CALC. NO. IP3-CALC-SI-01772 REVISION 0
CALCULATION IS: PRELIMINARY ___ FINAL X

	NAME	SIGNATURE	DATE
PREPARER:	P.C. Xie		2/11/96
CHECKER:	A.D.Harrison		2/13/96 ADH
(DESIGN) VERIFIED/NA	F.W. Martsen		2/13/96
APPROVED:	K. Eslinger		2/13/96

ORIGINATOR: NYPA ☒ OR OTHER ☐
SYSTEM NO./NAME SI-MOV-1835A Pressure Locking Analysis

FOR INFORMATION ONLY

QA CATEGORY: I DISCIPLINE: MOV STRUCTURE: N/A
MODIFICATION NO./TASK NO. GL-95-07 DBD REF. NO. N/A

PROBLEM / OBJECTIVE / METHOD

Assess actuator capability versus requirements under pressure locking conditions.

DESIGN BASIS / ASSUMPTION

Valve Factor = .5, Degraded Voltage, Stem Friction Coefficient = .2

SUMMARY / CONCLUSIONS

Actuator is capable of operating under postulated conditions.

THIS CALC SUPERSEDES OR VOIDS CALC. NO.

DISTRIBUTION: C = CONTROLLED I = INFO

NAME	DEPT	LOC	C	I
K. Eslinger	DSE	IP3	X	~~N/A~~
F. MARTSEN	PEP	WPO		X

SI
CAT I
52-B-0198

SUBJ:
QA CAT:
FILE #:
COMP. PRINTOUT LOC:

COMPONENTS

MAJOR EQUIPMENT	PIPE NO.	VALVE NO.	SUPT. NO	INST.NO.	PENE. NO.
N/A	N/A	SI-MOV-1835A	N/A	N/A	N/A

RELATED DOCUMENTS

NYPA COM-RPT-0002
IP3-RPT-MULT-1763
IP3-CALC-SI-01057
IP3-RPT-MULT-01279

RELATED DRAWINGS

NONE

SECURITY: (Y/N) N COMPUTER PRINTOUT: (Y/N) N

P1	=	Upstream Pressure at valve inlet, psig
PB	=	Bonnet Cavity Pressure, psig
P2	=	Downstream Pressure at valve outlet, psig
VF	=	Valve Factor
AS	=	Seat Area, in^2
SA	=	Stem Area, in^2
$PL_{assumed}$	=	Packing Load, lbs
$MCUV_{open}$	=	Motor Capability, lbs (Degraded Voltage)
$T_{degraded\ voltage}$	=	Capability at Degraded Voltage, ft-lbs
PL_{actual}	=	Packing Load, lbs
SF_{actual}	=	Stem Factor

P1	=21 (IP3-RPT-MULT-01763)
PB	=1622 (IP3-RPT-MULT-01763)
P2	=900 (IP3-RPT-MULT-01763)
VF	=0.5 (NYPA COM-RPT-0002)
AS	=12.965 (IP3-CALC-SI-01057)
SA	=2.074 (IP3-CALC-SI-01057)
$PL_{assumed}$	=2500 (IP3-CALC-SI-01057)
$MCUV_{open}$	=10,099 (IP3-CALC-SI-01057)
$T_{degraded\ voltage}$	=173.7(IP3-CALC-SI-01057)
PL_{actual}	= 800 (MOVATS Test Date 9/14/94)
SF_{actual}	=0.0115 (IP3-RPT-MULT-01279)

Opening Thrust Requirement Determination:

$$Thrust_{open} = [(PB-P1)+(PB-P2)](AS)(VF)-(SA)(PB)+(PL)$$

$$Thrust_{open} = [(1622-21)+(1622-900)](12.965)(0.5)-(2.074)(1622)+(2500) = 14{,}195\ lbs$$

Opening Thrust Requirement with actual packing load:

$$Thrust_{open} = [(PB-P1)+(PB-P2)](AS)(VF)-(SA)(PB)+(PL_{actual})$$

$$Thrust_{open} = [(1622-21)+(1622-900)](12.965)(0.5)-(2.074)(1622)+(800) = 12{,}495\ lbs$$

Margin % Definition:

$$Margin = \frac{(Capability-Requirement)\ x\ 100}{Requirment}$$

$$= \frac{(10{,}099 - 12{,}495)\ x\ 100}{12{,}495} = -19\%$$

This margin is unacceptable and is based on over-conservative assumptions, as actual stem factor can be used to assess current installed margin (see next page).

Actuator Capability under actual Stem Factor and Degraded Voltage:

$$New\ Capability = \frac{173.7}{0.0115} = 15{,}104$$

Therefore:

If the actual Stem Factor is used and degraded voltage is assumed, the margin is

$$MARGIN = \frac{(15{,}104 - 12{,}495)\ x100}{12{,}495} = 21\%$$

Conclusion:

The opening thrust capability at degraded motor terminal voltage of the subject actuator is 15,104 lbsf. This proves that the actuator has moderate margin (21%) over the opening requirements postulated in the pressure locking/thermal binding report (IP3-RPT-MULT-01763). The Stem Factor of $Thrust_{open}$ calculation is 0.0115, as determined in IP3-RPT-MULT-01279.

New York Power Authority

☒ - IP3
☐ - JAF

DESIGN VERIFICATION COVERSHEET

Verification of:

Document Title: SI-MOV-1835A PRESSURE LOCKING ANALYSIS

Document Number: IP3-CALC-SI-01772

Subject: GL 95-07

Modification/Task Number (if applicable): N/A

QA Category: I

Review Required	Discipline	Review Complete (initial of reviewer)
	ELECTRICAL	
	MECHANICAL	
	INSTRUMENT & CONTROL	
	CIVIL/ STRUCTURAL	
	FIRE PROTECTION	
	SIMULATOR	

New York Power Authority

[X] IP3
[ ] JAF

DESIGN VERIFICATION CHECKLIST

IDENTIFICATION:

Document Title: SI-MOV-1835A PRESSURE LOCKING ANALYSIS
(print title)

Doc. Number: IP3-CALC-SI-01772 Doc. Revision: 0

QA Category: I

DISCIPLINE:

[ ] ELEC [ ] I&C
[ ] MECH [ ] Fire Protect
[ ] C/S [ ] Simulator
[ ] Other MOV (specify)

METHOD OF VERIFICATION:

[X] Design Review [ ] Alternate Calculations [ ] Qualification Test

Selected Verifier: FRED MARTIEN PEP WP06789
print name_department_phone ext.

#	Design Verification Questionnaire All questions shall be explained in the space provided.
1.	Were the inputs correct and incorporated into the design?

Explanation: YES - ALL INPUTS ARE TAKEN FROM APPROVED REFERENCES

2.	Are the physical and functional characteristics of the proposed design within the approved design basis of the system(s) structure(s) or component(s)?

Explanation: N/A - THIS IS A CALCULATIONAL EVALUATION OF THE EXISTING DESIGN

3.	Does the proposed design incorporate license Commitments?

Explanation: N/A

4.	Are assumptions necessary to perform the design activity adequately described and reasonable: Where necessary, are the assumptions identified for subsequent reverifications when the detailed design activities are completed?

Explanation: YES SEE PG 1 OF CALC

5.	Are the appropriate quality and quality assurance requirements specified? e.g., safety classification?

Explanation: YES - CAT I

6.	Are the applicable codes, standards and regulatory requirements including issue and addenda properly identified and are their requirements for design met?

Explanation: N/A

#	Design Verification Questionnaire All questions shall be explained in the space provided
7.	Have applicable construction and operating experience been considered?

Explanation: YES- This calc supports GL95-07 PLTB review which considers operating experience.

8.	Have the design interface requirements for mechanical, electrical/I&C, and civil/structural engineering been satisfied? N/A

Explanation: N/A

9.	Was the appropriate design method used? YES

Explanation: The calculation uses standard industry methods

10.	Is the output reasonable compared to inputs? YES

Explanation: The required opening forces are reasonable

11.	Are the specified parts, equipment and processes properly suited for the fire protection Appendix R, QA, and EQ classifications required for the application?

Explanation: N/A

12.	Are the specified materials compatible with each other and the design environmental conditions to which the material will be exposed?

Explanation: N/A

13.	Have personnel requirements and limitations for maintenance, testing, and inspection been satisfied?

Explanation: N/A

14.	Are accessibility, maintenance, repair, and inservice inspection requirements for the plant including the plant conditions under which these will be performed been considered?

Explanation: N/A

15.	Has adequate accessibility been provided to perform the in-service inspection expected to be required during the plant life?

Explanation: N/A

#	Design Verification Questionnaire All questions shall be explained in the space provided
16.	Has the design properly considered radiation exposure to the public and plant personnel? (ALARA/cobalt reduction)
Explanation:	N/A
17.	Are the acceptance criteria incorporated in the design documents sufficient to allow verification that design requirements have satisfactorily accomplished?
Explanation:	YES. The conclusion is reached by directly comparing required thrust to capability
18.	Have adequate pre-operational and subsequent periodic test requirements been appropriately specified?
Explanation:	N/A
19.	Are adequate handling, storage, cleaning and shipping requirements specified?
Explanation:	N/A
20.	Are adequate identification requirements specified?
Explanation:	N/A
21.	Are the conclusions drawn in the Safety Evaluation fully supported by adequate discussion in the test or Safety Evaluation itself?
Explanation:	N/A
22.	Are necessary procedural changes specified, and are responsibilities for such changes clearly delineated?
Explanation:	N/A
23.	Are requirements for record preparation, review, approval, retention, etc., adequately specified?
Explanation:	YES. In accordance with calc procedure and control per NYPA process.
24.	Have supplemental reviews by other engineering disciplines (seismic, electrical, etc.) been performed on the integrated design package?
Explanation:	YES - System Engineer has reviewed PLTB scenarios.
25.	Have the drawings, sketches, calculations, etc., included in the integrated design package been reviewed?
Explanation:	YES

#	Design Verification Questionnaire All questions shall be explained in the space provided
26.	Have reviews been performed to identify any effect on the Check Valve Maintenance Program?

Explanation: N/A

27.	Does the design for check valves meet the intents of INPO SOER 86-03?

Explanation: N/A

28.	Is the plant reference simulator physical and functional fidelity affected and it's design change been factored into the cost?

Explanation: N/A

29.	Are all references listed (including design calculation/analysis) that were used as part of the design review?

Explanation: YES - SEE CALC PG 3

REMARKS/COMMENTS:

Design Verification Complete: Fred Martsen FRED MARTSEN (print name) (signature) (date) 2/13/96