

NRC GENERIC LETTER 95-07 PVNGS PRESSURE LOCKING METHODOLOGY

◆ Background

- PVNGS model development began (1994)**
- G.L. 89-10 supplement 6 (March 1994)**
- PVNGS modification development began (July 1994)**
- G.L. 95-07 (August 1995)**
- PVNGS modification implementation start (Oct. 1995)**

more...



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♦ Background

- Industry pressure locking testing (Dec. 1995)**
- Other industry pressure locking models (1994-1998)**
- NUREG/CR-6611 INEEL pressure locking testing (May 1998)**
- Limitorque technical update 98-01 (July 1998)**
- PVNGS modification implementation completion (May 2000)**



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◆ Pressure Locking Modifications

• Scope

- 60 of 69 valves hardware modification and peak cracking limit
- 9 valves controlled peak cracking limit

• Types

- Peak cracking limit
- Bonnet relief
- Gear change
- Actuator upgrade
- Valve internal upgrade



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EQIDS	Recommended Corrective Actions
AF-34/35 Motor AFP Iso Valves to SGs	-Install bonnet relief valve (1880 psig Bonnet Press. Limit) -Upgrade weak link by 35%
AF-36/37 Turbine AFP Iso Valves to SGs	-Install bonnet relief valve (1880 psig Bonnet Press. Limit) -Upgrade weak link by 35%
SG-134/138 SG Steam Supply Iso Valves to AFP Turbine	-Replace the actuator with an SB-1-60 (OAR=42.50) -Upgrade weak link by 35%
SI-604/609 LTC HPSI Valves	-Admin Control of maximum cracking thrust
SI-651/652 SDC Iso Valves	-Install Bonnet Relief Valve (2936 psig Bonnet Pressure Limit) -Admin control of maximum cracking
SI-653/654 SDC Iso Valves	-Install Bonnet Relief Check Valve (465 psig Limit) -Admin control of maximum cracking -Increase Actuator OAR (OAR=124.1)
SI-655/656 SDC Ctmt Iso Valves	-Install Bonnet Relief Check Valve (465 psig Limit) -Install a bonnet bypass spring check valve -Increase Actuator OAR (OAR=124.1)
SI-671/672 CS Control Ctmt Iso Valves	-Replace the actuator with an SB-1-40 (OAR=27.20)



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EQID	Recommended Corrective Actions
SI-685/694 SDC Hx Inlet Iso Valves (LPSI Pump)	-Increase Actuator OAR (OAR=61.64)
SI-686/696 SDC HX Disch Iso Valves	-Replace the actuator with an SMB-2-60 (OAR=80.00)
SI-688/693 SDC Hx Bypass Iso Valves	-Increase Actuator OAR (OAR=61.64)



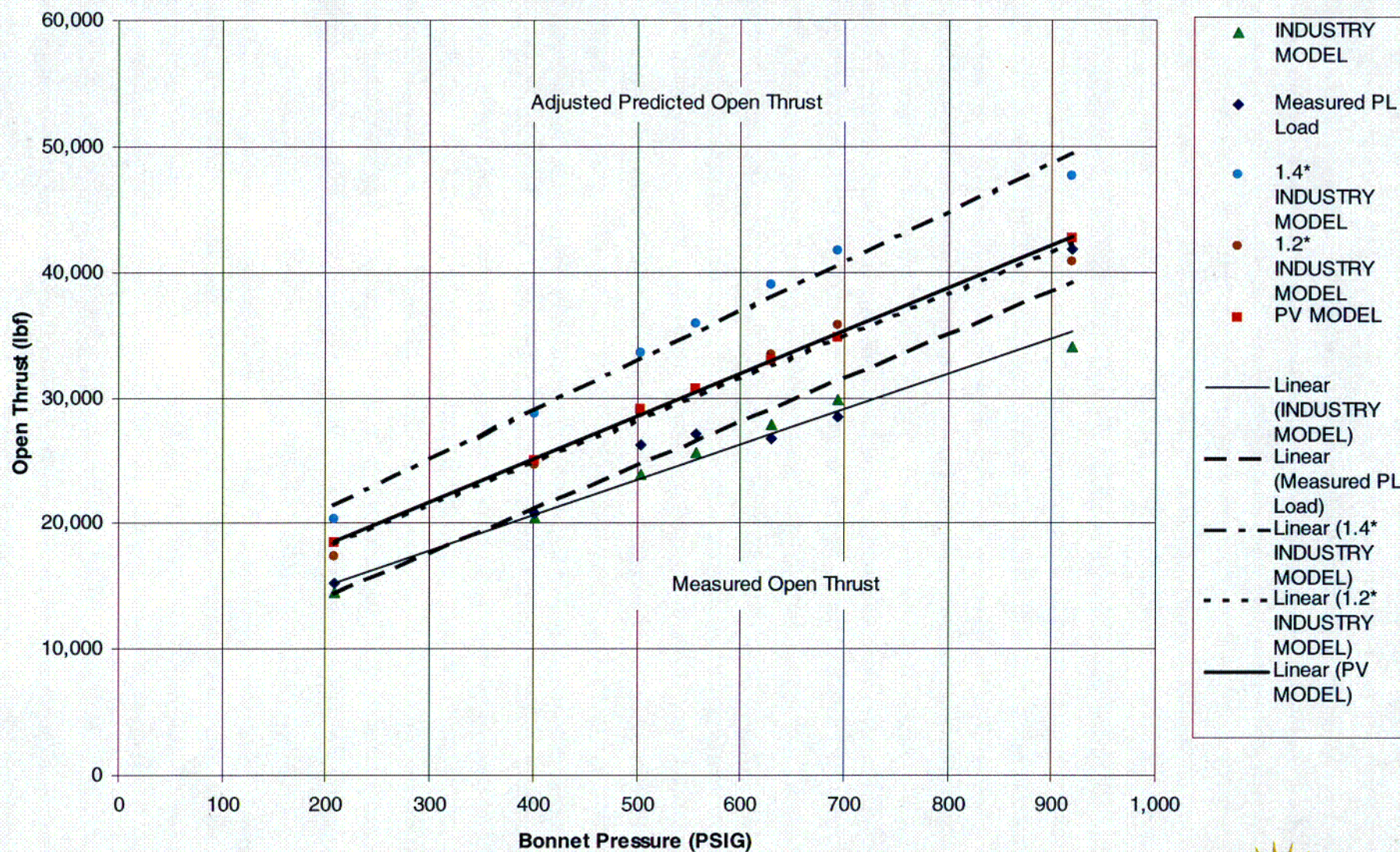
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♦ Model Comparison

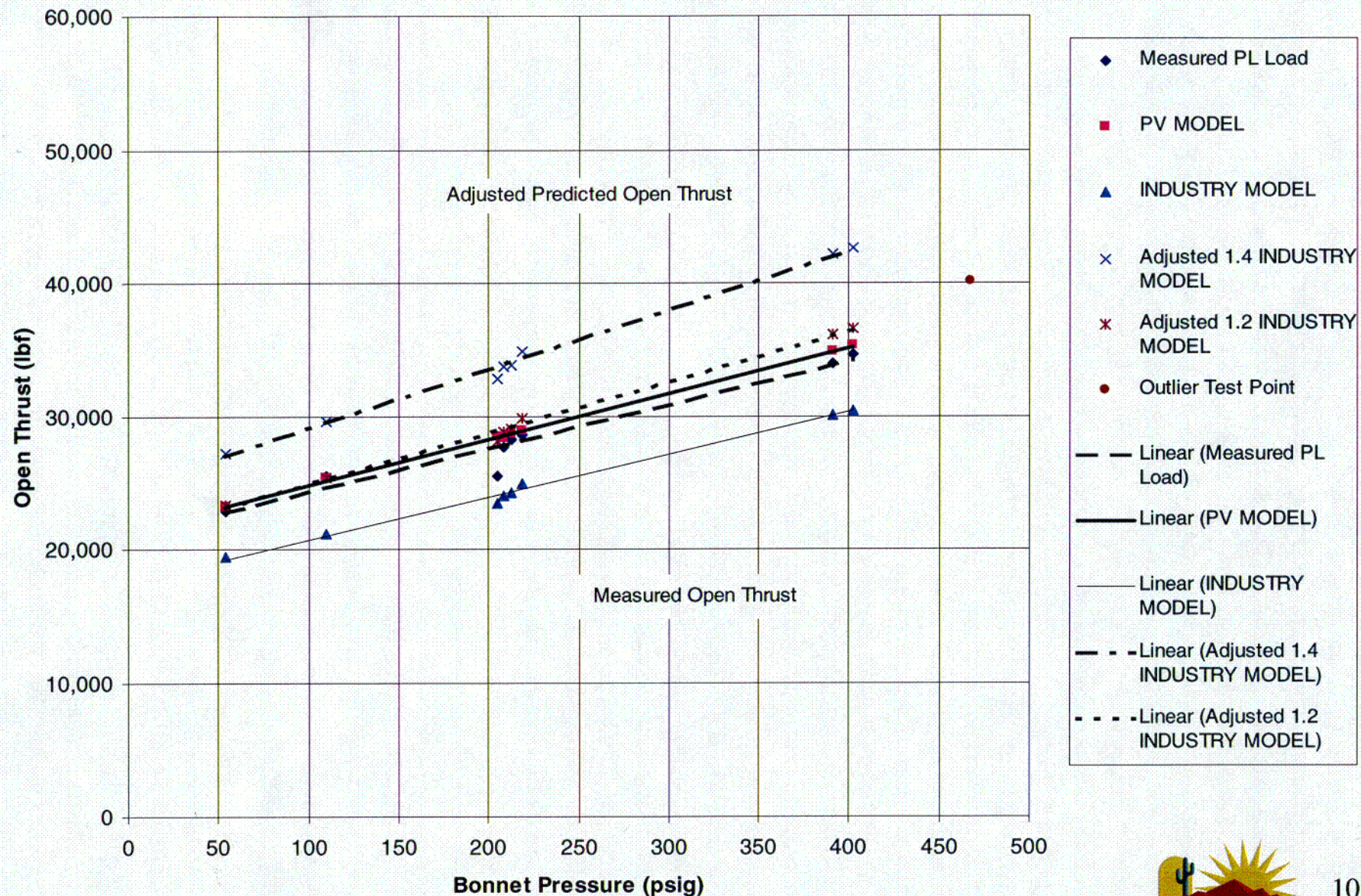
- Comparison w/results of model w/o line pressure
 - 10" 300# Borg-Warner Flexible Wedge Gate****
- Comparison w/results of model w/line pressure
 - 10" 900# Crane Flexible Wedge Gate****



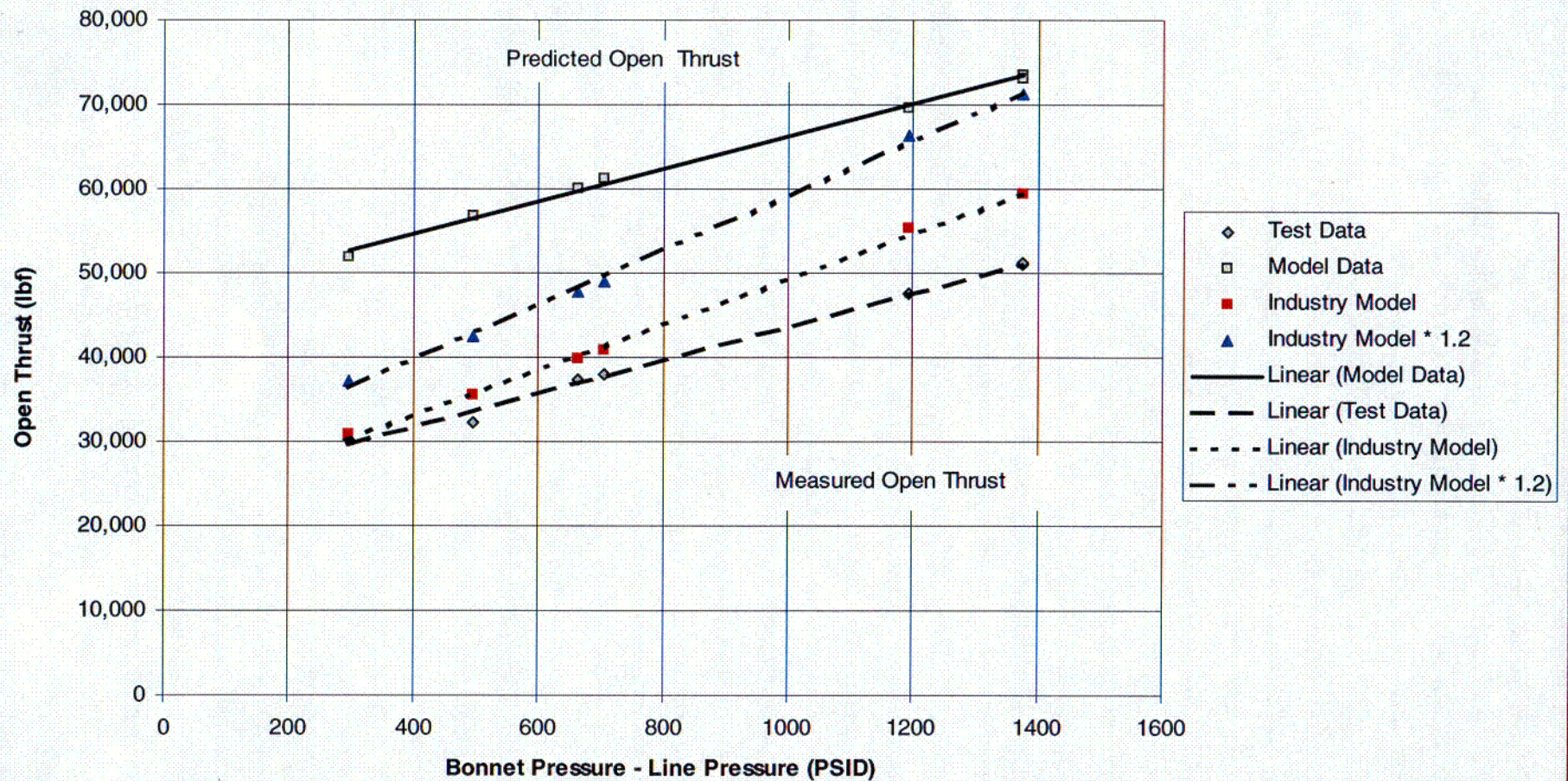
Open Thrust vs. Bonnet Pressure (Low Closing Thrust) (10" 300# Borg-Warner Gate Valve)



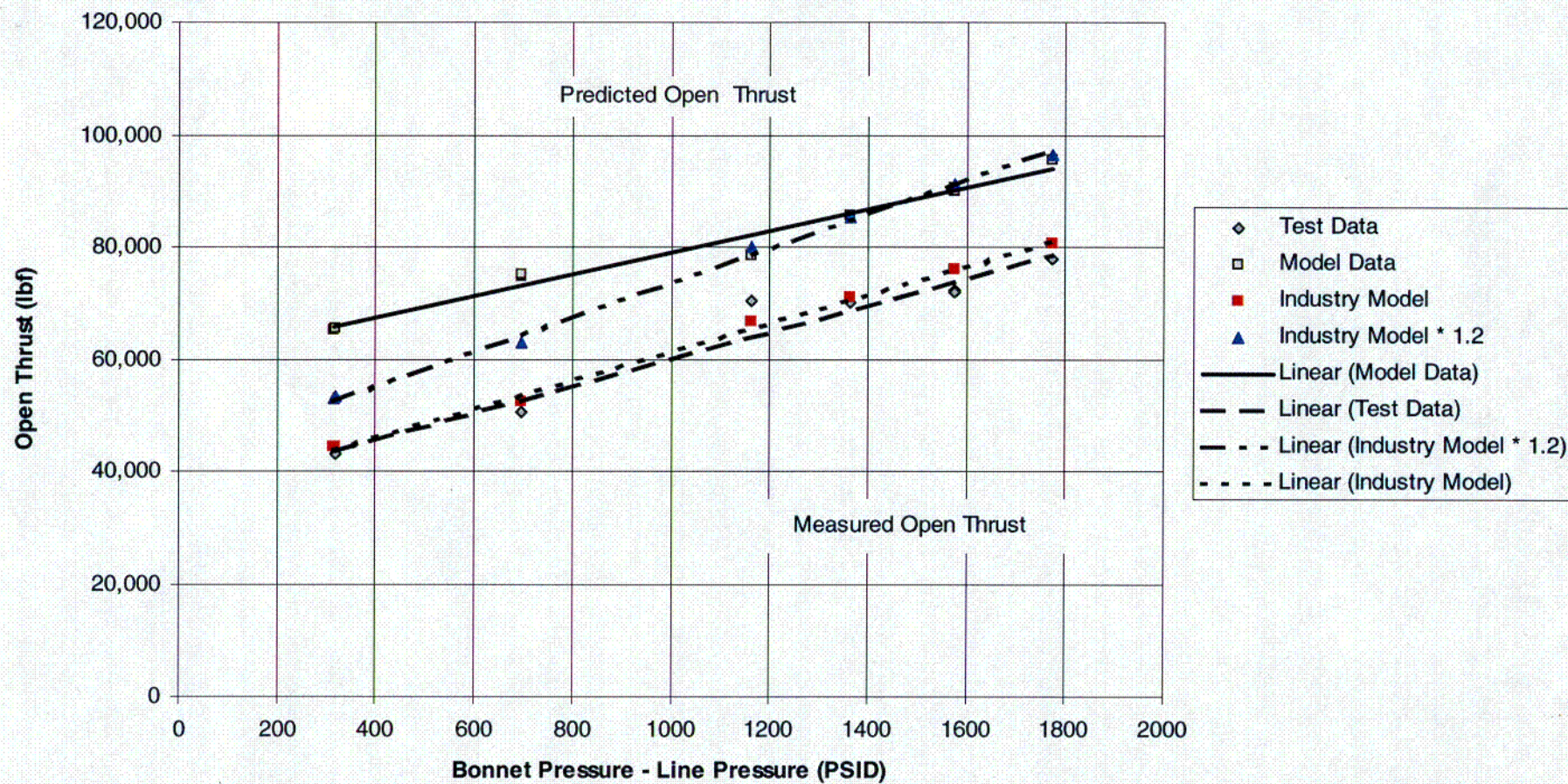
Open Thrust vs. Bonnet Pressure (High Closing Thrust) (10" 300# Borg-Warner Gate Valve)



Open Thrust vs. DP (Low Closing Thrust) (10" 900# Crane Flexible Wedge Gate Valve)



**Open Thrust vs. DP (High Closing Thrust)
(10" 900# Crane Flexible Wedge Gate Valve)**



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♦ NRC RAI questions

- Utilization of test specific valve factors**
- Clarification of “additional” margin**
- Basis for 10% margin w/bonnet pressure >200 psig Criterion**
- Application utilizing PVNGS PL Model**
- Exceptions to 10% margin criterion**



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- ◆ **Utilization of test specific valve factor**
 - **Review of test traces**
 - **Application of test values**
 - **Resulting valve factors**
 - **0.44 valve factor (Borg-Warner)**
 - **0.31 valve factor (Crane)**



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- ◆ **Clarification of “additional” margin**
 - **Minimum of 10 % margin between capacity and predicted loads**
 - **Maintained when applying model unless otherwise justified**
 - **Basic margin between measured loads and predicted loads**
 - **Difference between test and model linear regression curves**

more...



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- ◆ **Clarification of “additional” margin**
 - **Exception at one high closing thrust data point**
 - **Borg-Warner 10” 300# test 80**
 - **Outside conditions for PVNGS Borg-Warner 300 class valves**



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- ◆ **Other inherent uncredited margins**
 - **Conservatism and rigor of model**
 - **Validated for 10" 300# Borg-Warner Valve w/high seating loads**
 - **Difference between model and test linear regression curves**

more...



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◆ Other inherent uncredited margins

- Conservatism and rigor of input variables**
 - Utilization of high valve factors and COFs**
 - Difference between maximum closing load and field measurement**
 - Conservatism of input pressures**
 - Utilization of minimum voltage and Limitorque TU 98-01**



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- ◆ **Basis for 10% Margin w/bonnet pressure >200 psig criterion**
 - ◆ **Based on slight convergence of model w/Borg-Warner test results for high seating loads in initial model.**
 - ◆ **Ensure enveloping of identified nonlinear Borg-Warner data point 80 at 467 psig bonnet pressure and 32,000 lbf closing force.**
 - ◆ **Allowance for other uncertainties based on initial small sample of data points above 400 psig bonnet pressure and greater than 17,000 lbf closing force.**

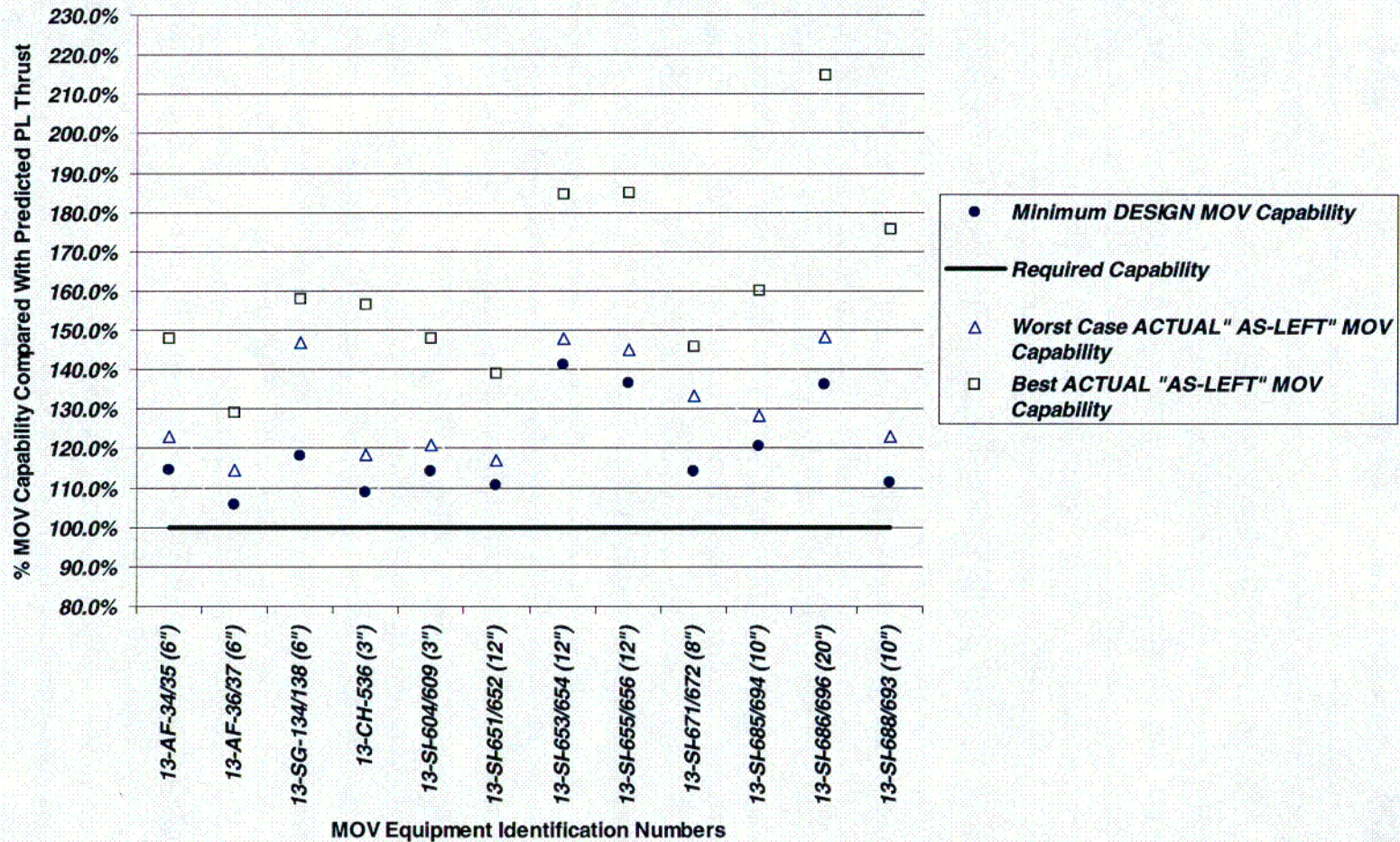


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- ◆ **Application utilizing PVNGS PL Model**
 - ◆ **Added some conservatism into model**
 - ◆ **Review of input variables**
 - ◆ **Review of actuator capacity and limits**
 - ◆ **Calculated 10% margin between valve capability and pressure locking loads**

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MOV Capability Compared to Predicted Required



505

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- ◆ **Exceptions to 10% margin criterion**
 - **3" 1500# Borg Warner valve CH-536 w/ bonnet pressure of 97 psig and closing force of 7,800 lbf (calculated design margin 9% , minimum actual calculated margin 18%)**
 - **Low bonnet pressure, low closing force, rigid disk**



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- ◆ **Exceptions to 10% margin criterion**
 - **6" 900# Anchor Darling valves AF-36/37 w/ bonnet pressure of 1816 psig and closing force of 41,000 lbf (calculated design margin 7%, minimum actual calculated margin 15%)**
 - **Conservatively high bonnet pressure**

