STATUS OF BWR OWNER'S GROUP

RESPONSE TO REQ. 2.1.2

T.O. VANDEVENTER
BWR O.G./NRC MEETING
JUNE 12, 1980

STATUS OF BWR OWNER'S GROUP RESPONSE TO REQ. 2.1.2

- OCTOBER 1979 - DECEMBER 1979

  - OWNER'S GROUP PRESENTED ITS POSITION TO NRC
    - NO SRV TESTING REQUIRED
  - NRC RESPONDED TO OWNER'S GROUP POSITION
    - LOW PRESS. LIQ. TESTING REQUIRED
    - POTENTIAL FOR HIGH PRESS. LIQ. DISCHARGE SHOULD BE CONSIDERED
  - OWNER'S GROUP COMMITTED TO PERFORM LOW PRESS. TEST AND ASSESS ALTERNATIVES FOR ADDRESSING POTENTIAL FOR HIGH PRESS. LIQUID CONDITIONS

- DECEMBER 1979 - MAY 1980

  - PRELIMINARY LOW PRESSURE TEST SPECIFICATION COMPLETED

  - SUBCONTRACTOR CHOSEN TO PERFORM TESTING

  - ACTIONS TO ADDRESS HIGH PRESS LIQ. COND.

    - EVALUATING :

      - SCOPE OF POSSIBLE HIGH PRESS LIQ. TEST

      - HIGH LEVEL TRIP UPGRADE

o MAY 1980 - PRESENT

- TWO TELECONS HELD WITH NRC
  - BWRs DIFFERENT THAN PWRs
    - LIKELIHOOD OF HIGH PRESSURE TWO PHASE/LIQ. SRV FLOW MUCH LOWER FOR BWR
    - BWR SRVs OPERATE REGULARLY DURING NORMAL TRANSIENTS (STEAM DISCHARGE)
  - A PROGRAM ADDRESSING PERFORMANCE OF SRVs UNDER HIGH PRESSURE STEAM AND LOW PRESSURE LIQUID CONDITIONS MORE APPROPRIATE FOR BWRs
  - SPECIFIC NRC CONCERNS
    - SRV CLOSURE RELIABILITY
    - SRV SET POINT VARIATION

LOW PRESSURE LIQUID TESTING

- o SCOPE OF LOW PRESSURE TEST — GE
  - SYSTEM REQUIREMENTS
  - TEST PROFILE
  - FACILITY DESCRIPTION
  - PIPING DATA

- o SUMMARY OF LILCO TEST PROGRAM — LILCO
  - PURPOSE
  - FACILITY DESCRIPTION
  - RESULTS

LOW PRESSURE LIQUID TEST

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SYSTEM REQUIREMENTS

- DEPRESSURIZE TO LOW PRESSURE~25 TO 50 PSIG.
- RETURN LOW PRESSURE (25-250 PSIG) WATER TO SUPPRESSION POOL.

TEST PROFILE

- POWER ACTUATE AND BLOWDOWN STEAM FROM 1000 PSI TO APPROXIMATELY 25 PSIG OR LESS.
- FLOOD INLET TO VALVE WITH SATURATED OR SLIGHTLY SUBCOOLED WATER (APPROXIMATELY 212°F).
- RAISE WATER PRESSURE TO 250 PSIG.
- CONFIRM THAT VALVE OPENS AND REMAINS OPEN.

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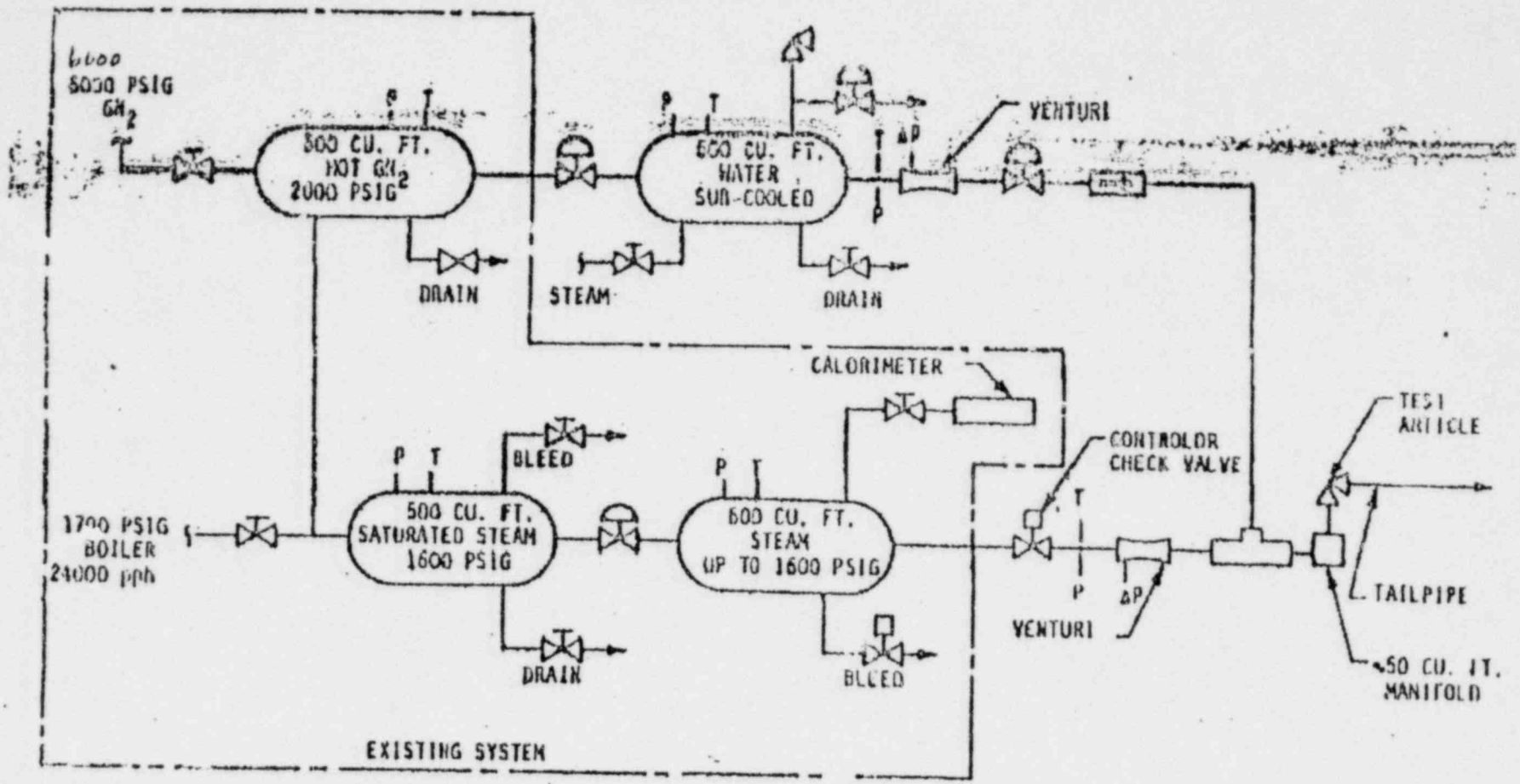
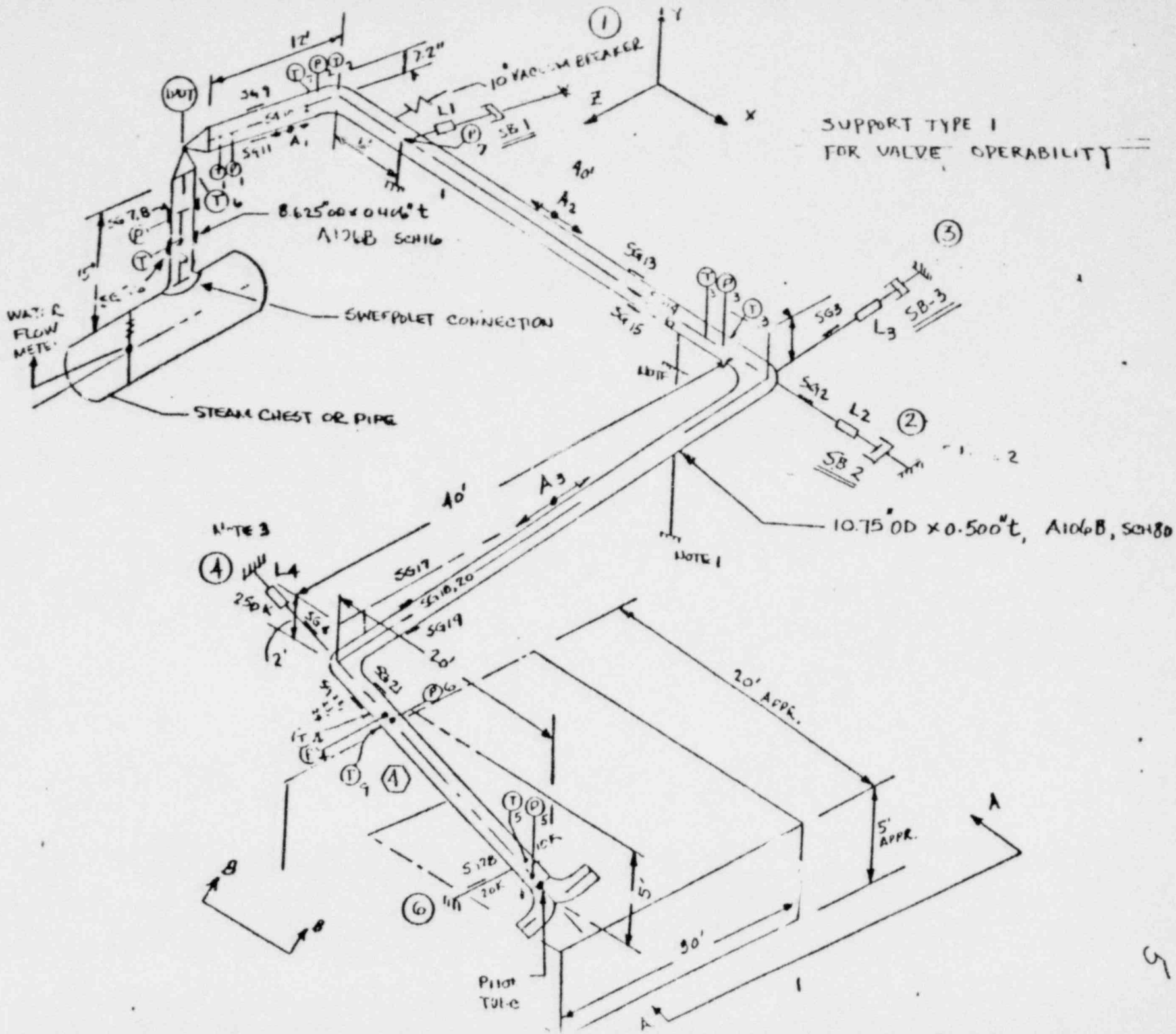
PROPOSED STEAM/WATER SYSTEM FOR FULL FLOW TESTING




SUPPORT TYPE 1
FOR VALVE OPERABILITY
10" VACUUM BREAKER
8.625" OD x 0.406" t
A106B SCH 40
SWEEPOLET CONNECTION
WATER FLOW METER
STEAM CHEST OR PIPE
10.75" OD x 0.500" t, A106B, SCH 80
NOTE 1
NOTE 3
20' APPR.
5' APPR.
90'
40'
20'
PITOT TUBE

PIPING DATA

- RESTRAIN PIPE
- RERUN A WATER FLOW TEST
- MEASURE LOAD ON PIPE
- CONFIRM WATER LOADS LESS THAN STEAM LOADS

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LONG ISLAND LIGHTING COMPANY

SHOREHAM NUCLEAR POWER STATION

S/RV LOW PRESSURE LIQUID FLOW TEST*

PERFORMED AT GE HIGH FLOW HYDRAULIC FACILITY.

TARGET ROCK TWO STAGE

PURPOSE

TEST OBJECTIVES

SUMMARY OF TEST

TEST LOOP SCHEMATIC DIAGRAM

PIPING & INSTRUMENTATION SCHEMATIC

RESULTS

*TARGET ROCK PILOT-OPERATED, TWO STAGE SAFETY/RELIEF VALVE (S/RV) DESIGNED TO RELIEVE SATURATED STEAM ABOVE 1150 PSIG.

PURPOSE

1. Determine S/RV Flow Performance Under Low Pressure Liquid Flow Conditions.

   a. Abnormal Long-Term Cooldown Scenario.

   b. Loss of RHR Suction From RPV.

   c. Actuate S/RV(S) and Hold in Open Position.

   d. Fill RPV Using Available ECCS Systems.

   e. Flow Path Established From RPV to Suppression Pool.

2. Verify Valve Operability.

TEST OBJECTIVES

THREE RELAY TWO SWITCH

WITH AIR OPERATOR ENERGIZED, DETERMINE:

1. MINIMUM ΔP AT WHICH VALVE WILL OPEN;
2. MINIMUM ΔP TO HOLD VALVE IN OPEN POSITION;
3. FLOW CHARACTERISTICS FOR RANGE OF ΔP'S.

SUMMARY OF TEST

1. TEST OBJECTIVES ACHIEVED.
2. VALVE REMAINED OPERABLE AT CONCLUSION OF TEST.

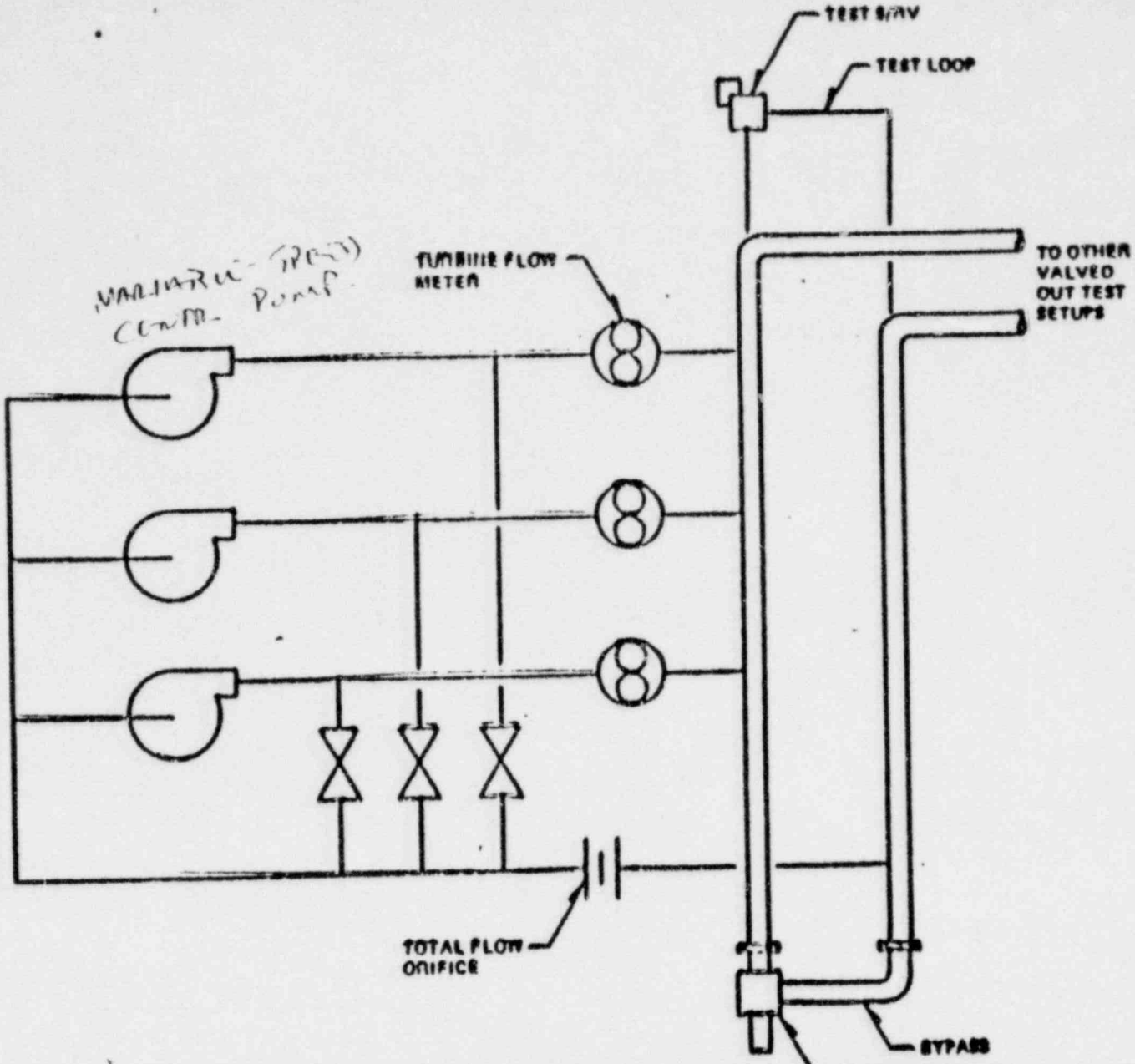

Figure 1. S/RV Water Flow Test

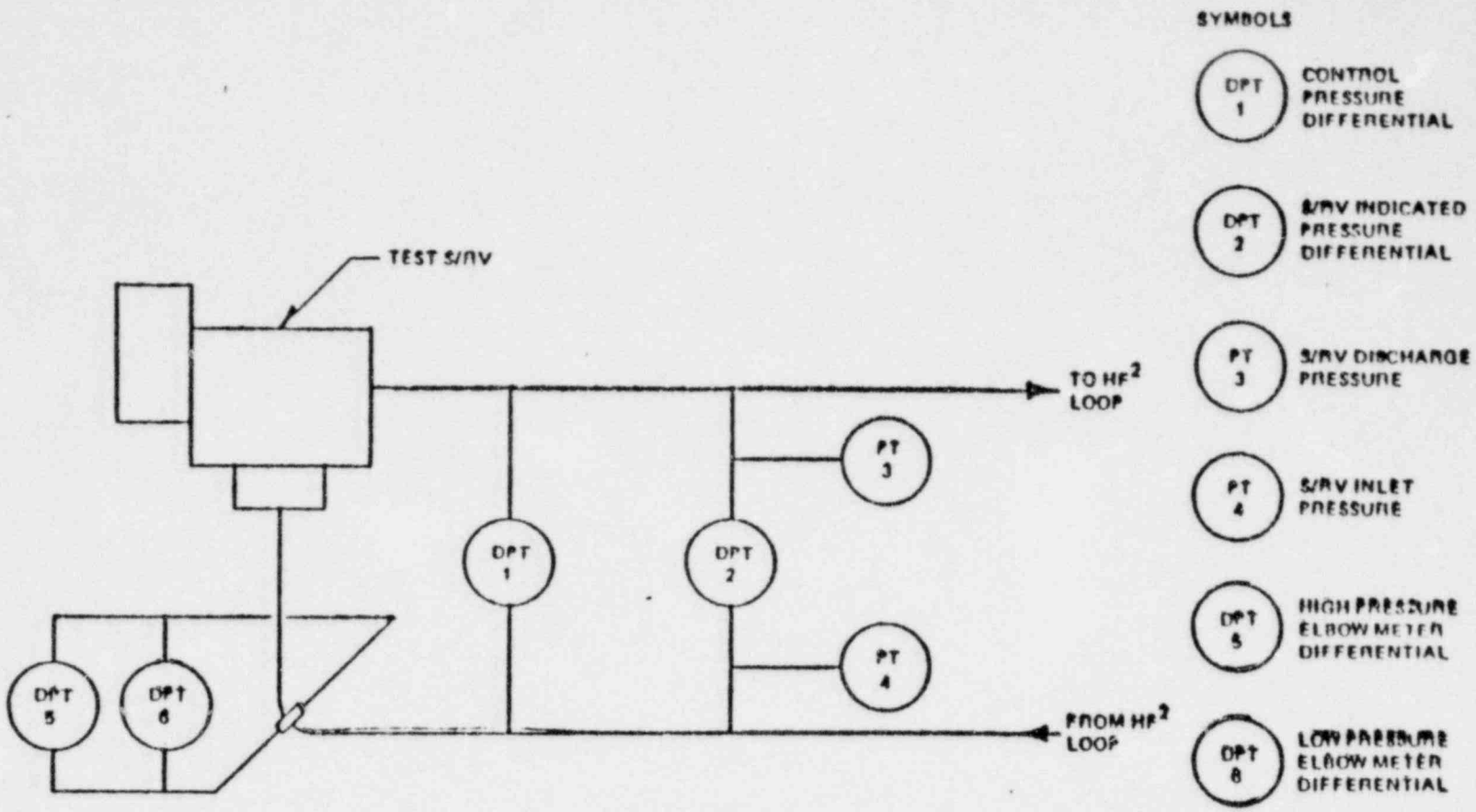

Figure 2. Test Piping Instrumentation Schematic

RESULTS

1. S/RV Performed Satisfactory Under LP Liquid Flow Conditions.

2. Minimum P To Open Ranged Between 24 - 31 PSID.

3. Minimum Closing P Ranged Between 16 - 19 PSID.

4. Flow Rates Ranged Between 3000 GPM At 30 PSID And 7000 GPM At 150 PSID.

SRV CLOSURE RELIABILITY

- o BWR RESPONSE TO A STUCK OPEN SRV (SORV)
  - REACTOR SYSTEM RESPONSE
  - CONTAINMENT RESPONSE
- o SRV CLOSURE RELIABILITY IMPROVEMENT
  - FOR EACH BWR VALVE TYPE:
    - DISCUSSION OF OPERATION
    - SERVICE LIFE
    - BLOWDOWN HISTORY
    - IMPROVEMENTS (WHERE APPLICABLE)
    - CONCLUSIONS

BWR O.G./NRC MTG.
JUNE 12, 1980

BWR RESPONSE TO STUCK OPEN SRV

- SAFETY AND RELIEF VALVES IN THE BWR
- VALVE DUTY
- SYSTEM RESPONSE TO SORV
  - REACTOR SYSTEM RESPONSE
  - CONTAINMENT RESPONSE
- IN-PLANT EXPERIENCE
- SUMMARY

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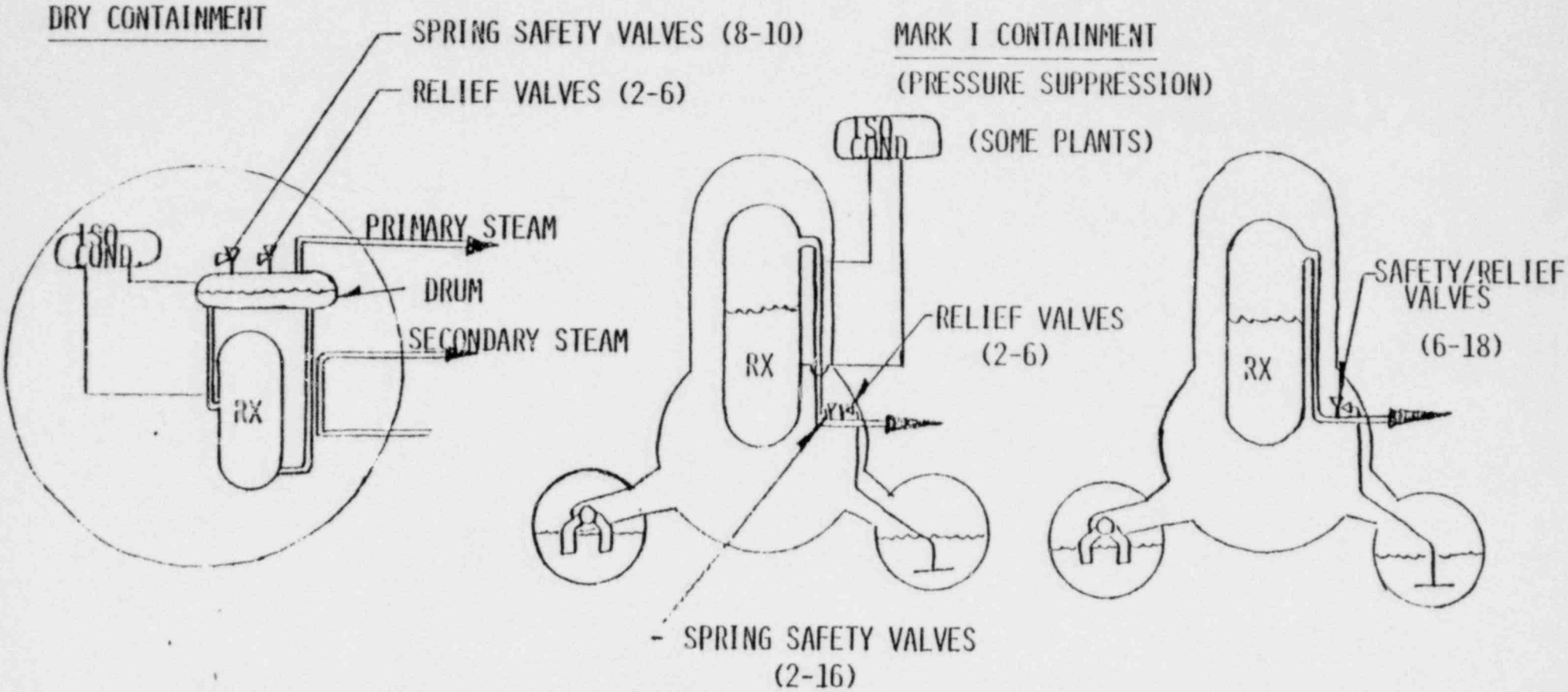
JUNE 12, 1980
J. F. HOSLER

SAFETY RELIEF VALVES IN THE BWR



SOME BWR/1

1BWR/1, BWR/2, SOME BWR/3, SOME BWR/4

SOME BWR/3, SOME BWR/4, BWR/5

(NOTE: HUMBOLT BAY HAS SIMILAR SYSTEMS BUT SAFETY VALVES ARE ALSO PIPED TO SUPPRESSION POOL)

VALVE DUTY

- DUAL FUNCTION SAFETY/RELIEF VALVES AND SINGLE FUNCTION RELIEF VALVES

  - ROUTINELY LIFT IN RESPONSE TO SYSTEM TRANSIENTS (6 EVENTS/ PLANT-YEAR)
  - DISCHARGE PIPED TO MASSIVE SUPPRESSION POOL
  - VALVES OCCASIONALLY FAIL TO CLOSE
    - 53 BLOWDOWNS IN BWR HISTORY

- SPRING SAFETY VALVES

  - SELDOM LIFT
    - 11 EVENTS IN BWR HISTORY
    - LOWER SET RELIEF VALVES
    - REDUNDANT ISOLATION CONDENSER LOOPS
  - DISCHARGE DIRECTLY TO DRYWELL

  - EXCELLENT BLOWDOWN HISTORY
    - 1 BLOWDOWN IN BWR HISTORY

SYSTEM RESPONSE TO A SORV

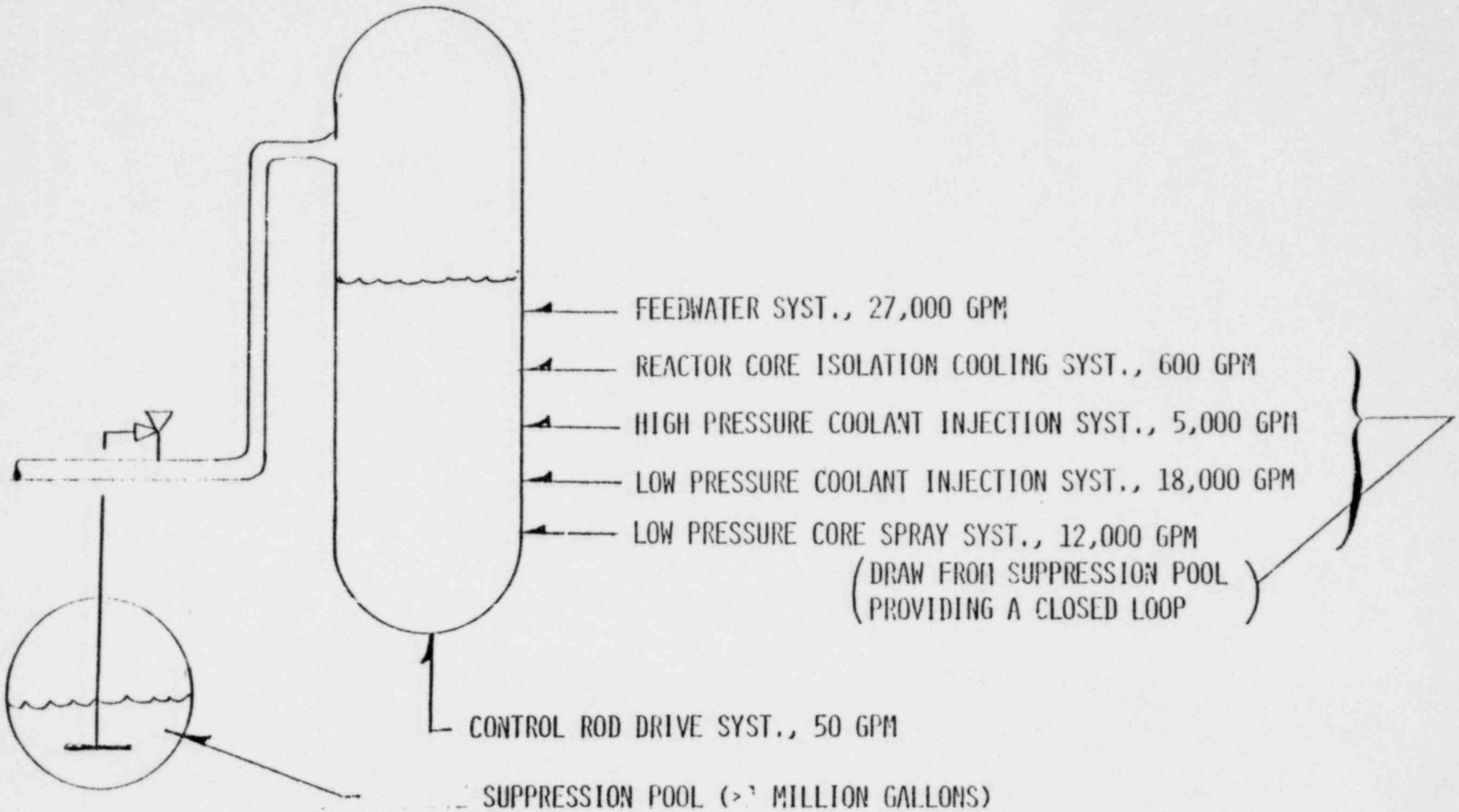
- CORE THERMAL RESPONSE TO LIMITING SORV EVENT
  (LOSS OF FW, HPCI, RCIC, + SORV)

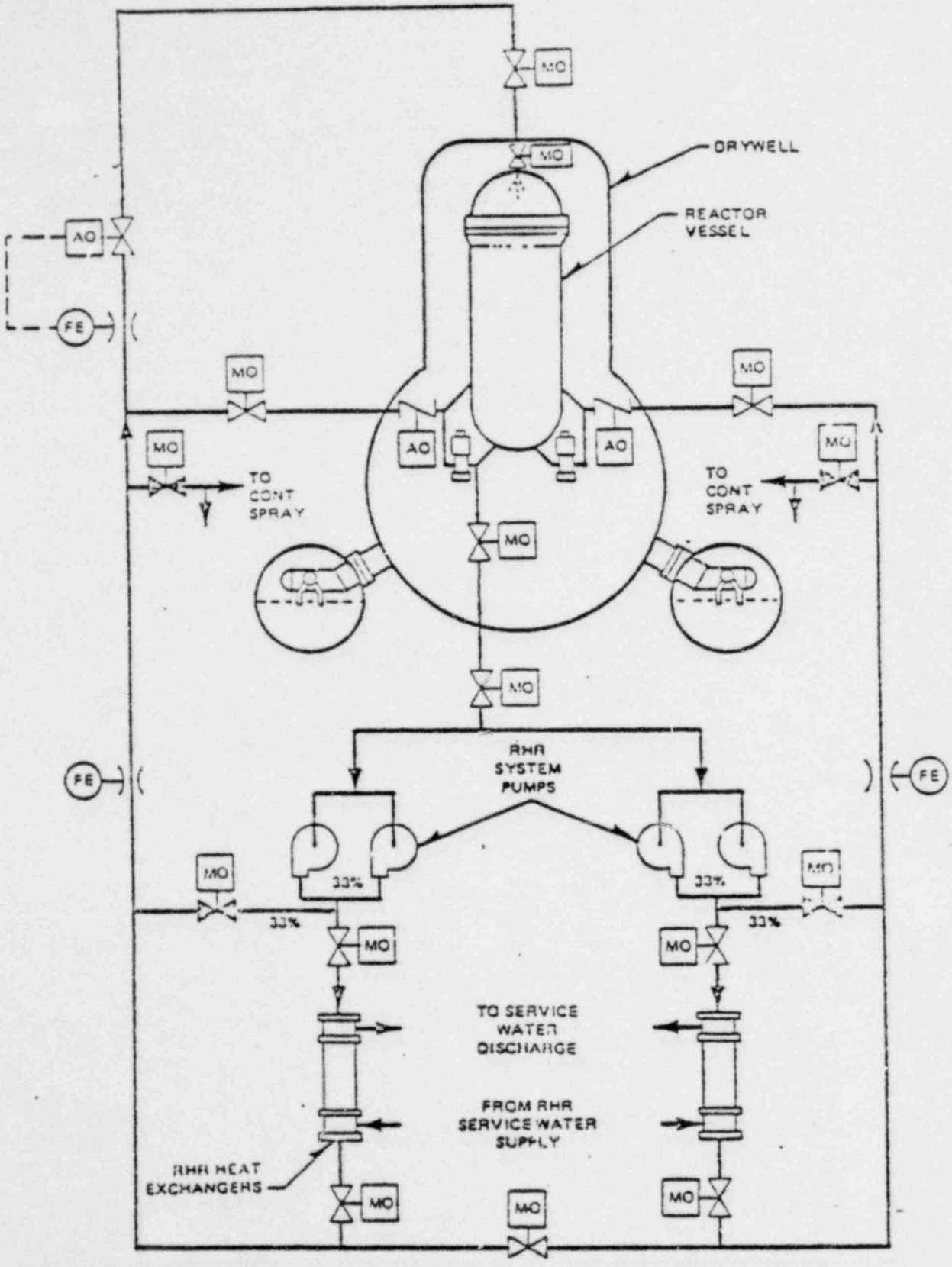
  - GRADUAL INVENTORY LOSS
    - EQUIVALENT TO 1800 GPM INITIALLY
    - DIMINISHES WITH DEPRESSURIZATION

  - REMAINING INVENTORY INJECTION SYSTEMS MORE THAN ADEQUATE TO ASSURE ADEQUATE CORE COOLING

  - SHUTDOWN PROCEDURES FAMILIAR, UNCOMPLICATED
    - OPERATOR OPENS ADDITIONAL SRV's AS REQUIRED TO DEPRESSURIZE ALLOWING LOW PRESSURE COOLANT INJECTION
    - REACTOR BROUGHT TO COLD SHUTDOWN USING RHR HEAT EXCHANGERS

SYSTEMS TO SUPPLY WATER TO CORE





TYPICAL Shutdown Cooling System

- CONTAINMENT RESPONSE TO DESIGN BASIS SORV EVENT
  (SORV + LOSS OF 1 RHR LOOP)

  - GRADUAL SUPPRESSION POOL HEAT-UP
    (3-4 DEGREES/MIN)

  - BULK POOL TEMP <190 DEGREES F

  - MINIMAL CONTAINMENT TEMPERATURE INCREASE
    (< 60 DEGREES)

  - POOL BOUNDARY LOADING WELL WITHIN
    DESIGN LIMITS

  - PRIMARY COOLANT CONTAINED IN POOL

IN PLANT EXPERIENCE

- 53 SORV EVENTS IN BWR OPERATION
  - NO CORE UNCOVERY
  - NO CORE HEAT-UP
  - MAX POOL TEMP $< 165^{\circ}$ F

SUMMARY

- BWR SYSTEM/CONTAINMENT DESIGNED TO ACCOMMODATE SORV EVENTS

- SHUTDOWN PROCEDURES FAMILIAR, UNCOMPLICATED

- SORV EVENTS HAVE OCCURRED OCCASIONALLY IN BWR OPERATION RESULTING IN MILD OPERATIONAL TRANSIENTS
  - 53 EVENTS
    - NO CORE UNCOVERY
    - MINIMAL CONT. PRESS/TEMP INCREASE
    - MODEST POOL TEMP TRANSIENTS

- DESIGN BASIS SORV ANALYSES PREDICT ADEQUATE CORE COOLING AND CONTAINMENT RESPONSE

- SORV EVENTS PRINCIPALLY AN AVAILABILITY CONCERN FOR THE BWR

S/RV CLOSURE RELIABILITY IMPROVEMENT

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- ELECTROMATIC RELIEF VALVE
- DRESSER SAFETY VALVE
- TARGET ROCK SAFETY/RELIEF VALVE
- CROSBY SAFETY/RELIEF VALVE
- DIKKERS SAFETY/RELIEF VALVE

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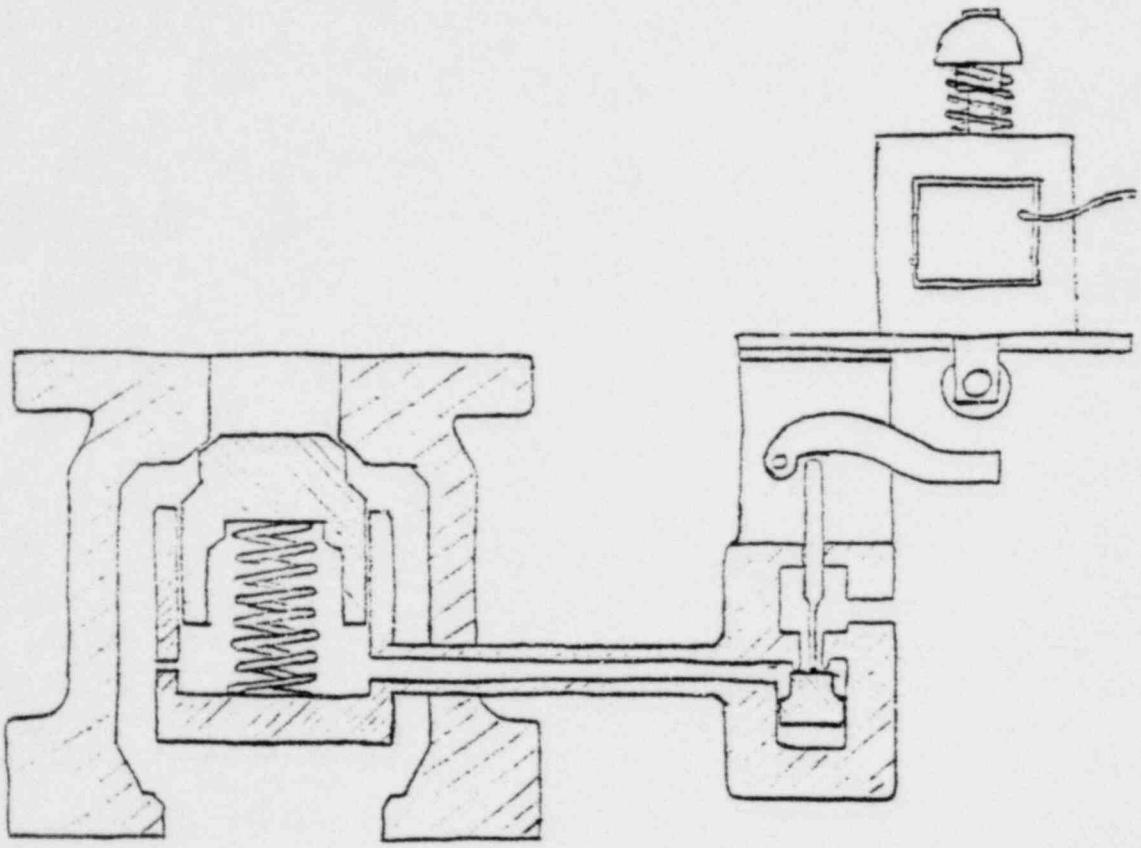
ELECTROMATIC



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ELECTROMATIC

- 230 VALVE YEARS OF SERVICE
  38 VALVES
  10 YEARS LONGEST SERVICE

- 2 BLOWDOWN OCCURRENCES
  4/1973 AND 11/1977

- MODIFIED SOLENOID PLUNGER GUIDES. MORE FREQUENT MAINTENANCE.

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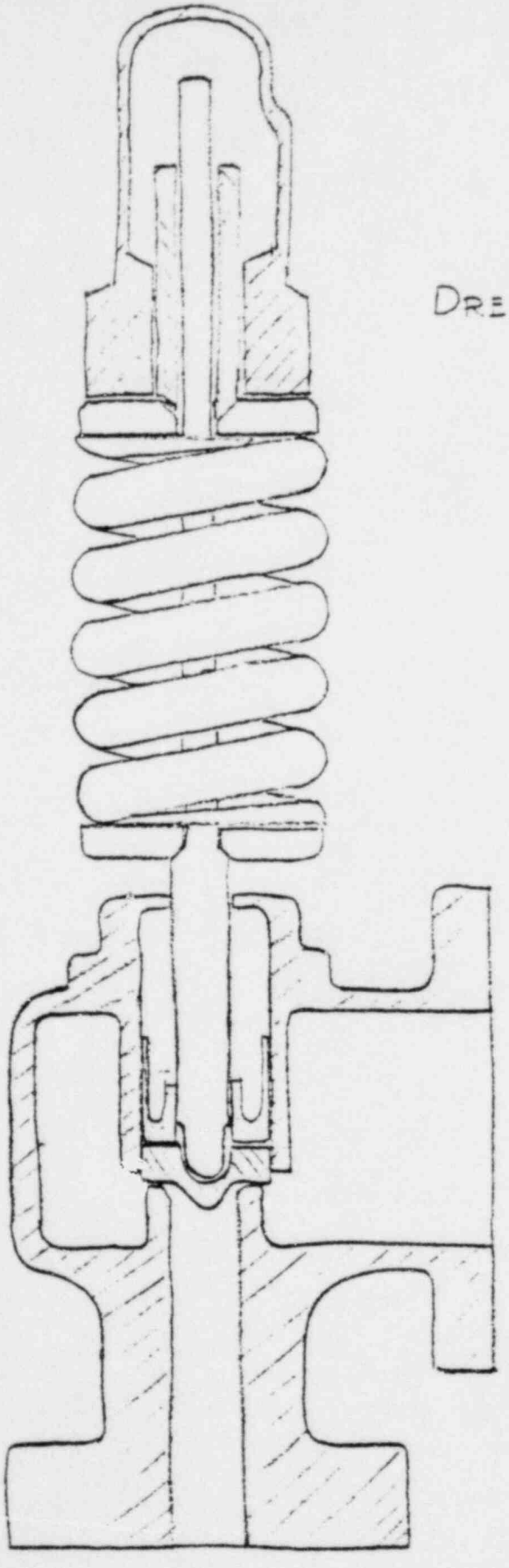

DRESSER

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DRESSER

- 600 VALVE YEARS OF SERVICE
  102 VALVES
  10 YEARS LONGEST SERVICE

- 1 BLOWDOWN OCCURRENCE

- REMOVED MANUAL OPENING ARMS

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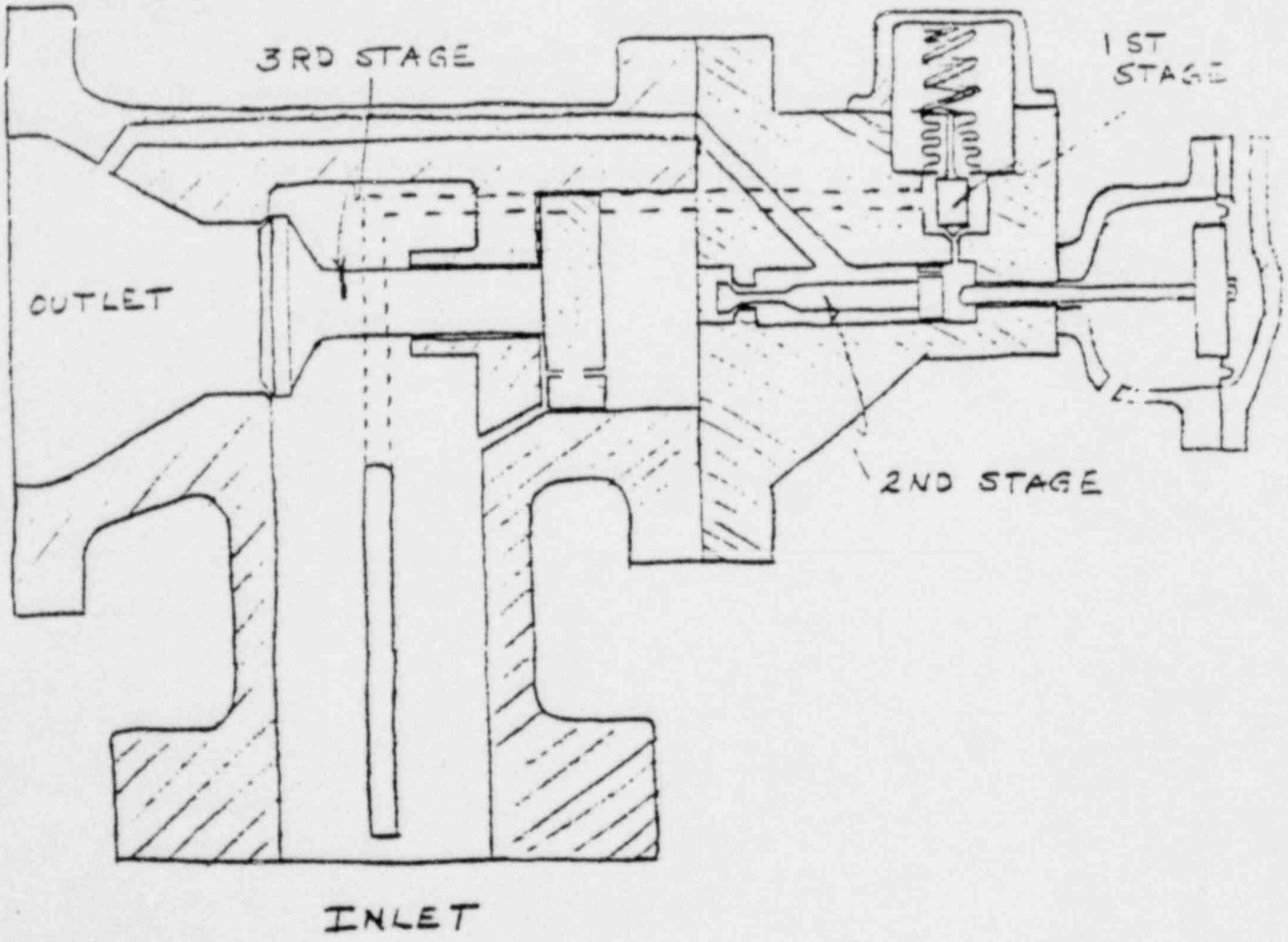
TARGET ROCK
3 STAGE



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TARGET ROCK 3-STAGE
BLOWDOWN OCCURRENCES

CAUSE	TOTAL 557 VALVE YEARS	PRIOR TO 3/1977 235 VALVE YEARS	3/1977 TO 5/1980 322 VALVE YEARS
SET POINT PILOT LEAKAGE	39	27	12
AIR OPERATOR	4	4	0
SOLENOID VALVE	4	3	1
SECOND STAGE NUT	1	1	0
SPRING RELAXATION	1	1	0
	49	36	13

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TARGET ROCK

FIX STRATEGIES

- INCREASE SIMMER MARGIN

  RAISE SET POINTS

- PLANT OPERATIONS

  REMOVE LEAKERS - REDUCE PRESSURE - MINIMIZE ACTUATIONS

- VALVE MAINTENANCE

  STRINGENT LEAKAGE ACCEPTANCE CRITERIA

- MODIFY TO TWO-STAGE DESIGN

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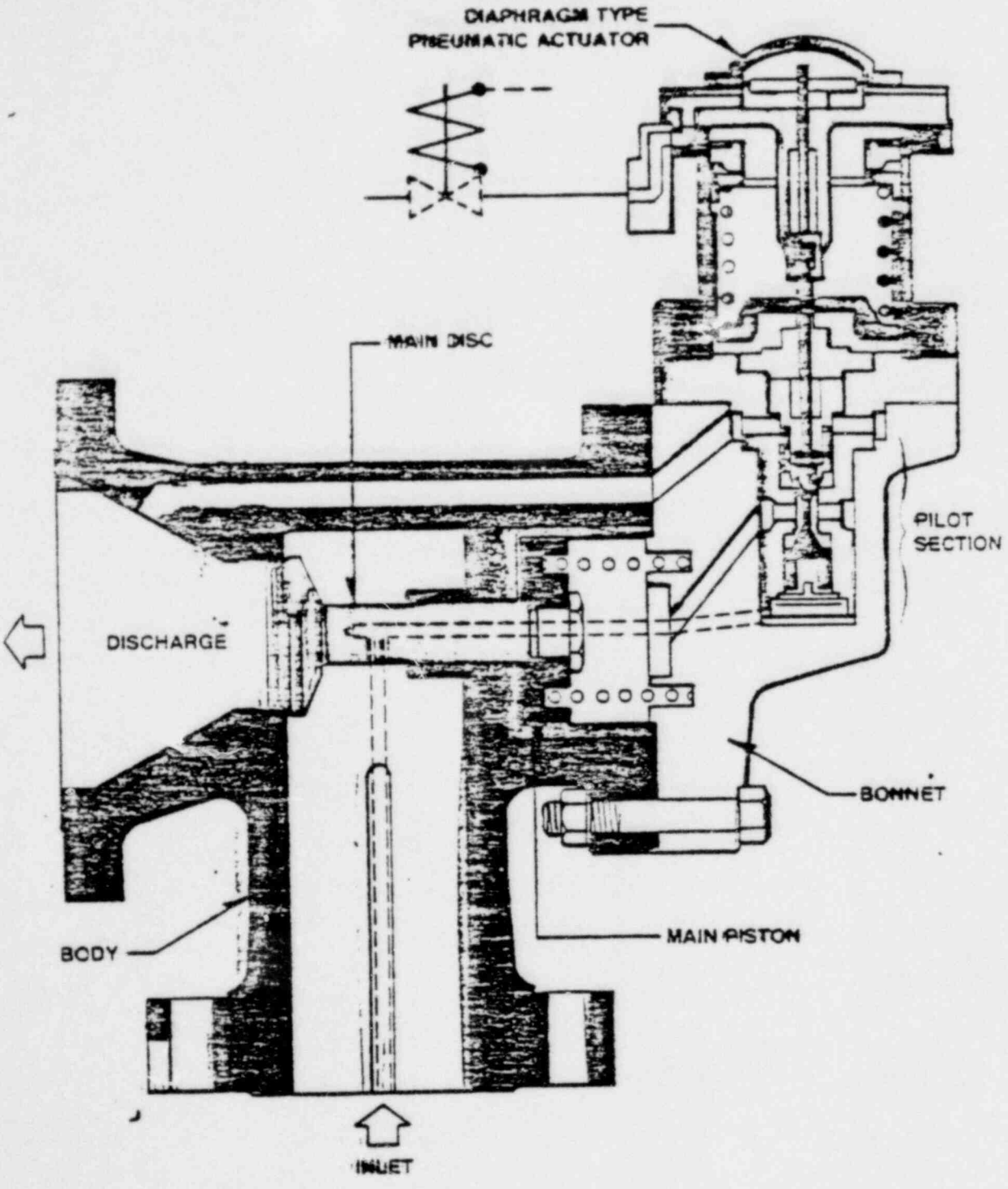
"TARGET ROCK" TWO STAGE, PILOT ACTUATED, SAFETY/RELIEF VALVE



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TARGET ROCK INSERVICE MIX

BY END OF 1980

	3-STAGE	2-STAGE	TOTAL
DOMESTIC	56	101	157
OVERSEAS	15	0	15
	71	101	172

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TARGET ROCK BLOWDOWN EVENTS

YEAR	# OF BLOWDOWNS	VALVES IN OPERATION
1975	7	120
1976	11	142
1977	8	150
1978	5	161
1979	4	172
1980 THRU MAY	0	172

LAST BLOWDOWN JULY 1979

NO TWO-STAGE VALVE BLOWDOWNS.

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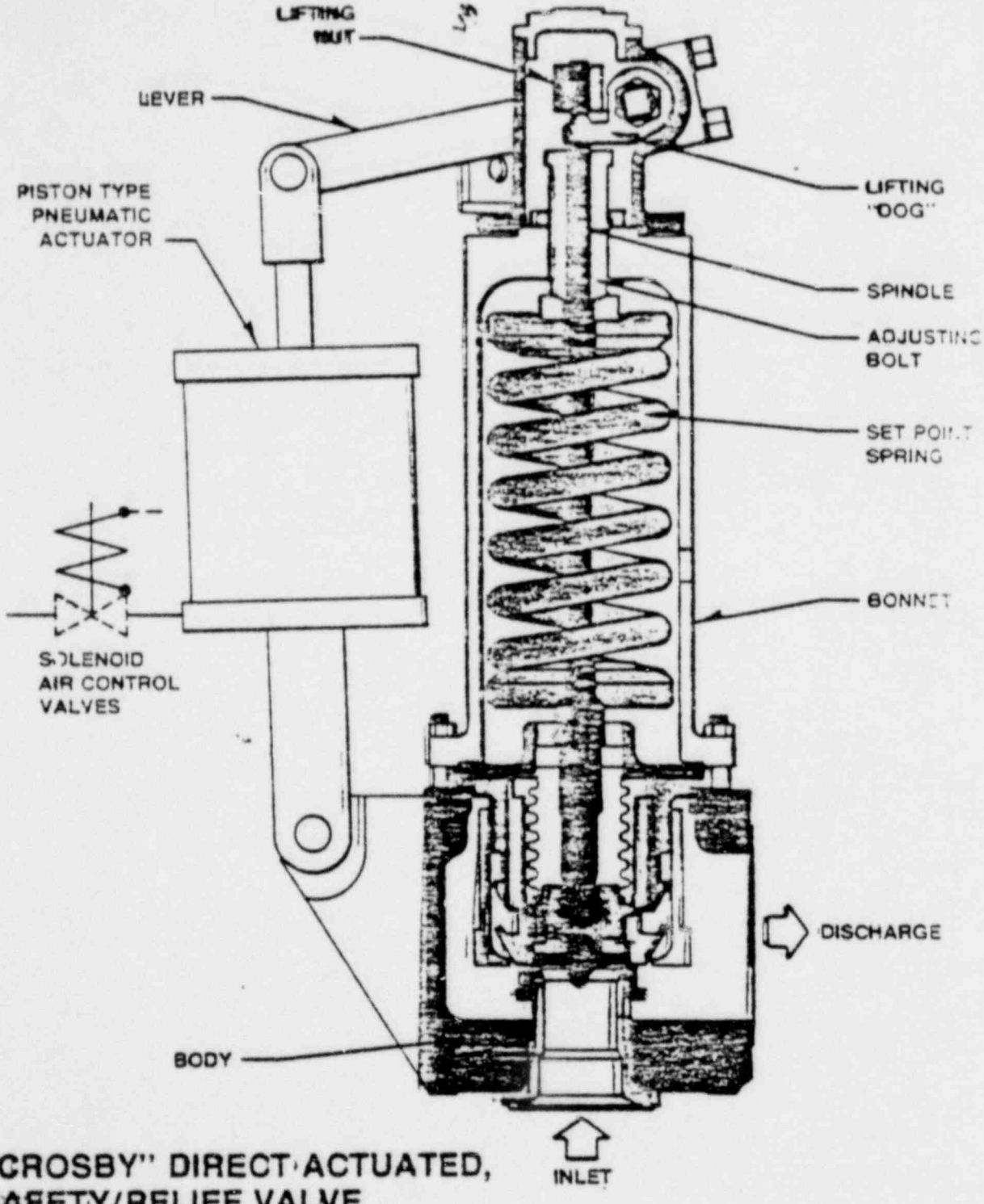

"CROSBY" DIRECT ACTUATED, SAFETY/RELIEF VALVE

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SUBJECT
NO.

CROSBY

- 1 BLOWDOWN OCCURRENCE - PROBABLY STUCK SOLENOID VALVE
- LIMITED PLANT EXPERIENCE
- EXTENSIVE QUALIFICATION TESTING

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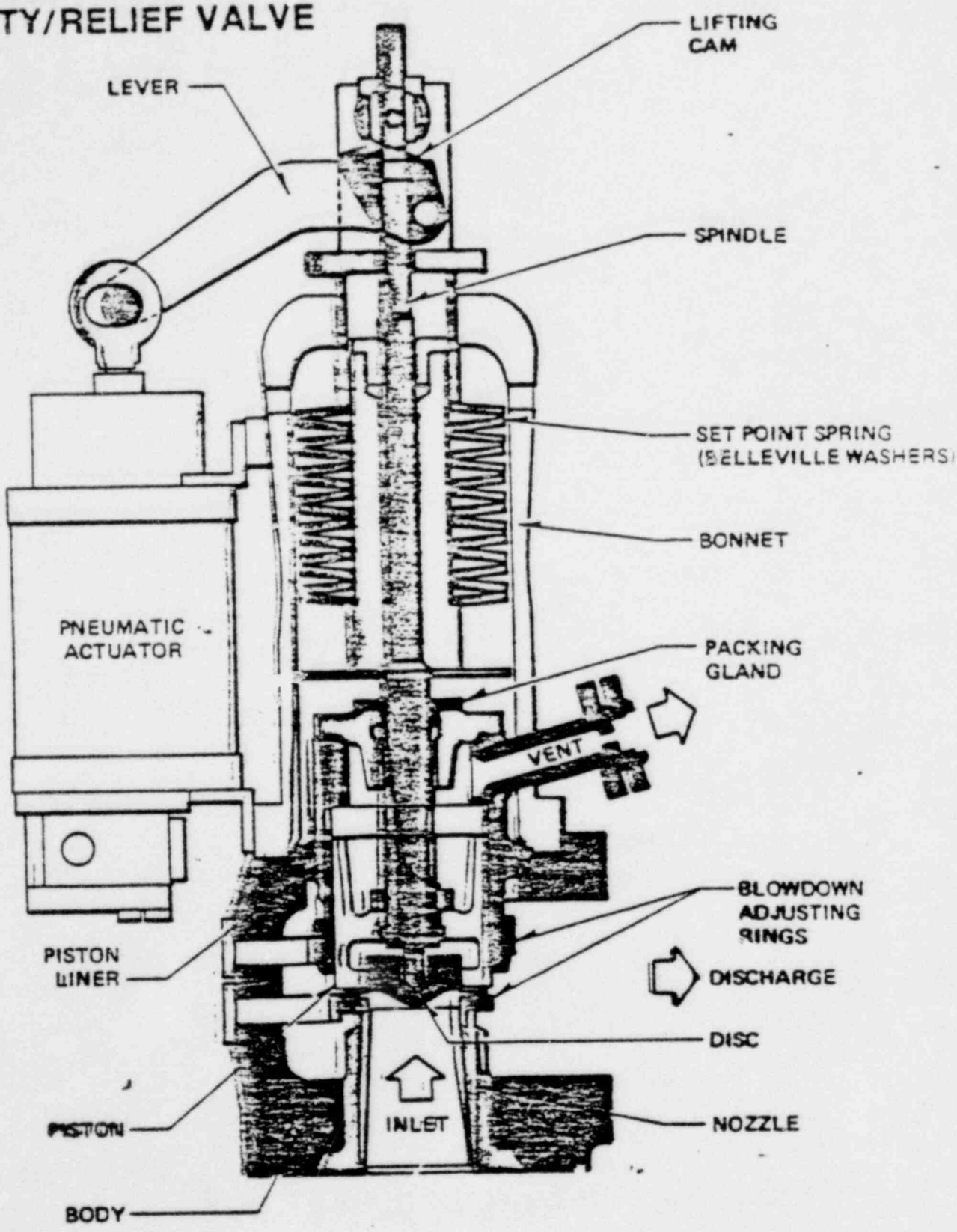
"DIKKERS" DIRECT ACTUATED SAFETY/RELIEF VALVE



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DIKKERS

- NO BLOWDOWNS ON EARLY DESIGNS
- EXTENSIVE QUALIFICATION TESTING

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CONCLUSIONS

- PROBLEMS ARE KNOWN.
- CORRECTIVE ACTION IS UNDERWAY.
- RESULTS ARE IMPROVING.
- KEEP GOING ON PRESENT VALVE PROGRAM.
- FURTHER IMPROVEMENT COULD BE FOUND REDUCING CHALLENGES.

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SRV CHALLENGE REDUCTION PROGRAM

- o DEVELOPING LIST OF SRV CHALLENGE REDUCTION CONCEPTS
- o SCREEN LIST FOR:
  - PRODUCT LINE APPLICABILITY
  - PRACTICALITY
  - ADVERSE CONSEQUENCES
  - COST EFFECTIVENESS
- o DISCUSS WITH NRC
- o DEVELOP IMPLEMENTATION PROGRAM
- o IMPLEMENT MODIFICATIONS ON PLANT UNIQUE BASIS

BWR O.G./NRC
MEETING
JUNE 12, 1980

D. NAAF

BWR SRV OPENING PRESSURE VARIATION

- o BWR RESPONSE TO SRV OPENING PRESSURE VARIATION
  - PARAMETERS AFFECTED
  - ASSESSMENT OF MARGINS IN LICENSING ANALYSES
  - DISCUSSION OF CONSERVATISMS
  - CONCLUSIONS
- o ASSESSMENT OF IN-PLANT SRV OPENING PRESSURE VARIATION
  - FOR EACH SAFETY & SAFETY RELIEF VALVE TYPE:
    - DISCUSSION OF AVAILABLE DATA
    - OPENING PRESSURE VARIATION IMPROVEMENTS (WHERE APPLICABLE)
    - CONCLUSIONS

BWR OWNERS' GROUP/NRC MEETING

BWR RESPONSE TO SAFETY/RELIEF VALVE SETPOINT VARIATION

ROBERT HUANG
JUNE 12, 1980

BWR RESPONSE TO S/R VALVE SETPOINT VARIATION

SYSTEM PARAMETERS POTENTIALLY AFFECTED

ASSESSMENT OF MARGINS IN LICENSING ANALYSIS

CONCLUSIONS

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SYSTEM PARAMETERS POTENTIALLY AFFECTED

- ▲ CORE THERMAL MARGIN
  - MINIMUM CRITICAL POWER RATIO, MCPR

- ▲ VESSEL OVERPRESSURE PROTECTION
  - MARGIN TO ASME CODE PRESSURE LIMIT

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ASSESSMENT OF MARGINS IN LICENSING ANALYSIS

▲ CORE THERMAL MARGIN

- VALVES ASSUMED AVAILABLE IN ANALYSIS
  - RELIEF VALVES (RV)
  - SAFETY/RELIEF VALVES (S/R V)
  - SPRING SAFETY VALVES (SSV)

- MCPR NOT IMPACTED BY VALVE SETPOINT VARIATION
  - VALVES WITH LOWEST SETPOINT OPEN AFTER OCCURRENCE OF MCPR
    - TYPICAL BWR/4 TURBINE TRIP WITHOUT BYPASS
      - MCPR OCCURS AT 1.2 SECONDS
      - FIRST VALVE OPENS AT 1.6 SECONDS

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ASSESSMENT OF MARGINS IN LICENSING ANALYSIS (CONT.)

▲ VESSEL OVERPRESSURE PROTECTION

- VALVES ASSUMED AVAILABLE IN ANALYSIS
  - ASME CODE QUALIFIED VALVES
    - SAFETY/RELIEF VALVES (S/R V)
    - SPRING SAFETY VALVES (SSV)

- DESIGN BASIS EVENTS
  - MAIN STEAMLINE ISOLATION VALVES (MSIV) CLOSURE - NO SCRAM - BWR/2 (REQUIRED BY EARLIER VERSION OF ASME CODE).
  - MSIV CLOSURE, NEUTRON FLUX (BACKUP) SCRAM - BWR 3/4/5

- CONSERVATIVE DESIGN BASIS ASSUMPTIONS USED IN ANALYSIS

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ASSESSMENT OF MARGINS IN LICENSING ANALYSIS (CONT.)

▲ VESSEL OVERPRESSURE PROTECTION (CONT.)

- WORST BWR 2/3/4/5 PLANT MARGIN (PSI) TO ASME CODE LIMIT (1375 PSIG)
  - ASSUME ALL VALVE SETPOINTS AT THEIR:
    - NOMINAL VALUE ≥ 68 PSI
    - NOMINAL +1% ≥ 60 PSI

- ANALYSIS IS NOT SENSITIVE TO INDIVIDUAL VALVE SETPOINT VARIATION IF AVERAGE SETPOINT REMAINS CONSTANT

- ALL PLANTS HAVE SUFFICIENT MARGIN (TYPICAL MARGIN 80 PSI) TO ACCOMMODATE SETPOINT VARIATION

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CONCLUSIONS

- SAFETY/RELIEF VALVE SETPOINT VARIATION HAS:
  - NO IMPACT ON CORE THERMAL MARGIN (MCPR)
  - SMALL EFFECT ON VESSEL OVERPRESSURE PROTECTION MARGIN

- BWR PLANTS HAVE SUFFICIENT MARGIN TO ACCOMMODATE SETPOINT VARIATION

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ASSESSMENT OF IN-PLANT

OPENING PRESSURE VARIATIONS

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TARGET ROCK SAFETY/RELIEF VALVES

DRESSER SAFETY VALVES

DIKKERS SAFETY/RELIEF VALVES

CROSBY SAFETY/RELIEF VALVES

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TARGET ROCK (3 STAGE) AS FOUND SET POINTS

SERIAL NUMBER	NAME PLATE PSIG	AS FOUND TEST RESULT PSIG
90	1090	1086
91	1100	1086
92	1090	1104
93	1080	1065
94	1080	1082
95	1090	1122
96	1080	1080
97	1080	1088
126	1080	1132
127	1090	1122
192	1090	1060
176	1110	1104
189	1100	1204
199	1100	1104
218	1090	1075
226	1090	1098
227	1110	1125

- OPENING PRESSURE AVERAGES 101.3% OF NAME PLATE SET PRESSURE.
- DATA CONSISTENT WITH ANALYSIS BASIS.

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TARGET ROCK 2-STAGE DATA SUMMARY
FROM HATCH 2 FEBRUARY 1979 MSIV
CLOSURE TEST AT FULL POWER

- VALVES CLOSED ABOVE DESIGN CLOSURE PRESSURE.
- AVERAGE OPENING PRESSURE WAS 104% OF NAME PLATE SET POINT.

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TARGET ROCK 2-STAGE

FEBRUARY 1979 DATA

MAX VESSEL PRESSURE - 1130 PSIG

VALVE DESIGNATION	NAME PLATE PSIG	INPLANT OPENING PRESS.- PSIG	TEST STAND OPENING PRESS-PSIG	INPLANT CLOSURE PRESSURE PSIG
B	1090	1128		1127
D	1100	1129		1126
F	1090	1130		1115
A	1100	1128		1106
H	1110	1123*		1102
E	1110	1110		1067
C	1090	-	1162	
G	1090	-	1134	
K	1100	**		
L	1110	-	1165	
M	1100	-	1155	

* OPENED AFTER VESSEL PRESSURE PEAK OF 1130 PSIG.

** SUBSEQUENTLY OPENED AT 1105 PSIG ON VESSEL REPRESSURIZATION.

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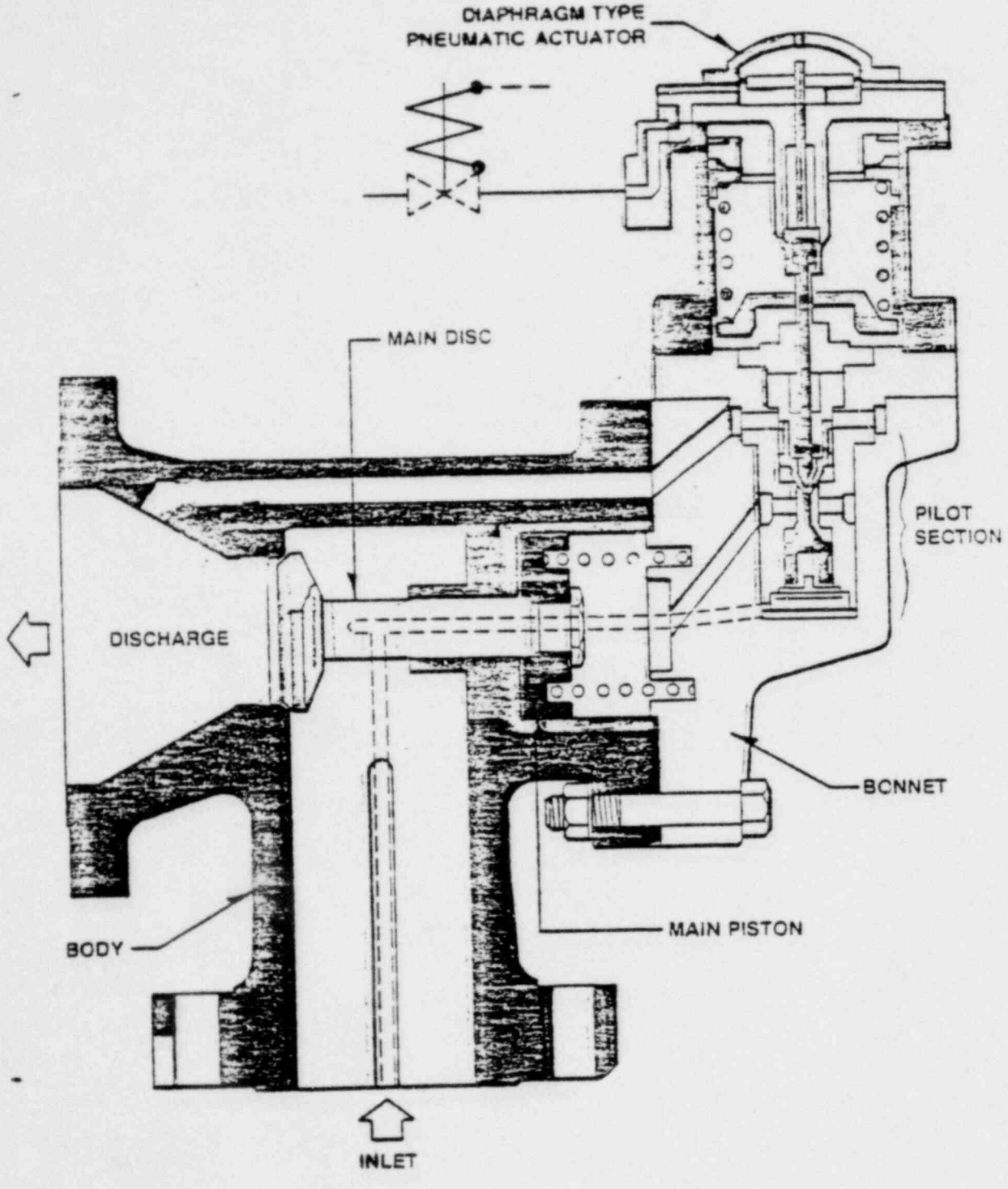
"TARGET ROCK" TWO STAGE, PILOT ACTUATED, SAFETY/RELIEF VALVE



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ACTION

- LOWERED CLOSURE PRESSURE
- INCREASE SET POINT PILOT ANGLE TO 75° TO REDUCE FRICTION.
- RERAN MSIV CLOSURE TEST JUNE 1979

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TARGET ROCK 2-STAGE
JUNE 1979 DATA
MAX VESSEL PRESSURE - 1086 PSIG

VALVE DESIGNATION	NAME PLATE PSIG	INPLANT OPENING PRESSURE-PSIG	INPLANT CLOSURE PRESSURE PSIG
B	1090	N/A	N/A
D	1100	N/A	N/A
F	1090	1085	974
A	1100	N/A	N/A
H	1110	N/A	N/A
E	1110	N/A	N/A
C	1090	N/A	N/A
G	1090	1086	1007
K	1100	1086	1031
L	1110	N/A	N/A
M	1100	N/A	N/A

SUMMARY

- VALVES CLOSED WITH DESIGN CLOSURE RANGE.
- 3 VALVES OPENED BELOW NAME PLATE.
- NO NAME PLATE SET POINT WAS EXCEEDED.

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ACTION ON ALL TARGET ROCK (2-STAGE)

- ALL DESIGNS CHECKED FOR CLOSURE WITHIN DESIGN RANGE.

- ALL SET POINT PILOT ANGLES INCREASED TO 75°.

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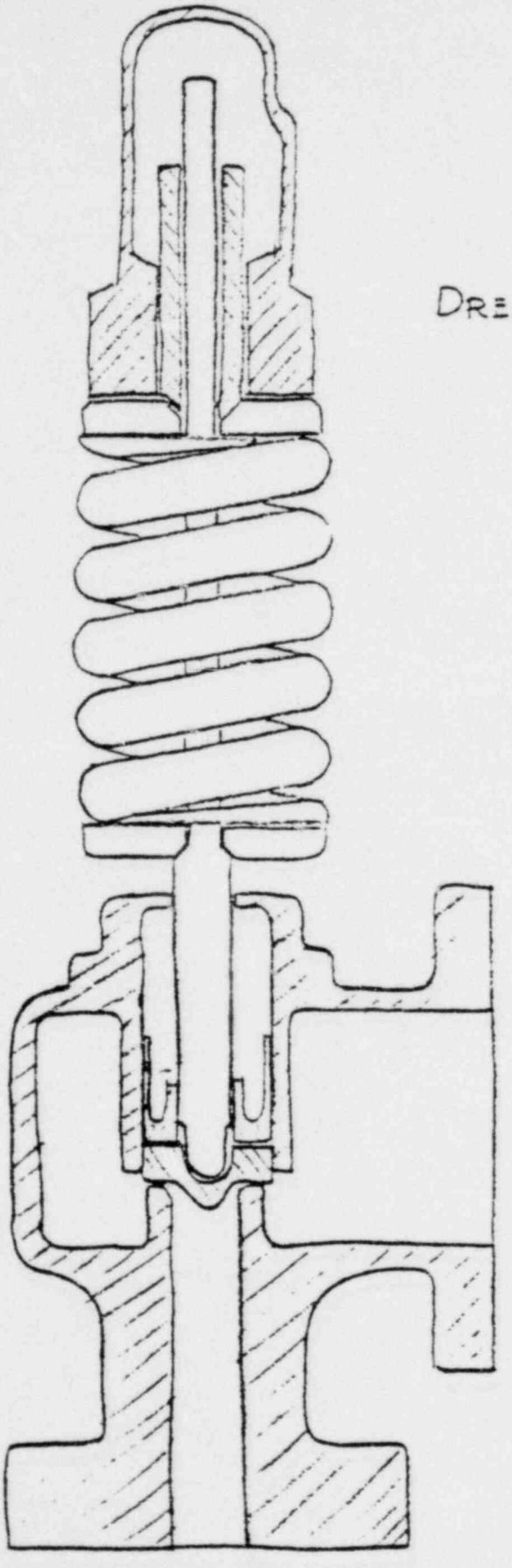

DRESSER

CBJ
6/9/80

DRESSER SAFETY VALVE

SET POINT DATA

- JUNE 1970 TO JUNE 1972
  11 CASES OF VALVES OPENING BELOW NAME PLATE.
- JUNE 1972 TO JUNE 1980
  NO CASES OF OPENING BELOW NAME PLATE
- CAUSE MOST PROBABLY WAS SPRING RELAXATION
- PRESENT PRACTICE IS TO "CAGE" AND BAKE SPRINGS

CBJ
6/9/80

DIKKERS AND CROSBY SAFETY RELIEF VALVES

- SIMILAR TO DRESSER SAFETY
- VERY LIMITED FIELD DATA
- "CAGED" AND BAKED SPRINGS USED
- EXTENSIVE PROTOTYPE AND SEISMIC TESTING

CBJ
6/3/80

CONCLUSION

- PROBLEMS HAVE BEEN IDENTIFIED AND FIXES IMPLEMENTED.
- DATA ARE CONSISTENT WITH ANALYSIS BASIS.

CBJ
6/9/80

SUMMARY

- OWNERS GROUP RESPONSE TO REQUIREMENT 2.1.2
  - LOW PRESSURE TEST ESSENTIALLY READY
  - PROGRAMS FORMULATED TO ADDRESS OTHER REQUIREMENTS OF NOV. 14 LETTER
  - CONCUR THAT HIGH PRESSURE STEAM OPERABILITY MORE RELEVANT TO BWR

- HIGH PRESSURE STEAM OPERABILITY
  - SRV CLOSURE RELIABILITY
    - MECHANICAL IMPROVEMENTS SUCCESSFUL, PROGRAM CONTINUES
  - FURTHER IMPROVEMENTS BY CHALLENGE REDUCTION
  - SET POINT VARIATION
    - NOT SIGNIFICANT

- RECOMMENDATIONS
  - CONDUCT LP TEST
  - COMBINE CHALLENGE REDUCTION PLANS WITH PERFORMANCE IMPROVEMENT PLANS
  - NRC TO CLARIFY 2.1.2 APPLICABILITY TO BWRS

Enclosure C

Response to ACRS Questions for BWR Safety and Relief Valve Test Program

RESPONSES TO ACRS QUESTIONS*
FOR BWR SAFETY/RELIEF VALVE
TEST PROGRAM

1. One of the major objectives of the safety/relief valve test program is to verify that these valves will open and close as required:

   a. What type of instrumentation will be employed to determine the flow conditions (saturated, two-phase, subcooled) at the valve disc face when the valve first opens and thereafter throughout the blowdown?

      RESPONSE: Not directly applicable to low pressure steam to water testing program planned as of 6-17-80.

   b. Will the test program evaluate the huddling chamber action (valve pop), blowdown, accumulation, and simmer margin for safety valves?

      RESPONSE: Not applicable for low pressure test program planned as of 6-17-80. Valves will be manually actuated using the air or hydraulic assist device normally installed on the PORV or safety/relief valve. The low pressure program pressures, about 250 psi max., are not high enough to actuate any of the valves in the safety mode during which the "huddling chamber" action assists in opening some types of valves.

   c. Is the blowdown test duration sufficient to prove the survivability of the valves and associated piping?

      RESPONSE: For the low pressure test program, yes.

   d. Will these tests prove that the valves will close when required?

      RESPONSE: For the low pressure conditions tested, yes.

   e. What is the permissible valve seat leakage following valve closure after blowdown?

      RESPONSE: No specific leakage criterion has been developed as of 6-17-80.

   f. Will the valve reaction time (time required to go from close to full open) be measured?

      RESPONSE: LVDT devices will be used to measure the opening time of most of the tested valves.

*As attached to agenda for June 17-18, 1980 S/C on Metal Components Meeting

g. What considerations are provided to test valve capacity for limiting system overpressure in normal system applications?

RESPONSE: The quantity of steam flowing through each of the test valves will be measured at the beginning of each test. It is not an objective of this program to try to confirm the valve relieving capacity which is assumed for overpressure protection of the reactor coolant system.

2. How will the ATWS testing be factored into the program?

RESPONSE: This question is not applicable for Boiling Water Reactors. For BWR's the Safety/Relief Valves relieve steam under temperature and pressure conditions within the design basis of the valves. No additional confirmatory testing of the valves is necessary for ATWS events. The effect of ATWS events on valve discharge piping and suppression pool integrity is less clear. The staff has requested additional information from G.E. relative to these effects.

3. What type of instrumentation will be employed to measure valve discharge rate?

RESPONSE: For the low pressure test program the water flow rate approaching the test valve and leaving or exiting the valve will be measured using venturis. Also thermocouples will be used to measure fluid temperature. More information on instrumentation will be obtained in future discussions with the BWR Owners Group and will be presented to the ACRS as it becomes available.

4. The NRC is considering the requirement to add an automatic PORV block valve closing feature:

a. Will this test program prove the operability of PORV block valves to open under system differential pressure and close under various (subcooled water, two-phase flow, etc.) flow conditions?

b. Valve operator action has been an area of concern in the past. Will the tests of the block valves include a variety of prototypical valve operators as well as valves?

RESPONSE: This question is not considered applicable to BWR's.

5. Will the various means of positive valve position indication be evaluated up to rated valve discharge?

RESPONSE: Assuming only the presently planned low pressure program is undertaken, there are no plans to evaluate position indication devices as described.

6. Waterhammer is being studied as a generic problem. Pressure transients in the valve piping may be caused by closure of the valves under test. What type of data can and may be collected to aid in the study for waterhammer and its effects on valves and piping?

   RESPONSE: Piping will be instrumented for measuring forces and moments acting on it. If any loading such as waterhammer is noted during the tests, the resulting forces and moments will be recorded.

7. Temperature effects may cause spring relaxation and valve seat distortion.

   a. Will the valves be tested at their normal operating temperatures?

      RESPONSE: The valves will be tested at normal operating temperatures associated with the Alternate Shutdown Cooling Mode of operation. All test valves will begin the low pressure test at the temperature they would be at prior to being utilized for the alternate cooling mode. To achieve this they will be temperature "soaked" until they are at the appropriate equilibrium temperature. Additionally the temperature and pressure of the test fluids will be as expected for the Alternate Cooling Mode of operation.

   b. What procedures will be used to establish the lift pressure for the valves prior to the tests?

      RESPONSE: This question is not applicable to the BWR low pressure test program where pressures will be much lower than valve set or lift pressure.

   c. How long will the valves be subjected to system pressure prior to the tests?

      RESPONSE: See response to 7a) above.

   d. Will the valves be calibrated in service at operating temperature and pressure?

      RESPONSE: See response to 7a) above.

8. Will this current test program verify the ASME Code requirements which allow the testing of reduced sized safety/relief valves in order to validate the proper operation of the actual valves where full-scale test facilities have not been available.

   RESPONSE: For the low pressure BWR test program no attempt will be made to confirm the adequacy of the ASME Code Capacity Certification Procedure. The fluid media, flow rate, temperatures, and pressures contemplated for this program would not be commeasurate with such a confirmation attempt.

9. The test program will investigate piping effects that influence valve operability. What effects are expected (thermal-hydraulic, pipe reaction forces, backpressure, etc.)? How will these effects be monitored?

   RESPONSE: Strain gauges will be installed on the sweepolet on which the test valve is mounted. The maximum moment across the valve body will be measured. Forces and moments on the test discharge pipe will be measured. For the low pressure test all forces mentioned in the question are involved i.e. valve and pipe reaction forces, thermal-hydraulic forces associated with steam, water, and some back pressure effects would be expected associated with the discharge piping configuration. As was noted above, more information on instrumentation will be obtained in future discussions with the BWR Owners Group and will be presented to the ACRS as it becomes available.

10. Information on the BWR Safety Relief Valve Testing Program has not been available at prior presentations. The above questions (applicable to BWRs) should be addressed at the upcoming meeting. (This test program is completely separate from the EPRI program.)

    RESPONSE: The response is contained in the staff's June 17 presentation and the responses to the above questions.

11. What funding and manpower are committed to the safety/relief valve test programs?

    RESPONSE: As of June 17 the staff does not believe that the BWR test program is fully defined. We will report to the ACRS on this at a later date when the full scope of the program is clear.