VELAN VALVE CORP. : 2-9-91 : 8:58 : VELAN WILLISTON→ 215 337 5324;# 2

NO.55 P003.

PDR

171691

Velan Valve Corporation
Ave "C"
Gressold Industrial Park
Williston, Vermont 05495

VELAN

'91 APR 24 P6:25

NUS File Copy

January 18, 1991

United States Nuclear Regulatory Commission
631 Park Avenue
King of Prussia, PA. 19406

Pt 21

Subject: Notification as required by 10CFR Part 21

Gentlemen:

As required by 10CFR Part 21 we are advising you of a potential safety related problem with our 2 1/2", 3" and 4" forged swing check valves.

Originally we assumed that this problem was isolated until we received information of a second related incident. In response to it we issued Service Bulletin SB104 (copy attached).

As result of a response to the Service Bulletin we believe that there is the possibility that other failures resulting from this deficiency may have occurred.

The problem is that the swing check valve may jam in the open position because of an accumulation of tolerances in the cage unit of the swing check assembly (sketch attached). Design changes have been made to eliminate this in future production of these valves and spare parts .

If there are any questions please feel free to contact the undersigned at 802-863-2561.

Sincerely,

VELAN VALVE CORPORATION

E.I. Francois
Vice President, Quality Assurance

EIF/atq
Encls.

RECEIVED
JUN 1 1 1991
PFS
Corresp. Control Center

cc: A.K. Velan
T.C. Velan
P.O. Velan
J. Farrell
B. Nilsson

Greene

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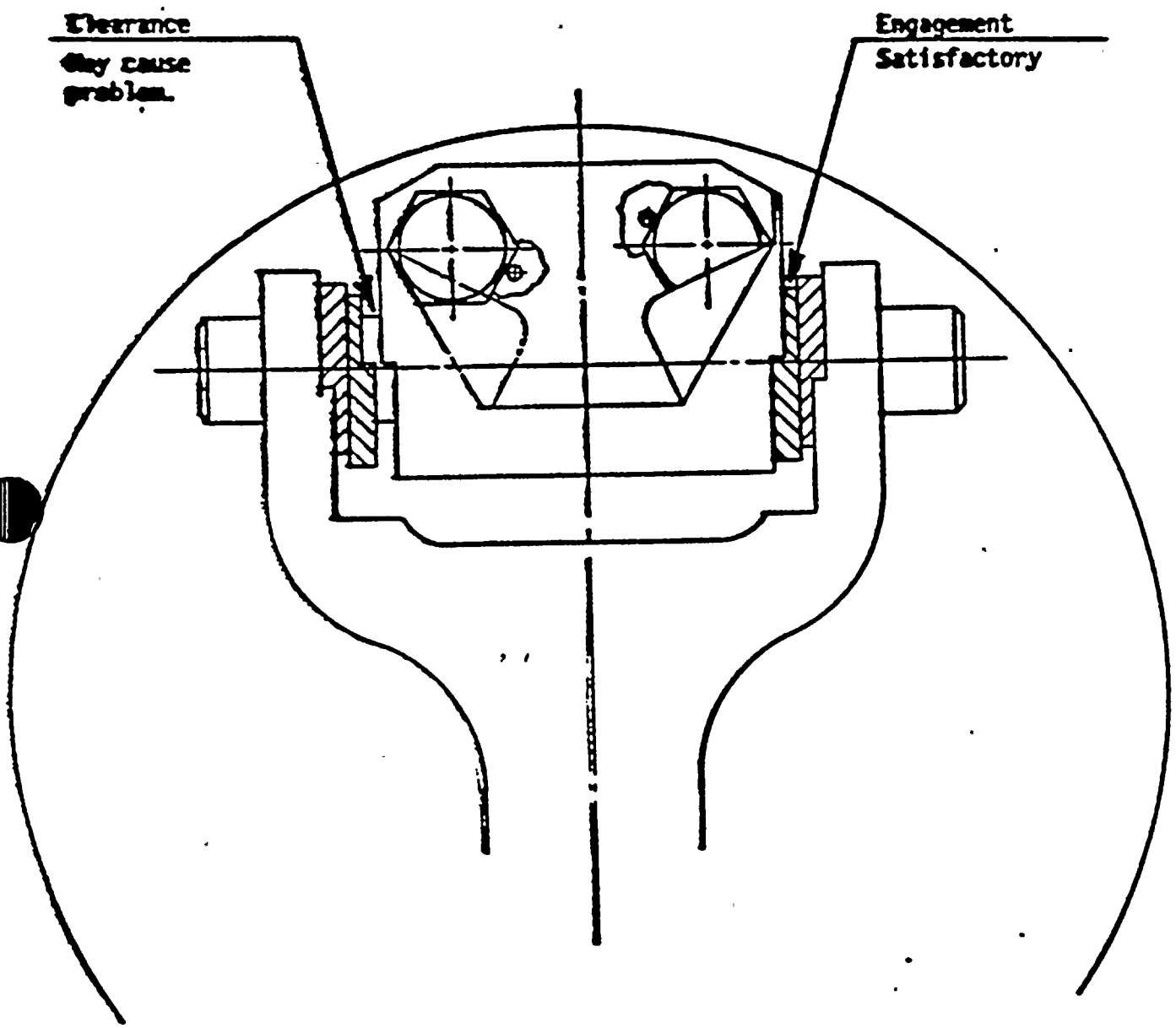
Clearance
may cause
problem.
Engagement
Satisfactory

EVENT HISTORY

8/91	Unit 2 Shows Increase in RCS Leak Rate Identified as CVCS-2-8378B First Off Normal Charging Check Valve First and Second Off Check Valves for Normal and Alternate Charging Added to Outage Scope
9/02/91	Inspection of Area Around CVCS-2-8378B Showed CVCS-2-8378A Was Also Leaking at Gasket
9/13/91	Valve Found Stuck Open When Opened to Repair Gasket Leak. Inspecting Engineer Assumes Bushing Problems
9/13/91 To 9/18/91	Radiation Protection Shields Area with Lead to Reduce Dose Rates from 180-100 mR/hr to 100-60 mR/hr

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MEL7

EVENT HISTORY
(Continued)

9/18/91	Returned to Repair After Installation of Temporary Shielding - Found Valve Now Shut and Moving Freely. Stud Removal/Repair Continues
9/20/91	Valve Internals are Removed for Evaluation. MM Engineering Still Assumes Valve was Stuck Due to Bushing Problems
9/22/91	Valve Parts and Valve Have Been Cleaned, Deconned, Inspected and Measured. A Dull Grey Yellow Film and a Slight Drag to Free Movement was Noted During Inspections. A Light Cleaning Alleviated the Condition

EVENT HISTORY
(Continued)

9/22/91	Senior MM Engineer Called in by Inspecting MM Engineer to Review Results of Inspection and Condition of Valve Internals. No Cause for Valve Sticking Open Could be Found. Bushings were Well Within Tolerance. Film/Crud was Removed. Valve Operated Freely
9/22/91	Old Valve Internals are Reinstalled Based on Inspection Results and Concern Regarding the Ability of New Trim to Fit in Valve
9/23/91	CVCS-2-8378A is Reassembled with Original Parts and Repeatedly Tested by Different MM Engineer along with Quality Control for Proper Function and Freedom with No Problems Identified

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MAINTENANCE HISTORY

- No Maintenance History Other than Bonnet Torque Check (9/82)
- Internals Probably Removed for Original Installation

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POTENTIAL FAILURE MECHANISMS

- Hinge Pin Bushing Excessive Clearance - 10CFR21
  - As-Found Clearances of 0.017 Inches is Insufficient for Problem
- Foreign Objects
  - Two Careful Wipe-Downs and Inspections by MM Engineer of Valve and Pipe Found Nothing
- Crud Deposit on Moving Components
  - Crud Found was Insufficient in Quantity and Strength
- Mechanical Interference
  - Possible Interferences
    - Hanger Block Shim Misaligned
    - Hanger Block Misaligned
    - Larger Cast Disc

Check Valve Failure Mechanism

CONCLUSIONS

- Although Actual Root Cause not Known, Maintenance Inspections and Careful Reassembly of Valve Provide Confidence That Problem will not Recur
- Multiple Visual Inspections Manipulate Moving Parts for Interference
- STP V-3K5 Flow Test Followed by Radiograph

INTRODUCTION

- DCPP Inspection Scope
- Industry Failure Frequencies
- Industry Failure Modes
- DCPP Inspection Plan Covers
  - All Failure Modes
- Force Available to Seat Valve
- Conclusion

3" and 4" VELAN SWING CHECK

- Unit 1 - 26
- Unit 2 - 19

DCPP INSPECTION RESULTS FOR 3" AND 4" VELAN SWING CHECK VALVES

- Before SB-104
  - 19 Valves Inspected
  - 1 Stuck Open (NCR 90-MM-N023)
- 1R4
  - 8 Valves Inspected
  - 0 Stuck Open
  - 1 Bushing Clearance Problem
- 2R4
  - 19 Valves Inspected
  - 1 Stuck Open
  - 1 Bushing Clearance Problem

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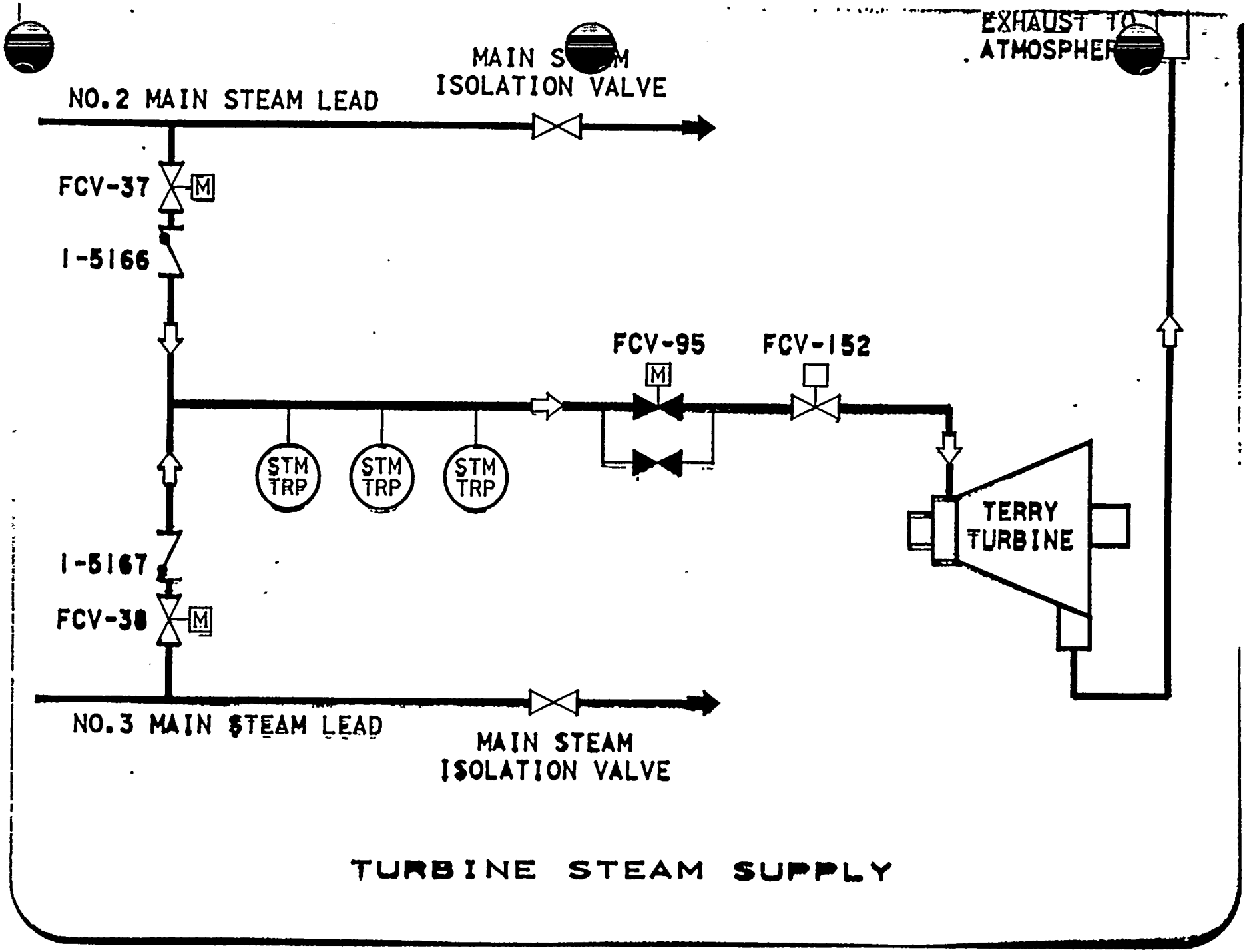
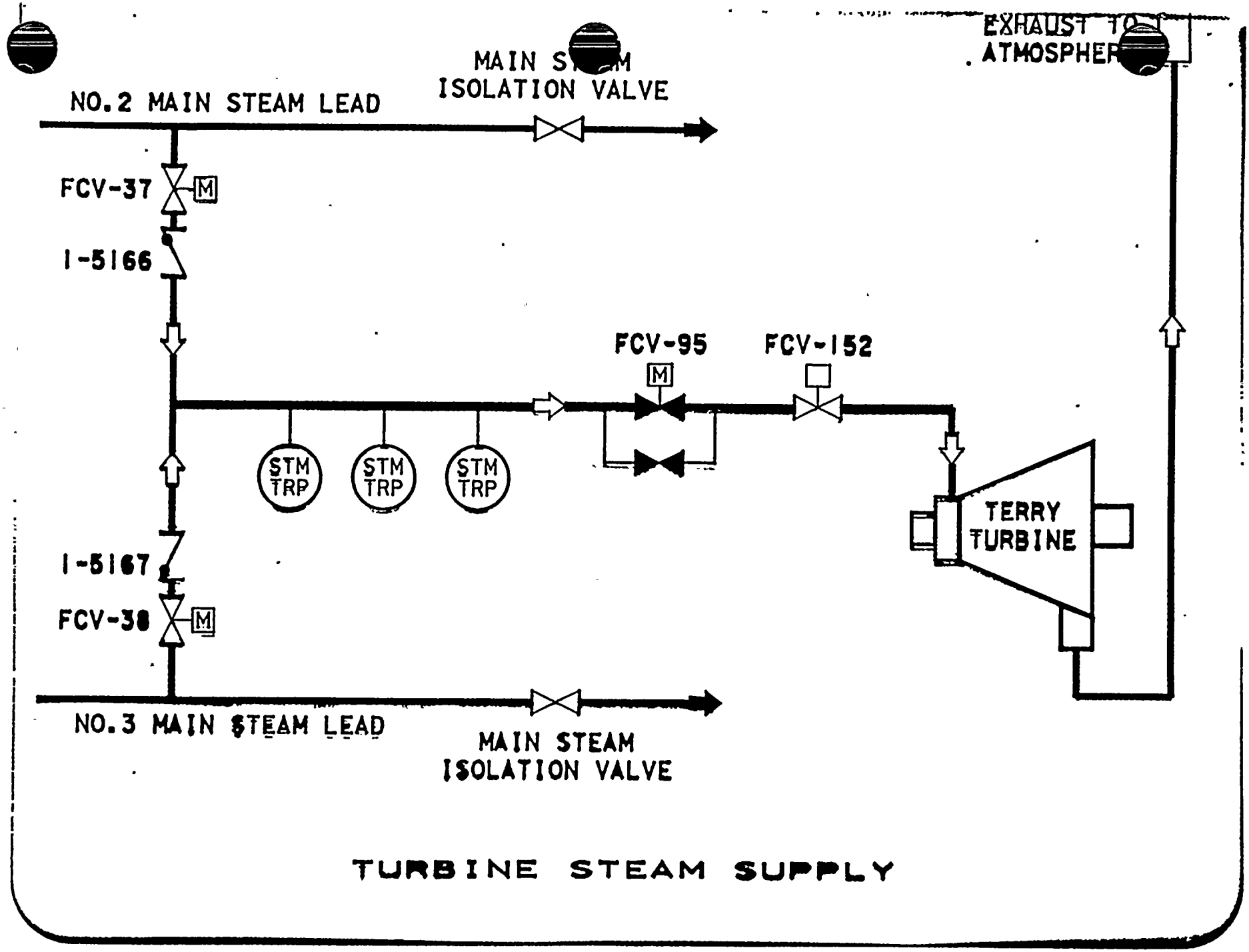


TURBINE STEAM SUPPLY



TURBINE STEAM SUPPLY

NCR 90-MM-N023

- Valve MS-2-5166 Non-Return Valve in the Steam Supply Line to TD AFW PP
- 1984 Bushings Machined by PG&E After Receipt Due to Tight Fit During Installation
- Discovered 80% Open in 2R3 (April 1990)
- Would Have Closed if Required
- History Search Showed This Was Only Valve With Machined Bushings

TABLE 1

Summary Of Unit 1 Valve Applicability Evaluation

Valve ID	Size (inches)	Last Inspected	Inspected Clearance	Surveiln. Perform.	Engrng Eval.
FW-1-362	4	1R8			X
FW-1-363	4	1R4	X		
FW-1-369	3	1R8			X
FW-1-370	3	1R4	X		
FW-1-372	3	1R3			X
FW-1-373	3	1R3			X
FW-1-374	3	1R4	X		
FW-1-375	3	1R3			X
FW-1-376	3	1R4	X		
FW-1-377	3	1R4	X (1)		
FW-1-378	3	1R4	X		
FW-1-379	3	1R3			X
FW-1-380	3	1R4	X		
RCS-1-508	4	NONE			X
CVCS-1-8378A	3	NONE			X
CVCS-1-8378B	3	NONE			X
CVCS-1-8378C	3	1R1			X
CVCS-1-8379A	3	NONE			X
CVCS-1-8379B	3	NONE			X
CVCS-1-8475	3	1R1			X
CVCS-1-8478A	4	1R2		X	
CVCS-1-8478B	4	1R3		X	
SI-1-8820	3	NONE			X
SI-1-8922A	4	NONE		X	
SI-1-8922B	4	NONE		X	
RP-1-380	4	1R4	X		

(1) AR A0222168, MP M-51.15 inspection identified overall internal clearances that were great enough to allow the bushings to potentially rotate free of the hanger block retention shoulders. Disc and hanger arm assembly were replaced.

2R4

VELAN CHECK VALVE INSPECTIONS

VALVE	WORK ORDER	SCHEDULED	ACTCMP DATE	INSPECTION RESULTS
CVCS-2-8378B	C0091233	9/19/91	9/24/91	GOOD
CVCS-2-8378A	C0090865	9/13/91	9/21/91	STUCK OPEN (NOTE 1)
CVCS-2-8379A	C0091089	9/11/91	9/19/91	GOOD
CVCS-2-8378C	C0091780	9/19/91	9/22/91	GOOD
CVCS-2-8379B	C0091781	9/26/91	9/23/91	DISC CONTACT (NOTE 2)
CVCS-2-8475	C0091793	9/18/91	9/20/91	GOOD
CVCS-2-8478A	C0091794	9/19/91	9/20/91	GOOD
CVCS-2-8478B	C0091795	9/19/91	9/20/91	GOOD
RCS-2-508	C0091784	9/20/91	9/20/91	GOOD
SI-2-8820	C0091782	9/17/91	9/22/91	GOOD
SI-2-8922A	C0091786	9/24/91	9/24/91	GOOD
SI-2-8922B	C0091787	9/24/91	9/24/91	GOOD
FP-2-867	C0091785	9/18/91	9/20/91	GOOD
FW-2-373	C0091788	10/2/91	10/2/91	GOOD
FW-2-374	C0091789	9/30/91	9/24/91	GOOD
FW-2-375	C0091790	10/2/91	10/2/91	GOOD
FW-2-376	C0091791	9/29/91	9/24/91	GOOD
FW-2-362	C0091792	10/2/91	10/5/91	BUSHING INTERF. (NOTE 3)
FW-2-363	C0091806	9/25/91	9/24/91	GOOD

NOTES:

1. AR A0242729 written to document stuck open condition.

2. AR A0243819 written to document disc to body contact on 8379B. Engineer also noticed that hinge connection was not loose as most check valves are. He characterized the bushings as appearing to have corrosion that inhibited the swing arm motion slightly. Valve internals have been replaced by new forged components.

3. AR A0246253 written to document that a side load applied on the swing arm caused the bushings to interfere. This valve failed the MP M51.15 inspection since the bushings can be maneuvered into binding. Disc and hanger block to be replaced.

OVERALL CHECK VALVE FAILURE HISTORY (SOER 86-3)

- 15,400 Valves in Database
- Information from January 1984 - April 1986
- 715 Reported Failures
  - 2% Per Year
  - 536 Minor Leakage
    - 1.5% Per Year
  - 86 Fails to Close
    - 0.2% Per Year
- A Substantially Higher % Occur During the Third and Fourth Years of Plant Operation

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UPDATED OVERALL CHECK VALVE FAILURE HISTORY

- 1986 Thru 1990
- 2796 Reported Failures
- 3% Per Year
- 25% of Failures Which Were "Fails to Close"
- 0.8% Valves Fail Per Year Due to "Fail to Close"

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CHECK VALVE FAILURE MODES INFORMATION SOURCES

- NPRDS (Nuclear Plant Reliability Data System)
- SREF (Safety Review Event Follower)

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VELAN

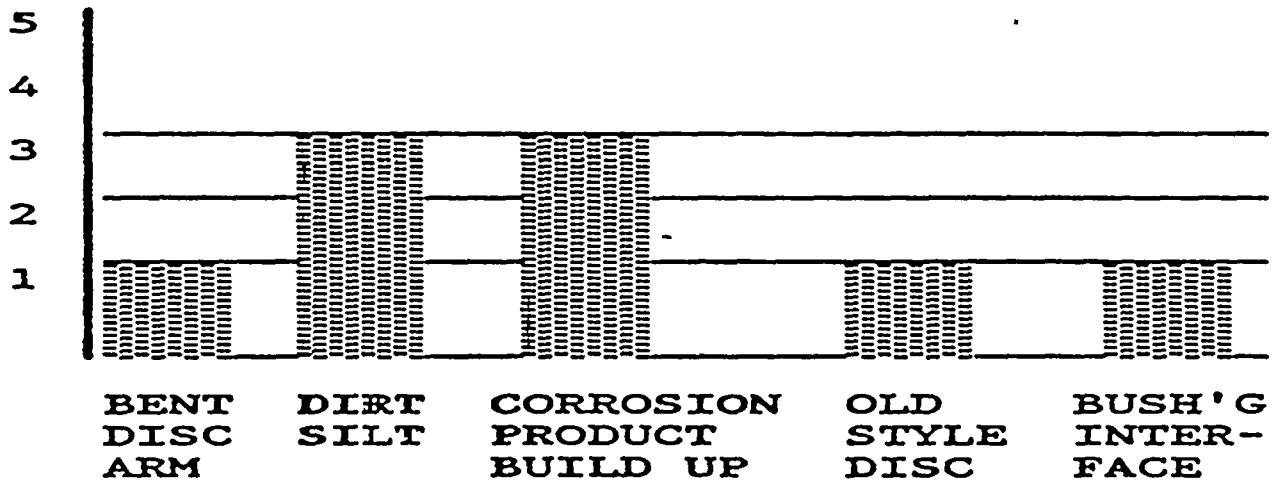
CHECK VALVE

42 INCIDENTS REVIEWED

80% OF INCIDENTS WERE SEAT TO DISC LEAKAGE

20% OF INCIDENTS WERE STUCK DISCS

STUCK DISC CAUSES



OPERATING EXPERIENCE ASSESSMENT

SREF NO.	SOURCE	SYSTEM	TYPE OF CHECK	DESCRIPTION
81-019	OPEX 182	SI-Salem 1	Not specified	A check valve was hung up in the open position due to boron solidification in the valve internals while the plant was shutdown.
81-102	SER 81-81 IEN 81-30	SI-Point Beach	Velan 6" swing check valve	The valve was stuck in the full open position due to interference between the disk nut lockwire and the valve body.
83-153	IEN 83-54	Main Steam-Trojan	Atwood Morril 28" reverse acting check valve	Main steam nonretum check valves stuck open due to packing-induced friction.
85-155	IEN 84-74	SI-Hatch 2 Core Spray System-Browns Ferry 1	Testable check valve Testable check valve	Check valve held open by an incorrectly assembled actuator. Check valve held open due to a plunger with reversed air ports installed in the solenoid valve.
89-223	SER 28-89	AFW-Comanche Peak	Borg-Warner	Vertical misalignment caused mechanical disc hang up which prevented the check valves from seating during backflow.
90-283	IEN 83-44 Sup.1	Floor drains-Quad Cities	Flap-type check valve	Valves stuck open as a result of debris and corrosion buildup.
91-156	10CFR21	All	Velan	The swing check valve may jam in the open position because of an accumulation of tolerances in the cage unit of the swing check valve assembly.

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APPENDIX B.2

TITLE: MAINTENANCE ENGINEER CHECK VALVE INSPECTION SHEET

COMPONENT:_____ UNIT/OUTAGE____/_____ SIZE: _____
SYSTEM _____ MODEL:_____ WORK ORDER No._____

		YES	NO
7.2	**Inspection Criteria**		
7.2.1	Are all retention devices secure?	[ ]	[ ]

Comments:_____

7.2.2	Is the disc anti-rotation device capable of performing the design function adequately and without hindering normal valves operation?	[ ]	[ ]
a.	A minimum of 1/16" interference exists between the anti-rotation pin and valve hanger arm.	[ ]	[ ]

Comments:_____

7.2.3	Is the valve free of internal damage which could hinder valve operation?	[ ]	[ ]

Comments:_____

7.2.4	Disc and seat seating surfaces are free of corrosion, impact damage, excessive wear or other damage that could hinder valve functions.	[ ]	[ ]

Comments:_____

7.2.5	Is the play in the valve adequate for proper valve operation?	[ ]	[ ]
a.	No excessively looseness or tightness?	[ ]	[ ]
b.	No disk to body contact?	[ ]	[ ]
c.	No excessive deformation?	[ ]	[ ]

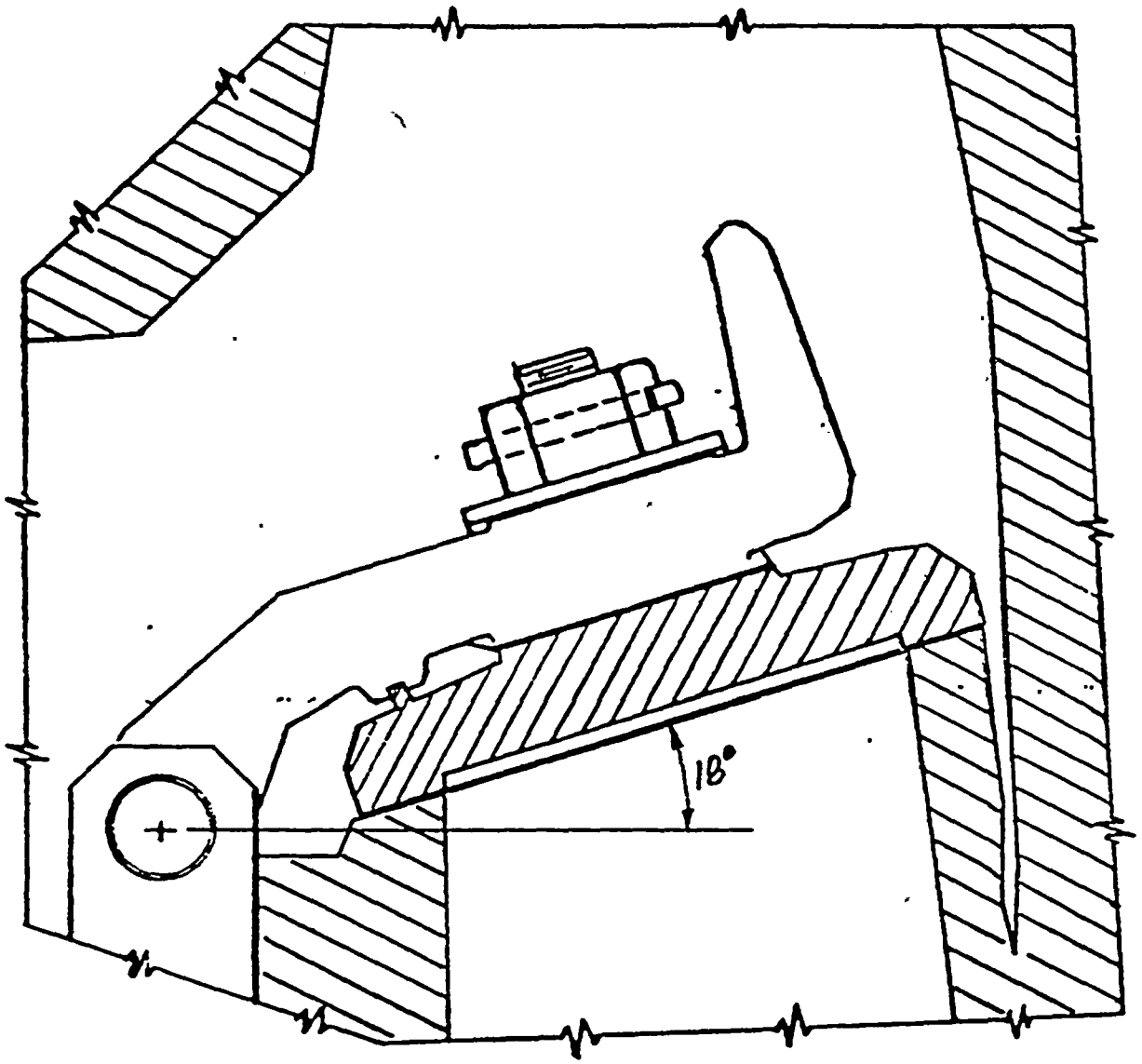
Comments:_____

7.2.6	Overall Internal clearances, CANNOT result in valve bushings rotating free of hanger block retention shoulders.	[ ]	[ ]

Comments:_____

NAME: _____ / _____
MAINTENANCE ENGINEER Date / Time

REVIEWED BY:_____ / _____
MAINTENANCE ENGINEER Date / Time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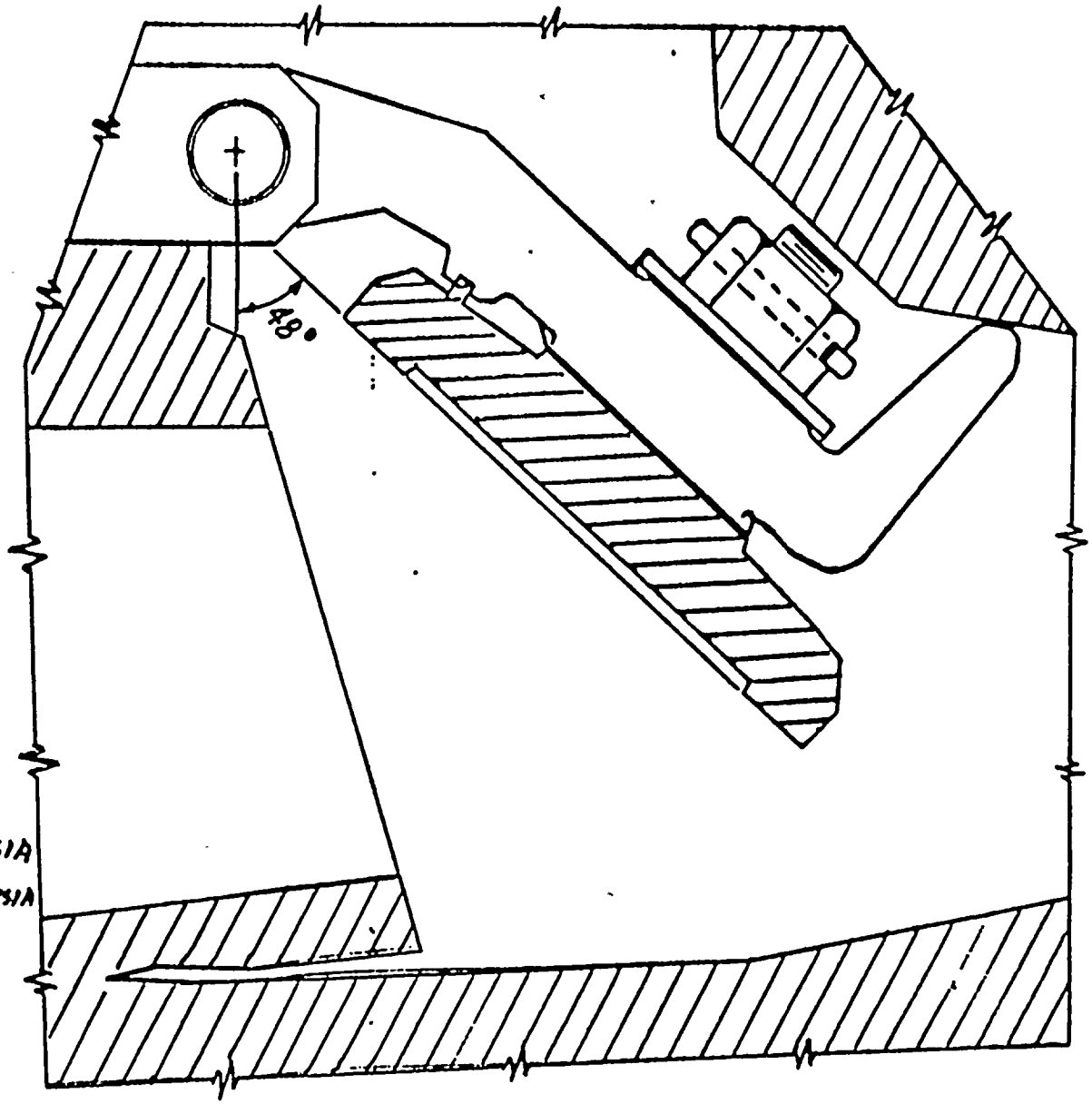

UPSTREAM PRESSURE = 1000 PSIA

DOWNSTREAM PRESSURE = 2250 PSIA

FORCE ACTING TO CLOSE VALVE WITH REVERSE FLOW > 15,000 LBS.

CONCLUSIONS

- All Known Failure Modes Examined
- Substantial Likelihood Valve Would Close Under Design Conditions
- Tests Demonstrated Valve Operability

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