

PRESSURE LOCKING EVALUATION FOR REQUIRED PULLOUT FORCE

= INPUTS

VALVE DESIGN DATA

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

MOV 1-FCV-68-332

VALVE DWG 88405-2

MARK No. 8000A

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

Valve type = Flex Wedge

EPRI MOV PPP INTERNAL DESIGN INFO, Ref. \_\_\_\_\_

D1 2.937 E1 2.187 M1 0.812  
 $a = ((D1 + E1) / 2) / 2 = 1.281$   
 $b = M1 / 2 = 0.406 = r_o$   
 $v = \text{Poisson's Ratio} = 0.3$

$\mu =$  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

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

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)(a<sup>2</sup> - b<sup>2</sup>)

2051.1 lb/in  
 -646.3 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)(a<sup>2</sup> - b<sup>2</sup>)

0 lb/in  
 0 lb/in

SEAT REACTION LOAD (Hub Area DP)Force on Hub due to DP = Whub = QH(DPdisk) + (DP)PI(b<sup>2</sup>)/2PI(b)

Reaction at Seat = QS(HubDP) = (-Whub)(b/a)

0 lb/in  
 0 lb/in

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

VF =  $\mu / (\cos A + \mu \sin A)$ 

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

Unwedging Load (Static test)

-1292.57 lb/in  
 0.387951  
 -4035.97 lbs  
 -5024 lbs

TOTAL THRUST = Thrust Load + Unwedging Load =

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

-9060 lbs

9608130256 960806  
 PDR ADDOCK 05000327  
 P PDR

Rev.

Prepared:

Checked:

**PRESSURE LOCKING EVALUATION FOR REQUIRED PULLOUT FORCE**

= INPUTS

**MOV****1-FCV-68-332**

Valve type =

**Flex Wedge****VALVE DWG****88405-2**

EPRI MOV PPP INTERNAL DESIGN INFO, Ref. \_\_\_\_\_

**MARK No.****8000A****VALVE DESIGN DATA**

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

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

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**

**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** psi  
**0** F  
**0** F  
**0** F  
**2235** psi

$\nu =$  friction coefficient  
 based on Calc method. & EPRI results

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

**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 =  $(C2L17 - C8L11) / (C2C9 - C3C8)$

**0.711633**

**SEAT REACTION LOAD (BONNET psi)**

Reaction at Hub Perimeter =  $QH(\text{Bonnet}) = P_{\text{bonnet}}(a)(\text{Load Constant})$

**2037.4** lb/in

Reaction at Seat:  $QS(\text{Bonnet}) = QH(\text{Bonnet})(b/a) - (P_{\text{bonnet}}/2a)(a^2 - b^2)$

**-642.0** lb/in

**SEAT REACTION LOAD (Disk Area DP)**

Reaction at Hub perimeter =  $QH(\text{DiskDP}) = (DP)(a)(\text{Load Constant})$

**273.4806** lb/in

Reaction at Seat =  $QS(\text{DiskDP}) = QH(\text{DiskDP})(b/a) - ((DP)/2a)(a^2 - b^2)$

**-86.1714** lb/in

**SEAT REACTION LOAD (Hub Area DP)**

Force on Hub due to DP =  $W_{\text{hub}} = QH(DP_{\text{disk}}) + (DP)PI(b^2)/2PI(b)$

**334.3806** lb/in

Reaction at Seat =  $QS(\text{HubDP}) = (-W_{\text{hub}})(b/a)$

**-105.979** lb/in

Sum of Seat Reaction Loads =  $2*QS(\text{Bonnet}) - QS(\text{DiskDP}) + QS(\text{HubDP})$

**-1303.76** lb/in

$VF = \mu / (\cos A + \mu \sin A)$

**0.387951**

Thrust Load =  $VF * (\text{Sum Seat Reaction}) * (\text{Seat Circumference})$

**-4070.91** lbs

Unwedging Load (Static test)

**-5024** lbs

**TOTAL THRUST = Thrust Load + Unwedging Load =**

**-9095** lbs

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

PRESSURE LOCKING REQUIREMENT =

9095 lbs

ACTUATOR/VALVE CAPABILITY EVALUATION

CALCULATION:

EPM-RJP-041091

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

1

Valve Factor (VF)

1.0 or (VF/460)\*\*2

0.7820

406.9VAC

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

312.13 ftlbs

SF =

Actuator Thrust Capability = Torque/Stem Factor

20008 lbs

0.0156

Actuator Thrust /Torque Rating

19600 lbs

250.00 ftlbs

Valve Weak Link Thrust/Torque Rating

14650 lbs

SF =

228.54 ftlbs

0.0156

Seismic Thrust/Torque Rating

21500 lbs

SF =

335.40 ftlbs

0.0156

Note 1: Reference: Limitorque Technical Update 93-03

RESULTS:

PRESSURE LOCKING REQUIREMENT =

9095 lbs

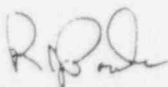
ACTUATOR / VALVE LIMITING CAPABILITY =

14650 lbs

COMMENTS:

Rev.

Prepared:



Checked:

