PRESSURE LOCKING EVALUATION FOR REQUIRED PULLOUT FORCE

(shaded) = INPUTS

MOV	1-FCV-68-333
VALVE DWG	88405-2
MARK No.	8000B
Valve type =	Flex Wedge

EPRI MOV PPP INTERNAL DESIGN INFO, Ref. _____

D1	E1	M1
2.937	2.187	0.812

a = ((D1 + E1) / 2) / 2 = 1.281

b = M1 / 2 = 0.406 = ro

v=Poisson's Ratio = 0.3

u = friction coefficient based on Calc method. & EPRI results

theta = 1/2 total valve disk angle

VALVE DESIGN DATA

u =	0.4	
a=	1.2810	inches
b=	0.406	inches
theta=	5	deg
ro=	0.406	inches
v =	0.3	

PRESSURE and TEMPERATURE DATA

Pbon =	2250	psi
Phigh =	0	psi
Plow =	0	psi
DP =	0	psid
Normal Temp =	0	F
Max Temp =	0	F
Delta Temp =	0	F
Pbonnet = Pbon + (Delta Temp*33psi/F)	2250	psi

ROARK FORMULAS

C2= (1/4){1-(b/a)2[1+2ln(a/b)]}	0.167176
C3= (b/4a){[(b/a)2+1]ln(a/b)+(b/a)2-1}	0.028914
C8= (1/2)[1+v+(1-v)(b/a)2]	0.685158
C9= (b/a){[(1+v)/2]ln(a/b)+[(1-v)/4][1-(b/a)2]}	0.286608
L11= (1/64){1+4(ro/a)2-5(ro/a)4-4(ro/a)2[2+(ro/a)2]ln(a/ro)}	0.005962
L17= (1/4){1-((1-v)/4)[1-(ro/a)4]-(ro/a)2[1+(1+v)ln(a/ro)]}	0.144066
Load Constant = (C2L17-C8L11)/(C2C9-C3C8)	0.711633

SEAT REACTION LOAD (BONNET psi)

Reaction at Hub Perimeter = QH(Bonnet) = Pbonnet(a)(Load Constant)	2051.1	lb/in
Reaction at Seat: QS(Bonnet) = QH(Bonnet)(b/a)-(Pbonnet/2a)(a2-b2)	-646.3	lb/in

SEAT REACTION LOAD (Disk Area DP)

Reaction at Hub perimeter = QH(DiskDP) = (DP)(a)(Load Constant)	0	lb/in
Reaction at Seat = QS(DiskDP) = QH(DiskDP)(b/a)-((DP)/2a(a2-b2))	0	lb/in

SEAT REACTION LOAD (Hub Area DP)

Force on Hub due to DP = Whub = QH(DPdisk)+(DP)PI(b^2))/2PI(b	0	lb/in
Reaction at Seat = QS(HubDP) = (-Whub)(b/a)	0	lb/in

Sum of Seat Reaction Loads = 2*QS(Bonnet)-QS(DiskDP)+QS(HubDP)	-1292.57	lb/in
VF = mu/(cosA + musinA)	0.3879	
Thrust Load = VF*(Sum Seat Reaction)*(Seat Circumference)	-4035.97	lbs
Unwedging Load (Static test)	-3666	lbs

TOTAL THRUST = Thrust Load + Unwedging Load = -7702 lbs

NOTE: THE NEGATIVE SIGN INDICATES THAT THE STEM IS IN TENSION

Rev. Prepared: RJP Checked: M. Johnson

PRESSURE LOCKING EVALUATION FOR REQUIRED PULLOUT FORCE

= INPUTS

	MOV	1-FCV-68-333
	VALVE DWG	88405-2
VALVE DESIGN DATA	MARK No.	8000B

Valve type = Flex Wedge

EPRI MOV PPP INTERNAL DESIGN INFO, Ref. ____

D1	E1	M1
2.937	2.187	0.812

a = ((D1 + E1) / 2) / 2 = 1.281
b = M1 / 2 = 0.406 = ro
v=Poisson's Ratio = 0.3

u = friction coefficient based on Calc method. & EPRI results

theta = 1/2 total valve disk angle

u =	0.4	theta=	5 deg
a=	1.2810 inches	ro=	0.406 inches
b=	0.406 inches	v =	0.3

PRESSURE and TEMPERATURE DATA

Pbon =	2235	psi
Phigh =	300	psi
Plow =	0	psi
DP =	300	psid
Normal Temp =	0	F
Max Temp =	0	F
Delta Temp =	0	F
Pbonnet = Pbon + (Delta Temp*33psi/F)	2235	psi

ROARK FORMULAS

C2= (1/4){1-(b/a)2[1+2ln(a/b)]}	0.167176
C3= (b/4a){[(b/a)2+1]ln(a/b)+(b/a)2-1}	0.028914
C8= (1/2)[1+v+(1-v)(b/a)2]	0.685158
C9= (b/a){[(1+v)/2]ln(a/b)+[(1-v)/4][1-(b/a)2]}	0.286608
L11= (1/64){1+4(ro/a)2-5(ro/a)4-4(ro/a)2[2+(ro/a)2]ln(a/ro)}	0.005962
L17= (1/4){1-((1-v)/4)[1-(ro/a)4]-(ro/a)2[1+(1+v)ln(a/ro)]}	0.144066

Load Constant = (C2L17-C8L11)/(C2C9-C3C8) 0.711633

SEAT REACTION LOAD (BONNET psi)

Reaction at Hub Perimeter = QH(Bonnet) = Pbonnet(a)(Load Constant)	2037.4	lb/in
Reaction at Seat: QS(Bonnet) = QH(Bonnet)(b/a)-(Pbonnet/2a)(a2-b2)	-642.0	lb/in

SEAT REACTION LOAD (Disk Area DP)

Reaction at Hub perimeter = QH(DiskDP) = (DP)(a)(Load Constant)	273.4806	lb/in
Reaction at Seat = QS(DiskDP) = QH(DiskDP)(b/a)-((DP)/2a(a2-b2)	-86.1714	lb/in

SEAT REACTION LOAD (Hub Area DP)

Force on Hub due to DP = Whub = QH(DPdisk)+(DP)PI(b^2))/2PI(b)	334.3806	lb/in
Reaction at Seat = QS(HubDP) = (-Whub)(b/a)	-105.979	lb/in

Sum of Seat Reaction Loads = 2*QS(Bonnet)-QS(DiskDP)+QS(HubDP)	-1303.76	lb/in
VF = mu/(cosA + musinA)	0.387951	
Thrust Load = VF*(Sum Seat Reaction)*(Seat Circumference)	-4070.91	lbs
Unwedging Load (Static test)	-3666	lbs
TOTAL THRUST = Thrust Load + Unwedging Load =	-7737	lbs

NOTE: THE NEGATIVE SIGN INDICATES THAT THE STEM IS IN TENSION

PRESSURE LOCKING REQUIREMENT = 7737 lbs

ACTUATOR/VALVE CAPABILITY EVALUATION CALCULATION: EPM-RJP-031191

Actuator Model		SMB-00	
Motor Start Torque (MT)		25 ftlbs	
Overall Gear Ratio (OGR)		49	
Pullout Efficiency (PE)		40 %	
Application Factor (AF)	0.9 or 1.0	0.9	
Valve Factor (VF)	1.0 or (VF/460)**2	1.0000	424.4VAC
Stem Factor (SF)		0.0156	
Max Temperature (Temp)		327 F	
Loss Percentage (elevated temp)		23.2 %	Note 1
Torque Loss Factor = 1-Loss%*(Temp-104)/(356-77)		0.8146	
Actuator Torque Capability = (MT * OGR * PE * AF * TLF * VF)		359.22 ftlbs	SF =
Actuator Thrust Capability = Torque/Stem Factor		23027 lbs	0.0156
Actuator Thrust /Torque Rating		19600 lbs 250.00 ftlbs	
Valve Weak Link Thrust/Torque Rating		14650 lbs 228.54 ftlbs	SF = 0.0156
Seismic Thrust/Torque Rating		21500 lbs 335.40 ftlbs	SF = 0.0156

Note 1: Reference: Limitorque Technical Update 93-03

RESULTS: PRESSURE LOCKING REQUIREMENT = 7737 lbs
ACTUATOR / VALVE LIMITING CAPABILITY = 14650 lbs

COMMENTS: