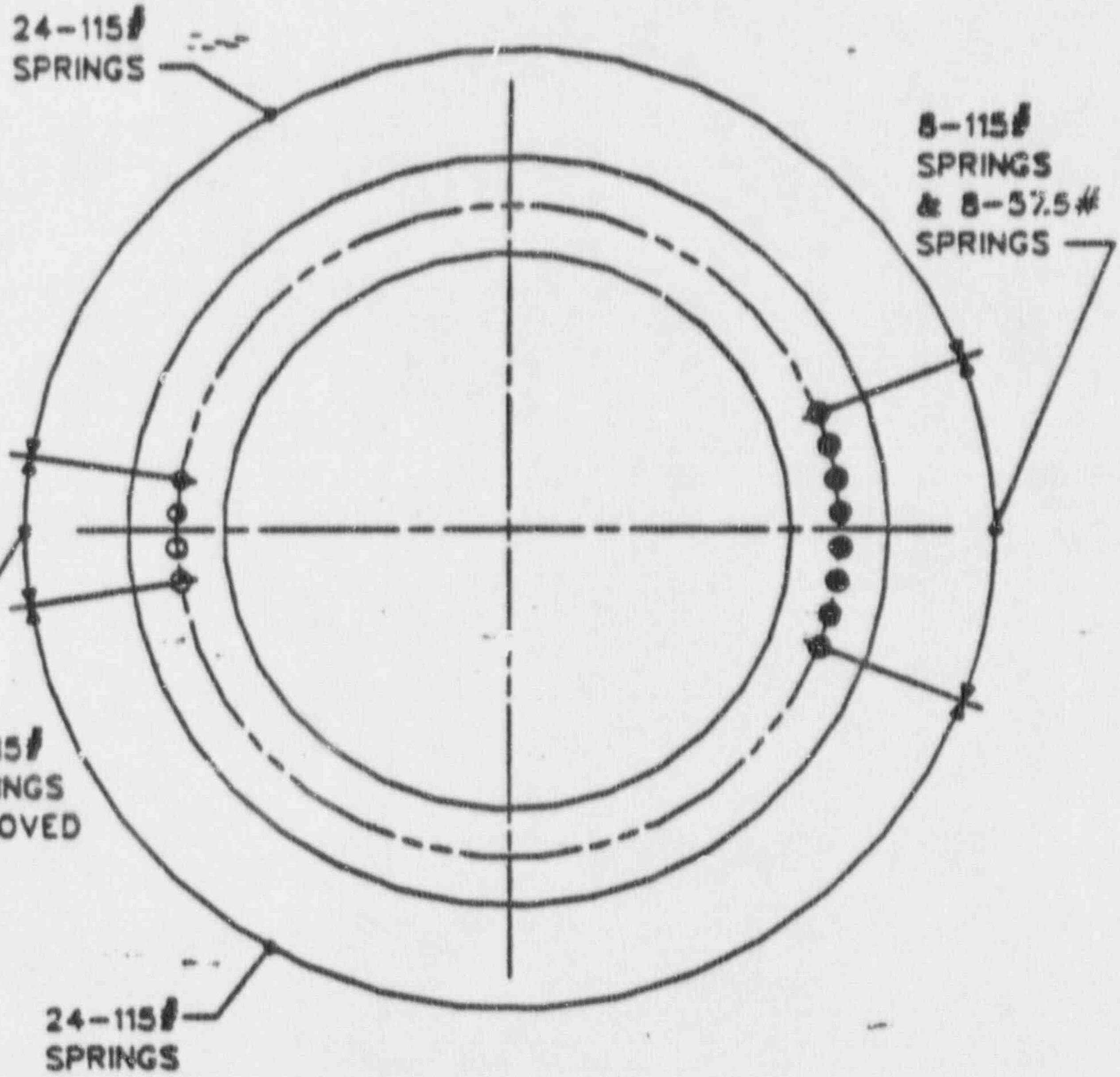
MSIV SEAL ARRANGEMENT
DETAIL "A"



BALL & SEAT ASSEMBLY IN THE CLOSED POSITION

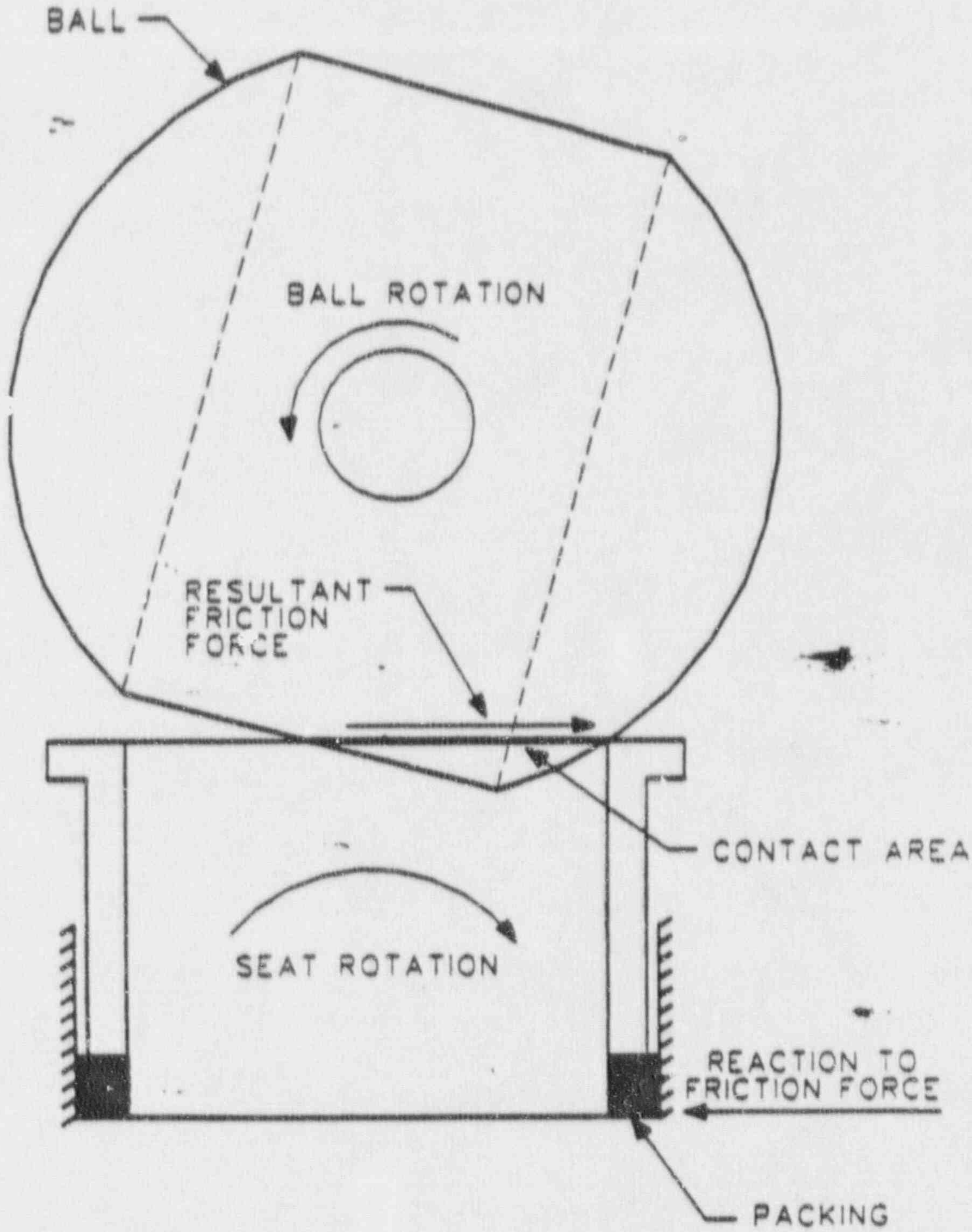
FIGURE 4-2

MODIFIED SPRING CONFIGURATION



TOTAL SPRING LOAD

56 - 115# SPRINGS	=	6440#
8 - 57.5# SPRINGS	=	460#
		6900#



VALVE OPENING FRICTION FORCE & ROTATION

NMMSIVM057

ACCUMULATED CYCLES	NEW BALL MODIFIED SPRINGS		BLENDED BALL ORIGINAL SPRINGS		BLENDED BALL MODIFIED SPRINGS	
	BS	TS	BS *	TS **	BS	TS
5	4.8	2.3	11.2	5.1	18.4	***
15	4.9	2.9	51	5.5	59	-
25	4.7	-	132	10.9	100+	-
35	4.4	-	-	-		-
45	4.2	-	-	-		-
55	4.0	-	-	-		-
65	3.9	-	-	-		-
75	4.4	3.2	-	-		-

NOTES:

* BETWEEN SEATS - SCFH

** THROUGH SEATS - SCFH

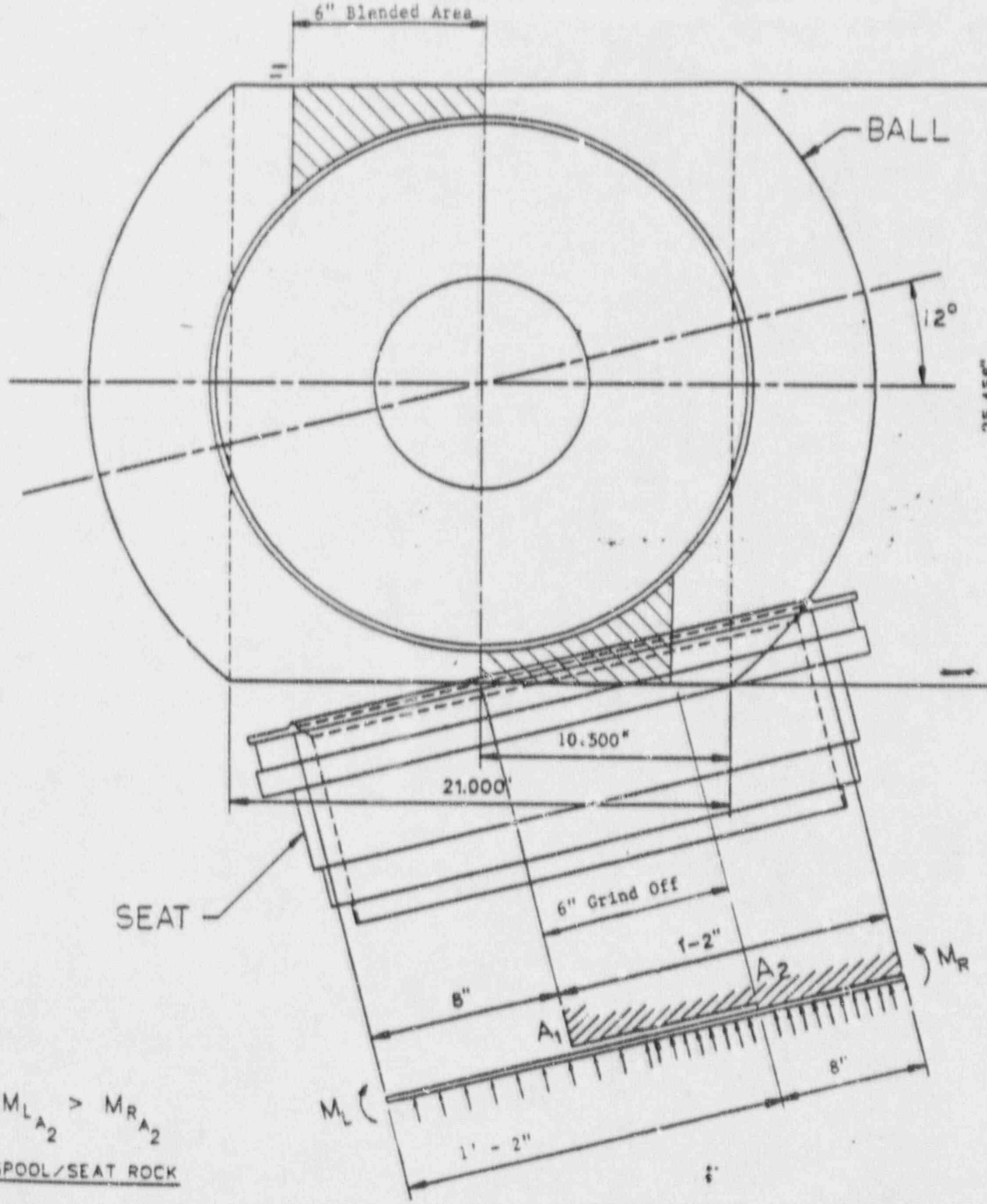
*** THROUGH SEAT TESTING NOT COMPLETED DUE TO POOR INITIAL TYPE "C" BETWEEN SEAT TESTING.

NMMSIVMD52

TEST LEAKAGE SUMMARY

TABLE 4-3

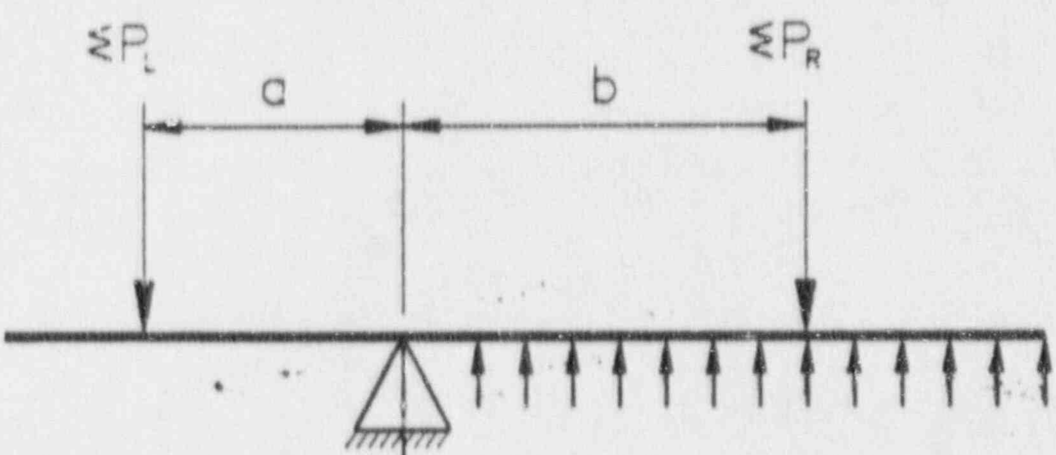
BLENDED BALL - MODIFIED SPRINGS



$M_{L_{A_2}} > M_{R_{A_2}}$

SPOOL/SEAT ROCK

SPOOL / SEAT MODEL - BALANCED SPRINGS



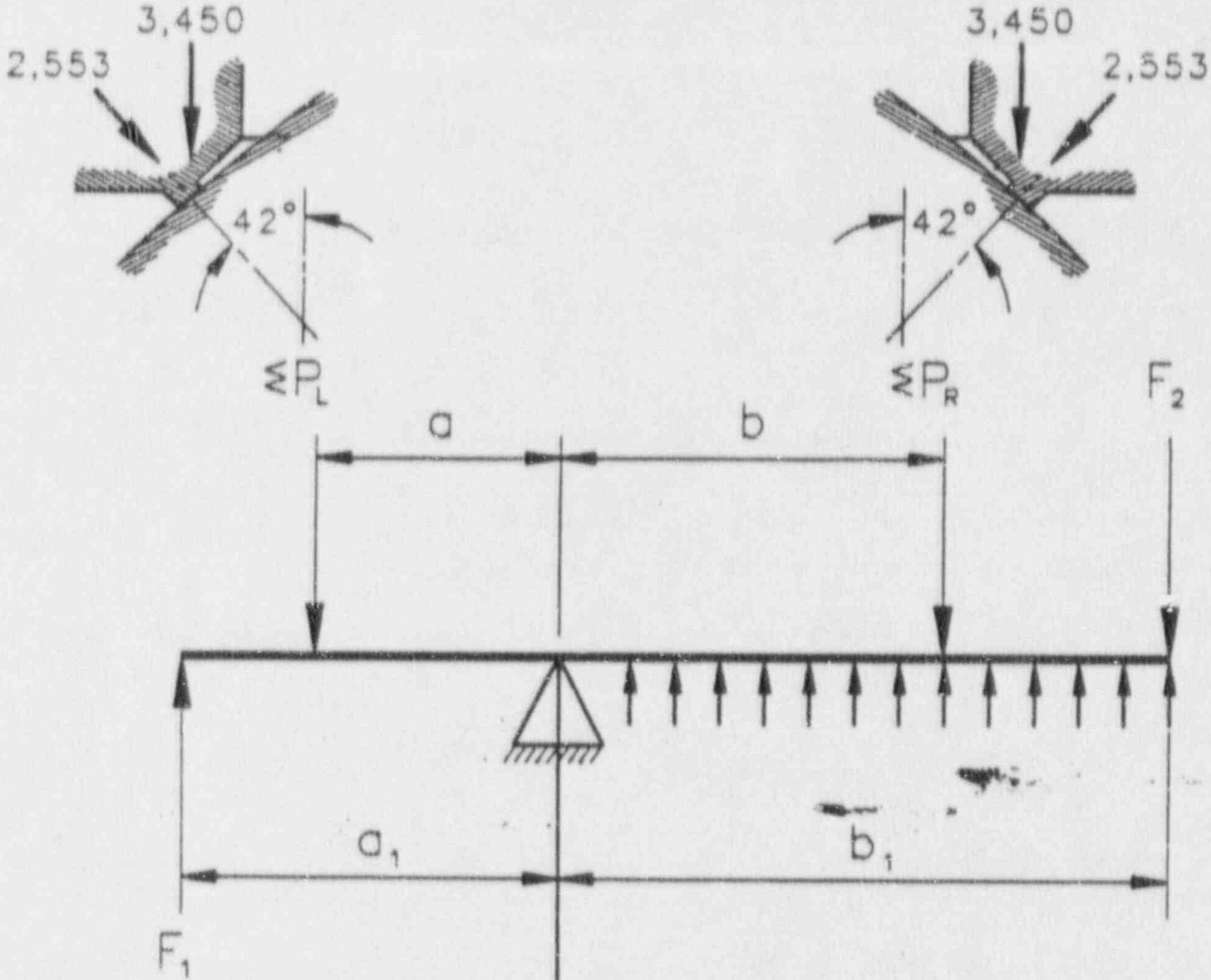
$$\Sigma P_L \times a = M_L \qquad \Sigma P_R \times b = M_R$$

$$M_R - M_L = 17{,}066 \text{ (lb-in)}$$

$$F = \frac{17{,}066}{7.2} = 2{,}370 \text{ (lb)}$$

$$\mu_{FR} = \frac{2{,}370}{6{,}900 \times 0.74} = 0.46$$

SPOOL / SEAT MODEL - MODIFIED SPRINGS



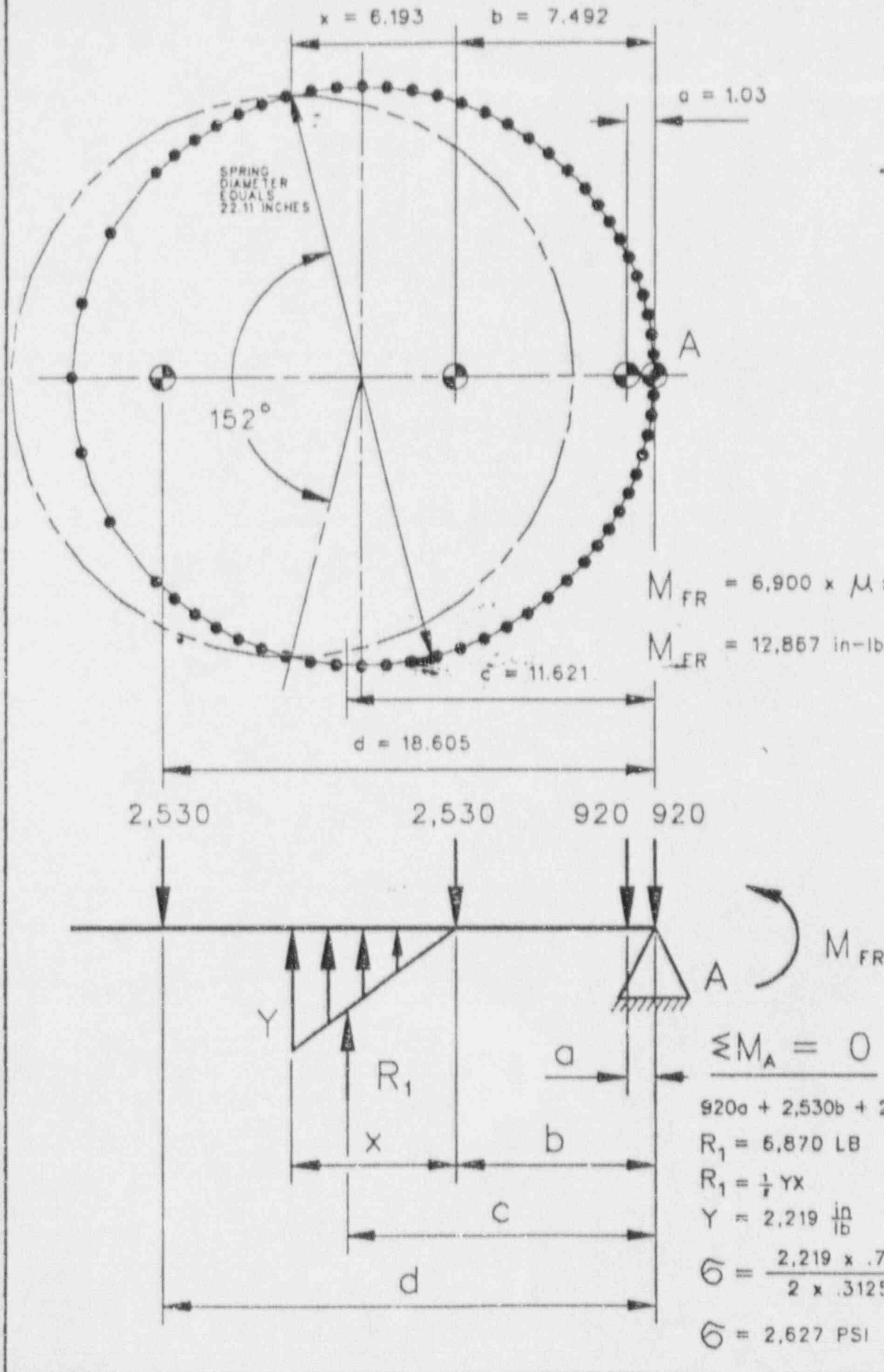
$$M_L = (\Sigma P_L \times a) - (F_1 \times a_1) \qquad M_R = (\Sigma P_R \times b) + (F_2 \times b_1)$$

$$M_R - M_L = 27{,}182 \text{ (lb-in)}$$

$$F = \frac{27{,}182}{7.2} = 3{,}775 \text{ (lb)}$$

$$\mu_{FR} = \frac{3{,}775}{6{,}900 \times 0.74} = 0.74$$

SPOOL / SEAT MODEL – MODIFIED SPRINGS



M_{FR} = 6,900 x μ x .74 x MOMENT ARM

M_{FR} = 12,867 in-lb

$\Sigma M_A = 0$

$920a + 2{,}530b + 2{,}530d + M_{FR} = R_1 c$

R_1 = 6,870 LB

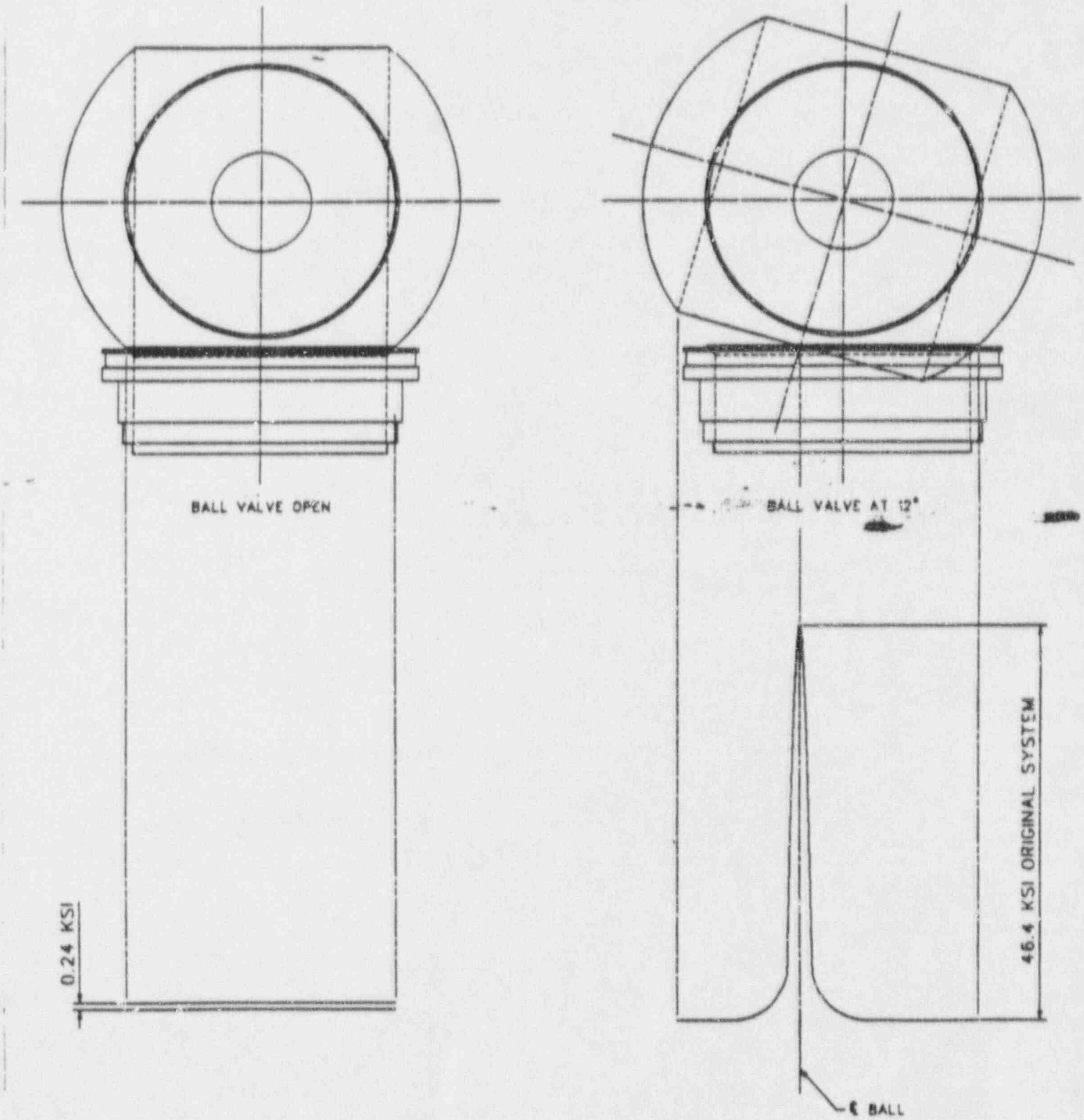
$R_1 = \frac{1}{2} YX$

Y = 2,219 $\frac{in}{lb}$

$\sigma = \frac{2{,}219 \times .74}{2 \times .3125}$

σ = 2,627 PSI

FOOTPRINT STRESS ON BALL

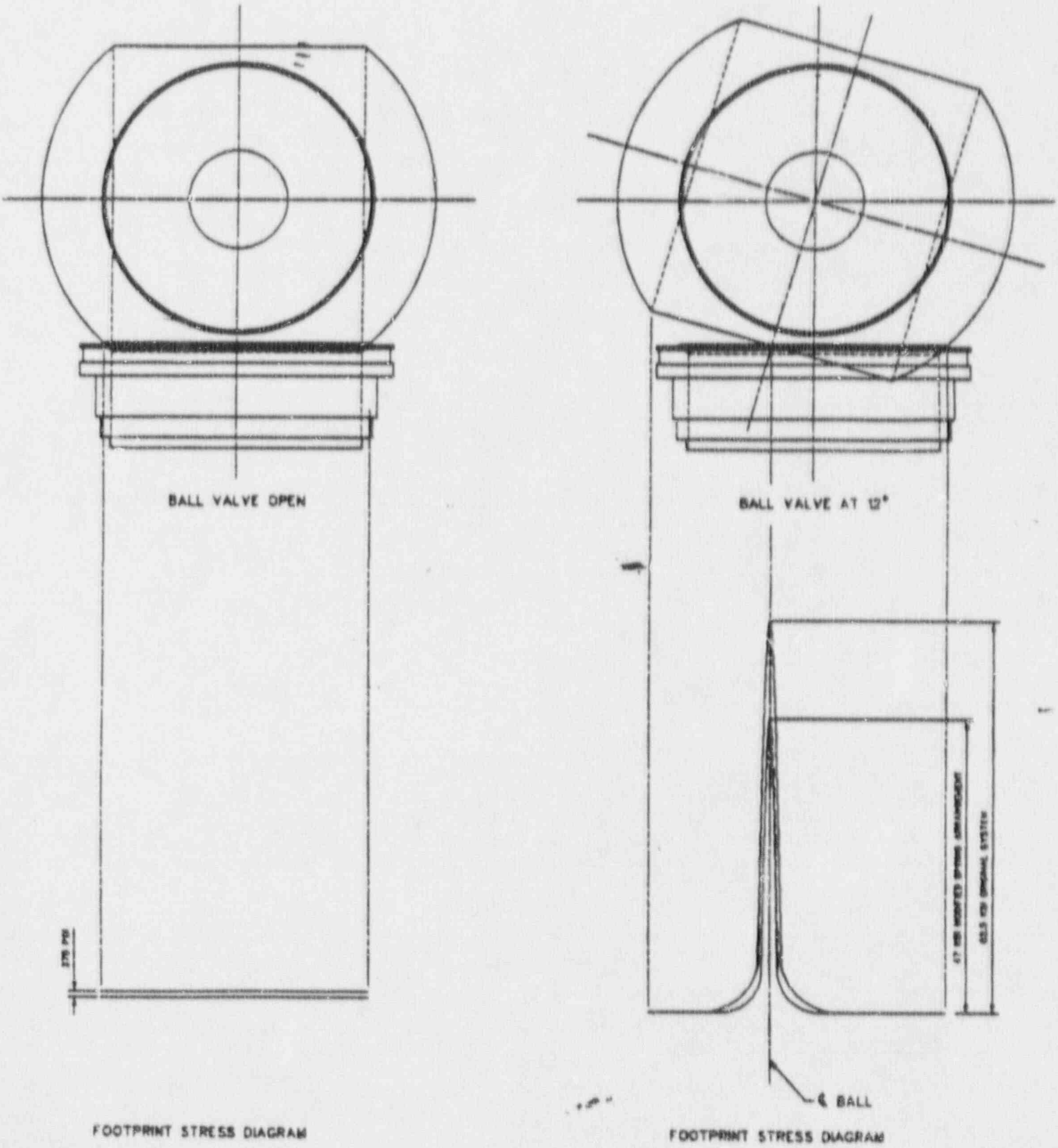


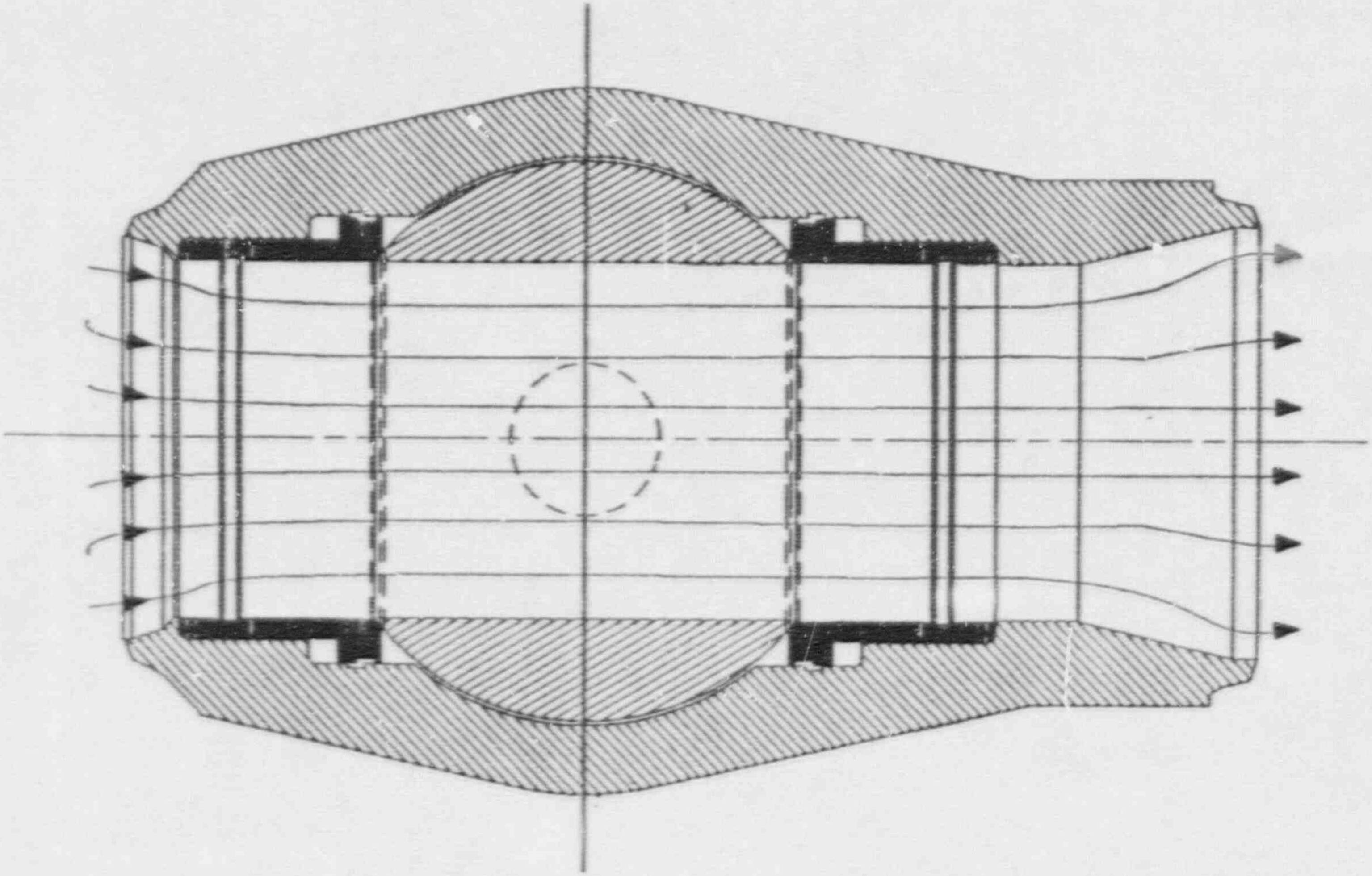
FOOTPRINT STRESS DIAGRAM

FOOTPRINT STRESS DIAGRAM

$$\sigma = \frac{6.9 \times .74}{2 \times .055} = 46.4 \text{ Ksi}$$

FOOTPRINT STRESS ON BALL

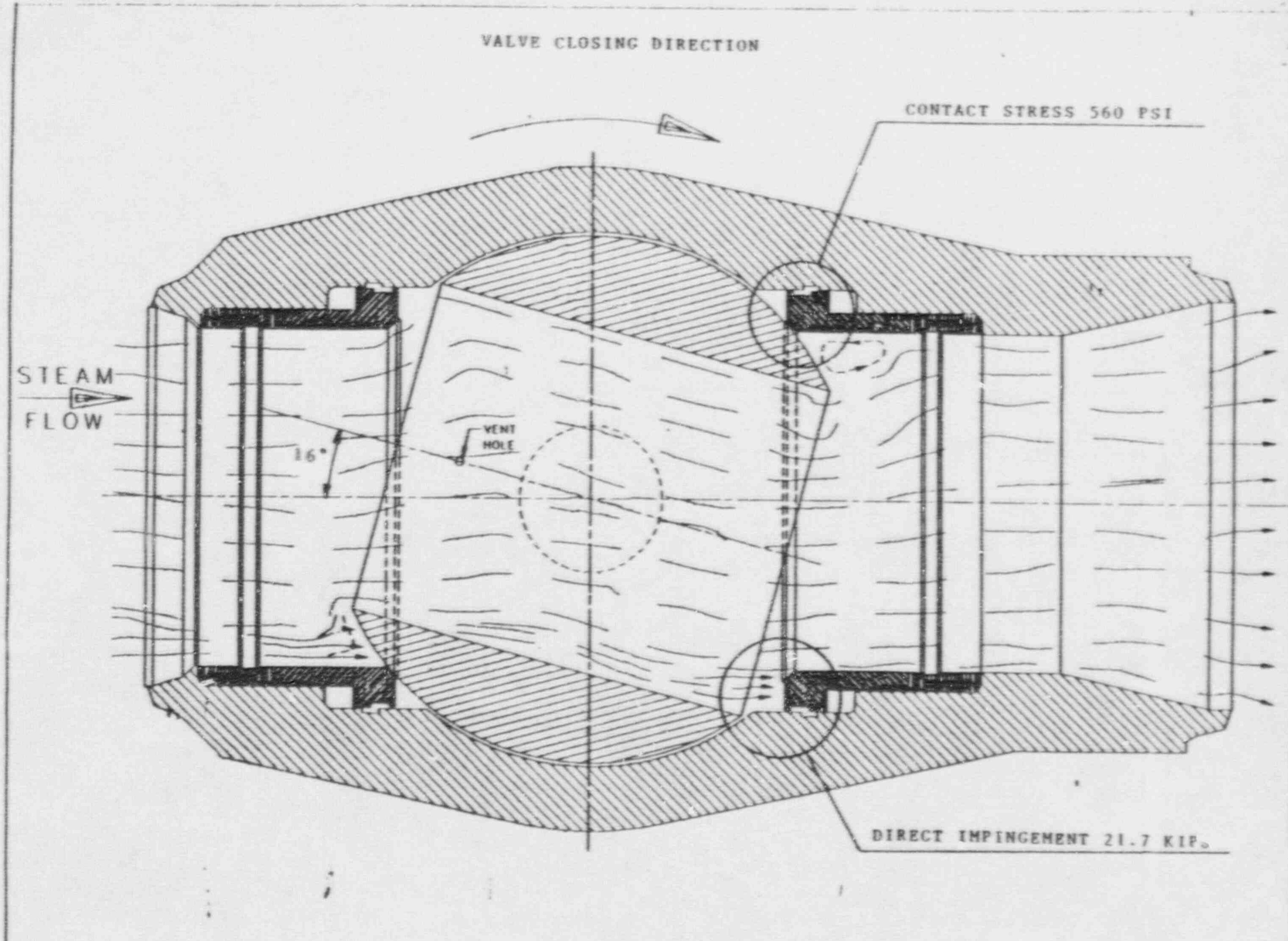




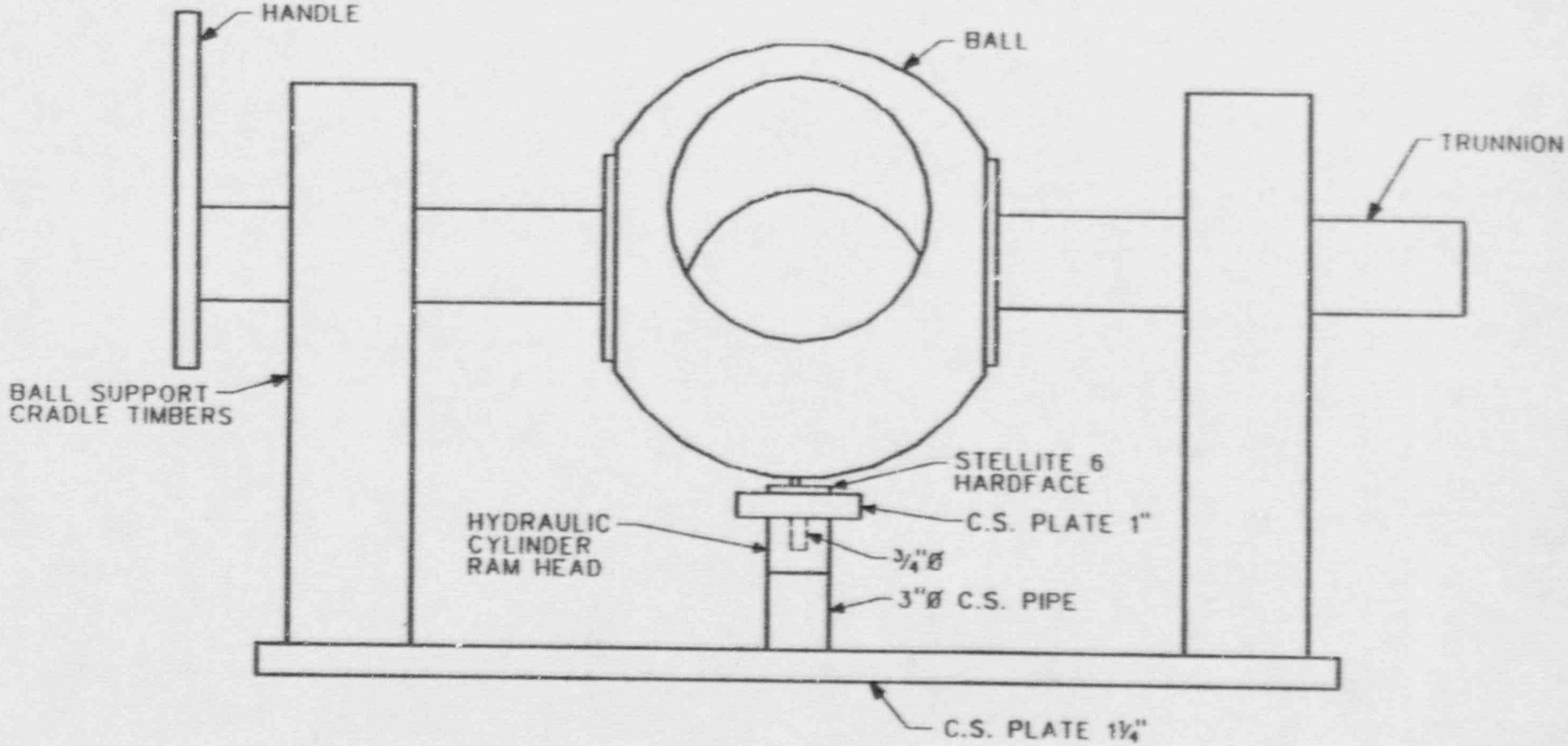
STEAM FLOW–
VALVE FULLY
OPEN

FIGURE 5-3

NMMSIVMD71



VALVE PARTIALLY CLOSED



MOCK UP
FRICTION
TEST

NMMSIVMD54

56,000 PSI BALL PRESSURE

SEAT AREA - .06 IN SQ.
TEMPERATURE - 450°F

NUMBER OF STROKES	MSIV BALL SURFACE	SIMULATED SEAT
10	DARKENED CONTACT AREA, SLIGHT WEAR	POLISHING
20	VISIBLE WEAR, SOME TRANSFER OF MATERIAL	VISIBLE WEAR
30	SMEARING, POCKMARKS GRAINY SURFACE APPEARANCE	POCKMARKS SCRATCHES
40	MORE WEAR, SIGNS OF FRACTURE CRACKS ACROSS WEAR SURFACE, LAYERED TEXTURE TO SURFACE	MORE WEAR MATERIAL REMOVED
50	WC FAILURE - COATING FLAKED OFF	MORE WEAR

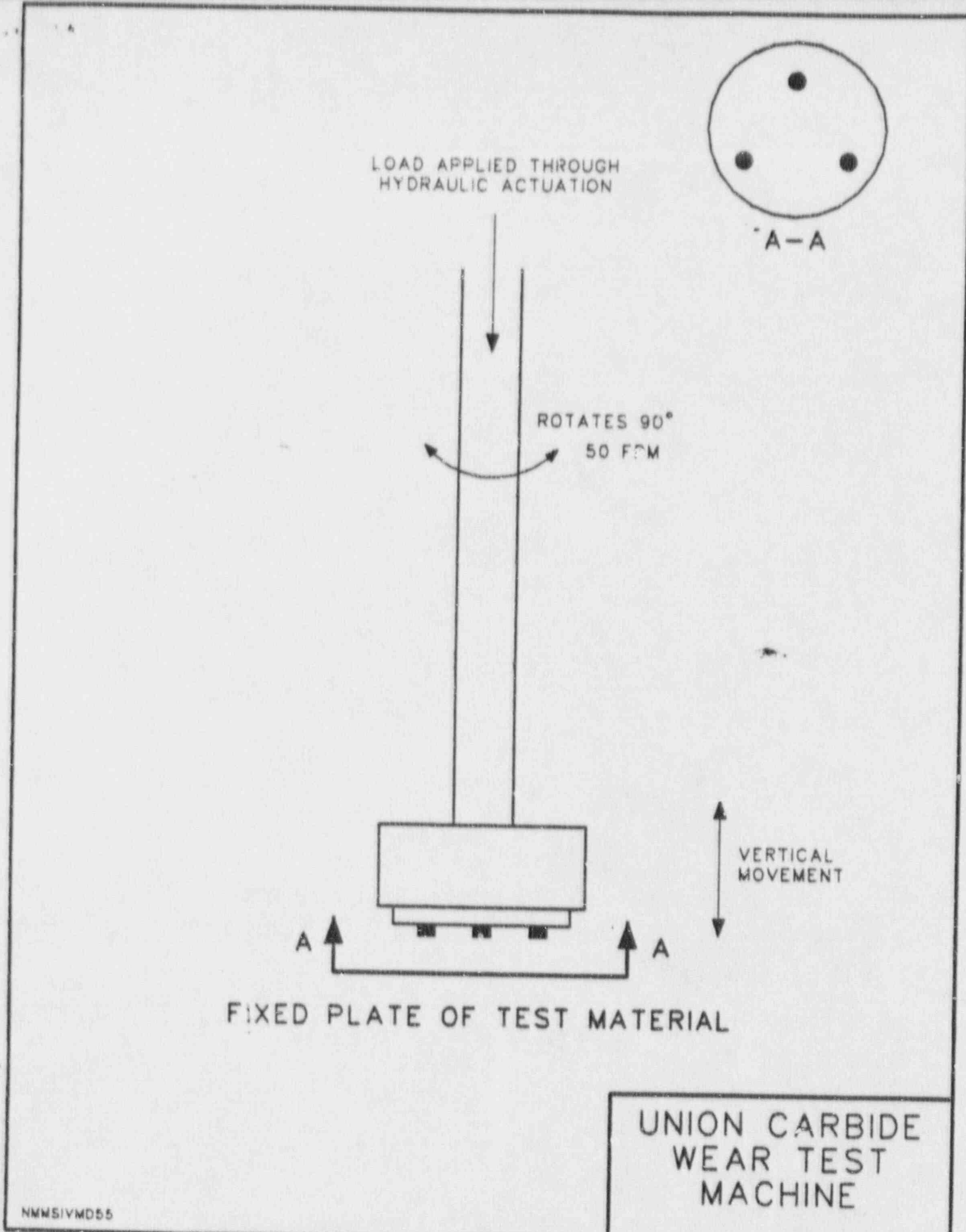
NMMSIVMP33

3,500 PSI BALL PRESSURE

SEAT AREA - .06 IN SQ.
TEMPERATURE - 65°F

NUMBER OF STROKES	MSIV BALL SURFACE	SIMULATED SEAT
15	NO WEAR BLACK LINE INDICATING CONTACT AREA	NO WEAR CONTACT AREA POLISHED
45	NO CHANGE	NO CHANGE
75	NO CHANGE	VISIBLE WEAR SCRATCHES & PITTING
125	ROUGHER SURFACE	WEAR HAS INCREASED
175	SHINY AREAS POSSIBLE TRANSFER OF SEAT MATERIAL TO THE BALL	WEAR ON SEAT HAS SLOWED DOWN
225	WEAR RATE HAS SLOWED DOWN - AMOUNT OF WEAR WOULD REQUIRE RELAPPING OF THE WC COATING	SAME AS ABOVE

NMMSIVMP32


LOAD APPLIED THROUGH
HYDRAULIC ACTUATION
A–A
ROTATES 90°
50 FPM
VERTICAL
MOVEMENT
A
A
FIXED PLATE OF TEST MATERIAL
UNION CARBIDE
WEAR TEST
MACHINE
NMMSIVMD55

SUMMARY – COEFFICIENT OF FRICTION

- REQUIRED TO INITIATE "ROCKING" - .4 – .5
  BALANCED SPRINGS

- UNION CARBIDE TEST RESULTS .3 – .5

- THEREFORE, "ROCKING" OCCURS–BALANCED SPRINGS

- REQUIRED TO INITIATE "ROCKING" .7 – .8
  MODIFIED SPRINGS

- THEREFORE, "ROCKING" WILL NOT OCCUR – MODIFIED SPRINGS

NMMSIVMP45

- FAILURE MECHANISM OF TUNGSTEN CARBIDE COATING

  - DURING INITIAL BALL CYCLES STELLITE FROM SEAT DEPOSITS ON CARBIDE COATING

  - AT HIGH LOADS AND ADDITIONAL CYCLES, STELLITE ON SEAT COLD WELDS TO STELLITE PREVIOUSLY DEPOSITED ON BALL

  - WITH CONTINUED CYCLING, TUNGSTEN CARBIDE COATING SPALLS FROM ITS LOCATION ON BALL

ATTRIBUTE	NEW BALL	RECOATED BALL
BALL MATERIAL	316 SS CASTING EXTENSIVE WELD REPAIRS SOL'N ANNEAL AFTER REPAIRS	ORIGINAL CASTING USED MINOR ADDITIONAL WELD REPAIRS NO SOL'N ANNEAL AFTER REPAIRS
HARDFACING MATERIAL	HAYNES 25 BY SAW WELD REPAIRS BY GTAW NO HEAT TREATMENT .080 TO .100 FINAL THICKNESS FINAL SURFACE GROUND FINAL PT	ORIGINAL DEPOSIT USED WELD REPAIRS BY GTAW NO HEAT TREATMENT .076 TO .097 FINAL THICKNESS FINAL SURFACE GROUND FINAL PT
TUNGSTEN CARBIDE COATING MATERIAL	APPLIED BY UNION CARBIDE SURFACE PREP BY BLASTING APPLIED BY D-GUN 0.010 MIN THICKNESS FINAL SURFACE GROUND LAPPED TO SEAT IN SHOP LAPPED TO SEAT IN FIELD	APPLIED BY UNION CARBIDE SURFACE PREP BY BLASTING APPLIED BY D-GUN 0.010 MIN THICKNESS FINAL SURFACE GROUND LAPPED TO SEAT IN SHOP

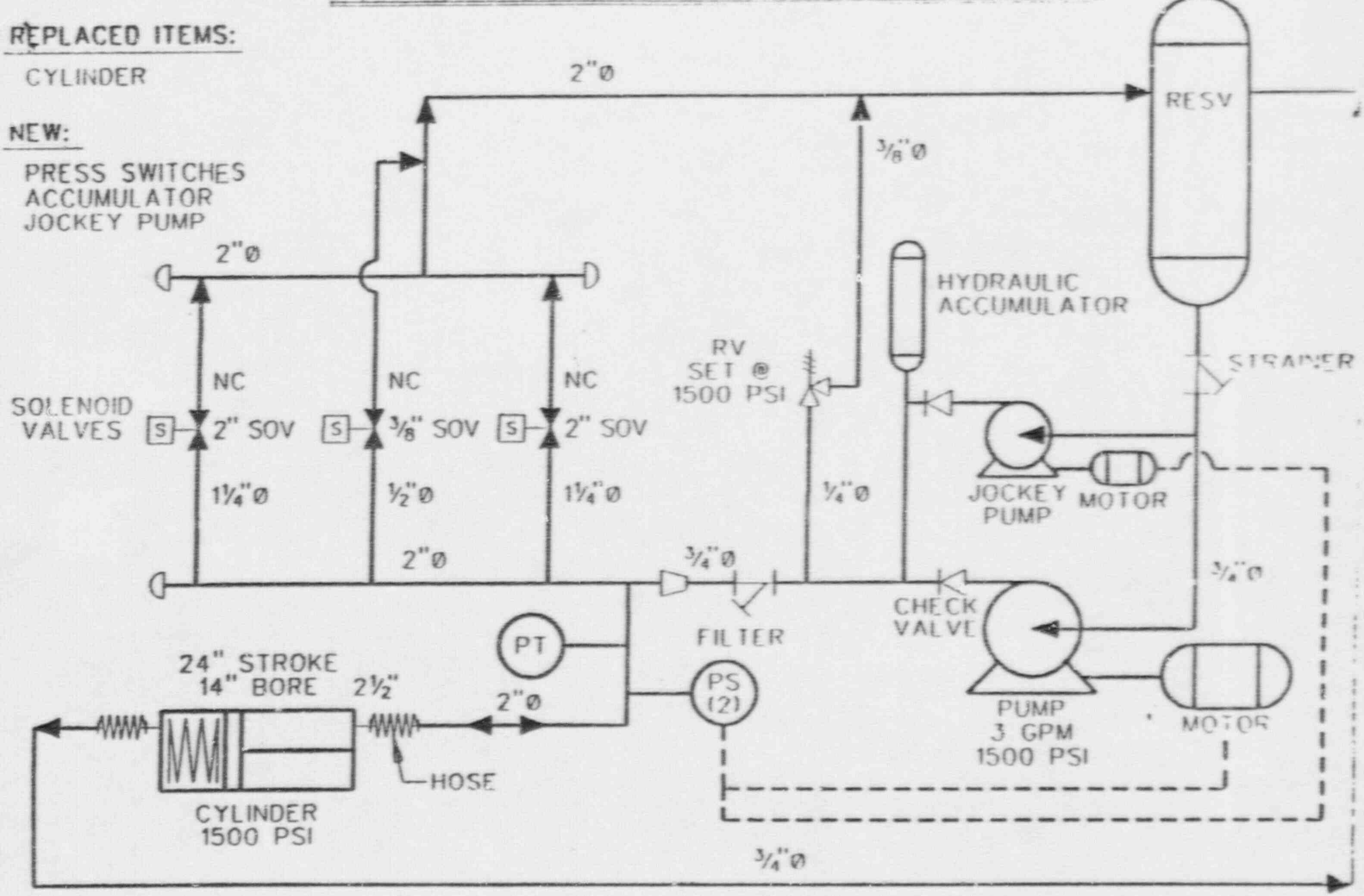
NMMSIVMP86

SCHEDULE OF REPAIRS

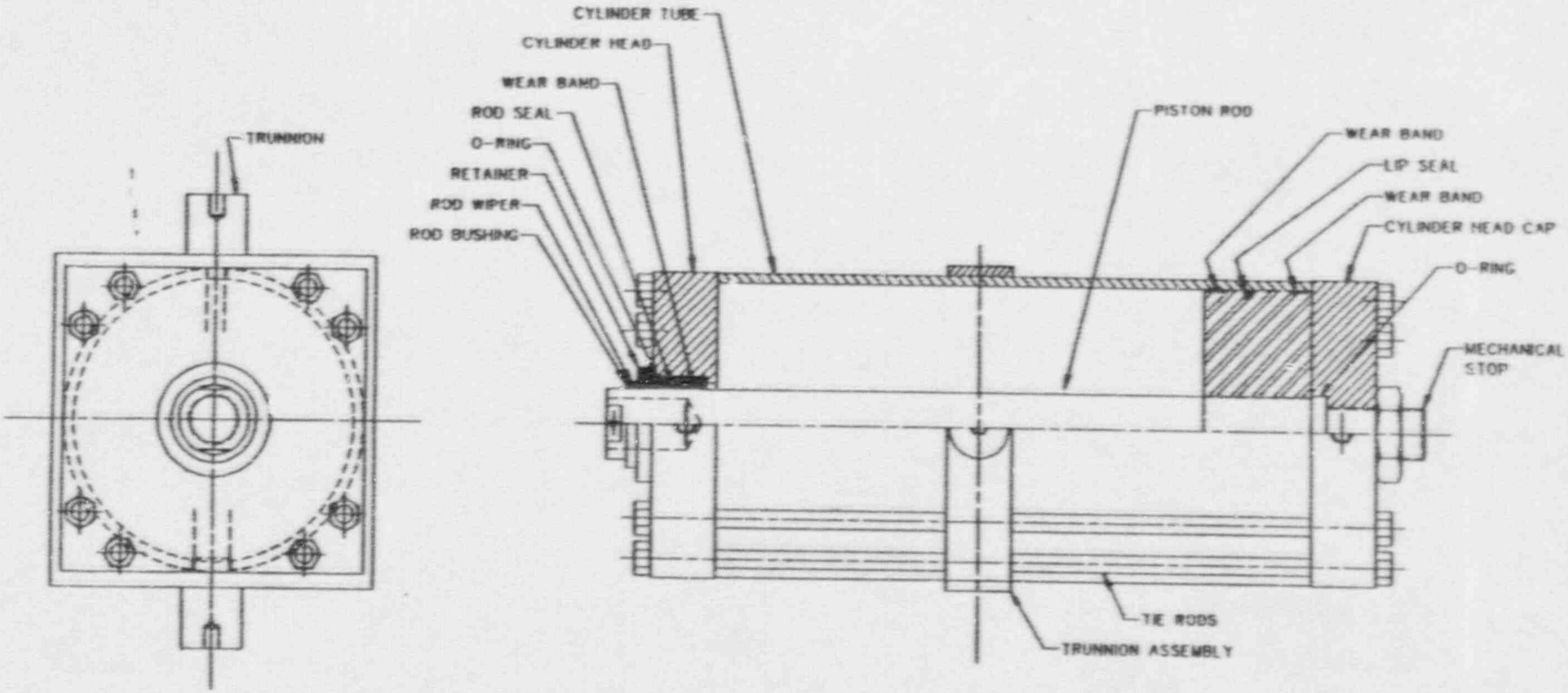
SERIAL NUMBER	COATING REMOVED	SURFACE PREPARATION	COATING REAPPLIED	SEAT LAPPING	AT SITE
12	X	X	X	X	10/15(A)
8	X	X	X		10/16(S)
4	X	X			10/20(S)
2	X				10/22(S)
6	X				10/25(S)
7	X				10/29(S)
3	X				10/31(S)
16					10/27(S)

NMMSIVMP43

MSIV CONVERTED HYDRAULIC SYSTEM



HYDROLINE HYDRAULIC CYLINDER



HYDRAULIC CYLINDER ENHANCEMENT

- MODIFY THE EXISTING CYLINDER DESIGN

  - ADDED MECHANICAL STOP TO ESTABLISH FULL OPEN POSITION

  - ADDED LIP SEAL TO PISTON FOR LEAKAGE CONTROL

- PROOF TESTING OF HYDRAULIC CYLINDER

  - HYDRO TEST TO 2250 PSI

  - CYCLE 100 TIMES FOR BREAK-IN

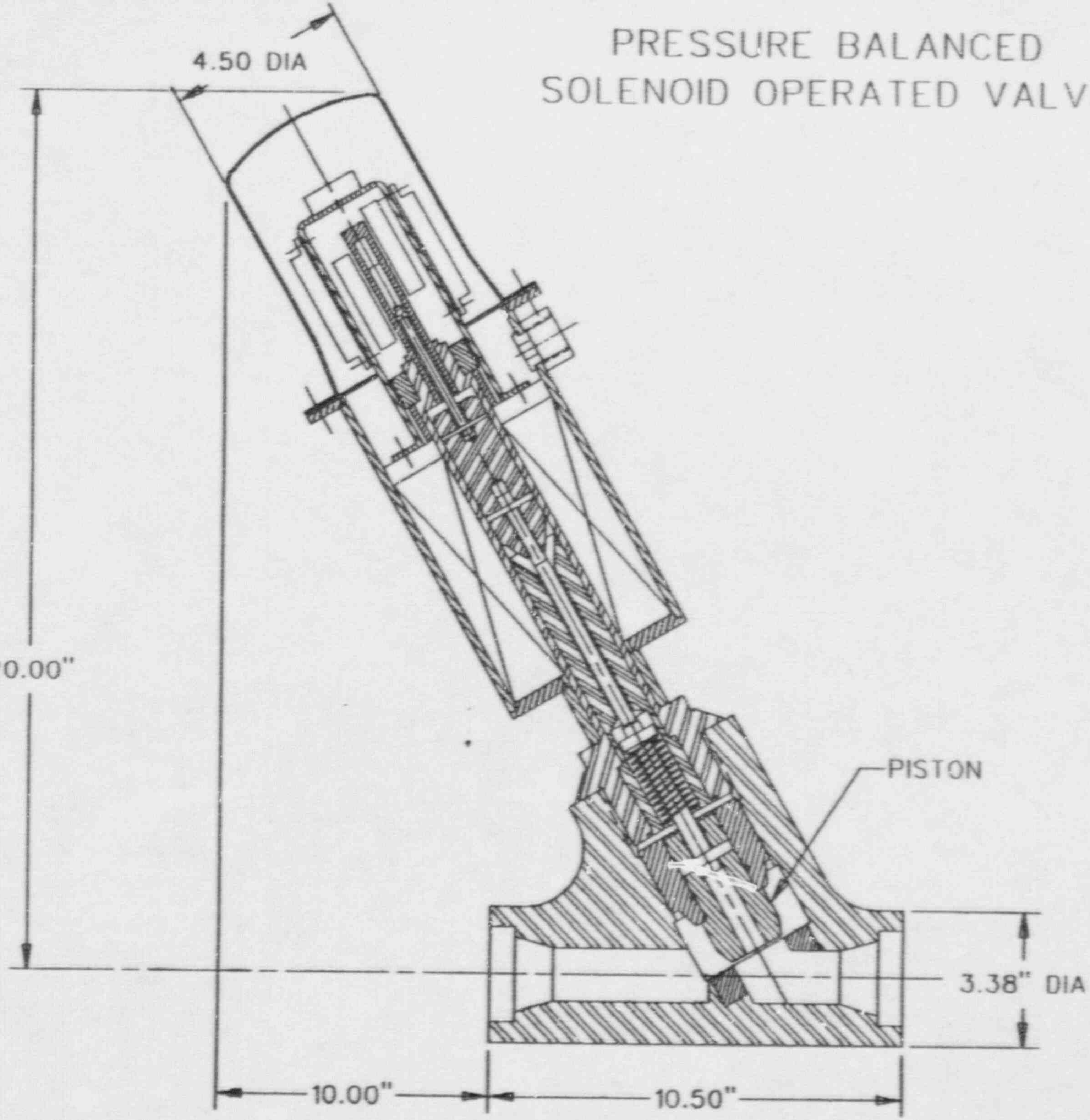
  - CYCLE 5 TIMES UNDER LOAD MAINTAINING 1500 PSI

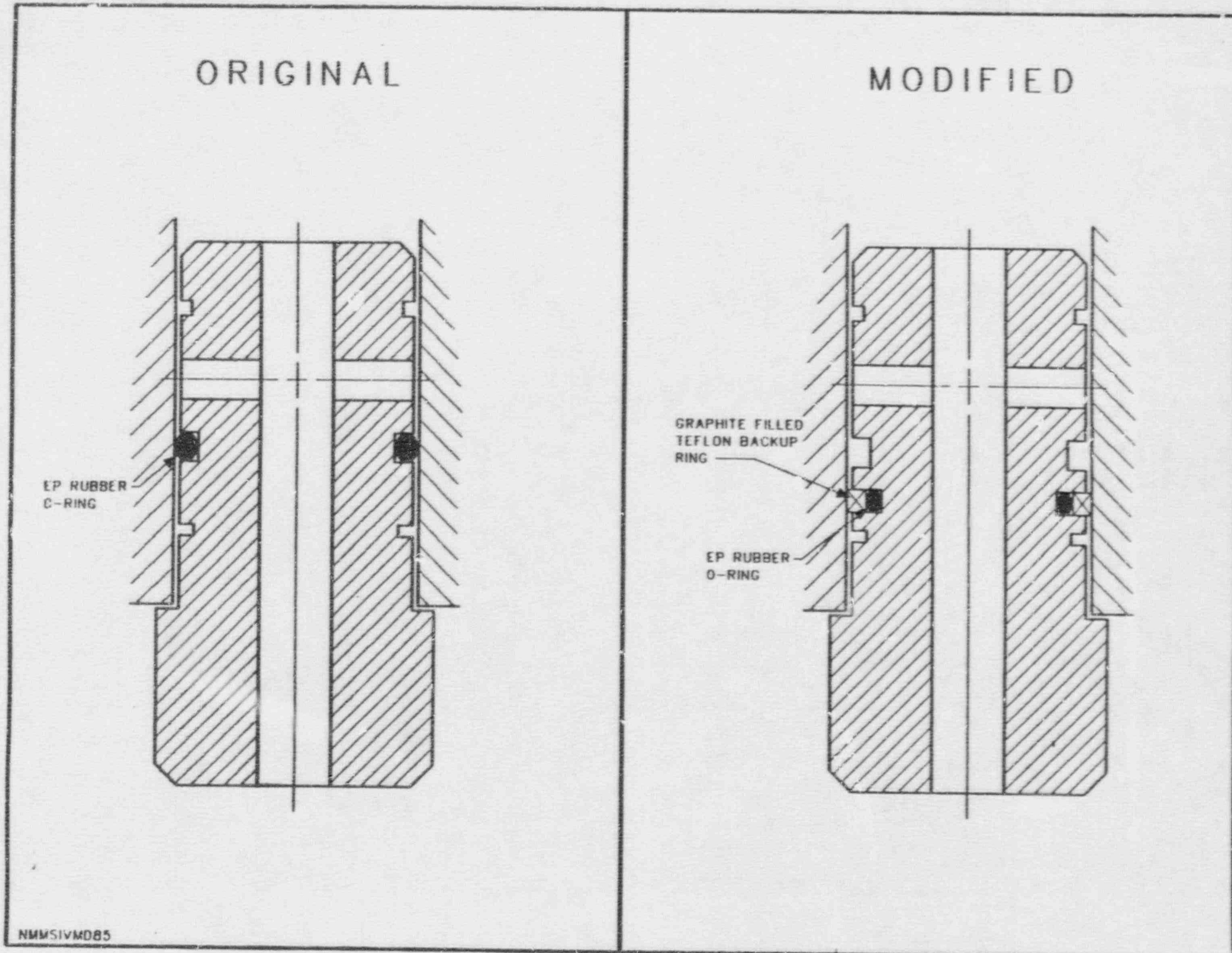
  - PRESSURIZE CYLINDER AND MEASURE LEAKAGE < 1/2 CUBIC INCH PER MINUTE

  - ISSUE TEST REPORT

  - SWEC POA WITNESS TESTS

PRESSURE BALANCED SOLENOID OPERATED VALVE




ORIGINAL
MODIFIED
EP RUBBER
O-RING
GRAPHITE FILLED
TEFLON BACKUP
RING
EP RUBBER
O-RING
NMMSIVMD85

SOV MODIFICATIONS

- TEST RESULTS INDICATED EXISTING 'O'RING NOT SUITABLE
  - 'O'RING WEDGED AT PRESSURE
  - DELAY IN ACTUATION AT PRESSURE

- ADDITIONAL MATERIALS TESTED
  - TEFLON
    - RADIATION CONCERN
    - MECHANICAL STABILITY CONCERN
  - TEFZEL
    - TOO HIGH COEFFICIENT OF FRICTION
  - GRAPHITE FILLED TEFLON
    - ENVIRONMENTALLY QUALIFIED FOR > 25 YRS
    - NO DELAY IN ACTUATION

NMMSIVMP35

TESTING RESULTS

- CYCLE TIMES
  - 20 HOURS
- LEAKAGE
  - SOV
    - UNDETECTABLE
  - HYDRAULIC CYLINDER
    - < 1/2 CU. IN. PER MIN.
- RESPONSE TIME
  - SOV TRIP WITHIN .5 SEC.
  - MSIV CLOSES WITHIN 3 TO 5 SEC. CLOSURE REQUIREMENT

TARGET SCHEDULE

ADDITIONAL EQUIPMENT	ON SITE
NEW HYDRAULIC CYLINDER	10/15
NEW SEALS FOR SOV	10/15
INSTALL EQUIPMENT	10/15 - 10/21
TESTING	10/21 - 11/3
MSIV'S ACTUATORS COMPLETE	11/5

NMMSIVMP39

CONCLUSION - LEAKAGE PROBLEMS

- SUFFICIENT UNDERSTANDING OF ROOT CAUSE TO DEVELOP FIX FOR OPERATING CYCLE

- ANALYSIS OF OPERATING CONDITIONS

  - DO NOT ADD SIGNIFICANTLY TO SEAT "ROCKING"

  - PROTOTYPE TESTING WILL CONFIRM ANALYSES OR IDENTIFY PROBLEMS EARLY IN OPERATING CYCLE

  - MID-CYCLE "TYPE C" TESTING PROVIDES ADDITIONAL ASSURANCE

- FINAL FIX TO BE THOROUGHLY DEVELOPED AND TESTED BEFORE FIRST REFUELING OUTAGE

- DESIGN AND PROCUREMENT FOR CONTINGENCY PROGRAMS CONTINUES ON AN EXPEDITED BASIS

CONCLUSION — ACTUATOR MODIFICATIONS

- FIRST CYCLE FIX — MODIFICATION OF HYDRAULIC SYSTEM
  - ACCEPTABLE MATERIALS
  - VERIFICATION TESTING IN SHOP
  - PRELIMINARY AND START-UP TESTING WILL COMPLETELY VERIFY OPERABILITY

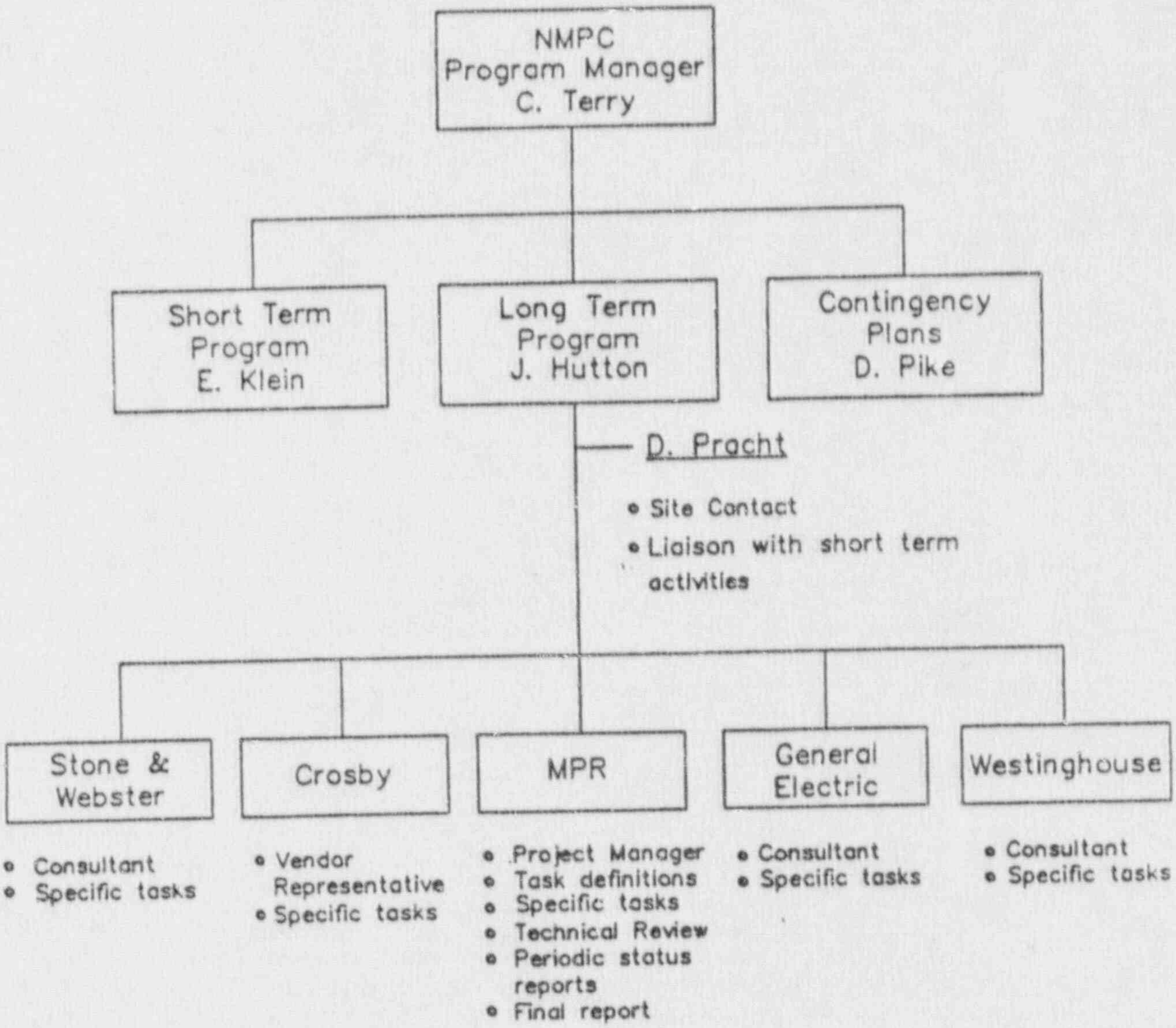
- MECHANICAL LATCH BEING DEVELOPED AS PART OF LONG RANGE PROGRAM

MSIV LONG TERM PROGRAM

OBJECTIVES

- CONFIRM FAILURE MECHANISMS
- REVIEW EXISTING DESIGN/MATERIALS
- FULL SCALE PROTOTYPE TESTING
- DESIGN/MATERIAL ENHANCEMENTS
- DEMONSTRATE LONG TERM OPERABILITY

Niagara Mohawk Power Corporation
Nine Mile Point Unit 2
MSIV Program



MSIV LONG TERM PROGRAM

GENERAL DESCRIPTION

- PHASE 1
  - FAILURE ANALYSIS
  - OPERATIONAL EXPERIENCE
  - VALVE/ACTUATOR DESIGN REVIEW
  - EVALUATE BALL/SEAT MATERIALS
  - INITIAL PROTOTYPE TESTING

- PHASE 2
  - IDENTIFY DESIGN ENHANCEMENTS
  - SELECT MATERIAL CHANGES
  - PROTOTYPE TESTING

- PHASE 3
  - DETAILED MODIFICATION DESIGN
  - DESIGN VERIFICATION TESTING
  - MATERIAL PROCUREMENT
  - INSTALLATION/PREOP TESTING

MSIV LONG TERM PROGRAM

PRELIMINARY SCHEDULE

°	PHASE 1 REVIEWS	OCT '86 - JAN '87
°	INITIAL PROTOTYPE TESTING	FEB '87 - MAR '87
°	SELECT ENHANCEMENTS	APR '87 - JUN '87
°	TEST ENHANCEMENTS	JUL '87 - DEC '87
°	FINALIZE DESIGNS	JAN '88 - MAR '88
°	DESIGN VERIFICATION	APR '88 - DEC '88
°	PROCURE MATERIALS	MAR '88
°	REFUELING OUTAGE	MAR '89