

PRESSURE LOCKING EVALUATION FOR REQUIRED PULLOUT FORCE

= INPUTS

MOV

2-FCV-68-333

Valve type = Flex Wedge

VALVE DESIGN DATAVALVE DWG
MARK No.88405-2
8000B

$\nu = 0.4$
 $a = 1.2810$ inches
 $b = 0.406$ inches

$\theta = 5$ deg
 $ro = 0.406$ inches
 $v = 0.3$

EPRI MOV PPP INTERNAL DESIGN INFO, Ref. _____

D1 E1 M1
 2.937 2.187 0.812

 $a = ((D1 + E1) / 2) / 2 = 1.281$ $b = M1 / 2 = 0.406 = ro$ $\nu = \text{Poisson's Ratio} = 0.3$ $\nu =$ friction coefficient

based on Calc method. & EPRI results

$\theta = 1/2$ total valve
 disk angle

PRESSURE and TEMPERATURE DATA

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

2250 psi
 0 psi
 0 psi
 0 psid
 0 F
 0 F
 0 F
 2250 psi

ROARK FORMULAS

$C2 = (1/4) \{ 1 - (b/a)^2 [1 + 2 \ln(a/b)] \}$
 $C3 = (b/4a) \{ [(b/a)^2 + 1] \ln(a/b) + (b/a)^2 - 1 \}$
 $C8 = (1/2) [1 + \nu + (1 - \nu)(b/a)^2]$
 $C9 = (b/a) \{ [(1 + \nu)/2] \ln(a/b) + [(1 - \nu)/4] [1 - (b/a)^2] \}$
 $L11 = (1/64) \{ 1 + 4(ro/a)^2 - 5(ro/a)^4 - 4(ro/a)^2 [2 + (ro/a)^2] \ln(a/ro) \}$
 $L17 = (1/4) \{ 1 - [(1 - \nu)/4] [1 - (ro/a)^4] - (ro/a)^2 [1 + (1 + \nu) \ln(a/ro)] \}$

0.167176
 0.028914
 0.685158
 0.286608
 0.005962
 0.144066

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

0.11633

SEAT REACTION LOAD (BONNET psi)Reaction at Hub Perimeter = $QH(\text{Bonnet}) = P_{\text{bonnet}}(a)(\text{Load Constant})$ Reaction at Seat: $QS(\text{Bonnet}) = QH(\text{Bonnet})(b/a) - (P_{\text{bonnet}}/2a)(a^2 - b^2)$

2051.1 lb/in
 -646.3 lb/in

SEAT REACTION LOAD (Disk Area DP)Reaction at Hub perimeter = $QH(\text{DiskDP}) = (DP)(a)(\text{Load Constant})$ Reaction at Seat = $QS(\text{DiskDP}) = QH(\text{DiskDP})(b/a) - ((DP)/2a)(a^2 - b^2)$

0 lb/in
 0 lb/in

SEAT REACTION LOAD (Hub Area DP)Force on Hub due to DP = $W_{\text{hub}} = QH(DP_{\text{disk}}) + (DP)PI(b^2)/2PI(b)$ Reaction at Seat = $QS(\text{HubDP}) = (-W_{\text{hub}})(b/a)$

0 lb/in
 0 lb/in

Sum of Seat Reaction Loads = $2 * QS(\text{Bonnet}) - QS(\text{DiskDP}) + QS(\text{HubDP})$ $VF = \mu / (\cos A + \mu \sin A)$ Thrust Load = $VF * (\text{Sum Seat Reaction}) * (\text{Seat Circumference})$

Unwedging Load (Static test)

-1292.57 lb/in
 0.387951
 -4035.97 lbs
 -5228 lbs

TOTAL THRUST = Thrust Load + Unwedging Load =

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

-9264 lbs

9608130259 960806
 PDR ADOCK 05000327
 P PDR

Rev.

Prepared:

Checked:

PRESSURE LOCKING EVALUATION FOR REQUIRED PULLOUT FORCE

= INPUTS

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

Valve type = Flex Wedge

VALVE DESIGN DATA

$u = 0.4$
 $a = 1.2810$ inches
 $b = 0.406$ inches

theta = 5 deg
 $ro = 0.406$ inches
 $v = 0.3$

EPRI MOV PPP INTERNAL DESIGN INFO, Ref. _____		
D1	E1	M1
2.937	2.187	0.812
$a = ((D1 + E1) / 2) / 2 = 1.281$		
$b = M1 / 2 = 0.406 = ro$		
$v = \text{Poisson's Ratio} = 0.3$		
$u = \text{friction coefficient}$ based on Calc method. & EPRI results		
theta = 1/2 total valve disk angle		

PRESSURE and TEMPERATURE DATA

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

2235	psi
300	psi
0	psi
300	psid
0	F
0	F
0	F
2235	psi

ROARK FORMULAS

$C2 = (1/4) \{ 1 - (b/a)^2 [1 + 2 \ln(a/b)] \}$
 $C3 = (b/4a) \{ [(b/a)^2 + 1] \ln(a/b) + (b/a) - 1 \}$
 $C8 = (1/2) [1 + v + (1-v)(b/a)^2]$
 $C9 = (b/a) \{ [(1+v)/2] \ln(a/b) + [(1-v)/4] [1 - (b/a)^2] \}$
 $L11 = (1/64) \{ 1 + 4(ro/a)^2 - 5(ro/a)^4 - 4(ro/a)^2 [2 + (ro/a)^2] \ln(a/ro) \}$
 $L17 = (1/4) \{ 1 - [(1-v)/4] [1 - (ro/a)^4] - (ro/a)^2 [1 + (1+v) \ln(a/ro)] \}$

0.167176
0.028914
0.685158
0.286608
0.005962
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)
 Reaction at Seat: QS(Bonnet) = QH(Bonnet)(b/a) - (Pbonnet/2a)(a² - b²)

2037.4	lb/in
-642.0	lb/in

SEAT REACTION LOAD (Disk Area DP)

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

273.4806	lb/in
-86.1714	lb/in

SEAT REACTION LOAD (Hub Area DP)

Force on Hub due to DP = Whub = QH(DPdisk) + (DP)PI(b²)/2PI(b)
 Reaction at Seat = QS(HubDP) = (-Whub)(b/a)

334.3806	lb/in
-105.979	lb/in

Sum of Seat Reaction Loads = 2*QS(Bonnet) - QS(DiskDP) + QS(HubDP)

VF = mu / (ccsA + musinA)

Thrust Load = VF * (Sum Seat Reaction) * (Seat Circumference)

Unwedging Load (Static test)

-1303.76	lb/in
0.387951	
-4070.91	lbs
-5228	lbs

TOTAL THRUST = Thrust Load + Unwedging Load =

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

-9299	lbs
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PRESSURE LOCKING REQUIREMENT =

9264 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

427.2VAC

Stem Factor (SF)

0.0156

Max Temperature (Temp)

327 F

Loss Percentage (elevated temp)

23.2 %

Note 1

Torque Loss Factor = $1 - \text{Loss}\% \cdot (\text{Temp} - 104) / (356 - 77)$

0.8146

Actuator Torque Capability = $(\text{MT} \cdot \text{OGR} \cdot \text{PE} \cdot \text{AF} \cdot \text{TLF} \cdot \text{VF})$

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 =

9264 lbs

ACTUATOR / VALVE LIMITING CAPABILITY =

14650 lbs

COMMENTS:

Rev.

Prepared:

R. J. Paul

Checked:

M. J. Paul