Exhil	oit	t C	
NEP-	12-	-02	
Revi	sid	on (0
page	1	of	2

COMMONWEALTH EDISON COMPANY CALCULATION TITLE PAGE

CALCULATION NO. QDC-1000-M-0077 PROJECT NO.: N/A PAGE NO.: 1
SAFETY RELATED REGULATORY RELATED NON-SAFETY RELATED
CALCULATION TITLE: Pressure Locking Calculation for RHR System Valve MOV 1-1001-29B
STATION/UNIT: Quad Cities/1 SYSTEM ABBREVIATION: LPCI
EQUIPMENT NO.: (IF APPL.) MOV 1-1001-29B
REV: 0 STATUS: QA SERIAL NO. OR CHRON NO. N/A DATE:
PREPARED BY: <u>K. Higgins</u> <u>Higgins</u> DATE: <u>11/9/51</u> REVISION SUMMARY: Original Issue DO ANY ASSUMPTIONS IN THIS CALCULATION REQUIRE LATER VERIFICATION YES \Box NO •
REVIEWED BY: <u>I. Kelly</u> Jol 2 Roll 11-9-95
REVIEW METHOD: Detailed review COMMENTS (C OR NC): <u>NC</u>
APPROVED BY: LORTER W C. PORTER 11/1/95
9602200297 960213 PDR ADDCK 05000237 PDR PDR

Exhibit C NEP-12-02 Revision 0 page 2 of 2

COMMONWEALTH EDISON COMPANY CALCULATION REVISION PAGE

CALCULATION NO. QD	C-1000-M-0077	PAGE NO.: 2
REV: STATUS:	QA SERIAL NO. OR CHRON NO.	DATE:
PREPARED BY:		DATE:
REVISION SUMMARY:		
	· •	х.
		• •
REVIEWED BY:		DATE:
REVIEW METHOD:		COMMENTS (C OR NC):
REV: STATUS:	QA SERIAL NO. OR CHRON NO.	DATE:
REVISION SUMMARY:		DA1E:
	· ·	
REVIEWED BY:		DATE:
REVIEW METHOD:		COMMENTS (C OR NC):

CALCULATION TABLE OF CONTENTS

	PROJECT NO. N/A			
CALCULATION NO. QDC-1000-M-0077	REV. NO. 0	PAGE NO. 3		
DESCRIPTION	PAGE NO.	SUB-PAGE NO.		
TITLE PAGE	1			
REVISION SUMMARY	2			
TABLE OF CONTENTS	3			
I. PURPOSE/OBJECTIVE	4			
II. METHODOLOGY AND ACCEPTANCE CRITERIA	4			
III. ASSUMPTIONS	8			
IV. DESIGN INPUT	9			
V. REFERENCES	9			
VI. CALCULATIONS	10-15			
VII. COMPARISON OF MODEL TO OTHER SOURCES OF INFORMATION	16			
VIII. SUMMARY AND CONCLUSIONS	17			
IX. ATTACHMENTS	17			
A) Telecopies from Crane Valves	A-1, A-2(Final)			
· · ·				

CA	ALCULATION NO. QDC-1000-M-0077	PROJECT NO. N/A	PAGE NO. 4
I.	PURPOSE/OBJECTIVE		
	Valve MOV 1-1001-29B, which is installed in the determined to be susceptible to the pressure locking is to determine that the valve will open when called event by calculating the force necessary to overcom Motor/Gearing Capability (MGC) of the MOV.	RHR System at Quad Cities g phenomena. The purpose d upon by design during a p ne pressure locking and the	, has been of this calculation ressure locking available
П .	METHODOLOGY AND ACCEPTANCE CRITER	IA	
	The methodology for calculating the thrust required locking scenario is based on the Reference 1 (Roard methodology has been previously applied by ComE The methodology determines the total force require scenario by solving for the four components to this force are the Pressure Locking Component, the stat component, and the "reverse piston effect" component the following steps.	to open the MOVs under the k's) engineering handbook. It is the References 2 and 1 and to open the valve under a required force. The four chic unseating component, the ent. These components are	he pressure This 0 calculations. pressure locking omponents of the piston effect determined using
	Pressure Locking Component of Force Require	d to Open the Valve	
	The valve disk is modeled as two plates attaches with the valve disk. A plane of symmetry is a of symmetry is considered fixed in the analysis	ed at the center by a hub wh ssumed between the valve d	ich is concentric isks. This plane
	Modeled As	S:	

REVISION NO. 0

CALCULATION NO. QDC-1000-M-0077

PROJECT NO. N/A

PAGE NO.5

The pressure force is assumed to act uniformly upon the inner surface of the disk between the hub diameter and the outer disk diameter. The outer edge of the disk is assumed to be unimpeded and allowed to deflect away from the pressure force. In addition, the disk hub is allowed to stretch. The total displacement at the outer edge of the valve disk due to shear and bending and due to hub stretch are calculated using the reference 1 equations.



An evenly distributed force is assumed to act between the valve seat and the outer edge of the valve disk. This force acts to deflect the outer diameter of the valve disk inward and to compress the disk hub. The pressure force is reacted to by an increase in this contact force between the valve disk and seats. The valve body seats are conservatively assumed to be fixed. Therefore, the deflection due to the known pressure load must be balanced by the deflection due to the unknown seat load. The deflection due to the pressure force is first calculated. Then, the reference 1 equations are used to determine the contact force between the seat and disk which results in a deflection which is equal and opposite to the deflection due to the pressure force. Because the disk thickness varies, the average thickness is used for purposes of this calculation.

REVISION NO.

0

The coefficient of friction between the seat and disk is determined based on the open valve factor from a DP test. The stem force required to overcome the contact load between the seat and disk which opposes the pressure force is equal to:

(seat load) x [(seat mu) cos(seat angle) - sin(seat angle)] x 2 (for two disk faces).

Static Unseating Force

The static unseating force represent the open packing load and pullout force due to wedging of the valve disk during closure. These loads are superimposed on the loads due to the pressure forces which occur during pressure locking. The value for this load is based on static test data for the MOVs.

Piston Effect

The piston effect due to valve internal pressure exceeding outside pressure is calculated using the standard industry equation. This force assists movement of the valve stem in the open direction.

Friedman = - - - Prime × (Prover - Prime)

"Reverse Piston Effect"(F_{vert})

The reverse piston effect is the term used in this calculation to refer to the pressure force acting downward against the valve disk. This force is equal to the differential pressure across the valve disk times the area of the valve disk times the sine of the seat angle times 2 (for two disk faces).



REVISION NO.

0

CALCULATION NO. QDC-1000-M-0077	PROJECT NO. N/A	PAGE NO.7

Total Force Required to Overcome Pressure Locking

As mentioned previously, the total stem force (tension) required to overcome pressure locking is the sum of the four components discussed above. All of the terms are positive with the exception of the piston effect component.

Determination of Motor Gearing Capability

Next the motor gearing capability available to overcome static unseating forces is determined using the statically measured stem factor, the pullout efficiency, the temperature factor, and the ComEd motor test data (for breakdown torque and voltage factor), Reference 5.

$$MGC_{open} = \frac{MR_{breskdown} \times TempFactor \times OAR \times Eff_{pullout} \times \left(\frac{Voltage_{swailable}}{Voltage_{roted}}\right)^{Zaponent}}{Stem Factor}$$

Determination of Open Valve Factor

The open valve factor is calculated by based on the open DP load. This load is determined by using the equation below: The O10 thrust is measured in the region of the trace during which the valve disk is sliding on the valve seat (prior to flow initiation). This thrust is based on the O4 zero since the valve is effectively closed at O10. The open running thrust is measured at the end of the open stroke and is referenced to the C3 zero since the valve is nearly fully open at the point at which the open running load is measured. The Line Pressure adjustment term in the equation accounts for the fact that the piston effect decreases during the opening valve stroke.

$$\nabla F_{open} = \frac{O10_{\text{thurst}} - \text{Running}_{\text{thurst}} + \frac{\sqrt{7}}{4} D_{\text{storm}}^2 (O10_{\text{linepressure}} - \text{Running}_{\text{linepressure}})}{DP \times \frac{\sqrt{7}}{4} D_{\text{stot}}^2}$$

Enhanced Capability Evaluation

The enhanced capability evaluation uses the measured overall MOV efficiency to predict the required motor torque during the pressure lock condition. This overall MOV efficiency is determined by dividing the actual motor torque during the latest static test by the measured pullout thrust. This ratio (MOV efficiency) is then multiplied by the estimated pressure lock pullout force to determine the required motor torque during pressure lock pullout. The available motor torque is set equal to the motor breakdown torque from the ComEd motor test data, Reference 5.

CALCULATION NO. ODC-1000-M-0077	PROJECT NO.	N/A	PAGE NO. 8
-			

Acceptance Criteria

The margin between one time structural limit and required thrust is calculated. A margin of 15% or greater is required. This margin accounts for equipment inaccuracy and degradation.

The margin between MGC and required thrust is calculated. A margin of 20% or greater is required. This margin accounts for equipment inaccuracy and degradation.

If the enhanced capability evaluation is applied, a margin of 40% or greater is required. This margin accounts for voltage, current, and thrust measurement inaccuracies from the static test and a possible reduction in overall MOV efficiency from the static condition to the estimated pullout condition.

III. ASSUMPTIONS

1. The valve disk is assumed to act as two ideal disks connected by a hub. The equations in reference 1 are assumed to conservatively model the actual load due to pressure forces. This assumption is considered conservative since inspection of the disk drawings show large fillets between the disk hub and seats which should make the valve disk stiffer than assumed in the reference 1 equations.

	· · · · · · · · · · · · · · · · · · ·		
	· · ·		
REVISION NO.	0		

CALC	ULAT	ion no. Q	DC-1000-M-0077	PROJECT	NO. <i>N/A</i>	PAGE NO.9
						e.
	2.	The coeffi under pres combination of the calc flex-wedge	icient of friction between the ssure locking conditions as i on with assumption 1) is con culation against ComEd and e gate valves.	e valve seat an t is under DP nsidered to be EPRI pressure	d disk is assu conditions. T justified based locking test	med to be the same his assumption (in 1 on bench marking data for similar
	3.	The upstre which the adjacent cl to 325 psig signal to o is 307 psig Cities. See	cam, downstream, and bonne valve bonnet is pressurized heck valves. A LOCA occur g. The LPCI pump comes u pen simultaneously. Total d g. The pressure values are b e reference 6.	et pressure val to reactor pres rs which cause p to speed and ynamic head f ased on a revi	ues are based ssure (1020 ps the reactor p the subject v for the RHR p ew of the UFS	on a scenario in sia) by leakage past pressure to drop off alve receives a ump in LPCI mode SAR for Quad
IV.	DESI	GN INPUTS	5			
	1.	Valve Disl Crane-Alog	c Geometry information is b yco Valve Company. (Attac	ased on the Rohment A)	eference 4, Fa	exes from the
	2.	Motor Dat	a is taken from the Reference	e 5 report and	i RSMDS, Re	ference 7.
	3.	Static and	DP diagnostic test data is ta	ken from the	most recent di	agnostic tests.
V.	REFE	ERENCES			. ,	
	1.	Sixth Edition	on of Roark's Formulas for	Stress and Str	ain	
	2.	MPR Calcu Load", data Function of	ulations 101-013-1, "Effect ed 3/23/95; and 101-013-4, f Bonnet Pressure", dated 3/	of Bonnet Pres "Estimate of " /23/95	ssure on Disc Valve Unseati	to Seat Contact ng Force as
•	3.	NMAC Rep	port NP-6660-D, " Applicat	ion Guide For	Motor Opera	ted Valves"
-						
KEVISI	ON NO).	0			

CALCU	JLAT	ION NO. <i>QDC-1000-M-0077</i>	PROJECT NO. N/A	PAGE NO.10
			• •	:
	4.	Crane Telecopies from Dave Dwyer an 5/3/95 and 6/16/95, Attachment A.	d Bruce Harry to Brian Bu	nte (ComEd) dated
	5. ·	ComEd White Paper 125, MOV-WP-12	25, Rev. 2, 10/4/95	
	6.	UFSAR Section 6.3.2.2.3.4, Tbl 6.3-5	, Tbl 4.1-3 and Fig 6.3-8	
	7.	ComEd Rising Stem MOV Data Sheet,	1-1001-29B, 02/06/95, 13	:11
	8.	Thrust values are taken from static VO VOTES Test 5, performed 11/12/93.	TES Test 7, performed 6/2	3/94 and DP
	9.	EMS Calculation CE-DR-030, "Pressur Operated Valves", dated 6/13/95.	e Locking Analysis of Dre	sden Motor
	10.	ComEd Calculation NED-M-MSD-182, Quad Cities Injection Valves Susceptible	"Verification of Operabili e to Pressure Locking", da	ty for Dresden and ted June 22, 1995.
	11.	Thrust and Torque Calculation, OTC-24	40, Rev. 4, Attachment A.	
Л.	CAL	CULATIONS		· -
	The f	following is provided for MOV 1-1001-29	9B.	
	Math	Cad calculation of:		
	1) 2) 3)	the pressure locking unseating force, the available motor gearing capability to the enhanced capability	o unseat while pressure loc	ked
		· .	•	

0

LCULATION NO. QDC-100	0-M-0077	PROJECT NO. N/A	PAGE NO. 11
VI QCNPS Valve 1- INPUTS:	1001-29B		:
Bonnet Pressure	P _{bonnet} = 1005 psi	Reference 6	
Upstream Pressure	P _{up} = 307 psi	Ref. 6 & Assum. 3	
Downstream Pressure	P _{down} = 325 psi	Ref. 6 & Assum. 3	
Disk Thickness, Avg	t := 2.75 in	Reference 4	
Seat Radius	a := 6.385 in	Reference 7	
Hub Radius	b := 2.125 in	Reference 4	
Hub Length	L := 2.4375 in	Reference 4	
Seat Angle	theta := 5 deg	Reference 7	
Poisson's Ratio (disk)	v := 0.3	Reference 1 & 11, Stain. Steel	
Mod. of Elast. (disk)	E := 27.6 $\cdot 10^{6}$ psi	Reference 1 & 11, Stain. Steel	
Static Pullout Force (Test 7)	F _{po} := 15000-lbf	Reference 8	·
O10 Thrust (DP test 5)	O10 := 9429 lbf	Reference 8	
Open Run Thrust (DP)	Run := 450 lbf	Reference 8	
DP	DPtest := 256 psi	Reference 8	
LP (valve closed)	LPclose := 256 psi	Reference 8	
LP (valve open)	LPopen := 0 psi	Reference 8	
Stem Diameter	D _{stem} := 3.0 in	Reference 7	

Valve Factor:

 $(O10 - Run) + \frac{\pi}{4} \cdot D_{stem}^{2} \cdot (LPclose - LPopen)$ VF := _____

 $\pi(a)^2$ DPtest

VF = 0.329

Coefficient of friction between disk and seat: (Reference 3)

 $mu := VF \cdot \frac{\cos(\text{theta})}{1 - VF \cdot \sin(\text{theta})}$

mu = 0.337

PRESSURE FORCE CALCULATIONS



DPavg = 689 • psi

REVISION NO. 0

CALCULATION NO. <i>QDC-1000-M-0077</i>	PROJECT NO. N/A	PAGE NO. 12
Disk Stiffness Constants (Reference 1, Table 24)		÷
$D = \frac{E(t)^{3}}{12(1-v^{2})}$	D = 5.256	• 10 ⁷ •lbf in
$G := \frac{E}{2 \cdot (1 + v)}$	G = 1.062	• 10 ⁷ •psi
Geometry Factors: (Reference 1, Table 24)		
$\mathbf{C}_{2} := \frac{1}{4} \cdot \left[1 - \left(\frac{\mathbf{b}}{\mathbf{a}} \right)^{2} \cdot \left(1 + 2 \cdot \ln \left(\frac{\mathbf{a}}{\mathbf{b}} \right) \right) \right]$	$C_2 = 0.16$	51
$\mathbf{C}_{3} := \frac{\mathbf{b}}{4 \cdot \mathbf{a}} \cdot \left[\left[\left(\frac{\mathbf{b}}{\mathbf{a}} \right)^{2} + 1 \right] \cdot \ln \left(\frac{\mathbf{a}}{\mathbf{b}} \right) + \left(\frac{\mathbf{b}}{\mathbf{a}} \right)^{2} - 1 \right]$	C ₃ = 0.02	8
$C_{8} := \frac{1}{2} \cdot \left[1 + v + (1 - v) \cdot \left(\frac{b}{a} \right)^{2} \right]$	C ₈ = 0.68	9
$C_{9} := \frac{b}{a} \cdot \left[\frac{1+v}{2} \cdot \ln \left(\frac{a}{b} \right) + \frac{1-v}{4} \cdot \left[1 - \left(\frac{b}{a} \right)^{2} \right] \right]$	C ₉ = 0.29	
$L_{3} := \frac{a}{4 \cdot a} \cdot \left[\left[\left(\frac{a}{a} \right)^{2} + 1 \right] \cdot \ln \left(\frac{a}{a} \right) + \left(\frac{a}{a} \right)^{2} - 1 \right]$	L ₃ =0	
$L_{9} := \frac{a}{a} \cdot \left[\frac{1+v}{2} \cdot \ln\left(\frac{a}{a}\right) + \frac{1-v}{4} \cdot \left[1 - \left(\frac{a}{a}\right)^{2} \right] \right]$	L ₉ =0	•
$L_{11} = \frac{1}{64} \left[1 + 4 \cdot \left(\frac{b}{a}\right)^2 - 5 \cdot \left(\frac{b}{a}\right)^4 - 4 \cdot \left(\frac{b}{a}\right)^2 \left[2 + \left(\frac{b}{a}\right)^2 \right] \cdot \frac{b}{a} \right]$	$\left[L_{11} = 0.00 \right]$)6
$L_{17} = \frac{1}{4} \left[1 - \frac{1-\nu}{4} \left[1 - \left(\frac{b}{a}\right)^4 \right] - \left(\frac{b}{a}\right)^2 \left[1 + (1+\nu) \ln \left(\frac{b}{a}\right)^2 \right] \right]$	$\left[\frac{a}{b}\right]$ L ₁₇ = 0.13	9
Moment (Reference 1, Table 24, Case 2L)		
$M_{rb} := \frac{-DPavg \cdot a^{2}}{C_{8}} \cdot \left[\frac{C_{9}}{2 \cdot a \cdot b} \cdot (a^{2} - b^{2}) - L_{17}\right]$	$M_{rb} = -1.0$	01•10 ⁴ •lbf
$Q_{b} = \frac{DPavg}{2 \cdot b} \cdot (a^{2} - b^{2})$	Q _b = 5.877	$7 \cdot 10^3 \cdot \frac{\text{lbf}}{\text{in}}$
REVISION NO. 0		

· .

•

CALCULATION NO. <i>QDC-1000-M-0077</i>	PROJECT NO. N/A	PAGE NO. 13
Deflection due to pressure and bending: (Referen	ce 1, Table 24, Case 2L)	
$y_{bq} = M_{rb} \frac{a^2}{D} C_2 + Q_b \frac{a^3}{D} C_3 - \frac{DPavg a^4}{D} L_{11}$	$y_{bq} = -5.783$	3•10 ⁻⁴ •in
Deflection due to pressure and shear stress: (Re	ference 1, Table 25, Case 2L)	
$K_{sa} := -0.3 \cdot \left[2 \cdot \ln \left(\frac{a}{b} \right) - 1 + \left(\frac{b}{a} \right)^2 \right]$	K _{sa} = -0.393	3
$y_{sq} := \frac{K_{sa} \cdot DPavg \cdot a^2}{t \cdot G}$	y _{sq} = −3.785	• 10 ⁻⁴ •in
Deflection due to hub stretch (from center of hub to	disk):	
$P_{\text{force}} = 3.1416 \cdot (a^2 - b^2) \cdot DPavg$	$P_{force} = 7.8$	847•10 ⁴ •lbf
$y_{\text{stretch}} = \frac{P_{\text{force}}}{3.1416 \cdot b^2} \cdot \frac{L}{(2 \cdot E)}$	y _{stretch} = 2	.443•10 ⁻⁴ •in
Total Deflection due to pressure forces:	· · ·	
$\mathbf{y} \mathbf{q} = \mathbf{y} \mathbf{b} \mathbf{q} + \mathbf{y} \mathbf{s} \mathbf{q} - \mathbf{y} \mathbf{stretch}$	$y_{q} = -0.001$	•in
Deflection due to seat contact force and shear stress	(per lbf/in.): (Reference 1, Ta Case 1L)	ble 25,
$y_{sw} = -\left[\frac{1.2 \cdot \left(\frac{a}{a}\right) \cdot \ln\left(\frac{a}{b}\right) \cdot a}{t \cdot G}\right]$ (per lbf/in)	y _{sw} = -2.888	$\cdot 10^{-7} \cdot \frac{\text{in}}{\left(\frac{\text{lbf}}{\text{in}}\right)}$
Deflection due to seat contact force and bending (per	r lbf/in.): (Reference 1, Table 2	(m) 24,
$y_{bw} = -\left(\frac{a^{3}}{D}\right) \cdot \left[\left(\frac{C_{2}}{C_{8}}\right) \cdot \left[\left(\frac{a \cdot C_{9}}{b}\right) - L_{9}\right] - \left[\left(\frac{a}{b}\right) \cdot C_{3}\right] + (per lbf/in)$	$-L_3 = -5.983$	$\cdot 10^{-7} \cdot \frac{\text{in}}{\left(\frac{\text{lbf}}{1}\right)}$
Deflection due to hub compression (per lbf/in), (from	center of hub to disk):	\ IN /
$y_{\text{compr}} = \frac{2 \cdot a \cdot \pi}{3.1416 \cdot b^2} \cdot \frac{L}{(2 \cdot E)}$ (per tbf/in)	$y_{compr} = 1.249$	$10^{-7} \cdot \frac{\text{in}}{(\text{lbf})}$
Total deflection due to seat contact force (per lbf//in.):	•	\ in /
^y w ^{= y} bw ^{+ y} sw ^{- y} compr (per lbf/in)	$y_{w} = -1.012 \cdot 1$	$10^{-6} \cdot \frac{\text{in}}{\left(\frac{\text{lbf}}{\text{in}}\right)}$
	i	r

CALCULATION NO. QDC-1000-A	M-0077	PROJECT NO. N/A	PAGE NO. 14		
Seat Contact Force for wh from pressure forces:	ich deflection is equal prev	viously calculated deflection	in .		
$F_s := 2 \cdot \pi \cdot a \cdot \frac{y_q}{y_w}$		$F_{s} = 4.762 \cdot 10$	0 ⁴ •lbf		
UNSEATING FORCES		Reference 2			
F _{packing} is included in me	easured static pullout Forc	e	•		
$F_{piston} := \frac{\pi}{4} \cdot D_{stem}^2 \cdot P_{bc}$	onnet	$F_{\text{piston}} = 7.104 \cdot 10^3 \cdot \text{lbb}$	ſ		
$F_{vert} := \pi \cdot a^2 \cdot \sin(theta) \cdot (2$	$P_{\text{bonnet}} - P_{\text{up}} - P_{\text{down}}$	$F_{vert} = 1.538 \cdot 10^4 \cdot lbf$			
$F_{preslock} = 2 \cdot F_{s} \cdot (mu \cdot co)$	s(theta) - sin(theta))	$F_{\text{preslock}} = 2.372 \cdot 10^4 \cdot \text{lbf}$			
$F_{\text{total}} := -F_{\text{piston}} + F_{\text{vert}}$	t + F preslock + F po	$F_{po} = 1.5 \cdot 10^4 \cdot lbf$			
$F_{total} = 4.699 \cdot 10^4 \cdot lbf$					
MOTOR / GEARING CAP	PABILITY INPUTS:				
Motor Torque:	MR := 145.95 ft lbf	Reference 5			
Temperature Factor:	Tf := .935	Reference 7			
Degraded Voltage:	DV := 397 volt	Reference 7	· .		
Under Voltage Factor:	n := 2.119	Reference 5			
Stem Factor:	SF := 0.0254 · ft	Reference 7			
Overall Ratio:	OAR := 46.13	Reference 7			

MOTOR / GEARING CAPABILITY CALCULATIONS:

Pullout Efficiency:

Eff _{po} = 0.65



Reference 7

		•	1	i i
KEVISION NO.	0			
		1	1	1
				

CALCULATION NO. QD	С-1000-М-0	0077		PROJECT NO	. N/A	PAGE NO. 15
OPEN STRUCTURA		StructuralL	imit := 104718	lbf Referer	nce 7	'n
OPEN LIMIT:		Limit := (1	min((Structure	ILimit MGC)))		
MARGIN:	Li Margin :=	mit – F _{total} F _{total}	· .	Margin = 1.228	•••	
· · · ·						• .
•						
. •						
• •			· .	• •		
				1		•
:		• .				
			· ·			
· ·						• .
VISION NO.		0		T		

CALCULATION NO.	QDC-1000-M-0077	PROJECT NO.	N/A	PAGE NO. 16

VII. COMPARISON OF MODEL OF OTHER SOURCES OF INFORMATION

Finite Element Calculation to Determine Seat Contact Force due to Bonnet Pressure

Results from the Reference 9 calculation demonstrate that the contact force between the seat and disk which is calculated using the MathCad model above is conservative and reasonably accurate (within 5%) for the 16" valve size modeled in this calculation. Once this Finite Element Analysis calculation is finalized, this calculation will be updated to provide the actual values.

Comparison to Actual Test Data

The reference 10 calculation demonstrates that the MathCad model calculates the pressure locking unseating thrust for the 6" flex-wedge Velan gate valve with good accuracy. In addition, pressure locking testing performed on a 10" Crane 900# Class flex-wedge gate valve at Quad Cities on July 21, 1995 indicates that the model accurately and conservatively predicts that pressure locking unseating force. A graph showing the initial results of this testing is provided below. Further testing is scheduled for later this year. The results of the entire test sequence will be formally documented in a ComEd report after all testing is completed.



		· · · · · · · · · · · · · · · · · · ·				
CALC	ULATION NO.	QDC-1000-M-0077	,	PROJECT	NO. <i>N/A</i>	PAGE NO.17
VIII.	SUMMARY AN	D CONCLUSION	IS			•. •
	This calculation 38,800 lbf and th Structural Limit 104,718 lbf (calc difference betwee unseating force, a margin of 122.89 The calculated m therefore, a press	has determined that nat the Motor/Gear for MOV 1-1001-2 sulated at 575 °F d en the limiting ope then dividing the r %. argin of 122.8% is sure locking event	t the force ring Capabi 29B, taken lesign temp n force, in esultant val s greater that will not pre	required to u lity (MGC) i from the RSI). The marg this case the ue by the tot an the 15% r event this val	inseat MOV 1- s 117,900 lbf. MDS, is the W in was determi weak link valu al unseating fo ninimum margive from perfor	1001-29B (F _{total}) is The Open eak Link value of ned by finding the ie, and the rce to produced a in requirement, ming its design
	function.		-		-	
IX.	ATTACHMENT	5			,	
	Telecopy from D Page A-1.	ave Dwyer (Crane	-Aloyco Va	lves) to Bria	n Bunte (ComI	Ed) dated 5/3/95,
	Telecopy from Br Page A-2.	uce Harry (Crane-	Aloyco Vai	lves) to Briar	n Bunte (ComE	d) dated 6/16/95,
	• •	• •				
				•		
		, ,				
REVISI	ON NO.	0				

(FINAL)

CRANE VALVES Nuclear Operations

FAX TRANSMITTAL

	H Dunne Protont Frances			740 - 7511	EAY 1946	177.4946
Uevid	N/S	·····			FAL 1013	2 / - 2 /
CT) •		DATE	3/3/35
RENCE	······································	•			TOTAL PA	GE3
NGE	BRIAN	Her Fo	دردار مارد		E APPR	WMATE
		The are (De 16)		£ 40		
	VIICUES	لر ۵۰ ۲۵ ۲۵ ••••••	We			
	MORNING	A) L (DIMEN	51000	5 12	INCHES
		- 1949 a				د. ۱۹۹۵ میلوند این این میلوند این اور این اور این اور این اور این این اور این این این میلوند این اور این اور این
	512 E	Ħ	UB DIA	(D)	LATE C	THICK MESS (
•.	•		. •		MIN	MAK
, ang	10	ranaman an ranama ar stratu a mamatak	2.5	a na ar na ar da n	1 3/16	2. 7//
	an de Marelan de Langelande a l'anter de marena de l'anter de l'Anter de la		· · · · · · · · · · · · · · · · · · ·	• • • • • • • • • • •		
	· · · · · · · · · · · · · · · · · · ·		A 7	• • • • • • • • • • • • • • •	3 3/4	
**	76	n maar oo dha ka naan maarii	~, ~ ,			
	•					
		-		· · · · · · · · · · · · · · · · · ·		ат. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1
ŕ	LATE THICK	C35 IS	GREN	Tersor	<i>Л</i> ⁷	
	• • • ••••••••••••••••••••••••••••••••	ann ann ann anns a Chana Ann a A				
		1. 1989 - 1. 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 199	· • · · · • • • • • • • •			
	n 1 maaaliin ahaa ka ay ahaa ah ah ah ah ah ah					
	19. au - Maria I. 19. an 19	. 1919 - p. 1911 - 1919 - 14, 14, 14, 14, 14, 14, 14, 14, 14, 14,			·····	
, • • •	بعد ورويور محجوب وروان والمحود المراجع					
•	•				דן	
خود ور به ويه			· · · • • • • • • • • • • • • • • • • •			
	••••••••••••••••••••••••••••••••••••••		· · · · · · · · · · · · · · · · · ·		PCKAN	
	م هد در درم و ر ر هم و ر به م م درم م م م م م					······································
		•			aldre	- cj
•				1		A CONTRACTOR OF THE PARTY
				12744		

CRANE.

CRANE VALVES NUCLEAR OPERATIONS TELECOPIER TRANSMITTAL 104 North Chicago Street, Joliet, IL 60431

ATE:6-16-95	
D: BRIAN BUNTE	FROM: BRUCE HARRY
ITLE: <u>SR. ENG</u>	TITLE: DEV. ENG.
OMPANY:	
HONE: 708-663-3824-	PHONE:
AX: 708-663-7181	FAX: (815) 727-4246
DTAL PAGES:/	•
SUBJECT! HUB DIM. FU	10" AND 16" FIG 783
FLEXIBLE W	ED465.
INTERNAL HUGS AN	LE 1 \$18" AND 27116"
FOR TITE 10" AND 16	SIZES, RESPECTIVELY.
······································	
<u>.</u>	~
	All. I.D. A Shi 2 of
-	